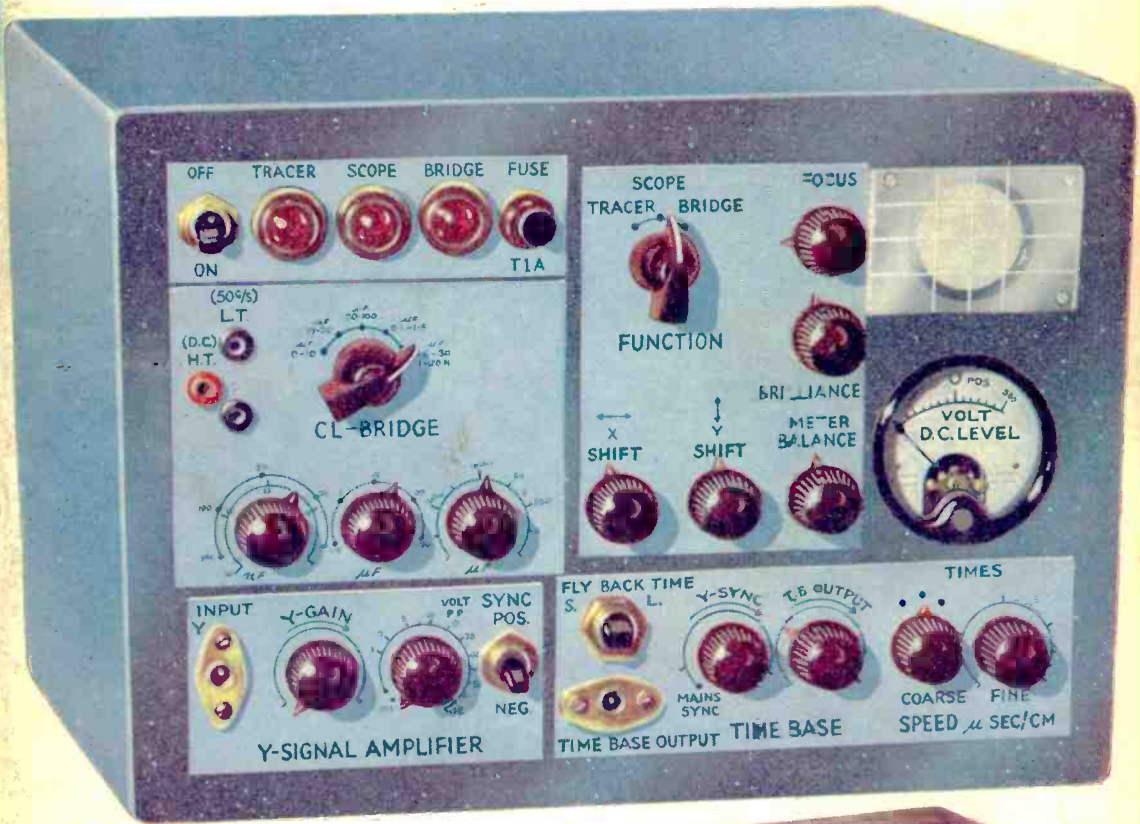
SEPTEMBER 1962

Practical WIRELESS

2/-

The MINISCOPE



The TUDOR 4-valve battery portable

CLYNE RADIO LTD.

THE COMPONENT SPECIALISTS

18 TOTTENHAM COURT ROAD, W.1 MUSeum 5929/0095
162 HOLLOWAY ROAD, LONDON N.7 NORth 6295/6/7
19 CAMBERWELL CHURCH STREET, S.E.5 RODney 2875

All post orders etc. to 162 HOLLOWAY ROAD, LONDON, N.7

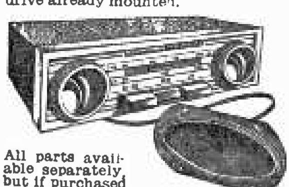
NEW! NEW! The "AIR KING"

A New Six transistor luxury portable with the new "SLIM LINE" look. To build yourself, with printed circuit chassis for reliability and simplicity in construction. May be used as Car Radio, with full MEDIUM wave and LONG wave coverage.
Look at these features!

★ 500 milliwatt output to high flux 7 x 3½in. high fidelity loudspeaker. ★ Six selected **Mullard Transistors** in latest super sensitive circuit, plus germanium diode. ★ Compact size—only 9½ x 3½ x 6½in. (high). ★ Attractive three tone cabinet, Black, Dark Grey, and Silver Grey, with gilt control knobs and all gilt fittings. ★ Coax socket for car aerial. ★ Brand New guaranteed components. ★ Push pull output. ★ Automatic volume control. ★ Long life battery. ★ Super sensitive internal ferrite rod aerial. ★ Nothing more to buy. Cabinet included.
Special inclusive price for all required components. **£7.19.6** Plus P. & P. 4/-.
Alignment service available. Full assembly details and individually priced parts list, all of which are available separately, price 1/6, post free.

The "HIGHWAYMAN"

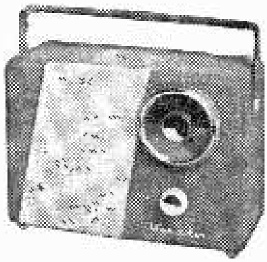
At last a quality Car Radio to build yourself, at an economical price.
Look at these features:—
★ Attractive styling. ★ Push-pull output. ★ 3 latest Mullard transistors plus valves type EBF 83 and ECH 83. ★ No Buzz. High Output and sensitivity. ★ Printed circuit (newest type). 7" x 4" High flux p.m. speaker. ★ Medium and Long Waves. ★ Push Buttons for fingertip control. ★ Extremely low Battery consumption (less than ½ amp). ★ Easy to fit any make car (Positive earth only). ★ 12 volt operation. ★ Compact size measures only 7" x 7" x 2" deep. ★ Easy assembly, supplied with dial and drive already mounted.



All parts available separately but if purchased at one time, the whole will be supplied at a special inclusive price of only
£10.19.6 Plus 4/- P. & P.
Parts list and comprehensive instruction booklet 2/6, post free. (Deducted from cost if complete parcel purchased later.)

The "CRUSADER"

Our new four transistor plus diode portable with big set quality!
★ Full Medium Wave coverage.
★ Completely self contained.

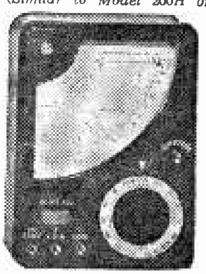


★ Five inch P.M. Speaker. ★ Genuine high grade Mullard or Ediswan Transistors. ★ New components throughout. ★ Attractive two-tone blue/grey Vynide-covered cabinet size 8 x 5½ x 3½in. with adjustable carrying handle. ★ Eyeletted chassis simplifies construction. ★ Longer life with larger size PP7 battery.

★ SPECIAL FEATURES! ★
SUPPLIED WITH JACK SOCKET FOR DIRECT CONNECTION TO CRYSTAL MICROPHONE FOR USE AS **BABY ALARM WITHOUT ANY MODIFICATION!** ALSO FOR DIRECT CONNECTION TO CRYSTAL PICK-UP FOR USE AS A **GRAMOPHONE AMPLIFIER!** SUPPLIED COMPLETE WITH RECESSED SOCKET FOR DIRECT CONNECTION TO **CAR AERIAL!**

All required components including full instructions, solder, battery, etc. at special inclusive price of **ONLY 95/-** Plus 3/- P. & P. All parts available separately. *Itemised parts list and full assembly instructions 1/6 post free.*

NEW IMPORT! Large quantity shipments enable us to offer keenest meter value yet!
20,000 ohms per volt
MODEL ITI-2. Volt-ohm-Milliameter
(Similar to Model 200H originally advertised)



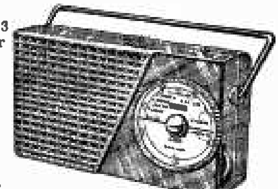
Ranges: A.C. Voltage: 10, 50, 100, 500, and 1000 volts (10,000 ohms per volt). D.C. Voltage: 5-25, 50, 250, 500, and 2.5k. (20,000 ohms per volt). D.C. Current: 0-50 microamps, 0-2.5 mA, 0-250 mA. Resistance: 0-6k, 0-6 meg. (300 ohm and 30k at centre scale). Capacitance: 10 pF to .001 mfd, .001 mfd to 1 mfd. Decibels: —20 to +22 dB.
A fully guaranteed pocket size meter (actual size: 4½" x 3½" x 1") knife edge pointer, top quality supplied complete with test prods and full operating instructions. ONLY **£5.5.0** POST FREE

ALSO AVAILABLE! MODEL TE10. Identical in appearance and size with rotary type switch but 10,000 Ω/v. Ranges: D.C. Voltage: 0-6-30-120-600-1200 volts (10,000 ohms per volt). A.C. voltage: 0-6-30-120-600-1200 volts (10,000 ohms per volt). D.C. Current: 0-120 microamp, 0-3-300 mA. Resistance: 0-30k, 0-3 Meg. (150 ohm and 15k at centre scale). Capacitance: 50 pF to 0.01 mfd., 0.001 mfd. to 0.15 mfd. Decibels: —20 to +63 dB in 5 ranges.
ONLY **89/6** POST FREE

Optional Extra
Attractive carrying case suitable for either meter, 13/6 only. (Bonafide trade enquiries invited.) Leaflet available.

NEW! NEW! The "COURTESAN"

Our New 3 transistor plus 2 diode pocket receiver with *full* Medium *and* Long Wave Coverage.



★ No external aerial and earth required.
★ Latest 2½"—75 ohm speaker.
★ First grade Mullard transistors.
★ Condenser tuning.
★ Volume control with on/off switch.
★ Easy assembly on pre-tagged circuit board.
★ Attractive red polystyrene cabinet measures 5½ x 3½ x 1½", chrome handle, attractive gold and black dial.
★ Luxembourg, Hilversum, etc., guaranteed in reception areas.

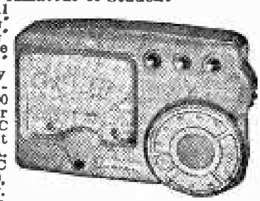
ONLY **63/-** Plus 2/6 P. & P.
All parts available separately, itemised parts list and full assembly instructions 1/6, post free.

The SMALLEST TRANSISTOR AMPLIFIER Size only 2" x 1" x ½" high. Three transistor, printed circuit, 125 milliwatts output. From 100-25,000 cycles, ± 1.5 dB. Will operate from 4.5 v. to 9.0 v. Output to any speaker 35 ohm to 80 ohm. Complete with free leaflet showing variety of uses. Radiogram amplifier, baby alarm intercomm, door answering device, etc. Price Only 45/-, post free.

INEXPENSIVE TEST GEAR

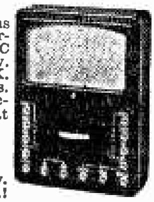
Two Ideal Pocket Instruments for Amateur or Student

MODEL T11
Size only 3½" x 2½" x 1½". Meter Size 1½" x 1½". Sensitivity 285 micro-amps —1000 ohms per volt AC/DC. DC Current 1.25, 250 mA. DC and AC volts 10, 50, 250, 1,000 v. Resistance 50 ohms—100 K Battery 1.5 v-U12. Complete with test prods, battery and full instructions.



Outstanding Value at **57/6** Plus 2/6 P. & P.

MODEL TK.50
Size 5" x 3½" x 1½" 1000 ohms per volt AC/DC. DC Current 1-250 mA DC and AC volts, 10, 250-500 and 1000 v. Resistance 0-10K, 0-100K. Complete with test prods, battery and full instructions. Outstanding buy at **63/-** Plus 2/6 P. & P.



ALSO AVAILABLE: MODEL 500. 30,000 o.p.v. £8.19.6. 10% Deposit H.P.!

"FAMILY FOUR"

Our supersensitive T.R.F. Receiver for home construction. Covers Long and Medium Wavebands, is housed in very smart plastic table cabinet in Brown or Black, 3 valve plus contact cooled rectifier. For A.C. mains 200/250 v. Comprehensive assembly instructions provided, including practical and theoretical diagrams, which are easy to follow and will enable you to complete this receiver which will be the envy of your friends. ALL NECESSARY COMPONENTS ARE BEING OFFERED FOR LIMITED PERIOD ONLY at the REMARKABLE PRICE of ONLY **79/6**, plus 2/6 P. & P. Instruction book available separately if you wish to study before purchase at 1/6 post free.

Technical Training in Radio, Television and Electronics Engineering with

ICS

The decision is YOURS. To be a success in your chosen career; to qualify for the highest paid job . . . to control a profitable business of your own. ICS home-study courses put your plans on a practical basis; teach you theory and practice; give you the knowledge and experience to take you, at your own pace, to the top.

Choose the RIGHT course:

RADIO & TELEVISION ENGINEERING
INDUSTRIAL TELEVISION

RADIO & TELEVISION SERVICING
RADIO SERVICE AND SALES

VHF/FM ENGINEERING : ELECTRONIC COMPUTERS & PROGRAMMING

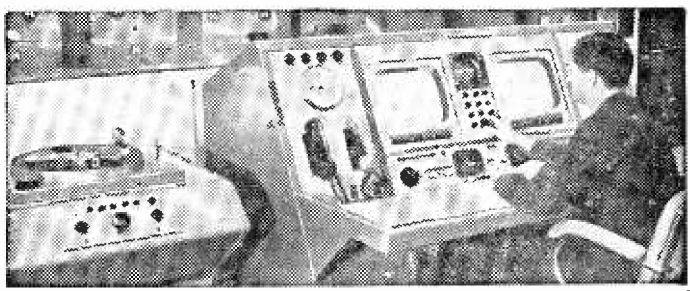
ICS provides thorough coaching for professional examinations:

Brit. I.R.E., City and Guilds Telecommunication Technicians, C. & G. Radio & TV Servicing (R.T.E.B.); C. & G. Radio Amateurs.

LEARN AS YOU BUILD

Practical Radio Courses

Gain a sound up-to-professional-standards knowledge of Radio and Television as you build **YOUR OWN** 4-valve T.R.F. and 5-valve superhet radio receiver, Signal Generator and High-quality Multimeter. At the end of the course you have three pieces of permanent and practical equipment and a fund of personal knowledge and skill. ICS Practical Radio courses open a new world to the keen Radio amateur.



THERE ARE ICS COURSES TO MEET YOUR NEEDS AT EVERY STAGE OF YOUR CAREER. FILL IN AND POST THIS COUPON TODAY.

You will receive the FREE 60 page ICS Prospectus listing examinations and ICS technical courses in radio, television and electronics PLUS details of over 150 specialised subjects.

Other I C S courses include:
MECHANICAL, MOTOR, FIRE, ELECTRICAL & CHEMICAL ENGINEERING.
FARMING, GARDENING.
ARCHITECTURE & WOODWORKING.
SELLING & MANAGEMENT.
ART. PHOTOGRAPHY,
etc., etc.

PLEASE STATE ON COUPON SUBJECT YOU ARE INTERESTED IN . .

INTERNATIONAL CORRESPONDENCE SCHOOLS

(DEPT. 170) INTERTEXT HOUSE, PARKGATE RD., LONDON, SW11

PLEASE SEND FREE BOOK ON...

NAME ....

ADDRESS ....

....

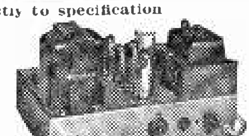
OCCUPATION... *AGE*..............

9.62

STERN'S MULLARD DESIGNS

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

MULLARD "5-10" MAIN AMPLIFIER



For use with the MULLARD 2-valve pre-amplifier with which undistorted power output of up to 10 watts is obtained. We supply SPECIFIED COMPONENTS AND NEW MULLARD VALVES, including PARMEKO MAINS TRANSFORMER and choice of the latest Ultra-Linear PARMEKO or the PARTRIDGE Output Transformer.

COMPLETE KIT OF PARTS (PARMEKO Output Trans.). **£10.0.0**

Alternatively we supply ASSEMBLED and TESTED. **£11.10.0** INCORPORATING PARTRIDGE OUTPUT TRANSFORMER, £1.6.0 EXTRA.

MULLARD'S PREAMPLIFIER TONE CONTROL UNIT

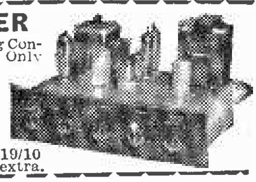
Employing two EF86 valves, and designed to operate with the MULLARD MAIN AMPLIFIERS, but also perfectly suitable for other makes.

PRICE COMPLETE KIT OF PARTS **£6.6.0** ASSEMBLED AND TESTED **£8.0.0**

Supplied strictly to MULLARD'S SPECIFICATION and incorporating:

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

THE MULLARD "510/RC" AMPLIFIER

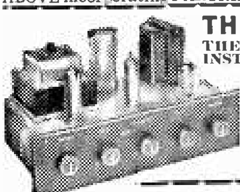


The popular and very successful complete "5-10" incorporating Control Unit providing up to 10 watts high quality reproduction. Only Specified Components and new MULLARD VALVES are supplied including PARMEKO MAINS TRANSFORMERS and choice of the latest PARMEKO or PARTRIDGE ULTRA-Linear Output Transformers.

KIT OF PARTS **£11.10.0** OR ASSEMBLED and TESTED **£13.10.0**

H.P. Dep. £2.6.0, 12 months at 17/0. Dep. £2.14.0 12 months at 19/10

ABOVE incorporating PARTRIDGE OUTPUT TRANS. £1.6.0 extra.



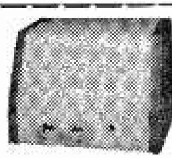
THE MULLARD "33/RC"

THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION PROVIDING EXCELLENT REPRODUCTION OF UP TO 3 WATTS OUTPUT

COMPLETE KIT OF PARTS **£7.10.0** OR ASSEMBLED and TESTED **£8.19.6**

(plus 6/6 carriage and insurance) H.P. Terms: Deposit £2.0.0 and 8 months at £1.0.0. Complete to MULLARD'S SPECIFICATION including Mullard valves and a PARMEKO OUTPUT TRANSFORMER.

STERN'S INTER-COMM BABY ALARM



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

PRICES . . . MASTER UNIT and ONE EXTENSION

KIT OF PARTS **£6.17.6** ASSEMBLED AND TESTED **£8.8.0**

Consists of a MASTER UNIT, size only 8½ x 5½ x 6in. and ONE EXTENSION (a second extension may be added to any time). The Master Unit incorporates switching and power supply and with the chassis completely isolated from the mains is operated in absolute safety. Cases covered in quality leatherette.

A BULK PURCHASE OF MARCONIPHONE TAPE RECORDING EQUIPMENT ENABLES US TO OFFER THE MODEL MTR/1 PORTABLE TAPE RECORDER

FOR ONLY **£26.0.0** (Carr. & Ins. 10/- extra)

Deposit £5.4.0, 12 months of £1.18.2. The list price of the MTR/1 is £44.2.0. It is a 3-Speed Twin Track Recorder incorporating the latest Collaro "Studio" Tape Deck and operates at 1⅞, 3¾ and 7½in./sec. Speeds. It incorporates a "Pause" Control, a safety interlock device which ensures that a recorded tape cannot be accidentally erased and a low level output socket so that the output may be fed into an external high fidelity amplifier for monitoring purposes or for high quality reproduction on playback.

PRICE REDUCTIONS

(a) The KIT OF PARTS to build both the "5-10" Main Amplifier and the 2-valve PRE-AMP CONTROL UNIT H.P. Dep. £3.7.0 and 12 months at £1.2.9.......... **£15.15.0**

(b) The "5-10" and the 2-stage PRE-AMP both ASSEMBLED and TESTED H.P. Dep. £3.16.0 and 12 months at £1.7.8.......... **£18.18.0**

With Partridge O/put Transformer £1.6.0 extra.

RECORD PLAYERS

The Latest Models are in stock many at reduced prices. Send S.A.E. For Illustrated Leaflet.

THE NEW GARRARD "AUTO-SLIM" 4-speed Autochanger with Crystal Pick-up **£8.10.0**

COLLARO "JUNIOR" 4-SPEED SINGLE RECORD PLAYER with separate Crystal Pick-up Carriage and Insurance 5/-. **£3.15.0** Above Pick-up separately for £1.6.6.

The NEW COLLARO C60 4-speed Autochanger unit with Studio "O" Pick-up...... **£7.19.6**

The E.M.I. 4-speed Single Record Player with Crystal Pick-up **£6.9.6**

B.S.R. MODEL UA14. A 4-speed mixer Autochanger with Crystal Pick-up **£7.10.0**

Available incorporating the B.S.R. STEREO Pick-up, plays L.P. and 78 Records...... **£8.13.10**

GARRARD MODEL TA/MK.II 4 speed Player fitted high output Crystal Pick-up.. **£8.10.0**

GARRARD MODEL RC210. Autochanger 4-speeds. High output. Crystal Pick-up... **£9.10.0**

Carriage and Insurance on each above 5/- extra.

SPECIAL CASH OFFER

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

The Amplifier consists of a 2-stage design incorporating 3 modern B.V.A. valves and has separate BASS and TREBLE CONTROLS.

The Portable Case will also accommodate almost any make of Autochanger and is attractively finished in Mushroom Grey Rexine.

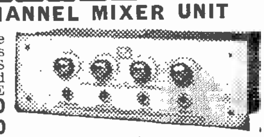
WE ALSO SUPPLY SEPARATELY—

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

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

(c) 6½in. P.M. SPEAKER 18/9. Carriage and Insurance 4/- extra.

MULLARD FOUR CHANNEL MIXER UNIT



Self powered with Cathode follower output. Incorporates Two inputs for MICROPHONES One for CRYSTAL PICK-UP and a fourth for RADIO or TAPE

Complete Kit of Parts **£8.8.0**

Assembled and Tested **£10.0.0**

TERMS: Deposit £2 and 12 months at 15/-.

MODEL I.L. one microphone Input matched for moving coil or Ribbon Mike. £1.17.0 extra.

The TOHPHONIC

TRANSISTOR BATTERY OPERATED INTERCOM

89/6 P. & P. 4/-

Including PP3 battery and 25 yards lead with plugs. A completely Portable Intercom with 101 uses being ideally suitable for the office or even as a Baby Alarm, since being battery operated, it is completely safe. Two-way calling system and volume on/off switch, the units are housed in attractive plastic cabinets (black/white) with chrome stands, it is extremely economical operating on one 9-volt battery, replacement price being 2/6

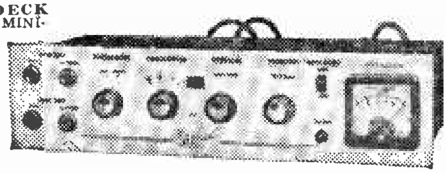
STERN RADIO 109, FLEET ST., LONDON, E.C.4. TELEPHONE FLEET ST. 5812-3 **PREMIER RADIO** 23, TOTTENHAM COURT RD., LONDON W.1. TELEPHONE MUSEUM 3451

MAIL ORDERS and all POSTAL ENQUIRIES to 7-9 TUDOR PLACE, TOTTENHAM COURT RD., LONDON, W.1. MUSEUM 6128/9

Stereophonic Sound by Stern's

THE "STP-1" STEREO TAPE PREAMPLIFIER DESIGNED TO OPERATE WITH

- BRENELL Mk. V TAPE DECK incorporating similar ¼-TRACK MINI-FLUX TAPE HEADS.
- PUSH-PULL OSCILLATOR CIRCUIT
- 4-SPEED EQUALISATION
- FERROXCUBE OSCILLATOR TRANSFORMER
- SENSITIVE METER FOR SIGNAL LEVEL
- SEPARATE GAIN CONTROLS IN EACH CHANNEL
- MULLARD VALVES INCORPORATED



COLLARO "STUDIO" TAPE DECK incorporating the latest ¼-TRACK REUTER TAPE HEADS.
OVERALL SIZE CASE 13¼ x 3in. FRONT PANEL (Choice of Black or White) 14 x 3½in.

PRICE
£28.0.0
Including separate Power Supply Unit.
Deposit £5.12.0, 12 months at £2.1.0.

COMBINED PRICE SCHEDULE

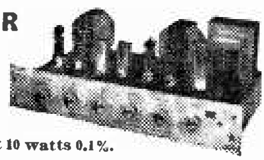
THE "STP-1" PREAMPLIFIER is offered WITH TAPE DECKS AS FOLLOWS:
- BRENELL Mk. V 4-TRACK MODEL.......... **£67.0.0**
  Deposit £13.8.0, 12 months at £4.18.5.
- COLLARO "STUDIO" 4-TRACK MODEL........ **£45.0.0**
  Deposit £9.0.0. 12 months at £3.6.0.

STEREOPHONIC RECORD PLAYER UNITS ARE AVAILABLE FROM STOCK

THE MULLARD "10+10" STEREO AMPLIFIER
(described below) with the "STP-1" PREAMPLIFIER and one of the TAPE DECKS provide a COMPLETE STEREOPHONIC INSTALLATION. *WE OFFER* the "10 + 10", the "STP-1" and the
- BRENELL Mk.V ¼-DECK........................ **£87.0.0**
  Deposit £17.8.0, 12 months at £6.7.8.
- As above with COLLARO "STUDIO" DECK **£65.0.0**
  Deposit £12.12.0, 12 months at £4.16.0.

Please enclose S.A.E. with all enquiries.

MULLARDS "10 PLUS 10" STEREO AMPLIFIER



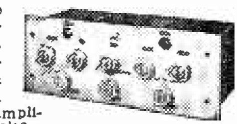
A high fidelity design based on the famous Mullard "5-10". Provides up to 10 watts (per channel) Superb reproduction. Frequency response flat to within 3 db from c/s. to 60 Kc/s at 50 Mw. Total Harmonic Distortion at 10 watts 0.1%.

(a) ASSEMBLED COMPLETE AMPLIFIER, including CONTROL UNIT (as Illustrated)...... **£21.0.0**
Deposit £4.4.0, 12 months at £1.10.10.
(b) A complete KIT of PARTS.................. **£18.10.0**
Deposit £3.14.0, 12 months at £1.7.2.

We also supply the assembled MAIN AMPLIFIER only (excludes control unit) for operation with our DUAL CHANNEL PREAMPLIFIER, this provides for a more versatile or elaborate installation and would be essential if a low output Magnetic Pick-Up, such as the Decca, is to be used.
(a) THE ASSEMBLED MAIN AMPLIFIER with the ASSEMBLED DUAL CHANNEL PREAMPLIFIER **£30.0.0**
Deposit £6.0.0, 12 months at £2.4.0.
(b) A complete KIT of PARTS for both Units **£26.0.0**
Deposit £5.4.0, 12 months at £1.18.2.

Illustrated and Descriptive Brochure available. Please enclose S.A.E.

DUAL CHANNEL AMPLIFIER



Incorporates two Mullard 2-valve Preamplifiers combined into a Single unit enabling it to be used for both STEREOPHONIC or MONAURAL operation. It is designed primarily to operate with our range of MULLARD MAIN AMPLIFIERS but will also operate equally well with any make of Amplifiers requiring an input of 250 m/volts.

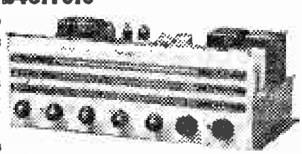
COMPLETE KIT OF PARTS **£12.10.0** — ASSEMBLED AND TESTED **£15.0.0**
H.P. £2.10.0 & 12 mths. at 18/4. H.P. £3.0.0 & 12 mths. at £1.2.0

ARMSTRONG RADIOGRAM CHASSIS

FULL RANGE IN STOCK. please enclose S.A.E. for leaflets.

STEREO 12 Mk. 2 £43.10.0

(ILLUSTRATED)



Deposit £8.14.0, 12 months at £3.3.10.
The most complete chassis ever produced, combines AM and FM Tuners, a Stereo Control Unit and two High Fidelity Amplifiers in one compact unit, provide a total of 16 watts for both mono and stereo. Other features include: inputs for tape recording, playback, pick-ups and stereo radio (should this come about); separate wide range bass and treble control and balance control.

STEREO 55 £32.15.0

Deposit £6.15.0 12 months at £2.7.8
A junior version of the Stereo 12 Mk. 2 providing ten watts output, five watts from each amplifier and covering the VHF and Medium wavebands.

JUBILEE Mk.2 £30.12.0

Deposit £6.4.0 12 months at £2.4.9
A Hi-Fi mono chassis giving eight watts push-pull output and covering VHF, medium and long bands. Tape recording and playback inputs.

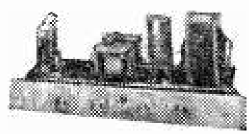
AF208 £22.18.0

Deposit £4.18.0 12 months at £1.13.0
An AM/FM chassis providing 5 watts output and covering the full VHF and medium wavebands. Tape recording and playback inputs.

TVB VHF TUNER £21.18.0

Deposit £4.14.0 12 months at £1.11.7
A self-powered high-fidelity tuner of outstanding design, incorporating features which are normally found only in the most expensive tuners. The full VHF band (87-108 M/cs) is covered and a matching output control enables the output to be varied between 0 and 500 mV.

The "TWIN-THREE" STEREO AMPLIFIER

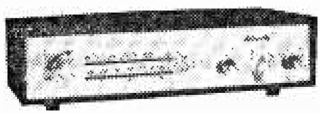


OFFERED ASSEMBLED and TESTED for **£7.15.0** (Carr. & Ins., 7/6 extra).
Based on a recent design by MULLARD LTD., the "TWIN THREE" is ideally suited for use in PORTABLE RECORD PLAYERS for which purpose we offer a specially designed Portable Case. It incorporates MULLARD ECL86 valves, separate BASS and TREBLE CONTROLS, and produces excellent reproduction of up to 3 watts per channel. Frequency response is 40 c/s to 30 Kc/s. Size is only 11¼ x 3 x 5in.

To construct a STEREO PORTABLE RECORD PLAYER *WE OFFER:* The assembled AMPLIFIER with two ROLA 8 x 5in. LOUDSPEAKERS and the PORTABLE CASE for **£14.0.0**
(Carr. & Ins., 10/- extra). Deposit £2.16.0.12 months at £1.0.6.

SUITABLE RECORD PLAYERS are AVAILABLE FROM **£8.14.0**

"The TUDOR" AM/FM TUNING UNIT



A SELF POWERED HIGH FIDELITY TUNER OF OUTSTANDING DESIGN.

PRICE ONLY **£19.19.0** Deposit £4.0.0 and 12 months at £1.9.4.

Provides full coverage of the VHF/FM band (87-108 Mc/s) and also the LONG and MEDIUM wavebands. Incorporates Multiplex outlet socket for stereophonic purposes (when adopted) and separate controls for tuning the FM and AM bands. Operates perfectly with the STERN-MULLARD AMPLIFIERS and contains matching FRONT PANEL in Black/Gold or White/Black. Also operates equally well with any Amplifier requiring input of 100 to 350 m/Volts.

"HI-FI" LOUDSPEAKERS WE HAVE IN STOCK A COMPLETE RANGE BY GOODMANS—WHARFEDALE—W.B. ILLUSTRATED AND PRICE LEAFLETS ON REQUEST.

STERN RADIO
PREMIER RADIO
MAIL ORDERS and all POSTAL ENQUIRIES to

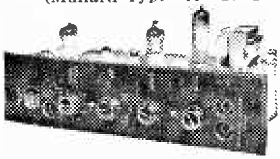
BUILD A HIGH QUALITY TAPE RECORDER LIKE THIS FOR £35.0.0

FOR THIS WE SUPPLY — Deposit £7.0.0 and 12 months at £2.11.4

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

ALTERNATIVELY WE SUPPLY THE COMPLETELY ASSEMBLED and GUARANTEED TAPE RECORDER FOR £39.10.0
H.P. Terms: Deposit £7.18.0 and 12 months of £2.17.11.

HF/TR3MKII TAPE AMPLIFIER
(Mullard Type "A" design)



A very high quality Amplifier incorporating 3-speed treble equalisation, by the latest FEROXCUBE POT CORE INDUCTOR. FOR COLLARO-TRUVOX-BRENELL WEARITE Tape Decks, has GILSEN Output Transformer. Includes separate Power Supply Unit.

KIT OF PARTS **£13.13.0** Deposit £2.15.0 12 months at £1.0.0

ASSEMBLED and TESTED **£17.0.0** Deposit £3.8.0, 12 months at £1.4.11.

SPECIAL "COMBINED ORDER" PRICES

For Constructors with their own cabinet—WE OFFER—

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

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

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

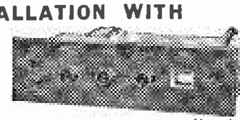
(d) As above but with HF/TR3 supplied ASSEMBLED and TESTED **£45.10.0**
Deposit £9.2.0. 12 monthly payments of £3.6.9

(e) THE ASSEMBLED AND TESTED HF/TR3 AMPLIFIER with the WEARITE MODEL 4A DECK, incorporates Wearite Head Lift Transformer etc. **£60.10.0**
Deposit £12.12.0. 12 monthly payments of £4.8.9.

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

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

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



The "Hi-Fi" link to add full tape recording facilities to High Fidelity home installations. Incorporates FEROXCUBE POT CORE PUSH PULL OSCILLATOR and 3-speed treble equalisation by FEROXCUBE POT CORE INDUCTOR FOR WEARITE-COLLARO-TRUVOX OR BRENELL TAPE DECKS. Includes separate power Supply Unit.

KIT OF PARTS **£14.0.0** Deposit £2.16.0. 12 mths. at £1.0.6

OR ASSEMBLED **£17.0.0** Deposit £3.8.0 12 months at £1.4.11

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

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

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

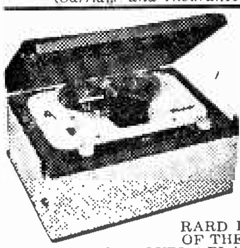
(c) The BRENELL Mk. V Deck with the Model "C" PREAMPLIFIER and POWER UNIT. ASSEMBLED and TESTED **£46.0.0**
Deposit £9.4.0 and 12 months at £3.7.6

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

(e) The WEARITE MODEL "4" DECK with ASSEMBLED and TESTED Model "C" PREAMPLIFIER and POWER UNIT incorporating WEARITE HEAD LIFT TRANSFORMER. Etc. **£60.10.0**
Deposit £12.2.0 and 12 months at £4.8.9

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

The MODEL HFG/2R PORTABLE TAPE RECORDER



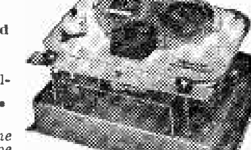
(Original Price £33.0.0)

FOR ONLY 22 Gns.

Deposit £4.14.0.12months£1.13.9 Crystal Microphone £1.0.0 extra. *(Carr. and Ins. 10/- extra).* Incorporates THE LATEST GARRARD "MAGAZINE" TAPE DECK and a HIGH QUALITY AMPLIFIER which is entirely based on the very successful MULLARD TYPE "A" DESIGN and specifically developed to operate the GARRARD DECK. Price INCLUDES SUPPLY OF THE GARRARD TAPE MAGAZINE and 4in. SPOOL OF DOUBLE PLAY TAPE. Comprises a Twin Track Recorder operating at 3¾in/sec. speed and providing up to 1 hour 10 mins. playing time. Truly "Portable", weighs only 22 lbs. Outstanding features are excellent performance and simplicity of operation

THE 'ADD-A-DECK'

Incorporating GARRARD TAPE DECK and MODEL HF/G2P PRE-AMPLIFIER



Supplied on ONE CHASSIS (as illustrated) READY FOR USE **18 Gns.**
(Carr. & Ins. 10/- extra.)

Price includes Garrard Magazine and a 4 in. Spool Double Play Tape

H.P. Deposit £3.16.0, and 12 months of £1.7.8.

Provides complete tape recording facilities and designed to operate through the pick-up sockets of the standard type of RADIO RECEIVER, or an AMPLIFIER, from which really first class reproduction is obtained. It consists of a Twin Track Deck connected to the Pre-amplifier and operates at 3¾in/sec. speed providing up to 1 hr. 10 mins. playing time.

THE TRUVOX "SERIES 80" TAPE EQUIPMENT

MODEL D82 TAPE DECK — Incorporating Twin Track Heads. Deposit £5.5. 12 months of £1.18.7 **£26.5.0**

MODEL D84 TAPE DECK — With Four Track Heads and Track Switch for Mono/Stereo operation. Deposit £6. 12 months of £2.2.11. **£29.8.0**

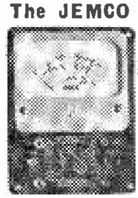
MODEL PD82 — Complete Twin Track Mono Recorder-Preamplifier Unit. Deposit £8.8. 12 months of £3.1.7. **£42.0.0**

MODEL PD84 — Complete Four Track Mono Recorder-Preamplifier Unit incorporating outlets for Stereo reproduction. Deposit £9.4. 12 months of £3.7.6. **£46.0.0**

The PD82 and 84 comprise two self-contained units to add full tape facilities to existing sound reproducing installations (Hi-Fi equipment, radiograms, record reproducers, or good radio receivers

DESCRIPTIVE LEAFLETS READILY AVAILABLE

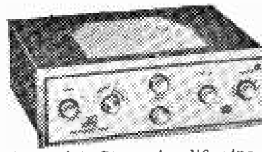
The JEMCO MODEL MT-955 MULTIMETER



50,000 ohms per volt — D.C.
5,000 ohms „ „ A.C.

A truly efficient Meter for the amateur or professional man, having features found normally in more expensive Meters. Ranges:
D.C. volts 2.5-10-50-250-1.K
A.C. „ 2.5-10-50-250-1.K
D.C. Current 100µA-10mA-100mA-500mA 10 amps
Resistance 4 Ranges up to 20 meg.
Add D.B. 0-46 Size 7 x 5¼ x 3in.
PRICE, including Full Test Lead Kit .... **£12.19.6** 4/- p. & p.

! SPECIAL OFFER !



WE HAVE A LIMITED QUANTITY of **HMV Model 544 STEREO AMPLIFIERS** and OFFER THEM FOR

£18.18.0 Deposit £3.16.0. 12 mths. £1.7.8.

LIST PRICE £27.6.0.

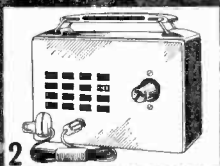
Size 11¼ x 10 x 4in. high.

A complete Stereo Amplifier incorporating All Controls. Suitable for Crystal or Ceramic Stereo Pick Ups producing 4 watts peak output per channel from input of 200 m/Volts. Operates with 15 ohm Loudspeakers and has power available for Radio Tuner.

109, FLEET ST., LONDON, E.C.4.
TELEPHONE FLEET ST. 5812-3
23, TOTTENHAM COURT RD., LONDON W.1.
TELEPHONE MUSEUM 3451
7-9 TUDOR PLACE, TOTTENHAM COURT RD., LONDON, W.1. TELEPHONE MUSEUM 6128/9

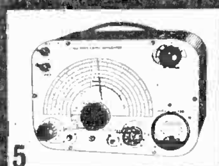
Just a few of our BARGAINS

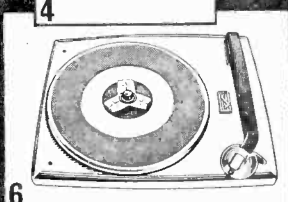

1


2

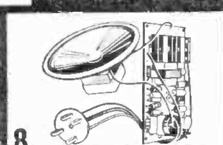

3

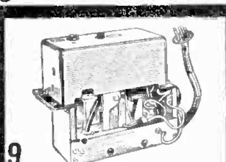

4


5


6


7

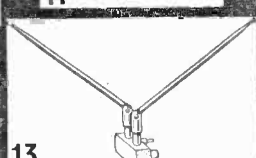

8

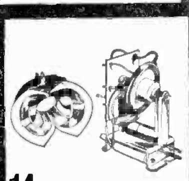

9


10


11


12


13


14

1. **SUPER 5 TRANSISTOR POCKET RADIO INCORPORATING PRINTED CIRCUIT & MINI-EARPIECE.** No Aerial or Earth required. $4\frac{3}{4}$ x $3\frac{1}{4}$ x $1\frac{1}{2}$in. Output 200 M.W. 5 first quality transistors. High flux moving coil speaker. M/L Internal high gain ferrox aerial. **£2.19.6.** P. & P. 3/6. Circuit diagram 1/6, free with parts. All parts available separately.
2. **TRANSISTORISED POCKET RADIO** with printed circuit, mini-earpiece, high gain ferrox slab aerial. No aerial or earth required. To build yourself for completely personal listening. $4\frac{3}{4}$ x $3\frac{1}{4}$ x $1\frac{1}{2}$in. Luxembourg in favourable areas. **Only 21/-.** P. & P. 2/6. All parts available separately.
3. **A.C./D.C. POCKET MULTI-METER KIT.** 2in. moving coil meter, scale, calibrated in A.C./D.C. volts, ohms and milliamps. Voltage range A.C./D.C. 0-50, 0-100, 0-250, 0-500. Milliamps 0-10, 0-100. Ohms ranges 0-10,000, 0-100,000, 24/6. P. & P. 2/-. Wiring diagrams 1/-, free with parts.
4. **SIGNAL GENERATORS.** Cash **£7.5.0,** or **30/-** deposit and 6 monthly payments of **21/6.** P. & P. 5/6. Coverage 100 kc/s to 100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Case 10 x $6\frac{1}{2}$ x $5\frac{1}{2}$in. Three miniature valves and Metal Rectifier. A.C. mains 200/250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent. Modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch, variable A.F. output. Magic eye as output indicator. Accuracy $\pm$ 2 per cent.
5. **SIGNAL GENERATORS.** Cash **£5.5.0.** P. & P. 5/6. Coverage 120 kc/s to 84 Mc/s. Case 10 x $6\frac{3}{4}$ x $4\frac{1}{2}$in. Size of scale $6\frac{1}{2}$ x $3\frac{1}{2}$in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent, modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch variable A.F. output and moving coil output meter. Accuracy $\pm$ 2 per cent.
6. **STAAR 45. 9 v. BATTERY RECORD PLAYER** complete with pick-up and deck. A completely portable player. Head protected by plastic dome with a brush which cleans the stylus as it rises into playing position. 45 r.p.m. Auto on/off switch governed motor, attractive two tone grey finish. **£2.14.6.** P. & P. 2/-.
7. **CARRYING CASE for STAAR 45 or COMPLETE KIT** beautifully styled in two tone with record compartment. Specially designed to take player and amplifier. Just screw in and connect up. All parts available separately. Case only **22/6.** P. & P. 4/-. **Complete kit £5.10.0.** P. & P. 5/-.
8. **TRANSISTORISED AMPLIFIER, suitable STAAR 45. Output 1 watt.** Size $4\frac{1}{2}$ x $2\frac{3}{4}$in. Printed circuit, tone/volume controls plus 4 transistors. Push-pull output complete with 3in. moving coil speaker. Built and tested, **49/6.** P. & P. 2/-.
9. **CHANNEL TUNER I.F.** 16-19 Mc/s. Continuously tunable from 174-216 Mc/s. Valves required—PCF80 and PCC84 (in series). Cover BBC and ITA ranges. Also Police, Fire and Taxis, etc. Brand new by famous maker, **10/-.** P. & P. 3/-.
10. **B.S.R. MONARCH UA8 WITH FUL-FI HEAD.** 4-speed, plays 10 records, 12in., 10in. or 7in. at 16, 33, 45 or 78 r.p.m. Intermixes 7in., 10in. and 12in. records of the same speed. Has manual play position: colour brown. Dimensions: $12\frac{1}{2}$ x $10\frac{3}{4}$in. Space required above baseboard $4\frac{3}{4}$in. below baseboard $2\frac{3}{4}$in. Fitted with Ful-Fi turnover crystal head, **£6.19.6.** P. & P. 5/6.
11. **PUSH PULL OUTPUT STAGE** inclusive of transistors with input and output transformers to match 3 ohms speech coil, suitable for use with the POCKET RADIO. Kit of parts, including transistors, **19/6.** P. & P. 2/-. Wiring diagram 1/6, free with parts.
12. **8-watt PUSH PULL 4 VALVE AMPLIFIER plus METAL RECTIFIER.** A.C. mains 200-250 v. Size $10\frac{1}{2}$ x $6\frac{1}{4}$ x $2\frac{1}{2}$in. 5 valves. For use with all makes and types of pick-up and mike. Negative feed back. Two input, mike and gram, and controls for same. Separate controls for Bass and Treble lift. Response flat from 40 cycles to 15 kc/s. 2 db down to 20 kc/s. Output 8 watts at 5 per cent total distortion. Noise level 40 db down all hum. Output transformer tapped for 3 and 15 ohms speech coils. For use with Std. or L.P. records, musical instruments such as guitars, etc. Suitable for small halls, **£3.19.6.** P. & P. 6/-. **Crystal mike to suit, 15/-.** P. & P. 2/-. **8in. P.M. Speaker to suit, 12/6.** P. & P. 2/-.
13. **INDOOR AERIAL for ITV/BBC/FM.** Complete with standard co-axial plug. Heavy chrome extending dipoles—7ft. fully extended. Plugs straight into T.V. or VHF Tuner. Fully directional, **10/6.** P. & P. 1/6.
14. **LINE E.H.T. TRANSFORMERS.** Built-in line width control. 14 kv. Scan coil 90in. deflection on ferrite yokes. Frame O.P. transformer pl. 18 kv smoothing condenser, suitable for 14in., 17in. or 21in. tubes. With circuit diagram, **29/6.** P. & P. 4/6. **Suitable Focus Magnet** (state tube), **10/-.** P. & P. 3/-.

RADIO & T.V. COMPONENTS [ACTON] LIMITED

21b HIGH STREET ACTON, LONDON, W.3.

ALL ENQUIRIES S.A.E.
GOODS NOT DESPATCHED OUTSIDE U.K.

AUDIOTRON HI-FI TAPE RECORDER KIT

REALISM AT INCREDIBLY LOW COST, CAN BE ASSEMBLED IN AN HOUR

Incorporating the latest Collaro Studio Tape Transcriptor. The Audiotrine High Quality Tape Amplifier with negative feedback equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Reel of Best quality Tape and a Handsome Portable carrying Cabinet with latest attractive two-tone polychrome finish, size 14½ x 15 x 8½in. high, and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£80 class. S.A.E. for leaflet.

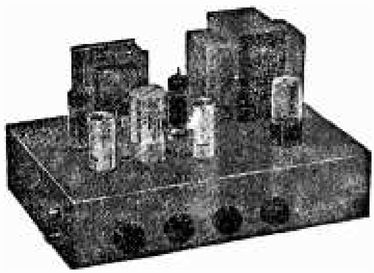
25½ GNS. Carr. 17/6

ONLY 8 PAIRS OF SOLDERED JOINTS PLUS MAINS

H.P. TERMS. Deposit £2.13.9 and 12 monthly payments of 44/-. Cash price if settled in 3 months.

HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP STAGES



Two input sockets with associated controls allow mixing of "mike" and gram. as in A10. High sensitivity. Includes 5 valves, ECC83, ECC83, EL34, EL84, 5Y3. High Quality sectionally wound output transformer specially designed for Ultra Linear operation and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut". Frequency response ± 3 D.B. 30-30,000 c/s. Six negative feedback loops. Hum level 60 D.B. down. ONLY 28 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs. For **STANDARD or LONG PLAYING RECORDS.** For **MUSICAL INSTRUMENTS** such as **STRING BASS, GUITARS,** etc. **OUTPUT SOCKET** with plug provides 300 v. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12-9-7in. For A.C. mains 200-250 v. 50 c.p.s. Output for 3 and 15 ohms speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Only **8 Gns.** Carr. 10/-

(Or factory built 51/- extra).

If required louvred metal cover with 2 carrying handles can be supplied for 18/9. **TERMS ON ASSEMBLED UNITS. DEPOSIT 24/9, and 9 monthly payments of 24/9.** Send S.A.E. for illustrated leaflet detailing Ready-to-assemble Cabinets, Speakers, Microphones, etc., with cash and credit terms.

R.S.C. STEREO/TEN HIGH QUALITY AMPLIFIER

A complete set of parts for the construction of a stereophonic amplifier giving 5 watts high quality output on each channel (total 10 watts). Sensitivity is 50 millivolts, suitable for all crystal stereo heads. Ganged Bass and Treble Control give equal variation of "lift" and "cut". Provision is made for use as straight (monaural) 10-watt amplifier. Valve line-up ECC83, ECC83, EL84, EL84, EZ81. Outputs for 2-3ohm speakers. Point-to-Point wiring diagrams and instructions supplied. Send S.A.E. for leaflet. **8 Gns.** Full constructional details and price list 2/6. Carr. 10/-.

Kit can be assembled, ready for use, 59/6 extra.

HI-FI CRYSTAL PICK-UP HEADS. (Cartridges.) Acos, Standard replacement for Garrard, B.S.R. and Collaro, 19/9. Acos Stereo/Monaural 49/9. Ronette Stereo/Monaural 50/6.

BRADMATIC RECORDING HEADS. High Impedance Record/Playback 22/-. Low Impedance Erase, 12/6.

PICK-UP ARMS. Complete with latest Acos/hi-fi Turnover head and rest. Only 29/11.

CRYSTAL MICROPHONES. Hand type NP110 14/9, R.T.C. 19/9, Acos Mic 40 25/9, Acos Mic 45 29/9, Stick type Acos 39-1 39/9, BM3 with neck band and heavy table stand 59/9. Lapel type 35/9.

COLLARO JUNIOR 4-speed Single Player Unit and Crystal Pick-up with hi-fi Turnover head. Only £3.19.6.

COLLARO CONQUEST 4-SPEED AUTO-CHANGER, with high fidelity Studio pick-up. Latest model. For 200-250 v. 50 c.p.s. A.C. mains. Our price £6.19.6. Carr. 5/6.

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

B.S.R. UA8 4-speed AUTO-CHANGERS with hi-fi turnover head, £6.19.9. Carr. 4/6.

GL3A MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with any single or auto-change unit. Output for 2-3 ohm speaker. For 200-250 v. A.C. mains. Size 11½ x 2½ x 2½in. Controls: Vol. and Tone with switch. Only 59/9.

R.S.C. BATTERY CHARGING EQUIPMENT

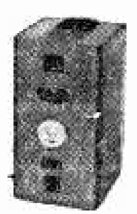
All for A.C. Mains 200-250v., 50c/s Guaranteed 12 months.

HEAVY DUTY CHARGER KIT 6/12 v. 6 amps. variable output. Consisting of Mains Transformer 0-200-230-250 v.: F.W. (Bridge) Selenium Rectifier: Ammeter. Variable Charge Rate Selector Panels, Plugs, Fuses, Fuseholder and circuit. 59/9. Carr. 4/6.

PARMEKO POTTED CHOKES

200 mA, 12 H 100 ohms	16/9
120 mA, 30 H 200 ohms	16/9
120 mA, 8 H 10 ohms	13/9

SOLDERING IRONS. 230-250 v. 30 watts. First quality. For Radio work, 19/9. Spare elements and bits available.



Assembled 6/12v. 4-5 amps. Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved blue hammer finished. Fused and ready for use with mains and output leads. **69/9** Carr. 5/-. Terms: Deposit 13/3 and 5 monthly payments 13/3. 6/12 v. 3a., all facilities as above. Only 59/9, carr. 3/9.

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

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

6v. or 12v. 1 amp.	24/9
As above, with Ammeters	32/9
6 v. 2 amps	25/9
6v. or 12v. 2 amps.	31/6
6 v. or 12 v. 2 amps, inclusive of Ammeter	42/9
6 v. or 12 v. 4 amps.	49/9
6 v. or 12 v. 4 amps. with Ammeter and variable charge rate selector	59/9

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

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

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

TOP SHROUDED DROP THROUGH

250-0-250v. 70mA, 6.3v. 2a, 0-5-6.3v. 2a	17/9
350-0-350v. 80mA, 6.3v.2a, 5v. 2a	18/9
250-0-250v. 100mA, 6.3v. 2a, 6.3v. 1a	21/9
250-0-250v. 100mA, 6.3v. 3.5a, C.T.	19/9
250-0-250v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a	25/9
300-0-300v. 130mA, 6.3v. 4a, 6.3v. 1a, for Mullard 510 Amplifier	20/9
300-0-300v. 100mA, 6.3v. 4a, 5v. 3a	26/9
350-0-350v. 100mA, 6.3v. 4a, 5v. 3a	26/9
350-0-350v 150mA, 6.3v. 4a, 0-5-6.3v. 3a	29/9

FULLY SHROUDED UPRIGHT

250-0-250v. 60mA, 6.3v. 2a, 0-5-6.3v. 2a, Midget type 2½-3-3in.	17/11
250-0-250v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a	27/9
300-0-300v. 100mA, 6.3v. 4a, 5v. 3a	27/11
300-0-300v. 130mA, 6.3v. 4a, C.T. 6.3v. 1a, for Mullard Amplifier	33/9
350-0-350v. 100mA, 6.3v. 4a, 5v. 3a	27/11
350-0-350v. 150mA, 6.3v. 4a, 5v. 3a	35/9
425-0-425v. 200mA, 6.3v. 4a, C.T. 5v. 3a	55/-

FULLY SHROUDED (continued)—

425-0-425v. 200mA, 6.3v. 4a, C.T., 6.3v. 4a C.T., 5v. 3a	59/9
450-0-450v. 250mA, 6.3v. 4a C.T. 5v. 3a	69/9

OUTPUT TRANSFORMERS

Midget Battery Pentode 66:1 for 3S4, etc.	4/6
Small Pentode, 5000Ω to 3Ω	4/6
Small Pentode 7/8,000Ω to 3Ω	4/6
Standard Pentode 5,000 to 3Ω	5/9
Standard Pentode 7,000 to 3Ω	5/9
10,000Ω to 3Ω	5/9
Push-Pull 8 watts, EL84, or 6V6 to 3Ω or matched to 15Ω	9/9
Push-Pull 10-12 watts to match 6V6 or EL84 to 3-5-8 or 15Ω	19/9

Following types for 3 and 15Ω speakers:

Push-Pull 10-12 watts 6V6 or EL84	18/9
Push-Pull 15-18 watts, 6L6, KT66	20/9
Push-Pull for Mullard 510 Ultra Linear	29/9
Push-Pull 20 watts, sectionally wound, 6L6, KT66, EL34, etc.	49/9

MIDGET MAINS Primaries 200-250 v. 50 c/s.

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

Both above size 2½ x 2½ x 2½ins.

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

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. 12/9; 0-9-15 v. 2 a. 14/9; 0-9-15 v. 3 a. 16/9; 0-9-15 v. 5 a. 19/9; 0-9-15 v. 6 a. 23/9; 0-9-15 v. 8 a. 28/9.

AUTO (Step up/Step down) TRANS. 0-110/120-230/250 v. 50-80 watts. 13/9; 250 watts, 39/9; 150 watts, 27/9.

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

—NOT DODGEY

YOU WILL BE TOP OF YOUR GIRL'S HIT PARADE WHEN YOU PACK A ...

PARISIENNE!

SWINGIN' !!!

ROPE IN LUXEMBOURG!

WITH THE FANTASTIC

PARISIENNE !!

A SUPERB POCKET TRANSISTOR

Dozens of continentals come rolling in! **LUXEMBOURG ROMPS IN LIKE THE LIGHT!!** Fully tunable over long and medium waves; the complete novice and experienced constructor alike will delight in building it. Already excellent reports have reached us from all over Europe and the U.K.! You will be **ASTOUNDED** by its tremendous volume and truly remarkable performance. Build-up presents **NO PROBLEMS! EVEN** to the **COMPLETE NOVICE!**

Components include a built-in ferrite rod aerial, high quality 3in. moving coil speaker, printed circuit, elegant style cabinet, etc.

A fully illustrated booklet, complete with step-by-step assembly instructions and all other data, comes to you for only 2/9 extra; PP4 press-stud type battery 2/3; post and packing on the lot 2/6.

This amazing little set
HAS TO BE HEARD TO BE BELIEVED
We will supply **ALL** *components at a total cost of only*

£3.19.6 !!!

YOU CAN'T GO WRONG!

SO GET WITH IT !!
and build yourself this superb little set **NOW!**
PUT THE WORLD IN YOUR POCKET!

Free advice bureau, second-to-none service and all your components top quality and fully guaranteed.

Transistors: OC76 **4/6**, OC71 **5/-**, Japanese Audio **2/6**, G.E.C. S1 Black Audio **3/-**, S2, Blue driver **3/-**, SB305 **9/-**, OC170 **10/-**, OC77 **12/6**, 2N398 **10/-**, SB240 **7/6**, OC42 **3/6**, XA701 **6/-**, GET 103 **6/-**, OA10 **6/-**, OA2 203 **7/6**, OA5 diode **5/-**, OA2 202 **7/6**, Latest miniature diode OA90 **2/11**, XC141 power output as OC16, only **10/-**, XA116 **6/-**, general purpose diodes **1/-**. P.P. 4d. on each transistor. All these are new.

OC28 **19/6**, OC35 **19/6**, OCP71 **19/6**, OC200 **12/6**, P.P. 6d. OC72 **5/-**, P.P. 3d. OC44 **5/6**. OA47 V.H.F. or h/speed switching diode **3/6**. OA86 **4/-**, 2N456 **19/6**, OC28 and OC29 **19/6**, CG12E diodes **4/-**, SB345 **6/6**, SB346 **7/-**.

12-way Tag Board, with resistors and condensers as follows, all ½in. watt transistor type: two 10 meg., two 0.01, one 3.9 M., 5.6 M, 3.3 M, 1.2 M, 2.2 M, 470 Ω, 470K. All for **2/-**. P.P. 3d.

6000Ω P.O. Relays. Platinum contacts, 3 way normal open, few only at **12/6**. P.P. 9d.

4 Transistor Amplifier, printed circuit with circuit **2/-**. P.P. 3d. Parts available, but not plans.

Car Aerials. Adjustable angle telescopic. 12in. closed, 36in. extended with Co-ax plug, **17/6**. Post paid.

Window Fixing, type for portable, **17/6**, post paid.

Miniature Mains Soldering Irons. Designed for transistor kit work, 30 watt, specially light weight, handle unscrews to cover bit so that iron can be carried even when hot, supplied with handsome pocket case in grey leather cloth P.V.C. Spares always available—ONLY **17/6**. Post paid.

WANTED

Valves, transistors, miniature components, all types of radio equipment, any quantity, but must be new, cash paid by return.

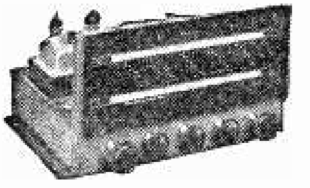
TRADE ENQUIRIES WELCOMED ON ANY LINES

F.T.R. II. Tape Recorder Kit. Sub-assembled, finished in one hour. Size: 6 x 8¼ x 2¼in. Fully portable. 20 min. play. Send for illustrated leaflet. S.A.E. Kit cost **£6.19.6.** P.P. **3/6.**

WOLVERHAMPTON RADIO & TV SUPPLIES, 43 Birmingham Rd, Wolverhampton

Terms:—C.W.O. to avoid delay. All orders mailed by return, subject to stocks surviving the onslaught!
All components can, of course, be supplied individually. Fuller details and/or prices by request, write (S.A.E.) or call Tel.: Wolverhampton 20315

ARMSTRONG AF208 AM/FM RADIOGRAM CHASSIS



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

PRICE **£22.18.0** Carr. Free

LATEST "EMI" 4 SPEED SINGLE RECORD PLAYER

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

Special offer **£6.5.0** post free.

SINGLE-PLAYER BARGAIN

Ready-built, complete with BSR TU9 4-speed gram pick-up unit. Handsome portable case. 3-watt amplifier with 2 valves and speaker. List price £12.12.0. OUR PRICE £8.19.6. Fully guaranteed in manufacturer's sealed cartons.

SUMMER SALE PRICES

New Boxed VALVES 90-day Guarantee

0Z4	5/-	6K7G	5/-	EABC80	8/-	PCL82	10/-
1R5	6/-	6K8G	5/-	EB91	4/-	PCL84	10/-
1S5	6/-	6L6G	8/-	EBC41	8/-	PL81	10/-
1T4	3/-	6N7M	5/-	EBC81	8/-	PL83	8/-
2X2	2/-	6Q7G	6/-	EBF80	9/-	PY80	7/-
3S4	7/-	6SN7	5/-	ECH42	9/-	PY81	8/-
3V4	7/-	6V6G	5/-	ECH81	9/-	PY82	7/-
3Q5	7/-	6X4	5/-	EF85	6/-	PY83	8/-
5U4	6/-	6X5	6/-	EF89	8/-	QP25	7/-
5Y3	6/-	12AT7	6/-	EL32	5/-	SP41	3/-
5Z4	9/-	12AU7	6/-	EL84	7/-	SP61	3/-
6AC7	4/-	12AX7	7/-	EY51	9/-	U22	7/-
6AM6	4/-	12BH7	7/-	EY86	9/-	UBC41	8/-
6AT6	6/-	12K7	5/-	EZ40	7/-	UBC81	9/-
6BA6	7/-	12K8	14/-	EZ80	7/-	UBF89	9/-
6BE6	5/-	12Q7	5/-	EZ81	7/-	UCH81	9/-
6BW6	7/-	25Y5G	9/-	L1148	1/-	UCL82	10/-
6C4	5/-	35L6	9/-	HABC80	10/-	UCL83	12/-
6D6	5/-	35Z4	5/-	HVR2A	5/-	UF89	9/-
6G6	4/-	807	5/-	KT33C	8/-	UL41	9/-
6H6	3/-	954	2/-	KT76	8/-	UY41	7/-
6J5	5/-	DAF96	8/-	MU14	7/-	UY85	7/-
6J6	5/-	DF96	8/-	PCC84	8/-	UU9	7/-
6J7G	6/-	DK96	8/-	PCF80	8/-	VR150	7/-
6K6	5/-	DL96	8/-	PCF82	8/-	W81	6/-

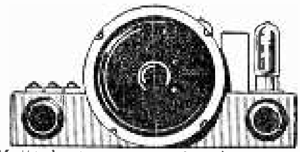
SETS OF VALVES

DK96, DF96, DAF96, DL96 — 29/6 set.
1R5, 1T4, 1S5, 3S4 or 3V4. — 19/6 set.

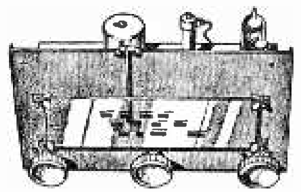
NEW ELECTROLYTICS — **FAMOUS MAKES**

TUBULAR		TUBULAR		CAN TYPES	
1/350V	2/-	50/350V	5/6	16/450V	5/-
2/350V	2/3	100/25V	3/-	32/350V	4/-
				100/270V	5/6
4/450V	2/3	250/25V	3/-	2,000/6V	4/-
8/450V	2/3	500/12V	3/-	5,000/6V	5/-
16/450V	3/-			32+32/350V	5/-
32/450V	3/9	8+8/450V	3/6	32+32/450V	6/-
25/25V	1/9	8+16/450V	3/9	32+32+32/350V	7/-
50/25V	2/-	16+16/450V	4/3	50+50/350V	7/-
				64+120/350V	11/6
50/50V	2/-	32+32/350V	4/6	100+200/275V	12/6

COMPLETE RADIO £4.19.6 post free



4 Mullard valves, 5in. speaker, frame aerial. 4 pre-set stations. 1 long, 3 med. wave. **Superhet Circuit. BRAND NEW.** Size 9 x 6 x 5½in. high. Tested by us ready for use. 200/250 v. A.C.-D.C. Mains.



DE LUXE MODEL as above but with illuminated dial. Fully tunable over Medium and Long Wave. 5 inch speaker. Bargain £5.19.6, post free. Tested by us before despatch. 12-month Guarantee.

MAINS TRANSFORMERS 200/250 v. A.C.

Postage 2/- each transformer.

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. 22/6, ditto, 350-0-350 .. 29/6
MINIATURE 200 v. 20 mA, 6.3 v. 1 a. 10/6
MIDGET, 220 v. 45 mA, 6.3 v. 2 a. .. 15/6
SMALL, 220-0-220, 50 mA, 6.3 v. 2 a. 17/6
STD., 250-0-250, 65 mA, 6.3 v. 3.5 a. .. 17/6
HEATER TRANS. 6.3 v. 1½ amp. .. 7/6
Ditto, tapped sec. 2, 4, 6.3 v., 1½ amp. 8/6
Ditto, sec. 6.3 v. 3 amp 10/6
GENERAL PURPOSE LOW VOLTAGE. 2 amp. 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24, 30 v. 22/6
AUTO TRANSFORMERS, 150 w. .. 22/6
0, 120, 200, 230, 250 v., 500 w. .. 82/6
MULLARD 510" Mains transformer .. 30/-
PARMEKO MAINS TRANSFORMER. Made for special contract, the ratings can safely be doubled. Guaranteed 2 years. Primary 0-110-210-230-250 v. H.T. 300-0-300 v. 50 mA. L.T. 6.3 v. 1.8 amp. Size 4 × 3½ × 3½ in. Weight 6lb. Post 2/6. .. .. 17/6
MAINS POWER PACK. Size 3½ × 4½ × 4 in. with mains transformer, metal rectifier and condensers to provide smoothed H.T. output 220 v. 45 mA. D.C., L.T. 6.3 v. 2 a. Centre tapped. All ready built on a strong metal chassis. Brand New. Bargain. Post 2/6 .. .. 29/6

O.P. TRANSFORMERS. Heavy Duty 50 mA. 4/6. Multiratio, push-pull, 7/6. Ditto, 10 w., 15/6. Miniature, 384m etc., 5/9. **L.F. CHOKES** 15/10H. 60/65 mA, 5/-; 10 H. 85 mA, 10/6; 10 H., 150 mA, 14/-. **FULL WAVE BRIDGE SELENIUM RECTIFIER:** 2, 6 or 12 v. 1½ amp., 8/9; 2 a., 11/3; 4 a., 17/6. **CHARGER TRANSFORMERS.** Tapped input 200/250 v. for charging at 2, 6 or 12 v., 1½ amps., 15/6. 2 amps., 17/6; 4 amps., 22/6. Circuit included. **4 AMP CAR BATTERY CHARGER** with amp meter Leads, Fuse Case, etc., for 6 v. or 12 v., 69/9

BOOKS list S.A.E.

40 Circuits for Germanium Diodes 3/-.
"W.W." Radio Valve Data, 6/-.
High Fidelity Speaker Enclosure, 5/-.
Valve and TV Tube Equivalents, 9/6.
TV Fault Finding, 5/-.
Quality Amplifiers, 4/6.
Radio Valve Guide. Books 1, 2, 3 or 4, 5/- each.
Transistor Superhet Receivers, 7/6.
Practical Radio Inside Out, 3/6.
Master Colour Code Chart, 1/6.
Transistor Controlled Models. 7/6.

C.R.T. BOOSTER TRANSFORMERS for heater cathode short circuit, C.R. tubes with failing emission. Full instructions supplied.

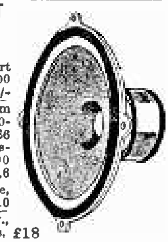
Type A optional 25% and 50% boost. 2v. or 4v. or 6.3v. or 10.8v. or 13.3v. Mains input. **PRICE 10/6.**

LOUDSPEAKER P.M. 3 OHM. 2½, 3, 4in., 19/6. 5in. Rola, 17/6; 8in. Plessey, 19/6; 7in. x 4in. Rola, 18/-; 6½in. Rola, 18/6; 10 x 6in. 27/6; 10in. Rola 30/-; 4in. Tweeter, 25/-; 12in. R.A. 30/-; 13½ x 8in., Double Cone E.M.I. 45/-.

STENTORIAN HF1012. 10in. 3 to 15 ohms, 10 w., 95/- 35 ohm, 7 x 4in., 25/-; 3½in., 19/6.

BAKER SELHURST LOUDSPEAKERS

Details S.A.E.



12in. Baker 15w. Stalwart 3 or 15 ohms, 45-13,000 c.p.s. 90/-

12in. Baker Stalwart, Foam Suspension, 15 ohms, 40-13,500 c.p.s. .. £6

12in. Stereo, Foam Suspension, 12w., 35-16,000 c.p.s. .. £6.17.6

12in. Baker Ultra Twelve, 20 c.p.s. to 25 kc/s. £17.10

15in. Auditorium, 35 w., Bass. 20 c.p.s. to 12k /cs. £18

TWIN GANG TUNING CONDENSERS. 365 pF miniature 1in. x 1½in. x 1½in., 10/-. 500pF Standard with trimmers, 9/-; midget, 7/6; with trimmers, 9/-. 500 pf slow motion tuning 9/-
SMALL 3 gang 500 pF, 17/-.
SINGLE 25 pF, 50 pF, 75 pF, 100 pF, 160 pF, 5/6. Solid dielectric 100, 300, 500 pF, 3/6.

CONDENSERS. New stock. 0.001 mfd. 7 kV: T.C.C., 5/6; Ditto, 20 kV, 9/6; 0.1 mfd., 7 kV, 9/6. Tubular 500 v. 0.001 to 0.05 mfd., 9d., 0.1, 1/-; 0.25, 1/6. 0.5/500 v., 1/9. 0.1/350 v., 9d. 0.1/2,000 v. 0.1/1,000 v., 1/9; 0.1 mfd., 2,000 volts, 3/6.
CERAMIC CONDS. 500 v. 0.3 pF to 0.01 mfd., 9d.

SILVER MICA CONDENSERS. 10% 5 pF to 500 pF 9d.; 600 pF to 3,000 pF, 1/-. Close tolerance (± 1 pF) 2.2 pF to 47 pF, 1/-. Ditto 1% 50 pF to 815 pF, 1/-; 1,000 pF to 5,000 pF, 1/9.

465 kc/s SIGNAL GENERATOR Price 15/-. Uses B.F.O. Unit, ZA 30038 ready made with valve 1S5. **POCKET SIZE** 2½ x 4½ x 1in. Slight modifications required, full instructions supplied. Battery 8/6 extra 69V 1½V. Details S.A.E.

WAVECHANGE SWITCHES
8 p. 4-way 2 wafer long spindle 6/6
2 p. 2-way, or 2 p. 6-way long spindle or 4 p. 2-way or 4 p. 3-way long spindle 3/6
3 p. 4-way, or 1 p. 12-way long spindle .. 3/6
Wavechange "MAKITS", Wafers available; 1 p. 12 way, 2 p. 6 way, 3 p. 4 way, 4 p. 3 way, 6 p. 2 way. 1 wafer, switch 8/6; 2 wafer switch, 12/6; 3 wafer switch, 16/-: additional wafers up to 12, 3/6 each extra.

Toggle Switches, s.p., 2/-; d.p., 3/6; d.p.t.d., 4/-. Ex. Govt. s.p.d.t., 1/-.

CRYSTAL MIKE INSERT, 6/6
Precision engineered. 1½in. dia. x ¼in.

ACOS 39-1 DE LUXE STICK MIKE 35/-
TSL QUALITY STICK MIKE......25/-

Valveholders. Pax. int. oct., 4d. EA50, 6d. B12A, CRT, 1/3. Engl. and Amer. 4, 5, 6 and 7 pin, 1/-. MOULDED Mazda and int. oct., 6d.; B7G, B8A, B8G, B9A, 8d. B7G with can, 1/6. B9A with can, 1/9. Ceramic EF50, B7G, B9A, int. oct., 1/-. B7G, B9A cans, 1/- each.

Quality 2-Stage HI-FI AMPLIFIER A.C. only, 200-250 v. Valves ECL86 and EZ80. 3 watt quality output. Mullard tone circuits, bass boost, treble and volume controls. Separate engraved Perspex front-panel with de-luxe finish. Heavy duty output transformer 3 ohm. Shrouded mains transformer. Stove enamelled chassis size 6in. x 5in. x 3in. **Bargain Price £4.10.0.** Circuit supplied.

THE ORIGINAL RADIO COMPONENT

Our written guarantee with every purchase.
NEW COMPONENT LIST 1/-

Bus 133 or 68 pass door
S.R. Station Selhurst

Volume Controls

Linear or Log Tracks. Long spindles. Midget 5 K ohms to 2 Meg. L/S, 3/-; D.P., 4/6 Stereo L/S 10/6; DP 14/6

80 ohm CABLE COAX

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

TELESCOPIC CHROME AERIALS. 13in. extending to 43in., 8/6 ea. Coax Adaptor Plug, 1/6 extra.
TRIPLEXERS Bands I, II, III 12/6
COAX PLUG .. 1/- LEAD SOCKET.. 2/-
PANEL SOCKETS 1/- OUTLET BOXES 4/6
BALANCED TWIN FEEDER yd. 6d. 80 or 300 ohms.
DITTO SCREENED per yd. 1/6. 80 ohms only.
WIRE-WOUND POTS, 3 WATT. Pre-set Min. TV Types. All values 10 ohms to 25 K., 3/- ea. 30 K., 50 K., 4/-. (Carbon 30 K., to 2 meg., 3/-).
WIRE-WOUND 4 WATT Pots. Long spindle. Values, 50 ohms to 50 K., 6/6; 100 K., 7/6.
PHILIPS TRIMMERS, 0-10 pF, 3-30 pF, 1/-.
TRIMMERS, Ceramic. 30, 50, 70 pF, 9d.; 100 pF, 150 pF, 1/3; 250 pF, 1/6; 500 pF, 750 pF, 1/9.
T.V. etc. TRIMMER, 1000 pF, with knob, 2/-.
RESISTORS. Preferred values. 10 ohms to 10 meg., ¼ w., 4d.; ½ w., 4d.; 1 w., 6d.; 1½ w., 8d.; 2 w., 1/-.
HIGH STABILITY. ½ w., 1%, 2/-. Preferred values. 10 Ω to 10 meg. Ditto 5%, 10 Ω to 22 meg., 9d.

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

AMERICAN "BRAND FIVE" PLASTIC RECORDING TAPE

			Spare Plastic Reels	
Double Play	7in. reel, 2,400ft.	60/-		
	5in. reel, 1,200ft.	37/6		
Long Play	7in. reel, 1,800ft.	35/-	3in.	1/6
	5¾in. reel, 1,200ft	23/6	4in.	2/-
	5in. reel, 900ft.	18/6	5in.	2/-
Standard	7in. reel, 1,200ft.	25/-	5¾in.	2/-
	5in. reel, 600ft.	16/-	7in.	2/6

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

CRYSTAL SET BOOKLET, 1/-.
CRYSTAL DIODE G.E.C., 2/-. GEX34, 4/-. OA81, 3/-.
HIGH RESISTANCE PHONES. 4,000 ohms, 15/- pr.
SWITCH CLEANER. Fluid squirt spout, 4/6 tin.

HIGH GAIN TV PRE-AMPLIFIERS BAND 1 B.B.C.

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

Paxolin Panels, 10 x 8in., 2/-.
Miniature Contact Cooled Rectifiers, 250V 50mA, 7/6; 250V 60mA, 8/6; 250V 85mA, 9/6; 200mA, 21/-; 300mA, 27/6.
TV etc. Silicon Sub.-Min. Rectifier. 125V. 300mA, 6/6; 250V. 300mA, 14/6.
Selenium Rect., 300V 85mA. 5/-.
Coils Wearite "P" type, 3/- each.
Osmor Midget "Q" type. adj. dust core. from 4/- each. All ranges.
Teletron D.W.R. L. and Med. T.R.F. with reactions, 4/-. Med wave D.R.. 3/6.
Ferrite Aerials, M.. 8/9; M. and L.. 12/6.
Osmor Ferrite Rod Aerials, L. and M. for transistor circuits, 10/- each.
Ferrite Rods, 8 x ⅜in., 3/-; 8 x 5/16in., 3/-.
H.F. Chokes, 2/6. Osmor QC1, 6/9.
T.R.F. Coils, A/HF, 7/- pair; HAX, 3/-, Repanco DRR2, 4/-. DRX1, 2/6.
Radio Screwdriver, 5in., 6d.
Neon Mains Tester Screwdriver, 5/-.
Solder Radiograde, 4d. yd., ½lb. 5/-.
Black Crackle Paint. Air drying, 3/- tin.

Aluminium Chassis. 18 s.w.g. Plain undrilled, 4 sides. riveted corners, lattice fixing holes, 2½in. sides, 7 x 4in. 4/6; 9 x 7in., 5/9; 11 x 7in., 6/9; 13 x 9in.. 8/6; 14 x 11in., 10/6; 15 x 14in.. 12/6; 18 x 16 x 3in., 16/6.
Aluminium Panels, 18 s.w.g.. 12 x 12in. 4/6; 14 x 9in., 4/-; 12 x 8in., 3/-; 10 x 7in.. 2/3; 8 x 6in., 2/-.

6 TRANSISTOR RADIO MED. & LONG WAVE KIT

First class components to make a 6 transistor 2 wave band superhet chassis. Ideal for portable or table radio. All parts including BVA transistors ferrite aerial, printed circuit, 8¼in. x 2¼in., but EXCLUDING speaker and cabinet. Simple instructions 1/6 (Free with kit).
Speakers, 35 ohm, 7 x 4in. 25/- extra or 3½in. round 19/6 extra. **£4.5.0**

TV Plug-in "V" Aerial 16/6

JACKS. English open circuit, 2/6. Closed circuit, 4/3. Grundig type, 3 pin, 1/3.
JACK PLUGS. English, 3/-; Screened, 4/-; Grundig, 3 pin, 3/6.
Wirewound Ext Speaker Control, 10 Ω 3/-.
ALADDIN FORMERS and cores, ¼in., 8d.; ⅜in., 10d.
0.3in. FORMERS 5937 or 8 and cans TV1 or 2, ½in. sq. x 2½in. or ⅜in. sq. x 1¾in., 2/- with cores.
SLOW MOTION DRIVES. 6:1, 2/3.
SOLON IRON, 25W, 200V or 230V, 24/-.
ANTEX SUB-MIN IRON 15w. 200 or 240v. 29/6

JASON FM TUNER COIL SET.

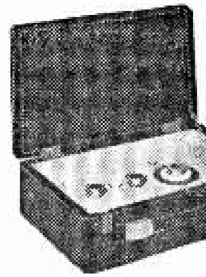
29/-. H.F. coil, aerial coil. oscillator coil, two i.f. transformers 10.7 Mc/s. detector transformer and heater choke. Circuit and component book using four 6AM6, 2/6. Complete Jason FMT.1 Kit. Jason chassis with calibrated dial. components and 4 valves, £6.5.0.

MAINS DROPPERS. Midget adjustable sliders. 0.3A, 1,000 ohms, 5/-; 0.2A, 1,200 ohms, 5/-; 0.15A, 1500 ohms, 5/-; 0.1A, 2,000 ohms, 5/-.
LINE CORD. 0.3A 60 ohms per foot, 0.2A 100 ohms per foot, 2-way, 1/- per foot; 3-way 1/- per foot.
MIKE TRANSFORMER. 50-1, 3/9.
P.V.C. Conn. Wire, 8 colours, single or stranded, 2d. yd. Sleeving, 1.2mm, 2d.; 4mm, 3d.; 6mm, 5d. yd.
SPEAKER FRET. Gold cloth, 17 x 25in., 5/-; 25 x 35in., 10/-. Tygan, various colours, 52in. wide, from 10/- ft.; 26in. wide, from 5/- ft. Samples, S.A.E. Expanded Metal, Gold, 12 x 12in., 6/-.

TELEVISION REPLACEMENTS

Line Output Transformers from 45/- each, NEW Stock and other timebase components. Most makes available. S.A.E. with all enquiries

"REGENT" 4 VALVE



"96" RANGE VALVES
KIT PRICE
£6. 6. 0.
carr. 4/-

PRINTED CIRCUIT BATTERY PORTABLE KIT

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

MONARCH RECORD PLAYER

Kit with ready built amplifier, speaker and cabinet.
carr. and ins. 5/- **£12.10.0**

4 Speed Autochanger, B.S.R., U.A.14		£7.10.0
B.S.R.. U.A.12 Stereo/Mono	..	£8.5.0
Garrard Model Autoslim	..	£7.19.6
4 Speed Single Players, EMI	..	£6.5.0
Garrard TA Mk.II, GC8 Head	..	£8.0.0
Garrard Model 4SP GC8	..	£6.17.6
Garrard 4HF Transcription	..	£17.19.6
Amplifier player cabinets (except 4 H.F.)		70/-
2-valve amplifier and 6½in. speaker	..	95/-
3-valve amplifier and 6½in. speaker	..	105/-

Wired and tested ready for use with above.
All sapphire styli available from 6/-.

I.F. TRANSFORMERS 7/6 pair

465 kc/s slug tuning miniature can. High Q and good band width. Data sheet supplied.

ARDENTE Transistor Transformers

Type D3035, 7.3 CT; Push Pull to 3 ohms for OC72, etc., 1 x ⅞ x ⅞in. 9/6
Type D3034, 1.75 : 1CT. Push Pull Driver for OC72, etc., 1 x ⅞ x ⅞in. 9/6
Type D3058, 11.5 : 1 Output to 3 ohms for OC72, etc., 1 x ⅞ x ⅞in. 9/6
Type D167, 18.2 : 1 Output to 3 ohms for OC72, etc., ⅜ x ⅜ x ½in. 12/-
Type D239, 4.5 : 1 Driver Transformer, 10/-
Type D240 8.5 : 1 Driver Transformer, 10/-

ARDENTE TRANSISTOR CONTROLS

Type VC1545, 5K with switch, dia. 0.9in., 8/-.
Type VC1760, 5K with switch, dia. 0.7in., 10/6
Deaf aid ear piece xtal or magnetic, 7/6.

WEYRAD

COILS AND TRANSFORMERS FOR A 2-WAVE TRANSISTOR SUPERHET WITH PRINTED CIRCUIT AND FERRITE ROD AERIAL

Long and Medium Wave Aerial—RA2W. On 6in. rod, 7/16in. diameter, 208pF tuning..	12/6
Car Aerial Coil.	1/-
Oscillator Coil P50/1AC. Medium wave. For 176pF tuning.	5/4
1st and 2nd I.F. Transformers—P50/2CC. 470 kc/s, 11/16in. dia. by ⅞in. high.	5/7
3rd I.F. Transformers—P50/3CC. to feed diode detector.	6/-
Spare Cores.	6d. each.
Driver Transformer—LFDT4. 1 5/16 x ⅞ x 1⅛in.	9/6
Wavechange Switch.	3/6
Printed Circuit—PCA1. Size 2⅞ x 8¼in. Ready drilled and printed with component positions.	9/6
Volume Control.	4/6
7 x 4in., 35 ohm Speaker.	25/-
3½in. round 35 ohm speaker.	19/6
24 Fixed Resistors.	10/6
16 Fixed Condensers.	21/-
Tuning Gang with trimmers.	10/6
6 Mullard Transistors and diode.	42/-
Constructor's Booklet	2/-

NEW MULLARD TRANSISTORS & DIODES

Audio OC71 6/- R.F. OC44 8/9 OA70 3/-
OC72 7/6 OC45 8/9 OA81 3/-
Sub Miniature Condensers. 0.1 mfd. 30 v. 1/3. 1, 2, 4, 5, 8, 16, 25, 30, 50, 100 mfd. 15 volt. 2/6 each.

B.B.C. Pocket 2 Transistor. M.W. and L.W. Radio Kit, 22/6. Miniature earpiece, 7/6. Batt. 2/3.

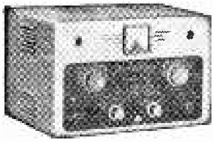
COMPONENT SHOP SPECIALISTS

337 WHITEHORSE ROAD WEST CROYDON

Telephone: THO 1665

Post 1/-. unless otherwise stated. *C.O.D. 2/-* *(Export welcome. Send remittance and extra postage).*

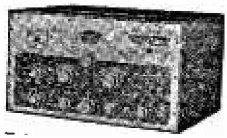
See the whole range at **Heathkit** DAYSTROM *The Radio Show, Stand 15.*



DX-40U

AMATEUR TRANSMITTER. Model DX-40U. Self-contained. 80-10 m. Power input 75 w. C.W., 60 w. peak, C.C. phone. Output 40 w. to aerial. Provision for V.F.O. **£32.10.0**

AMATEUR TRANSMITTER. Model DX-100U Covers all amateur bands, 160-10 m. 150 w. D.C. input. Self contained with power supply. Modulator, V.F.O. **£71.10.0**



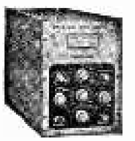
DX-100U

AUDIO SIGNAL GENERATOR. Model AG-9U. 10 c/s-100 kc/s, switch selected. Distortion less than 0.1%. 10 v. sine wave output metered in volts and dB's **£19.19.6**

VALVE VOLTMETER. Model V-7A. Measures volts to 1,500 (D.C. and R.M.S.) and 4,000 pk to pk. Res. 0.1Ω-1,000 MΩ. D.C. input impeded. 11 MΩ. With test prods, leads and standardising battery. **£13.0.0**

R.F. SIGNAL GENERATOR. Model RF-1U. Gives accurate source of R.F. up to 100 Mc/s on fundamentals and 200 Mc/s on harmonics. Up to 100 mV output on all bands. **£11.18.0**

SINGLE SIDEBAND ADAPTOR, Model SB-10U



SB-10U

May be used with most A.M. transmitters. Less than 3W R.F. input power required for 10W output. Operation on 80, 40, 20, 15 and 10m bands on USB, LSB or DSB **£37.6.0**

HI-FI 18W STEREO AMPLIFIER Model S-99. Ganged controls. Stereo/mono gram, radio and tape recorder inputs. Push-button selection. Printed circuit construction. **£26.19.0**

S-99

HI-FI AM/FM TUNER. Tuning range: FM: 88-108 Mc/s. AM: 16-50, 200-550, 900-2,000 m. Tuning heart (£5.5.6 incl. P.T.) and I.F. amplifier (£19.8.0) sold separately. Printed circuit board. ... ... Total **£24.13.6**

AM/FM Tuner

SHORTWAVE TRANSISTOR PORTABLE. Model RSW-1. Two short bands, trawler and medium **£21.6.0**

6-TRANSISTOR PORTABLE. Model UXR-1. Prealigned I.F. transformers, printed circuit, 7 x 4in., high flux speaker. Real hide case. **£14.3.0**

TAPE RECORDING/PLAYBACK AMPLIFIER Stereo (TA-IS) ... £23.6.0 Monaural (TA-IM) ... £18.2.6

TA-IS

5in. OSCILLOSCOPE. Model O-12U. Wideband amplifiers essential for TV servicing, F.M. alignment, etc. Vertical freq. response 3 c/s-5 Mc/s without extra switching. T/B covers 10 c/s-500 kc/s in 5 ranges **£36.10.0**

PORTABLE SERVICE OSCILLOSCOPE. Model OS-1. Compact portable scope ideal for servicing and general work. Y amplifier sensitivity 10 mV/cm; response. 3 dB 10 c/s-2.5 Mc/s. Time base 15 c/s- 150 kc/s. Printed circuits. Case 7⅞ x 4¾ x 12½in. long. Wt. only 10½lb. **£19.10.0**

THE "MOHICAN" GENERAL COVERAGE RECEIVER, Model GC-1U. Fully Transistorised Including 4 piezo-electric transfilters. Excellent portable or general purpose receiver for the amateur and short-wave listener. **£38.15.0**

GC-1U

VAR. FREQ. OSCILLATOR. Model VF-1U Calibrated 160-10 m. fundamentals 160 and 40 m. Ideal DX-40U and similar transmitters. **£11.2.0**

HI-FI F.M. TUNER. Tuning range 88-108 Mc/s. Tuning Unit (FMT-4U) with 10.7 Mc/s I.F. output (£3.2.0 inc. P.T.) I.F. Amplifier (FMA-4U) complete with cabinet and valves (£11.11.0) ... ... Total **£14.13.0**

6-W STEREO AMPLIFIER. Model S-33. 3 w/chl. inputs for radio/tape and gram., Stereo or Mono ganged controls. Sensitivity 200 mV. **£12.8.6**

SINGLE CHANNEL AMPLIFIER. Model MA-12. 10-12 watt Hi-Fi amplifier. Extremely low distortion and wide frequency range **£10.19.6**

STEREO CONTROL UNIT USC-1. Luxury model with press-button inputs to suit any pick-up or tuner and most tapeheads. Output 1.3 v. R.M.S. per channel. Printed circuit construction. **£18.18.6**

Money Saving "PACKAGED DEALS" of Complete Stereo Equipment from **£44.9.0**

HI-FI SPEAKER SYSTEM. Model SSU-1. Ducted-port bass reflex cabinet "in white." Twin speakers. Pedestal model **£11.15.0.** Bookcase model. **£10.14.0**

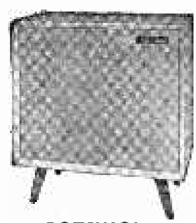
MALVERN

HI-FI EQUIPMENT CABINETS. Range available to meet various needs. Details on request. (MALVERN equipment cabinet illustrated on the left) from £11.12.6 to £18.10.0.

STEREO HEAD PREAMPLIFIER USP-1. Ideal for boosting tape-head output and low output pick-ups (e.g. Decca ffss) **£6.17.6**

"COTSWOLD" HI-FI SPEAKER SYSTEM. Acoustically designed enclosure "in the white" 26 x 23 x 15½in. 12in. bass speaker with 2in. speech coil, elliptical middle speaker. Pressure unit covers the full freq. range of 30-20,000 c/s., complete with cross-over unit, level control, etc. **£21.19.0**

AUDIO & DO-IT-YOURSELF accessories also available



COTSWOLD

Assembled models also available—prices on request. Deferred terms available over £10. Free delivery U.K.

Prices will be approximately 5% greater after 20th August

Please send me FREE CATALOGUE (Yes/No)________
Full details of model(s)________
____
NAME ________
ADDRESS ________
________ PW9

DAYSTROM LTD.

Dept. P.W.9, GLOUCESTER, ENGLAND

A member of the Daystrom Group, manufacturers of the WORLD'S LARGEST-SELLING ELECTRONIC KITS

Practical Wireless

Vol. XXXVIII No. 667 SEPTEMBER, 1962

Editorial and Advertisement Offices:
PRACTICAL WIRELESS
George Newnes, Ltd., Tower House, Southampton Street, W.C.2.

Phone: Temple Bar 4363

Telegrams: Newnes, Rand, London. Registered at the G.P.O. for transmission by Canadian Magazine Post.

SUBSCRIPTION RATES
including postage for one year

Inland - - - - £1.9.0 per annum
Abroad - - - - £1.7.6 per annum
Canada - - - - £1.5.0 per annum

Contents

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

COMMERCIAL RADIO

THE possibilities of introducing commercial sound broadcasting in this country have long been evident but until the Pilkington Committee reported, no decision could be given. The Committee reported in June and recommended that a service of local sound broadcasting should be introduced by the BBC and that commercial sound broadcasting (broadcasting financed from advertisement revenue) should not be introduced. The reasons for the Committee's decision were similar to those given for their recommendation that there should be a radical overhaul of the commercial television broadcasting services. They were that, when programmes are financed from revenue derived from the sale of advertisement time, then the planners of the programmes always, consciously or unconsciously, arrange the programmes to attract as much advertisement revenue as possible. The programmes, the Committee stated, must necessarily decline in standards and it therefore considered that local sound broadcasting should be provided by the BBC and financed from licence revenue. It had been argued that a commercial network would be able to provide the public with "what it wanted" rather than "what set of programme controllers thought it wanted". However, the Committee pointed out the fallacies in this argument: public taste would gradually be debased—unless the opportunity is available to listen to or view programmes of a high standard, such programmes can never be appreciated or enjoyed by the majority of the general public. The aim should be to improve public taste gradually yet provide programmes which are of high entertainment value.

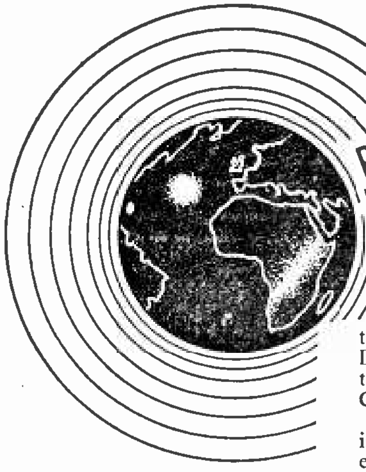
In the White Paper published by the Government after the Pilkington report, it was stated that there has been little evidence of any general public demand for local sound broadcasting, and the Government would study public reaction before making a decision. We are inclined to think that the lack of demand for a system of local sound broadcasting is due to the lack of public knowledge of the subject; no doubt demand will increase when the public realises the potentialities of such a service. We should be interested to hear readers' views.

MORE BLUEPRINTS

With the next issue, dated October, we are beginning another series of free double-sided blueprints. On one side of the blueprint in next month's issue, will be the first of a series of designs for a comprehensive hi-fi system. This part will consist of the main amplifier and power supply sections of the chain. The main amplifier will have a maximum output in excess of 20W with very low distortion.

On the other side of the October blueprint will be a design for a simple signal generator covering 150 kc/s to 30 Mc/s, modulated or unmodulated. Provision will also be included for use of the internal audio oscillator for test purposes. Although the signal generator uses a simple circuit, is inexpensive, and is easy to build with the large clear diagrams included on the blueprint, all amateur constructors will find it a valuable addition to their range of test equipment.

Our next issue dated October, will be published on September 7th.



ROUND THE WORLD of WIRELESS

NEWS AT HOME AND ABROAD

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of May, 1962, in respect of wireless receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland. The numbers include Licences issued to blind persons without payment.

Region	*Total*
London	642,217
Home Counties	593,774
Midland	429,006
North Eastern	457,568
North Western	395,333
South Western	350,584
Wales and Border Counties ..	202,893
Total England and Wales	3,071,375
Scotland	329,276
Northern Ireland	107,557
Grand Total	3,508,208

Sound at Wimbledon

FOR over 30 years the sound amplification and distribution for the Wimbledon Lawn Tennis Championships has been the responsibility of the Public Address Department of Standard Telephones and Cables Limited.

STC equipment feeds all sound, except commentaries, from the Centre Courts Nos. 1, 2 and 3 to the BBC and into the Wimbledon distribution system generally. It feeds a ring of monitoring loudspeakers from which the electric scoreboards are operated; it provides facilities for car-park calling, turnstile control, emergency police control, and an over-riding call system under the control of Col. A. D. C. Macaulay, the secretary of the All England Lawn Tennis Club.

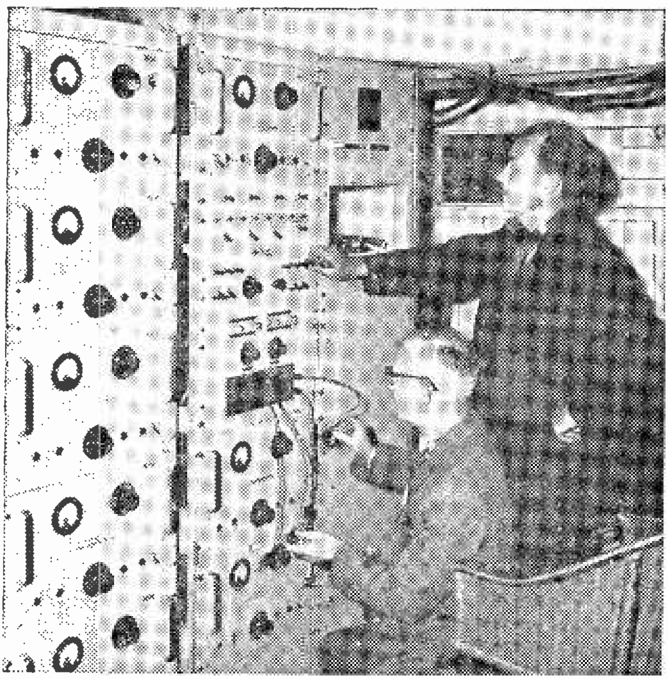
An elaborate telephone system is also installed by STC to link each umpire with the chief umpire and the referee's room, and also to link the pay boxes and turnstiles.

Fuel cell battery power for GEMINI two-man Spacecraft

THE fuel cell, one of the most promising new ways of making electricity, will be put to operational use for the first time in the next phase of the United States' manned spaceflight programme.

Under contract to McDonnell Aircraft Corporation, U.S. General Electric will develop a fuel cell battery, the most advanced of its type yet produced, to supply primary power for the two-man Gemini spacecraft.

In the Gemini vehicle, fuel cells will for the first time take the place of conventional batteries or mechanical power units as the primary electrical power source in space.



Two STC engineers of the Public Address (Hire) Department, making final adjustments to the amplifier equipment before the start of play at the Wimbledon Lawn Tennis Championships.

The fuel cell system was chosen for Gemini because its weight will be significantly less than that of a combination of conventional batteries and solar cells which could also be used in space flight.

The Gemini fuel cell battery will deliver a peak load of almost two kilowatts of D.C., providing primary power for all equipment aboard the spacecraft, including control, artificial environment, communication and instrumentation apparatus.

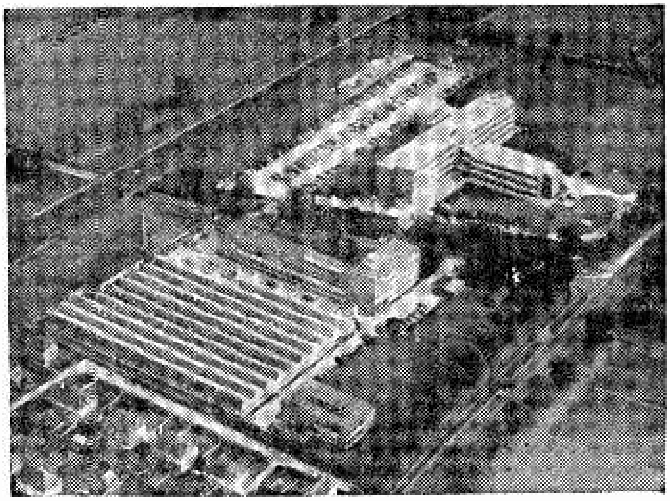
In addition to its electrical output, it will have a by-product in the form of pure, potable water, accumulating at the rate of one pint per kilowatt-hour of operation. This water can be used, without treatment, to augment the supply stored aboard the spacecraft for drinking, cooling or other life-supporting purposes.

The system is based on General Electric's ion-exchange membrane fuel cell, which produced electricity through the chemical reaction of oxygen and hydrogen. A fuel cell battery is composed of many of the sandwich-like cells connected in series to form building blocks that can in turn be connected in series or parallel to meet specific power requirements. Each cell is separated into two sections by the membrane, a sheet of tough plastic.

In operation, hydrogen gas is fed to one side of the membrane and oxygen to the other. Electrons from the hydrogen atoms are picked up by a thin metallic electrode in contact with the membrane surface, while the remaining hydrogen ions pass through the membrane. The electrons flow into an electrical circuit, providing power, and then return to the other side of the membrane, where they re-combine with the ions and join with the oxygen atoms in the formation of water.

Radio tour of the Guildhall

THE Lord Mayor of London, Sir Frederick Hoare, inaugurated the Radio tour of the Guildhall in the City of London, on July 5th this year. The radio tour enables visitors to hear a taped commentary of the 15th century Hall and its Crypt, its connections with the Corporation of London, the Freedom of the City and the Livery Companies, by means of a hand-held receiver which picks up the transmissions which are radiated at a fixed frequency.



The Mullard research laboratories at Salfords, Surrey, was visited recently by representatives of the Press. At these up-to-date laboratories, much experimental work is carried out on colour television, transistors, computors, and many other aspects of the electronics industry.

Radio for Mobil Tanker

THE "Mobil Endurance", a tanker built for the Mobil Shipping Co. Ltd., has been fitted with radio equipment by Associated Electrical Industries Ltd.

The "Mobil Endurance", which has now completed her acceptance trials, is the third of five vessels to be built for Mobil at Gothenburg. All five ships will finally be fitted with AEI marine apparatus. The radio installation on the "Mobil Endurance" will include a 600W W.T./R.T. transmitter, a 28 channel international channel transceiver and an AEI "Escort 601" Chartplan radar.

Satellite Communication System Ground Station

ALMOST all of the equipment at the British Post Office Satellite Communication Ground Station at Goonhilly Downs, Cornwall, planned for the initial experimental projects Relay and Telstar, is of British design and manufacture.

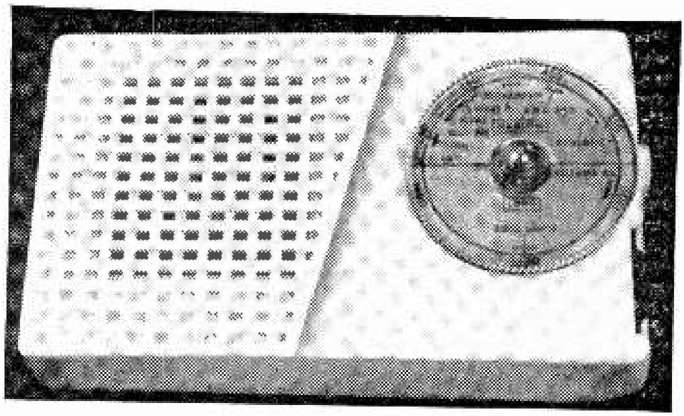
The predominating feature of the facilities which have been provided is an 85ft diameter steerable aerial. The aerial is in the form of a paraboloidal dish with full automatic steerability over the hemisphere above the horizontal plane on the basis of predicted orbital data, and manual control for resetting purposes.

The steering of the aerial in azimuth and elevation is by means of closed-loop servo type motors. The angular positions of the azimuth and elevation shafts are indicated by digital shaft-angle encoders.

Not the least important of the equipment at Goonhilly, the design authorities for which are the Space Communications Branch and the Research Branch of the Post Office Engineering Department, is the variety of cables which form the vital interconnections between the aerial and the control building, as well as those on the equipment on the aerial itself. The former cable runs in troughs above ground level.

British Insulated Callender's Cables Limited have supplied no less than 20 miles of cable, comprising all of the coaxial cable (31,000yd) which runs from the azimuth and elevation position encoders back to the control building—a distance of about a quarter of a mile—and some 5000yd of the multicore PVC SWA PVC sheathed 250/440 and 660/1100V control cabling between the aerial and the control building.

MEDIUM WAVE POCKET SUPERHET



by J. G. THOMPSON

AN ECONOMICAL PORTABLE RECEIVER

THE circuit of this receiver is shown in Fig. 1, and has the advantage that the battery drain is quite small. The full superhet circuit provides very good sensitivity, and the single-ended push-pull output stage is particularly economical. Current consumption, at low volume, is only about 8mA. At average listening volume, this rises to about 12mA to 14mA or so. The usual small type of 9V battery thus has a long working life.

Coverage

The receiver tunes medium waves only, as this simplfies the first stage, but it is possible to add long waves later, without disturbing other parts of the set.

If possible, it is recommended that an OC44 is used for Tr1, with OC45's for Tr2 and Tr3, and an OC71 for Tr4. However, other transistors of similar type were found to work satisfactorily in these stages. For the output stage, a maker's matched pair of OC72 transistors (2 × OC72) should be fitted. Resistors R18, R19, R20 and R21 should also be of 5% tolerance, while all others can be of 10% tolerance. Correct working conditions will then be assured, without any need to experiment, or change resistor values.

Paxolin Panel

This should be made first, all important drilling being finished before mounting any parts. The panel is 5¼in. × 3in. × $\frac{1}{16}$in. thick, this giving a little clearance all round in the specified cabinet. Drill three holes so that the panel can be secured in the case by short 6B.A. bolts. (A piece of thin card can be used as a template, piercing holes in it in the correct positions.)

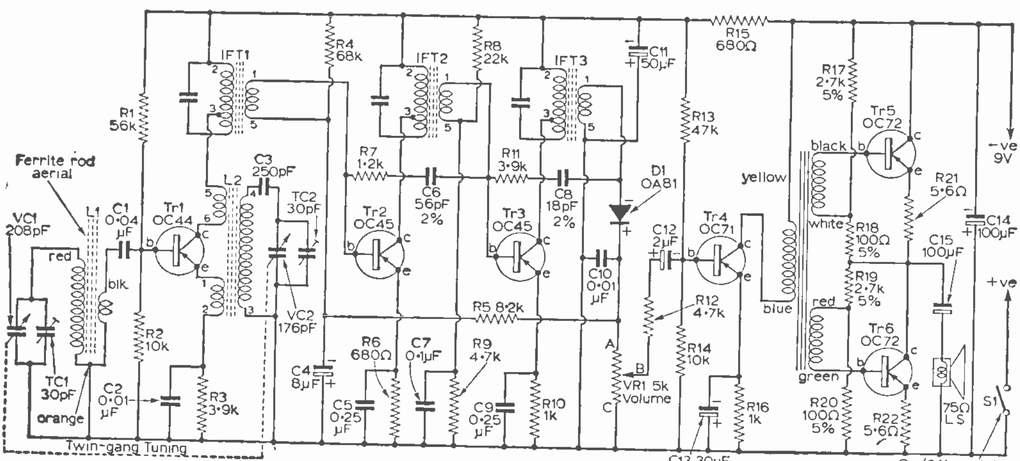


Fig. 1—The circuit diagram.

The gang condenser fits in a fairly large clearance hole. Check that there is space for the battery, with at least ¼in. to spare; then, drill holes for the three short 4B.A. bolts shown in Fig. 3. The pierced card will show exactly where to drill. If the screws project more than the thickness of the condenser plate, washers are needed under their heads.

Volume Control

Mount the volume control as in Fig 2. One switch tag projects up through a hole, and the other tags are bent flat. Check that the set will fit in the case, and that the battery can be accommodated. The volume control slot in the case will need widening slightly, with a small file. It may also be necessary to enlarge the tuning condenser hole.

These parts are then removed, and the holes are drilled for the four screened coils. If the pins are pressed on the thin card template, this will show where to drill. Check that each coil fits easily, then place it on one side. If any holes are not quite correct they can be enlarged with a small round file.

Loudspeaker Mounting

The loudspeaker hole is about ¼in. larger all round than the loudspeaker magnet. It can be made with a washer cutter, a fretsaw or other very small saw, or by drilling holes, and clearing up with a half-round file. Temporarily position the loudspeaker, mark the two speaker fixing holes (Fig. 3) and drill them.

After drilling holes for the driver transformer, transistor lead holes can be positioned as in Figs. 2 and 3. A short 4B.A. bolt holds the rod mounting.

Clean up all holes, and mount the rod, gang condenser, speaker, driver transformer and screened coils, and check that the whole can fit readily in the case, with battery. Note that the case tapers slightly towards the back; there should be a little clearance all round.

The loudspeaker is now removed until the set is wired. When finally mounted, it is held by two 6B.A. countersunk bolts, inserted from the front. The bolt near the rod mount has two nuts, one locking the loudspeaker, and the other giving correct clearance between loudspeaker and panel, a third nut then being tightened behind the panel. The remaining loudspeaker mounting hole (Fig. 3) is obscured by the driver transformer. A short countersunk bolt is therefore inserted from behind, and locked with a 6B.A. terminal head. The transformer can then be permanently mounted. Another 6B.A. bolt may then be inserted from the front of the loudspeaker, and run into the terminal head, washers or nuts providing spacing.

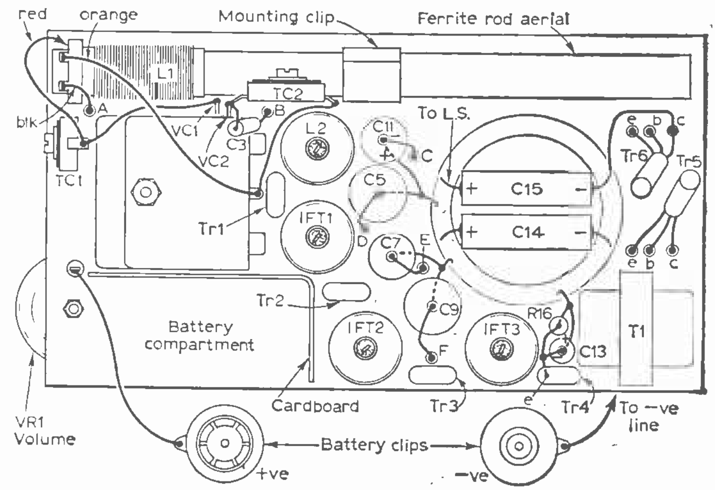
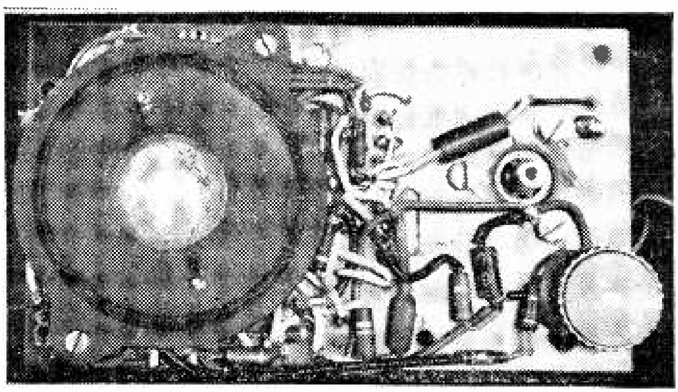


Fig. 2—The layout and wiring diagram of the rear of the receiver panel.



The loudspeaker side of the panel, with the wiring complete.

Construction

All wiring is of 26s.w.g. tinned copper wire, insulated with 1mm sleeving. It will be helpful to use red sleeving throughout the positive side of the circuit, and black sleeving throughout the negative line, with yellow or some other colour for all other leads. Sleeving is also placed over all transistor leads, and the wire ends of all resistors and condensers. Sleeving on the transistor leads can be of such a length that the tops of the transistors Tr1 to Tr4 come about level with the tops of the screened coils; Tr5 and Tr6 are bent over as in Fig. 2. Be sure that the transistors are in their correct stages, and that the collector base and emitter leads all emerge as

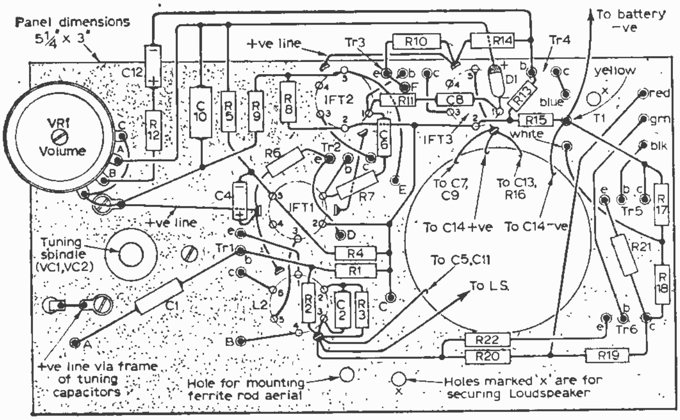


Fig. 3—The wiring on the front of the panel.

In Figs. 1, 3 and 4, A is one end of the element, B the slider, and C is the other end of the element and one switch tag. The remaining switch tag passes through the hole in the panel (see Fig. 2). A short piece of thin red flex is soldered on here and fitted with a positive battery clip.

The trimmer TC1 has one tag inserted in a hole, so that it can be soldered to the tag held by the 4B.A. bolt, in Fig. 3. Trimmer TC2 is soldered directly to the 176pF tag of the gang condenser (VC2), a short lead returning to the condenser frame.

All leads and components are kept close against the panel. Leads and resistors should also be clear of the position which shown by the letters c, b and e in Fig. 3.

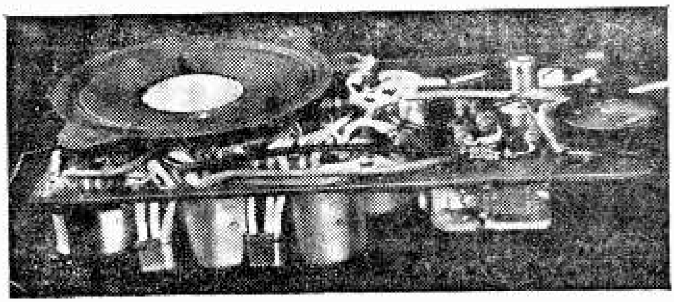
The various points marked MC form the earth, or positive, side of the circuit, and are all joined. These include the can tags of the oscillator coil and I.F. transformers, and the metal frame of the gang condenser.

Control Wiring

Fig. 4 shows the tag side of the volume control.

the speaker will occupy. Electrolytic condensers are wired with the polarity shown in Fig. 3. Other condensers, and all resistors, may be wired in either way round. The negative end of the diode must go to pin 1 of the third I.F. transformer.

C13 and R16 are wired in parallel. The wire end of R16 passes through a hole, to the MC tag in Fig. 3. The negative lead of C13 goes to the same hole as the emitter of Tr4, to which it is joined.



Another view of the completed set, less its case.

The negative end of C15 passes into the same hole as the collector of the one OC72, as in Fig. 2, these leads being joined, and also going to R19, R20 and R22 (Fig. 3).

It is best to leave all the transistor leads reasonably long, but prolonged heating with the soldering iron should be avoided.

The larger fixed condensers are mounted behind the panel. as in Fig. 2; C5, C7, C9 and C11 each have a lead passing directly down through the panel, and all are soldered to the MC or earth line. The top wires of these condensers

COMPONENTS LIST

Resistors: (10% unless otherwise indicated):

R1	56k	R9	4·7k	R17	2·7k 5%
R2	10k	R10	1k	R18	100Ω 5%
R3	3·9k	R11	3·9k	R19	2·7k 5%
R4	68k	R12	4·7k	R20	100Ω 5%
R5	8·2k	R13	47k	R21	5·6Ω
R6	680Ω	R14	10k	R22	5·6Ω
R7	1·2k	R15	680Ω		
R8	22k	R16	1k		

VR1 5k miniature vol. control with switch

Condensers (All miniature types):

C1	0·04μF	C6	56pF 2%	C11	50μF
C2	0·01μF	C7	0·1μF	C12	2μF
C3	250pF	C8	18pF 2%	C13	30μF
C4	8μF	C9	0·25μF	C14	100μF
C5	0·25μF	C10	0·01μF	C15	100μF

TC1 30pF trimmer TC2 30pF trimmer

VC1/VC2 208/176pF gang with screen

Transistors:

Tr1 OC44 Tr3 OC45

Tr2 OC45 Tr4 OC71

Tr5 and Tr6 matched pair OC72's

Diode: OA81

Other Parts:

Split secondary driver transformer (Fortiphone L442)

M.W. Ferrite rod, oscillator coil, 1st, 2nd and 3rd IFT's (Osmor)

75Ω loudspeaker, 2½in., with plastic chassis (W.B.)

3¼ x 6½ x 1⅝in. Pocket Superhet case

Paxolin, wire, sleeving, etc.

are bent over, and pass down through other small holes, as in Fig. 2, so that they can be connected as in Fig. 3.

C14 and C15 must have insulated sleeves, or be covered with insulated material. They are secured side by side with tape, and rest on the speaker magnet. C14 goes from the positive line to the negative line. C15 is wired from collector to loudspeaker, as in Fig. 2.

In Fig. 1, short pieces of thin coloured flex are soldered to the aerial winding tags, for identification. Both "earth" ends of the windings are joined, for the orange lead. These leads are then connected up as in Fig. 2. That is, orange to condenser frame, red to T1 and VC1, and black to C1, Fig. 3.

After checking the wiring, solder lengths of thin flex to the 75Ω loudspeaker. One lead goes to MC in Fig. 3, and the other passes back to the positive end of C15. Fix the loudspeaker as described, making sure that its tags do not bear upon leads or parts already fitted. The loudspeaker itself is of insulated material. The spacing between loudspeaker and panel should be so adjusted that the loudspeaker rests on the front of the inside of the cabinet. A pad of material, such as thin soft card, is cut to fit inside the speaker opening, and an aperture is cut to match the speaker cone. This avoids buzzing noises due to vibration between case and speaker frame.

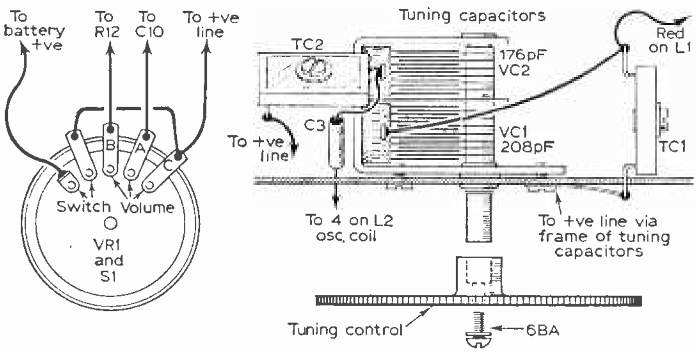
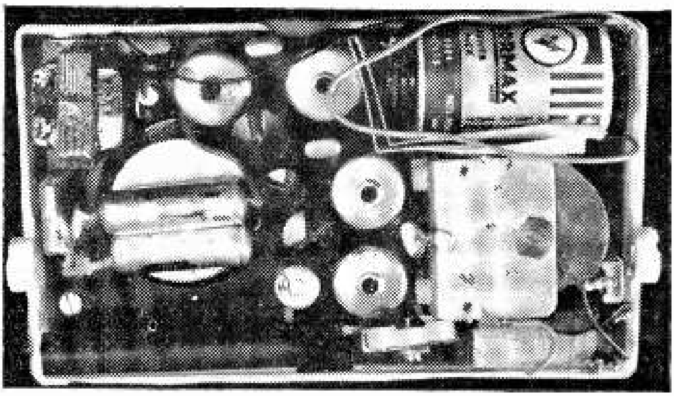


Fig. 4—The details of the volume control and tuning condensers.

Check that the receiver will fit readily in the case. The unwanted tags of the gang condenser are bent down, to leave more space for the battery. A piece of cardboard, bent as in Fig. 2 isolates the battery from other parts, and prevents contact between the battery and second I.F. transformer.

Testing and Adjusting

If possible, a meter should be included in one battery lead. This should read about 7mA when the set is switched on. If the meter shows a high current, switch off at once, disconnect the battery, and check the wiring for shorts or errors.



The receiver mounted inside its case.

A strip of paxolin or similar material should now be filed so that it will engage with the coil and transformer cores, to be used as an adjusting tool.

If a signal generator is available, set it for 470kc/s, with modulation, and connect its output to the black lead in Fig. 2, including an isolating condenser in circuit. Put the receiver volume control at maximum, reducing the generator signal, if volume is too great. The three transformer cores are then adjusted for best results, which will also be the highest reading on the meter included in the battery circuit. All cores should have quite a sharp tuning peak.

Alignment on Stations

If no generator is available, tune in the local station, adding an external aerial a few feet long, if required. Then adjust the three transformer cores for best volume. They should be in a reasonable position, not screwed right in, or very far out.

Aerial and oscillator stage tuning can then be adjusted. TC1 and TC2 must be capable of reaching a low capacity. To begin, unscrew both trimmers, carefully separating the plates, if necessary. If a signal generator is available, adjust it to 550m, close the gang condenser, and rotate the oscillator coil core for best results. Then move the aerial winding on the rod, to obtain maximum volume. The generator is then set to 205m, the gang condenser is opened, and TC1 and TC2 are adjusted for best results.

If coverage is restricted on the low wavelength end of the band, this probably indicates that TC1 and TC2 need opening to a lower capacity. Repeat the trimming and inductance adjustments described a number of times, always adjusting the trimmers at a low wavelength, and the aerial and oscillator coil inductances at a high wavelength. Keep the receiver volume control at maximum, but choose

(Continued on page 417)

INCREASING VOLTMETER RANGES

By G. A. W. Partridge

THERE are several types of high reading voltmeters on the market—the multimeter which caters for current and resistance measurement usually reads up to 1000V. But not all instruments have such high ranges. There are, however, quite simple ways of increasing the range of a voltmeter either permanently or temporary.

The most well-known method is to use a resistance type of multiplier connected as shown in Fig. 1. In this case a 0-500V instrument is able to read from 0-1,000V, by connecting a suitable resistance known as a multiplier in series with it.

Multipliers

The following example will show how a multiplier is chosen. The voltmeter reads from say, 0 to 100V and it is desired to increase its range to 1,000V. The sensitivity of the voltmeter is 10,000Ω/V.

The total resistance of the meter and the multiplier must be 1,000V × 10,000Ω/V which is 10,000,000Ω. Now the resistance of the meter alone is 100V × 10,000Ω/V which is 1,000,000Ω.

10,000,000−1,000,000=9,000,000Ω; the required resistance of the multiplier.

Alternative Calculation

Another way of calculating this resistance is first to find the current taken by the meter on its own, at full scale deflection, which is 100V.

$$I=\frac{E}{R};\qquad =\frac{100}{1,000,000}$$

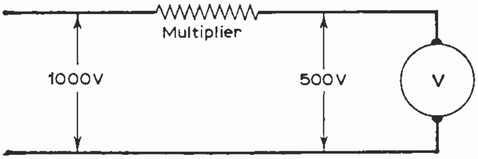
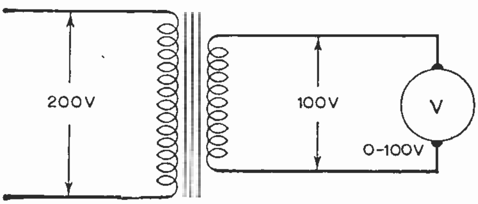


Fig. 1 (above)—The use of a multiplier to increase the range of a voltmeter.

Fig. 2 (below)—A transformer used as a multiplier.



$$I=\frac{1}{10,000}\ \text{A}\quad(0{\cdot}1\text{mA})$$

At full scale deflection with the multiplier in circuit it must still draw 0·1mA. The voltage across the multiplier will be 1000−100=900. Its resistance will be:-

$$R=\frac{E}{I};\qquad =900\Big/\frac{1}{10,000}$$

$$R=9,000,000\Omega.$$

In this case the instrument reading will have to be multiplied by 10 to give the correct voltage. The wattage of the multiplier is also important. It will be given by I.E, which is 1/10,000×900= 0·09W. A 0·25W resistor will be ample here as it will not overheat.

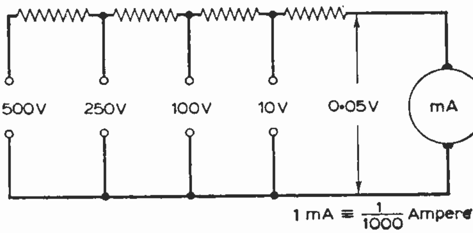


Fig. 3—Converting a milliameter for use as a voltmeter.

If alternating current is to be measured, the calculations must be based on the internal impedance, or ohms-per-volt rating of the instrument as an A.C. meter, not as a D.C. instrument. The multiplier must be non-inductive.

There are special types of instrument resistors on the market which are designed to remain at constant values for many years.

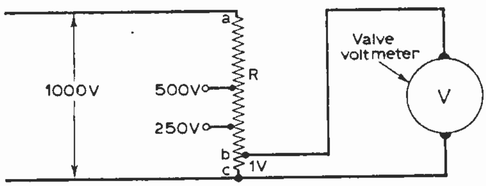


Fig. 4—The voltage divider.

Transformer Multiplier

For temporary and less accurate A.C. work, a transformer can be used as a multiplier (Fig. 2). In this case it has a ratio of 220/110V. The voltmeter reads from 0 to 100 and the transformer doubles this scale. The ratio error has been overlooked, but a reliable transformer should be chosen in order to prevent erroneous readings.

A 0-1 milliameter can also be used as a voltmeter provided a suitable multiplier is connected in series with it. Fig. 3 shows an instrument of this type arranged to measure up to 500V. The internal resistance of the meter is 50Ω. Therefore the voltage required for full scale deflection is:

$$E=IR;\ =1/1,000\times50;\ 0{\cdot}05\text{V}.$$

(Continued on page 400)

High-fidelity Main Amplifier

By J. Haskell

THIS UNIT PROVIDES A GOOD QUALITY 10W OUTPUT

THE increasing number of hi-fi enthusiasts who wish to start a hi-fi system from scratch will welcome this article about a hi-fi amplifier capable of providing up to 10W of good quality reproduction with negligible distortion, and good frequency response.

Circuit

The main amplifier is usually built separately and can be stored away from the control unit if desired. An obvious choice for the output section in an amplifier of good quality is a push-pull one. The output stage consists of two EL84's in push-pull, under normal or low-loading conditions as required. Distributed loading was considered but due to the lack of peak power handling this arrangement was discarded. The normal loading condition for the output valves results in a distortion figure of about 0·3% at 10W over a power response of better than 30—15,000c/s within one decibel. This response is more than adequate for even the most critical of listeners, and only very expensive speaker systems can reproduce below 30c/s at the rated output. The frequency response is 10c/s to 20kc/s ± 1dB or better.

The valves are cathode-biased under both loading conditions. A balance control is included in the cathode circuit of V2 and V3.

Low-loading

Under this loading, the distortion content at 10W is approximately 0·1% over the specified range, and is therefore more suitable for music and speech reproduction in the home than normal loading. The anode to anode load for EL84's, in normal and low-loading conditions is 8.000Ω and 6,000Ω respectively. The usual "grid stopper" resistors are included in the circuit to prevent any parasitic oscillations from taking place.

The Phase Inverter

The phase inverter circuit is designed around a high-gain double-triode valve type ECC83, the first section of which acts as a driver and the second section as the phase inverter proper. This type of circuit gives good reproduction and is quite popular, the only disadvantage being that the overall gain is slightly more than unity (1·8). Since the cathode resistors of the phase inverter are not by-passed, there is heavy negative feedback, giving good transient response and also

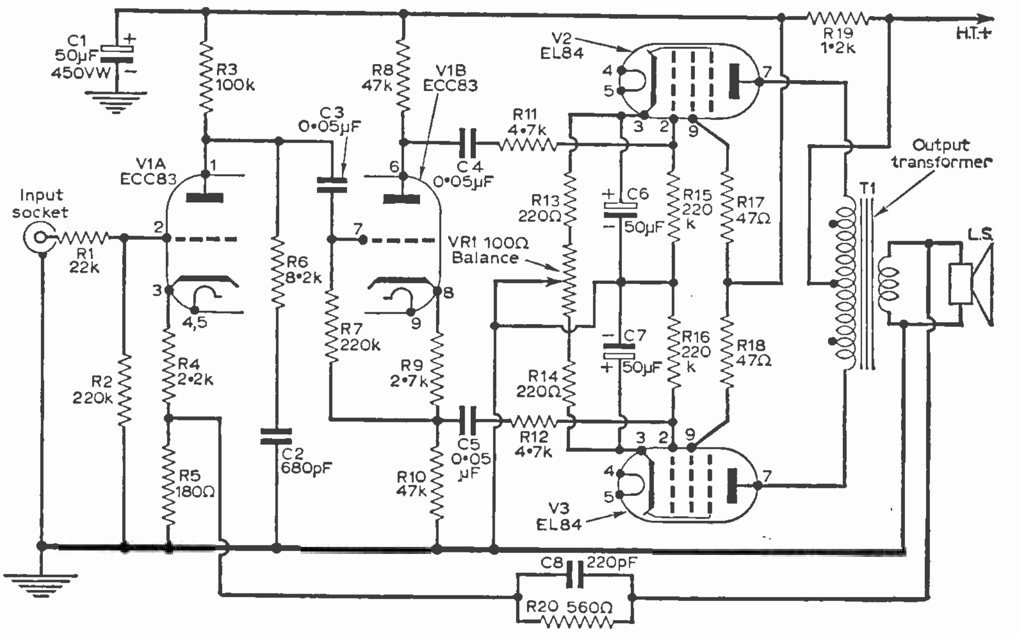


Fig. 1—The circuit diagram.

helping towards the balance of the output stage.

The output transformer was a Partridge type P3667. which has an 8k primary winding tapped at 6k. The constructor may therefore try both loadings out on the output stage, bearing in mind that resistors R13 and R14 will have to be changed as well (220Ω for normal loading and (390Ω) for low-loading conditions).

Increased Feedback

The degree of negative feedback is about 20dB, and increasing it to 30dB resulted in no instability, giving a good feedback stability margin.

An interesting feature about the driver-section is the resistor R6 and condenser C2 in series from the anode of V1A to earth. This is to prevent parasitic oscillations (rarely present in triode valves) and to provide a time constant giving good stability in the lower registers of the frequency range.

Close tolerance resistors should be used for the anode and cathode loads of the phase inverter, as well as in the grid resistors and stoppers of the output valves. The two coupling condensers, C4, C5 should have no leakage since any D.C. on the output valve grids will result in distortion.

The Power Supply

(Fig. 1). Valve V5, used in the prototype, was a 5Y3, though an EZ81 may also be used. In this case, the rectifier winding will be 6·3V at 1A. If additional current is not required for a radio tuner, 10mA for a pre-amplifier is available. An EZ80 may be used instead of the EZ81, and

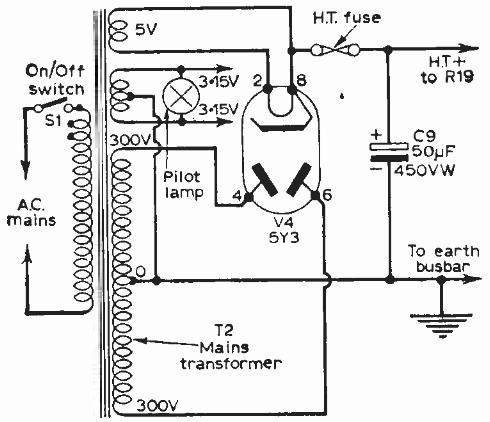


Fig. 2—The circuit of the power supply.

a common heater winding can then be used for all the valves. It should be noted that on no account should more than 90mA be drawn from an EZ80. Two resistors must be included in the anode circuit of the rectifier; the values for the EZ81 are 190Ω per anode. and for the EZ80 216Ω per anode. Under normal loading conditions the amplifier requires about 80mA of H.T. current, and 60mA under low-loading.

Since a smoothing choke was not used, a large smoothing condenser was required to supply the extra voltage on peak drives of the output stage.

COMPONENTS LIST

Resistors (all ½W unless otherwise stated)

R1	22k	R4	2·2k
R2	220k	R5	180Ω ±5%
R3	100k	R6	8·2k
R7	220k (may be increased to 1M for H.F. stability)		
R8	47k ±2%	R11	4·7k
R9	2·7k	R12	4·7k
R10	47k ±2%		
R13, R14	220Ω (for normal loading) or 390Ω (for low loading) (R13 and R14 are both 5% 3W)		
R15	220k	R18	47Ω
R16	220k	R19	1·2k 1W
R17	47Ω		
VR1	100 w.w. potentiometer		

Capacitors

C1, C9 50µF 450V elec.
C2 680pF
C3 0·05µF 600V
C4 0·05µF 600V } low leakage types
C5 0·05µF
C6 50µF elec.
C7 50µF elec.
C8 220pF ±5% (for 3·75Ω speaker)

Valves:

V1	ECC83	V3	EL84
V2	EL84	V4	5Y3

Mains transformer
Primary: 200-220-240V
Secondaries: 300-0-300V, 60 or 80mA (see text)
3·15-0-3·15V, 2A
Winding to suit heater of V5

Output transformer:
Partridge P3667

Chassis:
12in. x 9in. x 2½in. approximately.
Pilot lamp, wire, solder, bolts, sockets, etc.

The possible change in line voltage is only 0·5%. Adequate decoupling of the stage is also assured.

Feedback

The values of R5 and R20 govern the degree of voltage fed back, and the values used in the prototype were 560Ω and 180Ω respectively. giving about 20dB of feedback. Constructors who wish to increase the feedback may do so by decreasing the value of R20 slightly. Resistors R8 and R10 should be good quality components of ±2% tolerance. Lack of balance here or in the output stage itself will result in unnecessarily high second harmonic distortion, owing to incomplete cancellation of the distorted anti-phase wave forms. A condenser in parallel with the feedback loop resistor promotes a phase shift opposite to that of the output transformer at the high frequency resonance of this component, and thus prevents the feedback from becoming positive at this frequency. If the output transformer is different from the one specified, it may be necessary slightly to modify the value of this component. The optimum value is best found by trial and error. Best results

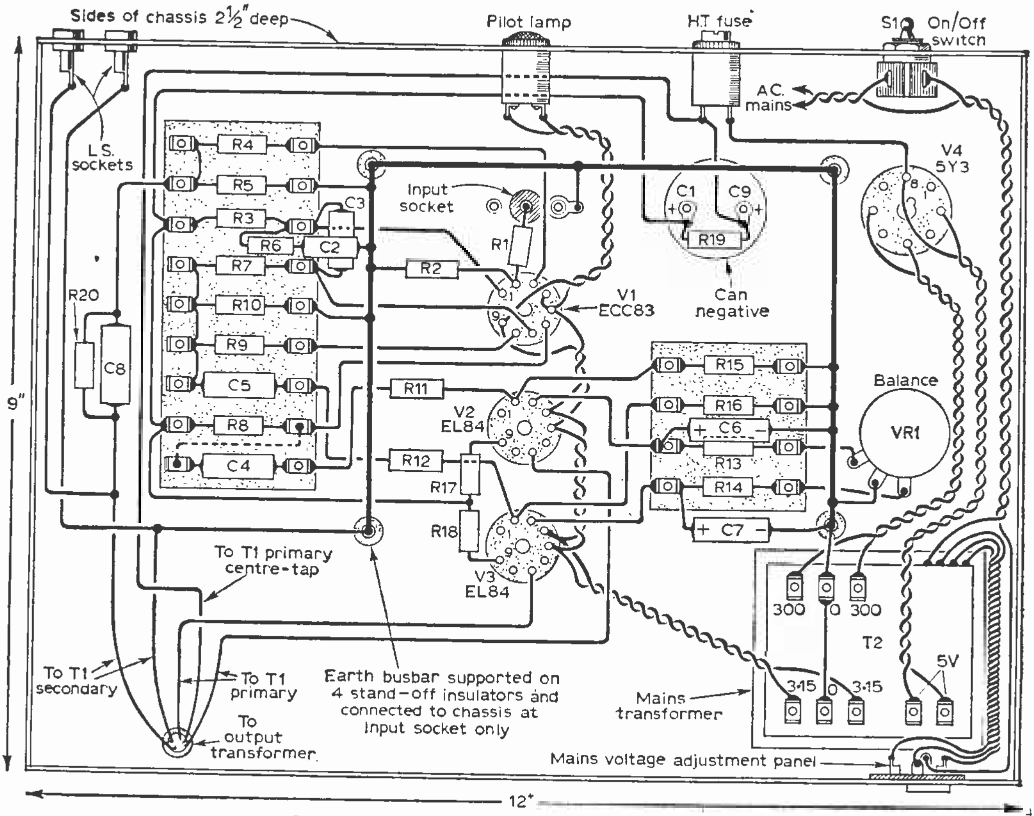


Fig. 3—The complete underchassis wiring diagram.

will be obtained if this amplifier is used in conjunction with the pre-amplifier designed by the author (June issue, 1961), as this was used with the prototype. The basic sensitivity is about 600mV and any high quality pre-amp capable of this output may be used.

Assembly

The components are first mounted on the group boards as shown in Fig. 3. When resistors R8 and R10, R15 and R18 are being soldered, a heat shunt should be used. Only one wire goes beneath the group boards, this is from C3 to R6 and is shown dotted in Fig. 3. When the group boards are assembled, they may be bolted into place with a spacer located between the board and the chassis, to allow for the wiring underneath.

All earth connections are soldered to the busbar, which may be held insulated from the chassis by means of two tagstrips: this busbar should be earthed to chassis at the input socket only.

An output socket may be included if desired, and should be insulated from chassis if possible.

Wiring

The heater and power supply should be wired in first. Tightly twisted wires are used for all A.C. circuits, and this wiring should be kept away from signal circuits and positioned as close to the chassis as possible.

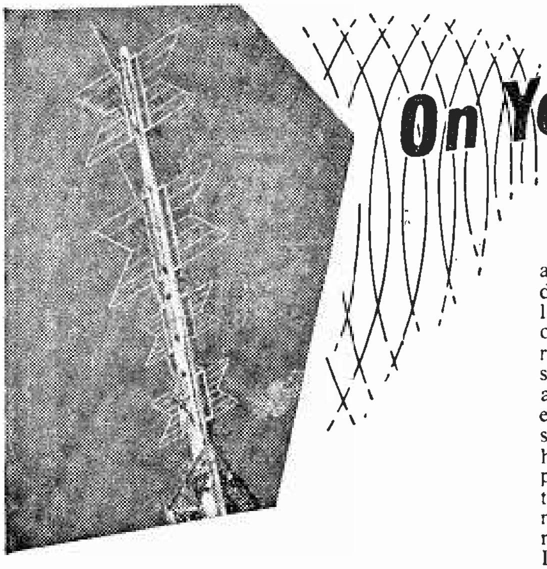
Feedback

For negative feedfack to take place, the amplifier output secondary winding must be correctly phased in relation to the input. If in phase with the input, violent oscillations will take place, which may damage a high-grade speaker suspension; hence, it is best to use a low-grade speaker to secure the correct phase relation.

Output Stage Balance

The output stage is next balanced and is a very simple procedure. The balance control VR1 should be slotted with a file for screwdriver adjustment only. Before switching on, check for an H.T. short with the meter. After switching on, if positive feedback occurs, then switch off immediately and reverse the anode connections on the output transformer primary. After about thirty seconds the set should have warmed up and a very slight hum only should be present (the hum level is approximately 80dB below full output).

A D.C. voltmeter is next connected across the anodes of the EL84's and the balance control VR1 is adjusted until no reading is obtained (ignore random fluctuations). The valves are now balanced from the D.C. aspect, which is usually the same for signal input. If a balance cannot be obtained, the valves should be switched over and the procedure carried out again: if a balance is still not obtained, then the valves should be checked for emission. Usually a balance is easily obtained. ■



On Your Wavelength

By THERMION

Transistor Sets Again

CONSIDERABLE publicity has been given recently in a certain section of the daily press, to a suggestion made in a letter on the "killing" of interference from transistor portables. A reader suggested that the annoyance from these sets could be removed by using a radiating device —which readers will remember was first suggested on this page a long time ago, and I mentioned the fact that it was not known at the time what the reaction of the Post Office authorities would be on the use of such "jamming apparatus". We subsequently published a quotation from the Wireless Telegraphy Act which pointed out that it was an offence to use any apparatus which could cause interference with other apparatus and that therefore such jamming equipment would be considered to be illegal. The references to the interference device quoted in the opening paragraph of these notes has brought apparently shoals of letters in which such terms as "knighthood" and even "canonisation" have been suggested as suitable rewards for the student whose letter first drew attention to the idea. It is, of course, not an "invention", but merely an application of a known device, which is, in fact, being used illegally if its purpose is to iam another receiver, and most readers will know that even a simple super-regenerative set, if it does not have a buffer input stage, can cause interference over a wide area even under the most correct operating conditions. The estimate of £20 for constructing one of these "jammers" seems rather excessive.

Remote Controls

Hard on the heels of my notes about remote controls (August issue) a reader reminds me of a demonstration given many years ago of a magnetic induction form of control which seems to have disappeared with time—although it would appear to have some useful possibilities. The demonstration consisted of a dance where, if one looked in at the door during the demonstration one would have seen dozens of couples waltzing round the hall in dead silence—yet all in perfect step. The secret was that they were all wearing a form of hearing aid earpiece inserted in the ear, and they carried a small unit which picked up sound from a loop running round the floor of the hall. Fed to this was the output from a record player, and the signal was inductively coupled to their pick-up device. It would seem that there are many very suitable uses for this type of coupling, not only inside buildings, but also out of doors. I will leave my readers to think of some of the most intriguing of these.

Electronic Games

I have now received a large number of letters on the above subject and some of these make most interesting reading. The one I like best is that describing a "Bingo machine" built by a reader in Kent, and when I have had time to study all of these, I will try and see if the Editor can afford the space to publish details of one or more. Some very ingenious ideas seem to have been applied, and so far expense seems to have been saved by utilising standing equipment which can be obtained very cheaply. I felt sure that our readers would overcome difficulties such as "expense" by making do, and this now does seem to be the case.

One reader suggested the simple plan of having ordinary on-off switches, either toggle or simple bell type, by means of which two people could play against each other, and he pointed out that these switches may be obtained with a bias in some cases so that their operation consists merely of pushing them against the bias, which will operate a desired circuit, and then on releasing them they will return to their original setting. This does offer some scope, but in most cases this arrangement could only be used with what I might call "electrical" circuits, rather than electronic. That is to say, battery and lights with switches in circuit could be employed, and by this means the "game" would be reduced to its most simple form, but this is not the type of device I had in mind in my first remarks on this subject. I was visualising the arrangement where a form of "electronic brain" was employed, whereby after one player operating a button or switch recorded information in the complete equipment analysed the results of his "move" and automatically made an answer to that move and thus enabled one person to "play" the machine. And, of course, such a machine could be so constructed that it could not lose but would always win or draw.

SUPERB COMMUNICATION RECEIVERS

AMERICAN AR88D RECEIVERS. Fresh release of these renowned sets. 14 valves, 6 wavebands, covering 500 Kc/s-32 Mc/s. Incorporate every possible refinement and have internal A.C. mains pack for nominal 5/230 v. Thoroughly reconditioned, immaculate in appearance, and in perfect working order. ONLY **£35** (add carriage 30/- and 50/- deposit on returnable transit case). S.A.E. brings illustrated leaflet.

MARCONI CR. 100/8 COMMUNICATIONS RECEIVER. Covers 60 Kc/s to 30 Mc/s. Complete with all valves, makers instruction manual, and internal A.C. Power unit for 200/250 volts. BRAND NEW IN ORIGINAL TRANSIT CASES. Aerial tested before despatch. ONLY **£35** (carr. etc. 40/-). S.A.E. for full details.

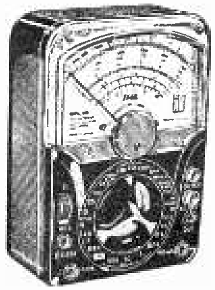
TEST METERS FOR EVERY PURPOSE & POCKET

2,000 O.P.V. MODEL TP-10. Reads A.C. & D.C. Volts up to 1,000; D.C. Current to 500mA; Resistance to 1 Meg; Capacitance to 1uF; Decibels from —20 to +36; Output jack for Audio Measurements. Size 3½in. x 5in. x 1¼in.

£3.19.6

20,000 O.P.V. MODEL TP-5S. Reads voltage up to 1,000; D.C. at 20,000 ohms per volt and A.C. at 10,000 o.p.v.; D.C. Current to 500mA; Resistance to 10 Megs.; Capacitance to 0.1uF; Decibels from —20 to +36. Size 3½in. x 5¼in. x 1¾in.

£5.19.6



30,000 O.P.V. MODEL 500. Volts to 1,000: D.C. at 30,000 O.P.V., A.C. at 20,000; 12 Amps D.C. Current; 60 Megs Resistance; —20 to +56 Dbs; Internal buzzer short circuit warning. Size 3⁵/₁₆in. x 6⁵/₁₆in. x 2¼in.

£8.19.6

All New Stock, with leads, prods, and internal batteries. 6 months' guarantee backed by full service facilities. Details S.A.E.

AMPLIFIER TYPE A1413. Ex R.A.F. For normal A.C. Mains use. 5Z4 Rectifications with 6V6 output. Input and output jack sockets, gain control, fully fused. 600 ohms output transformer easily changed for 3 ohms type. Standard rack mounting size 19" x 7" x 6". Used, good condition. ONLY **59/6** (carriage etc. 10/6).

12 VOLTS AMERICAN DYNAMOTORS. Deliver 220 volts at 100 mA. Size 5½ x 3½in. diameter. Ideal for running Electric Shaver etc. from Car battery. ONLY **32/6** (post 2/6).

POWER UNITS TYPE 234. Primary 200/250 v. 50 cycles. Outputs of 250 v. 100 mA. and 6.3 v. 4 amps. Fitted double smoothing. For normal rack mounting (or bench use) having grey front panel size 19" x 7". Fitted Input and Output Voltmeter, **79/6**, or model less meter **59/6**. (Carriage either type 10/6.)

AVOMETER MODEL 7 LEATHER CASES, fitted with carrying handle and long strap. BRAND NEW. ONLY **32/6** (Post 2/6).

PCR COMMUNICATION RECEIVERS

Manufactured by **Pye & Philips.** One of the Army's most versatile and sensitive sets. RF stage and 2 of I.F., using 6 British I.O. type valves. Large 180 degrees Illuminating and Calibrated Dial. Flywheel Tuning with locking device. Aerial Trimmer. Tone and Vol. Controls. Band Switch from panel jacks for speaker or phones. In black metal case, size 17in. L x 8in. H x 10in. D. Model PCR covers 6-18 Mc/s, 200-550 metres and 850-2,000 metres and has internal 5-in. speaker. **£6.19.6. Model PCR2** has similar L & M waveband coverage, Short wave 6-22 Mc/s, but no speaker. Used but excellent condition **£5.19.6.** Every receiver aerial tested before des. Add 10/6 carr. all models. Designed to operate from bulky EXTERNAL power supply, but any set can be fitted with BRAND NEW COMPONENTS INTERNAL PACK for 200/250 v. A.C. at extra cost of £2.

S.A.E. FOR ILLUSTRATED LEAFLET

THE "GOOD COMPANION" Mk. II

USING TRANSFILTERS, THE LATEST MANUFACTURING TECHNIQUE TO SAVE ALIGNMENT DIFFICULTY

THE FINEST COMBINED PORTABLE and CAR RADIO YET DESIGNED FOR THE HOME CONSTRUCTOR

★ 750 mW output.

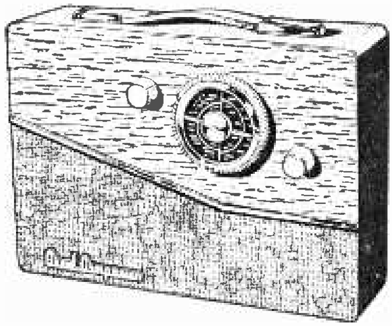
★ 6 transistors and 2 diodes.

★ Full Medium and Long Wave coverage.

★ Quality speaker.

★ Brilliantly styled 2-tone cabinet, size 11 x 8 x 3in.

★ Very fine tuning with calibrated dial.

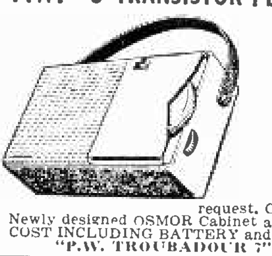


★ Latest printed circuit. ★ Internal high gain aerial with car aerial socket. ★ Easy to follow construction data (available separately 3/6). All parts sold separately and full illustrated details will be sent on request.

Total Cost **£9.19.6.**

With alternative luxury cabinet using 7 x 4in. speaker, **£10.19.6.** Either type, plus 5/- post and ins. (Battery 3/6 extra).

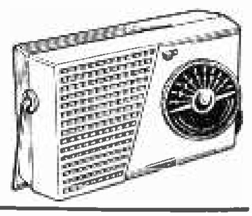
"P.W." 6 TRANSISTOR PERSONAL RECEIVER



Designed by the technical staff of *Practical Wireless:* easy to build, using printed circuit and 1st Grade Matched Transistors and Diode. Full Medium and Long Wave coverage to internal speakers. All parts sold separately (new components only) enabling you to buy as required and full detailed price list will be sent on request. Constructional details 1/6. Newly designed OSMOR Cabinet and reduced price. TOTAL COST INCLUDING BATTERY and CABINET NOW **£8.10.0.** "P.W. TROUBADOUR 7" Parts List, S.A.E.

"POCKET 4" TRANSISTOR RECEIVER

Uses miniature speaker, proper tuning condenser, and volume control. Built-in aerial makes unit efficient and portable. Ideal for the beginner. Full medium wave coverage. All components and case for only **42/6** (p. & p. 2/6). Ten-page constructional book free with parts or separately 1/6. S.A.E. for parts price list.



HARRIS ELECTRONICS (LONDON) LTD

138 Gray's Inn Road, London, W.C.1

Phone TERminus 7937

Please include carriage costs on all items. (Open until 1 p.m. Saturdays). We are 2 mins. from High Holborn (Chancery Lane Station) and 5 mins. by Bus from King's Cross.

POWER Rectifier Circuits

common and uncommon

By L. N. Nash

A SURVEY OF PRINCIPLES OF PRACTICAL IMPORTANCE, AND USES OF SUCH CIRCUITS

(Continued from page 308 of the August issue)

LAST month's article finished with an explanation of the advantage of the cascade voltage doubler circuit over the conventional voltage doubler circuit.

Fig. 21 gives an example of a combined H.T./EHT supply on these principles. A further advantage of this circuit is shown in Fig. 22, where the same circuit but of inverse polarity is added to the same transformer winding, in the same method of circuit development as the previous treatment of the other basic circuits. The result here is an output at *four times* the voltage output of a simple half-wave circuit, so that this circuit is called the "Cascade Quadrupler". These types of circuit are called "Cascades" on account of their cumulative method of working. Thus the first rectifier and condenser, MR1 and C1, function as a normal simple half-wave circuit, charging up C1 to the peak. On the half cycle of opposite polarity, where MR1 is now blocked, polarities are such that the charged C1 and the reversed transformer winding voltage act in series addition as voltage drive for the second rectifier and condenser MR2, C2 also operating in simple half-wave circuit, thus clearly leading to a doubled voltage output. The operation of C3/MR2 and MR4/C4 follows similar lines.

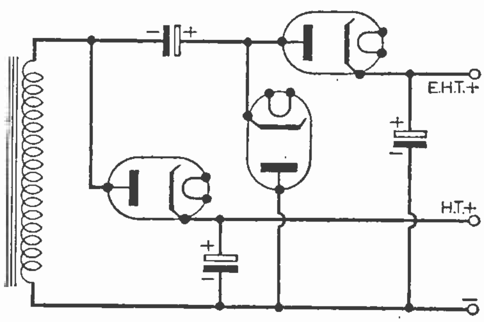


Fig. 21 (above)—Combined H.T./EHT circuit using the cascade voltage doubler principle.

Progressive Cascading

In principle, the charge voltage on C2 and the transformer voltage can be made to act in series across a further rectifier on the next half cycle, and so on up to any number of cascaded stages. Thus a D.C. output voltage of any desired multiple of the output of a simple half-wave circuit is possible with rectifier cascade-multipliers, without the need for any transformers. But such circuits are of little use to the constructor, because rectifiers and condensers of the large voltage ratings required are not commercially available.

It may be mentioned, however, that the rectifiers may be replaced by spark-gaps of graded separation, trimmed so that breakdown just occurs at the half-cycles corresponding to the maximum voltage, exactly where a normal rectifier would be required to conduct in such a circuit. This is an interesting example of the use of spark gaps in substitution for rectifiers, which has actually been used in historical equipment for high-voltage supply for atomic research. Generators with spark-gap cascades have been built with an output of well over a million volts, using a transformer winding input of some thousands of volts.

This completes the survey of those rectifier circuits considered to be of practical use to the experimenter. Many other interesting types, such

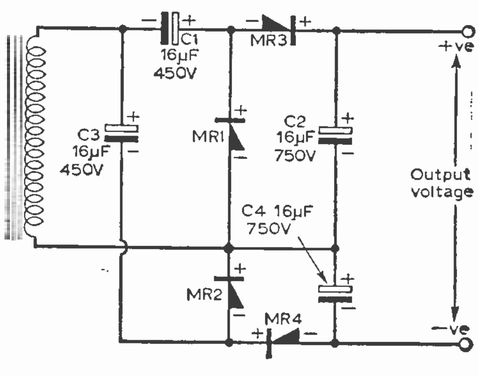


Fig. 22 (right)—The cascade voltage quadrupler circuit. Transformer secondary 250V r.m.s.; rectifiers E250C50 selenium. Do not mount on the same metal chassis, as otherwise flashover inside the casing is likely. Use separate cooling plates of aluminium insulated from each other. (The values given are approximate.)

as three-phase and polyphase equipment, grid-controlled rectifiers, etc., are not considered to be of practical importance for the general experimenter.

Peaking and Smoothing

All rectifier circuits work into an output load through which the D.C. output current flows. In basic principle, this output load consists of a resis-

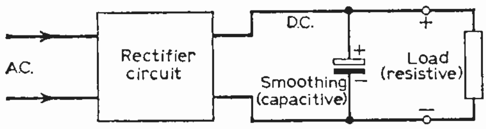


Fig. 23—Resistive and capacitive elements in parallel representing the output load.

tive element (the actual useful load) and a capacitive element (the "smoothing") in parallel, as shown in Fig. 23. Fig. 24 shows the more conventional smoothing, where the capacitive element is split at the "hot" end into two, and a choke or resistor inserted. This enhances the characteristic that the A.C. component of the output (hum ripple) goes preferably through the capacitive element to earth, whilst the true D.C. component goes through the resistive element (real load) to earth, which is the familiar purpose of smoothing —namely to remove as much as possible of the remaining A.C. component of the output.

Now, the capacitive element of the circuit of Fig. 23, as long as it is not charged to the final voltage, represents a short-circuit as soon as the

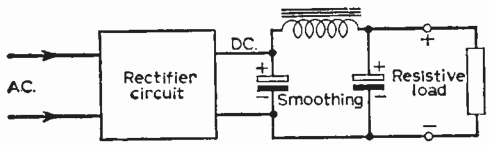


Fig. 24—Conventional smoothing.

transformer winding voltage has reached a part of the half cycle of the conduction-polarity where the voltage has risen above that to which the condenser is at the moment charged and charge current will then flow into the condenser to increase its voltage. It is thus perfectly obvious that this process goes on until the condenser has charged up to the peak voltage of the A.C. wave, which is about 1·5 times the r.m.s value for the mains sine wave. This property of rectifier circuits is known as (capacitive) peaking, and raises the peak inverse voltage rating required for the rectifier, as explained earlier in this article. Even if no physical condenser is present, the circuit stray capacities, even if very small, are inevitably fully sufficient to give full peaking on open-circuit output, so that no reduction in inverse voltage rating of the rectifiers is permissible even if no physical smoothing condensers are used, as in common accumulator charging circuits.

Load Characteristics

The remarks regarding full peaking made in the previous section apply to open-circuit output, i.e., the case when the resistive component of the output load is of infinitely large resistance. As soon as a finite resistive component is connected, i.e. an actual pure D.C. output current is drawn, this will draw charge away from the smoothing condensers.

Thus, in actual practice, the final operating output voltage will be somewhat less than the full peak voltage, according to the balance struck between the load current passing out of the condensers and the rectifier current passing into them on the appropriate portions of the A.C. cycle. Zero output D.C. load results in full peaking, as explained above, and as the output D.C. load current increases the voltage will fall below the peak, the decrease being normally linear with rise of current in most circuits, which means that Ohm's Law is obeyed to the extent that a definite corresponding internal impedance may be ascribed to the circuit. This *internal impedance* lies in the region of about 1k to 2k for normal conventional full-wave H.T. rectifier circuits, so that a decrease of 1V to 2V may be expected in the output voltage for each rise of about 1mA of output current drawn. The actual exact figures in a particular case will depend greatly on the smoothing capacity values, rectifiers, resistances of transformer windings. etc. A good power supply should have as small a change of voltage with load current as possible, i.e. as low an internal impedance as possible.

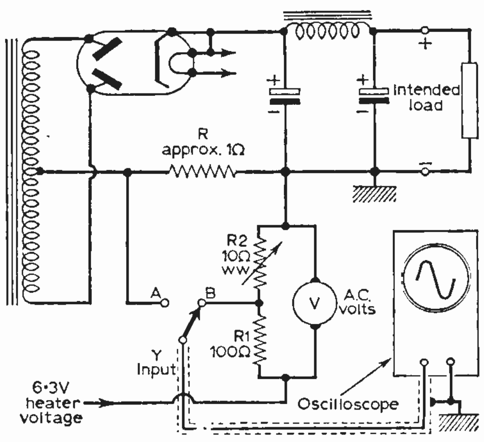


Fig. 25—Measuring peak surge rectifier current.

Condenser Values

Large values of smoothing capacities reduce the internal impedance, in that they keep the output voltage high at greater load currents, but this is at the expense of large surges of current through the rectifier at the A.C. cycle peaks, which exceed the surge-current rating of the rectifier for smoothing capacities larger than a critical value for a given circuit. Thus the use of too large a smoothing capacity can cause overheating and flashover in the rectifier.

Metal rectifiers, and especially the new silicon rectifiers, can tolerate higher peak currents than normal valve rectifiers. This is a great advantage of these devices, and allows the use of much larger smoothing capacities, which is very useful in half-wave circuits requiring the extra smoothing effect. It is extremely difficult to determine the maximum tolerable smoothing capacity on theoretical lines if one is about to try out a new rectifier circuit of one's own design, but fortunately it is a simple matter to measure the peak rectifier current in an experimental circuit if one posesses an oscilloscope and an A.C. voltmeter. Fig. 25 shows the arrangement for such a measurement, as typically applied to a conventional full-wave H.T. rectifier circuit. The normal load which the circuit is intended to feed is connected, and the small measuring resistor of about 1Ω (the resistance (R) of which must be known accurately) is connected as shown. It does not disturb the function of the circuit appreciably, serving merely to monitor the rectifier current.

The oscilloscope input is now connected to A, and the trace adjusted to suitable height and the timebase to display a convenient number of cycles. The waveform will not be a sine wave, but will display the regular current surges through the rectifiers. Without altering any settings of the oscilloscope controls, the oscilloscope input is now switched to B, and R2 adjusted until the mains sine wave display has exactly the same peak to peak amplitude as the peak to peak amplitude of the rectifier current display. If V is the reading of the A.C. voltmeter, then the peak rectifier current is given by

$$I \text{ peak} = \frac{V}{R} \times \frac{3R2}{R1 + R2} \text{ Amps}$$

$$\left(\begin{array}{c} \text{Resistances in Ohms} \\ \text{V in Volts r.m.s} \end{array} \right)$$

The data list should then be consulted to check whether the measured peak current is within the *surge-current* rating of the rectifier in use. If not, then the smoothing capacity must be reduced, the load current reduced, a different rectifier type used, or a surge limiting resistor or choke inserted (Fig. 26), or any suitable combination of such measures. If one were very careful in the design of circuits, the initial surge currents through the rectifiers as the condensers charge up from zero upon initially switching on would also be studied.

Surge Limiters

If the initial surges are found to exceed the rating of the rectifiers, then the same measures as indicated above can be used, though the best measure in this case would be the use of surge-limiter resistors or chokes. There is in principle a choice of three positions for such components, as illustrated in Figs. 26 a, b, c. Fig. 26a is normally used if resistors are used, whereas Fig. 26b is common if a choke is used, whereas Fig. 26c is seldom found.

There is not a great deal to choose between the three arrangements, the particular preferences being largely a matter of convention. Fig. 26b represents the familiar choke-input smoothing circuit, which has the characteristics of a very rapid initial fall of output voltage away from the full peak at low output currents, but thereafter far slower fall of output voltage with output current in the region of the operating value of output current (assuming proper choice of component values). The result is that such a smoothing

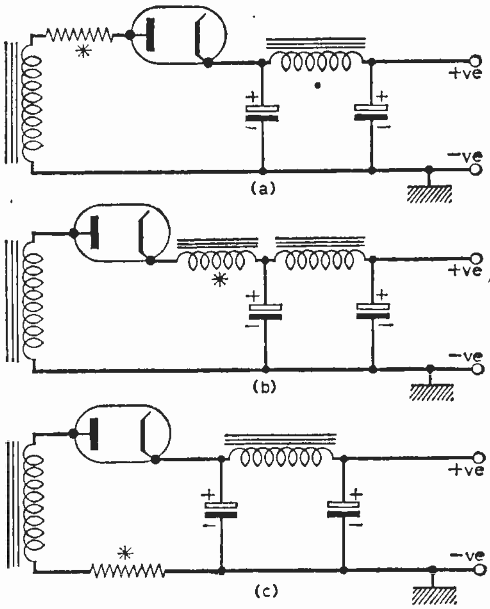


Fig. 26—The three positions for surge limiters.

circuit gives a smaller output voltage at a given load than the conventional smoothing circuit of Fig. 24, but the effective internal impedance is lower, i.e the regulation is better.

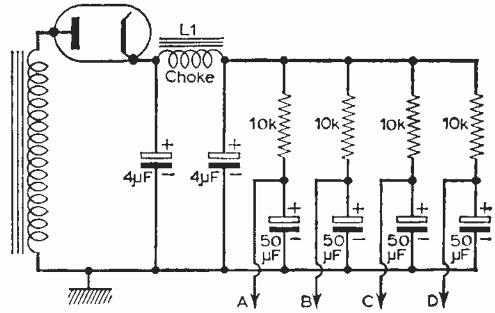


Fig. 27—This circuit provides decoupling and smoothing in one, and avoids unnecessarily large rectifier surge currents.

High Ratings

It should be mentioned that the use of television booster diodes as power rectifiers, in addition to advantages already discussed, has the further advantage of high surge-current rating. This is because these diodes are specially designed for pulse-operation in television line-output circuits, and therefore are fitted with excellent high-emission cathodes. Thus the PY81 is rated at a peak surge current of half an amp. so that with a 400V r.m.s. transformer winding giving a peak voltage of 600V forward, the surge-limiting resistance would only need to be at the very most about 1000Ω. The

(Continued on page 438)

A HOME-MADE HI-FI OUTPUT TRANSFORMER

BY W. GROOME

THE USE OF A TERTIARY FEEDBACK WINDING ARRANGEMENT SIMPLIFIES THE CONSTRUCTION OF THIS TRANSFORMER AND REDUCES THE COST.

PRICES of quality output transformers are still high enough to deter the experimenter who has economy in mind, particularly when the cost has to be doubled for stereo. Substitutes bring distinct risks of trouble with published designs, a fact which emphasises the importance of considering transformer and amplifier circuit side by side. Despite this cautionary remark, the transformer to be described will be found to be stable in several circuits and will provide the basis for some interesting, inexpensive experiments.

Sections

The number of winding sections is small and their arrangement simple enough for home workshop methods and yet the transformer does not lend itself to factory production, possibly because it requires a centre-partitioned bobbin and a "stop-and-start' procedure unsuitable for automatic machinery. Therefore, despite its advantages of small size, simplicity, cheapness and high-quality performance, it is not likely to appear in the shops.

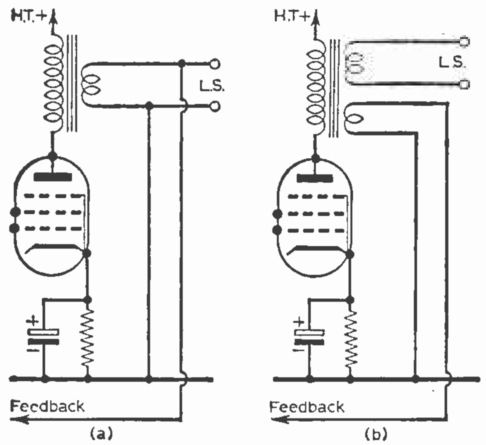


Fig. 1a—Voice-coil feedback circuit; b—tertiary feedback circuit.

The achievement of stability in an amplifier having overall feedback generally demands a complex sectionalised winding arrangement in the output transformer. A successful alternative for the small amplifiers which, in stereo pairs, can supply a total of about 10W output, is to operate the output stage safely within class "A" conditions so that small and simple transformers can be used. Another method is to apply heavy negative feedback over the output stage to clean up distortion at its principal source, thereby reducing somewhat the risks of instability with the voice-coil loop.

Separate Feedback Winding

A further arrangement is the provision of a tertiary (third) winding to supply a

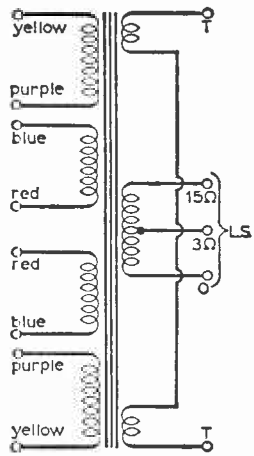
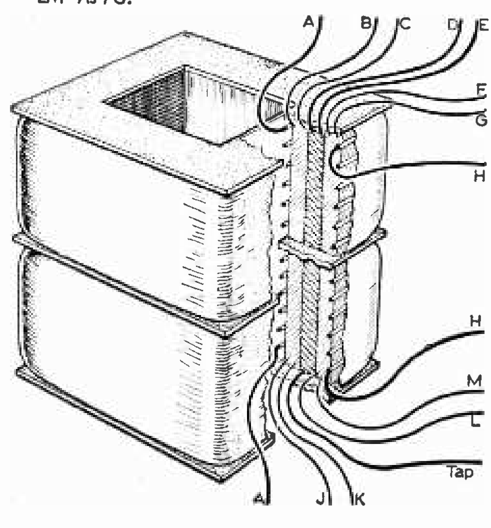


Fig. 2 (right)—A push-pull output transformer with tertiary windings (T).

Fig. 3 (below)—Each anode winding is confined to one side of the partition and divided into two sections separated by the secondary. The secondary and tertiary are wound across the full width of the former.

- AA *Tertiary, one layer, full width;*
- BC *Primary, inner section, one side of the partition;*
- DE *Secondary, full width;*
- FG *Primary, outer section, one side of the partition;*
- H *Tertiary, one layer, full width;*
- JK *As BC;*
- *Tap secondary tap;*
- LM *As FG.*



feedback voltage that suffers none of the distortions to which voice-coil connections are prone. It becomes possible to apply very heavy feedback without the sectionalising normally required. This is the basis of this transformer. To obtain the greatest versatility, the windings are so arranged and insulated that the leads, which are all brought out instead of being internally connected, provided a choice not only of turns ratio but also of output stage conditions and feedback circuits.

Fig. 1 shows in the simplest forms (a) the conventional feedback circuit and (b) the tertiary arrangement. A very simple tertiary winding would seem to be possible by wrapping the very few necessary turns around the outside of any transformer winding. This can be tried and the transformer may be found to behave reasonably well, but the feedback will be out of balance and some distortion is certain. A virtual replica of the anode signal can be obtained when the tertiary is divided into two single-layer sections in series, one on the inside of the bobbin and the other on the outside. It is also preferable, and easily arranged, to have a balanced primary having the winding for each valve of a push-pull pair kept to its own side of a partitioned bobbin. This not only gives excellent push-pull conditions but balances the D.C. supply and the resistive component of the A.F. load.

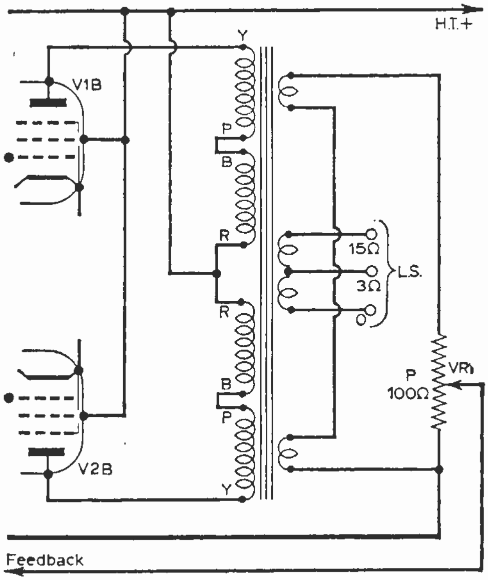


Fig. 5—The method of obtaining variations of gain and feedback by the potentiometer (P) placed across the tertiary windings.

Tertiary Sections

The arrangement adopted has both primary windings divided into two sections, each pair on its own side of the partition with the secondary as a single section wound across the full width and tapped for alternative loudspeaker impedances. The tertiary sections comprise only

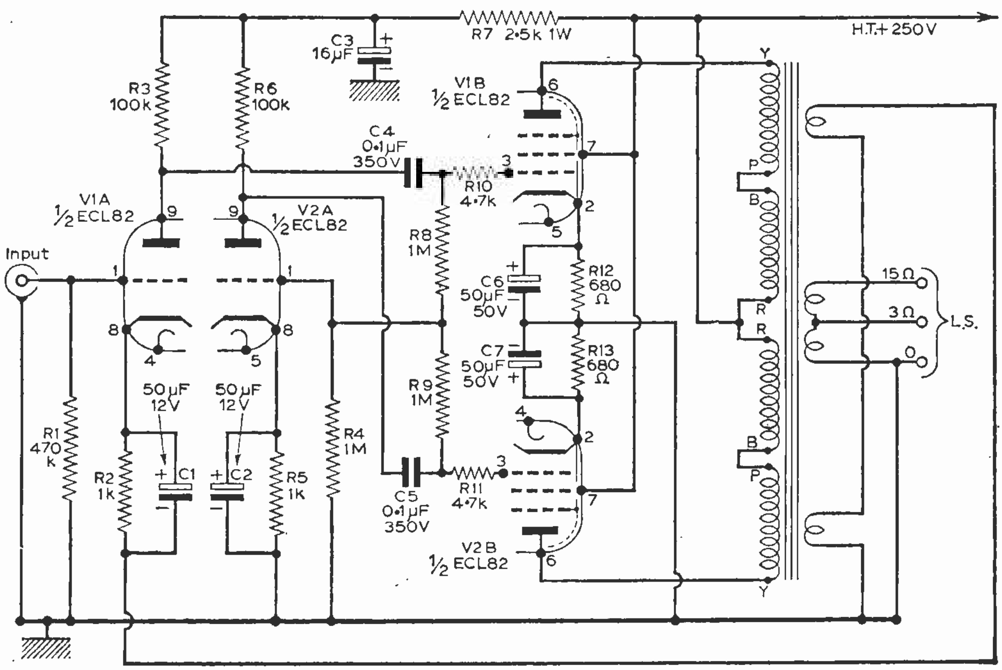
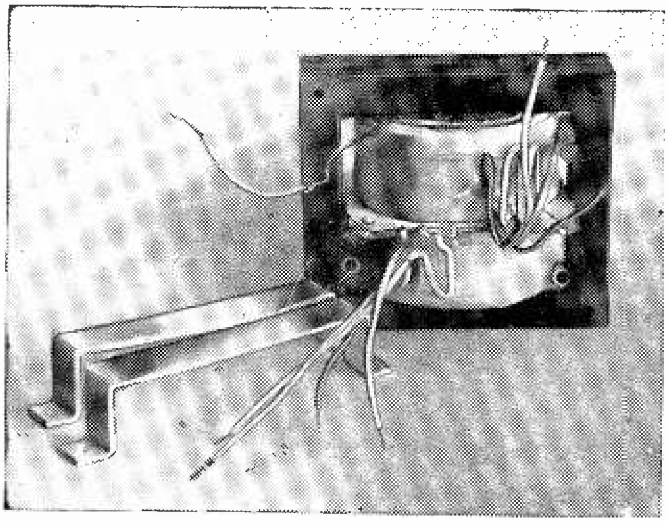


Fig. 4—The circuit of a two-stage push-pull amplifier.

twelve turns each, spaced across the full width. The arrangement of the sections is shown schematically in Fig. 2, with colour identification that will be used throughout this article and the one which follows. Fig. 3 will give some idea of the actual positions of the sections.

No rigid specification for core dimensions and quality will be given because of the difficulty of obtaining laminations of any particular size and grade in the shops. Instead, some guidance will be offered to enable the constructor to use the best he has or can obtain and to adjust the windings to suit. A feature of the transformer is that it is tolerant in this respect, and good results can be achieved with cores rather smaller than might be needed with others. High frequency response is good and there seems to be little to gain by dividing the windings into the many sections found in the usual high quality job. Nevertheless, for the very finest quality, a generous stack of good quality laminations should be provided. In a 10W amplifier very fine bass down to 30c/s is possible with a 1½in. stack; a ¾in. stack gives excellent results in a stereo amplifier giving about 6W per channel.



One of the author's experimental transformers.

Pre-amp

The amplifier should have sufficient gain to overcome the attenuation of heavy feedback, and the necessary amplification must be achieved with the minimum of A.C. coupled stages. Two stages coupled by one R.C. network is safe enough, and the tertiary transformer can be made to work quite well in a three-stage amplifier. The phase shift with three stages can be kept well within the stability margin if one is direct-coupled. With more than three stages an amplifier is likely to be unstable with any transformer if all are within the feedback loop. A safe and satisfactory method for small domestic amplifiers is to use a two-stage main amplifier and to feed it from a pre-amplifier having its own local feedback. The object of the main loop is to clean up the distortion that is generated chiefly in the output stage and there is no point is using voice-coil or tertiary feedback for earlier stages where simple local loops can be more effective and stable.

In Fig. 4, a triode "see-saw" phase-splitter and amplifier stage feeds the output pentodes. The tertiary winding, earthed one end, supplies feedback to V1 via R1 and provides a path for the cathode current.

(To be continued)

INCREASING VOLTMETER RANGES *(Continued from page 388)*

The multiplier must take $500-0{\cdot}05=499{\cdot}95$V. Its resistance will therefore be:-

$$R=\frac{E}{I}=\frac{499{\cdot}95}{1/1{,}000}=499{,}950\Omega.$$

Such a multiplier can most conveniently be made by connecting 470,000, 22,000, 7,000, 820, 100 and 30Ω resistors in series. Taps can be arranged for 250, 100 and 10V or other such ranges, calculated in the same way.

The multiplier in circuit at 500V is 499,950Ω, at 250V is 249,950Ω, at 100V is 99,950Ω, and at 10V is 9,950Ω.

The Voltage Divider

Valve voltmeters and oscillographs have a different multiplier system. Fig. 4 illustrates the arrangement. R is known as a divider. The valve voltmeter is connected to a small portion of R and therefore measures only a fraction of the voltage under test. R is usually made up of several high resistances connected in series giving a total value of about 20M. It is essential to have R as high as possible in order to maintain the sensitivity of the valve voltmeter.

In Fig. 4 the total value of R is 20M. Therefore on 1,000V it will pass:-

$$I=\frac{1{,}000}{20{,}000{,}000}=1/20{,}000\text{A}=0{\cdot}05\text{mA}$$

The valve voltmeter reads one volt at full scale deflection. Therefore the resistance between b and c will be:-

$$R=\frac{1}{1/20{,}000};\quad=20{,}000\Omega.$$

The resistance between a and b will, of course, be the difference between 20,000,000 and 20,000= 19,980,000Ω. Tappings can also be arranged between the various components of R to give, say 500, and 250V ranges. In Fig. 4 the resistors are as follows: b to c=20,000Ω, b to 250V tap= 4,980,000Ω, 250 to 500V tap=5,000,000Ω, and 500 to 1000V tap=10,000,000Ω.

SERVICING TAPE RECORDERS

PROGRAMME SOURCES AND SIGNALS

(Continued from page 315 of the August issue)

By T. S. Smith

LAST month we dealt with record and replay equalisation and discovered how a reasonably flat overall frequency response can be obtained by applying controlled treble lift on record and bass boost on replay. This month we shall be considering the various programme sources and signals used by the home recordist.

Recording from the Radio

The radio is undoubtedly the most used source of programme material exploited by the amateur but, unfortunately, full advantage is not always taken of this medium and consequently the quality of reproduction may be sadly lacking.

The easiest way of getting a radio recording is to site the microphone in front of the loudspeaker and record in the usual manner. Although the results so obtained are acceptable to some, this is a very poor method of recording technically and far better results are possible by the use of other methods. With the loudspeaker/microphone method, three basic distortions are introduced to the recorder, and these are: (i) the inherent distortion in the output stage of the receiver (even the best sets produce some distortion in the output stage); (ii) the distortion and coloration produced by the loudspeaker itself and by its baffle or enclosure; and (iii) the distortion, reverberation and coloration reflection reflected from the room.

The first kind of distortion is present always and cannot be reduced or eliminated; (ii) is, again, always present and depends much on the loudspeaker and enclosure employed by the receiver; (iii) however, can be varied to some extent by playing with the spacing between the loudspeaker and microphone and by cutting out excessive reverberation by covering the channel between the loudspeaker and microphone with a heavy cloth.

The loudspeaker/microphone channel is virtually an electro-acoustic transducer, in which there are two distortions to contend with: the "electro" distortion and the acoustical distortion, as already described.

Eliminating the Acoustics

It is rather pointless to use the A.F. signal produced by the set to operate a loudspeaker, and for this loudspeaker to cause the diaphragm of a microphone to vibrate in sympathy, and then to use the signal produced by the microphone for recording (see Fig. 25). By far the best idea is to utilise the A.F. produced by the set as the recording signal (Fig. 26).

This, then, presents several problems; the best way of extracting the A.F., etc. The obvious arrangement is to disconnect the loudspeaker and apply the two loudspeaker wires to the input of the recorder. This, although obvious, is a bad thing to do for several reasons. One is that as soon as the loudspeaker is disconnected from the set, the output stage is operating without a load. This immediately introduces quite a lot of extra distortion, but not only that, it also causes the A.F. voltage to rise to dangerous peaks at the anode of the output valve and across the primary of the output transformer. Before very long either the valve would flash over or the primary of the transformer would short-circuit or break down.

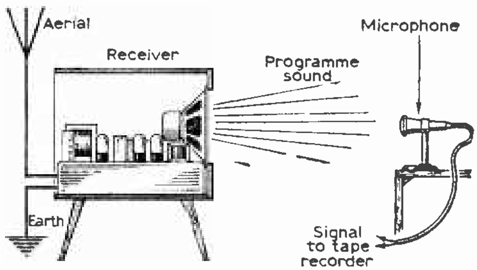


Fig. 25—The simplest way of recording from the radio is to site the microphone in front of the loudspeaker. This is technically poor, however, since there are various distortions introduced to the programme signal as this diagram shows.

If this method of feeding is to be used, then it is essential for either the loudspeaker to remain connected or a resistive load to be used instead. The resistive load should have a value equal to the impedance of the loudspeaker, which, in most ordinary valve-type receivers, is of the order of 3Ω. With transistor receivers, the impedance may be entirely different and in some cases the loudspeaker speech coil may be centre-tapped, in which case special precautions will have to be taken to prevent damage to the output transistors.

Where possible, it is best to operate without the loudspeaker for, apart from the disturbances created by a watt or so of audio during a recording exercise, the varying impedance with frequency of the loudspeaker can detract from the quality of the recording and, in certain cases, upset the equalisation. When a resistor is used instead, it should be able to handle the full output power of the set or amplifier hook-up. As 3Ω resistors are rather difficult to come by, a length of resistance wire (available almost anywhere) wound round the body of a ceramic high-value resistor, and terminated at the lead-out wires, is adequately suitable for this application.

Voltage and Matching

Next things to consider are the signal voltage required at the input of the recorder to give full modulation without overload, and the impedance matching between the output of the set and the input of the recorder.

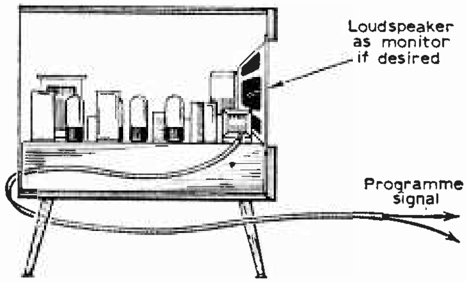


Fig. 26—If the A.F. signal is taken from the loudspeaker circuit, the loudspeaker must be left connected or a load resistor equal to the impedance of the speaker, must be connected instead.

Voltage Considerations

Tape recorders usually have two (or more) inputs, one for microphone and the other for radio. The microphone input is usually more sensitive than the radio input. This is because the voltage at the output of a microphone is much below that available from a radio set. Typical levels for full modulation are: microphone 1mV and radio 100/150mV. Sometimes there is a second radio input suitable for low-level signals direct from the diode detector, but this will be considered later.

The question, then, is what sort of voltage is present at the loudspeaker leads of an average radio set? This depends very much on the impedance of the loudspeaker circuit and the output of the set. The voltage is easily found, however, for any set, by using the simple expression $E = \sqrt{(W \times R)}$, where E is the r.m.s. output voltage W the watts output and R the impedance of the loudspeaker or load resistor in ohms.

A typical set, for example, might be giving, say 3W across 3Ω. Three times three is nine, and the square-root of nine is three. Thus, it follows that, at full output, 3V r.m.s. exist across the loudspeaker load. This is well above the input signal required on most recorders, so the signal is either turned down at the set (set's volume control) or at the recorder—but this can cause trouble. For example, say the radio is turned up to nearly full output, using a resistive load instead of a loudspeaker, so that 3V peak are applied to the recorder. This will mean that the record level control will have to be turned well back to avoid overmodulation as indicated on the modulation depth indicator. Indeed, under such conditions the record level control will only be a fraction on.

Now, although the modulation or record level indicator will be showing that overloading is not apparently taking place, the recording will almost certainly be very poor indeed. The main reason for this is not so much a question of matching, but one of overloading in the first stage. The recording level control is usually connected *after* the first valve, so the first valve is receiving a full 3V of A.F.! It cannot handle that, of course, and distortion will occur, the distortion being controlled, in terms of recording level, by the level control after the amplifier.

The Best Settings

The best way of setting up such a combination is, first to turn on the recording level control almost to maximum, then turn up the radio volume control for maximum record level as indicated. In

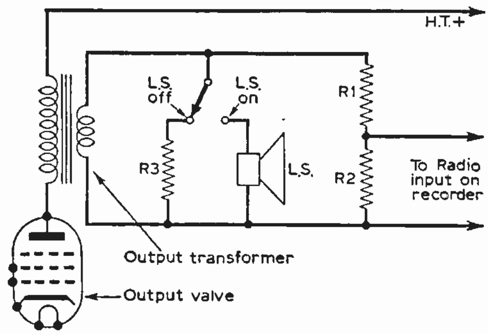


Fig. 27—This circuit shows a "loudspeaker on/off" switch, a dummy load R3 and an attenuator R1 and R2. The attenuator ensures that the first stage of the recorder is not inadvertently overloaded and also gives a theoretically better match between the set and the recorder.

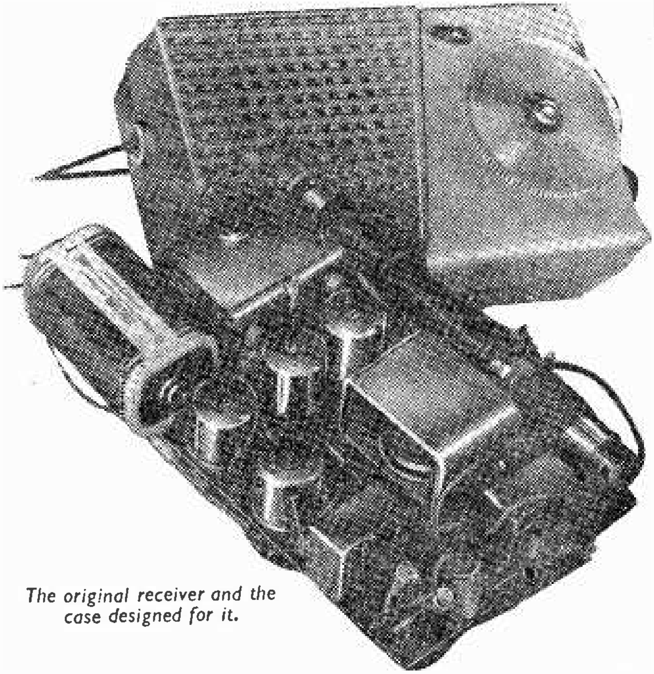
that way the first stage of the recorder will always work well below the distortion level, but difficulty may be had in obtaining a sufficiently low setting of the receiver's volume control—a slight touch being sufficient to push the recording level indicator well over the limit. Also, if the receiver's loudspeaker is to be used as programme monitor, the low volume control setting will not give sufficient output, bearing in mind that only 0·001V or so is required to drive fully the recorder and that this corresponds to very little audio power across 3Ω.

Attenuation

Thus, an attenuator is a good thing to have between the set output and the tape recorder input. This will enable the set to be operated at near normal volume without overloading the first stage

(Continued on page 418)

Servicing the P.W. POCKET SUPERHET RECEIVER



The original receiver and the case designed for it.

SERVICING DATA FOR THIS POPULAR PRACTICAL WIRELESS DESIGN

By F. G. Rayer

THIS receiver, the blueprint of which was presented with the November 1960 issue of PRACTICAL WIRELESS, is capable of very good results indeed, but errors in component values, or in the placing of components or wiring, may introduce difficulty. The use of transistors or other alternative parts, of different type from those specified, can also influence results. Where slight modifications have been made, to use items to hand, or for other reasons, it should still be possible to obtain satisfactory results.

The servicing details given here apply to the circuit and construction given on the blueprint, and the circuit is given again in Fig. 1 for easy reference. There are also a few constructional points.

Results Expected

It is not easy to give an anticipated standard of results, as these depend to some extent on local conditions. If the set is used in average conditions, and not in a screened locality such as a vehicle or metal building, about thirty stations should be heard at sufficient loudspeaker volume, on the M.W. band, during evening. On the L.W. band, about three stations should be received.

Local stations, and a few stations which come in at best strength, should give ample speaker volume with the volume control only advanced by a quarter revolution, or less.

Speech and music should be of pleasant quality, from low volume right up to ample volume for ordinary listening in an average room.

Battery Space

The unused tags of C1 and C2 should be bent in against the condenser. A round body battery such as the Vidormax T.6004, will fit more easily than a square battery. The IFT2 can safely be positioned a little more to the right, and larger battery clips can then be accommodated. Neither clip must touch the IFT can. To avoid this, a piece of thin card, about 2¾in. x 1in. may be bent to isolate the battery from the IFT and C1 and C2.

If a trifle more space is needed the tuning condenser can be moved slightly higher by elongating the holes in the paxolin. This can be carried out with a small round file. The T.6004 battery should fit without need for this, unless the holes for the securing screws have been drilled a little inaccurately.

Waveband Coverage

This is about 200-525m on M.W. and 1100-1750m on L.W. A high minimum capacity in the trimmer C3 will prevent 200m from being reached. If so, the spacing between the trimmer plates needs increasing. This can be done by unscrewing the trimmer and bending up the plates with a knife, taking care not to break the insulation.

Stray minimum capacity should be as low as possible, so leads to C7 and C8, and the switch, should be clear of the condenser frame, or earthed wiring.

Trimming can be on 208m (Radio Luxembourg) with the audio gain control at maximum, the set being oriented to keep volume low. Failure to tune to a sufficiently low wavelength indicates that the trimmer is screwed down too much, or that stray capacity is too high.

If signals at about 525m cannot be reached, with the tuning condenser closed, this probably indicates that the oscillator coil core is not screwed into the coil far enough. Even half a turn on this core will considerably influence band coverage. If C8 is abnormally low in value, this will have the same result.

On the L.W. band, 1500m (Light Programme) should be found near the middle of the L.W. range. If not, C7 may be too low in value, or the oscillator coil core may not be screwed in far enough. If C7 is too low in capacity, wiring a 60pF trimmer in parallel with it will correct this. Adjust C4 near 1200m and the position of the L.W. winding on the rod near 1700m. Poor L.W. reception may be caused by wrong wiring to the L.W. winding tags, switch, or C7.

Complete failure of the oscillator stage to work, with a set just constructed, may arise from wrong oscillator coil positioning. There is electrical continuity between pins 1 and 2, between pins 3 and 4, and between pins 5 and 6. If this is not so, remove the coil, turn it as necessary, and replace it.

Noisy Reception

Receiver background noise should be very low. If high, a transistor may be responsible. Reputable transistors of named make will have passed a low noise test, but cheap or surplus transistors may be noisy.

Noise from defective soldered joints may be found by examination, by moving suspected leads carefully with an insulated tool, or by checking each stage individually. It takes only a moment to "tin" the leads of resistors, etc., by applying the iron and cored solder. If this is always carried out, no joint should be defective.

I.F. Oscillation

Instability in the intermediate frequency amplifier may be heard as a whistle or similar noise. It may arise from wrong values for R7 and R11, or C10 and C13, which should be of 2% tolerance. Very long leads to Tr2 and Tr3 may contribute, and base and emitter wires should not be close together.

If the trouble ceases on tuning in a strong station, it is very slight. If it ceases only on detuning one or more I.F. transformer, check that wiring is short and direct. Increasing the values of C11, C12 and C14 may help. This is most easily done by adding other condensers in parallel, to a total of 0·1μF or 0.25μF.

Current Drain

A meter included in one battery lead should read approximately 8mA, with no programme

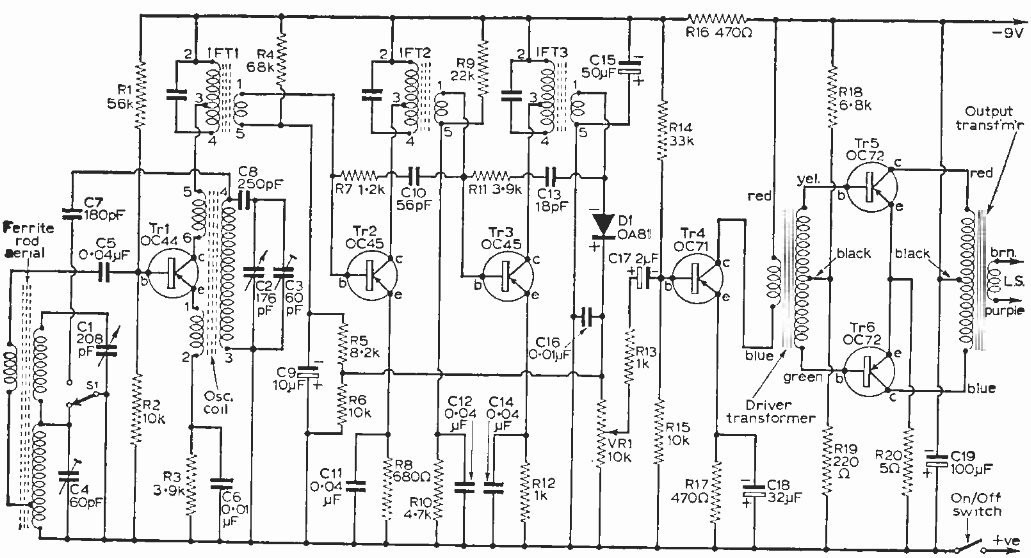


Fig. 1—The original circuit of the pocket superhet.

If R14 is of abnormally low value, or R15 unusually high in value, noise may increase. Noise from this cause will remain if one end of C17 is temporarily disconnected.

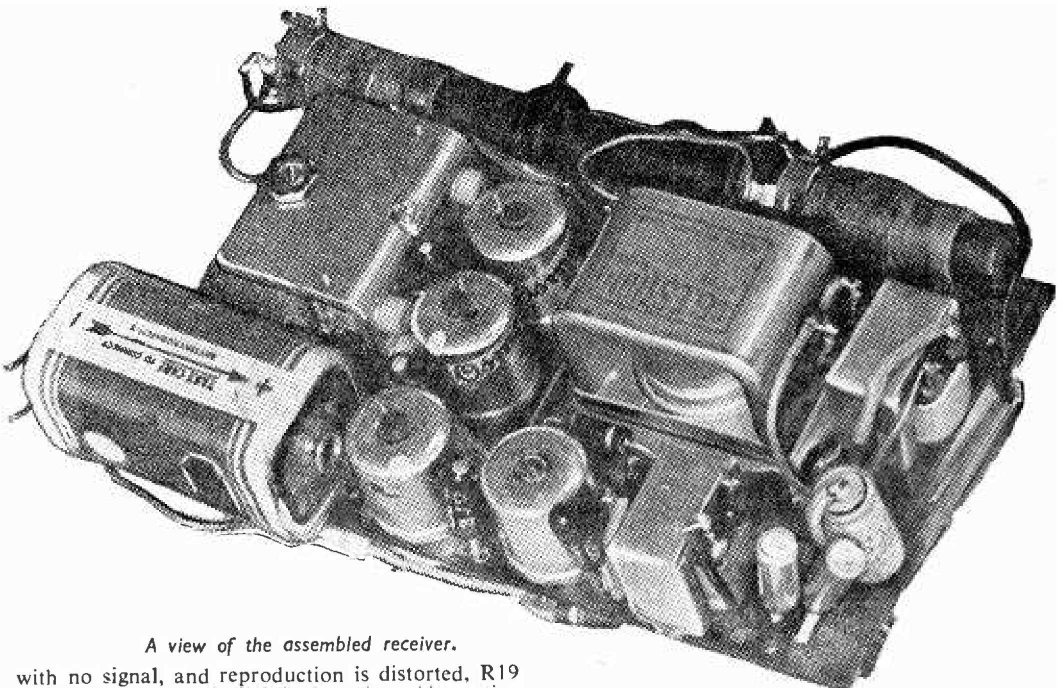
A high background noise which ceases abruptly if one or more of the IFT's is detuned, is caused by I.F. instability, described later. This will usually be accompanied by whistles.

Noise generated outside the set, due to ignition systems, light switches etc., cannot be prevented, but the receiver may be placed as far as possible from the source, or from mains wiring.

tuned in, or with volume very low. Current consumption depends directly on volume, rising to about 15mA on peaks with average good volume. Maximum volume from a local station can give peaks of 25mA or higher.

Consumption up to and including Tr4 should be about 6mA. If the no-signal drain of the output stage, Tr5 and Tr6, is much over 2mA, R19 should be slightly reduced in value to correct this. R18, R19 and R20 should be of 5% tolerance, and these values are correct only for OC72's.

If consumption of the output pair is very low,



A view of the assembled receiver.

with no signal, and reproduction is distorted, R19 should be increased slightly in value. Alternative transistors will probably require some change to the value of R18 or R19, to obtain a suitable base voltage. With the OC72's, R20 may be 4·7Ω.

The driver and output transformers are for OC71 and OC72's and near equivalents. Resistor values shown permit economical working with full output.

Low Temperatures

Very low temperatures, such as may arise in winter in a vehicle or unheated room, may shift transistor characteristics, so that output is reduced and distorted. This is common to many such circuits, and is most likely when R18 and R19 chance to be of such a value as to make the output pair base voltage rather positive. The need for a new battery may be suspected. The trouble should cease when the set is run for some time in a heated room, or is otherwise allowed to reach a more normal temperature.

If this effect is unduly troublesome, R19 should be increased slightly in value to suit the actual output pair fitted. R19 should not be unnecessarily high in value as this will increase current consumption.

Distortion

This is most probably caused by wrong values for R18 or R19, as explained, or for R14, R15 and R17. The first three stages can be most simply checked by wiring phones across R15. Adequate volume with good quality should be obtained.

Transferring the phones to the driver transformer primary should give a very great increase in volume with good quality maintained. If not, suspect R14, R15 and R17, or Tr4. If quality is good here, but not from the speaker, suspect R18 or R19.

Resistor Coding

Errors in reading values are most likely with low values, such as 4·7Ω, 47Ω, and 470Ω. If values are in doubt, they should be checked with a meter.

The 5% tolerance resistors should have a gold band, and all other resistors should have a silver band to indicate 10% tolerance. Unmarked resistors (20%) should not be used.

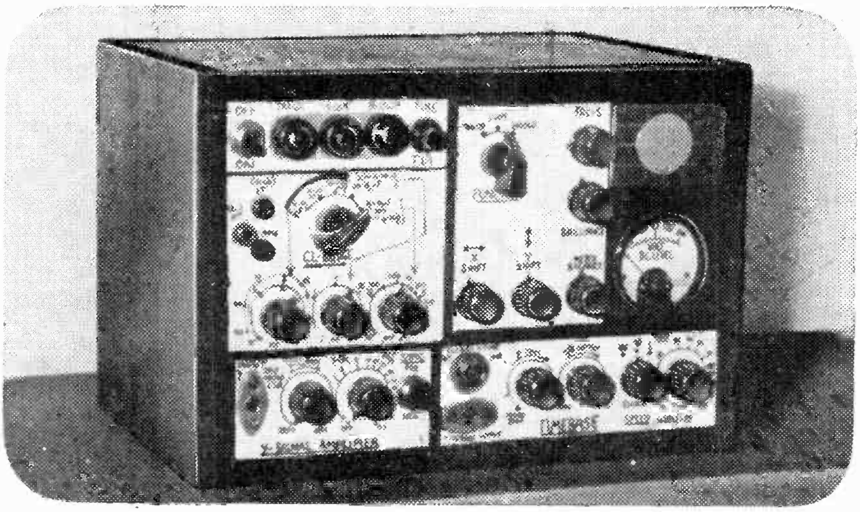
Transistors

Leads will be of about the right length if the transistor tops are level with the tops of the I.F. transformers. Alternative transistors will be found to work satisfactorily, if of equivalent or near equivalent type.

If different transistors are incorporated, some changes in component values may be required. With Tr1 (OC44 specified) R2 might require changing, or a low value resistor may need adding between collector and pin 6. With different transistors for Tr2 and Tr3 (OC45's specified) it could occasionally be necessary to modify neutralising values, or base supply resistors.

Warning

This article has been published for the benefit of those readers who built the original P.W. design and the servicing information given here may not apply to later versions of the receiver although it may be found of assistance. ■



By M. L. Michaelis

THIS article describes the construction of a compact test-set combining the functions of several separate units of conventional construction, and enabling a multitude of qualitative and quantitative measurements to be performed on wireless and amplifier circuits.

Introduction

Many keen experimenters must confine their activities to some odd corner of a room used for other purposes too, or possess only a workshop of very limited size. Experimental work, on the other hand, is considerably hampered if essential apparatus has to be stored away in inaccessible places, requiring considerable preliminary setting-up work prior to any working session. This trouble is particularly aggravated if such apparatus is bulky or consists of many separate units. It is thus highly desirable to have the essential measuring and test equipment in as compact and multi-purpose a form as possible, so that it may be left permanently set up ready for immediate use, even under conditions of very limited space.

The "Experimenter's Power Pack" (already published in this magazine in the January 1962 to July 1962 issues inclusive) is aimed to meet experimental power-supply needs under the conditions just mentioned. This article describes a very compact test-set, measuring only 11½in. x 8in. x 7½in. deep, which embodies the full functions of (a) oscilloscope (b) signal tracer (c) audio test-oscillator (d) frequency-meter (e) valve-voltmeter (for A.C. and D.C.) (f) quantitative waveform analyser, and (g) resistance-Inductance measuring bridge. It uses only seven valves and a miniature cathode-ray tube, and has a built-in moving-coil meter and all power-supplies also built-in.

Very considerable experimenting time has been devoted during design to obtaining a really stable and reliable circuit which should function well without any difficulties if the points discussed in the course of this series of articles are carefully observed.

Equipment for the Experimental Workshop

The following question has often been raised: "What basic equipment does the keen experimenter require if he really wants to be able to observe systematically what exactly is going on in his experimental circuits, rather than rely on more hit-and-miss methods?". The "Experimenter's Power Pack" and the "Miniscope" of the present article are the answer which this magazine offers, in a practical way, to this vital question. In addition to these two items (apart from the obvious need for an adequate set of the usual hand-tools such as soldering-iron, screwdrivers, files, pliers, etc.) the following may also be recommended:

(a) A good multimeter which may be home-made, according to information already published in these pages, or any good commercial model from the wide selection of advertiser's offers.

(b) A small handy grid-dip meter covering those ranges of radio frequencies with which the experimenter intends to work. For general-purpose use, an instrument with a set of plug-in coils covering the range 100kc/s to 100Mc/s would be ideal. It is of advantage to see that this instrument is usable as R.F. and I.F. signal generator and absorption-wavemeter too (as most grid-dip meters will already be, or will be after simple modification). Capacities below 1,000pF and inductances in the milli-henry and micro-henry ranges can then be measured with this instrument, as well as tuning-ranges of tuned circuits, etc., thus augmenting the functions of the Miniscope.

A useful third item here would be a small wobbulator for use in conjunction with the "Miniscope" for aligning tuned circuits, bandpass filters, etc. Provision is made on the Miniscope for connection of such a wobbulator, in conventional fashion.

A constructor possessing this list of equipment, and having acquired the necessary skill and knowledge in its practical use and possibilities, should be in a position to carry out almost any quantitative or qualitative observation on processes in normal experimental work, giving him a very clear picture of what is going on in his circuits at every stage.

Regarding the Miniscope in particular in this scheme of equipment, the parts-list may appear formidable, with 73 resistors and 43 condensers

The second position of the function switch, entitled "scope", brings the small cathode-ray tube and the sawtooth-sweep timebase circuit into operation in addition. The signal can now be observed in form of its waveform on the CRT in addition to the continued audibility via the earphones, speaker or external amplifier. Of the three pilot lamps the green one labelled "tracer" is still lit and the red one labelled "scope" is switched on too in this setting. A zener-diode calibrator is included in the signal circuits, enabling the vertical-deflection sensitivity to be set accurately to any desired value between 1V/cm and 125/cm. This enables the A.C. component voltage of any waveform to be read off (A.C. Valve-Voltmeter function), whilst the D.C. component which the waveform may possess in addition is simultaneously indicated, in polarity and magnitude, on the moving-coil meter situated on the panel below the CRT, this representing the D.C. valve-voltmeter function.

THE MINISCOPE

and a quantity of other material. But, remembering that this instrument combines the functions of about seven instruments which would otherwise have to be built and bought separately, and which are all essential, the price of these components is in fact astoundingly cheap for the benefits reaped.

General Circuit Plan

The Miniscope consists basically of four circuit-portions. The first is the combined H.T./EHT power-supply. The second is the Wide-Band Signal Amplifier (Y-amplifier), including valve-voltmeter functions in the input stage and a signal-tracer output stage. The third is the special time-base circuit, calibrated *quantitatively* for time and frequency measurements in the range from a few microseconds to about 25 milliseconds. The time-base-wave is available externally at a coaxial socket for feeding a wobbulator, or for general use as audio test signal. The fourth circuit portion comprises the additional elements and switching for a novel phase-bridge for L and C measurements.

A function-switch selects three operating positions. The first is entitled "tracer". In this position only, the Signal Amplifier (and associated valve-voltmeter) is operating. The amplifier signal may be heard on headphones connected to the output provided or on a miniature loudspeaker which is connected there, or else passed into an external separate power amplifier. Of the three pilot lamps only the green one labelled "tracer" is lit.

If the applied signal is pure A.C., then the waveform appears on the CRT, but the meter needle does not move. If the applied signal is pure D.C., then the meter shows it, but the CRT shows only the undisturbed timebase trace. The advantage of this arrangement over the otherwise more conventional signal-amplifier passing the full D.C. component (D.C. amplifier) and giving D.C indication by a corresponding bodily shift of the trace on the CRT screen is that *the relative D.C and A.C. sensitivities may be chosen independently* to suit the relative D.C. and A.C. contents of the waveform being observed. Thus, for example accurate observation of hum-ripple percentage on a power supply is immediately possible which requires two separate measurements with a conventional D.C. oscilloscope.

Furthermore, the arrangement here adopted allows the essential D.C. measurements yet does not require a full D.C. amplifier, which would normally be tricky to construct under amateur conditions. A straightforward, stable and reliable A.C. amplifier is thus used.

The main signal amplifier has a bandwidth, level to within the usual specifications of ±3dB, extending from 25c/s to 120kc/s, and will thus give accurate displays of pulsed waveforms even at the highest audio frequencies. A low-pass filter is built in between the CRT-feed stage and the tracer output stage to prevent frequencies higher than 15kc/s reaching the earphones/speaker output (as these could otherwise be rectified at the input to a subsequent amplifier, causing grid-current blocking or distortion or creating various forms of instability). Thus, even if applied signals are of a frequency well above the highest audible, they are still displayed on the CRT, yet give no tracer output. The amplifier still shows appreciable (though much reduced) gain at 1Mc/s and will just resolve individual cycles of the carrier of medium-wave stations operating around this frequency on the CRT display. These will be seen by connecting a tuned circuit and good aerial to the input or the output of an R.F. signal-generator if local-station signal strength is not sufficient.

The third position of the function switch brings the L-C bridge into operation. The green pilot lamp "tracer" is now extinguished, the red "scope" lamp is still lit, and the third lamp, a green one labelled "bridge", is now also lit. The signal amplifier is operating, as is the CRT, but the sawtooth-sweep timebase is inoperative, the X-deflection now being by the mains 50c/s sine wave. A fixed R-C combination shifts this sine wave so that it is running 45° out of phase with the local mains. If now a sample of the in-phase mains wave is applied to the Y-amplifier (from the 6·3V heater line) the oblique-ellipse trace characteristic of two waves of equal frequency but constant phase-shift relative to each other is obtained on the screen.

But the in-phase wave is taken from the heater line, via an unknown condenser to be measured, on to a calibrated potentiometer, taking the Y-amplifier input from the potentiometer. This gives a phase-shift of an amount dependent upon the relative sizes of condenser and resistance, and a certain definite combination gives 45°, so that X and Y signals are then in phase again, both being 45° off the mains. This condition gives a clean *diagonal line* on the CRT. As the potentiometer is adjusted, therefore, the ellipse will close up to a narrow diagonal line at balance, and open up again beyond, and the potentiometer may be calibrated in capacity values correspondingly. This arrangement gives very clean, unambiguous balance readings. Ranges giving continuous coverage from 1,000pF to 30μF are incorporated in the Miniscope. Smaller capacities are better measured with a grid-dip meter and larger ones by a method described later in this article.

Inductances give a phase-shift in the opposite direction to condensers with the arrangement here described and thus augment the phase difference between X and Y signals. A good reference

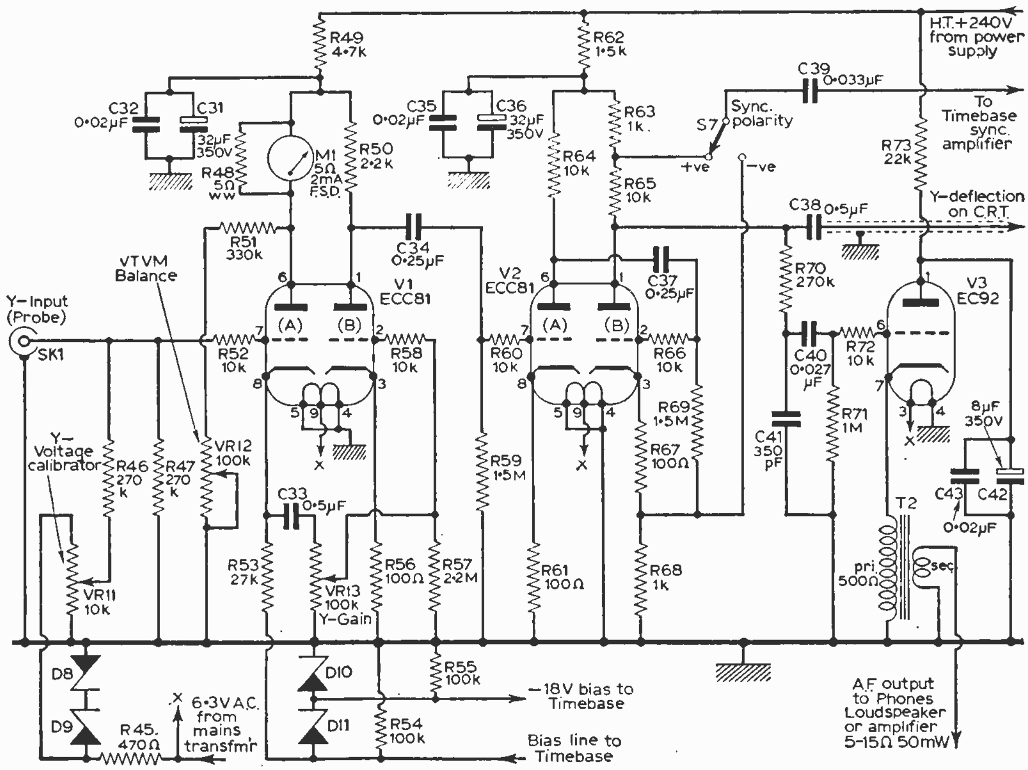


Fig. 1—The Y-amplifier circuit. The input is direct-coupled, and will tolerate a maximum D.C. component of 25V (of either polarity), or an A.C. signal of maximum amplitude 50V peak-to-peak. With the probe to be described at the end of this article, fifteen times these inputs are tolerable, and the calibrations on the D.C. level meter and on the calibrator are made to apply to conditions when using the probe. It is undesirable to use the Miniscope without the probe, unless the extra sensitivity is indispensible. Less waveform distortion of H.F. components of a signal is also obtained when using the probe.

COMPONENTS LIST

Resistors

(All carbon, ±10%, 1W unless otherwise stated)

R1	15k	R26	270k	R51	330k
R2	100k	R27	470k	R52	10k
R3	68k	R28	220k	R53	27k 2W
R4	470k	R29	2·2k	R54	100k
R5	47k	R30	100k	R55	100k
R6	500Ω 2W ww	R31	220k	R56	100Ω
R7	500Ω 2W ww	R32	220k	R57	2·2M
R8	680k 2W	R33	47k	R58	10k
R9	22k	R34	100k	R59	1·5M
R10	68k	R35	100k	R60	10k
R11	22k	R36	15k	R61	100Ω
R12	330k	R37	330k	R62	1·5k
R13	270k	R38	47k	R63	1k
R14	270k	R39	100k	R64	10k 2W
R15	1M	R40	47k	R65	10k 2W
R16	1M	R41	560k	R66	10k
R17	100k	R42	2·7M	R67	100Ω
R18	47k	R43	10k 2W	R68	1k
R19	270Ω	R44	47k	R69	1·5M
R20	3·9k	R45	2·7M	R70	270k
R21	39k	R46	270k	R71	1M
R22	470k	R47	270k	R72	10k
R23	47k	R48	5Ω ww	R73	22k 2W
R24	47k	R49	4.7k 2W		
R25	2·7M	R50	2·2k		

Capacitors

C1	8μF 450V elec
C2	16μF 350V elec
C3	16μF 350V elec
C4	8μF 450V elec
C5	16μF 350V elec
C6	1μF 750V metal-paper
C7	8μF 350V elec
C8	100μF 50V elec
C9	8μF 350V elec
C10	8μF 350V elec
C11	8μF 450V elec
C12	50μF 50V elec
C13	0·01μF 1000V paper
C14	0·01μF 500V paper
C15	16μF 350V elec
C16	8μF 350V elec
C17	0·082μF 350V elec
C18	8μF 350V elec
C19	8μF 350V elec
C20	0·25μF 500V elec
C21	0·047μF 500V paper
C22	300pF 500V paper see text
C23	3000pF 500V paper } see text
C24	0·03μF 500V paper } see text
C25	330pF 500V paper } see text
C26	3300pF 500V paper } see text
C27	0·033μF 500V paper } see text
C28	0·2μF 500V paper
C29	0·1μF 500V paper
C30	220pF 500V paper
C31	32μF 350V elec
C32	0·02μF 500V paper
C33	0·5μF 500V paper
C34	0·25μF 500V paper
C35	0·02μF 500V paper
C36	32μF 350V elec
C37	0·25μF 500V paper
C38	0·5μF 500V paper
C39	0·033μF 500V paper
C40	0·027μF 500V paper
C41	350pF 500V paper
C42	8μF 350V elec
C43	0·02μF 500V paper

Potentiometers

VR1	50k lin	VR5	5k log
VR2	250k lin	VR6	50k log
VR3	2M lin	VR7	500k log
VR4	2M lin		
VR8	250k log with D.P. switch (S4)		
VR9	2M log	VR12	100k lin
VR10	100k lin	VR13	100k log
VR11	10k log		

Valves

V1	ECC81	V5	EB91
V2	ECC82	V6	EF86
V3	EC92	V7	EC92
V4	EF80		

V8: DG3-12A cathode ray tube (Telefunken).

These are obtainable from Tellux Ltd., 44 Brunel Road, London, W.3. Orders will take from 2 to 3 weeks to be despatched. (Other 1½ to 2in. electrostatic CRT's may be used if they have 6·3V heaters and require 400-500V on the final anode.)

Larger surplus tubes, such as the VCR135A, may be used, but will require cabinet modifications and possibly slightly different resistor values in the EHT-chain.

Diodes

D1	E250C85	(250V A.C./85mA D.C.)
D2	E250C50	(250V A.C./50mA D.C.)
D3	E250C50	(250V A.C./50mA D.C.)
D4	S36	100mA/ W/150 maximum
D5	S36	350V peak inverse voltage
D6	S36	10pF capacity
D7	S36	500kc/s maximum
D8	Z7·5 7·5V 25mA	Zener Diodes
D9	Z7·5 7·5V 25mA	Zener Diodes
D10	Z18 18V 20mA	Zener Diodes
D11	Z18 18V 20mA	Zener Diodes

(Diodes D4 to D11 are available from The Bush Crystal Co. Ltd., Hythe, Southampton.)

Switches

S1	6-pole 3-way ceramic rotary
S2	Single-pole on/off toggle
S3	2-pole 5-way ceramic rotary
S4	2-pole with VR8
S5	2-pole 3-way miniature ceramic rotcry
S6	Single-pole 2-way toggle
S7	Single-pole 2-way toggle

Transformers

T1 Mains 250V 60mA/110V 10mA/6·3V 3A: primary to suit mains

T2 Output 9k (R 500Ω)—5/15Ω)

Miscellaneous

Thermocouple R.F. Meter

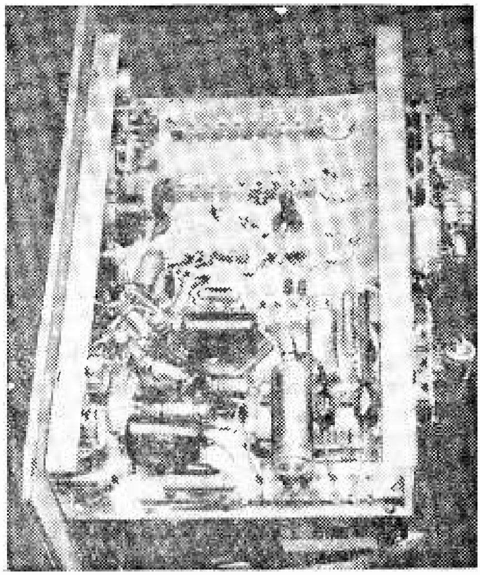
LP1, 2 and 3 Panel pilot lamp holders (2 green, one red); 3 12V 0·15A bulbs; 13 pointer knobs; 3 insulated wander-plug sockets; 2 coaxial sockets; F1 panel fuse holder; 4 Noval and 3 B7G ceramic valveholders with screening cans; 'phones output plug; mains cable and plug; tagstrips; wire, sleeving, etc.

condition is then when the phase difference has been complemented to 90°, giving a vertical or horizontal ellipse instead of an oblique one, which can be adjusted to a **true circle** by suitable adjustment of the Y-amplifier gain. The potentiometer is thus calibrated for coils for the condition for having a trace in the form of a true circle on the CRT screen. A range of 1H to 20H is incorporated for chokes, transformers, etc. Smaller values arising in R.F. coils, etc., are better measured with a grid-dip meter.

A number of other useful measuring operations are possible in the "bridge" setting of the Miniscope, which will be discussed below in conjunction with the circuit details.

The Signal Amplifier (Y-amplifier)

Fig. 1 shows the theoretical circuit of this portion of the Miniscope circuitry. It employs three valves, using high-slope triodes throughout. The input stage, V1 (pins 6, 7 and 8), is a Class-A cathode-follower with unity voltage gain but impedance step-down. The purpose of this arrangement as input stage is to meet several requirements. Firstly, it accepts very high input amplitudes without overloading, so that the input can be run "fully open"—i.e., without a gain control. The input is at high impedance (as it must be, otherwise the signal source would be loaded and its waveform possibly changed in nature) and any volume control connected there would shunt high frequencies considerably on account of its inevitable self-capacity. The wide bandwidth achieved here would then not have been possible. The cathode-follower input stage, however, transforms the impedance at its output down to a mere one or two hundred ohms and considerable shunt capacity is tolerable there without high-frequency loss—thus the gain-control appears in this position.



A view of the sub-chassis with the Y-amplifier wiring.

(To be continued)

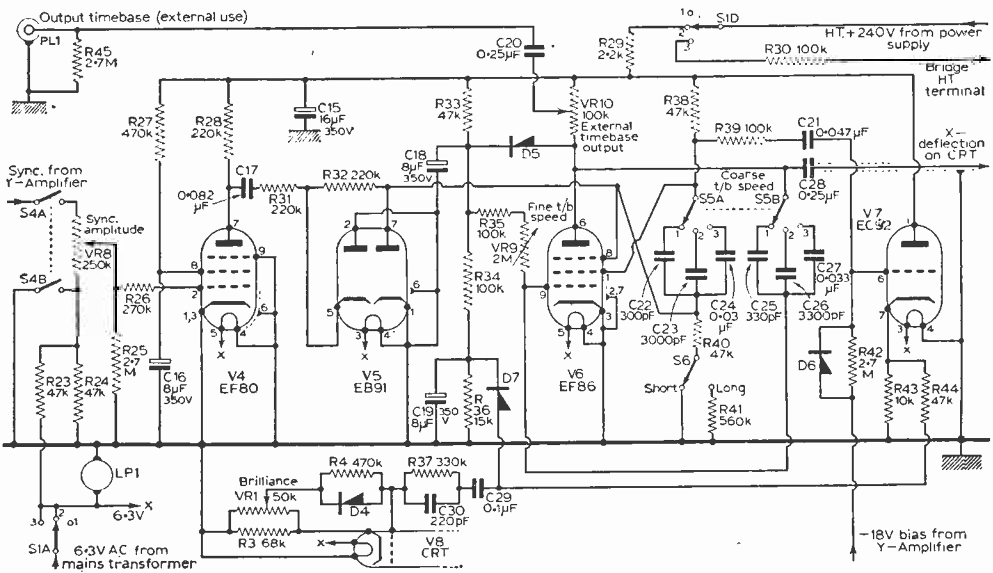


Fig. 2—The timebase circuit. This embodies an extremely linear sweep generator, with speed continuously variable from 12µsec/cm to 25m sec/cm on the CRT screen and also a powerful sync circuit, operating on the Y-signal on either polarity at will, or on the mains frequency. The sync amplifier acts as Buffer, preventing timebase signals entering the Y-circuits, as well as amplifying the sync signals, so that lock is rigid even at tiny Y-amplitudes on the CRT screen. Finally, the timebase screen-grid waveform is shaped in a special circuit, giving effective flyback-blanking, avoiding confusion in displays.

A COMPACT CONVERTER for short waves

A. Sydenham

THIS INSTRUMENT WILL PROVIDE SHORT WAVE LISTENING ON A MEDIUM WAVE RECEIVER

(Continued from page 319 of the August issue)

THE constructor following the instructions given in last month's issue will have fixed the chassis to the front panel and mounted some of the larger components.

When this stage is reached, wiring can be begun using Figs. 4 and 5 for reference. (Avoid overheating the coil spills when soldering.) The small dimensions of the chassis permit short and mostly self-supporting wiring, which is a desirable feature in short-wave equipment. Note the location of the stand-off insulater used as an anchoring and take-off point for the coaxial outlet lead.

All fixed capacitors should be of very high quality and of modern miniature design, since leaky specimens are likely to cause poor operation. Ceramic valve bases were used in the prototype, but are perhaps not entirely essential.

Testing the Converter

If all wiring is correct S1/S2/S3 may be adjusted to position "2", valves inserted and batteries connected at the appropriate points. polarity being carefully observed. Coaxial cable should then be connected to the aerial and earth sockets of the receiver with which the unit is to be used, after first transferring the aerial lead to the converter.

The receiver should then be switched on and tuned to a silent point on its dial around 1·5Mc/s (200m), the volume control being turned well up. The converter sensitivity control, VR1, should next be set to the H.T. end of its travel and VC3 set at approximately half capacity—with its moving vanes half enmeshed in the stationary ones. The converter can now be switched on and aligned.

If no signal generator is to hand the dial of the converter should be rotated until some hiss or a

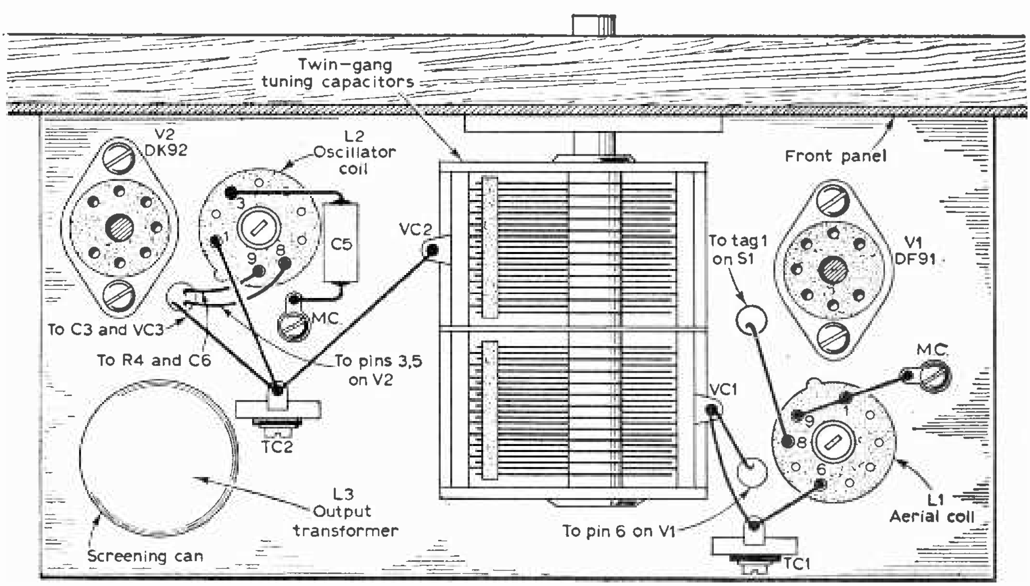
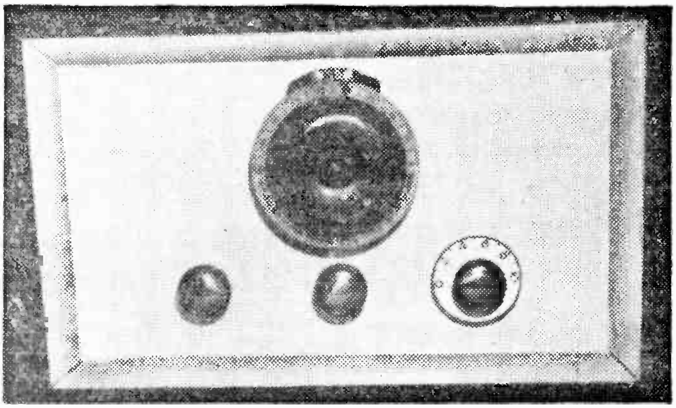


Fig. 4 (above)—Chassis layout of components.

signal is heard when the core of L3 should be manipulated in an attempt to strengthen the signal. The next step lies in trimming and padding the signal and oscillator circuits at the high and low frequency ends of the scale, taking care to allow only the minimum of capacity to be introduced via the trimmers. The oscillator should operate on the high side of the signal frequency, and normally the coil cores will be screwed in reasonably well.

No adjustments should be made to VC3 until alignment is complete, which might take a little time in the absence of a signal generator. The sensitivity control might need to be turned



(Above)—The front of the unit.

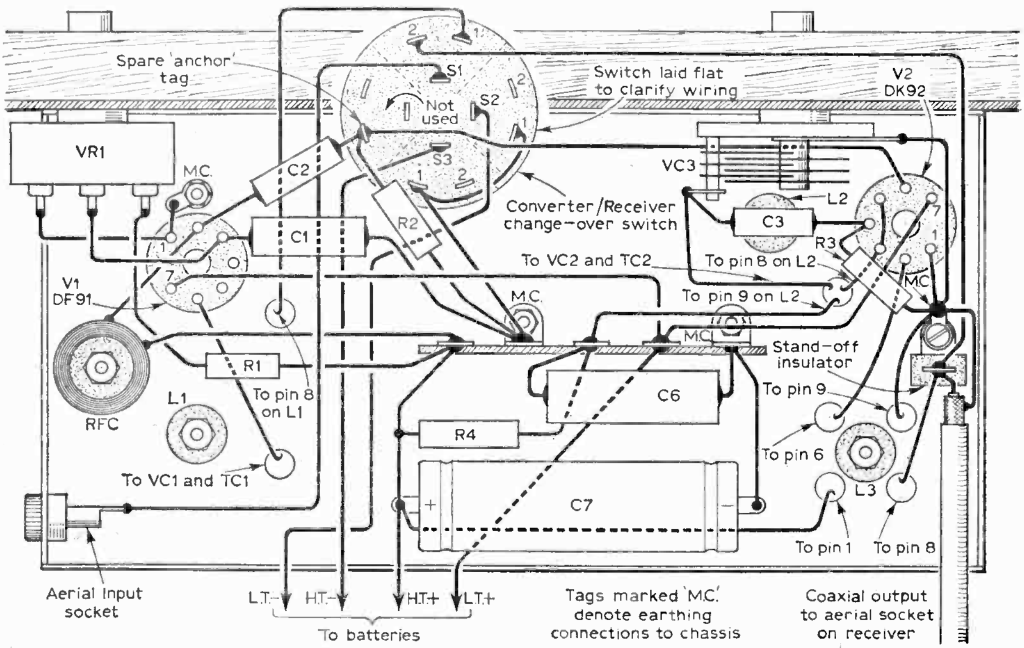


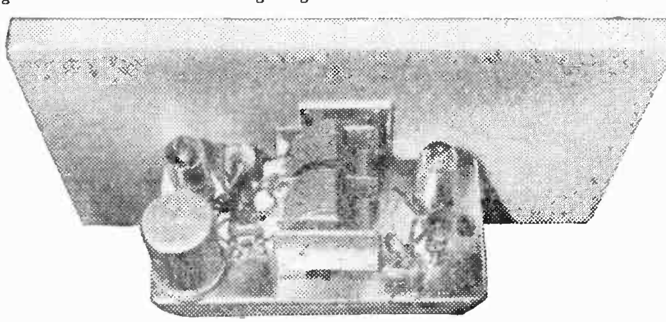
Fig. 5—The underchassis wiring diagram.

down as certain transmissions are received.

Faults

The above supposes "first time working", which in practice might not result. When the converter is first switched on, silence might well result, and if this occurs, and voltage supplies, etc. are in order, as indicated by a suitable testmeter, the oscillator section of V2 should come under suspicion. All-dry frequency changers quite often are more

(Continued on page 417)



An above-chassis view.

Tel: Mitcham 6202

Open Daily to Callers

R S T

All Valves Brand New and Fully Guaranteed

211 STREATHAM ROAD, MITCHAM, SURREY

Special 24 Hour Express Mail Order Service

- AC2PEN 21/-
- AC2PEN DD 21/-
- ACTP 32/-
- ACVP1 17/6
- AZ1 15/-
- AZ31 10/-
- B36 10/-
- C1C 12/6
- CBL31 21/-
- CCH35 21/-
- CL33 18/6
- CY1 15/-
- CY31 15/9
- D77 4/-
- DAC32 9/6
- DAF91 7/6
- DAF96 8/9
- DCC90 14/6
- DF33 10/-
- DF91 4/-
- DF92 7/-
- DF96 8/6
- DF97 9/6
- DH63 6/-
- DH77 7/-
- DK32 11/6
- DK91 8/-
- DK92 8/6
- DK96 8/6
- DL33 8/6
- DL35 10/6
- DL92 7/6
- DL93 7/-
- DL94 8/-
- DL96 8/6
- EA50 2/-
- EABC80 6/-
- EAC91 4/-
- EAF42 9/6
- EB34 2/6
- EB41 7/6
- EB91 4/-
- EBC3 21/-
- EBC33 4/6
- EBC41 9/-
- EBC81 10/-
- EBF80 8/6
- EBF83 8/6
- EBF89 8/6
- EBL1 22/6
- EBL21 22/-
- EBL31 21/6
- ECC34 15/-
- ECC35 8/-
- ECC40 21/-
- ECC81 5/9
- ECC82 8/6
- ECC83 7/6
- ECC84 8/6
- ECC85 8/-

- ECC88 17/6
- ECC91 4/-
- ECF80 8/6
- ECF82 8/6
- ECH3 21/-
- ECH21 22/-
- ECH42 9/6
- ECH35 10/-
- ECH81 8/-
- ECH83 8/6
- ECL80 9/-
- ECL81 10/-
- ECL82 9/6
- ECL83 12/-
- EF6 21/-
- EF9 21/-
- EF22 14/-
- EF36 4/-
- EF37 8/-
- EF37A 8/-
- EF39 4/-
- EF40 15/-
- EF41 8/-
- EF42 10/-
- EF50A 4/-
- EF50E 3/6
- EF80 5/-
- EF85 5/-
- EF86 10/6
- EF89 9/-
- EF91 4/-
- EF92 4/-
- EF95 7/6
- EF97 12/6
- EF98 10/-
- EF183 18/-
- EF184 14/-
- EK32 8/6
- EL2 21/-
- EL3 21/-
- EL6 21/-
- EL32 4/6
- EL33 10/-
- EL34 15/-
- EL35 10/-
- EL37 17/6
- EL38 21/-
- EL41 10/-
- EL42 10/-
- EL81 12/6
- EL84 6/9
- EL85 10/-
- EL90 8/6
- EL91 4/-
- EL95 10/6
- EM80 8/6
- EM81 8/6
- EM84 9/6
- EM85 10/-
- EY51 8/6
- EY81 8/6
- EY83 15/-

- EY86 8/6
- EZ35 6/-
- EZ40 7/-
- EZ41 7/-
- EZ80 7/-
- EZ81 7/-
- EZ90 7/-
- E1148 2/-
- FC2 21/-
- FC2A 21/-
- FC4 15/-
- FC13 21/-
- FC13C 21/-
- FW4/500 9/-
- FW4/800 9/-
- GZ30 10/6
- GZ32 10/6
- GZ33 19/3
- GZ34 13/6
- GZ37 19/3
- HABC80 10/-
- HL41DD 8/6
- HL92 8/6
- HL133DD 10/-
- HN309 22/6
- IW4/350 10/-
- IW4/500 10/-
- KT33C 8/-
- KT36 17/6
- KT55 17/6
- KT61 9/6
- KT66 15/-
- KT76 10/-
- KT81 15/-
- L63 5/-
- LN152 9/-
- LN309 12/6
- LZ319 12/6
- MKT4 17/6
- M54B 17/6
- MVSPEN 17/6
- MVSPENB 17/6
- MU14 9/-
- MX40 15/-
- N18 8/-
- N37 14/-
- N78 17/6
- N108 18/-
- N308 20/-
- N339 30/-
- N369 10/6
- OD3 5/-
- OZ4 5/6
- P2 10/-
- PABC80 13/-
- PCC84 9/-
- PCC85 9/6
- PCC88 15/-
- PCC89 9/6

- PCF80 9/6
- PCF82 7/-
- PCF84 16/-
- PCF86 15/-
- PCL82 9/6
- PCL83 12/6
- PCL84 10/6
- PCL85 16/-
- PENA4 17/6
- PENB4 17/6
- PEN4DD 25/-
- PEN4VA 17/6
- PEN36C 21/-
- PEN45 10/-
- PEN45DD 25/-
- PEN46 5/-
- PEN453DD 27/6
- PENDD4020 25/-
- PL33 15/-
- PL36 15/-
- PL38 21/-
- PL81 12/-
- PL82 8/-
- PL83 10/6
- PL84 9/-
- PL820 18/-
- PM24M 13/6
- PX4 15/-
- PX25 25/-
- PY31 15/-
- PY32 12/6
- PY80 7/6
- PY81 7/6
- PY82 7/6
- PY83 8/6
- PZ30 18/6
- QS9510 10/-
- QS15015 10/-
- R2 10/-
- R3 10/-
- R12 8/6
- R16 17/6
- R19 19/-
- R20 19/-
- S130 7/6
- SP41 3/6
- SP61 3/6
- SU2150 25/-
- SU2150A 25/-
- T41 15/-
- TDD4 12/6
- TDD13C 17/6
- TH41 27/6
- TY86F 12/6
- U10 9/-

- U12 9/-
- U14 9/-
- U22 8/-
- U24 21/-
- U25 12/6
- U26 10/-
- U27 8/-
- U31 9/-
- U35 17/6
- U37 17/6
- U43 8/6
- U45 10/-
- U47 12/6
- U50 7/6
- U52 4/-
- U76 7/6
- U78 4/6
- U191 15/-
- U251 12/6
- U281 18/-
- U282 19/6
- U301 22/6
- U329 12/6
- U339 15/-
- U403 10/-
- U404 10/-
- U801 29/-
- UABC80 7/-
- UAF42 8/6
- UB41 7/6
- UBC41 8/6
- UBC81 10/-
- UBF80 8/6
- UBF89 7/6
- UBL21 21/-
- UCC84 10/6
- UCC85 7/6
- UCF80 13/6
- UCH21 21/-
- UCH42 9/6
- UCH81 8/-
- UCL82 10/-
- UCL83 13/6
- UF41 7/6
- UF42 7/6
- UF80 7/-
- UF85 7/6
- UF86 12/6
- UF89 6/6
- UL41 8/6
- UL44 21/-
- UL46 14/6
- UL84 7/-
- UL85 7/6
- UM80 10/6
- URIC 15/-
- UU6 19/-
- UU8 21/-
- UU9 7/6
- UYIN 12/6
- UY21 15/6
- UY41 7/6

- UY85 7/-
- VMS4B 12/6
- VP4 15/-
- VP4A 17/6
- VP4B 17/6
- VR10530 7/-
- VR15030 7/-
- VU39 9/-
- VU111 2/6
- VU120 2/6
- W61 11/-
- W76 5/-
- W77 4/-
- W81 6/-
- W81M 6/-
- X17 8/6
- X18 9/-
- X41 15/-
- X61 12/6
- X61M 22/6
- X65 12/6
- X76 12/6
- X76M 12/6
- X78 21/-
- X79 21/-
- Y61 10/-
- Y66 9/6
- Z63 7/6
- Z66 10/-
- Z77 4/-
- Z152 5/-
- ZD17 8/-
- ZD152 8/6
- OZ4 5/-
- 1A7 11/6
- 1C1 8/6
- 1C2 9/-
- 1C3 9/6
- 1C5 10/6
- 1D5 8/6
- 1D6 10/-
- 1H5 9/6
- 1L4 5/-
- 1LN5 4/6
- 1N5 9/6
- 1R5 7/6
- 1S4 8/-
- 1S5 7/6
- 1T4 4/-
- 1U5 5/9
- 3A4 5/-
- 3A5 10/6
- 3Q4 8/-
- 3Q5 9/-
- 3S4 7/-
- 3V4 8/-
- 5U4 4/-
- 5V4 7/9
- 5Y3 8/6
- 5Y3GT 8/6
- 5Z4 9/6
- 5Z4GT 12/6

- 6A7 9/-
- 6A8G 8/6
- 6A8GT 13/6
- 6AB8 9/-
- 6AJ8 9/6
- 6AK5 5/-
- 6AK8 7/6
- 6AL5 6/-
- 6AM5 5/-
- 6AM6 4/-
- 6AN5 7/6
- 6AQ5 6/6
- 6AQ8 9/3
- 6AT6 6/-
- 6AU6 9/-
- 6B8G 3/-
- 6BA6 6/-
- 6BE6 6/-
- 6BG6G 17/6
- 6BH6 8/-
- 6BJ6 6/-
- 6BQ7A 12/6
- 6BR7 12/6
- 6BS7 12/6
- 6BW6 7/-
- 6BW7 5/-
- 6BX6 5/-
- 6C4 3/6
- 6C5GT 8/-
- 6C6 6/6
- 6C9 12/6
- 6CD6G 32/-
- 6CH6 10/-
- 6D2 4/-
- 6D6 5/6
- 6E5 10/-
- 6F1 10/6
- 6F6 6/9
- 6F11 10/-
- 6F12 4/-
- 6F13 10/-
- 6F14 10/-
- 6F15 12/6
- 6F19 12/6
- 6F23 10/6
- 6F33 5/6
- 6H6 2/-
- 6J5 4/6
- 6J5GT 4/6
- 6J6 3/6
- 6J7 5/-
- 6J7GT 7/6
- 6K7 2/-
- 6K7GT 8/6
- 6K8 5/-
- 6K8GT 9/6
- 6K25 18/-
- 6L1 13/-
- 6L6 7/6
- 6L18 10/-
- 6L19 17/6
- 6LD20 14/-

- 6P25 10/6
- 6P28 17/6
- 6Q7 6/6
- 6Q7GT 8/6
- 6SA7 7/-
- 6SG7 7/-
- 6SH7 6/-
- 6SJ7 6/6
- 6SK7 5/6
- 6SL7GT 6/-
- 6SN7GT 5/6
- 6SQ7 8/6
- 6U4GT 10/-
- 6U5G 7/6
- 6V6 4/6
- 6V6GT 8/-
- 6X4 4/6
- 6X5 7/6
- 6X5GT 8/6
- 6X6 15/-
- 630L2 10/-
- 7B5 12/6
- 7B6 10/-
- 7B7 8/6
- 7B8 8/-
- 7C5 8/-
- 7C7 8/-
- 7D3 15/-
- 7D5 15/-
- 7D6 15/-
- 7D8 15/-
- 7H7 7/6
- 7K7 8/6
- 7Q7 10/-
- 7Y4 7/6
- 8D3 4/-
- 9BW6 12/6
- 10C1 12/6
- 10C2 17/6
- 10F1 15/-
- 10F3 15/-
- 10F9 12/6
- 10LD11 15/-
- 10LD12 10/-
- 10P13 15/-
- 10P14 19/-
- 10P18 15/-
- 11D3 23/6
- 11D5 23/6
- 12A6 6/6
- 12AH8 9/-
- 12AT6 7/6
- 12AT7 5/-
- 12AU7 8/6
- 12AX7 7/6
- 12AU6 17/6
- 12BA6 7/6
- 12BE6 7/6
- 12BH7 10/-
- 12C8 8/6
- 12J5GT 4/-
- 12J7GT 8/6

- 12K7GT 5/-
- 12K8GT 10/-
- 12Q7GT 6/6
- 12SA7 8/6
- 12SK7 6/-
- 12SQ7 8/6
- 12SL7 8/-
- 12SN7 10/-
- 13D3 12/6
- 14H7 10/-
- 14R7 10/-
- 14S7 15/-
- 19AQ5 8/-
- 19B6G 21/-
- 20D1 10/-
- 20F2 17/6
- 20L1 17/6
- 20P1 25/-
- 20P3 25/-
- 20P4 22/-
- 20P5 25/-
- 21B6 12/-
- 25A6 8/-
- 25L6 8/-
- 25Y5 8/-
- 25Z4 7/6
- 25Z5 8/-
- 25Z6 8/-
- 275U 17/6
- 30C1 9/6
- 30F5 10/-
- 30FL1 10/6
- 30L1 9/6
- 30L15 11/6
- 30P4 21/-
- 30P12 10/-
- 30P16 9/-
- 30PL1 15/-
- 30PL13 12/6
- 35L6GT 8/6
- 35W4 7/6
- 35Z3 16/-
- 35Z4 7/6
- 35Z5 8/6
- 40SUA 15/-
- 41STH 21/-
- 42 12/6
- 50C5 10/-
- 50L6 8/6
- 50CD6G 36/6
- 53KU 12/6
- 75 8/-
- 78 7/6
- 80 9/-
- 85A2 12/6
- 185BT 30/-
- 305 9/6
- 807BR 5/-

METAL RECTIFIERS

RM1	5/3	14RA 1-2-8-2	17/6 (FC31)	14A97	25/-
RM2	7/6	16RC 1-1-16-1	8/6	14A100	27/-
RM3	7/9	14RA 1-2-8-3	19/- (FC31)	16RD 2-2-8-1	12/-
RM4	14/-	18RA 1-1-16-1	6/6 (FC116)	16RE 2-1-8-1	8/6
RM5	19/6	18RA 1-2-8-1	11/-	18RA 1-1-8-1	4/6
14A86	17/6	18RD 2-2-8-1	15/- (FC124)		

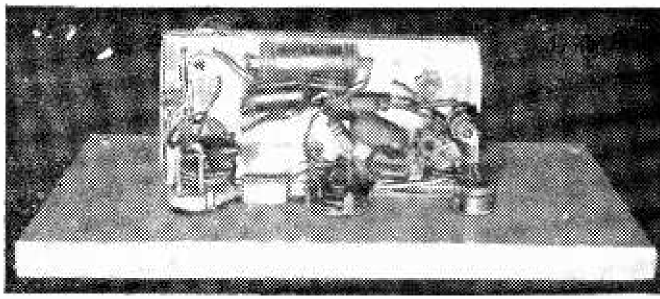
SPECIAL OFFER

EABC80 6/-, EAC91 4/-, EB91 4/-, EBF89 8/6, ECC81 5/9, ECC85 8/-, ECC91 4/-, ECH81 8/-, EBC33 4/6, EF39 4/-, EF50 3/6, EF80 5/-, EF85 5/-, EF91 4/-, DF91 4/-, EL84 6/9, PCC89 9/6, PL84 9/-, UABC80 7/-, UBF89 7/6, UF41 7/6, UL41 8/6, UF89 6/6, UL84 7/-, UY85 7/-, W81 6/-, OZ4 5/-, 5U4 4/-, 6AQ5 6/6, 6BA6 6/-, 6BE6 6/-, 6D2 4/-, 6K7 2/-, 6K8 5/-, 6L6 7/6, 6Q7 6/6, 6SL7 6/6, 6SN7 5/6, 6V6 4/6, 8D3 4/-, 807 5/-, 12AT7 5/-, 12AH8 9/-, 12BA6 7/6, 12BE6 7/6, 12K7 5/-, 12Q7 6/6.

TERMS OF BUSINESS C.W.O. or C.O.D. 3/2 PACKING CHARGE ON ALL C.O.D. ORDERS. POSTAGE 6d. PER VALVE

OBSOLETE VALVES A SPECIALITY. QUOTATIONS GIVEN ON ANY TYPE NOT LISTED

(Right)—The underchassis wiring of the converter.



(Continued from page 414)

temperamental than their mains-powered contemporaries, but oscillator functioning can be checked by disconnecting R4 from the H.T. line and inserting at this point a meter switched to read 0-10mA. The current flow should then be noted, and the value should alter when spills 8 and 9 of L2 are momentarily short circuited. Should no change be detected the oscillator is not operating and no frequency changing can occur. The remedy lies in checking that part of the circuit very carefully and reducing R4 to 10k or increasing the value of C3 to, say, 100pF.

When the oscillator is working, the above test should be made at several points on the tuning scale, for it is quite possible for it to cease functioning at a particular frequency. Should no signals be heard when oscillator operation is satisfactory, try removing V1 and temporarily connecting a lead from pin 6 on its base to pin 6 on V2 base. If signals now result, V1 or the associated circuitry is at fault and should be investigated.

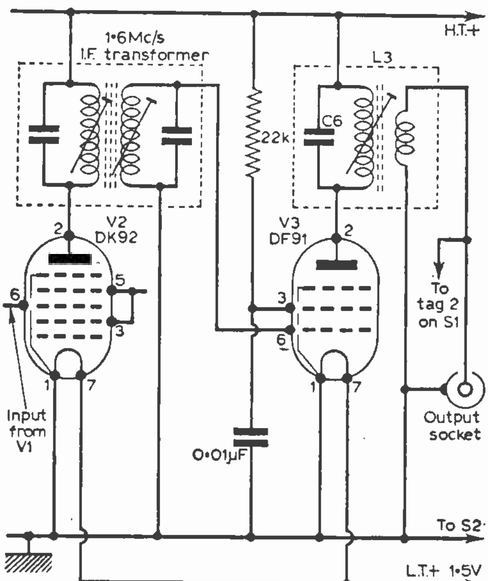


Fig. 6—A circuit modification to increase output.

Modifications

Where the output is considered insufficient, or where the broadcast receiver used with it is of low sensitivity, improved converter efficiency would result from fitting a further valve of the type specified for V1 and using it as an intermediate amplifier. The principle is shown in Fig. 7 where V3 is the added valve. Coil L3 is removed from the frequency changer anode and a miniature 1·6Mc/s I.F. transformer fitted instead. The amplified output is taken from L3, which is transferred to V3 anode. Extra care must be taken in a circuit of this kind to ensure adequate rejection of signals in the 1·5Mc/s band and a wavetrap tuned to the frequency might become necessary at the aerial input.

MEDIUM WAVE POCKET SUPERHET

(Continued from page 387)

weak signals. to keep volume down. Final adjustment should be at frequencies a little from the extreme ends of the bands, once it has been found that band coverage is satisfactory. It may be difficult to keep volume down to a level where the effect of adjustments can be easily heard, when aligning with broadcast stations. If so, rotate the whole receiver, to make use of the directional properties of the rod, to reduce volume. During alignment, volume should not be reduced with the receiver volume control, or an exact setting of trimmers and cores will be difficult to find.

Reproduction should be at adequate volume, and of pleasing quality. Should results sound extremely distorted, it is probable that one secondary of the driver transformer has been wrongly wired, in error. If so, reverse leads to one secondary.

The tuning knob should rotate with a little clearance. If not, a washer may be needed under it. The set can be used flat, or standing, with the rod horizontal. Only in rare instances need the receiver be rotated for best signal pick up, as volume should easily be sufficient.

The new version of the P.W. Pocket Superhet case can be used for this receiver; the use of this case will facilitate construction since it is larger than the original.

Short-wave Listeners' Log

FOR the best possible listening results, a general idea of the way in which short-wave signals are propagated will prove to be very helpful. Two types of signals are of interest—those furnished by the ground wave, and those from the sky wave.

On the S.W. bands, the ground wave is soon absorbed and lost, so long distance reception is not possible with its aid. Frequencies in the 20 and 15m bands, or around 14 and 21Mc/s, are most used for long distance reception, and ground waves from stations in these bands may already have become too weak at 20 or 30 miles range. For this reason, local stations may not be heard, even when remote overseas countries are coming in well.

The sky wave travels upwards at an angle, and reaches the ionised layers which surround the earth. When conditions are favourable the wave is bent or reflected by these layers, and returns to earth, often at a considerable distance. The distance from the transmitter to the point where the wave again reaches the earth is the "skip distance". There may be short or long skips, according to time of day, frequency, and other factors. The wave may be reflected from the earth, and again be deflected downwards by the ionised layers, reaching earth again at even greater distances from the transmitter. If conditions or frequencies are unsuitable, the wave may pass through the ionised layers, and be lost in space.

Long Distance Reception

Long distance reception is by waves that have been reflected from the ionised layers, possibly travelling a thousand miles or more at each hop, when skip is long. So best long distance reception will be around those times and frequencies giving long skip conditions.

The 20m or 14Mc/s band is extremely popular for long distance reception, and can give world wide coverage. The ionised layers are not stable, but are influenced by sunspots, magnetic storms, and solar radiation, so results change hour by hour. Usually, most remote stations (Australia, New Zealand) will be audible early in the morning. Somewhat later in the morning, there may be a period when only relatively near stations (European) can be heard. Range may increase after noon, with Near East, Far East, South African, and other distant stations coming in during early afternoon. These are likely to fade out later in the afternoon, when Far East stations are liable to disappear, and many American stations will begin to come up in strength. With evening, very considerable distances can still be covered.

A somewhat similar pattern is repeated daily, except that conditions vary day by day, and month by month, due to seasonal and other changes. With the 15m or 21Mc/s band, rather similar results can be expected, but with even more irregular fluctuation. So this band may be excellent one day, and almost dead the next.

Unless conditions are very bad, listening on these bands will almost certainly furnish some Dx (long distance) stations, and 15m and 20m are often termed the "Dx bands". When conditions are good, signal strength from remote countries may be good enough for satisfactory reception with simple 2-valve and similar receivers.

SERVICING TAPE RECORDERS

(Continued from page 404)

of the recorder, whilst leaving a reasonable margin on the recording level control for low level signals.

Fig. 27 shows a very convenient arrangement, where the attenuator comprises R1 and R2. The single-pole, two-position switch allows the set's loudspeaker to be used as programme monitor when required, while in the "loudspeaker off" position, the output stage is automatically loaded by R3. This resistor, of course, should have a value equal to the impedance of the loudspeaker.

Values for R1 and R2 are well worth considering. From the impedance aspect, there is not too much to worry about by connecting 3Ω across a megohm or so of the radio input socket. On the face of it, there would appear to be a bad case of mismatching, but in practice this has remarkably little adverse effect. Overloading is the chief trouble. However, when an attenuator is employed, the impedance can be stepped up to the tape recorder input so that the match is more theoretically exact.

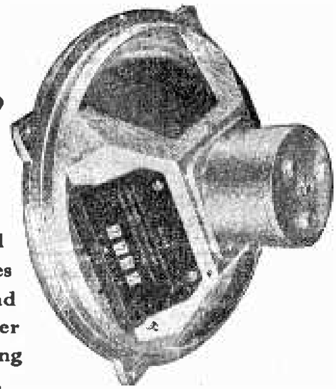
R1 and R2 simply form a potential-divider. That is, all the signal is applied across the two resistors in series and only a fraction of it is tapped off from across R2. Ignoring the loading effect of the recorder input circuits, then in proportion the voltage across R2 is equal to R2 divided by the sum of R1 and R2. For example, take R1 and 100k and R2 as 50k, then R2 would be 50 divided by 150, which is one-third, meaning that one third of the full voltage from the set's output stage would be fed to the recorder.

In practice, the applied signal would be a little below one-third, since R2 would be shunted by the input impedance of the recorder which, in effect, would reduce the value of R2 in relation to R1, but this should not make a lot of difference in the majority of cases. Thus, the attenuator can be made any required value simply by working out suitable combinations of resistors, as explained above. The value of 100k and 50k may well be used in practice, and this would mean that the input of the recorder would see a resistance almost equal to 50k and 100k in parallel, which is approximately 33k.

The signal should be conveyed via screened cable, the R2 side of which should be connected to the braid and earthed. But beware at this point, since the set may have a "live" chassis; that is, connected to one side of the mains supply to follow the now popular A.C./D.C. technique. This aspect of recording, however, will be discussed in next month's article.

(To be continued)

WB Stentorian



This range of Stentorian loudspeakers, incorporating the patented cambric cone, was developed to provide reproduction that takes full advantage of the television and V.H.F. sound transmissions and high fidelity recordings now available. The cone of the loudspeaker is made from uncured cambric and bonded pulp, the whole being completely cured together and made into one composite cone.

Type	Flux Density	Price	Type	Flux Density	Price
8" H.F.816*	16,000 gauss	£6.13.9	T.816	16,000 gauss	£6.6.9
8" H.F.812*	12,000 gauss	£4.1.3	T.12 tweeter	16,000 gauss	£13.4.6
8" H.F.810	10,000 gauss	£3.0.6	T.10 tweeter	14,000 gauss	£4.8.3
6" H.F.610	10,000 gauss	£2.10.3 Steel £2.12.3 diecast	T.359 tweeter	9,000 gauss	£1.14.0

MODEL H.F. 1016

10" Unit H.F. 1016. 16,000 gauss. Instantaneous matching at 3, 7·5 and 15 ohms. Handling capacity 10 watts. Frequency response 30 c.p.s. to 15,000 c.p.s. Bass resonance, 35 c.p.s.

Price £7.16.0 (inc. tax)

* *Incorporates a universal impedance speech coil.*

WHITELEY ELECTRICAL RADIO CO. LTD. MANSFIELD, NOTTS

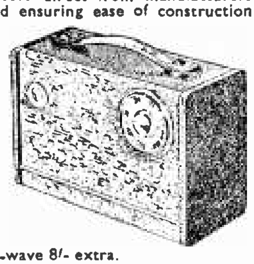
Telephone: MANSFIELD 1762-5 London Office: 109 Kingsway, London, W.C.2

WA3

MINISETS LTD. Hatherley Mews London E17

6-STAGE PORTABLE TRANSISTOR RADIO

★ All parts including transistors direct from manufacturers
★ Pre-assembled circuit board ensuring ease of construction
★ Full medium-wave coverage
★ **After-sales service**
★ Attractive two-tone case 9 x 6 x 4in.
★ Push-pull output, 350 milliwatts
★ 5in. high flux speaker
★ Built-in Ferrite Rod aerial No external aerial or earth required.
★ High performance, many stations received on test



Can be built for **£5.4.0** P.P. 3/-

Or with long-wave 8/- extra.
Full instructions 1/6 (Free with order).

6-STAGE TRANSISTOR POCKET PORTABLE

Can be built for **£4.19.6** P.P. 2/6

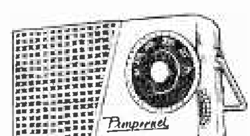
★ Completely self contained no aerial or earth required
★ Push-pull output, 250 milliwatts
★ 3in. high flux speaker
★ Pre-assembled circuit board with simple instructions ensuring easy construction
★ High Q Ferrite Rod Aerial
★ **After-sales service**

Can be supplied with long-wave 6/- extra.
Full instructions, price list 1/6 (Free with order)

3-TRANSISTOR RADIO (plus 2 diodes)

Total building **70/-** P.P. 2/6

★ Pre-assembled circuit board, ensuring easy construction
★ Full medium-wave coverage
★ Attractive case 5¼ x 3 x 1⅞in.
★ All components including transistors are brand new and direct from manufacturers
★ Ferrite Rod aerial coil, no external aerial or earth required
★ 2¼in. high flux speaker direct from manufacturer
★ **After-sales service**

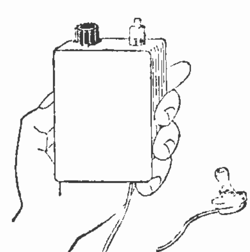


Send 1/6 for instructions, circuit and price list

2-TRANSISTOR RADIO (plus 2 diodes)

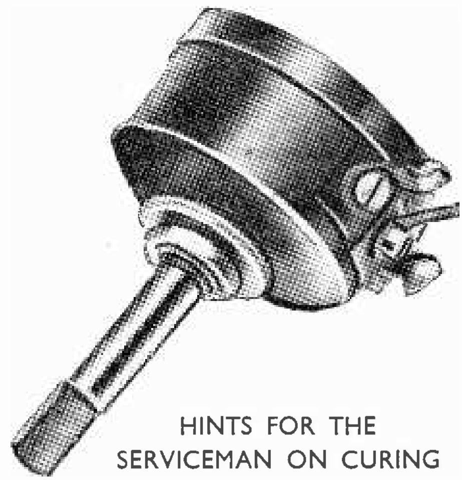
Ideal for personal listening

★ Built-in Ferrite aerial
★ Sensitive earpiece.
★ All parts including transistors direct from manufacturers
★ Pre-assembled circuit board and easy-to-follow instructions
★ **After-sales service**
★ Can be built for **50/-** P.P. 2/-



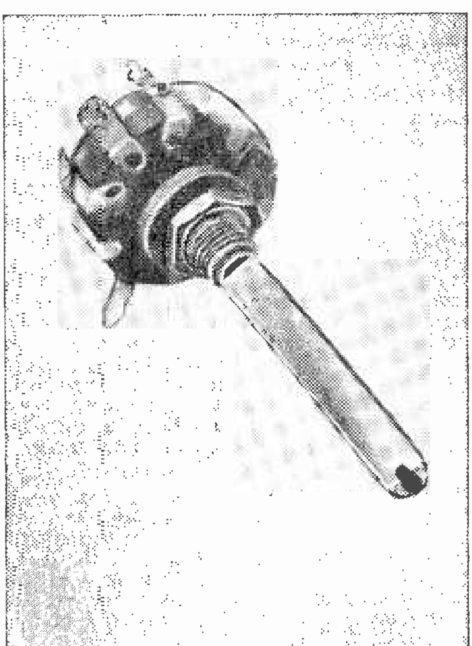
Full instructions, etc., 1/6 (Free with order).

Noisy Volume Controls



HINTS FOR THE SERVICEMAN ON CURING A COMMON FAULT

By E. Dexter



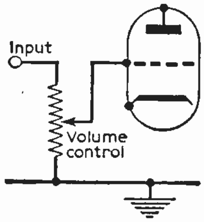
(Continued from page 345 of the August issue)

THE reader was introduced to three examples of correct and incorrect circuitry associated with volume controls in last month's article (Figs. 3, 4 and 5, pages 342 and 345).

Fig. 4 shows a volume control used in the same arrangement as Fig. 1, which is basically permissible, but the value is now made *very high*. If the grid leak of a valve is higher than half to one megohm, quite considerable D.C. voltages may be developed across it due to the electron-current reaching the grid of the valve by virtue of the electrons' energy of ejection from the cathode, even though the actual grid voltage may still be quite negative, and thus, theoretically, electron grid-current not to be expected. Thus no volume control track used directly in the grid leak position of a valve should have a total resistance exceeding about 500k. If a greater resistance is, for any reason, desired, then another blocking condenser or separate grid leak, as in Fig. 4b, should be used. Otherwise the volume control is likely to become noisy very quickly.

Fig. 5 gives a typical example from transistor circuitry. It is common practice in modern high-gain transistorised amplifiers to insert the volume control not right at the input to the first stage but between the first and second stages, so that signal-to-noise ratio is improved with reduction of volume (this feature is good practice in all high-gain amplifiers, valve or transistor, yet carries the danger of running the input unprotected from overload at the first stage).

Now a transistor, in contrast to the grid-circuit of a valve, always draws current at its input, with a D.C. component also in addition to the A.C. signal component. Thus the transistorised version of Fig. 1 is fundamentally incorrect in a transistor amplifier. The subsequent transistor will always draw D.C. through a volume control track if all or part of this were used as the direct-coupled input resistance to the stage. Thus, if a volume control is used between two *transistor* stages, a



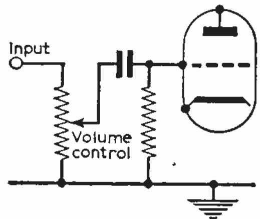


Fig. 6 (left)—A circuit often used for the input stage of audio amplifiers; this is satisfactory provided no D.C. is present with the input signal.
Fig. 7 (right)—Another input circuit for an amplifier—any D.C. present in the input is prevented from reaching the valve.

blocking condenser must be used *on both sides of it.* For a volume control between two valve stages we saw that a blocking condenser on the input side generally suffices, provided that the resistance of the volume control is not too high. Fig. 5b shows the correct arrangement for a volume control between two transistor stages.

Input Terminals for Amplifiers

The arrangement of Fig. 6 is often used for the input to the first stage of an amplifier. This is quite satisfactory as long as pure A.C. signals are applied as inputs. As soon as the signals contain a D.C. component, noisiness is likely. The arrangement of Fig. 7 would prevent the D.C. component shifting the operating point of the input stage, and thus prevent distortion under such circumstances. But, as the discussion in this article should have made clear, it will not remove noisiness in the presence of a D.C. component in the input signal. The arrangement of Fig. 8 will, however, remove this trouble, too. Thus Fig. 8 is considered to be the ideal arrangement for the input to an amplifier if the volume control is to be situated there. This circuit pattern applies equally to valves and transistors.

Time Constants

Consider Fig. 9. Here we have a transistorised amplifier input circuit, following the scheme of Fig. 8 and with typical component values given. Suppose now we feed this amplifier from a signal source containing a D.C. component and having an internal resistance of 2M—for the purposes of illustrating the following argument with an intentionally severe example. The input electrolytic C3, of 50μF, will now need to charge up to its final resting potential difference through a total resistance of 2M. This represents a time constant of 100 seconds. Charging will not be complete

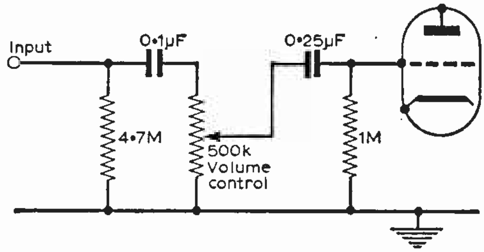


Fig. 8—The ideal input circuit for an amplifier if the volume control is to be situated at the input.

until three to five times this time. Thus it will take about five minutes. All this time D.C. will be flowing in the volume control track. The symptoms are thus that, upon switching on, the volume control will be extremely noisy, becoming gradually less and less so, until after some five minutes it will be quiet. This procedure will repeat itself every time the apparatus is switched on after a rest!

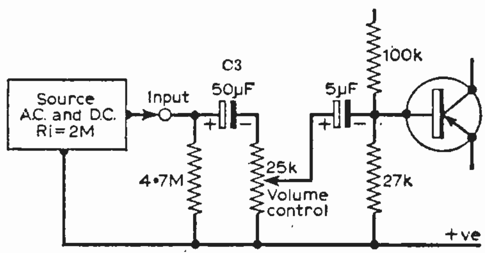


Fig. 9—Transistorised version of Fig. 8—in such a circuit, the large time constants need to be taken into account (see text).

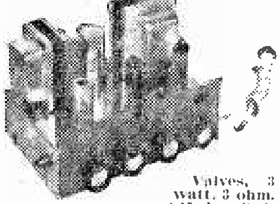
This point is trivial for valve circuits where capacities of coupling condensers are so small that time-constants are normally smaller than the filament-warming-up times of the valves. But for transistors, where large capacities are common, the point must be watched.

However, an arrangement such as Fig. 9 is undesirable anyway on account of its large signal-attenuation (unless this is deliberately wanted). Furthermore, C3 is an electrolytic operating in a low-current, high-impedance circuit—or with a high-impedance-to-capacity ratio. Under such circumstances electrolytics have been known to function as electrolytic rectifiers, giving severe signal distortion. Thus, if a high-impedance source is to feed a low-impedance transistor input circuit, it is desirable to interpose a cathode-follower, an emitter-follower, or a transformer.

Intermittent Faults in Coupling Condensers

The author has had receivers in for repair where intermittent, or permanent, crackling (of low rumbling pitch) appeared alone or in conjunction with volume control crackling of the usual relatively high pitch. This type of fault is indicative of intermittent or randomly-variable leakage in a coupling condenser. The variability of this fault—i.e., its A.C. component, is shunted by the capacity of the coupling-condenser, removing higher harmonics; hence the low pitch. ■

MULLARD 3-3 HI-FI AMPLIFIER



Valves, 3 watt, 3 ohm and 15 ohm. Output. A really first-class Amplifier giving Hi-Fi quality at a reasonable cost. Mullard's latest circuit. Valve line up: EF86, EL84, EZ81. Extra HT and LT available for Tuner Unit addition. This is the ideal companion Amplifier for FM tuner units.

TECHNICAL SPECIFICATION—Freq. Response: ± 1db. 40 c/s.-25 Kc/s. Tone controls: Max. Treble Cut 12 db at 10 Kc/s. Max. Bass Boost 14 db. at 80 c/s. Sensitivity: 100 Mv. for 3 w. output. Output Power (at 400 c/s): 3 w. at 1% total harmonic distortion. Hum and Noise Level: At least 70 db. below 3 w.

COMPLETE KIT (incl. Valves, all components, wiring diagram and special quality sectional Output Trans.). **ONLY £6.19.6.** Carr. 5/-. Complete wired and tested, 8 gns.

Bronze Escutcheon Panel, Printed Vol., Treble, Bass, On-Off, supplied with each Kit.

Wired O/P socket power and additional smoothing for Tuner Unit, **10/6** extra.
Recommended Speakers—WB HF1012 **95/-**. Goodmans AX1OM 110 **£5**, etc.

BARGAINS 4-SPEED PLAYER UNITS

Single Players Carr. 3/6
Garrard 4 S.P. **£6.19.6**
Garrard TA Mk.2 **£7.19.6**
Collaro "Junior" **75/-**
B.S.R. Latest TU12 **79/6**
E.M.I. Junior '985' **89/6**

Auto-Changers Carr. 5/-
Collaro "C 60" **£7.15.0**
B.S.R. (UA14) **£7.10.0**
Garrard "Auto-slim" **£8.12.6**
Garrard Model RC209 **9½ gns.**

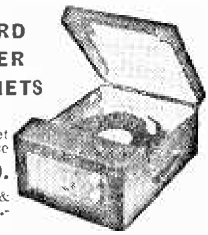
COLLARO STUDIO TAPE RECORDER KIT

SPECIAL BARGAIN OFFER. Comp. Kit only Carr. 12/6. **£25.0.0**

Famous mfrs. surplus offer—Listed 42 gns. A quality Tape Recorder Kit based on Mullard famous design—EF86. ECC83. EL84. EM84 and Rectifier. Specially designed Kit for Collaro latest Studio Deck. Freq. response ± 3dB. 7½in. per sec. Amp. and Power Pack straighter, inter. unit wiring only required. Cabinets size: 18 x 16½ x 6in. finished in contemp. 2 tone blue Rexine with gilt Speaker Escutcheon. Magic Eye indicator Circuit and Tech. Ir/Book, supplied free with kit. *Send 2/6 now for full details of to-day's outstanding Tape Recorder Bargain.*

Cabinet **£3.15.0** P. & P. 6/6.
Amplifier Kit **£8.19.6.** P. & P. 5/-.
Speaker 7 x 4 **16/6.** P. & P. -/-.
If above items are purchased together. **£12.19.6** P. & P. 10/-.

RECORD PLAYER CABINETS



Cabinet Price **£3.3.0.** Carr. & Ins. 5/-

Contemporary style, rexine covered cabinet in two tone maroon and cream. Size 18½ x 13½ x ht. 8½in., fitted with all accessories including baffle board and anodised metal fret. Space available for all modern amplifiers and autochangers, etc. Uncut record player mounting board 14 x 13in. supplied.

2-VALVE 2-WATT AMPLIFIER Twin stage ECL82 with vol. and neg. feedback Tone control. A.C. 200/250 v. with knobs, etc., ready wired to fit above cabinet, **£2.17.6.** P. & P. 1/6.
6in. Spkr. & Trans., **22/-.** P. & P. 2/-.
Complete Kit, including UA14 Unit as illustrated, **£12.19.6.** carr. 7/6.

SINGLE PLAYER KIT—Similar spec. to Autochanger Kit except Player is 4-speed B.S.R. T.U.9. Single Record Player Unit. Attractive Contemporary Styled Cabinet. Size: 13½ x 13 x 6 ins. with splendid volume and reproduction. Bargain Price, **£8.19.6** only. Carr. 5/-. All units ready wired. Simple screwdriver assembly only.

JASON FM TUNER UNITS Designer-approved kits of parts:
FMT1, 5 gns. 4 valves, **20/-.**
FMT2, £7. 5 valves, **37/6.**
JTV MERCURY 10 gns.
JTV2 £13.19.6. 4 valves, **32/6.**
NEW JASON FM HANDBOOK, 2/6. 48 hr. Alignment Service **7/6.** P. & P. **2/6.**

TYGAN FRET (contemp. pat.) 12 x 12in. **2/-.** 12 x 18in. **3/-.** 12 x 24in. **4/-.** 18 x 24in. **6/-** etc.

Speaker Fret — Expanded bronze anodised metal ¼in. x ¼in. diamond mesh, now **4/6** sq. ft., Multiples of 6in. cut max. width. 4ft.

Electrolytics All Types New Stock

TUBULAR		CAN TYPES	
25/25V	1/9	8+8/450V	4/6
50/12V	1/9	8+16/450V	5/-
50/50V	2/-	32+32/275V	4/6
100/25V	2/-	50+50/350V	6/6
8/450V	2/3	60+250/275V	12/6
16/450V	3/6	100+200/275V	12/6
16+16/45V	5/9		
32+32/450V	6/6		

SPECIAL BARGAIN OFFER

"6 plus 1" TRANSISTOR RADIO KIT . . . using 3 latest type surface Barrier Transistors **Now only £6.19.6** Complete Kit carr. 2/6.

MANUFACTURERS SURPLUS BARGAIN OFFER. PRICE BARRIER SLASHED—A further bulk purchase of this popular Kit enables us to pass on latest price reduction direct to Constructor. Kit is a modern, sensitive, quality Receiver with all latest circuit features and is complete with 7 x 3½in. Speaker (3 ohms), and full circuit and assembly instructions. 6 BVA Transistors and Germ. Diode. Printed Cct. Med. and L/W. Ferrite Aerial and Car Radio Coupling. 500 MW Output. Attractive Gilt dial and Slow Motion Drive with "Clear Vu" Tuning Knob, etc. Contemp. two-tone Cabinets 9 x 5 x 3½in., as illustrated. 25/- extra.

Condensers—Silver Mica. All values, 2pF to 1,000pF, **6d.** each. Ditto, Ceramics **9d.** Tub. 450V T.C.C., etc., 0.001 mfd. to 0.01 and 0.1/350V., **9d.** 0.02-0.1/500V **1/-.** 0.25 Hunts **1/6.** 0.5 T.C.C. **1/9,** etc., etc. **Close Tol. S/Micas**—10% 5pF-500pF **8d.** 600-5,000pF **1/-.** 1% 2pF-100pF **9d.** 100pF-500pF **11d.** 575pF-5,000pF **1/6.** **Resistors—Full Range** 10 ohms-10 megohms 20% ¼ and ½ W **3d.,** ¼W **5d.** (Midget type modern rating) 1W **6d.,** 2W **9d.** **Hi-Stab** 10% ¼W **5d.,** ½W **7d.** 5% ¼W **9d.,** 1% ¼W **1/6.**

Transistor Components

Midget I.F.'s—465 Kc/s. 9/16in. dia. **5/6**
Osc. Coil—M/W, 9/16in. dia. **5/3**
Osc. Coil—M. & L.W. **5/9**
Midget Driver Trans. 3.5:1 **6/9**
Midget O/Put Trans. P.P. to 3 ohms, **6/9.**
Ferrite Aerial M. & L.W., Car aerial coil, **9/3.**
Elect. Condensers—Midget Type 1 mfd-50mfd ea. **1/9.** 100 mfd. **2/-**: 12V wkg.
Condensers—.01 mfd. to .04mfd **9d.**: .05 mfd. to .1mfd. **1/-**; .25mfd **1/3**: .5 mfd. **1/6.**
Tuning Condensers—JB "OO" 208 pF. + 176 pF **8/6,** with Trimmers **9/6.** Single 365pF **7/6.** Sub min. ⅝in. J.B. Dile min. .0001, .0003 or .0005 **7/-** each.
Midget Vol. Control—with edge control knob. 5K ohms with switch, **4/9,** less switch **3/9.**
Speakers P.M.—2in. Plessey 75 ohms **15/6.** 2½in. Continental 8 ohms **13/6,** 2½in. E.M.I. 3 ohms **17/6.** 7 x 4in. Plessey 35 ohms. **23/6.**
Ear Plug Phones—Min. Continental type, 3ft. lead, jack plug and socket. High Imp. **8/-.** Low Imp. **7/6.**

RECORDING TAPE—Reduced Prices

Famous American Columbia (CBS) Premier Quality Tape at NEW REDUCED PRICES. A genuine recommended Quality Tape—TRY IT! Brand new, boxed and fully guaranteed. Fitted with leader and stop foils.

	Standard	Long Play	Double Play
5in.	600ft. **13/-**	900ft. **17/6**	1,200ft. **31/6**
5¾in.	900ft. **16/-**	1,200ft. **19/6**	1,800ft. **37/6**
7in.	1,200ft. **21/-**	1,800ft. **28/6**	2,400ft. **47/6**

P. & P. per reel 1/-. 6d. on each additional reel.
SPECIAL BARGAIN. 3in. mfrs. Tape 225ft. **4/9.** P. & P. 6d.
3in. Message Tape, 150ft. .. .. **2/9.** P. & P. 6d.
Plastic Tape Reels .. 3in. **1/3,** 5in. **2/-,** 5¾in. **2/-,** 7in. **2/3**
Plastic Spool Containers 5in. **1/6,** 5¾in. **2/-,** 7in. **2/3**

ENAMELLED COPPER WIRE—¼lb. reels, 14g.-20g **2/6**; 22g-28g. **3/-**; 30g-40g. **3/9.** Other gauges quoted for.

Ersin Multicore Solder 60/40 3d, per yard. ¼lb. **2/6,** etc.

Volume Controls—5K-2 Megohms, 3in. Spindles Morganite Midget Type 10in. diam. Guar. 1 year. LOG or LIN ratios less Sw. **3/-.** DP. Sw. **4/3.** Twin Stereo less Sw. **6/6.** DP Sw. **8/-.**

COAX 80 OHM CABLE High grade low loss Cellular air spaced Polythene— in. diameter. Stranded cond. Famous mfrs. **Now only 6d. per yard. Bargain Prices—Special Lengths—**
20 yd. **9/-.** P. & P. 1/6.
40 yds. **17/6,** P. & P. 2/-.
60 yds. **25/-,** P. & P. 3/-.
Coax Plugs **1/-.** Sockets **1/-.** Couplers **1/3.** Outlet Boxes **4/6.**

VALVES

New. Boxed — All Guaranteed

1T4	6/-	ECC83	8/-	PCC84	9/6
1R5	7/6	ECL82	10/6	PCF80	9/6
1S5	7/6	ECL80	10/6	PCL83	12/6
3S4	7/6	EF80	8/-	PCL84	12/6
3V4	7/6	EF86	12/6	PL81	12/6
DAF96	9/-	EL84	8/6	PL82	9/6
DF96	9/-	EY51	9/6	PL83	10/6
DK96	9/-	EY86	10/-	PY32	12/6
DL96	9/-	EZ81	7/6	PY81	9/6
ECC81	8/-	GZ32	12/6	PY82	7/6
ECC82	8/-	EM81	9/6	U25	12/6

TRANSISTOR BARGAINS
Brand New—BVA 1st Grade

OC44	10/6	GET114	6/6
OC45	9/6	OC72	7/6
OC81	7/6	OC70	7/6
2/OC81	15/6	OC71	6/-
XA102	10/-	OC78	7/6
XA101	9/6	GEX34	2/9
XB103	7/6	OA70	2/9
XC101	8/6	OA81	2/9

Special offer: One OC44, two OC45: **21/6.** One OC81D, two OC81's (matched pair) **19/6.**

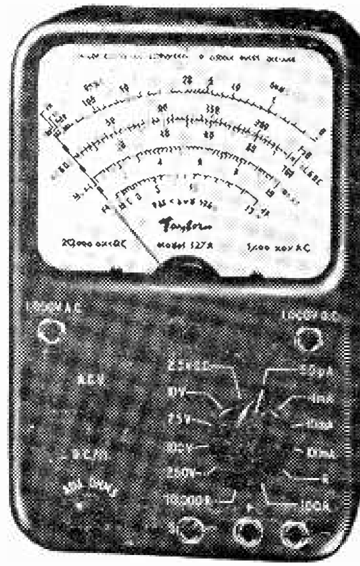
Send for detailed bargain lists, 3d. stamp.
We manufacture all types Radio Mains Transf. Chokes, Quality O/P Trans., etc. Enquiries invited for Specials, Prototypes for small production runs. Quotations by return.

TRS Est. 1946

RADIO COMPONENT SPECIALISTS

70 Brigstock Rd., Thornton Heath, Surrey. *Hours: 9 a.m. - 6 p.m., 1 p.m. Wed.* THO 2188. *Terms C.W.O. or C.O.D. Post and Packing up to ½lb. 9d.; 1lb., 1/3; 3lb. 2/3; 5lb., 2/9; 8lb., 3/6.*

20,000 o.p.v. Pocket Size Taylormeter 127a



Adopted by the G.P.O.

OUTSTANDING FEATURES

- ★ Sensitivity: 20,000 o.p.v. D.C., 1,000 o.p.v. A.C.
- ★ Very Robust—Shock proof moulding
- ★ Portability
- ★ 20 Ranges
- ★ D.C. current: 50μA, 10mA, 100mA, 'S' socket for D.C. shunts
- ★ Volts D.C. 0.3, 2.5, 10, 25, 100, 250, 1,000V (25kV by probe)
- ★ Volts A.C. 10, 25, 100, 250, 1,000V.
- ★ 3 Resistance Ranges: from 0-20 megohms (self-contained)
- ★ 40μA Meter 3¼in. arc.
- ★ Accuracy: D.C. 3%, A.C. 4%

price £10.10.0

Taylor

Write for fully illustrated catalogue to:

TAYLOR ELECTRICAL INSTRUMENTS LTD.,
MONTROSE AVENUE, SLOUGH, BUCKS.
Tel.: Slough 21381 Cables: Taylins, Slough

M GROUP

"CODAR CLIPPER" ALL BAND RECEIVERS 10-2000 METRES

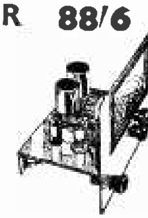
LISTEN TO AMATEURS, AIRCRAFT, SHIPPING, SHORT, MEDIUM, LONG WAVE BROADCAST STATIONS THROUGHOUT THE WORLD.

THE MINI-CLIPPER

NEW LOW PRICE **36/6**

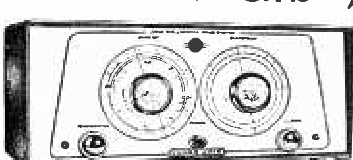
The ORIGINAL and finest one valve all band receiver. Outstanding performance. New first grade components ensure top efficiency. Low loss air spaced tuners, high gain polystyrene plug in coils. Satin Silver metal panel with engraved dials, grey pointer knobs. Provision for adding 2 transistor amplifier stage. Chassis ready punched. Total building cost, all parts, one coil 20-60 meters, wire solder full plans, **36/6.** P. & P. 2/6. Other coils 10-2000 meters and electrical bandspread available. Parts sold separately. Plans and parts list, 2/-.

THE SUPER CLIPPER **88/6**



This world-famous hybrid receiver has achieved remarkable success. Tremendous performance with Hi-gain valve detector PLUS two Ediswan transistor amplifiers which are supplied assembled, only 3 wires to connect. Large precision dial, 7 x 4in., with 2 pointers, bandset and bandspread, dual slow-motion drives air spaced variables. Punched chassis 8 x 5½in. Batteries last months. Covers 10-2000 metres (S coils). Total building cost including chassis, valve, 2 transistor stages, 2 coils 20-60 and 55-190 metres. Step-by-step pictorial plans, nuts, bolts, wire **88/6.** P. & P. 2/6. Plans only, 2/6. **THE CLIPPER.** As above but one transistor stage, **79/6.** P. & P. 2/6. Optional Front Panel, Silver Hammer finish, all holes, **6/9.**

THE NEW CR45 ★ *NEW STYLING TOP PERFORMANCE*



Previously produced exclusively for Export, the de-luxe version of this famous ALL BAND receiver is now also available for the home market. Superb new styling, satin silver front panel, frequency calibrated scales, grey and silver trim knobs, perspex disc cursors. High gain circuit with ECC81 duotriode, EL84 output, EZ80 full wave rectifier. Power output 3½ watts for 2/3 ohm speaker. 3 Planetary vernier slow motion drives, separate electrical bandspread. Covers 10-2000 meters (5 Coils). World wide reception. For A.C. supply 200-250 volts (Export version 105-120 volts). Total building cost all parts, valves, front panel, ready punched chassis, 2 coils, 20-60 and 55-190 meters, wire, solder, instruction manual. **£6.19.6** P. & P. 3/6. Optional extra. CR45 Cabinet 12 x 5 x 7in., slide flap for easy coil changing, Silver grey finish, 27/6.

No technical knowledge required to build these fine receivers. Send 3d. stamp for illustrated leaflets, testimonials, etc.
Now available the NEW 1962 CR 66 A.C. SUPERHET COMMUNICATION RECEIVER.

CODAR RADIO COMPANY, 24 CHAPEL ROAD, FISHERGATE, PORTSLADE, BRIGHTON

G3IRE *Canadian Distributors:* JAYCO ELECTRONICS, TWEED, ONTARIO. G3IPA

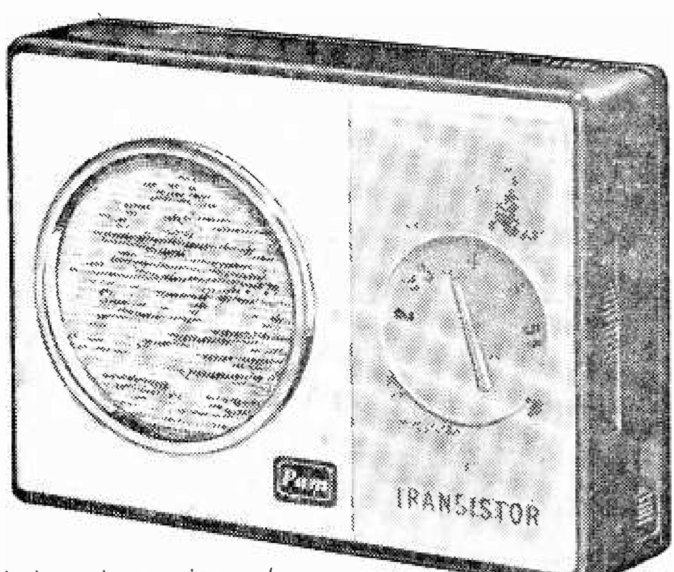
Trade News

TRANSISTOR PORTABLE

A NEW six-transistor pocket portable receiver has been introduced on to the market recently by Pam (Radio and Television) Ltd. The printed circuit gives a maximum output of 45mW through a 2in. loudspeaker. This set will tune over the medium wave band and also provides the Light programme on long waves.

The dimensions of the receiver are 4in. x 2¾in. x 1in. and the grey polystyrene cabinet has a facia of white and gold. A socket is provided in the cabinet for a 10Ω impedance ear-piece.

The power for the set is supplied by three 1·5V cells, giving a total of 4·5V. The price of the set is 10½ guineas and an optional carrying case is available at 7s. 6d. extra. *Pam Radio and Television Ltd., 295 Regent Street, London, W.1.*



A six-transistor receiver made by Pam Ltd.

POWER DISTRIBUTION UNIT

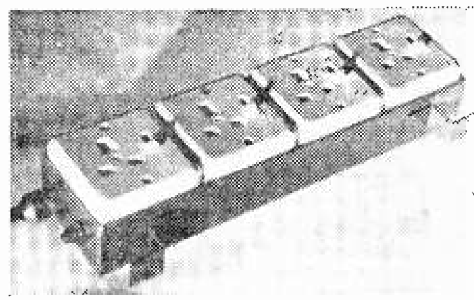
THE latest addition to the range of distribution boards made by Lexor Electronics Ltd., is the 'Dis-board' portable unit.

This unit is available in 2-, 4- and 6-way groups of 5, 13 or 15A sockets. The finish can be either in brown or ivory and the sockets may be switched or unswitched.

There is a wide variety of extension cables and plugs which can increase the usefulness of any particular unit. The 'Dis-board' is connected to the mains outlet by a length of heavy-duty flexible cable.

List prices range from £3 9s. 6d. to £5 19s. 0d. and all standard combinations (and the available combinations and types now exceed 300) are available from stock.

The manufacturers are *Lexor Electronics Ltd., 25 Allesley Old Road, Coventry, Warwickshire.*



A 4-way distribution unit from Lexor Electronics Ltd.

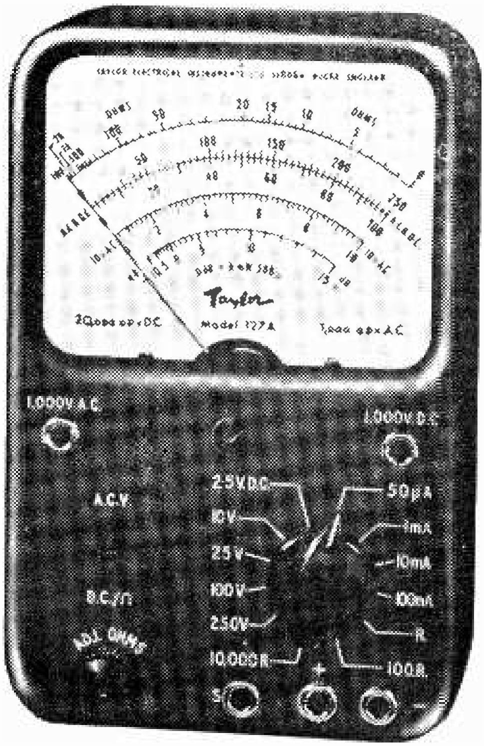
STABILISED POWER SUPPLY

THIS Heathkit power supply kit —model MSP-1—has been developed by Daystrom Ltd.

The stabilised D.C. output is variable over a range from 200 to 410V. by a control mounted on the front panel. Separate transformers are used for H.T. and L.T. supplies and Mains H.T. supplies are indicated by two neon lamps. A 3-position off/stand-by/on switch enables the D.C. outputs to be switched off while leaving the heater supplies connected. The unit also features an unstabilised 6·3V A.C. centre-tapped output at 4·5A.

Two models are available, one with meters and one without. In the former model, the meters are 3in. moving coil instruments; a voltmeter reading 0-400V, and a milliameter reading 0-25mA.

The unit is of all steel construction and the cabinet is louvred to ensure adequate ventilation. The dimensions of the cabinet are 13in. x 8½in. x 9½in. The kit is made by *Daystrom Ltd., Gloucester.*



(Above) *The model 127A Taylor Multimeter.*

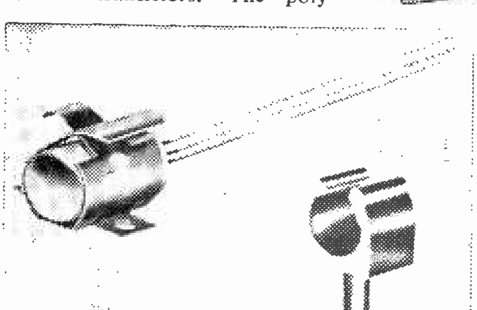
TRANSISTOR CLIPS

RECENTLY made available from the Plessey Co. Ltd., are two transistor clips (types A and B), which are intended for 5 or 6mm nominal diameter transistors.

The type A clip is moulded in virgin polythene which incorporates a high density pigment to eliminate absorption of ultraviolet radiation. This pigment also serves to identify the two sizes of clip—black for 5mm and brown for 6mm diameter transistors. The polythene used is completely inert and will not affect protective coatings on either metal or glass cased components. Tests indicate that these clips do not limit transistor heat dissipation and can be used over a range of ambient temperatures from −55°C to +70°C.

Type B is formed from beryllium copper, hardened by heat treatment. One clip covers both 5 and 6mm diameter transistor units.

The Plessey Co. Ltd., Ilford, Essex.



New Plessey transistor clips.

IMPROVED MULTIMETER

AN improved version of the Taylor 20,000Ω/V pocket size multimeter (model 127A) has been recently announced.

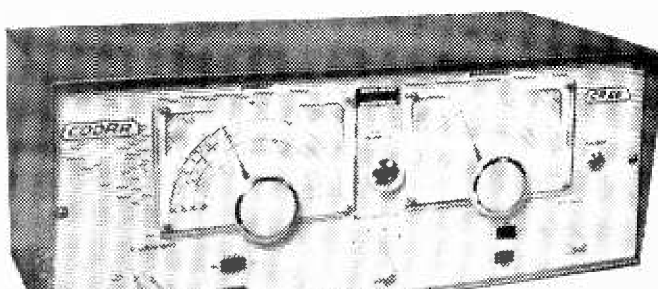
A feature of the new model is the facility for measurement of high D.C. The instrument now has a special "millivolt" socket and a range of "plug-in" miniature shunts is now available for readings of 1, 5 and 10A D.C. These shunts are designed to locate directly into the millivolt sockets incorporated in the Model 127A, thus forming a compact unit for measurement of high D.C. current.

A new type of ohms adjust control is now fitted which ensures greater stability and an improved type of A.C./D.C. selector switch is also incorporated.

The instrument is made by *Taylor Electrical Instruments Limited, Montrose Avenue, Slough, Buckinghamshire.*

COMMUNICATIONS RECEIVER

THE model CR 66 is a new communications receiver kit from the Codar Radio Company.



The CR66 communications receiver is sold in kit form by the Codar Radio Company.

The CR 66 covers a frequency range from 540kc/s to 30Mc/s in four ranges. The separate main tuning is calibrated in frequencies and the bandspread is calibrated in degrees. The circuit includes a regenerative I.F. stage for maximum gain and BFO for C.W. reception.

The size of the cabinet is 16in. x 6½in. x 8¾in. and the front panel is finished in silver and black. An output socket is provided for tape recorders etc. and also one for an external speaker.

The total cost of parts, less the cabinet, is £16 10s. and the cabinet costs £1 15s.

The kit is made by the *Codar Radio Company, Colebrook Road, Southwick, Sussex.*

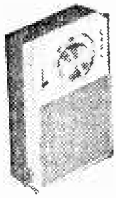
RADIO CLEARANCE LIMITED

27 TOTTENHAM COURT ROAD, LONDON, W.1.

THE OLDEST COMPONENT SPECIALISTS IN THE TRADE

TRADE ENQUIRIES INVITED — *Telephone:* MUSEUM 9188 — EST. 30 YRS.

YOU CAN HOLD EUROPE IN THE PALM OF YOUR HAND WITH THE



"CAPRI"

A **miniature** pocket transistor Radio that **REALLY** works, retaining the most attractive features of the famous "Contessa." Six first-grade Mullard transistors plus diode are employed in a highly sensitive superhet MW and pre-set LW circuit embodying the most modern design practices. A special $2\frac{1}{4}$in. high gauss loudspeaker provides surprising volume and a personal earpiece socket is also available. An attractive two-tone plastic case is supplied in two colours—ivory/red or ivory/blue, the full constructional details being furnished with each set of parts. The **total measurements** of the "Capri" are $4\frac{1}{2} \times 2\frac{3}{4} \times 1\frac{1}{4}$ in.

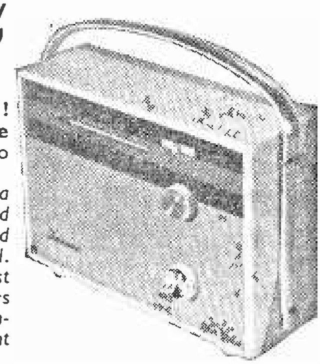
SEE AND HEAR A WORKING MODEL TODAY

Inclusive price for all associated components, case and constructional data, complete in every detail, or our BUY AS YOU BUILD Scheme, any parts sold separately. (9 volt battery 2/6 extra.) **£7.10.0** (Plus 2/- P. & Pkg.)

INTRODUCING THE NEW

"CONTESSA"

Mk III



The Best is Now Even Better! A brilliant conception of the finest 2-band 6-transistor radio **available.**

★ *Ultra-modern styling with a magnificent twin-tone cabinet fitted with fully expanded metal front and a slide-rule type waveband dial. GREATER OUTPUT using the latest high-efficiency Mullard Transistors and Diodes, incorporating an improved design, featuring different circuit constants.*

MORE punch—MORE gain—MORE stations—SUPERB appearance—the NEW "Contessa" scores again!! SEE it—HEAR it—you will BUY it!

- **Waveband coverage of 530 kc/s to 1,620 kc/s and 160 kc/s to 270 kc/s.**
- **Assured reception of at least a dozen stations in daylight!**
- **Large clearly-calibrated station-named dial.**
- **Internal high-gain Ferrite aerial.**
- **5 : 1 ratio slow motion tuning.**
- **Fitted with the latest 12,000-line high-flux loudspeaker.**
- **Power of 600 milliwatts from the single-ended push-pull final stage.**
- **Specially designed aerial matching coil for use in a CAR.**
- **Only first-grade Mullard fully-guaranteed matched transistors and diodes are used.**
- **Tape recorder socket provided.**
- **Double-tuned IF transformers for maximum gain and knife-edged selectivity.**
- **Fully drilled printed circuit panel marked with component numbers.**
- **The two-tone case outer measurements are $10\frac{1}{4} \times 7\frac{1}{4} \times 3\frac{3}{4}$in. and weighs approx. 4 lbs. when assembled.**
- **Battery lasts 4 months with normal usage.**
- **Book supplied with detailed assembly instructions, diagrams and circuitry.**
- **Anyone can build this set—everything supplied, just a soldering iron required.**
- **Cabinets available in two tone beige and two tone blue.**
- **Adjustable carrying handle.**

Inclusive price for all associated components, cabinet and battery complete, in every detail: Or our BUY AS YOU BUILD SCHEME, any part sold separately. Send for comprehensive descriptive Manual and Parts List, 2/10 post free. **£10.19.6** (Plus 3/6 P. & Pkg.)

CRASHING the PRICE barrier with SOUND!

A	The latest world-famous Collaro-Magnavox Studio Tape Transcriptor. 3 speeds $1\frac{7}{8}$-$3\frac{3}{4}$-$7\frac{1}{2}$ i.p.s. 2 tracks (spools not supplied), direct from the Manufacturers at.............	**£6.19.6**
B	Magnavox Amplifier to match above with Valves, interconnecting plugs and sockets, fully wired. Direct from the Manufacturers at....................................	**£3.10.0**
C	Power Supply to match above (only sold with A & B) with interconnecting plugs and sockets, rectifier, fully wired. Direct from the Manufacturers at.........................	**£1.10.0**
D	Separate components for Power Supply including Mains Transformer, Smoothing, Plugs and Sockets etc. etc.	**15/-** ONLY

This superb MAGNAVOX TM800 "Magitape" outfit ready to switch on for only **£11.19.6** Don't miss out on this amazing bargain offer—it cannot last long!

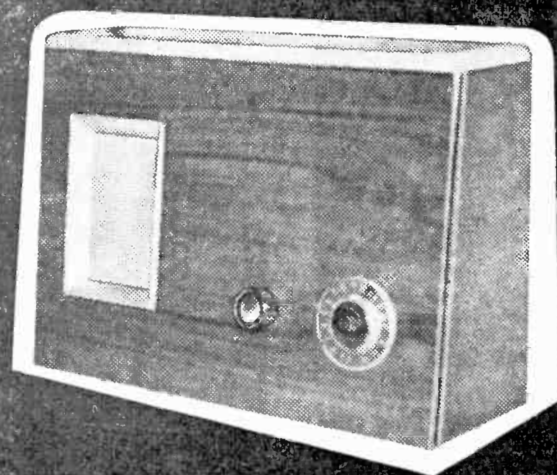
ROCK BOTTOM PRICES QUOTED ABOVE APPLY EVEN TO THE TRADE!

Items A, B and D can be sold separately but we regret CALLERS ONLY owing to suitable packing not being available.

STAMPED and ADDRESSED ENVELOPE with any enquiry please. But regret no lists or catalogues—our stocks move too quickly! PLEASE ALLOW FULL POSTAGE AND PACKING CHARGES

Terms of Business: CASH WITH ORDER OR C.O.D. ON ORDERS OVER 10/-.

THE CONSORT
TRF RECEIVER



(Continued from page 294 of the August issue)

By B. Lewisham

IN last month's article a description of the circuit was followed by details of the construction of the chassis. Now the constructor may proceed to the next stage, which is wiring.

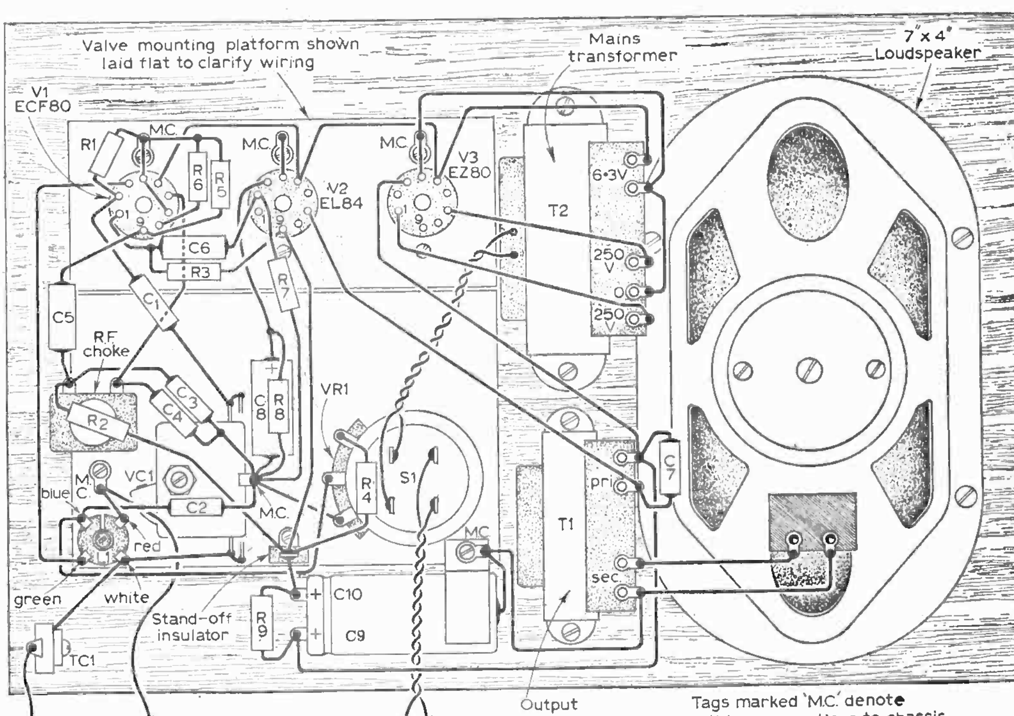


Fig. 4—The complete wiring diagram.

The chassis of the receiver can be wired up independently of the remainder of the circuit. Wiring is simple but the valveholders are best attended to first. In the layout and wiring diagram (Fig. 4), the valve platform is shown pressed out flat so that the underside connections may be seen clearly. Use of modern miniature capacitors and resistors is desirable in order to prevent undue congestion and the electrolytic decoupling capacitor, C8, should be a miniature type.

Testing

The usual tests and checks for faults in the wiring, etc. are made with a testmeter prior to switching on, particular care being taken to ensure that the mains wiring is correct. A three-pin plug should be fitted to the end of the mains lead in the correct sense and a pair of attractive control knobs fitted to the receiver. If all is in order, the receiver may be switched on and an aerial (a few feet of wire will do) connected. It should then be possible to tune in various transmissions by operating VC1 and VR1 judiciously, care being taken not to let the receiver oscillate. The precise setting of TC1 will depend upon the aerial in use, location, etc. but the best position can soon be found by experiment, the smallest capacitance possible probably giving the most satisfactory results over the band. The value of C7 can also be altered experimentally: for example, if reproduction tends to be shrill, the value may be increased to 5,000pF or more as required.

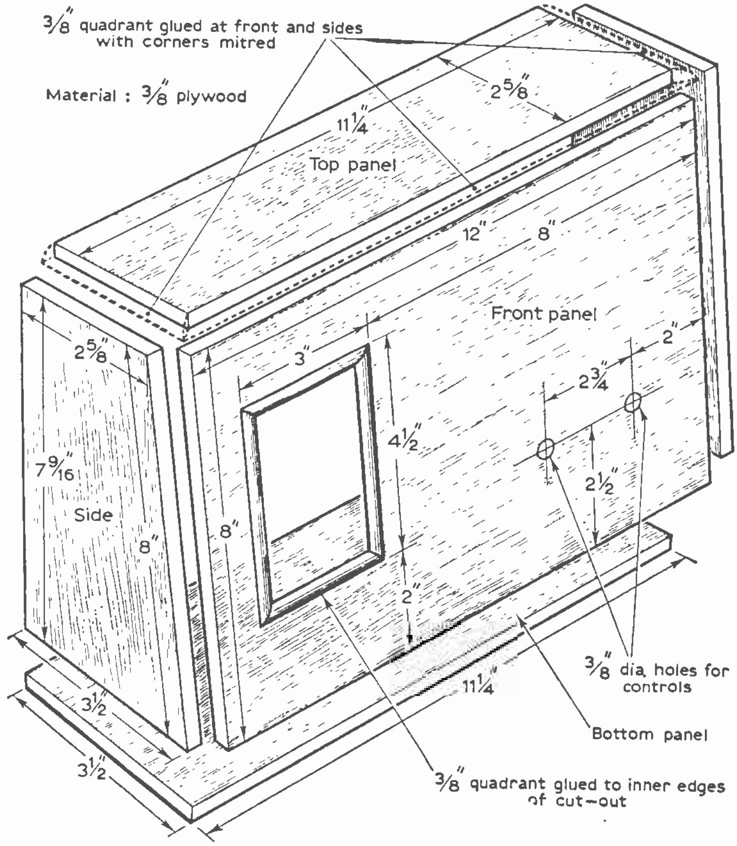
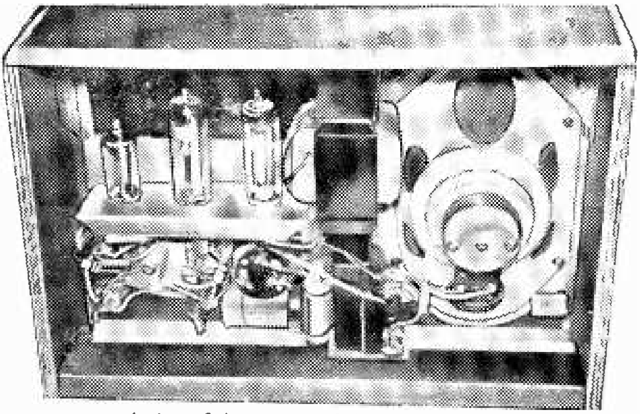


Fig. 5—The method of construction used by the author in making a suitable cabinet for the receiver.



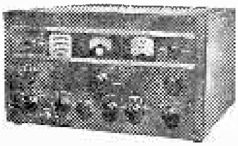
A view of the interior of the completed set.

Housing the Receiver

All the woodwork dimensions required are shown in Fig. 5. The sides are glued to the inside of the panel and are held securely by metal "L" brackets; wooden reinforcement blocks will also serve just as well. Quadrant ($\frac{3}{8}$in.) is glued to the top of the panel and sides to form a frame mitred at the front corners. Similarly, quadrant is fitted to the inside edges of the loudspeaker aperture. ■

UNIVERSAL AVOMETERS

Guaranteed perfect working order. Supplied complete with leads, batteries and instructions.
Model "D" 34 range £8.19.6 each
Model "7" 50 range £11.5.0 each
Model "8" 20,000 ohm/volt model ....15 Gns.
Registered post 5/- extra.



R.C.A. AR.88 RECEIVERS

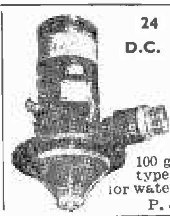
Model AR.88 D. Frequency coverage on 6 bands. 550 kc/s to 32 Mc/s, £35 each. Model AR.88 L.F. Frequency coverage on 6 bands. 75 kc/s to 550 kc/s and 1.5 Mc/s to 30 Mc/s, £32.10.0 each. Both models operate on 110/200/250 volt A.C. Supplied fully tested and checked and in excellent condition. Carriage 30/- extra.

AMERICAN C.B.S. TAPES

5in.	std.	600ft.........	13/-
5in.	L.P.	900ft.........	26/6
5in.	D.P.	1200ft.........	32/-
5¾in.	std.	900ft.........	16/-
5¾in.	L.P.	1200ft.........	19/6
5¾in.	D.P.	1800ft.........	37/-
7in.	std.	1200ft.........	21/-
7in.	L.P.	1800ft.........	29/6
7in.	D.P.	2400ft.........	47/-

Brand new and guaranteed. Please add postage. S.A.E. for full list.

24 VOLT D.C. PUMPS



100 gph impeller type. Suitable for water. 15/6 each. P. & P. 2/6.

MINE DETECTORS No. 4A

Will detect all types of metals. Fully portable. Complete equipment supplied tested with instructions, 39/6. Carriage 10/6. Battery 8/6 extra.

PRECISION COMBINATION VOLTMETER/AMMETER FOR A.C. AND D.C.

Two separate instruments housed in polished wood case. 6in. scales with knife edge pointers. Ranges:

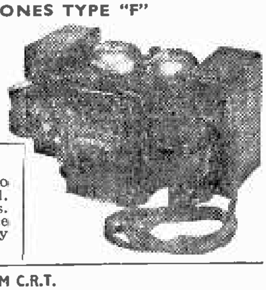
Volts A.C. and D.C. 160-300-600v.

Amps A.C. and D.C. 25-50-150-200A.

Supplied complete with all current shunts, leads and leather carrying case. Manufactured by Elliott Bros. Supplied brand new. £9.19.6 each. Carriage 7/6.

FIELD TELEPHONES TYPE "F"

Ideal for all inter-com systems, house, garage, office, building sites, etc. Generator bell ringing, 2-line connection. Supplied complete with batteries and wooden carrying case, fully tested. £4.19.6 per pair. Carr. 5/-.



BC-221 FREQUENCY METERS

Frequency coverage 125 kc/s to 20 Mc/s. Complete with crystal, valves and calibration charts. First class condition. Price £7.19.6 each. Available only to personal shoppers.

DUMONT K105 IPI DOUBLE BEAM C.R.T.

Brand New. Boxed. 59/6 each. Carriage 3/6.

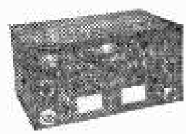
1 INCH C.R.T.

Ideal for small scopes. 4v. Heater. Brand New. Boxed. 15/6 each. P. & P. 1/6.

P.C.R. COMMUNICATION RECEIVERS

6 valves. Frequency coverage on 3 bands: 850-2,000 metres, 190-550 metres and 6-18 Mc/s. Super slow motion drive, AE trimmer, tone control, built in speaker. AS NEW £6.19.6 each. Carr. 7/6.

P.C.R. 2 RECEIVERS
850-2,000 metres, 190-550 metres, 6-22 Mc/s. Output for phones or 3 ohm speaker. AS NEW. £5.19.6. Carr. 7/6. Both above models can be supplied with internal power unit to operate on 200/250 v. A.C. at 39/6 extra or alternatively plug-in external power units are 35/-.
Circuit and details are supplied with each receiver.

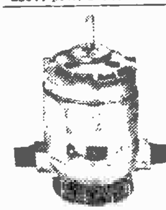


NATIONAL H.R.O. RECEIVERS

BRAND NEW! Senior model, table mounting. Complete with a full set of 9 coils covering 50 kc/s to 30 Mc/s. Supplied in original transit cases. £25. Carr. 20/-. Power units to operate direct from 200/250 volt A.C. 59/6 extra.

1kV.A. ISOLATION TRANSFORMERS

230v. pri., 230v. sec. Boxed, £5. Carriage 10/-.

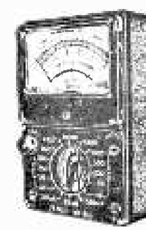


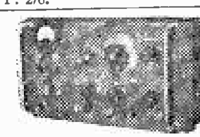
230/250 VOLT A.C. MOTORS

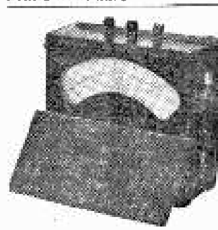
Size 4½in. x 3in. dia., 90 watt rating, 5,000 r.p.m., ¼in. drive spindle. Brand new. 22/6 each. P. & P. 1/6.

JEMCO 20,000 OHM/VOLT TESTMETER

D.C. and A.C. volts up to 1,000v.
Current up to 500 mA.
Resistance up to 5 megohm.
Decibels from —20 to +36 dB.
Supplied brand new, guaranteed with instructions, leads and battery. 5 gns. P. & P. 2/6.







CT-53 SIGNAL GENERATORS

Precision instruments covering 8.9 to 15.5 Mc/s and 20 to 300 Mc/s on 6 bands. Variable attenuator from 1 microvolt to 100 millivolts. Operation 110/200/250 volt A.C. Supplied in perfect working order complete with calibration charts. 19 gns. each. Carriage 10/6.

★ PRECISION A.C. & D.C. VOLTMETERS

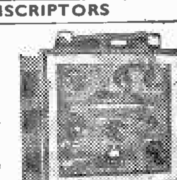
Two ranges, 160 and 320 volts. 8in. mirror scale with knife edge pointer. Housed in polished wooden case. Ideal for schools, labs., etc. Supplied brand new. £5.19.6 each. P. & P. 3/6.

7.5kV.A. AUTO TRANSFORMERS

0-115-230 volts. Brand new, boxed, £15. Carriage 10/-.

COLLARO STUDIO TAPE TRANSCRIPTORS

Brand new 1962 model. 3 speeds, 3 motors, digital counter, etc. Fitted with latest Bradmatic heads and interlock button. Supplied with spare spool, instructions and fixings. 10 gns. each. Carriage paid.

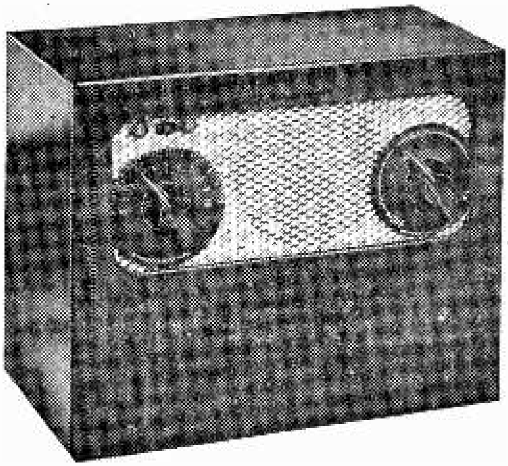


CLASS "D" WAVEMETERS Mk.II

Hetrodyne crystal controlled frequency meter covering 1.9 to 8 Mc/s. 6 volt D.C. operation. Supplied brand new and complete with crystal, valves, spare vibrator, headset and instruction manual. 59/6 each. P. & P. 3/6.

G.W. SMITH & CO (RADIO) LIMITED

Phone: GERRARD 8204/9155
Cables: SMITHEX LESQUARE
3-34 LISLE STREET, LONDON, W.C.2



the Tudor

A FOUR-VALVE BATTERY SUPERHET FOR MEDIUM AND LONG WAVES

WHILE transistors have unquestionable advantages for portable equipment, there are many constructors who still prefer the positive and assured results that are obtained with a well-tried and conventional valve circuit. By taking advantage of the miniature components that are now available a very compact valve set may be constructed with the sure knowledge that it will work first time and give good performance.

Modern low consumption valves are used in this circuit and these, in conjunction with an inexpensive combined H.T. and L.T. battery, provide quite an economical receiver.

All the parts are standard proprietory lines, easily obtainable from any of the suppliers who advertise in this journal and probably many constructors will find quite a few of the parts already in their own store of spares.

Circuit

It will be seen that the circuit (Fig. 1) is a completely conventional 4-valve superhet covering full medium wave and sufficient of the long wave to tune the Light programme, at good strength, anywhere in the country.

The actual lay-out has been very carefully arranged to achieve a neat and compact design and from the group-board wiring diagrams (Figs. 2 and 3) it will be seen that practically all the small components can be mounted on to two group-boards which can be completely assembled and wired up before fitting to the chassis.

The original prototype had the chassis and front panel made in one from a single piece of aluminium, but this had several disadvantages and it will be found much easier to make these as two separate items as shown in Figs. 4 and 5.

Wiring the Group-boards

Before assembling any components on to the chassis, it will be best to wire and mount the smaller components on the two group-boards; the exact position of these and the method of wiring up at the back of the boards will be seen quite

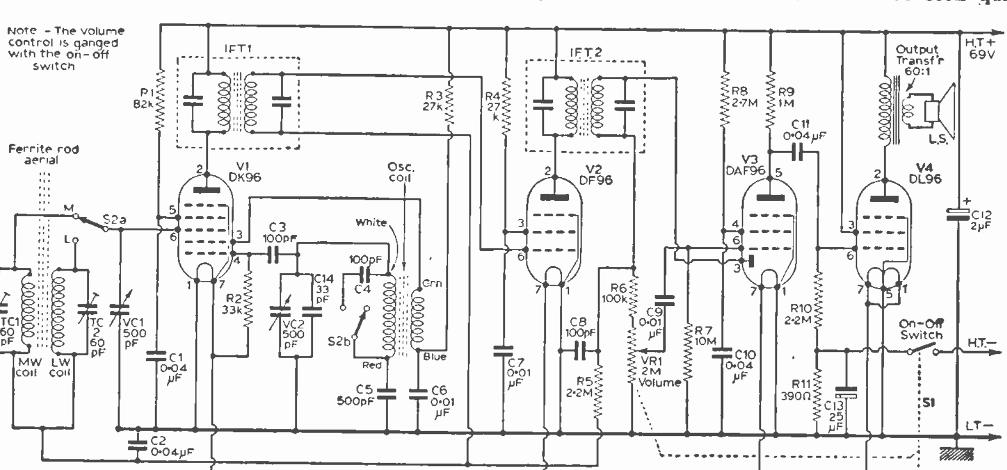


Fig. 1—The circuit.

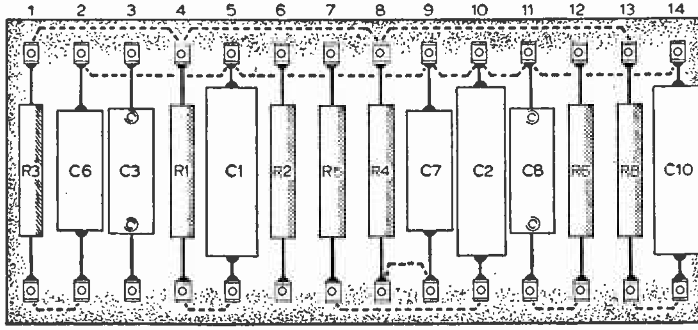
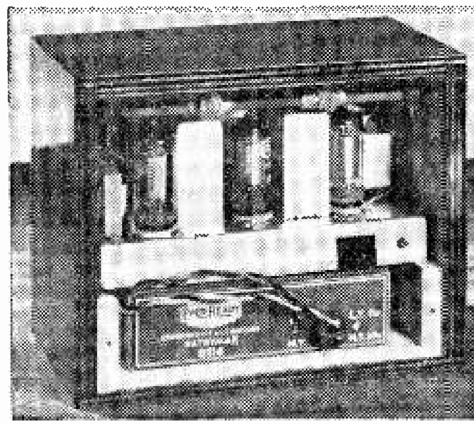


Fig. 2—Wiring of the main group-board.

clearly in Figs. 2 and 3. It is recommended that one end of the board is marked in some way, as it is quite easy to be confused when constantly turning it round for wiring up.

As these group-boards have to be bolted to the main chassis, remember to leave the two relevant components off until the boards have been mounted, to enable the screws to pass through the holes. It is also important to note that an insulated back-plate is placed between the back of the board and the chassis.



(Above)—The receiver assembled in its case.

Mounting the Major Components

Having completed and fitted the tag-boards, the next step is the mounting of all the main components to the chassis taking particular note of the orientation of the valveholders. The I.F. Transformers have similar windings for primary and secondary and it is not important which way round they are fitted. Some constructors may prefer to leave the front panel with its associated controls and

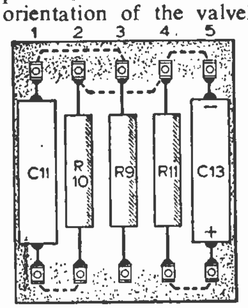


Fig. 3 (left)—Wiring of the auxiliary group board.

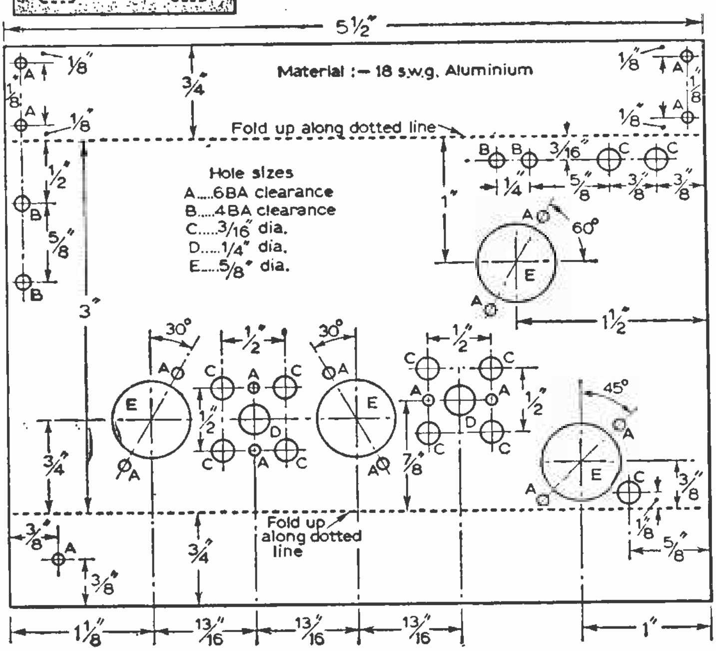


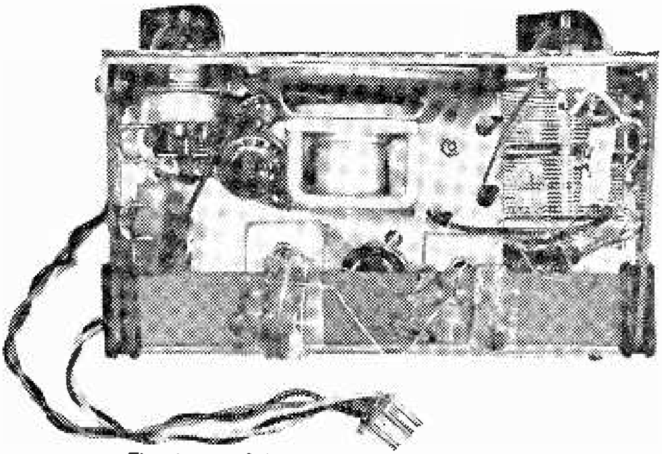
Fig. 4—The chassis drilling dimensions.

parts separate from the main chassis until later in the assembly, and it is suggested that a strip of insulation tape along the inside lower part of this front panel is a useful precaution as the clearance between it and the group-board tags is rather small.

It is advisable to leave the ferrite rod aerial to last as some alterations to it are necessary before fitting, and also it will eliminate the risk of breaking or damaging it during construction.

The two-gang tuning condenser is mounted from the front of the panel using three countersunk 4B.A. screws. (Ensure that these are cut down short enough to prevent them from projecting through and interfering with the movement of the vanes of the condenser.) The loudspeaker can also be mounted in a similar manner,

(Continued on page 437)



The chassis of the receiver viewed from above.

some slight alterations will need to be carried out to the rod aerial before fitting. In the first place it will be found that there are low impedance coupling windings over the top of each of the two coils and these were removed completely. If it is desired to use this set with a car radio aerial in a car these windings may be left on and taken in parallel to a suitable socket for the car aerial. In the prototype it will be seen that the medium wave winding is connected to the upper two tags with a miniature 60pF trimmer soldered into position across it, and the long wave winding is connected to the lower tags and another 60pF trimmer positioned in parallel.

COMPONENTS LIST

Resistors (All ½W 10%)

R1	82k	R5	2·2M	R9	1M
R2	33k	R6	100k	R10	2·2M
R3	27k	R7	10M	R11	390Ω
R4	27k	R8	2·7M		

VR1 2M log. with D.P. switch

Capacitors (All miniature components)

C1	0·04μF 150V	C8	100pF mica
C2	0·04μF 150V	C9	0·01μF 150V
C3	100pF mica	C10	0·04μF 150V
C4	100pF mica	C11	0·04μF 150V
C5	500pF mica	C12	2μF 150V elec
C6	0·01μF 150V	C13	25μF 15V elec
C7	0·01μF 150V	C14	33pF mica

VC1, VC2 500/500pF 2 gang tuning (Jackson type L)

TC1, TC2 60pF miniature compression trimmers

Valves

V1	DK96	V3	DAF96
V2	DF96	V4	DL96

Two Denco IFT.11 I.F. transformers (465kc/s)

Miniature output transformer

Oscillator coil (Weymouth radio type H03)

Switches

S1 D.P. switch on VR1

S2 D.P.D.T. slider switch

69V + 1·5V battery

Miniature 14-way and 5-way group-boards

Medium and long wave aerial (Repanco FS2)

2½in 3Ω loudspeaker

Miscellaneous:

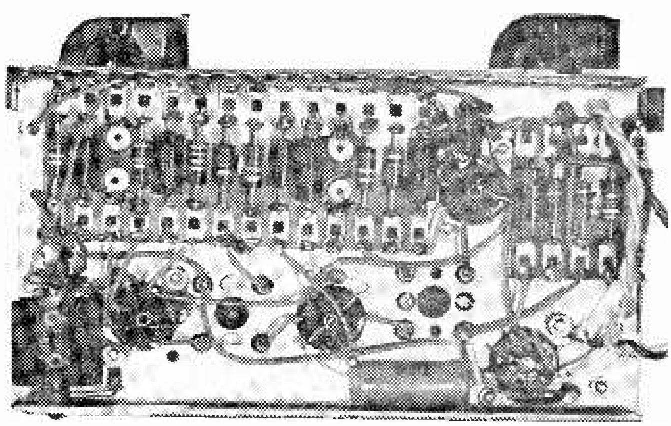
Valveholders; knobs; battery plug; nuts; bolts; etc.

(Continued from page 434)

using 4B.A. countersunk screws with nuts on the inside to make it secure. When all the parts have been fitted to the front panel it can be completed by covering with fine mesh expanded metal, or loudspeaker covering material, leaving a small aperture for the miniature wave-change switch. If it is intended to fit dials one can be mounted under the fixing nut for the volume control and the other one for the tuning indicator is best secured by using contact adhesive.

Most of the wiring is quite straightforward and obvious from a study of the diagrams.

In order to simplify the wiring



This underchassis view shows the two group-boards clearly.

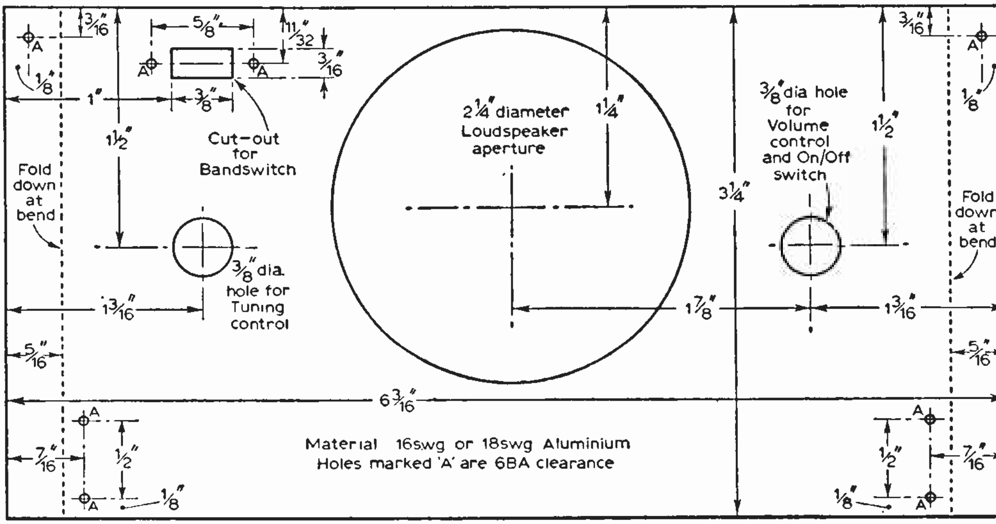


Fig. 5—The front panel drilling details.

Sufficient length of lead should be left to allow both these coils to be moved along the ferrite rod for tuning to the best position. It should be noted that this aerial coil wire is Litz and it is essential when making soldered joints that every single strand is carefully cleaned and tinned otherwise performance may be affected. The ends can be carefully cleaned by placing on a firm surface and scraping gently with fine emery cloth, or another method is to heat the wire ends in a small flame and while still hot, plunge them into methylated spirit after which the ends can be wiped clean and then soldered.

(To be continued)

Power Rectifier Circuits

(Continued from page 397)

resistance of the tranformer winding is often an appreciable fraction of this value, and added to this there is already the internal resistance of the rectifier present. Thus surge limiters of at the most a few hundred ohms will be needed with a PY81, however large the smoothing capacitors may be made. Under the conditions of Fig. 19 where the smoothing capacitors are only 5μF each, no limiting resistor was deemed necessary. It is in fact good practice not to make the smoothing condensers too large in the power supply itself, providing the additional smoothing internally in each consumer circuit connected, in the form of a large series resistor and electrolytic condenser, as shown in Fig. 27. This provides decoupling and smoothing in one, and avoids unnecessarily large rectifier surge currents.

Values

Good power supply designs use surprisingly small values for the smoothing capacitors, often only a few microfarads, especially for the first capacitor (the "reservoir" condenser) connected directly to the rectifier. If insufficient smoothing is thereby achieved, then electronic stabilisation is resorted to, which gives far lower internal impedances and far greater smoothing than is achieved by haphazard increases of smoothing capacities, and far lower strain is imposed on the rectifiers. Several such circuit designs have been published in this magazine.

All circuits using large values of smoothing capacitors connected directly to a rectifier are to be considered basically as compromises in compact or cheap-to-construct apparatus, where it is not deemed desirable to waste too much space or attention on the power supply. Such circuits give very reasonable performance life if capacities not exceeding about 32μF are connected direct to the output of normal valve rectifiers, and not exceeding about 64μF for metal rectifiers, and not exceeding about 100μF for silicon power-rectifiers. However, these figures must be treated as mere, very rough guides. The higher the reservoir capacity, the greater the strain on the rectifier, and the more is its useful life likely to be shortened.

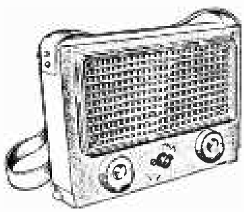
Domestic Equipment

In domestic radio sets and other equipment subject only to intermittent service with long periods of rest, the matter is far less critical than for laboratory apparatus intended for long-period non-stop experiments. Thus the author is at present conducting experiments with Geiger-counter monitors for atomic radiation, for which a large quantity of electronic equipment is in non-stop operation day and night for weeks on end. If insufficient attention would have been given to proper design of power supplies, for example, frequent breakdowns would have been inevitable, which would have caused the loss of valuable measurements, as well as the trouble and expense of such breakdowns. Even for television circuits a higher measure of care is required for power-supplies than for simple radio receivers, because higher voltages and currents are involved, more expensive equipment is in danger in case of breakdown, and the operating hours of television sets in most families are longer than those of radio sets! ■

SETTING A NEW STANDARD FOR DISCRIMINATING CONSTRUCTORS
HUNDREDS OF TESTIMONIALS PROVE THE EFFICIENCY OF OUR DESIGNS

THE SUPER SEVEN EASILY THE BEST

(7 Transistors plus 2 Diodes)



- ★ 2 R.F. STAGES.
- ★ Mullard and Surface Barrier Transistors.
- ★ Coverage of Medium, Long Waves, Trawler Band
- ★ Use as domestic radio, car radio or fit with strap for carry-about.
- ★ No aerial required except for use as car radio.
- ★ 3-inch speaker but will drive a larger speaker.
- ★ 400 milliwatts output stage.

May be built for **£6.9.6** SIZE: 7½ x 5½ x 1½in. plus 3/6 post, etc.

PARTS PRICE LIST AND EASY BUILD PLANS 2/-

THE EASY-BUILD-7

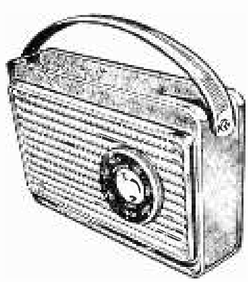
MED/L.W.

Case as Super Seven.

Simple construction for beginners. 7 transistors plus 2 diodes. Performance will amaze you. May be built for ONLY £5.19.6. P.P. 3/6. Parts price list and building plans 2/-.

NEW TRANSONA-6

(6 Transistors, plus 2 Diodes)
M/L & T. BAND



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

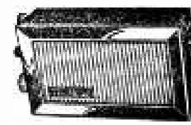
Total building cost **£4.19.6** P.P. 3/-. Size 6½ x 4½ x 1½in.

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

PARTS PRICE LIST AND EASY BUILD PLANS 1/6.

BEGINNERS POCKET 5

(MW/LW and TRAWLER BAND)
(5 Transistors, plus 2 Diodes)

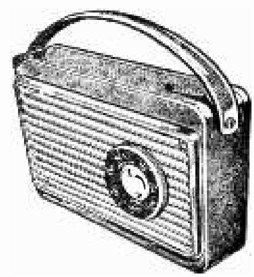


Designed round supersensitive **FERRITE ROD AERIAL** and 3in. moving coil speaker. Attractive case in black with speaker grille in red. On test Home, Light, Radio Luxembourg and many Continental stations were received.

Total cost of all parts **£2.19.6** P.P. 3/-

EASY BUILD PLANS AND PARTS PRICE LIST 1/6

THE MELODY SIX



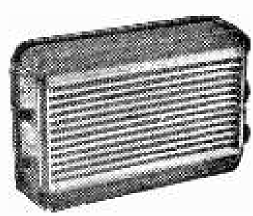
- ★ Ferrite road aerial.
- ★ 6 new type transistors and top quality components. Attractive case in blue and red and carrying strap with gold trim.
- ★ 3in. Speaker.
- ★ M.W/L.W.

£3.19.6
P.P. 3/-

Components price list and plans, 2/-.

BEGINNERS PUSH-PULL FIVE

(5 Transistors, plus Diode)



- ★ M/C Speaker, 2½in.
- ★ Ferrite rod aerial.
- ★ Tuning condenser.
- ★ Volume/oscillator control.
- ★ Case with speaker grille in red.
- ★ Fully tunable over med/long waves.
- ★ Simple assembly diagrams.
- ★ 250 Milliwatts output stage.
- ★ Can be built for **59/6** P.P. 3/-, or with 3in. speaker 68/-
- ★ PARTS PRICE LIST, etc. 2/-.

AFTER SALES SERVICE

NAME AND ADDRESS CAPITAL LETTERS PLEASE

RADIO EXCHANGE COMPANY

27 HARPUR STREET, BEDFORD
(Opposite Co-op)

PHONE 2367

10 a.m. to 1 p.m. SAT.

LASKY'S RADIO

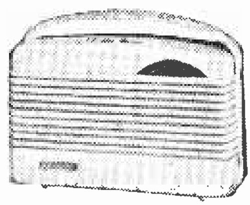
"BUILD-YOURSELF" TRANSISTOR RADIOS

The finest receiver at present available for home construction. Fully tunable long and medium wavebands. Uses 7 Mullard Transistors: OC44, 2 OC45's, OC71, OC81D and 2 OC81's, plus Crystal Diode OA70.

The "REALISTIC" Seven

STAR FEATURES ★★★★

- ★ 7 Transistor Superhet. 350 Milliwatt output into 4-inch high flux speaker.
- ★ All components mounted on a single printed circuit board, size 5¼ x 5¼in. in one complete assembly.
- ★ Plastic cabinet, with carrying handle, size 7 x 10 x 3½in. in choice of colours: Red/Grey, Blue/Grey, all Grey.
- ★ Easy to read Dial.
- ★ External Socket for car aerial.
- ★ I.F. frequency 470 K/cs.
- ★ Ferrite Rod internal aerial.
- ★ Operates from PP9 or similar battery.
- ★ Full comprehensive data supplied with each Receiver.
- ★ All coils and IF's, etc., fully wound ready for immediate assembly.



An Outstanding Receiver. Lasky's Price for the complete parcel including Transistors, Cabinet, Speaker, etc., and Full Construction Data.

£6.19.6 Postage and Packing 4/6

Battery 3/9 (included free with complete parcel). Data and instructions separately 2/6, refunded if you purchase the parcel.

The New "ALBERTA 5" Mk. II

Now using printed circuit and supplied with miniature earphones for personal listening at no extra cost.

Push-pull, 200 milliwatts output. Five transistors and one diode. 2½in. moving coil speaker, ferrite rod aerial. Med. and long wave. Smart plastic Case, 4¾ x 3¼ x 1½in. overall.

CAN BE BUILT FOR **59/6** Post 3/6

All components available separately. Full details, circuit diagram, 1/6 post free.

THE BETA TWO

A 2-transistor plus 2-diode personal receiver for home construction. Uses printed circuit and ferrite rod aerial. Personal earphone gives clear reception for private listening. Tunes over full medium waveband. Uses same cabinet as our Alberta 5 receiver, illustrated above, size 5¼ x 3¼ x 1¼ ins. overall. All components available separately. CAN BE BUILT FOR **21/-** Postage 2s. 6d. extra. Including personal earphone, cabinet, etc. Circuit diagram and step by step instructions 1s. 6d. (Free with parcel).

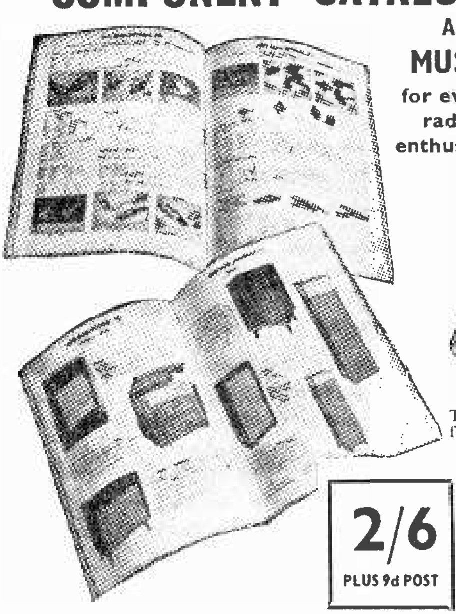
★ REBUILDING CLEARANCE
SALE
at 42 Tottenham Court Rd., W.1.
LAST SIX WEEKS!
HUNDREDS OF BARGAINS!!

207 EDGWARE ROAD, LONDON, W.2. Near Praed St. PADDINGTON 3271/2

33 TOTTENHAM COURT ROAD, W.1. Nearest Stn. Goodge St. MUSEUM 2605

BOTH OPEN ALL DAY SAT. Early Closing Thurs. Mail Orders to Dept. P.W. Edgware Road.

ACKNOWLEDGED TO BE THE BEST COMPONENT CATALOGUE



A
MUST
for every radio enthusiast

NOW
166 pages
Over **600** Illustrations
Over **5,000** components listed

This is to-day's most up-to-date, most comprehensive component catalogue for the radio constructor, experimenter, engineer and Hi-Fi enthusiast.

2/6
PLUS 9d POST

POST COUPON TODAY
Write CATALOGUE on top left of envelope
Enclose P.O. 3/3

Name.................................

Address.................................

....

Home Radio Ltd. (PW) 187 London Rd. Mitcham, Surrey

Letters to the Editor

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

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

P.C.R. COMMUNICATIONS RECEIVER

SIR,—I wonder if any of your readers could advise me as to what is the correct I.F. of the P.C.R. communications receiver currently available. Also, I would like to know, the make and type of a suitable BFO coil for use with half a 6SN7 in this set.

I would also be very grateful if anyone could sell or loan me a copy of the original circuit for the R.F. unit No. 24.—A. WATT (67 Glenhurst Avenue, Bexley, Kent).

AMERICAN STATION

SIR,—In answer to a query made by Mr. T. Gerrard in the July issue, regarding an American station he heard on the 32m band, the station is one of the American Telephone and Telegraph Co. radio telephone services. These stations are not engaged in broadcasting but are used solely for international communication.

A station which may be of interest to Mr. Gerrard and other readers, is WRUL New York, which broadcasts some excellent programmes and is, in fact, the only commercial S.W. station operating from the U.S.A. The times of transmissions are 15.00-23.00 GMT on week days; 18.30-23.00 GMT at weekends. The frequencies for Europe are 15,380kc/s (19m band) and 17,760kc/s (16m band).—R. PATRICK (Derby).

SIR,—The transmission identified by T. Gerrard (July issue) as coming from an American station, is in fact a single sideband transmission by a German station.

The message in English is as follows: "This is a test transmission by a single sideband system operated by the Overseas Service of the Deutsche-Post Francis Main Terminal. Please give identification signal on channel A for receiver adjustment".

The other message is in German. — R. R. DIAMOND (Stockport, Cheshire).

MEDIUM WAVE FADING

SIR,—I have been having trouble with a 12-year-old McMichael receiver. It has the habit of fading on medium waves after it has been switched on for about 10 minutes.

The only way I have found to rectify this, is by disconnecting the aerial lead-in and connecting it to earth! Could any reader explain this or suggest another way of curing the fault? — K. CLOUGH (Bolton).

THE P.W. TROUBADOUR

SIR,—I have just completed constructing the P.W. Troubadour, 7-transistor receiver (June and July issues) and am amazed at its performance. This pocket set gives better selectivity, sensitivity and none-fade reproduction than some expensive models owned by friends. Although it does work out expensive if the constructor has not any of the components in stock, this receiver must surely be worth double the complete kit price.—R. W. CRAIG (Bexley, Kent).

TELEVISION BREAK-THROUGH

SIR,—There have been a number of letters in recent issues about the reception of long-distance stations on crystal receivers and I think there is no doubt that in the majority of cases this reception is not direct from the station concerned, but re-radiated from a neighbouring aerial. I experienced a very similar effect some time ago. when I heard music as a background on my simple set, and on trying to resolve it found it was the BBC television programme. I felt that this could not be direct pick-up on account of the frequency used and my distance from the nearest station, and this was confirmed a little later when the station disappeared instantly—that is, it did not fade out. A few nights later I noted that the station returned, again in a sudden manner rather than a gradual signal strength build up, and I knew the people downstairs had a TV and made a few inquiries, as a result of which we carried out some tests, and the programme did, in fact come from their aerial, which was of the indoor type, and their contrast control had to be full up There was obviously some H.F. instability which resulted in the signal being radiated in this manner. I hope this will be of interest to others —E. GOWING (Portsmouth).

CORRESPONDENTS WANTED

SIR,—I am 22 years of age, and I am interested in radio servicing as a hobby. I would like to correspond with amateur enthusiasts of my age from any country. — D. L. KIRIWANDALA, P.O. Box 732, Colombo, Ceylon).

SIR,—I am 16 years of age and would like to correspond with amateurs of my age. I have been interested in S.W. for about a year now.—BUTCH BONE, c/o Daw Thein Wa's, Bookland, P.O Box 294, 385 Bogyoke Street, Rangoon, Burma.

Club News

REPORTS OF CURRENT ACTIVITIES

BRADFORD RADIO SOCIETY
Hon. Sec.: M. T. G. Powell, G3NNO, 28 Gledhow Avenue, Roundhay, Leeds 8.

On June 26th a number of members visited a firm of engineers. The two meetings for July consisted of an informal evening on 10th and a talk by G3OGV—"160m SSB"—on 24th.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: F. C. Ward, G2CVV, 5 Uplands Avenue, Littleover, Derby.

G3ERD/P operated from Harborough Rocks, Brassington on July 7th and 8th for the second R.S.G.B. Two-metre Field Day. L. Ball gave a talk on July 11th and the meeting for 18th was taken up by the fourth direction finding league fixture.

A sale of members' surplus equipment was held on August 1st.

Future Events:
August 15th—Direction finding league fixture, No. 5.
August 22nd—Stereophonic demonstration.

MIDLAND AMATEUR RADIO SOCIETY
Hon. Sec.: A. B. Watt, G2DRG, 11 Holly Road, Handsworth, Birmingham 20.

On Tuesday, 17th July, members attended a lecture given by H. C. Smith. The title of his lecture was "Tape Recording", and it was given at the Birmingham and Midland Institute.

Future Event:
August 21st—"G2DAF receiver for SSB" by G3LLN.

MORECAMBE AMATEUR RADIO SOCIETY
Hon. Sec.: K. J. Singleton, G3NLM, 8 Westmoor Grove, Heysham, Morecambe, Lancashire.

Meetings of this society are held on the first Wednesday of each month at the Liberal Club, Balmoral Road, Morecambe, and start at 7.30 p.m. Any new members will be made welcome.

For the July meeting, a number of members visited the automatic telephone exchange in Lancaster. The meeting for August was devoted to a ragchew.

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

Recent club activities have included a display of members' equipment which was held on July 4th.

At the meeting on August 1st, the society played host to members of the Manchester Radio Society, who gave a D.F. demonstration. On August 4th, members operated a demonstration station at the Warley Club and Institute Charity Gala.

PURLEY AND DISTRICT RADIO CLUB
Hon. Sec.: E. R. Honeywood, G3GKF, 105 Whytecliffe Road, Purley, Surrey.

A portable expedition was held on the evening of July 6th, at Walton Heath. Operation was on Two-metres and Top Band.

On July 20th, members heard an R.S.G.B. tape recorded lecture which was illustrated by slides.

Future Event:
August 17th—Film of National Field Day.

RADIO CLUB OF SCOTLAND
Hon. Sec.: A. Barnes, GM3LTB, 7 Southport Terrace, Glasgow W.2.

This is a new radio club which held its inaugural meeting on June 1st this year. Meetings are held every Friday evening, and commence at 8 p.m. A welcome is extended to anyone who is interested in the hobby of amateur radio. All interests are catered for but suggestions are always welcome for expanding the programme. The first Friday in every month is especially for beginners.

SERVICE SHEETS

SERVICE SHEETS: Radio, TV, 5,000 models. List 1/-. S.A.E. enquiries: TELRAY, 11 Maudland Bk., Preston.

SERVICE SHEETS for all makes of Radio and TV, 1930-1962. Prices from 1/- with free fault-finding guide. Catalogue of 6,000 models 1/6. 125 Radio/TV sheets covering many popular models 20/-. S.A.E. inquiries: HAMILTON RADIO, Western Road, St. Leonards, Sussex.

WHY TOLERATE DELAY when we can supply your Radio or TV Service Sheet by return of post at 4/- each, plus postage. List 1/-. Also Manuals for sale and hire. List 1/-. S.A.E. with inquiries please. Mail orders only to S.P. DISTRIBUTORS, 44 Old Bond Street, London W1.

FAULTFINDER FILES, showing common faults that each receiver is prone to and other useful servicing information, 2/- each. List 9d., plus postage. Mail orders only. S.P. DISTRIBUTORS, 44 Old Bond Street, London W1.

SERVICE SHEETS, Radio and TV, 4/- each. List 1/-. All orders dispatched on day received. Also manuals for sale and hire. List 1/-. SAE please, SULTAN RADIO, Pantiles Chambers, Tunbridge Wells, Kent.

SERVICE SHEETS; also Current and Obsolete Valves for sale. — JOHN GILBERT TELEVISION, 1b Shepherd's Bush Road, London W12. Phone SHE 8441.

CIRCUIT INFORMATION

18 SET TRANSMITTER RECEIVER
Description. Operation. Values. Diagrams. Tests, etc. P.O. 5/-

38 SET WALKIE TALKIE
Alignment procedure. Faults. Components. Description. Diagrams, etc. P.O. 5/-

CAMPBELL

Everland Road, Hungerford, Berks.

METAL WORK

METALWORK. All types cabinets, chassis, racks, etc. to your specifications. PHILPOTT'S Metalworks Ltd., Chapman St., Loughborough.

WANTED

WANTED: NEW valves and transistors, any quantity. S. N. WILLETS, 43 Spon Lane, West Bromwich, Staffs. Tel: WES 2392.

NEW VALVES WANTED

Any type, any quantity

CASH PAID

R.S.T. 211 Streatham Road, Mitcham, Surrey

Telephone: MITCHAM 6202

RATES: 7/3 per line or part thereof, average five words to line, minimum 2 lines. Box No. 1/- extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Wireless," Tower House, Southampton St., London W.C.2.

WANTED
(continued)

WANTED: TEST GEAR, Meters, Valves, Components, Communication Sets, Amplifiers. HUGGETS LTD., 2-4 Pawson's Road, West Croydon, Surrey.

WANTED: New Valves and Transistors, any quantity. Phone Cherrywood 3955. D. & B. TELEVISION, 131-131a Kingston Road, South Wimbledon, SW19.

WANTED VALVES

All types for prompt cash. Must be new. State quantity.

WILLIAM CARVIS LTD.

103 North Street, Leeds 7

NEW VALVES bought, state price. A.D.A. MANUFACTURING CO., 172 Alfreton Road, Nottingham.

A PROMPT CASH OFFER for your Surplus Brand New Valves and Transistors. R.H.S., Beverley House, Manville Terrace, Bradford 7.

VALVES WANTED

IMMEDIATE CASH SETTLEMENT

Must be new.

Phone, write or call

Radio Facilities Ltd.

38 Chalcot Road, London N.W.1

PRImrose 9090

The valve specialists

WANTED: T.C.S. Transmitters, Receivers, Connectors, Loading Coils etc. GILFILLAN, 98 Dominion Road, Worthing, Sussex. Tel.: Worthing 8719.

FOR SALE

100 BAYS of brand new adjustable Steel Shelving, 73in. high by 34in. wide by 12in. deep, stove enamelled dark green. Sent unassembled. Six-shelf bay £3/15/-. Sample delivered free. Quantity discounts. N. C. BROWN LTD., Eagle Steelworks, Lancs. Tel.: 69018.

ASK your dealer for American Ferro-dynamics. "Brand Five" Recording Tapes—the best tape value!

AMATEUR LICENCE Morse Course. The new Rhythm Method of teaching takes the drugery out of learning Morse and is the quickest known!!! For full explanatory booklet: S.A.E. G3CHS, 45 Green Lane, Purley, Surrey.

FOR SALE
(continued)

WE HAVE a large selection of amplifiers, radios, tape recorders, television sets record players, etc, that have been taken in part exchange ranging from Bush, GEC, Sobell, Philips, Pye, HMV Ferguson and many others. You are invited to call and offer any reasonable sum that you think might tempt us to sell. PORTERS RADIO LTD., Chapel Street, Guildford. Tel: 4766.

AUDIO. America's foremost journal. Year's subscription, 35/-. Specimen copy 4/-. Every American radio journal supplied. Price list free. WILLEN LTD. (Dept. 40), 9 Drapers Gardens, London EC2.

MONITOR 56 triggered oscilloscope. Apply details: MOXON, 19 Deanway, Wilmslow.

E. R. NICHOLLS

47 MIDDLE HILLGATE, STOCKPORT

RETAIL SHOP

BUMPER PARCEL

100 Resistors, 100 Condensers, 100 Cartridge Fuses, 3 Mains Droppers, 2 Rotary Toggle Switches, 6 Paxolin Panels, 2 B.C. Lampholders, 1 Transmitter, Chassis less Valves, 6 Potentiometers. **20/- Post Free.**

No. 2 PARCEL. 1 ex Unit Mains Transformer 250-0-250+4+5+6.3 volts, 1 Sound Output Transformer, 1 Isolation Transformer, 1 5in. Speaker P.M., 3 Jack Sockets, 4 Terminal Blocks, 2 Inert Cells, 1 Telephone Fuse Box, 1 12-volt 4-pin Vibrator, 100 Cartridge Fuses, 1 Helmet Spot Lamp, 1 Nylon Parachute for the youngster, 24 asstd. sizes Polythene Bags for the wife, 12 sheet Carbon Paper for the lodger, 1 Thermistor and if you send a local view (post card) I will send 12 High Stab Resistors. All this for 40/-, Post Free. **Don't Miss It.**

High Stab Resistors 6d. each. S.A.E. List.

20 ft. Telescopic Masts 50/-, via BRS Post free

Mail Order to—

33/35 Carrington Field St., Stockport.

EQUIPMENT FOR SALE

WALNUT CABINETS by Pye, bargain £4 each. EMI 4-speed R/player units with Acos Pickup, new £3/10/- each.
HMV Walnut speaker enclosure Octagonal, bargain £8.
Richard Allan Speaker enclosure Walnut, fitted 8in. speaker, bargain £9. Nordyk cabinets fitted Dulc Stereo amplifier and control Teppa Stereo player unit Celestion speakers on Nordyk Bench ready to go, al new, bargain complete £40. Grundi TK35 (the best they ever made), new with guarantee demo only £50. Burn Jones Sonnetta speaker system, ligh oak, bargain £10.
Famous Audio Empire L08 stere cartridges few only at £12/10/- eacl straight from U.S.A.
Grundig T.K.L. Tape Recorders new £20 each. Full range Wharfedal Loudspeakers 20% under list price for one month only. Bargains in al makes of Tape Recorders, Amplifiers Speakers, Pickups, Turntables, etc Write Your wants for Our price. Sol British Agents for famous Germa Elac Pickup cartridges, Mirapho and Miracord Record players an changers.
The Best in the World. Terms cas with order. THE HIGH FIDELIT CENTRE, 61 West Street, Dorkin Surrey.

RECEIVERS & COMPONENTS

NEW TRANSISTORS MONEY BACK GUARANTEE.

MARKED AND TESTED SUCH AS XA101, XA102, XB103, XC101, ETC. 20/- PER PACKET OF 10.

UNMARKED BUT TESTED MOST RADIO TYPES 20/- PER PACKET OF 16.

UNMARKED UNTESTED 20/- PKT OF 40.

DUDS MAY BE SUITABLE AS DIODES 20/- PKT OF 80.

POST FREE

ANY 2 PACKETS 37/6 | CASH WITH ORDER

QUANTITY DISCOUNT

K.R. WHISTON (DEPT PWT), NEW MILLS, STOCKPORT.

SPEAKER REPAIRS, Cones/Fields fitted. Clock coils wound. L. S. REPAIRS, Pluckley, Ashford, Kent.

NEW AND SURPLUS Valves, guaranteed from 3/6. Also reclaimed Valves, perfect, from 1/6. Many bargains. S.A.E. for complete list. LEWIS, 46 Woodford Avenue, Ilford, Essex.

"HEATHKITS" can now be seen in London and purchased on easy terms. Free brochure. DIRECT TV REPLACEMENTS LTD., Dept. P.W. 7/8, 138 Lewisham Way, SE14. Tideway 6666.

SPECIAL OFFER. MINIATURE 6-TRANSISTOR SUPERHET chassis (3¾in. x 2¾in.) All components mounted on printed circuit board. Long and Medium waves; 200mW Push pull output: 2in. moving coil speaker. Earpiece socket fitted. Each set complete with battery and guar. working perfectly. Supplied without case, £5/12/6, p & p and insurance 5/- extra. SAVOY ELECTRONICS (Sales) LTD., 15 Maiden Lane, WC2. TEMple Bar 5484.

TRANSISTOR COMPONENTS. 7 x 4in. 35 ohm speakers, 25/-, 7 x 4in. 3 ohm, 19/6. **EARPIECES.** 7 ohm, 150 ohm, 6/6. Xtal with Jack, 7/6, all complete with plugs. 4 pole 2 way switches 1 inch spindle, 2/6 each. Min. Caps, 15 v. wkg.—1, 2, 4, 5, 8, 10, 16, 32, 50 mfd., 64 mfd. 10 v., 100 mfd. 6 v., 100 mfd. 12 v., all at 1/10 each. Resistors mostly 10% small, 10 ohms to 10 meg., 3d. each. Ceramicons, most values in stock, 1 pfd. to 5,000 pfd. Slide switches, DP/DT, 3/- each.

TRANSISTORS. OC44, OC45 7/6 each, A.F. Pack OC81D, 2 OC81, 18/6, set. G.E.C. 874, 4/6, S6, S7, good output transistors, 2/6 each. Red spots, 2/3, White spots, 2/6, OC76 3/6, OCP71 12/6, OA81 Diodes 2/6, GEX 00 9d. Terms C.W.O. or C.O.D.

BROADWAY ELECTRONICS
92 Mitcham Road, Tooting, S.W.17.

KITS BUILT, complete, S.A.E. leaflet. J. KINDER (Dept. 4), 6 Hooker Rd, Heartsease, Norwich, Norfolk.

Speakers, 8/9d., 6in., 8in., and 7 x 4in. Ex-Manufacture salvage. P. & P. 2/9d.

T.V. Tubes, 15/-, 31/74, 124, 121. Ex-rental. Ideal spares, Carr. 10/-. Also 36/24. Very good condition, 35/-. Carr. 10/-. Set tested. Valves **9d.** 6AL5, 6AM6, 6D2, 6F14, 8D3, 9D2, 78, EB91, EF50, EF91, P61, SP61, etc: Post 9d. T.V. Sets. Complete for 25/-.

Stamp for FREE List. Mail Order Only.

P.P. COMPONENTS LTD.,
623 Romford Rd, Manor Pk, London E.12.

A.1. POST FREE BARGAINS. First grade Transistors. White spots 3/9. Red spots 3/-. OC44 9/-, OC45 7/3, OC71 5/-, OC76, OC200 6/-. Matched pairs two OC81 and OC81D 21/-, two OC44 and OC45 23/6. Reclaimed Valves all tested: EB91, EF50, EF91 9d, 10F1 1/-, 6F1 2/-, L63, 20D1 3/-, ECL80, PY81, PZ30, B36 4/-, PCF80, PL82, PL83, PY80, PY82, KT33C 4/6, PL38, N37, KT36 5/-, PCL83 6/-. PY32, 6K25 7/6, 185BT 12/6. 10% reduction on six, 25% on 12. Loud Speakers: 6in. x 4in. 5/6, 7in. x 4in., 8in. 6/6, 10% reduction on 12. 25k, 50k. w.w. Pots., S.P. switch 4/6 each. A.1. RADIO COMPONENTS, 14 The Borough, Canterbury, Kent.

SOUND RECORDINGS

TAPE BARGAINS IN ALL SIZES. Example: Top Brand 5¾in. 1200ft. 19/6 p & p 1/3. S.A.E. for list. Large choice of new and used recorders. E. C. KINGSLEY & CO., 132 Tottenham Court Road, London W1. EUS 6500.

BOOKS & PUBLICATIONS

FIND TV SET TROUBLES IN MINUTES from the great book "The Principles of TV Receiver Servicing", 10/6 all bookhouses and radio wholesalers. If not in stock, from Secretary, I.P.R.E., 20 Fairfield Road, London N8.

MISCELLANEOUS

YOUR OWN Kits built up or assistance given, Bradford/Leeds area. S.A.E.: TVS, 19 Aberdeen Terrace, Bradford 7, Yorkshire.

—ELECTRONIC MUSIC?—

Then how about making yourself an electric organ? Constructional data available—full circuits, drawings and notes! It has 5 octaves, 2 manuals and pedals with 24 stops—uses 41 valves. With its variable attack you can play Classics and Swing.

Write NOW for free leaflet and further details to **C. & S., 20 Maude Street, Darlington, Durham.** Send 2½d. stamp.

EDUCATIONAL

"HOW AND WHY" of Radio and Electronics made easy by a new, non-maths practical way. Postal instruction based on hosts of experiments and equipment building carried out at home. New courses bring enjoyment as well as knowledge of this fascinating subject. Free brochure from: Dept. P.W. 12, RADIOSTRUCTOR, Reading.

THE Incorporated Practitioners in Radio and Electronics (I.P.R.E.) Ltd. Membership Conditions booklet 1/-. Sample copy of I.P.R.E. Official Journal 2/- post free. Secretary, 20 Fairfield Road, London N8.

£'s MADE

By repairing Radio and TV Sets as a job or as a spare time business. Our practical course will show you the way. No previous experience is required.

SEND FOR FREE BOOK TODAY!

RADIOSTRUCTOR
Dept. G77 READING, BERKS.

BRIAN E. HAMPSHEIR (R & T) LTD.
Dept PWA, 23 NORTHCROSS ROAD, S.E.22.

6F13	EF80	EF91	6P25	10F1	Z77	25L6GT
EB91	6P28	6F1	EF50	L63	6F12	

SALVAGED. GUARANTEED 100% ALL AT ONE PRICE
£1 for 10, p. & p. FREE

(Continued on next page)

EDUCATIONAL *(continued)*

WIRELESS. See the world as a Radio Officer in the Merchant Navy; short training period. low fees: scholarships. etc. available. Boarding and Day students. Stamp for prospectus. WIRELESS COLLEGE, Colwyn Bay.

Radio Television & Electronics

Learn at home with the world's largest home study organisation, Brit.I.R.E.; City & Guilds; P.M.G.'s certs., etc. Also Practical Courses with equipment. No books to buy.

Write for FREE prospectus stating subject to

I.C.S.

(Dept. 541), Intertext House, Parkgate Road, London, S.W.11

BECOME TECHNICALLY QUALIFIED in your spare time. Guaranteed diploma and exam. Home study courses in Radio. TV Servicing and Maintenance. R.T.E.B., City and Guilds, etc., Highly informative 132-page Guide free. N.I.E. (Dept. 363), 148 Holborn, London EC1.

LEARN RADIO AND ELECTRONICS the new and practical way! Hosts of absorbing experiments carried out at home under expert guidance to teach you Radio in a new. enjoyable and interesting way. Construction. servicing and fault-finding on equipment made easy for the first time! No previous experience needed. No mathematics used. Free brochure from: Dept. 11, P.W. RADIOSTRUCTOR, Reading.

$$X = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

DON'T FUMBLE with Formulae. Master Mathematics quickly and easily the Understandable Way.

1st lesson and details FREE

The Dryden School of
UNDERSTANDABLE MATHEMATICS
11F9 Dryden Chambers, Oxford St. London, W.1.

Name ....
Address ....

COURSES

COUNTY BOROUGH OF SOUTHAMPTON
EDUCATION COMMITTEE

SOUTHAMPTON TECHNICAL COLLEGE

Principal: F. T. WEST, M.B.E., A.I.STRUCT.E., M.I.PROD.E., M.R.S.H.

Department of Electrical Engineering

Head of Department:
K. E. EVERETT, M.SC. (ENG.), B.SC. (HONS.), A.C.G.I., A.M.I.E.E., M.BRIT.I.R.E.

Places are now being allocated in the following full-time courses in the Department of Electrical Engineering from September 1962:

Communication Engineering of Electronics:
Three-year course leading to College Diploma which exempts from Graduateship Examination of British Institution of Radio Engineers. Minimum age 17 years.

Marine Radio and Radar:
Two-year course leading to the Postmaster General's First Class Certificate for Radio Officers and the Ministry of Transport Certificate in Radar Maintenance. Holders of these qualifications become qualified Radio and Radar Officials in the Mercantile Marine. Minimum age 16 years.

Further details and forms of application may be obtained from the Registrar, Southampton Technical College, St. Mary Street Southampton.

COURSES *(continued)*

City and County of Bristol
Education Committee
BRISTOL TECHNICAL COLLEGE
Principal: E. POOLE, B.SC. (ENG.), M.I.MECH.E., M.I.PROD.E.

SCHOOL OF MARINE RADIO AND RADAR
Lecturer-in-Charge:
F. E. BARLTROP (ex. A.S.T. Hamble)

MARINE RADIO OFFICERS

A full-time Course for prospective Radio Officers in the Merchant Navy, leading to 2nd and 1st Class P.M.G. Certificates, and M.O.T. Radar Maintenance Certificate, is provided, and entry may be made in January May or September of each year.

Fees: **P.M.G. Courses**
Over 18 years of age, £23.10. per College year.
Under 18 years of age, £2 per College year.
M.O.T. Radar, £5 per term.

A six-week Course of Pre-Sea Training is also held, and entry is normally made on completion of Radar Course.

Details from:
Registrar, Bristol Technical College, Ashley Down, Bristol, 7.

SITUATIONS VACANT

CENTRAL ELECTRICITY GENERATING BOARD
SOUTH THAMES DIVISION
Vacancy No. 269A
ELECTRICIAN (TELEPHONES)— BRIGHTON DISTRICT

Duties consist of installation and maintenance of communications and remote control apparatus together with V.H.F. radio equipment. Applicants must have basic knowledge and experience of automatic telephone exchange apparatus with the G.P.O. or a telephone equipment manufacturer. A knowledge of radio work would be an advantage but is not essential.

The successful applicant will be required to travel around an area roughly bounded by Worthing—Lewes—Brighton, and return to base at Brighton Power Station at the end of each working day.

Rate of pay 5/8½ per hour for a 42-hour. 5-day week. Good conditions with generous holidays and sick pay scheme; optional Superannuation Scheme.

Applications stating age, training, experience, etc., should be sent to the **District Communications Engineer, Brighton "B" Power Station, Portslade-by-Sea, Sussex.**

UNITED KINGDOM
ATOMIC ENERGY AUTHORITY
ATOMIC ENERGY
ESTABLISHMENT, WINFRITH

ELECTRONIC INSTRUMENT MECHANICS

Opportunities exist for men possessing a good basic knowledge of valve and transistor electronics to carry out fault diagnosis, repair, test and calibration in the advancing field of nuclear electronic instrumentation.

Applicants should have several years experience of electronic equipment servicing but a good basic knowledge, enthusiasm and ability to learn new techniques are equally important.

Much of the equipment is of new design and, where appropriate, training will be given to successful applicants.

Married men living beyond daily travelling distance may be eligible for housing and this will be determined at time of interview. A lodging allowance is payable whilst waiting for housing. Working conditions are good and include sick pay and pension schemes.

An application form may be obtained by sending a post card quoting your name, address and the reference EL/INST/NAT to the Labour Department, A.E.E. Winfrith, Dorchester, Dorset.

SITUATIONS VACANT *(continued)*

IF YOUR HOBBY IS IN ELECTRONICS AND RADIO

perhaps you would be interested in a position on the clerical staff in the Sales Department of an Electronic Component Manufacturer in London, S.W.18. Someone aged 20/35 years, with previous commercial experience. Hours 9—5.30, five day week. Staff dining room, social club, medical facilities. Please write stating age, experience and salary required to Box 39.

RADIO MECHANIC required for work on transistor kits. Good wages and prospects for capable person. Savoy Electronics Ltd., 15 Maiden Lane, Strand, WC2. Phone: TEM 5484.

TRAINEE ELECTRO-MECHANICAL ENGINEERS

The opportunity occurs for bright young men (age 18-22), looking to the future, to build their careers in the computer field.

DO YOU have a real interest in repairing light electro-mechanical equipment and have you, through your hobbies, work or studies, acquired a basic working knowledge of electrical engineering? Are you keen to learn more and willing to work in order to advance?

If so IBM offers you practical training (on overhaul of punched card machines initially) and theoretical instruction in the engineering school, together with assistance with your college studies. After 18-24 months, according to ability, you can progress via the overhaul of more complex machines to a responsible appointment in the Workshop or to the highly responsible position of field Data Processing Customer Engineer. The starting salary is not less than £520 p.a. with free Life insurance and Pension plans.

Write now to the
MANAGER OF
PERSONNEL SELECTION,
IBM United Kingdom Limited
101 Wigmore Street
London, W.1.
(or telephone or call on
Mr. W. E. CROSS
(BYRon 7286)
Stanley Road, South Harrow, Middlesex)
Quoting reference: CE/PW/13

MINISTRY OF AVIATION E.I.D.

ELECTRONIC INSPECTORS

required for

Radio, Radar, Components and Electrical Ancillaries in laboratories at Bromley and Woolwich, and for inspection at firms' works in various part of London and Southern England on a resident or a visting basis. Varied and interesting work with opportunities for gaining valuable experience and further training. Excellent prospects of promotion to grades with pay ranging up to £1,400 a year.

PAY for FULLY SKILLED men:

£13. 6s. 0d.—£14. 1s. 0d. per week
or: £14. 6s. 0d.—£15. 6s. 0d. per week

Rate varies according to ability and class of work available.

For men not **fully skilled,** but with several years' experience in electronic work, there are vacancies at BROMLEY & WOOLWICH, with the following scales of pay:—

£12. 11s. 2d.—£12. 19s. 2d. per week
£13. 0s. 2d.—£13. 6s. 2d. per week

(with prospects of further progression).

All rates quoted are for the London area and for a 5-day week; in the provinces rates are slightly less.

Post coupon (or telephone IMPERIAL 2600 Extn. 19) for further information:—

To: **The Personnel Officer, Inspection Division, Aquila, Golf Road, Bromley, Kent. (P.W.)**

Please send me further details of inspectors' posts in ____________(type of work desired) at ____________area.

NAME ____________

ADDRESS ____________

____

TV AND RADIO, A.M.Brit.IR.E., City and Guilds, R.T.E.B. Cert., etc. on "No pass—no fee" terms. Over 95% successes. For details of exams and courses (including practical apparatus) in all branches of Radio, TV and Electronics, write for 148-page handbook, free. B.I.E.T. (Dept. 242G), 29 Wright's Lane, London W8.

A.M.I.Mech.E., A.M.Brit.I.RE., City and Guilds, G.C.E., etc., brings high pay and security. "No pass—no pay" terms. Over 95% successes. For details of exams and courses in all branches of Engineering, Building, Electronics, etc. write for 148-page handbook, free. B.I.E.T. (Dept. 242B), London W8.

ENGINEERS REQUIRED, experienced in audio techniques and relay circuitry, for work on public address systems. Also VHF test engineer for television equipment. Write, giving details to CLARKE & SMITH MFG. CO. LTD., Hanworth Air Park, Feltham, Middx.

CITY AND GUILDS (Electrical, etc.) on "No pass—no fee" terms. Over 95% successes. For details of Electrical Engineering, Applied Electronics, Automation, etc., send for our 148-page handbook, free and post free B.I.E.T. (Dept 242A), 29 Wright's Lane London W8.

Please mention "Practical Wireless" when replying to Advertisements.

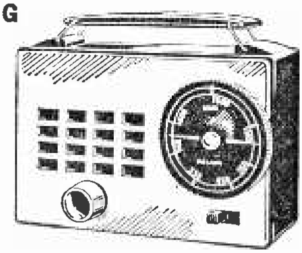
SUPER 5 TRANSISTOR POCKET RADIO

INCORPORATING

Printed Circuit — *Miniature earpiece*

Completely portable

No Aerial or Earth is required



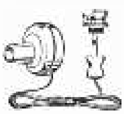
★ Size 4¾x3¼x1½in.

★ Output 200mW

★ 5 First quality transistors

★ Push-pull output

★ Fitted 2½in. high-flux moving coil speaker



ONLY **59/6**

3/6 P. & P.

Complete with internal high-gain ferrox aerial and twin tone case in Red and Black. Med/Long wave. Earpiece has sub-min jack and socket with 3ft. fine cable. Almost invisible in use. All parts available separately. Circuit diagram 1/6—Free with parts.

RADIO & TV LTD. (Dept. 5T)

21B HIGH STREET, ACTON, LONDON, W.3.

SERVICE IN A SMALLS

CONDENSERS

Miniature Ceramics. All values, 1—5,000 P.F., **6d.**

SMALL PAPERS 150v.

.001, .002, .003, .005, .01, .02, .04, .05, .1, **9d.** .25, .5, **1/3.**

SUBMINIATURE ELECTROLYTICS

15V. 1, 2, 4, 5, 8, 10, 16, 32, 50mfd. **2/-.** 12V. 100, 250, 500mfd. 3V. 1,000mfd. **2/6.**

Miniature Resistors, 10Ω—10M., **3d.**

All suitable for transistor circuits and like all our components they are Guaranteed for 12 months.

★ **MULLARD TRANSISTORS** ★

A.F. pack, 1 OC81D and matched pair, OC81, **18/-.** R.F. pack, 1 OC44, 2 OC45, **24/9.** G.E.C. Diodes, **1/-** each. 6 for **5/-.**

Yellow Plastic Case, 3 x 1$\frac{11}{16}$ x 1⅜in. Covered metal hinge, sprung snap lid, **1/6.** 3 for **3/10.** Ideal for small radios.

Why not send stamp for latest component list?

Build a Battery Operated Record Player E.M.I. 9 v. 4 SPEED PLAYER UNIT, **£5.9.6.** E.M.I. 6—9 v. 4 TRANSISTOR. Printed circuit amplifier. 1 watt output. With Speaker, **£4.9.6.** The two units, **£9.9.0.**

STUART SPARES

34 ESSEX RD., RUSHDEN, NORTHANTS

Make Your Ability PAY

UNLIMITED OPPORTUNITIES exist today for "getting on" . . . but only for the fully trained man. Let I.C.S. tuition develop *your* talents and help you to success.

STUDY IS EASY with I.C.S. guidance. The courses are thorough. Printed manuals, fully illustrated, make study simple and progress sure.

YOUR ROAD TO SUCCESS can start from here—today. Complete this coupon and post it to us, for full particulars of the course which interests you. MODERATE FEES INCLUDE ALL BOOKS.

Take the right coarse now . . .

ADVERTISING
Gen. Advertising, Retail & Dept. Store Copywriting.

ART
Oil & Water Colour
Commercial Illustrating

BUILDING
Architecture, Clerk of Wks., Buildg. Constr. & Allied Trades, Quantity Surveying.

CIVIL ENGINEERING
Highway Eng., Struct. Engrg., Concrete Engineering

COMMERCE
Bookkeeping, Accountancy, Office Training, Costing, Secretaryship Storekeeping
Shorthand & Typewriting

DRAUGHTSMANSHIP
Architectural, Mechanical, Maths. & Machine Drawing
Drawing Office Practice
Structural Drawing

ELECTRONICS
Industrial Electronics
Computers & Maintenance

FARMING
Arable & Livestock
Farm Machinery Maint.
Pig & Poultry Keeping
Market Gardening

FIRE ENGINEERING
I.F.E. Examinations
Fire Service Promotion

GENERAL EDUCATION
Good Eng., Foreign Langs.
G.C.E. subjects at ordinary or advanced level

HORTICULTURE
Complete Gardening
Flower & Veg. Growing

MANAGEMENT
Business Management
Hotel Management
Office Management
Industrial Management
Personnel Management
Work Study, Foremanship

MECHANICAL & MOTOR ENGINEERING
Engineering Maths., Weldg.
Diesel Engines and Locos.
Inspection, Workshop Pract.
Refrigeration, Motor Mech.
Running and Maintenance (many other subjects)

PHOTOGRAPHY
Practical Photography
P.D.A. Examination

POLICE
Police Entrance Exam.

RADIO, T.V. & ELECTL.
Radio Servicing & Engrg.
T.V. Servicing & Engrg.
Radio Constrn. (with kits)

SELLING
Commercial Travellers
Sales Mangnt, Ret. Selling

WRITING FOR PROFIT
Short Story Writing
Free-Lance Journalism

And many other subjects

INTENSIVE COACHING for all principal examinations including C.I.S., A.C.C.A., I.C.W.A., B.I.M., A.M.I.Mech.E. Brit.I.R.E., I.Q.S., City & Guilds of London Institute, R.H.S., P.M.G. Certificates in Radiotelegraphy, etc.

Start today the I.C.S. way!

(Dept. 172)

Intertext House, Parkgate Rd., London, S.W.11

Send FREE book on ______________________

Name ______________________

Address ______________________

____

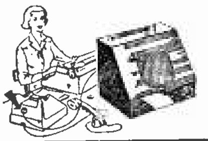
Occupation ______________________

9.62

INTERNATIONAL CORRESPONDENCE SCHOOLS

ALL-TRANSISTOR
● TIME SAVER ●
OFFICE OR HOME TELEPHONE PICK-UP AMPLIFIER

★ No more "holding on" wasting time waiting for your call to come through. When it does the amplifier can be switched off if required. **No** connections, just press the pick-up coil to back of phone as below. Fully Guaranteed. Housed in attractive Gold Finish Cabinet.



BUILT, TESTED, READY TO USE

£5.10.0

P.P. 2/6

4 TRANSISTOR BABY-ALARM
Very sensitive, £5.10.0 P.P. 2/6.

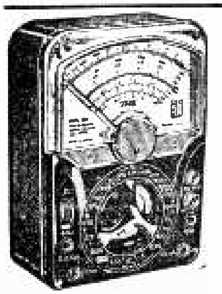
MODEL TH-L33

2,000 ohms per volt AC/DC. Size 5 x 3½ x 1½in.

79/6 Fully Guaranteed

with test leads, battery and instructions.

0/10/50/250/500/1000 volts D.C., 0/10/50/250/500/1000 volts A.C., 0/500µA/10/250mA., D.C.
3 ranges resistance 0/10K/100K/1 Meg. Capacity and db ranges.



MODEL 500

30,000 ohms per volt multi-meter

£8.19.6

Fully Guaranteed

8 Ranges D.C. volts to 1 kV.
7 Ranges A.C. volts to 1 kV.
5 Ranges D.C. current to 12 amps.
3 Range resistance to 60 meg.
Short circuit, Buzz test. Output meter dB, etc., etc. Size 6½ x 4½ x 2½in. With Leads, Batteries and Instructions.

MODEL TP5S

A.C./D.C. voltage up to 1,000 in 5 ranges. D.C. current 4 ranges up to 500mA. 4 range resistance to 10 megs. Capacity dB scales, etc. **20,000 ohms/volt** Fully Guaranteed

£5.19.6

With Test Leads, Battery and Instructions. Size 5½ x 3½ x 1¾in.

LATEST ILLUSTRATED CATALOGUES NOW AVAILABLE 1/-

1. 4-Transistor 2-way Intercomm. 2-way buzzing, 2-speakers, ready to use, **8 gns.** P.P. 2/6.
2. Miniature 15 watt Solder Iron, $\frac{3}{16}$ bit. Ideal for all printed circuit work, **29/6,** P.P. 1/6.
3. New Model Control Book with 60 pages of transistor circuits, **7/6,** P.P. 6d.
4. Complete Set of Meter Leads with Prods. Clips etc. with pouch, **8/6,** P.P. 1/-.
5. Telephone Recording Coil to record conversations. For all amplifiers and recorders, **14/-**, P.P. 9d.
6. Printed Circuit Kit, to etch your own circuits. Complete with boards and details, **19/6,** P.P. 1/-.
7. Miniature 850 ohm Record/Playback Head, with mounting block, **12/6,** P.P. 9d.
8. 4,000 ohm lightweight Headphones with leads. Very sensitive, **12/6,** P.P. 1/-.
9. Transistor Pocket RF, IF Generator for Radio, TV etc. Fault finding, **52/6,** P.P. 1/-.
10. 8-Range All Transistor Signal Generator, 200 kc/s to 220 mc/s: RF, AF, IF, HF, etc., **£7.10.0,** P.P. 3/6.
11. GS12C (Dekatron) Bi-directional 12 way indicator tube. Brand new, **25/-.**
12. 4½-9 volt Tape Recorder Motor, governed. **12/6.** P.P. 1/-.
13. 30 watt Pocket Solder Iron, with pocket pouch and mains plug, **18/6,** P.P. 1/-.
14. 931A Photo Multiplier. Brand new, **60/-.**
15. 1 Kc/s Transistor Audio Test osc., variable output, **39/6,** P.P. 1/6.
16. Crystal Contact Microphone. Very sensitive. Ideal for Guitar, **12/6,** P.P. 9d.
17. Practical Transistor Circuits. 40 circuits to build, **3/6.**
18. Personal Earphones with leads, Jack plug and socket, 600 ohm, **10/6;** 1000 ohm **12/6;** Crystal **9/6;** 8/10 ohm **9/6.**
19. W/W Erase Head, FE7, **7/6,** P.P. 6d.
20. Dynamic Microphone, **49/6,** P.P. 1/6.
21. Extension Speaker Unit. Plugs into phone socket of most portables. Gives big set volume. Ideal for car use, **57/6,** P.P. 1/6.

Miniature Panel Meters
0/50µA (DC) 39/6
0/500µA (DC) 32/6
0/1mA (DC) 27/6
0/5mA (DC) 27/6
0/300 volts (DC) 27/6
Brand New Boxed

Miniature 4-Transistor 250 mW Amplifier. Size 3 x 1¾ x ¾in. Push-Pull output. Built and tested with circuit. **52/6.** P.P. 1/6

22. 7-Section Telescopic Aerial, **12/6.**
23. LAI Ferrite Pot Core, **12/6,** P.P. 6d.
24. Stereo Stethescope Type Miniature Phones, **27/6,** P.P. 1/6.
25. Miniature Jack and Socket, **3/6,** P.P. 6d
26. No. 19 Set Crystal Calibrator with Handbook, **79/6,** P.P. 2/-.
27. New 2-way Intercomm with 2-way calling. Supplied with cable, battery, etc. Housed in moulded cabinets. **89/6,** P.P. 2/-.
28. Battery Eliminator and Charger for PP3 9 volt Batts. Ready to use. **29/6,** P.P. 1/6 with details
29. 9 volt 80 mA battery eliminator kit for larger portables, **35/-,** P.P. 1/6.
30. Transistor Pocket Radio with speaker output. Complete in moulded cabinet with battery, earphone, carry case telescopic aerial, etc., **99/6,** P.P. 1/6.

Henry's Radio Ltd

PADdington 1008/9
5 HARROW ROAD, LONDON W2
Open Monday to Sat. 9-6, Thurs. 1 o'clock
TRADE SUPPLIED

PLEASE TURN TO BACK PAGE

TRANSISTOR PORTABLE TAPE RECORDER
FOR OFFICE, HOME OR TRAVEL

● Play/record up to 30 mins. ● Built-in speaker, volume control, batteries and play/record/rewind. ● Quality reproduction. ● Sturdy case 6 x 8½ x 2¾in.

£10.10.0
P.P. 3/6.

Fully guaranteed

Supplied complete with microphone, tape, batteries and personal phone (for monitoring), and full instructions. Built and tested.

CRYSTAL MICROPHONES

ACOS 39-1. Stick Microphone with screened cable and stand (list 5 gns.), **32/6.** P.P. 1/6.
ACOS 40. Desk Microphone with screened cable and built-in stand (list 50/-), **15/-.** P.P. 1/6.
ACOS 45. Hand Microphone with screened lead, very sensitive, **25/-.** P.P. 1/6.
100 C. Stick Microphone with muting switch and screened cable, detachable desk stand, cord and neck, **39/6.** P.P. 1/6.
MC 24. Stick Microphone with muting switch and cable, **25/-.** P.P. 1/6.
LAPEL. Miniature Mic. With clip. Ideal for recording, **15/-.** P.P. 1/-.

3/4 WATT 4 TRANSISTOR AMPLIFIER

● 1 watt peak output.
± 3db 70c/s to 12 kc/s.
Output to 3 ohm speaker
9 volt operated.
Details on request.

Built and Tested **69/6** P.P. 1/6 **OR** **Kit of Parts** **59/6** P.P. 1/6

A printed circuit high gain amplifier size 4 x 2¼ x ¾in. using Mullard OC71/OC81D and 2-OC81 Transistors. Ideal for Intercomm., Record Player, Tuner Amplifier or any application requiring a quality and reliable amplifier.

BATTERY RECORD PLAYER

● 6-7½ volt Garrard turntable with crystal pick-up. Plays 45 r.p.m. Ideal for above amplifier.
65/- P.P. 1/6
● Suitable cabinet for amplifier and player **22/6.**

TRANSISTORS AND COMPONENTS

We can supply from stock 1st grade transistors, diodes, rectifiers. Silicon or Germanium. Matched sets at special reduced prices. Complete list on request.

QUOTATIONS FOR YOUR CIRCUIT BY RETURN

Practical Wireless

—BLUEPRINT— —SERVICE—

ALL OF these blueprints are drawn full-size and although the issues containing descriptions of these sets are now out of print, constructional details are available free with each blueprint except for the PW Monophonic Electronic Organ and the PW Roadfarer.

The Index letters which precede the Blueprint Number indicate the periodical in which the description appeared. Thus PW refers to PRACTICAL WIRELESS; AW to *Amateur Wireless* and WM to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the Blueprint (stamps over 6d. unacceptable) to PRACTICAL WIRELESS, Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, London. W.C.2.

Title	*Number*	*Price*
CRYSTAL SETS		
Junior Crystal Set	PW94	2/-
Dual-wave Crystal Diode	PW95	2/6
STRAIGHT SETS		
Battery Operated		
Modern One-valver	PW96	2/6
All-dry Three	PW97	3/6
Modern Two-valver	PW98	3/6
SUPERHETS		
A.C. Band-pass Three	PW99	4/-
A.C. Coronet-4	PW100	4/-
A.C./D.C. Coronet	PW101	4/-
The PW Pocket Superhet	—	5/-
MISCELLANEOUS		
The PW 3-speed Autogram	—	8/-
The PW Monophonic Electronic Organ *(No constructional details are available with this blueprint)*	—	8/-
The PW Roadfarer *(No constructional details are available with this blueprint)*	—	5/-
TELEVISION		
The PT Band III converter	—	1/6

SPECIAL NOTE

THE following blueprints include some pre-war designs and are kept in circulation for those constructors who wish to make use of old components which they may have in their spares box. *The majority of the components for these receivers are no longer stocked by retailers.*

Title	*Number*	*Price*
A.C. Fury Four	PW20	2/6
Experimenter's Short Wave	PW30a	2/6
Midget Short Wave Two	PW38a	2/6
Band-Spread Three (Battery)	PW68	2/6
Crystal Receiver	PW71	2/-
Signet Two (Battery)	PW76	2/6
Simple S.W. One-valver	PW88	2/6
Pyramid One-valver	PW93	2/6
BBC Special One-valver	AW387	2/6
A One-Valver for America	AW429	2/6
Short-Wave World Beater	AW436	3/6
Standard Four Valve S.W.	WM383	3/6
Enthusiast's Power Amplifier	WM387	3/6
Standard Four Valve	WM391	3/6
Listener's 5-Watt Amplifier	WM392	3/6

QUERY COUPON

This coupon is available until 7th September, 1962, and must accompany all queries in accordance with the notice on our "Letters to the Editor" page.

PRACTICAL WIRELESS, SEPTEMBER, 1962

Published on the 7th of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, London, W.C.2, and printed in England by WATMOUGHS LIMITED, Idle, Bradford; and London. Sole Agents for Australia and New Zealand; GORDON & GOTCH (A/sia). Ltd., South Africa and Rhodesia; CENTRAL NEWS AGENCY, LTD. East Africa; EAST AFRICAN STANDARD LTD. Subscription rate including postage for one year: Inland £1.9.0. Abroad £1.7.6 (Canada £1.5.0.). Registered at the General Post Office for the Canadian Magazine Post.

Redesigned 'Contessa' Mk. III

★ *combined portable and car radio* ★

NOW WITH 600 mW **MELLOWTONE** OUTPUT ON MEDIUM AND LONG WAVES.

NOW FITTED HORIZONTAL TUNING SCALE WITH ALL STATIONS CLEARLY MARKED.

NOW SUPPLIED WITH SIX MULLARD TRANSISTORS AND TWO DIODES.

NOW FITTED RECORDING SOCKET AND CAR AERIAL SOCKET.

NOW SUPPLIED WITH TWO-TONE BEIGE OR TWO-TONE BLUE CABINET WITH GOLD FITTINGS.

GUARANTEED THE VERY BEST OBTAINABLE

● **All parts sold separately** ●

TOTAL COST £10.19.6 P.P. 3/6

OVERALL SIZE $10\frac{3}{4} \times 7\frac{3}{4} \times 3\frac{5}{8}$in.

● **Detailed Leaflet on Request** ●

The New "CONTESSA" 6-Transistor Portable Superhet Radio features simple printed circuit construction and fully illustrated building instructions, with all parts clearly marked and identified. Fitted with 8 inch Ferrite Aerial, double IFT's and the latest in components and design. Full tuning of both Medium and Long Wave Bands with unbeatable Selectivity and Sensitivity. Clearly marked station dial and room filling "MELLOWTONE" push-pull output are standard features. Performance is guaranteed to be better than any other design available to the home constructor whether used at home, out and about, or in a car.

FULL AFTER SALES SERVICE AND GUARANTEE

★ **ALL THESE EXTRA FEATURES AT NO EXTRA COST** ★

"QUINTET" MEDIUM AND LONG WAVE POCKET RADIO

PUSH-PULL SPEAKER OUTPUT

Size $5\frac{1}{4} \times 3 \times 1\frac{3}{4}$in.

Red or Blue with Gold trim.

Total Cost £5.10.0 P.P. 2/-

A Five-Transistor and Diode medium and long wave printed circuit loudspeaker radio. Features Mullard transistors and plainly marked printed circuit with carded components. Excellent results with full station separation guaranteed. Including Radio Luxembourg. Push-pull output up to 200 mW. Fitted 'Phone/Record socket and Car aerial socket. **Full after sales service and guarantee.**

"TRANSFIVE" PORTABLE RADIO

Medium and Long Wave Portable

$8\frac{1}{2} \times 6\frac{1}{2} \times 3\frac{1}{2}$in.

£6.19.6 P.P. 2/6

A simple to build 5-Transistor and Diode, Printed Circuit, Medium and Long Wave Portable. Features 5in. speaker, Car aerial socket, Mullard transistors and carded components. Building plans free on request. THE IDEAL PORTABLE. **Full after sales service and guarantee.**

"CAPRI" POCKET SIX. 6-TRANSISTOR MEDIUM AND LONG WAVE POCKET SUPERHET RADIO.

● SIZE $4\frac{1}{2} \times 2\frac{3}{4} \times 1\frac{1}{4}$in. REALLY POCKET SIZE ●

The most compact 6-transistor and diode radio with speaker available to the home constructor. Features the latest in miniature components and circuitry. Supplied with Mullard transistors and two-tone moulded cabinets in red/white or Blue/White with gold fittings. All components are supplied in packets and clearly identified. A printed circuit is used with fully illustrated building instructions. Push-pull output coupled with a sensitive and selective circuit make the "CAPRI" hard to beat. Fitted Earphone/Record socket.

● FULL AFTER SALES SERVICE AND GUARANTEE.

● ALL PARTS SOLD SEPARATELY—DETAILED LEAFLET ON REQUEST

★ **DESIGNED BY EXPERTS FOR THE HOME CONSTRUCTOR** ★

TOTAL COST £7.10.0 P.P. 2/- (Battery 2/6)

"RANGER 3"

Size $4\frac{3}{4} \times 3 \times 1\frac{1}{2}$in.

A Three-Transistor Two-Diode Personal Radio for Medium Waves and Amateur top band and shipping. Quality output on personal phone. Fitted air spaced tuner, vol. control. No aerial or earth. **Luxembourg guaranteed.**

69/6 P.P. 1/6

"CARVERTER"

MOBILE TRANSISTOR SHORT WAVE CONVERTER

As featured in the May Edition of Radio Constructor. Just plugs into the aerial socket of your car radio. Crystal controlled—covers amateur and short wave broadcast bands from 5 to 16 Mc/s.

Total cost with sprayed cabinet, etc. 69/6 P.P. 2/-

Supplied complete with long life battery and 39/40 metre band crystal. Send 1/- stamp for full Booklet. **No modifications to car radio at all.**

'PW' TROUBADOUR

7-Transistor Superhet

Medium and Long Wave Radio

Size $5\frac{3}{4} \times 3\frac{3}{8} \times 2$in.

£8.10.0 P.P. 2/-

('PW' SIX £7.19.6 P.P. 2/-)

Modified version of previously advertised "PW" Superhet. Now with new style Two-Tone Cabinet. 1st grade components and transistors. Printed circuit. Features matched set of 7 Transistors, New $2\frac{1}{2}$ inch quality speaker and new illustrated building instructions.

PW Troubadour
PW Mercury
PW Regency
PW Alpha 3
PW Mini-amp
PW Citizen
P Superhet
PW Shortwave 2
PW Feeder Unit

All parts in stock for ALL PW Designs. Parts Lists on Request.

And the latest PW Designs.

Henry's Radio Ltd

PADdington 1008/9

5 HARROW ROAD, LONDON W2

Open Monday to Sat. 9-6 Thurs. 1 o'clock

Send 1/- Stamp for Latest Illustrated Price Lists.

PLEASE TURN PAGE

7 18