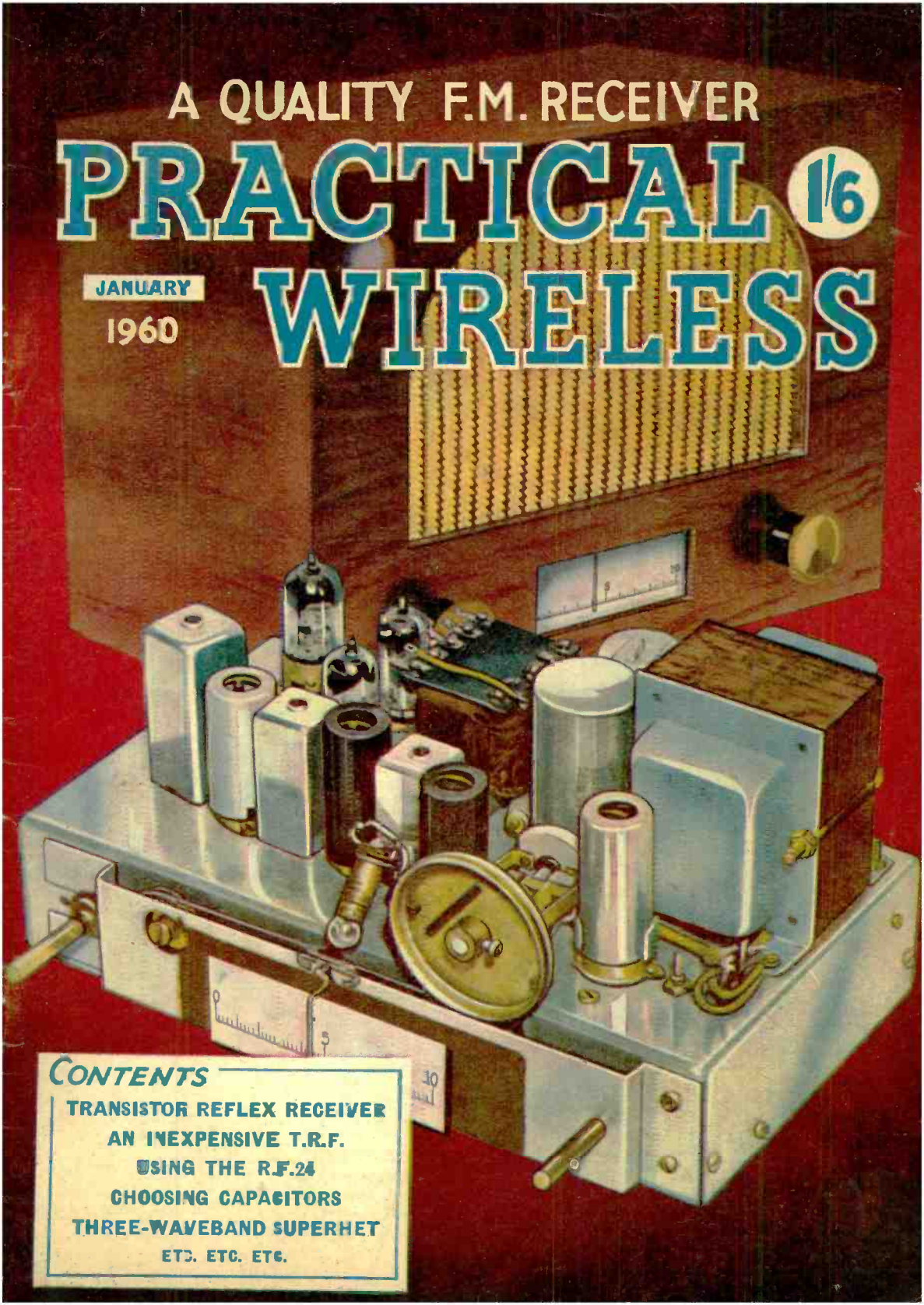
A QUALITY F.M. RECEIVER

PRACTICAL WIRELESS

1/6

JANUARY 1960



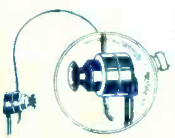
CONTENTS

COLLINS T.C.S. TRANSMITTERS & RECEIVERS

If both units purchased together. £17.0.0. carr. 25/-.

T.C.S. TRANSMITTER. Designed for Mains and Mobile operation covering 1.5-12 Mc/s. (160-80-40 metre bands) consists of V.F.O., buffer, doubler, P.A. with internal push-pull modulator, provision for V.F.O. or crystal control on 4 channels. Output 25 watts phone, 50 watts C.W. Complete with aerial current meter scaled 0-3 amps. R.F. and plate current meter scaled 0-200 M.A., for phone and C.W. Panel controls : Aerial coupling, plate tuning, aerial selector, aerial loading unit, band selector, oscillator selector emission switch, power switch, geared and calibrated tuning drive, microphone and key inputs. Offered in used condition complete with full details. **£9.10.0** carr. 15/-.

T.C.S. RECEIVER. 1.5 — 12 Mc/s. 7 valve superhet, built like a dream. 12SK7-RF, 12SA7 mixer, 12A6 oscillator, 12Q7 detector, AVC-BFO-1st AF, 12SK7-1.Fs. The 12A6 final puts 1.4 watts into 500 ohms with an input modulated only 30%. Panel controls : R.F. Gain, A.F. Gain, C.W. Pitch, bandswitch, mod-C.W. switch, power switch, ground and aerial posts, M.O. or crystal frequency switch, speaker jack, card holder to log 30 stations, hand vernier tuning knob turning a large etched calibrated plate behind hair lined window, anti-backlash gears used. Used condition. **£8.10.0** carr. 15/-.



LIGHT-WEIGHT HEADSET. These H.S. 30 phones are the smallest used by the U.S. Air Force. 250Ω imp. using soft rubber miniature ear moulds for maximum music and voice reproduction of the finest quality. Supplied free is a small transformer unit with cord and plug which steps impedance up to 4.000Ω. ONLY 15/-. P. & P. 2/6.

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

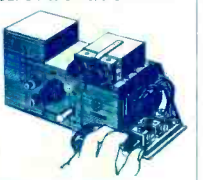
WALKI TALKI INTERCOM Two "space styled" telephone units in beautiful two-tone finish. No batteries or soldering required, simply connect twin wire between the two units and talk into microphone or listen on one and listen to speaker or talk on the other. Ideal for intercom from house to house, room to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

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

CONVERT TO V.H.F.

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

COMPLETE MORSE TRAINING UNIT



Complete Code Set contains key, buzzer, headphones, pitch control, operating internal battery, housed in portable wooden case. Brand new, only 12/6. carr. 5/-, battery 1/6 extra.

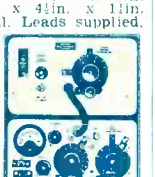
WIRELESS SET NO. 19 MK.II

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

POCKET MULTIMETER

2,500 o.p.v. Multi range 6/30/120/300/1,200 v. A.C., ditto D.C. 0-1 K., 0-1 megohm : 400 MicroA., 12 mA., 300 mA. —00 to +64 D.B. 5 ranges : 3in. x 4½in. x 1¼in. Large clear dial. Leads supplied.

List Price £6.19.6.
OUR PRICE £4.7.6.
Saving you £2.12.0.
P. & P. 2/6.



PORTABLE TRANS/RECEIVER No. 18

A self-contained Trans/Receiver for Telephone and C.W. Range approx. 10 miles. Freq. : 6-9 Mc/s. (50-33.3 metres). Valve line-up : 3 ARP-12, 2 AR-8, 1 ATP-4. Complete with aerial, H.T. and L.T. meter and all accessories. Weight 20 lbs. Size 8 x 10 x 17in. BRAND NEW ONLY 80/- Carr. 10/-.

CONTROL BOX—B.C.602.

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

D.M.34. America's finest little dynamotor offering 12 v. in with 220 v. out at 80 mA. With suppression and smoothing mounting base. Size 4½ x 2½ x 2¾in. Original packing. ONLY 35/-. P. & P. 3/6.

1 mA METER 2in. round, 17/6. P. & P. 1/6.

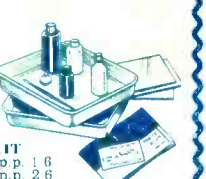
HI-FI CO-AX SPEAKERS BRAND NEW—U.S.A. MADE. 12in. Co-axial Speaker. The woofer uses 6.8 oz. Alnico 5 magnet. Has 3in. tweeter and an electronic crossover network to separate the speaker functions. Frequency response : 40-17,000 cycles. Output 12 watts, impedance 8 ohms. ONLY 160/-. 8in. 2½in. tweeter, 10 watts, etc.. 90/-. P. & P. 4/- on each.

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

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

ETCH YOUR OWN PRINTED CIRCUITS

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



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

1 Transistor diode pocket radio ... 24/6. p.p. 1/6
2 valve 3 watt mains amplifier ... 49/6. p.p. 2/6
3 Transistor Super Pocket Radio ... 72/6. p.p. 2/6

All kits supplied entirely complete with full wiring and assembly details. Fully guaranteed.

Relda Radio ltd

Callers: **87, Tottenham Court Road, London, W.1.**
Mail orders: **(Dept. P), 32a, Coptic Street, London, W.C.1.**
Telephone : **MUSeum 9607**

See top of opposite page for another RELDA SPECIAL!

Stern's "fidelity" TAPE EQUIPMENT

A SELECTION OF HIGH FIDELITY PORTABLE TAPE PREAMPLIFIERS

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

IN ALL MODELS WE INCORPORATE THE TYPE "C" PREAMPLIFIER

AND OFFER IT COMPLETE IN CASE WITH . . .

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

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

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

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

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

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

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

PRICES.....INCLUDING SEPARATE SMALL POWER SUPPLY

COMPLETE KIT OF PARTS **£14.0.0**

ASSEMBLED AND TESTED **£17.0.0**

Dep. £3.9.0 and 12 of £1.4.11.

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

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

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

(a) The COLLARO "STUDIO" TAPE DECK and our Mullard Type "C" PREAMPLIFIER and Power Unit Assembled and Tested..... H.P. Deposit £6.10.0. and 12 months £2.7.8. **£32.10.0**

(b) As above but TYPE "C" PREAMPLIFIER supplied as complete KIT OF PARTS..... **£29.0.0**

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

(d) As (c) but Type "C" as COMPLETE KIT OF PARTS **£32.0.0**

(e) The TRUVOX Mk. VI DECK and the assembled Type "C" Preamplifier and Power Unit..... H.P. Deposit £8.0.0. and 12 months £2 18.3. **£40.0.0**

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

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

(h) As (g) but Type "C" as complete KIT OF PARTS **£43.0.0**

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

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

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

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

YOU CAN BUILD A COMPLETE TAPE RECORDER

for £36.0.0

H.P. TERMS Deposit £7.4.0. 12 months £2.12.10.

FOR THIS WE SUPPLY:

★ COMPLETE KIT OF PARTS TO BUILD THE HF/TR3 TAPE AMPLIFIER.
★ THE NEW COLLARO "STUDIO" TAPE DECK.
★ PORTABLE CARRYING CASE (as illustrated).
★ ROLA-CELESTION 10in. x 6in. P.M. LOUDSPEAKER.
★ ACOS CRYSTAL MICROPHONE. 1.200ft. SPOOL E.M.I. TAPE. For those who prefer another type of TAPE DECK we will supply precisely as above—but IN PLACE of the COLLARO "STUDIO" DECK—WE INCLUDE :

(a) The Mk. IV COLLARO "TRANSCRIPTOR" DECK **£39.15.0**
H.P. Deposit £8.0.0 and 12 months £2.18.2. (£1 extra if we are required to wire up the Transcriptor Switch Banks.)

(b) The New TRUVOX Mk. IV DECK..... **£45.0.0**
H.P. Deposit £9.0.0. and 12 months £3.6.0.

(Carriage and Insurance on all above is 12/6 extra.)

For Constructors with their own Cabinet WE OFFER :

(a) COMPLETE KIT to build the HF/TR3 Amolifier, together with the COLLARO "STUDIO" DECK... **£28.0.0**

(b) As above but with HF TR3 supplied ASSEMBLED and TESTED **£31.10.0**
H.P. Deposit £6.6.0. and 12 months £2.6.0.

(c) COMPLETE KIT to build the HF/TR3, together with the Mk. IV COLLARO "TRANSCRIPTOR" TAPE DECK **£30.15.0**
(£1 extra if we are required to wire up Deck Switch Banks.)

(d) As above but HF/TR3 supplied ASSEMBLED and TESTED **£34.10.0**
(£1 extra if we are to wire up Deck Switch Banks.)

(e) COMPLETE KIT to build the HF/TR3, together with the NEW TRUVOX Mk. VI TAPE DECK..... **£36.0.0**

(f) As above but HF/TR3 supplied ASSEMBLED and TESTED **£39.10.0**
H.P. Deposit £7.18.0. and 12 months £2.17.11.

(g) COMPLETE KIT to build the HF/TR3 AMPLIFIER with the BRENELL Mk. V TAPE DECK..... **£41.10.0**

(h) As above but HF/TR3 supplied ASSEMBLED and TESTED **£45.0.0**
H.P. Deposit £9.0.0. and 12 months £3.6.0.

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

Attractive PORTABLE CASE is available to accommodate the TRUVOX or COLLARO TAPE DECKS and we offer it, together with ROLA-CELESTION 10in. x 6in. LOUDSPEAKER—ACOS CRYSTAL MICROPHONE—and 1,200 ft. SPOOL E.M.I. TAPE—ALL FOR £9.0.0. Carriage and Insurance 5/- extra.

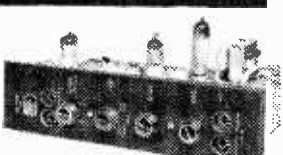
WE HAVE THE NEW 2 SPEED TWIN TRACK TRUVOX Mk VI TAPE DECK IN STOCK £26.5.0
DEPOSIT : £5.5.0 and 12 MONTHS : £1.18.6

THE MODEL HF/TR3 TAPE AMPLIFIER

INCORPORATING

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

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



PRICE FULLY ASSEMBLED & TESTED £16.10.0

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

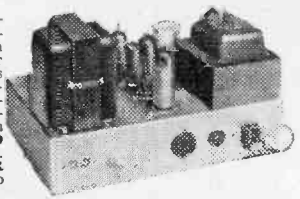
MULLARD DESIGNS

Still by far the finest value

Designed by MULLARD—presented by STERNS strictly to specification.

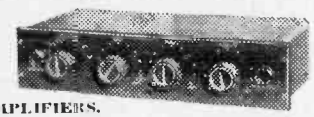
COMPLETE KIT OF PARTS—

MULLARD "5-10" MAIN AMPLIFIER



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

MULLARD'S PRE-AMPLIFIER TONE CONTROL UNIT



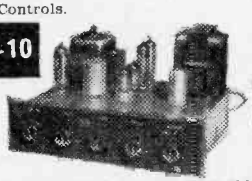
Employing two EF86 valves, and designed to operate with the MULLARD 3-3 and 5-10 **MAIN AMPLIFIERS**, but also perfectly suitable for other makes.
PRICE, COMPLETE KIT OF PARTS, **£6.6.0** Alternatively we supply ASSEMBLED AND TESTED **£8.0.0** (Carriage & Insurance, 5/- extra.)
Our kit is strictly to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

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

SPECIAL PRICE REDUCTIONS

(a) The **COMPLETE KIT OF PARTS** to build both the "3-3" **MAIN AMPLIFIER** and the 2-**STAGE PRE-AMPLIFIER-CONTROL UNIT** **£12.10.0**
(b) The **COMPLETE KIT OF PARTS** to build the "5-10" **MAIN AMPLIFIER** and the 2-**STAGE PRE-AMPLIFIER-CONTROL UNIT** **£15.15.0**
(a) The "3-3" and the 2-**STAGE PRE-AMPLIFIER** both **ASSEMBLED** and **TESTED** **£15.0.0**
H.P. : **DEPOSIT** £3.0.0 and 12 **Monthly Payments** of £1.2.0.
(b) The "5-10" and the 2-**STAGE PRE-AMPLIFIER** both **ASSEMBLED** and **TESTED** **£18.18.0**
H.P. : **DEPOSIT** £3.16.0 and 12 **Monthly Payments** of £1.7.8. When ordering include an extra 7/6 to cover Carriage and Insurance.
PRICES FOR THE "5-10" ARE SUBJECT TO £1.6.0 EXTRA IF THE PARTRIDGE TRANSFORMER IS REQUIRED.

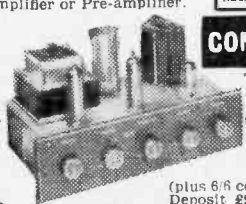
COMPLETE MULLARD 5-10



The popular and very successful complete "5-10" incorporating Control Unit providing up to 10 watts high quality reproduction. Input channels for high output pick-ups and all modern Radio Tuning Units only Specified Components and new **MULLARD VALVES** are supplied, including **PARMEKO MAINS TRANSFORMER** and choice of the latest **PARMEKO** or **PARTRIDGE** ULTRA-Linear Output Transformers. Adequate power available to drive Radio Tuner. **£11.10.0**

Alternatively we supply ASSEMBLED and TESTED **£13.10.0**
HIRE PURCHASE (Assembled Amp. only) DEPOSIT : £2.14.0. 12 MONTHS : 19/10.
ABOVE incorporating PARTRIDGE OUTPUT TRANS.. £1.6.0 extra.

COMPLETE MULLARD 3-3



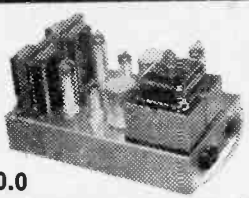
THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION

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

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

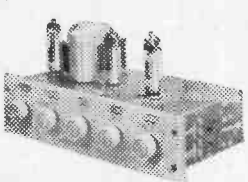
MULLARD—STERN STEREO DESIGNS

DUAL "3-3" MAIN AMPLIFIER



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

COMPLETE STEREO AMPLIFIER



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

DUAL CHANNEL PRE-AMPLIFIER

This model incorporates two 2-valve Pre-Amplifiers (described above) combined into a Single Unit, enabling it to be used for both **STEREOPHONIC** or **MONAURAL** operation. It is designed primarily to operate with our range of **MULLARD MAIN AMPLIFIERS** but will also operate equally well with any make of Amplifiers requiring an input of 250 m/volts.
COMPLETE KIT OF PARTS **£12.10.0** ASSEMBLED AND TESTED **£15.0.0**
It will operate equally well for **MONAURAL** only operation with one "3/3" or one "5/10" Main Amplifier to which the second Main Amplifier can at any time be added, thus very easily providing for both **STEREO** or **MONAURAL** reproduction. Recommended combinations for **STEREO** operation :
(a) The **DUAL CHANNEL PRE-AMPLIFIER** together with the Dual "3.3" **MAIN AMPLIFIER.**
(b) The **DUAL CHANNEL PRE-AMPLIFIER** together with two "5/10" **MAIN AMPLIFIERS.**
THE ASSEMBLY MANUAL is available for 2/6.

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

STERN RADIO LTD.

Stern's "fidelity" TAPE RECORDERS

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

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

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

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

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

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

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

!! RADIOGRAM CHASSIS !!

ARMSTRONG MODEL AF/208..... **£23.2.0**
7 valve AM/FM Chassis producing Max. 5 watts output.

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

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

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

RADIO TUNING UNITS

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

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

DULCI "H4/T" AM/FM UNIT **£23.15.8**
A 4 waveband self-powered high-fidelity tuner covering the VHF/FM transmissions plus the long, medium and short wavebands.
NEW HIRE PURCHASE TERMS are available on all above. Illustrated leaflets available—send S.A.E. (Carr. and Ins. 5/- extra.)

A SPECIAL CASH ONLY OFFER !!

This very attractive **PORTABLE AMPLIFIER CASE** together with a good quality **GRAM AMPLIFIER** and a matched **P.M. SPEAKER.**

ALL for ONLY **£8.7.6** (Plus 7/6 Carr. & Ins.)

The Amplifier consists of a 2-stage design incorporating 3 modern B.V.A. valves and has separate BASS and TREBLE CONTROLS. The Portable Case will also accommodate almost any make of Autochanger and is attractively finished in Mushroom Grey Rexine.
WE ALSO SUPPLY SEPARATELY—
(a) The 2-stage (plus Rectifier) **AMPLIFIER** **£4.2.6** (b) The **PORTABLE CARRYING CASE** **£3.17.6**
(c) **P.M. SPEAKER** **18/9** Carriage and Insurance 4/- extra.

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A bulk purchase enables us to offer a very useful
INTERCOM SET OR BABY ALARM *for only* **£5.5.0**
(Plus 5/- carriage & Insurance).
Consists of MASTER UNIT and one EXTENSION, providing 2-way TALK-LISTEN facility. Complete in polished wood cases, size of each only 7¼ x 4¼ x 6in. high.

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

PRICE £14.5.0 (Plus 5/- Carr. and Ins.)
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Incorporates the latest MULLARD PERMEABILITY TUNING HEART and the corresponding MULLARD VALVE LINE-UP. A really first-class Tuner, very attractively presented and comparable to many offered at much higher prices. Power consumption is only 15 amps. at 6.3 volts and 25 m/a at 250 volts.
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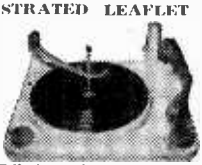
£6.12.6



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

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100 RESISTORS 7s. 6d.
A WELL-BALANCED SELECTION—A MUST

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DIODES. Equivalent to **GEX44, 3/9.**

B.S.R. MONARCH UA8

4-speed mixer Autochanger **£7.19.6**

COLLARO "CONQUEST"

Hi-Fi 4-speed, 10 record Autochanger. Brand new, unused. **£6/19/6** Limited Quantity

or Carton containing 2 Players **£13/-/-**

STEREO: Famous make single player. Stereo equipped. Unrepeatable at this price. **£6/19/-** Carr. 3/-

4-SPEED RECORD PLAYERS

Latest Turntable, together with lightweight Staar Galaxy dual sapphire crystal turnover pick-up head. Truly amazing value. at **£3/10/-** Carr. 3/-

A RADIO SET, complete for only **29/-**

6K7, 6K8, 6Q7, 6V6 with Speaker plus 5/- and 6-volt vibrator pack. Suitable for carriage, adaption as car radio.
TRANSMITTER POWER PACKS. 230v. A.C. 2 separate smoothed outputs 375, 550 or 620 v. 200/250 mA., 6.3 v. 5 a. Boxed. 4 5U4G, **£7/10/-.** Less valves **£6/10/-.**

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PL81 SOILED, AMAZING VALUE AT ONLY **7/-**
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0Z4	5/6	6BR7	10/6	6P28	9/6	12BE6	9/-				
1A3	2/6	6BW6	5/-	6Q7G	7/6	12BH7	9/6				
1A5GT	6/-	6BW7	8/6	6Q7GT	9/3	12C8	6/6				
1A7GT	14/6	6BX6	5/6	6SA7	6/-	12J5GT	3/6				
1C5GT	10/6	6C4	4/-	6SD7	9/-	12K7GT	6/-				
1D5	16/6	6C5	5/6	6SG7	5/-	12K8GT					
1H5GT	10/6	6C6	4/3	6SH7	4/6		12/-				
1L4	3/9	6C9	9/6	6SJ7	5/6	12Q7GT	6/-				
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1R5	7/-	6CD6G	18/6	6SL7GT		12SK7	6/-				
1S5	6/6	6CH6	9/6		6/9	12SN7GT	8/6				
1T4	5/3	6D2	4/-	6SN7GT	4/9	19AQ5	7/6				
2A7	8/6	6D3	9/6	6SS7	6/6	19BG6G					
2D21	4/6	6D6	4/6	6U4GT	10/6		16/-				
3A5	9/6	6F1	6/6	6V6G	5/9	20D1	9/6				
3Q5GT	8/9	6F6G	6/6	6V6GT	8/6	20F2	9/6				
3S4	7/-	6F12	4/-	6X2	9/6	20L1	12/6				
3V4	7/9	6F13	5/9	6X4	6/-	20P1	11/6				
5R4G	9/6	6F14	9/6	6X5G	5/-	20P3	12/6				
5U4G	5/9	6F15	8/6	6X5GT	6/6	20P4	15/-				
5V4G	9/6	6F33	5/6	7A7	11/6	25A6G	8/-				
5Y3G	6/-	6H6M	2/-	7B6	8/-	25L6G	6/-				
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5Z4G	9/-	6J5G	2/-	7C5	7/6	25Y5G	9/-				
5Z4GT	11/6	6J5GT	3/6	7C6	7/6	25Z4G	7/9				
6A7	9/6	6J6	2/6	7H7	7/6	25Z6G	9/-				
6A8G	8/6	6J7G	5/-	7K7	8/-	27SU	16/-				
6AB8	2/6	6J7GT	8/6	7S7	9/6	30C1	7/9				
6AC7	4/6	6K6GT	6/6	7Y4	7/6	30LF1	9/6				
6AG7	6/-	6K7G	2/3	10C1	9/-	30L1	7/9				
6AJ7	4/6	6K7GT	5/3	10C2	12/6	35L6GT	9/6				
6AK5	6/6	6K8G	6/6	10F1	10/-	35W4	6/9				
6AL5	4/-	6K8GT	9/6	10F9	7/6	35Z4GT	6/-				
6AM6	4/-	6K25	7/6	10LD11	12/6	35Z5GT	8/6				
6AQ5	6/9	6L1	13/6	10P13	12/-	42	7/6				
6AT6	7/-	6L6G	7/6	10P14	12/-	50C5	10/6				
6B8G	3/6	6L7	6/-	12AT6	8/6	50L6GT	9/6				
6BA6	6/6	6L18	9/6	12AT7	6/-	53KU	10/6				
6BE6	6/6	6L19	11/8	12AU7	6/9	54KU	8/6				
6BG6G	12/8	6LD20	8/6	12AX7	7/6	58	5/-				
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77	4/6	DA30	12/6	EABC80	7/9	ECF80	10/6	EF92	4/9	L63	2/9		4/6	UF86	16/-
78	6/-	DA100	25/-	EAC91	5/3	ECF82	10/6	EF95	6/6	LN152	8/6	T41	7/6	UF89	8/6
83	9/6	DAC32	9/9	EAF42	8/6	ECH42	8/9	EL32	4/-	LN309	11/6	U18	9/-	UL41	7/6
83	9/6	DAF91	6/6	EB34	1/6	ECH81	8/3	EL33	9/-	LZ319	7/9	U22	6/6	UL44	12/6
90AV	4/6	DAF96	8/3	EB41	7/-	ECL80	8/6	EL38	12/6	MU14	8/-	U24	7/6	UL46	9/6
185BT	16/-	DF33	8/9	EB91	4/-	ECL82	11/-	EL41	9/3	N37	11/-	U25	12/-	UL84	8/3
323A	15/-	DF91	5/3	EBC2	9/-	EF36	2/6	EL42	9/6	N78	15/-	U26	12/-	UM80	9/6
723A	35/-	DF92	3/9	EBC33	5/-	EF37	4/6	EL84	8/3	N108	11/-	U31	7/9	UU6	9/6
807USA	6/-	DF96	8/3	EBC41	8/9	EF39	4/6	EL85	11/-	P41	4/6	U33	11/-	UU7	9/6
808	15/-	DH63	7/6	EBC91	7/6	EF40	12/6	EL91	4/9	P61	2/3	U35	8/6	UU8	16/6
813	55/-	DH77	7/6	EBF80	10/-	EF41	8/9	EL95	9/6	PCC84	7/9	U50	6/-	UU9	7/-
2050	3/6	DK91	7/-	EBF89	10/6	EF42	8/6	EM34	9/3	PCC85	9/6	U52	8/3	UY41	6/6
5763	10/-	DK92	8/6	EC91	4/6	EF50-BR		EM80	9/3	PCC89	18/-	U78	6/-	UY85	7/3
7193	2/-	DK96	8/6	ECC31	9/6		1/6	EM81	9/3	PCF80	7/9	U191	9/6	VR150/30	
AZ31	9/-	DL35	10/6	ECC32	3/9	EF50		EM84	10/6	PCF82	9/9	U201	9/6		7/-
B36	8/6	DL91	9/-	ECC33	7/6	RED	2/-	EM85	10/6	PCL82	10/-	U281	8/6	W91	9/6
B65	4/9	DL92	7/-	ECC34	9/-	EF50		EN31	16/-	PCL83	11/6	U301	9/6	W61M	9/6
CL33	19/3	DL94	7/9	ECC81	6/9	USA	2/6	EY51		PCL84	12/6	U319	7/6	W76	6/3
CV6	3/6	DL96	8/3	ECC82	6/9	EF54	3/6	Small	9/6	PEN25	5/-	U329	12/6	W77	4/9
CY31	9/6	DW4/350	8/6	ECC83	7/6	EF80	5/6	EY86	9/6	PEN45	7/6	U339	9/6	W81	5/6
D63	1/6	DW4/500		ECC84	9/-	EF85	7/6	EZ40	7/-	PEN46	5/-	U403	9/6	W142	8/9
D77	4/-		8/-	ECC85	8/6	EF89	8/6	EZ41	8/-	PEN383	9/-	U404	9/6	W149	7/6
								EZ80	6/9	PL33	9/-	UABC80	9/-	W150	8/9
								EZ81	7/6	PL36	13/6	UAF42	9/-	X63	8/6
								GZ32	8/6	PL38	14/6	UB41	8/-	X65	11/-
								GZ44	12/6	PL81	10/6	UBC41	8/3	X66	11/-
								HL41DD		PL82	8/9	UBC81	12/-	X76M	9/6
									9/6	PL83	8/9	UBF80	8/6	X78	15/-
								HVR2	6/6	PX25	9/6	UBF89	9/3	X79	15/-
								KT33C	6/6	PY31	8/6	UCC84	14/6	X81	9/6
								KT36	8/6	PY32	12/6	UCC85	8/9	Y63	6/-
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								KT45	8/6	PY81	7/-	UCH42	8/-	Z14	9/9
								KT61	9/-	PY82	7/6	UCH81	9/3	Z63	5/-
								KT66	12/6	PY83	9/6	UCL82	12/-	Z66	7/6
								KT81	19/-	PZ30	8/6	UCL83	13/6	Z77	4/-
								KTW61	5/6	SP41	2/6	UF41	8/9	Z152	5/6
								KTW63	5/6	SP61	2/6	UF42	8/6	Z719	5/6
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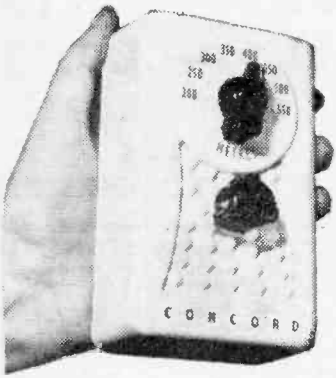
Post: 2 lbs., 1/6, 4 lbs. 2/-, 7 lbs. 2/9, 15 lbs. 3/6. No C.O.D. Callers always welcome (E.C. Weds.)
LIST OF 1,000 ITEMS 6d. ALL ITEMS LESS 5% AND POST FREE IN DOZENS.

TECHNICAL TRADING CO.

P.O. BOX 21(P),
350-352, FRATTON ROAD, PORTSMOUTH

NEW! EASY-TO-BUILD AND

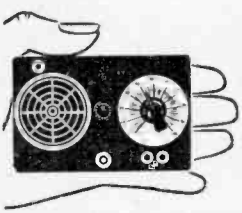


The new, exciting De Luxe "Gold Star" Pocket Radio in beautiful moulded plastic case—choice of four lovely colours, Red, Green, Blue and Pink. This model is a highly sensitive, self-contained set covering all medium waves. Uses modern miniature "button-base" valve and specially designed high efficiency coil. Exceptionally easy to build from our step-by-step plans—the case is supplied ready drilled! Size of radio only 4¼in. x 2¾in. x 1¼in.!—and batteries fit inside. We can supply all parts including case, detachable aerial, instruction book, screws, wire, etc., for only 48/- plus 2/- Post and Packing. C.O.D. 2/- extra. (Parts sold separately, priced parts list 1/9.)

Our engineers have designed a novel Wrist-Watch Radio using latest Transistor Techniques. Size only 1¾in. x 1in. x ¾in.!!!—"Feather-weight"—yet gives clear, crisp, personal-phone reception over all medium waves. Tiny battery inside lasts months—costs 5d. No Snags, anyone can build it in an hour or two using our pictorial step-by-step simple plans. All parts supplied (including case and strap) for only 29/6 (add 2/6 Post, etc.). C.O.D. 2/- extra. (All parts sold separately, priced parts list 1/6.) Send Now!

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

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

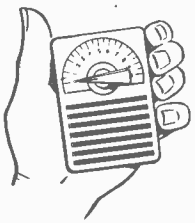


THIS TRANSISTOR SET Can Be Built For Only 29/6. The "Sky-Scout" Pocket two-stage transistor set, size only 4in. x 3¼in. x 4¼in. Covers all medium waves and works entirely off tiny "penlight" battery which costs 6d. and fits inside case. All parts tested before despatch. Can be built for 29/6, plus 2/- Post and Packing. INCLUDING CASE, TRANSISTOR, STEP-BY-STEP PLANS FOR ABSOLUTE BEGINNERS, nuts, bolts, etc. (C.O.D. 2/- extra.) Parts sold separately, priced parts list and plans, 1/6. VERY SIMPLE TO BUILD.

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

ADDRESS ON OPPOSITE PAGE →

FUN-TO-MAKE CONCORD RADIOS



Postage, etc., 2/-. (C.O.D. 2/- extra.) (Parts sold separately. Priced parts list and plans 1/6.) RUSH YOUR ORDER TODAY!

TWO-TRANSISTOR POCKET SET. Can Be Built for 45/-. BUILD THE "SKYGNOME" VEST-POCKET TWO TRANSISTOR RADIO which gives a superb performance and is highly sensitive. Weight under 7 ozs.—yet it is a THREE-STAGE receiver covering all medium waves, working entirely off a "penlight" battery. Every part tested before despatch! SPECIAL STEP-BY-STEP PLANS FOR ABSOLUTE BEGINNERS. Total building cost including case, transistors, etc. — everything down to the last nut and bolt—ONLY 45/- with plans.

LIMITED QUANTITY ONLY!—Never before such amazing value! A high grade universal testmeter. Large scale (3½in.), highly sensitive movement (500 MicroAmps!) Measures A.C Volts, D.C. Volts, D.C. Current, Ohms, Decibels, Inductance and Capacitance! Ranges: D.C. Volts—0-10 v., 50 v., 250 v., 500 v., 1,000 v. A.C. Volts—0-10 v., 50 v., 250 v., 500 v., 1,000 v., D.C. Current—0-500 MicroAmps, 25 MilliAmps, 250 MilliAmps. Resistance—0-10 K ohms and 1 Megohm. Decibels— — 20 dB. to + 22 dB. and — 20 dB. to — 36 dB. Capacitance—100 pfd. to 0.6 mfd. Inductance—10 to 1,000 Henries (also with external D.C. voltage will measure to 100,000,000 ohms!). A beautiful, strongly-made instrument. Brand New, not a kit, at only **97/6**, including test prods, instruction book and internal batteries (replacements cost only 6d. each). Plus 2/6 Post and Packing. (C.O.D. 2/- extra.)

BUILD THIS POCKET RADIO
Can Be Built for **39/6.**

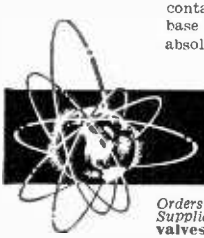
Anyone can build this beautiful precision Pocket Radio in an hour or two. No knowledge whatever needed. Our simple pictorial plans take you step-by-step! Remarkably sensitive—covers all medium waves, inc. Luxembourg, Home, Light. Size only 2in. x 3in. x 5½in.—Not a Toy! But a Real, Personal-phone. Valve Radio With Detachable Aerial! IDEAL FOR BEDROOM, GARDEN, etc. We supply ALL parts necessary, together with plans, etc., for the special price of **39/6**, plus 2/6 post and packing. (C.O.D. 2/- extra.) BUILD YOURS NOW! (All parts sold separately, priced parts list 1/9). Send Today! Money refunded if parts returned intact within 7 days.

Can Be Built for **47/6**. Build this exceptionally sensitive high efficiency personal phone radio. Uses unique assembly system and can be built by anyone without any radio knowledge whatever in 45 minutes. Handsome black-crackle steel case with specially made black and gold dial with stations printed. Size of radio only 6½in. x 5in. x 3in. Covers all medium and long waves. H.T. consumption only 1 to 1.5 mA. Ideal for Bedroom, Garden, Holiday, etc. BUILD THE "SKYROMA" NOW! Total building cost—everything down to the last nut and bolt, **47/6** (Postage, etc., 2/-)—with full set of clear, easy-to-follow plans. (Parts sold separately. Priced parts list and plans **1/6.**) C.O.D. 2/- extra.

The "COMPANION" PRINTED CIRCUIT POCKET SET.

BUILD THIS 3 TRANSISTOR POCKET RADIO . . . PRINTED CIRCUIT VERSION! The "Companion" is comparable in sensitivity to a three-valve battery set. It is exceptionally small in size (4¼in. x 3in. x 1¼in.) and is a self-contained pocket radio that does not need aerial or earth. It has built-in speaker and covers medium and long waves. This unique little set can be built FOR ONLY **97/6**. EVERYTHING INCLUDED! (Plus post and packing 2/6.) All parts sold separately, price list, etc. **6d.** C.O.D. 2/- extra.

The sensational "Silvertone" model! A highly compact self-contained miniature "button-base" valve pocket radio at absolute "rockbottom" building cost! Covers all the medium waves with the very latest circuitry bringing in stations from all over Europe—without fuss. Easy as A.B.C. to assemble, using our step-by-step instruction manual. Size only 4¼in. x 2¼in. x 1¼in.—a fascinating little pocket radio. We can supply all the parts including beautiful two-tone case, detachable aerial, instruction book, screws, wire, etc., for only **29/6** (plus 2/- post and packing). C.O.D. 2/- extra. (Parts sold separately, priced parts list **1/9.**)



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210, Church Road, Hove, Sussex
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Orders receive prompt attention. Cheques accepted. Cash on delivery 2/- extra. Please print name and address in block letters. Suppliers to Schools, Universities, Government and Research Establishments. **Complete range of components and valves stocked.** *Regret no C.O.D. abroad.*

RETURN-OF-POST SERVICE

NEW ILLUSTRATED LISTS

New illustrated lists are available on all the following. Any will be sent free upon request.
GRAMOPHONE EQUIPMENT. Details of many types of Auto Changers, Single Record Players and Transcription Units including all the latest models. Many at special prices.
TEST GEAR. Test meters, Signal Generators, etc., by AVO, Jason, Pullin and Taylor.
LOUDSPEAKERS. Full details of Goodmans, Whiteley, Wharfdale and Elac types.
TAPE DECKS. All popular makes with a special offer.
RECORDING TAPES. A very wide range of all tapes and accessories.

LATEST AVO TEST METERS

AVOMETER MODEL 8. The finest multi-range meter available. 20,000 ohms per volt on D.C. ranges. Eight D.C. Voltage ranges 2.5 v. to 2,500 v. Seven D.C. current ranges 50 micro-amps. to 10 amps. Seven A.C. Voltage ranges 2.5 v. to 2,500 v. Four current ranges 100 mA. to 10 amps. Three resistance ranges. Fully detailed leaflet available. Price **£23.10.0.** H. P. Deposit **£4.14.0** and 12 monthly payments of **£1.14.6.** Price with leather carrying case. **£27.8.0.** H.P. Deposit **£5.8.0** and 12 payments of **£2.0.4.**
Other **AVO** Meters available include the Model 7, **£19.10.0.** H.P. Deposit **£3.18.0** and 12 payments of **£1.8.8** and the Multiminor price **£9.10.0.** H.P. Deposit **£1.18.0** and 12 monthly payments of **14/4.**

TRANSISTORS

All at the new reduced prices.
AUDIO. B.T.H. Red Spot. 7/6. G.E.C. Yellow/Green. 7/6.
BRIMAR. TS1. 10/-. TS2. 21/-. TS3. 13/6.
EDISWAN. XB102. 10/-. XB104. 10/-.
MULLARD. OC70. 14/-. OC71. 14/-.
GOLDTOP. V10/15A. 15/-.
AUDIO OUTPUT. Matched Pairs. Mullard OC72, 34/-. Ediswan XC101. 32/-.
R.F. G.E.C. Yellow/Red. 15/-.
EDISWAN. XA101. 23/-. XA102. 28/-. XA103. 15/-. XA104. 18/-.
MULLARD. OC44. 26/-. OC45. 23/-.
All transistors post free.

OUTPUT TRANSFORMERS

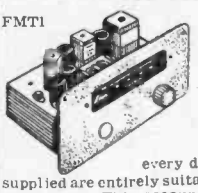
We can supply a wide range of High Quality Output Transformers and full details are given below. All are fitted with sectionalised secondaries and can be connected for either 3 or 15 ohm speakers.
PARTRIDGE
P3591A. Ultra Linear. Push Pull EL84. 20% Taps. 7,000 ohm load. Specified for GEC 912. 99/-.
P5202. Ultra Linear. Push Pull EL84. 43% Taps. 7,000-9,000 ohm load. Suitable for the Mullard 510. 95/-.
P5203. Ultra Linear. Push Pull EL84. 20% Taps. 5,000-7,000 ohm load. Suitable for the G.E.C. 912. 95/-.
P4014. "C" Core. Push Pull Ultra Linear EL84. 8,000 ohm load. 43% Taps. Specified for the Mullard 510. 98/6.
P4131. Push Pull Ultra Linear EL84. 43% Taps. 8,000 ohm load. Specified for the Mullard 510. 60/-.
P3667. Push Pull EL84. 8,000 ohm primary tapped at 6,000 ohms. Specified for the Mullard 510. 52/6.
GILSON
W0696A. Push Pull EL84. Load 8,000 ohms. Specified for the Mullard 510. 50/6.
W0696B. Push Pull EL84. Load 6,000 ohms. Specified for the Mullard 510. 50/6.
W0710. Push Pull Ultra Linear EL84. Load 7,000 ohms. 20% Taps. Specified for the G.E.C. 912. 55/6.
W0710/8K. Push Pull Ultra Linear EL84. Load 8,000 ohms. 43% Taps. Specified for the Mullard 510. 55/6.
W0892. Push Pull Ultra Linear EL84. Load 8,000 ohms. 43% Taps. Specified for the Mullard 510. 62/6.
ELSTONE
OT/ML. Push Pull Ultra Linear EL84. 8,000 ohm load. 43% Taps. 45/-.
OT/3. Single EL84. 5,000 ohm load. Specified for Mullard 3-3. 25/-.
PARMEKO
P2641. Single EL84. Load 5,000 ohms. Potted. Specified for the Mullard 3-3. 27/-.

TRANSISTORISE YOUR CRYSTAL SET

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

JASON FM TUNER

FMT1



There are no less than four different Jason FM Tuner Kits now available to the Home Constructor. Brief details are given here and individual lists on any are available free.
MOST IMPORTANT. We take great pains to see that the kits we supply are *absolutely complete* in every detail and also that all components supplied are entirely suitable in every way. This accounts for differences in price you may notice between our prices and those of some of our competitors. THIS SHOULD BE BORNE IN MIND WHEN COMPARING PRICES.
Hire Purchase Terms available.

FMT2 & 3

STANDARD TUNERS

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

FRINGE TUNERS

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

INSTRUCTION MANUALS

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

MULLARD TAPE PRE-AMPLIFIER

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

AMPLIFIER KITS

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

WATTS RADIO (MAIL ORDER) LTD.

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

MAINS TRANSFORMERS

All the following are suitable for High Quality Amplifiers. Normal Primaries for 200-250 volts 50 cycles are fitted in all cases.

PARTRIDGE
H300/100. 300-0-300 volts. 110 ma. 6.3 v. 2.5 a. 6.3 v. 2 a. tapped at 5 a. Specified for Mullard 510 and GEC 912. **72/-.**

GILSON
W0741AR. 300-0-300 v. 150 ma. 6.3 v. 5 a. 6.3 v. 1 a. tapped 5 v. 2 a. Specified for Mullard 510 and GEC 912. **63/-.**

ELSTONE
MT510. 300-0-300 v. 100 ma. 6.3 v. 2 a. 6.3 v. 2 a. tapped 5 v. Specified for Mullard 510. **42/-.**
MT/MU. 300-0-300 v. 120 ma. 6.3 v. 2 a. Twice. 6.3 v. 1 a. Specified for Mullard 510. **45/-.**
MT/3M. 300-0-300 v. 80 ma. 6.2 v. 2 a. 6.3 v. 1 a. Specified for the Mullard 3-3. **35/-.**
MT/912. 300-0-300 v. 120 ma. 6.3 v. 2.5 a. 6.3 v. 1 a. Specified for the GEC 912. **44/-.**

PARMEKO
P2631. Potted. 300-0-300 v. 60 ma. 6.3 v. 2 a. 6.3 v. 1 a. Specified for the Mullard 3-3. **32 3.**

GRAMOPHONE EQUIPMENT

ALL LATEST MODELS	Cash Price	Hire Purchase Deposit	Mthly. Pmts.
RECORD CHANGERS			
COLLARO Conquest (Studio O PU)	**£7.19. 6**	**£1.12. 0**	6 of **£1. 4.7**
GARRARD RC121 (GC8 PU)	**£9.19. 6**	**£1.19. 6**	12 of **15/-**
GARRARD RC88 (GC8 PU)	**£16. 8. 0**	**£3. 6. 0**	12 of **£1. 4.0**
GARRARD RC98 (GC8 PU)	**£18.12. 8**	**£3.15. 8**	12 of **£1. 7.3**
B.S.R. UA8 Monarch (TC8 PU)	**£7. 5. 0**	**£1. 9. 0**	6 of **£1. 2.8**
BSR UA12 Monarch (TC8 PU)	**£9.19. 6**	**£1.19. 6**	12 of **15/-**
BSR UA12 Monarch (TC8S Stereo PU) ...	**£10.17. 6**	**£2. 3. 6**	12 of **16/2**
SINGLE RECORD PLAYERS			
GARRARD TA (GC8 PU)	**£8.10. 0**	**£1.14. 0**	12 of **13'-**
BSR TU9 (TC8 PU) ...	**£4.10. 0**	**£1. 5. 0**	3 of **£1. 5.0**
COLLARO RP584 (O, P or T PU)	**£8.18.11**	**£1.15.11**	12 of **13/7**
COLLARO RP594 (O, P or T PU)	**£9.18. 9**	**£1.18. 9**	12 of **15/-**
TRANSCRIPTION UNITS			
COLLARO 4T/200 (TX88 PU)	**£18.13. 0**	**£3.15. 0**	12 of **£1. 7.4**
COLLARO 4TR/200 Motor only	**£13.18. 3**	**£2.15. 3**	12 of **£1. 0-5**
GARRARD 4HF (GC8 PU)	**£18. 9. 9**	**£3.15. 9**	12 of **£1. 7.0**

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

LOUDSPEAKERS

	Cash Price	Hire Purchase Deposit	Mthly. Pmts.
WHITELEY			
HF1016 10"	**£7.12.3**	**£1.10.3**	6 of **£1.3.8**
HF1012 10"	**£4.15.0**	**£1.10.0**	3 of **£1.5.0**
HF816 8"	**£6.10.6**	**£1. 6.6**	6 of **£1.0.8**
HF817 8"	**£10.16.6**	**£2. 3.6**	12 of **16.1**
T816 Cone Tweeter ...	**£6. 3.9**	**£1. 3.9**	6 of **£1.0.0**
T10 Tweeter	**£4. 4.0**	**£1. 4.0**	3 of **£1.3.4**
T359 Cone Tweeter ...	**£1.13.3**	—	—
Crossover CX3000 ...	**£1.10.0**	—	—
Crossover CX1500 ...	**£1.18.3**	—	—

Other Whiteley Speakers available, also full ranges of Goodman and Wharfedale.

CATHODE-RAY TUBES

BRAND NEW STOCK. NOT REBUILDS.
12 MONTHS' GUARANTEE

We can supply all BVA branded tubes at the new reduced prices. This includes Brimar, Cossor, Emiscope, Emitron, Ferranti, G.E.C., Mazda and Mullard. Full list of all available types sent on request.

MULLARD. 12in. and 14in. types. **£10.10.0.** H.P. Deposit **£2.2.0** and 12 monthly payments of **15/8.** 17in. Types (except MW43/43). **£12.0.0.** H.P. Deposit **£2.8.0** and 12 payments of **17/8.** 17in., MW43/43 **£14.0.0.** H.P. Deposit **£2.16.0** and 12 payments of **£1.0.8.** 21in. Types **£16.0.0.** H.P. Deposit **£3.4.0** and 12 payments of **£1.3.5.**

All tubes sent carriage free and safe delivery guaranteed.

LATEST CABY TEST METERS

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

MODEL A-10. Sensitivity 2,000 ohms per volt A.C. and D.C. Five voltage ranges 10-1,000 volts A.C. and D.C. Three D.C. current ranges .5-250 ma. Two resistance ranges. Size 5¼in. x 3¼in. x 1¼in. Price, **£4.17.6.** H.P. Deposit **£1.7.6** and three monthly payments of **£1.6.8.**

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

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

RECORDING TAPE

DOUBLE PLAY

BASF. 300ft. (3in.). **14/-** ; 600ft. (4in.). **25/-** ; 1,200ft. (5in.). **42/-** ; 1,600ft. (5¾in.). **52/6** ; 2,400ft. (7in.). **77/6.**
SCOTCH BOY 200. 400ft. (3½in.). **17/-** ; 1,200ft. (5in.). **45/-** ; 2,400ft. (7in.). **80/-.**
TELEFUNKEN. 1,200ft. (5in.). In plastic container. **40/-.** 2,400ft., (7in.) **75/-.**

LONG PLAY

BASF. 210ft. (3in.). **9/-** ; 850ft. (5in.). **28/-** ; 1,200ft. (5¼in.). **35/-** ; 1,800ft. (7in.). **50/-.**
EMITAPE 99. 250ft. (3in.). **9/6** ; 850ft. (5in.) **28/-.** In Emicase. **30/6.** 1,200ft. (5¼in.). **35 -.** In Emicase. **37 6.** 1,800ft. (7in.). **50/-.** In Emicase. **52/6.** 2,400ft. (8¼in.), **72'6.**
GELOSO. 430ft. (3¼in.). **16/-.**
GRUNDIG. 1,200ft. (5¼in.). **35/-** ; 1,800ft. (7in.). **50/-.**
MSS. 225ft. (3in.). **8/6** ; 450ft. (4in.). **14 6** ; 850ft. (5in.). **28/-** ; 1,200ft. (5¼in.). **35/-** ; 1,800ft. (7in.). **50/-** ; 2,400ft. (8¼in.). **70/-.**
PHILIPS. 850ft. (5in.). In plastic container, **28/-.** 1,800ft. (7in.), **50/-.**
SCOTCH BOY 150. 300ft. (3¼in.). **9/6.**; 900 ft. (5in.). **28/-** ; 1,275ft. (5¾in.). **35 -** ; 1 800ft. (7in.). **50 -.**
SPECIAL OFFER. 1,200ft. Standard Tape. Brand new. Famous maker. Fully guaranteed. **25 -.** Four for **95 -.**
Full range of standard tape and accessories also stocked. Send for list. All tape post free.

TRIPLE TONE AMPLIFIERS

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

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

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

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

STEREO PICK-UP CARTRIDGES

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

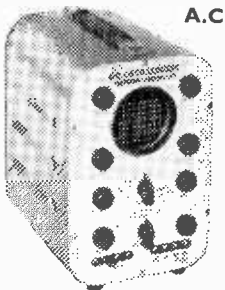
HIRE PURCHASE

H.P. Terms are available on any item. Repayments may be spread over 3, 6 or 12 months. Details as follows : Three months: Deposit 8/- in the £. Service charge 5% but minimum charge 10/-. Six and Twelve months: Deposit 4/- in the £. Service charge 10%, but minimum charge 20/-.
Terms of Business.—Cash with order or C.O.D. Postage extra under £3. We charge C.O.D. orders as follows. Up to £3, postage and C.O.D. fee minimum 2/8. Over £3 and under £5, C.O.D. fee only 1/6. Over £5 no charge.

54 CHURCH STREET, WEYBRIDGE, SURREY. Telephone : Weybridge 4556
PLEASE NOTE : POSTAL BUSINESS ONLY FROM THIS ADDRESS.

D.C. OSCILLOSCOPE

A.C. MAINS 200-250 VOLTS



SIMPLIFIED SERVICING PROBLEMS WHEN USING THE

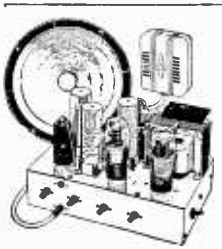
'TESTGEAR' SCOPE

3in. D.C. OSCILLOSCOPE

Engineered to precision standards, this high-grade instrument is made available at the **lowest possible price**, incorporating the essential features usually associated with luxury instruments.

This **"SCOPE"** will appeal particularly to Service Engineers and Amateurs. **A high gain, extremely stable differential Y-amplifier** (30 mV/C.M.). Provides ample sensitivity with A.C. or D.C. inputs. Especially suitable for **measurement of transistor operating conditions** where maintenance of D.C. levels is of paramount importance. Push-pull X amplifier ; Fly-back suppression ; Internal Time-base Scan Waveform available for external use ; **pulse output** available for checking **T.V. Line O/P Transformers**, etc. ; Provision for external **X I/P** abd **CRT.** Brightness Modulation. Size 10in. high, 6¼in. wide, 9in. deep. Wgt. 11¼ lbs. **£15.15.0.** plus P. & P. 7/6, or **30/-** deposit, plus P. & P. 7/6 and 12 monthly payments of **26/6.**

FULL 12 MONTHS' GUARANTEE INCLUDING VALVES AND TUBE.



8-WATT PUSH-PULL AMPLIFIER

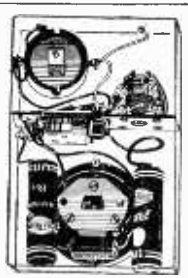
COMPLETE WITH CRYSTAL MIKE AND 8in. LOUDSPEAKER

A.C. mains 200-250 v. Size 10¼in. x 6¼in. x 2¼in. Incorporating 6 valves. H.F. pen., 2 triodes, 2 output pens and rectifier. For use with all makes and type of pick-up and mike. Negative feed back. Two inputs, mike and gram., and controls for same. Separate controls for Bass and Treble lift. Response flat from 40 cycles to 15 Kcs., ± 2 dB ; 4 db down to 20 Kcs. Output 8 watts at 5% total distortion. Noise level 40 db down all hum. Output transformer tapped for 3 and 15 ohm speech coils. For use with Std. or L.P. records, musical instruments such as Guitars, etc.

£4.19.6 Plus P. & P. 7/6.

Or 20/- deposit Plus P. & P. 7/6. and 4 monthly payments of 23/-.

2-TRANSISTOR POCKET RADIO



Plus Germanium diode, fully tuneable over medium and long waves. Size 3¼in. x 4¼in. x ¼in. Complete set of components including case, 2 transistors and earpiece (less batteries).

19/6 Plus P. & P. 1/6.

Point to point wiring diagram 1/6 free with kit

PUSH-PULL OUTPUT STAGE

Inclusive of transistors with input and output transformers to match 3 ohm speech coil, suitable for use with the above kit. Complete kit of parts including transistors.

19/6 Plus P. & P. 1/6.

Point to point wiring diagram 1/6 free with kit

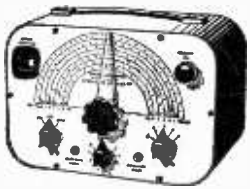
AC/DC POCKET MULTI-METER KIT

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

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

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

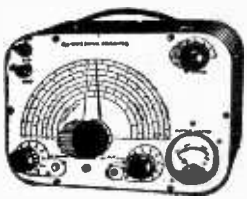
SIGNAL GENERATORS



Cash **£6.19.6** or 25/- deposit and 6 monthly payments of **21/6.** Post and Packing 5/- extra.

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

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



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

B.S.R. MONARCH UA8 WITH STEREO HEAD

4-speed plays 10 records 12in., 10in or 7in. at 33, 45 or 78 r.p.m. Intermixes 7in., 10in. and 12in. records of the same speed. Has manual play position ; colour brown. Dimensions: 12¼in. x 10¼in. Space required above baseboard 4¼in., below baseboard 2¼in. Fitted with Full-Fi turnover crystal head.

£7.19.6 Plus 5/- Postage & Packing.

With standard head £6.19.6. plus 5/- P. & P.

PLAYER CABINET

Finished in 2-tone leatherette, will take B.S.R. UA8, with room for amplifier and 7in. x 4in. speaker. Overall size, 15¼in. x 13¼in. x 9¼in.

39/6 Plus 5/- P. & P.

Similar to the above in POLISHED WALNUT will take Collaro

39/6 Plus 5/- P. & P.

MAINS TRANSFORMERS

All with tapped primaries. 200-250 volts. 0-160, 180, 200 v., 60 ma., 6.3 v. 2 amps. **10/6.** 320-0-320 v. 75 ma., 6.3 v., 2.5 amp., 5 v., 2 amp., **10/6.** 280-0-280, 80 ma, 6.3 v. 2 amp., 6.3 v. 1 amp., **10/6.** Postage and packing on the above 3/-.

F.M. TUNER UNIT

Permeability tuned, by famous German Manufacturer. Coverage 88—100 Mc/s. Complete with ECC85. Size 4in. x 2in. x 2in.

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

Circuit diagram 1/-, free with unit.

IMITATION LOG FIRE EFFECT

Size 14 inches × 11 inches

19/6 Plus P. & P. 2/6.

RADIO CHASSIS

A.C. MAINS 200/250 v. Medium & Long Wave Superhet.

4 valve and rectifier. Complete with 8in. P.M. speaker. Valve line-up 6K8, 6K7, 6Q7, EL32 and rectifier. These have been used but fully serviced with new Electrolytics and valves. FULLY GUARANTEED.

42/6 Plus 7/6 P. & P.

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

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

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

Components Would Cost More

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

Building A Scope?

3in. oscilloscope tube American made Type No. 3FP7. Octal base 6.3 v. .6 amp heater, electrostatic deflection. Brand new and guaranteed. 15 - each, plus 1/6 post and insurance. Complete with circuit diagram.

Multi-Purpose Mains Transformer

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

Specification :—

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

In addition there is a window space for extra L.T. windings, winding ratio is 2½ turns per volt. Weight of transformer is 12 lb., size approximately 6in. x 4¼in. x 4¼in. Connections all brought out to terminals on bakelite panel. We have only 500 of these, so order at once to avoid disappointment. Non-callers add 3/6 postage please.

Fluorescents

All complete with polyester filled choke and interference suppressor starters.
5 ft. 80 watt., 39/6 plus 5/- carr. & ins.
4 ft. 40 watt. 32/6 plus 4/6 carr. & ins.
Or complete with tube, 39/6 plus 5/6 carr. & ins.
3 ft. 40 watt. 31/6 plus 3/6 carr. & ins.
Or complete with tube, 39/6 plus 4/6 carr. & ins.
2 ft. 20 watt. 29/6 plus 3/6 carr. & ins.
Circular 40 watt. 49/6 plus 3/6 carr. & ins.
Or complete with tube. 87/- plus 4/6 carr. & ins.

Miniature Microphone

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

Assure Your Future

The ownership of a good instrument has been the turning point in many a famous career. You can own the latest Pullin Series 100 Test Set which is undoubtedly a most useful instrument by a firm long famous for fine instruments, entirely redesigned, it has a square movement with diacon plastic cover, this makes for a brighter, more readable scale, extra scale length and wider angle of vision. With the test set is included a pair of combined test prods and crocodile clips also a stand for inclining the meter at the best reading positions. Ranges A.C. Volts : 0-10, 0-25, 0-100, 0-250, 0-500, 0-1,000 ditto D.C. A.C. Current 0-100 mA. D.C. Current 0-2.5, 0-10, 0-100, 0-500 mA. Resistance : 0-1M and 0-10K. All at 10,000 ohms per volts. Price £12/7/6 or £1/4/- deposit and 26 fortnightly payments of 10/-, non callers add 5/- carr. and insurance.

FREE GIFT.—All purchasers of the above item this month will receive Range Extender scale and data which add capacity 2pF—1mFd. in two ranges. Inductance 0-100 henrys, etc., etc.

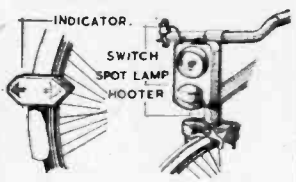
Six Useful Articles

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

Towards Hi-Fi Perfection

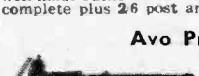
The revolutionary B.J. tweeter unit stands on top of the cabinet, and with it the best in the loudspeaker is brought out by top "C" positive and controllable. Frequency response 2,000 to 18,000 c.p.s. effective acoustic spread 360 deg.—dimensions 6½" x 5" diameter—weight 1½ lbs. approximately, finished in sapele mahogany veneer. Price £4.19.1, plus 3/6 carriage & insurance. Fuller technical details available on request.

For Cycles and Scooters



This three part outfit comprises combined headlamp with built-in hooter and a rear fitting direction indicator and a combined indicator switch and push button—altogether a well made outfit which will make cycling safer. 15/6 complete plus 2/6 post and packing.

Avo Prodclips



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

FOR ADDRESS SEE OPPOSITE PAGE

R1155 for Spares

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

Radio Stethoscope

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

Tube Tester and Reactivator

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

Super Sensitive (2,000 O.P.V.) Multimeter Kit

17 ranges including D.C. volts to 1,000 v. A.C. volts to 1,000 v. D.C., milliamps to 500 ohms, to 2 meg. All the essential parts, including metal case, selected resistors, wire for shunts, selected switches, calibrated scale and instructions, 32/6, plus 2/6 post and insurance.

Transistor Set Parcel

Cabinet as illustrated—with handle and motifs—2 gang tuning condenser—printed circuit—tuning scale—full circuit diagram showing other necessary parts—separate value £3—will all be sent for 29/6, plus 2/6 post and insurance.

Battery Charging Rectifier—Selenium 12-15 v. full wave 5 amp. 9/6, plus 1/6 carriage.

Metal Chassis—Punched for Mullard 510 amplifier—complete with inner screening sections and stove enamelled. 12/6, plus 2/6.

Geiger Counter Tubes—20th Century type. Type No. G24—complete with circuit or geiger counter. 29/6, plus 2/6.

Heavy Duty Test Prods—Red and black with plug-in lead attachments 8/6 pair, plus 1/-.

Speaker Bargain

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

Hi-Fi Snip
Infinite Wall Baffle

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

BEGINNER'S SUPERHET

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

W.D. Circuit Details

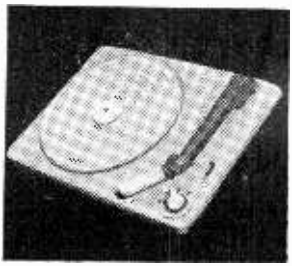
Diagrams and other information extracted from official manuals. All 1/6 per copy, 12 for 15/-.

A.1134	R.109
BC.348	HRO Receiver
BC.312	R28/ARC5
R.103A	R1116 A
BC.342	RA-1B
RA-1B	AR88D
R-208	AN APA-1
R-1155	78
R-1124A	76
R-1132A/R-1481	R.T.18
R-1147	CAY-46-AAM-
R-1124A	RADAR
R-1092	A.S.B.-3
R-1355	Indicator 62A
B.C.1206-A/B	Indicator A.S.B.3
B-455-A (or -B)	Indicator 62
B-454-A (or -B)	Indicator 6K
B-456-M-A (or -B)	R.F. unit 24
Transmitter T1154	R.F. unit 25
Fifty-eight walkie talkie	R.F. unit 26
	R.F. unit 27
Frequency meter B.C. 221	Wireless set No. 19 Demobbed valves

CONNECTING WIRE

P.V.C. covered in 100ft. coils—2/9 a coil or four coils different colours, 10/-, post free.

Philips AG2009 Transcription Unit



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

Eddy Current Brake gives ±2% fine adjustment on all four speeds. **Continuously variable** pick-up playing weight (2-12 gms.).
Supplied with Philips Hi-Fi crystal head, type AG3019 for microgroove and 78 r.p.m.
Frequency response 30-15,000 c/s.
Pick-up lifting and lowering device.
Individually balanced heavy turntable.
Muting switch fitted.
Can be used with any amplifier or radio set.
Complete with monaural pick-up. £10.10.0, or £1 deposit and 21 fortnightly payments of 10/-.
Available also with stereo head, diamond or sapphire stylus. Prices on request.

Component Storage Drawers

Stout board construction these drawers are ideal for small parts. Supplied complete with simple erection instructions—1/6 each or 12 drawers each 6 x 2½ x 6½in., 13/6, post 2/-.

THIS MONTH'S SNIP

5 valve F.M. receiver kit. Note: this is not just a tuner but a complete receiver with power supplies—made by the famous Cossor Company. Until very recently this cost £15.15.0, but due to a large purchase we are able to offer this at the remarkably low price of £8.19.6, plus 3/6 post and insurance. Complete with full constructional details. The circuit uses 5 B9A valves and special features are the cascode R.F. stage and the Foster Seeley discriminator. All valves and components, printed circuit, printed dial, 10in. x 6in. elliptical speaker, in fact everything except the cabinet is supplied. Do not miss this wonderful bargain!

CABINET SNIP

Extremely well made portable amplifier case finished in two-tone and very modern in appearance. Large enough for stereo outfit with tape deck or autochanger. Snip price 59/6, plus 3/6 carriage and insurance.

Thermostats

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

Band III Converters

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

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

A.C./D.C. Multimeter Kit

Ranges: D.C. volts 0-5, 0-50, 0-100, 0-500, 0-1000. A.C. volts 0-5, 0-50, 0-100, 0-500, 0-1000. D.C. milliamps 0-5, 0-100, 0-500. Ohms 0-50,000 with internal batteries. 0-500,000 with external batteries. Measures A.C./D.C. volts, D.C. current and ohms. All the essential parts including metal case, 2in. moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions, price 19/6, plus 2/6 post and insurance.

Cabinet Snip

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

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

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

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

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

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

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

REALISM AT INCREDIBLY LOW COST. CAN BE ASSEMBLED IN 1 HOUR The Recorder incorporates the Latest Collaro Mark IV Tape Transcriptor listed £25. The Linear LT45 High Quality Tape Amplifier listed £12.12.0. High Flux P.M. Speaker listed 30/-, empty Tape Spool, a Reel of Best Quality Tape listed 22/6, and a Handsome Portable carrying Cabinet finished in veneered walnut, size 18in. x 13in. x 9in. high, listed £4 10.0. and circuit. Total cost if purchased individually approx. £45. Performance equal to units in the £60-£80 class. Send S.A.E. for leaflet.

29½ GNS. Carr. 17/6. **H.P. TERMS. Deposit** 3 gns. and 13 monthly payments 53/9. Cas price if settled in 3 mths.

HI-FI 8 WATT AMPLIFIER

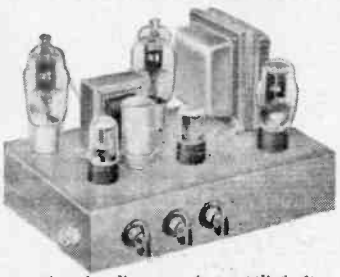
Special Purchase due to Cancelled Export Order. For 200-250 v. A.C.

£4-19-9 Carr. 7/6.

A limited number is available of these highly sensitive Push Pull units guaranteed brand new and in working order and with separately controlled inputs for 'mike' and gram. etc., LATEST B.V.A. VALVES. Excellent performance.

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

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



For **STANDING or LONG - PLAYING RECORDS.** For **MUSICAL INSTRUMENTS** such as **STRING BASS, GUITARS,** etc. **OUTPUT SOCKET** with plug provides 300 v. 33 mA. and 6.3 v. 1.5a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12-9-7in. For A.C. mains 200-230-250 v. 50 c/cs. Outputs for 3 and 15 ohm speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Unapproachable value, at £7/15/- or factory built 45/- extra. Carriage 10/-.

£7-15-0

If required louvred metal cover with 2 carrying handles can be supplied for 18/9. Additional input sockets, with associate Vol. control so that two different inputs such as Gram and 'Mike' or Tape and Radio can be mixed, can be provided for 13/- extra. Guaranteed 12 months.

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

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

STAAR GALAXY 4-SPEED MIXER AUTO-CHANGERS

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

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

SPECIAL OFFER. Two tone Portable cabinet, Gram amplifier, Staar. Changer and 7in. x 4in. P.M. Speaker. 10 gns. Carr. 10/- or with B.S.R. UA8. 12 gns.

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

R.S.C. PORTABLE TAPE RECORDER

A completely assembled unit in attractive two-tone revine covered carrying case. Excellent frequency response. Auto-erase. Fast rewind. Takes up to 5in. tape spools. High Flux speaker. 3 watts output. Inputs for Radio Gram and 'Mike.' For 230/250 v. 50 c.p.s. A.C. mains. Sensational value! Price, including 'Mike' Reel of best quality tape and empty spool. Usual 12 months' guarantee. H.P. Terms: Deposit 44/- and 12 monthly payments of 33/4.

Carr. 10/6

19 GNS.

PICK-UP ARMS complete with Hi-Fi turnover crystal head. Acos GP51. Limited number brand new, perfect, at approx. half price. Only 29/11.

ACOS CRYSTAL MICROPHONES. Mic 40 hand or desk. Listed 45/-. Only 29/9. Type 33-1, hand or desk. List price 50/-. Brand new, cartoned. 35/9.
39-1 Stick type, list price 5 gns. Brand new. 39/6.

COSSOR VHF/FM RADIO RECEIVER KITS

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

EXTENSION SPEAKERS

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

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

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s is available. **Suitable for all battery portable receivers requiring 1.4 v. and 90 v.** This includes latest low consumption types. Complete kit with diagrams. 39/9, or ready to use, 46/9.

Type BM2. Size 8 x 5½ x 2½in. Supplies 120v. 90 v. and 60 v., 40 mA. and 2 v. 0.4 a. to 1 amp. fully smoothed. **Thereby completely replacing both H.T. batteries and L.T. 2 v. accumulators** when connected to A.C. mains supply 200-250 v. 50 c/s. **SUITABLE FOR ALL BATTERY RECEIVERS** normally using 2 v. accumulator. Complete kit of parts with diagrams and instructions. 49/9, or ready for use, 59/6.

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

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

250-0-250 v. 70 mA, 6.3 v. 2 a, 5 v. 2 a... 16/9
350-0-350 v. 80 mA, 6.3 v. 2 a, 5 v. 2 a... 18/9
250-0-250 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a... 23/9
300-0-300 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a... 23/9
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a... 23/9
350-0-350 v. 100 mA, 6.3 v. 4 a, 4 a, C.T. 0-4-5 v. 3 a.... ... ... 23/9
350-0-350 v. 150 mA, 6.3 v. 4 a, 5 v. 3 a... 28/9

FULLY SHROUDED UPRIGHT

250-0-250 v. 60 mA, 6.3 v. 2 a, 5 v. 2 a, Midget type 2½-3-3in. 17/6
250-0-250 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a... 28/9
300-0-300 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a... 28/9
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a... 28/9
300-0-300 v. 130 mA, 6.3 v. 4 a, 6.3 v. 1 a, for Mullard 510 Amplifier 35/9
350-0-350 v. 150 mA, 6.3 v. 4 a, 5 v. 3 a... 33/9
350-0-350 v. 150 mA, 6.3 v. 2 a, 6.3 v. 2 a, 5 v. 3 a. 35/9
425-0-425 v. 200 mA, 6.3 v. 4 a, C.T. 6.3 v. 4 a, C.T., 5 v. 3 a. Suitable Williamson Amplifier, etc. 49/9

FILAMENT TRANSFORMERS

All with 200-250 v. 50 c/s. primaries 6.3 v. 1.5 a, 5/9; 6.3 v. 2 a, 7/6; 0-4-6.3 v. 2 a, 7/9; 12 v. 1 a, 7/11; 6.3 v. 3 a, 8/11; 6.3 v. 6 a, 17/6; 12 v. 3 a, or 24 v. 1.5 a, 17/6.

OUTPUT TRANSFORMERS

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

ELIMINATOR TRANSFORMERS

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

SMOOTHING CHOKES

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

CHARGER TRANSFORMERS

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

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

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

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

R.S.C. A12 STEREOPHONIC AMPLIFIER KIT

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

£3-19-6 Carr. and pkg. 5/-

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

£6-19-6 Carr. 7/6

LINEAR LT45 HIGH QUALITY TAPE DECK AMPLIFIER. With "built in" power pack and oscillator stage. For Tape Decks with High or Low Impedance. Playback and Erase Heads, such as Lane, Truvox, Collaro, Brennel, etc. For A.C. Mains 230-250 v. 50 c/cs. **Linear frequency response** of ± 3 db. 50-11,000 c/cs. Switched negative feedback equalisation for 3½, 7½ and 15in. per sec. Output 4 watts. Send S.A.E. for leaflet.

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

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

A highly sensitive Push-Pull high output unit with self-contained Pre-amp. Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 db. down. Frequency response ±3 db. 30-30,000 c/cs. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used, EF86, EF86, ECC83, 807, 807, GZ33. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 millivolts so that **ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE.** The unit is designed for **CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS,** etc. For use with Electronic **ORGAN, GUITAR, STRING BASS,** etc. For standard or long-playing records. **OUTPUT SOCKET PROVIDES** L.T. and H.T. for a **RADIO FEEDER UNIT.** An extra input with associated vol. control is provided so that two separate inputs such as Gram and 'Mike' can be mixed. Amplifier operates on 200-250 v. 50 c/cs. A.C. Mains and has output for 3 and 15 ohm speakers. Complete kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required cover as for A8 can be supplied for **18/9.** The amplifier can be supplied, factory built with 12 months' guarantee, for **£13.19.6. TERMS: DEPOSIT 24/9** and 12 monthly payments of **24/9.**

11 GNS. Carr. 10/-

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

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

GARRARD 4-SPEED AUTOCHANGERS. Type RC120H. Very limited number at only **£9.19.6.** Carr. 5/6.

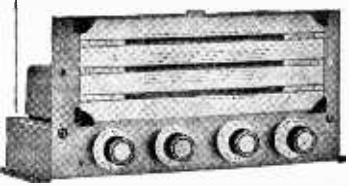
R.S.C. 3-4 WATT A7 HIGH-GAIN AMPLIFIER

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

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

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

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



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

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

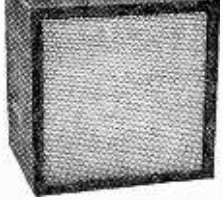
R.S.C. PORTABLE GUITAR AMPLIFIERS

Junior 5 watts High Quality output. Separate Bass and Treble 'Cut' and 'Boost' controls. Sensitivity 15 m.v., Twin inputs. High Flux 8in. Lousdpeaker 'built-in'. Handsome, strongly made Cabinet (size approx. 14 x 14 x 7in.) finished in satin walnut, and fitted carrying handle. H.P. Terms. Deposit £1 and 9 monthly payments of **£1.**

£8-19-6 Carr. 7/6

Senior 10 watts High Fidelity output. Separate Bass and Treble 'Cut' and 'Boost' controls. Twin separately controlled high gain inputs so that two instruments such as Guitar and String Bass can be used at the same time. Two loudspeakers are incorporated, a high Flux 12 in. for Bass notes and a 7 x 4 m. elliptical for Treble. Cabinet is well made and finished satin walnut. Size approx. 18 x 18 x 8 in. H.P. Terms. Deposit 23/6 and 12 monthly payments of 23/6. Both models for 200-250 v. A.C. mains.

13 GNS. Carr. 10/-



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

Gauss 12,000 lines. Speech coil 3 ohms or 15 ohms. Only **£4.19.6** Carr. 5/-. Terms: Deposit 11/- and 9 monthly payments of 11/-.

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

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

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

Hi-Fi CRYSTAL PICK-UP HEADS. (Turnover type with sapphire stylus). HGP59. Standard replacement for Garrard and B.S.R. B.S.R. Ful-fi, Garrard GC2, **19/9.**

POWER PACK KIT. Output 250 v. 50 mA, fully smoothed and 6.3 v. 1.5 a. Consisting of Mains Trans., Selenium Rectifier, Smoothing Choke, Double Electrolytic Condenser. Chassis 6in. x 3½in. and Circuit. Only **18/9.**

P.M. SPEAKERS. 2-3 ohm, 2½in. Perdio **21/9.** 5in., **17/9.** 6in., **16/9.** 8in., **19/9.** 8 x 5in. **25/9.** 10in. **26/9.** 10 x 6in. **29/9.** 12in. **29/11.** 10in. W.B. "Stentorian" 3 or 15 ohms type HF1012 10 watts, hi-fidelity type. Recommended for use with our A8 Amplifier, **£4.10.9.** 12in. Plessey 3 ohms 10 watts (12,000 lines). **59/6.**

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

LG3 MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with any single or auto-change unit. Output for 2-3 ohm speaker. For 200-250 v. 50 c p.s. A.C. mains. Over-all size 6½ x 4½ x 2½in. Controls: Vol. and Tone with switch. Guaranteed 12 months. Only **57/9.**

SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner Unit (specially suitable for use with any of our Amplifiers). Delayed A.V.C. employed. The W.Ch. Sw. incorporates Gram position. Controls are Tuning, W.Ch. and Vol. only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size of unit approx. 9-6-7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustration, 2/6. Total building cost **£4/15/-.** For descriptive leaflet send S.A.E.

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

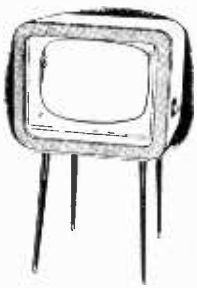
TERMS: C.W.O. or C.O.D. No C.O.D. under £1. Post 1/9 extra under £2 : 2/9 extra under £5. Open 9 to 6 ; Weds. until 1 p.m. Trade supplied. S.A.E. with all enquiries.

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

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

SOLO SOLDERING TOOL 12/6

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



★ 17" T.V. 19 GNS.

CASH PRICE

OR 20/7 initial payment & 19 weekly payments of 19/11.

OR 11/1 initial payment & 35 weekly payments of 11/1.

(4 weekly payments required in advance before despatch—plus ins. carr. 30/-.)

FEATURES

Beautiful latest finish cabinet in contemporary style covered and washable.
★ Polished legs 18in. optional extra for 25/-.
★ 17in. Rectangular Tube. Guaranteed fully for 12 months.
★ 12 channels "Turret Tuned"—ITV/B.B.C. (Extra coils at only 7/6 a pair with order.)
★ Chassis. 14 B.V.A. Valves—Salvaged but reconditioned and guaranteed 3 months.
Due to overwhelming demands, some delay may occur. Please enquire when ordering.

T.V. Chassis at clearance prices.

The popular 12in. Plessey chassis 9/6

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

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

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

TIMEBASE 2/9

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

POWER PACK & AMPLIFIER 12/6

Output stage 6V6 with O.P. trans. 3 ohms choke smoothed H.T. 350 v. at 250 mA 6.3 v. at 5 amp 22 v. at 3 amp. 6.3 v. at 4 amp and 4 v. centre tapped. Less valves Ins. carr. 5/6.

13 CHANNEL TURRET TUNER 65/-

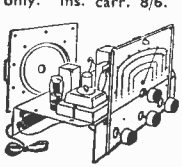
Brand new. Well-known manufacturer. 38 Mc/s. Complete with valves PCF80 and PCC84. .3 series line up and channel coils covering channels 1, 2, 3, 4, 5, 8 and 9. Carr. & ins. 3/6.

FAMILY RADIO 99/6

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

SUPER SUPERIOR RADIO 89/6

4 waveband. 5 valve superhet radio. 2 tone covered metal cabinet. Size 24½ x 12 x 10in. deep. 4 control knobs. Position for gram p.u. and extension speaker. A.C. only. Ins. carr. 8/6.



SUPER CHASSIS 79/6

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

REPLACEMENT RE-BUILT T/V TUBES

CASH PRICE **£8.10.0**

12 months' full guarantee.

All sizes except 10in. Completely rebuilt gun assembly new cathode, heaters, etc., giving the high standard required for long picture life, quality and value. Carr. & ins. 15/6.

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

FROM OUR NEW RANGE OF CONTINENTAL TYPE RECORD PLAYER CABINETS

In gay two-tone colours.

T.W.1 CABINET

79/6

Size 15⅝ x 19¾ x 10⅝in. Takes B.S.R. U.A.8 4-speed auto-changer, twin speakers. 3 control amplifier. Carr. & ins. 4/6.

World's Finest AUTOCHANGERS

U.A.8. B.S.R. MONARCH 4-SPEED AUTOCHANGER

£6 . 19 . 6

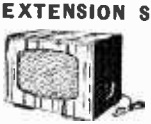
COLLARO CONQUEST 4 SPEED AUTOCHANGER £6.19.6.
U.A.12 LATEST B.S.R. MONARCH 4 SPEED MIXER £8.9.6.
COLLARO CONQUEST STEREO AUTOCHANGERS 11 gns

P. & P. on all the above 5/6.

PORTABLE AMPLIFIER MK. D.3 89/6

De luxe model. Printed circuit. Latest design. Dimensions 7 x 2½ x 5in. A.C. only. Mains isolated. 3-4 watts output. Incorporating the latest ECL82 triode pentode output valve giving higher undistorted output. Volume, treble & bass control. Knobs 3/6 extra. P. & P. 3/6.

EXTENSION SPEAKERS 19/9



Polished oak cabinet of attractive appearance. Fitted with 8in. P.M. speaker W.B. or Goodmans of the highest quality. Standard matching to any receiver (2-5 ohms). Switch and flex included. Ins. carr. 3/9

IDEAL FOR STEREOPHONIC SOUND

8in. P.M. Speakers, 8/9. With O.P. trans fitted, 10/-. Post 2/6.
7 x 4in. Elliptical speakers, 19/6.
9½ x 4½in. Elliptical speakers, 22/6. Post 2/9.

DUKE & CO.

(Dept. D.1),

621/3, ROMFORD ROAD, MANOR PARK, E.12.

Tel.: ILF. 6001/3

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Practical Wireless

VOL. XXXV, No. 635, JANUARY 1960

Editorial and Advertisement Offices :
PRACTICAL WIRELESS
George Newnes, Ltd., Tower House, Southampton Street, Strand, 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 - - - - - £1.3.0 per annum
Abroad - - - - - £1.1.6 per annum
Canada - - - - - 19s 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, Strand, W.C.2. Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.*

IMPORT CONTROLS

IN a written reply to a Parliamentary Question, the President of the Board of Trade, Mr. Reginald Maudling, announced that most of the remaining controls on imports from the Dollar Area, Western Europe, and a number of other countries were to be removed with effect from Monday, November 9th. The continuing strength of the £ and of the balance of payments position of the United Kingdom has enabled more progress to be made in freeing trade.

From our point of view the most interesting part of the announcement is that electrical equipment and apparatus is included in the list of freed goods. This heading includes valves but not transistors, although the reason for the omission of transistors is not clear. It seems to us that relaxation of import control of transistors would be of benefit both to industry and to the home constructor.

CLUB REPORTS

WE are always pleased to print reports of club activities whether past, present or future, and such insertions are free. As we have previously pointed out, to assist us in the preparation of "News from the Clubs," club reports should be sent, whenever possible, in the style in which we print them. The title of the club should be given first, followed by the meeting place, the name and address of the secretary, reports of past activities, and finally, future events. We adopt this method of presentation because it is easy to follow and because the reports tend to be uninteresting to readers unless there is some uniformity.

Reports should reach us well in advance ; on or before the first of the month preceding the issue in which the report is to appear. Any "future events" listed should, of course, occur after the issue concerned is published and, in general, reports should include information of interest to readers who are not members of the club.

CONTRIBUTIONS

THOSE of our readers who wish to submit articles should send them direct to the Editor at the address given on this page. Manuscripts should be typewritten with double spacing although legible hand-written articles are also acceptable. Articles should be between 1,000 and 2,000 words in length, be written on one side of the paper only, and deal with the home construction of items of radio and electronic equipment. We do not require articles of a theoretical nature unless these are written expressly for the amateur constructor. Clear drawings of the apparatus should be included with the article and need only be sufficient for our draughtsmen to prepare suitable illustrations. We also like to include with articles photographic illustrations. Large clear prints, or preferably negatives, should be sent if possible but we are prepared to take the necessary photographs ourselves if the apparatus can be sent to us for inspection. An illustrated article is always of more appeal as the methods of construction are shown more clearly.

Our next issue, dated February, will be published on January 7th

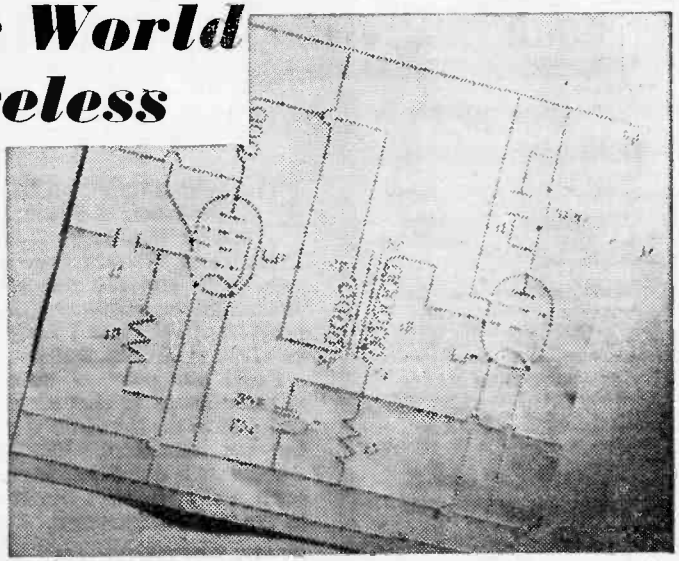
Round the World of Wireless

POTENTIAL AND CURRENT NEWS

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of September, 1959, in respect of wireless receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland. The numbers include Licences issued to blind persons without payment.

Region	*Total*
London Postal	869,184
Home Counties	857,971
Midland	636,090
North Eastern	726,396
North Western	585,002
South Western	511,480
Wales and Border Counties ...	315,813
Total England and Wales ...	4,501,936
Scotland	542,662
Northern Ireland	154,823
Grand Total	5,199,421



The Royal National Institute for the Blind is aware of the interest taken by its readers in technical literature and the illustration above shows part of one of the many embossed diagrams in a recently brailled book on radio engineering.

Commonwealth Cable Order

AN order has been placed by Cable & Wireless Ltd. for 1,635 nautical miles of light-weight, co-axial, deep-sea cable for the first section of the Commonwealth round-the-world telephone cable at a cost of £2,300,000. The cable will be laid between Scotland and Newfoundland in the summer of 1961, and will be made by Submarine Cables Ltd., of London, at their Greenwich factory. The estimated total cost of the trans-Atlantic section of the cable, which will carry 60 simultaneous telephone conversations, is £6,000,000. It is being jointly financed by Cable & Wireless Ltd. and the Canadian Overseas Telecommunication Corporation.

Technical articles

THE scheme for awarding annual premiums for articles on electronics, organised in the past by the Radio Industry Council (London) is now under the joint sponsorship of the Council and of the Electronic Engineering Association.

Articles published during 1959 will be considered by the panel of judges early in the New Year, and explanatory leaflets can be obtained from the Electronic Engineering Association, 11, Green Street, London, W.1, to whom also eligible articles should be submitted before the end of the year.

Six premiums of 25 guineas are offered to writers not earning their living wholly or mainly by writing. The judges, headed by Professor H. E. M. Barlow, Professor of Electrical Engineering, University College, London, are given the greatest possible freedom in allocating awards, but main factors taken into consideration are:—

The value of the article in making known British achievements in radio and electronics; originality of the subject; technical interest; and presentation and clarity.

Articles published abroad as well as in the United Kingdom are eligible as are articles in journals serving the many fields in which electronic methods of control and production are being increasingly used.

Equipment for India

AN agreement has been concluded between Marconi's Wireless Telegraph Company and the Government of India (Ministry of Defence) for the manufacture under licence in India of Marconi V.H.F. multi-channel radio terminals and repeaters, and ancillary equipment. The Marconi V.H.F. multi-channel radio equipments to be manufactured in India are the HM 100 series, used by telecommunications authorities in many parts of the world, including India, where they are used on the railway network. This series was developed by Marconi's for use in terrain unsuitable for the construction of line or cable routes. They are designed to carry up to 48 telephone channels, any of which may be sub-divided to give either 18 or 24 telegraph channels.

New British Standard

THIS standard deals with *Fixed carbon resistors for use in telecommunication and allied electronic equipment*—Part 1: general requirements and tests. B.S. 2112: Part 1: 1959 applies to fixed carbon resistors having a dissipation not exceeding 3watts at 70 deg. C. and a rated resistance value of not less than 10ohms and not greater than 10megohms. The resistors to which this standard applies are intended for use over the

ambient temperature range—40 deg. C. to + 100 deg. C. in one of the humidity classes (H1, H2, H3 or H3A) of B.S.2011, "Basic climatic and durabilty tests for components for use in radio and allied electronic equipment."

The new publication specifies *general requirements and tests.* Part 2, which is to follow, will give a list of standard sizes, ratings, etc., of resistors.

The standard colour code for the indication of resistance value, tolerance, and, in certain instances the grade of resistors, is described in an Appendix to Part 1.

Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. Price 10s. (Postage will be charged extra to non-subscribers.)

Philips S.W. Headquarters

PHILIPS ELECTRICAL LTD. has recently opened a new and enlarged headquarters for their South West region at 51, Victoria Street, Bristol. The new building covers an area of over 17,000sq. ft. and occupies an island site bounded by St. Thomas Street, St. Thomas Street East, Long Row and Victoria Street. It has four storeys which house offices, stores, a trade counter, a modern public showroom for the display of the firm's products and various other departments.

A special feature of the showroom, designed by J. Lohman, is that many of the items on show are mounted on movable stands. This allows for greater flexibility of layout and also permits the showroom to be converted into a lecture room. A section devoted to electrical appliances has full demonstration facilities, and the lighting section includes a selection of lamps for all purposes, and a display of fittings. A sales and service centre to cover the whole of Wales and the West is situated on the top floor and also the drawing offices of the Lighting Design Service. The building also has a Hearing Aid Centre. Equipped with the very latest apparatus for conducting hearing tests, it is staffed by fully-qualified audiometricians.

New Branch

A NEW branch office at 247, Western Road, Leicester, has recently been acquired by Siemens Edison Swan Ltd. for their customers in Leicestershire, Northants and Rutland. Easier access for lorries and vans and car parking facilities for customers are two immediate advantages over the old premises in Leicester's congested High-cross Street. Additionally, new buildings to be erected will mean better service facilities.

"Talking" Books

"IT would be difficult to express the amount of sheer bliss the talking book library affords one." So writes one of the 5,500 "readers" of the unique library of long-playing gramophone records which provides so much companionship and entertainment to the elderly and the house-bound blind.

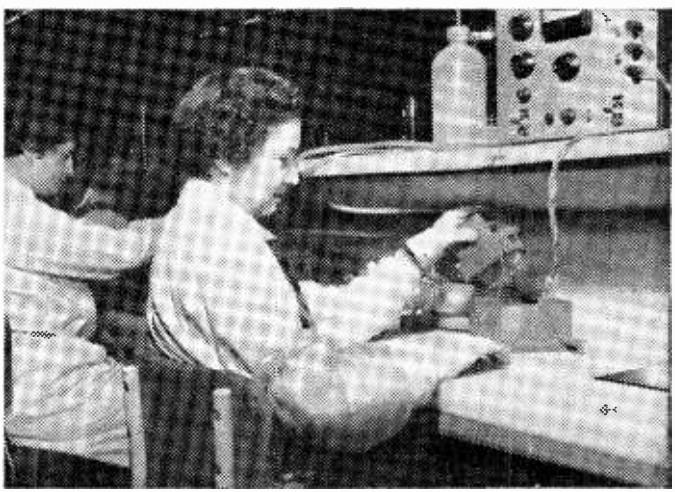
The care taken to select for recording only the best examples of books from a wide range of categories is reflected in the continued steady increase in reading by individual members.

In the latest report of the executive council, the R.N.I.B. states:

"It is with sincere pleasure that we record the grateful thanks, not only of ourselves but of our members to the two thousand amateur radio and sound recording enthusiasts throughout the country who render us such magnificent help in servicing the machines. Their generosity in giving so freely of their time and skill not only frequently reduces the period during which a faulty instrument may be out of use, but also relieves the owner of the cost of the necessary repairs."

Radar Installation for Wellington (N.Z.) Airport

WELLINGTON AIRPORT, which has just been officially opened, is the first airport in the world to have a high-power (500kW) 50cm radar installation. This has been supplied and installed by Marconi's who were awarded the contract after an exhaustive independent evaluation of other radars available in Europe and the U.S.A. The equipment supplied is the Marconi Type S264A, with a dual transmitter/receiver installation, either unit of which can be switched to a common radar aerial. Two-way microwave radio links are provided, over which the radar signals are passed to displays at the airport and the airways control centre four miles away; the links also provide a path for the remote control of the radar head.

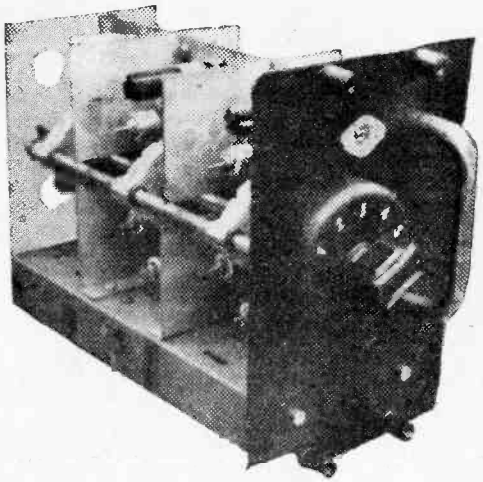


The recently built Mullard Semiconductor Plant at Southampton is one of the most advanced in the country and work is proceeding to enable transistors to be mass-produced. Here, a batch of silicon alloy transistors is about to be finally etched to attain the desired characteristic.

Using the RF24

THIS EX-GOVERNMENT UNIT CAN BE USED WITH MANY RECEIVERS

By D. Noble and D. Pratt



MANY receivers have a maximum frequency range such that they are unable to receive transmissions on the 14, 21 and 28Mc/s amateur bands. Many people are, therefore, faced with the problem of how the frequency range of their receiver may be extended without too much trouble.

Crystal Control

The cheaply-obtainable R.F.24 unit, is, in its original condition, very suitable for use as a converter for 21 and 28Mc/s. It has, however, certain drawbacks. The oscillator tends to drift, and thus it cannot be accurately calibrated. By using a crystal oscillator circuit in place of the original variable local oscillator, however, and if the receiver with which the converter is used is suitably calibrated, there will be no need to calibrate further. Say we had a local oscillator frequency on 22Mc/s, then 28Mc/s will appear on the receiver dial at 6Mc/s. and 30Mc/s will be on 8Mc/s, and the intermediate frequencies pro-rata.

TABLE I

Switch position	R.F. padder	Mixer padder
1	82 pF (C43)	150 pF (C46)
2	15 pF (C44)	47 pF (C47)
3	15 pF (C45)	47 pF (C48)
4	not required	not required
5	not required	not required

By careful selection of a local oscillator crystal, it can be arranged that either the fundamental or the second or third harmonics will give approximately the same I.F. output frequency for each of the 14, 21 and 28Mc/s amateur bands. A different crystal may be used for each band, of course, but then the cost may become prohibitive, while if a crystal is chosen so that the I.F. frequencies corresponding to the three bands differ widely from each other, it will be necessary to add another switch wafer to retune the I.F. coil of the converter to the appropriate frequency for each band.

"Birdies"

If crystals of certain frequencies are chosen it will be found that as the receiver is tuned over the I.F. frequencies concerned a number of apparent carriers will be heard. These are not a

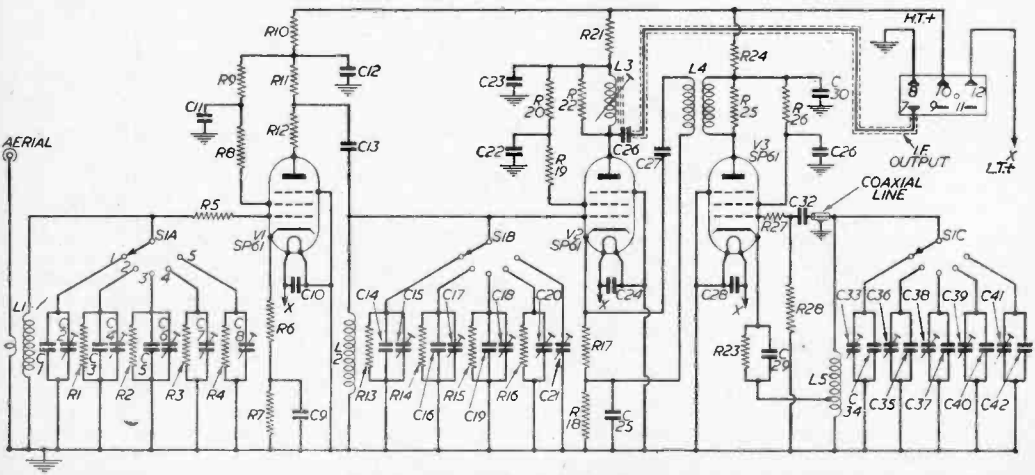


Fig. 1.—The original circuit diagram.

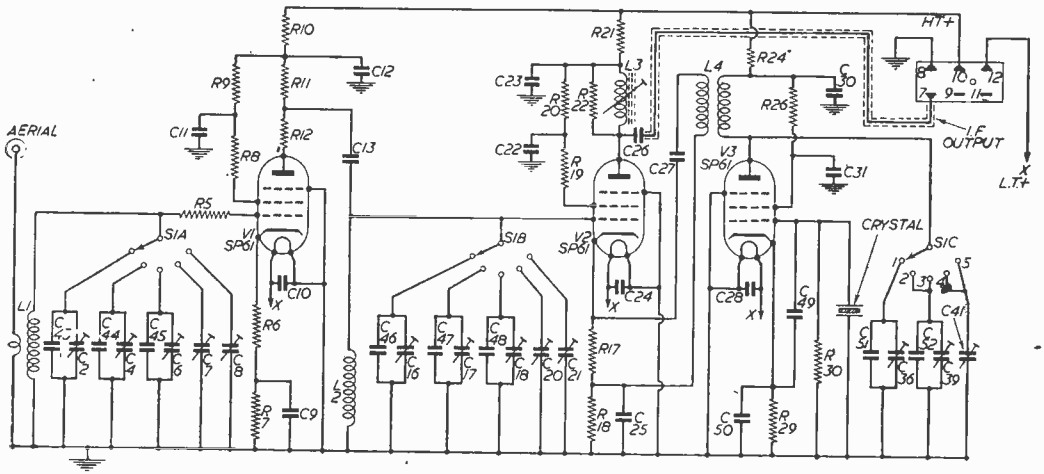


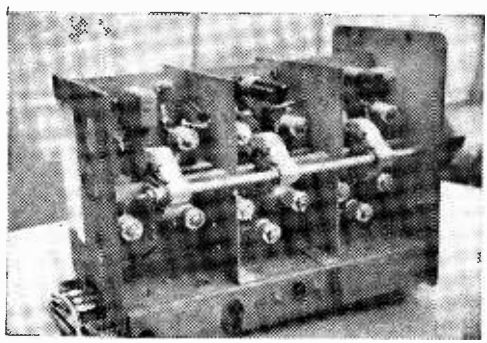
Fig. 2.—The modified circuit diagram.

number of thoughtless people who have left their transmitters running by mistake, but they are what are known as "birdies." These are caused when the I.F. tuning range is extended over the local oscillator harmonics and fundamental frequency. If a 7.5Mc/s crystal is employed, then, apart from the harmonics of the receiver local oscillator appearing on the converter input frequency range, the only "birdy" caused by the converter itself will be on the fourth harmonic of the crystal on 30Mc/s and can be put to good use as a band edge marker (see Table II).

Before commencing modification, the R.F.24 converter should be tested in its original form so that if it is faulty, it can be ascertained that any fault is not due to the modifications. After connecting up as indicated in Fig. 1, with a short aerial, signals should be received when the main receiver is tuned around the I.F. frequency of about 7.5Mc/s.

Procedure

The first stage in the modifications is to remove all the padding condensers and damping resistors connected in parallel with the concentric trimmers. The wiring of the oscillator stage above the chassis should be stripped, and the oscillator trimmers for ranges 1 and 3 removed. The coaxial line fastened to the dividing screen should be taken out as should also the oscillator grid coil. There should now be sufficient space available in which to fit the 7.5Mc/s crystal and its holder, and the crystal oscillator can be wired up according to Fig. 2.



Padding condensers should be fitted across the trimmers of the R.F. and mixer stages, and are given in Table I.

The damping resistor across the oscillator anode coil is not necessary, and may be removed. Also, so as to enable the oscillator anode coil to tune on each

TABLE II

Switch position	Converter freq. range	Local oscillator harmonic used	I.F. tuning range	Tune R.F. and mixer stages on :
	Mc/s	Mc/s	Mc/s	Mc/s
1	14.0-14.35	7.5	6.5-6.85	14.2
2	21.0-21.2	15	6.0-6.2	21.1
3	21.2-21.45	15	6.2-6.45	21.3
4	28.0-29.0	22.5	5.5-6.5	28.5
5	29.0-30.0	22.5	6.5-7.5	29.5

band, five turns should be taken off its winding.

Alignment

The converter is now ready for testing. It should be connected to a suitable power supply, and its output fed into a receiver. The converter is switched to each position in turn, and the receiver tuned to a signal at about the centre frequency of the range given in Table II, column 4. The corresponding trimmers in each stage should then be tuned for maximum response either aurally, or by the deflection of the S-meter if the receiver has one fitted.

Many amateur stations use the R.F.24 both as modified and in its original form: but the unit modified to crystal control has the advantage that the frequency is accurately known, and it is, therefore, more suitable for serious amateur radio listening.

COMPONENTS LIST

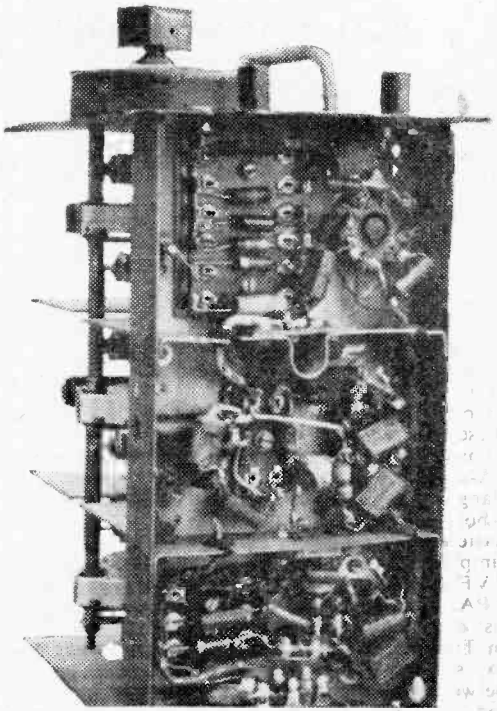
C1, C42, C44, C45, C49	15pF
C2, C4, C6, C7, C8, C15, C17, C18, C20, C21, C33, C36, C38, C39, C41	3-30pF trimmers
C3, C19, C26	10pF
C5	5pF
C9, C11	0.001μF
C10, C12, C22, C23, C24, C25, C28, C29, C30, C31	300pF
C13	100pF
C14	40pF
C16, C37	25pF
C27, C32	50pF
C34	35pF
C35	30pF
C40	20pF
C43	82pF
C46	150pF
C47, C48, C50	47pF
C51	680pF
C52	22pF
R1	3,900 ohms
R2	4,700 ohms
R3	6,200 ohms
R4	6,800 ohms
R15, R17, R27	47 ohms
R6	27 ohms
R7, R19	100 ohms
R8	12 ohms
R9, R16, R22, R26, R28	10,000 ohms
R10, R14, R21, R24	2,200 ohms
R11	3,000 ohms
R12	22 ohms
R13	1,500 ohms
R15	3,600 ohms
R18,R25	1,000 ohms
R20	100,000 ohms
R25	2,400 ohms
R29	270 ohms
R30	68,000 ohms
V1, V2, V3	Mazda SP61 (VR65)
S1	3-bank, 3-pole, 5-way ceramic switch
Xtal	7.5 Mc/s quartz crystal

COMPONENTS REMOVED DURING MODIFICATION :

C1, C3, C5, C14, C16, C19, C29, C33, C34, C35, C37, C38, C40, C42.
R1, R2, R3, R4, R13, R14, R15, R16, R23, R27, R28.

COMPONENTS ADDED DURING MODIFICATION :

C43, C44, C45, C46, C47, C48, C49, C50, C51, C52.
R29, R30.
7.5 Mc/s crystal.



Books Received

Principles of Frequency Modulation

THIS book is intended primarily for students, radio engineers and radio amateurs. In concise form and logical sequence it gives a comprehensive account of the fundamentals of frequency modulation and its application. This book is published by Illiffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1, and costs 21s., postage 10d. extra. It consists of 147 pages and 87 diagrams. The size of the book is 8¾in. × 5½in. The contents include Basic Principles of Frequency Modulation, Theory of Frequency Modulation, Frequency Modulation and Interference, F.M. Receivers, etc. Now that the incorporation of V.H.F. in broadcast receivers is standard practice this book is of great value for all radio technicians and students.

The Television Annual for 1960

THIS year's edition of the Television Annual includes many interesting articles by television personalities including Tommy Steele, Charlie Drake, Dr. Bronowski, Sir Kenneth Clark, Peter Scott, Max Jaffa, Perry Como and Gilbert Harding. It is published by Odhams Press Ltd., 96, Long Acre, London, W.C.2, and costs 10s. 6d. It consists of 158 pages and many photographs of television actors, actresses and personalities.

Becoming an Amateur

No. 5.—AMATEUR ABBREVIATIONS AND MORE RADIO THEORY

By J. D. Pearson, G3KOC

MANY beginners are discouraged when first tuning the amateur bands by the apparent gibberish spoken between licensed stations. This is due to the use on phone (telephony) of certain abbreviations and slang terms designed originally for use on C.W. (telegraphy), in order to speed up communication. Some of these words are obvious contractions, such as "condx" for "conditions," "XYL" for "wife" (ex-young lady), and so on. Others are pure slang derivations, i.e., "cans" for "headphones," "bottles" for "valves." Another practice, hastened no doubt by war-time brevity, is to use simply the initial letters of words, as with "VFO" for variable frequency oscillator, and "PA" for power amplifier. A full and complete list of the abbreviations in current usage is given in Table I. With this by his side the newcomer to short-wave listening can follow contacts between amateurs with interest, and when licensed will find this list absolutely essential. In order to develop familiarity with these terms they will be used where necessary throughout the remainder of this series.

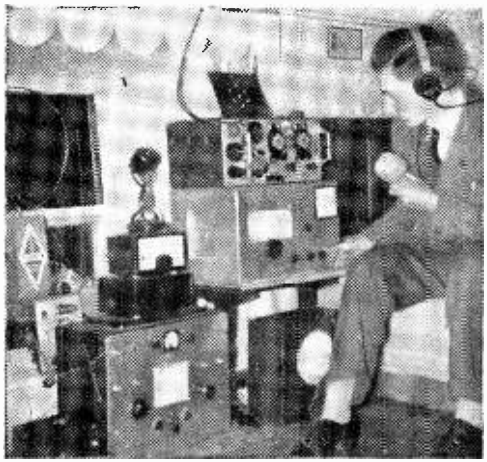
Circuit Diagrams

Before attempting construction of any type of radio or electronic gear the beginner must be able to "read" a circuit-diagram. This consists of a composition of various printed signs and symbols, each of which represents a particular component; it shows also the quantity and value of individual components, and their *electrical* disposition. A circuit-diagram should not be confused with a wiring diagram, which shows the *physical* disposition of various components which go to make up a completed piece of equipment. It is the practice of this magazine to give both circuit and wiring diagrams, except in the case of extremely simple circuits.

A working knowledge of the various signs and symbols used in radio circuitry, and the units used to express capacity, inductance and resistance can be gained by reference to the publications mentioned in previous articles.

Ohm's Law

This is a simple law dealing with the relationship between current, voltage and resistance which states that if any two of the quantities are known the third can be calculated. No apology is made for dealing with so basic a principle here as correspondence shows that several readers, when seeing the question on calculation of power input and R.F. output in copies of past R.A.E. examination papers, have expressed inability to tackle the question. They are either not familiar with Ohm's Law, or have failed to appreciate that the question is designed to test the candidate's knowledge of this law.



D. W. Dillon of Ballycastle in his den.

In the following formulae the letter "E" represents voltage, "I" current and "R" resistance. Ohm's Law states that:—

$$E = I \times R,\ I = \frac{E}{R}\quad R = \frac{E}{I}$$

It will be seen that two of the equations involve division, whilst the first requires multiplication. An aid to memory is the fact that in the equation involving multiplication the addition of an "e" would cause it to read the name of the Irish Republic—"EIRE." And if one remembers also that in the two equations involving division the "E" is always at the "top," a second's thought will always produce the required formula.

Analogy

When dealing with calculations involving Ohm's Law, the beginner may obtain assistance from a useful analogy: A large-bore horizontal pipe filled with water, such as a water main, is connected at one end to a water pump. When the pump is started the "pressure" behind the resultant flow represents the voltage; the "rate-of flow" past a given point on the pipe represents the current; and the inside diameter, or "bore" of the pipe represents resistance.

Consideration of the above analogy will reveal what occurs in a comparative circuit containing direct current, voltage and resistance. Circuits involving A.C. will be dealt with at a later stage when discussing A.C. theory.

Current and voltages are always referred to in whole numbers, or fractional parts of amps or volts. Resistance is measured in "ohms," after the scientist who established the theory which bears his name. The circuit symbol for ohms is the Greek letter Omega, thus: Ω.

Several prefixes are in common use in connection with electrical quantities; these are given in Table II. It is essential when using Ohm's Law to ensure that all quantities are expressed

as whole or fractional parts of the *basic* unit before multiplication or division takes places. For instance, multiplying 250mA by 100 ohms directly will result in the completely erroneous figure of 25,000 volts. The calculation should, of course, be set down as 0.25amps × 100ohms, which gives the correct result as 25V. This is an elementary mistake, but one often made on R.A.E. examination papers.

Watts

There are two further simple formulae with which the beginner must become thoroughly conversant. These state respectively that:—

$$W=E \times I \text{ and also } W=I^2 \times R$$

where W=Watts.

To illustrate the use of these two formulae it is proposed to examine in detail a typical question from an R.A.E. examination paper. The following information is usually given in the question:—

The D.C. input to the final anode of the power-amplifier stage of a transmitter is 1,000V at 100mA. The measured R.F. current in the aerial, which has a radiation resistance of 75 ohms, is 1 amp. State:—

a. The power input.
b. The power output.
c. The anode dissipation.
d. The stage efficiency.

A compound question of this nature usually carries 15 marks. The reader should be able to answer parts (a) and (b) confidently, using the basic formulae already given. If he feels he cannot do so he should turn back to the heading "Ohm's Law" and study the formulae again. A little intelligent detective work should reveal the answer to part (c) although admittedly this has not yet been discussed. Part (d) will be obvious only if the first three parts have been answered correctly.

Calculation

Let us first examine part (a) more fully. The question asks for an expression of power. Power is expressed in watts, and we have seen that W can equal volts × amps, or alternatively, amps squared × resistance. The first equation would seem more suited to our immediate needs because the question gives us circuit values which will fit the formulae. By substitution, therefore, we have:—

$W=E \times I$ (or $W=A \times V$)$=1{,}000V \times 0.1A$ (remembering that we must convert 100mA into 0.1A, as required by Ohm's Law)$=100W$. This is the power input.

Using exactly the same procedure we can determine the power output, but this time we find the wattage formulae we require is $I^2 \times R$. At this stage we may not be quite sure as to what is meant by the term "radiation resistance," but let us rest content that we have found a value for substitution in our equation. We have now then:—$W=I^2 \times R=$ 1amp × 1amp × 75ohms= 75watts. This is the power output.

Anode Dissipation

Unless any piece of radio or electrical equipment is 100 per cent. efficient (which it never is) the power output must be less than the power input. This power-loss occurs by way of heat losses in the form of radiation primarily, but there are other factors involved.

In the final power-amplifier stage of a transmitter power is lost chiefly by way of heat dissipation. A badly designed P.A. coil and poorly insulated tuning condensers will also contribute to lowered efficiency.

It will be seen, therefore, that anode dissipation equals power input minus power output, the case under discussion being 100W −75W=25W. This is a realistic figure, and a transmitter providing these figures which represent an efficiency of

TABLE 1.—SOME OF THE COMMONER ABBREVIATIONS USED BY AMATEURS.

abt	—about	gb	—goodbye	sigs	—signals
agn	—again	ge	—good evening	SWL	—Short Wave Listener
ani	—any	gld	—glad	tks	—thanks
ant	—antenna	gnd	—ground	tnx	—thanks
BC	—broadcast	gud	—good	tu	—thank you
BCL	—broadcast listener	hi	—laughter	tx	—transmitter
BCI	—broadcast interference	hpe	—hope	tvi	—Television interference
cct	—circuit	hr	—here	u	—you
clg	—calling	hrd	—heard	ur	—your, you're
CO	—crystal oscillator	hve	—have	vfo	—Variable Frequency Oscillator
cpse	—counterpoise	kcs	—kilocycles	vy	—very
CQ	—Require qso	mni	—Many	WX	—weather
condx	—conditions	mcs	—Megacycles	wid	—with
cul	—see you later	nw	—now	wkd	—worked
de	—from	ob	—old boy	wl	—will
dx	—long distance	om	—old man	wud	—would
ECO	—Electron coupled oscillator	op	—operator	xmtr	—transmitter
ere	—here	pa	—Power Amplifier	Xtal	—crystal
es	—and	pse	—please	XYL	—wife (ex young lady)
f b	—fine business	R	—all received	YL	—young lady
fer	—for	rprt	—report	73	—Best regards
fone	—telephony	rx	—receiver	88	—Love and kisses
		sa	—say		
		sed	—said		

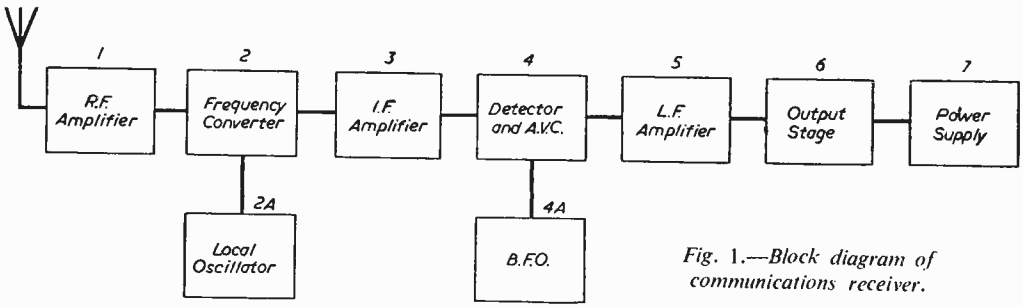


Fig. 1.—Block diagram of communications receiver.

75 per cent. would be considered quite satisfactory.

Stage Efficiency

The efficiency of any device, whether mechanical, electrical, electronic or hydraulic is usually expressed as the ratio of input to output, in terms of a percentage. This is the case with the problem under analysis, and we find that a simple formula can be derived which will cover all similar problems:—

$$\text{Stage efficiency } (\%) = \frac{\text{Power output (W)}}{\text{Power input (W)}} \times 100.$$

Calculation Practice

The beginner should now be in a position to set himself various problems involving Ohm's Law and obtain the right answer every time.

PREFIXES		
Sign	Expression	Explanation
k	kilo 10^3	X 1,000
m	milli 10^{-3}	one thousandth part of
M	Mega 10^6	x 1,000,000
μ	micro 10^{-6}	one millionth part of
p	pico 10^{-12}	one millionth part of one millionth part of

Table II.—The above prefixes are commonly used in connection with electrical and radio units and quantities.

Eventually he will be able to do all calculation (excepting that which is really unwieldy), mentally. It is useful to remember that 100mA is 0.1A. and that 50mA is 0.05A.

Basic Receiver Principles

There are two main methods employed in the detection and amplification of a radio signal. Both must be fully understood for R.A.E. purposes. A third system, detection of frequency-modulated signals, cannot be dealt with at this stage.

The first system, known as "tuned radio frequency" reception (usually abbreviated to T.R.F.) and even more commonly as "straight" reception, is one with which many older readers will be familiar. This method involves the detection and amplification of a radio signal *on the same frequency as it is received.*

The second system is a little more complicated. The incoming signal is first "mixed" or heterodyned with another signal which is generated in the receiver by the "local oscillator." This locally generated signal is different in frequency to the incoming signal by only a few hundred kc/s (usually 465kc/s). The result of "mixing" the two signals produces, at the anode of the frequency-changer valve (sometimes known as the "mixer"), several different frequencies. One of these, 465kc/s, say, is passed on for further amplification *before* detection; or to use the correct term, demodulation.

It will be appreciated that as any succeeding stages of amplification following the frequency-changer have to deal with only one frequency, they can be designed to operate with maximum efficiency at that particular frequency. This has the effect of increasing selectivity far in excess of that obtainable with a "straight" receiver. There are other advantages with this second system of reception, which is known as the "superheterodyne" principle, usually abbreviated "superhet," but the object at the moment is simply to impress upon the beginner the basic essential differences between the two modes of reception.

It should be noted that the frequency chosen for amplification in the superhet is known as the I.F., or intermediate frequency; and that although 465kc/s has been quoted almost any frequency may be used. Many TV receivers use an I.F. of 10Mc/s; the "surplus" receiver R1155 uses an I.F. of 560kc/s.

Theory Required

For the Radio Amateur's Examination the candidate must be capable of discussing intelligently the merits and faults of both superhet and T.R.F. receivers; he may be required to draw a circuit of a 3-stage "straight" receiver, but it is unlikely he will be asked to draw a complete circuit of a superhet. He should be in a position, however, to draw a "block" diagram of a superhet, showing the various functional stages. Such a diagram is shown in Fig. 1. It is sufficient for the moment that the reader understands the points outlined, however; greater attention can be given to this subject in a future article when the beginner fully understands the operation of the tuned circuit.

As stated in a previous article it is almost essential that the newcomer to amateur radio spends a period as a short-wave listener before becoming licensed.

(To be continued)

Preventing I.F. Breakthrough

FEW EXTRA COMPONENTS ARE REQUIRED

By J. B. Dance, M.Sc.

IT is sometimes found that a certain unwanted signal interferes with many wanted programmes from a receiver and that this interference is not removed by alteration of the tuning, although a large tuning alteration may reduce its strength. The trouble—which may be present on more than one waveband—is caused by a signal of approximately the same frequency as the I.F. of the receiver finding its way into the I.F. chain. It will then be amplified and detected together with the wanted signal. As far as possible, receiver designers avoid the trouble by choosing the receiver I.F. so that it is unlikely that a powerful signal will be picked up on the frequency. Frequencies within the medium wave band are therefore avoided for I.F.s. It is possible that interference may come from coastal navigational stations, especially if one lives near to them.

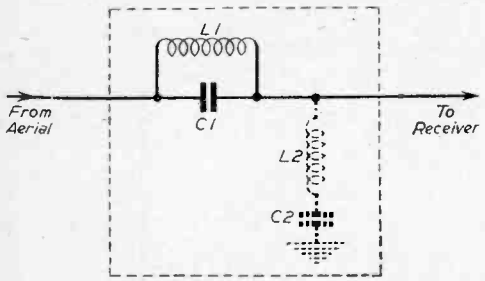


Fig. 1.—Using a filter circuit in the aerial lead.

First I.F. Stage

Occasionally the interfering signal of the I.F. frequency is picked up between the anode of the frequency changer and the grid of the first I.F. amplifier. Any signal picked up after the first I.F. amplifier will not be amplified enough to cause appreciable interference. Interference which is picked up after the frequency changer will be present on all wavebands and, providing the receiver gain is constant (no A.G.C. used), it will not vary in strength as the tuning is altered. The interference will still be heard if the frequency changer grid is earthed. Suitable screening from the frequency changer anode to the first I.F. amplifier grid will provide a complete cure for this type of I.F. pick-up; screened leads (preferably coaxial) may be used for connections between the frequency changer and the first I.F. valve, but the first transformer must then be realigned.

Breakthrough from the Aerial

A more common form of I.F. breakthrough occurs when a fairly strong signal near the I.F. is picked up by the aerial and passes with the wanted signal to the frequency changer grid. It is then amplified by the frequency changer and passed to the I.F. amplifier without its frequency being altered. Whilst passing from the aerial to the frequency changer, however, it has to pass through the R.F. tuned circuits which are resonant at a different frequency to the interference (namely the signal frequency); the interfering signal must therefore be fairly strong at the aerial or the attenuation of the R.F. tuned circuits would render it inaudible. For a certain setting of the receiver gain, this type of interference will probably be worst when the wanted signal frequency is fairly close to the I.F., as the attenuating effect of the signal frequency tuned circuits will then be less. The greater the R.F. selectivity, the better will be the rejection of I.F. interference picked up in the aerial. The trouble is most likely to occur when no R.F. stage is used, as the interfering signal will then normally have to force its way through only one tuned circuit resonant at the frequency of the wanted signal.

When the interference is picked up by the aerial, it may be possible to get rid of it by improving the selectivity of the R.F. tuned circuits, i.e., by using coils of a higher "Q" or by using more tuned R.F. circuits (possibly with the addition of an R.F. amplifier). This is not always practicable, however, and other methods have to be found.

Aerial Filters

One of the best solutions is the use of a tuned circuit resonant at the receiver I.F. which is placed in the aerial lead as shown in Fig. 1. Normally either the parallel rejector circuit (L1C1) or the series acceptor circuit (L2C2, shown dotted) is adequate, but one of these circuits may give somewhat better results than the other and the

(*Continued on page 759*)

Table 1.—Number of turns required on a coil to make it resonate at certain commonly used I.F.s when used with the capacitance shown.

I.F. (kc/s)	C (pF)	Former Diameter (in.)	Winding length (in.)	NUMBER OF TURNS	
				Without dust core.	With dust core.
455-470	120	0.4	0.5	455	415
455-470	150	0.4	0.5	410	375
1600	100	0.4	0.4	128	116
560 (As in the 1155 receiver)	120	0.4	0.5	375	340

A TRANSISTOR REFLEX RECEIVER

AN UNUSUAL REGENERATIVE CIRCUIT

By D. B. Pitt

THIS transistor receiver is a reflex-action receiver. There is nothing unique in this, of course. Reflex receivers became popular in the early days of thermionic valves when these were still very expensive, and have returned to favour recently because of the high price of R.F. transistors. In a reflex receiver, one transistor does the work of two.

Circuit

It is also a regenerative receiver, but again there is nothing unusual about this fact in itself. The unusual feature is that it combines these two methods of achieving volume and sensitivity in a rather special way and with a very high order of efficiency.

Many aspects may appear rather odd. The aerial is not attached to the "beginning" of the set which although being a reflex receiver, contains no R.F. chokes at all and although it is regenerative there is no reaction coil as such. Instead of a regeneration control, it has a degeneration adjustment. It cannot be duplicated using valves; only a transistor will work efficiently in the circuit because of its high level of internal feedback. Lastly, it cannot work at all without regeneration which is inherent in the design, not something just added to a functioning receiver to give it extra power.

Operation

In some ways its working is rather complex and no attempt will be made to go into detail; this article being of an essentially practical nature.

First, the "oddities" of the set, the tuning circuit is connected, you will notice, directly to the collector or "out" terminal of the R.F. transistor, T1, so also is the aerial assuming you intend to use one. In a neutral set this would be a dismal failure, but in a regenerative receiver the advantages of the "normal" position disappear as regeneration increases, until, at the point of oscillation, which readers may remember is the point where the gain of the transistor (or valve) equals all the regenerative circuit losses, it matters little at which point in the loop the signal is injected. Because this receiver, like most regenerators, is intended to work fairly close to the point of oscillation, and there happen to be additional advantages, as will be seen, the unorthodox position shown has been chosen.

It may be apparent to readers familiar with reflex circuits that one component is missing. There is no R.F. choke in the collector choke. This is because the tuning circuit does this job itself but much more efficiently, creating a very high rejector-circuit impedance to the signal frequency at the collector terminal and diverting it to the detector stage.

There is also no coupling coil because the aerial is connected to the high impedance end of the transistor and therefore matching down becomes unnecessary.

The coil L2 provides a source of signal, but primarily acts as an inductive load to balance the impedance created by the tuned circuit. Without such a load, internal regeneration would not take place.

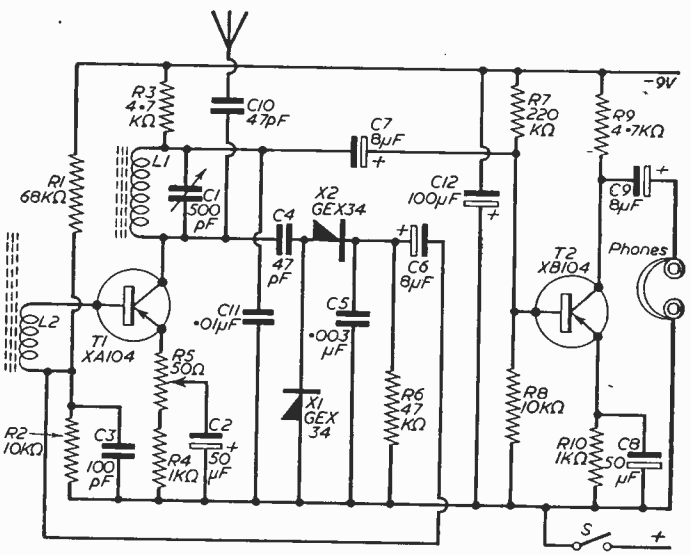


Fig. 1.—The circuit diagram. A capacitor, C13, of 46pF between the emitter and collector of T1 may improve results (see text).

Degeneration Control

Finally, there is the degeneration control R5. This effectively acts in opposition to L2, creating a degenerative effect which cancels out regeneration to the degree required by allowing a portion of the emitter resistance to remain unbypassed by the condenser C2. As it also introduces audio degeneration (this being a reflex receiver) the control functions to some extent as a volume control.

The other components have their normal function as in an orthodox reflex set. The tuned circuit feeds the amplified signal to the detector. The residual R.F. is removed by C5 and the audio fraction passed via the blocking condenser C6 back to the base of the transistor. It is then amplified again, passes through the tuning coil, and is R-C coupled to the second transistor. This is a normal audio stage and may be followed by a similar third stage if more volume is required.

Layout

The components may be mounted in any convenient way. The author used a ½in. thick baseboard with a plywood panel fixed to its edge at right-angles. On the panels were mounted C1, R5 and S together with the ferrite rod. All other parts were fixed on the baseboard which had two parallel brass strips attached by woodscrews to act as negative and positive bars. The bars were separated by 3in. and this proved quite adequate for miniature components.

For each transistor, three tag-washers with the tags bent at right-angles, were arranged in a line, ½in. apart, and fixed by round-headed woodscrews to the board. The pigtails of the transistors were clamped firmly under these washers after all wiring-up was completed, thus avoiding all the risks of soldering these components.

Coil

The success of this rather unusual circuit depends on the development of a very sharply peaked resonance in L1. In order to ensure this, a pot-core assembly, Neosid D.10, obtainable from Denco, Ltd., is used. These pot-cores, which provide a completely closed magnetic circuit, permit a Q-factor of 200 or more to be achieved, and in addition make coil-winding a very simple matter indeed.

If the reader has not had any previous experience of pot cores, he should, on obtaining one, take it carefully to pieces to see how it is constructed. Proceed as follows:—

First undo the slotted plastic screw on the top of the pot, and lift off the upper ferrite cup. Take out the small polystyrene bobbin and notice that it has three annular slots to accommodate three separate coils. We shall only be using the middle one. Take the rest of the pot apart and notice that each cup has two semi-circular grooves, one each side. These must coincide when the pot is reassembled to provide two circular holes for the coil lead-in wires.

In the construction of this receiver two strips of brass are laid on the base to serve as positive and negative bars; that in the prototype is ½in. × 1/16in., a gauge readily obtainable from hardware shops.

The two rails, after cleaning with fine emery paper, are drilled at each end and screwed down parallel, and 3in. to 4in. apart. Round-headed brass woodscrews are used on a wooden baseboard; on a plastic base (which saves weight and some space), 6B.A. round-headed brass bolts, ½in. long, are ideal.

You should now obtain 19 tag-washers, size 6B.A., and bend up all the tags through almost a right angle. These provide all the anchoring points needed. Four of them go under the heads of the screws at the ends of the two bars, the other fifteen being arranged in the pattern shown.

The various basic components can now be fitted on, using the component wires themselves to provide conductors. It is best to connect up without soldering until all the conductors are in position. Simply pass each wire through the appropriate tag-hole, bend round to secure, then snip off the surplus wire. Leave the transistors and diodes on one side until all the soldering (including the few connecting wires needed) has been completed. At the last moment you can loosen a little the nine screws concerned, and clamp the transistor and diode wires firmly under the washers. Provided the wires and washers are quite clean, the contacts so made are perfectly good, and the four semi-conductors can suffer no damage by overheating.

Wires

The few insulated connecting wires used should be kept as short as possible. The six fly-leads shown can be allowed a little more length and may be twisted into "flex" for convenience and neatness. If you do this, be careful with the battery fly-lead and use two different colours of wire so as to make no mistakes of polarity.

The ferrite rod (actually three thin 6in. rods, bound together) was fixed high up behind the front panel. In this position L1 and L2 are far enough apart not to interact, their axes being at right-angles to each other, anyway. Note also the plastic extension to the shaft of the tuning condenser to remove hand-capacity effects.

(To be continued.)

SET ANALYSER

IN the article on the Set Analyser given in the June, 1959, issue, double-pole, changeover switches were specified, but several readers have informed us that they are experiencing difficulty in obtaining this type of switch. Double-pole, double-throw switches are, however, more readily available and a wiring diagram is given below so that a pair of such switches may be used in the Analyser.

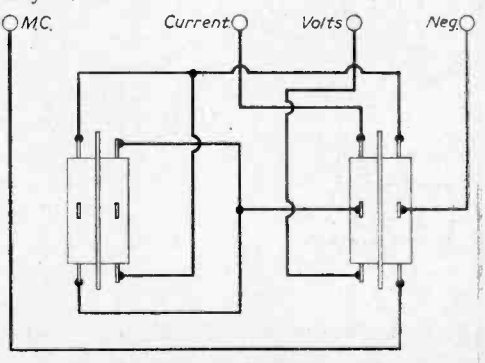


Fig. 1.—Wiring of DPDT switches.

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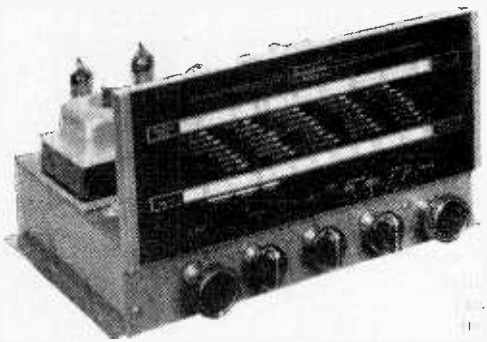

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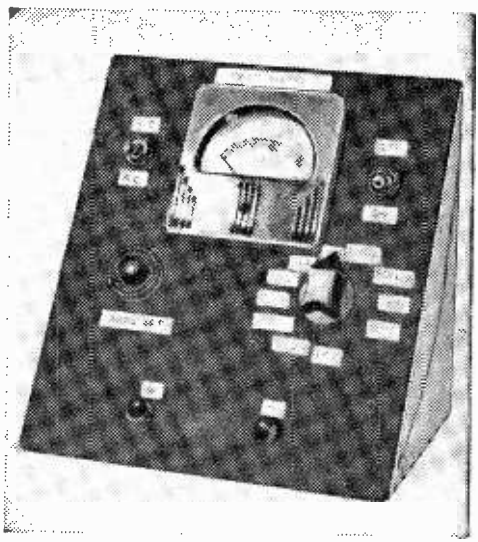
Beginner's Test-Meter

No. 6.—ADDING THE RESISTANCE RANGE TO THE MULTI-METER

By E. V. King

IN the previous two articles the wiring for the current ranges was added to the meter and the shunts were constructed. The wiring of the multi-meter should now be as shown in Figs. 14 and 17 (which were given on pages 572 and 573 of the November 1959 issue). Before proceeding further you should make sure that your meter operates perfectly on all the ranges so far completed. The method of testing the various ranges was given in the previous article (in the December issue).



The completed meter.

Resistance Range

The resistance range to be added to the meter can be used to read resistance values from about 200ohms to 0.5megohms, the accuracy being greatest around readings of 3,000 to 5,000ohms. Although the meter will not be as accurate as a resistance bridge, it will suffice for most tests needed in servicing that will be encountered by the beginner or even by those with more experience. In most radio receivers and in most electronic equipment, resistor values are not particularly critical and a really accurate resistance meter is, therefore, unnecessary.

The additional parts required for the resistance range are VR1, a battery, and R10. Resistor R10 has a value of 3.3k (3,300ohms) and is in series with VR1 which has a value of 1k. This latter variable resistor is inserted to compensate for the changes in battery voltage which occur at the end of its life. The 3.3k resistor limits the current through the meter and when you choose this resistor make sure that you read the colour code correctly as the insertion of an incorrect value could cause the meter to be burnt out.

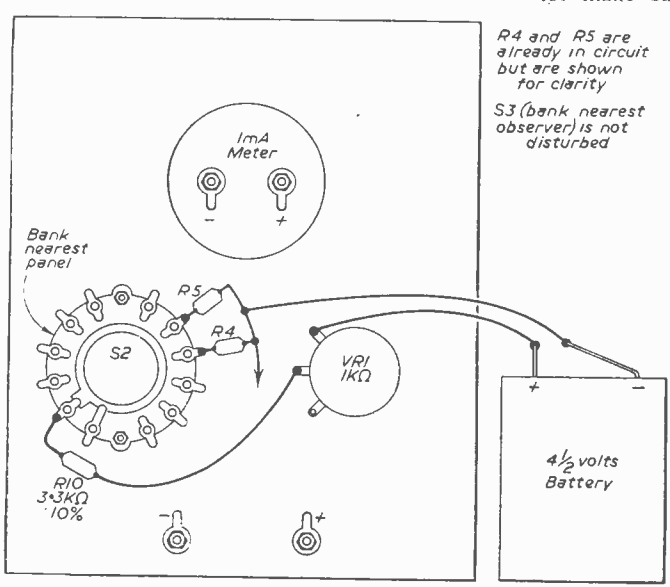


Fig. 26.—Extra wiring for the resistance range.

Variable resistor VR1 is mounted in the only spare hole in the panel (which has been shown in many diagrams). It is fitted with a small knob which need not be of the pointer type.

Wiring

Refer to Fig. 26 and compare it with Figs. 27 and 28 (a). At first sight, these diagrams may appear rather confusing to the beginner but all will become clear later. Meanwhile note that no wires already in position have to be altered. Three wires are needed in addition to R10, VR1 and the battery (4½V, "flat").

Solder two 6in. leads on to the battery tags and take the positive lead (the one from the shorter tag) to one of the outside tags of VR1. Take the other lead to the "busbar" which joins all the voltage resistors together. R4 and R5 being shown in Fig. 26. Join the centre

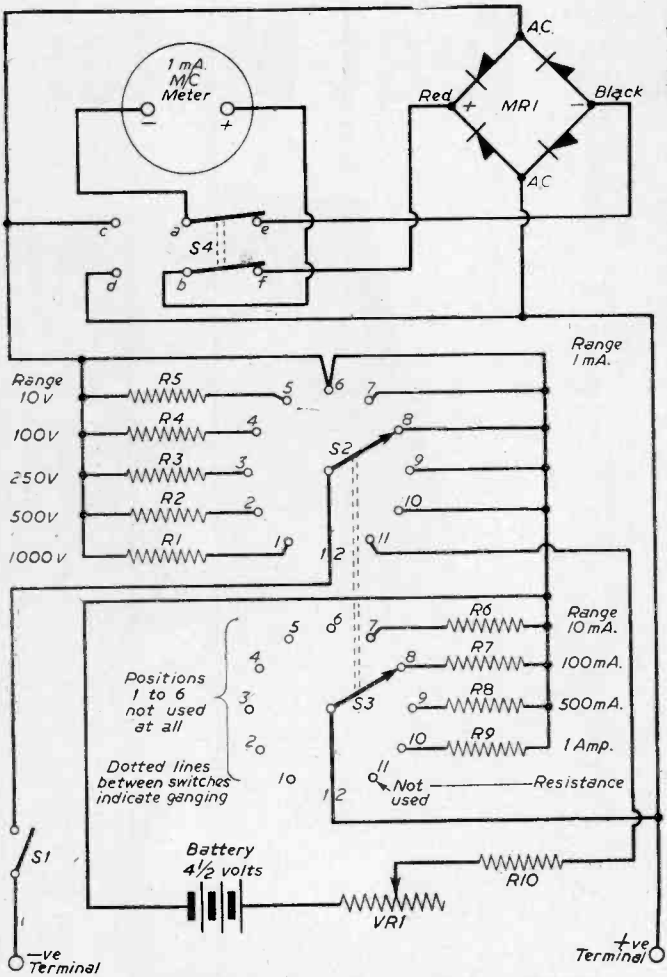


Fig. 27.—The final circuit diagram of the multimeter.

tag of the potentiometer to tag 11 on S2 via the 3.3k resistor. Mount this on a short lead on the switch tag. Note that S2 is being used and is the wafer nearer to the panel. Now verify that all the tags of S2 are in use and that the first six of S3 are not used.

Testing the Resistance Range

As always when testing, do not put S1 on until you are ready. Clip the test leads to a resistor of between 5k and 20k and make sure that good contact is made. Switch on S1 with the range switch pointing to resistance (see Fig. 12). The meter should move but should not go over beyond 0.7 on the scale. If it does then R10 is probably faulty. If the movement is not too great, then all is well. Take the resistor off and clip the test leads together. The pointer will now move right across the scale to show 'zero' resistance. Now carefully set the zero setting control VR1 so that the needle shows 1mA exactly. The zero control is then left in this position and normally will not need further adjustment for a long time. Eventually the zeroing control will be unable to compensate for the low battery voltage and a new battery will have to be fitted.

Explanation of the Circuit

In Fig. 28(a) is shown the resistance range of the meter in simple form. Electrons leave the negative pole of the battery being repelled by the 4½V of the battery through the meter, the resistance being tested, the variable resistance, and the 3.3k resistor until eventually they arrive at the positive pole of the battery. When the resistance under test is a straight wire of no resistance the current through the circuit is exactly 1mA. Readers can refer to any text book on electricity to gain a knowledge of Ohm's Law.

If we now insert a resistance of about 4,500ohms in circuit in place of the wire the battery voltage will not force 1mA through, but only ½mA. This is the calibration point for 4.5k. Thus the higher the resistor placed in the circuit the less the current and the less the deflection of the needle. Values below about 500ohms give such a large current (almost 1mA) that it is difficult to read accurately. The same applies to values of over 0.5M. However, a 1M resistor will just show a needle movement if it is all right.

Now refer to Fig. 27. The switch S4 has not yet been added to the circuit, but in the D.C. position the tag c is joined (via S4) to meter minus and tag d to meter plus. Thus for the moment we may consider c and d as meter terminals.

Starting with battery minus follow the circuit through as follows (remember, the switch is on No 11 range):—

1. Battery minus to "c", i.e., meter.
2. Through meter to the plus terminal of the meter, i.e., "d."
3. From "d" to the plus terminal of the multimeter and through the test lead.
4. From the test lead through the resistance to be tested to the other lead and the negative

PARTS REQUIRED

R10, 3.3 k., ½W. resistor, 10 per cent. tolerance (silver line).
Two-pole two-way, toggle switch.
Meter rectifier, 1 mA. (or use diodes as suggested in text).
4½V. flat torch battery.
Tin plate (from cocoa tin, etc.), screws, etc

terminal of the multi-meter.

5. Then through S1 (if it is on).

6. From S1 to the slider of S2 which is connecting with tag 11.

7. Tag 11 leads the current through the 3.3k resistor and the variable resistance VR1 and so back to the other side of the battery.

The beginner should follow the above circuit through on the diagrams and on his meter so that he is quite sure how it all works.

Calibration

The author has already mentioned that the beginner is to be cautioned against taking the meter to pieces as he is very likely to damage it in some way. However, it is quite possible to do so, especially if the operator is able to control his fingers within fine limits as in watch repairing. In that case, a new scale may be added with black or white Indian ink so that a kilohms scale can be directly read off. This could be done using good resistors, but can be done fairly accurately by using the chart given below. These figures are affected by your value for the 3.3k, your battery voltage and the meter resistance. The figures are within 10 per cent. accurate.

Another method which the author favours for beginners is to obtain at the stationers some graph paper, standard ¼in. squares will do, but you could use a sheet from a "radio diary."

A suitable layout for the graphs is shown in Fig. 29. The milliamps shown by the needle are down the left-hand side and along the bottom are the kilohms which will cause such a deflection. The graphs may be plotted using the points given in the chart or may be copied from Fig. 29. An example of how to find a plotting point is taken; a 1k resistor causes a deflection of 0.8mA. A dot is made at the intersection of the 1k line upwards with the 0.8mA line horizontally. When all the dots are marked in, the *smooth* line may be carefully drawn in.

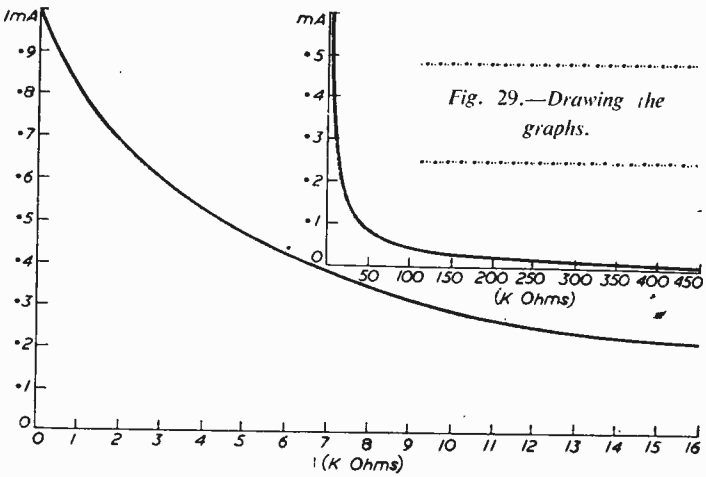


Fig. 29.—Drawing the graphs.

In Fig. 29 you will notice a smaller graph in the top right-hand corner, this could, of course, be on another piece of paper. The kilohms scale is different, so that you can read off high resistor values with more accuracy. Suitable scales are given here:—

Low Kilohms

Milliamps: 0.1 milliamp to each ½in., starting at 0.3milliamps along the bottom from the right angle to the front panel finishing, of course, with 1milliamp.

Kilohms: 1k to each ½in., starting at zero at the right angle, upwards along the back to 10k. This will be about 1in. from the top of the side.

High Kilohms

Milliamps: 0.1 milliamps to each ½in., starting at zero along the bottom from the right angle to the front panel finish with 0.6mA.

Kilohms: 50k to each ½in., starting at zero at the right angle and working upwards along the back to 500k (0.5M), which will be about ½in. from the top of the side.

Chart for Resistance Calibration (or the Graph)

Meter reading	Resistance (approx.)
Zero	Very high or infinite resistance
0.1	40,000ohms.
0.2	18,000ohms.
0.3	10,500ohms.
0.4	6,750ohms.
0.5	4,500ohms.
0.6	3,000ohms.
0.7	2,000ohms.
0.8	1,000ohms.
0.9	500ohms
1.0	Very low or no resistance

(To be continued)

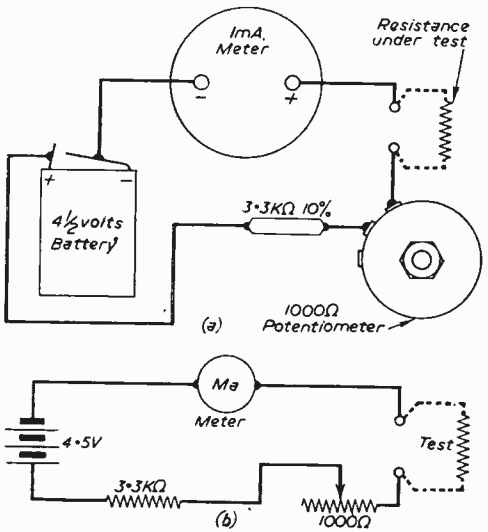
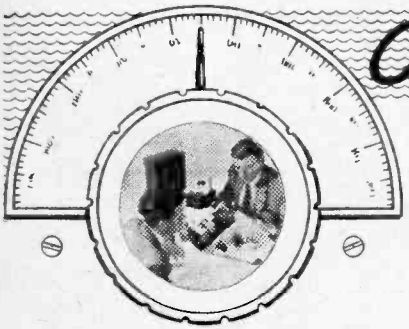


Fig. 28.—The circuit of the resistance range.



On Your Wavelength

BY THERMION

CONSEQUENT upon my assessment of the present state of Amateur Radio in my article last month, I have received a number of letters; all of them have proved most interesting reading. The majority express agreement with my views, especially those from older readers who remember the thrills of the early days of our hobby. Younger readers tend to be in disagreement with me.

Mr. Graham S. H. Stubbs, of Hitchin, does not hold my views and his letter contains some interesting guesses concerning my character and knowledge which would amuse my friends. Mr. Stubbs said:

"Thermion's latest assessment of amateur radio is the greatest example of his own ignorance he has yet offered.

"He states in the December, 1959, issue; 'Nowadays everything is over; there is nothing left to discover.' Nothing could be further from the truth; there is so much work yet to be done by the radio amateur that the real problem is to know where to begin.

"Much work in the field of radio communication can only be carried out by the radio amateur who has the experience, patience and enthusiasm to develop ideas which might be rejected by the professional engineer as economically unworthy of development. The professional left it to the radio amateur to open up the higher frequency bands before the war, and on these same bands the modern radio amateur can make new developments and discoveries; as yet very little work has been done on the higher frequencies using transistors entirely in place of thermionic valves. This is but one example of a field in which the radio amateur has a big part to play."

Mr. Stubbs says, "Much work in the field of radio communication can only be carried out by the radio amateur who has the experience, patience and enthusiasm to develop ideas which might be rejected by the professional engineer as economically unworthy of development." While the first part of this statement may have been true in the very early days of radio communication, it certainly no longer applies. Mr. Stubbs seems to revere the word "amateur" and seems to think only those who can be called amateurs are capable of possessing any of the three qualities—experience, patience and enthusiasm—which he lists. These are qualities of the professional as well as the amateur, although they are often more marked in the amateur, but only because he does not make his living by the application of electronics. In these days, any professional is bound to have more experience than the amateur—by "professional" I mean someone who spends his time on research into radio subjects, not a radio serviceman. As for patience, this is a quality possessed by everyone to some degree, from farmers to pharmacists and is certainly not unique to the radio fraternity. Enthusiasm, too, is a quality which depends upon whether one is interested in one's work, and not on what work one does.

Facilities

It is obvious that the professional has the advantage of better facilities. Few amateurs have access to a laboratory, to precision instruments, or to sufficient money for their optimistically-named "research schemes." Nowadays, it is a mistaken belief that the amateur has much to offer to the development of radio: this sentiment is purely wishful thinking. It appeals to the whimsically minded to convince themselves and say that with all the much-vaunted facilities of the professional research worker, it takes an amateur, struggling in some cold, dark, dingy shed at the bottom of his garden, to solve a problem which has been baffling the professional for months. Nothing could be further from the truth and any clear-thinking person will agree with me.

As I said previously, it may have been true that, in the past, many far-reaching discoveries were made by amateurs, but I maintain that this state of affairs no longer exists. It is true that there is much to occupy the amateur, but this is mainly in the nature of testing or confirming the results obtained by the professional and not in branching out into some hitherto uncharted field of development. The amateur has neither the time, money, experience and, very often, ability for detailed scientific research work. Even the results he does manage to obtain are qualitative rather than quantitative.

No, the days of the amateur radio as an instrument of research are wellnigh over; it is only the monetarily and mentally gifted amateur who stands a chance. The advantages of the professional are overwhelming and it is best to consider amateur radio purely as an interesting, absorbing, and exceedingly instructive hobby.

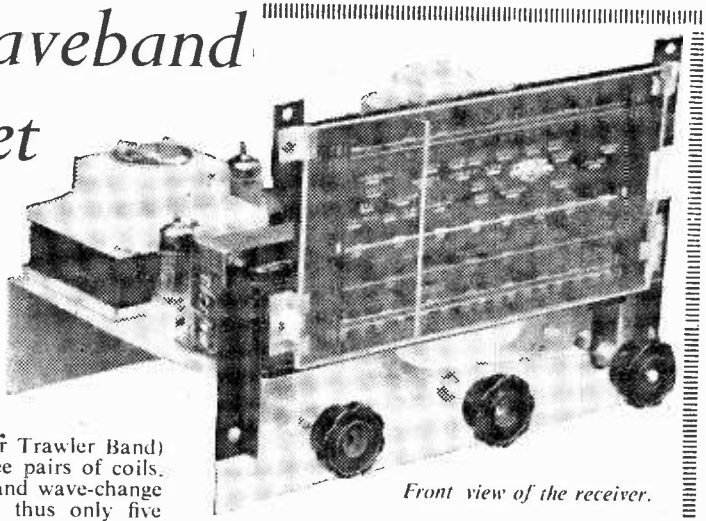
Don't forget the
P.W. AND P.T. FILM SHOW
Caxton Hall, Westminster, London
January 22nd, at 7.30 p.m.

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

Three-waveband Superhet

EASILY CONSTRUCTED AND ALIGNED

By R. MORGAN



Front view of the receiver.

THE construction and wiring of a receiver of this type is much simplified by using a ready-made coilpack. The one fitted allows long, medium and short waves (or Trawler Band) to be tuned and contains the three pairs of coils, six associated trimmers, padders and wave-change switch, ready wired. There are thus only five connections from the pack, in addition to the mounting bush, and this should be particularly appreciated by the constructor who feels that the wiring of individual coils, trimmers, padders and switch may be too difficult.

Size

As miniature construction also tends to introduce difficulties, the receiver is of fairly large size and this makes wiring and soldering less awkward. It also allows a large attractive tuning dial, with vertical pointer, to be fitted, which gives clear indications of wavelengths and stations for the long and medium wavebands and shows wavelengths and short wavebands on the S.W. portion of the scale.

The receiver circuit is shown in Fig. 1, the numbered points connecting up to the tags on the coilpack. A receiver of this kind can give very good results, with ample volume from a large number of M.W. stations and a lively performance on S.W. Automatic volume control is provided in the usual way, to counteract fading. The two 200pF condensers and 10k resistor (or R.F. choke) form a modulation hum filter, designed to cut out the tunable hum which may in some circumstances otherwise be troublesome.

Readings

It should be noted that if accurate dial readings are to be expected on all bands, it is necessary to use the specified coilpack, tuning condenser and dial. These are intended to work together. Miniature I.F. transformers can be fitted, if desired, provided they are for 465kc/s and are efficient. Some transformers have coloured leads, while others have projecting tags and it is important that the transformers are wired correctly.

This is shown in Fig. 2, which also indicates

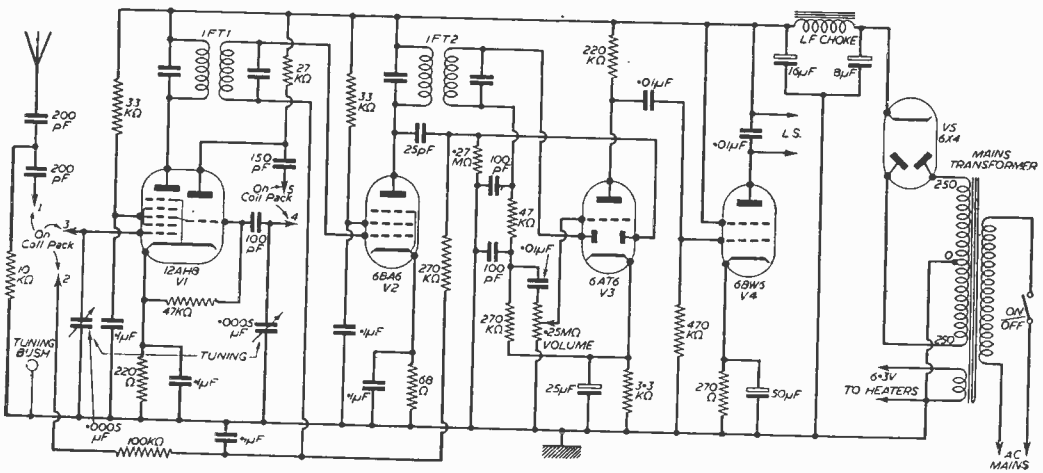
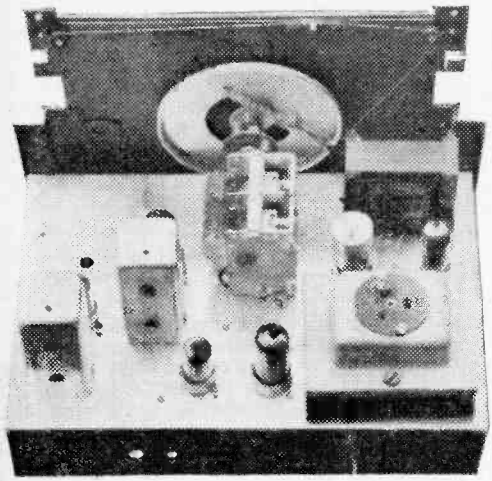


Fig. 1.—The circuit diagram.

where the valves should be inserted, when the receiver is completed. Construction is much simplified by using a ready-drilled chassis, as there is then no need to cut valveholder holes, or an aperture for the mains transformer.

The dial and 2-gang condenser should be located so that the spindles come in line, so that the flexible coupler fits easily and no excessive friction is caused. This is most easily assured by lining up the spindles with the coupler removed.



Rear view of the receiver.

When the gang condenser has been bolted in place, the dial can be removed until wiring is completed. The bolts holding the front fixing feet of the condenser should be inserted from below. If inserted from above, they may foul the coilpack.

Valveholders

When bolting down the valveholders, position them so that the sockets come approximately as shown in Fig. 3. Note that the 6BW6 and 12AH8 valves use 9-pin holders and that the latter has two heater tags joined, as this is necessary when running the 12AH8 from a 6.3V heater circuit.

The layout of components below the chassis will be seen from Fig. 3. There is no need to position resistors and condensers exactly as shown, provided all connections are reasonably short and direct. In the actual receiver, some parts will tend to overlap others, but they should not touch each other, or other leads, or the chassis.

Wiring

All connections in the receiver are shown in Fig. 3. Two leads pass from the positive tags of the 8 plus 16μF condenser to the smoothing choke. Lead "X" goes from tag 4 of the pack, to the rear set of fixed plates on the gang condenser. Lead "Y" passes from tag 3 to the front set of fixed plates.

Four small tag strips are used to anchor various points. Strip "A" has one tag joined to the chassis and holds the modulation hum filter components. About 6ft. of thin flex is soldered to the free tag, as shown, to provide an aerial. A longer indoor or outdoor aerial may be joined to this, if desired.

Tag strip "B" has two free tags and one joined to the chassis and provides connecting points for the two 100pF condensers, 47k resistor, and other leads.

Strip "C" has three free tags, two of which are joined to allow various resistors and other leads in the H.T. positive circuit to be wired up easily. The 33k resistor is also joined on here, the left-hand tag forming the screen grid connecting point for the I.F. stage.

Strip "D" has two free tags, these forming junction points for the A.V.C. line and 0.01μF condenser. Here, as elsewhere in Fig. 3, all points marked "E" should be joined to the chassis. This is best done by soldering the leads to 6 B.A. tags held with short 6 B.A. bolts.

With the first I.F. transformer, "A" indicates the anode lead or tag and "H.T." the high tension positive connection. The primary of the second I.F. transformer is wired in the same way, "A" to anode and "H.T." to H.T. line. With the first transformer, the secondary connection "G" goes to the I.F. valve grid, while the lead marked "A.V.C." is taken to the A.V.C. line. With the second transformer, "D" goes to diode and "D.L." to diode load components. All these connections are shown in Fig. 3. The colour coding or numbering given by the transformer maker should be followed, so that these components are correctly wired in.

Condensers

With the 8 plus 16μF condenser, the negative connection is made by the mounting bracket

(*Continued on page 755*)

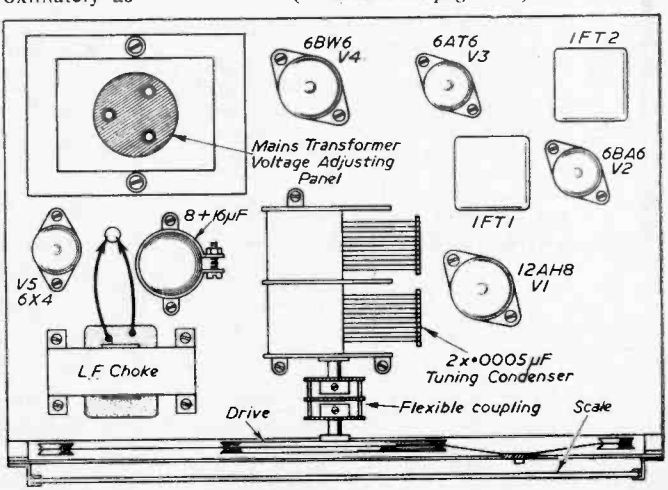


Fig. 2.—Chassis layout.

bolted to the chassis. Card condensers, or condensers with isolated cans, will have a negative tag or lead, which must be wired to the chassis.

The tags marked "H" are wired together and the 6.3V secondary of the mains transformer. If wiring is systematically checked against Fig. 3, the receiver should be expected to work properly as soon as completed. A suitable length of good twin flex should be used for the mains leads.

When wiring in the coil pack, follow Fig. 3, and note that the tags are not numbered consecutively from right to left, as the actual numbering agrees with Fig. 1.

Operational Details

Best results cannot be expected until the circuits have been aligned, but this is not difficult. When the coilpack and transformers are fitted, alignment will not be exact, but it should not be so in error that no signals can be heard at all. It is thus best not to begin adjusting the trimmers or cores until reasonable reception shows that the set is correctly wired and otherwise in order.

It is essential that a matching transformer be used between the receiver and speaker. The optimum load for the output valve is 5kΩ. With a 2 to 3 ohm speaker, a transformer with a ratio of approximately 45 : 1 will thus be necessary. For a 15 ohm speaker, the transformer should be approximately 18 : 1.

I.F. Alignment

The I.F. transformers should be aligned first. If a signal generator is available, adjust this to give a 465kc/s output and inject this *via* a very small capacitor at tag 3 of the pack. (In most cases clipping the lead on to the insulation of lead Y will suffice.) The I.F. cores are then adjusted for maximum response. This can be done by ear, or by using an output meter. With these methods, temporarily shorting the A.V.C. line to the chassis will give a sharper indication. If a 10kΩ/V meter is to hand, this may be connected from A.V.C. line to chassis. Alignment will then be for maximum A.V.C. voltage, as shown by the meter. Positive is taken to chassis and the 10V or 25V range will suffice. A further method is temporarily to disconnect the H.T. lead to the second I.F. transformer and to insert a 10mA or similar meter here, with a 0.1μF bypass condenser in parallel. Alignment is then for minimum reading on this meter.

COMPONENTS LIST

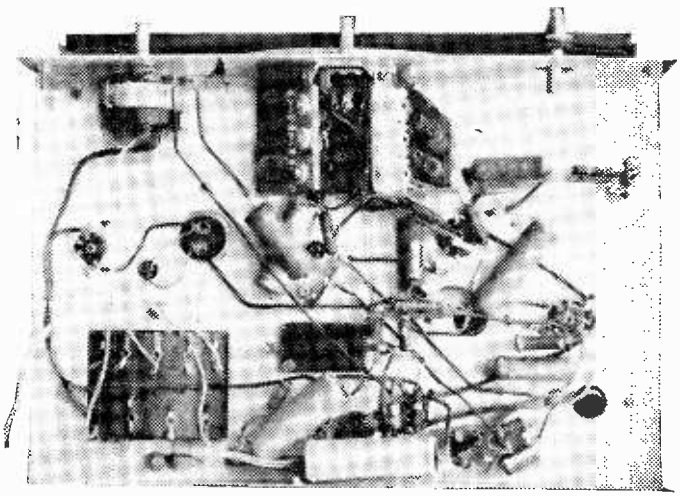
Fixed Condensers		Resistors : (½ watt)	
1—25pF	3—.01μF	1—68 ohm	2—47k
3—100pF	5—.1μF	1—220 ohm	1—100k
1—150 pF	1—8-16μF 350 v.	1—3k	2—220k
2—200pF	1—25μF 25V.	1—10k	3—270k
	1—50μF 25V. or 50 v.	1—27k	
		2—33k	1—470k
		1—270 ohm—(1 W.)	
		1—250k potentiometer with switch.	

3-Band Superhet Coilpack (Osmor).
2-gang 500pF, tuning condenser with drive.
Dial assembly.
60 mA smoothing choke.
250-0-250V., 60 mA, 6.3V, 3A mains transformer.
3 x B7G valveholders. 2 x 9-pin B9A valveholders.
Valves : 12AH8 ; 6BA6 ; 6AT6 ; 6BW6 and 6X4.
Chassis approx. 11½in. x 7½in. x 2½in.
2 x 465 kc/s I.F.T.'s.
5in. to 8 in. P.M. speaker with transformer as specified.

The use of some form of meter more easily gives an exact indication, but satisfactorily alignment is readily achieved by ear alone.

If no signal generator is available, tune in the local station and adjust the I.F. transformer cores for best reception. No core should be at the limit of its travel in either direction. If it is, readjust the three other cores, retune with the control knob, and again peak all cores for best results. A more exact, final adjustment will be possible with a weak station, but the transmission chosen should not be subjected to fading.

Once the I.F. transformers have been adjusted for better results they should not be touched again.



The wiring of the receiver.

Coil Alignment

When aligning the coilpack, it is best to do the M.W. band first. It should be remembered that there are two cores and two trimmers for each waveband. When one band has been dealt with, leave the cores and trimmers for this band untouched when aligning the other bands. Never adjust cores and trimmers together.

The drive coupler should be securely locked, so that the pointer travels from minimum reading with the condenser fully open. Fig. 3 shows the positions of the various trimmers and cores.

To deal with the M.W. band, tune in a station fairly low on the scale (say, below 250m) and adjust the M.W. trimmers for best volume, or

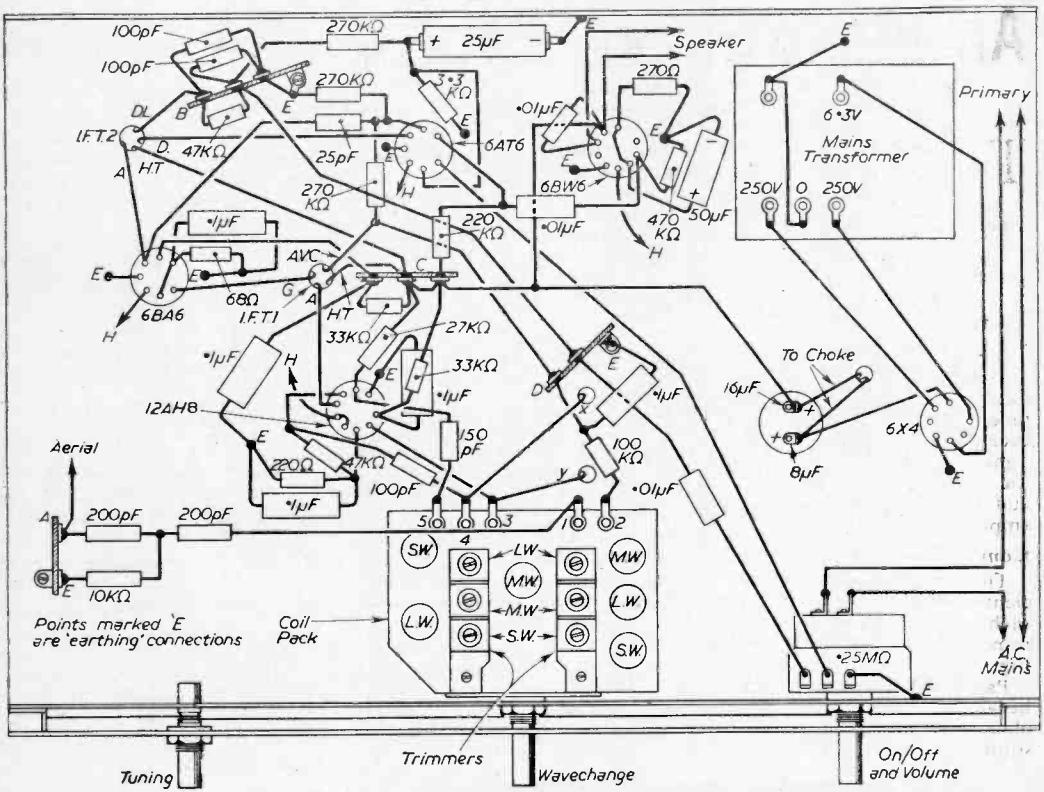


Fig. 3.—Underchassis wiring diagram.

maximum response as shown by the meter. Then tune to a station of fairly high wavelength (say, around 500m) and adjust the M.W. cores for best results. Return to a low wavelength station and make careful trimming adjustments again. Then retune to a high wavelength station and make any further, final adjustment which may be needed to the cores, for best volume.

The wavechange switch control knob is then turned to L.W. and the procedure repeated, the L.W. trimmers and cores being adjusted.

Finally, the S.W. band is similarly dealt with. Here, it will be found that adjustments are quite critical. After initial alignment has provided good volume throughout the S.W. band, final adjustments can be made with stations of known wavelength, or by means of the 20m and 40m amateur bands.

In all cases a metal screwdriver may be used for the first, rough adjustments only. For final adjustments, a tool with an insulated blade is essential and this can be fashioned from a length of ebonite rod, or any similar strong, insulated material. A screwdriver with an insulated handle only is not satisfactory, because the presence of the metal blade in the coils will change their inductance and thus upset alignment.

The scales can be illuminated by fitting a 6.3V dial lamp at each end of the plate. The mains transformer should be adjusted to the correct mains voltage, before using the set. If the exact figure is not provided, select the next highest figure on the transformer (e.g., the 230V) for 220V mains, and so on).

With the circuit as shown, hum is at a low level. If it is desired to reduce this further, especially for a large speaker with good bass response, then a 47k resistor may be added between the 6AT6 220k anode load resistor and H.T. line. A 8μF or similar condenser is wired from the junction of 47k and 220k resistors to chassis, the latter being negative. It is also possible to screen the leads from the 0.25m potentiometer and 0.01μF coupling condenser.

An Inexpensive T.R.F.

A MAINS RECEIVER FOR THE BEGINNER

By A. M. Stirling

THIS receiver, though designed for excellent results, can be built by the absolute beginner for the minimum of expense.

Operation

The radio signals are "picked up" by the aerial and fed to the first tuned circuit, where the desired station is selected and then enormously amplified by the first valve. The reactance of the H.F.C. presents a large impedance to radio frequencies, and will, therefore, act as a load. The voltage variations across this component are then passed to the second tuned circuit, which will be tuned to the same frequency as the aerial circuit, because the tuning condensers are ganged. The signal is then detected by the crystal diode and the audio component is amplified by V2. The audio signal is then passed to V3 for final amplification.

Components

Thre three valves used are very robust and efficient and can be obtained at a few shillings each. The two tuning coils are identical in every respect and can be wound easily, as shown in Fig. 2.

Paxolin tubes make the best coil formers because of their rigidity, but if these cannot be obtained, cardboard pepperpots are an ideal substitute. If these pots are used the bases should not be removed, otherwise they will not be rigid enough to enable a neat tight coil to be wound. (They can also be glued to the chassis by their base. See Fig. 2.)

The number of turns has not been stated, because counting whilst winding can be very difficult. If the turns are close wound to form coils 1in long on the 1¼in. diameter formers, the inductance will be correct for full coverage of the medium waves. The trimmers will be adjusted to compensate for any slight difference in inductance between the two coils.

Although it entails a few more components in the detector stage than the standard leaky grid type of detector, the increase in sensitivity and quality when using a diode detector make it well worthwhile. Because of the large signal that the diode handles, a cheap one will perform just as well as the more expensive types. It is only when diodes are used in the aerial circuit that the quality of the better diodes is realised.

Detector

Firstly, an aluminium or steel chassis should be obtained approximately to the measurements shown. Do not use a chassis that is very much smaller, because the layout will be too cramped. A larger chassis can, of course, be used with advantage.

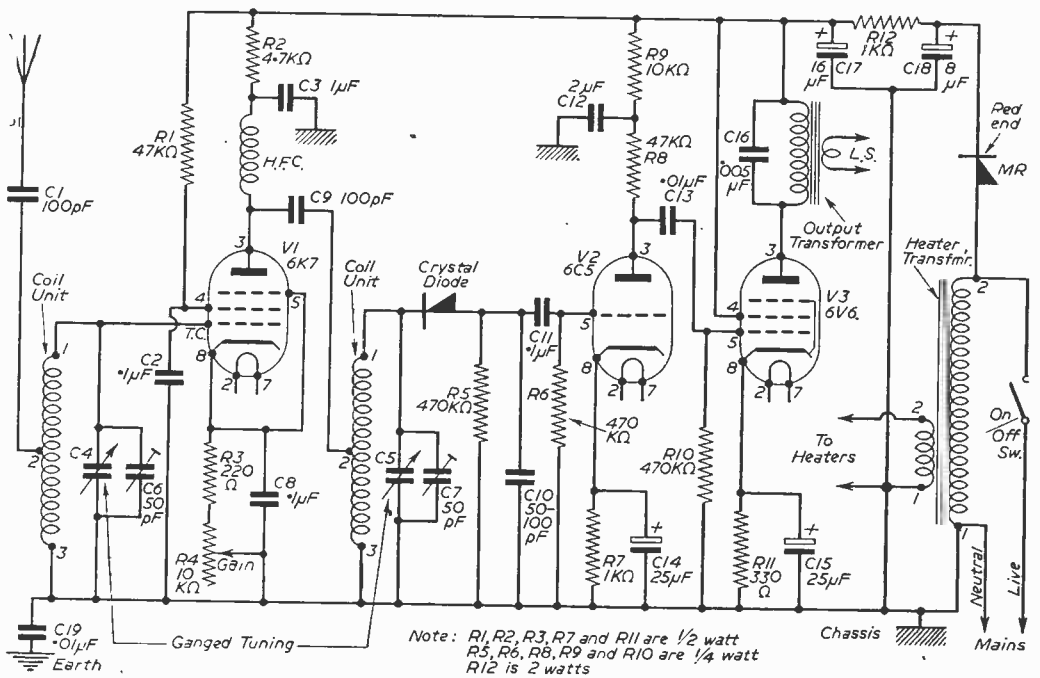


Fig. 1.—The circuit diagram. C4 and C5 are 500pF.

The components do not have to be arranged exactly as shown, but it is desirable that L1 and L2 are kept reasonably apart, otherwise instability will occur. The output valve V3 and its transformer should be situated as far as possible from V1 and its associated components, for the same reasons. (See Fig. 4.)

Chassis measuring 12in. × 6in. with three holes, for I.O. valve holders, are usually stocked by most radio dealers. It does not matter if the chassis has numerous other holes in it, because some of these can be used for mounting the components. In most cases, though, all the necessary holes will have to be drilled.

Wiring

The components under the chassis must be wired before the above-chassis components are mounted, so that the chassis can be placed flat on a table and the wiring done comfortably.

First wire the valve heaters by connecting pin 7 of all three valveholders together. Connect a 6in. length of wire to pin 7 of V3; this will go to the heater transformer when it is mounted. Next earth pin 2 of each valve holder. This will complete the heater circuit, because one side of the secondary of the transformer will also be earthed to chassis.

The valve-holders are of the I.O. type and when they are inserted, earth tags should be affixed under the nuts. The securing nut of V2 should hold a seven-way tag strip, as shown in Fig. 3. The valveholders are then wired with their various components.

It is a good idea to wire in all the resistors first and then the condensers, so as to avoid confusion. All the component leads should be covered with sleeving, and care must be taken when soldering the crystal diode into position. The heat can be shunted away by holding the connecting lead with a pair of pliers when the iron is applied.

To prevent chafing of the insulation of wires that pass through holes in the chassis, rubber grommets should be used. Alternatively, the wires could have a length of insulation tape wound round them at the point where they pass through the holes.

The H.F.C. recommended is a midget type, which can be secured to the underneath of the chassis. If a top-mounting choke is used it must be screened.

Now that the underneath part is wired, the chassis should be turned over and the top components mounted with nuts and bolts. The wiring of these components is then completed.

If there is a twin tuning condenser at hand without trimmers, do not discard it, because trimmers can be purchased very cheaply and are easily soldered into position, on the top of the tuning condenser.

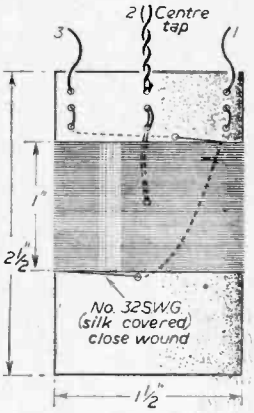


Fig. 2.—Coil winding.

Testing

When everything is connected, check the wiring very carefully before switching on. *Ensure also*

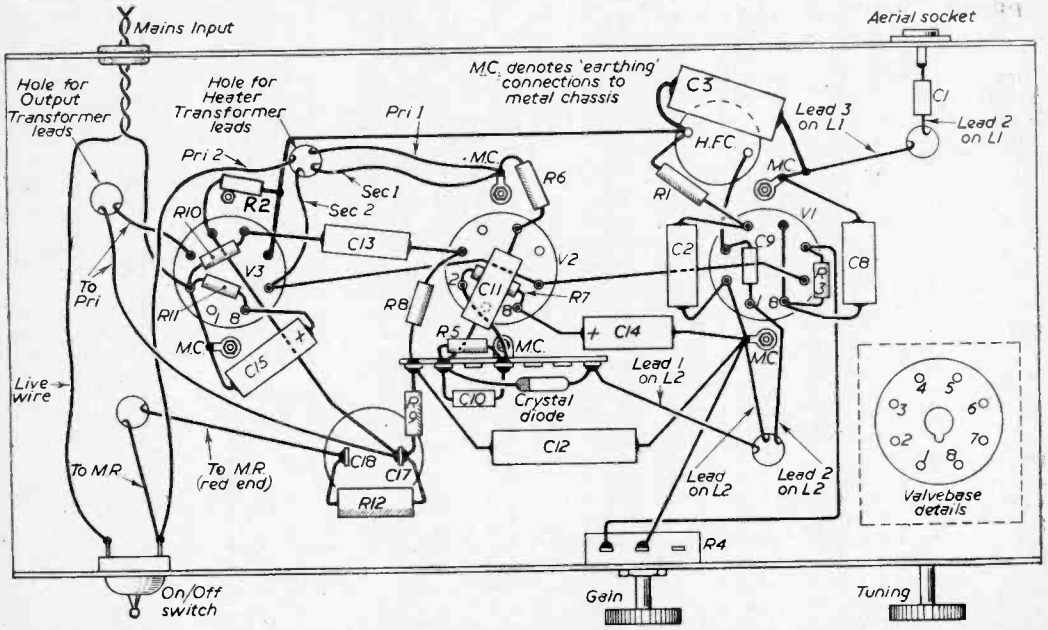


Fig. 3.—Wiring diagram.

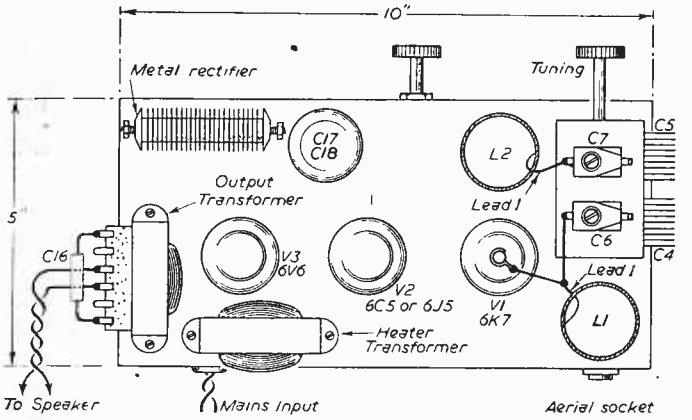


Fig. 4.—Above-chassis layout.

that the black lead (neutral) of the mains flex is the one that is connected to the chassis, and that this lead is also connected to the neutral pin of the mains plug, which should be the non-reversible type. This point cannot be emphasised enough, because there is a danger of electric shock when the leads are connected the wrong way round.

With a good aerial plugged in, switch on and allow the valves two or three minutes to "warm up" properly. When this is done, set the aerial condenser trimmer, C6, to about half way, then tune in to a low wavelength. (The more the condenser is open the lower will be the wavelength received.) Turn down the volume control until the station is just audible and then adjust the other trimmer, C7, for maximum volume. If it is found that the trimmer is at the limit of its travel either way, the aerial trimmer should be readjusted to compensate. If instability should occur, earth one of the speaker transformer secondary leads. If instability still persists, though the wiring has been properly done, the lead to the top cap of V1 should be screened.

In some cases, modulation hum may be present. A cure is nearly always effected by wiring a 0.01μF (1000V D.C.) from the live mains leads to chassis.

(If the trimmers (C6 and C7) are not connected to the body of the tuning condenser they should be connected to chassis at a convenient point.)

Selectivity

If the selectivity is found to be rather poor, particularly after dark when hundreds of stations start to transmit, the aerial coupling condenser should be substituted for a 50pF preset condenser. This condenser is then adjusted for a compromise between selectivity and sensitivity. It will be found that as the selectivity is increased—by decreasing the aerial coupling—the sensitivity will fall. When this aerial trimmer is adjusted the tuning condenser will have to be adjusted accordingly. It may also be found necessary to readjust the trimmer, C7, afterwards.

PREVENTING I.F. BREAKTHROUGH

(*Continued from 742*)

same condenser and coil can be tried in each position. In an extremely difficult case both the parallel and series circuits could be used to obtain very great attenuation of the interfering signal, but the two tuned circuits should then be separately screened. It must be possible to tune the circuits either by using a coil with an adjustable dust core or by using a variable capacitor for a portion of C1 (and C2, if used) in the resonant circuit of Fig. 1. The components may be placed on the receiver chassis, but careful screening is necessary to prevent pick up of signals radiated from the I.F. stages. Alternatively the filter may be placed in a separate box in the aerial lead.

Coils

If half a spare I.F. transformer of the same frequency as the receiver I.F. is available, the condenser and coil in it will be of the correct values for use in the Fig. 1 circuit. The transformer can will also be useful for screening. In case any readers do not have a spare I.F. transformer of the correct frequency available, Table 1 shows the number of turns which should be placed on a coil of the dimensions given in order to make it resonate at the typical I.F.s shown when the capacitor value used is as stated. Single silk-covered enamelled copper wire (30s.w.g.) is suitable for a coil to resonate at 1.6Mc/s, but somewhat thinner wire is better for lower frequencies. When the circuit has been fitted into the aerial lead, the tuning of the filter should be altered until the interference disappears or at least becomes a minimum.

It must be emphasised that an aerial filter cannot reduce any interference which is picked up at any point other than the aerial.

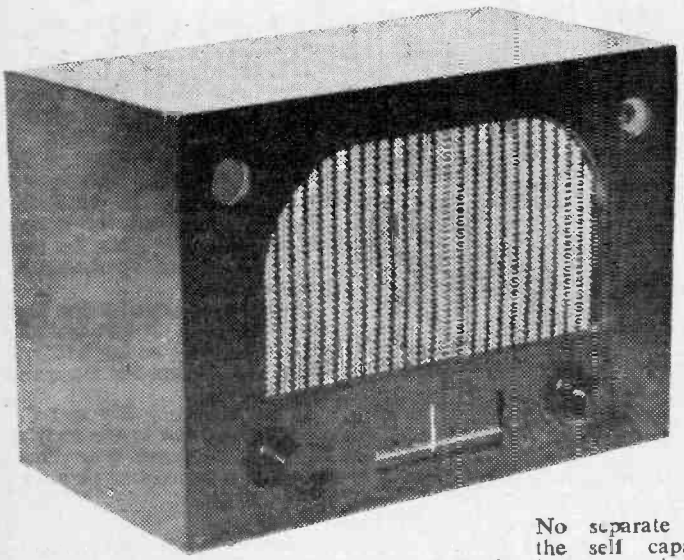
I.F. breakthrough may also be very much reduced by altering the tuning of all the I.F. transformers slightly so that no strong signal of the same frequency as the I.F. is present at the receiver. This method is applicable to I.F. signals picked up at any point, but will necessitate realigning the receiver if the tracking is to be kept perfect. Generally the interference can be eliminated more easily by the other methods given.

TRADE NEWS

TO coincide with expected record sales of tape recorders and magnetic tape this Christmas, "Scotch" Brand are marketing their new Accessory Kit gift wrapped in a gay "to-and-from" Christmas sleeve. This will prove a most acceptable gift both for the recorder enthusiast and the beginner. The sleeve can be easily removed after the Festive season is over, preventing dealers' stock becoming out-dated.

A QUALI

THIS SET CONTAINS ITS



THIS design resulted from the author's requirement for a compact receiver giving good quality reproduction for use in a position where the level of electrical interference was high. V.H.F. reception is the only adequate remedy for interference and was accordingly decided upon, while for the double advantage of minimum heat generation in the receiver and economy in cost of components, the power requirement was kept to a minimum. The degree of success achieved in this direction may be judged from the fact that the receiver requires only 52mA at 250V and 3A at 6.3V and includes a 4W push-pull output stage.

Sections

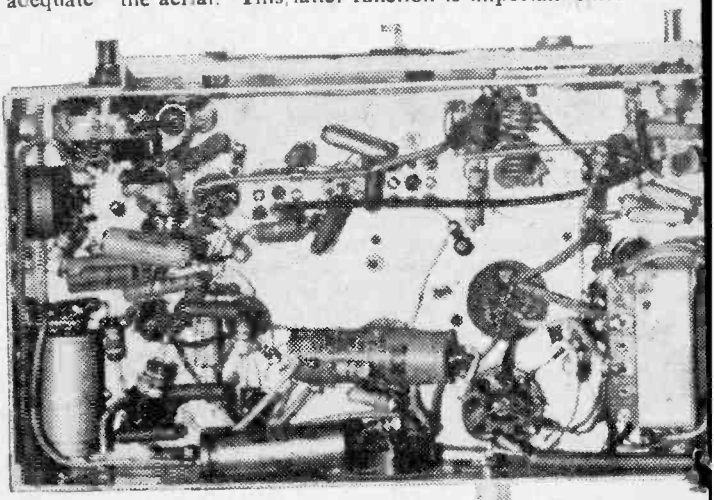
The set will be described in two sections, the V.H.F. receiver and the A.F. amplifier. It may be constructed complete, or as an F.M. tuner, self-powered or otherwise, for use with an existing amplifier. For housing the complete receiver, a description will also be given of an easily made cabinet of professional appearance which will avoid domestic criticism and which requires only simple tools and the expenditure of a few shillings.

The V.H.F. Receiver

This is largely conventional though a little unusual in that it employs both a limiter valve and a balanced ratio detector for the elimination of interference. This feature, combined with a stable form of oscillator, results in the complete elimination of impulsive interference and a minimum of inter-station noise and is well worth the cost of the few extra components required. Further, when the receiver is slightly off-tune, as it will be when first switched on from cold, the programme is received at once, clear of noticeable distortion and extraneous noise, provided of course, that the set was left tuned to the station when last switched off.

Circuit

Referring to the circuit diagram (Fig. 1) it will be seen that the signal from the aerial is applied to the grid of V1 via the coil L1, which is slug tuned to the centre of the three stations it is desired to receive No separate tuning capacitance is required, the self capacitance of the coil plus the input capacitance of V1 being sufficient. V1 functions as an R.F. amplifier and in addition to providing worthwhile gain, effectively prevents any appreciable oscillator radiation from the aerial. This latter function is important since the second harmonic of the oscillator frequency falls within television Band III. The amplified signal appears at the anode of V1 and is transferred to the grid of V2.



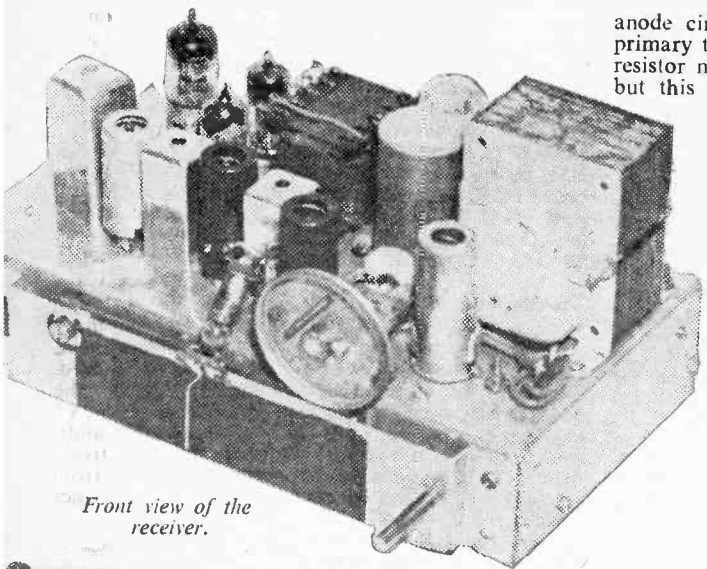
View of the wiring.

V2 is an additive frequency changer. It oscillates at a frequency determined by the inductance L2 connected to the screen grid, this frequency being combined within the valve with the signal at the control grid, to produce in the anode circuit the intermediate frequency of 10.7Mc/s. To ensure stability, no capacity other than the 2-gang tuning condenser is placed across L2 and L3. R5

TY V.H.F./F.M. RECEIVER

OWN POWER PACK AND PUSH-PULL OUTPUT STAGE

By V. E. Holley



Front view of the receiver.

is connected across C8 as shown, for the same reason.

I.F. Amplification

The signal at intermediate frequency is next dealt with by V3 which is arranged as a conventional I.F. amplifier. The transformer in its anode circuit has a 47k resistor, R9 across the primary to flatten the response curve. A similar resistor may be used across the primary of IFT, but this was not found necessary in the prototype. The signal is next presented to the grid of V4, the noise limiter. Because of its low anode and screen voltages, this valve is in a saturated condition and amplitude changes (impulsive interference) present at the grid are not reproduced to any extent in the anode circuit. This action is assisted by the network C15, R11 in the grid circuit, which generates bias and reduces the anode current to a very low value. The anode of V4 is loaded by the ratio detector transformer (RDT) which may be regarded as a conventional I.F. transformer with an additional winding known as a tertiary winding.

Diodes 1 and 2 are so connected that they conduct on the same half cycle of applied voltage and when a signal is applied to the transformer, a rectified current flows around the series circuit Diode 1—R14—VR1—R15—Diode 2. This current is "smoothed" by the "reservoir" action of the capacitors C21 and C22 and a steady potential is built up across the diodes. The capacity of C21 and C22 is such that this voltage remains constant at a level related to the average value of the incoming signal, even upon the receipt of a large interference pulse. Such inter-

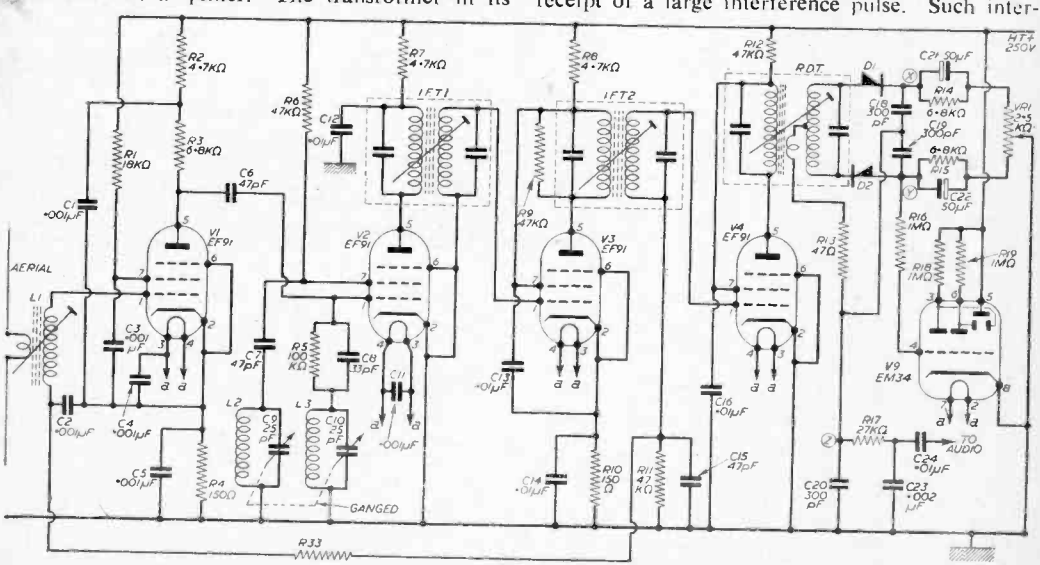


Fig. 1.—The circuit diagram of the V.H.F. section. (There is no C17.)

ference is thus excluded from the output of the detector and the steady D.C. potential may be used for automatic gain control or the operation of a tuning indicator.

Audio Output

So long as the applied signal remains constant at 10.7Mc/s the voltages at the ends of the RDT secondary are equal and opposite and both diodes conduct equally. When modulation is present, i.e., when the signal deviates from 10.7Mc/s the secondary obeys the laws of coupled tuned circuits, the state of balance is upset and one diode receives momentarily a larger and the other a smaller voltage. There is thus a variation at audio frequency in the ratio of division of the total steady D.C. potential between the diodes according to the instantaneous frequency of the carrier. An audio frequency signal can be extracted from the centre tap of the A.C. shunt load connected across the diodes: C18 and C19. The tertiary winding is connected to the centre tap of the secondary and inductively coupled to the primary. Being untuned, it is not affected in the same way as the secondary by variations of frequency and provides a datum to which the behaviour of the secondary can be referred.

The 2.500ohm potentiometer, VR1, is part of the diode load. Its slider is connected to earth and provides an adjustment by means of which the remains of interference pulses can be balanced out.

De-emphasis

Finally, in F.M. transmissions, it is usual to emphasise the higher audio frequencies at the transmitter. This emphasis is removed by the network C23, R17, having a time constant of 50μs. Alteration of this time constant will, of course, affect the frequency response of the receiver.

The diodes used in this receiver are GEX34 crystals. A double diode valve, 6AL5 may be substituted with no alteration in performance. If crystal diodes are employed and the receiver is to be used in an area of high signal strength, some measure of automatic gain control is necessary in order to limit the voltage applied to the crystals. This may be obtained in the manner shown from the grid of V4 or if a larger control voltage is required, from the negative end of C22 through a resistor of 1M. In the former case, it is essential that the decoupling resistor, R33, be sited at the junction of R11 and C15 to prevent I.F. harmonic radiation from the A.G.C. line. If A.G.C. is not required, the bottom end of L1 can be returned to earth at V1 through a resistor of from 47k to 100k.

Tuning Indicator

Since it is not possible to tune a V.H.F. receiver accurately by ear, a tuning indicator is essential. The valve selected for this receiver is the EM34. It is especially suitable for the purpose, having a double display, one side of which requires only −5volts for zero shadow angle. A less sensitive valve can be used, as will be described later, but if the receiver is to be aligned without instruments, a sensitive tuning indicator is essential. It will be found convenient to mount the indicator with its socket and associated resistors at the end of about 12in. of flexible 4-core cable, arranged to plug into a suitable socket on the chassis. A B7G valve holder with plug to suit was used in the prototype. The useful life of the indicator will be

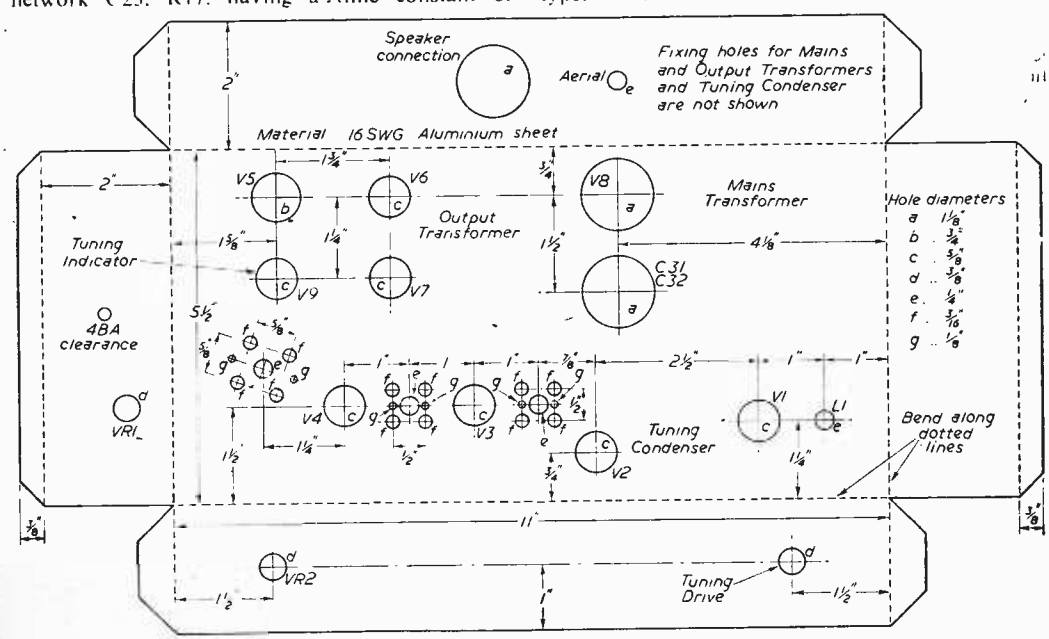


Fig. 2.—The drilling details of the chassis.

prolonged if the target voltage is limited to about 220 by means of a suitable series resistor.

Construction

Those who wish to build a tuner with self-contained power supply will probably find it convenient to use the chassis designed for the complete receiver (Fig. 2). If a power supply is not being included then the front half only of this chassis will be suitable. The prototype receiver was built on a chassis 10in. × 5in. which was to hand, but this led to some inconvenient congestion at one end, as will be seen from the illustration, and the size recommended is 11in. × 5¼in. × 2in.; 16s.w.g. aluminium is suitable material.

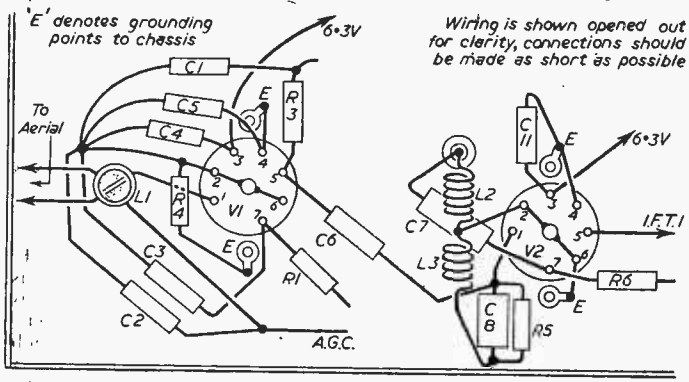


Fig. 3(a).—Wiring of the R.F. and frequency changer stages.

To those with no previous experience of V.H.F. apparatus let it be said that the construction is no more difficult than that of a conventional A.M. receiver. Alignment is, if anything, easier, because all the circuits are broadly tuned and therefore more easily brought into line; oscillator tracking presents no difficulty. It is necessary, though, that the technique and principles of this kind of construction should be understood.

Instability must be avoided at all costs, since even a trace will result in a asymmetrical response curve and consequent audio frequency distortion. Reception will be spoiled, too, if harmonics of the intermediate frequency are allowed to appear in the R.F. and frequency changer stages. This latter fault produces what appear to be strong unmodulated carriers which can be seen on the tuning indicator at tuning positions coincident with harmonics of the frequency to which the I.F. circuits are tuned.

Wiring

The requirement, therefore, is for efficient by-passing and decoupling and minimum radiation from wiring and components. It must be remembered that even short lengths of wire have considerable inductance at very high frequencies and that radiation may be picked up by a near-by conductor and conveyed to another part of the chassis. Symmetrical and orderly lay-out must be abandoned in favour of connections as short and direct as possible. Miniature components help greatly, especially ceramic condensers, and a small soldering iron of the instrument type is required. Too much heat must not be applied in making connections and with delicate components, such as the crystal diodes, the wire ends should be held with a small pair of pliers acting as a heat shunt while the iron is applied.

The constructor may be assured, however, that if this receiver is built to specification it will be entirely free from the faults mentioned.

The positioning of the components is not unduly critical, but the constructor is advised to copy faithfully the lay-out of the R.F. and frequency changer stages (Fig. 3(a)).

Coils

The aerial coil, L1, consists of 3½ turns of 20 gauge tinned copper wire on a ⅜in. former having a ¼in. adjustable dust core. The winding should commence about ¼in. from the open end of the former, the turns being spaced a little more than one wire diameter. If the wire is first wound on a 5/16in. former, removed and slipped over the ⅜in. former, it will be a tight spring fit. The aerial coupling coil of one complete turn should then be added and both windings secured in position with cellulose cement. The arrangement of the windings will be clear from Fig. 3(b).

The R.F. anode and oscillator coils are wound as one self supporting unit with 16s.w.g. tinned copper wire in a clockwise direction on a 5/16in. former. The turns should be close wound with a space of ¼in. between the two coils. Five turns are required for L2 and four for L3. The former should then be removed and the coils opened out evenly to overall lengths of 13/32in. (L2) and 21/64in. (L3). The ends should, of course, be left long enough to pass through the chassis to connect with the tuning condenser. The coils should be mounted about ⅜in. below the chassis so that C7 can be fitted diagonally underneath them (when viewed from below chassis). The Jackson U101 is a suitable tuning condenser, but any surplus 2-gang component can be pressed into service provided it is of suitable physical size and the rotor is earthed. The maximum capacity should be reduced if necessary by removing plates from the rotor—three plates in

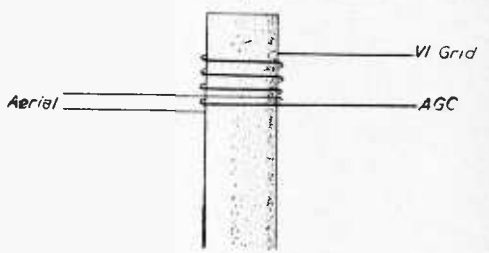


Fig. 3(b).—Construction of the coil L1.

(*Continued on page* 785)

Choosing Capacitors

PROPERTIES OF THE VARIOUS TYPES

By J. Ball

ALMOST all constructors appreciate the importance of choosing a capacitor of suitable value and of adequate voltage rating for the circuit in which it is to be used, but the particular uses of the very wide range of capacitors now available is not so well known. Only the most commonly used types of small capacitors will be discussed here.

Electrolytics

Electrolytics are useful because it is possible to obtain very large values in comparatively small containers. It should be noted, however, that they can only be used when connected the correct way round with a suitable D.C. voltage across them. The considerable leakage current which occurs with all electrolytics and their large power factor (about 0.2) renders them unsuitable for many purposes. After the D.C. working voltage has been applied for three minutes, the leakage current is normally of the order of 0.15CV amps where C is the capacitance in Farads and V is the applied voltage. The leakage current is much higher immediately after the D.C. voltage has first been applied. Electrolytics present a fairly high impedance at radio frequencies and are therefore not very satisfactory for R.F. decoupling.

The maximum working voltage of a single electrolytic capacitor is about 600V. If two (or more) are connected in series, the safe working voltage is increased by a factor of about 1.7; no potential dividing resistors should be placed in parallel with each electrolytic when in series, as when no resistors are used, the leakage current allows a lower voltage to be developed across the weaker electrolytic.

Electrolytics are especially suitable for mains frequency smoothing and audio decoupling when large values are required. They are almost the only reasonably small type of condenser which can be made in values of a few thousand microfarads rated at voltages which are quite small.

Ceramics

There is a very large variety of modern ceramic condensers, many of them being suitable for miniature equipment.

The Hi-K (high permittivity) ceramic condensers have a poor power factor (about 0.025) and a rather indeterminate temperature coefficient. They enable a condenser of several thousand pF to be put in a narrow tube less than 1in. long and are usually rated at only 300V D.C. They are more satisfactory in low frequency circuits than at high radio frequencies. Such condensers are almost invariably marked "Hi-K."

The common type of tubular ceramic condenser (other than Hi-K) usually has a power factor comparable to mica condensers (about 0.003) and is therefore suitable for use at high frequencies. The stability (about 10 per cent.) is much less than that of mica, however, so that this type is not suitable for tuned circuits in which a high stability is required. Ceramic condensers can be obtained with either a positive or negative temperature coefficient and are therefore useful in circuits in which it is desired to minimise thermal drift. Typical values of temperature coefficients are $(+100 \pm 60) \times 10^{-6}$ and $(-750 \pm 80) \times 10^{-6}$ per degree centigrade. Such capacitors would be marked P 100 or N 750, the P and N standing for positive and negative respectively. These small tubular ceramics are not normally used when values much above 1,000pF are required, but values down to 1pF are common. The D.C. working voltage is usually 500 and the insulation resistance about 10,000M, so that the leakage is low.

Ceramic condensers are also available in "feed through" types which are mounted in a hole in the chassis or screening and are extremely useful for decoupling at high radio frequencies where the absolute minimum of inductance is required. The values normally range from about 100pF to 500 or 1,000pF. The power factor and working voltage are similar to ordinary ceramic condensers.

Small ceramic capacitors are also made with the very small power factor of 0.0005 for use at several kilovolts D.C. or A.C. with high R.F. currents passing through them.

Table showing advantages which certain types of condensers can have.

	Paper	Mica	Hi-K Ceramic	Ordinary Ceramic	Electrolytic
Small size			★		★
Large values... ...	★				★
High Stability ...		★			
Low Power Factor ...		★		★	
High Leakage Resistance ...		★		★	
Negative Temp. Coefficients ...				★	
Small Temperature Coefficients ...		★		★	
High working voltage	★				

(*Continued on page 790*)

Transistorised Mixer Unit

AN IDEAL CIRCUIT FOR STAGE EFFECTS

By A. M. Shafford

THERE are many occasions when it is desirable to mix two or more separate inputs into a common audio amplifier system. In dance-band work two or three microphones are needed to give overall coverage and in studio applications it is frequently necessary to combine speech with a musical background or to fade in sound effects. The mixer unit described will perform all these functions and is a valuable accessory to a tape-recorder.

Gain Controls

An audio mixer accepts two or more separate inputs and combines them into a single output for amplification. Gain controls are provided on

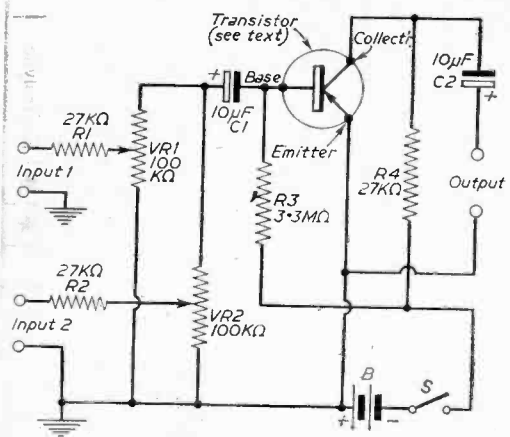
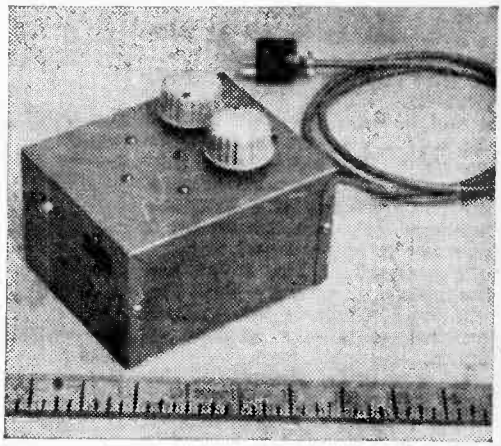


Fig. 1.—A two-channel mixer.

each channel to enable the individual levels to be set up to the required amount. In more ambitious designs, the variation of gain on one channel has no appreciable effect on the level of other channels. This simplified mixer is not entirely free from interaction between gain controls but the effect is so small that it does not represent a serious disadvantage. This is especially true when the mixer is used in a "dynamic" role to fade up one channel whilst simultaneously fading down another.

Self-contained Unit

The illustration shows a two-channel form of the mixer, although it can be constructed to accommodate three or even four separate inputs.



A completed two-channel mixer.

The unit is cheap, small in size and requires no external power supplies, having its own internal battery made up of two pen-light cells.

In the photograph the two control knobs, one for each channel, which adjust the gain are clearly shown, and the channel input sockets are visible at the end of the box. In the model shown, different types of input socket are used for each channel, but this is simply to suit the writer's particular requirements. Any input socket can be used, and similarly, the cable connecting the mixer to the amplifier can be terminated with any suitable plug. This cable is shown in the illustration in a coil at the rear of the unit.

Components Not Critical

Fig. 1 shows the circuit of a two-channel mixer and lists the component values, none of which is critical. The transistor can be a red-spot type or an OC71, both of which are readily available at a low price. The unit operates on two pen-light cells in series (total 3V) held in a clip designed for this purpose which is available from radio parts dealers. Alternatively the cells can be soldered directly into circuit since the drain on them is so low that a battery life of several hundred hours can be expected.

COMPONENTS FOR FIG. 1

R1, R2—27k ¼-watt.
R3—3.3 M ¼-watt.
R4—27k ¼-watt.
VR1, VR2—100k potentiometers.
C1, C2—10μF 25V.W. electrolytic.
S—Single-pole on/off switch.
B—2 penlight cells (two 1½V.).

COMPONENTS FOR FIG. 2

R—27k ¼-watt.
VR—100k potentiometer.
R3—3.3M ¼-watt.
R4—27k ¼-watt.
C1, C2—10μF 25V.W. electrolytic.

Use as a Pre-amplifier

With both knobs set at mid-scale the output is shared more or less equally between both channels. With a little practice it will be found possible to fade the channels up and down quite smoothly. By setting one gain control at zero, the other channel can be used singly as a transistor pre-amplifier which makes for a very useful and compact unit.

The circuit of Fig. 2 indicates the method of adding a third and additional channels when it is required to mix a number of inputs.

It is a useful feature of this unit that since it uses no A.C. power supplies it is hum-free, an important point for high quality reproduction.

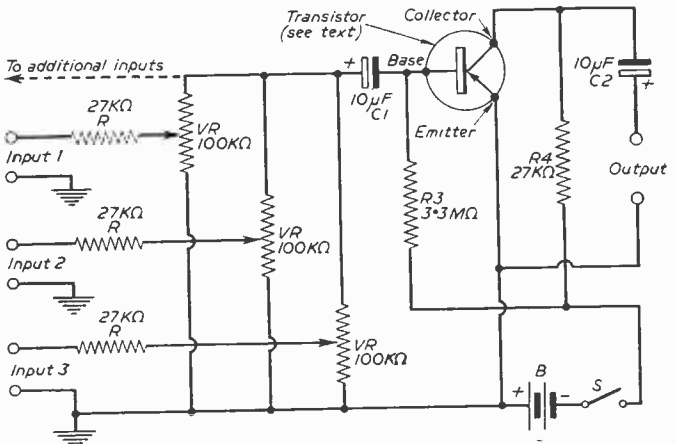
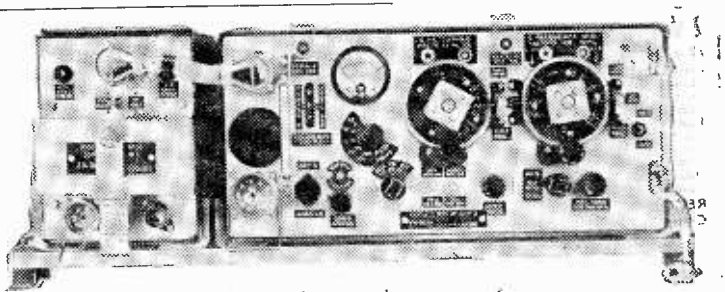


Fig. 2.—Method of adding a third and additional channels.

Wireless Set No. 19 Mk. II

NOTES ON THIS EX-GOVERNMENT RECEIVER

By R. G. Fenby



The No. 19 set and power pack.

THE following points on the Wireless Set No. 19 might be of interest to owners of this transceiver of which many thousands were recently released by the Ministry of Supply.

In the H.F. receiver 2Mc/s, one disadvantage that is often talked about is lack of selectivity in the I.F. amplifiers. When newly produced, the I.F. response curve was about 8kc/s wide, and over the years the sets have aged so much that many of them in amateur use now have very broad selectivity curves.

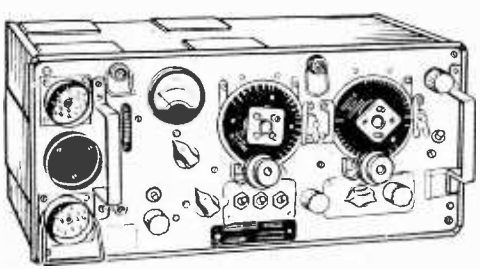
This broad selectivity of 8kc/s was produced purposely by the designers, and reference to a circuit diagram will show that across each I.F. transformer primary coil there is a resistor to 100k. The function of this is to broaden the selectivity curve artificially, which is not required for amateur use.

The original reason for a broad I.F. was that Army stations always operated on "nets" of several stations, using one frequency. Unfortunately, owing to the rough conditions in which they were used, the sets used to drift off frequency and so all the stations on one net were usually covering several kc/s at the end of an hour or so. Thus the I.F. response had to be broad.

The remedy is obviously to remove these resistors, and such action will sharpen the selectivity appreciably. Since the majority of the Mark 2 sets in current release were made in Canada in the Second World War, they are now almost 20 years old and, consequently, the tuning capacitors of the I.F. transformers will almost certainly be "leaky." This will tend to give the same effect reported above, so it is worthwhile replacing all these capacitors and retrimming the transformers using the meter switched to "AVC," tuning for maximum dip, using a steady signal.

In the same way the AVC smoothing condensers will also be leaky and should be replaced. Proof of this is available by examining the drop in "AVC" reading on the meter when tuning into a strong station. There should be a dip of 50 per cent. for an S9 signal. No dip or a very small dip, signifies leaks in the AVC capacitors.

Lastly, it is very strongly advised that you use the correct variometer between aerial and input of the set. By simply connecting the aerial to the aerial socket on the receiver, the signal-to-noise ratio will decrease, and there will be more second channel interference.



Another view of the No. 19 set.

TRS

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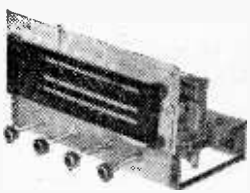

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6V6	7/6	ECF80	11/6	10/6
6X4	7/6	ECF82	11/6	12/6
7C5	9/-	ECH81	10/6	12/6
7Y4	8/6	ECL80	10/6	10/6
DAF96	9/-	ECL82	11/6	10/-
		PCF80	10/6	
		PCF82	9/6	
		PCL83	13/6	
		PL81	8/6	
		PL82	10/6	
		PL83	9/6	
		PY80	10/6	
		PY81	10/6	
		PY82	10/6	
		PY83	7/6	
		U25	7/6	
		U191	9/6	
		UCH42	10/6	
		UF41	10/6	

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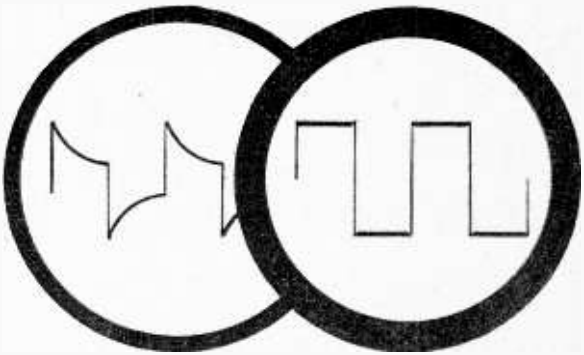
Improving Amplifier Quality

USING NEGATIVE FEEDBACK TO REDUCE DISTORTION

By C. Stone



THE quality of reproduction obtained from inexpensive and simple amplifiers can usually be improved considerably by making small circuit changes, such as adding negative feedback. Or it may be feasible to enlarge the amplifier, possibly replacing a single output valve by means of a push-pull stage, or by adding a pre-amplifier to compensate for the reduced gain arising from the use of feedback.

Lower Gain

Negative feedback always reduces amplification over that part of the amplifier to which it is applied. The gain with feedback is :

$$\frac{A}{1+Ab}$$

where A is the original gain of the amplifier before feedback was used, and b is the fraction of voltage

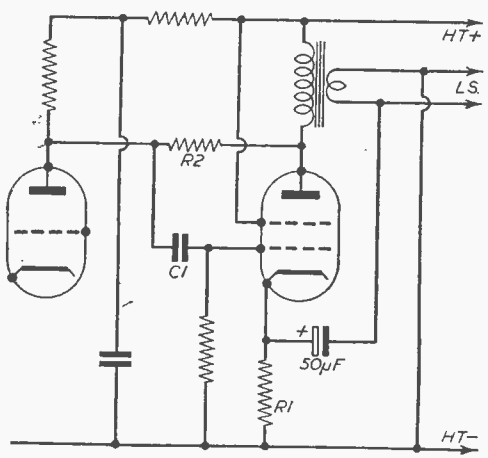


Fig. 1.—Applying negative feedback to the output stage.

fed back. For example, assume the amplifier originally had a gain of 500, and the fraction fed back is 1/200th, or 0.005. Gain with feedback is :

$$\frac{500}{1+(500\times.005)} = \frac{500}{3.5} = 143 \text{ approx.}$$

At first sight this reduction may seem rather severe. However, it is seldom necessary to have the gain or volume control at maximum. If it is, the reduction in volume may not be too great, because the human ear does not convey a sensation of volume directly proportional to power, instead having increased sensitivity at lower volumes. If volume *does* become insufficient, it can in any case be restored by adding a small triode, current for which will usually be available without overloading the existing power pack.

Reduced Distortion

The improvement in quality, with feedback, can be approximately calculated from the following :

$$\frac{d}{1+Ab}$$

where d was the distortion without feedback, A the amplifier gain, and b the fraction fed back. Asssume the amplifier gave 4 per cent. distortion. With the proportion of feedback previously mentioned this becomes :

$$\frac{4 \text{ per cent.}}{1+(500\times.005)} = \frac{4}{3.5} = 1.1 \text{ per cent. approx.}$$

This is a considerable reduction in distortion. If feedback is increased, distortion falls. For example, with 5 per cent. feedback, the figure becomes approximately 0.15 per cent. Amplification is also reduced as feedback is increased.

If the feedback is positive, instead of negative, the amplifier will give very distorted results, or oscillate. This is usually corrected by reversing connections to the output transformer secondary, which is usually included in the feedback circuit.

Applying Feedback

Two very simple methods of applying feedback to an output stage are shown in Fig. 1. The cathode by-pass condenser circuit is completed through the output transformer secondary, so that feedback is applied directly to the cathode. If oscillation arises the transformer connections must be reversed. This applies to other circuits where feedback is taken from the secondary.

R2 also applies feedback to the output valve grid, and helps to compensate for the falling bass characteristic of C1. That is, C1 passes high frequencies most readily. These frequencies therefore appear most strongly at the output valve anode, and are applied through R2 to the input. R2 is of high value (say 0.5 to 1M) and has little effect on the anode load of the triode.

With most simple two or three valve amplifiers, feedback can be applied to the cathode of an early

valve, as in Fig. 2. Values are for the valves indicated, but the same circuit can, of course, be used with other valves.

The amount of feedback can be increased by reducing the value of R1. Initially, 4.7k can be used, but the best value depends on the extent to which amplification can be reduced. With such a circuit

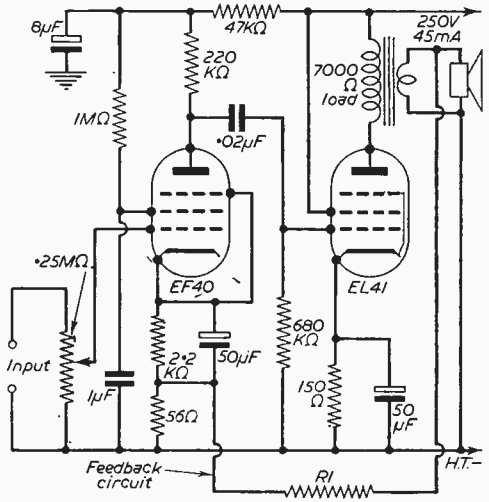


Fig. 2.—Addition of negative feedback to a simple amplifier.

employing only two valves, there is little gain to spare with small inputs, but plenty to spare with large inputs, such as from a valve radio feeder.

When adding feedback to powerful amplifiers, do not allow oscillation to build up or reach maximum or persist, but switch off and reverse connections as explained. Nor should feedback be applied over parts of the circuit in which tone controls exist though it can be used over all stages *after* the tone control circuits.

Triode Operation

A very simple means of reducing harmonic distortion in an output stage employing a pentode or tetrode is to re-wire the holder for triode operation. To do this, join screen grid and anode, as in Fig. 3. It is usually best to remove any by-pass condenser across the output transformer, at the same time, as it is no longer needed.

This modification is almost always possible, the exception being with very small valves where the maximum screen grid voltage is lower than the anode voltage actually present. Triode running will somewhat reduce gain in this stage.

This simple modification is particularly useful when no feedback is applied and the harmonic distortion of the output stage is felt to be rather high. For example, a pair of 6V6 valves in push-pull would normally have a harmonic distortion of about 3.5 per cent., but this falls to about 0.5 per cent. with triode operation. The power output from the stage is also reduced, and this must not be overlooked if the amplifier is used for public-address or other purposes where maximum output is necessary.

Changing to triode operation somewhat reduces the optimum load. For example, the optimum load for two 6V6 valves, tetrode operated, with a 285V. supply, is 8,000 ohms. This falls to 4,500 ohms for triode operation. The output transformer need not necessarily be changed, however, because triodes work well with somewhat higher loads than optimum. This means that an improvement is still possible with the same transformer. But if the transformer has tappings enabling a lower ratio to be selected, these should be chosen.

Transformer Ratio

Distortion can easily arise from the wrong output transformer ratio. The correct ratio can be found from the following :

$$\sqrt{\frac{\text{Optimum Load}}{\text{Speaker Impedance}}}$$

For example, assume the output stage optimum load is 8,000 ohms, and a 5 ohm speaker is used. Transformer ratio equals :

$$\sqrt{\frac{(8,000)}{5}} = \sqrt{(1,600)} = 40.$$

A transformer of approximately 40 : 1 ratio should thus be fitted.

When feedback is applied, the effective output impedance falls. With triodes, this is not usually very critical, because a slightly higher impedance than that actually required is not important. But for best possible results, or when using tetrodes or pentodes, the transformer ratio can be modified.

The approximate effective output impedance, with feedback, may be calculated from the following :

$$\frac{r_a}{1+\mu b}$$

where r_a is the anode impedance of the output valve, and μ its amplification factor, b being the fraction of output voltage fed back. For example, assume the amplification factor is 20, and anode impedance 10,000 ohms. The effective output impedance, with 0.005 (or 1/200th) feedback is :

$$\frac{10,000}{1+(20\times 0.005)} = \frac{10,000}{1.1}$$

= 9,000 ohms approx.

In the event of the amplification factor of the valve not being listed, it can be found by multiplying the Mutual Conductance in mA/V by the anode impedance in kilohms. For example, anode impedance 10,000 ohms or 10k, Mutual Conductance 2mA/V, so amplification factor = 10 × 2 = 20.

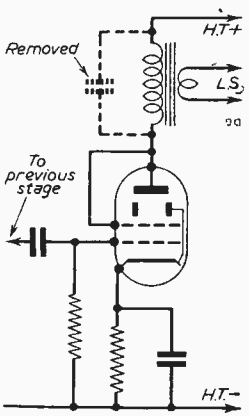


Fig. 3.—Triode operation of pentodes and tetrodes.

When negative feedback is used the characteristics of the output transformer become particularly important, and for the best possible results a transformer of sound design is necessary. With very small, cheap transformers internal capacity or other defects may cause phase shift at some frequencies, so that the feedback is no longer even approximately 180deg. out of phase with the input to the amplifier.

(To be continued)

A.C. Pre-tuned Superhet

ALTERNATIVE SWITCHING FOR PRE-SET STATIONS

IN the A.C. Pre-Tuned Superhet (December, 1958, issue) a 5-pole 5-way switch was used. In some circumstances a simpler type of switch may be used instead.

Original Circuit

The original circuit is shown in Fig. 2 and is followed by I.F. detector and output stages of ordinary type. With the 5-pole switch in one position, the L.W. aerial and oscillator coils are in use, a pair of pre-sets tuning-in the 1,500m transmitter. For the other four positions, the M.W. coils are in circuit, four pairs of pre-sets furnishing four pre-tuned stations. In one position, a standard 2-gang condenser may be switched in, giving manual tuning.

New switches with this number of separate poles are quite expensive Ex-service or surplus switches can be obtained from time to time, or made up by including separate wafers on a common spindle. A surplus switch with one wafer for each pole is easiest to use, but switches having two or more poles on each wafer are equally suitable. The number of "ways" is also unimportant, provided one position is available for each station. For example, a 3-way switch would give pre-set tuning for three stations; alternatively, it could provide manual tuning, with two pre-selected stations.

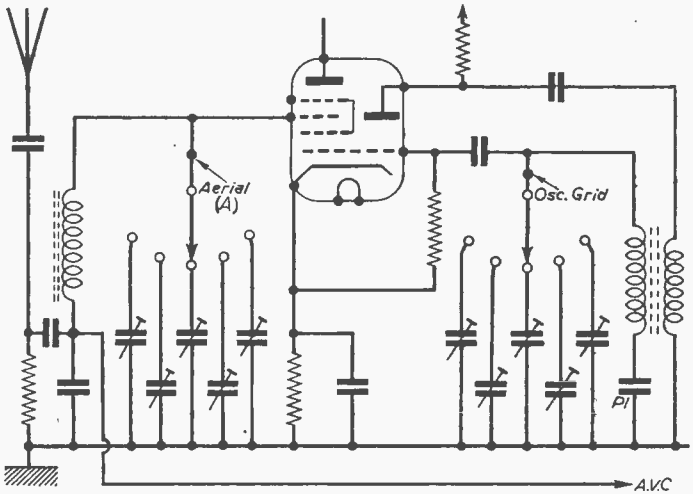


Fig. 1.—The new frequency changer circuit.

M.W. Only

In some areas the Light Programme is satisfactorily received on the M.W. band. There is then no need to fit long-wave coils and a switch with only two poles is required, wired as shown in Fig. 2. Such switches can be readily obtained at low cost, as surplus, or purchased new.

A compact rotary switch suitable for this

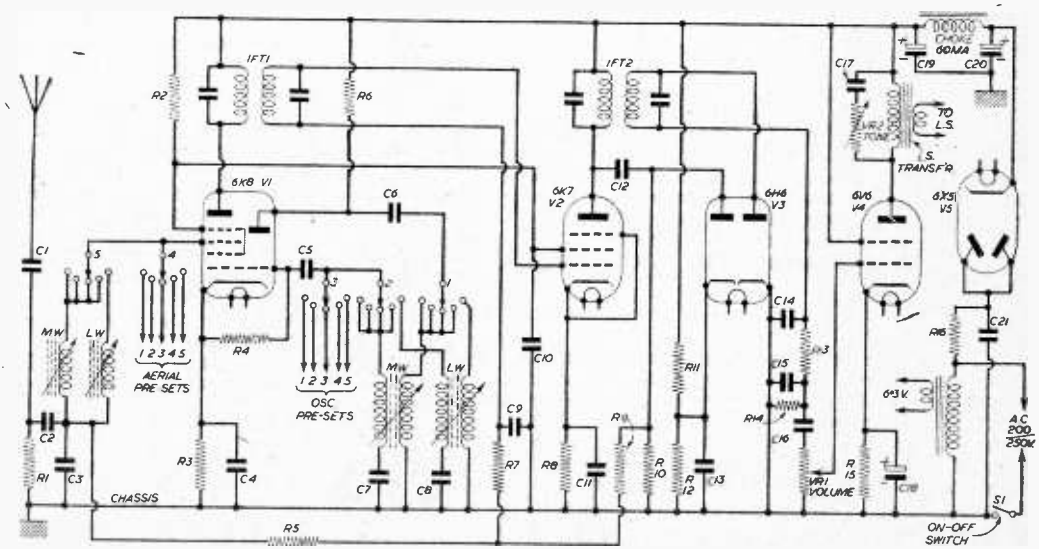


Fig. 2.—The original circuit of the receiver.

circuit is a 2-pole 9-way model. Wiring for this switch is given in Fig. 3. The extra tags may be left unused, or may be wired to further pairs of pre-sets, thereby giving more pre-selected stations. Or one set of tags may bring in the usual gang condenser for manual tuning, in addition to the pre-set stations. Because of its simplicity, the circuit in Fig. 1 is recommended when a long-wave range is not needed.

3-pole L.W. Working

With some modification to the circuit, a 3-pole, 6-way switch can provide one L.W. station, with up to five pre-set M.W. stations (or four, with manual tuning).

For this circuit, the aerial portion of the frequency changer is wired as in Fig. 1, two poles of the switch being used for this purpose. In the oscillator section, the M.W. oscillator coil is permanently wired, as in Fig. 2, but the padder, P1, is omitted. It is now possible to adjust one pre-set to 665kc/s, thereby giving reception of the 200kc/s (1.500m) transmitter, with the M.W. oscillator coil.

Efficiency will be a little reduced, compared with that achieved with a separate L.W. coil, but will normally be good enough for adequate volume from the 1.500m Light Programme transmitter. If a manual tuning control is provided, the padder must be added in series with the gang condenser fixed plates. The oscillator coil core will need to be well in, to secure sufficient inductance and a 500pF trimmer will be necessary for the L.W. station. For other pre-set stations, in the M.W. band, rather low settings will be necessary, as all the trimmers have to be reduced in value to compensate for the loss of the oscillator coil padder. This can be done by removing one or more plates, if necessary.

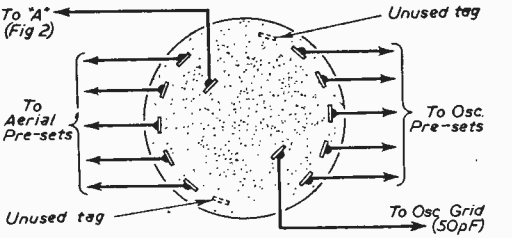


Fig. 3.—Wiring of the switch.

NUVISTOR VALVES

THE constant attention of electronic engineers concerned with the design and manufacture of receiving valves is towards providing improved performance, quality and reliability, and with the advent and growth of the transistor the question of size is now of paramount importance.

From recent research work, RCA engineers have presented the "Nuvistor," which is now in the advanced stages of development. Many factors were considered in the design of the Nuvistor, including planar structures, cylindrical structures, metal-to-glass seals and metal-to-ceramic seals. For example, ease of assembly led to research in using planar tube elements, but any advantage to be gained by this was offset by disadvantages in electrical and thermal characteristics. In contrast, cylindrical tube elements offered electrical and thermal stability and efficiency, and at the same time could be easy and economical to manufacture. The new design employs concentric cylinders supported in an open-ended cantilever construction, together with a combination of new materials, processes and manufacturing techniques.

Construction

For ruggedness a strong ceramic base-wafer is used as a platform on which is erected an array of valve electrodes, each solidly held in place by a tripod-like structure. The electrodes are thus strongly supported in an open-ended cantilever construction. These electrodes are small, light cylinders which, because of their form and low mass, are able to withstand a high degree of shock or vibration.

There are no micas to fray under vibration or to interfere with high-temperature exhaust processing of the tube. There is no glass to limit the processing temperature or to break under mechanical or thermal shock.

All joints in the valve are brazed together in one simple operation at high temperatures, and thus the parts are joined in a strain-free assembly. Because the valve elements are accurately secured in their original strain-free position, the possibility of shorts developing in the valve during operation is remote.

Comparison With Competitive Devices

Some of the more significant advantages of electron valves, and in particular the Nuvistor, over competitive devices can be summarised as follows:

1. In a valve the electrode spacing can be 50 times larger than the electrode spacing in a transistor intended for comparable performance. Valve spacings and the associated tolerances can, therefore, be more easily controlled in manufacturing operations.
2. The valve is economical in initial cost, has high impedance and gain, and generally requires less expensive associated circuit components.
3. At high frequencies the noise factor and the gain of the valve are superior.
4. The valve has a high uniformity of initial characteristics and does not require a costly selection process.
5. The valve is capable of handling momentary overloads.
6. The valve is inherently less susceptible to radiation damage.
7. Valves, and particularly the Nuvistor design, maintain their characteristics over a wide range of ambient temperatures.

Calculating Resistor Values

THE PROCEDURE EXPLAINED

By J. Golding

WHEN repairing or modifying a receiver it may be necessary to find resistor values to suit changed valves or conditions, or to replace damaged resistors with obliterated markings. Calculations of this kind usually prove to be quite straightforward, because when any two of the three terms voltage, current, or resistance are known, the remaining term can be found. To find a resistance value, the calculation is:

$$\text{Resistance} = \frac{\text{Voltage}}{\text{Current}}$$

When it is necessary to know what voltage is dropped by a resistor, the calculation is:

$$\text{Voltage} = \text{Current} \times \text{Resistance}.$$

It may also be necessary to know what current flows in a circuit where voltage and resistance are known, and this can be found from the calculation:

$$\text{Current} = \frac{\text{Voltage}}{\text{Resistance}}$$

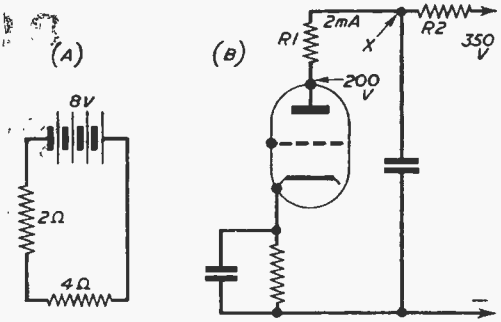


Fig. 2.—Circuits with resistors in series.

A few simple examples will show how these methods of calculating resistance, voltage and current are applied, and how circuits with more than one resistor can be dealt with.

Single Series Resistor

Fig. 1 shows a simple example, and a case which could arise if a small battery set were to be run from a 3V dry battery, instead of 2V accumulator.

At "A" voltage and resistance are known, so the current flowing can be found from

$$\frac{\text{Voltage}}{\text{Resistance}}$$

That is,

$$\frac{4}{2} = 2\text{A}$$

With "B" the valves are in parallel, and thus take .3 ampere. They require 2V. but the battery is 3V. R1 must therefore drop 1V. The resistance required is thus:

$$\frac{1}{0.3} = 3\tfrac{1}{3} \text{ ohms}$$

With any simple series resistor circuit this same calculation is used. That is:

$$\frac{\text{Voltage to be dropped}}{\text{Current flowing}} = \text{Resistance required.}$$

Resistors in Series

When resistors are in series, their values are added. At "A" in Fig. 2, the total resistance is 6 ohms.

$$\text{Current flowing} = \frac{8}{6} = 1\tfrac{1}{3}\text{A}$$

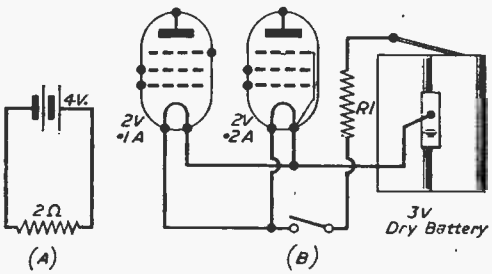


Fig. 1.—Series resistor circuits.

At "B" an audio-frequency triode is shown needing 200V at its anode and operated in such a way that 2mA anode current is taken. Assuming that R1 has to be 50k. because this is the optimum load for the valve, the decoupling and dropping resistor R2 has to be chosen so that the anode voltage is correct.

With small currents it is important to remember that

$$1\text{A} = 1{,}000\text{mA}$$

The voltage drop in R1 can then be found from

$$\text{Current} \times \text{Resistance} = \text{Voltage}$$

That is,

$$0.002 \times 50{,}000 = 100\text{V}$$

A potential of 300V will thus be needed at the point "X," so that 50V must be dropped in R2, which draws current from the 350V H.T. line.

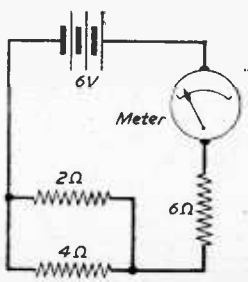


Fig. 3 (a).—Circuit involving resistors in series and in parallel.

The resistance required can be found from:

$$\frac{\text{Voltage}}{\text{Current}} = \frac{50}{0.002} = 25{,}000 \text{ ohms}$$

Series and Parallel

When resistors are in series, their values are simply added. But with two resistors in parallel, the value is shown by:

$$\text{Total resistance} = \frac{R1 \times R2}{R1 + R2}$$

It is thus easy to calculate the current which the meter at "A" in Fig. 3 would indicate. First,

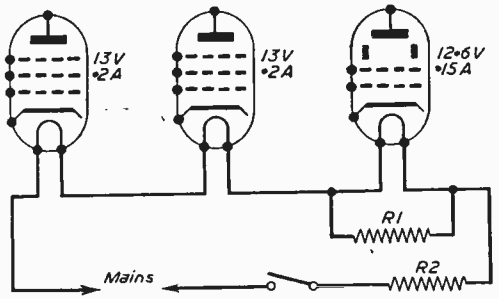


Fig. 3.—Valve circuit with resistors in series.

the overall value of 2 ohm and 4 ohm resistors in parallel will be:

$$\frac{2 \times 4}{2 + 4} = \frac{8}{6} = 1\tfrac{1}{3} \text{ ohm}$$

The 6 ohm resistor is in series, so the total resistance is $7\frac{1}{3}$ ohms.

$$\text{Current} = \frac{6}{7\frac{1}{3}} = \frac{6}{1} \div \frac{22}{3} = \frac{6}{1} \times \frac{3}{22} = \frac{9}{11}\text{A}.$$

At "B" in Fig. 3 a 3-valve mains receiver using two 13V 0.2A valves and one 12.6V 0.15A valve is to be run from 230/240V mains. R1 has to be of such a value that the heater of the 0.15A valve is not over-run. It will be seen that the circuit will be passing 0.2A but that only 0.15A must flow through the 12.6V valve. The surplus 0.05A must thus flow through R1. As 12.6V will be applied to this resistor, its value will be:

$$\frac{12.6}{0.05} = 252 \text{ ohms}$$

The mains dropper or line cord R2 can now be calculated. The three valves require 38.6V together. Taking this from 240V shows that 201.4V must be dropped in R2. R2 therefore equals:

$$\frac{201.4}{0.2} = 1007 \text{ ohms}$$

In practice, a 1000 ohm 0.2A dropper would be suitable for 230/250V mains.

Potential Dividers

When the current flowing is stable, a lower voltage can be obtained by using a series resistor, as already explained. But if the current is subjected to fluctuation a potential divider will furnish a more stable source of voltage. In Fig. 4, 100V will be required for the screen grid of an automatic volume controlled stage with a nominal S.G. current of approximately 2mA. Assuming that R1 and R2, in parallel with the H.T. supply, must not pass more than 10mA, in order that a small safety margin shall exist, the value of R1 can easily be found, since

$$\text{Resistance} = \frac{\text{Voltage}}{\text{Current}}$$

$$R1 = \frac{100}{0.01} = 10{,}000 \text{ ohms}$$

In the case of R2, the 2mA S.G. current must be added to the 10mA flowing through R1, and R2 must drop 150V at 12mA.

$$R2 = \frac{150}{0.012} = 12{,}500 \text{ ohms}$$

As the current consumption equals the current through R2, and is 12mA, this is well within the 15mA maximum which could be drawn from the H.T. circuit without overloading.

At "B" in Fig. 4 it is assumed that an "all dry" receiver taking 10mA at 90V is to be run from a power pack normally supplying 240V at 40mA. R3 can thus pass 30mA. Its value is

$$\frac{90}{0.03} = 3{,}000 \text{ ohms}$$

R4 must drop 240−90, or 150V, with 40mA flowing. It is thus

$$\frac{150}{0.04} = 3{,}750 \text{ ohms}$$

When calculating a resistor value it is nearly always possible to deal with one resistor at a time, as indicated, and this greatly simplifies

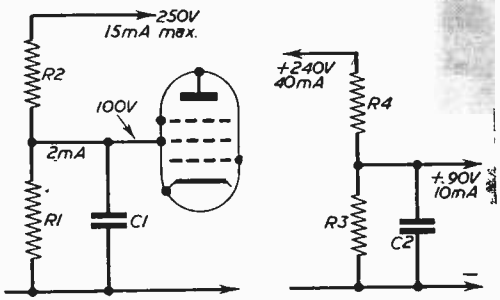


Fig. 4.—Potential divider circuits.

working. If there are two or more resistors, or different currents in various parts of the circuit, as in Figs. 3 and 4, the same solution can be reached by various methods.

When moderately high currents or fairly large voltages are encountered, the minimum resistor wattage should be calculated.

$$\text{Wattage} = \text{Voltage} \times \text{Current}$$

The wattage can be found easily, and the rating of the resistor should be equal to this; or larger. In practice, it is usual to select a resistor of standard value and ample rating. Referring to Fig. 4

for R1: $100 \times .01 = 1\text{W}$,
for R2; $150 \times .012 = 1.8\text{W}$,
so a 2W resistor could be used,
for R3: $90 \times 0.03 = 2.7\text{W}$,
so a 3W resistor could be fitted,
for R4; $150 \times 0.04 = 6\text{W}$

For long periods of running, or when ventilation is not very good, the resistors can best be of generous size. For example, a 5W component could be used for R3, and a 8W resistor for R4.

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						1S4	9/6
						1S5	9/-
						3Q4	8/-
						3Q5GT	9/-
						3V4	10/6
						5U4	9/-
						5V4G	7/-
						5Y3GT	9/6
						6Z4	8/6
						6A7G	10/-
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						6BW7	5/-
						6BX6	6/6
						6D2	7/-
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						6J5GT	5/-
						6J7GT	4/6
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						6Q7G	7/6
						6SL7GT	8/-
						6SN7GT	6/6
						6U4GT	5/6
						6V6G	11/6
						7B7	8/-
						7C5	8/-
						7C6	8/-
						7S7	10/6
						7Y4	7/6
						12AH8	10/-
						12AT7	8/-
						12AU7	9/-
						12AX7	9/6
						12BH7	15/-
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Crystal Receiver and Amplifier

A CONSTRUCTIONAL ARTICLE INTENDED FOR THE BEGINNER

By James Saunders

FROM the circuit diagram (Fig. 1) it will be seen that there are two diodes, one in the earth lead and the other in the aerial lead, so that there is full-wave rectification of the radio frequencies. The diodes are of the inexpensive type sold for a shilling or so as no considerable difference was noticed when better quality diodes were tried. These diodes should both be connected the same way round, that is with the red end away from the coils.

Notice the 0.0003μF fixed condenser across the variable condensers; this couples the two tuned

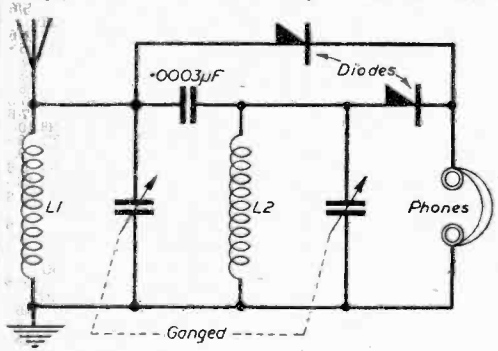


Fig. 2.—The circuit redrawn to show the capacitive coupling between L1 and L2.

circuits together and so improves selectivity. Fig. 2 is the same circuit drawn another way and shows this more clearly.

Coils

The coils are wound on 1¼in. formers, 3½in. long, using 94 turns of No. 24s.w.g. enamelled wire. If cardboard formers are used they must be varnished before the coils are wound.

Begin the construction with the baseboard. The components can be held in place with ¼in. woodscrews. So that the screws holding the coils can be reached, holes large enough for a slim screwdriver are made at each end of the coil. Stick a piece of insulation tape on the tuning condenser before fixing in the coil L1 to prevent the coil touching. Also, stick some thin paper on this coil to prevent the back of the set from chafing the winding.

Layout

When all the components are screwed in place, solder the leads to their connections as shown in

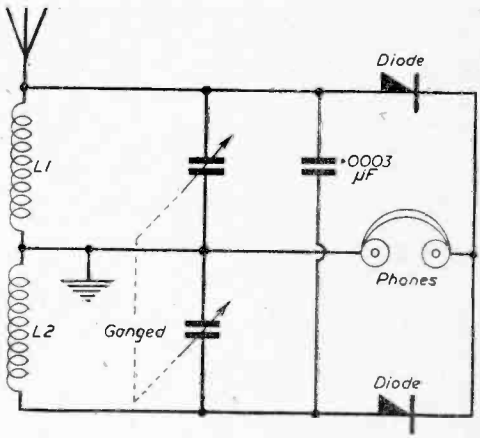


Fig. 1.—The circuit diagram.

the layout diagram (Fig. 3). If you are unused to making soldered joints, then a word about it may not be out of place here.

Use a multi-cored solder as this contains several cores of flux so there is no need to apply a flux to the joint. But make sure the components are clean. The solder and the iron should be applied simultaneously. Do not melt the solder on to the iron and then carry it to the joint—the proper way is to apply the solder to the component, then place the bit on top so that the solder is fused to the joint. This way, you can make a tidy join using the minimum amount of solder.

Cabinet

For the cabinet, ordinary deal is strong enough, but for a really strong job ¼in. oak would be best. The back and front are cut from ¼in. hardboard. To find the right position for the hole through which the condenser spindle protrudes, put a small drop of ink on the end of the spindle then line up the front panel with the cabinet and press it lightly against the spindle. The ink will

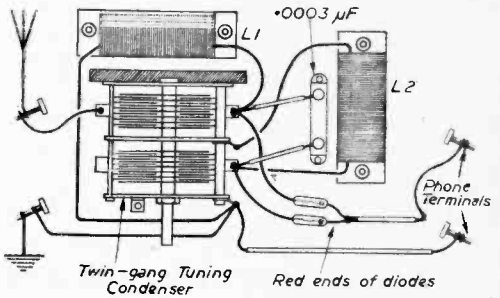


Fig. 3.—Wiring diagram.

leave a mark enabling a ¼in. hole to be bored in the right position. Either ½in. woodscrews or panel pins may be used to hold the cabinet together.

A good finish can be obtained by sandpapering the wood to a smooth surface then varnishing. I used some passe-partout (sold at 1s. 3d. for a

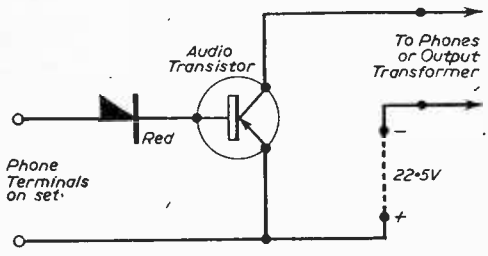


Fig. 4.—The circuit of the transistor amplifier.

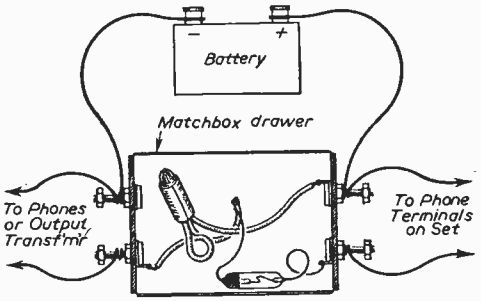


Fig. 5.—Wiring the amplifier.

fair-sized roll). This was stuck to the top and sides and given a coat of varnish. To finish off, the whole cabinet should be given two or three coats of varnish. Before varnishing the back and front. rub in linseed oil which helps to preserve the material. cleans away any natural oils. and helps the varnish to take more easily.

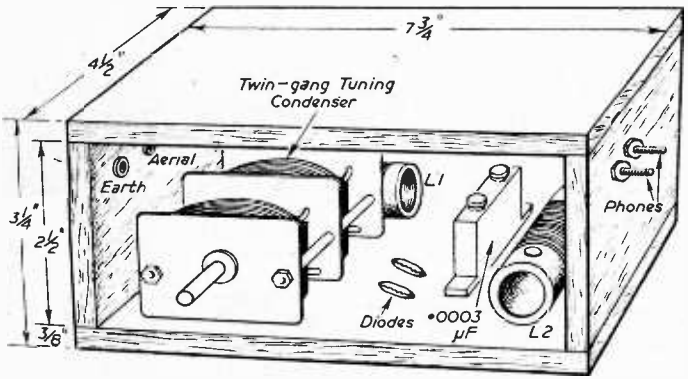


Fig. 6.—Layout of the parts.

Amplifier

If the set is to operate a loudspeaker. then a single transistor will provide ample volume for bedside listening. The circuit for a small amplifier is shown in Fig. 4 and the diode in series with the base is to replace the earphones in the crystal circuit—without it the tuning is so affected that stations spread right across the tuning range.

The amplifier is so small that it can be housed in a matchbox which may be covered with passepartout the same as the cabinet.

An audio transistor is required here, such as an XFT2 (Hivac) or a yellow/green spot. To protect the leads of the transistor so that they will not snap off. obtain a length of flex and push each lead into about 1½in. of the wire, as shown in Fig. 5; then wind a piece of insulation tape close to the transistor to hold the wires together.

If a layer-type hearing aid battery is used it can be attached to the matchbox with elastic bands. There is only one soldered connection in the amplifier where the diode joins the base of the transistor but when applying the solder make the joint quickly because too much heat can damage both the diode and the transistor.

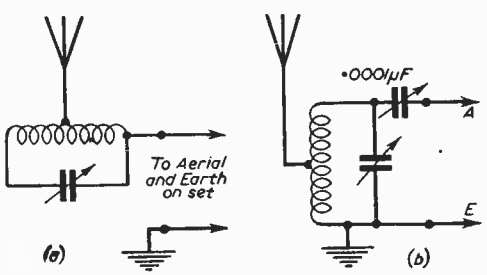


Fig. 7(a and b).—Two methods of improving selectivity.

Aerial

The higher the aerial. the more effective will it be. Adding a few feet to the height is as good as adding another valve or transistor to the set. But where it is impracticable to erect an outside aerial. a length of wire can be stretched out in a loft. This set will give good results with an indoor aerial provided the wire is kept clear of the walls and is about 50ft. long.

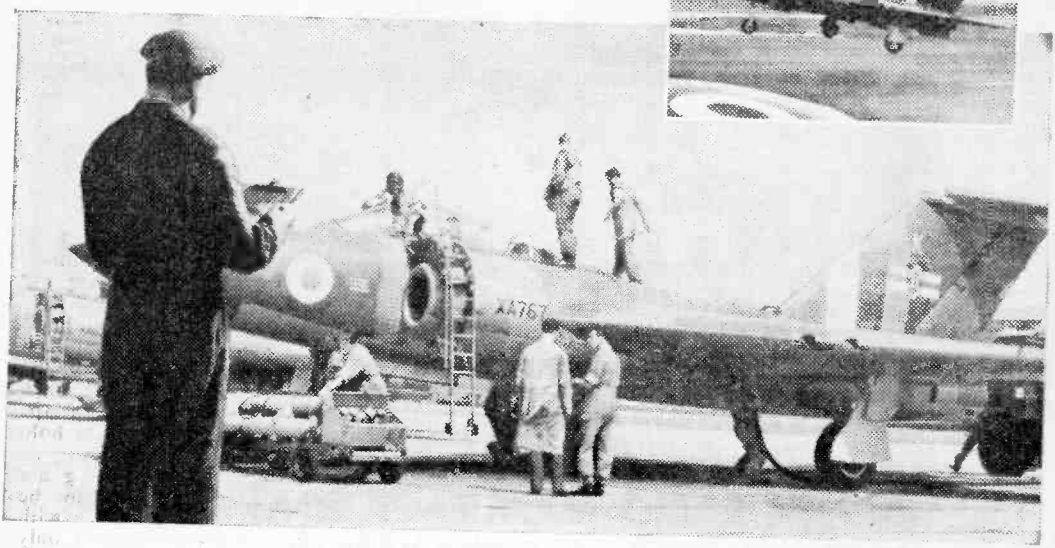
Aerial wire for use out of doors is mostly sold with a strong protective covering to guard against the harmful effects of rain and snow. etc., but for an indoor aerial either cotton-covered or enamelled wire will suffice provided a fairly stout gauge of wire is used. say, 22 to 26s.w.g. In a bedroom an aerial wound round the window frame gives a good reception and in some cases will be found to be more selective than an outside aerial.

Earth

A good earth is as essential as a good aerial so try to keep the lead-in as short as possible. The wire can be taken to a cold water pipe—or to a metal stake. about two feet long. driven into the earth if the room overlooks a garden. If it is impossible to obtain a good earth without using

(Continued on page 785)

Touch-down!



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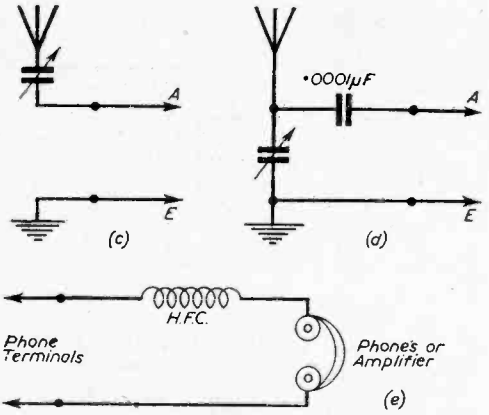


Fig. 7(c, d and e).—Three more circuit modifications.

a long wire try attaching the wire to the springs of a bed for this can be quite effective.

Should the selectivity be poor, then there are a few methods you can try with the crystal set to prevent the stations overlapping each other. Fig. 7(a) shows a wave-trap which is much used by some constructors to tune out a station that persists in crowding out all other stations. The coil for this is a medium-wave coil wound the same as the coils in the set, that is, 94 turns on 1¼in. diameter former. The coil is tapped halfway down as this further increases the selectivity. In Fig. 7 (b) another tuned circuit is connected across the aerial and earth terminals with a 0.0001μF preset condenser to couple the circuit to the tuned circuits in the set. You could go on adding tuned circuits, but with too much selectivity the quality of reproduction is so affected that voices and music sound tinny.

Series Condenser

Sometimes a simple arrangement, such as a variable or preset condenser in series with the aerial Fig. 7(c) will be effective. An arrangement that is particularly good when the aerial is about 50 to 53ft. long is as in Fig. 7(d) where the aerial, earth and 0.0005μF variable condenser are treated as a tuned circuit. Another method is to put an H.F. choke in series with the phones (Fig. 7 (e)).

However, constructors will most probably find the set will bring in enough stations for comfortable listening without any outside attachments.

If the amplifier is intended to be a permanent part of the set, it can be fixed inside the cabinet over the coil, L2.

A QUALITY V.H.F./F.M. RECEIVER

(*Continued from page 763*)

each section will generally provide sufficient capacity.

Layout

No attempt should be made at neat and tidy lay-out, the aim being to make all connections as short and direct as possible without regard to appearance, especially in the "hot" parts of the circuit.

As a precaution against I.F. harmonic feedback along the heater line, decoupling is provided at V1 and V2 and the heater supply, one side of which should be earthed, is fed in at both ends of the tuner, so that there is no direct connection between V2 and V3.

Alignment

Alignment instructions will now be given for the benefit of those readers who wish to build the tuner only. If the complete receiver is being built, alignment should be deferred until it is complete.

The ideal method requires the use of a frequency-modulated signal generator and an oscilloscope. Those fortunate enough to possess these instruments will be well acquainted with their use and no more need be said about this method. Equally good results can be obtained with a little care, using an amplitude modulated generator and a value voltmeter or a high resistance multimeter (20,000Ω/V for preference). It is also possible to align this receiver satisfactorily without any instruments at all, especially if pretuned I.F. transformers are used.

If instruments are available, connect the meter on the 10V D.C. range between points X and Y on the circuit diagram and inject an unmodulated signal at 10.7Mc/s at V4 grid. Adjust the primary of the detector transformer (top core) for maximum reading. If no response can be obtained, try injecting the signal at V3 grid. Next, with injection at V3 grid, adjust both cores of the second I.F. transformer, reducing the output of the signal generator progressively so that the meter reading does not exceed about 5 volts. Transfer the generator to the grid of V2 and adjust the cores of the first I.F. transformer. Now connect the meter between earth and point Z and adjust the bottom core of the detector transformer for zero reading. The acceptance bandwidth of the tuner should now be checked by moving the generator slowly over the range 10.4 to 11Mc/s. The meter should indicate a maximum voltage at about 10.6, zero at 10.7 and a reverse maximum at 10.8. The two maxima should be of equal magnitude and equidistant from the zero. Since the various adjustments are to a certain extent inter-dependent, it is now advisable to repeat the whole operation as a check.

The tuner should now be connected to an audio amplifier and an amplitude modulated signal at 10.7Mc/s injected into the grid of V4 at sufficient strength to be heard in the speaker. VR1 is then adjusted for minimum response. This adjustment will probably affect the bottom core of the detector transformer which should be re-adjusted.

Connect an aerial and if the tuning capacity is about right, transmissions will be heard somewhere in the first 90 deg. of rotation of the tuning condenser. Stations will also probably be heard at near mimium capacity, but the lower oscillator frequency is the one to be used and the rotation of the condenser should be limited by suitable stops to restrict tuning to the desired range.

(*To be continued*)

Club News

REPORTS OF CURRENT ACTIVITIES

BRADFORD AMATEUR RADIO SOCIETY
Cambridge House, 66, Little Horton Lane, Bradford 5.

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

THREE very interesting lectures have been given recently : on September 8th J. Davidson (G3JKD) gave a lecture with numerous practical demonstrations on "Television Tuners and Printed Circuitry." This was followed on the 22nd by H. D. Kitchen's lecture on "The Interpretation of Valve Data," and on October 20th M. Firth (G3MMK) lectured on the "K.W. Vanguard Transmitter and Z-match Tuner." The annual Mullard film meeting was held at St. George's Hall on October 6th.

Copies of the new syllabus are available from the secretary and except where otherwise stated meetings are held at 7.30 p.m. Morse classes are held by arrangement before meetings to which all interested in radio and television are invited. Transport arrangement for visits, etc., are made at the meeting prior to each visit.

Future events :

December 8th.—Annual social evening at the Mechanics' Institute Cafe.

December 29th.—Film show.

1960

January 12th.—"Colour Photography," by A. R. Baily, M.Sc. (G3IBN).

January 26th.—Display of members' gear.

February 9th.—"Inexpensive Sound Fidelity," by G. M. Pratt (G3KEP).

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

Meetings for December, 1959 :

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

December 10th at 6.30 p.m.—Computer group meeting. "The Simulation of Nuclear Reactors and Power Plants," by W. J. G. Cox and J. Dowsing.

December 15th at 3 p.m. and 6 p.m.—Half-day symposium on "Magnetic Recording Techniques."

"Magnetic Recording Heads."—M. B. Martin.

"Some Engineering Aspects of Magnetic Tape System Design."—D. W. Willis and P. Skinner.

"Magnetic Head Whose Output Signal is Independent of Tape Speed over a Wide Range."—D. Kerr and E. J. M. Quirk.

"Assessment of Reliability of Magnetic Tape for Data Processing."—R. Noble, B.Sc.

"Instrumentation Magnetic Recording."—Dr. P. E. Axon, O.B.E.

"A Fast Start/Stop Magnetic Tape Transport Mechanism."—W. C. R. Withers.

"The Development of a High Performance Tape Handler."—H. M. Harrison.

"Data Recording in Nuclear Instrumentation."—F. H. Wells.

December 16th at 6.30 p.m.—Medical electronics group meeting. "Measurements in the Presence of Noise," by Dr. D. A. Bell, M.A., and Dr. G. D. Dawson.

Birmingham. West Midland Section.—Meetings are held at the Matthew Boulton Technical College, Suffolk Street.

December 8th at 7.15 p.m.—"The Development of High Frequency Tape Recording," by P. J. Guy.

Bristol. South-western Section.—Meetings are held at the School of Management Studies, Unity Street.

December 17th at 7 p.m.—"The Transistor and its Use in Communication and Control Equipment," by E. Wolfendale, B.Sc.

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

December 18th at 7 p.m.—"The Digital Voltmeter," by J. A. Irvine and D. A. Pucknell.

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

December 17th at 7 p.m.—"The Digital Voltmeter," by J. A. Irvine and D. A. Pucknell.

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

December 10th at 6.30 p.m.—"Learning Machines," by P. Huggins (associate member).

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

December 9th at 6 p.m.—"Micro Miniaturisation," by H. G. Manfield.

MIDLAND AMATEUR RADIO SOCIETY
The Birmingham Midland Institute, Paradise Street, Birmingham.

Hon. Sec. : Mr. C. Haycock (G3JDJ).

FUTURE events :

December 15th, at 7 p.m.—"Do and be done by night". An auction for the benefit of the Society when all members bring their "spare" components and items for disposal.

1960

January 7th at 7 p.m.—Talk by Mr. Ron Rew on construction of a complete 70 cm. Transmitter.

January 19th, at 7 p.m.—Talk by Mr. H. Buckley, of Bradmac. The talk will probably be on high quality recording and reproduction.

February 16th, at 7 p.m.—Talk by Mr. R. Roberts of the BBC on "15W in 50 countries."

DERBY AND DISTRICT AMATEUR RADIO SOCIETY
Room No. 4, 119, Green Lane, Derby.

Hon. Sec. : F. C. Ward (G2CVV), 5, Uplands Avenue, Littleover, Derby.

Future events :

December 9th at 7.30 p.m.—Open evening in sub-basement rooms.

December 11th at 7.30 p.m.—Christmas party.

December 16th at 7.30 p.m.—Electronic gadgets for amusement from the junk box.

December 23rd and 30th.—Club rooms closed. Top band net will operate Christmas Eve and New Year's Eve for exchange of greetings.

1960 :

January 6th at 7.30 p.m.—Open evening ; collection of 1960 subscriptions. Seniors 5s. Juniors 2s. 6d.

RAVENSBOURNE AMATEUR RADIO CLUB
Hon. Sec. : J. Wilshaw (G3MPX), 4, Station Road, Bromley, Kent.

CLUB meetings at Downham have been cancelled and it is proposed to hold monthly meetings elsewhere. Details can be obtained from the Secretary. The club transmitter (G3HEV) will still be active in contests and field days.

READING AMATEUR RADIO CLUB
Hon. Sec. : R. J. Nash (G3EJA), "Peacehaven" 9, Holybrook Road, Reading, Berkshire.

THE October meeting was well attended when G3DXJ concluded his lectures on "SSB for the Ham." A party of members went along to the Newbury Hamfest and had a good time. The November meeting was held at 7 p.m. at Palmer Hall, West Street, Reading, when a talk was given on aerials. A junk sale and rag chew followed.

All subscriptions become due on January 1st, 1960, and it is hoped that those members who do not attend the December meeting will send their subscriptions to the treasurer G3GKH.

We are finishing the year 1959 in a much stronger position ; membership has trebled and attendance at meetings has increased both of which give encouragement for the future.

Future event :

December 19th.—"Home-built communication receivers." This talk will be given by G3LLK and based on the receiver which he has recently constructed and should be of great interest to those short wave listeners about to embark on similar subjects.

Catalogue Received

Home Radio* (Mitcham) *Ltd.

THE 1960 edition of Home Radio's catalogue is now available from them price 2/-. This catalogue consists of 127 pages of information and is of great interest to all radio enthusiasts. It is produced on art paper and contains a three-page index and a page of useful formulae. Many of the items in the catalogue are depicted by half-tone illustrations. The catalogue lists almost every component on the market and contains a handy bookmark with a list of abbreviations used throughout the catalogue. When sending to Home Radio for the catalogue please enclose 9d. in stamps for postage and packing.

C.R.T. ISOLATION TRANSFORMERS
TYPE A. OPTIONAL 25% and 50% BOOST. 2 V. *OR* 4 V. *OR* 6.3 V. *OR* 10.8 V. *OR* 13.3 V, 12/6. MAINS INPUT.
OUR LATEST SUPERIOR PRODUCT
TYPE A2, HIGH QUALITY, LOW CAPACITY. 10/15 pF. OPTIONAL BOOST 25%, 50%, 75%, 16/6 EACH. MAINS INPUT.
TYPE B. MAINS INPUT. MULTI OUTPUT 2, 4, 6.3, 7.3, 10 AND 13 VOLTS. BOOST 25% AND 50%. LOW CAPACITY. 21/-.

TRIMMERS, Ceramic, 30, 50, 70 pf., 9d. ; 100 pf., 150 pf., 1/3 ; 250 pf., 1/6 ; 500 pf., 750 pf., 1/9.
RESISTORS, Preferred values. 10 ohms to 10 meg., ½ w., 4d. ; ¼ w., 4d. ; 1 w., 6d. ; 1½ w., 8d. ; 2 w., 1/-
HIGH STABILITY. ½ w., 1%, 2/-. Preferred values. 100Ω to 10 meg. Ditto, 5%, 100Ω to 5 meg. Ω., 9d.

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

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

GEVAERT GEVASONOR
Long play plastic tape. 1,700 ft. 7in. Reel, 35/- ; 850ft. 5in. reel, 21/-. M.S.8. 225ft. 3in. reel. 7/6.
SUPERIOR 1,200 ft. Plastic Tape on 7" Plastic Reels 24/-. 600ft. 5in. reel, 15/-. Long play 1,200 ft. 5½in. reel, 28/-.
SPARE REELS, ALL SIZES. 3/-.
"Instant" Bulk Tape Eraser and Head Deluxer. 200/250 v. A.C., 27/6. Leaflet, S.A.E.

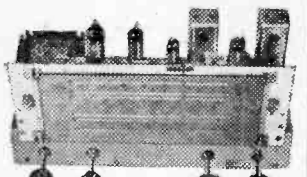
O.P. TRANSFORMERS. Heavy Duty 30 mA., 4/6. Multiratio, push-pull, 7/6. Miniature, 3S4, etc., 4/6. L.F. CHOKES 15/10 H. 60/65 mA., 5/- ; 10 H. 85 mA., 10/6 ; 10 H. 150 mA., 14/-.

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

ALADDIN FORMERS and core, ¼in., 8d. ; ⅜in., 10d. 0.3in. **FORMERS** 5837/8 and Cans TV1/2. ½in. sq. x 2"in. and ¾in. sq. x 1¼in., 2/- ea., with cores.
TYANA.—Midget Soldering Iron, 230 v. 40 w., 16/9.
REMPLOY Instrument Iron, 200 v. 25 w., 17/6.
MAINS DROPPERS. 3in. x 1¼in. Adj. sliders. 0.3 amp., 750 ohms, 4/3. 0.2 amp., 1,000 ohms, 4/3.
LINE CORD. .3 amp., 60 ohms per foot, 2 amp., 100 ohms per foot, 2-way, 6d. per foot, 3-way, 7d. per ft.
LOUDSPEAKER P.M. 3 OHM. 5in. Rola, 17/6. 8in. Plessey, 19/6. 6in. x 4in. Rola, 18/-. 6½in. Rola, 18/6. 8 x 5in., 21/-. 10 x 6in., 27/6. 10in. Rola, 30/-. Hi-Fi Tweeter. 25/-. 12in. R.A., 30/-.
STENTORIAN HF1012 10in. 3 to 15ohm 10 w., 95/-. 12in. Baker 15 watt 3 ohms. or 15 ohms, 105/-. 12in. **BAKER FOAM SUSPENSION** 15 ohm, £8.
CRYSTAL DIODE G.E.C., 2/-. GEX34, 4/-.
HIGH RESISTANCE PHONES. 4,000 ohms, 16/6 pr.
MIKE TRANSF. 50:1, 3/9 ea. : 100:1, Potted, 10/6.
SWITCH CLEANER. Fluid squirt spout. 4/3 tin.
TWIN GANG TUNING CONDENSERS. .365 pf. miniature 1in. x 1½in. x 1⅝in., 10/-. .0005 Standard with trimmers, 9/- ; less trimmers, 8/- ; midget, 7/6.
SINGLE, 50 pF., 2/6 ; 80 pF., 100 pF., 160 pF., 7/-. Solid dielectric 100, 300, 500 pF., 3/6.
SPEAKER FRET. GOLD CLOTH. 17in. x 25in., 5/-. 25in. x 35in., 10/-. Tygan 4ft. 6in. wide, 10/- ft. ; 2ft. 3in. wide, 5/- ft. Samples, S.A.E.

New and Boxed VALVES 90-day Guarantee.

1R5	8/6	6K8G	8/6	EABC80	10/6
1S5	8/6	6L6G	10/6		
1T4	8/6	6N7M	7/6	EB91	6/6
2X2	3/6	6Q7G	10/6	EBC33	8/6
3S4	8/6	6SA7	7/6	EBC41	10/6
3V4	8/6	6SJ7M	10/6	EBF80	10/6
5U4	8/6	6SN7	8/6	ECC84	12/6
5Y3	8/6	6V6G	7/6	ECF80	11/6
5Z4	10/6	6X4	7/6	ECH42	10/6
6AM6	8/6	6X5	7/6	ECL82	12/6
6B8	5/6	12AT7	9/6	EF39	7/6
6BE6	7/6	12AU7	9/6	EF41	10/6
6BH6	10/6	12AX7	9/6	EF50	5/6
6BW6	10/6	12BE6	10/6	EF80	10/6
6D6	7/6	12K7	8/6	EF91	8/6
6F6G	7/6	12Q7	8/6	EF92	5/6
6H6	3/6	35L6	9/6	EL32	5/6
6J5	6/6	35Z4	9/6	EL84	10/6
6J6	7/6	80	10/6	EM81	12/6
6J7G	8/6	807	6/6	EZ40	8/6
6K6GT	6/6	954	1/6	EZ80	8/6
6K7G	5/6	EA50	1/6	E1148	1/6
				HABC80	10/6
				HVR2A	7/6
				MU14	10/6
				P61	6/6
				PCC84	12/6
				PCF80	11/6
				PCL82	11/6
				PEN25	6/6
				PL82	10/6
				PY80	8/6
				PY81	10/6
				PY82	8/6
				SP61	5/6
				UBC41	10/6
				UCH42	10/6
				UF41	10/6
				UL41	10/6
				UY41	8/6
				U22	10/6
				VR105	8/6
				VR150	8/6



1960 RADIOGRAM CHASSIS
THREE WAVEBANDS. FIVE VALVES S.W. 16 m.—50 m. LATEST MULLARD M.W. 200 m.—550 m. ECH81, EF89, EBC81, L.W. 800 m.—2,000 m. EL84, EZ80, 12-month guarantee.
A.C. 200/250 v. 4-way Switch : Short-Medium-Long-Gram. A.V.C. and Negative feedback 4.2 watts. Chassis 13½ x 5½ x 2¼in. Glass dial horizontal or vertical size 10in. x 4¼in. Aligned and calibrated. Isolated Chassis.
£9.10.0 Carr. & Ins. 4/6.
TERMS : Dep. £5.5.0 and five monthly of £1.
MATCHED SPEAKERS FOR ABOVE CHASSIS. 8in., 17/6 ; 10in., 25/- ; 12in., 30/-.

NEW AM-FM MODEL
6 Valves **£18.19.6** Leaflet, S.A.E.

£6.19.6
TERMS : Dep. £3.10.0 and four monthly of £1.
Stereo Model UA8 £7.19.6 : UA12 £10.10.0.

COLLARO LATEST MODEL
HIGH-FIDELITY AUTOCHANGER
4-SPEEDS—10 RECORDS
With Studio "O" pick-up
BRAND NEW IN MAKER'S BOXES
OUR PRICE £7.19.6 post free.

BUILD THIS REPRODUCER BARGAIN SINGLE PLAYER KIT
Ready for immediate assembly.
4-speed Collaro "Junior" Unit £4 12 6
Handsome case, 17½ x 13½ x 7in., with room to play 12in. records ... £2 5 0
Ready-built 3-watt amplifier with two valves and loudspeaker £3 12 6
or **£9.15.0** complete kit post free.

STEREO E.M.I 4-SPEED SINGLE RECORD PLAYER. Acos 73 hi-fi stereo and normal xtal pick-up. Silent motor heavy turntable. **Special Offer £6.19.6.** Post 3/6.

ALUMINIUM CHASSIS. 18 s.w.g. undrilled. With 4 sides, riveted corners and 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.

TRANSISTORS, GENUINE EDISWAN R.F. 4 Mc/s, 18/- ; 2 Mc/s, 15/-. Audio, 10/-. Complete data sheets supplied.

CRYSTAL MIKE INSERT by Acos, precision engineered. Size only ¼in. x 3/16in., 6/8.

HI-GAIN BAND 3 I.T.A. PRE-AMP KIT. Cascode circuit with valve ECC84, Price 29/6. With Power Pack, 49/6. Plans only 6d.
Band I B.B.C. version same prices.

BBC TRANSISTOR RADIO. M. & L. wave. Complete kit 32/6, phones 7/6 extra. Deaf Aid Earpiece 12/6. Special Lead 2/6. Details 6d.

GARRARD 4SP. SINGLE PLAYER
AUDIO PERFECTION
Designed to play 16, 33, 45, 78 r.p.m. Records 7in., 10in., 12in. Lightweight Xtal pick-up. GC2 turnover head, two separate sapphire styli.
OUR PRICE **£7.10.0** each. Post Free
Model TA Mk. II **£8-10-0.** Model 4HF 218-6-0. With Plug-in Normal Heads.
(Stereo heads £2 extra). Leaflets, S.A.E.

Volume Controls
Long spindles. Guaranteed 1 year. 5K ohms to No 8w. 3/- Linear or Log Tracks. Midget 2 Meg. D.P.8w. 4/9

80 ohm CABLE **COAX**
Postage 1d. per yard.
Semi-air spaced ¼in. Stranded core. Losses cut 50% Fringe Quality Air Spaced. **6d.** yd. **1/-** yd.

COAX PLUGS ... 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. T.V. Type. All values 25 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, 100 ohms to 50 K., 6/6; 100 K., 7/6.
CONDENSERS. New Stock. .001 mfd. 7 kV. T.C.C., 5/6; Ditto, 20 kV., 9/6; .1mfd. 7 kV., 9/6; Tubular 500 v .001 to .05 mfd., 9d. ; .1, 1/-; .25, 1/6; .5/350 v., 1/9 ; .1/350 v., 9d. ; .1/1000 v., 1/9 .01/2,000 v., 1/9 ; .1 mfd., 2,000 volts, 3/6.
CERAMIC CONDS. 500 v., .3 pf. to .01 mfd., 9d.
SILVER MICA CONDENSERS. 10% 5 pf. to 500 pf., 1/-; 600 pf. to 3,000 pf., 1/3. Close tolerance (±1 pF.) 1.5 pF. to 47 pF., 1/6. Ditto 1% 50 pF. to 815 pF., 1/9; 1,000 pF. to 5,000 pF., 2/-.

I.F. TRANSFORMERS 7/6 pair.
465 Kc/s Slug Tuning Miniature Can, 2¼in. x 1in. x 1in. High Q and good bandwidth. By Pye Radio. Data sheet supplied.
Wearite M800 I.F. 465 Kc/s. 12/6 per pair.
Wearite 550 I.F. 465 Kc/s. 12/6 per pair.

NEW ELECTROLYTICS. FAMOUS MAKES

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

SELENIUM RECTIFIER. 300 v.85 mA., 7/6.
CONTACT COOLED 250 v. 50 mA., 7/6; 60 mA., 8/6; 85 mA., 9/6; 200 mA., 21/-; 300 mA., 27/6.
COILS Wearite "P" type, 3/- each. Osmor Midget "Q" type adj. dust core from 4/-. All ranges.
TELETRON, L. & Med. T.R.F., with reaction, 3/6.
FERRITE ROD AERIALS. M.W., 8/9; M & L., 12/6.
T.R.F. COILS A/HF, 7/- pair. H.F. CHOKES, 2/6.
FERRITE ROD. 7in. x 3/8in. dia., 2/6.

JASON F.M. TUNER COIL SET, 26/-. H.F. coil, aerial coil. Oscillator coil, two I.F. trans. 10.7 Mc/s. Ratio Detector and heater choke. Circuit book using four 6AM6, 2/6.
COMPLETE JASON F.M. KIT WITH VALVES, £6.15.0. Fringe area kit, 22/6 extra.

FULL WAVE BRIDGE SELENIUM RECTIFIERS : 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 amp., 17/6; 4 amps., 22/6. Circuit included.
VALVE and T.V. TUBE equivalent books, 9/6.
TOGGLE SWITCHES. S.P. 2/-. D.P. 3/6. D.P.D.T.4/-.
WAVECHANGE SWITCHES
5 p. 4-way 2 wafer long spindle 6/6
2 p. 2-way, or 3 p. 2-way short spindle ... 2/6
2 p. 6-way, 4 p. 2-way, 4 p. 3-way long spindle... 3/6
3 p. 4-way, or 1 p. 12-way long spindle ... 3/6
VALVEHOLDERS. Pax. Int. Oct., 4d. EF50, EA50, 6d. B12A, CRT. 1/3. Eng. and Amer. 4, 5, 6, and 7 pin, 1/-. **MOULDED MAZDA and Int. Oct., 6d.** B7G, B8A, B8G, B9A, 9d. B7G with can., 1/6, B9A with can., 1/9. **CERAMIC** EF50, B7G, B9A, Int. Oct., 1/-. 8 Can., B7G, B9A, 1/-.
COSSOR MAINS-BATTERY POWER PACK 90 v. H.T. 1½ v. L.T. Same size as **BATTERY** B126 and RD 35. List 63/-, our price 39.6.

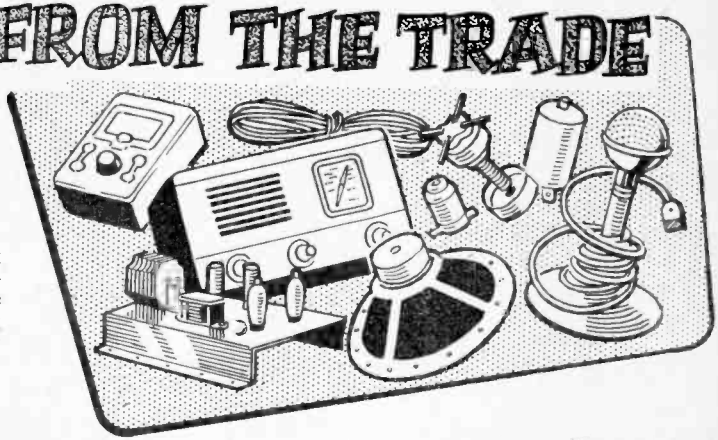
RADIO COMPONENT SPECIALISTS

OUR ONLY ADDRESS
337 WHITEHORSE RD., WEST CROYDON

48 Hour Postal service. 1/-, over £2 free. *(Export Extra.)* C.O.D. 1/6. (Wed. 1 p.m.) *Catalogue 1/6.* THO 1665. Buses 133 or 68

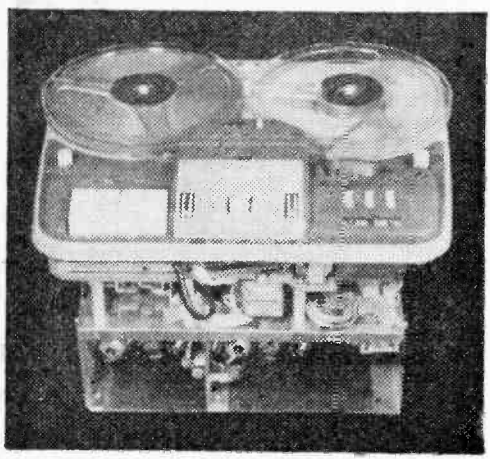
NEWS FROM THE TRADE

LATEST DEVELOPMENTS IN RECEIVERS AND COMPONENTS



TAPE DECK

THE TM 60, the tape deck of the TK 60 stereophonic and monophonic tape recorder released by Grundig (Great Britain) Limited is now available. The deck itself is identical with that of the TK 60 and contains the whole electronic equipment of the TK 60 other than power amplifiers and speakers. A separate box attached to the main unit by a connecting lead contains three sockets for microphone inputs. Although designed primarily for use with the Grundig Gainsborough Radiogram, the TM 60 can be used with any good amplifier or stereo amplifier, radio or radiogram. The price, including 1,800ft. of long play tape, is 90 guineas.



The Grundig TM60 tape-deck.

NEW KITS

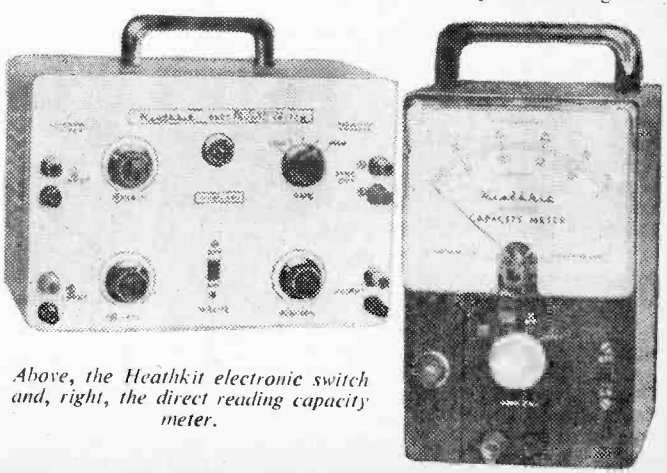
IT is announced by Daystrom Ltd., of Gloucester, that a direct reading capacitor meter and an electronic switch for oscilloscopes are to be added to their range of "Heathkits." The capacitor meter which weighs 7lb. has four ranges with full scale deflections of a 100pF, 1,000pF, 0.01μF and 0.1μF. The unit is powered from 200-250V A.C. mains and has an accuracy of 1 per cent. on the 100 and 1,000pF ranges and 2 per cent. on the 0.01 and 0.1μF ranges. The unit is approximately 7in. $\times$ 5in. $\times$ 4in.

The oscilloscope trace doubler has switching rates of approximately 150, 500, 1,500, 5,000 and 15,000c/s and the frequency response is $\pm$ 1dB over the range 0-100kc/s. The valves used are two ECC83s, three ECC82s, one EC90 and one EZ81. The unit weighs 8lb and is approximately 9½in. $\times$ 6½in. $\times$ 5in.

Further details can be obtained from Daystrom Ltd., Glevum Hall, Southgate Street, Gloucester.

STEREOPHONIC AMPLIFIERS

AFTER a period of more than a year during which many improvements have been incorporated in the Whiteley stereophonic amplifiers, the WB Stentorian equipment now covers the wide range of apparatus suitable for stereophonic sound reproduction. The Whiteley stereophonic amplifier consists of two sections, a control unit and the power amplifier. The control unit has provision for radio and tape input as well as for crystal and low output magnetic pick-ups. Full bass and treble controls are provided together



Above, the Heathkit electronic switch and, right, the direct reading capacity meter.

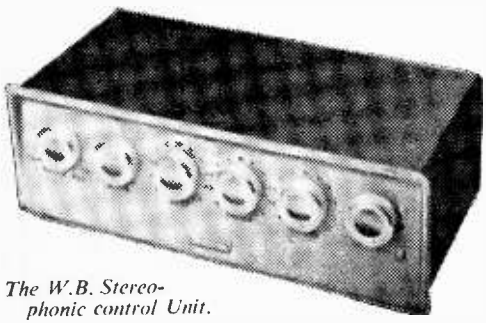
with a balance control and a stereo/mono-phonic switch. The unit may be used in conjunction with two W.B.12 main amplifiers or with a single W.B. stereophonic power amplifier. This consists of two 8W output channels and a common power supply mounted on a single chassis. A low value of distortion is obtained and the two units form a compact medium power high quality system suitable for most domestic requirements.

DULCI PRODUCTS

IN announcing that they have taken over the Dulci Company, Messrs. Lee Products (Gt. Britain) Ltd. add still further to the range of products they manufacture and distribute throughout the radio and electrical industries. It is understood that the Dulci factory at Willesden, N.W. London. is included in the deal and it is the new owner's intention to continue to produce existing Dulci lines. Furthermore, plans are well advanced for extending and improving the range. at the same time maintaining the very high standards of design and manufacture so closely associated with the products of both companies.

CATALOGUE

A NEW catalogue entitled "Hi-Fi, Stereo and Tape Recorder" is now available from City Sale and Exchange Ltd., 93-4, Fleet Street.

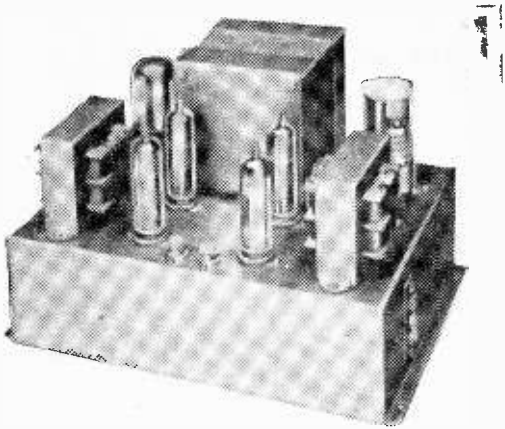


The W.B. Stereophonic control Unit.

London, E.C.4. This catalogue includes all the latest type of hi-fidelity equipment which many people are having built into their own fixtures at home. With stereo to-day these units can be very compact and will not take up a lot of room. The catalogue includes details of most of the latest recorders, business dictating machines, tuners, tape decks, etc., found on the market to-day. A copy of this may be obtained free from the above firm. When writing, please send in stamps for necessary postage.

PRICE REDUCTION

OWING to the increasing demand for the "Thoroughbred" tape recorder manufactured by Winston Electronics Limited, Shepperton, Middlesex, it has been reduced in price from 69 guineas to 59 guineas. The de luxe model of the "Thoroughbred" is also being reduced in price from 79 guineas to 69 guineas. The prices include the microphone and 1,800ft. of tape.



The W.B.8S Stereophonic power amplifier.

CHOOSING CAPACITORS

(Continued from page 764)

Mica Condensers

Mica condensers are the most suitable for use when very high stability is required. Ordinary mica condensers have a stability of about 1 per cent. and a power factor of about 0.003 at 1Mc/s. Although the insulation resistance of mica condensers is high (about 10,000M), it is important to remember that the working voltage of small mica condensers is normally only 350 D.C. They have the small temperature coefficient of about 50×10^{-6} per degree centigrade. Whilst mica condensers are made in values larger than 0.1μF and working voltages which may be very high, such condensers are always comparatively large

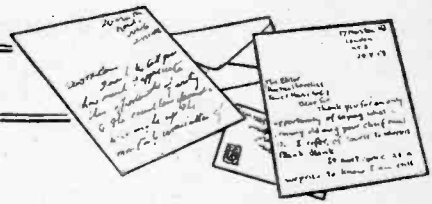
Paper Condensers

Paper condensers are comparatively cheap and are normally manufactured in a range of values varying from about 500pF to about 50μF. The stability is of the order of 15 per cent. The working voltages vary widely according to the type and thickness of the paper. Metallised foil paper condensers are usually smaller but the working voltages and insulation resistance are normally lower than the normal type of paper condenser. The insulation resistance of paper condensers is normally lower than that of good quality ceramic or mica components and the power factor (about 0.015) is about five times that of mica or ceramic.

Paper condensers are very suitable for decoupling at normal radio frequencies and for coupling and decoupling in audio amplifiers.

The table shows the types of capacitors which possess the advantages mentioned.

Open to Discussion



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

Radio Pick-up

SIR,—In reply to Mr. Trueman's problem of radio pick-up (November issue), may I suggest that he earths the co-axial cable at the recorder end only and if the recorder has a two-pin plug (I believe that most, if not all, have co-axial plugs) he checks that the outer of the co-axial is connected to the earthed or earthy side of the input.

With reference to Mr. Kingdon's letter on earth and mains connections I would like first to stress his point about the correct connection of mains plugs. There is at least one maker who fits three-core mains leads but they also provide an earth socket in the usual manner, perhaps one of your readers could say why two earthing connections are provided.—J. DIXON (Portishead).

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

SIR,—In reply to Mr. Trueman in the November issue, may I offer to help him by passing on some information derived from experience and also from manufacturers of tape recorders. May I begin by assuming that he is using a high impedance mike such as a condenser or crystal, and that the trouble mainly occurs on "record." Firstly he should try the effect of shunting the grid leak resistor with a capacitor of around 22pF. If this does not cure the trouble, a small choke can be wired in the live lead of the mike. Also if he is using a high impedance mike on a long run, the loss will be very high indeed and I would advise a low impedance mike and matching transformer with twin screened mike cable.

If the trouble manifests itself on playback, a 50pF capacitor can be wired directly across the head which should cure the trouble. I hope these little pointers may be of service.—C. BRADDOCK (266, Waterloo Road, Blackpool).

SIR,—With reference to Mr. Trueman's letter on radio pick-up, the trouble can be due to one of three things. (1) Detection is taking place at the crystal microphone (assuming it is crystal), the co-axial cable outer acting as the "aerial," the audio being fed to the grid circuit in the conventional way. (2) The first and second amplifier stages are oscillating somewhere well above audibility due to accidental positive feedback in the circuit, and this oscillation, or one of its harmonics, is beating with some short wave station(s) at the amplifier input and rectification (detection) owing to the anode bend effect is taking place. (3) In a sensitive amplifier, minute signal voltages picked up on the input lead are detected by a poorly soldered joint or "dirty" plug connection. A few ohms D.C. resistance along its length can produce sufficient R.F. pick-up owing to the "earthing" impedance of the lead being high from an R.F. viewpoint.

The cure for (1) and (3) is simple and consists of inserting extra components in the grid circuit of the input stage. A resistor of 22k is wired in series with the lead to the grid of the valve and a condenser of 50pF is wired from the grid to earth. The normal grid leak is wired to the other end of the 22k resistor and a capacitor of 50pF is also connected from this point to earth.

To remedy (2) the self-oscillation must be stopped, and the usual remedies such as screening of input from output, etc., tried. For extra protection the components given above may also be fitted to a circuit even after the self-oscillation has been cured.

Incidentally it will be found very handy on tape recorder inputs, etc., operating very near amateur radio transmitters, and has been loosely called a "CQ 40" chopper circuit.—B. PHILLIPS (Preston).

Becoming an Amateur

SIR,—I have thought for some time about becoming a "ham" and your new course about how to become an amateur has prompted me to start a class at school with the object of teaching some of the pupils and myself the necessary theory to sit for the R.A.E.

I have two or three books from which I am obtaining my information for teaching the class, but, unfortunately, they do not describe the necessary theory about control of a transmitter. As I am not able to purchase, or borrow for a sufficient length of time from the public libraries, books explaining the above theory, perhaps it is possible that you could reintroduce "Transmitting Topics" and "Short Wave Section." I am sure, also, that the items would be of great value to others in similar predicaments to my society.—A. T. ROBINSON (Chairman of Westcliff High School for Boys Amateur Radio Society).

[*Further articles in the series mentioned are planned for future issues.*—ED.]

Transistors v. Valves

SIR,—The Editorial in your November issue proved a little disappointing to me. I am interested in all branches of electronics and have been building valve sets for twenty-five years, but what a welcome change the transistor has made.

There are many applications of the thermionic valve that cannot yet be matched or even performed by the transistor but it is a definite advantage to have a receiver small enough to be slipped into a "vest pocket," which weighs only ounces instead of pounds and which will work for many months on a single 1½V cell. Judging by the ever-increasing number of advertisers in your journal who feature transistors and sub-miniature components there is a great deal of interest in this aspect of amateur electronics.

Let us by all means continue with articles on valve sets. but please publish new circuits, new applications and every bit of additional information that you can glean about the transistor (my own tastes run to reflex and super-regenerative receivers).—L. F. GRAY (W.7.).

[*A reflexed transistor receiver is described on page* 743.—ED.].

SIR,—I would like to say a word on the side of the transistor which has been criticised so much in your columns. I am surprised that the critics do not appear to realise that valves can be damaged just as easily as transistors. A transistor set can be operated much easier than a valve set as there is no reaction to tune in and they take no time to "warm up." I will agree that for the moment we cannot altogether dispense with the services of the valve although there are some jobs which a transistor can do just as effectively and cheaper. For example, I have a two-transistor set on which I have heard eleven recognisable stations, and not all of them English, by any means. I get 150 hours of listening from a two-shilling battery, a PP4. The set can be left on for days without any ill effects. If this happened to a valve set a new H.T. and L.T. battery would be needed very frequently.—D. A. PRICKETT (Bury).

Transistors on Mains

SIR,—Perhaps other readers would be interested in a battery eliminator for a transistor set which is used frequently by myself.

Transistors may, of course, use the mains supply the same as valves. Since the current consumption is extremely small a rectifier with cooling fins is unnecessary and a crystal diode may be used.

Either a 100ohm resistance or a choke will suffice for smoothing with two 25μF, 25V.W. condensers. although I find that one condenser is sufficient. If a transformer giving a higher voltage is used (up to say. 45V) then two diodes should be used in series.—J. SAUNDERS (Cardiff).

Transistor Signal Tracer

SIR,—I have made up the transistor signal tracer (see Sept./Oct. issue), using transformer coupling, as I had one to hand, and I have found it has many more applications, as an amplifier and preceded by a coil and condenser it makes a stand-by radio. It will take the mike or a pick-up and the output can be fed into a push-pull output stage for a loudspeaker.—S. J. REECE (Ashford).

Rectification

SIR,—Replying to G. R. E. (Bristol) in the December issue, I would like to say that I have also received stations when using an audio amplifier with no detector at all. My explanation is that the anode current/grid volts curve of the first valve at the point of working is not quite straight and there is a slight anode-bend detection taking place. I am interested to know that others have met this.

I enjoy listening to classical LP records on a Hi-Fi gramophone but I find one fault standing out above any other. Sometimes on a long note the pitch slowly rises and falls most unpleasantly as the record revolves. I have found that it is due to the hole in the record being slightly larger than the spindle on the turntable, and the record is not quite in the middle. The effect is only noticeable on a sustained note, but it sounds awful to a musical ear. Is this fault peculiar to my own gramophone, or have other readers noticed this effect ?—G. BRIAN JAMES (Grasmere).

[*We have found that many instances of radio reception on tape recorders, etc., have been due to induction from a neighbour's receiver.*—ED.]

Miniature Mains Receiver

SIR.—I am one of the younger readers of your fascinating magazine, and am naturally very glad to see simple and inexpensive sets described in your pages. I enclose a photograph of the miniature mains set as described in the June edition. It gives excellent reception of Medium Wave stations with a 5ft. aerial. As regards the transistor *v.* valve dispute, I think both have their place.—J. BELL (Aberdeen).

[*We were interested to see Mr. Bell's receiver which is well constructed in a small cabinet.*—ED.].

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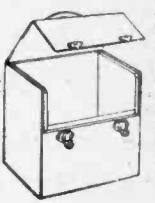

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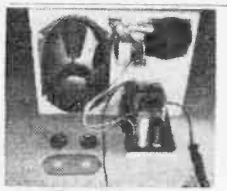

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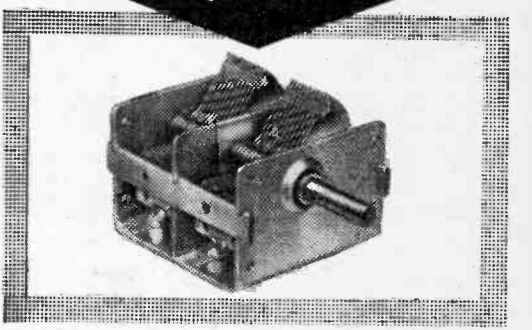

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3Q5	9/-	7C5	8/-	DK91	7/-	EF41	9/6	EY51	10/-	PCF80	9/-	UABC80	9/-	UF85	9/6	VS70	6/-
3S4	7/-	7C6	7/6	DL91	7/-	EF42	11/-	EY86	10/-	PCL82	12/-	UAF42	9/-	UF89	10/-	Z77	5/-
3V4	7/6	7C7	8/6	DK96	9/-	EF89	8/6	EY91	6/-								
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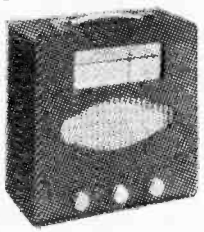

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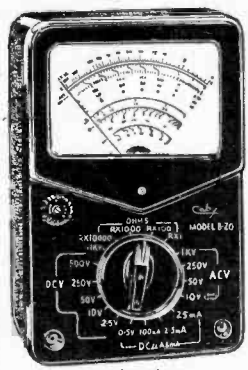

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Practical Wireless

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ALL OF these blueprints are drawn full-size and although the issues containing descriptions of these sets are now out of print, an asterisk in the list below denotes that constructional details are available free with the blueprint.

The index letters which precede the Blueprint Number indicate the periodical in which the description 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, Strand, 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		
Mains Operated		
A.C. Band-pass Three	PW99*	4/–
A.C. Coronet-4	PW100*	4/–
A.C./D.C. Coronet	PW101*	4/–
MISCELLANEOUS		
The PW 3-speed Autogram ...	—*	8/–
The PW Monophonic Electronic Organ	—	8/–
TELEVISION		
The PT Band III Convertor ...	—*	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
Short-Wave Two	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
TELEVISION		
Argus Television Receiver ...	—*	3/–
Simplex Television Receiver ...	—*	3/6

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PRACTICAL WIRELESS, JANUARY, 1960

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Junior Crystal Set	PW94*	2/–
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STRAIGHT SETS		
Battery Operated		
Modern One-valver	PW96*	2/6
All-dry Three	PW97*	3/6
Modern Two-valver	PW98*	3/6
SUPERHETS		
Mains Operated		
A.C. Band-pass Three	PW99*	4/–
A.C. Coronet-4	PW100*	4/–
A.C./D.C. Coronet	PW101*	4/–
MISCELLANEOUS		
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PRACTICAL WIRELESS, JANUARY, 1960

Published on the 7th of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and printed in England by W. SPEAIGHT & SONS, Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand: GORDON & GOTCH (Asia), LTD. South Africa and Rhodesia: CENTRAL NEWS AGENCY, LTD. Subscription rate including postage for one year: Inland £1.3.0. Abroad £1.1.6 (Canada 19s.). Registered at the General Post Office for the Canadian Magazine Post.