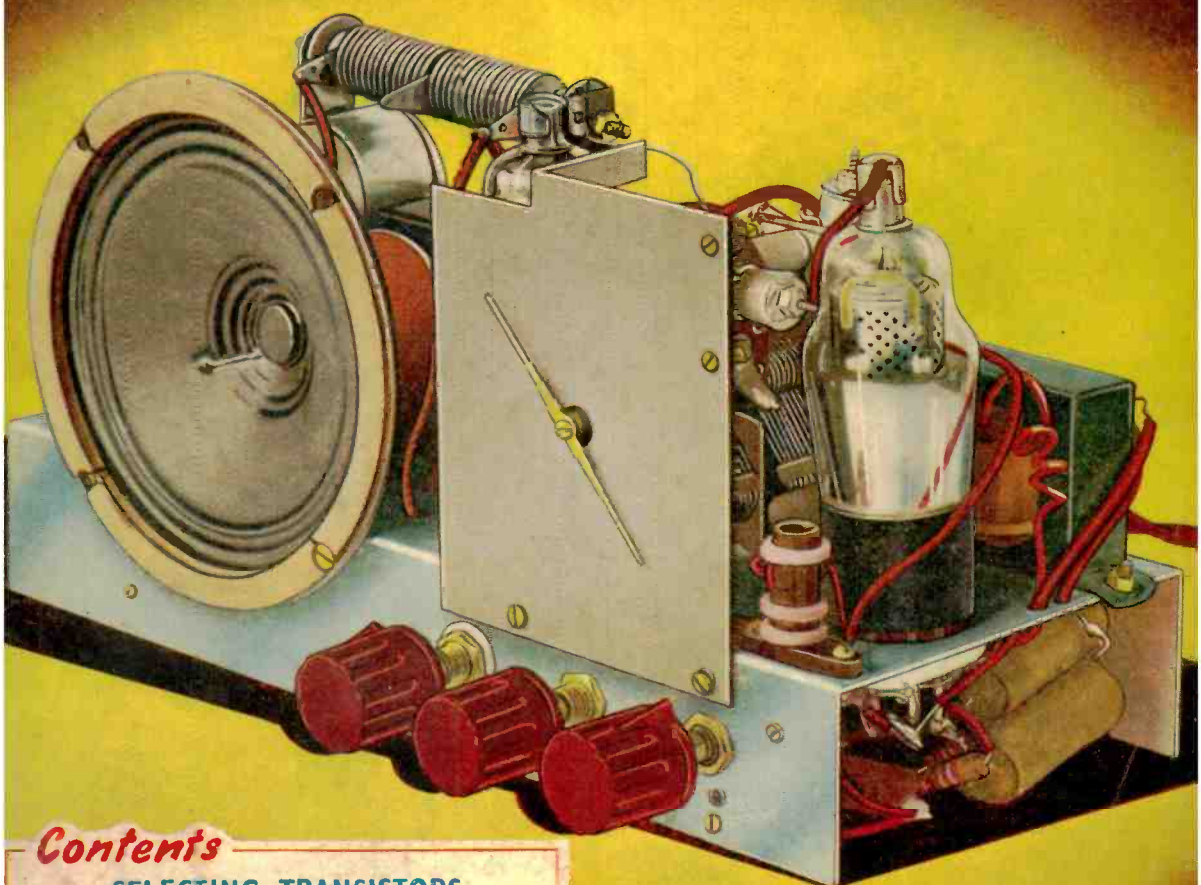
A TRANSISTORISED "N" CIRCUIT

PRACTICAL WIRELESS

1/6

DECEMBER 1959



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A BEAT FREQUENCY OSCILLATOR

IMPROVING SUPERHETS

A TRANSISTORISED PRE-AMPLIFIER

A STEREO AMPLIFIER

A Mains 3-Valver

ETCH YOUR OWN PRINTED CIRCUITS

You can now make your own printed circuits in the comfort of your own home. Etch-your-own kits do not require any skill or additional equipment, errors can be corrected at any stage, and can be completed within 1 hour. Each kit contains more than 60 square inches of laminated board and sufficient chemicals to make dozens of printed circuits. Highest quality materials and completely safe to handle. Absolutely any schematic can be made to printed circuit. This kit opens a whole new field for the radio constructor, hobbyist, etc., no matter how limited his skill. Complete kit, with comprehensive manual containing advice and illustrated examples on translating schematics into printed layouts, etc. Fully guaranteed. ONLY **19/6** P. & P. 1 6.

SPECIALLY DESIGNED MINIATURE KITS FOR OUR ETCH-YOUR-OWN PRINTED CIRCUIT KIT

1 Transistor diode pocket radio ... ... **24'6**. p.p. 1 6
2 valve 3 watt mains amplifier ... ... **49'6**. p.p. 2 6
3 Transistor Super Pocket Radio ... ... **72 6**. p.p. 2 6
All kits supplied entirely complete with full wiring and assembly details. Fully guaranteed.

POCKET MULTI - METER. 2,500 o.p.v. Multi range 6 30/120/300 1,200 v. A.C., ditto D.C. 0-1 K., 0-1 megohm : 400 MicroA., 12 mA., 300 mA.—00 to +64 DB. 5 ranges ; 3in. x 4½in. x 1¼in. Large clear dial. Leads supplied. List Price £6.19.6. OUR PRICE **£4.7.6.** Saving you £2.12.0. P. & P. 2 6.

CONVERT TO V.H.F. Within minutes you can extend the frequency of your receiver to cover V.H.F. by using our brand new V.H.F. Converter. **R.F.26** covers 50-65 Mc/s, vernier calibrated tuning, **20/-**. **R.F.25** covers 40-50 Mc/s. Switched tuning, **8/6**. Circuits supplied. P. & P. 3 6 on each.

TRANSMITTER BC625. Covers 100/156 Mc s, will deliver 15 watts, consists of seven valves (2-832), 3 for modulation, 4 for R.F. Complete with operating details and circuits. ONLY 25/-. P. & P. 5/-.

D.M.34. America's finest little dynamotor offering 12 v. in with 220 v. out at 80 mA. With suppression and smoothing mounting base. Size 4¼ x 2¾ x 2¾in. Original packing. ONLY **35**'-. P. & P. 3/6.

V.H.F. MOBILE AERIAL and base, as used by Taxis, Police, etc., **7/6**. P. & P. 2/6.

LIGHTWEIGHT HEAD SETS. These H.S. 30 phones are the smallest used by the U.S. Air Force. 250Ω imp., using soft rubber miniature ear moulds for maximum music and voice reproduction of the finest quality. Supplied free is a small transformer unit with cord and plug which steps impedance up to 4,000Ω. ONLY 15'-. P. & P. 2'6.

VERDIK HI-FI AMPLIFIER. 10-watt push-pull ultra-linear feedback. Beautifully styled in green steve enamel. Provision for tuner, bass and treble, 5-position selector for radio, tape, mike, tape, L.P. and std. records. List price 20 gns. OUR PRICE **£13.19.6.** P. & P. 7/6.

MICROPHONES — BRAND NEW. Throat magnetic **4/6** ; Throat carbon **3/6**; No. 8 carbon with switch **6/6**; No. 7 moving coil **6/6**. Tannoy power mikes only 5.-.

Beautifully styled—precision made. Supplied complete. Fully guaranteed. ONLY **30/-** P. & P. 2'6

INSTANT VALVE FILAMENT TESTER MODEL VT-41

Pocket-size—battery operated

GIVES INSTANT CHECK OF :

- All Receiver Valves.*
- All T.V. Valves.*
- All T.V. Radio Set Fuses.
- All Pilot Lamps.
- Has built-in miniature 7 and 9-pin valve straighteners and battery test.

* International Octal, B8. B9, B7 Battery and Mains types.

PORTABLE TRANS/RECEIVER SET

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

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

TWO FOR £6 POST FREE.

WIRELESS SET NO. 19 MK. II

Incorporates "A" Set—TX/RX covering 2-8 Mc/s (37.5-150 metres), "B" Set—VHF TX/RX covering 230-240 Mc/s (1.2-1.3 metres) and intercom, amplifier. Complete with 15 valves, 500 microamp check and tuning meter, circuit and instruction book. (American manufacture.) In used condition, **65/-**. Carr. 10/-.

BUILD AN F.M. TUNER with this miniature 9.72 Mc's I.F. Strip. Has 6 modern miniature valves, I.F.T.s, etc., supplied with full F.M. Tuner conversion details. Hailed by all our previous purchasers as a wonderful F.M. Tuner. Brand new, only **40**-. P. & P. 3 6.

COLLINS T.C.S. EQUIPMENT. T.C.S. Transmitter. **£9.10.0**, carr. 15.-. T.C.S. Receiver. **£8.10.0**, carr 15'-. S.A.E. for further details.

HI-FI CO-AX SPEAKERS BRAND NEW—U.S.A. MADE 12in. Coaxial Speaker. The woofer uses 6.8 oz. Alinco 5 magnet. Has 3in. tweeter and an electronic crossover network to separate the speaker functions. Frequency response : 40-17,000 cycles. Output 12 watts, impedance 8 ohms. ONLY **160**-.

8in. 2½in. tweeter, 10 watts, etc., **90**'-.
P. & P. 4'- on each.

COMPLETE MORSE TRAINING UNIT. Complete Code Set, contains key, buzzer, headphones, pitch control, operating internal battery, housed in portable wooden case. Brand New, only **12/6**, carr. 5 -. Battery 1/6 extra.

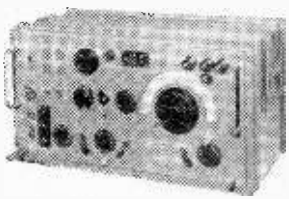
ACCUMULATORS. 2 volts 16 A.H. (unspillable). Ideal for 6 and 12 volts supply, etc. Brand new. Original cartons. Size 4in. x 7in. x 2in., **5 6** each. P. & P. 1 6. 3 for **15**'-. P. & P. 3/6. 6 for **27 6**. P. & P. 5 -.

F.M. TRANS / RECEIVERS B.C.620. 20-28 Mc/s, crystal controlled, contains 14 valves, filament plate, alignment and voltage meter, volume control, and 12 volt supply unit and dry battery case. Complete station. **£8.10.0**. carr. 20.-. U.S.A. Hand Set, 20 - extra.

VISIT OUR STAND No. 6 at the Radio Hobbies Exhibition

ALL BAND RECEIVER R107

AMATEUR — SHIPPING — BROADCAST



This magnificent 9-valve, 3-wave band receiver gives world wide reception over 1.2-17 Mc/s (18-250 metres). The sensitivity is 1 micro volt on C.W., and 2-6 micro-volts on R.T. Panel controls include Band width switch (" Wide " or " Narrow "), choice of A.V.C. and B.F.O., Audio Filter, R.F. Gain, Aerial Trimmer. Has built-in Output stage with internal speaker. Headphones sockets. Incorporates internal A.C. mains power unit (100-250 v. A.C.) and 12 volts D.C. Vibrator pack. Size 24 x 13 x 17in. These sets are extensively tested prior to despatch. SUPPLIED COMPLETE AND READY FOR IMMEDIATE USE.

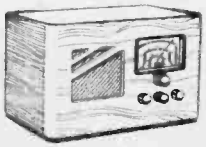
MODEL 1, Slightly used appearance **£8.10.0.** **MODEL 2, Very good appearance** **£10.10.0.**

Carr. 20/- (England and Wales), rest of U.K. extra.

Relda Radio Ltd.

Callers : **87, TOTTENHAM CT. RD., LONDON, W.1.**
Mail orders : **(DEPT. P), 32a, COPTIC STREET, LONDON, W.C.1.**
Telephone : MUSeum 9607.

WOT ! ***You don't own a Relda catalogue ! It's terrific and fully illus. Only 1/3.***



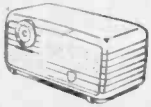
HOME RADIO 79/6

A.C./D.C. Universal mains 5 valve octal superhet 3 waveband receiver can be adapted to gram p.u. In attractive wooden cabinet. 9¼ x 18½ x 11¾in. Ins. carr. 4/6.

FAMILY RADIO 99/6

5 valve (octal) superhet. A.C. 3 waveband and gram. position. 4 controls. Modern attractive cabinet size 15¼ x 18 x 10½in. in cream and brown. Carr. & ins. 8/6.

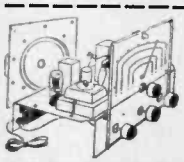
BAKELITE CABINETS 5/9



Brand new. Colour brown. Attractive design. Size 12 x 7 x 5½in. Ideal for small receivers, converters, etc. P. & P. 3/9.

SUPER SUPERIOR RADIO 89/6

4 waveband. 5 valve superhet radio. 2 tone covered metal cabinet size 24¼ x 12 x 10in. 4 control knobs. Positions for gram p.u. and extension speaker. A.C. only. Ins. carr., 8/6.



SUPER CHASSIS 79/6

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

★ T.V. CHASSIS AT CLEARANCE PRICES ★

THE POPULAR 12" PLESSEY CHASSIS 9/6

A bargain for anyone wanting to make up their own T.V. at a very low cost. A chassis in one unit. Less valves and tube. Chassis size 12 x 14½ x 11in. I.F.'s 10.5—14 Mc/s. Can be adapted for a 12 channel Turret Tuner and modified to take a larger tube. Carr. & ins. 10/6.

SOUND/VISION AND I.F. STRIP 7/9

Plessey. I.F.'s 10.5 Mc/s sound. 14 Mc/s vision. 8 valveholders. Less valves. Size 8½ x 5 x 4½in. Circuit incl. The tuner unit plugs directly into this chassis. P. & P. 2/6.

TIME BASE 2/9

Containing scanning coils, line transformer, etc., less valves. Drawings free with order. P. & P. 2/6.

IDEAL RADIO CHASSIS 39/6

5 volt superhet A.C. Radio or Radiogram chassis. 3 waveband and gram. switched 8in. P.M. speaker included. Valve line-up: 6K8; 6K7; 6Q7; 6V6; 5Z4 (not included). Chassis size 19¼ x 7½ x 9in. Knobs 2/- extra. Set of valves 45/9 extra. Complete £4.5.0. Ins. carr. 5/6.

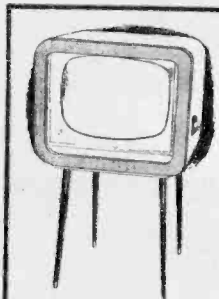
CHASSIS 1/-

6 or 8 valve latest type midget valve design for A.M. or F.M. Brand new. Cadmium plated. Size 12¼ x 7⅛ x 2⅜in. P. & P. 1/9.

OUR LATEST ADDITION TO THE CHASSIS RANGE

A COMPLETE & WORKING 17" T.V. CHASSIS 24 GNS.

Latest chassis including 17in. tube, permanent magnet speaker, 13 channel Turret Tuner (any two selected channels fitted). Other channels supplied on request at 7/6 each. 13 valves. Chassis and valves guaranteed for three months. CRT for 12 months' full guarantee.
Sound I.F. 19.5 Mc/s. Vision 16 Mc/s. A.C. only.
Ready and working to fit into your own cabinet. Carr. & ins. 25/-.
As above with 14in. tube complete and working £19.19.0.



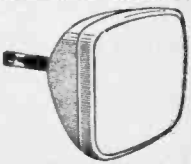
★ 17" T.V. 19 GNS.

CASH PRICE

FEATURES:

★Beautiful latest finish cabinet in contemporary style covered and washable.
★Polished legs 18in. optional extra for 25/-.
★17in. Rectangular Tube. Guaranteed fully for 12 months.
★12 channels "Turret Tuned"—ITV/BBC. (Extra coils at only 7/6 a pair with order.)

Chassis. 14 B.V.A. Valves. Salvaged but re-conditioned and guaranteed 3 months.
Carr. & ins. 30/-.
Due to overwhelming demands, some delay may occur. Please enquire when ordering.



REPLACEMENT

RE-BUILT T.V. TUBES

Cash price £8.10.0

OR YOURS for 8/6 initial payment (plus carr. & ins.) and 19 weekly payments of 8/6.

★ **12 months' full guarantee.**
All sizes except 10in. Completely re-built gun assembly, new cathode, heaters, etc., giving the high standard required for long picture life, quality and value. Carr. & ins. 15/6.

EXPRESS DESPATCH SERVICE

Please 'phone to confirm Tube in stock. Send Telegraph Money Order. Tube despatched Passenger Train same day. This service only available with remittance by a Telegraph Money Order and cash sales, not terms.

13 CHANNEL TURRET TUNER 65/-

Brand new. Well known manufacturer. 38 Mc/s. Complete with valves PCF80 and PCC84. .3 series line-up and channel coils covering channels 1, 2, 3, 4, 5, 8 & 9. Carr. & ins. 3/6.

SOLO SOLDERING TOOL 12/6

110 v., 6 v. or 12 v. (special adaptor for 200/250 v. 10/- extra). Automatic solder feed including a 20ft. reel of Ersin 60/40 solder and spare parts. It is a tool for electronic soldering or car wiring. Revolutionary in design. Instantly ready for use and cannot burn. In light metal case with full instructions for use. Post 3/6.

TRANSFORMERS

MAINS TRANSFORMER 5/9

Primary 200-250. Secondary 0-100-250. 150 mA. Suitable for small amplifier with .1 series valves. 2⅜ x 1⅝in. P. & P. 1/9.

OUTPUT TRANSFORMER & SMOOTHING CHOKE COMBINED 4/9

2⅜ x 1⅝in. Suitable for EL84s in single or push-pull output. P. & P. 1/9.

T.V. AERIALS 23/6

For all I.T.A. channels. Outdoor or loft. 3 elements. P. & P. 2/6.

AERIALS 15/6

B.B.C. indoor type. Folded dipole with 12ft. co-ax. cable fitted. Post 1/9.

T.V. AERIALS 7/9

For all channels. Complete with co-ax. cable. For use indoors or in the loft. Post 1/3.

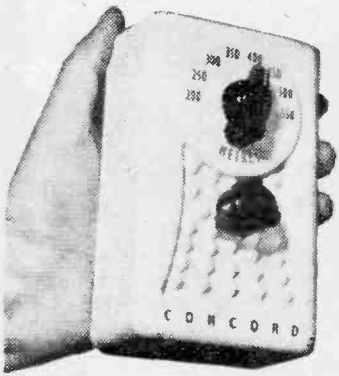
CO-AX CABLE 6d. yd

Cut to any length. Good quality. Post 1/6 on 20 yds.

CATALOGUES FREE

DUKE & CO.

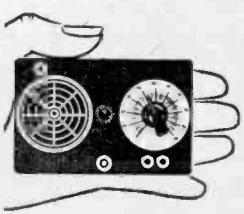
NEW! EASY-TO-BUILD AND



The new, exciting De Luxe "Gold Star" Pocket Radio in beautiful moulded plastic case—choice of four lovely colours, Red, Green, Blue and Pink. This model is a highly sensitive, self-contained set covering all medium waves. Uses modern miniature "button-base" valve and specially designed high efficiency coil. Exceptionally easy to build from our step-by-step plans—the case is supplied ready drilled! Size of radio only 4¼in. x 2¼in. x 1¼in. !—and batteries fit inside. We can supply all parts including case, detachable aerial, instruction book, screws, wire, etc., for only 48/- plus 2/- Post and Packing. C.O.D. 2/- extra. (Parts sold separately, priced parts list 1/9.)

Our engineers have designed a novel Wrist-Watch Radio using latest Transistor Techniques. Size only 1¼in. x 1in. x ¼in. ! ! !—"Feather-weight"—yet gives clear, crisp, personal-phone reception over all medium waves. Tiny battery inside lasts months—costs 5d. No Snags, anyone can build it in an hour or two using our pictorial step-by-step simple plans. All parts supplied (including case and strap) for only 29/6 (add 2/6 Post, etc.). C.O.D. 2/- extra. (All parts sold separately, priced parts list 1/6.) Send Now!

Choice of beautiful walnut veneered cabinet or ivory bakelite. This is the lowest possible price consistent with high quality. No radio knowledge whatever needed . . . can be built by anyone in 2-3 hours using our very simple, easy-to-follow diagrams. The terrific new circuit of the "Ocean-Hopper" covers all medium and long waves, has razor-edge selectivity and exceptionally good tone. Price also includes ready drilled and punched chassis, set of simple-to-follow plans—in fact everything! Parts tested before despatch! Uses standard octal-base valves. (Low running costs—approximately 18 watts.) Size 12in. x 6in. x 5in. Build this long-range powerful midget NOW. TOTAL BUILDING COST INCLUDING PLANS, ETC., £5/7/6. (Post and Packing 3/6.) Parts sold separately. Priced parts list and plans, 1/9. C.O.D. 2/- extra.



THIS TRANSISTOR SET Can Be Built For Only 29/6. The "Sky-Scout" Pocket two-stage transistor set, size only ¾in. x 3¼in. x 4¼in. Covers all medium waves and works entirely off tiny "penlight" battery which costs 6d. and fits inside case. All parts tested before despatch. Can be built for 29/6, plus 2/- Post and Packing. INCLUDING CASE, TRANSISTOR, STEP-BY-STEP PLANS FOR ABSOLUTE BEGINNERS, nuts, bolts, etc. (C.O.D. 2/- extra.) Parts sold separately, priced parts list and plans, 1/6. VERY SIMPLE TO BUILD.

This amazing "Tiny-Tim" model—no larger than a matchbox—costs nothing to run—ever! No batteries! No Valves! No electricity! Will *never* run down or burn out. Uses the latest TRANSISTOR TYPE GERMANIUM DIODE, receives local stations anywhere—without extra aerial. Clear, Crisp Tone. No snags, anyone can build it within an hour using our step-by-step instruction book, etc., for only 17/6, plus 1/6 Post and Packing (C.O.D. 2/- extra). (Parts sold separately, priced parts list 1/9.)

Learn Electricity by building a low cost Concord Model! Concord models include the latest electronic advances and are constantly being modernised by Concord's own research department. Concord designs are years ahead. Every latest advance finds its way into the educational and highly practical Concord Models. Special instruction books describe minutely every step in the assembly. Build, Learn from AND USE Concord Designs. TRADE ENQUIRIES INVITED. WE BULK PURCHASE ELECTRONIC COMPONENTS AND EQUIPMENT.

ADDRESS ON OPPOSITE PAGE →

Stern's "fidelity" TAPE EQUIPMENT

THE FINEST RANGE OF TAPE EQUIPMENT FOR THE HOME CONSTRUCTOR

A SELECTION OF HIGH FIDELITY PORTABLE TAPE PREAMPLIFIERS

Adds "Hi-Fi" TAPE RECORDING TO YOUR EXISTING AUDIO INSTALLATION

IN ALL MODELS WE INCORPORATE THE TYPE "C" PREAMPLIFIER

AND OFFER IT COMPLETE IN CASE WITH . . .

(a) The new COLLARO "STUDIO" 3 Speed Deck **£36.10.0**
Deposit. £7.6.0. 12 months £2.13.6.

(b) The COLLARO Mk. IV "Transcriptor" 3 Speed Deck **£41.10.0**
Deposit. £8.6.0. 12 months £3.0.11.

(c) The New TRUVOX Mk. VI. Tape Deck. **£43.10.0**
Deposit. £8.14.0. 12 months £3.3.10.

(d) The BRENELL Mk. V 3 Speed Deck **£51.10.0**
Deposit £10.6.0. 12 months £3.15.7.

(e) The WEARITE MODEL 4A. Tape Deck **£61.0.0**
Deposit. £12.4.0. 12 months £4.9.5.

STERN'S MULLARD TYPE "C" TAPE PREAMPLIFIER-ERASE UNIT

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

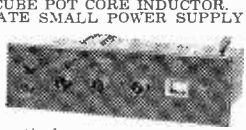
PRICES.....INCLUDING SEPARATE SMALL POWER SUPPLY

COMPLETE KIT OF PARTS..... **£14.0.0**

ASSEMBLED AND TESTED..... **£17.0.0**

Deposit £3.8.0 and 12 months of £1.4.11.

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



(Carriage and Insurance is 5/- extra).

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

FOR PERMANENT HIGH QUALITY INSTALLATIONS WE ALSO OFFER (excluding case)

(a) The COLLARO Mk. IV TAPE DECK and the MULLARD TYPE "C" PREAMPLIFIER & Power Unit assembled, tested **£35.0.0**
H.P. Deposit £7 and 12 months £2.11.4.

(b) As in (a) above but the Type "C" supplied as COMPLETE KIT OF PARTS **£32.0.0**

(c) The TRUVOX Mk. VI TAPE DECK and the assembled Type "C" Preamplifier and Power Unit **£40.0.0**
H.P. Deposit £8.0.0 and 12 months £2.18.3.

(d) As above but the Type "C" supplied as complete KIT OF PARTS **£36.10.0**

(e) The BRENELL Mk. V DECK and the assembled Type "C" PREAMPLIFIER and POWER UNIT... **£46.0.0**
H.P. Deposit £9.4.0 and 12 months £3.7.6.

(f) As above but the Type "C" supplied as complete KIT OF PARTS **£43.0.0**

(g) The WEARITE 4A DECK with TYPE "C" assembled and tested **£56.0.0**
H.P. Deposit. £11.4.0 and 12 months £4.2.1

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

PLEASE ENCLOSE S.A.E. WITH ALL CORRESPONDENCE.

STERN RADIO LTD.
109 & 115 FLEET ST., LONDON, E.C.4
Telephone: FLEET STREET 5812/3/4

YOU CAN BUILD A COMPLETE HIGH QUALITY RECORDER ◀ LIKE THIS for £39.15.0

WE OFFER THIS SELECTION

(a) The COLLARO Mk. IV TAPE DECK with the assembled and tested HF/TR3 Amplifier **£34.10.0**
H.P. Deposit £6.18.0 and 12 months £2.10.8

(b) As above but the HF/TR3 supplied as KIT OF PARTS **£30.15.0**
NOTE: Messrs. Collaro when supplying the Mk. IV Deck do not wire up the Deck Switch backs. We will do this for £1 or supply a wiring diagram to the Home constructor

(c) The TRUVOX Mk. VI TAPE DECK with the assembled and tested HF/TR3 amplifier **£39.10.0**
H.P. Deposit £7.18.0 and 12 months £2.17.11.

(d) As above but the HF/TR3 supplied as KIT OF PARTS **£36.0.0**

(e) The BRENELL Mk. V DECK with the assembled and tested HF/TR3 amplifier..... **£45.0.0**
H.P. Deposit £9 and 12 months £3.6.0.

(f) As above but the HF/TR3 supplied as KIT OF PARTS **£41.10.0**

(g) The PORTABLE CASE illustrated here (£5). 1,200ft. EMITAPE (35/-). ACOS CRYSTAL MIKE (35/-). ROLA 10 x 6in. LOUDSPEAKER (30/-) ALL FOR **£9.0.0**

Carriage and Insurance on each above 10/- extra.

WE HAVE THE NEW 2 SPEED TWIN TRACK TRUVOX Mk VI TAPE DECK IN STOCK £26.5.0

DEPOSIT: £5.5.0 and 12 MONTHS: £1.18.6

THE MODEL HF/TR3 TAPE AMPLIFIER

INCORPORATING

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

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

PRICE FULLY ASSEMBLED & TESTED **£16.10.0**

HIRE PURCHASE. Deposit £3.6.6 and 12 monthly payments of £1.4.2. A very high-quality Amplifier based on the very successful TYPE "A" design completed in the MULLARD LABORATORIES. ONLY NEW HIGH-GRADE COMPONENTS are incorporated including MULLARD VALVES and a GILSON OUTPUT TRANSFORMER . . . other features are—Magic Eye Recording hand indicator—Effective Tone Control—Monitoring and Extension Speaker Sockets—Has own Power Supply and can be used as independent Amplifier for direct reproduction of Gram Records or from Radio Tuner. Overall size 11in. x 6in. x 6in. Can be supplied for use with Truvox—Collaro—Lane—Brenell or Motok Decks. Please specify which. Send S.A.E. for leaflet or 2/6 for complete Assembly Manual.

The New B.S.R. "MONARDECK"

INCORPORATING A CORRECTLY MATCHED PREAMPLIFIER

Deposit £3.12.0 **£17.17.0**
12 months £1.6.2.

Designed to operate through the Pick-Up Sockets of the standard RADIO RECEIVER through which first-class results are obtained. It consists of a single-speed Twin Track Tape Deck, incorporating matched Pre-amplifier, and operates at 3¾in. sec. speed. Carr. & ins. 10/-

The equipment is supplied fully tested and completely assembled on attractive wood plinth. It can therefore be "dropped" directly into an existing Cabinet and only requires connections to the mains supply and the Pick-Up Sockets, for which purposes "floating" leads are incorporated on the Preamplifier.

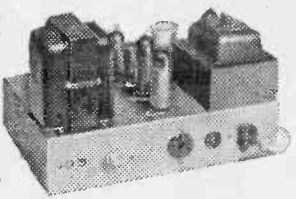
MULLARD DESIGNS

Still by far the finest value

Designed by MULLARD—presented by STERNS strictly to specification.

COMPLETE KIT OF PARTS—

MULLARD "5-10" MAIN AMPLIFIER



For use with the MULLARD 2-stage pre-amplifier (described below) with which an undistorted power output of up to 10 watts is obtained. This combination is thoroughly recommended to "Hi-Fi" enthusiasts who contemplate a versatile and very high quality home installation. We supply **SPECIFIED COMPONENTS AND NEW MULLARD VALVES**, including **PARMEKO MAINS TRANSFORMER** (which has extra Power available to drive Radio Tuner) and the choice of the latest Ultra-Linear **PARMEKO** or the **PARTRIDGE** Output Transformer.
PRICE COMPLETE KIT (PARMEKO Output Trans) **£10.0.0** Alternatively we supply **ASSEMBLED** and **TESTED**, £11.10.0.
ABOVE INCORPORATING PARTRIDGE OUTPUT TRANSFORMER, £1.6.0 EXTRA.

MULLARD'S PRE-AMPLIFIER TONE CONTROL UNIT

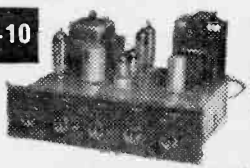
Employing two EF86 valves, and designed to operate with the MULLARD 3-3 and 5-10 **MAIN AMPLIFIERS**, but also perfectly suitable for other makes.
PRICE, COMPLETE KIT OF PARTS. **£6.6.0** Alternatively we supply ASSEMBLED AND TESTED **£8.0.0** (Carriage & Insurance, 5/- extra.)
Our kit is strictly to **MULLARD'S SPECIFICATION** and incorporates :

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

SPECIAL PRICE REDUCTIONS

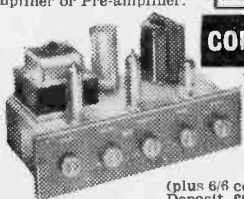
(a) The **COMPLETE KIT OF PARTS** to build both the "3-3" **MAIN AMPLIFIER** and the **2-STAGE PRE-AMPLIFIER-CONTROL UNIT** **£12.10.0**
(b) The **COMPLETE KIT OF PARTS** to build the "5-10" **MAIN AMPLIFIER** and the **2-STAGE PRE-AMPLIFIER-CONTROL UNIT** **£15.15.0**
(a) The "3-3" and the **2-STAGE PRE-AMPLIFIER** both **ASSEMBLED** and **TESTED** **£15.0.0**
H.P.: **DEPOSIT** £3.0.0 and 12 Monthly Payments of £1.2.0.
(b) The "5-10" and the **2-STAGE PRE-AMPLIFIER** both **ASSEMBLED** and **TESTED** **£18.18.0**
H.P.: **DEPOSIT** £3.18.0 and 12 Monthly Payments of £1.7.8. When ordering include an extra 7/6 to cover Carriage and Insurance.
PRICES FOR THE "5-10" ARE SUBJECT TO £1.6.0 EXTRA IF THE PARTRIDGE TRANSFORMER IS REQUIRED.

COMPLETE MULLARD 5-10



The popular and very successful complete "5-10" incorporating Control Unit providing up to 10 watts high quality reproduction. Input channels for high output pick-ups and all modern Radio Tuning Units only Specified Components and new **MULLARD VALVES** are supplied, including **PARMEKO MAINS TRANSFORMER** and choice of the latest **PARMEKO** or **PARTRIDGE** ULTRA-Linear Output Transformers. **£11.10.0**
Adequate power available to drive Radio Tuner. **£13.10.0**
Alternatively we supply ASSEMBLED and TESTED
HIRE PURCHASE (Assembled Amp. only) DEPOSIT : £2.14.0. 12 MONTHS : 19/10.
ABOVE incorporating PARTRIDGE OUTPUT TRANS., £1.6.0 extra.

COMPLETE MULLARD 3-3

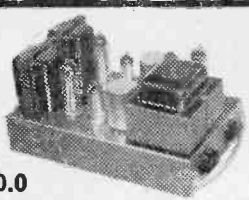


THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION
COMPLETE KIT OF PARTS **£7.10.0**
Alternatively supplied ASSEMBLED and FULLY TESTED **£8.19.6**
(plus 6/6 coverage and insurance) H.P. Terms : Deposit £2.0.0 and 8 Months at £1.0.0. Developed from the very popular 3-valve 3-watt design. Complete to MULLARD'S SPECIFICATION including Mullard valves and a **PARMEKO OUTPUT TRANSFORMER.**

Only new **HIGH GRADE** Specified Components and **MULLARD VALVES** are supplied.

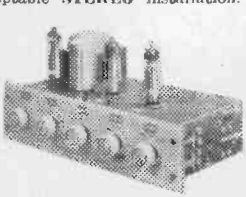
MULLARD—STERN STEREO DESIGNS

DUAL "3-3" MAIN AMPLIFIER



Comprises two "3-3" **MAIN AMPLIFIERS** (described above) on one chassis and is designed to operate with our **DUAL CHANNEL PRE-AMPLIFIER** for both **STEREOPHONIC** or **MONAURAL** operation.
PRICE: COMPLETE KIT OF PARTS **£10.0.0**
Alternatively ASSEMBLED AND TESTED **£11.15.0** H.P. Terms: Deposit £2-7-0 & 12 months at 17/4. Its output power is 6 watts (3 watts per channel) and together with our **PRE-AMPLIFIER** provides a very acceptable **STEREO** installation.

COMPLETE STEREO AMPLIFIER



A thoroughly recommended design that very effectively meets the many requests for a low-priced but good quality **DUAL CHANNEL STEREOPHONIC AMPLIFIER.**
PRICE: COMPLETE KIT OF PARTS..... **£8.10.0**
ALTERNATIVELY ASSEMBLED AND TESTED **£10.10.0**
Two **MULLARD ECL82** Triode Pentode Valves are incorporated in the design; they form a "CLASS A" single-ended output stage in each channel. The input sensitivity is 300 m/volts, therefore when used with most **STEREO** Crystal Pick-Ups, or Radio Tuning Units, an output of 2 watts per channel is achieved, or similarly when switched to **MONAURAL** Pick-Up position a combined output of 4 watts is produced.

DUAL CHANNEL PRE-AMPLIFIER

This model incorporates two 2-valve Pre-Amplifiers (described above) combined into a Single Unit, enabling it to be used for both **STEREOPHONIC** or **MONAURAL** operation. It is designed primarily to operate with our range of **MULLARD MAIN AMPLIFIERS** but will also operate equally well with any make of Amplifiers requiring an input of 250 m/volts.
COMPLETE KIT OF PARTS **£12.10.0** ASSEMBLED AND TESTED **£15.0.0**
It will operate equally well for **MONAURAL** only operation with one "3/3" or one "5/10" Main Amplifier to which the second Main Amplifier can at any time be added, thus very easily providing for both **STEREO** or **MONAURAL** reproduction.
Recommended combinations for **STEREO** operation :
(a) The **DUAL CHANNEL PRE-AMPLIFIER** together with the Dual "3/3" **MAIN AMPLIFIER.**
(b) The **DUAL CHANNEL PRE-AMPLIFIER** together with two "5/10" **MAIN AMPLIFIERS.**
THE ASSEMBLY MANUAL is available for 2/6.

Please enclose S.A.E. if ILLUSTRATED and DESCRIPTIVE LEAFLETS are required . . . alternatively the COMPLETE ASSEMBLY MANUALS are available at 1/6 each.

STERN RADIO LTD.

Stern's "fidelity" TAPE RECORDERS

BEFORE YOU BUY—HEAR THESE RECORDERS THEY ARE COMPARABLE TO THE MUCH HIGHER PRICED MODELS

MODEL CR3/S. Incorporates the New COLLARO "STUDIO" TWIN TRACK 3-Speed Deck **£41.0.0**
H.P. Terms: Deposit £8.4.0 and 12 months of £3.0.2.

MODEL CR3/T. Incorporates the very popular 3-Speed COLLARO Mk. IV "TRANSCRIPTOR" Deck which has both upper and lower tape tracks..... **£49.10.0**
H.P. Terms: Deposit £9.18.0 and 12 months of £3.12.7.

MODEL TR3/Mk. VI. Incorporates the New TRUVOX Mk. VI TWIN-TRACK 2-Speed Tape Deck **£49.10.0**
H.P. Terms: Deposit £9.18.0 and 12 months of £3.12.7.

Each Model incorporates the highly successful HF TR3 Amplifier (described opposite) thus ensuring truly "Hi-Fi" record and playback facilities.

All prices quoted provide for the COMPLETE RECORDER including CRYSTAL MICROPHONE and 1,200 ft. Spool of Tape.

There are no better value for money Tape Recorders on the market—if you can't call and hear them, send S.A.E. for fully descriptive leaflets.

"MODERNISE YOUR OLD RADIOGRAM"

IT IS CHEAPER AND BETTER VALUE TO REPLACE YOUR OLD CHASSIS AND GRAM UNIT

!! RADIOGRAM CHASSIS !!

ARMSTRONG "STEREO TWELVE"..... £37.16.0
The most complete AM FM unit yet produced for Stereo, giving 6 watts high-fidelity push-pull output on each channel, 12 watts for monaural.

ARMSTRONG "JUBILEE"..... £29.8.0
An AM/FM chassis with nine valves and with push-pull output stage providing 6 watts.

ARMSTRONG AM/FM "STEREO 44"..... £28.7.0
Provision is made for Stereo and monaural playback from pick-up or tape. Outputs provided for Stereo or Monaural tape recordings.

RADIO TUNING UNITS

DULCI MODEL FMT/2..... £19.17.6
A complete self-powered F.M. Tuner incorporating automatic frequency control.

ARMSTRONG "S.T.3" AM/FM UNITS..... £27.6.0
A self-powered high-fidelity Tuner covering full VHF, medium, and long wavebands with automatic frequency control on VHF.

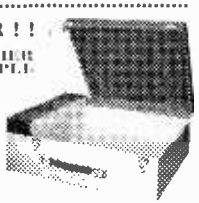
DULCI "H4/T" AM/FM UNIT £23.15.8
A 4 waveband self-powered high-fidelity tuner covering the VHF.FM transmissions plus the long, medium and short wavebands.

NEW HIRE PURCHASE TERMS are available on all above. Illustrated leaflets available—send S.A.E.

THE DULCI DUAL CHANNEL STEREO PREAMPLIFIERS

THE "STEREO EIGHT" PREAMPLIFIER £23.2.0
THE "STEREO TWO" PREAMPLIFIER..... £9.9.0
(Carr. and Ins. 5/- extra.)

A 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.)

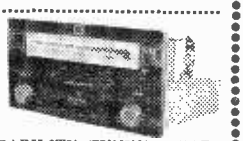
The Amplifier consists of a 2-stage design incorporating 3 modern B.V.A. valves and has separate BASS and TREBLE CONTROLS. The Portable Case will also accommodate almost any make of Autochanger and is attractively finished in Mushroom Grey Rexine.

WE ALSO SUPPLY SEPARATELY—

(a) The 2-stage (plus Rectifier) **AMPLIFIER** **£4.2.6** (b) The **PORTABLE CARRYING CASE** **£3.17.6**

(c) **P.M. SPEAKER** **18/9** Carriage and Insurance 4 - extra

STERN'S MK. II *"fidelity"* F.M. TUNING UNIT



PRICE £14.5.0 (Plus 5/- Carr. and Ins.)

HIRE PURCHASE: Deposit £2.17.6 and 12 Monthly Payments of £1.0.11.

Incorporates the latest MULLARD PERMEABILITY TUNING HEART and the corresponding MULLARD VALVE LINE-UP. A really first-class Tuner, very attractively presented and comparable to many offered at much higher prices. Power consumption is only 1 5 amps. at 6.3 volts and 25 m.a at 250 volts.

HOME CONSTRUCTORS! YOU CAN BUILD THIS TUNING UNIT FOR ONLY £10.10.0 (Plus 5 - Carr. & Ins.) Please send S.A.E. for fully descriptive leaflet, or the Assembly Manual is available for 1 6.

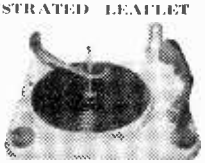
109 & 115 FLEET ST., LONDON, E.C.4
Telephone: FLEET STREET 5812/3/4

!! RECORD PLAYERS !!

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

SEND S.A.E. FOR ILLUSTRATED LEAFLET

B.S.R. MONARCH UA8 4-speed mixer Autochanger with Crystal Pick-up **£6.12.6**



The **NEW COLLARO MODEL RP594** 4-speed Single Record Player. Studio Cartridge **£9.18.9**

The **COLLARO "CONQUEST"** 4-speed Autochanger, Studio Pick-up **£7.10.0**

The latest **COLLARO "CONTINENTAL"** 4-speed MIXER Autochanger Studio "O" Pick-up **£8.10.0**

The **COLLARO** 4-speed Single Record Player, Studio Pick-up..... **£6.6.0**

THE NEW B.S.R. Model UA12 is in Stock. A 4" SPEED" MIXER AUTOCHANGER **£8.7.6**

UA12 also available incorporating the **B.S.R. STEREO** Pick-up, plays L.P. and 78 Records **£10.10.0**

B.S.R. MODEL TU9 4-speed Single Record Player, complete with separate Crystal Pick-up **£4.4.0**

Carriage and Insurance on each above 5 - extra.

HIGH-FIDELITY UNITS ARE ALSO IN STOCK . . . *as follows:*

GARRARD MODEL 301 . . . 4HF . . TA Mk.II . . . RC98 . . . RC121 4 . . . T.P.A.12 PICK-UP . . . etc.
Send S.A.E. For Leaflet.

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

SPECIAL CASH ONLY BARGAIN

A* bulk purchase enables us to offer this very useful

INTERCOM SET OR BABY ALARM *for only* **£5.5.0**
(Plus 5 - carriage & Insurance.)

Consists of MASTER UNIT (Illustrated) and one EXTENSION, providing 2-way TALK-LISTEN facility. Complete in polished wood cases, size of each only 7¼ x 4¼ x 6in. high.

HOME CONSTRUCTOR

A RANGE OF "EASY TO ASSEMBLE" PREFABRICATED CABINETS

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

Band III Converters

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

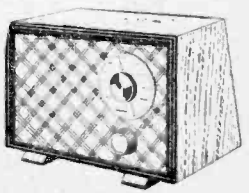
Please send two more kits, the one you sent last week is performing magnificently. We receive this sort of letter every day of the week, so if you have hesitated because you thought our kits too cheap you need hesitate no longer.

A.C./D.C. Multimeter Kit

Ranges: D.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. A.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. D.C. milliamps 0-5, 0-100, 0-500. Ohms 0-50,000 with internal batteries. 0-500,000 with external batteries. Measures A.C./D.C. volts, D.C. current and ohms. All the essential parts including metal case, 2in. moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions, price 19/6, plus 2/6 post and insurance.

1960 All Mains Amplifier

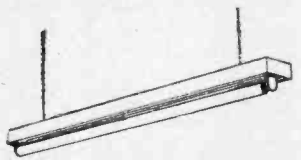
Undoubtedly finest value obtainable in amplifiers—powerful three valve circuit ideal for dances, parties, etc. Complete with valves, mains transformers, volume and tone controls, but less chassis, speaker and cabinet. Price only 29/6, plus 2/6 post and ins. Data free with parts or available separately 1/6.



New Improved Circuit for the 1960 Skysearcher

This is a three valve receiver kit using modern circuitry. Ideal as a second set for the bedroom, workshop, etc. All parts including mains transformer, valves, resistors, coils, etc., but not cabinet, chassis or speaker, 29/6, plus post and ins. 3/6. Data free with parts or available separately 1/6.

Inductor Fluorescents



These represent today's best value in lighting. All models are complete with polyester filled chokes (so far as we know not available in any other low priced fittings), all are made from heavy gauge sheet steel stove enamelled white, all use canister type plug-in starters, and all are fitted with interference suppressors. Guaranteed for two years.

Inductor 80 for 5ft. 80 watt lamp, 39/6 plus 5/- carriage and insurance.

Inductor 40 for 4ft. 40 watt lamp, 32/6 plus 4/6 carriage and insurance.

The Three Forty for 3ft. 40 watt lamp, 31/6 plus 3/6 carriage and insurance.

Inductor 20 for 2ft. 20 watt lamp, 29/6 plus 3/6 carriage and insurance.

Circle Light for 40 watt circular lamp, 49/6 plus 3/- carriage and insurance.

Note: Prices do not include tube but these are the latest bi-pin type easily obtainable from your local electrical shop or if you wish direct from us.

SPECIAL OFFERS:

Inductor 40 complete with tube ready to work, 39/6 plus 5/6 carriage and insurance.

Three Forty complete with tube ready to work, 39/6 plus 4/6 carriage and insurance.

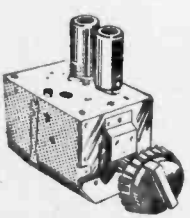
The Dulci F.M.T/2 Hi-Fidelity F.M. Tuner

The Tuner which includes every feature and refinement for perfect reception, reliability and simplicity of operation. An exclusive feature **Automatic frequency control** makes this the finest tuner available. Uses 7 valves and metal rectifier, has its own internal power supply and sockets for audio output and aerial input. Limiting on two stages provides constant output free from interference and is therefore ideal for tape recording. Engraved copper bronze facia and modern styling completes a perfect tuner. Size approx: 2½in. x 3½in. x 9½in. Highly suitable for working with DPA10 amplifier. Price **£19.17.6**. H.P. terms and full technical specification on request.

Unique Opportunity to build Fine Transistor Set

Constructor's parcel: to build Pocket 6 Transistor Set as currently being sold at £17.17.0. Parcel comprises motifed, two-tone cabinet as illustrated, tuning dial, two gang tuning condenser, combined bakelite chassis/printed circuit and easy-to-follow circuit. Costing value 57/6—offered while supplies last at only 29/6, plus 2/6 post. Suitable for your own circuit or to build original circuit. All parts available at highly competitive prices. Do not miss this tremendous bargain.

12-Channel Turret Tuner



Ideal for converting an old or building into new T.V. These are brand new stock, not surplus, supplied complete with valves and coils for local Band I and Band III stations.

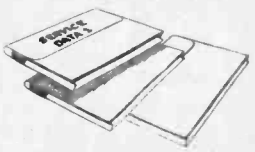
Model 1. I.F. Output 33 38 Mcs series heaters (parallel heaters, 5/- extra).

Model 2. I.F. Output 16 19 Mcs parallel heaters (series heaters, 5/- extra). With instructions and circuit diagram. 79/6, knobs 3/6 extra. Postage and insurance 2/6.

FOR ADDRESS SEE NEXT PAGE

BEGINNER'S SUPERHET

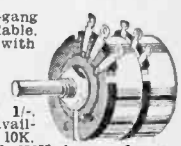
All the components including valves, metal rectifier, coils, tuning condenser, etc., required to build the "Beginner's Superhet" as described in the January, 1958, issue, are available as a parcel. Price £3 plus 3/- post and insurance.



Service Data

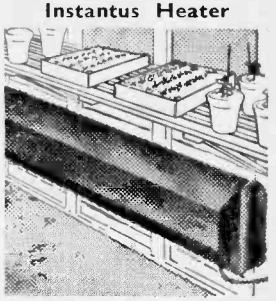
100 service sheets, covering British receivers which have been sold in big quantities and which every service engineer is ultimately bound to meet. The following makers are included: Aerodyne, Alba, Bush, Cossor, Ekco, Ever-Ready, Ferguson, Ferranti, G.E.C., H.M.V., Koister-Brandes, Lissen, McMichael, Marconi, Mullard, Murphy Philco, Philips, Pye, Ultra. Undoubtedly a mine of information invaluable to all who earn their living from radio servicing. Price £1 for the complete folder.

Morganite Potentiometers



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

Instantus Heater



Convector heater. Made from heavy gauge sheet steel (galvanised). For greenhouse, workshop, aviary, etc. 500 watt, £1.12.6: 1,000 watt, £2.10.0. 1,000 watt with wired but separate thermostat, £3.17.6. 2K watt free standing or wall mounting, £3.19.6: 2K watt with built-in thermostat, £4.19.6. Carriage and insurance 5/- per heater. ALL ARE GUARANTEED FOR 5 YEARS.

Avo Prodclips

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

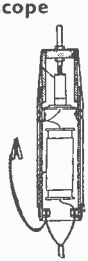
Thermostats

Useful for the control of appliances such as convectors, gluepots, vulcanisers, hot plates, etc. Adjustable to operate over temperature range 50-550 deg. F., fitted with heavy silver contacts, 8/6. Other types : 1½ amp., 3/6 ; 5 amp., 8/6 ; 2 amp. QMB. 5/6 ; 15 amp. QMB. 15 - ; 15 amp., encased wall mounting type, 29/6.

Yaxley Switches

1 Pole 3 way	...	...	...	1/6
1 Pole 5 way	...	...	...	2/-
1 Pole 11 way	...	...	...	2/6
2 Pole 2 way ceramic		...	...	2/6
2 Pole 4 way	...	...	...	2/-
2 Pole 6 way	...	...	...	2/6
2 Pole 8 way	...	...	...	3/6
2 Pole 11 way	...	...	...	3/6
2 Pole 12 way	...	...	...	4/6
3 Pole 3 way	...	...	...	1/6
3 Pole 6 way	...	...	...	3/6
4 Pole 4 way	...	...	...	3/-
6 Position shorting		...	...	2/-
6 Pole 3 way	...	...	...	2 6
6 Pole 3 way ceramic		...	...	3/6
8 Pole 2 way	...	...	...	2 -
9 Pole 3 way	...	...	...	2 6
12 Pole 2 way	...	...	...	2 -

Radio Stethoscope



This can be slipped into the pocket rather like a fountain pen. With it in most districts a receiver can be checked from the grid of the first valve right through to the output without a signal generator, the stethoscope will operate in both L.F. and R.F. circuits without alteration. It is a complete fault-finder.
All the necessary parts to make this tracer 9 6. post 1 -.

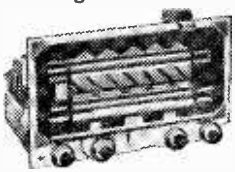
Crystal Mike by Acos

Model 39 1 this is ideal for tape or general amplifiers complete with screened lead 39/6, plus 1 - post, desk stand 2.6.

Special This Month

Battery Charger Rectifier. Selenium 12-15 v., 5 amp., 9/6.
Blank Metal Chassis. All 2½in. deep from 18 gauge aluminium. Sizes : 6in. x 2in., 4.6 ; 7½in. x 5in., 6 - ; 13½in x 9in., 10in. x 7½in., 7 - ; 11½in. x 7½in., 8/-.
Metal Chassis. Punched for Mullard 510 Amplifier, complete with inner screening sections and stove enamelled, 6/6 set.
Geiger Counter Tubes. 20th Century type. Type No. G21, with circuit of geiger counter, 29/6.
Twin Twisted Lighting Flex. Equivalent 14/36, rubber insulated, cotton covered, 17/6 per 100-yard coil.
Heavy Duty Test Prods. Red and black with plug-in lead attachments, 8/6.
Filament Transformer. 6.3 v., 1½ amps., 6/6.

Dulci AM/FM Radiogram Chassis



Chassis Model H.3. This has three wavebands. F.M. 87-101 Mc/s, Medium Wave 187-540 metres and Long Wave 1,000-2,000 metres, uses 7 of the latest miniature valves and built-in ferrite aerial. "Why not modernise your Radiogram, get the best from modern records with this hi-fi 4 watt output chassis?" Price. £19.17.6 or £2 down and 20 fortnightly payments of £1.0.6. Hi-Fi Model H4 PP. £27.16.6 or £2.16.6 down and 26 fortnightly payments of £1.2.0. (Note : Hire-purchase figures include insurance for 12 months.)

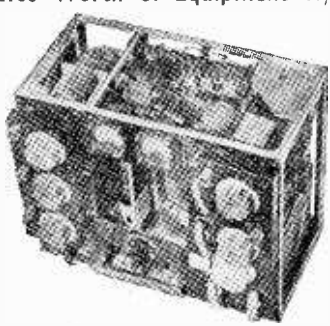
Six Useful Articles

Our 1960 catalogue now ready gives constructional hints and circuits for the following items :
Moisture operated switch.
Simple but clever signal tracer.
Versatile power pack costing only 10 -.
Instantaneous heater for workshop or den.
Six transistor pocket superhet.
Photo-flood controller.
Send for this catalogue to-day, price 2 6 refundable from purchases.

Components Would Cost More

Car Battery Charger—ready-made high output battery charger in stove enamelled sheet steel louvred case. New, complete and ready to work. Rated at 12 v 4 amps. and variable rate selector for trickle charging. also a meter to show charging rate. Suitable for 230/250 A.C. mains. Special snip price of 55 -, plus 3/6 post and insurance.

£100 Worth of Equipment 19/6



The famous R1154—unused but slightly soiled. Covers 200-500 kc/s. 3-5.5 Mc/s and 5.5-10 Mc's. Has unique "click stop" mechanism. Wonderful breakdown value—meters, relays, switches. Complete with valves —real bargain at 19/6, plus 10/- carriage.

Dulci DPA10 Amplifier

Made by the Dulci Company. It is laboratory designed, and is of the highest fidelity, has superb reproduction and complete freedom from hum, high output sensitivity. 10-watt output and ample feedback all combined to give a truly linear output. Uses all-glass miniature valves, including two EL84s in push-pull. Price £12.12.0 or 25/- down and 26 fortnightly payments of 10/-. Carr. & Ins. 6/6.

Special This Month

Moving Coil Meters :

0—500 microamp. 2in. flush	...	17 6
250-0-250 microamp, 2½in. surface		27/6
750 microamp. 2½in. surface	...	17 6
5-0-5 microamp. 2½in. flush	...	17/6
0-30 milliamp. 2½in. flush	...	17 6
0-100 milliamp. 2½in. flush	...	15 -
0-300 milliamp. 2½in. flush	...	15 -
0-500 milliamp. 2½in. flush	...	15 -
0-1 milliamp. 2½in. flush	...	25 -

Luminous Switch. Double pole designed for electric blankets, neon indicators glow when appliance is switched on. 10 -.
Unbreakable Mains Lead. Type of lead fitted to electric razors makes fine lead for test meters and any other devices where subject to continuous bending. Twin figure eight construction, soft cream p.v.c. covered. Normally costs 2 - per yard. Three 6ft. leads for 2.-.
Metal Rectifier. Equivalent RM5. 12/6.
Metal Rectifier. 60 80 mA 250 300 v., 4/6.
Output Transformer. Standard Pentode. 4/6. Multi ratio. 6/6.
Bi-metal Strip. with heavy duty contact. ideal for thermostat, fire, lamp, etc., etc., 2 6.
Neon Lamp. Midget wire ended. ideal mains tester, etc., 2 -, ex. gov. 1 6.
Philips Trimmers. 0-30pF, 1 - each. 9 - doz.
Set of 8 Allen Keys. 3/6.
Install those extra Points. 3.029 twin flat T.R.S. cable. Big purchase enables us to sell this at 45 - per 100 yds., carriage 3/6.
Low Resistance Head Phones. Ideal crystal sets, etc., 7 6. plus 2 6.
Goodmans Multi Ratio Output Transformer. 6 watt, 8 ratios, from 12-1 to 72-1. Centre tapped for push pull, 7/6 plus 1 -.
Ditto unbranded. 6/6. post 1'-.
Cold Cathode Valve CV413. Voltage regulator or trigger switch—unused but ex-equipment. 2 - each.
Tag Panels. Ideal for constructors, experimental circuits, etc., 3 of each of 12 different types, 5 -, post 1 6.
Slydlok Panel Mounting Fuses with carrier, 5 amp. 2 - each, 15 amp. 2/6 each.
Belling Lee 2BA fully insulated terminals for mounting through metal panels 2'- each.
Terminal Heads, insulated 4BA, 2 - doz.
.1 mFd. 350 v. Small tubular metal cased condensers made by Dubilier. 2 6 doz.
50 Assorted Resistors. Well mixed and useful values ¼ and ½ watt, 5 - for 50.
Ditto, but 1 watt. 6 6 for 50.
Mains Transformer. Standard 230 v., input 250-0-250 at 80 mA., 6.3 v. at 5 A., 12 6.
Toggle Switch. Standard metal body type with round dolly, fixing ring and on/off indicating plate. 1/3 each or 12 - doz.
Screened Cable. Rubber covered, flexible with metal braiding, ideal for microphone or gramophone extensions. 4d. per yd., 30'- per 100 yds.

Miniature Microphone

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

All items advertised can be obtained from the following Companies.
If ordering by post, address your order to the Company nearest to you and please include postage.

Electronics (Ruislip) Ltd.
42-46, Windmill Hill, Ruislip, Middx.
Phone : RUISLIP 5780.
Half day Wednesday.

Electronics (Croydon) Ltd.
266, London Road, Croydon.
Phone : CRO 6558.
Half day Wednesday.

Electronics (Finsbury Park) Ltd.
29, Stroud Green Rd., Finsbury Park, N.4.
Phone : ARChway 1049.
Half day Thursday.

Electronics (Manor Park) Ltd.
520, High St. North, Manor Park, E.12.

RETURN-OF-POST SERVICE

NEW ILLUSTRATED LISTS

New illustrated lists are available on all the following. Any will be sent free upon request.

GRAMOPHONE EQUIPMENT. Details of many types of Auto Changers, Single Record Players and Transcription Units including all the latest models. Many at special prices.

TEST GEAR. Test meters, Signal Generators, etc., by AVO, Jason, Pullin and Taylor.

LOUDSPEAKERS. Full details of Goodmans, Whiteley, Wharfedale and Elac types.

TAPE DECKS. All popular makes with a special offer.

RECORDING TAPES. A very wide range of all tapes and accessories.

LATEST AVO TEST METERS

AVOMETER MODEL 8. The finest multi-range meter available. 20,000 ohms per volt on D.C. ranges. Eight D.C. Voltage ranges 2.5 v. to 2,500 v. Seven D.C. current ranges 50 micro-amps. to 10 amps. Seven A.C. Voltage ranges 2.5 v. to 2,500 v. Four current ranges 100 mA. to 10 amps. Three resistance ranges. Fully detailed leaflet available. Price £23.10.0. H.P. Deposit £4.14.0 and 12 monthly payments of £1.14.6. Price with leather carrying case, £27.8.0. H.P. Deposit £5.8.0 and 12 payments of £2.0.4.

Other AVO Meters available include the Model 7, £19.10.0. H.P. Deposit £3.18.0 and 12 payments of £1.8.8 and the Multiminor price £9.10.0. H.P. Deposit £1.18.0 and 12 monthly payments of 14/4.

CRYSTAL DIODES

Brimar. GD3, GD4, GD5, GD6, GD8. 7/6.
G.E.C. GEX34, GEX35. 4/-. Surplus type, 1/3.
Mullard. OA79, OA81. 4/-.

TRANSISTORS

All at the new reduced prices.
AUDIO. B.T.H. Red Spot. 7/6. G.E.C. Yellow/Green. 7/6.
BRIMAR. TS1. 10/-. TS2. 21/-. TS3. 13/6.
EDISWAN. XB102. 10/-. XB104. 10/-.
MULLARD. OC70. 14/-. OC71. 14/-.
GOLDTOP. V10/15A. 15/-.
AUDIO OUTPUT. Matched Pairs. Mullard OC72. 34/-. Ediswan XC101. 32/-.
RF. G.E.C. Yellow/Red. 15/-.
EDISWAN. XA101. 23/-. XA102. 26/-. XA103. 15/-. XA104. 18/-.
MULLARD. OC44. 26/-. OC45. 23/-.
All transistors post free.

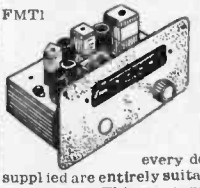
TRANSISTORISE YOUR CRYSTAL SET

A kit to construct a single transistor amplifier for any Crystal Set. Increases the volume many times. No soldering required and full instructions supplied. Complete kit with brand new Transistor, 21/6. Post free.

VALVES

All available types by Mullard, Brimar, Mazda, G.E.C., Osram, Cossor or Emitron can be supplied. Many types have been recently reduced in price. Any type sent C.O.D. or quotation given as you prefer.

JASON FM TUNER



FMT1

There are no less than five different Jason FM Tuner Kits now available to the Home Constructor. Brief details are given here and individual lists on any are available free.

MOST IMPORTANT. We take great pains to see that the kits we supply are *absolutely complete* in every detail and also that all components supplied are entirely suitable in every way. This accounts for differences in price you may notice between our prices and those of some of our competitors. THIS SHOULD BE BORNE IN MIND WHEN COMPARING PRICES.
Hire Purchase Terms available.

FMT2 & 3

STANDARD TUNERS

STANDARD TUNER. FMT1. The very popular tuner which is supplied with a chassis assembly fitted with a gold hammer finish front panel and glass dial. Employs four EF91 valves. External power supply is required. Complete kit **£6.19.6**
Power pack kit, 39/-.
STANDARD TUNER IN SHELF MOUNTING CASE. FMT2. This is a new version of the above tuner. The circuit has been brought up to date and is built into the very attractive shelf mounting case of the new Fringe Tuner mentioned below. The circuit uses four EF80 valves and the power supply can be built into the case if desired. Complete Kit **£7.17.6** without power supply components. £9.16.0. with power supply.
MERCURY SWITCHED TUNER. This is a tuner in chassis form which has a three position switch for the three BBC programmes. Uses one ECF80 and four EF80 valves. External power supply is required. Complete Kit **£9.19.0.**
Power Pack Kit 39/-.

FRINGE TUNERS

NEW FRINGE TUNER IN SHELF MOUNTING CASE. FMT3. This is an entirely new Fringe Tuner and is supplied complete with a very attractive green shelf mounting case with Perspex dial. The tuner is fitted with variable AFC. Internal power supply if desired. Valves used are one ECC81 and five EF80. Complete Kit £9.19.6 without power supply components. £11.18.0 with power supply.

TV SOUND/FM SWITCHED TUNER

This tuner, also supplied in an attractive shelf mounting case, has a TV type Coil Turret fitted to provide TV sound from any BBC or ITV Sound channel as well as the three BBC FM programmes. Fitted with internal power supply. Valves: one ECC84, one ECF80, one EF80, one EF89, one EM81 and one E780. Complete Kit £15.15.0.

INSTRUCTION MANUALS

All our kits include the appropriate instruction manual. All available separately as follows:—
Manual covering both Standard Tuners and the new Fringe Area model, 2/10; "Mercury," 2/3; TV Sound/FM, 3/-. All post free.

MULLARD TAPE PRE-AMPLIFIER

This unit is intended for use with an existing amplifier and provides all the circuits necessary for tape recording and playback. Instruction manual, giving full constructional information is available price, 2/10, post free.
COMPLETE KIT containing every item required down to the last nut and bolt. First-class items only included. **£14.7.0.** H.P. Deposit £2.17.0 and six monthly payments of £2.2.6. Kit less valves, £10.19.6. H.P. Deposit, £1.19.6 and six payments of £1.13.4. Power Unit kit, £3.19.6.

AMPLIFIER KITS

We carry in stock all the items needed for the following amplifiers. Fully detailed lists are available.
MULLARD 3-3 and 510 Amplifiers.
Two- and Three-valve Pre-Amplifiers.
Four Channel Mixer Unit.
G.E.C. 912 Plus Amplifier.
JASON. Jupiter and JSA2 Stereo Amplifiers.
Publications giving full details of the above are available as follows: Mullard "Circuits for Audio Amplifiers," 9/4; G.E.C. 912, 4/6; Jason Jupiter, 2/10; Jason JSA2, 2/4. All post free.

WATTS RADIO (MAIL ORDER) LTD.

We offer a really efficient Mail Order Service on all items stocked. All cash orders are dealt with on the day of receipt. Hire Purchase orders are subject to slight delay but this is kept to the absolute minimum.

GRAMOPHONE EQUIPMENT

ALL LATEST MODELS

	Cash Price	Deposit	Hire Purchase Mthly. Pmts.
RECORD CHANGERS			
COLLARO Conquest (Studio O PU)	£7.19. 6	£1.12. 0	6 of £1. 4.7
GARRARD RC121 (GC8 PU)	£9.19. 6	£1.19. 6	12 of 15/-
GARRARD RC88 (GC8 PU)	£16. 8. 0	£3. 6. 0	12 of £1. 4.0
GARRARD RC98 (GC8 PU)	£18.12 8	£3.15. 8	12 of £1. 7.3
B.S.R. UA8 Monarch (TC8 PU)	£7. 5. 0	£1. 9. 0	6 of £1. 2.8
BSR UA12 Monarch (TC8 PU)	£9.19. 6	£1.19. 6	12 of 15/-
BSR UA12 Monarch (TC8S Stereo PU)	£10.17. 6	£2. 3. 6	12 of 16/2
SINGLE RECORD PLAYERS			
GARRARD TA (GC8 PU)	£8.10. 0	£1.14. 0	12 of 13/-
BSR TU9 (TC8 PU)	4.10. 0	£1. 5. 0	3 of £1. 5.0
COLLARO RP584 (O, P or T PU)	£8.18.11	£1.15.11	12 of 13/7
COLLARO RP594 (O, P or T PU)	£9.18. 9	£1.18. 9	12 of 15 -
TRANSCRIPTION UNITS			
COLLARO 4T/200 (TX88 PU)	£13.13. 0	£3.15. 0	12 of £1. 7.4
COLLARO 4TR/200 Motor only	£12.18. 3	£2.15. 3	12 of £1. 0.5
GARRARD 4HF (GC8 PU)	£18. 9. 9	£3.15. 9	12 of £1. 7.0

Many of the above can be supplied for stereo working. See our Gramophone Equipment List for details

GRAMOPHONE STYLI

ACOS. GP15, GP25, GP27, GP29, GP59, GP61, HGP33, HGP35, HGP37, HGP39, HGP41, HGP45, HGP55, HGP57, HGP63. All 6/8 each.
B.S.R. TC4, TC8, TC8S. All 5/9 each.
DECCA. XMS. 14/-.
GARRARD. GC2, GC3, 5/7 ; TOM1, TOM2. 17/11. Miniature Magnetic, 7/-. Hi-Fi PU. 12/1.
IMPORTANT.—Please state Std. or LP when ordering.

STEREO PICK-UP CARTRIDGES

RONETTE DC284. For all Collaro Models to replace the Studio Cartridge. Turn-over for 78/LP/Stereo. **£3.19.6.**
B.S.R. TC8S. Will replace the TC8H or TC8M in any Monarch Changer. Plays 78/LP/Stereo records. **£3.6.0.**

LOUDSPEAKERS

GOODMANS	Cash Price	Hire Purchase Deposit	Mthly. Pmts.
New Axiom 110 10"	£5. 0.0	£1.10.0	3 of £1.6.8
New Axiom 112 10"	£8.10.0	£1.14.0	6 of £1.6.0
Axiom 300 12"	£11. 5.9	£2. 5.9	12 of 16.8
Axiom 400 12"	£16. 1.0	£3. 4.0	12 of £1.3.7
Axiette 8"	£6.12.0	£1. 6.0	6 of £1.1.0
Teeday Tweeter	£6. 4.0	£1. 4.0	6 of £1.0.0
X05000 Crossover Unit	£1.19.0	—	—
WHITELEY			
HF1016 10"	£7.12.3	£1.10.3	6 of £1.3.8
HF1012 10"	£4.15.0	£1.10.0	3 of £1.5.0
HF816 8"	£6.10.6	£1. 6.6	6 of £1.0.8
HF817 8"	£10.16.6	£2. 3.6	12 of 16.1
T816 Cone Tweeter	£6. 3.9	£1. 3.9	6 of £1.0.0
T10 Tweeter	£4. 4.0	£1. 4.0	3 of £1.3.4
T359 Cone Tweeter	£1.13.3	—	—
Crossover CX3000	£1.10.0	—	—
Crossover CX1500	£1.18.3	—	—

Other Goodmans and Whiteley Speakers available, also full Wharfedale range.

CATHODE-RAY TUBES

BRAND NEW STOCK. NOT REBUILDS.
12 MONTHS' GUARANTEE

We can supply all BVA branded tubes at the new reduced prices. This includes Brimar, Cossor, Emiscope, Emitron, Ferranti, G.E.C., Mazda and Mullard. Full list of all available types sent on request.
MULLARD. 12in. and 14in. types, **£10.10.0.** H.P. Deposit £2.2.0 and 12 monthly payments of 15/8. 17in. Types (except MW43/43), **£12.0.0.** H.P. Deposit **£2.8.0** and 12 payments of **17/8.** 17in., MW43/43 **£14.0.0.** H.P. Deposit **£2.16.0** and 12 payments of **£1.0.8.** 21in. Types **£18.0.0.** H.P. Deposit **£3.12.0** and 12 payments of **£1.6.6.**
All tubes sent carriage free and safe delivery guaranteed.

LATEST CABY TEST METERS

Now in stock. CABY SUPREME MULTI-RANGE METERS. Made abroad. We can confidently recommend these meters as being accurate, well made and very good value for money.

MODEL A-10. Sensitivity 2,000 ohms per volt A.C. and D.C. Five voltage ranges 10-1,000 volts A.C. and D.C. Three D.C. current ranges .5-250 ma. Two resistance ranges. Size 5¼in. x 3¼in. x 1¾in. Price, **£4.17.6.** H.P. Deposit **£1.7.6** and three monthly payments of **£1.6.8.**

MODEL B-20. Sensitivity 4,000 ohms per volt A.C. and D.C. Voltage ranges—Five D.C. 10-1,000 volts. Four A.C. 10-1,000 volts. Four D.C. current ranges, .5-250 ma. Four resistance ranges. Price **£6.10.0.** H.P. Deposit £2 and three monthly payments of **£1.13.4.**

Illustrated leaflet giving full details of both models free upon request.

RECORDING TAPE

DOUBLE PLAY

BASF. 300ft. (3in.), 14/- ; 600ft. (4in.), 25/- ; 1,200ft. (5in.), 42 - ; 1,600ft. (5¼in.), 52/6 ; 2,400ft. (7in.), 77/6.
SCOTCH BOY 200. 400ft. (3¼in.), 17/- ; 1,200ft. (5in.), 45/- ; 2,400ft. (7in.), 80/-.
TELEFUNKEN. 1,200ft. (5in.). In plastic container, 35 -. 2,400ft., 72/6.

LONG PLAY

BASF. 210ft. (3in.), 9/- ; 850ft. (5in.), 28 - ; 1,200ft. (5¼in.), 35/- ; 1,800ft. (7in.), 50 -.
EMITAPE 99. 250ft. (3in.), 9/6 ; 850ft. (5in.) 28 -. In Emicase, 30/6. 1,200ft. (5¼in.), 35/-. In Emicase, 37/6. 1,800ft. (7in.), 50 -. In Emicase, 52/6. 2,400ft. (8¼in.), 72 6.
GELOSO. 430ft. (3¼in.), 16/-.
GRUNDIG. 1,200ft. (5¼in.), 35/- ; 1,800ft. (7in.), 50/-.
MSS. 225ft. (3in.), 8/6 ; 450ft. (4in.), 14/6 ; 850ft. (5in.), 28/- ; 1,200ft. (5¼in.), 35/- ; 1,800ft. (7in.), 50/- ; 2,400ft. (8¼in.), 70 -.
PHILIPS. 850ft. (5in.). In plastic container, 28/-. 1,800ft. (7in.), 50/-.
SCOTCH BOY 150. 300ft. (3¼in.), 9/6.; 900 ft. (5in.), 28/- ; 1,275ft. (5¼in.), 35/- ; 1,800ft. (7in.), 50/-.
SPECIAL OFFER. 1,200ft. Standard Tape. Brand new. Famous maker. Fully guaranteed, 25/-. Four for 95/-. Full range of standard tape and accessories also stocked. Send for list. All tape post free.

TRIPLE TONE AMPLIFIERS

We particularly recommend the Tripletone ready-built Amplifiers. The performance is very good, construction excellent and they represent excellent value for money.

HI-FI MAJOR. Push-Pull stage gives 12 watt output. Separate tone controls for Treble, Middle and Bass. Input for Microphone. Frequency response 15-20,000 cycles.

Price **£15.18.9d.** H.P. Deposit **£3.3.9** and 12 monthly payments of **£1.3.5.**

POPULAR. Three valve amplifier giving three watts output. Separate time controls for Bass, Middle and Top.
Price. **£6.19.6.** H.P. Deposit **£1.0.6** and six monthly payments of **£1.3.2.**

HIRE PURCHASE

H.P. Terms are available on any item. Repayments may be spread over 3, 6 or 12 months. Details as follows : Three months: Deposit 6/- in the £. Service charge 5%, but minimum charge 10 -. Six and Twelve months: Deposit 4/- in the £. Service charge 10%, but minimum charge 20/-.

Terms of Business.—Cash with order or C.O.D. Postage extra under £3. We charge C.O.D. orders as follows. Up to £3, postage and C.O.D. fee minimum 2/8. Over £3 and under £5, C.O.D. fee only 1/6. Over £5 no charge.

54 CHURCH STREET, WEYBRIDGE, SURREY. Telephone : Weybridge 4556

PLEASE NOTE : POSTAL BUSINESS ONLY FROM THIS ADDRESS.

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

REALISM AT INCREDIBLY LOW COST. CAN BE ASSEMBLED IN 1 HOUR The Recorder incorporates the Latest Collaro Mark IV Tape Transcriptor listed £25. The Linear LT45 High Quality Tape Amplifier listed £12.12.0. High Flux P.M. Speaker listed 30/-, empty Tape Spool, a Reel of Best Quality L.P. Tape (850ft.) listed 28/6, and a Handsome Portable carrying Cabinet finished in veneered walnut, size 18in. x 13in. x 9in. high, listed £4 10.0, and circuit. Total cost if purchased individually over £45. Performance equal to units in the £60-£80 class.

29½ GNS. H.P. TERMS. Deposit Carr. 17/6. 3 gns. and 12 monthly payments 53/9.

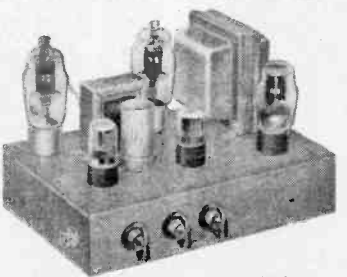
HI-FI 8 WATT AMPLIFIER

Special Purchase due to Cancelled Export Order. **£4-19-9** Carr. 7/6.
For 200-250 v. A.C.
A limited number is available of these highly sensitive Push Pull units guaranteed brand new and in working order and with separately controlled inputs for 'mike' and gram, etc., LATEST B.V.A. VALVES. Excellent performance.

R.S.C. A8 HIGH FIDELITY 12 WATT AMPLIFIER

Ultra Linear Push-Pull Amplifier with "Built-in" Tone Control. Pre-amp stages, high sensitivity, includes 5 valves (807 outputs). High Quality sectionally wound output transformer, specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut." Frequency response +3 db. 30-30,000 c/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 STANDING or LONG - PLAYING RECORDS. For MUSICAL INSTRUMENTS such as **STRING BASS, GUITARS,** etc. **OUTPUT SOCKET** with plug provides 300 v. 30 mA. and 6.3 v. 1.5a. 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/-.
If required louvred metal cover with 2 carrying handles can be supplied for 19/9. Additional input sockets, with associate Vol. control so that two different inputs such as Gram and 'Mike' or Tape and Radio can be mixed, can be provided for 13/- extra. Guaranteed 12 months.
£7-15-0



TERMS on assembled two input model: **DEPOSIT 18/9** and 12 monthly payments. **18/9.**
HIGH FIDELITY MICROPHONES and **SPEAKERS** in stock. Keen cash prices or credit terms if supplied with amplifier.

STAAR GALAXY 4-SPEED MIXER AUTO-CHANGERS

Brand new, cartoned. Turnover sapphire styli. Many exclusive features. Unique design motor virtually free from rumble. For 200-250 v. A.C. mains. Only £5.19.6.

PORTABLE CABINETS Full range of attractive designs from **15/9**

WE ARE STOCKISTS OF ALL REPANCO DESIGNS and COMPONENTS

SPECIAL OFFER. Two tone Portable cabinet, Gram amplifier, Staar Changer and 7in. x 4in. P.M. Speaker. **£9.19.6.** Carr. 10/- or with B.S.R. UA8. 11 gns..

THE SKYFOUR T.R.F. RECEIVER. A design of a 3-valve Long and Medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.F. stage and low distortion anode bend detector. Power pentode output. Valve line-up 6K7, SP61, 6V6G. Selectivity and quality are well up to standard, and simplicity of construction is a special feature. Point-to-Point wiring diagrams, instructions and parts list, 1/9. Maximum building costs **£4.19.6.** inc. attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 6½ x 5½in.

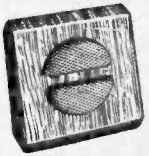
COLLARO 4-SPEED SINGLE PLAYER UNITS. Type AC/4/564 with turnover crystal head. £6.12.6. Carr. 4/6.

ACOS CRYSTAL 'MIKE' INSERTS. Approx. 1in. square. Fly lead connections. Only 5/11 each. Brand New.

PICK-UP ARMS complete with HI-FI turnover crystal head. Acos GP54. Limited number brand new, perfect, at approx. half price. Only 35/9.

ACOS CRYSTAL MICROPHONES. Type 33-1, hand or desk. List price 59/-. Brand new, cartoned. **35/9.**
39-1 Stick type, list price 5 gns. Brand new. **39/6.**

EXTENSION SPEAKERS



Ready for use in walnut veneered cabinet.
6½in. 2-3 ohms. **29/11.**
8in. 2-3 ohms. **35/9.**
10in. 2-3 ohms. **58/9.**
Very limited number.

10 WATT AMPLIFIERS. Unused and in good order but slightly store soiled. For 200-250 v. A.C. mains input. Output for 15 ohm speaker. Inputs for "mike" and Gram. Limited number, complete with Mullard valves. Only **£6.15.0** carr. 5/-.

COSSOR VHF/FM RADIO RECEIVER KITS

Including 6 valves, Printed Circuit and Goodman's 10" x 6" Elliptical Speaker. Made to retail at 15 GNS. Limited number at **£8-19-6**

A SIX TRANSISTOR "POCKET" SUPERHET RADIO

All parts including Transistors Printed Circuit. Attractive Cream or Coloured Plastic case. Ferrite aerial, 2½in. P.M. Speaker, etc., etc. and full instruction booklet. Size 5½ x 3½ x 1¼in. completed. Long and Medium Wavebands 250 M.W. push-pull output. Demonstrated at our counter premises. **£9.19.6**

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250 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.

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

Interleaved and Impregnated. Primaries 200-230-250 v. 50 c/s. Screened. TOP SHROUDED DROP THROUGH

250-0-250 v. 70 mA, 6.3 v. 2 a, 5 v. 2 a... 16/9
350-0-350 v. 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... 23/9
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a... 23/9
350-0-350 v. 100 mA, 6.3 v. 4 a, 4 a, C.T. 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 2½-3-3in. 17/6
250-0-250 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a... 26/9
300-0-300 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a... 26/9
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a... 26/9
300-0-300 v. 130 mA, 6.3 v. 4 a, 6.3 v. 1 a, for Mullard 510 Amplifier 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 200-250 v. 50 c/s. primaries 6.3 v. 1.5 a, 5/9; 6.3 v. 2 a, 7/6; 0-4-5.3 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.

OUTPUT TRANSFORMERS

Midget Battery Pentode 66:1 for 3S4, etc. 3/9
Small Pentode, 5000 Ω to 3Ω 3/9
Small Pentode 7/8,000 Ω to 3Ω 3/9
Standard Pentode 5,000 Ω to 3Ω ... 5/6
Standard Pentode, 7/8,000 Ω to 3Ω ... 5/6
10,000 Ω to 3Ω 5/6
Push-Pull 10-12 watts 6V6 to 3Ω or 15Ω 16/9
Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15Ω 18/9
Push-Pull EL84 to 3 or 15Ω 16/9
Push-Pull 15-18 watts, 6L6, KT66 ... 22/9
Push-Pull for Mullard 510 Ultra Linear 29/9
Push-Pull 20 watts, sectionally wound 6L6, KT66, etc., to 3 to 15Ω ... 47/9

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

SMOOTHING CHOKES

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

CHARGER TRANSFORMERS

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

AUTO TRANSFORMERS. 50 watt 0-110/115—230/250 v. 8/11 each.

COLLARO CONQUEST 4-SPEED AUTO-CHANGER with high fidelity Studio pick-up. Latest model. Brand new. Cartoned. For 200-250 v. 50 c.p.s. A.C. mains. Our price **£7.19.6.** Carr. 5/6.

GARRARD 4-SPEED AUTO-CHANGERS Type R.C.120H. Very limited number at **9 gns.** (approx. half price). Carr. 5/6.

R.S.C. A12 STEREOPHONIC AMPLIFIER KIT

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

£3-19-6 Carr. and pkg. 5/-

STEREO EQUIPMENT OFFER. Comprising A12 Kit, 2 matched 8in. L/Speakers, and Acos T/O Stereo head with diamond stylus suitable most pick-ups.

£6-19-6 Carr. 7/6

LINEAR LT45 HIGH QUALITY TAPE DECK AMPLIFIER. With " built in " power pack and oscillator stage. For Tape Decks with High or Low Impedance, Playback and Erase Heads, such as Lane, Truvox, Collaro, Brennel, 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 for 3¾, 7½ and 15in. per sec. Output 4 watts. Send S.A.E. for leaflet.

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

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

A highly sensitive Push-Pull high output unit with self-contained Pre-amp. Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 db. down. Frequency response ±3 db. 30-30,000 c/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 output for 3 and 15 ohm speakers. Complete kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required cover as for A8 can be supplied for 18/9. The amplifier can be supplied, factory built with 12 months' guarantee, for **£13.19.6. TERMS: DEPOSIT 24/9** and 12 monthly payments of **24/9.**

11 GNS. Carr. 10/-

LINEAR ' DIATONIC ' 10-14 WATT HIGH FIDELITY PUSH-PULL ULTRA LINEAR AMPLIFIER. For 200-250 v. A.C. mains. Valves ECC83, ECC83, EL84, EL84, EZ81. Self-contained Pre-amp Tone Control stage. Separate Bass and Treble Controls. Independent ' Mike ' and Gram input sockets. Outputs for 3 and 15 ohm speakers. Only **12 GNS.**; or Deposit 22/3 plus 10/- carr. and 12 monthly payments of 22/3. Send S.A.E. for leaflet.

LINEAR L50 50 WATT P.A. AMPLIFIER. High quality and sensitivity. **19 GNS.** Send S.A.E. for leaflet.

GARRARD 4-SPEED AUTO-CHANGERS. Type RC120H. Very limited number at only **9 gns.** (approx. half price). Carr. 5/6.

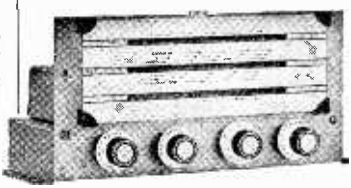
R.S.C. 3-4 WATT A7 HIGH-GAIN AMPLIFIER

For 200/250 v. 50 c/cs. Mains input. Appearance and Specification, with exception of output wattage, as A5. amplifier. Complete Kit with diagrams. £3.15.0. Carr. 3/6.

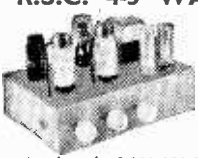
LINEAR L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER. Suitable for use with any record playing unit, and most microphones. Negative feed-back 12 db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c/cs. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 6-5-5¼in. high. Guaranteed for 12 months. Only **£5/19/6.** Send S.A.E. for illustrated leaflet. Terms. Deposit 22/6 and 5 monthly payments of 22/6.

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 **£2.12.0** and 9 monthly payments of **£2.12.0.**



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



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

R.S.C. PORTABLE GUITAR AMPLIFIERS

Junior 5 watts High Quality output.

Separate Bass and Treble ' Cut ' and ' Boost ' controls. Sensitivity 15 m.v., High Flux 8in. Loudspeaker ' built-in.' Handsome, strongly made Cabinet (size approx. 14 x 14 x 7in.) finished in satin walnut, and fitted carrying handle. H.P. Terms. Deposit £1 and 9 monthly payments of £1.

£8-19-6 Carr. 7/6

Senior 10 watts High Fidelity output.

Separate Bass and Treble ' Cut ' and ' Boost ' controls. Twin separately controlled high gain inputs so that two instruments such as Guitar and String Bass can be used at the same time. Two loudspeakers are incorporated, a high Flux 12 in. for Bass notes and a 7 x 4 m. elliptical for Treble. Cabinet is well made and finished satin walnut. Size approx. 18 x 18 x 8 in. H.P. Terms. Deposit 23/6 and 12 monthly payments of 23/6. Both models for 200-250 v. A.C. mains.

13 GNS. Carr. 10/-

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

Gauss 12.000 lines. Speech coil 3 ohms or 15 ohms. Only **£4.19.6** Carr. 5/-. Terms : Deposit 11/- and 9 monthly payments of 11/-.

12 in. 20 WATT HI-FI LOUDSPEAKERS IN CABINETS. Size 18 x 18 x 9 in. Finish as above. Terms: Deposit 13/10 and 12 monthly payments of 13/10. Only £7.19.6. Carr. 8/6.

COLLARO 4-SPEED SINGLE PLAYER. Separate pick-up (GP54). Only **£3.15.0.** Twin sapphire styli. 200-250 v. A.C. mains.

PLESSEY DUAL CONCENTRIC 12in. 15 ohms HIGH FIDELITY SPEAKER (12,000 lines) with built-in tweeter (completely separate elliptical speaker with choke, condensers, etc.), providing extraordinarily realistic reproduction when used with our A8 or similar amplifier. Rated 10 watts. Price only **£5/17/6.**

ACOS Hi-Fi Crystal Cartridges. (Turnover type with sapphire stylus.) HGP59 Standard replacement for Garrard and B.S.R. Only **19/9.** B.S.R. Ful-fi. **17 9.** Garrard GC2. **19/9.**

COLLARO Mk. III 3-SPEED TAPE TRANSCRIPTORS
Limited number brand new cartoned.

15 GNS. Carr. 7/6

P.M. SPEAKERS. 2-3 ohm. 2½in. Perdio **25/9.** 5in. **17/9.** 6½in. **16/9.** 8in. **19/9.** 8 x 5in. **25/9.** 10in. **26/9.** 10 x 6in. **29/9.** 12in. **29/11.** 10in. W.B. " Stentorian " 3 or 15 ohms type HF1012 10 watts, hi-fidelity type. Recommended for use with our A8 Amplifier, **4 gns.** 12in. Plessey 3 ohms 10 watts (12,000 lines). **59/6.**

TWEETERS. Plessey 3 ohms **19 9.** Rola-Celestion 7.5 ohms **25/9.**

LG3 MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with any single or auto-change unit. Output for 2-3 ohm speaker. For 200-250 v. 50 c p.s. A.C. mains. Over-all size 6¾ x 4¼ x 2¼in. Controls : Vol. and Tone with switch. Guaranteed 12 months. Only **57/9.**

SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner Unit (specially suitable for use with any of our Amplifiers). Delayed A.V.C. employed. The W.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, instructions and priced parts list with illustration. **2/6.** Total building cost **£4/15/-.** For descriptive leaflet send S.A.E.

E.M.I. 4-SPEED SINGLE RECORD PLAYER UNITS with turn-over crystal head for Stereo and Monaural. Only **£7 15/-,** carr. 4/6.

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. Open 9 to 6 ; Weds. until 1 p.m. Trade supplied. S.A.E. with all enquiries.

R.S.C. (Leeds) Ltd. **BRADFORD, MANCHESTER and LEEDS**

Mail Orders to 29-31 Moorfield Rd., Leeds 12.
Callers to 5 and 7 County (Mecca) Arcade, Briggate, Leeds 1, and 8-10 Brown St. (Market St.), Manchester 2, or 56, Morley Street, (Next to Majestic Ballroom) Bradford.

Practical Wireless

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Contents

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

 PRACTICAL WIRELESS *incorporates "Amateur Wireless."*

INTERFERENCE

WHEN radio broadcasting first began, the problem of mutual interference of stations did not arise. Initially there were only one or two stations operating and these for only short periods of the day, and therefore even with somewhat crude receiver circuits it was always possible to ensure that good reception of all of the stations could be obtained. The novelty of radio as a medium of entertainment did not disappear for some years and reception of any sort of radio signal was tended to be regarded as a great achievement.

This is no longer true ; radio today has established itself as a means of recreation and learning. Now that there are several hundreds of broadcasting stations operating in Europe alone, many on identical wavelengths, the quality of the reception is marred. The situation is worse in the evening on the most used wavelengths which lie in the medium waveband. The BBC has done much to improve the enjoyment of its programmes by building chains of transmitters operating with frequency modulation in the V.H.F. bands. This policy has definitely improved the status of sound radio in this country, but while clear reception of the BBC by most of the community has thus been assured, little has been done to alleviate conditions on the medium and long wavebands.

Many listeners enjoy broadcasts from abroad ; there are, for instance, concerts and performances of operas and other items of cultural interest for which the barrier of languages does not exist. However, in the evenings, when most of the interesting broadcasts are given, the mutual interference on these wavebands completely spoils listening enjoyment.

Obviously the solution employed for improving local broadcasts in this and other countries is of no use where foreign broadcasts are concerned. Frequencies of the order of 80 Mc/s can only be used for comparatively short range transmissions. Thus the overcrowding on the medium and long wavebands can only be remedied by closer control of the frequencies used and the number of stations operating.

THE "P.W." AND "P.T." FILM SHOW

WE are pleased to announce that another film show, sponsored by this journal and our companion journal *Practical Television*, is to be held at Caxton Hall, Westminster, on Friday, January 22nd, 1960, at 7.30 p.m., when the Editor will take the chair. Admission will be by ticket only. The event is being arranged in conjunction with Mullard Limited.

The films are entitled " Mirror in the Sky," " From Us to View " and " Photo Emission." " Mirror in the Sky " deals with events leading up to the experiments by Sir Edward Appleton to confirm the existence of the Heaviside Layer. It continues with the discovery of the Appleton Layer and the subsequent development of the pulse techniques that became the basis of radar. The film concludes with a description of further developments in this field up to the introduction of the radiotelescope.

Applications for tickets should be made now. Please mark your envelopes " Caxton Hall " in the top left-hand corner, and include a stamped addressed envelope for the tickets.

Our next issue, dated January, 1960, will be published on December 4th

Round the World of Wireless

POTENTIAL AND CURRENT NEWS

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of August, 1959, 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	876,799
Home Counties	872,844
Midland	645,621
North Eastern	740,630
North Western	593,581
South Western	520,656
Wales and Border Counties ...	320,022
Total England and Wales ...	4,570,153
Scotland	554,735
Northern Ireland	156,693
Grand Total	5,281,581

Linear Accelerator for Australian Hospital

A FOUR million electron-volt linear accelerator for X-ray treatment of deep-seated tumours is being built in this country by Mullard Equipment Ltd. for the Cancer Institute Board of Victoria. Valued at £60,000 it will be installed at the board's Peter MacCallum Clinic in Melbourne in the middle of next year. This is the fourth medical linear accelerator to be built by the Company. The accelerator will give an X-ray output more than ten times greater than that of a normal, 250kV therapy machine, and will enable treatments to be given at the rate of 60 a day—about three times the number possible with the conventional apparatus. The high voltage rating of the accelerator also produces an X-ray beam of greater penetration, making it possible to reach tumours seated too deep for effective treatment with conventional machines. Damage to the patient's skin, which can be a serious problem when low-voltage X-rays are used, is virtually eliminated, and there is less side-scattering of the beam during its passage through the body. The accelerator is mounted on a rotatable gantry, which enables the X-ray beam to be directed precisely to the diseased area and at exactly the required angle.

The aerial head of the Marconi long range and terminal area surveillance radar system now operating at Jersey Airport. This new radar will fulfill the dual role of airways surveillance and approach control. Operating on a 50cm. wavelength it is virtually unaffected by weather.

Berec in East Africa

BEREC INTERNATIONAL LTD., the Exports Sales Division of The Ever Ready Company (Great Britain) Ltd., have made radio history in East Africa by the inauguration of the first-time commercial sponsored radio programme produced in East Africa for their battery products. The programme, which features the famous and popular "Jambo Band" is being heard each Friday evening at 6.30 p.m. on the National programmes of the Kenya Broadcasting Service which covers the whole of Kenya and other parts of East Africa. The programme is scheduled to continue until April, 1960, and further extensions of the plan are envisaged, which will create even greater interest as it is Berec's desire not only to effect bigger and better sales of their products in East Africa, but also to provide the best in entertainment for all radio listeners.

New BBC Publication

THE BBC have recently published No. 26 in their series of Engineering Monographs entitled "Transistor Amplifiers for Sound Broadcasting." The author is Mr. S. D. Berry, Associate I.E.E., of the Designs Department BBC Engineering Division. It deals with the application of transistors to the audio-frequency amplifiers used in sound broadcasting, for which a high standard of performance is required. The principles followed in the design of such amplifiers are discussed and five examples of various types are described and illustrated together with performance details. The operating conditions of D.C. feedback pairs and of "super-alpha" pairs are analysed and some numerical evaluations given. Finally, some conclusions are drawn regarding the use of transistors in high-performance amplifiers of this nature. BBC Engineering Monograph No. 26 can be obtained, price 5/- post free, from BBC Publications, 35, Marylebone High Street, London, W.1, or through newsagents and booksellers.

Hungarian Radio

HUNGARY'S radio services are developing more links with foreign stations. Western stations are mainly interested in recordings of works by Kodály, Bartók and contemporary Hungarian composers. The American C.B.S. recently broadcast Hungarian recordings of Bartók's "Duke Bluebeards Castle" and Kodály's "Székely Spinnery." The BBC has asked to hear

recordings of a recently discovered Haydn opera "L'Infidelta delusa" which was performed during the 75th anniversary celebrations of the Hungarian State Opera House. Radio programmes are exchanged regularly with most of the socialist countries, including China and the national stations of 11 Soviet republics. Programmes are also being exchanged with the Japanese State Radio and with radio stations in India, Ghana and Iraq. Though most foreign stations are mainly interested in taking musical programmes, one Canadian station has asked for details of Hungarian radio games.

Industrial Maser

A MASER amplifier, thought to be the first working assembly to be built in this country by an industrial laboratory, came into operation recently at Mullard Research Laboratories, Salfords, Surrey. Construction of the Maser and investigation of its properties and performance has been carried out in the Laboratories' Solid State Physics Division where considerable work on semiconductor effects at low temperatures is being done by a group of scientists led by Dr. J. C. Walling. Maser amplifiers are a recent scientific development which make use of the natural oscillations of the paramagnetic ions in certain crystalline substances—ruby for example. One of their chief uses lies in their ability to give useful amplification of very weak radio signals without producing unwanted signals which would otherwise swamp them. The Mullard Maser, which was constructed in co-operation with the Royal Radar Establishment, Malvern, operates at a wavelength of 10 cm in the "S" band and at a temperature of 1.7°K (approximately −271 deg. Centigrade).

British Clock for Australia

A CLOCK which will not gain or lose more than a second in 25 years is to be installed in the Australian Post Office Research Laboratories at Melbourne by a team of British Scientists. The clock, known as an ammonia maser has been constructed at the Ministry of Supply Signals Research and Development Establishment, Christchurch, Hants, and is accurate to within one ten thousandth of a second per day and will be the first of its kind in the Southern Hemisphere. One job for which the maser will be used is the measurement of the rate at which electric pulses sent out by a radio transmitter near Rugby are received in Melbourne, some 15,000 miles away. Although the transmitting rate is constant the pulses are not received at a constant rate, owing to variations in the ionosphere, the radio "mirror" which surrounds the earth. The maser will be used to measure these variations, providing more information about the ionosphere.

Largest Recording Club

THE British Recording Club, 145, Fleet Street, London, E.C.4, has now, by agreement, absorbed the British Tape Recording Society and in future the full name of the organisation will be "The British Recording Club Incorporating the British Tape Recording Society." This makes the B.R.C. the largest organisation of its kind in the world with direct links with thirty-six countries. This is a milestone in the tape club movement and starts a new era of unified co-operation to further the interests of tape enthusiasts and users everywhere.

UNESCO Study

RECENTLY published by UNESCO is a study entitled "Broadcasting without Barriers" which reviews the state of broadcasting throughout the world. Its author is Mr. George A. Codding who has worked for the international telecommunication union in Geneva and is now assistant professor of political science at the University of Pennsylvania U.S.A.

Mr. Codding traces the development of broadcasting and shows its varied role as a medium of information and entertainment. The author also describes the different ways in which broadcasting is controlled and relates in detail the long history of the ITU's effort to secure agreement on the distribution of frequencies of broadcasting.

In a foreword to the book, UNESCO points out that "uncertainty within governments and among radio broadcasters themselves prompted the conclusion that a study on an international scale would be of help to those concerned."

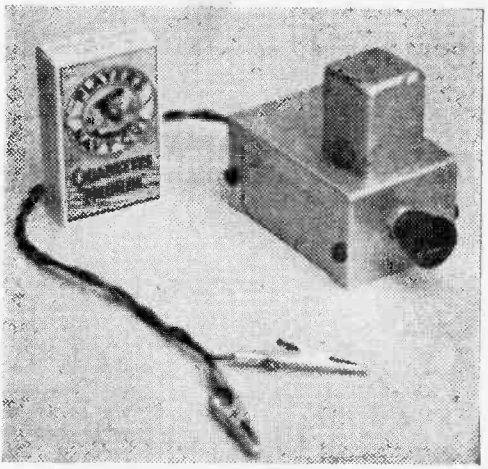
The use of two-way radio communication systems is increasing rapidly. An unusual application is illustrated above. Walter H. Malcolm, haulage contractors, of Renfrewshire, have had their Chaseside loading shovel fitted with a two-way radio. Head office maintains constant contact with the operator who can be instructed to move quickly from site to site to deal with urgent loading.

Audio Test Oscillator

A ONE-TRANSISTOR CIRCUIT

By A. M. Shafford

THIS audio oscillator has its own power supplies and is small enough to slip into a pocket. Naturally in so small a space, only a simple circuit is possible, and therefore the unit is designed to operate on a single fixed frequency. However, if a small increase in size is acceptable, the addition of a few extra components will permit the selection of any one of a number of fixed frequencies over quite a wide range.



A completed oscillator

Uses

Some obvious uses for the unit include the checking of amplifiers (including the audio sections of radio and TV receivers); as a morse-code practice oscillator; as a source for an A.C. bridge or, in conjunction with a pair of head-phones, as a continuity checking device. Many other applications will suggest themselves, once the unit has been constructed and some experience gained in handling it. The great merit of this oscillator, apart from its small size, is the fact that it is always ready for use at the turn of a switch since its single transistor requires no warm-up time and oscillation commences immediately the internal batteries are applied. Furthermore, the output leads with their crocodile-clip terminations are permanently soldered into the circuit making it unnecessary to search for pieces of wire to connect up the unit before making a test.

The cost of the unit is small, even if all the components have to be purchased, although most junk boxes will provide everything that is needed with the possible exception of the transistor.

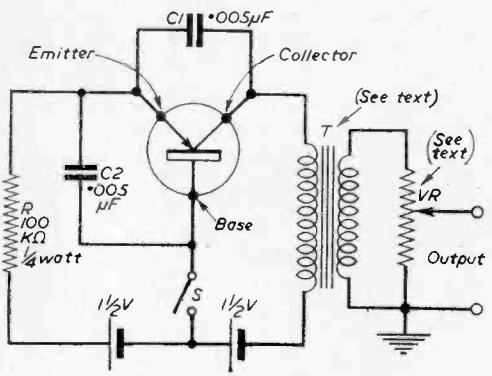


Fig. 1.—Circuit for a fixed frequency

Size

The illustration shows the construction and small size of the unit built by the writer, but since there is nothing critical in either the component values or the layout, the constructor can make up the circuit in any convenient form to suit his requirements. No part of the circuit operates at a voltage above 3, and therefore no insulation problems arise and no special precautions need be taken in arranging the spacing between components.

The circuit of the oscillator is shown in Fig. 1. It is powered by two 1½V penlight cells connected in series, and the base of the transistor is connected to the junction of the two batteries through the on/off switch which is part of the output control potentiometer VR.

Components

The transformer is not very critical. The one used in the model illustrated is a blocking oscillator transformer, but any audio transformer will suffice. Most suitable would be an interstage transformer with a ratio of about 2:1 or 3:1, the winding with the smallest number of turns being used as the output side. A miniature loudspeaker transformer will operate quite successfully, but the large turns-ratio results in a loss of output owing to the step-down action. Since the oscillator develops only a few millivolts of audio, this step-down may be undesirable. However, when the unit is used to test an audio amplifier, very small outputs are required.

For a given transformer the frequency can be controlled by varying C2. Quite a range can be

(*Continued on page* 685)

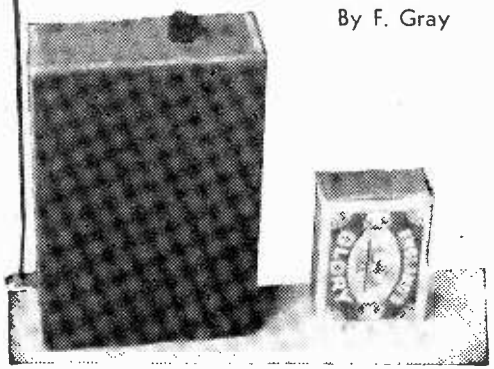
COMPONENT VALUES FOR FIG. 1

C1—.005 μF.
C2—.005 μF.
R—100,000 ohms ¼ watt.
VR—See Text.
T—See Text.
S—On Off switch (on output level control).

27 Mc/s Pocket Transmitter

A SHORT-RANGE UNIT OPERATING FROM BATTERIES

By F. Gray



THIS transmitter was made for indoor or other short-range work, and is self-contained, with batteries. For short distances, with a sensitive receiver, the usual type of one-valve model control transmitter has ample output. Indeed, adequate control can often be maintained with a very low H.T. voltage. These facts have been responsible for the pocket transmitter described here, which uses a single B7G output valve, with 45V H.T. supply from two 22½V deaf-aid type batteries. As a result, the whole unit, with H.T. and filament batteries, can be accommodated in a case of which the inside dimensions are only 4in × 2½in. × 1in.

Consumption

The H.T. drain is about 8mA, this current only being taken when the transmitter is actually keyed to radiate. The filament current is 0.1A, from a single dry cell, also required intermittently for a few seconds only, when keying. The batteries will thus have quite a long life.

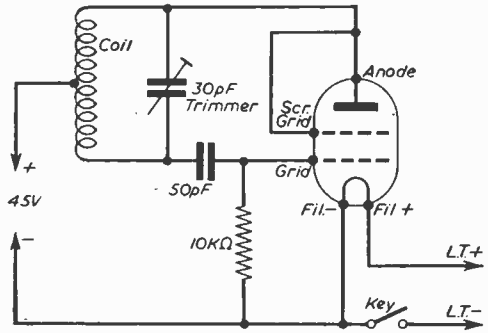


Fig. 1.—Circuit diagram.

The output from the transmitter is not sufficient for the control of a model at range. It is primarily intended for the radio control of a broadcast receiver (station selection and volume) but will also control models at short range. If the actuator or control device in the model requires rapid keying, then a filament switch will have to be provided in the transmitter, and the keying contacts will then be wired in the H.T. circuit.

With a purpose in view such as that previously mentioned, rapid keying is not necessary. Wiring the key contacts in the filament circuit then has the advantage that the transmitter filament is also off, when the transmitter is not in use, and no operation of a separate filament switch is required.

Other output valves than that shown are equally suitable, the holder being wired for the actual type fitted. Suggested valves include the 3S4, DL92, N17, CV820, 3V4, CV783, and similar battery output tetrodes or pentodes.

Building Details

If 3/16in. ply is used for the case, two pieces will be required 1in. × 2½in.; two 1in. × 4⅛in., and two 2⅛in. × 4⅛in. Wood of this thickness can be secured with small panel pins, glue being smeared on meeting surfaces first. Four small screws hold the back in place.

The transmitter circuit is shown in Fig. 1, the valve being triode connected. Figs. 2 and 3 show the layout, wiring, and valveholder and coil details. Insulated leads are best attached to the holder

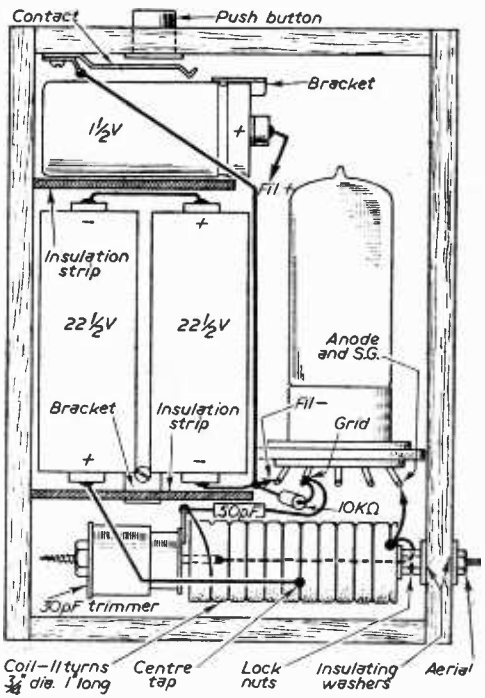


Fig. 2.—Layout of the parts.

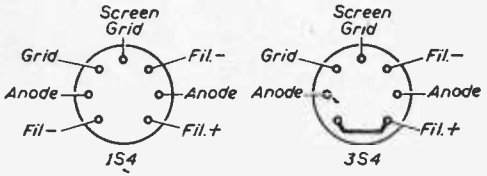


Fig. 3.—Valve base details.

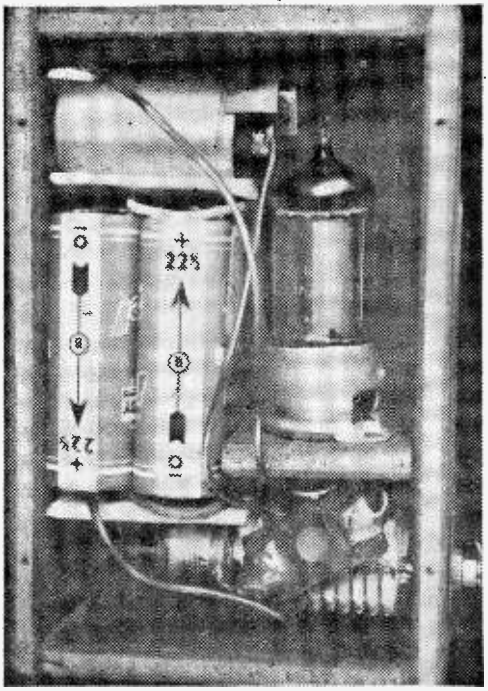
tags before fitting the holder, and sufficient space should be left above the valve for its removal.

The batteries are held in place by brackets and each other, but leads are secured to them with a touch of solder. This avoids any trouble from poor contact, and the batteries only need renewing after a long interval.

To save space, the beehive trimmer has its centre leg soldered to a long 6BA bolt, which passes down through the coil. To bring the transmitter on to frequency, this trimmer can be rotated a little at a time with the fingers. (This is not recommended with larger H.T. voltages.) The alternative is to cut a small "spanner" from paxolin, unless there is no objection to drilling a clearance hole in the side of the case for the usual trimming tool.

For short-range control, with a sensitive receiver, no aerial need be used. But for longer range, or a less sensitive receiver, a short vertical rod can be added. This can be some 6in. to 9in. or more, according to the purpose in view. Very long aerials will stop oscillation.

The transmitter must be tuned to frequency with the actual aerial which will be used, because changing the aerial will slightly modify the frequency.



Internal view (see Fig. 2).

COMPONENTS LIST

Valve: 3S4, D192, N17, CV820, 3V4, CV783 or a similiar battery output tetrode or pentode.
Resistor: 10k ½W.
Condensers: 30pF trimmer.
50pF ceramic or mica.
Battery: Two 22½V deaf-aid types in series.

Tuning Procedure

The output is not sufficient to give an indication with a bulb meter. However, the frequency meter circuit shown in Fig. 4 is satisfactory, and this unit can easily be made up. With the meter coil in line with the transmitter coil, and about 1in. away, a reading of about 1mA may be expected. The frequency meter is tuned to the middle of the 27Mc/s band, and the transmitter trimmer is then rotated for maximum reading on the meter. If the fingers are used for tuning, remove the hand well away between adjustments, and check that no change is required to the frequency meter tuning, for maximum reading.

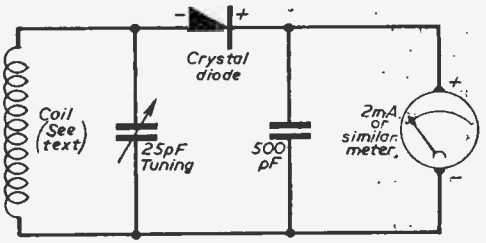


Fig. 4.—Simple frequency meter circuit.

It is possible to use a bulb meter if this has a low voltage, low current bulb, and if a higher battery voltage is temporarily used with the transmitter. If this method is chosen, a H.T. current check should be made to see that the maximum rating of the valve is not exceeded. No modification must be made to the aerial after tuning and, for these reasons, the circuit in Fig. 4 will be more convenient.

Beginner's Test-Meter

No. 4—MAKING THE SHUNTS AND USING THE NEW CURRENT RANGES

By E. V. KING

BEFORE the wiring of the current ranges can be carried out, it is necessary to check the basic (1mA) range of the meter. It is assumed that the wiring given last month has been carried out and that the voltage ranges are working correctly. Turn the range switch to position 6. Here is the test procedure: do not depart from it unless you are experienced or you will suffer the loss of the meter movement. Clip the positive crocodile clip to the short (positive) tag of 4½V flat battery. Now clip the negative crocodile on to one end of a 10,000 ohm resistor, and very gently and quickly flick the free end of the resistor on to the long tag of the battery. The meter will move. While testing verify that the needle does not go right over to the stop. If it does something is amiss and it must be found before proceeding. If the needle moves to about half way over. all is well. If a 9,000 ohm resistor of good accuracy is used instead of the 10,000 the result will be almost exactly ½mA flowing. Fig. 18 shows the circuit used.

Accuracy

This range, i.e., 1mA, uses the basic meter movement and its accuracy (and all others too) is dependent on the movement and will probably be about 2 per cent. In this respect the longer the scale. the better and the human element in viewing becomes less. A mirror scale, of course, makes accurate readings easier.

The 10mA Shunt

The making and accurate wiring in of the shunts is the hardest part of this multi-meter construction: the accuracy of the finished meter will depend on the care with which the job has been done.

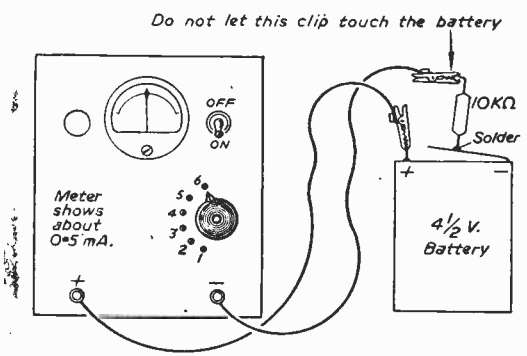
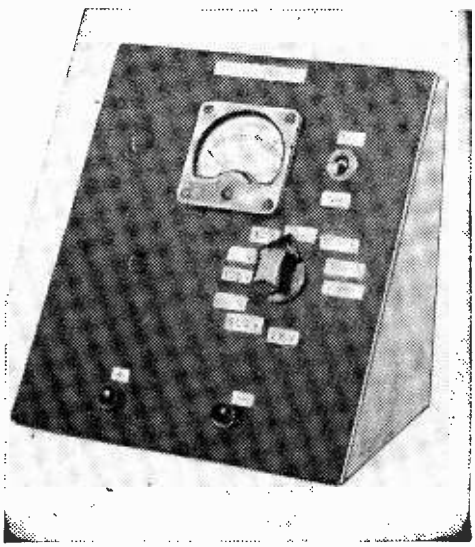


Fig. 18.—Procedure for testing the 1mA range.



The meter after the current ranges have been added.

Leave the meter switched to the 1mA range just tested. Put S1 off. Wire up as shown in Fig. 19. Here is the procedure. Verify that S1 is off and connect the red lead by the clip to the short tag of the battery. Solder a short lead to the other tag and take it to the bottom tag of a 10k potentiometer held in the position shown in the diagram. Take the positive clip to the central tag of the potentiometer. The top tag is not used.

Potentiometer

Now, holding the potentiometer in the position shown in Fig. 19 turn the knob fully anti-clockwise. If you are in doubt, study the working of the potentiometer. When set it must be such that the maximum resistance is introduced into the circuit. The value of 10k is a good one, but you can use one of up to 100k if you are very careful when you adjust it. A large knob would be a help whereas with the 10k you could use the spindle alone quite easily.

Do not proceed until you are quite sure the above conditions have been produced. Switch on S1. The meter may move a little. As you adjust the 10k pot. carefully, the meter will move over little by little (if it jerks about the potentiometer is faulty and must be replaced). Set it as accurately as possible for 1mA reading. 1mA is now flowing through the circuit.

Resistance Wire

Switch off S1. Fix two short clean tinned copper wires to the terminals of the multi-meter (see Fig. 19). Switch on S1. Verify the meter

reads accurately 1mA. Make sure that in the work to be done the negative crocodile clip cannot be moved accidentally to touch the negative tag of the potentiometer.

Take about 9in. of 41 or similar gauge resistance wire, clean one end and solder it to the copper wire attached to the positive terminal of the meter (see Fig. 19 for clarity). Scrape ½in. off the other end and hold it tightly with the fingers to the copper wire attached to the negative meter terminal. Some current is then by-passed through the wire shunt. The reading on the meter will drop from 1mA to say .2mA. Gradually scrape and clean the free end of the wire (½in. at a time) until it is shortened to such a degree that when it is held to the copper wire attached to the meter terminal the meter moves to exactly 0.1mA. That is. 1mA is flowing through the potentiometer, but only 0.1mA through the meter. It will then take 10mA to move the meter right over.

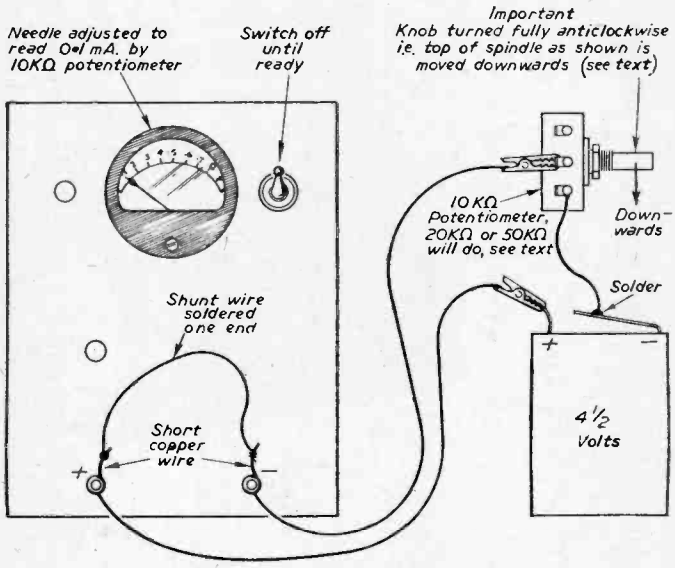


Fig. 19.—Making the shunt for the 10mA range.

Soldering the Shunt

Switch off S1. Note the exact length of shunt necessary and allow an extra ½in. for further adjustment. Remove the copper wires temporarily attached to the terminals. Refer to Fig. 20 and make up the resistor, R6, using the length of wire found in the above experiment. Solder one end of the fine wire permanently, but the other end only temporarily. Now solder in the resistor (R6) as shown in Figs. 16 and 17 (given last month).

Switch the range to 10mA, i.e., contacts on tag 7. Leave the potentiometer and associated circuit alone. as Fig. 19 (with the shunt removed). The meter should read about 0.1mA. If it is not exactly 0.1mA switch off S1. If the meter reads too high, shorten the wire round R6; if too low the wire will have to be replaced by a slightly longer one. Check that 1mA is still passing, by turning range switch to 1mA position.

Results

When the 10mA range is completed these conditions will obtain: circuit as in Fig. 19 but without the wire shunt; range 6 (1mA) potentiometer set to give meter reading of exactly 1mA; range 7 (10mA) meter should read exactly 0.1mA with potentiometer left as set.

The resistor can be any value in the brown, red or yellow ranges. It is quite unimportant and serves only a convenient former to hold the fine wire. The wire gauge is also relatively unimportant as long as it is of a "hair-like" type and is not copper.

Testing the 10mA Range

Put S1 off. Set range to 7 (10mA). Wire up as shown in Fig. 18. The meter should only move about one-twentieth of full scale. If it moves half-way something is wrong. If all is well put S1 off and replace the 10k resistor with one of 500 ohms. Use the flick test first always. The meter should now read just about 10mA, most likely a little under. If the meter does not do this the shunt is not working properly (assuming the 500 ohm resistor and battery are all right).

The 100mA Shunt

This is prepared by reference to the 10mA range already fixed up. The accuracy depends for the most part on the accuracy of the previous range. The method described will be accurate enough for most purposes.

Fix up Fig. 19 again, taking care that the potentiometer is in the position stated at first. If you have a 5k potentiometer at hand use that, if not the 10k one already used will do. One of a higher value is hardly suitable as the knob would have to be turned very little for a large variation in current. Put the range switch on to number 7 (10mA). Put S1 on.

Adjustment

Now carefully adjust the potentiometer until the meter shows 10mA, i.e., full scale deflection, exactly. 10mA is now flowing through the circuit. Take about 2ft. of 26 gauge resistance wire. Adjust it in a loop so as to cause no shorts and hold it between the two copper wires attached to the multi-meter terminals. The meter reading will drop. Gradually shorten the length of wire until it drops to show 0.1mA *on the scale* (i.e., 1mA will then be flowing since the meter is on the

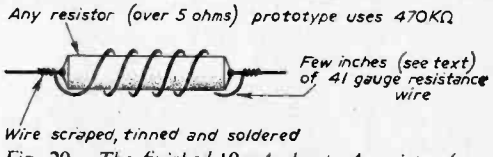


Fig. 20.—The finished 10mA shunt. A resistor (any value over 5 ohms) is used as a former.

10mA range). Allow ¼in. each end for soldering and cut the wire to length. Wind it very tightly in a single layer on an old control spindle (Fig. 21) or ¼in. former and gently pull the "spring" to separate the turns by as small a gap as possible. Refer to Figs. 16 and 17 and solder in position allowing the solder to run only along the ¼in. allowed at each end.

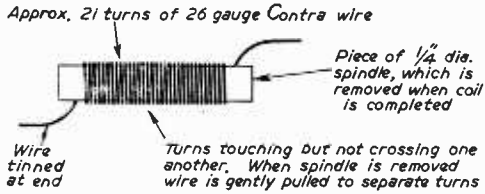


Fig. 21.—The 100 mA shunt. The shunt is wound on a ¼in. spindle which is then removed.

If you want your meter to be rather more accurate, in the above operation, adjust the meter to read 0.09 on the scale, not 0.1mA. This then allows for the fine shunt which is not finally in circuit, but was during the test.

Testing the 100mA Range

Switch the range to position 8. Fix up the circuit of Fig. 18 but use a 47 ohm resistor. Use the "flick test" first. The reading should be round about the full scale, i.e., 100mA will flow but only 1mA through the meter, the other 99 going through the resistance wire shunt.

The 500mA (½ ampere) Shunt

This is prepared by reference to the 100mA range just wired in and in turn its accuracy will be governed by the previous ranges in the meter.

Fix up the apparatus of Fig. 19 again, using a 1,000 ohm (1k) potentiometer (one will be needed in this meter later on, so you could buy one knowing it will be used permanently). Take the precautions previously stated. Put range on 8 (100mA). Switch on S1 and adjust the potentiometer carefully to obtain exactly 100mA flowing (work as quickly as possible as the battery will not deliver this current without a voltage drop for more than a few minutes). Take about 5in. of 26 gauge resistance wire and hold it between the copper wires on the meter terminals. The meter reading will drop. Carefully adjust the length of wire so that the meter reads exactly 0.2 on the scale. Remove the shunt made and, allowing ¼in. as before for soldering, fix it as shown in Figs. 16 and 17. Make sure the wire cannot touch the adjacent resistor already made and fixed. Adjust as on other ranges.

Greater Accuracy

If you wish for greater accuracy when making the shunt, arrange that the meter moves back to 0.17 instead of 0.2mA on the scale. This allows for the shunt R7 which was in circuit during the test, but is not in circuit finally in the completed meter on that range.

Testing the 500mA Range

Fix up the apparatus of Fig. 18, putting the range on to number 9 (500mA). Use a small 3.5 volt flashlamp for the resistance. Carry out the flicking test first. The meter should move over to somewhere between 0.3 and 0.8. This depends on the bulb and battery in use. Thus if the reading is 0.3mA on the scale it means that 167mA is passing (for the full scale range is 500mA, and 0.3 of 500 is 167).

Making and Wiring in the 1 Amp Shunt

This range is fitted purely as a safety device as mentioned earlier, and is not designed to give continuous operation or to be of very great accuracy. This range has very few uses in ordinary radio servicing. The suggested method of finding the correct shunt is not quite the same as for the other ranges as a torch battery will not supply 500mA for long enough for the operation to be performed.

Put the meter on range 9 and wire up as in Fig. 19, but use the flashlamp bulb in place of the potentiometer. Switch on S1. Note the reading of the meter (between .3 and .8mA with ordinary bulbs). Now take a few inches of 26 gauge resistance wire and hold it across the copper wires fixed to the multi-meter terminals. The meter

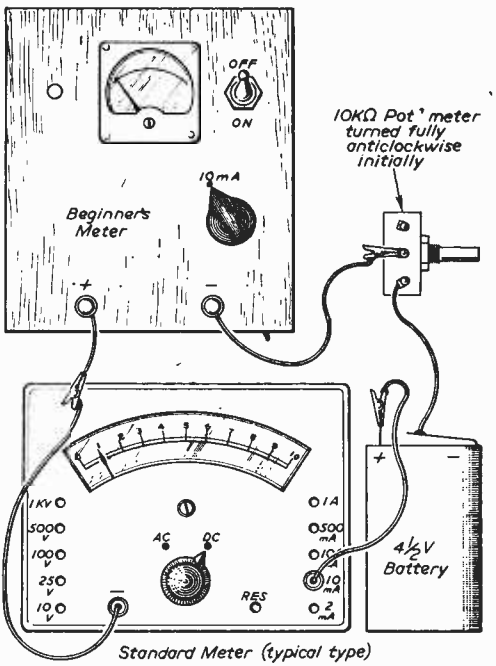


Fig. 22.—Calibrating the beginners' meter against one of known accuracy.

reading will drop, adjust so that the drop is half the existing reading. The current ranges are now completed by soldering this short shunt in position allowing exactly ¼in. each end.

Accuracy

If you wish for greater accuracy you may allow for R8 being in circuit in the test and not in the completed meter by adjusting the shunt for one third the reading.

The meter is now completed for the D.C. voltage and current ranges. The beginner must be very careful when using current ranges or the

meter will be burnt out. Always start on the 1 amp range, switching off S1 before altering the range switch.

Make quite sure the shunts are firmly in circuit. If a multiplier becomes unsoldered no harm can occur, but if a shunt fails the meter will almost certainly be ruined.

Adjusting the Shunts With the Aid of Another Meter

If you have a friend with an accurate multimeter you can, after the preliminary work already given, adjust your meter to finer limits. For instance, the circuit shown in Fig. 22 can be wired up using your meter on the 10mA range and your friend's on a similar range of current. A potentiometer of 10k and a 4½V battery are also needed. Make sure that the potentiometer is in the position of maximum resistance and switch on both meters. Adjust the potentiometer (carefully) until your friend's meter shows 10mA exactly. Your meter should also read 10mA; if it does not, then lengthen or shorten the shunt as necessary. Of course you must switch off at each adjustment and make sure that the wire is resoldered, otherwise the meter will be damaged when making the test. Before finally testing make sure that the resistance wire has cooled down, because its resistance alters with temperature. When you solder the wire, remember that if solder runs down the wire the shunt is in effect shortened.

CHART TO SHOW THEORETICAL LENGTHS OF WIRE SHUNTS
(100-ohm Meter)

Range	Shunt	Length 42g of Eureka	Length of 26g Eureka
1mA	NO SHUNT	—	—
10mA	11.1 ohms	7in.	Too long to use
100mA	1.01 ohms	0.7in.	13in.
500mA	0.2 ohm	Too small to use	2.6in.
1,000mA	0.1 ohm	Too small to use	1.3in.

The other ranges of the meter may be adjusted in a similar manner but the beginner is advised to adjust the meter initially, using the methods described earlier, and leave the accurate adjustment against the standard meter until practice has been obtained in using the meter. In any case, the accuracy achieved by the second method is hardly necessary from the beginner's point of view.

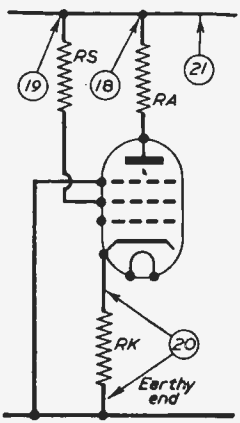


Fig. 23.—Circuit and check points for a pentode valve (omitting capacitors).

How to Use the Multimeter Milliamp. Ranges

Refer to Fig. 23 for a normal pentode circuit. The voltage test points of such a circuit have already been discussed.

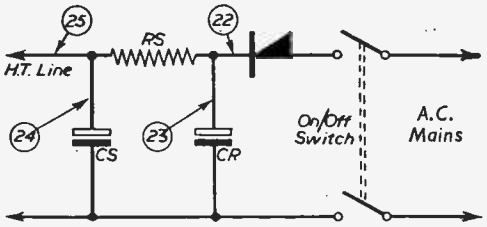


Fig. 24.—A.C./D.C. power pack with metal rectifier.

Sometimes when H.T. is present (21) and the voltage across Rk (20) is low (bias) the valve itself is suspected. From a service sheet or the maker's valve data, the anode current for the valve is often known. The meter is used to check this. If the voltages are correct and the number of milliamps passing is low, then the valve is faulty. The meter for such a test may be inserted in the H.T. line to Ra, that is, unsolder Ra on the H.T. side. Clip the positive meter lead to H.T. line and the negative to Ra (not earth as when using volts ranges). All current now taken by the anode passes through the meter. Set the range to 1 amp. and then switch on S1. If the meter only moves a little try the next range and so on until you obtain a reasonable deflection of the needle. The anode current is then read. Output valves usually draw between 25 and 60mA, L.F. amplifiers about 10mA, detectors very little. If you wish to know the screen current, it may be checked similarly by unsoldering Rs. Sometimes the introduction of a meter will cause oscillations, etc., and it is best to check the cathode current. This is the sum of the anode and screen currents and can be tested by

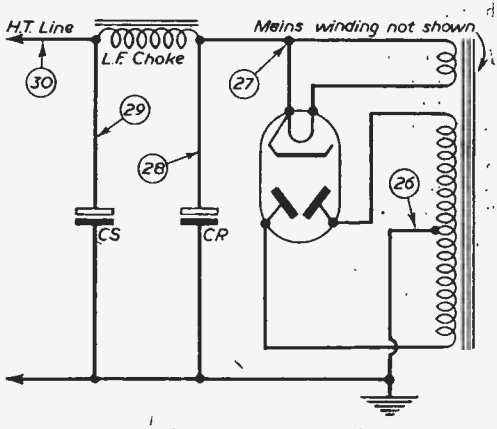


Fig. 25.—Normal A.C. power pack with valve rectifier.

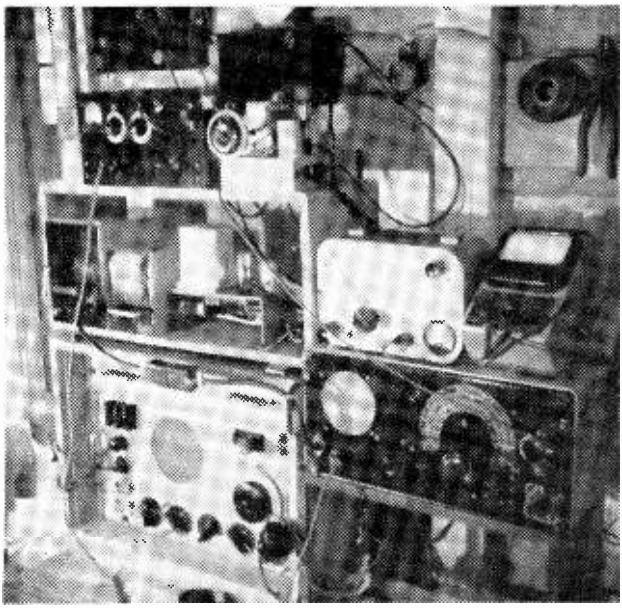
(Continued on page 648)

Becoming an Amateur

No. 4.—LEARNING MORSE

By J. D. Pearson, G3KOC

THE Morse code is a subject which many people feel they could never master, without ever having really made an attempt. The reader will find, no doubt, in pursuit of the subject, that there are differing opinions as to the best way to tackle the problem. The mode often used in the services is to shut a number of students in a room, day after day, with an instructor and a code oscillator until they emerge either as proficient operators or nervous wrecks. One could find fault with any system because so much depends on the individual. If one approaches the problem as an irksome task, a necessary evil towards obtaining an Amateur Licence, then a subconscious hindrance is planted at the outset in the mind of the student. The mental attitude should be such that one is possessed of a keen desire to acquire the ability to read all those mysterious dots and dashes one hears on the short wavebands.



The den of Mr. J. Mitchell of Warminster.

Procedure

The first essential, of course, is to memorise the various groupings of symbols which make the letters of the Morse alphabet. It will be seen from the table that instead of being represented by a series of dots and dashes the letters of the alphabet are matched by the equivalent morse sounds. The letters "di" represent a dot and the letters "dah" a dash. The two words hyphenated thus: "di-dah" equal the letter "a"; the group "di-dah-dah-di" the letter "p" and so on.

The reason for giving the Morse alphabet in this somewhat unusual manner is as follows: if the student learns the Morse alphabet from a printed list of dots and dashes, when hearing morse he automatically sees in his "mind's eye" a sequence of dots and dashes; he then has to convert these mentally into the letters they represent. Now supposing he had learned the Morse alphabet as being represented by a series of sounds, as given here phonetically; when hearing the sound "di-dah-di," for instance, he immediately recognises the letter "r"—the additional mental step of converting "dot-dash-dot" into its corresponding letter is avoided.

The anomaly arises, of course, because one is learning by sight a language which will be used solely by ear. The ideal method obviously is to learn the Morse alphabet "by ear," without ever consulting any printed matter. The method outlined here is given for the benefit of those who, as was the case with the writer, are compelled to resort to self-tuition.

Progress

The beginner should aim to learn at least four letters of the Morse alphabet each day. The letters should be taken consecutively and not by learning "all the dot only letters" or "all the opposites" as the writer has seen recommended: this merely leads to eventual confusion.

At the end of a fortnight the beginner should be able to think of any given letter and be able to say to himself its equivalent sound in morse. Practice whenever possible by translating passages from newspapers, cartons and hoardings into morse. Do this audibly at first (and when alone, of course, or one's friends and relatives are apt to give one curious glances). Weakness on any particular letter will be revealed when translating.

When the reader can ask a second person to say at random various letters of the alphabet in fairly rapid succession, and himself immediately think of the equivalent morse sound, he can consider that he knows the Morse alphabet. This means he can read morse at about four words per minute.

Practice

The next step is to listen to *good* morse as frequently as possible. Most of the C.W. the beginner will hear on the short wavebands is much faster than his present 4 w.p.m. Regrettably also, not all of it is good morse. This applies to amateur, as well as other stations.

There are several ways in which the beginner may tackle the bridging of the gap between 4 and 12 w.p.m. If there is a radio club in his

district he will find no doubt that "slow" morse classes are already in progress, or that they can be arranged on request. For the enthusiast who cannot contact a club there are the R.S.G.B. Slow Morse Transmissions which are undertaken by licensed amateurs situated in various parts of the country. A decent communications receiver is almost always capable of pulling in one or other of these transmissions given reasonable conditions. The dates, times, call-signs and frequencies of these transmissions appear in the monthly journal of the R.S.G.B.

TABLE 1 : INTERNATIONAL MORSE CODE

A—di-dah.	N—dah-di.
B—dah-di-di-di.	O—dah-dah-dah.
C—dah-di-dah-di	P—di-dah-dah-di.
D—dah-di-di.	Q—dah-dah-di-dah.
E—di.	R—di-dah-di.
F—di-di-dah-di.	S—di-di-di.
G—dah-dah-di.	T—dah.
H—di-di-di-di.	U—di-di-dah.
I—di-dj.	V—di-di-di-dah.
J—di-dah-dah-dah.	W—di-dah-dah.
K—dah-di-dah.	X—dah-di-di-dah.
L—di-dah-di-di.	Y—dah-di-dah-dah.
M—dah-dah.	Z—dah-dah-di-di.

NUMERALS

1—di-dah-dah-dah-dah.	6—dah-di-di-di-di.
2—di-di-dah-dah-dah.	7—dah-dah-di-di-di.
3—di-di-di-dah-dah.	8—dah-dah-dah-di-di.
4—di-di-di-di-dah.	9—dah-dah-dah-dah-di
5—di-di-di-di-di.	0—dah-dah-dah-dah-dah.

Another Method

For the unfortunate who cannot avail himself of any of the above methods there is but one tutor left—his receiver. Between the frequencies of 3-13Mc/s, there are innumerable C.W. transmissions of varying speeds. Some of these are commercial point-to-point stations who "idle" on their working frequency between traffic-handling sessions in order to keep the channel open. The "idling" consists often of long strings of V's interspaced with the letters "de" (meaning from), followed by a composite alphabetical/numerical call sign and possibly various "Q-code" groups. The morse is fast (by beginners' standards) but of excellent quality. Despite the speed, the beginner will, with perseverance and owing to the repetitive nature of the transmissions, eventually be able to copy them without error.

As with most things, constant practice is essential to proficiency. Half an hour each day is much more beneficial than, say, three hours each week-end.

It will be noted that so far no mention has been made of a morse-key or "tapper," as this instrument is often mis-called. This is deliberate and the beginner is advised to learn to read morse before any attempt is made at "sending" practice. When he knows what good, correctly spaced morse sounds like he is in a much better position to develop from the outset a perfectly spaced, rhythmic manner of sending.

A BEGINNERS' TEST-METER

(*Continued from page* 646)

unsoldering Rk at the earthy end and connecting meter negative to earth and meter positive to Rk in the same way as stated for the anode check.

Another method is to put the meter in the H.T. line by breaking the wire at the point 21, positive of meter going to the right and negative to the left (Ra and Rs, etc.). The meter reading is then the total of screen and anode currents. If the valve is now removed, under normal conditions the meter should show no reading. If it does, providing there is no bleeder network, etc., between H.T. and earth, a condenser is probably at fault. Note that all condensers have been omitted in the simple diagram given.

Checking a Simple A.C./D.C. H.T. Supply

Refer to Fig. 24. The voltage test points have already been discussed. If the meter is inserted at point (25), by cutting or unsoldering the wire, the total consumption of the valves in the set will be given. If the meter is then placed in the circuit at (22) the reading may be greater. This is the leakage current through the condensers Cs and Cr—it should not be greater than about 5mA. The meter may be inserted in the condenser leads at (23) or (24) when the leakage current of each condenser may be read. It will normally be about ½mA for each but could be, say, 2½mA. The total current taken by the valves may also be checked by inserting the meter at one end of Rs (which could be a choke).

Checking a Full Wave Rectifier H.T. Supply

Refer to Fig. 25. The total consumption of the valves may be found by inserting the meter in the H.T. line, broken at point (30). If one or more valves are removed the current taken by individual valves may be checked (in most cases this can do no harm). This should be done rapidly and the valves put back as soon as possible. The total consumption may also be taken by insertion in the circuit at points (27) and (26). Of these perhaps (26) is the better to take. The reading may be a little higher due to the leakage current of the condensers Cs and Cr which may be tested by insertion at points (29) and (28) in a similar way.

A Warning Note

Never be tempted to connect the meter with S1 on; never guess the range beforehand, always start with one amp. or 1,000 volts and work down; always check that everything is correct before switching on S1. If you follow this advice, your meter will give you years of good service.

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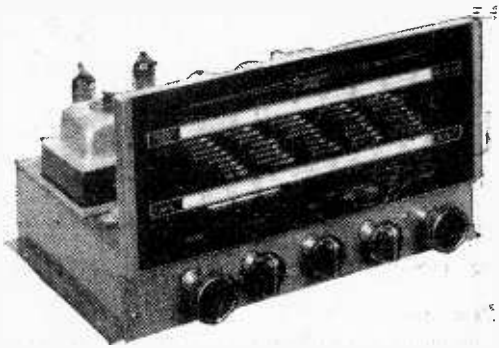

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1F3	7/6	6C10	9/-	25L6GT	9/-	ECC81	7/6	PCC84	9/-
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1L4	6/9	6J7GT	8/6	30L1	8/-	ECC84	9/6	PCL82	10/6
1P1	8/-	6K7G	5/6	35L6GT	9/-	ECF80	10/6	PL38	22/6
1P10	7/6	6K8G	7/6	35W4	8/6	ECF82	10/6	PL81	12/-
1P11	7/6	6L6G	10/6	35Z4GT	8/-	ECH42	9/-	PL82	9/-
1R5	7/6	6Q7G	7/6	53KU	11/6	ECH81	10/-	PY81	8/6
1S5	7/6	6SL7GT	7/6	5763	10/6	ECL80	10/6	PY82	7/6
1T4	7/6	6SN7GT	5/-	DAF91	7/6	EF41	9/-	U52	7/6
1U5	6/-	6V6G	7/6	DAF96	8/-	EF80	8/6	U76	7/6
3A5	10/6	6X4	7/-	DF91	7/6	EF86	11/-	U78	7/-
3Q4	8/-	6X5GT	6/-	DF96	8/-	EF91	4/6	UBC41	8/6
3S4	7/6	8D3	4/6	DH76	7/6	EF92	5/6	UCH42	9/6
3V4	7/6	12AH8	10/6	DH77	7/-	EL38	22/6	UF41	8/6
5U4G	7/6	12AT6	8/6	DH142	8/6	EL41	9/6	UL41	8/6
5Y3GT	7/6	12AT7	7/6	DH150	10/-	EL84	8/6	UY41	7/6
5Z4G	9/6	12AU7	7/6	DK91	7/6	EY51	10/6	W76	6/9
6AK6	6/6	12AX7	7/6	DK92	9/-	EZ40	7/6	W142	8/6
6AL5	5/6	12BH7	14/6	DK96	8/-	EZ80	7/-	X17	7/6
6AM6	4/6	12J7GT	10/-	DL92	7/6	EZ81	8/-	X142	9/-
6AT6	7/6	12K7GT	6/9	DL94	7/6	KT33C	9/6	X150	9/-
6BA6	7/-	12K8GT	12/6	DL96	8/-	KT66	11/6	Z77	4/6
6BE6	7/-			EABC80	8/6			ZD17	7/6

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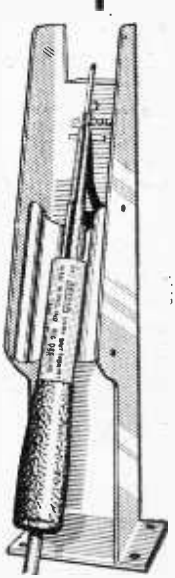

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SELECTING TRANSISTORS

BASE CONNECTIONS AND USES

By J. Brown

UNLIKE valves, which usually may be used for several different purposes with success, transistors usually need to be selected carefully for the purpose in mind. In this article we are concerned with transistors likely to be of use to the amateur constructor and not with the special types intended for computers and switching devices and similar equipment.

Procedure

In using transistors it is important to follow carefully the manufacturers' data; transistor circuitry tends to be rather more critical than that for valves and, to obtain the best possible results, transistors must be used only for their designed purpose. In some instances, circuits may employ certain transistors for a different purpose than that given in the manufacturers' information. However, it is usually found that to secure adequate operation, the transistors have to be specially selected for certain properties from a large batch—hardly a procedure open to the amateur.

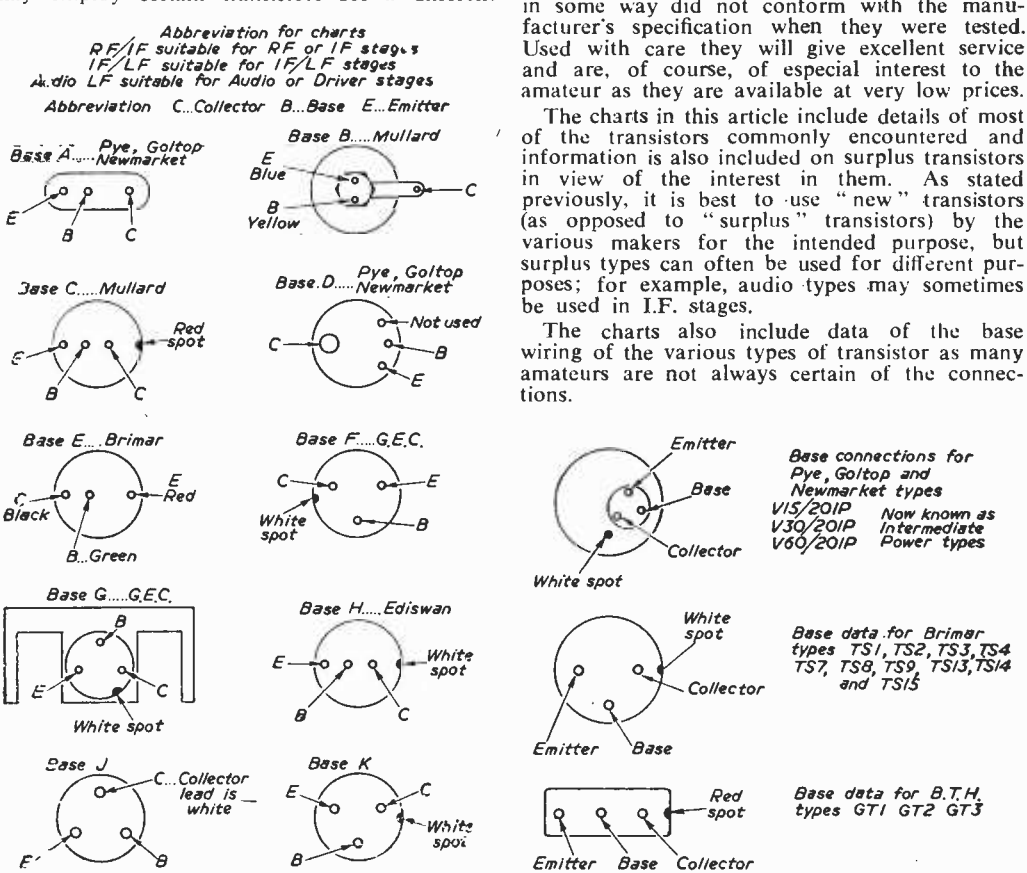
There are few *real* equivalents among the ranges of different manufacturers as yet and in following a particular design it is generally wise to employ the specified transistors. It is always wise to check on the ratings of the transistors when designing one's own circuit.

"Surplus" Types

There are available now so-called "surplus" transistors. These are in general transistors which in some way did not conform with the manufacturer's specification when they were tested. Used with care they will give excellent service and are, of course, of especial interest to the amateur as they are available at very low prices.

The charts in this article include details of most of the transistors commonly encountered and information is also included on surplus transistors in view of the interest in them. As stated previously, it is best to use "new" transistors (as opposed to "surplus" transistors) by the various makers for the intended purpose, but surplus types can often be used for different purposes; for example, audio types may sometimes be used in I.F. stages.

The charts also include data of the base wiring of the various types of transistor as many amateurs are not always certain of the connections.



Details of base connections for various makes of transistor.

CHART OF ESSENTIAL TRANSISTOR DATA

Manufacturer	Type	Base	Max. Freq.	Application
Ediswan	XB104	H	Gen. Pur.	Audio
	XA102	H	8 Mc/s	R.F.
	XA101	H	Gen. Pur.	I.F.
	XB103	H	Audio	L.F. amp.
	XC101	H	Power	Audio
Mullard	OC44	C	12 Mc/s	R.F.
	OC45	C	6 Mc/s	R.F./I.F.
	OC71	C	Gen. Pur.	L.F./audio
	OC72	C	Power	Audio
	OC16	B	Power	Audio
Brimar	TJ1	E	500 Kc/s	Audio/ L.F.
	TJ2	E	600 Kc/s	Audio/ L.F.
	TJ3	E	800 Kc/s	Audio/ L.F.
	TS1	E	500 Kc/s	Audio/ L.F.
	TS2	E	600 Kc/s	Audio/ L.F.
	TS3	E	800 Kc/s	Audio/ L.F.
	TK20A	J	3-8 Mc/s	R.F.
	TK25A	J	8 Mc/s	R.F.
	TK21A	J	200 Kc/s	L.F.
	TK24A	J	200 Kc/s	L.F.
	TK23A	—	200 Kc/s	L.F.
	TK26A	J	200 Kc/s	L.F.
	TK27A	J	200 Kc/s	L.F.
	TK40A	—	1.5 Mc/s	R.F./I.F.
	TS7	K	1 Mc/s	I.F./R.F.
	TS8	K	1 Mc/s	I.F./R.F.
	TS9	K	600 Kc/s	Audio
	TS13	K	500 Kc/s	Audio
	TS14	K	500 Kc/s	Audio
	TS17	K	600 Kc/s	Audio
B.T.H.	GT1	See text	800 Kc/s	Audio/ L.F.
	GT2		800 Kc/s	Audio/ L.F./ I.F.
	GT3		1 Mc/s	R.F./I.F.
	GT11		4 Mc/s	R.F./I.F.
	GT12		6 Mc/s	R.F./I.F.
	GT13		10 Mc/s	R.F.
Hivac	XFT2	See text	500 Kc/s	I.F./audio
G.E.C.	GET114	F	500 Kc/s	I.F./audio
	GET106	F	½ Mc/s	Audio
	GET103	F	Gen. Pur.	Audio
	GET104	F	–	Industrial
	GET115	G	Low Power	Audio
	GET116	G	Low Power	Audio
	GET105	G	Low Power	Audio
	GET110	G	—	Industrial
	GET120	G	—	Industrial

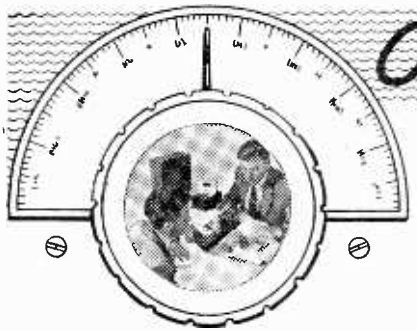
Manufacturer	Type	Base	Max. Freq.	Application
G.E.C.	GET871	F	5 Mc/s	R.F.
	GET872	F	10 Mc/s	R.F.
	GET873	F	5 Mc/s	R.F. / I.F.
	GET874	F	10 Mc/s	R.F.
Pye	V10/15A	A	1,000 Kc/s	L.F./I.F.
	V10/30A	A	1,200 Kc/s	L.F./I.F.
	V10/50B	A	2,000 Kc/s	L.F./I.F.
	V6/R2	A	4 Mc/s	R.F./I.F.
	V6/R4	A	8 Mc/s	R.F.
	V6/R8	A	10 Mc/s	R.F.
	V15/10P	D	Power	Audio
	V15/20P	D	Power	Audio
	V15/30P	D	Power	Audio
	V30/10P	D	Power	Audio
	V30/20P	D	Power	Audio
	V30/30P	D	Power	Audio
Goltop	V10/15A	A	Power	Audio/ I.F.
	V10/15	A	Power	Audio/ I.F.
	V15/10P	A	Power	Audio
	V6/R2	A	3 Mc/s	R.F./I.F.
	V15/10P	A	Power	Audio
	V15/20P	A	Power	Audio
	V15/30P	A	Power	Audio
	V30/10P	D	Power	Audio
	V30/20P	D	Power	Audio
	V30/30P	D	Power	Audio
	V60/201P	D	Power	Audio
	V30/201P	D	Power	Audio
	V15/201P	D	Power	Audio
Newmarket	V6/R2	A	4 Mc/s	R.F./I.F.
	V6/R4	A	4-8 Mc/s	R.F./I.F.
	V6/R8	A	8 Mc/s	R.F./I.F.
	V6/R1	A	3 Mc/s	I.F.
	V10/15A	A	1,000 Kc/s	L.F./audio
	V10/30A	A	1,200 Kc/s	I.F./audio
	V10/50B	A	Low Power	Audio
	V30/20P	D	Power	Audio
	V30/30P	D	Power	Audio
	V15/30P	D	Low Power	Audio
	V15/20P	D	Low power	Audio
Ediswan	XA104	H	6 Mc/s	R.F./I.F.
	XA103	H	4 Mc/s	R.F./I.F.
	XB102	H	Audio	L.F. amp.
G.E.C.	GET3/D		Audio	L.F. amp.
Surplus Yell./Red	Paint spot	A	8 Mc/s	Mixer/ R.F.
Yell./Green	Paint spot	A	Power 600 Kc/s	Audio
Red Spot	Paint spot	A	800 Kc/s	L.F./audio
White Spot	Paint spot	A	5 Mc/s	R.F./I.F.

Colour-coding

The leads of some manufacturers' transistors are colour coded; for example in BTH transistors the collector is coloured white and the next connection reading clockwise is for the base and the remaining one is for the emitter. In the Hivac XFT2 the base is the central lead and the collector is colour coded red.

Although some of the transistors given in the charts are obsolete, having been replaced by more efficient types, they are included for the sake of completeness. The transistors mentioned in the charts are today employed in many kinds of circuit and will be found in all types of electronic equipment.

Many firms other than those mentioned above manufacture transistors; e.g., Semiconductors Ltd., Texas Instruments Ltd., etc. Generally these firms produce semiconductor devices for use in specialised electronic equipment and their products will rarely be encountered by the amateur.



On Your Wavelength

BY THERMION

IT is now many years since I made my first receiver; a simple crystal receiver it was and well do I remember the hours of hard work and perserverance that went into its construction. In those days, radio amateurs were a different breed; we enjoyed our hobby and took a great pride in building as much as possible of our receivers. Initially, of course, this policy stemmed from necessity rather than from personal preference; we were unable to buy parts, we *had* to make them if we wanted to build a set. How many of you remember winding coils on wooden mangle rollers? I do for one. There was the question of obtaining raw materials; where to find wire for coil winding; what to use for a detector—we used all manner of substances, ranging from coal, through carborundum to galena—; what to use for a baseboard, and so on.. Yes, those were the days! Then, there was always what might be termed a spirit of adventure among the radio enthusiasts; a sort of bonhomie which is entirely lacking today. The hobby has now become a trade and everything is bought. If you have recently built a set, pause and reflect how much of the construction was your own unaided work. Precious little I am certain. You may argue that you have no time to spare and have to buy ready made items. Nonsense: in my day, we had even less time; we did a hard day's work and came home ready to spend an evening, or rather enjoy an evening, experimenting with our latest project. Where is this spirit today?

The main reason for lack of enthusiasm is the lack of new inventions or discoveries in the world of amateur radio today. When radio first began, hardly a day went by without details being given or talked about concerning some new station, some new combination of crystals, etc. Nowadays, everything is over; there is nothing left to discover. Any amateur with the money and inclination can talk to Australia if he so desires. In that preceding sentence lies the answer: money. Today, any item of radio gear or any component can be bought and as is often said, more cheaply than making the item and, of course, much more quickly. In the old days, one had to be a millionaire to buy radio parts and it was impossible to see many items, let alone purchase them. I mentioned another aspect of the modern trend above; the fact that not only can components be bought more cheaply than made, but also they can be bought quickly. This is often given as an excuse for buying costly parts. Why is there this insistence on speed? Is the modern way of life so different to that of thirty years ago that the virtues of patience and perserverance have disappeared? Surely not. This is the basic difficulty. Every new idea must be completed quickly. What does it matter if the building of a receiver takes six months if afterwards you can say that you built three-quarters of it? How few people now take a pride in their construction work. "It may look awful," they say "but it works". This sentiment is typical of many in these times and is spreading like a blight through the world of amateur radio.

It has, in fact, been in evidence for some time in many radio shops selling components. How many of you can say that your local dealer knows you and is prepared to help you out of your difficulties? Very few dealers of my acquaintance would be prepared to help their customers in this way. Why not? They never tell me. Perhaps it is the fault of the customer and not of the dealer. However, from the outside, all that is in evidence is a great lack of goodwill and understanding between most dealers and constructors. What a great pity it is! So many of the dealers are old hands and should be willing to help their customers to share their knowledge. It is this fact that makes me suspect that faults lie on both sides.

However, all is not lost. I have found when talking to young enthusiasts—many of them still attending school—that their attitude is different. They take a pride in their sets; they build many of the parts—they have to on 1s. to 10s. per week pocket money. They enjoy the hobby for the hobby's sake; it is not so much a means to an end as an end in itself. It is curious, too, that dealers are often particularly willing to help these young people. Why is this? Could it be that they are learning their hobby in the same atmosphere of discovery that the dealer encountered in his youth? Perhaps this establishes a common bond; at any rate there is a startling affinity.

Radio Dens

I AM still receiving a steady stream of photographs and negatives in response to my appeal some time ago for pictures of readers' radio dens.

On page 686 of this issue the den of Mr. T. Fuller, of Beaminster, is illustrated. Mr. Fuller is 16 years old and his enthusiasm can be judged by his equipment.

The den of Mr. J. Mitchell, of Warminster, is illustrated on page 647. Shown in the picture are on the left a modified R208 and on the right a PCR3. Above the R208 are the two receiver power packs and a spare unit. Above the power packs on the left is a home-made top band TX and on the right an R.F. converter used as a front end with the PCR3.

Improving Superhets

SIMPLE MODIFICATIONS FOR BETTER RESULTS

By J. Johnston

WHEN an ordinary superhet receiver is primarily used for long distance or short wave reception, a number of useful additions can be made to increase selectivity and sensitivity, simply tuning, etc. Some features of this kind will be present in a communications receiver, but not in the more straightforward conventional all-wave set. The improvements will, of course, be equally effective on long and medium waves, giving improved reception, or a more accurate indication of correct tuning.

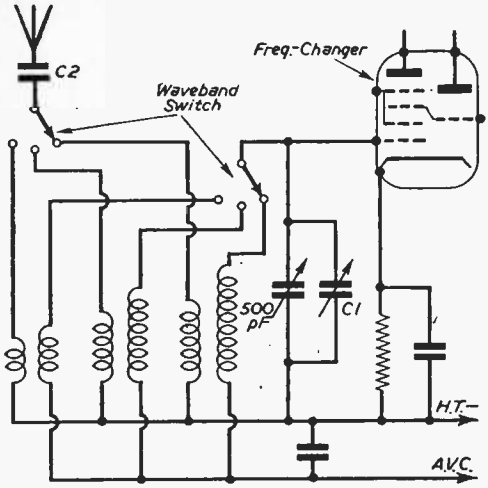


Fig. 1.—Using a trimmer (C1) in parallel with the aerial tuning section of the gang condenser.

Aerial Trimming

In many average receivers alignment between aerial and oscillator tuning is not exact throughout each waveband. This can be so even when trimming and core adjustment are correct, and arises from slight variations in gang condenser capacity, etc. The loss of efficiency is unimportant with strong signals, but can be material with weak signals.

Loss of sensitivity from this cause can be overcome by wiring a small panel-operated trimmer across the aerial tuning section of the gang condenser, as shown at C1 in Fig. 1. The pre-set trimmers fitted to the coils should be unscrewed, or removed, so that the panel trimmer is normally at about half capacity. Slight final adjustments can then be made with this control, as necessary, when listening to very weak stations. A maximum capacity of 30pF or 50pF will normally be suitable, and a small S.W. type air-spaced variable condenser will be convenient.

At the same time it may be worth while reducing damping on the aerial coils, by including a small pre-set or fixed condenser, C2. With a sensitive receiver, this can be quite low in value; say 25pF, or even less. The increased selectivity in the aerial circuit will then help to reduce second channel interference, which can be troublesome on the short wave bands.

Optimum adjustments of the panel trimmer will not be necessary with powerful stations, and it can thus be left untouched during normal reception.

Bandspread Tuning

With the usual 500pF or similar gang condenser, tuning becomes very critical and crowded on the S.W. bands. This can be overcome by adding a bandspread tuning condenser in parallel with the main gang condenser, as shown in Fig. 2. Any particular S.W. band can then be explored readily, and stations can be recorded by dial reading if the main condenser is returned to a particular setting. Two-way conversations between amateurs can also be followed, because the readings of each transmitter can be noted, and returned to as needed.

For general use on 25, 31, 40m and higher bands, a maximum capacity of about 25pF or 30pF will be satisfactory. If more attention is given to lower bands, a maximum capacity of 15pF will be sufficient. Wiring to the condenser should be reasonably short. It may be possible to match up the control knob and dial with existing controls. If a large dial knob can be used, the epicyclic reduction drive is not essential. With a 25pF condenser, the full 180 deg. rotation will give a similar wavelength coverage to roughly 9 deg. rotation of the 500pF condenser.

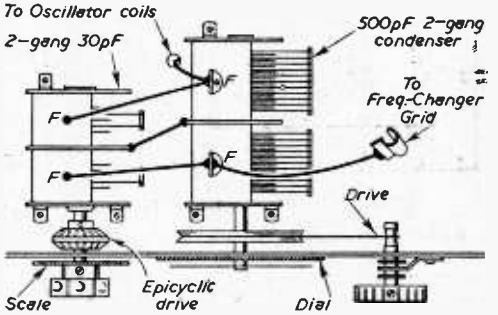


Fig. 2.—Using a bandspread tuning condenser in parallel with the main gang condenser.

Tuning Indicators

A tuning indicator will show if alignment and trimming are correct, besides showing the tuning point for stations. A 1½in. to 2in. or similar moving coil meter will provide a very sensitive and exact indication of tuning, if wired to an A.V.C. operated stage, such as the I.F. amplifier as in Fig. 3.

The meter and shunt should be so chosen that the meter can be set to show full-scale deflection, with no signal tuned in. A 1mA, 2mA or 5mA meter can be shunted so that the usual 6mA to 10mA anode current of the I.F. stage valve gives a full scale reading. The 0.05μF by-pass condenser is necessary to preserve stability.

The 100 ohm or similar variable resistor should be set to a low value, and the receiver tuned until no signal is heard. The resistor is then adjusted until the meter reads full scale. When a station is tuned in, the reading will fall. The correct tuning position is that giving lowest reading on the meter.

Improvements which increase sensitivity, such as adjustment of aerial trimming, or I.F. transformers, will also give a further reduction in meter reading. The receiver has thus been adjusted for optimum results when no further fall in reading can be obtained, with a given station. External improvements, such as those to aerial or earth, will also be shown by the meter reading, and this can be very useful indeed.

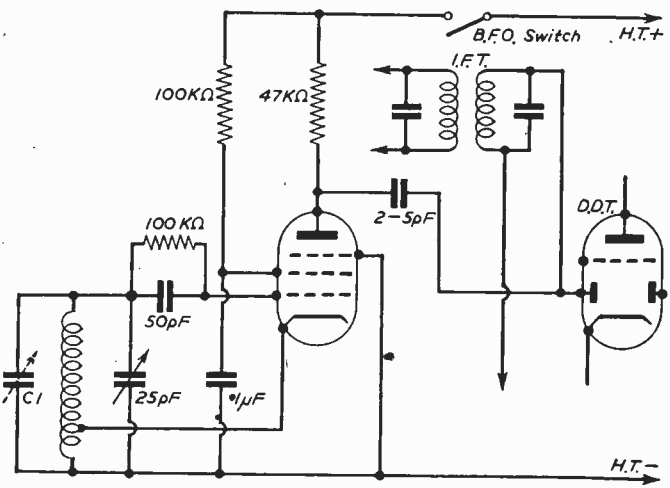


Fig. 5.—Circuit of a simple beat frequency oscillator.

With fading stations, the meter will tend to rise and fall, owing to the A.V.C. action. With very weak stations and delayed A.V.C., no indication may be obtained. This can be largely overcome, if desired, by increasing I.F. gain in the manner described later.

A magic eye may also be used for tuning indication, and pin connections for a 6U5G are shown in Fig. 4. This is convenient for guidance in correct tuning, but is less suitable when an exact note needs to be made, as with the meter.

Beat Frequency Oscillator

With unmodulated continuous wave Morse, reception is impossible with an ordinary superhet, because there is no local oscillation to beat with the received signal and thus produce an audible tone. With communications receivers, a local beat frequency oscillator is used for this purpose. Any small triode, or pentode valve, will be satisfactory, and its heater rating can be chosen to suit the receiver supply. The circuit shown in Fig. 5 is an easy one to adjust, and requires practically no modification to the main

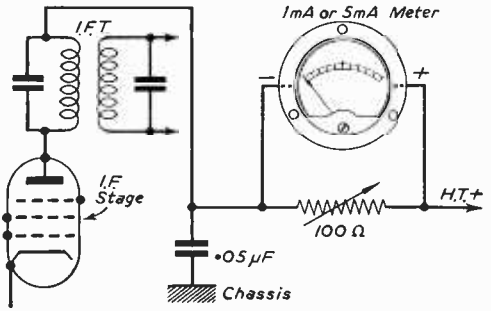


Fig. 3.—A simple tuning indicator.

part of the receiver. Values are suitable for a 6K7, or any average R.F. pentode.

The B.F.O. coil should be tunable to a frequency near that used by the receiver I.F. stages. If the receiver employs 465kc/s, as is usual, the B.F.O. can be tuned to 466kc/s, or 464kc/s, to produce an audible tone of 1kc, or 1,000c/s. In practice, variable tuning is useful in the B.F.O. stage. The beat frequency can then be varied at will, to avoid monotony, and to give maximum readability over interference. The upper or lower beat frequency can also be selected, according to whether an interfering station occupies the upper or lower sideband.

Coil

In Fig. 5, C1 is a pre-set condenser, and it is adjusted until no beat note is produced, with the 25pF variable condenser at half capacity. The higher or lower frequency can then be selected and adjusted by means of the 25pF condenser control knob. The B.F.O. coil may consist of one winding from a discarded 465kc/s I.F. transformer, with about two extra turns, close wound, to provide a tapping, or any aerial, oscillator, or home-wound coil tunable to 465kc/s (approximately 645m) can be used.

The B.F.O. stage is best built in a screening can, especially if the coil is not screened. The

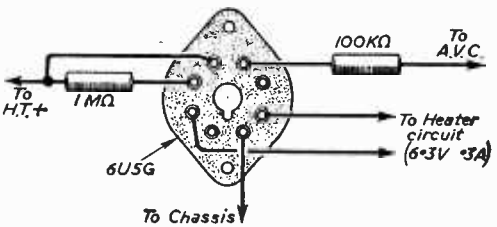


Fig. 4.—Wiring a 6U5 as a tuning indicator.

25pF condenser can be operated by an extension spindle, if necessary. The coupling capacity to the D.D.T. stage must be small, as shown. An insulated wire wound round the diode connection will usually provide enough coupling, or a very small pre-set can be incorporated, and adjusted

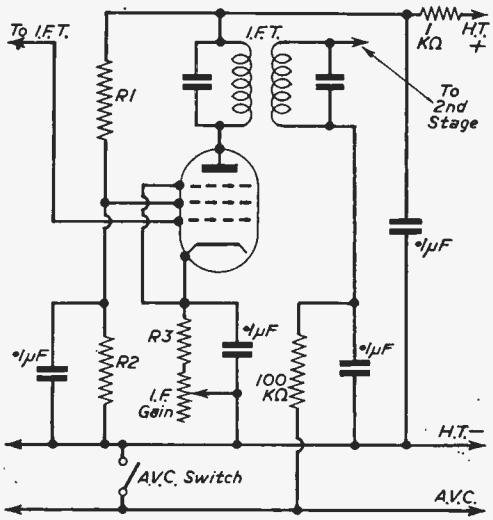


Fig. 6.—Adding an A.V.C. switch.

for best results. The value is in no way critical.

The B.F.O. stage must be rendered inoperative for reception of speech and music, and a B.F.O. control switch is thus included in the H.T. supply to the valve. In battery sets, a filament switch would be more suitable.

A.V.C. Circuit Modifications

When unmodulated C.W. morse is received, the tuning meter or eye will endeavour to follow the signal. This, and the erratic operation sometimes caused, can be eliminated by fitting an A.V.C. switch, as shown in Fig. 6. Component values in the F.C. and I.F. stages should be such that the valves receive optimum bias when the A.V.C. line is shorted to chassis. Such a switch is sometimes ganged with the B.F.O. switch, so that when the B.F.O. is operating, the A.V.C. is inoperative. If not, the A.V.C. switch should be closed when the B.F.O. is switched on.

With the A.V.C. off, critical adjustment of an aerial trimmer like that in Fig. 1 will be simplified without a tuning meter because gain will be constant. But there will, of course, be no compensation for fading, and overloading may arise with powerful stations. The A.V.C. is thus normally left in action, except when receiving morse.

In many receivers the F.C. and I.F. stage valves draw screen current from a series resistor wired to H.T. positive. When the A.V.C. circuit develops bias, the valve anode currents drop. This usually causes a drop in S.G. current. The S.G. series resistor then passes less current, so that the S.G. voltage rises. To some extent this offsets the A.V.C. action. When the best possible degree of A.V.C. is required, the valves should therefore have their screen grids operated from a divider, as provided by R1 and R2 in Fig. 6. The overall value of these resistors should be fairly low—say, not over 25k in all. This, however, will depend on the H.T. current available, because of the consumption of the two resistors in parallel with the H.T. supply. It is necessary to take the values for R1 and R2 from the valve maker's data, or to ascertain the S.G. voltage, and calculate the values from this, and screen grid current.

Very many receivers have only one I.F. stage, and it is usually easy to add an extra I.F. stage to these, thereby securing a very worthwhile increase in sensitivity and selectivity. Fig. 6 shows a complete I.F. stage, which can be added between existing F.C. and I.F. stages.

Cathode Resistor

The I.F. transformer must be for the correct frequency (usually 465kc/s). Wiring should be short and direct, or instability may arise. As the gain may easily be too high for normal listening, a variable cathode resistor, with panel control knob, should be provided. With many valves, a 25k or 50k potentiometer will be satisfactory. The usual fixed bias resistor R3 is also included, so that normal bias is present when the I.F. gain control is set for maximum gain (e.g., minimum resistance). With some receivers, decoupling of the H.T. circuit will not be necessary. With others, this may be required in the feed to the frequency changer.

The additional transformer is adjusted for maximum sensitivity, as indicated by the tuning meter. If instability arises, evidenced by an abrupt fall in meter reading, with no signal tuned in, and with the I.F. gain control approaching maximum, then the layout of this extra stage needs improving. The valve may be placed in a screening can, and anode and grid leads may be shortened and screened.

Selectivity

If the receiver is often used for musical programmes, the I.F. transformers should be staggered slightly, or the number of I.F. circuits present will make tuning too sharp for good reception.

When additional amplification is made available in this way, the delay voltage may be removed from the A.V.C. circuit, if desired. It will then begin to operate even with weak signals. Most receivers employ a double-diode-triode, with the triode cathode bias acting as A.V.C. delay voltage. The delay voltage can then be removed by shorting the cathode to chassis, the bias resistor being eliminated. At the same time the triode grid resistor is increased to 8 to 10MΩ, so that triode bias is obtained by grid rectification. The effects arising from this modification will be particularly apparent when a tuning meter has been fitted.

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6H6	3/6	35L6	9/6	EL32	5/6
6J5	6/6	35Z4	9/6	EL84	10/6
6J6	7/6	80	10/6	EM81	12/6
6J7G	8/6	807	6/6	EZ40	8/6
6K6GT	6/6	954	1/6	EZ80	8/6
6K7G	5/6	EA50	1/6	E1148	1/6
					HABC80
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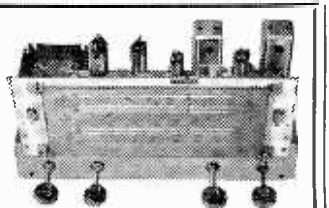

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8/500v.	2/9	8+8/450v.	4/6	2,500/3v.	4/-
16/450v.	3/6	8+8/500v.	5/-	6,000/6v.	5/-
16/500v.	4/-	8+16/450v.	5/-	32+32/350v.	4/6
32/450v.	5/6	8+16/500v.	5/6	50+50/350v.	7/-
25/25v.	1/9	16+16/450v.	5/6	64+120/275v.	7/6
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An Experimental "Super" Transistor Receiver

AN UNUSUAL DESIGN USING A "BASKET" COIL

By Capt. R. F. Graham

THE basic circuit of this receiver gives phone reception without any aerial or earth. This, however, is not advisable because only a very small maximum output is permissible from an R.F. transistor. In the practical circuit an audio transistor is therefore added. Phone reception is then very loud from a BBC station 50 miles distant.

Circuit

This circuit was evolved by simplifying the superhet first stage mixer. Instead of the many separate coils (which have many snags). taps and auto-transformer methods were tried, gradually reducing coils to one with an untuned end tending to produce a lower frequency. I.F.. and other frequencies which vary with tuning. A diode is therefore used to rectify all the frequencies and a sort of reflex action is thereby added. The transistor amplifies both R.F. and A.F. and output is increased enormously. Local stations come in perfectly. but weaker ones need boosting by feedback which produces partial super-regeneration.

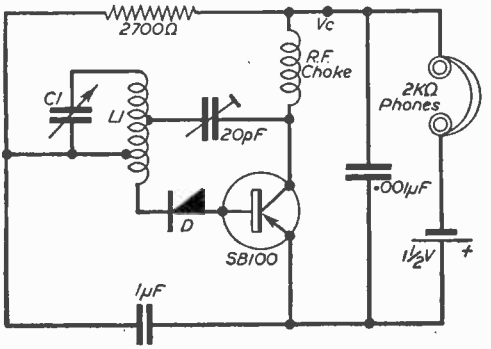


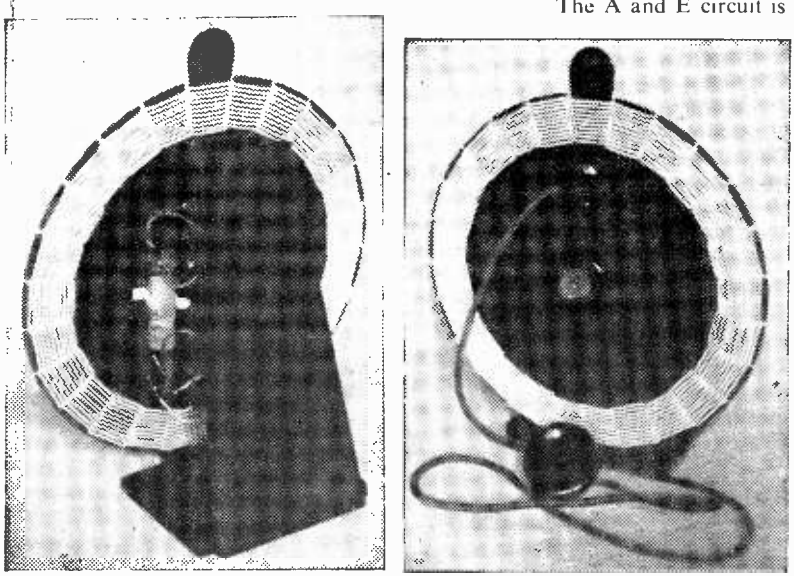
Fig. 1.—The basic circuit.

The Practical Circuit

Variable condenser C1 (500pF) tunes part of L1, a directional loop coil. R1 (270k) supplies bias to Tr1 base, through the other part of L1 and diode D. Input is from the untuned section of L1, to base and emitter, through C3 (1μF). Output is from collector and common emitter. R.F. from collector is stopped by R.F. choke L2 but the audio passes through to C5 (8μF) and on to Tr2 base. C4 (0.001μF) by-passes stray R.F. and prevents overloading of Tr2. C2 (20pF trimmer) controls R.F. feedback into L1. This increases both sensitivity and selectivity. The output load for audio Tr2 is R2 (5.600 ohms) in parallel with the R3 (22k) and R4 (2.7k). The voltage divider resistors supplying bias to Tr2. These three are high in value and necessitate stabilising Tr2 but since 2k phones are used, peak currents are limited to a safe value, and the total battery drain is less than one milliamp.

Aerial Circuit

The A and E circuit is for Continental or weak signals. It is not needed for local broadcasts. It is in a separate box with a loop coil on top, like L1, but without extra untuned turns. C (500pF) tunes L (200μH). An indoor aerial should be at least 10 yards long and connected to the third turn from the earthed end. For an outdoor aerial one turn suffices. The optimum coupling between coils is obtained when they face each other 1ft. apart. Less spacing reduces selectivity and gain may fall. More spacing reduces sensitivity but increases selectivity. Care must be used, even while tuning slowly, to



Front and rear views of the author's receiver which shows clearly the construction of the tuning coil.

avoid suddenly overloading the receiver. Coils should be far apart, 2 to 3ft. usually, for phone reception. Do not connect an aerial direct to the receiver. It is important to note that L can add considerably to signal input, if it faces L1 the correct way round. However, L can also absorb signal from L1 if the aerial or earth are poor.

This unit can be used without an aerial and earth, as an absorption meter, for station indentification if C is calibrated. Place L about 18in. from L1 and tune L until the station is hardly audible; then read frequency in kc/s (calibrated on C). To calibrate C tune to known stations and draw a graph.

Tests and Details

The diode and the transistors must be really good to cope with small signals. The best way to test, more accurately than some expensive testers, is as follows:—use a high resistance volt meter on the 2.5 volts D.C. range, with its positive lead connected to the positive terminal of a 2 volt accumulator. Connect the negative lead on to the diode cathode (red end) and touch the negative accumulator terminal with the anode end of the diode.

Bias—Ic, Vc

Since Tr1 bias affects feedback, it may be desirable to replace R1 by 180k or 220k in series with a variable 100k for adjusting Ic from 0.1 to 0.3mA but usually 0.2mA is best. This is measured between the junctions of L2-C4 and R2-R3 where Ic=0.2mA is shown on the circuit. Voltage drop across R2 provides Tr1 with −1.3 volts. This can be measured at point Vc on the circuit.

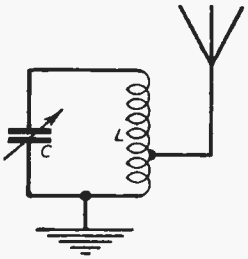


Fig. 2.—A and E circuit.

If a 4.5V battery is preferred for the output transistor, then R2 should be increased so that Vc does not exceed 2 volts. R3 may also need changing so that Tr2 works at an Ic of between 0.5 and 0.6mA measured between phones and (−).

Feedback

The trimmer C2 must not short at any adjustment. A fixed 20pF mica or ceramic in series with about 50pF variable may be preferred, or better still, a small reaction type with rotating vanes in between two sets of fixed plates, one of which is connected to (+) for bypassing excess RF. This C2 should be on the panel, with C1 and switch S, because it needs readjusting slightly at the higher frequencies where most transistors do not amplify so well. It should be borne in mind that the following alterations increase feedback or produce turns ratios tending to create oscillations: (1) Increasing C2; up to 10pF should suffice in all cases. (2) Increasing turns for C2; from 10 to 11 turns. (3) Increasing bias, from 0.1 to 0.3mA Tr1, Ic. (4) Reducing turns between D and C3 (from seven to six). (5) Making C1 tune two or three more turns; crossing over the tap for C3.

These readjustments should be tried in the order given, testing the receiver at high and low

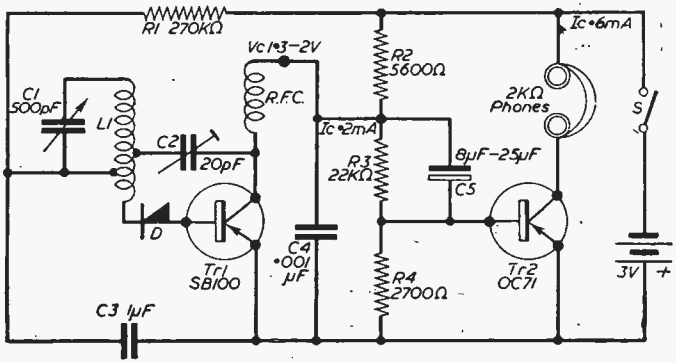


Fig. 3.—The practical circuit.

frequencies each time, reverting to the best as soon as instability becomes apparent. Do not exceed by more than one turn the recommended numbers, except for C2 tap—a few extra turns may be needed if the choke or Tr1 is poor. Note, diode is connected to the inner end of the coil. With the circuit as given, best results are C2 varying from zero to about 8μF and taps fixed at 11th and 7th turn counting from the diode end; Vc, 1.3 volts; Tr1-Ic 0.2mA; Tr2-Ic 0.6mA and the total current from the battery is less than 1mA when giving loud phone reception. It is possible to tune in stations from lowest obtainable frequency to nearly one megacycle without readjusting C2 if it has been correctly pre-set.

Strictly avoid turning C2 full on as all kinds of oscillations will be produced from whistles to growls which cause Ic to jump to over 1.5mA.

R.F. Choke

The R.F. choke may be any high Q type of I.F. coil, if it has no capacitor across the windings, or it can be wound on a piece of three-eighth diameter ferrite rod with about 200 turns of thin wire, and if the layers are interleaved with thick paper strips, so much the better.

The Loop Coil

The loop coil is easy to make, but time and care are needed for it to be pleasing to the eye. Cut a 12in. square of 1/16in. insulating material or ¼in. fibreboard as used by builders. Draw the two diagonals to locate the centre and from this describe five circles: ¼in., 8in., 8½in., 9in. and 12in. diameters. With a protractor at the centre, mark off 25 points for 25 radial lines at equal angles of 14.4 degrees (360/25). The readings from zero will be: 14.4—28.8—43.2—57.6—

(*Continued on page 663*)

A Simple B.F.O.

USE THIS UNIT WITH THE DOMESTIC SUPERHET

By R. H. Wright

MANY enthusiastic listeners to the short wave bands using the domestic receiver are hampered by the fact that only modulated signals are rendered audible and so, on the amateur bands in particular, many choice

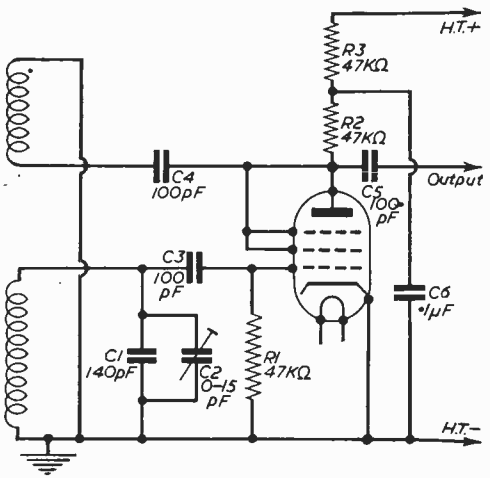


Fig. 1.—The circuit diagram.

"DX" stations are missed. However, there are two ways in which C.W. signals can be made audible thereby increasing the listening pleasure of those who have mastered the morse code. The first method is to make the intermediate frequency amplifier of the receiver oscillate, but as this involves circuit modification it is probably best left alone by all but the skilled service engineer. The second method is by use of a Beat Frequency Oscillator (B.F.O).

Briefly, the function of a B.F.O. is to produce an oscillation differing from the intermediate frequency of the receiver by about one kilocycle per second. These two oscillations will now "beat" together to produce a third frequency equal to the difference between the two. For example, if the receiver I.F. is, say, 460kc/s and another oscillation of 461 or 459kc/s is injected into the receiver, an oscillation of 1kc—which is audible—will result and will be reproduced in the loudspeaker. This is the system employed in communications receivers.

COMPONENT LIST

C1—140 pF fixed capacitor } See
C2—0-15 pF trimmer } text
C3, C4, C5—100 pF fixed capacitor.
C6—0.1 μF, 350 V.W.
R1, R2, R3—47,000 Ω (1 watt).
Valve—See text.
Coil—Denco B.F.O. coil, type BF02/465.

A B.F.O. unit for use with most receivers can be constructed easily and a suitable circuit is shown in Fig. 1. The oscillator coil is a special beat frequency oscillator coil manufactured by Messrs. Denco (Clacton) Ltd., of Clacton, Essex. It may be obtained through any good component supplier. The complete unit may be constructed on a small chassis measuring 2¼in.× 2¼in. × 1¼in. and so fit inside the cabinet of most receivers. The valve used in the prototype was an EF91, triode connected (anode, suppressor grid and screen grid pins joined together at the valveholder base). Power requirements are extremely modest being 250V at 5mA for H.T. and 6.3V at 0.3A for L.T. In many cases these supplies may be obtained from the receiver itself. Alternatively a separate power supply may be used. For readers with mains power supply difficulties who may wish to use the unit with a battery receiver, a battery powered version of the oscillator is just as effective. The circuit of this unit is shown in Fig. 2 and here the valve used was a Mullard DF92. A single U2 type cell provides L.T., and H.T. may be obtained from a dry battery of 45V.

With either unit, the capacitor arrangement shown in the grid circuit of the oscillator enables the unit to tune to any frequency between 450 and 470kc/s thus covering the I.F. bands.

To bring the unit into operation a length of insulated wire should be taken from the output point and allowed to lie near the I.F. section of the receiver. The best position to give a suitable degree of coupling can only be found by trial

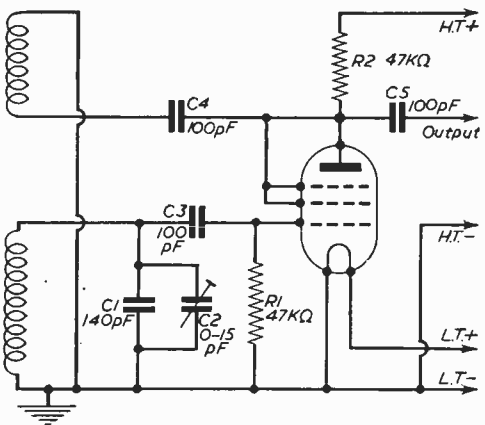


Fig. 2.—A battery version.

and error. Now tune to a signal on the receiver and adjust the trimming capacitor (or variable, if used) until a beat note is heard. C.W. signals will now be received, but for telephony or broadcast reception, the unit must be switched off. When first adjusting the unit, note particularly if it causes a marked reduction in the strength of the signal being received. If so, the B.F.O. is adding to the action of the Automatic Gain Control and therefore coupling between the unit and the receiver should be reduced. On the other hand, if the beat note is very weak, coupling should be increased.

Choosing Resistors

PROPERTIES OF VARIOUS TYPES OF RESISTOR

By J. B. Dance, M.Sc.

THE two most important features of a resistor are its power rating and the resistance value. If these two quantities are chosen correctly, the resistor will normally function satisfactorily in simple low frequency circuits, but for some applications it is necessary to choose a resistor more carefully.

TABLE I.
Typical sizes of ordinary composition resistors.

Power Rating (W)	Diameter (in.)	Length (in.)	
1/10	0.15	0.4	Ceramic tube
½	0.25	0.7	Ceramic tube
1	0.25	1.25	Ceramic tube
2	0.4	2.0	No ceramic tube
5	0.7	2.5	No ceramic tube

The power rating of a resistor in watts is the voltage across it multiplied by the current in amps passing through it. If excessive power is dissipated in a resistor, it will become hot, will probably change in value and may burn out completely if the overload is very great. Calculations of the power rating which a resistor should have for a particular purpose was discussed more fully on page 402 of the July, 1959, issue of PRACTICAL WIRELESS by F. G. Rayer.

Carbon Composition Resistors

The ordinary cheap composition resistor usually consists of a composition carbon rod inside a ceramic tube. There are brass caps at each end of the carbon rod and connecting wires are fastened to these caps. The body of the resistor (consisting of the ceramic tube) is colour coded and is an insulator. There are certain types, especially for high power ratings, in which the ceramic tube is omitted. Care must then be taken to prevent the body of the resistor from touching the chassis or any wire.

If the power rating of a resistor is unknown, the approximate rating may be found from its size. Table I shows the actual sizes of some resistors of various power ratings. If the resistor becomes too hot, a waxy material may often be seen dripping from it.

The composition resistor usually generates from ten to one hundred times as much noise as the cracked carbon type of resistor and the noise increases with the amount of power being dissipated in it. Composition resistors should not, therefore, be used as load resistors in the early stages of high gain audio amplifiers.

H.F. Frequencies

Composition resistors are the best type for use at radio frequencies. Nevertheless, the resistance at high frequencies is usually less than that at low frequencies. At 30Mc/s a normal 1M resistor only presents an impedance of a little over 1/10M. This effect is less for resistors which have a small value and for frequencies which are not too high. If the resistance in ohms is multiplied by the frequency and the product obtained is not greater than about 5×10^{10}, then the resistance at that frequency will be approximately equal to the resistance to direct current. For example, a 1M resistor may be expected to have an approximately constant resistance up to about 50kc/s, a 10,000 ohm resistor up to 5Mc/s and a 100 ohm resistor up to 500Mc/s. Generally resistors for use at high frequencies should be long rather than have a large diameter and the connections should be short.

Resistors for use at high voltages (over 2,000V) should be long. It is better to use two or more resistors in series than to use a single resistor for very high voltages in order to reduce the possibility of flashover.

TABLE II.
Typical sizes of high stability cracked carbon resistors.

Power Rating (W)	Diameter (in.)	Length (in.)
¼	0.17	0.75
½	0.18	1.1
1	0.32	1.3
2	0.32	2.0

Cracked Carbon Resistors

Cracked carbon resistors are also known as high stability or grade 1 resistors and are much more expensive than composition resistors. They consist of a ceramic tube with a thin carbon film deposited on it by means of a special process. Metal caps are fitted over the ends for making connections. A spiral cut is made in the carbon film so that the current has to go a longer distance through the carbon. The value of the resistor can thus be raised somewhat as desired. A coating is painted over the carbon track, but the insulation is not always very good and it is advisable to keep the body of the resistor away from the chassis and other metal objects. Measured sizes of some typical grade 1 resistors are shown in Table II. These resistors are not usually made in 1/10W size.

Grade 1 resistors normally have a tolerance not greater than 5 per cent. and even though they may be marked with this tolerance, they are almost always within 1 per cent. or at least 2 per cent. of their marked value. The value and tolerance are normally written on them, i.e., they are not colour coded. The value of these resistors remains very constant during use—hence the name high stability. Grade 1 resistors should always be used when accurate values are required, e.g., in certain devices such as filters which depend on accurate phase changing.

Noise

The noise generated by a cracked carbon resistor increases with applied voltage approximately as shown in Fig. 1. The graphs are for one particular value of resistor. It will be noted that there is some noise even when no voltage is applied across the resistor. This noise is called

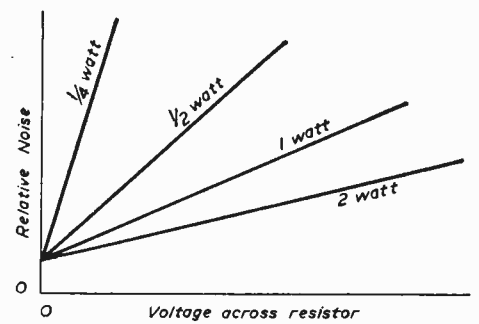


Fig. 1.—Graph of noise generated by a cracked carbon resistance against applied voltage.

"Johnson noise" and it can be shown theoretically that it is not possible to make a resistor which generates less noise than this. Grade 1 resistors are very useful in the anode circuits of the early stages of high gain amplifiers where minimum noise is important. A resistor of much larger power rating than the actual power which it will have to dissipate should be used when any current is passing through it. When the current is extremely small, however, a ¼W grade 1 resistor gives no more noise than a 2 watt resistor (see Fig. 1).

Cracked carbon resistors have the disadvantage that they possess considerable inductance owing to the fact that the current has to pass along the spiral carbon track which acts as a coil. They are not, therefore, very suitable for use at high frequencies.

Vitreous Resistors

Vitreous resistors are wire wound resistors, the wire normally being wound on a ceramic tube and being covered with a green or blue vitreous enamel. This type of resistor is always made for high power ratings, as vitreous resistors operate satisfactorily at temperatures up to several hundred degrees centigrade. They are smaller than carbon resistors of the same power rating because they can work at a high temperature;

TABLE III.
Typical sizes of vitreous resistors.

Power Rating (W)	Diameter (in.)	Length (in.)
4½	0.27	1.5
6	0.30	1.5
10	0.43	2.3

typical sizes of vitreous resistors are shown in Table III. This type of resistor normally has a tolerance of 5 per cent. or better. Vitreous resistors have a considerable inductance because of the number of turns of wire on them and are not therefore suitable for use at high frequencies. The inductance of a vitreous resistor is high enough for it to be used as a combined choke and resistor for certain purposes.

An Experimental "Super" Transistor Receiver

(*Continued from page 660*)

72.0—86.4—100.8—115.2—129.6—144.0 — 158.4—172.8 — 187.2—201.6—216.0—230.4—244.8—259.2—273.6—288.0—302.4—316.8 — 331.2 — 345.6 — 360.0. Draw radii through these points. Add two parallel lines ⅛in., one at each side from the 8½in. diameter circle to the edge of the board. Cut out 25 radial slots ¼in. wide, between the two parallel lines, from the edge to the 9in. or 8½in. or 8in. if necessary. File the saw cuts smooth and round off all the sharp edges. If the coil is wound into this square frame, it can be used for the back cover of the receiver. If it is fibreboard, apply two coats of varnish.

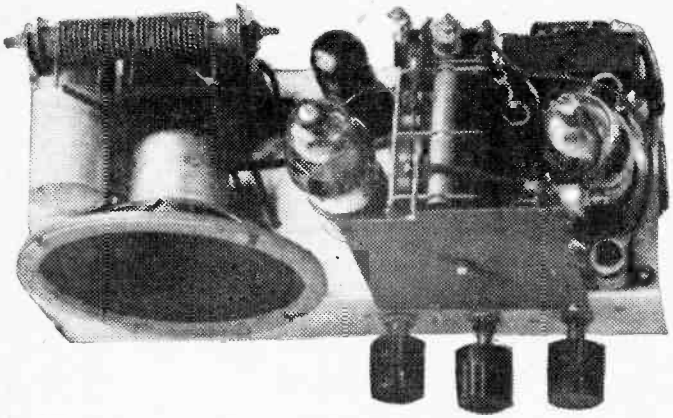
Plug-in Coils

If it is to be a plug-in coil, cut off two opposite corners around the 12in. diameter circle. Shape one end for holding the coil and the other end for fixing on to a block with four valve pins, to which tap leads can be soldered. The coil is wound with 20 s.w.g. 0.036 wire (plastic insulated). Starting from the plug-in corner, pass the wire into a slot from the front and back out of the next slot, pull and flatten the wire at the back, against the board, then into the third slot and out of the fourth, zig-zag all round, pulling and flattening the wire at each section to make a neat, evenly spaced coil almost up to the 12in. diameter circle. There should be 28 turns.

The coil for the aerial, if wanted, should have 20 turns up to the 12in. diameter circle. Ferrite rod coils were tried, but did not give good results even when Litz wound with spaced turns.

Construction

The construction is not critical; a small panel may be used or the components may be mounted on to the middle of the coil board. The R.F. choke should be near to the collector of Tr1 and C2, with its turns not magnetically coupled to the loop but at right angles, or screened.



A Mai

This design allows c of valves and other

THE circuit is shown in Fig. 1, and details of alternative valves of suitable type are given later. A standard 3-valve T.R.F. receiver of this kind can provide a good selection of stations. Either air- or dust-cored coils can be fitted, the latter being recommended. The volume control reduces input, as well as increasing cathode bias applied to the R.F. stage, and this allows even a powerful local station to be kept at low volume if required. An anode bend detector and triode connected power output stage follow. Hum is very low, due to the modulation hum filter aerial circuit, the type of detector, and additional H.T. smoothing to the latter.

Valves

The cheap surplus 9D2 is used in the R.F. stage, but direct equivalents such as the 13VPA, C5ON, and VP1322 can be inserted instead. Octal types such as the 12K7 and KTW74M are virtually equivalent except for the change of holder. All these may be run from a 12.6V heater transformer. In the 6.3V types, the 6K7, OM6 and KTW63 all give similar results. Any of the foregoing may be used in the R.F. position with no wiring changes.

For detector, a 13SPA may be inserted instead of the 8D2. The 12J7, with octal holder, is also suitable for 12.6V. In the 6.3V range, the 6C6, 6J7 and 6BR7, with appropriate holders, have equivalent characteristics.

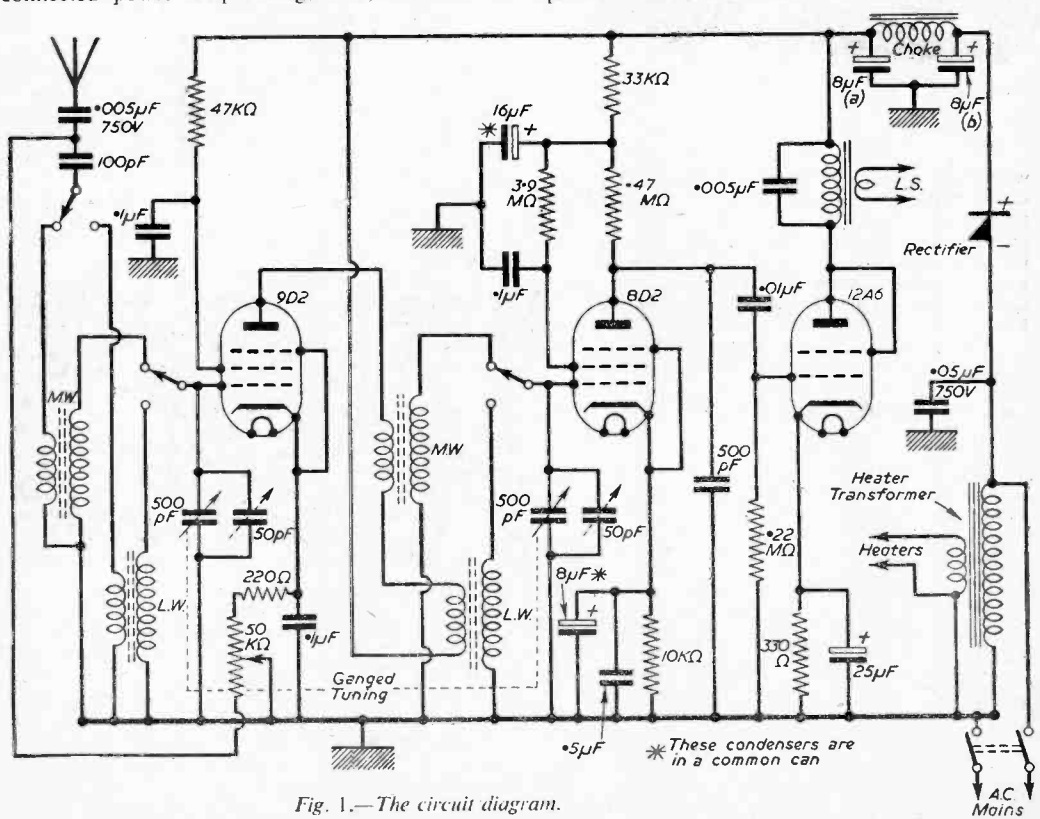


Fig. 1.—The circuit diagram.

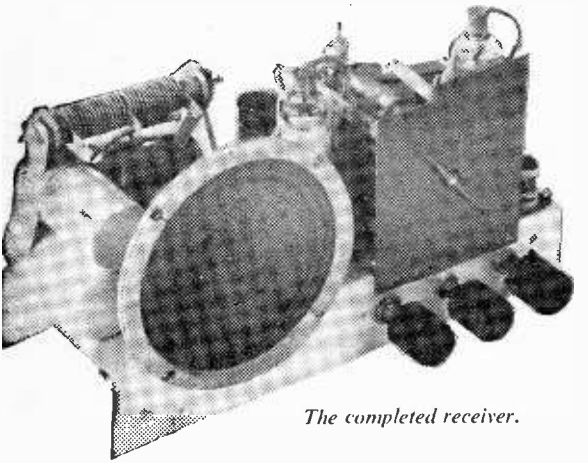
s: 3-Valver

siderable latitude in the choice mponents

By F. G. Rayer

Output Valve

For output purposes, the 12A6 is intended for a 12.6V heater supply, and gives good results, requiring an anode load of about 7.5k. and a 350 ohm bias resistor. For 6.3V operation, a 6V6, 6AQ5, or 6BW6 may be used, with 5k transformer, and 270 ohm bias resistor. A 6F6, with 7k load, and 440 ohm bias resistor, or 6K6G,



The completed receiver.

with 7.6k load and 500 ohm bias resistor, will be satisfactory, if to hand. These optimum loads are for normal pentode or tetrode operation, and a transformer of rather lower ratio will be found to give best results when the valve is triode wired, by joining anode and screen grid, as in Fig. 1.

For 6.3V valves, a 6.3V transformer should be used. For two 6.3V valves, with 12.6V output valve, a 12.6V transformer is required, the R.F. and detector heaters being wired in series. The various 12.6V and 13V valves listed also require a 12.6V transformer.

Chassis Drilling

Fig. 2 shows the receiver layout, a chassis about 10½in. × 4½in. × 2in. deep being just large enough to accommodate the components. The positions of valveholders, etc., can often be adjusted to suit a ready-drilled chassis. If not, all large holes should be completed before mounting any components. The speaker is best left until last.

The rectifier can be mounted on brackets as shown in Fig. 3. One bracket is bolted to the top of the output transformer, the outer shaped section being temporarily removed for drilling, and countersunk 6 B.A. bolts inserted from below. The second rectifier bracket can be bolted or soldered to the long clip which secures the two smoothing condensers, as also shown in Fig. 3. Rectifier tags or fins must not touch other parts, and the positive rectifier tag must be taken to the smoothing circuit.

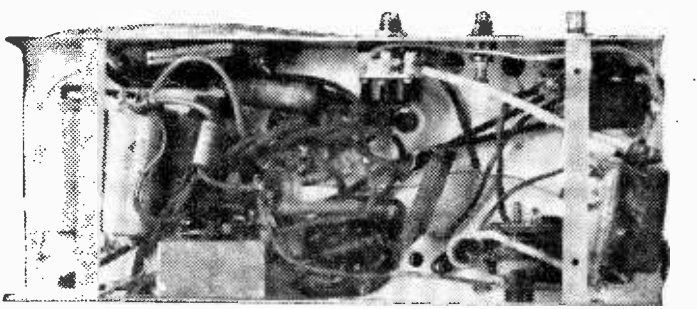
If a small cabinet is to be used, a cut-out will be required to accommodate the bottom of the speaker unit, as in Fig. 2. Cutting and drilling will be much easier with an aluminium chassis than with the steel type. Suitable holes should also be drilled to match up with tuning condenser, heater transformer, and other parts, and to clear the tuning drive cord.

COMPONENTS LIST

Fixed condensers.
100pF ; 500 pF ; 0.005μF 750V.W. ; 0.01μF (mica) ; 0.05μF 75V.W. ; three 0.1μF 350V.W. ; 0.5μF ; three 8μF 350V.W. 16μF 350V.W. ; 25μF 25V.W.
Two-gang 500pF tuning condenser. Drum, pointer, cord, spring and drive. Three knobs. Two 50pF trimmers.
Resistors :—
220 ohms ; 10k ; 33k ; 47k ; 270k ; 470k ; 3.9M (all ½W). 350 ohm 1W.
50k potentiometer with double pole mains switch.
3-pole 2-way switch. Pair M.W. Aerial and Detector coils, ditto L.W.
Valves :—
9D2, 8D2, 12A6. Two British 7pin holders and one Octal holder.
12.6V 0.75A heater transformer for 200/250V mains.
60mA 250V metal rectifier.
Permanent magnet speaker with output transformer for mains valve.

Wiring

Most connections and small parts are shown in



Underchassis view.

Fig. 4; holder wiring being for the valves indicated in Fig. 2. The heaters should be wired first, for 6.3V or 12.6V running, one side of the heater circuit being returned to chassis. Other parts may then be added. All connections should be short and direct, and protected with insulating sleeving. If joints are sound, and correctly checked as they are wired, the set should work properly as soon as it is completed.

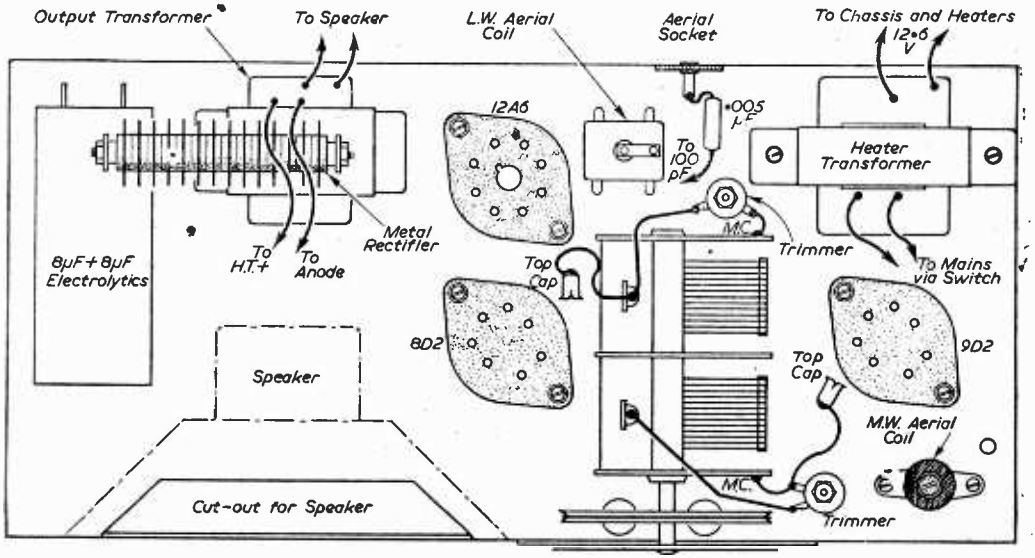


Fig. 2.—Above-chassis layout.

marked M.C. are soldered to tags bolted tightly to the chassis.

The two 750V condensers should be of high quality. The 0.005μF component serves to keep mains voltages out of the aerial, while the 0.05μF condenser must withstand the mains voltage. As shown in Fig. 4, a 16-plus-8μF condenser is used for detector cathode by-pass, in conjunction with a 0.5μF paper condenser, and also for anode decoupling and smoothing. Separate condensers are equally suitable. The electrolytic alone is not sufficient for cathode by-pass, with this circuit, for best results, but the paper condenser can be reduced to 0.1μF or 0.05μF, if this is to hand. The correct polarity must be observed when wiring up the electrolytic condensers.

In the receiver illustrated, the M.W. coils were of different manufacture to the L.W. coils. This is not important, provided a pair of matched coils, for aerial and detector, is used for each waveband.

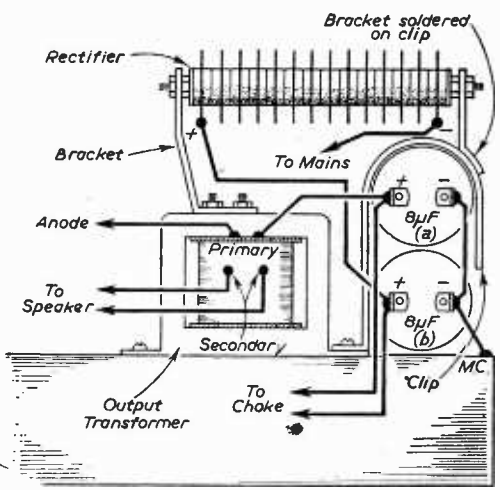


Fig. 3.—The power supply.

Coil Connections

Coil connections are shown in Fig. 5, and the tags can be identified from the maker's leaflet. Referring to the aerial coils, 1 is the aerial connection, 2 and 4 earth (chassis) connections, and 3 the R.F. grid connection. With the detector coils, 1 indicates R.F. anode, and 2 H.T. positive, these windings being connected in series, with no switching. As with the aerial coils, 3 indicates grid, and 4 chassis, or earth.

The aerial coils must be on top of the chassis, and the detector coils below, to avoid instability. Leads pass up through the chassis to the gang condenser, as in Fig. 5. Short lengths of flex are taken from the upper tags of the condenser, to the R.F. and detector valve caps, as in Fig. 2. Coil and switch wiring should be short and direct, and aerial coil wiring should be clear of the detector coil connections.

A 50pF trimmer is required in parallel with each section of the gang condenser, as shown in Fig. 2, unless trimmers are already fitted to this component.

Mains Supply and Testing

If the receiver is inserted in an insulated cabinet, with no exposed metal parts, the standard of safety will be that usual with A.C./D.C. sets, or A.C. sets drawing H.T. directly from the mains. If possible, it is best to use a non-reversible supply plug (e.g., three-pin) and to wire this so that the receiver chassis is taken to mains neutral. No shock will then be felt on touching the chassis. When the set is switched off, the double-pole switch completely disconnects it from the mains.

If the "live" main is taken to chassis, the

receiver, speaker, etc., will be at mains voltage above earth, and in no circumstance should they then be touched.

Alignment is extremely easy. The set should be switched to the M.W. band, and the trimmers are then adjusted for best volume from a station received at about 200 to 250m. A station around 450 to 500m. should then be tuned in, and the M.W. coil cores are adjusted for best reception. The procedure should be repeated once or twice, until no further improvement is possible. The L.W. coil cores are then adjusted for best L.W. reception.

Dial Reading

Pointer readings can be matched up with a printed dial by careful adjustment of trimmers and cores. With a surplus gang condenser, exact readings throughout the wavebands may be impossible, however. Trimmer settings will most influence low-wavelength readings, while high-wavelength readings, will be most readily modified by changing the coil core positions.

It was found that the use of a clear glass valve in either R.F. or detector positions resulted in the receiver just going into oscillation, at the maximum setting of the volume control. In such circumstances, adding a valve-screening can, bolted to chassis, removed oscillation. Oscillation is unlikely with screened valves, unless wiring causes stray coupling between aerial and detector circuits.

A few feet of flex or other insulated wire will form a suitable indoor aerial. Reception of weak stations will, of course, be improved with a longer or outdoor aerial, but the latter is by no means essential.

It will be noted that one side of the mains is connected to the chassis of this receiver. Accordingly, no earth connection must be made to the chassis and no part of the receiver should be touched when it is switched on.

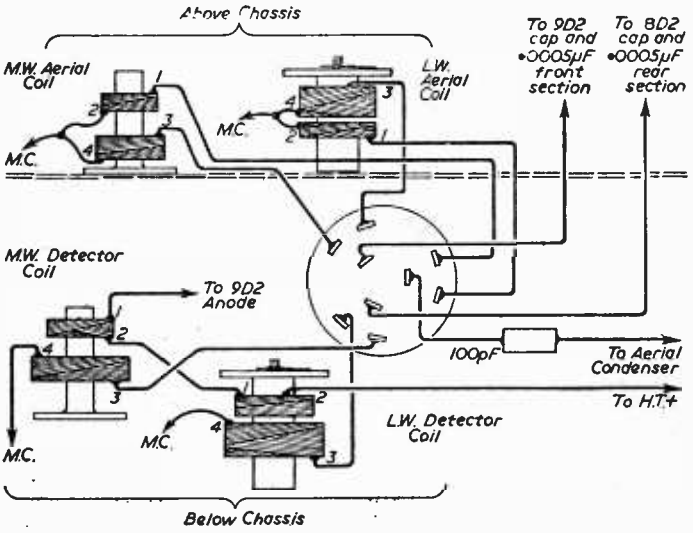


Fig. 5.—Coil and wavechange switch wiring.

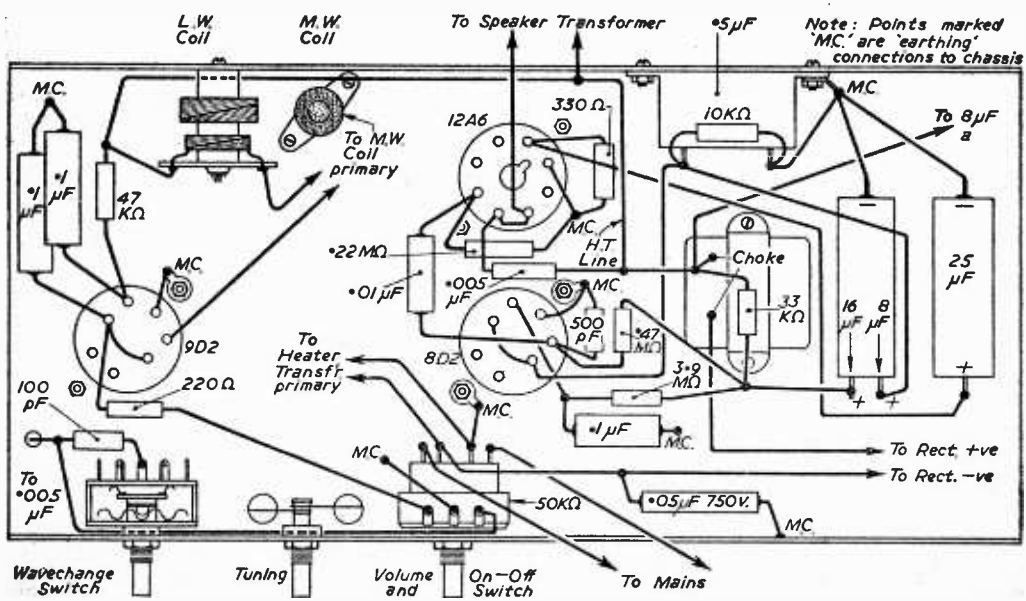


Fig. 4.—Under-chassis layout and wiring.

A Charger and D.C. Unit

TAPPINGS PROVIDE SEVERAL OUTPUT VOLTAGES

By E. G. Heath

THIS unit is for use with A.C. mains, and gives any required direct current output up to a maximum of approximately 20V at 2A. It may thus be used as a charger for the accumulators employed to run models, etc. The output is also sufficient for charging motor-cycle or scooter batteries, or keeping large 6V or 12V car batteries in good condition.

Models

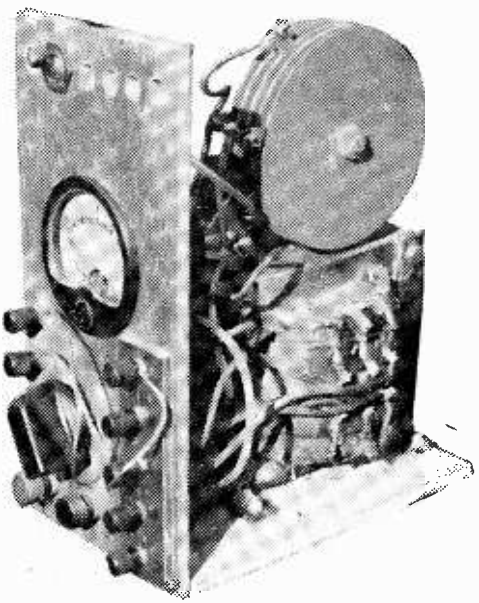
With models having permanent magnet motors (such as electric trains) the unit allows running from the mains, with no battery. It may also be used to run model motors with wound field and armature, and to provide current for illuminated models, though in these cases A.C. taken directly from a transformer would serve.

The circuit is shown in Fig. 1, and the transformer has a tapped secondary so that various voltages may be selected. In addition to the voltages provided by adjacent tappings, two or more sections may be in use, to obtain other figures. For example, 2 and 4 provide 8V, 1 and 3 supply 10.5V, 1 and 4, 15V, 3 and 5, 18.5V, and so on. The 5 ohm variable resistance gives further adjustment, so that any voltage can be obtained. The maximum will depend on the rectifier rating, and there is normally no point in using a rectifier with a higher voltage rating than the highest voltage which will ever be required.

Operation

To run a model, an approximate voltage is selected by fitting the two flexible leads to the terminals. The resistance control knob is then adjusted until the model runs at normal speed. If the voltage needed is not known, it can easily be found by trial, beginning with a low voltage and increasing until the model works normally.

For accumulator charging, select 4.5V for 2V accumulators, 10.5V for 6V accumulators, and 18.5V for 12V accumulators, slowly turning the control knob from maximum resistance, until the meter indicates the required charging current. For trickle charging, or to restore a cell left standing in a sulphated condition, a lower voltage can be selected.



Construction of the unit.

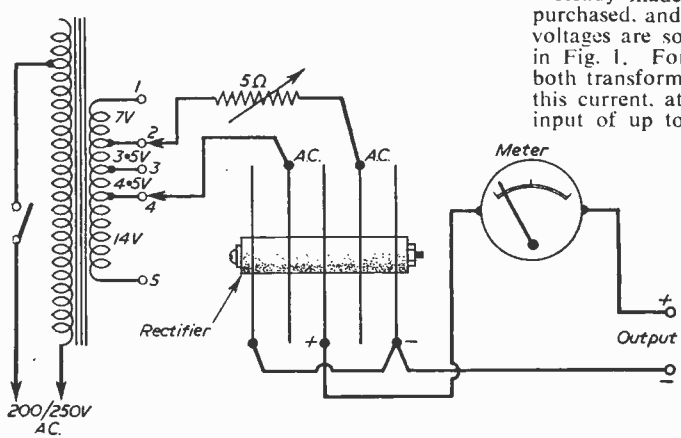


Fig. 1.—The circuit diagram.

Transformer and Rectifier

Ready made transformers of this type can be purchased, and it does not matter if the secondary voltages are somewhat different from those given in Fig. 1. For a maximum output of up to 2A both transformer and rectifier should be rated for this current, at least. A rectifier intended for an input of up to 18V to 20V, or so, will be large enough for charging 12V accumulators.

If a transformer is to be wound 32s.w.g. enamelled wire can be used for the primary and 17s.w.g. or 18s.w.g. for the secondary. There is, of course, no reason why slightly thicker gauges should not be used provided the bobbin can accommodate the wire. If the transformer core has a cross-sectional area of 1sq.in. then eight turns per volt may be used for primary and secondary. That is, the centre stack of core

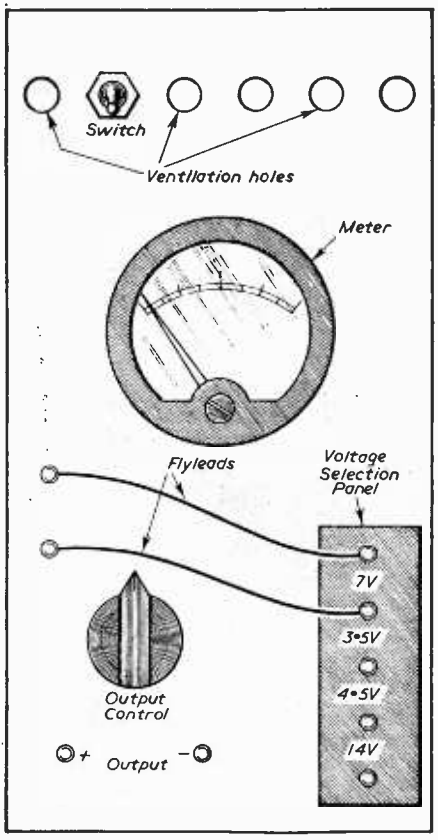


Fig. 2.—Control panel layout.

stampings would be 1in.× 1in., and the primary would have 1,600 turns for 200V, 1,840 turns for 230V, or 2,000 turns for 250V. Tappings for mains voltages other than that of the actual supply need not be provided, and a few turns more or less will be unimportant. Similarly, eight turns are used for each one volt required from the secondary. That is, 56 turns for 7V, then 28 turns for 3.5V, followed by 36 turns for 4.5V, and finally 112 turns for 14V. All turns must be in the same direction, and layers of insulating paper should be placed over each layer of wire. Ample insulation must be provided between primary and secondary.

The Meter

This can be purchased with the required range, or adapted from a cheap surplus meter. Thermo-couple meters are among the least expensive, if one is to be used, it should be opened and the thermo-couple taken out. The meter prongs or terminals are then used for connections directly to the meter moving coil, and the instrument is replaced in its case. It will then have a full-scale deflection of some 2mA to 5mA or so (the figure depends on the actual meter) and *must* be equipped with a shunt, before it can be used to read 0 to 2A. The shunt is a piece of wire, of very low resistance, securely soldered across the meter terminals, as in Fig. 3. A few inches of 20s.w.g. copper wire will usually prove suitable.

The length of wire to use for the shunt can be found by trial. If a calibrated meter reading up to 1A or 2A is available, wire this in series with the output of the unit, then adjust the length of wire in the shunt so that the meter indicates the same current as the calibrated meter. Switch off each time the shunt is removed for adjustment. If the unit meter reads higher than it should, this indicates that the length of the shunt wire is too great.

If no calibrated meter is to hand, a lamp taking a known current can be connected to the output terminals. For example, a 6W 6V lamp will pass approximately 1A. The shunt is then adjusted as already described, until the meter indicates 1A. Other markings will then be proportional, as shown in Fig. 2.

Construction

With the layout shown in Fig. 2, a three-ply panel 3¾in. × 7¼in. will be suitable, but this can

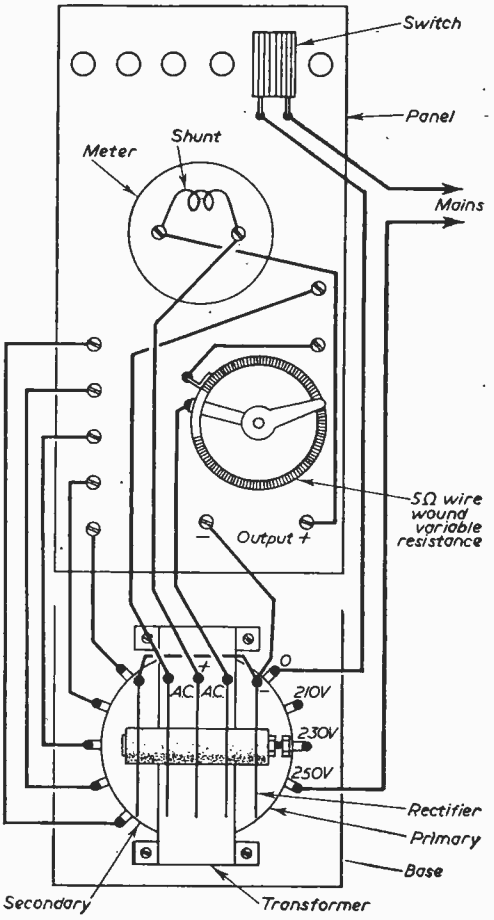


Fig. 3.—Wiring diagram.

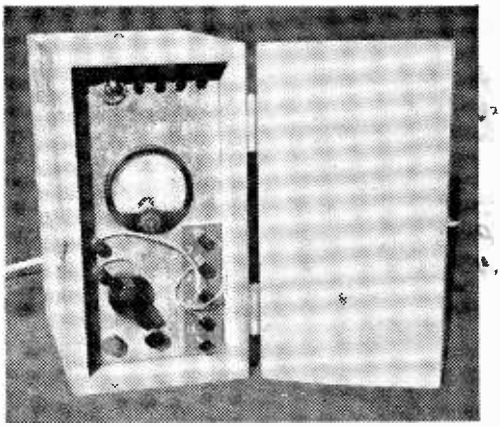
be modified to suit an existing case or box. Terminals may be mounted directly on the wood, or on a terminal strip. The exact position of the various parts does not matter in a unit of this kind.

A clearance hole will be needed for a flush mounting meter. Some ventilation holes are also required. as indicated, unless these are present in the top and bottom of the case, or in the back near top and bottom.

Fig. 3 shows connections. Panel and base can be joined with angle brackets, and the transformer and rectifier must clear the resistance and meter. The rectifier can be mounted by securing it to two wooden or metal strips which are bolted to the transformer.

Connections

Insulated flex can be used for all connections. The actual markings on the rectifier should be followed. because tags are sometimes placed in different positions. Green is sometimes used to indicate the "A.C." tags, with red for positive and black for negative. The rectifier fins should be vertical, to assist cooling. Very little heat will be generated with small outputs but when maximum output is required the transformer and rectifier will eventually warm up slightly.



The unit in its case.

A containing case is required, both to protect the unit and avoid any chance of mains connections being touched. If a three-pin plug can be used, the transformer core and one secondary terminal should be wired to the earth pin. When current is taken from a 13A point, a low-rating fuse can be inserted in the plug.

British Institution of Radio Engineers

THE Council of the British Institution of Radio Engineers has announced the Awards which are to be made for outstanding papers published in the Institution's Journal during 1958. The senior award, the Clerk Maxwell Premium, goes to Mr. C. Powell and Mr. D. A. Hendley (Decca Navigator Company Limited) for the paper "Dectra: A Long Range Radio Navigation Aid" which was read at an Institution Meeting in March of last year and published in the May, 1958. journal.

Other awards are as follows:—The Heinrich Hertz Premium, which is for the most outstanding paper on the mathematical or physical aspects of radio is to be presented to Mr. K. Foster, (Cossor Radar and Electronics Limited) for the paper, "The Characteristic Impedance and Phase Velocity of High-Q Triplate Line." (Published in December, 1958.)

For the third successive year the Sir Louis Sterling Premium for an outstanding paper on Television Technique is to be awarded to Dr. A. van Weel (Philips, Eindhoven). His paper "Design of Detector Stages for signals with Symmetrical or Asymmetrical Sidebands," concludes his detailed examination of the design of successive stages of the television receiver.

The Sir J. C. Bose Premium is being awarded to three Indian physicists from Andhra University, South India. They are Dr. B. Ramachandra Rao, Dr. M. Srirama Rao and Mr. C. Abhirama Reddy. Their paper is entitled "Magneto-ionic Fading in Pulsed Radio Waves reflected at Vertical Incidence from the Ionosphere" and was published in November, 1958. Dr. M. S. Rao is now with the National Research Council of Canada.

The Brabazon Premium is for an outstanding paper on Electronic Aids to Aircraft Safety and it is to be awarded for two associated papers by members of the Electrical Engineering Department of Birmingham University—Professor D. G. Tucker, D.Sc., Dr. V. G. Welsby, Mr. R. Kendall and Mr. D. E. N. Davies, M.Sc. The papers are entitled "Electronic Sector Scanning" and "Radar Systems with Electronic Sector Scanning."

The Marconi Premium is the third of the Institution Premiums this year to be awarded to overseas engineers. It goes to Dr. Morton B. Prince and Mr. M. Wolf of Hoffman Electronics Inc., Evanston, Illinois, U.S.A. Their paper, "New Developments in Silicon Photo-voltaic Devices" was read at a meeting in London in June, 1958.

The award of prizes to outstanding candidates in the Graduateship Examination of the British Institution of Radio Engineers during 1958 has been announced as follows:—

The President's prize for the most outstanding candidate in Section B of the Examination is to be awarded to Kenneth Henry Green (now an Associate Member) of Woodmansterne, Surrey.

The S. R. Walker prize for the most outstanding candidate in Section A of the Examination is to be awarded to Dennis Grant Skinner of Romford, Essex.

The Electronic Measurements prize for the most outstanding candidate taking the Part B optional subject of Electronic Measurements is to be awarded to Ian Frederick Howard Goult (now an Associate Member) of Enfield, Middlesex.

A Stereo Amplifier

A SINGLE PUSH-PULL AMPLIFIER FOR BOTH STEREO CHANNELS HAVING MATRIXING OUTPUT TRANSFORMERS

By A. G. Bourne

IN the U.S.A. this circuitry has created considerable interest, and references have begun to appear over here. Without going deeply into the mathematics of the subject, one need just say that it stems from the simplex technique used for many years by broadcast line engineers.

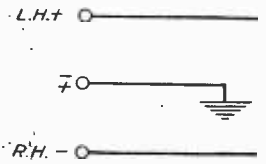


Fig. 1.—The required input phasing.

It has now been re-introduced for stereo application by the Columbia Broadcasting Company, though with several modifications. It enables one push-pull amplifier to amplify both channels of a 45/45 stereo recording. The idea of one complete push-pull amplifier with an inexpensive output transformer doing the job of two separate push-pull amplifiers is definitely desirable if cost, space and electronic simplicity is considered.

Circuit

In effect, an ordinary monaural push-pull amplifier is two separate amplifiers, all valves and components being duplicated. The exception is that one pushes and the other pulls, the ties being at the input or phase inverter, outputs and power output transformer. Therefore, each side can be used for one of the stereo channels. The two channels of information in the stereo groove are referred to as right and left, but they really depend on the degree of vertical and horizontal motions; it is a relationship of sum and difference signals.

Without further ado, one fact, a limitation if

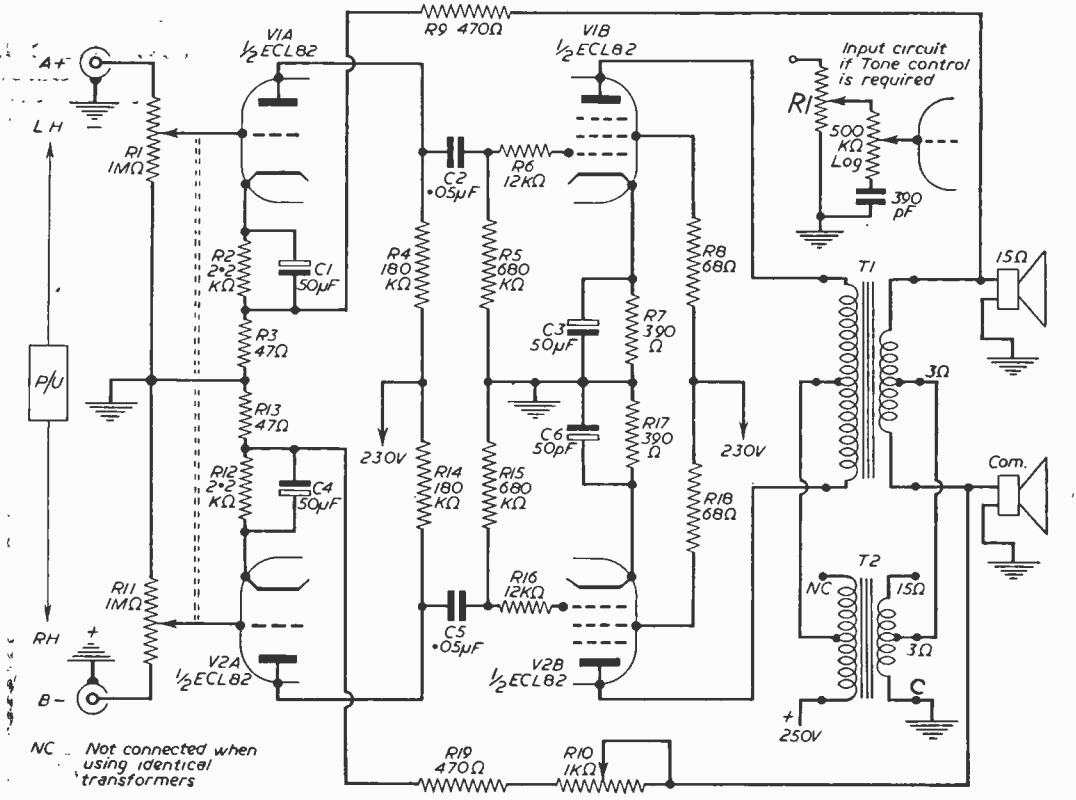


Fig. 2.—The circuit diagram.

you like, must be mentioned. Most stereo cartridges are phased in such a way that lateral motion gives two positive outputs, but with this circuit, it is necessary to reverse one set of leads. In other words the pick-up is connected with one

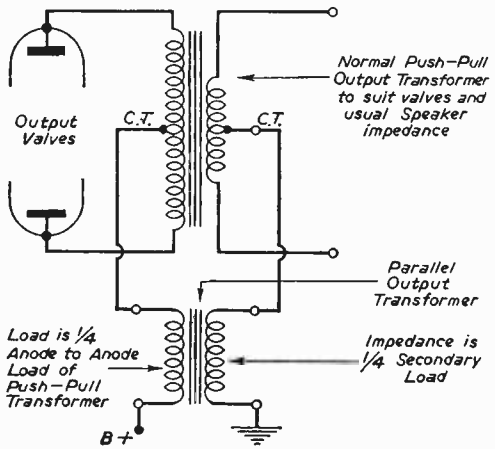


Fig. 3.—Using a single-ended output transformer for the parallel channel.

output positive and the other negative to supply the necessary input phasing. A four terminal cartridge is therefore needed and three terminal types which are not phased specially for this simplex operation cannot be used. The phasing of the two inputs is shown in Fig. 1.

Valves

It will now be apparent that one can, within reason, use valves for both high or low power output, and the author has constructed a very simple unit based on a medium power output, using ECL82s and an EZ80 rectifier, from which an acceptable output with adequate sensitivity is possible. The circuit is shown in Fig. 2. Again, 6V6s and EL84s have been tried with consequently higher outputs, adding one ECC83, an EZ81, and a further ECC83 with tone controls.

In the prototype, both transformers are push-pull types since they were on hand, but as previously mentioned a single-ended version would do equally well for the parallel channel provided the centre tap arrangements of primary and secondary were reasonably accurate (Figs. 3 and 4); nevertheless negative feedback does help in this direction. A balance control has been specified in one negative feedback chain, but, alternatively, separate volume or gain controls could have been chosen, and fixed negative feedback used for both channels.

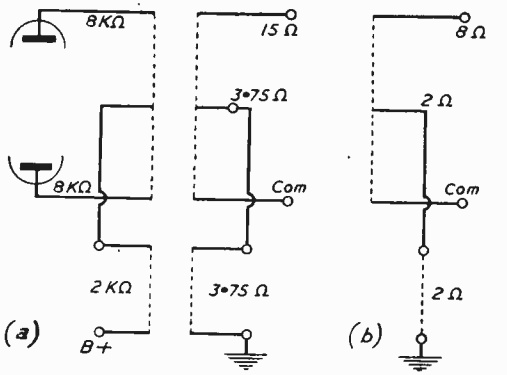


Fig. 4.—Examples of transformer connections.

Loudspeakers

The choice of speakers is left entirely to the constructor. Several methods have been tested with inexpensive and high fidelity types, either as separate full range units, or a combined bass speaker with two additional types for frequencies above 250c/s and crossover (see Fig. 5). Little if anything is lost by this latter configuration. In every instance satisfactory performance has been achieved. Perhaps a word might be necessary here to say that this design was not intended to compete with its much more expensive brothers. However, the overall quality from this compact system is very good. After one has played with express trains and racing cars, one settles for a compromise in the spacing of speakers. Theoretically, it seems, one should space these

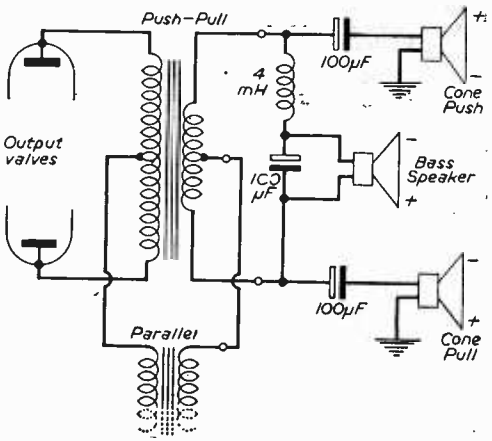
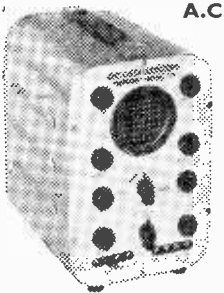


Fig. 5.—"Combined" bass speaker system for frequencies below about 250 c/s with separate loudspeakers for frequencies above 250 c/s. Signs plus and minus refer to a cone "pushing" and a cone "pulling" when checked with a torch battery for phasing. Some speakers are marked with a red line for the "push" condition.

six, eight or ten feet apart, situated equidistant from each. However, it's your home not an audio fair booth or dealer demonstration room! Likewise a pure 100W is necessary, etc., etc. Of course, some of the "gimmick" attraction for the benefit of friends is lost with close spacing of speakers, but there still remains the depth and clarity so noticeable with stereophonic reproduction of music, and the system shares the room with the furniture rather than replacing it. The choice is yours.

D.C. OSCILLOSCOPE

A.C. MAINS 200-250 VOLTS



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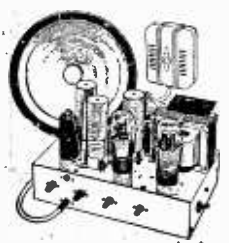

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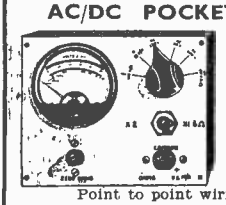

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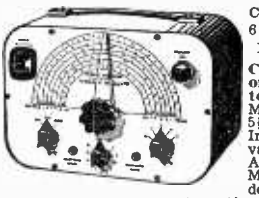

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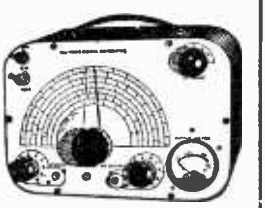

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A Transistorised "N" Circuit

A NEW APPLICATION OF AN OLD CIRCUIT

By J. Saunders

SOME years ago, PRACTICAL WIRELESS published a very interesting series of articles by W. Nimmons entitled "Old Circuits Reviewed." Amongst the circuits dealt with was the Lodge "N." I have constructed all the circuits mentioned and found the Lodge "N" could be adapted for use with transistors.

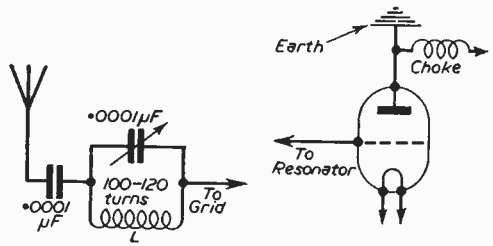


Fig. 1.—(Left) The "N" resonator.
Fig. 2.—(Right) Valve circuit.

Mr. Nimmons wrote, "In the 'N' circuit we have a closed resonator consisting of a relatively large inductance coil and a relatively small capacity. This is stimulated by impulses conveyed to it by a single wire and builds up only those oscillations to which it is itself in tune.

"Referring to the circuit in Fig. 1, the inductance is about 100/120 turns, and the capacity 0.0001μF. The condenser in the aerial lead is a fixed one of 0.0001μF.

"The frequency at which the resonator is tuned is called the 'N' frequency.

"Now, if a suitable choke is placed in the anode circuit of the valve (Fig. 2), and if the grid has alternating potentials of a frequency

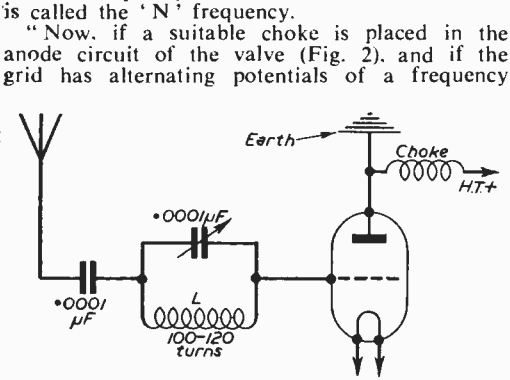


Fig. 3.—Combination of the circuits of Figs. 1 and 2.

'N' applied to it, and if the plate is earthed, then the earthed plate will pulse gently at that frequency."

Regeneration

When these two circuits are combined (Fig. 3) the "N" circuit builds up energy both from the aerial by collection and from the capacity effect between aerial and earth. Regeneration takes place when the "N" resonator is tuned to a frequency different from that of the incoming signals. If the difference is very slight the incoming signals will build up to an amount in accordance with the energy curve of a tuned circuit and heterodyning will take place in the circuit. The aerial, being a collector only, and out of tune with the incoming signals, cannot respond, and therefore cannot radiate. This is why the "N" circuit is non-radiating. In any case, the amplitude factor is so low when using transistors that the problem is not serious.

Unfortunately, the circuit as shown in Fig. 3 allows strong signals to force their way through to the grid. To remedy this, Lodge inserted a choke coil between aerial and earth. The purpose of this coil is to shunt unwanted signals to earth

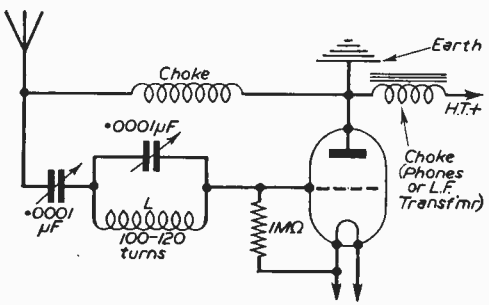


Fig. 4.—Wiring a choke between aerial and earth.

and it should have about 40 fewer turns than the "N" coil (Fig. 4).

Transistors will not oscillate and detect well at the same time, but this was easily overcome by placing a crystal diode between the "N" resonator and the emitter (Fig. 5).

Results

The set gives excellent results like this but strong signals persist in breaking through to the base, making the reception of distant stations difficult. A wave-trap would cure this fault, although it was found that a tuned circuit could be placed between the aerial and earth (Fig. 7) without interfering with the operation of the "choke" or the "N" resonator. This improves the tuning, making for greater selectivity.

The coils are, as Mr. Nimmons recommended, on 2½in. formers. The "choke" and tuning coil are wound with 60 turns of 26 s.w.g. enamelled copper wire, while the "N" coil is wound with 100/120 turns (I used 100 turns). These coils should be arranged at right angles to each other as shown in Fig. 6. The construction of the coils is not critical; no tappings are necessary which

simplifies winding. The coils could be wound on smaller formers, but since most transistor sets work best with a large loudspeaker, there is really no less room inside a cabinet with large coils than with small coils. Also, large coils are more efficient.

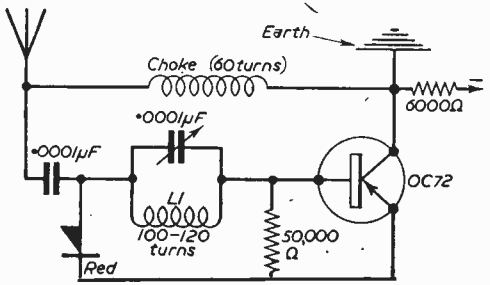


Fig. 5.—The use of a crystal diode between the "N"-resonator and the emitter.

Transformer Coupling

In the amplifier I used resistance-capacity coupling, but transformers could be used here if preferred. Originally, a 0.0005μF condenser was included in the aerial lead in order to prevent the possibility of the signal overloading the transistors, although in practice it was found not to be necessary even though I am within a mile of the BBC Welsh transmitter. The 0.0001μF condenser in series with the aerial and the "N" resonator controls the regeneration.

Oscillation of the set is quite stable—in fact, stations come through at full volume with the reaction condenser set at a low value—so that local stations can be tuned in without the necessity of producing howls from the receiver.

Battery

In the circuit diagram (Fig. 7) the battery is a 9V type, although other voltages can be used. However it may be found that too high a voltage will make the circuit unstable, so I suggest that a battery of between 9 and 18 volts be used. The H.F. choke in the collector lead of the first transistor is important because Sir Oliver Lodge stressed the desirability of a load in the circuit at this point.

Tuning is mostly achieved through C3, the 0.0001μF condenser (C1) brings the signal up to strength. Reaction is controlled in the usual way, that is, the knob is tuned until oscillation begins, and then tuned so that the set is just on the threshold of oscillation, when the signal should be heard clear of interference.

Quality

One thing that is very noticeable about most regenerative receivers, and the Lodge "N" circuit is no exception, is that there is a marked difference in the quality of the sound produced when compared with other sets. There is less background noise and music is reproduced with a good resemblance to the original at the broadcasting station.

The set is very easy to construct, being quite a simple affair to put together. I have given no details of the size of cabinet used because this will depend on the components to hand and on the type of amplifier used, although the set does give quiet volume with one transistor and a 6in. speaker, provided a good aerial and earth are used. Selectivity is much the same as a "straight" set using two or three tuned circuits, but there is more volume.

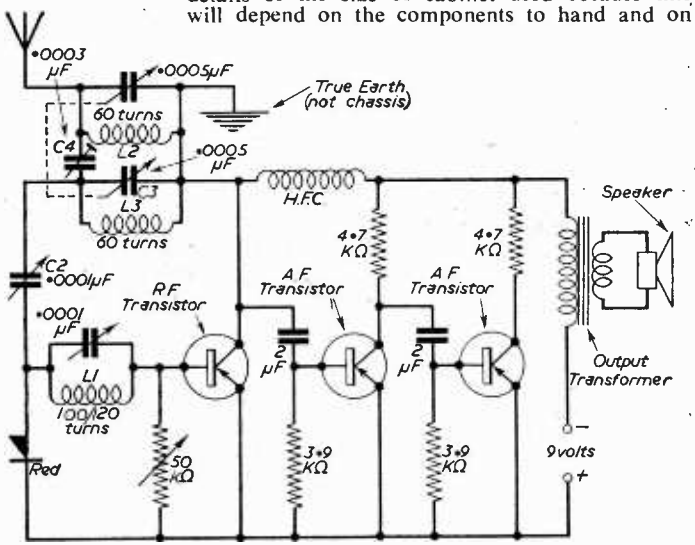
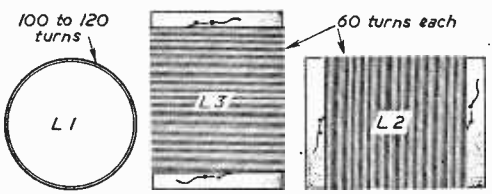


Fig. 7.—The final circuit diagram.



Coils wound on 2½" diameter formers

Fig. 6.—Details of the coils.

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The unit may be used for driving the direct-coupled transistor amplifier stage described on page 569 of the November issue. This combined circuit will give the advantage of eliminating transformers between the pre-amp and the loudspeaker. Thus four transistors can be used to give about 1W output, all stages being resistance-capacity coupled.

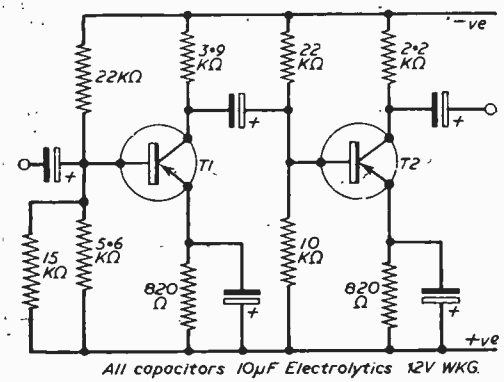


Fig. 1.—The circuit diagram.

Circuit

The circuit diagram of the unit is shown in Fig. 1. The two transistors used are a V10/15A and a V10/30A. The voltage required to operate the unit is low: 3 to 6, depending on the output required. Batteries form an easy source of power for the unit but if required the supply can be taken from the cathode of an output valve if the pre-amp is to be used with a conventional valve amplifier. Here the negative of the supply will be connected to the chassis and the input to the pre-amplifier must be connected to the input capacitor and the chassis and the output taken from the output capacitor and chassis, no signal connections being made to the positive line.

It will be noted from the circuit diagram that the lower resistor for the base potential divider of T1 is made up of two resistors in parallel, viz. 15k and 5.6k as no preferred value is suitable.

Power Supply

If the circuit is powered from a cathode circuit of an output valve, then it is necessary to calculate the values of the decoupling condenser and resistor required. The cathode voltage of the valve should be measured and also the current taken by the transistor pre-amp. using a battery of 6V. Then suppose the cathode voltage of the output valve were 9V, then a voltage drop of three would be necessary so that if the current taken by the pre-amp. were 3mA then the unit could be decoupled from the valve by a 1,000 ohm. half watt resistor and, say, a 100μF capacitor. The working voltage of this capacitor need only be 6.

Lower Voltages

However, suppose the cathode voltage were only 6 or less, as may be the case. Then, it will be necessary to use a lower voltage for the pre-amplifier and a resistor of 560 or 470 ohms could be used together with a 1000μF capacitor for decoupling. Although this will reduce the output, it should still be sufficient for most amplifiers.

If the unit is to be used for the direct-coupled output stage, then the same power supply can be used for both the output stage and the pre-amplifier. The supply for the pre-amplifier should be decoupled with a 220 ohm resistor and a large capacitor. For example, 1,000μF. If the decoupling is not adequate there will be a tendency to motorboating which may damage the transistors. The gain when the pre-amplifier is used with direct-coupled output stage is high enough for a crystal receiver with a good aerial and earth to load the amplifier.

Lay-out

The circuit is simple and the layout of the components can to a large extent follow the lay-out of the circuit diagram. When soldering, a good hot soldering iron is essential and cored solder should be used. Bare wires can be covered with sleeving to avoid possible shorts. When soldering the transistors a heat shunt can be used or the author's method of using the fingers to hold the wire being soldered can be employed. This method ensures that the transistors are not damaged by the heat of the soldering. Base connections for the transistors are easy to remember; the three connections are in line, with the base connection in the middle. The emitter is the connection closer to the base and the remaining connection farther from the base is for the collector.

Caravan and Car Radio Circuits

(*Concluded from page 567 of the November issue*) By C. Stone

IF valves such as the 12AD6, 12AC6, 12AE6 and 12K5 are used, a caravan or car radio receiver can be made up to work from the normal 12V vehicle supplies, no conventional H.T. supply being required. A suitable circuit, using a transistor output stage is shown in Fig. 5.

Acrial Connections

It is often required to use a "portable" receiver in a caravan or a car and the problem of connecting an aerial arises. Fig. 6 shows two methods of providing an external aerial connecting point. At "A" the external aerial is taken to a small fixed or pre-set condenser, which is wired to the frequency changer signal grid. This can most easily be found by trying the connection in turn on each set of fixed plates of the gang condenser. The fixed or pre-set condenser should not be omitted, or be of large value, or the aerial may upset aerial tuning alignment.

It is sometimes possible to arrange a small coupling winding near the tuned frame or coil in the receiver. With a ferrite-rod aerial, this can consist of 30 to 40 turns of thin insulated wire, near the original winding, as shown in Fig. 6. With a frame aerial, only two or three turns will be necessary. The aerial can then be taken to this coupling winding, as shown at "B." This method is less liable to upset receiver tuning.

Most small portables of ordinary design lack sufficient output for use when the vehicle is being driven. But this depends to some extent on exactly what is required.

Adapting a Receiver

Circuits such as those in Figs. 1 and 3 (last month) are the same as equivalent mains receiver circuits, but with the transformer and rectifier, or other power supply components removed. A small mains receiver of ordinary type, with 6.3V or 12.6V valves can, therefore, be adapted quite easily for use in a caravan, with a 6V or 12V accumulator supply.

Rectifier and heater circuits should be disconnected, and a 3-core flexible load provided for H.T., heater and chassis connections. The polarity of the current applied to the heaters is of no importance.

If the receiver is compact, and a superhet of good sensitivity, it can be modified for use in a vehicle. It may be necessary to modify or remove the tuning dial. The loudspeaker will generally need to be situated elsewhere, as the receiver with speaker will probably be too large to accommodate. The bigger type of set cannot be adapated for a vehicle, but may be modified for 12V running and used in a caravan. A.C./D.C. sets having some 6.3V or 12.6V valves may prove reasonably suitable. The rectifier will not be needed, and little change other than fitting a 6.3V or 12.6V output valve will usually be necessary.

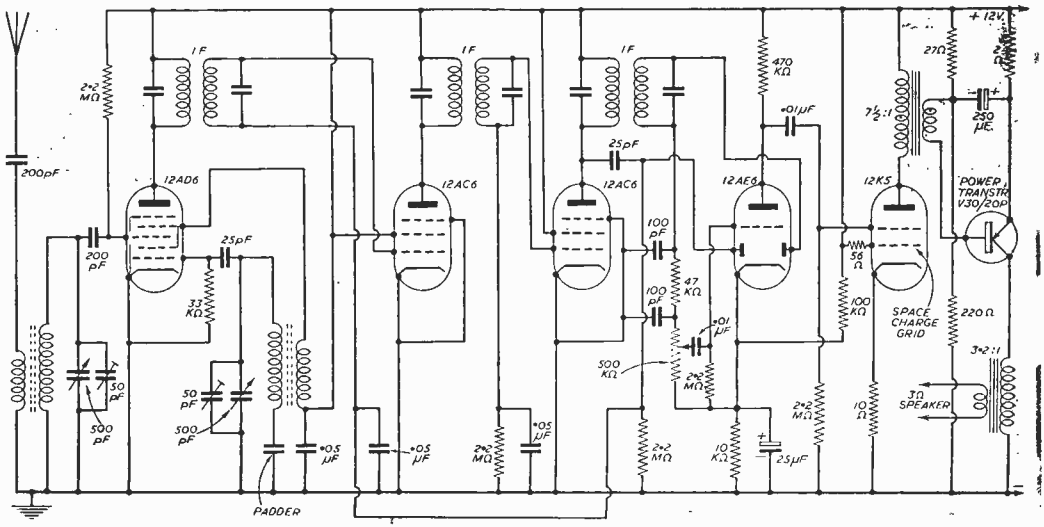


Fig. 5.—Circuit for 12V H.T. valves using a transistor output stage.

Aerials

The signal pick-up of most vehicle aerials is not very great, and this can give poor volume. A sensitive receiver helps to compensate for the poor signal, but with the simpler type of receiver the aerial may be very important indeed.

Signal strength is best when the aerial is as high as possible, reasonably long, and well clear of chassis, bodywork and other metal items. A vertical telescopic rod aerial is thus usually among the most satisfactory. The best fixing position depends on the vehicle, and it can be tried temporarily in various positions, before being permanently fixed, if necessary. The aerial and lead-in should be reasonably clear of vehicle wiring, and especially spark coil, distributor, and sparking plug leads. Suppressors will usually be needed, unless the radio is only to be used when the car or caravan is stationary.

With a receiver used for camping or in a parked caravan, a permanent aerial need not be fitted because a throw-out aerial, consisting of a few feet of insulated wire, can usually be hooked up. The height of this wire, and its proximity to metalwork, will greatly influence results. If one end can be kept a few feet high, signal pick-up will usually be sufficient.

Earth

With a camp or stationary caravan radio, an earth is often feasible. A metal spike or pointed rod, with a few feet of flexible wire ready attached, can be used for this. It is pushed into the ground, and will often give quite good volume when used as an aerial connection. Or, if an aerial is available, it can act as the normal earth, being taken to the receiver chassis. With sensitive receivers an earth is scarcely worth while, because the vehicle chassis connection made through the accumulator circuit has a similar effect.

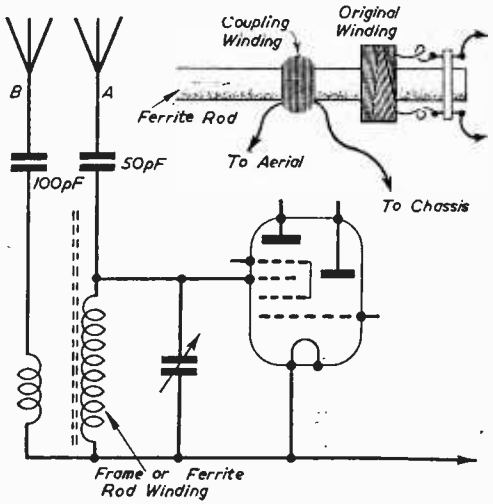


Fig. 6.—Using an external aerial with a frame or ferrite-rod aerial circuit.

For temporary use there is no need to fix the receiver in place, but it should not be overlooked that the chassis in a receiver such as that in Fig. 5 is negative, while the vehicle chassis and metal parts will usually be positive. Direct contact must thus be avoided. If the receiver is permanently mounted, insulated fixing bushes can be used, or a wooden panel or securing strips can be provided, so that there is no direct contact between receiver and vehicle.

AUDIO TEST OSCILLATOR

(*Continued from page* 640)

covered by choosing C2 somewhere between 0.001 and 0.005μF.

Output

The value of the output control VR depends to some extent on the transformer used. If an interstage transformer of, say, 3:1 turns ratio is employed, the output will be high impedance and VR should be about 100,000 ohms. If a speaker transformer is used, then the low impedance output will permit the use of much lower values of VR, e.g., 1,000 ohms. As previously mentioned, this control should also incorporate the on/off switch, so that to operate the unit it is necessary only to turn the control knob to actuate the switch and adjust the output to the desired level.

At the frequency of operation of this oscillator (about 400 to 1,000c/s), almost any transistor will work satisfactorily. The red-spot type on sale for a few shillings is quite suitable, also the OC71 and any type designed for audio applications.

A modification to provide operation on more than one frequency by switching C2 is shown in Fig. 2. The values of the additional condensers can be chosen by experiment, but those shown in Fig. 2 should give a good frequency coverage.

COMPONENT VALUES FOR FIG. 2

C1—.005 μF.
C2—.005 μF.
C3—.002 μF.
C4—.001 μF.
R—100,000 ohms ¼ watt.
S2—Rotary switch, single pole, 3 position.

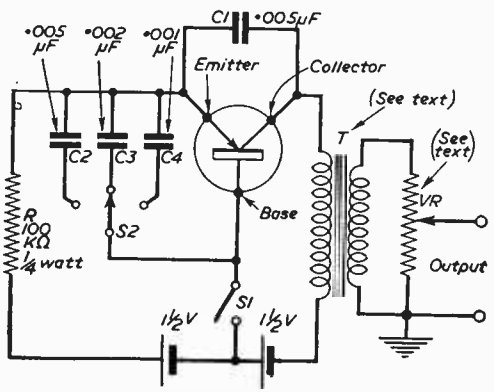


Fig. 2.—Circuit for three different frequencies

NEWS FROM THE CLUBS

ALDERSHOT AND DISTRICT AMATEUR RADIO CLUB
Hon Sec. : J. E. Fuller (G310E), 9, Laws Terrace, Aldershot, Hants.

MEETINGS are held fortnightly as from November 11th at the Cannon Hotel, with morse practices and lectures. The meetings start at 7.30 p.m. New members are welcome. Morse practices are held every Saturday afternoon at the Hon. Sec's QTH.

BLACKBURN AMATEUR RADIO CLUB
Hon. Sec. : F. Bird (G3GXE), 14, Old Bank Lane, Whinney Heights, Blackburn, Lancs.

THE club has now taken over a room annex at the Corporation Park Hotel, Renridge Road. A committee has been formed to deal with the club's aerials and a morse class has been started for beginners. It is hoped to include a class on radio theory at a later date for those wishing to sit for the R.A.E. The club has applied for a transmitting licence and it is on the air on Forty and Top Band 'phone. Plans are in hand for the building of a new 150W rig.

THE BRITISH INSTITUTION OF RADIO ENGINEERS
9, Bedford Square, London, W.C.1.

A COPY of the programme booklet for meetings during the first half of the 1959-60 session can be obtained on application to the Institution at the above address.

Meetings for November, 1959 :

London Section.—Meetings held at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1.

November 11th at 6.30 p.m.—Medical Electronics Group Meeting. "Physiological and Acoustical Aspects of Hearing," by Dr. R. P. Gannon, B.Sc., M.B., Ch.B.

November 18th at 3 p.m. and 6 p.m.—Half-day Symposium on "Electronic Digitizing Techniques" to be opened by G. J. Herring, M.Sc.

Bristol—South-western Section.—At School of Management Studies, Unity Street.

November 18th at 7 p.m.—"Data Recording and Presentation," by D. W. Thomasson (Associate Member).

Cheltenham—South Midlands Section.—Meetings are held at North Gloucestershire Technical College.

November 27th at 7 p.m.—"A Vidicon Television Camera Channel," by B. J. Pover (Associate Member).

Edinburgh—Scottish Section.—Meetings are held at the Department of Natural Philosophy, The University, Drummond Street.

November 12th at 7 p.m.—"The Transistor and its Uses in Communication and Control Equipment," by E. Wolfendale, B.Sc.

Glasgow—Scottish Section.—Meetings are held at the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent.

November 11th at 7 p.m.—"The Transistor and its Use in Communication and Control Equipment," by E. Wolfendale, B.Sc.

Liverpool—Merseyside Section.—Meetings are held at the University Club, 2, Mount Pleasant.

November 10th at 7 p.m.—"The Use of Transistors in Communications and Control," by E. Wolfendale, B.Sc.

Manchester—North-western Section.—Meetings are held at Reynolds Hall, College of Technology, Sackville Street.

November 12th at 6.30 p.m.—"Progress in Permanent Magnet Materials," by J. E. Gould.

Newcastle-upon-Tyne—North-eastern Section.—Meetings are held at the Institution of Mining and Mechanical Engineers, Neville Hall, Westgate Road.

November 11th at 6 p.m.—"Electronic Welding Controls," by C. R. Bates (Associate Member).

Wolverhampton—West Midlands Section.—Meetings are held at Wolverhampton and Staffordshire College of Technology, Wulfruna Street.

November 11th at 7.15 p.m.—"Recent Developments in Semiconductor Rectifiers."

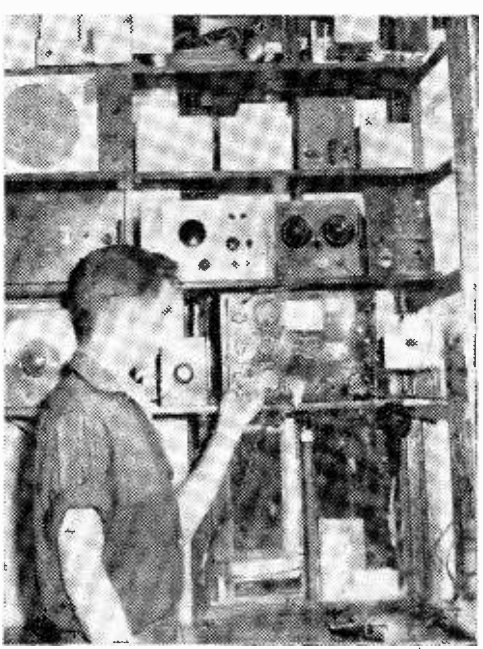
LEEDS AMATEUR RADIO SOCIETY
Swarthmore Education Centre, 4, Woodhouse Square, Leeds 3.
Hon. Sec. : D. Dinsdale, 8, Quarry Mount Street, Leeds 6.

Forthcoming events :

November 11th.—Visit to Spen Valley Amateur Radio Society, George Hotel, Cleckheaton.
November 18th.—Demonstration of Simple S.W. Superhet, by W. Ripley.
November 25th.—Visit to see Electron Microscope in Dept. of Biomolecular Structure.
December 2nd.—Snag night.
December 9th.—Discussion for social.
December 16th.—Social evening.
January 6th, 1960.—Visit to see electronic computer in Leeds University.
January 13th.—Junk sale.
January 20th.—Tape recorders by Philips Electrical Ltd., George Hotel, Cleckheaton.
January 27th.—Film show in Psychology Dept.
February 3rd.—Rag chew.
February 10th.—Some simple items of test gear. E. Sollitt and W. Ripley.
February 17th.—Visit to Mains Radio Gramophones Ltd., Bradford, 7 p.m.
February 24th.—Receiver contest night.
March 2nd.—Demonstration of Photo Electric Devices. E. Sollitt.
March 9th.—Film show in Dept. of Psychology.
March 16th.—Demonstration of hi-fi equipment by Fane Acoustics Ltd..
March 23rd.—Practical demonstration of home-built table top transmitter, by W. Ripley.
March 30th.—Visit to Leeds Police Information Room, 7.30 p.m.
April 6th.—Radio controlled models.
April 27th.—Visit to Roneo Ltd., 7.30 p.m.
May 4th.—Film show in Dept. of Psychology.
May 11th.—Tape recorders.
May 18th.—Field day discussion.
May 25th.—Bring and buy sale for club funds.
June 1st.—Annual general meeting.

THE SLADE RADIO SOCIETY
The Church House, High Street, Erdington, Birmingham 23.
Hon. Sec. : C. N. Smart, 110, Woolmore Road, Erdington, Birmingham 23.

(*Continued on page 689*)



T. Fuller of Beaminster in his den.

PROGRAMME for November and December, 1959.
November 20th.—Annual general meeting.
December 4th.—"Colour Organs"—a talk and demonstration of this fascinating branch of Electronics and Music, by D. T. Wilson (Member).
December 18th.—"Fun and Games"—presented by L. H. Blackwell and G. L. Turner.
All meetings are held at 7.45 p.m. Full details from the secretary.

SPEN VALLEY AMATEUR RADIO SOCIETY
George Hotel, Cleckheaton.
Hon. Sec.: N. Pride, 100, Raikes Lane, Birstall, Leeds.
FUTURE events:
November 11th.—Lecture on The Coupling of Aerials to Transmitters, by the Senior Maintenance Engineer of Holme Moss.
November 25th.—Talk on printed circuits by a member of the development staff of Mains Radio Gramophones Ltd., Bradford.
December 9th.—Demonstration and talk on aerial problems, by A. R. Bailey, B.Sc.
Classes are now being held for those wishing to take the R.A.E.

THE TEES SIDE AMATEUR RADIO CLUB
Settlement House, Newport Road, Middlesbrough.
AT the annual general meeting the following officers were elected: chairman, J. B. Harding (G3JYH); secretary, A. L. Taylor (G3MMO); treasurer, A. E. Moon (G3KBM).
A good attendance was made at the recent visit to the Pontop Pike BBC Television Transmitting Station and the BBC staff were very helpful.
Future events:
November 13th.—The Panadaptor—G3JMO.
November 27th.—A tape-recorded lecture.
December 12th.—Annual dinner.
All meetings are held at Settlement House, Newport Road, Middlesbrough, at 8 p.m. For further details write to the hon. sec. at 12, Endsleigh Drive, Acklam, Middlesbrough, Yorks.

WELLINGBOROUGH AND DISTRICT RADIO & TELEVISION SOCIETY
Silver Street, Wellingborough.
Hon. Sec.: D. J. Trusler, 87, Irchester Road, Rushden, Northants.
IT is announced that Mr. G. Abrams, A.M.I.P.R.E., A.M.T.S., has accepted the presidency of the society.
Future events:
November 12th.—Members' slide night.
November 19th.—"Tape recorders," G. E. Shaw.
December 3rd.—"A brief history of electric lighting," J. Farr.
December 10th.—Three films on the "Application of Steel."
December 17th.—Annual Christmas dinner at the Hind Hotel.
January 7th, 1960.—Annual general meeting.
Meetings are held every Thursday at 7.30 p.m. in the club room above the W.I.C.S. Fruiterer's in Silver Street, Wellingborough. Visitors and new members are always welcome.

CLIFTON AMATEUR RADIO SOCIETY
225, New Cross Road, S.E.14.
Hon. Sec.: C. Bullivant (G3DIC), 25, St. Fillans Road, Catford, S.E.6.
AT the annual general meeting of the society the chairman, W. Martin (G3FVG), hon. secretary C. Bullivant (G3DIC), hon. treasurer N. Moore and committee, Messrs. E. Godsmark (G3IWL), R. Poppi and R. Schilling, were re-elected for the coming year. An Audio Section was formed to cater for members interested in hi-fi amplifiers and tape recorders under the guidance of Mr. D. Reed. This section will be pleased to hear from prospective members interested in this field. The recent Club Transmitting Field Day was won by C. Hatfull (G3HZI).
Club meetings are held every Friday evening and the club-room opens Sunday morning and Wednesday evenings. Plans are in hand to extend the facilities of the club station to include a V.H.F. operating position and also a SWL position.
Forthcoming event:
November 13th.—Grand Junk Sale.

BURTON-ON-TRENT AND DISTRICT RADIO SOCIETY
Club Room, Stapenhill Institute.
Hon. Sec.: J. A. Morris, 9, Rosliston Road South, Drakelow, Burton-on-Trent, Staffs.
SOME interesting lectures have been planned for the winter months and a programme of forthcoming events may be obtained from the secretary. Meetings are held every Wednesday at 7.30 p.m. at Stapenhill Institute and lectures are held on the second Wednesday in every month. Every week a general get-together is held when the TX is put into use. New members are always welcome.
Forthcoming event:
November 18th.—Annual Dinner.

Aligning Tape Heads

NO INSTRUMENTS ARE NEEDED

By G. Tully

ABOUT a year or so ago when experimenting with a tape recorder, I was surprised to find that the high frequencies were highly attenuated when the alignment of the R/P head was slightly upset whilst playing back. Alignment in this case meaning that the length of the head gap is at right angles to the length of the tape in the plane of the tape. With a slightly misaligned head there would be little loss of quality when playing back one's own recordings, although the "gap" would be effectively wider, but the reproduction from pre-recorded tapes would be bound to suffer. The method I adopted to ensure that the head was aligned is as follows:

Method

First make a recording in the normal way on the end of a tape (see Fig. 1), and run the tape off the left hand spool; music with tinny percussion gives best results. Now play the recording back

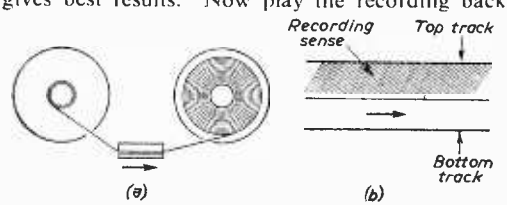


Fig. 1.—Recording

with the back of the tape against the head, i.e., do not turn the tape "over," but change over the spools (see Fig. 2), the left-hand spool will now run in the reverse direction so do not use the rewind control. The recording is now heard backwards and some of the signal is lost due to tape thickness. Note the existing position of the head and assuming there is an adjusting screw,

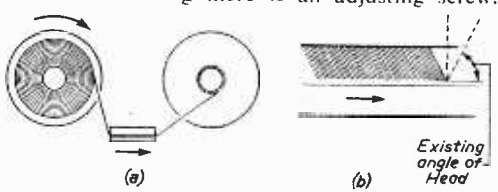
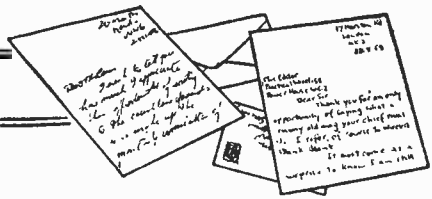


Fig. 2.—Playing-back

count the number of turns required to give the highest frequency response. Now move the head so it is exactly between these positions, i.e., half the number of turns back. The head is now correctly aligned but it is as well to repeat the process again as a check. This method works best with double-play tape as the adjustment is not very sharp when playing backwards through standard thickness tape. Of course, the alignment may also be adjusted while a professionally pre-recorded tape is being played back.

Open to Discussion



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

Mains Polarity

SIR.—Seeing the letter from Mr. Kingdon in last month's issue on earth connections brought to mind a point in connection with the mains which I have not yet had fully explained. I am on A.C. and have a simple A.C./D.C. type of set with resistance smoothing. The house is wired with two-pin sockets and consequently the set plug has two pins and may thus easily be reversed in the socket. I found that with the plug in one way round, reception is clear and undistorted, but if the plug is turned round the signal has a ripple on it giving a sort of bubbling with speech or music. This is presumably due to the smoothing not being too effective on account of the resistance in place of a good choke. To ensure that the set always gave good reception the plug and socket were marked with a spot of red cellulose paint. The set is fitted in a bedroom cabinet and one morning when switched on, the reproduction was "bubbly," and thinking that the plug was in the wrong way round I went to change it, but found that it was correct—according to my red marks. Since this happened I have found on many occasions that the plug has to be turned round from time to time, indicating, I think, that the phase at the power station is somehow changed. How can this be done with the present system of frequency-controlled mains, etc. I thought that the system was fool-proof, but cannot see any other explanation for the ripple, other than changes in "Live" and "Neutral" wiring at the power station, unless there is some other explanation?—G. F. WATTS (N.W.9).

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.

Rectification

SIR.—My father tells me that in his young days when crystal sets were the only ones used, pieces of coal, etc., were used as crystals, and rectification seemed to take place under the most unusual conditions. When valves came into use, a similar state of affairs existed, and in many cases one could obtain a signal without any grid leak or condenser, the essentials for rectification apparently existing in the material from which the valveholder was made. Could this account for a peculiar reception I am getting on my tape recorder, where, if I run a lead to an upstairs room I can get the BBC programmes? I cannot see otherwise where rectification is taking place, as none of the valves is surely working at voltages or conditions relative to detection, and I would have thought that the audio conditions and components would have precluded rectification.—G. R. E. (Bristol).

Transistors on V.H.F.

SIR,—I have tried to make up a pocket transistor set to receive the TV sound programmes, but so far without much success. On the continent there are dozens of V.H.F. transistor sets, and I cannot find one in this country. I know the ordinary red spot doesn't go down very low, but surely an ordinary good one should be capable of receiving TV sound. The aerial need only be very small, and I would think that there would be a good demand for a small set of this type. What is the snag? Have any of your readers made a set of this type which works satisfactorily? If so, perhaps they could pass on the details, as I am sure there are many who would be interested.—G. PARRISH (Eastbourne).

[*Whilst it might be possible to make a set with existing transistors to function on the Band I television stations, so far as we are aware there are no suitable components to enable a Band III receiver to be constructed. If any readers have successfully tackled this problem we should be glad to receive details, and if suitable to pass them on to our readers.*—ED.]

M.W. Reception

SIR.—I have been a S.W.L. for a number of years, both to Ham and BBC stations and would now like to obtain DX on M.W. I understand that it is possible to obtain U.S.A. stations on M.W. and would be pleased to hear from anyone who has done so, giving details of the best time and frequency to use, etc.—E. R. WILOS (Streatham House, High Street, Wilden, Beds).

High Fidelity

SIR.—Each year on my visit to the Radio Show I make a point of attending demonstrations of Hi-Fi given by various exhibitors. I am not a musician but this so-called high fidelity is quite unacceptable to my ears. True, some of the reproducers gave a very pleasant rendering of bass and middle registers, but nearly all gave

(*Continued on page 693*)

a very nasty "edge" to the treble. On some, the sound from the violins appeared to come via comb and tissue paper. How can this be termed high fidelity when it does not resemble the original sound.—A. E. EVANS (Pulborough, Sussex).

Simple Tone Controls

SIR,—With reference to Fig. 7 in the above article in the June issue, I found on building the control for a crystal pick-up the treble control. R5. did not alter the treble content of the signal at all. By experiment, I found that by disconnecting the track of R5 from the join of C3 and R4, and connecting a 470pF capacitor between R5 and earth the simple treble-out circuit enabled excellent results to be obtained. Using a Garrard G.C.2 crystal T.O. cartridge, the bass response and control is superb, and superior to that obtained by the circuit given in the "High Quality Record Player," which I have successfully built.—A. R. WILLS (Wallington, Surrey).

Adding an "S" Meter

SIR,—I have been a regular reader of PRACTICAL WIRELESS for many years and have been looking back through some of my issues for 1943 for articles on the S meter. However, the only thing I could find was the Communication Receiver. I operate a R107 receiver, and would like to add an S meter for station comparison. Could any reader supply information on this modification, also the alignment details?—J. W. BARNETT (77, The Crescent, Dunscroft, Nr. Doncaster).

Correspondence Wanted

SIR,—I would like to communicate with other readers of PRACTICAL WIRELESS who are interested in short wave radio.—JAMES RYAN (Sgmm.) ("Signals" Custumer Bks., Althlone, Co. Westmeath).

Earth Connections

SIR,—With reference to the letter from G. Y. Kingdon, of Norbury (November, 1959), there are two main reasons for using an earth connection to radio receivers. One is to provide a good path to earth (ground) of the signal picked up by the aerial. The more direct this path the better. If the power point earth was used for this purpose. it would in the majority of cases be long, acting perhaps as a counterpoise earth. which is not a good thing except for specialist work. Being laid alongside the mains supply wires. it can pick up mains interference readily. The second reason is safety. again in reference to radio. One point I think is overlooked is where earth leakage circuit breakers are installed in a house. The general public is unaware of this theory. If a radio set. A.C. type. with a 3-core lead is connected to a mains earth system with a circuit breaker. and its owner connects an outside earth lead to the earth terminal of the set, then the circuit breaker coil is short-circuited and. in theory. cannot trip if an earth leak occurs in any other appliance connected within the house.—W. PASCOE (Truro).

Transistors v. Valves

SIR,—May I. too. enter the discussion about transistors v. valves? I am one of the "Younger Radio Set" who started seriously with transistors. When I started I knew nothing about their susceptibility to heat. reversed polarity. etc.. and was in consequence often connecting them with wrong polarity. None of them has ever broken down from this cause. and this is perfectly understandable. since the reason for this breakdown is that the emitter and collector junctions have different heat dissipating capabilities. However, the transistor is almost always well within the maximum dissipation of both the junctions. and consequently it is only in badly designed circuits or when the transistor is working near to its maximum dissipation that any harm is liable to occur. and then only when the polarity is kept reversed for a long time.

As to their sensitivity to heat. this is definitely overrated, since I have known transistors become too hot to touch. Once indeed, I accidentally laid a very hot soldering iron on one, and by the time I noticed it the transistor was too hot to touch. I despairingly tried it, and to my surprise it worked as well after this treatment as before.

Furthermore, another aspect of transistors that has been greatly overrated is their cost. It is true that most valves have an almost standard price. transistors have not. If the constructor insists on buying the most expensive, of course, he will be led to believe that they are expensive. Very few people seem to be aware that one manufacturer sells R.F. transistors which are neither surplus nor out of date for 8s. 6d.! Audio types can also be bought for 7s. 6d., and valves are at least twice the price.

The last point that I wish to emphasise is the interchangeability of transistors. for very nearly any similar type of transistors can be interchanged for any other with good results so long as they are of similar type.—R. J. TORRENS (Sherborne).

SIR,—In reference to the letter by R. Kerr in your November issue, I would like to comment on some points. Firstly, I have known transistors to be very hot and not to be damaged. I have known an output transistor to have its base shorted to earth so that the transistor was smoking yet it works as well as it did before.

I have known the polarity of a set to be reversed and no harm to be done. Transistors are now being built with metal walls and even if they are glass it is simplicity itself to screen them. Transistors do not mean midget sets. they mean that the receiver part can occupy smaller space and hence remove obstructions to sound from behind the set. A definite advantage is that all lethal voltages are removed and danger of fire and sparking is removed. R. Kerr's comment on a one-valve set is also wrong as the PCF80 is two valves in one and a lot more components are needed such as mains transformers and rectifiers. My transistor portable is not a midget as it measures 10in. × 5in. × 4in. and gives very good reproduction. Incidentally, R. Kerr comments on a crystal set which is a form of semi-conductor set.—K. PYROL (Redhow).

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6BE6	6/6	6K25	7/6	10C2	12/6	30F1	9/6	GZ34	12/6	PY82	7/6	UCC85	8/9		
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6F15	8/6	6V6GT	6/6	1487	13/6	DF33	9/9	EB34	1/6	ECC85	8/3	U329	12/6	UY85	7/-		
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6J7G	5/-	7B7	7/6	25A6G	8/-	78	6/-	DK92	8/6	EBF89	8/6	ECL82	11'	EZ41	8 -	PL81	10/6	UB41	8/-	X81	9/6
6J7GT	7/6	7C5	7/6	25L6G	6/-	80	8/-	DK96	8/6	EBL31	16/-	EF36	2/6	EZ80	6/9	PL82	7/9	UB41	8/-	X84	9/6
6K6GT	6/9	7C6	7/6	25L6GT	9/-	807E	7/6	DL35	10/6	EC91	4/6	EF37	6/6	EZ81	8 -	PL83	8/9	UBC41	8 -	Z63	5/-
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6K7GT	5/3	7K7	8/-	25Z4G	7/9	AZ31	9/-	DL92	7/-	ECC82	3/9	EF40	13/6	EZ91	7/6	PY32	11/-	UBF80	8/6	Z77	3/9
6K8G	8/6	7S7	9/6	25Z6G	9/-	B36	8/6	DL94	7/9	ECC83	7/6	EF41	8 6	GT1C	12/6	PY80	7/-	UBF89	9 3	Z152	5/6
6K8G	6/-	7Y4	7/6	27SU	16/-	B65	4/9	DL96	8/3	ECC84	9/-	EF42	7/6	GZ32	8 6	PY81	7	UCC84	14/6	Z719	5/6
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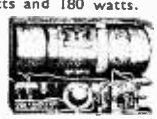

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1D5	9/6	6P25	9/-	30C1	7/6	EBL21	20/6	EZ81	7 6	U25	11 6
1H5GT	10'-	6Q7G	7/6	30L1	7/9	ECC81	7/6	FW4/500	9 6	U26	12 6
1N5GT	10'-	6Q7GT	9/6	35L6GT	10'-	ECC82	6/6	GZ32	9 -	U50	7 6
1R5	6'9	6SL7GT	7/-	35Z4GT	6/6	ECC83	7/-	KT33C	7 -	U52	6·6
1S4	9/-	6SN7GT	5/6	35Z5GT	8.6	ECC84	8/9	KT41	14·6	U76	6 6
1S5	6/3	6U4GT	11/-	43	12.6	ECC85	9/6	KT61	10'-	U78	6 9
1T4	5'3	6V6G	6/-	50CD6G	26/9	ECF80	11/6	KT63	6 6	UABC80	8 6
1U5	6/6	6V6GT	7/6	50L6GT	9/9	ECF82	11/6	KT71	12 6	UAF42	9 6
3A5	10'6	6X4	6/9	AZ31	9/6	ECH21	20/6	MH4	6 -	UBC41	8 6
3Q4	8/6	6X5GT	6/-	B36	15/6	ECH35	6/9	MU14	9 -	UBF80	9 6
3S4	6/9	7B7	8/-	CL33	13/6	ECH42	9/6	MX40	12 6	UBF89	8 6
3V4	7/6	7C5	8/-	DAC32	10'-	ECH81	8/6	N18	8 6	UBL21	20 6
5U4G	6/6	7C6	8/-	DAF91	6 3	ECL80	8/6	N152	10 -	UCC84	12 9
5V4G	10'3	7H7	8/-	DAF96	8/6	ECL82	10/6	PCC84	7 9	UCC85	8 -
5Y3GT	7/6	7S7	9/9	DCC90	10.6	EF39	5/6	PCC89	14 -	UCF80	14 -
5Z4G	9/6	7Y4	8/-	DF33	10'-	EF41	9/6	PCF80	7 6	UCH21	20 6
6AL5	3/9	10C1	14/6	DF91	5'3	EF42	11/6	PCF82	9 3	UCH42	9 -
6AM5	5'-	10C2	17/6	DF96	8/6	EF80	6/6	PCL82	9 3	UCH81	9 -
6AM6	3'9	10F1	15/6	DH76	6/6	EF85	7/6	PCL83	12 6	UCL82	11 6
6AQ5	7'-	10F9	10/6	DH77	7/3	EF86	11/6	PCL84	11 6	UCL83	14 3
6AT6	7'3	10F13	15/9	DK32	14 6	EF89	8/-	PENA4	11 -	UF41	9 3
6BA6	6'-	12AH8	10/6	DK40	14/-	EF91	3/9	PEN36C	9 6	UF42	8 6
6BE6	7'-	12AT7	7/6	DK91	6/9	EF92	4/6	PEN45	8 -	UF89	7 6
6BH6	6/9	12AU7	6/6	DK92	8 6	EL33	10/-	PEN46	5 6	UL41	8 -
6BJ6	6/-	12AX7	7/-	DK96	8.6	EL38	21/6	PL36	13 -	UL44	21 6
6BR7	10/6	12BA6	8/-	DL33	9.-	EL41	9/-	PL38	14 6	UL84	8 -
6BW7	6'6	12K7GT	6'6	DL35	12 3	EL42	10/6	PL81	10 -	UR1C	8 -
6CD6G	28'9	12K8GT	12/6	DL92	6.9	EL84	8/6	PL82	8 6	UY1N	12 6
6F1	14'6	12Q7GT	6/6	DL94	7'6	EM34	8/6	PL83	8 6	UY21	14 -
6F6G	6/6	12Z3	7/6	DL96	8 6	EM80	9/6	PY32	12 6	UY41	7 -
6F13	12'6	14S7	16/9	EABC80	7.9	EM81	8/9	PY80	7 6	UY85	6 9
6F14	17'6	19AQ5	7/6	EAF42	9'6	EM84	10/-	PY81	6 9	VP4B	9 6
6K7G	3/9	20F2	17/6	EB91	3/9	EY51	9/6	PY82	7 -	VP41	6 -
6K7GT	6/-	20L1	17'6	EBC33	7/-	EY86	9/-	PY83	8 -	W76	6 6
6K8G	6/9	25A6G	11/-	EBC41	8/6	EZ40	7/6	PZ30	17 -	W77	4 6
6L1	16/9	25Z4G	9/-	EBF80	8/9	EZ41	7/6	SP61	3 6	Z77	3 9

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Practical Wireless

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PRACTICAL WIRELESS, DECEMBER, 1959

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