THE BEGINNERS' TEST METER

# PRACTICAL WIRELESS

1/3

JULY 1959


## Contents

# U.S.A. HIGH-FIDELITY COAXIAL SPEAKERS

***Recognised as the finest Hi-Fi speakers produced today! Imported by us from U.S.A. to bring you the best quality at the lowest prices ever!***

### 15" Coaxial Speaker

The woofer uses 6.8 oz. Alinco 5 magnet. Has 5in. tweeter and an electronic crossover network to separate the speaker functions. Frequency response: 40-17,000 cycles, output: 15 watts, input to system 8 ohms. Sturdy frame.

ONLY **160/-** P. & P. 4/-.

### 12" Coaxial Speaker

This American-made speaker is ideal for low cost improvement of your Radio, T.V. or gramophone. Woofer uses 6.8 oz. of Alinco 5. Includes 3in. tweeter and crossover network. Handles 12 watts. Impedance 8 ohms.

ONLY **120/-** P. & P. 4/-.

### 8" Coaxial Speaker

A pleasant surprise is in store for you when you hear this speaker with 2½in. tweeter, 8in. woofer with 3.16 oz. Alinco 5, and built-in cross-over network. Handles 8-10 watts. Impedance 8 ohms. Are you price conscious?

ONLY **90/-** P. & P. 4/-.

**U.S.A. DYNAMOTORS** manufactured by EICOR. Input 12 v., output 400 v. at 180 mA. Size 7in. x 4in. x 4¼in. Brand new **45/-**. Same as above, output 250 v. at 100 mA., size 5½in. x 3in. x 3¼in., **30/-**. P. & P. 3/6 on each.

**VIBRATOR PACKS.** 12 volt input, 300 volts output at 150 mA. Fully smoothed. ONLY **25/-**, carr. 7/6. **Also** 6 v. input, 230 v. output at 100 mA. Fully smoothed. **25/-** each. P. & P. 3/6.

**"PYE" 10in. HIGH QUALITY SPEAKER.** Supplied in magnificent cabinet complete with 30ft. of lead and plug. Ideal for Hi-Fi and Stereo. Brand New in original packing. **45/-** each, carriage 5/-.

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

**HEADPHONES — BRAND NEW.** American chamois padded, moving coil, 100 ohms, **25/-**. Dynamic D.L.R.5, **8/6**. Low resistance 120 ohms. **6/6**. P. & P. 1/6 on each.

**WALKIE/TALKIE SET.** Consisting of transreceiver covering 7.4-9 Mc/s, range up to 10 miles, complete with 5 valves, headphones, microphone, junction box, aerial and circuit. ONLY **60/-** each. P. & P. 4/-. Two for **£6**. Post Free.

**H.R.O. SENIOR RECEIVERS.** 50 kc/s-30 Mc/s. Complete with all valves, 4 frequency coil sets, "S" meter, crystal gate, matching mains power pack. Fully tested and supplied ready for immediate operation. ONLY **£16.19.6.** Carr. 20/6.

**PORTABLE 6 V. ACCUMULATORS.** Brand new fully portable 6 v. 40 A.H. accumulators complete in steel carrying case with handle and output terminal. Size 10in. high by 9in. wide by 5in. deep. ONLY **45/-**. Carr. 7/6.

**U.S.A. WHIP AERIALS.** 12ft., 12/6. P. & P. 2/6.

**COMPLETE HEADPHONE & MICROPHONE ASSEMBLY.** A must for every Constructor and "Ham," consists of moving coil, padded headphones and "press to talk" microphone. **10/-**. P. & P. 3/6.

## 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 meter, circuit and instruction book. (American manufacture.) In magnificent condition. **60/-**. Carr. 10/-.

## GEIGER COUNTERS

Designed to detect and measure variations in gamma-ray intensity, i.e. emissions of radio active potassium, minute traces of uranium and thorium, etc., in ordinary soil and rock. The readings being measured on a 50 microamp meter, working battery life is approx. 2,000 hours. Instrument housed in tough plastic case, hermetically sealed. All components I.S.C. Tech. C. approved. Size 8¼ x 8 x 3¼in., weight 6¼ lbs. Supplied with canvas carrying case. Fully guaranteed. **£7.10.0.** P. & P. 7/6.

## WALKI/TALKI INTERCOM

Boys! They're terrific! Two "space styled" hand telephone units in beautiful two-tone finish. No batteries or soldering required, simply connect twin wire between the two units and talk into microphone or listen on one and listen to speaker or talk on the other. Ideal for intercom from house to house, room to room, tent to tent, etc., operates anywhere even up to 200 yards. Brand New! Complete with 25ft. of wire. ONLY 6/6 Per Set. P. & P. 1/-.

## PORTABLE TRANS/RECEIVER No. 18

A self-contained Trans/Receiver for Telephone and C.W. Range approx 10 miles. Freq.: 6-9 Mc/s. (50-33.3 metres). Valve line-up: 3 ARP-12, 2 AR-8, 1 ATP4. Complete with aerial, H.T. and L.T. meter. Weight 20 lbs. Size 8 x 10 x 17in. ONLY **60/-**. Carr. 10/-

## AMERICAN LIGHT-WEIGHT HEADSET

*They're High and Low Impedance!*

These H.S.30 phones are the finest 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.

**CONTROL BOX—B.C.602.**

Complete push-button control box. 4 position and on/off, with dual coloured indicators for instant channel check. In black crackle case 5½in. x 3½in. x 1¾in. Bargain price. 5/- each. P. & P. 1/6. Two for 8/-. P. & P. 2/6.

**BARGAIN OFFER.** Relay package containing: one 6, 12 and 24 volt stepping relay giving 4 break positions alternatively, two miniature 12 and 24 volt coils with one make position, one 12 and 24 volt heavy duty relay with 2 make and break and 1 break positions, one miniature gate switch double pole press to make 1 amp. 250 volts. Made by leading American manufacturers, all for only 8/-. P. & P. 2/-.

**TELEPHONE HANDSET.** Brand new. 12/6. P. & P. 1/-.

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

**PICTURE FRAME AERIAL.** Incorporates MW and LW aerial with provision for tuning out unwanted signals, noise, etc. Size 8¼ x 11½ x 1¼in. Magnificent appearance. Brand new with full instructions. 12/6. P. & P. 2/6.

**WESTINGHOUSE J.50 PENCIL RECTIFIERS.** 500 v. 5 mA., 3/6. P. & P. 1/-.

**SOLDERING IRON.** Instrument type 230 to 250 volt A.C. 25 W. with neon indicator. ONLY 16/6. P. & P. 1/6.

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

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

**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/-.

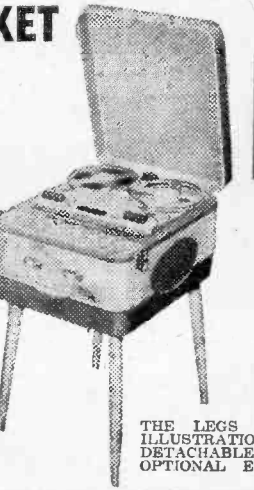
**ACCUMULATORS.** 2 volts 16 A.H. (unspillable). Ideal for 6 and 12 volts supply, etc. Brand new. Original cartons. Size 4in. x 7in. x 2in., 5/6 each. P. & P. 1/6. 3 for 15/-. P. & P. 3/6. 6 for 27/6. P. & P. 5/-.

# THE BEST VALUE ON THE MARKET

## Stern's "fidelity" TAPE RECORDER

## DIRECT—MANUFACTURER to USER

**NO "MIDDLEMAN'S" DISCOUNT IS INCLUDED IN OUR PRICES.**



**IT INCORPORATES**

- The latest COLLARO TRANSCRIPTOR TAPE DECK.
- The model HF/TR3 "fidelity" AMPLIFIER. (Described below).
- Matching elliptical 7in. x 4in. P.M. Speaker.
- 1,200 reel HIGH QUALITY EMITAPE.
- ACOS Crystal Microphone.

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

(Plus £1.10.0 Carriage and Insurance, of which £1 is refunded on return of Packing Case.)

PRICE
**£49.10.0**

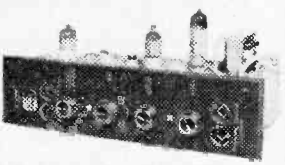
Terms: Dep. £9.18.0 and 12 monthly payments of £3.12.7 or Dep. £16.10.0 and 12 monthly payments of £3.0.6.

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

## THE 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 Motek Decks. Please specify which.
Send S.A.E. for leaflet or 2/6 for the complete Assembly Manual.

## STERN'S—MULLARD TYPE "C" TAPE PRE-AMPLIFIER-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**

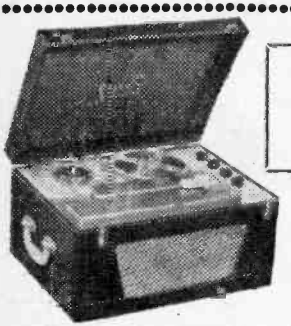
COMPLETE KIT OF PARTS **£14.0.0**

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" Pre-amplifier strictly to Mullard's specification incorporating ONLY NEW HIGH-GRADE COMPONENTS and the SPECIFIED NEW MULLARD VALVES. It comprises a COMPLETELY SELF-CONTAINED UNIT, all components and valves being contained in a well-ventilated Box-Chassis neatly finished in Hammered Gold with a very attractively engraved PERSPEX FRONT PANEL.



## HOME CONSTRUCTORS

## YOU CAN BUILD THIS PORTABLE TAPE RECORDER from £39.15.0

**TO ADD FULL TAPE RECORDING FACILITIES**

**WE OFFER YOU THIS SELECTION**

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

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

(b) The COLLARO MK. IV TAPE DECK (£25.0.0) and the HF/TR3 AMPLIFIER Assembled and Tested. FOR . . . **£34.10.0**

H.P. Deposit £6.18.0 and 12 months of £2.10.8.

(c) As in (b) above, but HF/TR3 supplied as COMPLETE KIT OF PARTS..... **£30.15.0**

(d) THE MK IV TRUVOX TAPE DECK WITH the assembled and tested HF/TR3 AMPLIFIER **£41.0.10**

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

(e) As in (d) above but the HF/TR3 supplied as COMPLETE KIT OF PARTS..... **£38.0.0**

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

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

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

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

(a) The COLLARO MK. IV TAPE DECK and the MULLARD TYPE "C" PRE-AMPLIFIER with Power Unit Assembled and Tested ..... **£35.0.0**

H.P. Deposit £7.0.0 and 12 months of £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. IV TAPE DECK with the assembled and tested TYPE "C" PRE-AMPLIFIER and POWER UNIT..... **£42.10.0**

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

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

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

## STERN RADIO LTD.

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

**Telephone: FLEET STREET 5812/3/4**

# AMPLIFIERS PRE-AMPLIFIERS

FOR THE "HI-FI" ENTHUSIAST

# MULLARD DESIGNS FOR THE HOME CONSTRUCTOR

MODEL 510/M

THE VERY POPULAR MULLARD "5-10" MAIN AMPLIFIER

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

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

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

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

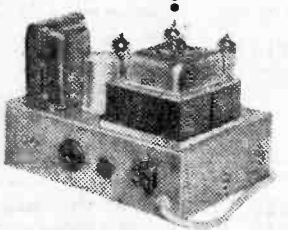
A completely new design employing two EF86 valves, and in particular designed to operate with the Mullard range of Power Amplifiers, but also perfectly suitable for other makes, etc.
Briefly it incorporates :

- Equalisation for the latest R.I.A.A. characteristics.
- Input for variable reluctance.
- Magnetic Pickups.
- Input for Crystal Pickups.
- Input for Tape replay.
  - (a) Direct from High Impedance Tape Head.
  - (b) From a Tape Amplifier or Pre-amplifier.
- Sensitive Microphone Channel.
- Wide range Bass and TREBLE Controls.
- Attractive Perspex front control panel.
- Our Kit is strictly to MULLARD'S SPECIFICATION.

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

MODEL 3-3/M

THE NEW MULLARD 3-3 MAIN AMPLIFIER



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

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

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

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

## SPECIAL PRICE REDUCTIONS . . .

(a) The COMPLETE KIT OF PARTS to build both the "3-3" MAIN AMPLIFIER and the 2-STAGE PRE-AMPLIFIER-CONTROL UNIT ... **£12.10.0**

(b) The COMPLETE KIT OF PARTS to build the "5-10" MAIN AMPLIFIER and the 2-STAGE PRE-AMPLIFIER-CONTROL UNIT ... **£15.15.0**

PRICES FOR THE "5-10" ARE SUBJECT TO £1.6.0 EXTRA IF THE PARTRIDGE TRANSFORMER IS REQUIRED.

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

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

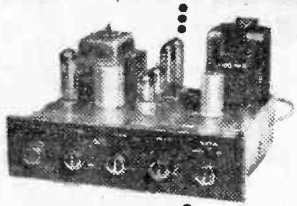
(b) The "5-10" and the 2-STAGE PRE-AMPLIFIER both ASSEMBLED and TESTED ... ... **£18.18.0**

H.P. : DEPOSIT £3.16.0 and 12 Monthly Payments of £1.7.8.

When ordering include an extra 7/6 to cover Carriage and Insurance

MODEL 510/RC

THE NEW COMPLETE MULLARD 5-10 AMPLIFIER



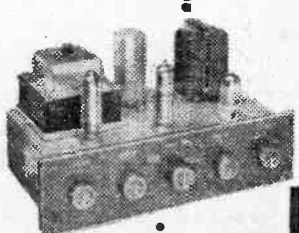
Designed for a simple domestic installation with Genuine High Quality reproduction up to a maximum of 10 watts. Separate BASS and TREBLE Controls are incorporated with switched inputs for 78 and L.P. Records plus Radio Tuning Unit.
We incorporate SPECIFIED COMPONENTS and NEW MULLARD VALVES. We also give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

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

H.P. Terms : Dep. £2.14.0 and 12 Monthly Payments of 19/10.
Send S.A.E. for ILLUSTRATED LEAFLET or 1/6 for the ASSEMBLY MANUAL.

MODEL 3-3/RC

THE NEW 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 (plus 6/6 coverage and insurance) **£8.19.6**

H.P. Terms : Dep. £2.0.0 and 8 Months of £1.0.0.
Developed from the very popular 3-valve 3-watt Amplifier designed in the Mullard Laboratories. Our kit is complete to MULLARD'S SPECIFICATION including supply of specified components, Mullard valves and a **PARMEKO OUTPUT TRANSFORMER.**
Send S.A.E. for leaflet or 1/6 for ASSEMBLY MANUAL.

# STERN RADIO LTD.

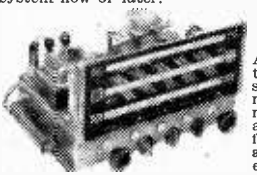
# "MODERNISE YOUR OLD RADIOGRAM"

**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 unit yet produced for Stereo, giving 6 watts high-fidelity push-pull output on each channel, 12 watts for monaural. Full VHF band, medium and long wavebands. Stereo and monaural inputs or records, tape and radio, and a tape output for stereo and monaural tape recording. Comprehensive matching for all types of crystal pick-ups. The perfect basis for a complete monaural reproducing system or for a complete stereophonic system now or later.



### ARMSTRONG "JUBILEE" £29.8.0

An AM/FM chassis with nine valves and two diodes and with push-pull output stage providing 6 watts. Full VHF, medium and long wavebands with automatic frequency control on FM and ferrite aerial on AM. Tape record and playback facilities. Can be adapted for stereo at any time by the addition of our compact, easy-to-fit converter amplifier.

### ARMSTRONG "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. Alternative inputs enable the use of most crystal pick-ups, together with tape recorders or tape pre-amplifiers (such as our type "C" unit). 8 Watts output. Radio covers med. waveband and the complete VHF/FM transmissions 87-108 Mc/s.

### DULCI "H4PP"..... £27.16.6

An eight-valve AM/FM 4 waveband chassis giving 6 watts ultra linear output. Covers short, long, medium wavebands plus the VHF/FM band and has internal aerial on the medium and long wavebands. Tape outlet incorporated and suitable for 3 to 15 ohm loudspeakers.

### DULCI "H3"..... £19.17.6

A 6-valve AM/FM chassis giving 4 watts output. Covers medium and long wavebands, on which an internal aerial operates, plus the VHF/FM band. Full AVC on all wavebands and Tape outlet incorporated.

### AM/FM RADIO TUNING UNITS

Containing own Power Supply Units.

### ARMSTRONG "S.T.3"..... £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"..... £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.**

## STERN'S FOR STEREO

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

**WE OFFER PRE-AMPLIFIER and AMPLIFIER AT SPECIALLY REDUCED PRICES**

*Send S.A.E. for full details.*

## 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 Maroon and Grey Rexine.

WE ALSO SUPPLY SEPARATELY—

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

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

## STERN'S 12 VOLT CAR RADIO

***Incorporating* PRINTED CIRCUIT *and* POWER TRANSISTOR**

A versatile design covering both LONG and MEDIUM WAVEBANDS, incorporating Transistor Output, thus having very low battery consumption. Is operated direct off 12 volt Car Battery.

We offer it on the UNIT ASSEMBLY BASIS, consisting of THREE SEPARATE FULLY WIRED, ALIGNED and TESTED UNITS, plus the complete loudspeaker assembly. All for **£15.0.0**

Only 12 solder joints are required to finish the complete receiver. Send 1/6 for Manual containing complete data.

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

**Telephone: FLEET STREET 5812/3/4**

## !! RECORD PLAYERS !!

**THE LATEST MODELS ARE IN STOCK**

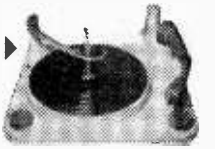
**MANY AT REDUCED PRICES!!!**

**SEND S.A.E. FOR ILLUSTRATED LEAFLET**

### A FEW CASH BARGAINS

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

**£6 . 12 . 6**



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..... **£4.5.0**

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

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

GARRARD MODEL 301 . . . 4HF . . . TA/Mk11 . . . 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.**

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.

**STERN'S MK. II** *fidelity* **F.M. TUNING UNIT PRICE** (Plus 5/- Carr. and Ins.) **£14.5.0**

HIRE PURCHASE: Deposit **£2.0.0** and 12 Monthly Payments of **£1.0.9.**

Incorporates the latest MULLARD PERMEABILITY TUNING HEART and the corresponding MULLARD VALVE LINE-UP comprising ECC85, 2 type EF85s(or EF89s) EM84 Tuning Indicator, plus 2 type O.A.79s Germanium Diodes. A really first-class Tuner, very attractively presented and comparable to many offered at much higher prices. Power consumption is only 1.5 amps at 6.3 volts and 25 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.**

## HOME CONSTRUCTORS

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

# QUICK, EFFICIENT UP-TO-DATE COMPONENT SERVICE!

## TWO-TRANSISTOR POCKET SET

Can Be Built For **47/6**

**BUILD THE "SKY PIXIE" VEST-POCKET TWO-TRANSISTOR PLUS DIODE RADIO** which gives a superb performance and is highly sensitive. Size only 4¼in. x 3¼in. x ¾in., weight under 7oz.—yet it is a **THREE-STAGE** receiver covering all medium waves, working entirely off a tiny "pen-light" battery. Every part tested before despatch! **SPECIAL STEP-BY-STEP PLANS FOR ABSOLUTE BEGINNERS.** Total building cost including case, transistors, etc.—everything down to the last nut and bolt—**ONLY 47/6** with plans. Postage, etc. 2/-. C.O.D. 2/- extra. (Parts sold separately. Priced parts list and plans 1/6.) **RUSH YOUR ORDER TODAY!**

## POCKET VALVE RADIO

Can Be Built For **39/6**

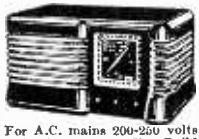
Anyone Can Build This Beautiful Precision Pocket Radio in an hour or two. No knowledge whatever needed, our Simple, Pictorial Plans take you step by step! Remarkably sensitive—covers all medium waves, incl. Luxembourg, Home, Light. Size only 2in. x 3in. x 5¼in. **Not a Toy! But a Real Valve Radio!** Uses self-contained battery and is a really personal-phone, pocket radio with **Detachable Aerial. IDEAL FOR BEDROOM, GARDEN, etc. We supply ALL parts necessary together with plans, etc.—for the Special Price of 39/6** (Plus 2/6 post, etc.). **BUILD YOURS NOW!** (All parts sold separately.) Priced parts list, etc., 1/9. Big demand certain—**Send Today!** C.O.D. 2/- extra.

## RECORD CHANGER AND PLAYER BARGAINS!

**B.S.R. MONARCH**, 4-speed, mixer auto-changer unit, model UA8. Fully complete with crystal pickup, etc. Brand new—Limited Stocks Only. **GIFT £6/19/6.** (Plus post and packing, 5/-.) **LATEST "COLLARO"** 4-speed auto-changer, with Hi-Fi. pickup. Complete in maker's sealed cartons. **BARGAIN £7/19/6.** (Plus post and packing 4/6.) **"COLLARO" JUNIOR**, 4-speed, single player, with crystal pickup, using HGP59 cartridge. **OUR PRICE 92/6.** (Plus 4/- post and packing.)

Choice of beautiful walnut veneered cabinet or ivory or brown 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 easy-to-follow plans—in fact, everything! **Parts tested before despatch!** Uses standard octal-base valves. For A.C. mains 200-250 volts (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.

Can Be Built For **107/6**



## COMPONENT BARGAINS!

**Red-Spot Transistors**, tested, **8/6.**
**White-Spot Transistors**, tested, **15/-.**
Also all Mullard and standard types stocked.

**Moving Coil P.M. Speakers.** 2½in. 17/6; 3½in. 19/6; 5in. 17/6; 8in. 19/6.

**ALL TYPES OF COMPONENTS STOCKED AT COMPETITION PRICES**

## PRINTED CIRCUIT POCKET SET

**BUILD THIS 3 TRANSISTOR POCKET RADIO . . . PRINTED CIRCUIT VERSION!** The "Companion" is comparable in sensitivity to a three-valve battery set, it is exceptionally small in size (4¼in. x 3in. x 1½in.) and is a self-contained pocket radio that does not need aerial or earth. It has built-in speaker and covers medium and long waves. This unique little set **CAN BE BUILT FOR ONLY 97/6. EVERYTHING INCLUDED!** (Plus post and packing 2/6.) All parts sold separately. Price list, etc., 6d. C.O.D. 2/- extra.

## PRINTED CIRCUIT POCKET SUPERHET

**BUILD THIS PROFESSIONAL-LOOKING, FIRST-CLASS 6 TRANSISTOR POCKET SUPERHET THE "TRANSIDYNE."** Size only 6¾in. x 3¼in. x 1¼in. Beautiful red and cream plastic case with engraved dial. Set weighs only 20oz. with batteries! Covers medium and long waves. Works off two No. 8 batteries. **The second I.F. Stage is reflexed to give additional audio gain.** In-built ferrite rod aerial and 2½in. P.M. speaker. This TRANSIDYNE is probably the best yet of its kind, it is **simple to build** and really sensitive. **ALL COMPONENTS INCLUDING CABINET, PRINTED CIRCUIT, TRANSISTORS—IN FACT EVERYTHING CAN BE SUPPLIED FOR £11/15/-.** (Plus post and packing 2/6.) (All parts sold separately. Price list, circuit, etc., 9d.) C.O.D. 2/- extra.

**CAN BE BUILT FOR 47/6** Build this exceptionally sensitive high efficiency Pentode radio. Uses unique assembly system and can be built by anyone without any radio knowledge whatever in 45 minutes. Handsome black-crackle steel case with specially made black and gold dial with stations printed. Size of radio only 6¼in. x 5in. x 3in. Covers all Medium and Long waves—uses only one all-dry battery. H.T. consumption only 1 to 1.5 mA. Uses personal phone. Ideal for Bedroom, Garden, Holiday, etc. **BUILD THE "SKYROMA" NOW!** Total building cost—everything down to last nut and bolt—47/6 (Postage etc., 2/-)—with full set of clear, easy-to-follow plans. (Parts sold separately. Priced Parts Lists & Plans 1/6d.) C.O.D. 2/- extra.

## READ WHAT OTHERS SAY!

**"—I WAS SURPRISED AT THE NUMBER OF STATIONS—"**
**L. D. C., of Worcester,** writes, "—Just a few lines to let you know how pleased I am with the midget portable radio. I was surprised at the number of stations I could get, with a clear performance. The price was a real bargain. Have you lists of other bargains? If so, please send them—"

**"—I MUST SAY I AM VERY PLEASED—"**
**J. W. S., of Scarborough, Yorks,** writes, "—I feel I must say I am very pleased in the way you do business and if at any time I require anything, or can recommend you to anyone, I will not hesitate to help you—"

**"—I'VE HEARD MUCH PRAISE OF THEM—"**
**J. E., of Hilton, Nr. Derby,** writes, "—I would like one of your portable radio kits as I've heard much praise of them—"

**"—THIRTY-TWO STATIONS RECEIVED—"**
**J. N., of Oxted,** writes, "—Yesterday evening on the Medium Waveband, between 10 p.m. and 10.30 p.m., I counted 32 distinguishable stations! I am very pleased with the set, which is well worth the money—"

**"—MY DEEPEST ADMIRATION—"**
**J. R., of North Shields, Northumberland,** writes, "—The honest and direct dealing of your firm has earned from me my deepest admiration—"

**"—ITS PERFORMANCE IS ALMOST UNBELIEVABLE—"**
**E. F., of Ipswich,** writes, "—For so small a set I think it is a wonderful station getter with ample volume on all. Its performance is almost unbelievable, and it's a very convenient little set giving me stations I've never been able to get on a larger set—"

## THIS TRANSISTOR SET

**CAN BE BUILT FOR ONLY 29/6** **VERY SPECIAL OFFER WHILE STOCK OF PARTS LASTS!—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 & Plans, 1/6. **VERY SIMPLE TO BUILD.**

# CONCORD ELECTRONICS

**69, PRESTON STREET, BRIGHTON.** Dept. PW9

*Orders receive prompt attention. Cheques accepted. Cash on delivery 2/- extra. Please print name and address in block letters Suppliers to Schools, Universities, Government and Research Establishments.* **Complete range of components and valves stocked.** *Regret no C.O.D. abroad. Money refunded if parts returned intact within 7 days.*

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

**REALISM AT INCREDIBLY LOW COST**

The Recorder incorporates the Latest Collaro Mark IV Tape Transcriptor. The Linear LT45 High Quality Tape Amplifier, High Flux P.M. Speaker, empty Tape Spool, and a Reel of Best Quality L.P. Tape (850ft.) are included. A Collaro Studio Microphone can be supplied with the recorder only at a special price of 37/6. SEND S.A.E. FOR LEAFLET. Cabinet finish veneered walnut. Size 18in. x 17in. x 14in. high.

**39½ GNS.** Carr. 15/-. **H.P. TERMS.** Deposit 3 Gns. and 12 monthly payments £3.10.6.

## HI-FI 8 WATT AMPLIFIER

Special Purchase due to Cancelled Export Order. For 200-250 v. A.C.

**£4-19-9** Carr. 7/6.

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.

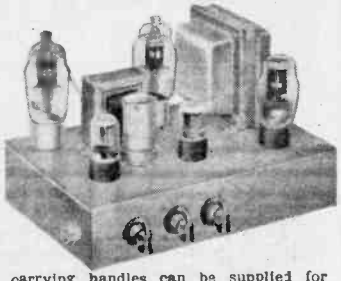
## R.S.C. A8 HIGH FIDELITY 12 WATT AMPLIFIER

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 200-250 v. 50 c/cs. Outputs for 3 and 15 ohm speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Unapproachable value, at £7/15/- or factory built 45/- extra. Carriage 10/-.

**£7-15-0**

If required louvred metal cover with 2



carrying handles can be supplied for 18/9. Additional input sockets, with associate Vol. control so that two different inputs such as Gram and 'Mike' or Tape and Radio can be mixed, can be provided for 13/- extra. Guaranteed 12 months.

**TERMS** on assembled two input model: **DEPOSIT 18/9** and 12 monthly payments, 18/9.

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

## STAAR GALAXY 4-SPEED MIXER AUTO-CHANGERS

Brand new, cartoned. Turnover sapphire stylii. Many exclusive features. Unique design motor virtually free from 'wow.' For 200-250 v. A.C. mains. Only **£5.19.6**, while stocks last or fitted Acos turnover head for 78 r.p.m., L.P. or Stereo records. **£8.19.6.** Carr. 3/9 extra.

**PORTABLE CABINETS.** High Quality Finish. Rexine covered. Attractive design. Inside measurements: 17in. x 12½in. x 8½in. high. Clearance above baseboard 5½in. Below 2½in., **69/9** each. Or size 14½in. x 13½in. x 6½in., only **47/9.**

**SPECIAL OFFER.** Above cabinet, LG3 Amplifier, Staar. Changer and 6½in. P.M. Speaker. **11 Gns.** Carr. 10/-.

**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.

**ACOS CRYSTAL 'MIKE' INSERTS.** Approx. 1in. square. Fly lead connections. Only **5/11** each. Brand New. Round type approx. 1¼in. diam. Ex-equipment, tested, **4/11** each.

**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 50/-. Brand new, cartoned. **29/6.**

**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, **56/9.**
Very limited number

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

## 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** Carr. 3/6 extra.

## 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 120v. 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. **49/6.** 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 21-3-3in. ... ... ... **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**; 0-4-6.3 v. 2 a, **7/9**; 12 v. 1 a, **7/11**; 6.3 v. 3 a, **8/11**; 6.3 v. 6 a, **17/6**; 12 v. 3 a, or 24 v. 1.5 a, **17/6.**

**OUTPUT TRANSFORMERS**

Midget Battery Pentode 66:1 for 3S4, etc. ... ... ... ... ... **3/9**
Small Pentode, 5000Ω to 3Ω ... ... **3/9**
Small Pentode 7/8,000Ω to 3Ω ... ... **3/9**
Standard Pentode 5,000Ω to 3Ω ... **4/9**
Standard Pentode, 7/8,000Ω to 3Ω ... **4/9**
10,000Ω to 3Ω ... ... ... ... ... **4/9**
Push-Pull 10-12 watts 6V6 to 3Ω or 15Ω ... ... ... ... ... ... **15/9**
Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15Ω ... ... ... ... **16/9**
Push-Pull EL84 to 3 or 15Ω ... ... **16/9**
Push-Pull 15-18 watts, 6L6, KT66 ... **22/9**
Push-Pull 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.**

**COLLARO RC54 3-SPEED AUTO-CHANGERS** with Studio pick-up. Brand new. For 110 v. 50 c.p.s. A.C. mains. Price with 110 v. to 220-250 v. Auto Trans. only **£5.19.6.** Carr. 5/6.

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

**COLLARO 4-SPEED SINGLE PLAYER** with separate pick-up, GP54 with sapphire stylii. For 200-250 v. A.C. mains. **£4.10.0.**

## R.S.C. A12 STEREOPHONIC AMPLIFIER KIT

A complete set of parts to construct a Stereo amplifier with an undistorted output total 6 watts (3 watts each channel). 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 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. 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, EF98, ECC83, 807, 807, G233. 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 2/9** 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 miniature Mullard. Self-contained Pre-amp. Tone Control stage and separate Bass and Treble Controls. Independent 'Mike' and Gram input sockets are provided. Output Matchings for 3 and 15 ohm speakers. Only 12 **GNS.**: or Deposit 22/3 plus 10/- carr. and 12 monthly payments of 22/3. Send S.A.E. for leaflet.

**LINEAR L10 HI-FI** 10 watt Amplifier and separate Pre-amplifier. **15 GNS.** Complete. 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.

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

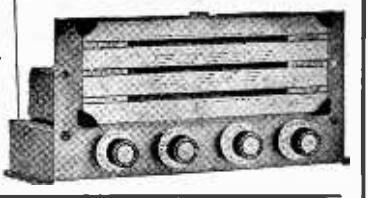
## BUILD A HIGH QUALITY TAPE RECORDER FOR 29½ GNS.

Carr. 12/6

Kit consists of latest Collaro Tape Transcriptor Mark IV listed £25. Linear LT45 complete Tape Amplifier listed 12 Gns. Acos 33-1 microphone listed 50/-. Reel of recording tape listed 28/6. 6in. x 4in. or 6½in. loudspeaker listed 29/6, and wiring diagrams.

**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. 3-4 WATT A7 HIGH-GAIN AMPLIFIER

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

**LINEAR STEREOPHONIC L3/3 3+3 WATT QUALITY AMPLIFIER**

Output 6 watts when not used with stereo head. For 200-250 v. 50 c.p.s. A.C. mains. Ganged controls, Volume and Tone. Outputs matched by preset balance control. For use with 2 matched 3 ohm speakers. Only requires connecting to Pick-up speakers and mains point. Sensitivity 150 m.v. Supplied with guarantee and instructions. Send S.A.E. for leaflet. Terms available. **7 GNS.**

**LINEAR L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER.** Suitable for use with Collaro, B.S.R. or any other record playing unit, and most microphones. Negative feed-back 12 db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c/cs. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 6-5-5½in. high. Output for 2-3 ohm speaker. Guaranteed for 12 months. Only £5/19/6. Send S.A.E. for illustrated leaflet. Credit Terms. Deposit 22/6 and 5 monthly payments of 22/6.

**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/-.

**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 17/9. Stereo Type for 78, L.P. and Stereo records. Will fit B.S.R., Collaro, Garrard, and Galaxy changers. 52/6.

**COLLARO Mk. III 3-SPEED TAPE TRANSCRIPTORS 15 GNS.** Carr. 7/6
**Brand New Cartoned & Limited Number.**

**SPEAKERS.** 10in. W.B. "Stentorian" 3 or 15 ohms type HF1012 10 watts, hi-fidelity type. Recommended for use with our A8 Amplifier, £4/10/9. 12in. Plessey 3 ohms 10 watts (12,000 lines), 59/6.

**LG3 MINIATURE 2-3 WATT GRAM AMPLIFIER.** For use with above or any other single or auto-change units. Output for 2-3 ohm speaker. For 200-250 v. 50 c.p.s. A.C. mains. Over-all size 6½ x 4½ x 2½in. Controls: Vol. and Tone with switch. Guaranteed 12 months. Only 55/9.

**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.

**COLLARO AC4/564 4-SPEED SINGLE RECORD PLAYER UNIT.** With Turnover crystal head £6/9/6. carr. 3/6.

**COLLARO 4T/200 TRANSCRIPTION UNITS.** With Transcription Pick-up. Mounted in attractive rexine covered carrying case. Only 19 **GNS.**

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

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

Mail Orders to 29-31 Moorfield Rd., Leeds 12.
Callers to 5 and 7 County (Mecca) Arcade, Briggate, Leeds 1. and Universal Bazaars Ltd., 8-10 Brown St. (Market St.), Manchester 2.

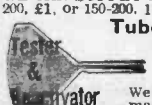
## Hi-Fi Snip
### Infinite Wall Baffle

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

## T.V. Service Sheets

200 sheets covering most popular post-war televisors by leading makers—Cossor, Ekco, Ferguson, Pye, etc. £2 post free. PREVIOUS PURCHASERS OF THESE SHEETS PLEASE NOTE: WE CAN SUPPLY SHEETS Nos. 100-200, £1, or 150-200, 10/-.

## Tube Tester and Re-Activator




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

## Miniature Microphone

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

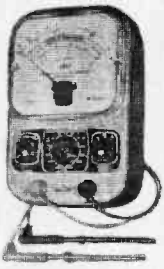
## Speaker Bargain

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

## Don't Stumble in the Dark

Install 2-way switches. Our outfit comprises: 30 yds. Multicore cable, two 2-way switches, two wood blocks. Full instructions, 9/6 each, post and insurance 2/6.

## *Assure your future*



The ownership of a good instrument has been the turning point in many a famous career. You can own the latest Pullin Series 100 Test Set which is undoubtedly a most useful instrument by a firm long famous for fine instruments, entirely redesigned, it has a square movement with diacon plastic cover, this makes for a brighter, more readable scale, extra scale length and wider angle of vision. With the test set is included a pair of combined test prods and crocodile clips also a stand for inclining the meter at the best reading positions. Ranges A.C. Volts: 0-10, 0-25, 0-100, 0-250, 0-500, 0-1,000, ditto D.C. A.C. current 0-100 mA. D.C. Current 0-2.5, 0-10, 0-100, 0-500 mA. Resistance: 0-1 M and 0-10 K. All at 10,000 ohms per volts. Price £12.7.6 or 10/- deposit and 21 fortnightly payments of 10/-. (This figure includes insurance for 12 months.) Non-callers add 5/- carr. and insurance. **FREE GIFT.**—All purchasers of the above item this month will receive Range Extender scale and data which add: capacity 2pF-1mFd., in two ranges. Inductance 0-100 henrys, etc., etc.

## 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 Motiffed 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 the tremendous bargain.

## Special introductory offer

Introducing our new 'Inductor 40' Fluorescent fitting. This is a batten type fitting nicely finished, white enamel. Suitable for chain suspension or direct fixing, uses fully compounded choke ballast and radio suppressed starter. Offered at a special price this month to introduce it, namely 39/6, complete with tube. Carriage up to 150 miles 5/6; up to 250 miles, 7/6.

## 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.)

**B.B.C. Television Transistor Set.** All parts available—total cost, including two transistors, with copy of circuit diagram and instructions. Postage 2/- extra.

**FOR ADDRESS SEE NEXT PAGE**

## Band III Converters

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

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.

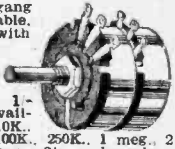
## Cabinet Snip

This fine cabinet as illustrated but less control knobs is available this month at a special snip price of 12/6, plus 3/6 post and insurance. Size is 13½in. x 9in. x 4in. and it is nicely covered in two-tone I.C.I. fabric.

## R1155 for Spares

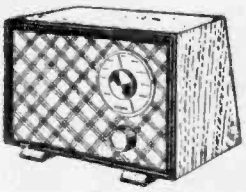
These are less valves but otherwise reasonably complete—ideal for spares—prices £2 to £4 depending on condition—carriage 7/6.

## Morganite Potentiometers



Single and 2-gang types available, standard size with good length spindle, all beand boxed. Single types 1/- each, values available: 5K., 10K., 25K., 50K1., 100K., 250K., 1 meg., 2 meg., Gang type 3/- each—values available: 5K., + 5K., 100K., + 100K., 1 meg. + 1 meg., 2 meg. + 2 meg.

## LAST FEW



## The Skysearcher

This is a 2-valve plus-metal receiver set useful as an educational set for beginners, also makes a fine second set for the bedroom, workshop, etc. All parts, less cabinet, chassis and speaker. 19/6. Post and ins., 2/6. Data free with parts or available separately. 1/6. **3 valve battery version also available at the same price.**

## Bargains

**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.

**Twin Twisted V.I.R. Flex,** 7/-, .006 (14/36 equiv.), 17/6 100 yd. coil.

**Mains Lead.** 4 core rubber insulated and circular braided overall. Has prepared ends suitable converter or similar. 6 ft. long 9d. each, 7/6 doz.

**Metal Rectifier.** Equivalent of RM5—250 mA., 250 v., 12/6.

**Welding Transformer.** 12v.-50 amp continuous rating — intermittent rating for spot welding—exceeds 2,000 amps. 45/-, carriage and packing 5/-.

**6ft. 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—we offer three leads for 2/-.

**.1 mfd 350 v.** Small tubular metal cased condensers made by Dubilier. 2/6 doz.

**50 Assorted Resistors.** Well mixed and useful values ½ and ¼ 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 or 12/- doz.

**Metal Rectifier.** 250 v. 60-80 milliamps, ideal for mains set or instrument or to replace that expensive valve, 4/6.

**Screened Cable.** Rubber covered flexible with metal braiding, ideal for microphone or gramophone extensions. 4d. per yd., 30/- per 100 yds.

**Neon Lamp,** midget wire ended. Ideal for making mains tester or for any of the dozen-and-one applications to which a neon can be put. New 2/-. Ex-equipment 1/6.

**Instrument Transformer.** Input 200-230 v., output 6.3 v. at 3/4 amps, and two separate 85 v. 10 milliamp windings which can be joined in series or parallel. 8/6, plus 1/6 post & packing.

**3½in. Meter Moving Coil,** flush mounting, really beautifully made by G.E.C. Two types available 500-0-500 microamp and 1 milliamp f.s.d. 37/6, plus 2/- p. & i.

**Winking Eye,** telephone or circuit indicator, 5/-.

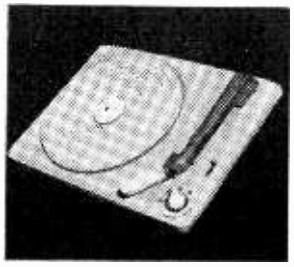
**Parmeko (Neptune Series) "C" Core Transformers (potted).**—Model No. 6000/53 15 watt output transformer 6,500 ohms centre tapped, primary, secondary 2.4 ohms centre tapped. Price 27/6.

Model No. 6000/85—mains transformer, primary standard 50 cycle mains 200-240 volt (5 volt tappings) and 115 volt.

Secondary 525-0-525 at 250 mA, 335-0-335 at 180 mA. Price £5 each.

## Virtually A Transcription Unit

## Philips AG2009 Record Player



Philips AG2009 Record Player, a modestly priced 4-speed unit with many outstanding features, is ideal for the enthusiast who is assembling his own equipment or modernising an older installation. The pick-up arm is wired for stereo and the Philips stereo head is available as an optional extra.

**Eddy Current Brake** gives ± 2% fine adjustment on all four speeds.

**Continuously variable** pick-up playing weight (2-12 gms.).

Supplied with Philips Hi-Fi crystal head type AG3019, for microgroove and 78 r.p.m.

**Frequency response** 30-15,000 c/s.

**Auto-stop** and automatic release of idler wheel.

**Pick-up** lifting and lowering device.

**Individually balanced** heavy turntable.

**Wow and rumble** of a low order.

**Muting switch** fitted.

Can be used with any amplifier or radio set.

Mains voltage range : 110-127 v. and 200-240 v., A.C.—50 cycles.

Complete with monaural pick-up, **£10.0.0**, or £1 deposit and 22 fortnightly payments of 10/-, carriage, etc., 5/-.

**Available also with stereo head, diamond or sapphire stylus. Prices on request.**

## This Month's Snip

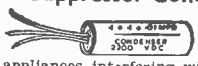
**American Receiver C646068**

This is a 12-valve receiver originally designed for military operation on the 60-80 m/c band. One stage of R.F. and three stages of I.F. with additional stages for noise suppression and A.V.C. make this an extremely versatile receiver, also crystal in oscillator provides highest stability. On the front panel are all controls and moving coil input and output meters. Complete with its own power supplies, these, however, are intended to operate on American voltage 115. So with each receiver we supply a step down transformer. A limited quantity only of these offered at the extremely low price of **£6.10.0** plus 12/6 carriage and packing. Size approx. 26in. x 9in. x 17in. Note : these sets are unused but have been in store for some years and may therefore require servicing before being put into operation. At the low price charged we cannot test these nor do we give any guarantee. Complete with valves and one crystal. Circuit diagram and technical notes free with equipment or separately price 2/6.

## Navigation Compass

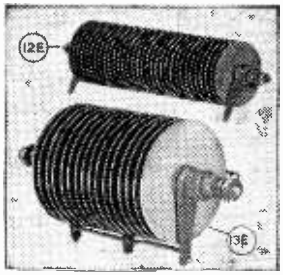
In carrying case but less fluid, may be slightly damaged. 4/6, plus 2/6.

## Suppressor Condenser




Stop your drill or other appliances interfering with your or your neighbours' radio or television. Simple instructions given. 1/6 each. 12/- dozen.


## Rectifier Bargains




Selenium rectifier type 12, 500 v. ½ A. half-wave, easily rebuilt into full wave or multiple type, contains 30 35 mm. discs. Price 8/6, plus 1/6 post. Type 13, 36 volt 9 amp easily rebuilt into six full wave charger rectifiers suitable for 6 or 12 volt batteries as 3 amps, contains 24 84 mm. discs. Real bargain at 19/6, plus 1/6 post.

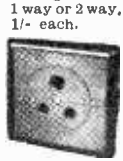
## Electrical Accessories

We carry good stocks of most accessories at competitive prices.

### 5 Amp. Wall Switches

By Hicraft, bakelite, positive action, oblong brown 1 way or 2 way, 1/- each.

### Sockets Hicraft



Flush type for skirtings, 5 amp, 3-pin shuttered. 1/3 each ; ditto with switch, 2/3 each.

**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.**

| | | | |
|---|---|---|---|
| **Instrument Co.**<br>**6, High Street,**<br>**Thame, Oxon.**<br>Phone : THAME 182. | **Electronics (Ruislip), Ltd.**<br>**42-46, Windmill Hill,**<br>**Ruislip, Middx.**<br>Phone : RUISLIP 5780.<br>Half day Wednesday. | **Electronics (Croydon), Ltd.**<br>**266, London Road,**<br>**Croydon.**<br>Phone : CRO 6558.<br>Half day Wednesday | **Electronics (Finsbury Park), Ltd.**<br>**29, Stroud Green Rd.,**<br>**Finsbury Park, N.4.**<br>Phone : ARChway 1049.<br>Half day Thursday. |

# PRACTICAL WIRELESS

EVERY MONTH
VOL. XXXV, No. 631, JULY 1959

27th YEAR OF ISSUE


COMMENTS OF THE MONTH

BY THE EDITOR


Editorial and Advertisement Offices :
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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.*



# NATIONAL RADIO SHOW

THIS year's National Radio and Television Exhibition will be held at Earls Court from August 26th to September 5th. The newly-formed Radio Industry Exhibitions Company is organising the event, with the aid of a reconstituted organising committee. H.M. The Queen has again honoured the radio industry by becoming Patron of the Exhibition.

The ground floor arrangements will be much the same as last year, with the large commercial stands in the well of the Hall and the offices and demonstration rooms around the perimeter. The Audio Hall will be on the first floor in the Philbeach wing. It will be considerably larger than it was last year.

Normally, it is impossible to demonstrate portable radio receivers at the Exhibition by virtue of the construction of the Earls Court building, but if there is sufficient demand, the organisers will arrange for the installation of a cable system carrying amplified radio signals of suitable wavelengths. A wire loop at Stands requiring the service would provide radiation adequate for good reception. TV signals will be piped to Stands as before, and demonstrations of record-players, tape-recorders, etc., will be permitted, provided that they are not an annoyance to neighbouring stands.

In view of the popularity of the Radio Show with the trade, the amateur and the public alike, we think that the organisers of smaller exhibitions should consider making their shows part of the National Show. After all, hotels are not really the best places for serious demonstrations.

## *A BEGINNERS' TEST-METER*

IN the centre pages of this issue will be found the first article of a series describing the building of a multi-range test-meter. In this issue, the meter movement is discussed and a simple 0-10V range is wired. In the next article, parts will be added to make a multi-range D.C. voltmeter reading from 0 to 1,000V. In subsequent articles, the instrument will be progressively increased in scope until it may be used on A.C. as well as D.C. and also for resistance measurements.

The illustration on the cover shows the meter in three of the stages of construction ; in the foreground, wiring of the multi-range D.C. voltmeter is being completed. Behind this, on the left, all the D.C. ranges have been incorporated and the meter reads 0-1,000V and 0-1A. On the right, the meter is shown with A.C. and resistance ranges added to complete the construction. The graph on the side of the stand is for resistance readings.

The series is intended for the beginner and, accordingly, very little knowledge is assumed. The construction proceeds in simple stages and each of these is explained with clear text and suitable illustrations. However, the meter is suitable not only for the beginner, but also for the more experienced constructor who is in need of less detail than is given and who must, perforce, bear with the writer if the explanations seem somewhat laboured or unnecessary.

***Our next issue, dated August, will be published on July 7th***

# ROUND THE WORLD OF WIRELESS

By "QUESTOR"

### *Broadcast Receiving Licences*

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of March, 1959, in respect of 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... ... ... | 905,526 |
| Home Counties ... ... | 896,057 |
| Midland... ... ... ... | 659,039 |
| North Eastern ... ... ... | 788,924 |
| North Western... ... ... | 619,316 |
| South Western... ... ... | 539,062 |
| Wales and Border Counties ... | 332,161 |
| Total England and Wales ... | 4,740,085 |
| Scotland ... ... ... | 579,014 |
| Northern Ireland ... ... | 161,892 |
| Grand Total ... ... ... | 5,480,991 |

### *1959 Radio Hobbies Exhibition*

THIS year's International Radio Hobbies Exhibition will open at the Royal Horticultural Society's Old Hall, Westminster, on Wednesday, 25th November and will close on Saturday, 28th November.

This year's show, which as always is organised for the R.S.G.B., will have "communications receivers of the world" as its main feature. Amateur television features will be well to the fore and kits for radio, television, etc., for the home constructor will be seen, many being shown for the first time.

A silver trophy will again be awarded for the most outstanding item of home constructed amateur equipment, and for the first time a silver trophy will be awarded for the outstanding piece of equipment manufactured industrially for radio amateur use on show at the exhibition.

### *New Managing Director for Marconi (South Africa) Ltd.*

MR. HERMAN BAKER, for the past six years Far East Regional Manager for Marconi's Wireless Telegraph Company, has been appointed Managing Director of Marconi (South Africa) Ltd. He has been with Marconi's since 1930.

### *Pye I.L.S. for the Congo*

IN view of the recent controversy about the relative merits of British and American Instrument Landing Systems it is interesting to note that the Government of the Belgian Congo have decided that Pye Instrument Landing Systems should be installed at both Elisabethville and Leopoldville airports.

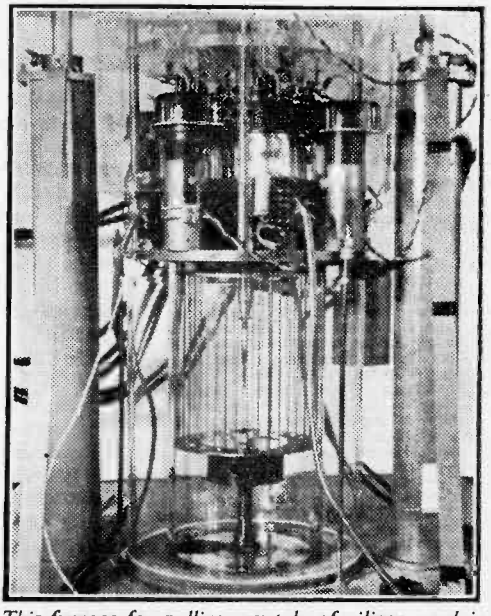
Pye Telecommunications Ltd. of Cambridge have previously installed Instrument Landing Systems at Geneva International Airport, and at Prague and Moscow Airports and the Indian Air Force are at present installing their first Pye I.L.S. system.

One of the features of Pye I.L.S. most appreciated by airport administrators is the ease with which ground installation can be erected so that no expensive fitting parties from England are needed. The contract for the Belgian Congo installations is valued at £60,000.

### *SHF Multichannel Link for Finland*

THE Posts and Telegraphs Administration of Finland has placed a contract with Marconi's Wireless Telegraph Company for the supply of SHF multichannel radio equipment for the establishment of a two-way radio telephone link between Pori and Tampere, a distance of 104 km. Included in the order are aerials, feeders and spares.

The Finnish authorities decided in favour of multichannel radio equipment because of the mountainous nature of the terrain and the arctic conditions experienced. Under such circumstances, multichannel radio offers not only a large saving in initial outlay but also consider-



*This furnace for pulling crystals of silicon used in transistor manufacture was exhibited by A.E.I., Ltd., at the recent International Transistor Convention.*

ably reduced maintenance costs.

The 104 km. between Pori and Tampere will be bridged by repeater stations at Kokemaki and Nohkua.

### *Extension to Laboratories*

TWO new laboratory blocks are being built on a site adjacent to the existing buildings of Mullard Research Laboratories at Salfords, Nr. Redhill, Surrey.

An extra 45,000 sq. ft. of floor space will be provided by the new buildings, which will consist of a three and a four storey block. They will house the electronics, telecommunications, transistor applications and television laboratories which have been built up during recent years, and parts of which have hitherto been operating in temporary buildings. It will also improve the facilities for the valve, semi-conductor and materials research activities.

### *BBC Engineering Appointment*

THE BBC announces the appointment of Mr. E. W. Hayes, M.I.E.E., as Head of Planning and Installation Department in succession to Mr. A. N. Thomas, A.M.I.E.E., who has retired after 33 years service.

Mr. Hayes joined the Corporation in 1933 as an Assistant Maintenance Engineer and, after service at the Daventry transmitting station, where he became a Senior Maintenance Engineer and was engaged in development work on short-wave transmitting aerials, he was appointed Assistant Engineer-in-Charge of the Rampisham short-wave transmitting station in 1940 and of the Skelton transmitting station in 1942. In 1948 Mr. Hayes was appointed Resident Engineer, British Far Eastern Broadcasting Service, Singapore, where he was responsible for the building and later the operation of the high-power short-wave transmitting station at Tebrau. On his return to the United Kingdom in 1951 he was appointed Head of the Transmitter Equipment Section of the Planning and Installation Department.

### *More Radio Channels for Private Mobiles*

DOUBLE the number of radio channels will become available for private mobile services as a result of approval by the Postmaster - General of the recommendations in the Third report of the Mobile Radio Committee. This committee advises him on matters affecting the users of V.H.F. mobile radio services.

This increase in radio channels in the lower V.H.F. band will be obtained by introducing equipment capable of operating on channels 25 kc/s wide instead of 50 kc/s. The use of narrower channels has been made possible by advances in equipment design by British manufacturers.

The new channel-spacing comes into force on June 1st, 1959. Thereafter, all new land-mobile schemes in the V.H.F. low band will have to use equipment meeting the 25 kc/s specification. With few exceptions, the new equipment standard will also apply to additions or replacements for existing systems. There is a "Five Year Plan" for the change-over of existing services to 25 kc/s equipment to be completed by June 1st, 1964.

### *New High-speed Flash Tube*

A NEW range of high-speed cathode-ray flash tubes which produce a flash of the same order of intensity as a gas-filled electronic flash tube, such as is used in photography, has been introduced by the Electronics Department of Ferranti Ltd.

These tubes, known as the CL60 and CL70 series, light up all over simultaneously in contrast to the behaviour of the normal cathode-ray tube.

*View from the aerial tower at Kuhe Sefid which shows the mountains crossed by the chain of radio repeater stations. (See "Iranian Oil Pipeline Radio System.")*

### *Iranian Oil Pipeline Radio System*

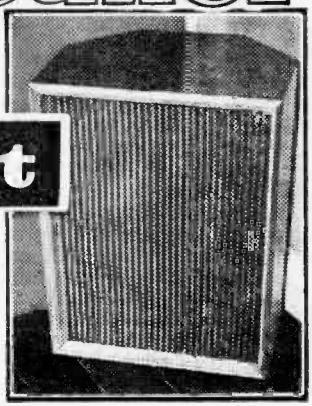
A FURTHER contract to the approximate value of £84,000 has been received by Marconi's Wireless Telegraph Co. Ltd. for the supply and installation of V.H.F. multi-channel radio equipment for the National Iranian Oil Company. In 1956 the oil company awarded a £350,000 contract to Marconi's for the supply and construction of a complete V.H.F. multi-channel radio system along the length of their 600 mile oil pipeline from Abadan to Teheran. The original scheme has now been working for some time and the new order represents an extension to the system.

The tower system is becoming very popular, as the structures do not require frequent overhaul, as do poles, nor do extremes of temperature affect them.

### *Westinghouse Appointment*

WESTINGHOUSE BRAKE AND SIGNAL COMPANY LTD. announce that Mr. George William Dunkley, O.B.E., has been appointed a Director.

# A Twin Speaker BASS Reflex Cabinet



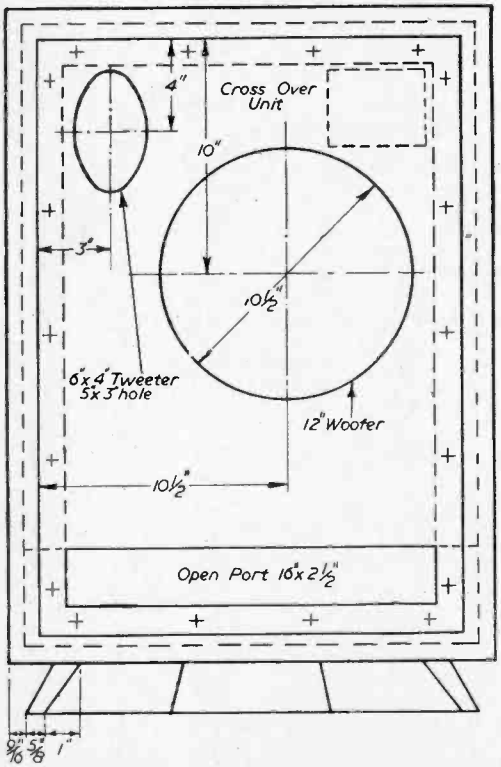
IMPROVE RESULTS FROM YOUR AMPLIFIER WITH THIS LOUDSPEAKER ENCLOSURE

By L. F. G. Burrell

AS the number of hi-fi enthusiasts increases, many will be constructing their own equipment and will find, as I did, a lack of information on a simple and efficient loudspeaker cabinet which is also a pleasing item of furniture. The design given here is of the bass reflex type and is a modified version of an American model. This cabinet can also be used for a 10in. "Woofer" plus a "Tweeter" or 12in. or 10in. single speakers, and for those of limited means, the "Tweeter" could be provided for, and the hole blocked internally, with a thick piece of ply, purchasing it when finances allow. If only a single speaker is to be used, the hole in the baffle board could be centralised horizontally.

### *Materials and First Steps*

The main carcass needs solid, rigid timber, and the best for this is 15 mm. (12 ply) which is approximately 9/16in. thick. Other than that, only ¾in. block board, or solid timber at least ¾in thick will do. Any thinner material will not allow the speakers to give of their best and may lead to distortion and unwelcome vibrations at certain frequencies. Depending on the finish



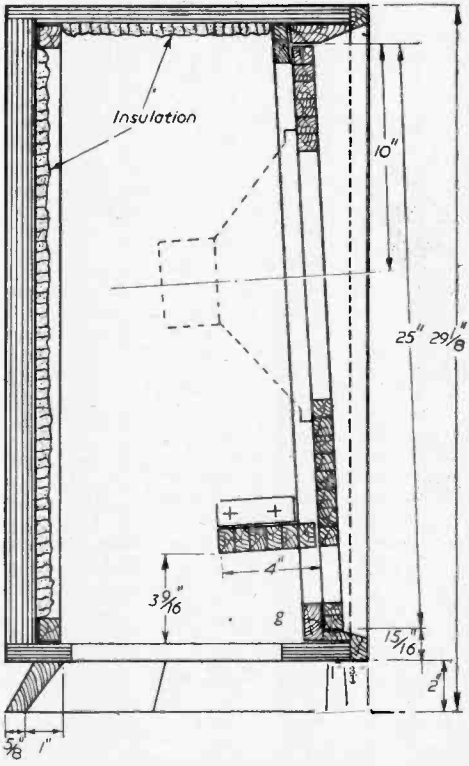




*Fig. 1a (Left)—Front elevation of the cabinet. Fig. 1b (Right)—Side elevation.*

required and money available 15 mm. ply could be obtained farced one side with a wod veneer.

By a careful layout and a little delicate work with a hand saw (Fig. 2), the size of the piece of ply required can be reduced down to 42in. × 48in. or 14 sq. ft., or smaller still if back and bottom are made from slightly less expensive ¾in. block board.

Laid out thus. the resulting grain pattern with faced ply is rather pleasing. To make the baffle board, I chose ¼in. block board. It is very rigid and slightly cheaper than 15 mm. ply. As it is covered with mesh afterward, faced ply would be a waste of money.

**MATERIALS**

**42in. x 48in. oak-faced plywood (15mm. thickness).**
**3¾ sq. ft. of ¾in. block board for deflector and baffle.**
**20ft. of battening.**
**3ft. 2¾in. x 1¼in. hardwood for feet.**
**8ft. x 1in. x ¾in. hardwood for framing.**
**8ft. x 3⅛in. x ¾in. oak.**
**2ft. 6in. x 2ft. Tygan mesh.**
**1 gross assorted screws.**
**Glue and wadding as required.**

A piece of Tygan mesh 24in. × 30in. with the pattern running the longest way is required. Silk could be used but has a muffling effect. The other alternative is expanded alloy mesh, but this can be very expensive and does not give quite the professional finish of Tygan.

Other materials required are some lengths of hardboard for feet and battens and odd offcuts for a mitre block which is used to make the feet. Brass screws (a must if battens and feet are of oak), glue, tacks, polish and a couple of packets of wadding (for acoustical damping) are also needed. A pound or so can be saved by using second-hand hardwood for the battens. (Breaking up an old piece of furniture can yield some very useful timber.)

### *Construction (base)*

The following point must be borne in mind while construction proceeds. Airtight joints should be made wherever possible if the best is to be got from the speakers. This may sound absurd when there are holes in front and the bottom, but losses in quality will occur if sound can leak through cracks in the cabinet sides.

Also ensure that everything inside is tight and cannot rattle. Loose screws, threads of hardened

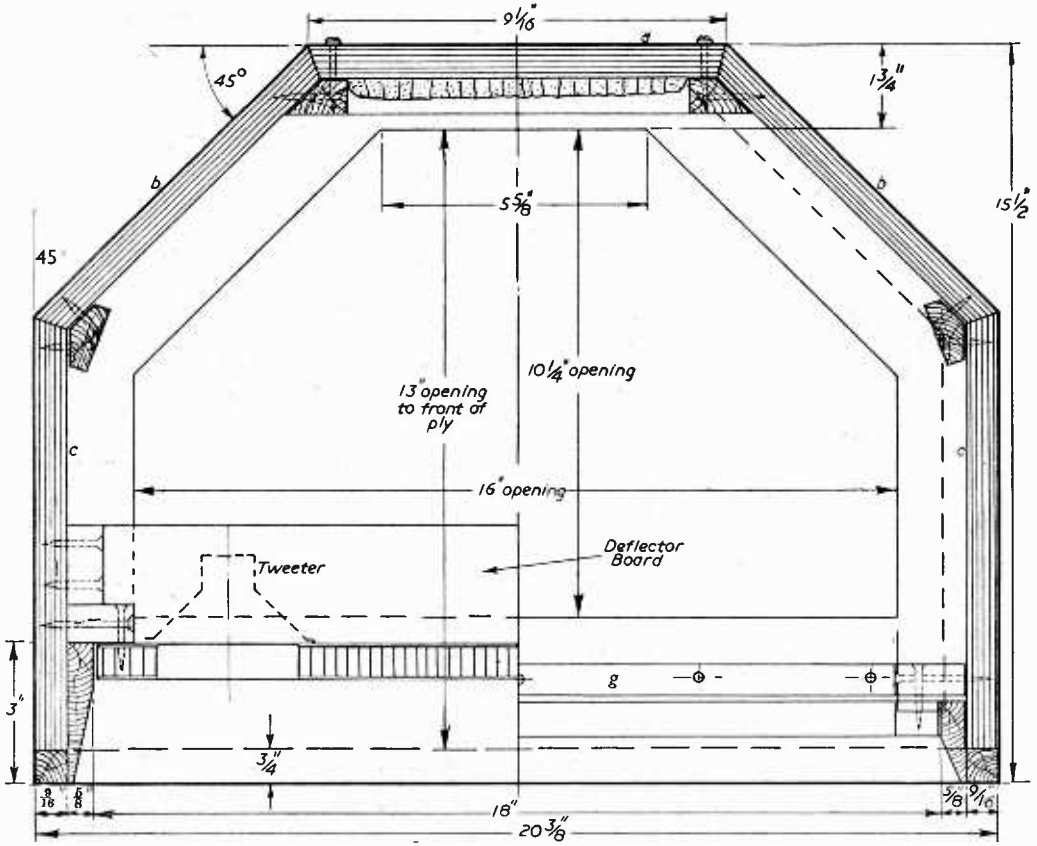



*Fig. 1c.—Plan view at top and bottom of baffle board. (Note: The thickness of the bevelled edge at the front of the cabinet is 3/16in.)*

glue, etc., can cause peculiar noises to be heard at certain frequencies.

Having studied Fig. 1 set out the parts on the faced side of the ply sheet (Fig. 2). Choose one edge as a straight edge and true if necessary. If possible, use a tee-square and set-square, but, failing this, a large try square will be second best. Draw plan of base first and measure off widths of sides and back from this. Allow $\frac{1}{8}$in. on each dimension on the drawing for planing and jointing. Saw on the waste side of the lines, checking the sizes of each piece *before* sawing. Saw the hole in the base "a" with a bow or pad saw. Alternatively, drill round the inside of the hole with brace and bit, link holes with a pad saw, and finish off with a rasp and sandpaper. For this operation and holes in baffle board, a power drill would save a great deal of work.

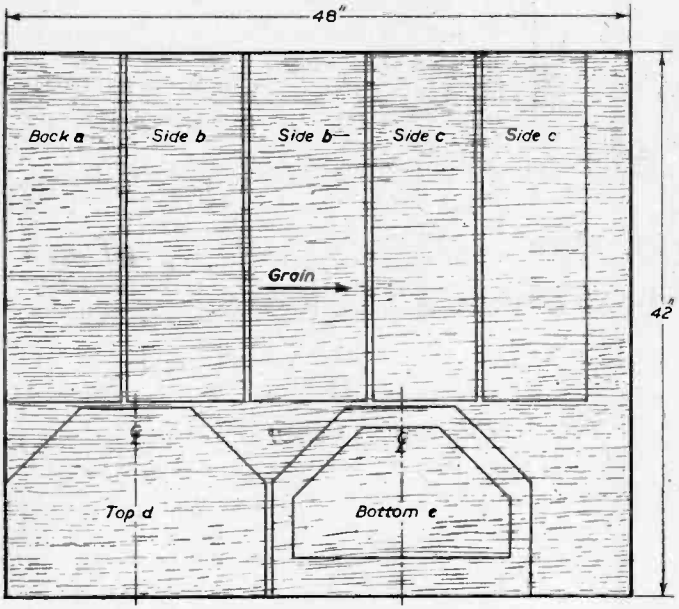



*Fig. 2.—The marking out of the ply sheet.*

### *Drawing*

A full size drawing, on a piece of hardboard, of the base plan is useful in checking shape of base and angles of cut of the feet. Check all the edges of the base after trueing up, for squareness, as the more near square they are the stronger will be the glued joint.

The feet are cut from hardwood $2\frac{3}{4}$in. × $1\frac{1}{4}$in. and mitred together using a special mitre block made from 4in. × 1in. hardboard or 15 mm. ply offcuts (Fig 3). The dimensions shown are arbitrary and can be varied to suit personal taste and materials available. Square and screw the mitre block up carefully. Mark the angles of cut with a level square and square up from the bottom of the block on the inside. (The bevel square is one tool you must have for this job.) Saw down dead on line with a tenon saw and the block is ready to cut the feet.

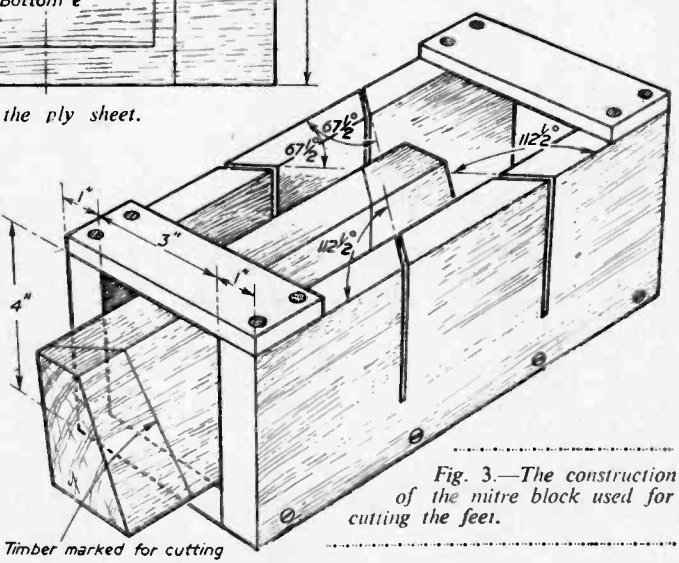



*Fig. 3.—The construction of the mitre block used for cutting the feet.*

### *Making the Feet*

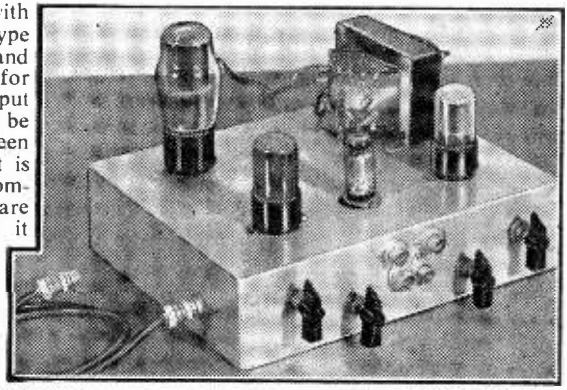
Prepare the timber for the feet and plane the top and bottom to angle first, using a full sized section drawn on scrapwood as a profile. Working from one face edge, either top or bottom, cut the feet to angle, using the full sized plan to ascertain lengths. Draw the inside line of the feet on the underside of the base "e" and temporarily pin the feet in position from the underside. Turn the base over and drill and screw the feet in place with $1\frac{1}{4}$in. No. 8 countersunk screws. Remove, glue up and rescrew in position, taking care not to forget to glue the mitred joints and fill any holes or cracks with glue also. Clean off the bottom of the feet to form level floor contact, chamfer the outer edge to avoid splintering and glasspaper to a smooth finish.

### *Main Carcass*

The baffle board fixing batten "g" is required next. Size $1\frac{1}{2}$in. × $\frac{3}{4}$in. with bottom slightly bevelled to allow for the slope of the baffle. This batten extends the full width of the base and is set back 1in. from the front edge. Drill it for screwing to the baffle board. Cramp in correct

(*Continued on page* 410)

THIS unit was originally designed for use with a gramophone amplifier. The prototype was required to mix up to four inputs and boost the resultant signal to a suitable level for fully loading the main amplifier. Each input had its own gain control so that it could be adjusted to give any desired balance between the four. If only two inputs are required it is quite in order to omit one of the 6SN7's completely. On the other hand if six inputs are required another 6SN7 may be added, but it should be remembered that each additional valve requires about another 10mA of H.T.



# A Mixer Pre-amp Unit

FOUR INPUTS ARE PROVIDED EACH WITH ITS OWN VOLUME CONTROL

By J. A. Scuffam

## Circuit

The circuit is straightforward, having two double triodes (6SN7's) as the mixers, which feed the mixed signal to a high gain pentode (EF86) in a voltage amplifier circuit. The output from the EF86 is fed via a .01μF coupling condenser to the output socket. The output is at high impedance and can be fed directly into any amplifier having a high input impedance. The prototype had its own power unit built in as it requires just over 20mA of H.T., which would have put an excessive load on the power unit of the the main amplifier. There is no reason why power should not be taken from an external source. Before taking power from any other equipment it is well to make sure that the necessary current is available. If it is desired to build the power unit, a suitable circuit is shown in Fig. 2.

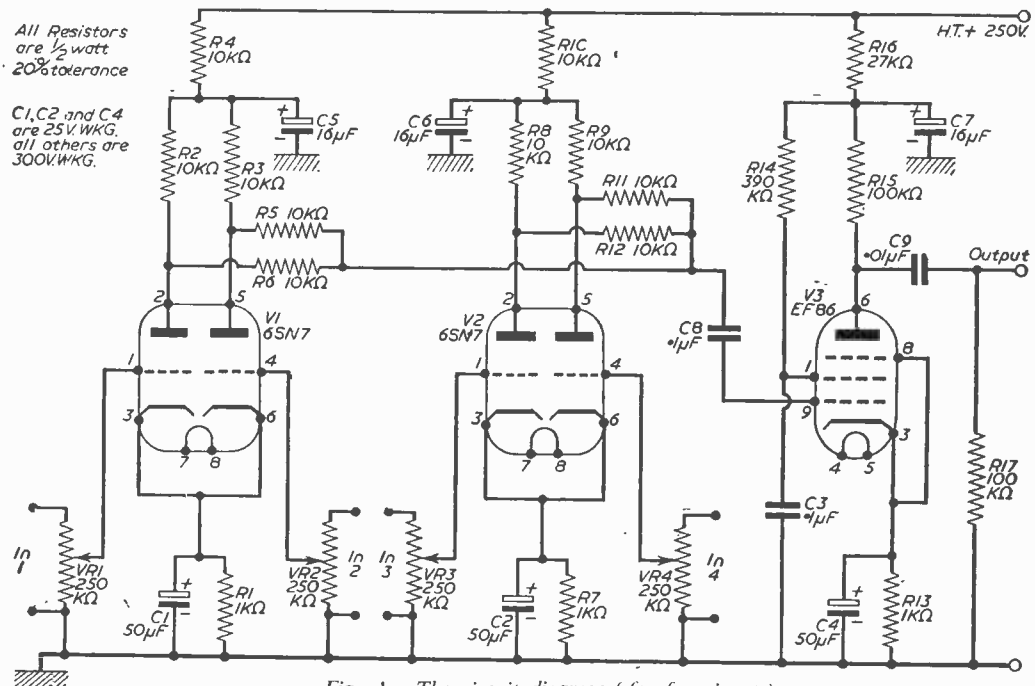



*Fig. 1.—The circuit diagram (for four inputs).*

Each stage is adequately decoupled and this contributes to the high stability of the unit. It also helps to keep the hum level down, but screened cable must be used in all the grid circuits. In addition to this, pins 3 and 7 on

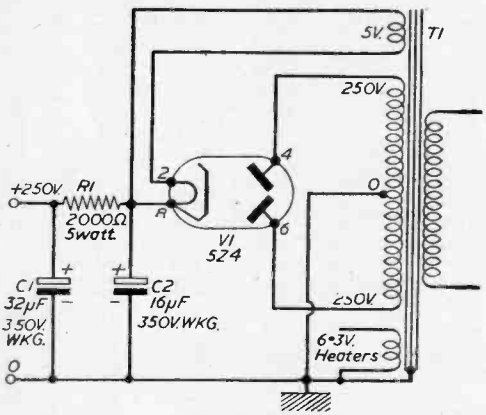



*Fig. 2.—A suitable power-pack.*

the EF86 should be earthed as these are connected to the internal screening of the valve.

### Construction

The original was built on a chassis 11in. × 8in. × 2½in. which gave sufficient room for the power unit. If the power unit is to be omitted the chassis size may be reduced to 11in. × 5in. × 2½in. The layout was as shown in Fig. 3. The gain controls were staggered as they were somewhat larger than average. The front panel can be redesigned as required, the layout not being critical. Full use of chassis room should be made and all components well spaced.

Wiring should begin with the power unit and all heater leads, the latter running close to the chassis and being well twisted together. One side of the heater supply should be connected to the chassis but if the mains transformer has a centre tap on the heater supply this should be connected to the chassis instead of one side of the supply.

### Screened Wiring

The next step is the screened wiring in the grid circuits. Care must be taken here as it is most important that all these leads are well screened. The cases of the potentiometers should be connected to earth. When soldering to coaxial sockets the lead should be trimmed first and the joint made quickly with a hot iron. This

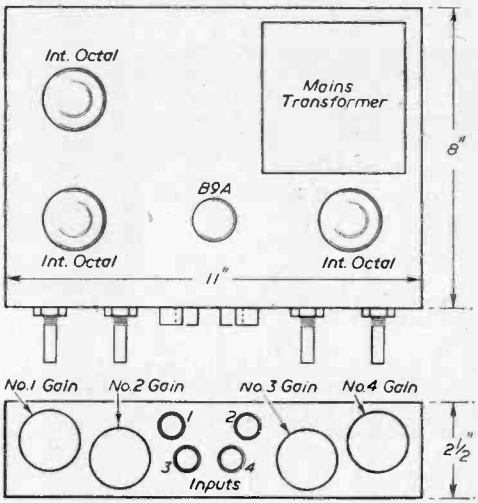
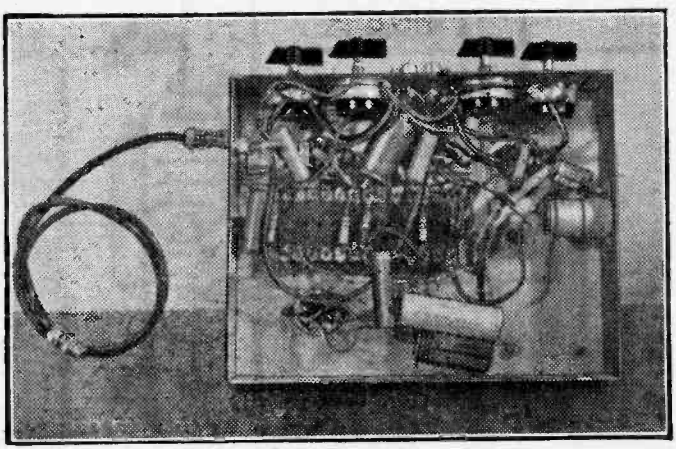



*Fig. 3.—Layout of the chassis and control panel.*

avoids unnecessary melting of the polythene insert.

The rest of the wiring may now be carried out. Although a tag board was used, this was only intended for anchoring the heavier components. Much of the wiring is self-supporting and all resistors leading to valveholder tags should be soldered direct to them whenever possible.



*Underchassis view of the unit.*

### Operation

It will be found on using this unit that the settings of gain controls become much more critical. This is due to the high gain of the EF86 which may tend to overload the main amplifier. If your main amplifier has its gain control in the grid circuit of its first valve, the best results are obtained by reducing the gain of the main amplifier as much as possible to give the maximum output required for the lowest available input. All control of volume should then be confined to the gain controls on the mixer pre-amp. unit.

When using a gramophone or similar equipment which has a relatively high output it may be found that the gain control can

(*Continued on page* 384)

# Basic Theory for the Constructor

## No. 5.—ALTERATIONS TO SERIES HEATER CIRCUITS

By G. Palmer

THERE may well arise an occasion where an experimenter has available a valve which would be suitable as a replacement for a defective one in a series-connected heater chain were it not for the difference in heater current.

In the previous article in this series we discovered that a valve with a heater current rating less than the heater chain current would be over-run owing to the resulting increase in volts drop across the heater when introduced in a constant current circuit, and that conversely a valve with a heater current rating greater than the heater chain current would be under-run. It was also shown that the heater voltage rating is of little moment in relation to the current rating in a series-connected heater chain.

### *Modification*

During the war it was often found necessary to modify series-connected heaters circuits to cater for a valve with a heater current different from the chain current. These days such a modification is considerably less likely to be warranted since most A.C./D.C. type valves, even those dating back before the war, are not unduly difficult to obtain.

Nevertheless, certain valves of this nature are in short supply, and it often happens that a valve from the "junk box" could be put to good use


*Fig. 1.—Simple series-connected heater circuit.*

in an A.C./D.C. type receiver which is so old that it is uneconomical to employ a new replacement, bearing in mind that old type valves are often costly and carry a high rate of tax.

### *By-passing the Surplus Current*

A typical series-connected heater circuit is shown in Fig. 1. Three of these valves may have 12.6 v. heaters and the remaining two 25 v. heaters, giving a total of almost 88 v. If the supply is 230 v., then the ballast resistor R is called upon to drop the difference between 230 v. and 88 v., which is 142 v. If the heaters are rated at 0.3A, which is most probable with this range of voltages, from Ohm's law ($R=E/I$) we find that R has to have a value of 473 ohms.

We have already delved into such simple problems in previous articles, but $I^2R$ (the power formula) indicates that R will be called upon to dissipate about 42.5 w. ($0.3^2 \times 473 = 0.09 \times 473 = 42.57$ w.). A 50 w. resistor would almost certainly be used here.

Now let us suppose that V4 is a 25L6GT (25 v. 0.3A heater) and that a replacement is not readily available, but we have in hand a 35L6GT. The 35L6GT has characteristics almost identical to the 25L6GT, apart from the heater rating, which is 35 v. 0.15A.

### *Over-running*

If this substitution was made without any alteration to the circuit, the set would undoubtedly work for a short while, but the 35L6GT heater would have about 70 v. developed across it; it would thus glow very brightly and soon burn out. Moreover, A.F. distortion would be likely to result from over-heating of the valve.

However, a simple resistor can be arranged to bypass the surplus current from the 0.15A heater of the 35L6GT, as is shown in Fig. 2. Thus, the value of Rs is adjusted so that in relation to the voltage across it, it passes 0.15A.

### *Calculating Rs*

We must, of course, ensure that the 35L6GT has a full 35 v., no less and no more. The Ohm's law formula is again brought into action. Hence, $Rs=E/I$, where E is the heater voltage of the valve (35 v. in our case) and I is the difference between the heater chain current 0.3A and the replacement valve heater current 0.15A (0.3 minus $0.15=0.15$). This method of working should be followed irrespective of the heater rating of the replacement valve and the heater chain current. It can thus be adopted to suit any case which may arise.

We now discover that $Rs=35/0.15$, which works out to some 233 ohms. This means that provided the heater chain is passing 0.3A, the voltage developed across V4 heater in parallel with Rs is 35 v., and that V4 heater is passing only 0.15A, the resistor passing the surplus 0.15A. All very straightforward.

Theoretically, though, the overall volts drop across the series-connected heaters has risen because the circuit, in relation to R, was designed originally for a drop of 88 v. That was when V4

had a 25 v. heater, but since the modification it represents a 35 v. heater.

### *Chain Current*

Roughly speaking, this means that the chain current will be a little less than the optimum 0.3A. There will, for example, be 98 v. developed across the whole of the heaters in series, instead of the original 88 v. If the supply is still 230 v., then the ballast resistor R will be required to drop 132 v., instead of the original 142 v. This means that the heater current will now equal 132/473 (I=E/R), which works out to be a little less than 0.28A.

The difference, even though only very small as worked out above, may be less than that computed owing to the slight increase in resistance of the valve heaters as the result of their very slightly reduced operating temperature owing to the current reduction. In other words, there occurs a kind of compensating balance in the heater chain.

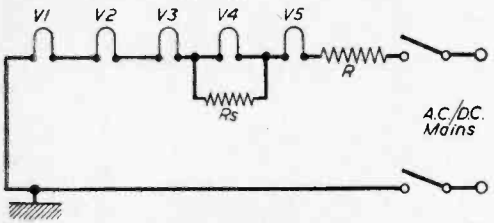



*Fig. 2.—A valve of heater current less than the chain current could be employed in the chain, provided it is shunted with a resistor (Rs) of a suitable value to bypass the surplus current.*

### *Checking the Current*

In practice, an alteration to the value of R to compensate more fully would hardly be warranted, but after such a modification it may well be of interest to check the chain current if a fairly accurate A.C. ammeter is available. The instrument could be inserted almost anywhere in the chain, provided H.T. current is not inadvertently measured along with the heater current. Probably, the best thing to do would be to break a link between two of the valves, say, V2 and V3, and connect the meter in place of the link, as shown in Fig. 3.

If the meter was inserted in series with the mains supply proper, H.T. current would also be measured, and a reading in excess of normal would be obtained, thereby giving rise to some bewilderment. Of course, if the set is operated on D.C. mains, then a D.C. ammeter would be suitable.

If the current is low and R is adjustable, it would pay to use a voltage tapping on R which provides the correct heater chain current, but if the current is well out after the modification, check the accuracy of the ammeter, particularly if the valve heaters appear to be lighting at normal brilliance.

### *Power Rating of Rs*

So far nothing has been said about the power rating of Rs. A resistor of small rating would quickly burn out in this position and V4 would be left with 0.3A in its 0.15A heater.

There are two ways of finding the power rating. One is by using the $W=I^2R$ formula, where I is the current and R the value of Rs. Since the current has to be worked in amps., this formula introduces a lot of decimals, and the alternative $W=E \times I$ formula is best. E is the voltage across V4 heater (which is the same as across Rs) and I is the current in the resistor. This gives $W = 35 \times 0.15$, which works out to about 5.25 w. A 6 w. resistor, wire-wound type, should thus be used.

### *Pilot Lamp Shunt*

The idea can be extended to any other element in a series-connected circuit. For example, a shunt is often advantageous across the pilot lamp in an A.C./D.C. type receiver, not only to prevent frequent replacements but also to prevent the set from ceasing to function in the event of bulb failure.

Bulbs normally used in such positions are invariably rated at 6 v. 0.3A, or 6 v. 0.15A, to match the heater current of the valves. Owing to their very nature they inevitably represent the weakest link in the series chain, and a failure usually open-circuits the chain and causes the valve heaters to go out. The inclusion of a resistor, Rs in Fig. 4, maintains continuity in such an event, but in addition it means that the bulb is not run to its limit.

### *Bulb Life*

Let us suppose that the pilot lamp is, in fact, rated at 6 v. 0.3A, and to safeguard its future it is decided to run it at a lower voltage, say, 4.5 v. Now, if at 4.5 v. the bulb current drops to 0.2A, which is a likely value, then Rs should be made to equal 4.5/0.1 (Rs=E/I, where E is the voltage required across the bulb and I is the difference between the heater chain current and the bulb current), which is 45 ohms.

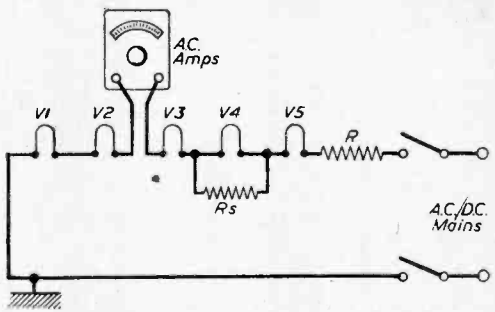


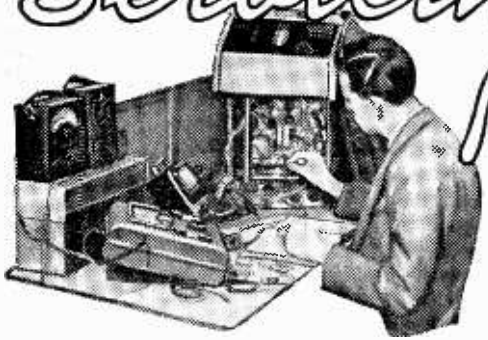

*Fig. 3.—Heater chain current can be measured by introducing an ammeter in a suitable position in the chain, as shown.*

### *Wattage of Shunt*

Under this condition the resistor will dissipate $4.5 \times 0.1$ w., so a 1 w. resistor would serve quite well. However, if the bulb should fail, the resistor will pass the full 0.3 A of the heater chain.

(*Continued on page* 413)

# Servicing Radio Receivers



## THE PILOT "CLIPPER" F.M./A.M. RECEIVER

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

THE Pilot "Clipper" is a table model having a V.H.F.-F.M. band in addition to the M.W. and L.W. bands. It features a built-in compressed dipole for V.H.F., an internal ferrite rod aerial for the A.M. bands, a reduction drive to facilitate accurate tuning and a full length illuminated station scale.

There is also a large loudspeaker which is driven from a single pentode output stage having negative feedback. Sockets for external aerials, gram. pick-up and extension loudspeaker are also incorporated. The chassis is of the A.C./D.C. type and operates within the range of 200-250 volts. It contains six valves, including a half-wave rectifier, the complete circuit being given in Fig. 1.

### *Valve Line-up*

V1 (UCC85) is concerned solely with the V.H.F. section, it being arranged in the form of an earthed grid R.F. amplifier (V1A) and a self-oscillating frequency changer (V1B). V2 (UCH81) is the A.M. frequency changer, but when the receiver is switched to the V.H.F. band the local oscillator triode section is switched off and the heptode section serves as an extra I.F. amplifier, it picking up its signals from the V.H.F. tuner.

V3 (UF89) is the I.F. amplifier for both A.M. and F.M., its anode and control grid circuits, as

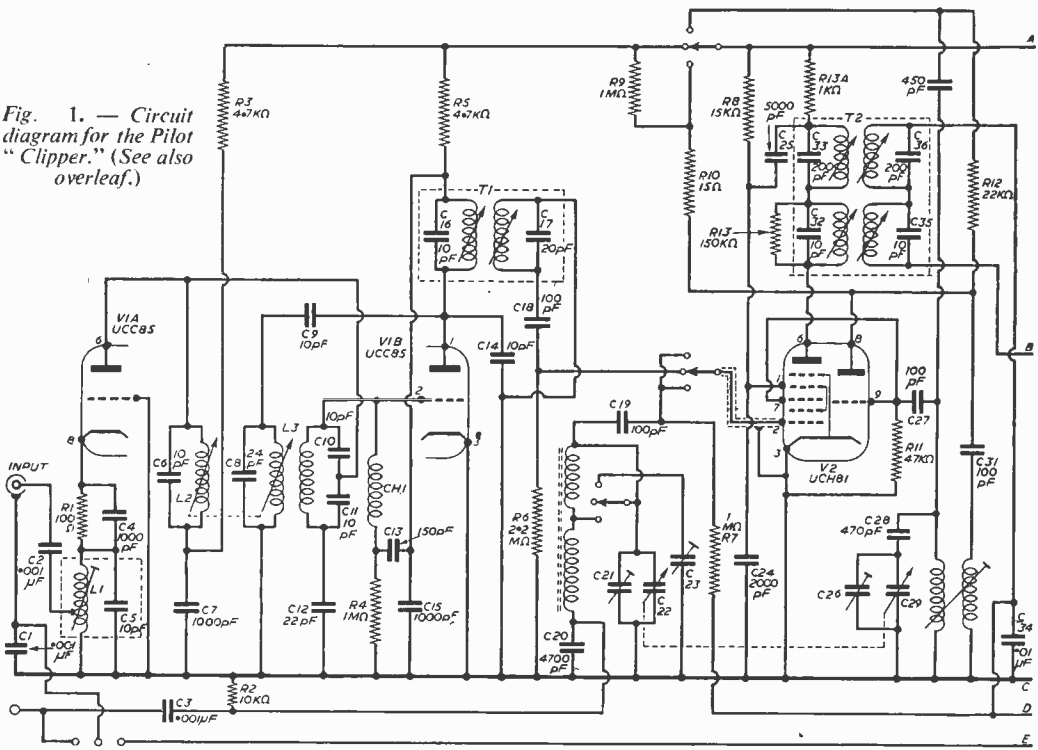



*Fig. 1. — Circuit diagram for the Pilot "Clipper." (See also overleaf.)*

with the anode of V2 heptode, being loaded with two I.F. transformer windings in series—the windings actually connected to the valve electrodes are concerned with the F.M. intermediate-frequency, this being standard practice.

V4 (UABC80) is really three valves in one envelope working from two cathodes. There is a single diode, a double diode and a triode. The single diode has its own cathode, while the double diode and the triode share the other cathode. This arrangement allows the valve to operate in three different modes, which are (1) ratio detector for F.M., using the single diode and one of the double diodes; (2) A.M. detector, using one of the double diodes and (3) A.F. voltage amplifier, the triode being used for this operation.

V5 (UL84) is simply the output valve on both services, it being biased by the volts drop across the 270-ohm cathode resistor.

V6 (UY85) supplies H.T. voltage to the receiver, it being the rectifier. Its anode is energised direct from the power supply, via the 82-ohm surge limiting resistor (R30).

### *Heater Circuit*

The heaters of all the valves are rated at 0.1 amp. and are connected in series as is normal A.C./D.C. practice. It will be seen that the chassis of the set is connected to one side of the mains power supply by way of the on/off switch. Thus, to the chassis is connected one side of V4 heater, the other side of the heater to V1 heater and so on through the chain to V6. Chain continuity is maintained first through the pilot lamps, B1 and B2, through the thermistor M2, the volts dropper resistor R29 and the surge limiting resistor R30, and back to the other side of the mains power supply.

It will be realised, therefore, that failure of any valve heater or component in the heater chain will result in all valve heaters going out. This will not apply to failure of a pilot bulb, since both bulbs are shunted with thermistor M1. In the event of bulb failure, this thermistor will quickly heat up and its resulting reduction in resistance will tend to balance the heater chain.

With A.C./D.C. type of receivers, it is always desirable to ensure that the power lead which is in connection with the chassis, through the switch, is plugged into the mains neutral socket. Failure to observe this precaution may result in the receiver chassis being at mains potential with respect to earth, and a serious electric shock may result on touching the chassis when the set is connected to the mains.

### *Circuit Notes*

The anode of the tuner R.F. amplifier valve section is coupled to the frequency changer valve section at a point of minimum oscillator signal, this being at the junction of C10 and C11. The oscillator circuit, in conjunction with the capacitors mentioned and C12, forms a balanced bridge circuit so that undue oscillator signal is not radiated by the aerial system.

The oscillator signal coupling to the R.F. stage will increase if the "bridge" balance is disturbed due to alteration in value of one of the capacitors. If the balance is considerably upset for any reason, apart from the above effect, the V.H.F.

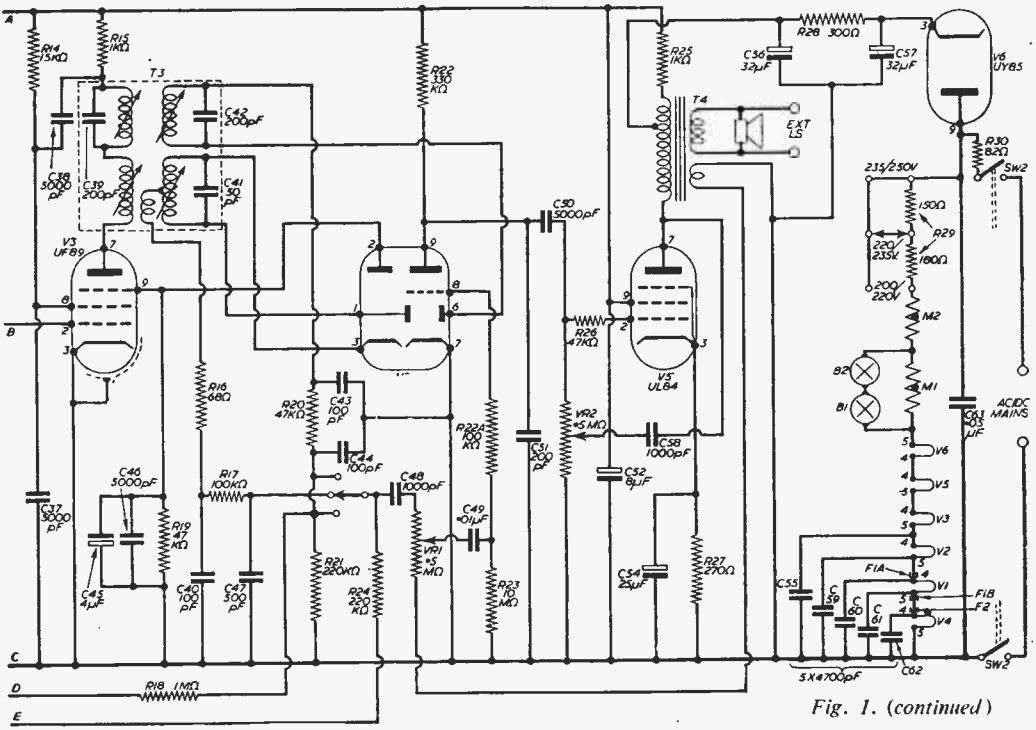
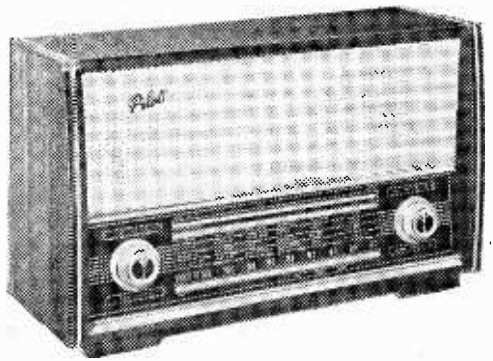



*Fig. 1. (continued)*

tuner will fail to track correctly over the V.H.F. band.

The V.H.F.-F.M. intermediate-frequency is 10.7 Mc/s, this being developed in the first instance across the tuner I.F. transformer, T1. When the set is switched to "V.H.F.", the signal from this transformer is conveyed to the signal grid of V2 heptode and the oscillator is cut out. After its passage through the I.F. amplifier, the F.M. I.F. signal appears considerably magnified across the ratio detector transformer in T3 (the transformer whose windings are connected to pin 7 of V3 and pins 1 and 3 of V4).

The demodulated F.M. signal appears across C40 and is applied to the top of the volume



*The Pilot "Clipper" F.M./A.M. radio.*

control, VR1, by way of the de-emphasis network, R17 and C47, and C48 A.F. coupling capacitor. From the slider of the control, the signal is carried to the grid of V4 triode through C49 and R22A. The A.F. signal appears considerably magnified across the load resistor, R22, in the anode circuit of V4 triode. From here it is coupled to the signal grid of V5, through C50 and R26.

The output transformer, T4, appears to be rather complex. The primary winding is tapped and H.T. is applied to the tap in such a way that the winding serves as a hum neutralising device, it being seen that H.T. for the rest of the set is obtained from the top of the winding, through R25. The smoothing capacitors are C52 and C56, while the electrolytic C57 is the reservoir. Resistor R28 also helps reduce the hum level, it being the filter resistor, used instead of a choke, which is common practice these days.

The ratio detector load resistor proper is R19, it being shunted with the stabilising capacitor C45, the two together forming a time-constant of optimum value for the suppression of A.M. interference. An interesting point is the application of the negative potential appearing across the ratio detector load resistor to the suppressor grid of the I.F. amplifier valve, V3. This provides an A.G.C. control, it being remembered that the stronger the F.M. signal the greater the negative voltage across the load, and the greater the voltage applied to V3 suppressor, the less the gain of the valve.

When the set is switched to the A.M. bands, R20 and R21 comprise the A.M. detector filter and load resistors, filtering also being assisted by C44. The direction of the A.F. signal is the same as detailed above, but on A.M. the D.C. voltage, negative to chassis, which is present across R21 in magnitude dependent on the signal strength, is applied to V2 and V3 as an A.G.C. (automatic gain control) bias.

There are two negative feedback loops in the A.F. stages. One working in relation to the tone control, VR2, this being frequency selective by virtue of C58. Negative voltage feedback is also applied over stages V4 and V5 from the voltage induced in the small feedback winding on the output transformer, T4. One side of this winding is connected to receiver chassis, while the other side is connected to the grid circuit of V4 triode.

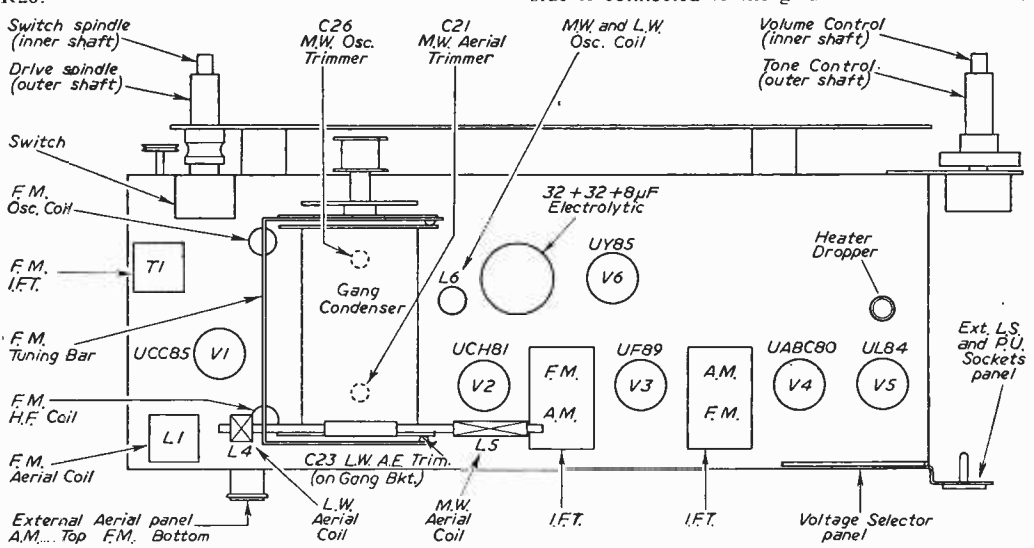



*Fig. 2.—Top view of the chassis, showing tuning cores and trimmers*

### Notes on Alignment

In Fig. 2 is depicted a top view of the chassis, revealing the position of the trimmers and transformers. Fig. 3 serves to identify the indents in the top of the receiver backplate. Before the alignment process is commenced the tuning pointer should be carefully set to coincide with the "pointer set" indent on the backplate. Care should also be taken to ensure that the correct tuning cores are identified before making any adjustment.

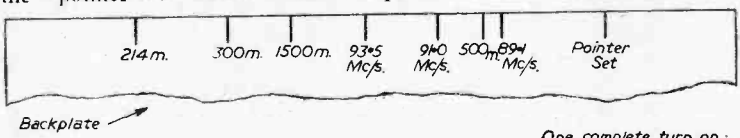
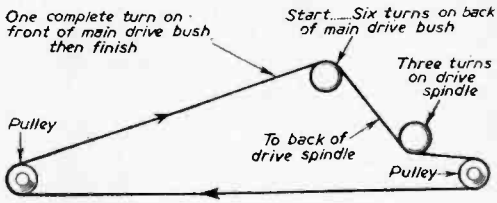



*Fig. 3. (Left)—The tuning points on the backplate.*

*Fig. 4. (Below)—Details of tuning cord drive.*




*Drive cord viewed from front of chassis with gang shut*

### A.M. Intermediate-frequency

Switch receiver to M.W. and set the tuning gang to the fully closed position. Inject a 470kc/s 30 per cent. modulated signal into pin 2 of V2 through an 0.1μF capacitor. Adjust T3 and T2 top and bottom cores for maximum audio output.

### Medium and Long Waves

Couple the signal generator to the ferrite rod aerial by way of a coupling coil positioned, at least, 6in. from the aerial. Trim at 1,400kc/s C25 and C20. Pad at 600kc/s L6. Tune the receiver and generator to 200kc/s and trim C22.

### F.M. Intermediate-frequency

Connect an oscilloscope to the junction of R17 and C45. Inject a 10.7 Mc/s plus and minus 100 kc/s frequency modulated signal into pin 6 of V1 through an 0.1μF capacitor. Adjust T3, T2. T1 top and bottom cores for maximum output on the oscilloscope with minimum distortion.

### F.M. R.F. Section

Tune the receiver to 91 Mc/s. Inject a 91 Mc/s plus and minus 100 kc/s frequency modulated signal into the F.M. aerial socket and adjust L3, L2 and L1 for maximum output on the oscilloscope.

### Tuning Drive

Full details for replacing the cord of the tuning drive are given in Fig. 4.

# 1959 National Radio Control Championship

*Rules.*—MYA/IRCMS Provisional Rules.
*Date.*—August 29th/30th, 1959.
*Place.*—Poole Park, Dorset.
*Programme.*— The event will be sailed over a triangular course using the MYA Tournament system of sailing.
*Class.*—Yachts holding a current "A" Class certificate measurer with or without radio equipment and ex-"A" Class yachts similarly measured.
*Entrance fee.*—10s. per boat.
*Frequencies.*—27 Mc/s and 465 Mc/s.
*Equipment.*—Any type of control equipment is allowed provided it complies with the Rules and does not cause interference to other competitors in either of the above bands. This will necessitate the use of crystal control and superhets unless group system is entered, details of which must be approved by the Poole MYC before entry. Early notification of crystal frequencies is essential so that the position may be studied.
*Closing date.*—August 8th, 1959.
*Entry forms.*—MYA entry forms will be used by all entrants. IRCMS members to forward all forms to Mr. Carrington-Wood together with entry fees not later than July 30th, 1959.
*Entrants.*—Members of clubs affiliated to the MYA or IRCMS.
*Sailing Committee.*—Messrs. Miller, Dehon, Cobb, Brooks and Allan-Drake.
*Further details.*—Site facilities and other ancillary details will be published by the Poole MYC as soon as possible.

Further details may be obtained from T. Brook, 12, Gorse Hill Road, Poole. (See also page 413.)

## A MIXER PRE-AMP UNIT

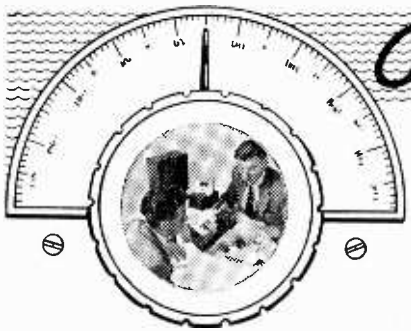
(*Continued from page 378*)

only be used over a small part of its track otherwise the unit is overloaded. In this case the trouble can be overcome by using a pre-set potentiometer (mounted on the gram unit and well screened.) This should be set to give the output required, and locked in position.

### Gain Controls

The gain controls in the original design were 250kΩ potentiometers. which matched the microphones and inputs that were used. Most crystal microphones would be better matched into 1MΩ or more, depending on the maker's instructions.

Providing that extreme mismatch is avoided, the 250kΩ potentiometers will work perfectly well in general use, but it is advised that the reader matches his potentiometers as nearly as possible to the impedance of the microphone. etc.. used. This only applies to inputs of a higher impedance than 250kΩ. Low impedance inputs should be matched through a suitable transformer.



# On Your Wavelength

BY THERMION

*"Mad Dogs . . ."*

THE warm weather is with us again, bringing with it the temporary decline in the practice of indoor hobbies including radio. Experimental gear is put on one side in the workshop or in a box on top of the wardrobe to collect dust and lie forgotten until the evenings are once again cold and dark. What a pity this all is! I don't suggest that the radio enthusiast should spend hot summer evenings indoors toiling away at some intricate piece of constructional work but there are many aspects of radio which can be enjoyed in the summer months; new aerials can be built and tried out by both listeners and transmitters, while the opportunity can be taken of building a shack for all the gear that the family tell you is a lot of junk.

One keen experimenter who I know does no constructional work at this time of year but in odd moments of spare time, after a game of tennis, for instance, he sits in a deck-chair in the garden or in one of the cooler rooms of his house, depending on his mood, and designs various pieces of gear to construct during the winter months. It is a revelation to see him manipulate his slide-rule and estimate the performance of the finished unit. As he says, it's useful practice in radio theory and half the enjoyment proceeds from finding how far the practical results differ from the theoretical, predicted, results.

Of course, few of us have the knowledge or inclination to go to this extreme, but I seriously suggest that we do waste a great deal of time in the summer months which could be employed for the furtherance of our hobby. Those who intend to become amateur transmitters could study a little of the theory which they will require for the R.A.E. A few evenings thus spent would be very valuable later when the real hard effort started.

*Turning a Deaf Ear*

TALKING of warm summer evenings, picture the following scene. Low evening sunshine, a pleasant garden, a young radio enthusiast in a deck-chair underneath the apple tree (swotting for the R.A.E.) and suddenly a voice floating across on the breeze—"Use Y's soap powder." This invasion of privacy is becoming more common than ever before and I cannot see any cure for it. Nearly everyone now possesses some electronic gadget whether record-player, radio or "idiot's lantern," and with the high volume output stages now fitted it is almost impossible to sit in the garden of an evening and not hear at least one radio or TV programme right through or the current "top ten." Why, some unintelligent and selfish folk even take their record-player or portable radio out in the garden with them and annoy the neighbours over quite a large area.

As I said before, I cannot see any cure for this state of affairs. Even the tactful appeals by the radio and TV announcers have little effect other than perhaps causing an increase in the volume of the offending apparatus. The worst part is that one never hears anything one enjoys; for example, I always manage to hear the latest popular records of which regular readers of this page will know I am not over-fond.

I should be very interested to hear from anyone who has found a (peaceful) remedy. Please do not suggest that I should sit in a sound-proof room!

*The Show*

THE Radio Show will be held this year at Earls Court as usual. The dates are August 26th to September 5th. The mixture will be much "as before" but nevertheless I am sure that its popularity will be just as great as in previous years. On the whole, amateurs are the most enthusiastic visitors, even if they cannot afford to buy much of the equipment.

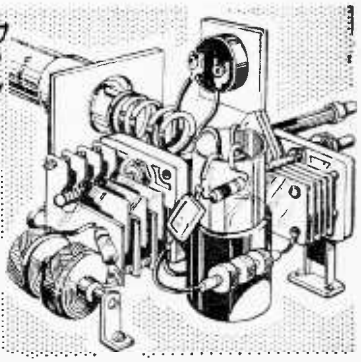
The BBC exhibit will be housed in the West End fly-over as usual but the sound theatre will be on the Brompton side near the TV Celebrity Dais. An exhibit for the independent television companies will be organised by the I.T.A. and will be on the first floor. The stands manned by the Services will be in the Brompton wing.

The Audio Hall which was introduced last year will be enlarged this time, as the innovation was popular and more and more interest is being shown in this side of the radio industry.

*Stereo*

FOR my own part, I think that stereo sound reproduction has a long way to go before it surpasses the mono reproduction in all respects. Stereo can give wonderful effects, I agree, but so far very little is known about the theoretical aspects of the subject. The findings of the recent two-day I.E.E. Stereo Convention illustrate my viewpoint. The views expressed showed that much of the present theory is subjective and empirical and has little scientific basis. Various experts put forward differing views as to the mechanism of sound source location, and until some theory is found which fits all aspects of this complex subject I think that stereo progress will be slow.

# SHORT-WAVE SECTION



## IMPROVING RECEIVER SELECTIVITY

By J. B. Dance, M.Sc.

THE short-wave listener who requires a better performance from his receiver must adopt some method of obtaining increased selectivity. The two methods most frequently employed are the use of crystal filters and conversion to a double superheterodyne.

The double superhet operates, as its name suggests, by converting the incoming signals first to an intermediate frequency which is fairly high (often 1.6 Mc/s or possibly 465 kc/s) and then converting the frequency to a very low intermediate frequency (probably between 50 and 100 kc/s). The rejection of image interference is good because of the fairly high first intermediate frequency. The selectivity can be made excellent because of the low second intermediate frequency.

### *Practical Details*

A single superhet receiver can be converted into a double superhet using the circuit in Fig. 1 as an add-on unit.

The input to this unit should be taken from the anode of the last intermediate frequency amplifier of the receiver via a small condenser. C1. Valve V1 is a 6K8 frequency changer. but any other suitable frequency changer could be used with appropriate circuit modifications. V2 is an amplifier operating at the second intermediate frequency and may be a 6K7 or EF39 or, if a single-ended valve is preferred, V2 could be a 6BA6 (miniature) or 6SK7 (octal). V3 is a cathode follower detector (also known as an infinite impedance detector) and any small triode (or triode connected pentode) such as a 6J5 or 6C4 can be used.

### *Choice of Second I.F.*

The individual constructor must decide what second intermediate frequency he wishes to use. Generally any frequency between 50 and 120 kc/s

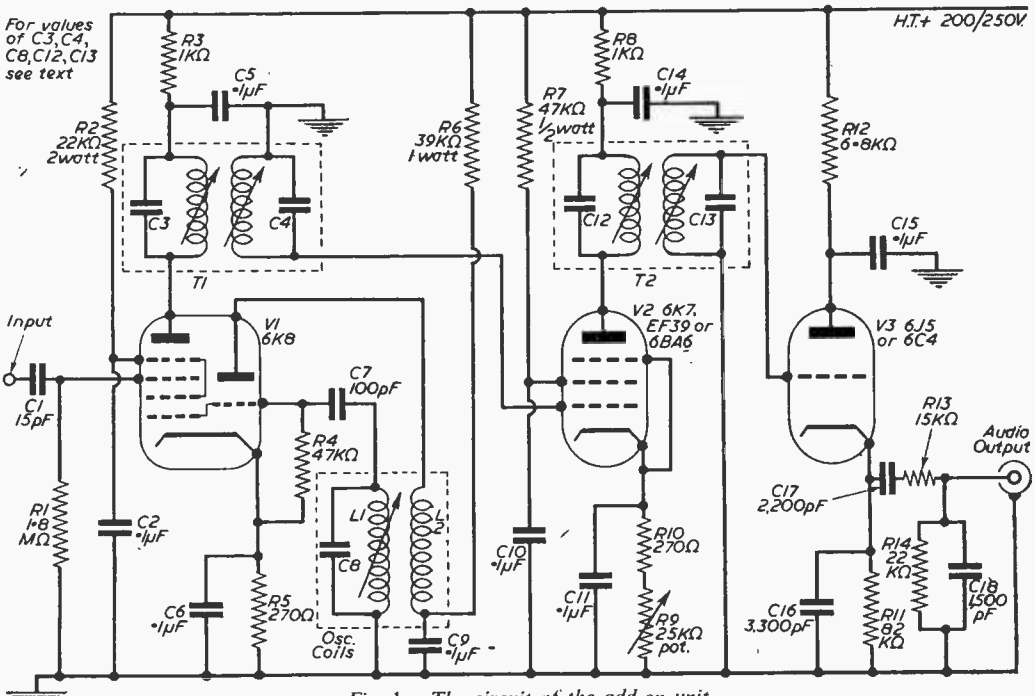



*Fig. 1.—The circuit of the add-on unit.*

is perfectly satisfactory, but the lower frequencies give rather more selectivity. 85 kc/s transformers (T1 and T2 of Fig. 1) may be purchased or obtained from surplus BC453 units. The frequency may be lowered somewhat if desired by using a larger parallel condenser with each coil. Alternatively, suitable transformers may be constructed quite easily. Some unwanted transformers were bought on the "surplus" market and the cans were used to construct the transformers shown diagrammatically in Fig. 2. It is desirable that they should be permeability tuned (i.e., there should be an iron dust core in the centre of each coil for the purpose of altering its

**WINDING DATA FOR COIL L1**

| 1st I.F. (kc/s) | 2nd I.F. (kc/s) | C8 (pF) | Number of turns on L1 with dust core | Number of turns on L1 without dust core |
|---|---|---|---|---|
| 1,600 | 85 | 150 | 64 | 73 |
| 1,600 | 85 | 100 | 76 | 87 |
| 1,600 | 50 | 100 | 74 | 85 |
| 465 | 85 | 200 | 228 | 254 |
| 465 | 50 | 250 | 174 | 202 |

inductance). The coils made by the author consist of 1,000 turns of 38 s.w.g. single silk enamelled copper wire wound on a half inch diameter former. The coils should be held in position by coating them with a suitable cement —preferably polystyrene. It is convenient to wind the coils between cardboard cheeks which are removed when the cement has partly set. The wire should be wound in a random manner and during the actual winding the cardboard cheeks should be supported with plasticine or another suitable material. The spacing between the centres of the two coils of each transformer should be about 1.2in. The cans used were about 1.4in. square. When a 220pF condenser was placed in parallel with one of these coils, the tuned circuit was found to resonate at about 85 kc/s (Q=75), but the capacitance could be increased to 680pF giving a resonant frequency of about 50 kc/s (Q=60). The second intermediate frequency can therefore be varied somewhat as desired. The inside connection from each coil should be connected to earth or H.T. + and the outside connection to grid or anode of the valve. The amount of selectivity obtained depends on the design of transformers T1 and T2 and the size of wire used for the coils of these transformers is important.

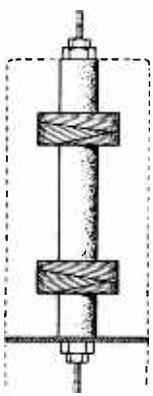
### Oscillator Coil

The oscillator coil may also be conveniently placed in an old transformer can for screening purposes. The number of turns on the tuned coil (L1 in Fig. 1) depends on both the first and second intermediate frequencies and on the value of C8. Typical values for the number of turns required on L1 are shown in the table above for a coil 0.2in. long on a former 0.5in. in diameter; values are quoted both when L1 contains an iron dust core and when no core is used. These values are correct to within a few turns, but provision must be made for varying the oscillator frequency either by iron dust core tuning of L1 or by using a fixed condenser in parallel with a small trimmer for C8. The coupling coil, L2, should consist of about half the number of turns on the tuned coil. Silk covered copper wire, 30 to 38 s.w.g., is suitable for both oscillator coils. It is extremely important that all components of the oscillator should be rigidly fixed to the chassis. If this is not done, the oscillator frequency may alter and throw the unit out of alignment.

The coupling coil must be connected the correct way round or the oscillator will not work. The cathode end of the 47kΩ grid resistor should be disconnected and an 0—1mA meter inserted between the free end of this resistor and the cathode as shown in Fig. 3. If the oscillator is working the meter will probably read between 25 and 500μA. If no reading is obtained, reverse the connections of the coupling coil, L2, and if it is still impossible to obtain a reading, the number of turns on the coupling coil may be increased and it may be moved nearer to L1. The spacing between the two coils should be of the order of a quarter of an inch. The spacing of the coils and/or the number of turns on the coupling coil should then be altered until the meter reads 140 ± 10μA. The oscillator is then operating at the correct voltage of about 7 volts. The meter should then be removed and the end of the 47kΩ resistor reconnected. It is worthwhile checking the meter reading when the alignment of the oscillator has been completed.

### Decoupling

The intermediate frequency amplifier (V2) is of conventional design and requires little comment. R9 controls the amplification of the unit and



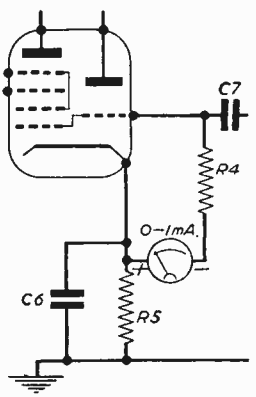



*Fig. 2 (Left).—The low-frequency I.F. transformers (T1 and T2).*

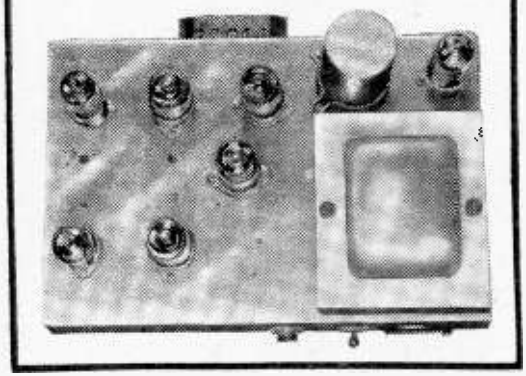
*Fig. 3 (Right).—Using a 0-1mA meter for checking the oscillator voltage of the 6K8 frequency changer valve.*

could be omitted if desired. It is important to use a reasonably large value for the decoupling condensers (because of the low intermediate frequency); 0.1μF should be regarded as the minimum value for these condensers.

A cathode follower detector is recommended because this type of detector does not impose any

(*Continued on page* 418)

# A MASTER RELAY UNIT



THE DIMENSIONS AND CONSTRUCTIONAL DETAILS OF THE CHASSIS By Hugh Guy

*(Continued from page 242 of the May issue)*

AS mentioned in the previous article, if loudspeakers are to be used instead of headphones. then power tetrodes capable of delivering sufficient power for the number of speakers used must be substituted for the cathode follower stages. The power pack must be able to give sufficient current and a suitable supply together with one power output stage is shown in Fig. 3.

The successful distribution of signal power to drive a loudspeaker system requires a more careful layout than that for a headphone system if excessive power losses and the generation of crosstalk are both to be avoided. As a result the terminations at each listening point should be matched resulting in a slightly greater complexity of circuitry associated with each loudspeaker.

However. the distribution systems required for both headphone and loudspeaker reception are discussed later after the constructional details of the headphone relay unit have been described.

### *Constructional Details*

The chassis is made from 18 s.w.g. aluminium sheet. All the marking out and drilling information is given in Figs. 4 and 7 from which it can be seen that an open-ended construction is used.

It is important that the R.F. section of the combined receiver be carefully screened. This is essential if R.F. instability is to be avoided. The two screens are made from 18 s.w.g. material and differ slightly in the way they are bent, as the separate drawings of each show—Figs. 5 and 6.

Two ¼in. struts in ¼in. material serve a double purpose. The first is to strengthen the assembly when they are fitted after the wiring is complete and the second is to provide a means of fixing the unit to its cabinet. These will be illustrated next month.

A simple front panel completes the metal work required. This panel is designed to be mounted directly on to the chassis, and countersunk fixing

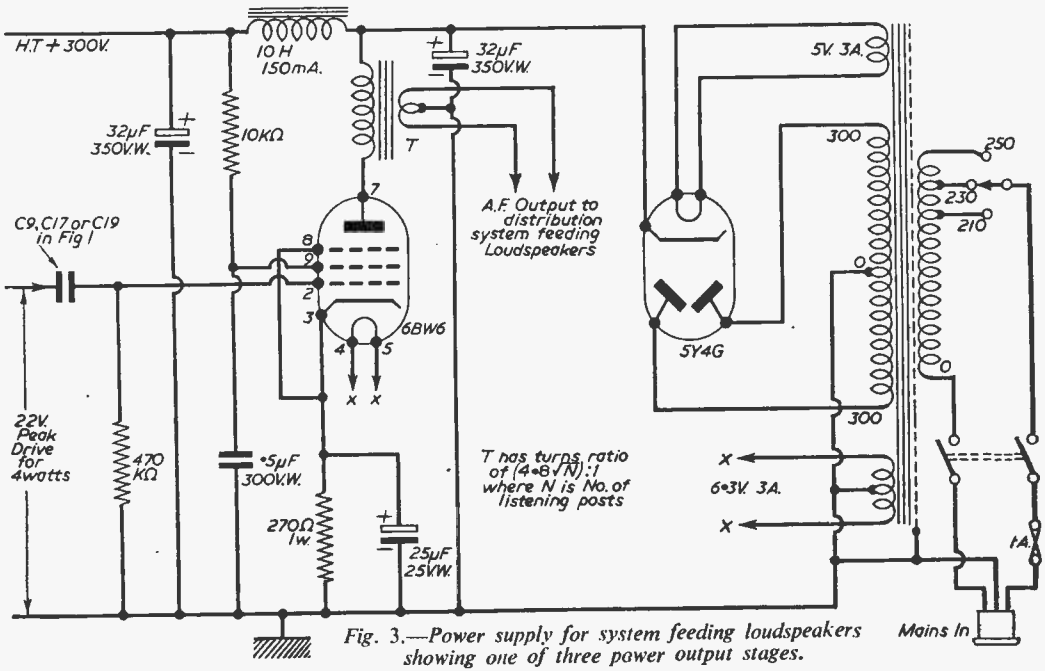



*Fig. 3.—Power supply for system feeding loudspeakers showing one of three power output stages.*

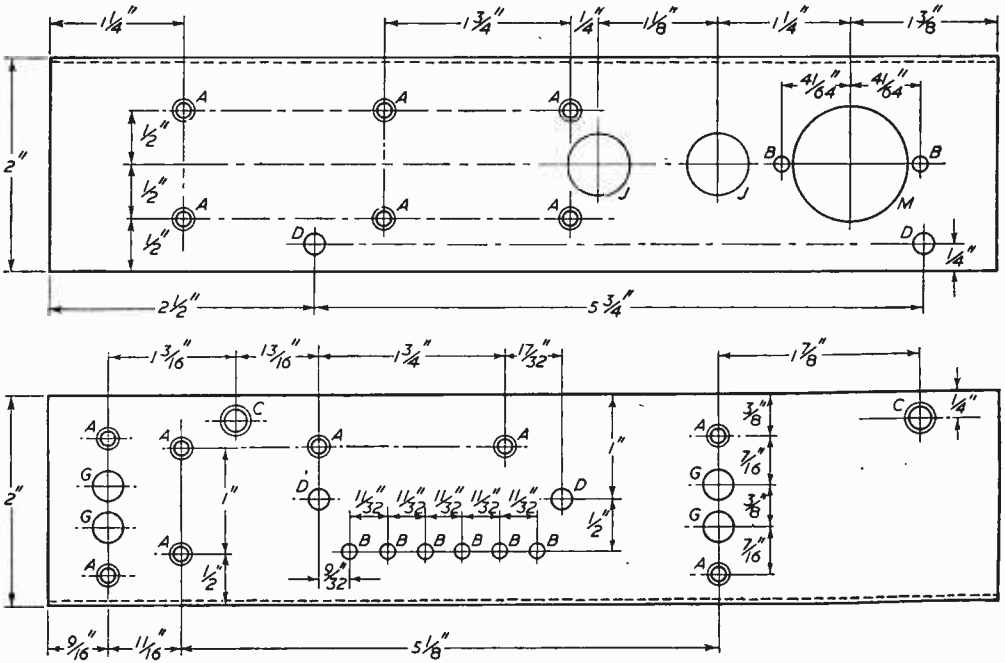



*Fig. 4.—Drilling details of the front and rear chassis runners.*

holes at the top and bottom of the panel provide a means for attaching whatever is used as a cabinet. Design details of the latter are left to readers, some of whom may want to incorporate the unit in the record player from which the third programme is obtained, while others will want to construct the device as a separate assembly.

**HOLE SIZES FOR FIGS 4 and 7**

| | | | |
|---|---|---|---|
| A | 6BA C'sk (No. 31 Drill) | G | 5/16in. dia. |
| B | 6BA (No. 31 Drill) | J | ½in. dia. |
| C | 4BA C'sk (No. 26 Drill) | K | ⅝in. dia. |
| D | 4BA (No. 26 Drill) | L | ¾in. dia. |
| E | ⅛in. dia. | M | 1⅛in. dia. |
| F | 2BA (No. 12 Drill) | | |

The cabinet used in the models designed for hairdressing salon applications, is made of aluminium and stove enamelled white, with louvres at the top and sides for ventilation purposes.

### *Assembly*

First screw the screening plates into position. Mount the valve holders, chassis sockets and terminal block, followed by the mains transformer and power supply electrolytic condenser. Leave the mains supply fittings until later as these have to be mounted through the corresponding holes on the front panel.

The underchassis view indicates where solder tags are required for earthing purposes and in addition shows a five-way tag strip for distributing the H.T. supply.

Finally, before commencing the wiring fit the coils. The recomended coils are an iron dust-cored variety manufactured by Messrs. Weymouth Radio Mfg. Co. Ltd. If the Light and Home programmes are both to be received on the medium waveband then the types required are KA3 and KH3, aerial and H.F. coils respectively. Two of each kind will be needed. For long-wave reception of the Light

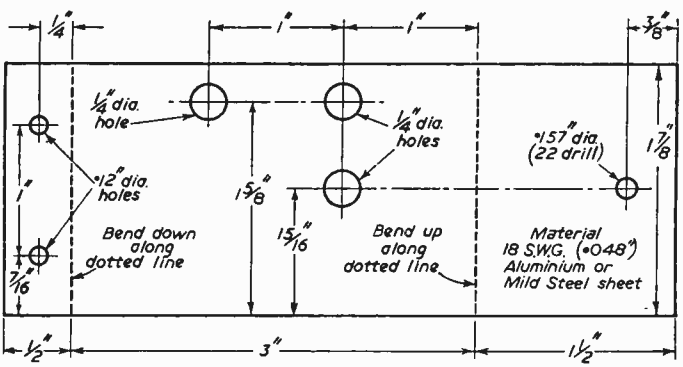



*Fig. 5.—First screen for the R.F. section.*

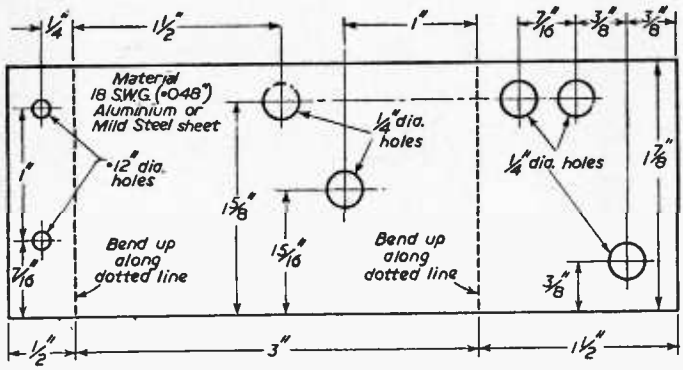



*Fig. 6.—Second screen for the R.F. section.*

programme, the appropriate coils are types KA1 and KH1.

Wire the heaters to the valves first using twisted pairs of wire to minimise hum radiation. The coils may now be wired. Do not apply too much heat to the connecting tags as wax pours everywhere making further soldering very difficult. The coils should be carefully orientated so that the shortest possible leads may be used. Next wire the resistors to the various stages. Finally, solder the condensers in place except for those tuning the coils. Some selection of values may be required for the latter on test. One important point to note is that, as far as possible, the earthed connections are returned to one common point on the chassis for each stage.

### *The Input Connection*

The amplifier input connection is taken via a short length of screened lead to the grid point to prevent hum pick-up. If the input is provided by a fairly low impedance source then the screened lead may be dispensed with provided that the input connection is kept clear of the heater leads. Therefore all leads should be kept as short as possible for this reason and, as the underchassis view shows, as many components as can be are mounted directly between the valve pins that they link. For this reason, miniature components have been used as far as possible.

The front panel is now fixed and the mains plug, switch and fuse are fitted and wired. The unit is then ready for preliminary testing.

### *Testing*

To facilitate testing, one receiver station is required. This should comprise essentially a three-position single pole switch, each of the three poles of which is connected to one of the programme, and with a pick-up connected to the wiper of which should be connected to one terminal of a headset. The other terminal of the latter is returned to the common earth point.

*(To be continued)*

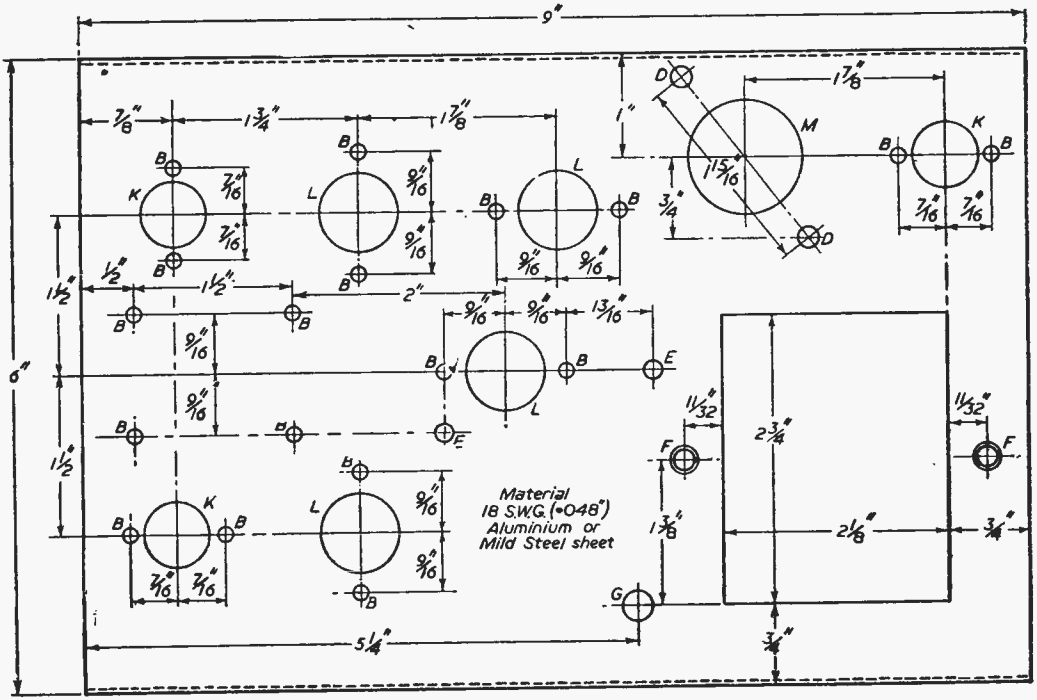



*Fig. 7.—Details of the chassis.*

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**HIGH STABILITY.** ½ w., 1%, 2/-. Preferred values. 100Ω to 10 meg. Ditto, 5%, 100Ω to 5 meg. Ω, 9d.

| | WIRE-WOUND RESISTORS | |
|---|---|---|
| 5 watt | 25 ohms—10,000 ohms | 1/3 |
| 10 watt | | 1/6 |
| 15 watt | | 2/- |

15,000 ohms—50,000 ohms, 5 w., 1/9; 10 w., 2/3.

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

| | |
|---|---|
| **MAINS TRANSFORMERS 200/250 v. A.C.** | |
| **STANDARD,** 250-0-250, 80 mA., 6.3 v. 3.5 a. tapped 4 v. 4 a. Rectifier 6.3 v. 1 a. 5 v. 2 a., or 4 v. 2 a. ditto, 350-0-350 ... ... ... | 22/6 |
| **MINIATURE.** 200 v. 20 mA.. 6.3 v. 1 a. | 10/6 |
| **MIDGET.** 220 v. 45 mA.., 6.3 v. 2 a. ... | 15/6 |
| **SMALL,** 250-0-250, 100 mA. 6.3 v. 3.5 a. | 19/6 |
| **STANDARD.** 250-0-250, 65 mA., 6.3 v. 3.5 a. ... ... ... ... ... ... | 17/6 |
| **HEATER TRANS.** 6.3 v. 1½ amp. ... | 7/6 |
| Ditto, tapped sec. 2, 4, 6.3 v., 1½ amp. | 8/6 |
| Ditto, sec. 6.3 v. 3 amp. ... ... ... | 10/6 |

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**REMPLOY Instrument Iron,** 25 w., 17/6.
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| 2X2 | 3/6 | 6Q7G | 10/6 | EBC33 | 8/6 | MU14 | 10/6 |
| 3S4 | 8/6 | 6S4A7 | 7/6 | EBC41 | 10/6 | P61 | 6/6 |
| 3V4 | 8/6 | 6S.J7M | 10/6 | EBF80 | 10/6 | PCC84 | 12/6 |
| 5U4 | 8/6 | 6S8N7 | 8/6 | ECC84 | 12/6 | PCF80 | 11/6 |
| 5Y3 | 8/6 | 6V6G | 7/6 | ECF80 | 11/6 | PCL82 | 11/6 |
| 5Z4 | 10/6 | 6X4 | 7/6 | ECH42 | 10/6 | PEN25 | 8/6 |
| 6AM6 | 8/6 | 6X5 | 7/6 | ECL82 | 12/6 | PL82 | 10/6 |
| 6B8 | 5/6 | 12AT7 | 9/6 | EF39 | 7/6 | PY80 | 10/6 |
| 6BE6 | 7/6 | 12AU7 | 9/6 | EF41 | 10/6 | PY81 | 10/6 |
| 6BH6 | 10/6 | 12AX7 | 9/6 | EF50 | 5/6 | PY82 | 10/6 |
| 6BW6 | 10/6 | 12BE6 | 10/6 | EF80 | 10/6 | SP61 | 5/6 |
| 6D6 | 7/6 | 12K7 | 8/6 | EF91 | 8/6 | UBC41 | 10/6 |
| 6F6G | 7/6 | 12Q7 | 8/6 | EF92 | 5/6 | UCH42 | 10/6 |
| 6H6 | 3/6 | 35L6 | 9/6 | EL32 | 5/6 | UF41 | 10/6 |
| 6J5 | 6/6 | 35Z4 | 9/6 | EL84 | 10/6 | UL41 | 10/6 |
| 6J6 | 7/6 | 80 | 10/6 | EM81 | 12/6 | UY41 | 10/6 |
| 6J7G | 8/6 | 807 | 6/6 | EZ40 | 10/6 | U22 | 10/6 |
| 6K6GT | 6/6 | 954 | 1/6 | EZ80 | 9/6 | VR105 | 8/6 |
| 6K7G | 5/6 | EA50 | 1/6 | E1148 | 1/6 | VR150 | 8/6 |

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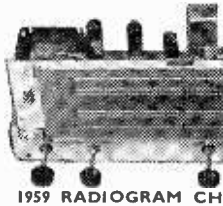

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| 8/450 v. | 2/3 | 500/12v. | 3/- | 100/270v. | 5/6 |
| 8/500 v. | 2/9 | 8+8/450v. | 4/6 | 2,500/3v. | 4/- |
| 16/450v. | 3/6 | 8+8/500v. | 5/- | 6,000/6v. | 5/- |
| 16/500v. | 4/- | 8+16/450v. | 5/- | 32+32/350v. | 4/6 |
| 32/450v. | 5/6 | 8+16/500v. | 5/6 | 50+50/350v. | 7/- |
| 25/25v. | 1/9 | 16+16/450v. | 5/6 | 64+16/275v. | 7/6 |
| 50/25v. | 2/- | 32+32/350v. | 4/6 | 64+126/350v. | 11/6 |
| 50/50v. | 2/- | 32+32/500v. | 7/6 | 100+200/275v. | 12/6 |

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**MAINS TYPE SELENIUM** 300 v. 85 mA., 7/6.
**CONTACT COOLED** 250 v. 50 mA., 7/6; 60 mA., 8/6; 85 mA., 9/6; 200 mA.. 21/-; 300 mA., 27/6.
**COILS** Wearite "P" type, 3/- each. Osmor Midget "Q" type adj. dust core from 4/-. All ranges.
**TELETRON.** L. & Med. T.R.F., with reaction, 3/6.
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5 p. 4-way 2 wafer long spindle ... ... 6/6
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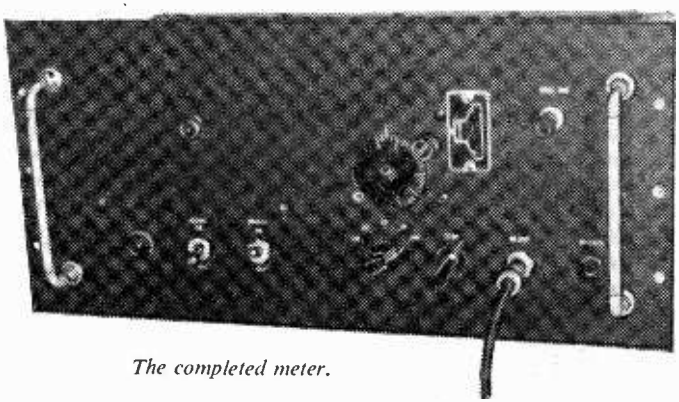
# Crystal Heterodyne Frequency Meter

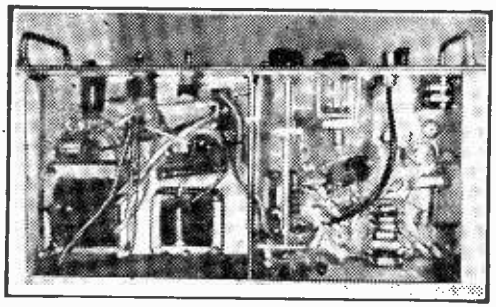
## A USEFUL ACCESSORY FOR THE AMATEUR TRANSMITTER WHICH MAY BE ADAPTED ALSO FOR SERVICING

By A. G. Barnsley



*The completed meter.*

AT one time or another most of us have had need for some means of measuring frequency to a reasonable degree of accuracy. The Heterodyne Frequency Meter is the instrument usually employed for such measurements. It is in any case an essential piece of equipment for any enthusiast to build. Indeed, if the reader is an amateur using a variable frequency oscillator (V.F.O.) to drive his transmitter, the G.P.O. will insist on his being able to measure his frequency to an accuracy of 0.1 per cent. The instrument to be described will easily measure to this accuracy. Furthermore, if a modulator is included, its use is extended to cover radio servicing. It was felt necessary to keep the cost of the unit as low as possible, and in fact, the majority of the components will probably be at hand already.



*View of the underside of the meter.*

### *Principles of Operation*

The arrangement, as shown in Fig. 1, is the basic system of the Heterodyne Frequency Meter. The variable oscillator, which is abundant in harmonics, is usually designed to cover the lowest frequency expected to be used. Measurements of the higher frequencies can be effected by using the harmonics of the V.F.O.

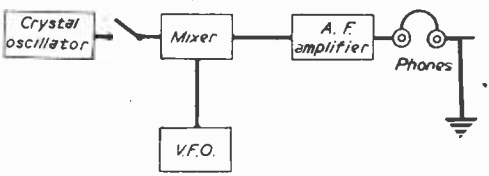
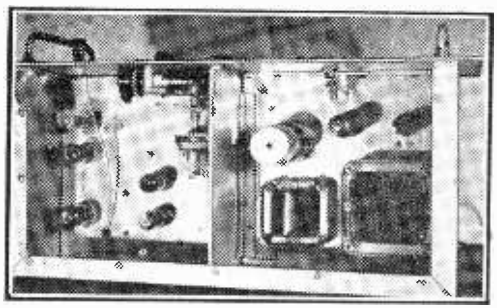



*Fig. 1.—A block diagram of the basic system of the meter.*

The crystal oscillator operates at a frequency of 100 kc/s and is the frequency standard of the instrument. The output of this oscillator together with that from the V.F.O. is fed to a mixer valve, and, as a result, beats will be heard between harmonics of the V.F.O. and harmonics of the crystal oscillator. The resultant audio frequency is amplified by V4 and can be heard in the 'phones. The frequency of the V.F.O. may be checked every 100 kc/s and any discrepancy may be tuned out by the "zero" control, C1.

We now have a variable source of R.F. accurately checked to as high a frequency as the maximum harmonic frequency of the V.F.O., and to help in this direction a separate amplifier is used with its anode circuit broadly tuned by means of switched coils resonating with the stray circuit capacitances at 144, 50 and 28 Mc/s. (The information for winding these coils is given in the table.) A radio frequency choke is connected to the fourth position and gives ample strength at the lower frequencies.



*Plan view showing the layout.*

### *The Circuit*

The circuit, which is shown in Fig. 2, uses a crystal oscillator of fairly conventional form,

with provisions for switching it off when the V.F.O. only is used. This circuit has the advantage that no tuning coil is required and will oscillate readily with crystals widely differing in frequency, amplitude of oscillation being adjusted by C10.

The V.F.O. uses a Z77 in an E.C.O. circuit, tuning from 3.5 Mc/s to 4.0 Mc/s, and is quite stable in operation provided good quality components are used. One half of a 12AX7 acts as a mixer for calibration purposes and the other half as an A.F. amplifier. If a pair of phones are plugged into the jack, the instrument becomes a satisfactory monitor, R.F. being picked up by means of a short wire connected to the "crystal out" terminal. In order to obtain the utmost stability from the V.F.O., a neon stabiliser is used to supply H.T. to the screen grids of both the V.F.O. and harmonic amplifier and also to the crystal oscillator.

### COMPONENTS LIST

CH1—15 H., 60 mA.
T1—250-0-250v., 60 mA : 6.3v., 3.0 A.
LP1—6.3v. M.E.S. indicator bulb.
S1—S.P.S.T. xtal on/off.
S2—5 way single pole Yaxley.
S3—D.P.D.T. mains on/off.

### RESISTORS AND CAPACITORS

R1, 7, 10, 11—100K.
R2, 5, 13—470K.
R3—470Ω
R4—15K.
R6—10K.
R8—30 or 33K.
R9—15K.
R12—2.7K.
C1—3-50pF.
C2—5-150pF.
C3—360pF.
C4, 6, 8, 11—100pF.
C5, 9, 12, 17, 18—.01μF. 350 v.w.
C7, 14—.01μF, 350 v.w.
C10—75pF. trimmer.
C13—10pF.
C15—47pF.
C16—470pF.
C19, 20—16μF., 350 v.w.

### *Calibration*

Switch the instrument on for about 15 minutes to allow it to warm up. Then, if it is thought necessary to check the accuracy of the crystal, this can be accomplished by running a short lead from the "crystal out" terminal near to the aerial input of a receiver that will cover the range required, and, by tuning the receiver to one of the National Physical Laboratories standard frequencies transmissions on, say, 2.5 Mc/s or 5 Mc/s and with the crystal switched in, zero beat, or a very low audio frequency should be heard.

The receiver may also be used to check provisionally the fundamental frequency range of the V.F.O. which should be from 3.5 Mc/s to 4.0 Mc/s. If the low end is not correct, the frequency may be increased by reducing C3, or vice versa. Having obtained the right limits for the V.F.O. it can be calibrated as follows. With C2 at maximum and the dial set to 3.5 Mc/s, it should be possible to zero beat against the crystal. The dial is now accurately set to 3.5 Mc/s. Tuning through the range will give numerous other beats and plenty of patience will be needed to identify them. The stronger beats can be noted and used as crystal check points so that the V.F.O. may be compared at these points with the crystal and any difference tuned out by the zero control C1.

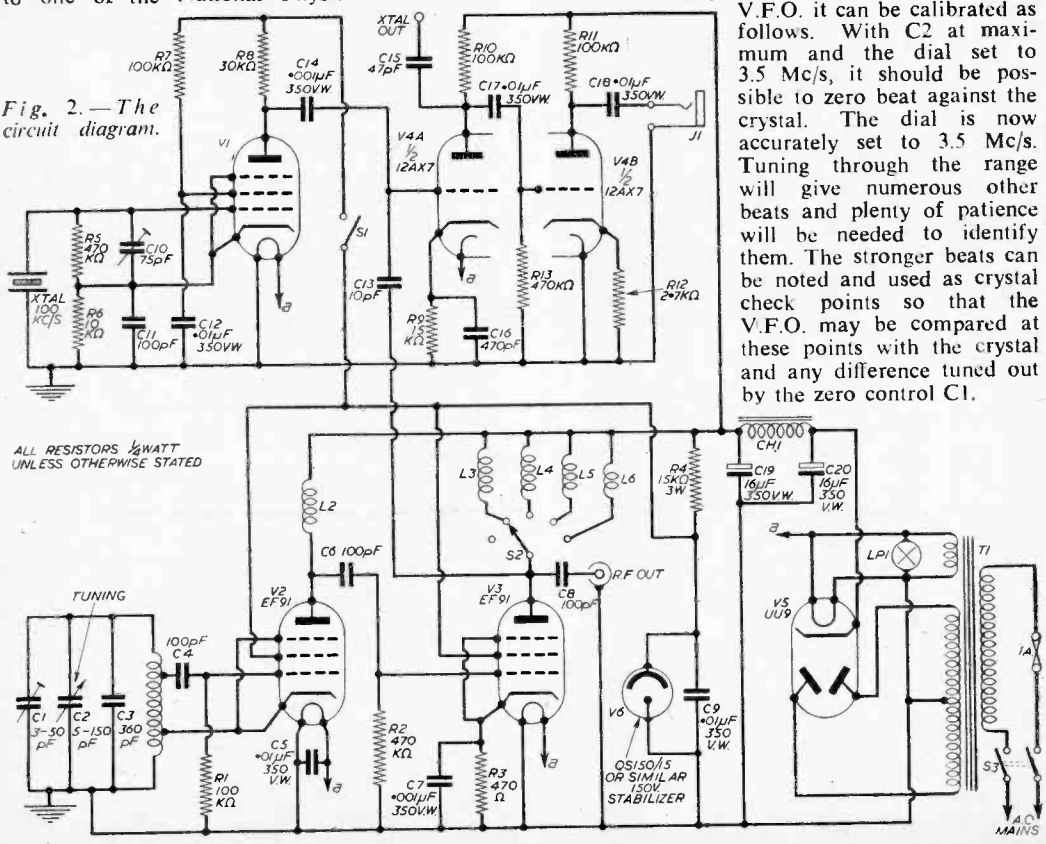
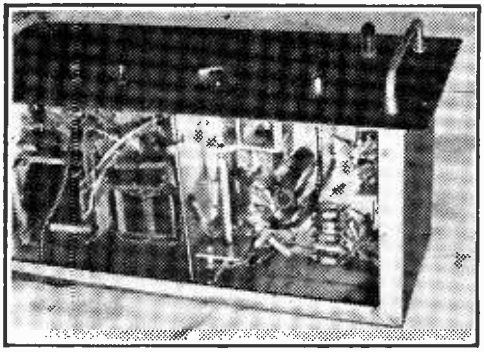



*Fig. 2.—The circuit diagram.*

*Fourth Harmonic*

Again, the receiver can be used as an auxiliary. For example, if the receiver is adjusted to pick up the fourth harmonic of the V.F.O. (14 Mc/s to 16 Mc/s), and this harmonic beats against the crystal, the 100 kc/s intervals on that range will give 25 kc/s intervals on the fundamental. A number of such points can be obtained and plotted on graph paper, or better still, five separate graphs with 100 kc/s coverage on each graph and at least one crystal check point.



*Another view of the underside of the meter.*

Provided care is taken to keep the wiring short and rigid a stable instrument should result.

**COIL WINDING DATA**

| Coil | No. of turns | Wire gauge | Former diameter | Comments |
|---|---|---|---|---|
| L4 ... | 24 | 19 s.w.g. enamel | ¼ in. | Close wound |
| L5 ... | 11 | 19 s.w.g. enamel | ¼ in. | Close wound |
| L6 ... | 2 | 18 s.w.g. enamel | ¼ in. | Spaced to be ½ in. long |

L1 : 18 turns of 20 s.w.g. enamelled wire wound on a ¾ in. diameter paxolin former tapped at 6 and 15 turns from earthy end.
L2 L3 : 2.5 mH. chokes.

Large diameter wire (16 s.w.g.) is recommended for all leads associated with the tuned circuits, and should run as directly as possible. The variable capacitors should be firmly mounted, and all the other components should be wired on tag boards or straight across the pins of their respective valveholders. A solidly made cabinet is also desirable to house the instrument.

# New RCA Transistors

RCA-2N649 is a new alloy-junction transistor of the germanium n-p-n type. It is designed for use along with its p-n-p counterpart, RCA-2N408, in class B complementary-symmetry power output stages of compact, transformerless battery-operated portable radio receivers, record-players, and audio amplifiers operating at battery-supply voltages up to 9 volts. In such equipment, the 2N649 ensures good frequency response and relatively high power output at low cost. This transistor may also be used in conventional class B push-pull and in class A audio amplifier circuits.

In a typical class B complementary-symmetry circuit, a 2N649 (n-p-n type) and a 2N408 (p-n-p type) used together in the output stage and driven by a 2N408 as a class A driver are capable of providing a power output of approximately 100 milliwatts at a power gain of 54dB.

In a typical push-pull circuit, two 2N649's used in the output stage and driven by another 2N649 as a class A driver are capable of providing a power output of approximately 100 milliwatts at a power gain of 66dB.

The 2N649 has a D.C. current gain which is essentially constant over the operating current range to insure circuit linearity, a collector cut-off current of only 14 microamperes to ensure stable performance under varying ambient temperature, and excellent uniformity of characteristics to provide unit-to-unit interchangeability.

The 2N649 has flexible leads and is hermetically sealed in a metal case.

*Drift Transistors*

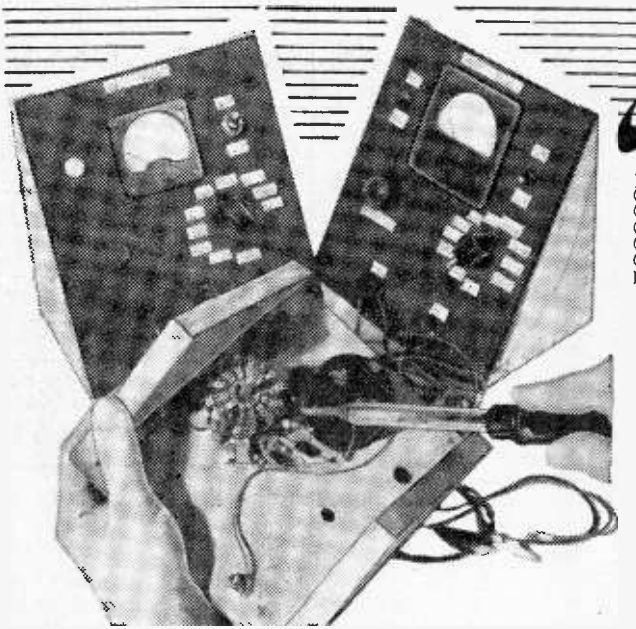
RCA also announce three new drift transistors of the germanium p-n-p type. These transistors are designed specifically for A.M. Broadcast Band applications in car receivers—the 2N640 for radio-frequency amplifier service, the 2N641 for 262.5 kc/s or 455 kc/s intermediate-frequency amplifier service, and the 2N642 for converter service. These transistors provide the equipment designer with a transistor complement which makes practicable quantity-produced 5-transistor car receivers utilising an audio driver stage and a single-ended output stage, and featuring high signal-to-noise ratios, high gain per stage, and good A.G.C. characteristics.

The 2N640 in an unneutralised circuit is capable of providing a power gain of 28dB at 1.5 Mc/s; the 2N641, in a neutralised circuit, power gains of 41dB at 262.5 kc/s, and 40dB at 455 kc/s; and the 2N642, a useful conversion power gain of 40dB at 1 Mc/s.

These drift transistors have excellent uniformity of characteristics, exceptional stability, and low feedback capacitance made possible by their unique design. Furthermore, close manufacturing controls for the small-signal parameters insure optimum performance in car receivers operating over the frequency range of 535 kc/s to 1,640 kc/s.

The 2N640, 2N641 and 2N642 utilise flexible leads and are hermetically sealed.

Additional information on these components may be obtained from: RCA Great Britain Limited, Windmill Rd., Sunbury, Middx.



# A Beginn

THIS NEW SERIES OF CONSTRUCTI
OF THE POPULAR "BE

MANY beginners find difficulties when they have wired up some apparatus and it does not work. If they had at their command a simple multimeter, sensitive but not necessarily very accurate, they would in most cases be able to sort out the fault very quickly.

### *Accuracy*

The meter proposed by the author will be quite accurate (within 5 per cent.) on all D.C. voltage ranges, rather more accurate on current ranges, especially the lower ones, but on A.C. the accuracy will not be so great, probably about 10 per cent. depending on the components used. Thus the meter is not intended for the laboratory technician, but for the amateur radio enthusiast.

There are many types of basic meter, some are on the market as voltmeters for a few shillings, but few are worth buying as they draw too much current from the circuit being tested and thus give a false reading unless a battery or other large source is being tested. What is required is a sensitive meter which will take a very small current, but at the same time will stand up to a fair amount of mechanical mishandling (e.g., being pulled off the bench) and electrical overloading (e.g., putting the meter on 100V when it is set for 10V). With this in mind the basic movement is a one milliamp moving-coil meter. Any size will do; the larger it is the better and more accurate the finished instrument. A small 2½in. instrument with a flange fitting is very suitable.


### *Construction*

It is proposed to make the meter in three stages, each one leaving the meter in working order for testing and practice in the art of trouble locating using the ranges so far completed. The first stage consists of making a multi-range D.C. voltmeter to read 0 to 10V; 0 to 100V; 0 to 250V; 0 to 500V; and 0 to 1,000V.

### *Purchasing the Parts*

Do not buy any other type of meter but a moving-coil with one milliamp *Fig.* 1 (*a*), (*b*

**PARTS TO BUY FIRST :**

- ⅛in. ply or hardboard, 7in. by 8in.
- ½in. softwood, 8in. by 8½in.
- One milliampere moving-coil movement, any size, the bigger the better, resistance unimportant unless a very accurate instrument is required.
- One toggle switch, one-pole, one-way.
- One range switch, two banks of one-pole, 11-way. Pointer knob to suit.
- Two terminals or wander plug sockets, preferably red and black. Insulated types are most suitable.
- Red and black plastic multi strand flex.
- Crocodile clips.
- ½ or ¼ watt, gold line resistors (silver line or ordinary resistors will do for less accurate results) as follows : R5, 10kΩ ; R4, 100kΩ ; R3, 250kΩ ; R2, 500kΩ ; R1, 1MΩ.

**PARTS REQUIRED TO COMPLETE THE METER :**

- Wire for shunts, 26 s.w.g. Eureka or Constantan wire (about a yard only is required) ; 600 watt electric fire element wire would do.
- 38 to 42 s.w.g. Eureka or Constantan wire (about 4yd. will allow for errors and breakages) or use an old 25 or 50kΩ wire-wound pot. obtainable at any servicing depot.
- One toggle switch ; two-pole, two-way.
- One 4½ v. torch battery.
- One 1mA meter rectifier (you may care to wait before you buy this as you can use germanium diodes which are obtainable for a few pence. Details will be given later.)
- One 3.3kΩ silver line resistor (R10.)
- One 1kΩ potentiometer, round knob to suit.

# 's Test-Meter

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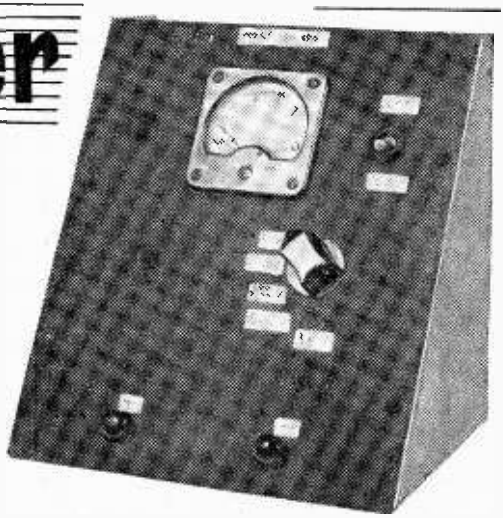
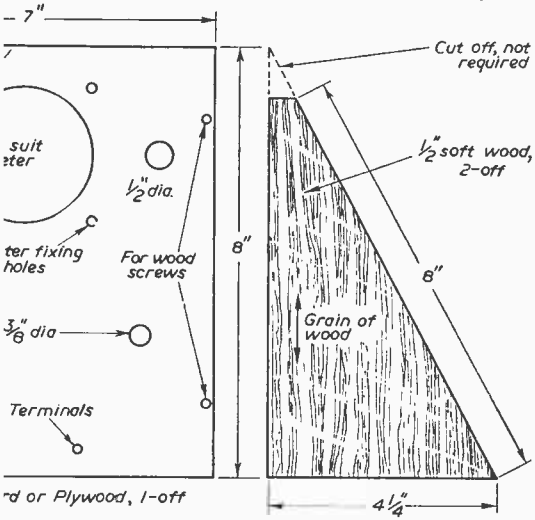


*The multi-range D.C. voltmeter.*

full scale deflection or the resistors will all be of the wrong value. Make sure the needle is free when you gently shake the meter and ask the seller to show you that it works by putting it in series with his own meter on resistance range. If the needle shows the slightest tendency to stick, reject it. If the needle is bent at the tip the meter has been overloaded at some time and should be rejected.



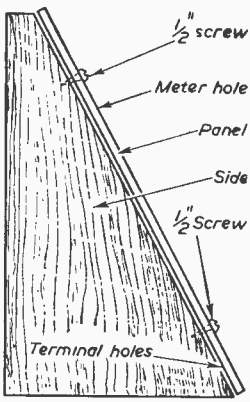

*ıd (c) (Below, right).—The construction of the meter panel and stand.*

The scale reading should be from 0 to 10, or multiples thereof. Some meters are calibrated for a specific purpose (e.g., 0 to 6) and these should be cheaper. It is not an easy job to make and fit another scale, but it could be done, or a conversion graph could be made up. A meter with this type of "odd" scale is not recommended for multi-meter purposes. Most meters have an internal resistance of 100 ohms, but for the accuracy required of this multi-meter it will not matter, almost any internal resistance will suit.

### *Examining the Meter*

Do not be tempted to try out the meter on a torch battery. Many a meter must have been ruined in this fashion. Be patient and satisfied at first with a thorough examination externally. If you have an old meter (or one you have burnt out!) by all means open it up and examine the working parts. Do not do this with a new one unless you are a watch-maker or other fine instrument maker. Notice that the needle may be set accurately at zero by means of the little screw head about ¼in. below the pivot point of the needle. This screw controls the hairspring. When the meter is mounted in its *working* position this screw is adjusted to give a perfect zero when viewed from directly over the needle. Oblique viewing will introduce an error. Out of interest try looking at the meter from a point 1ft. to the left and then 1ft. to the right. Different readings will appear, neither being correct. Good meters have a mirror above and behind the scale and you have to view so that the needle and the image of the needle are superimposed.

Gently turn the zero screw. If it has been waxed it will help to gently warm the outside of the case. The screw will turn right round indefinitely (it is not really a screw inside) and the needle will then move either side of zero. Set the meter to zero again after experiment with the screw.




### *Replacing the Case*

If you ever have the front off a meter the zero screw can easily be broken on the inside when replacing the

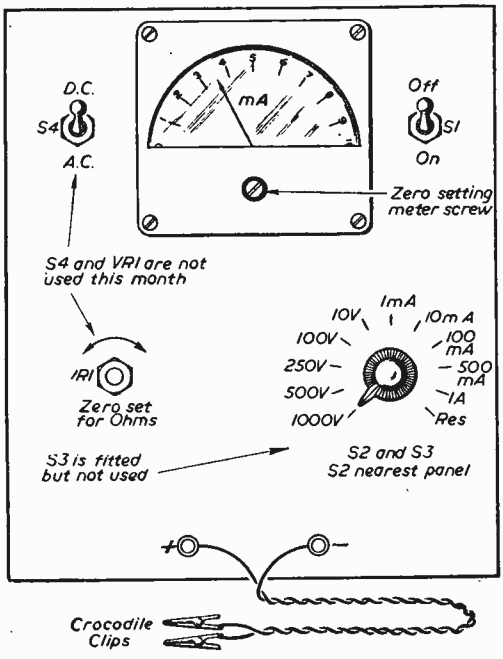



*Fig. 2.—The meter panel (when completed).*

front in position. Examine the mechanism very carefully and make sure the little "pip" on the inside is located in the long groove on the hair spring adjuster before turning the screw. If it is incorrectly replaced and then adjusted, the "screw" will fracture, and your instrument will not be suitable for very accurate work. It could be set at zero inside and then left, but it would be inaccurate after some use, or in different temperatures (when the hairspring expands or contracts).

If there is no information supplied to the contrary with the meter, it may be assumed that it will work in any position, horizontal or vertical. To be "on the safe side" this meter is mounted at an angle somewhere between the two. On some meters designed specifically for horizontal or vertical operation this might introduce a small error (not to be worried about in this instrument) so the reader may care to make the panel as shown, but mount it in some other way—for instance in a box.

### *Making the Panel and Stand*

In the interests of safety it is best to cut the panel and all holes and mount the meter before anything else is done. The panel may be mounted on the stand, but it will probably help to leave it off until all the wiring is finished. If the left-hand part of the stand is attached to the panel it will leave the side with the complicated wiring (to the 11-way switches) with easy access.

The panel and associated parts are shown in Fig. 1 (a), (b) and (c). The panel is cut to the size shown and the various holes cut out. The larger ones can be cut with a fretsaw. The material may be plywood, or hardboard. Iron or any magnetic metal must not be used at it may affect the meter, but brass or aluminium could be used. Chances of short circuits are reduced by using wooden panels.

The stand consists of two triangles of wood with the points sawn off as shown in Fig. 1 (b). When mounting the switches in the holes shown at the side of the meter allow room for the triangles to be screwed alongside. There is plenty of room if the triangles are of ½in. wood. Make sure the grain is along the height of the triangles or they will break as you cut them or when you screw on the panel.

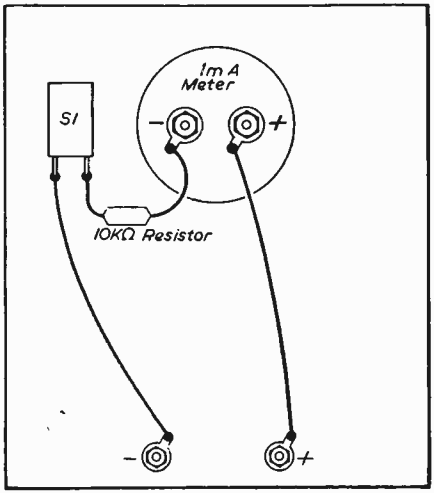
Make sure the meter stand does rest firm and level when made. If it does not, rub the base down with sandpaper until it is square and flush with the bench. If the meter is to be used for servicing receivers in the living-room, stick felt to the bottom of the stand.

### *Drilling*

When drilling hardboard always drill from both sides or the result will be very rough indeed, and it helps future work on the front panel (i.e., blacking and marking figures in white) if the high gloss is gently removed with sandpaper too.

When finished the panel can be painted with black Indian ink. This may be rubbed a bit before the meter is finally finished, but it may be redone finally when the A.C. switch has been fitted.

Fit S1 as shown in Fig. 2, also the two terminals. These could be plugs and can be coloured or otherwise and in any event should be of such a type that they are insulated on top. Metal terminals are not suitable. Plugs have the



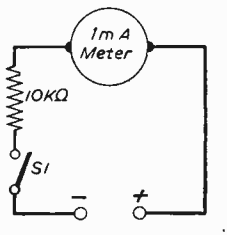




*Fig. 3 (a) (Left).—Making a trial 10V meter.*

*Fig. 3 (b) (Above).—Circuit diagram for the 10V meter.*

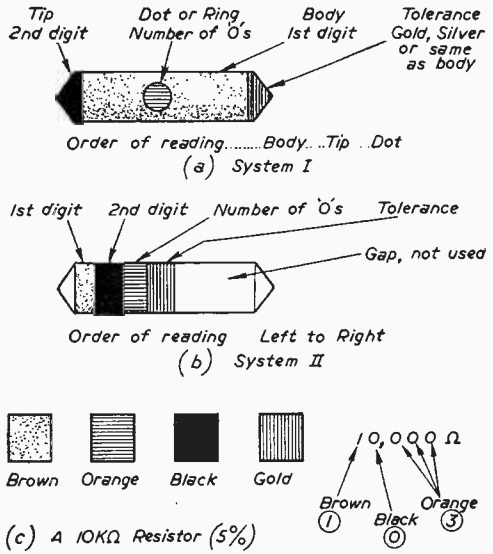



*Fig. 4.—Reading the resistor colour code.*

advantage that they are easily removed to use on some other gear, but suffer the disadvantage that they often give erratic connections, especially when old. Then mount the meter itself. You may need some small nuts and bolts (⅛in. Whit. from the ironmonger would do) or the screwed rods may have been pressed into the plastic case in which event you must be very careful to do the nuts up tight, but no more.

### *The 10V Range*

First, it is proposed to make the simple 0 to 10V meter shown in Fig. 3. The reader will note how simple the theoretical diagram is and will no doubt be able to follow it in the practical one.

Ignoring the resistance of the meter the 10kΩ resistance will restrict the current from a 10V. battery applied to the plus and minus terminals to one milliamp (1mA). Thus, the meter needle goes right over and points to 1mA, but we read it as 10 volts. When it points to 0.45mA, as it would on a flat type torch battery, we read 4.5V.

Having mounted the components and made sure the switch S1 is on when it is down by using a torch battery and bulb, proceed as follows. Wire soldering tag on negative terminal to one tag of S1. Other tag of S1 *via* a 10kΩ 5 per cent resistor (be very careful indeed that you really have this value or your meter may be damaged beyond repair).

### *Test Leads*

Attach two crocodile clips carefully to the ends of some red and black plastic-covered multistranded wire. The other ends are attached to the terminals About 2ft. or 2ft. 6in. of wire is ideal. The author likes to make a small loop of wire round a nail a little bigger than the terminal to be used. This loop is then run over with solder to make a neat permanent loop for attachment to the terminal.

| Colour Code Chart | | |
|---|---|---|
| Black | 0 | ✳ |
| Brown | 1 | ✳ |
| Red | 2 | ✳ |
| Orange | 3 | ✳ |
| Yellow | 4 | ✳ |
| Green | 5 | ✳ |
| Blue | 6 | |
| Violet | 7 | ✳ |
| Grey | 8 | |
| White | 9 | |
| Silver | 10% | |
| Gold | 5% | |

✳ *The beginner should learn these by heart*

Test this simple meter out on various torch batteries, none of which will be over 10V. Remember that each dry cell gives 1½V. If the meter does not work, then either one of the components is faulty (test by substitution) or you have wired up incorrectly. This can usually be diagnosed as the needle tries to move backwards, but can only do so for ⅛in. or so. You could make quite a good test on a car battery by attaching the negative clip to the small lug and working upwards cell by cell, remembering to scrape the lead connectors each time you need a contact. You should not test all the cells of a 12V battery, although it would probably do no harm, as these meters are fairly robust. Lead acid cells are not exactly 2V each. This is only a mean figure depending on the state of charge.

### *Reasons for Inaccuracy*

If you buy a new flat torch battery which contains three cells in series, the needle should go fairly accurately over to 0.45mA. The reasons for errors are as follows in order of importance:

1. The resistor may not be exactly 10kΩ but could be 9,500 or 10,500 ohms.
2. We have, in stating 10kΩ, ignored the resistance of the meter; if this is 100Ω then strictly speaking we should use a 9.9kΩ resistor. Such a resistor is not made as standard. A special one of high accuracy would have to be purchased.
3. Small errors in the meter and the battery voltage.

### *The Colour Code*

Refer to Fig. 4 and to the resistors which you have purchased in order to make the meter. If these are of the 5 per cent. type which is recommended, then they may have a gold band on them. This means that they are within 5 per cent. of the specified value. You could use 10 per cent. ones which have a silver band or 20 per cent. ones which have no metallic colour on them. The accuracy of the meter would suffer with the latter unless you are able to get a friend to select values "spot on" with a bridge. This is the best way of all. Values of resistor a little too low may be increased by carefully filing away with a nail file. Do not join resistors in series as you may have shorts, etc., develop in the meter which will often be moved about.

The chart with Fig. 4 gives complete details of what each colour stands for, those with the asterisk are very common ones and should be learnt by heart as soon as possible.

In the next article, the author explains in detail the two systems of colour codes used for resistors and goes on to deal with the working of the range switch and the construction of a multi-range D.C. voltmeter.

*(To be continued)*

# RESISTOR WATTAGES

## HOW TO CALCULATE THE RATINGS FOR VARIOUS RESISTORS

By F. G. Rayer

IN circuits of receivers, amplifiers and other equipment, the resistance values are specified, so that the constructor can wire in suitable components. Quite frequently the wattages are not shown, and this may cause some doubt as to best wattage to use. This problem can also arise when replacing a defective resistor.

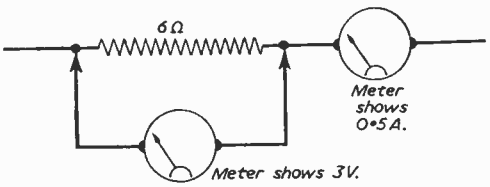



*Fig. 1.—A current of 0.5 amps flows through a resistor of 6 when the P.D. across it is 3 v.*

### Calculation

Difficulties of this kind are easily overcome when the methods of calculating wattage are known. There are three methods, each of a simple nature, and that chosen for a particular calculation usually depends upon the factors known. These factors are voltage, current and resistance, and wattage may be determined by any of the following methods: (Voltage × Current) or $\frac{(\text{Voltage})^2}{\text{Resistance}}$ or (Current)² × Resistance.

A simple example will show how these calculations are worked in practice. In Fig. 1, 3 v. are applied to a 6-ohm resistor so that .5 amp. flows. Using each of the methods in turn gives the following results:

(Voltage) × (Current) : $3 \times 0.5 = 1.5$ W.

$\frac{(\text{Voltage})^2}{\text{Resistance}}$ : $\frac{3 \times 3}{6} = \frac{9}{6} = 1.5$ W.

(Current)² × Resistance :

$0.5 \times 0.5 \times 6 = .25 \times 6 = 1.5$ W.

It will thus be seen that if any two of the factors (voltage, current, resistance) are known, the wattage can be found. It will also be clear that the factors must be expressed in volts,

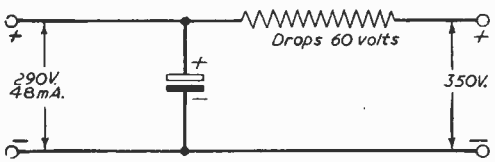



*Fig. 4.—H.T. dropper resistor.*

amps. and ohms, and this must always be remembered when dealing with resistor values indicated as kilohms, or currents of low value given in milliamps. Before working, these can be converted. 1 k = 1,000 ohms, and 1 amp. = 1,000 mA.

### Circuit Resistors

It is usual to indicate voltage by V, current by I, and resistance by R. Fig. 2 shows a valve with anode and screen grid resistors. Any of the methods listed will indicate the wattage dissipated.

Assume that 100 v. are dropped in the resistor, which is 50 k.

$\frac{V^2}{R} = \frac{100 \times 100}{50{,}000} = 0.2$ W.

Assume a meter shows 2 mA to flow, with 100 v. dropped. Then VI or $100 \times 0.002 = .2$W.

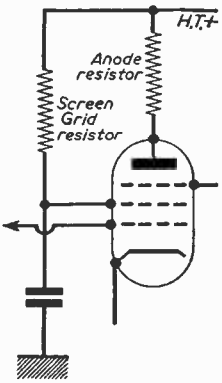



*Fig. 2.—Anode and screen-grid resistors.*

If measurement or the valve data show 2 mA to flow, with the 50 k resistor, then $I^2 \times R = .002 \times .002 \times 50{,}000 = 0.2$ W.

The smallest rating which may be employed would thus be 0.2 W, or 1/5th watt, but a ¼-watt resistor would usually be fitted, because the next larger generally available wattage is suitable. If ½-watt or 1-watt resistors were to hand they would be equally suitable, unless space is so limited that they cannot be accommodated.

When larger currents are encountered, resistors of fractional wattage rating may be too small. In Fig. 3, anode and screen grid currents total 49.5 mA. An average cathode current of 50 mA may thus be assumed, to simplify calculation. Resistance and current being known, $I^2 \times R$ gives the wattage. That is, $.05 \times .05 \times 250 = .625$ W. A ¼-watt resistor is too small, so a 1-watt resistor can be used here.

### H.T. Dropper

In Fig. 4, a 350 v. H.T. supply is dropped to 290 v., and 48 mA flows. The resistor thus drops 60 v. at 48 mA. Therefore, V × I, or $60 \times .048 = 2.88$ W. As the next larger manufactured value has to be selected, a 3-watt resistor would be used.

In some circuit positions, especially A.V.C. circuits and grid circuits, exceedingly small currents will flow, so that calculation shows the power dissipated to be small fractions of a watt. Small resistors, such as those of ¼-watt rating or less can be employed uniformly here.

(*Continued on page 429*)

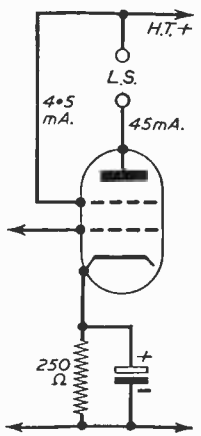



*Fig. 3. — Cathode bias resistor.*

# Becoming an "Amateur"

AMATEUR RADIO FOR BEGINNERS—No. 1

By J. D. Pearson, G3KOC

THIS series of articles is intended to put the raw beginner on the right road to a transmitting licence, and to assist with some of the problems he will meet on the way.

*The first of a new series written especially to aid the newcomer to the field of amateur radio transmission. This month's article explains the procedure to be followed to obtain a transmitting licence.*

### *The Law*

To-day it is illegal in the United Kingdom to operate any type of transmitting equipment without a licence to do so. The sole authority for the issue of licences in this country is the Postmaster-General. Anyone wishing to engage in the hobby of radio transmission for experimental, self-educational or entertainment reasons on the amateur bands must be in possession of a licence. This is known as the Amateur (Sound) Licence.

### *The Amateur (Sound) Licence*

This licence costs £2 per annum and owing to the fact that it permits unrestricted operation on a wide band of frequencies with equipment which may be home-constructed the P.M.G. insists that all intending licensees shall be capable of correctly installing and operating such equipment. This entails a certain standard of theoretical knowledge on the part of the licensee. The standard required is the minimum necessary to ensure complete capability of the operator and, contrary to a certain school of thought, is not designed expressly to limit application for licences.

The reader's main concern at this stage no doubt is the exact standard required and how best to obtain it. The City and Guilds of London Institute holds a yearly examination known as the Radio Amateurs' Examination. A pass-slip for this is accepted by the Post Office as sufficient indication of the applicant's theoretical qualifications. Arrangements to take the R.A.E. must be made through the reader's local technical college or evening school. The C. and G. will not accept applications direct from persons wishing to take the examination, which is held each May, and applications must be in before the end of the previous February. For less than half-a-crown the City and Guilds will supply a syllabus which details precisely the standard of knowledge required for the R.A.E. They will also supply copies of past years' examination papers at 6d. per copy, together with a list of recommended books for study. The address is: City and Guilds of London Institute, 76. Portland Place, London. W.1. It is essential to quote "Subject No. 55, Radio Amateurs' Examination" when writing.

### *Exemption from the R.A.E.*

It should be mentioned here that certain people who possess higher qualifications may be granted exemption from the R.A.E. (e.g., university graduates who have taken certain radio subjects); certain Service trades are also exempt, provided application is made within a certain time of service completion, but, generally speaking, the reader, if he is a beginner, will certainly have to take the R.A.E. A full and complete list of these exemptions can be obtained from the following address: Headquarters, G.P.O., Radio and Accommodation Branch, St. Martin's-le-Grand, London, E.C.1. Together with this list the G.P.O. will supply a considerable amount of useful information regarding licencing conditions.

### *The Next Step*

Having gone so far the reader will now have some idea of what amateur radio is, and the knowledge required to obtain a licence. The next question he asks is: "How and where can I obtain this knowledge?" followed closely by: "How long will it take to acquire?"

There are three methods of study: (a) technical college or evening institute; (b) correspondence course; (c) self-tuition at home. The first method is the most efficient as the student can usually ask questions concerning difficult points and receive immediate verbal replies, whereas with the other two methods he is apt to become discouraged when stuck on some theoretical problem. The reader is advised first to ascertain whether a course of instruction is available at his local evening school, stressing that he wishes to study for the R.A.E., and not some other branch of radio for which a course may be in progress. If a course is not available it should be borne in mind that most of these evening institutes are prepared to inaugurate particular courses if there is sufficient demand. Fees are quite moderate and courses usually run from September or October until April or May.

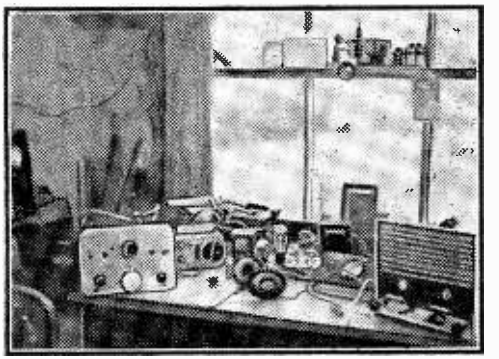
If, owing to distance, etc., attendance at an evening school is impossible then method (b) should be considered. Here financial considerations will usually be the deciding factor. Again, when making enquiries, ensure that you mention the R.A.E.

### *Studying at Home*

Finally, we come to method (c). There will be many readers who, for various reasons, will favour this method which, incidentally, was the one used by the writer. There are a large number of people who, although wishing to adopt this method, feel it to be an almost impossible task to undertake. The writer regarded the situation in just this way some years ago, and whilst not wishing in any way to minimise the effort involved, it may be

stated here that any person of average intelligence can undertake the necessary self-tuition with a reasonable chance of ultimate success. given one other essential quality—enthusiasm! Without it discouragement comes quickly.

The next consideration is the time-factor. Purely as a guide, the reader may find the following information useful. The writer studied theory for some six months before taking the R.A.E. At the beginning of the period of study absolutely nothing was known of the subject. Four or five nights a week were occupied with theory, the remainder being given over to short-wave listening and other interests. Prior to commencing serious



*The den of Mr. R. Bulbert of Co. Tipp., Eire.*

study, three years were spent as a short-wave listener.

### *Mathematics*

Several correspondents have raised this subject and all were doubtful as to whether their standard was sufficient to get them through the R.A.E. There is no reason for anxiety on this point. If the reader can add, subtract, multiply and divide simple fractions and decimals, and extract a square root this is all he will require. A knowledge of logarithms and the ability to use indices is extremely useful, but not absolutely essential. It should be borne in mind that the R.A.E. is not designed to discover the candidate's mathematical ability, but to ensure that he is qualified to be let loose on the air with a hundred and fifty watts at his finger tips.

### *The Morse Test*

Apart from the theoretical qualification, the Postmaster-General also requires that all applicants for an Amateur (Sound) Licence shall be capable of sending and receiving morse at 12 words per minute. The test is held at various centres throughout the country, and the Post Office is very obliging regarding the arrangement of dates and times to suit individual applicants for this test.

The reader should forget all about the actual morse test until he has passed the R.A.E. If the R.A.E. is not taken and passed within twelve months of passing the morse test then the morse test has to be taken again! This is not to say that some form of regular morse instruction and practice should not be initiated almost immediately one has decided that the Amateur (Sound) Licence is the final objective.

### *The G.P.O. Test*

The Post Office hold their own R.A.E. yearly, every October. This is held at certain large cities, and all details will be supplied from Post Office Headquarters on request, at the address given previously. Taking this examination usually necessitates travelling a long distance, but if you happen to live in one of the few large cities where it is held and feel qualified to take the R.A.E., a long wait until the following May can be avoided.

### *The Radio Amateur's Certificate*

This is an attractive, well-printed parchment suitable for framing. It is issued automatically by the G.P.O. to all applicants for an Amateur (Sound) Licence who has passed the R.A.E. and the Morse Test. It is not issued to anyone who, whilst they may be eligible for a licence, claim exemption from the R.A.E. or the Morse Test.

The holder of this certificate is allowed to operate a station owned by another licensee, provided the said licensee is present and that an entry is made in his log-book accordingly. The reason for this is as follows: a person may, for various reasons, not wish to take out an Amateur (Sound) Licence immediately, although he has passed both the R.A.E. and the Morse Test. He can, however, operate a station owned, for instance, by a friend.

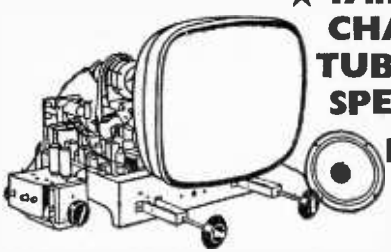
If a licence is not taken out within two years of the issue of a Radio Amateur's Certificate then the Morse Test must be taken again before a licence can be issued.

### *Further Steps*

The reader will by now have a fairly clear idea of what he must do to obtain a transmitting licence. Further progress is now dependent on the individual, but the writer will be pleased to deal with queries arising from a study of theory as the basis for future articles. All queries should be forwarded to the Editor in the usual manner *with the query coupon from the current issue.*

*(To be continued)*

## ★ 17in T.V. CHASSIS, TUBE and SPEAKER 16 GNS.



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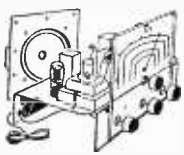

5 valve superhet chassis including 8in. P.M. speaker and valves. Four control knobs (tone, volume, tuning, w/change switch). Four w/bands with position for gram. p.u. and extension speaker. Ins., carr. 5/6.

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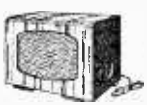

Polished oak cabinet of attractive appearance. Fitted with 8in. P.M. speaker W.B. or Goodmans of the highest quality. Standard matching to any receiver (2-5 ohms). Switch and flex included. Ins., carr. 3/6.

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# AN EXPERIMENTAL "PRINTED" CIRCUIT AMPLIFIER

*THE WIRING IS MADE FROM METALLIC CONDUCTING FOIL GLUED TO A HARDBOARD CHASSIS*

By S. Woods

WHILE this amplifier is not a true printed circuit design it will nevertheless enable the amateur to obtain some experience in the practical applications of this method of wiring.

First, cut a piece of hardboard ⅛in. thick and 7in. × 5in. Lay out the components and mark round them as in Fig. 2. The valveholders should be pressed down so that the tags are spread out slightly. These should lay flat on the chassis. Make a

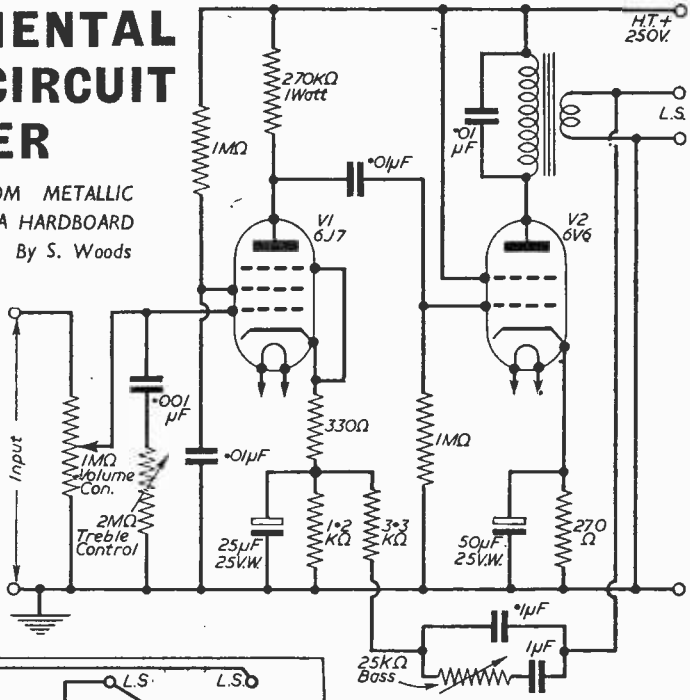



*Fig. 1 (Above). — The circuit diagram.*

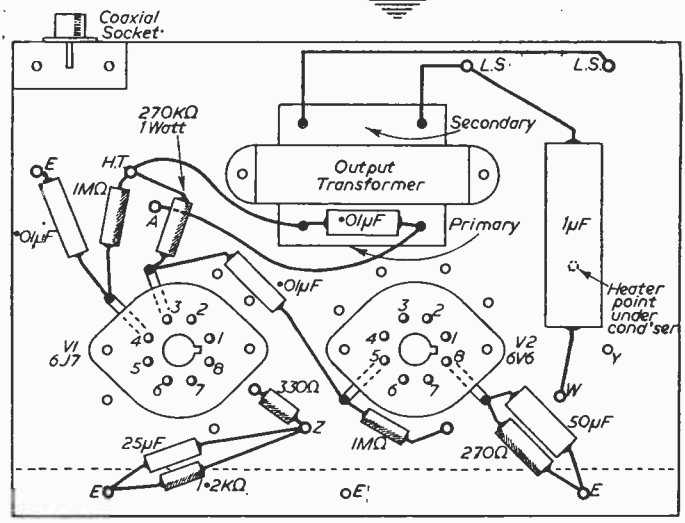



*Fig. 2 (Above).—Layout of the parts.*

*Fig. 3 (Below, right).—Mounting the controls on the panel.*

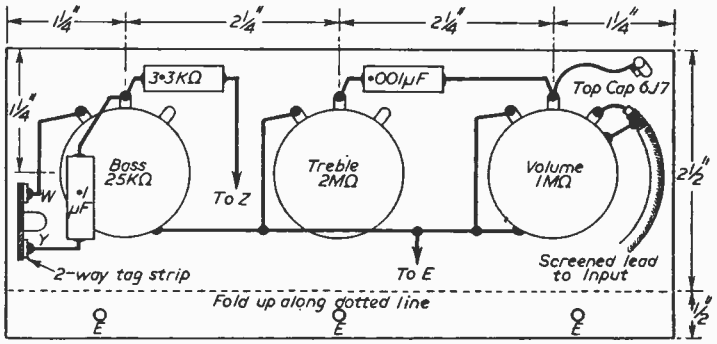
pencil dot on the chassis through the holes in the tags.

### The Conducting Foil

Drill holes 6 B.A. to correspond with the valveholder tags that are to contact the "printing," i.e., tags 1, 2, 5, 7 and 8 on valve one; and 1, 2, 3, 4 and 7 on valve two.

Next cut a piece of foil the same size. (Foil obtainable from empty tea chests.) Stick this on the underside of the hardboard, i.e., the rough side, with suitable adhesive. Before this is quite set, cut away the shaded part as shown. The holes that have been drilled will show up in outline through the foil.

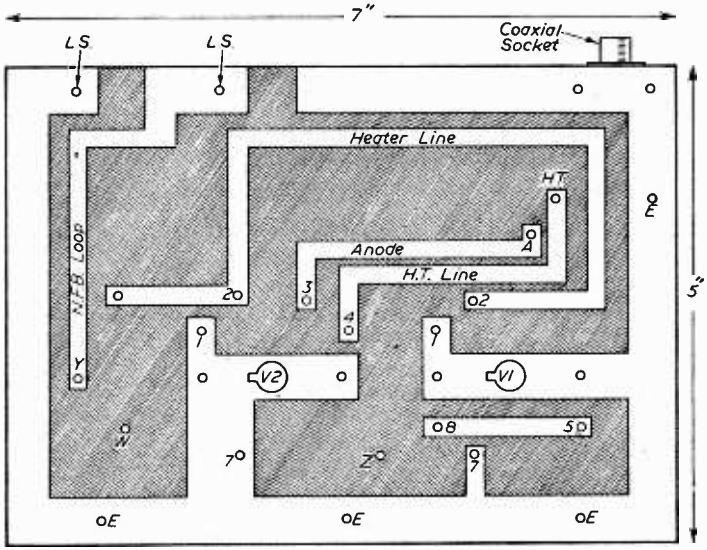
Next put the 6 B.A. screws through the holes with a washer under the head and nut. These screws should be just long enough to go through the hardboard. If longer, cut off the surplus and file flat to the nut. Tin the screw heads and nuts



with solder. The two screws marked LS have terminal heads fitted and form the output terminals. A small aluminium bracket must be made up for the co-ax. socket.

*Assembly*

The chassis is now ready for assembly. Bolt the valve-holders to the chassis. Quarter inch spacers are needed between the holders and the chassis. Pull out the tags slightly and solder to their respective screw heads. i.e., tags 1, 2, 5, 7 and 8 on valve one; tags 3, and 4 are surface wiring as shown in Fig. 2. The rest of the assembly is self explanatory. Flex leads are soldered to screw heads marked "Heater." H.T. and earth. and taken to power supplies.



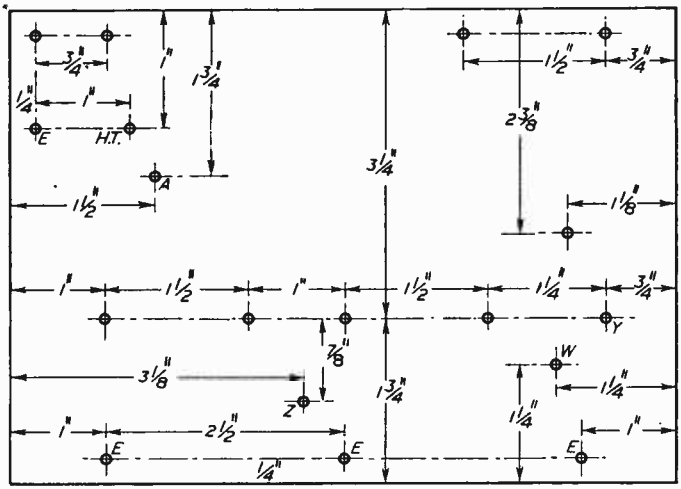




*Fig. 4 (Above).—The "printed" wiring, shown by the unshaded areas.*

*Fig. 5 (Below, left).—Drilling details of the chassis.*

It is advisable to dope the chassis before assembly with shellac varnish. This improves the appearance and protects the "printing." The controls are mounted on a panel as in Fig. 3. This is wired in the normal way and bolted on the front of the chassis. The power supply is conventional giving 250 volts H.T. and 6.3V heater. Should the amplifier oscillate reverse the secondary connections on the output transformer.

## A TWIN SPEAKER CABINET

*(Continued from page 376)*

position and pin temporarily. Screw in place from the underside using 1¼in. No. 8 screws.

The remaining 1in. × ¾in. fixing battens are prepared and cut next. Drill in both directions. Cramp in place and screw them with 1¼in. No. 8 screws. The whole of the battens on the bottom can now be removed, glued and screwed back permanently in position. True up the sides and back dead square to the edges of the base ready to receive the ply.

The next step calls for extreme care and patience, as the neater the joints the more praiseworthy the finished article. Clean up and square the long front and bottom edge of the sides "c" left and right and lay in position against the bottom. Mark the inside edge of the bevel on both pieces and transfer this (working from the true bottom edge), to the top edge. Set the bevel square to 67½ deg. and mark the bevel on top and bottom edges. A straight line should now be drawn down the inside and outside and the waste planed off.

Before preparing or screwing battens, mark off and plane the bevelled edges of sides "b" left and right, the back "a" in a similar manner. Having prepared them, clamp the two sides "c" left and right truly in place (take care to use scrap wood under the cramps to avoid bruising the oak facing). Screw them on through the base battens, and measure for the lengths of the battens running from top to bottom.

*(To be continued)*

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All the above are fitted with Monaural cartridges. Some can be supplied with Stereo inserts and details are given in our illustrated list of Gramophone Equipment.

## DOUBLE PLAY TAPE

Double Play Tape uses a new plastic base which is half the thickness of standard tape. Any reel will thus hold twice the length of Double Play Tape compared to Standard Tape. Owners of Recorders which take 5in. or smaller reels will find this tape of particular interest as the playing time can be considerably increased.

**BASF.** 300ft. (3in.), **14/-.** 600ft. (4in.), **25/-.** 1,200ft. (5in.), **42/-.** 1,600ft. (5½in.), **52/6.** 2,400ft. (7in.), **77/6.**

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New list of Standard and LP Tapes and Accessories free upon request.

## MULLARD TAPE "C" PRE-AMPLIFIER

A booklet giving full technical details and constructional information is now available. Price **2/10,** post free. COMPLETE KIT containing every item needed right down to the last nut and bolt. First-class items only are included. Ready drilled chassis and gold finished front panel. Price **£14.10.0.** H.P. Terms. Deposit **£2.16.0** and six monthly payments of **£2.3.0.** POWER PACK KIT, **£4.0.0.** All components are available separately and our detailed list is available free. CONVERSION KIT to convert original version to the new model, instruction manual included, **52/6,** post free.

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**AUDIO.** BTH Red Spot. Latest type, **7/6** ; GEC Yellow/Green, **10/-** ; Brimar TS3, **13/6** ; Ediswan XB102, **10/-,** XB104, **10/-** ; Goldtop V10/15A. **15/-** ; Mullard OC70, **21/-,** OC71, **24/-.**

**AUDIO OUTPUT.** Mullard OC72 Matched pair, **60/-** ; Ediswan XC101 Matched pair, **60/-.** R.F. GEC Yellow/Red, **17/6.** Ediswan XA101. **35/-,** XA102, **40/-,** XA103. **15/-,** XA104. **18/-** ; Goldtop V6/R2. **24/-** ; Mullard OC45, **35/-.** All transistors post free.

# WATTS RADIO (MAIL ORDER) LTD.

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***CLOSED FOR ANNUAL HOLIDAYS AUGUST 8TH TO 22ND.***

# NEWS FROM THE CLUBS

### HALIFAX AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: A. Robinson (G3MDW), Candy Cabin, Ogden, Halifax.

THE monthly meeting of the Halifax and District Amateur Radio Society, held at the Sportsman Inn, Ogden, on May 5th, was in the form of a sale of "junk" from which the club benefited by over £6. Most of the gear was given by Mr. J. H. Bateman, G6BX. The chairman, Mr. Makin, presided.

Meetings of the Society are held on the first and third Tuesdays of each month.

Future meetings:
June 16th, Ragchew.
July 7th, Open.
July 21st, Social.

### INTERNATIONAL RADIO CONTROLLED MODELS SOCIETY

THE Annual Contest for Model Boats, Cars, etc., will be held this year on August Bank Holiday Sunday and Monday, (2nd and 3rd) in East Park, Kingston-upon-Hull. The contest is open to all radio-control modellers, whether or not they are members of the Society and, of course, visitors will be very welcome. Anyone interested is advised to make early application to participate. Entry forms, copies of Rules and any further information will be sent, on request to the Honorary Competition Secretary, B. E. Veal, 33, Steynburg Street, Newbridge Road, Kingston-upon-Hull, Yorks. (See also page 384.)

### LIVERPOOL AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: H. James, G3MCN, 448, East Prescot Road, Knotty Ash, Liverpool, 14.

MEETINGS are held every Tuesday, at 8 p.m., at the Gladstone Mission Hall, Queens Drive, Childwall, Liverpool (opposite the Signal House T.A. Centre).

As Mr. W. D. Wardle (G3EWZ) is leaving the city, he has had to resign as Hon. Sec. and his place has been taken by Mr. H. James (G3MCN).

The society has a very full programme ahead as apart from the normal Tuesday evening programme, visits to establishments of interest have been arranged.

An amateur station using the call GB3AHD will be in operation on all bands during the Liverpool Show, July 16th to 18th.

Anyone wishing to join the Society will be most welcome, as will any visitors to Liverpool.

Future events:
June 9th, Open discussion on NFD.

### OVERSTONE AMATEUR RADIO SOCIETY

Hon. Sec.: P. Crane, 120, The Drive, Northampton.

AT the Annual General Meeting on April 8th, the following officers were elected: Chairman, A. Hazelwood; Treasurer, M. Bateman; Secretary, P. Crane; and Committee Members, P. Lea, D. Crane and "Bert."

The Club meets every Wednesday evening, and the subscription is 7d. per week. At present, at least half an hour each week is devoted to Morse practice.

The meeting on April 15th was held at the home of Cyril Wileman (G2HDK), where the Club went "on the air." Several very interesting visits have been made to the Northampton Short Wave Radio Club. We are always pleased to see new members—further details are available on application from the Hon. Secretary.

### PORTSMOUTH AND DISTRICT RADIO SOCIETY
(Affiliated R.S.G.B.)

Hon. Sec.: A. C. Cake (G3CNO), 7, Wheatstone Road, Southsea, Hants.

THE Society holds its meetings every Tuesday evening at 7.30 p.m., over "Scarrs (Drapers) Ltd." in Albert Road, Southsea. New members are always very welcome. Morse instruction classes are held before meetings by special arrangement.

National Field Day plans are the main topic at present. At a meeting held recently, a site for operation was agreed upon—an open space off Eastern Road, Portsmouth. All members and friends are cordially invited to be present and we are particularly hoping to see as many former members of the Society as possible.

### SLADE RADIO SOCIETY

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

THE Club Station (G3JBN) at The Church House, High Street, Erdington, Birmingham, 23, is available for the use of members for constructional purposes. Instructional morse classes are held every Wednesday, at 7.45 p.m. Slow morse transmissions are radiated on the air each Tuesday evening from Station G3AYJ on 1.9 Mc/s, at 8 p.m.

Visitors to the Society's meetings, which commence at 7.45 p.m., prompt, and to the Club Station, are cordially welcome. Full particulars of the Society are obtainable from the Hon. Sec.

Forthcoming events:

June 19th.—"The Design of Direction Finding Receivers." A talk by Messrs. G. Nicholson, G3HKC, and C. N. Smart; to be followed by a discussion.

June 28th.—RSGB D/F Contest Preliminary—High Wycombe.

### WORTHING AND DISTRICT AMATEUR RADIO CLUB
(Affiliated R.S.G.B.)

Hon. Sec.: J. R. Tootill, 113, Kings Road, Lancing, Sussex.

THE Club continues to meet regularly at 8 p.m. on the second Monday of each month except August, at the Adult Education Centre, Worthing, which is almost opposite the Police Station in Union Place. There is a varied programme of lectures and talks, and new members are always welcome. The annual "Bucket and Spade Party" is being held on Sunday, June 28th on the raised promenade and, as usual, will be quite informal. All interested in Amateur Radio are cordially invited to come along with their families and friends, and full details can be obtained from the Honorary Secretary.

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## BASIC THEORY FOR THE CONSTRUCTOR

(*Contined from page 380*)

and since its value is 45 ohms, it will dissipate $0.09 \times 45$ W (i.e., $W = I^2R$), or 4.05 W. Thus, it would possibly pay to use a 5 W wire-wound resistor.

A small thermistor could be used in this position. With such a component, bulb failure would simply result in the thermistor increasing in

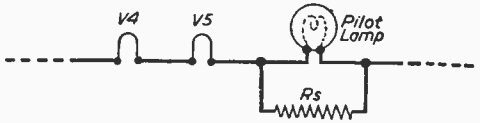



*Fig. 4.—A reduction in bulb voltage can be secured by the shunt resistor Rs.*

temperature and decreasing in resistance, thereby maintaining almost perfect chain balance. With an ordinary resistor, the chain current will be reduced slightly, as already described, when the bulb fails.

### *A Difficulty*

It will now be apparent that substituting in a series chain a valve of which the heater is rated above the chain current is not a simple matter. Indeed, it would hardly be worth the trouble, since the whole of the chain, apart from the substituted valve, would have to be raised in current to suit that of the new valve. This may well mean the replacement of the ballast resistor.

(*To be continued*)

# An Intercom Amplifier

IMPROVE RESULTS FROM SIMPLE HOME TELEPHONE CIRCUITS WITH THIS ONE-TRANSISTOR UNIT

By G. R. Francis

HOME telephone circuits, for amusement or communication between one room and another, usually have no means of amplification incorporated. They are sometimes termed "sound powered" and in the simplest possible form consist of two earphone or similar units, wired together as in Fig. 1. Additions may be present, such as a bell ringing circuit, or a buzzer, and two units may be employed at each end of


*Fig. 1.—Simple intercom circuit.*

the line, one as microphone, and one as receiver. However, it is only with the actual telephone part of the circuit that the amplifier is concerned, not with the bells or buzzers, which can remain unchanged.

### *Volume*

Though workable, an arrangement like that in Fig. 1 suffers from rather poor volume. Words spoken near unit "A" generate a current, operating unit "B." To reverse conversation, "B" is used as a microphone, and "A" as receiver. Losses, and the absence of any amplification make reproduction somewhat weak. This difficulty is increased if two units are used at each end of the line, as microphone and receiver, because the output of one unit is then distributed among the other three.

With magnetic units of this kind, a microphone step-up transformer cannot be used, while a valve amplifier would require H.T. and L.T. batteries, if it were not mains operated. All these difficulties may be overcome by using a transistor amplifier. A single transistor, with a $1\frac{1}{2}$, 3, or $4\frac{1}{2}$V dry battery, will give a worthwhile improvement in volume, so that conversation can be carried on easily, results being more nearly like those from a G.P.O. telephone.

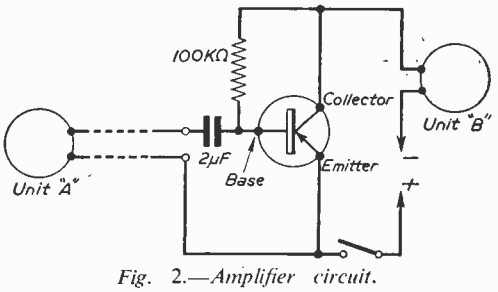



*Fig. 2.—Amplifier circuit.*

Fig. 2 shows a simplified circuit without switching, so that the method of working can be readily understood. Here, it is assumed that unit "A" is acting as microphone. The signal from it is amplified by the transistor, so that unit "B," acting as receiver, works at much increased volume. The 100kΩ (100,000 ohm) resistor is of the small carbon type, as used in radio sets. The coupling condenser may be .5μF to 16μF capacity. About 2μF to 8μF is most satisfactory. It may be a "paper" condenser, bias condenser, smoothing condenser, or miniature transistor coupling condenser, as all give similar results.

### *"Speak" and "Listen" Switch*

To avoid the need for two complete amplifiers, a change-over switch, wired as in Fig. 3, allows either unit to be used as microphone in turn. To simplify switching, the battery has been transferred to the other side of the unit circuit.

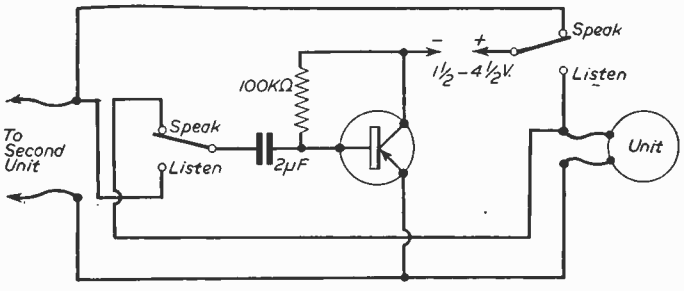
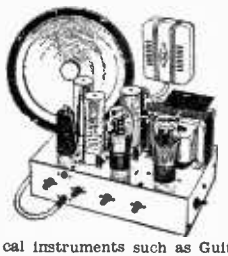



*Fig. 3.—Amplifier circuit with "Speak/Listen" switch.*

When changing from speaking to listening, the switch has to be operated. This resembles the method of working adopted with simple loudspeaker communication systems. The amplifier thus needs to be within reach of one unit, or built into a case in which the unit can be fitted. The switch has an "off" position to put the amplifier out of action.

When the buzzer or bell circuit gives warning, the user turns the switch to "speak" and answers, afterwards turning the switch to "listen." Two units, wired in series, can be used at each end of the line, to avoid the inconvenience occasioned by a single unit. When conversation has ended, the switch is returned to "off." If the person at the amplifier end is making the call, he operates the bell or buzzer push, turns the switch to "listen" and waits until the second person speaks.

(*Continued on page* 417)



## 8-WATT PUSH-PULL AMPLIFIER

**COMPLETE WITH CRYSTAL MIKE AND 8in. LOUDSPEAKER**

A.C. mains 100-250 v. Size 10½in. x 6½in. x 2½in. Incorporating 6 valves, H.F. pen., 2 triodes, 2 output pens and rectifier. For use with all makes and types of pick-up and mike. Negative feed back. Two inputs, mike and gram., and controls for same. Separate controls for Bass and Treble lift. For use with Std. or L.P. records, musical instruments such as Guitars, etc. **£4.19.6** Plus P. & P. 7/6.

Or 35/- deposit Plus P. & P. 7/6, and 3 monthly payments of 25/-.

## 6-WATT PUSH-PULL AMPLIFIER

A.C. Mains 200/250 v., incorporating 4 valves and metal rectifier, 2 inputs, high and low, and controls for same. Separate controls for Bass and Treble lift. Size of chassis 11in. x 4½in. x 2½in.

**59/6** Plus P. & P. 5/-.

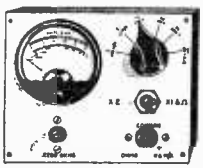
## PORTABLE AMPLIFIER

Size 6½in. long, 5in. high, 2½in. deep. Will suit any type of crystal pick-up. Output approx. 2 watts. Incorporating ECC83 double triode. Cossor 142BT output pentode and contact-cooled rectifier. Fully isolated mains transformer for 230/250 A.C. mains. Base, treble and volume controls.

**49/6** Plus P. & P. 3/6.

**5in. SPEAKER with O.P. TRANSFORMER,** purchased with the above, 18/6, plus P. & P. 1/6.

## AC/DC POCKET MULTI-METER KIT



Comprising 2in. moving coil meter, scale calibrated in AC/DC volts, ohms and milliamps. Voltage range AC/DC 0-50, 0-100, 0-250, 0-500. Milliamps 0-10, 0-100. Ohms range 0-10,000. Front panel, range switch, wire-wound pot (for ohms zero setting), toggle switch, resistor and rectifier. In grey hammer finish case.

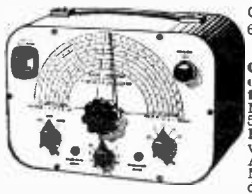
**19/6** Plus P. & P. 1/6 Built and tested 7/6 extra.

Point to point wiring diagram 1/-, free with kit.

## MAINS TRANSFORMERS

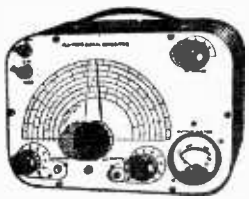
All with tapped primaries. 200-250 volts. 0-160, 180, 200 v., 60 ma., 6.3 v. 2 amps. 10/6. 320-0-320 v. 75 ma., 6.3 v., 2.5 amp., 5 v., 2 amp., 10/6. 350-0-350 v. 250 ma., 6.3 v. 7 amp., 5 v. 2 amp., 19/6. Postage and packing on the above 3/-.

## SIGNAL GENERATORS



Cash £6.19.6 or 25/- deposit and 6 monthly payments of 21.6. Post and Packing 5/- extra.

**Coverage 100 Kc/s-100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics.** Metal case 10in. x 6½in. x 5½in., grey hammer finish. Incorporating three miniature valves and Metal Rectifier. A.C. Mains 200/250 v. Internal Modulation of 400 c.p.s. to a depth of 30% ; Modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch, variable A.F. output. Incorporating magic eye as output indicator. Accuracy plus or minus 2%.

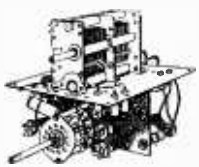


Cash £4.19.6 or 25/- deposit and 4 monthly payments of 21/6. Plus Postage and Packing, 5/-.

Coverage 120 Kc/s-84 Mc/s. Metal case 10in. x 6½in. x 4½in. Size of scale, 6½in. x 3½in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30%, modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch variable A.F. output and moving coil output meter. Grey hammer finished case and white panel. Accuracy plus or minus 2%.

## 4-WAVE BAND COIL UNIT

Complete with tuning condenser. Separate sections for Short Wave. Coverage 10-21 m. 21-45 m., 44-100 m, and 190-545 m. I.F. 470 Kc. BRAND NEW, by famous manufacturer. Completely assembled on sub-chassis. With circuit diagram.



**19/6** Plus P. & P. 3/6.

## B.S.R. MONARCH UA8

4-speed, plays 10 records 12in., 10in. or 7in. at 33, 45 or 78 r.p.m. Intermixes 7in., 10in. and 12in. records of the same speed. Has manual play position ; colour brown. Dimensions: 12½in. x 10½in. Space required above baseboard 4½in., below baseboard 2½in. Fitted with Full-Fi turnover crystal head.

**£6.19.6** Plus 5/- Postage & Packing.

## F.M. TUNER UNIT

Permeability tuned, by famous German Manufacturer. Coverage 88—100 Kc/s. Complete with ECC85. Size 4" × 2" × 2".

**25/-** Plus P. & P. 1 6.

## IMITATION LOG FIRE EFFECT

Size 14 inches × 11 inches

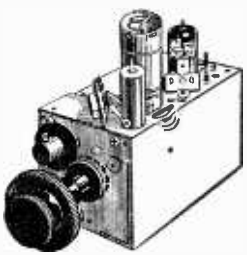
**19/6** Plus P. & P. 2.6.

## 13 CHANNEL TUNER

34 to 38 Mc s. complete with PCF80 and PCC84. These have been removed from chassis.

**23/-** Complete with knobs. P. & P. 3/6 extra.

as above, 16-19 Mc/s' complete with knobs less valves. 13/- Plus P. & P. 2.6.



## CONSTRUCTORS' PORTABLE PARCEL

Comprising case, chassis, top plate, scale, 5in. P.M. speaker with O.P. trans., twin gang, 2 470 Kc/s. I.F.s, trimmers, four valve holders, wave-change switch and volume control with switch.

**39/6** Plus 3/6 Postage & Packing.

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

**23 HIGH STREET, ACTON, LONDON, W.3.**

All enquiries S.A.E. Goods not dispatched outside U.K.

It should be noted that the amplifier works best with units of reasonably high impedance, and many balanced armature and-diaphragm type earpieces are of this kind. Low impedance units, such as ex-service moving-coil phones, or low impedance balanced armature units, will prevent the transistor amplifier operating properly, unless a matching or coupling transformer is added to the circuit of each unit.

### *Wiring Details*

The parts may be assembled on a small insulated panel, as in Fig. 4. With the inexpensive "Red Spot" type of transistor, the red spot indicates the collector, marked "C" in Fig. 4. Here, "B" indicates base, and "E" is the emitter connection. If another type of transistor is used, the maker's connecting data must be followed, because there is no standard method of showing leads, and wrong connections can easily damage the transistor. Any small low-frequency or audio-frequency type of transistor is satisfactory.

A 1½V dry cell is shown, but a 3V or 4½V battery can be used if the extra volume is wanted. The battery *must* be wired in in the correct polarity, negative (or zinc case) going to the collector. Reversing the battery may destroy the transistor.

A small rotary switch is suitable for change-over. With this type of switch, one position is used as "off" so that a two-pole, three-way switch is required. If a two-pole, two-way switch without off position is to hand, it can be used if an on/off switch is added in series with one battery lead. In the circuit diagram (Fig. 3) the switch is shown, for simplicity, as a two-pole two-way.

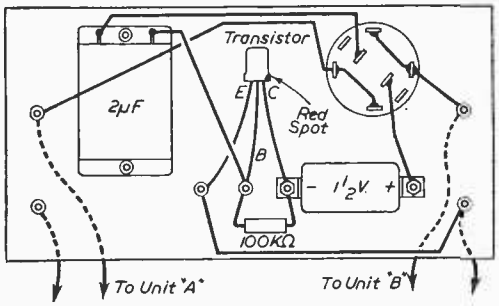



*Fig. 4.—Wiring diagram.*

However, in the wiring diagram (Fig. 4) a two-pole, three-way switch is shown, in which the position between "speak" and "listen" is used as the "off" position.

### *Condensers*

Paper condensers can be wired in either way, but electrolytic or polarised condensers will have positive and negative markings. The *positive* tag or lead must then go to the switch, with the *negative* tag or lead to the base of the transistor.

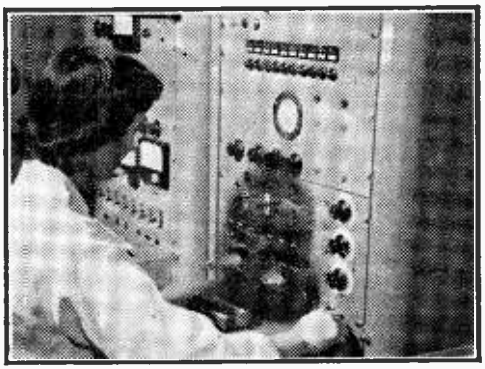
The transistor leads can be taken to small bolts, which serve as junction points for other wiring. Four small terminals provide connections for the two sets of units. At the amplifier end, two or three feet of twin flex will be sufficient. For the second unit, or combined microphone and receiver, a long line of thin twin flex will be required. This will already be present if a circuit such as that in Fig. 1 has been used.

# MULLARD SOUTHAMPTON WORKS

WORK on the second stage of the central Mullard semiconductor plant at Southampton has now been completed. The new section adds approximately 50,000 square feet of floor space to the plant's manufacturing capacity, and is already in production.

### *Silicon Transistors*

Much of the space arising from the new section is given over to the large-scale production of silicon transistors and diodes. The demand for silicon devices, which can operate at much higher temperatures than their germanium counterparts, is growing rapidly for industrial and military purposes, and an increasing amount of the plant's resources is being devoted to manufacturing them. It is expected that by 1960 silicon devices will account for a significant proportion of the total output.



*Final testing of germanium audio frequency transistors using semi-automatic equipment.*

### *Future Development*

The next stage in the development of the Southampton plant is the construction of a 30,000 square foot administration wing, scheduled for completion early in 1960. This will release for manufacturing purposes a further area of factory floor space now being used for offices. Following this a further large section is to be added to the main factory building.

When completed, the Southampton plant will employ between 2,000 and 2,500 people. Its payroll at present numbers 1,000, of whom no fewer than 70 are graduate scientists and engineers working in the plant's research and development laboratories. The total number employed on transistor production throughout the Mullard organisation is at present 1,500.

# The "Gramdeck" Tape-Recorder

## A TAPE TRANSPORT MECHANISM WHICH CAN BE DRIVEN FROM AN ORDINARY GRAMOPHONE TURNTABLE

THE "Gramdeck" is a cleverly designed unit for converting a gramophone into a tape-recorder. It consists of a diamond-shaped base plate in the centre of which is the tape drive capstan. A 5in. diameter plate is attached to the underside of the capstan and supports the whole unit on the turntable, as can be seen in the illustration. A slot is cut in one corner of the base plate and engages with a metal pillar fixed to the motor board, thus preventing rotation with the turntable. The unit is otherwise completely free to move, allowing for a turntable or drive plate which is out of true, thereby removing the possibility of wow.

### *Operation*

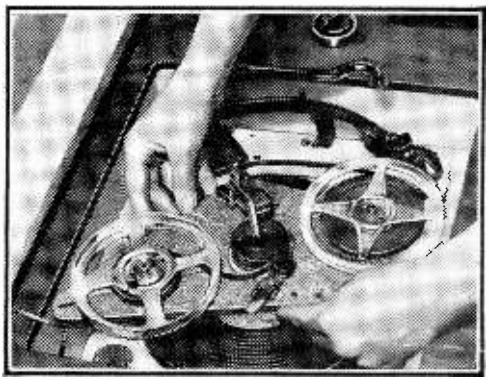
The spindle of the take-up spool is driven by a plastic belt from the capstan and the slipping drive required is provided by friction between the spool, a felt washer and the rotating spindle. For rewinding, friction is increased by a weight, supplied with the unit.

In use, the tape passes from the feed spool over either of two guides, one of which contains a permanent magnet for erasing, to a tape head which records on half the tape width with the standard track sense. It then passes into a groove in the capstan and is held in place by a spring loaded roller. This roller locks in the open position by means of a catch with a push-button release.

### *Pre-amplifier*

The head is of the high-impedance type and the output can be fed to a suitable audio amplifier or to the pre-amplifier supplied in the "Gramdeck" equipment. This amplifier, battery-powered, and measuring approximately 7¼in. × 4¾in. × 3¾in., uses two transistors, one as the playback or microphone amplifier and one as a 40kc/s recording bias oscillator. The battery used has an operating life of between 600 and 800 hours, and the output from the unit is about 250mV peak.

The frequency response is good, even at the slower gramophone speeds; at 78 rev./min. the tape speed is the standard 7½in./s., but at other gramophone speeds the tape speed is not standard. No wow, other than that already present in the gramophone unit, was detected during our tests. The unit performs very well, providing care is taken to set it up correctly. The threading of the tape can be a tricky operation, but becomes easier with practice.



*The "Gramdeck."*

The "Gramdeck" itself costs £7 10s. and the transistorised control unit £5 12s. 6d. Further details can be obtained from the suppliers, Messrs. Andrew Merryfield, Ltd., "Gramdeck," 29, Wright's Lane, Kensington, London, W.8.

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## SHORT WAVE SECTION

(*Continued from page 389*)

appreciable load on the I.F. transformer feeding it. A diode detector would reduce the selectivity obtainable because it would load the last transformer of the unit (T2). Capacitors C16 and C18 by-pass the I.F. signals but not the audio signals. The I.F. used is not very much above the highest audio frequencies and its complete removal is not easy. A small coupling condenser, C17, is used to introduce bass cut.

### *Alignment*

The alignment of the unit is relatively simple. C1 should be connected to the receiver from which the signals are taken and, with V1 working, the last intermediate frequency transformer of the receiver supplying the signals to the unit should be re-trimmed, as the extra capacitance of C1 will have thrown it slightly off tune. Resistor R9 should be set for minimum resistance, i.e., maximum gain, and the value of either L1 or C8 should be altered until a signal is received at the output of V3 which should be connected to an audio amplifier. The audio amplifier of the receiver could be utilised if the signal is fed back from the second I.F. amplifier into the receiver. If no signal can be obtained, another condenser either slightly higher or slightly lower in value should be substituted for C8 until one is obtained. The cores of T1 and T2 should then all be set for maximum signal strength. This can be done much more accurately if a 0-1mA meter is placed in the anode lead of V3 and the cores of the two transformers are adjusted for maximum reading on this meter. A fairly strong signal is required to give a meter reading, but the meter reading then increases rapidly with increasing signal strength. The unit is then fully aligned.

# TUBES

**FACTORY REVACUUMED. ALL GUARANTEED 6 MONTHS. Carriage and insurance 12/6. Enquiries welcomed for any types not listed.** Due to the high quality of our tubes and low number of returns, we are able to maintain the following unusually low prices.

6501, 8504, 6505, CRM91, CRM92, MW22-7, MW22-14, MW22-14C, **£2/15/-**
MW22-17, MW22-18.

C12FM, CRM121, CRM121A, CRM122, MW31-7, MW31-14C, MW31-17 **£3/5/-**
MW31-18, T12/54.

3/16, 3/31, 14KP4, 14KP4A, 108K, 121K, 141K, 7201A, 7302A, 7203A, AW36-21, C14FM, CRM141, CRM143, MW31-16, MW31-74. **£3/15/-**
ME36-24, MW36-44, T12-549.

17ARP4, 17ASP4, 6706A, C17FM, CRM171, CRM172, MW43-43, **£4/10/-**
MW43-64, 7401A.

3/6A, 4/15, 6901A, C14BM, C17BM, CRM151, CRM152A, CRM152B, CRM153, MW41-1, MW43-80, TA15. **£5/5/-**
TR14-2, MW43-69.

C21HM, C21NM, CRM211, CRM212, **£6/15/-**
MW53-20, MW153-80.

# REGUNNED TV TUBES

ALL GUARANTEED 12 MONTHS. Excellent workmanship. Carr. & ins. 12/6.

MW31/16, MW31/74, 121K, 12KP4. **£5/10/-**

MW36-24, AW36-21, 141K, 14KP4, CRM141, CRM142. **£5/15/-**

CRM152A, CRM152B, CRM153, CRM171, MW43/64, 171K, 17ASP4. **£6/15/-**

171K, 17ASP4, MW53-20, MW53-80, CRM211, CRM212. **£9/10/-**

# NEW TV TUBES

Subject to Manufacturers Guarantee. Carriage and insurance 12/6 extra.

All standard types available including Cossor, G.E.C., Emitron, Emiscope, e.g.

MW6-2, £6.

MW31-74, AW36-21, AW36-80, MW36-24, MW36-44. **£10/10/-**

C14FM, C14BM, £11.15.

AW43-80 MW43-64, MW43-69, MW43-80. **£12/-/-**

MW41-1, CRM141, CRM142, £12.15.0.

CRM121, CRM123, £13.0.0.

CRM171, CRM172, CRM173, C17BM, C17FM. **£13/10/-**

CRM153, £15.15.0, CRM152B, £16.15.0.

AW53-80, MW53-20, MW53-80, £18.0.0.

# SPECIAL OFFERS

**4-SPEED RECORD PLAYERS.** Latest B.S.R. TU9 Turntable, together with lightweight Staar Galaxy dual sapphire crystal turnover pick-up head. Truly amazing value at Carr. 3/-. **£3/10/-**

# TV SETS

**5-CHANNEL T.V.s.** Modern. Table 12in., tested pictures before dispatch, all good tubes, tunable all B.B.C. stations, all top makes. Carr., etc., 12/6. **£6/15/-**

Complete but Ditto untested. **£4/10/-**

Ditto Single Channel. Complete but untested. Mainly Channel 1. **£3/10/-**

**14in. T.V.s.** 5-channel. Absolutely complete as above. Special Offer. Carr., etc., 12/6. **£9/15/-**

**13-CHANNEL T.V.s.** 12in. 5-channel B.B.C. T.V. with separate mains-driven Band III converter (new, listed £7). Carr., etc., 12/6. **£9/10/-**

**14in. T.V.s.** 13-channel. As above. Absolutely complete. Special Offer. Carr., 12/6. **£12/10/-**

**T.V. CHASSIS.** Complete with line trans., etc., focus magnet, R.F. strips, etc., etc. In Table Cabinets requiring only valves, tube and speaker to complete. Most makes. Carr. Free. **29/-**

**T.V. CHASSIS.** As above. But 5-channel. Carr. Free. **45/-**

**GUARANTEED P.M. SPEAKERS.** Standard 3 ohms, ex-equipment, tested top makes performance guaranteed.

6½in. **7/6** 5in. **12/-** 10in. **14/-**
8in. 7X4 10X6

**B.S.R. 4-SPEED AUTOCHANGER PORTABLE RECORD PLAYERS.** Consisting of type UA8 autochanger, 2.2 watt amplifier, speaker, assembled in a two-tone rexine case. Truly amazing value. (Listed over £20). Carr. 6/-. **£13/13/-**

# RECORD PLAYERS

| | | |
|---|---|---|
| COLLARO 4-speed RCC554 ... | ... | £6.19.0 |
| GARRARD 4-speed 4SP ... | ... | £7. 7.6 |
| GARRARD 4-speed TA MKII | ... | £8.19.0 |

**10 RECORD AUTOCHANGERS**

| | | |
|---|---|---|
| COLLARO CONQUEST 4-spd. | ... | £8.17.6 |
| B.S.R. UA8 Latest 4-spd ... | ... | £6.15.0 |
| GARRARD RC75A Senior ... | ... | £7.19.0 |
| GARRARD BC80M A.C./D.C. | ... | £10.19.0 |
| GARRARD RC88/4 ... ... | ... | £12.15.0 |
| GARRARD RC120D MKII | ... | £9. 7.6 |
| GARRARD RC121/4 MKII | ... | £9.19.0 |

Carr. and pack., 4/-.

# I WATT TRANSISTOR

**4 TRANSISTOR AMPLIFIERS, 1 WATT.** From a single 6 v. all-dry battery. Latest GET15 Power Transistors. In PUSH-PULL. Two Transistor High Gain pre-amplifier stages. Output transformer (3 ohms), **£4.10.0.** Post 2/6.

**FREE TRANSFORMERS**

To the purchaser of each manufacturer matched pair of GET15 Power 1 watt Power Transistors, price **50/-**, we give free of charge the correct Push Pull **INPUT AND OUTPUT TRANSFORMERS** of High Grade construction and a complete 4 Transistor Amplifier circuit. Will transform your existing receiver or amplifier into a truly "Mains Volume" outfit.

**TRANSISTORS AND DIODES**

**RED SPOT.** Transistors for I.F., L.F. and Output up to 800 kc/s, **6/6. WHITE SPOT.** R.F. and I.F. 2.5 Mc/s., **9/9; XA103, 15/-; XA104, 17/6; XB104, 10/-. GET15, 25/-. GERMANIUM DIODES.** General purpose famous make. **9d., 8/- doz. DIODES.** Equivalent to GEX44. **3/9. RECTIFIERS, SPECIAL OFFER.** Fully guaranteed ex-equipment. RM4, **9/6**; 14A/86, **9/6**; 14RA 1-2-8-2, **9/6**; 14RA 1-2-8-3, **9,6.**

**H.T. RECTIFIERS**

280LU679A (240 v. 80 mA), **5/-**; RM1, **6/-**; RM2, **6/6**; RM3, **9/-**; RM4 (ERA), **15/6**; RM5 (ERA), **21/-**; 14A86, **17/-**; 14A97, **22/-**; 14A100, **25/-**; 16RC1-1-16-1, **7/6**; 18RA 1-1-16-1, **7/9**; 14RA 1-2-8-2, **18/-**; 18RD 2-2-81-, **14/-**; 14RA 1-2-8-3, **22/-.**

**CHARGING EQUIPMENT**

**RECTIFIERS.** Iron selenium full wave. 12 v. 1 amp., **5/-**; 12 v. 2 amp., **8/-**; 12 v. 3½-4 amp., **9/6. TRANSFORMERS.** (Primary 0-210 v.-240 Secondary 0-3.5 v. -9 v.-17 v.) for charging 2 v., 6 v. or 12 v. batteries. 1 amp. size, **9/9**, 1/- post. 2 amp. size, **14/6**, 1/6 post. 4 amp. size, **19/-**, 1/9 post.

# 100 CONDENSERS 10/-

Due to huge purchase we can offer a wide well balanced range of mainly the latest miniature Ceramic and Silver Mica Condensers from 3 pF to 10,000 pF. LIST VALUE OVER £5. A must for your spares box. Only **10/-.**

# VALVES 7/-

**SPECIAL OFFERS ALL GUARANTEED 3 MONTHS**

EY51 Short ends, **7/-.**
U25 Short ends, **7/-.**
P181 Soiled, **7/-.**

## NEW TV TUBES

MULLARD FRUSTRATED EXPORT ORDER GUARANTEED 12 MONTHS. CARRIAGE 12/6.

MW31/74, MW36/24, MW34/44, AW36/21, AW36/80 **£8/15/9**

AW43/80, MW43/64, MW43/69, MW43/80 **£9/15/0**

# VALVES

**GUARANTEED 3 MONTHS. 24 HOUR SERVICE FREE TRANSIT INSURANCE.** All valves are new or of fully guaranteed ex-Government or ex-equipment origin. Satisfaction or Money Back Guarantee on goods if returned unused within 14 days.

**10% DISCOUNT SPECIAL OFFER TO PURCHASERS of any SIX VALVES marked in black type (15% in dozens).** Post: 1 valve, 6d.; 2-11, 1/-.

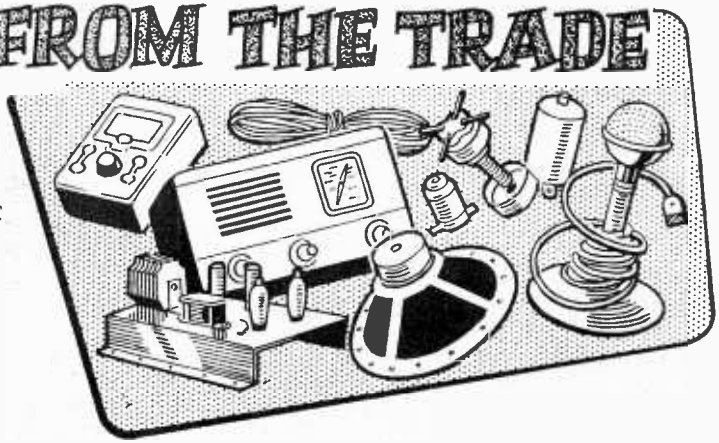
| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A3 | 2/6 | 5Y3GT | 8/6 | 6BX6 | 5/6 | 6J6 | 2/6 | 6SH7 | 5/- | 12Q7GT | 6/6 | 2050 | 3/6 | EBC91 | 9/- | EF86 | 14/6 | KTW61 | 6/6 | 8P4B | 9/- | UCH81 | 10/6 |
| 1A7 | 14/6 | 5Z4G | 9/6 | 6C4 | 3/6 | 6J7G | 5/- | 6SJ7 | 7/- | 12SJ7 | 7/- | 5763 | 8/6 | EBF80 | 9/- | EF89 | 9/6 | KTZ63 | 5/6 | SP41 | 3/- | UCL82 | 14/6 |
| 1C5GT | 11/6 | 5Z4GT | 11/6 | 6C5GT | 5/6 | 6J7M | 9/6 | 6SK7 | 7/- | 19AQ5 | 9/6 | AZ31 | 9/- | EBF89 | 9/- | EF89 | 9/6 | L63 | 3/- | SP61 | 3/- | UCL83 | 15/- |
| 1C6 | 6/- | 5A8G | 8/- | 6C6 | 4/6 | 6K6GT | 7/6 | 6SL7GT | 7/- | 20D1 | 9/6 | B36 | 9/6 | EBL31 | 23/3 | EF91 | 4/- | LN152 | 9/6 | SU2150A | 4/6 | UF41 | 9/- |
| 1D5 | 15/- | 6AB8 | 9/6 | 6C9 | 9/6 | 6K7G | 2/3 | 6SN7GT | 5/6 | 20P2 | 9/6 | CBL31 | 24/4 | EBL81 | 11/- | EF92 | 5/- | LZ319 | 9/- | T41 | 7/6 | UF42 | 9/- |
| 1H5GT | 10/6 | 6AC7 | 5/- | 6C10 | 9/6 | 6K7GT | 5/6 | 10F1 | 9/6 | 35Z4GT | 6/- | CCH35 | 8/6 | EC52 | 4/- | EF95 | 5/- | MG14 | 8/6 | TH30C | 12/6 | UF80 | 10/- |
| 1L4 | 3/9 | 6AG7 | 5/- | 6CH6 | 11/- | 6K8G | 7/- | 10F9 | 10/6 | 35Z5GT | 8/6 | DL96 | 9/6 | EC91 | 4/6 | EL32 | 4/- | N37 | 9/6 | U18 | 9/- | UF85 | 10/- |
| 1N5GT | 10/6 | 6AJ7 | 5/- | 6D2 | 4/6 | 6K8GT | 10/6 | 10L D11 | 12/6 | 42 | 7/6 | DL35 | 11/6 | ECC32 | 9/- | EL33 | 9/6 | N78 | 11/ | U22 | 6/6 | UF86 | 16/- |
| 1R5 | 7/6 | 6AK5 | 5/- | 6D3 | 6/6 | 6K25 | 9/- | 10P13 | 14/- | 50C5 | 10/6 | DL92 | 7/6 | EF36 | 4/- | EL34 | 9/6 | N108 | 9/6 | U24 | 7/6 | UF89 | 10/- |
| 1S5 | 6/6 | 6AL5 | 4/6 | 6D6 | 5/- | 6L1 | 13/6 | 10P14 | 12/- | 50L6GT | 9/6 | DL94 | 8/6 | EF37 | 7/- | EL41 | 9/6 | P41 | 4/6 | U25 | 13/6 | UL41 | 9/6 |
| 1T4 | 5/6 | 6AM6 | 4/- | 6F1 | 9/6 | 6L6G | 8/- | 12AT6 | 9/- | 53KU | 11/- | DL96 | 9/6 | EF39 | 5/- | GZ32 | 9/6 | P61 | 2/6 | U26 | 13/6 | UL44 | 13/- |
| 2A7 | 8/6 | 6AT6 | 7/6 | 6F6G | 7/- | 6L7 | 9/6 | 12AT7 | 7/- | 54KU | 11/- | EA50 | 9d. | EF40 | 14/- | GZ34 | 12/6 | PC84 | 8/6 | U31 | 8/- | UL46 | 9/6 |
| 2D21 | 4/6 | 6B6G | 4/- | 6F12 | 4/- | 6L19 | 11/6 | 12AU7 | 7/- | 61BT | 9/6 | EABC80 | 9/- | EF41 | 9/- | HL41DD | 9/6 | PL83 | 9/6 | U41 | 8/6 | UL84 | 10/6 |
| 3Q5GT | 9/- | 6BA6 | 6/- | 6F13 | 9/6 | 6LD20 | 9/6 | 12AX7 | 8/- | 615PT | 11/- | EAC91 | 6/6 | EF50 | | HVR2 | 6/6 | PX25 | 8/- | UBC41 | 6/- | UL84 | 10/6 |
| 3S4 | 7/6 | 6BE6 | 6/- | 6F14 | 9/6 | 6P25 | 9/6 | 12BA6 | 8/6 | 80 | 7/6 | EAF42 | 9/- | -Brit. | 1/6 | KT33C | 6/6 | PY31 | 8/6 | UBC81 | 12/- | Y63 | 6/- |
| 3V4 | 8/6 | 6BG6G | 9/6 | 6P15 | 9/6 | 6P28 | 11/- | 12BE6 | 9/- | 83 | 7/6 | EB34 | 1/6 | Red | 2/- | KT36 | 9/6 | PY32 | 16/- | UBF80 | 8/- | Z63 | 5/- |
| 4D1 | 2/6 | 6BJ6 | 7/- | 6F33 | 6/6 | 6P28 | 11/- | 12BH7 | 9/6 | 90AV | 4/6 | EB41 | 7/6 | U.S.A. | 2/6 | KT44 | 9/6 | PY80 | 8/- | UBF89 | 9/6 | Z66 | 9/6 |
| 5R4GT | 11/- | 6BH6 | 8/- | 6H6M | 2/6 | 6Q7G | 8/6 | 12J5GT | 4/- | 185BT | 16/- | EB91 | 4/6 | EF42 | 9/6 | KT45 | 9/6 | PY81 | 8/6 | UCC85 | 10/- | Z77 | 4/- |
| 5U4G | 7/- | 6BR7 | 11/- | 6J5 | 5/- | 6Q7GT | 10/6 | 12K7GT | 6/6 | 807E | 5/- | EBC3 | 9/- | EF54 | 3/6 | KT61 | 9/6 | PY82 | 8/6 | UCF80 | 9/6 | Z152 | 5/6 |
| 5V4G | 9/6 | 6BW6 | 8/6 | 6J5G | 3/- | 6SA7 | 7/- | 12K8GT | | 808 | 15/- | EBC33 | 6/- | EF80 | 5/6 | KT66 | 12/6 | PY83 | 9/- | UCF81 | 9/- | Z719 | 6/6 |
| 5Y3G | 6/6 | 6BW7 | 8/- | 6J5GT | 4/- | 6SG7 | 5/9 | | 13/6 | 813 | 45/- | EBC41 | 9/- | EF85 | 7/- | KT81 | 8/- | PZ30 | 9/6 | UCH42 | 9/- | ZD152 | 9/- |

Post: 2 lbs. 1/6, 4 lbs. 2/-, 7 lbs. 2/9, 15 lbs. 3/6. No C.O.D. Callers always welcomed. (E. C. Weds.)
LIST OF 1,000 ITEMS 6d. ALL ITEMS LESS 5% AND POST FREE IN DOZENS.

**TECHNICAL TRADING CO.** (Dept. W), P.O., BOX 21, 350-352, FRATTON ROAD, PORTSMOUTH.

# NEWS FROM THE TRADE

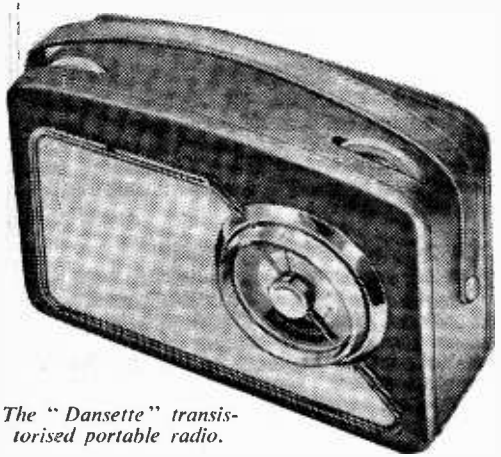
LATEST DEVELOPMENTS IN RECEIVERS AND COMPONENTS



## TRANSISTOR PORTABLE

A PORTABLE transistorised radio has been added to the "Dansette" range of J. and A. Margolin, 112-116, Old Street, London, E.C.1. The receiver has a socket for a car aerial. The case is covered with hard-wearing plastic and there is a choice of colours: off-white, red or pastel green.

The overall size is 8¼in. × 5¼in. × 3in. and the set weighs 3lb. 4oz. including the battery which has a life of some 130 hours. The retail price is 19 guineas, including purchase tax.



*The "Dansette" transistorised portable radio.*

## NEW POWER AMPLIFIER

DYNATRON RADIO'S new audio amplifier type LF20 provides 20 watts of audio output power with negligible distortion. In physical construction, the equipment is robust and engineered to a high standard. The chassis contains a power supply for the pre-amplifier (normally the TC20) and radio feeder completely separate from the main power pack to ensure amplifier stability.

The circuit consists of a low-noise pentode directly coupled to two high-gain triodes, functioning as a cathode-coupled phase inverter stage which drives the push-pull output valves operating in an ultra-linear circuit.

The preamplifier for use with the LF20 is the Controller Mixer Unit TC20. This unit is a low-noise high-gain pre-amplifier with mixing circuits for four channels and a comprehensive control system. Various inputs are provided for all types of pick-up, radio tuner units, tape recorders and microphones. Details from Dynatron Radio Ltd., Maidenhead, Berks.

## PRICE REDUCTION

WESTINGHOUSE BRAKE AND SIGNAL COMPANY LTD. have recently announced readjustments in the prices of their range of germanium power rectifier units resulting in reductions of up to 33 per cent. on some types. These reductions are made possible by improvements in manufacturing technique and increased production capacity.

Simultaneously with the introduction of the revised prices a new publication (Technical Publication 601) has been issued, in which are contained full details of the existing range of germanium rectifier units.

## TAPE HEAD DEMAGNETISER

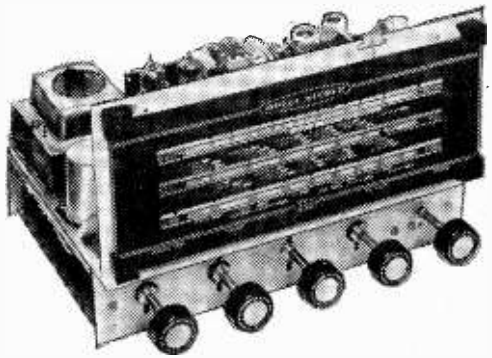
RESIDUAL magnetism in tape recorder heads can cause unwanted hiss and background noise, degrading both recording and playback. This can be avoided by periodically demagnetising the heads. Cinesmith Products, Britannic Works, Regent Street, Barnsley, has produced the "Cinesmith Depolariser" for this operation. The device is housed in a plastic moulding with press switch at one end and operative pole pieces at the other. The "toe" of the pole piece is designed

*Dynatron power amplifier LF20.*

so that the recorder heads can be reached easily without any dismantling. The price is 34s. from dealers or post free from the manufacturers.

## STEREO CHASSIS

A CHASSIS which is suitable for converting older types of radiogram to give reproduction of stereo records has been marketed recently When switched to radio, the output is 8 watts and



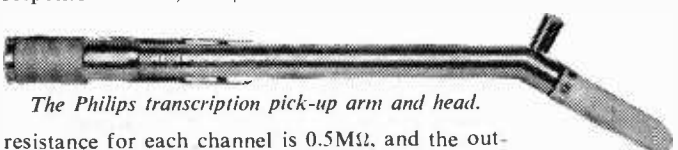
*The Dulci stereogram chassis.*

in the 'gram position, 4 watts per channel. This chassis, known as the H3S Stereogram, is £27 16s. 6d., including tax. Descriptive literature is available from the manufacturers, Dulci Co., Ltd., 97-99, Villiers Road, London, N.W.2.

## PICKUP ARM AND HEAD

PHILIPS ELECTRICAL LTD., Shaftesbury Avenue, London, W.C.2, have introduced a Transcription pickup arm (Type NG.5400/S) fitted with a head (Type AG.3060) which is designed for reproduction of stereophonic as well as monophonic long playing records. Arm and head complete sell as £15 15s.

The arm is professional in appearance, with a durable satin chrome finish. It is equipped with a playing weight adjustment and the arm pedestal and rest are adjustable in height. The crystal pickup head has a diamond stylus and a frequency response of 30-12,000 c/s. The recommended load



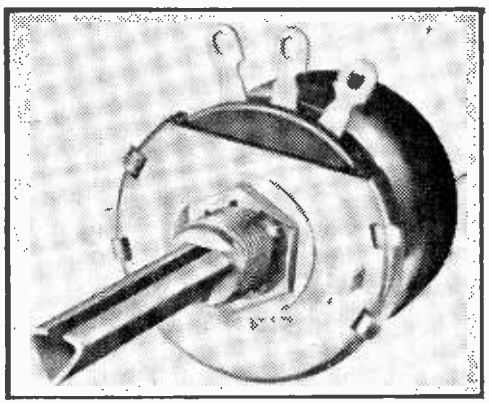
*The Philips transcription pick-up arm and head.*

resistance for each channel is 0.5MΩ, and the output is approximately 0.5V for each channel. The suggested playing weight is 4-6 grams.

## HOLLOW SPINDLE POTENTIOMETER

A NEW approach to spindle-controlled variable components by The Plessey Company Limited, Ilford, Essex, has resulted in the production of a triangular-spindled potentiometer in which the spindle is formed from flat brass strip.

The design of the spindle is such that the need for machining special flats and knob fixings, etc., has been obviated, all locations and fixings being achieved by bending or forming the hollow brass spindle to accommodate a polystyrene ring which, in turn. holds the brush gear. The limit stop and switch operating lug are also incorporated in the polystyrene ring.



*The Plessey triangular-spindled potentiometer.*

## CHANGE OF ADDRESS

MESSRS. WILSON, 48, Cathay, Bristol, 1, inform us that they are moving to more suitable premises at 213, Stapleton Road, Bristol, 5 (Tel.: 57819 and 51850). By moving to this new address they hope to give a full retail and mail order service.

## LEARNING ABOUT RADIO

A NEW postal teaching service has been started under the name of "Radiostructor" by Educational Technical Developments Ltd. At present there are five courses ranging from one suitable for the beginner to one for the more advanced student. Every main fact is shown in a picture-strip technique and none of the courses is mathematical.

With each course, parts are supplied for the building of at least one piece of high grade equipment and this provides a valuable means of practical instruction. Emphasis is also placed on the use of measuring instruments. Although no previous knowledge or experience is required, any student who possesses such knowledge will find that the material makes an interesting way of revising old facts and, perhaps, of learning new ones. Full details can be obtained from "Radiostructor," 46, Market Place, Reading, Berks.

## STABILISED POWER SUPPLY UNIT

THE "Advance" stabilised power supply Type L.101 is a special-purpose instrument providing a constant voltage source of 600 volts positive and two stabilised 150 volts negative D.C. supplies. one of which is a variable line having a high impedance source. Two stabilised 6.3 volts A.C. heater supplies are also provided. Further details can be obtained on application to the manufacturers, Advance Components Ltd., Roebuck Road, Hainault, Ilford, Essex.

# ...and NOW

## THE TOURIST PORTABLE

*4 valve, 2 waveband (Med. and L.W.) Lightweight Battery Radio. Wt. 3½ lbs., incl. Battery.*

Complete Receiver Component Kit ... 57/6 P. & P. 1/6
Set 4 miniature valves (96 series) ... ... 35/- P. & P. 9d.
Sin. Speaker & O/put. Trans. ... ... ... 21/- P. & P. 1/6
Cabinet, Dial & Knobs, etc. ... ... ... 22/6 P. & P. 2/-

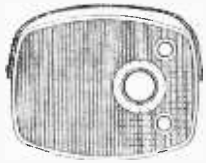
*Parts List and Instruction Booklet, 1/6. (Free with Kit.)*

***Latest circuitry, delayed AVC & A.F. Neg. feedback.***

Sensitive Ferrite Rod Internal Aerial. Contemporary style l'weight Cabinet. Operates from B114 Battery, 69 v. + 1½ v. (8/- extra)

MAINS UNIT KIT Available shortly Only 45/-.

*Size only 8in. x 5¼in. x 4in.*



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|---|---|---|---|
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| 6.3V. | .6A ,, | 12/6 | ,, |
| 10.5V | .3A ,, | 12/6 | ,, |
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| 7Y4 | 8/6 | ECL80 | 12/6 | PC84 | 10/6 |
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| | | | | | |
| PCF82 | 10/6 | | | | |
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| PL81 | 14/6 | | | | |
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**and many others too numerous to mention.**

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***AUTOCHANGERS*** 4-speed **BSR** (UA8), **£6.19.6**; 4-speed **COLLARO**, **£7.19.6**; **GARRARD** (RC121/D Mk. II) Plug-in head, stereo adapted, **10 gns. BSR** UA12 latest Stereo and Monaural model, **10 gns.** Carr. and ins. 4/6. All above units are latest 4-speed models, fitted lightweight crystal pick-up and twin sapphire stylii. Complete and ready to use.

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VALVES: Types PCC84, PCF80, ECC84, ECF80. Per pair, new, boxed, Mullard or Brimar, **£1 post free.**

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| 600 mV | 60 V | 12 mA | 60 mA |
| 1.2 V | 120 V | 60 mA | 120 mA |
| 6 V | 240 V | 120 mA | 600 mA |
| 12 V | 480 V | 600 mA | 1.2 A |
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| 120 V | 1,200 V | 6 A | 12 A |
| 240 V | | 12 A | |
| 480 V | | | Resistance |
| 600 V | | | 1,000 Ohms |
| 1,200 V | | | 10,000 Ohms |
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## AMPLIFIER N24

Manufactured for the Admiralty in 1952 by Burndept, this utilises 4 valves, 1 each 5Z4G - 6V6G - 6J6G - 6J5G, and high quality components such as "C" Core-Transformers and Block Paper Smoothing Condensers. Has A.C. Mains Pack for nominal 110/230 volts. Provision for 600 ohms or High Impedance Input, and has Output to 600 ohms Line. For normal use only requires changing Output Transformer. Can be used for speech or Music, giving High Quality Reproduction. Output approximately 4 watts. Enclosed in metal case, and designed for Standard 19in. Rack Mounting, having grey front panel, size 19in x 7in. with Chromium Handles. All connections to rear panel, front having "On/Off" Switch. Gain Control, Indicator Light, Fuses and Valve Inspection Panel. BRAND NEW IN MAKER'S PACKING. ONLY **£4/9/6** (carriage 10/6).
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**12 VOLTS AMERICAN DYNAMOTOR.** Delivers 220 volts at 100 mills. Ideal for running Car Radio or Electric Shaver, etc., from Car Battery. ONLY **32/6.**
**6 v. VIBRATOR PACKS.** Output approx. 130 v. at 30 mA., fully filtered and smoothed. Complete. BRAND NEW. ONLY **12/6.**
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**SPRAGUE CONDENSERS.** Metal cased, wire ends. New .01 mfd. 1,000 volt, and .1 mfd. 500 volt, **7/6** per dozen. Special quotes for quantities.

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# ZENER DIODES

## EXAMPLES OF THE USE OF THESE DEVICES IN VOLTAGE STABILISATION

By E. G. Bulley

THESE units belong to the semi-conductor category and can be classified as silicon diodes. When the zener diode is wired into D.C. circuitry, it is connected with reverse polarity.

The conventional silicon diode has a high reverse resistance together with a low forward resistance, but in the zener diode, this reverse resistance is broken down at what is known as the zener voltage. This voltage is the reverse voltage specified by the manufacturer.

### *Voltage Stabilising*

In such diodes, however. the reverse voltage is related to the reverse current, and this current value is more or less zero for all values of reverse voltage until the zener value is reached when breakdown occurs and the reverse current increases. The reverse voltage in this region is then more or less independent of the current passing through the device, in which case, the voltage can be said to be constant.

One must, however, bear in mind that the upper reverse current range is limited by the permissible dissipation of the diode and furthermore, the lower limit is governed by the slope or reverse resistance.

It is this constant voltage characteristic that lends the device to voltage regulation applications.

Such applications will have advantages over many of the conventional methods now in use

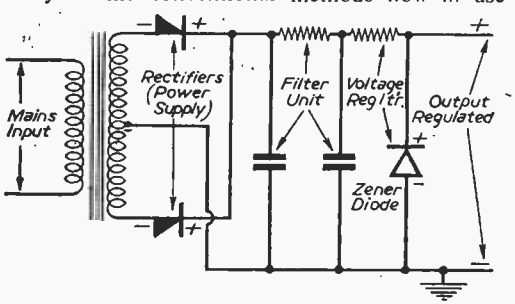



*Fig. 1.—Circuit using a Zener diode to obtain a stabilised output from a power supply.*

including small physical size and extremely long life, both important factors.

### *High Voltages*

It is recommended by the manufacturers that several of these devices should be connected in series if it is required to regulate several hundreds of volts rather than using an individual diode of much larger breakdown voltage. The reason is that the heat dissipation is spread over many diodes instead of one single unit.

Basic circuits showing these devices connected as voltage regulators are shown in Figs. 1 and 2.

New applications for zener diodes will no doubt be developed more fully this year, and will undoubtedly include such applications as wave-

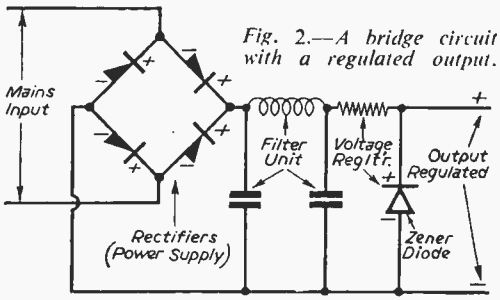



*Fig. 2.—A bridge circuit with a regulated output.*

form clipping and reference circuits.

These devices lend themselves to the experimenter and constructor and will prove interesting to those who like to develop new circuits and applications.

## Books Received

**THE PRACTICAL HI-FI HANDBOOK. By G. J. King. Published by Odhams Press, Ltd., 96, Long Acre, London, W.C.2. 224 pages. Price 30s.**

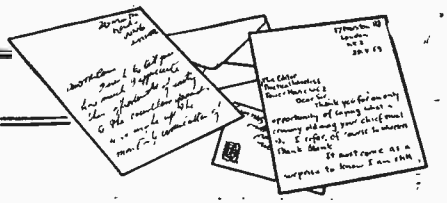
This profusely illustrated book, as its name implies, covers the subject of high fidelity equipment, and has been written with the aim of providing practical and up-to-date information on the various kinds of hi-fi equipment and their choice, operation and servicing. It deals with pre-amplifiers, loudspeakers, enclosures, pickups, record players, microphones and mixers and has a chapter devoted to stereophony.

**RADIO CIRCUITS : A STEP-BY-STEP SURVEY. Fourth Edition. By W. E. Miller, M.A.(Cantab.), M.Brit.I.R.E. Published by Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 15s. net (by post 15s. 10d.). Size 8¾in. x 5½in. 172 pages, including 84 diagrams in the text, and two fold-outs.**

This popular book explains in simple language and in easy stages all the varieties of circuits that are found in radio receivers of the kind that are used for broadcast reception. It does this by taking separately each stage of the receiver. item by item. and explaining it without the complication of all the associated circuits round it.

In this way every detail can be absorbed easily by the reader, who is not obliged to cope with more than he can assimilate at any one time. As he acquires familiarity with several parts, however, he is introduced to their association with one another, and he is finally led to an understanding of the complete circuit of a receiver.

# Open to Discussion



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

## Transistors v. Valves

SIR.—As a member of the younger generation to which G. Plachey refers (May issue, "Open to Discussion"), I would like to answer his points in support of valves.

One very important factor in support of the transistor is its size and it seems obvious to me that, as TV sets (and for that matter radio sets) become more and more complicated in the search for better quality and more sensitivity, the only way to keep them down to a reasonable size will be to use transistors.

As for the small home radio, why the need for two sets, home and portable? The transistor set can compete on equal terms with the mains set where economy is concerned. With transistors a set with enough power and quality for a home radio can easily be made light enough to be taken out on a picnic or holiday as a portable, as indeed has been done by a prominent manufacturer.—MARTIN ROBINSON (13) (A.H.G.S. Grammar School, York).

*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.*

SIR.—I feel I must disagree with the views expressed by Mr. R. S. Jenkins of Burton-on-Trent (June issue, PRACTICAL WIRELESS). As a keen radio enthusiast with many friends similarly interested, I am sure I am correct in saying that very few young people believe that valves are out of date. While transistors remain so expensive, and as long as valves are available at prices well within most "budgets," then no one could possibly reject them as out of date. As Mr. Jenkins so rightly stated, transistors still have a very long way to go; the vast majority of young people are only too aware of this fact, and very few, I think, would contemplate calling valves useless until transistors are capable of doing successfully the many tasks that valves are to-day called upon to perform, bearing in mind the all-important factor of price range.—C. R. DOHERTY (17 years) (Birkenhead, Cheshire).

SIR,—I sympathise with the nostalgic feelings of your two correspondents (May and June "Open to Discussion") for the thermionic valve, but like all of us older folk brought up on cathodes, grids and anodes we must "pull ourselves together" and take stock. The irrefutable fact is that the days of the valve in common application are severely limited. Unfortunately this country has lagged behind in industrial production of semi-conductors, America and Western Germany being well ahead. However, the last twelve months have seen giant strides and several new factories have come into production.

Transistors have many advantages—they don't wear out and, in spite of popular belief, the associated circuitry is simpler and involves fewer components. For example, take the crystal diode (a semi-conductor) which replaced the valve in many makes of domestic superhet years ago—and simplified the circuit. Transistors will be considerably cheaper to produce; we have seen retail price reductions in recent months.

To older readers, I would say, "One is as young as one's mental approach."—VINCENT EVANS (Parbold, Lancs).

## Cabinets

SIR.—I wonder if anyone can solve a problem that many a constructor has to face—that of acquiring a smart cabinet to house his newly built chassis; after all, our hobby is wireless, not carpentry, and the trouble about purchasing a cabinet by post is the cost of carriage. It would help if a cabinet firm could supply a set of, say, five cabinets of such sizes that they would fit into each other (like a nest of tables) for ease of transport and storage. The sizes of the cabinets should also be such that each would suit a standard size of chassis. Perhaps one or two new standard sizes of chassis would have to be created and the writers of constructional articles would be recommended to use one of the standard chassis where possible.—T. G. BELL (Manchester, 20).

## Meter Shunts and Multipliers

SIR,—Recent issues have dealt with the conversion of milliammeters to voltmeters, which can be done merely by putting in series with the milliammeter a multiplier resistance R1 given by $R1 = V/I - Rm$ where V is the required voltage range, Rm is the meter's resistance and I is the FSD current of the meter. Two diff-

*(Continued on page 429)*

culties arise; first, R1 usually comes to a number which is not available as a preferred value, and secondly, the resistor must be accurate, with a tolerance of only a few per cent., instead of 20 per cent. as with the usual resistors.

Initially, use for the multiplier a 20 per cent. resistor of the nearest preferred value above R1, and call this one R2. This will make the voltmeter read low. To find out how low, use the voltmeter in its present state to measure a known voltage, such as a battery that is new or has been checked with a standard voltmeter, and obtain the ratio x = actual voltage/reading shown. x will therefore be just greater than one. Then obtain a resistance $R3 = x.R1/x - 1$ and put this in parallel with R2.

As an example, with a meter I = 1mA and Rm = 100Ω to read to 5 volts.
R1 = (5/0.001) − 100 = 4,900Ω.

Therefore R2 = 5,600Ω, being the nearest preferred value above. Then, allowing for R2 being 20 per cent. tolerance, let us assume that a 3-volt battery gave a reading of 2.7V. Then the term $\frac{X}{X-1}$ becomes 10, and R3 is 49Ω, and for this a 47k resistor can be used, which again need only be of 20 per cent. tolerance, though 10 per cent. could be used as these are normally the same price.

Not only does this method give a multiplier of the required value, but although neither resistor is an accurate one, the error is only 1 per cent. if R3 is a 10 per cent resistor, because R3 is so much greater than R2.—J. C. ALLDRED (Romsey, Hants).

SIR,—Mr. Berry, in the May issue, claims that his method of calculating shunt values is simpler than the formula given in the April issue, but is it ?

The formula $Rs = \frac{Im.Rm}{I-IM}$ consists of one multiplication, one subtraction, and one division. Mr. Berry's method adds to that number to the tune of one multiplication and one division.

My own method, and I use it daily, is as follows.

Taking Mr. Berry's example, subtract the meter current, 1mA, from the total current, 1A, leaving 999mA, which is the current in the shunt. The shunt current is 999 times as great as the meter current, so the shunt resistance required is 999 times smaller than the meter resistance. Divide 999 into 100 ohms, therefore, which gives the answer, 1.001 ohms. If the reader will compare this method with the formula he will see that it is exactly the same, but done in three logical steps.—R. MASSEY (Leeds, 7).

### "Arrangements"

SIR,—With reference to Mr. W. J. Nye's letter in the June issue of PRACTICAL WIRELESS, I should like to point out that, while not denying that certain classical composers use themes from works of other composers, at least they openly admit that they "borrow," as shown in the titles. Examples which spring to mind include Rachmaninov's "Rhapsody on a Theme of Paganini" and Benjamin Britten's "Variations and Fugue on a Theme of Purcell."

With regard to Dvořák's "New World Symphony," I would point out that, though negro spirituals inspired him to write this symphony during a visit to America, the various movements were not derived directly from them. —M. HUTCHINSON (Petts Wood, Kent).

SIR,—I have been reading with considerable interest the correspondence in your columns on the above subject, and find myself in complete agreement with "Thermion." I am firmly of the opinion that no one has the right to "arrange" a composer's work, for the composer, and he alone, knows just how he intends the music to be performed. It appears to be nothing but sheer laziness and cheating on the part of a few so-called "musicians" who would prefer to monkey about with someone else's tunes rather than coin their own. Outrageous misquotations from poetry and plays generally bring forth a spate of indignation. Why then is this not the case with music? —S. LEWIS (London, S.E).

### Correspondents Wanted

SIR,—I am 16 years of age and very interested in amateur radio. I shall soon be taking up radio and television as a career, and would like to correspond with any amateur radio listeners of my own age.

I would also like to know if anyone could tell me the frequency and time at which Radio Budapest comes on the air for the radio amateurs' programme.—G. CUNDY (6, Oswald Crescent, Park Estate, Ashbourne, Derbyshire).

SIR,—I am 15 years of age and very interested in amateur radio. I hope to be a radio amateur in the near future, and would, therefore, like to correspond with any boys of my age who are interested in radio. I should like to say that I enjoyed very much reading your series "Printed Circuits." I found it very interesting.—J.v.d. HOVESS (98. Twin Street, Rustenburg, Transvaal, South Africa).

## RESISTOR WATTAGES

(*Continued from page* 402)

Resistors will often withstand some overrunning without breaking down, but this is not wise. Instead, when appreciable power is dissipated, it is better to use a resistor with a generous wattage rating, as a precaution against early failure.

### *Mains Droppers*

With resistors of high wattage, such as mains droppers and line cords, it is usual to rate the component or cord in terms of the current it is designed to carry. This will usually be .15A, .2A, or .3A. Provided the dropper or cord has the appropriate current rating, the wattage need not be known. It will, however, be large. For example, a .3A dropper used with a 80V heater chain, with 240V mains, would drop 160V. From this, 160V × .3 A = 48 watts.

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