

LOW-DRIFT V.H.F. RECEIVER

PRACTICAL 1/6 WIRELESS

SEPTEMBER
1960



CONTENTS

SIX VALVE 9W AMPLIFIER
TRANSISTORISED OHMMETER
COMBINED RECEIVER AND
SIGNAL GENERATOR
USING ABSORPTION
WAVEMETERS
BEGINNERS' dB METER
ETC. ETC. ETC.

SHORT WAVE RECEIVER

MODEL MARK 38

Frequency range 7.4 to 9 Mc/s. Here is your opportunity to own a real communication receiver and explore the world on the short waves. On test this receiver astounded us for on a short aerial we heard over 65 short wave stations including several airport, police, fire brigade and civil defence broadcasts and numerous European programmes. The MK 38 operates from standard dry batteries 3 v. L.T. 120 v. H.T. Supplied complete with headphones. Aerial, Junction Box and battery connection details.

ONLY **57/6**

Plus P & P 2/-
Batteries 20/- extra.



COMPLETE HEADPHONE & MICROPHONE ASSEMBLY

A must for every constructor and "Ham", consists of moving coil padded headphones and "press to talk" microphone. 10/- P. & P. 3/6

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/-

POCKET MULTIMETER

BRAND NEW. 2,500 o.p.v. Multi range 6/30/120/300/1,200 v. A.C. ditto D.C. 0-1K. 0-1 megohm. 400 Micro-A. 12 mA. 300 mA. — 00 to +64 db 5 ranges. 3in. x 4 1/2in. x 1 1/2in. Large clear dial. Leads supplied.

Our Price 70/- P. & P. 2/6

T.C.S. TRANSMITTER. Designed for mains or mobile use covering 1.5-12 Mc/s. (160-8040 metre bands) consisting of a VFO, Buffer, Doubler PA with an internal push-pull modulator. Provision for VFO or crystal control. Output 40 watts phone, 100 watts C.W. Complete with aerial and plate current meters, less loading coil. ONLY 47/- Carriage 15/-

CONSOB OSCILLOSCOPE. A truly magnificent first grade L.F. oscilloscope incorporating a hard valve time base, speeds 1.5-40 milliseconds, easily extended for a few shillings to 3 c.n.s. to 30 kc. speeds. Has high-class amplifier with fine and coarse gain controls. Brightness and focus controls, X and Y shifts, 115 v. and 230 v. Mains power pack fully fuse protected. Employs 2 1/2in. tube ACH 10 size 19in. x 7in. x 12in. Only 20 in stock so first come first served. Generously cost 45/- each, our price 112.10.0. Carr. 15/-

SPARE VALVE KIT

Here's a gift for all 38 and 18 Set owners. Case contains 1 n.g. 4 ARP12and 1 ATP1 valves. Only 10/- P & P 2/6



NEW! MORSE CODE SET



Here's a real bargain. The morse key has adjustable spring tension and contact clearance. 12ch frequency buzzer. Provision for headphones. Complete with morse code alphabet and battery. Only 10/6. P & P 1/6. Sensitive earphone 3/6 extra.

TWO TRANSISTOR POCKET RADIO with Miniature Speaker

Anyone can build it! This powerful



pocket radio gives reception over the entire broadcast band. Complete with all parts, including 2 transistors, exclusive ferrite rod, miniature speaker tuning condenser, plastic case, wiring diagram, and step by step instructions. Size 4 1/2 x 1 1/2 x 3ins. ONLY 27/6. P & P 1/6. Battery 1/- extra.

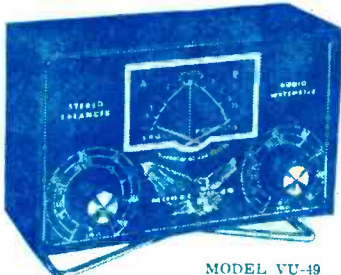
PORTABLE

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-1. Complete with aerial, H.T. and L.T. meter and all accessories. Weight 20 lbs. Size 8 x 10 x 17in. Only 80/- Carr. 10/-

NEW! STEREO BALANCER & AUDIO WATTMETER

The most versatile instrument ever offered to the Hi-Fi Enthusiast!



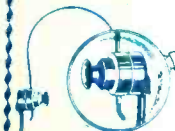
Solves all stereo balancing problems and ensures studio perfect stereo balance regardless of room acoustics. Instead of continuously running back and forth between listening position and amplifiers you can now balance the entire system in one step. It is very seldom that the listener is in the exact centre of the area between the speakers, therefore the VU-49 controls compensate for differences in room acoustics.

The unique meter incorporates two independent high resistance movements. Each coil is connected to the speaker system of each channel. The dials continuously monitor both channel outputs without affecting speaker damping or response, matched meter deflections denotes balanced outputs. Calibrated 0-30 watts for both 8 ohm and 15 ohm inputs.

Contemporary cabinet with gold stain and matching gold and black panel and controls. Size 6 1/2 x 3 1/2 x 1 1/2in.

Price 7 Gns. COMPLETE WITH INSTRUCTIONS

MODEL VU-49



LIGHT WEIGHT HEADSET

These H.S. 30 phones are the smallest used by the U.S. Air Force. 2500 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 4000Ω. ONLY 15/- P & P 2/6.

WIRELESS SET NO. 19MK. 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. In used condition, 65/- Carr. 10/-

CONTROL BOX—B.C.602. Complete push-button control box. 4 position on and off, with dual coloured indicators for instant channel check. In black crackle case 3 1/2in. x 3 1/2in. x 1 1/2in. Bargain price, 5/- each. P & P 1/6. Two for 8/- P & P 2/6

EAGLE VALVE FILAMENT TESTER MODEL VT41. Gives instant test of valves, fuses, continuity etc. (as described in May issue, page 70). Supplied complete 30/- P & P 2/6

T.C.S. RECEIVER, 15 to 12 Mc/s. 7-valve superhet, built like a dream. Panel controls: R.F. Gain, A.F. Gain, C.W. Pitch, band-switch, 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 air lined window, anti-backlash rears used. Used condition, 28.10.0. Carriage 15/-

HOOVER ROTARY TRANSFORMERS

12 v. input, 500 v. output at 65 mA, or 6 v. input, 250 output at 75 mA. Only

10/6

EACH P. & P. 2/-



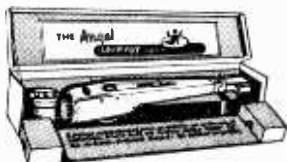
Callers: 87 Tottenham Court Road, London W.1
Mail Orders (Dept. P) 32a Coptic Street, London W.C.1
Telephone MUSEUM 9607

FULLY ILLUSTRATED CATALOGUE 1/3 Post Free.

HARVERSON SURPLUS CO. LTD.

83 HIGH STREET, MERTON, S.W.19. CHERRYWOOD 3985/6/7

THE WORLD FAMOUS E.M.I. ANGEL TRANSCRIPTION P.U. (Model 17A)



A Pick-up for the connoisseur originally priced at £17.10.0. The last remaining few offered at **£4.10.0** Plus P. & P. 5/-

1/6 H.P. MOTOR

140 Watt (Approx. 1/6 H.P.). Series wound, 220/250 volt 50 cycle motor. Off load 14,000 rev/min. on load 8,500 rev/min. Ideal small saw, sewing machine, etc. **30/-** post free.

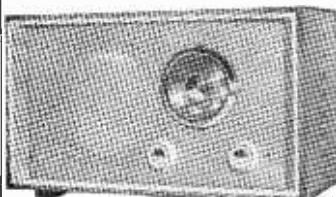


MONAURAL AMPLIFIER



This amplifier as illustrated, made by a leading manufacturer. Mullard valves—ECC83, EL84 x EL84, EZ80. Bass, Treble and Volume on remote panel. Elegant Knobs. OUR PRICE one month only **£4.16.6** plus P. & P. 3/6.

HARVERSON T.R.F. EASY FOUR KIT



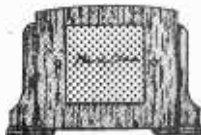
All parts and theoretical wiring diagram only. OUR PRICE **£4.0.0** Plus P. & P. 3/6.

WHY NOT VISIT US ?

Our new retail premises at 83 High Street, Merton, London S.W.19 are London's biggest walk around shop. 1,000's of bargains, all enthusiasts welcome, no obligation to buy. 1 min. South Wimbledon Tube

EXTENSION SPEAKER

An attractive cabinet 8 x 6 x 2in. fitted with 3 ohm 5in. speaker complete with lead, a few only, **19/6** P. & P. 2/6.



TAPE RECORDER

- ★ CONTEMPORARY Red and White Tygan Cabinet. Size 13½ x 14½ x 9½ inches.
 - ★ B.S.R. DECK.
 - ★ MAGIC EYE tuning.
 - ★ INPUTS for RADIO and MIKE.
 - ★ VOLUME and TONE Controls.
- This instrument has to be seen and heard to be believed. Complete with ACOS Xtal Mike. **ONLY 18 gns.**

AM/FM RADIOGRAM CHASSIS

- ★ By famous manufacturer. ★ 220/250 volts A.C. ★ Coverage 1000-1900 m, 200-500 m, 88-98 Mc/s. ★ Tuned by 5 "Piano Keys"—Off, LW, MW, FM and Gram. ★ Sockets for P.U., Ae, E, Extn. Spkr. and Dipole. ★ Tuning and tone controls fitted. ★ Valves, ECH81, EF89, EABC80, EL84, ECC85 and EZ80.
- 50 Only at ridiculous price of **12 gns.** plus 8/6 P. & P.

STEREOPHONIC AMPLIFIER £5.10.0

Complete with 2 Loudspeakers

Plus 4/6 P. & P.

This is a compact amplifier embodying the latest features and giving a high standard of reproduction, with ample volume. Supplied complete with valves (ECL82, ECL82, EZ80), panel, knobs, etc., and two specially selected 3Ω matched loudspeakers. We only have a few, and we will never be able to repeat this offer at such a low price! Don't risk disappointment! Order now!

TRANSISTOR

TRANSISTOR by leading manufacturer. First Grade Equivalent OC44. For one month only, the first 100 customers **8/6** post free, **6 for 50/-**

PICK-UP CARTRIDGE BARGAINS

STUDIO P	...	...	17/6
ACOS HIGH G.	...	...	17/6
E.U. POWER POINT	...	...	12/6
RONETTE	...	...	18/6
G.C.Z.	...	...	16/6

THIS MONTH'S OFFER

Plessey 6 x 4in. 3Ω Loudspeaker, 14/- each. 7 x 4in. Goodmans, 16/6. 25 amp 2½in. flush mounting meters, new, 7/6.

12 Assorted Pots. Wire wound and carbon. Switched and unswitched—all useful sizes at **15/-** the dozen. Plus P. & P. 1/-.

60 Milliamp Chokes at per **2/6** each.

AMAZING SCOOP—Cossor 10in. Tubes. 108 K. New and Boxed, 15/- plus 6/- P. & P. Twin Padded, Grey, Maroon Tracer Mains Lead. Usually 10d. per yard. Our price 15/- per 100-yard coil.

IF YOU DO NOT SEE WHAT YOU WANT ON THIS PAGE WE WILL GET IT FOR YOU Write (enclosing S.A.E. please) for our list of small parts and accessories for the Constructor. Trade willingly supplied.

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

REALISM AT INCREDIBLY LOW COST. CAN BE ASSEMBLED IN HALF AN HOUR

The Recorder incorporates the Latest Collaro Studio Tape Transcriber. The Linear LT45X High Quality Tape Amplifier listed \$12.10 High Flux P.M. Speaker listed 30¢, empty Tape Spool, a Reel of 30' of 1/4" tape listed 22/6, and a Handsome Portable carrying Cabinet finished in Two-tone covering, size 18 x 13 x 9in. hgh. listed \$4.10.0. and circuit. Total cost if purchased individually approximately £40. Performance equal

to units in the £60-£80 class. Send S.A.E. for leaflet.

25 1 GNS. Carr. 17/6

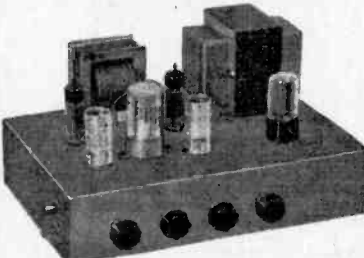
H.P. TERMS. Deposit £5.75 and 12 monthly payments of 2 gns. Cash price if settled in 3 mths.

TELEVISION RECTIFIERS. 250v, 200mA, small size. Only 6/9 ea. **RE-ENTRANT SPEAKERS.** Tannoy, 8 watt, 7.5 ohms. Only 22/6 each. **Parmeko Horn Type** 10 watt, and 300 ohm matching, 59/6. **R.C.A.** 20 watt, 15 ohms or 200 ohms. 6 gns.

HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

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

Two input sockets with associated controls allow mixing of "mike" and gram, as in A10. High sensitivity. Includes 5 valves, ECC83, ECC83, EL84, EL84, 6Y3. High Quality sectionally wound output transformer specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. **INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut."** Frequency response ± 3 D.B. 30-30,000 c/s. Six negative feedback loops. Hum level 60 D.B. down. **ONLY 23 millivolts INPUT** required for **FULL OUTPUT.** Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs. **FOR STANDARD or LONG PLAYING RECORDS.** **FOR MUSICAL INSTRUMENTS** such as **STRING BASS, GUITARS, etc.** **OUTPUT SOCKET** with plug provides 300 v. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT**, S.P. 12-97in. For A.C. mains 200-250 v. 50 c/s. Output for 3 and 15 ohms speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. **Only 8 gns.** Carr. 10/- (Or factory built 45/- extra).



If required louvered metal cover with 2 carrying handles can be supplied for 18/9. **TERMS ON ASSEMBLED UNITS. DEPOSIT 24/3, and 5 monthly payments of 24/3.** Send S.A.E. for illustrated leaflet detailing Ready-to-assemble Cabinets, Speakers, Microphones, etc., with cash and credit terms.

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

A complete set of parts for the construction of a stereophonic amplifier giving 5 watts high quality output on each channel (total 10 watts). Sensitivity is 60 millivolts, suitable for all crystal stereo heads. Gained Bass and Treble Controls give equal variation of "HF" and "cut". Provision is made for use as straight (monaural) 10 watt amplifier. Valve line-up ECC83, ECC83, EL84, EL84, E221. Outputs for 23 ohm speakers. Point-to-point wiring diagrams and instructions supplied. **8 Gns.** Carr. 10/-

R.S.C. BATTERY CHARGING EQUIPMENT

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

ASSEMBLED CHARGERS

- 6 v. 1 amp. 19/9
 - 6 v. or 12 v. 1 amp. 29/9
 - 6 v. 2 amps. 29/9
 - 6 v. or 12 v. 2 amps. 38/9
 - 6 v. or 12 v. 3 amps. with ammeter. 59/9
- Above ready for use. With mains and output leads. Carr. 3/6.

HEAVY DUTY CHARGER KIT

6/12 v. 6 amps. variable output. Consisting of Mains Transformer 0-200-230-250 v., F.W. (Bridge) Selenium Rectifier; Ammeter, Multi-Position Switch with Knob; Panels, Plugs, Fuses, Fuseholder and circuit. 59/8. Carr. 4/6.



Assembled 6 v. or 12 v. 4 amps.

Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvered steel case with stoved blue hammer finish. Fused **69/9** and ready for use with Carr. 5/- mains and output leads. Terms: Deposit 13/3 and 5 monthly payments 13/3.

ASSEMBLED CHARGER

6 v. or 12 v. 2 amps.

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

BATTERY CHARGER KITS

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

- 6 v. or 12 v. 1 amp. 24/9
- As above, with Ammeter. 32/9
- 6 v. 2 amps. 25/9
- 6 v. or 12 v. 2 amps. 31/6
- 6 v. or 12 v. 2 amps. inclusive of Ammeter 42/9
- 6 v. or 12 v. 4 amps. 53/9
- As above, or 12 v. 4 amps. with Ammeter and variable charge rate selector, 59/9.

CHARGER AMMETERS. 0-1.5 a., 0-3 a., 0-4 a., 0-7 a., 0-25 a., 0-60 a. 8/6.

R.S.C. MAINS TRANSFORMERS

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. 17/9
- 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. 2 a. 6.3 v. 1 a. 19/9
- 250-0-250 v. 100 mA. 6.3 v. 3.5 a. C.T. 22/9
- 250-0-250 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. 25/9
- 300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. 25/9
- 350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. 25/9
- 350-0-350 v. 100 mA. 6.3 v. 4 a. 4 a. C.T. 25/9
- 0-4.5 v. 3 a. 25/9
- 350-0-350 v. 150 mA. 6.3 v. 4 a. 5 v. 3 a. 29/9

FULLY SHROUDED UPRIGHT

- 250-250 v. 60 mA. 6.3 v. 2 a. 5 v. 2 a. 17/11
- Mikogut type 2f-3-3in. 17/11
- 250-0-250 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. 26/9
- 300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. 26/9
- 350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. 26/9
- 300-0-300 v. 130 mA. 6.3 v. 4 a. 6.3 v. 1 a. 26/9
- or Mullard 510 Amplifier 35/9
- 350-0-350 v. 150 mA. 6.3 v. 4 a. 5 v. 3 a. 35/9
- 425-0-425 v. 200 mA. 6.3 v. 4 a. 5 v. 3 a. 49/9
- 6.3 v. 4 a. C.T. 5 v. 3 a. 49/9

FULLY GUARANTEED We can quote for special types singly or in any quantity

FILAMENT TRANSFORMERS

A2 with 200-250 v. 50 c/s. primaries 6.3 v. 1.5 a. 5/8; 6.3 v. 2 a. 7/8; 0-4-6.3 v. 12 a. 7/8; 12 v. 1 a. 7/11; 6.3 v. 3 a. 9/11; 6.3 v. 6 a. 17/6; 12 v. 1.5 a. twice. 17/6.

OUTPUT TRANSFORMERS

Midget Battery Pentode 68:1 for 354. etc. 3/9

- Small Pentode, 5000 Ω to 3 Ω 3/9
- Small Pentode 7/8,000 Ω to 3 Ω 3/9
- Standard Pentode 5,000 Ω to 3 Ω 5/6
- Standard Pentode 7/8,000 Ω to 3 Ω 5/6
- 10,000 Ω to 3 Ω 5/6
- Push-Pull 10-12 watts 6V6 to 3 Ω or 15 Ω 18/9
- Push-Pull 10-12 watts to match 6V6 18/9
- Push-Pull EL84 to 3 or 15 Ω 19/9
- Push-Pull 15-18 watts, 6L6, KT66 29/9
- Push-Pull for Mullard 510 Ultra Linear 29/9
- Push-Pull 30 watts, sectionally wound 6L6, KT66, etc., to 3 to 15 Ω 47/9

ELIMINATOR TRANSFORMERS

Primaries 200-250 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
- 50 mA. 10 H 350 ohms 5/9
- 50 mA. 10 H 400 ohms 4/11

CHARGER TRANSFORMERS

All with 200-230-250 v. 50 c/s. Primaries:

- 0-9-15 v. 1 a. 11/9; 0-9-15 v. 2 a. 14/9; 0-9-15 v. 3 a. 16/9; 0-9-15 v. 5 a. 19/6; 0-9-15 v. 6 a. 23/9.

AUTO (Step up/Step down) TRANS.

- 0-110/120-230/250 v. 50-80 watts. 13/9
- 0-110/120-200/230/250 v. 150 watts 27/6.

MICROPHONE TRANSFORMERS

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

R.S.C. A12 STEREOGRAPHIC 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 Volume and Tone Controls. Preset balance control. Full instructions and point-to-point wiring diagrams supplied. Only good quality Carr. and pkg. 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.

4 Gns.

STEREO EQUIPMENT OFFER.
Comprising A12 Kit, matched 8in. L/Speakers, and Acos TVO Stereo head with sapphire stylus suitable most pick-ups. Carr. 7/7
£6.19.6

PICK-UP ARMS complete with Hi-Fi turnover crystal head, Acos GP54. Limited number but perfect, at approx. half price. Only 29/11.

ACOS CRYSTAL MICROPHONES. Mic40 stand or desk, Listed 45/-, Only 27/9. 49-1 Stick types, listed 5 gns. Only 39/6.

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/s. 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, 80C, CZ33. 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/s. 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 31/9 and 9 monthly payments of 31/9.

1 gns.

Carr. 10/-

FULL RANGE OF LINEAR AMPLIFIERS ALWAYS IN STOCK.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5 1/2 x 4 1/2 x 2 1/2 in. approx. Complete. Replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s is available. Suitable for a battery operated receivers requiring 1.4 v. and 90 v. This includes latest low consumption types.



Type BM2. Size 5 1/2 x 2 1/2 in. Supplies 120 v. 90 v. and 60 v., 40 mA. and 2 v. 0.4 a. to lamp. Fully smoothed. Thereby completely replacing both H.T. batteries and L.T. accumulators when connected to 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.

Complete kit with diagrams, 39/9, or ready to use, 46/9.

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

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

R.S.C. BRADFORD, MANCHESTER and LEEDS

(Leeds) Ltd.

LINEAR L45 MINIATURE 45 WATT QUALITY AMPLIFIER Suitable for use with any record playing unit, and most microphones. Negative feedback 12 db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 7-5-5 1/2 in. 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.

R.S.C. 45 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, 13db. of Negative feedback is used. H.T. or 200 v. 50 c/s. 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 £24.15.0. 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. Loudspeaker 'built-in'. Handsome, strongly made Cabinet (size approx. 14 x 14 x 7in.) finished in satin walnut, and fitted carrying handle. H.P. Terms, Deposit £1 and monthly payments Carr. 7/6

£8-19-6

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 12in. for Bass notes and a 7 x 4 in. elliptical for Treble. Cabinet is well made and finished satin walnut. Size approx. 18 x 18 x 18in. H.P. Terms, Deposit 34/9 and 9 monthly payments of 34/9. Both models for 200-250 v. Carr. 10/- A.C. mains.

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Gauss 12,000 lines. Speech coil 15 ohms or 15 ohms. Only £4.19.6 Carr. 5/- Terms: Deposit 11/3 and 9 monthly payments of 11/3.
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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. Rates 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. Fuji-f. Garrard GC2 and B.S.R. Stereo/Monaural. 39/11.

P.M. SPEAKERS. 2-3 ohm, 2 1/2 in. Perdio 21/9, 5in., 17/9, 6in. 16/9, 8in., 19/9, 8 in. 25/9, 10in. 26/9, 10 x 6in. 29/9, 12in., 29/11. 10in. W.B. 'Santorlan' 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 3D 19/9, 15D 25/9.

GLA 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 1 1/2 x 2 1/2 x 2 1/2 in. Controls: Vol. and Tone with switch. Guaranteed 12 months. Only 59/6.

SUPERHIT FEEDER UNIT. (Design of high quality Radio Tuner Unit (specially suitable for use with any of our Amplifiers). Delayed A.V.C. employed. The W.C. 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 £4.15.0. For descriptive leaflet send S.A.E.

COLLARO CONQUEST 4-SPEED AUTO-CHANGER with high fidelity Studio pick-up. Latest model. For 200-250 v. 50 c.p.s. A.C. mains. Our price £8.19.6. Carr. 5/6.

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Sub-miniature electrolytic Condensers, for transistor sets: 1 mfd., 18 v.; 1.5 mfd., 6 v.; 2.5 mfd., 5 v.; 6 mfd., 6 v.; 6 mfd., 6 v.; 8 mfd., 12 v.; 8 mfd., 6 v.; 10 mfd., 6 v.; 16 mfd., 12 v.; 25 mfd., 6 v.; 30 mfd., 3 v. All normally 3/- each. Sale price 1/6.

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Miniature Microphone, Dynamic American. Beautifully made. Sale price 2/-.

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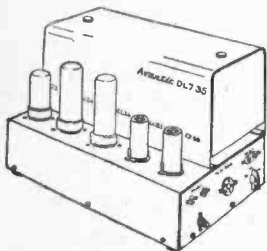
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With our **COSSOR TURRET TUNER ZB2**

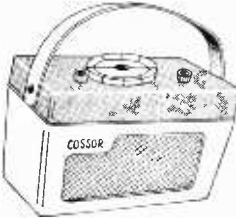
2-valve cascade R.F. amp, using one 7 an 7-valve 1 freq. charger 8A8, output from converter, sound 10.1 Mc/s, vision 13.6 Mc/s. Fitted with aerial panel, fine tuning control. Brand new in carton with full instructions and circuit. List price 7 gns. **Our price 37/6d. P. & P. 2/-.**
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(Traveller's Friend) **Transistorised**
£7.19.6 **POCKET RECEIVER**
in leatherette case

This set can be built for **£7.19.6**. Size 6 x 3½ x 1½in. Weight 17 ozs. This set covers medium waveband 190/500 metres intermediate frequency. 470 kc/s using 4 transistors (Ediswan) and 2 diodes on a printed circuit board, plus a 2½in. moving coil speaker. Instruction book with point to point wiring diagram, 2/6 each. Batteries, PP4 (Ever Ready) 2/- each. P. & P. 2/-.

ALL PARTS CAN BE SOLD SEPARATELY



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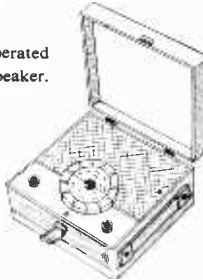
P. & P. 3/6

A printed circuit, 5in. speakers are features of this battery portable. An internal ferrite rod aerial for L and M Bands. A polythene wrapper provided to protect receiver. Width 10in., height 6½in., depth 5½in.

£7.19.6

P. & P. 3/6

This extremely sensitive battery operated set has a printed circuit and 5in. speaker. A frame aerial fitted in the lid gives high quality listening on L and M Bands.



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- B.S.R. .. 18/-

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Type CME/1702 90° (seconds)
with line EHT Transformer,
Scanning Coil, COMPLETE
and Frame **£6.19.6**
Output Trans- P. & P. 10/-
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Acos Crystal Stick mike, type MIC39/1. Complete with cable 39/6.
Type 40 Mike, hand or table mike, 25/6. P. & P. 2/-.



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4-SPEED SINGLE PLAY £3.15.0

P. & P. 3/6

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£3.9.6

P. & P. 5/-

We can now supply the following parts to build this unit:

- 1) Player Case.
- 2) Garrard Motor (BA.1).
- 3) Knob, Plugs, etc.



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Switch control for Stereo and Mono dual volume and tone control. Output 3 ohms suitable for use with ACOS GC/71-GP73 and GARRARD GC10.
Complete with wiring diagram.

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B.S.R. "Monarch" UA8, 4-speed unit with B.S.R. Full-Fi cartridge, £6.19.6.
B.S.R. "Monarch" UA8, as above but fitted with B.S.R. Full-Fi STEREO cartridge, £7.19.6.

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Garrard RC121 4D, 4-speed unit with rc11 in pick-up head £10.19.6.

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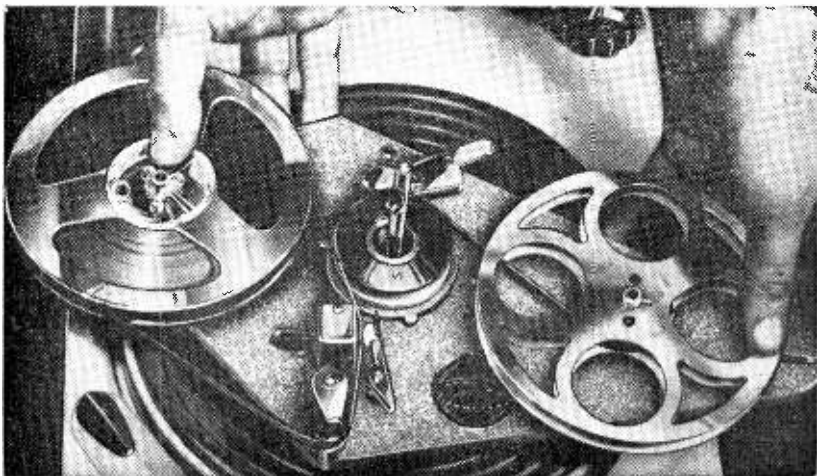
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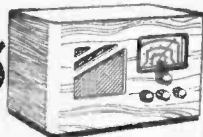
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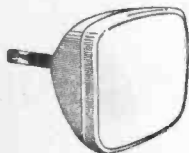
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79/6



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29 gns.



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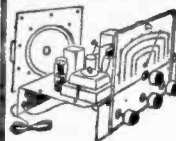
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R.P.2

59/6 CASH OR 4/1 Initial Payment

Balance at 2/11 a week or 19 weeks. Made by a famous manufacturer. In polka dot cloth with clipped lid and carrying handle. Size 16 x 14½ x 8½ in. deep. Carr. & Ins. 4/6. Will take B.S.R. Monarch 4-speed Auto-changer, 7in. x 4in. Elliptical speaker and our Mk. D.2 Portable Amplifier.

17" TVs complete 19 gns.

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ITV/BBC. Beautifully styled polished cabinets. These are table models with the option of contemporary legs fitted (2 gns extra). 17in. rectangular tube guaranteed for 12 months. Valves and Chassis guaranteed for 3 months (chassis salvaged but reconditioned). Where possible personal collection is advised.

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19/9



Excellent 8in. P.M. Speakers fitted in polished oak cabinets. Complete. Standard matching to any receiver (2-5ohms). Switch and flex included. Relay your favourite radio programme to wherever you are. Carr. & Ins. 3/9.

ELLIPTICAL SPEAKERS

15/9

7" x 4" and 8" x 3"

Carr. & ins. 2/9

AMPLIFIERS

ALL PORTABLE
12 MONTHS' GUARANTEE

MK. D.1 59/6

Brand new. Latest design with printed circuit. Dimensions 7 x 2½ x 5in. A.C. only. Mains isolated 3 watts output. Incorporating EL84 as high gain output valve. Volume and tone controls. Knobs 2/6 extra. P. & P. 3/6.

MK. D.3 89/6

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Simple circuit employing ECL80 triode pentode output valve giving 2-3 watts output. A.C. only. Mains isolated. Single control for volume and on/off switch with knob. P. & P. 3/6.

Tape Recorder Amplifier £7.19.6

Compact, well designed 5-valve amplifier. Output 3.5 watts. Valve line up—ECC83. Double triode first audio amplifiers. ECL82 Triode pentode further audio amplifier and output valve. 6BV6 Dias and erase oscillator. EM84 Record level indicator. EZ80 H.T. rectifier. Input for mike, radio and gram. Controls: Record Playback volume and On/Off Playback tone. Dia. 8½ x 3 x 4½ in. Ins. and carr. 4/6. Terms. Knobs, 2/6 per set. Beautiful perspex dial plate, 3/6. Completed with sockets for Mike. Radio and superimpose switch.

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RECORDER
CABINET

29/9

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Complete with both LP and Standard stylus. Replaces Studio O. B.S.R. Ful Fi standard mounting assembly which will fit almost all types of pick-up heads. P. & P. 9d.

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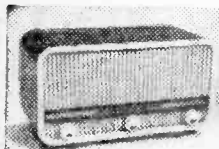
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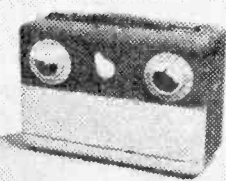
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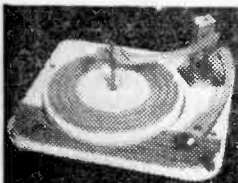
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17/6

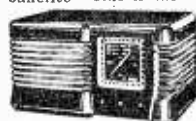


39/6

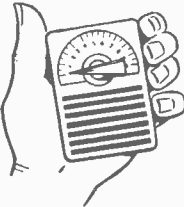
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107/6



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

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1960

LOOK AT THESE PRICES!
TUBES DIRECT FROM OUR FACTORY

Due to the increasing demand for our wide range of C.R.T.S. and our efficient handling methods we offer unbeatable value.

REGUNNED TUBES have new Guns, Getters, Aquadac Coating, Bases, etc.
TOP QUALITY GUARANTEED

Carriage and insurance 12/6	8 MONTHS REYACQUED	12 MONTHS REYACQUED	12 MONTHS BRAND NEW TYPES
CRN92, MW22-7, MW22-14, MW22-14C, MW22-17, MW22-18	£1-10	£3	
12KPA, 12LK, C12B, CRM121, CRM121A, CRM121B, CRM122, CRM123, MW31-14C, MW31/16, MW31/15, MW31/74	£2	£4	MW31/74 £4-10
141E, 2201A, C14FM, CRM141, CRM142, CRM143, MW36-24, MW36-44 17ASP4, 17LK, AW36/21, C17FM, CRM171, CRM172, MW48-64, MW48-69	£2-10	£4-10	MW36/24 £5-15
7401A, AW43-30, C14BM, C17BM, CRM151, CRM152A, CRM152B, CRM153, CRM173, MW43-30, MW41-1	£3	£5-5	MW43/64 £6-15
AW53-30, CRM21E, MW53-20, MW53-30	£4	£6-10	£6-15

PLEASE NOTE: Many other types not listed available. S.A.E. enquiries.

READ THIS ADVERT CAREFULLY

FINEST

13 CHANNEL TV'S

TABLE MODELS, FAMOUS MAKERS. Complete with all valves and tubes. These sets are unequalled in value due to huge purchase direct from source. They are second set and are not guaranteed to be in working order.

AMAZINGLY POPULAR-IDEAL UNCEST SETS

12" — **£3.19.** (p. & p.)

14" — **£6.19.** (p. & p.)

17" — **£9.19.** (p. & p.)

12" 5 CHANNEL TV'S 45/- (p. & p. 12/6)

14" 5 CHANNEL TV'S 85/- (p. & p. 12/6)

12in. TV's 5 channel table models including speaker, line trans. cabinet. Top makes requiring only valves and tube to complete your choice if available (carr. 4/-). (Or £8 per dozen, carr. free.) **15/-**

14in. TV's 5 channel as above **35/-** (carr. 4/-)

*** TAPE DECKS ***

E.S.R. "MONARDEC". Latest type, 3 1/2 i.p.s., takes 5 1/2 in. spools. Simple controls. **£9.15.0**
LATEST COLLARO STUDIO TAPE TRANS-CRIPTOR. Three motors, three speed, 10, 33, 8 1/2 i.p.s., takes 7 in. spools, super quality finish. Push-button controls. **£14.10.0**

Stereo Outfit

Consisting of two 3 valve (10F3, 10P14, U109) 3 watt mains amplifier, each complete with 8 in. loudspeaker, in two tone bakelite cases with independent controls, together with U48 stereo changer and screened lead, unrepeatable. **£11.10.0**
 Amplifiers only 49/- each.

U48 Stereo Changers

E.S.R. famous Monarch autochangers, fitted with quality stereo cartridge. **£6.19.0**
 Truly amazing value.

*** Record Players Carriage 4/- ***

COLLARO 4-speed 4/546	.. ..	£5 19 0
EMI 4-speed Stereo	.. ..	£6 19 0
GARRARD 4-speed 4HF	.. ..	£17 15 0
E.S.R. (U48) AUTOCHANGER	.. ..	£6 15 0
GARRARD RC120D MKII	.. ..	£9 7 6

*** Starr Galaxy Spares ***

We hold the most comprehensive range of spares in the country, send 6d. stamp for Service Sheet and Spares Price List.

*** Pick-up Arms ***

The well-known Starr "Galaxy" lightweight pickup arm, dual aspirin turnover/ single hole fixings, adjustable needle pressure, can be used with any 3 and 4 speed turntable. Supplied complete with famous cartridges above listed at **19/6** approximately £2.

*** Cosor D.B. Scopes ***

Fortunate purchase enables us to offer these excellent instruments at an unusually low price complete and in good order. **£19**

*** Test Sets Type 74A ***

A service scope easily convertible for standard use, 290/250 v.a.c., all valves, E.C.R.30 tube. Excellent case worth £10. Our price. **£4.10**

SPECIAL OFFERS

External ITV Converters with internal power pack

Finished in hammered gold. Very compact. Gain and Trimming controls. Listed at £7.7. Our Price **39/-** Carriage 2/6.

UA14 B.S.R. Changers

Very latest super finish, superseding the UA8 and UA13 amazing value at **£7.19.0**

ALL DRY PORTABLES

A fortunate purchase enables us to offer you these Brand New Stella, shoulder strap, lightweight models, in makers' sealed cartons, with guarantees and instructions. Economy valves. Superior finish. Listed at £13.2.6. amazing value **£7.15.0** Carr. 4/-.

4-SPD. RECORD PLAYERS

Latest B.S.R. TU9 Turntable, together with lightweight Starr Galaxy dual sapphire crystal turnover pick-up head. Truly amazing value **£3.10.0** Carr. 3/-.

CO-AXIAL CABLE

Semi-Air-Spaced low loss, 1-19 yds., 7d. per yd., p. & p. 1/3. 20-39 yds., 6d. per yd., p. & p. 1/9. 50 YD. DRUMS, 2d/-.

VALVES ALL GUARANTEED 3 MONTHS.

PL81 SOILED, AMAZING VALUE AT ONLY 4/6

EY51SHORT 4/6 U25SHORT 8/6

100 RESISTORS 6/6

100 CONDENSERS 10/-

Due to huge purchase we can offer a wide, well balanced range of mainly the latest miniature Ceramic and Silver Mica Condensers, 3 pF to 10,000 pF. LIST VALUE OVER 45/-.

A must for your spares box. Only 10/-.

PM SPEAKERS Surplus 3 ohm

Tested, top makes, performance guaranteed.

6in. **7/-** 5in. **11/-** 7X4 **13/-**

10n. **13/-**

Stereo

Special Offer, matched pairs of speakers. 6in. or 5in. 14/- pr. 7 x 4 22/- pr. Special quotations for quantities of the above speakers or any other goods listed.

*** CHASSIS BARGAINS ***

Top quality, undrilled, lowest possible prices due to the large quantities handled.

PACK FLAT CHASSIS

Consisting of flat top plates with separate sides and ends, in stout "easy to solder" tin plate. 7in. x 5in. x 2in. 4/2; 10in. x 7in. x 2in. 5/- 10in. x 5in. x 2in. 4/6; 14in. x 5in. x 2in. 6/2 14in. x 10in. x 2in. 7/8.

TIN PLATE-BOX FORM

Complete with sides and ends in "easy solder" tin plate. 4in. x 2in. x 1 1/4in. 2/2; 6in. x 4in. x 2in. 3/2; 8in. x 6in. x 2in. 4/-.

ALUMINIUM BOX FORM

OPEN ENDED, in heavy gauge bright sheet. 6in. x 4in. x 2in. 3/8; 6in. x 6in. x 2in. 4/6; 10in. x 7in. x 2in. 5/2; 12in. x 6in. x 2in. 5/6; 12in. x 8in. x 2in. 6/-; 16in. x 8in. x 3in. 7/8

ALUMINIUM BOX FORM

Heavy gauge sides and ends. 6in. x 4in. x 2in. 4/-; 8in. x 6in. x 2in. 5/2; 10in. x 7in. x 2in. 5/9; 12in. x 6in. x 2in. 6/3; 12in. x 8in. x 2in. 6/8; 14in. x 10in. x 2in. 9/8.

*** TRANSISTORS ***

REDSLOT Now only 3/6.

WHITE SPOT 4/6.

Still the same high quality.

DIODES General purpose, famous make, 8d 8/- doz. GEX44 type, 3/9.

4 Transistor Amplifiers

ONE WATT—From a single 6v. all-dry battery. Latest GET15 Power Transistors. In PUSH-PULL Two-Transistor High Gain pre-amplifier stages. Output 3 ohms. **£3.19.0.**

1 watt Transistor Stage

To the purchaser of each manufacturer matched pair of GET15 Power 1 watt Power Transistors (listed 50/-) we give the correct Push-Pull INPUT AND OUTPUT TRANSFORMERS of High Grade construction and a complete 4 Transistor Amplifier circuit. Will transform your existing receiver or amplifier into a truly "Main Volume" outfit for a total price of ONLY **45/-**

*** Rectifiers ***

For Chargers, selenium, full wave bridge, 12 volt 3-4 amps 9/6. (Carr. 1/-) 25 per doz. 20 v. 60 mA, 5/-; R.M1, 6/6; R.M2, 8/-; R.M3, 9/-; R.M4, 15/6; R.M5, 21/-; 14AS6, 17/-; 14A97, 23/-; 14A100, 25/-; 16RC1-16-1, 7/9; 16RA1-1-16-1, 7/9; 18RD2-2-8-1, 14/-; 14RA1-2-2-2, 17/-; 14RA1-2-2-3, 20/-.

*** Loudspeakers ***

TOP MAKES—MANUFACTURER FRESH
 2 1/2in., 18/-; 3in., 19/-; 3 1/2in., 19/-; 5in., 16/-; 6 1/2in., 18/-; 8in., 19/-; 10in., 22/6; 12in., 25/6; 7 x 4in. elliptical, 18/-; 9 x 6in. elliptical, 22/6; 10 x 6in. elliptical, 23/6; 8in. Stentorian 15 ohm HF1012, 70/-; 10in. Stentorian 3-7.5-15 ohm HF1012, 98/9; 12in. Closed Field, 27/6.

STOP PRESS—Just out! 6 x 1 1/2in. HI-FI speakers built-in tweeters, 49/-.

TECHNICAL TRADING CO.

Postage must be added unless otherwise stated

September, 1960

PRACTICAL ELECTRONIC WIRELESS

IT MAY SAVE YOU £ £ £'s

VALUE

INSTRUMENTS C.R.T.'s.

Table listing various C.R.T. instruments with their model numbers and prices.

Carriage and packing: 3-5in. 4in. 4 1/2in. 5in. 6in. 7in. 8in. 9in. 10in. 11in. 12in. 14in. 15in. 16in. 18in. 20in. 22in. 24in. 26in. 28in. 30in. 32in. 34in. 36in. 38in. 40in. 42in. 44in. 46in. 48in. 50in. 52in. 54in. 56in. 58in. 60in. 62in. 64in. 66in. 68in. 70in. 72in. 74in. 76in. 78in. 80in. 82in. 84in. 86in. 88in. 90in. 92in. 94in. 96in. 98in. 100in.

Table listing various C.R.T. instruments with their model numbers and prices.

★ VALVES BY RETURN OF POST ★

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

NEW LOW PRICES GUARANTEED 3 MONTHS

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

Main table listing various vacuum tubes (valves) with their model numbers and prices.

OBSOLETE INDUSTRIAL AND TRANSMITTING VALVES GUARANTEED FOR THREE MONTHS

Table listing obsolete industrial and transmitting valves with their model numbers and prices.

ALL ITEMS LESS 5% & POST FREE IN DOZENS No C.O.D. (Callers always welcome). LIST OF 1000 SNIPS, 6d. Post: 2 lbs. 1/6, 4 lbs. 2/-, 7 lbs. 2/9, 15 lbs. 3/6 etc. 350-352 Fratton Road, PORTSMOUTH

THE MOST COMPREHENSIVE RANGE AND OUTSTANDING VALUE IN TAPE EQUIPMENT.

Stern's "fidelity" TAPE RECORDERS

EACH RECORDER IS SUPPLIED COMPLETE WITH MICROPHONE AND SPOOL OF TAPE

THE TYPE "C" PRE-AMP. HF/TR3 AMPLIFIER AND THE HF/G2 UNITS ARE STERN'S - MULLARD DESIGNS.



Model CR3/S

Incorporating the HF/TR3 AMPLIFIER and COLLARO "STUDIO" TAPE DECK. Twin track operates at 1, 3 $\frac{1}{2}$ and 7 $\frac{1}{2}$ in./sec. PRICE **£39.10.0**

H.P. Terms, Deposit, £7.18.0, and 12 months at £2.17.11.



PRICE **£29.15.0**

H.P. Terms, Deposit £6.0.0, and 12 months at £2.3.7.

Model HF/G2A-D Unit (described opposite). A small robust recorder with outstanding performance. Truly portable, weighs only 22 lbs. Twin track operates on 3 $\frac{1}{2}$ in./sec. speed.



Model CR3/T

Incorporates the HF/TR3 AMPLIFIER and COLLARO Mk.IV "Transcriptor" Tape Deck. Upper and Lower tape tracks operate at speeds 3 $\frac{1}{2}$, 7 $\frac{1}{2}$ and 15in./sec. PRICE **£47.10.0**

H.P. Terms, Deposit £9.10.0, and 12 months at £3.9.8.



Model HF/G2A-D

A complete self-contained chassis incorporating Loudspeaker and comprising the Model HF/G2A Amplifier connected to the Garrard Tape Deck. Operates at 3 $\frac{1}{2}$ in./sec. speed and supplied fully tested and ready for immediate operation, designed for easy fixing into a portable case or cabinet, only four fixing screws being required. PRICE **£25.0.0**

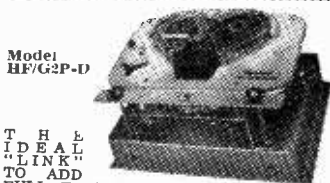
(Including a 4in. spool of Long Play Tape.) H.P. Terms, Deposit £5.0.0, and 12 months at £1.16.8. Alternatively we offer Complete Kit of Parts to build the HF/G2A Amplifier with the ASSEMBLED AND TESTED GARRARD TAPE DECK for £22.0.0. H.P. Terms, Deposit £4.8.0, and 12 months at £1.12.3.



Model TR3/Mk.VI

INCORPORATES THE HF/TR3 AMPLIFIER & TRUVOX Mk.IV TAPE DECK. Twin track operates at speeds 7 $\frac{1}{2}$ and 15in./sec. PRICE **£49.10.0**

H.P. Terms, Deposit £9.18.0, and 12 months at £3.12.7.



Model HF/G2P-D

THE "LINK" TO ADD FULL TAPE RECORDING FACILITIES TO HIGH QUALITY HOME INSTANTANEOUS RADIOGRAMS, etc. Comprises the HF/G2P Tape Pre-amplifier fitted to the Garrard Tape Deck, operates at 3 $\frac{1}{2}$ in./sec. speed, pick-up sockets of existing Amplifier or Radio Chassis. COMPLETE WORKING UNIT, containing 4in. spool of Long Play Tape. PRICE **£23.15.0**

H.P. Terms, Deposit £4.15.0, and 12 months at £1.14.10.

Alternatively we offer Complete Kit of Parts to build the HF/G2P Pre-amplifier with the ASSEMBLED AND TESTED GARRARD DECK for **£20.15.0**.

H.P. Terms, Deposit £4.3.0, and 12 months at £1.10.5.

HOME CONSTRUCTORS SPECIAL COMBINED ORDER PRICES

- (a) The COLLARO "STUDIO" TAPE DECK and our Mullard Type "C" PREAMPLIFIER and Power Unit Assembled and Tested. **£29.10.0**
- H.P. Deposit £5.18.0, and 12 months £2.3.3.
- (b) As above but TYPE "C" PREAMPLIFIER supplied as complete KIT OF PARTS. **£26.10.0**
- (c) The COLLARO Mk. IV TAPE DECK and the MULLARD TYPE "C" PREAMPLIFIER and Power Unit assembled, tested. **£35.0.0**
- H.P. Deposit £7, and 12 months £2.11.4.
- (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" Pre-amplifier and Power Unit. **£40.0.0**
- H.P. Deposit £8.0.0, and 12 months £2.18.3.
- (f) As above but Type "C" as complete KIT OF PARTS. **£36.10.0**
- (g) The BRENNEL Mk. V DECK and the assembled Type "C" PREAMPLIFIER and POWER UNIT. **£46.0.0**
- H.P. Deposit £9.4.0, and 12 months £3.7.6.
- (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. **£56.0.0**
- H.P. Deposit £11.4.0, and 12 months £4.2.1.

(Carriage and Insurance on above quotes 10% extra)

ALL THE ABOVE CAN BE SUPPLIED IN A PORTABLE CASE FOR £5.10.0 extra, THUS FORMING A COMPLETE PORTABLE PRE-AMPLIFIER.

FULLY DESCRIPTIVE LEAFLETS ON ALL OF ABOVE ARE AVAILABLE — BUT PLEASE ENCLOSE S.A.E AND STATE WHICH LEAFLET IS REQUIRED.

- (a) COMPLETE KIT to build the HF/TR3 Amplifier, together with the COLLARO "STUDIO" DECK. **£25.10.0**
- (b) As above but with HF/TR3 supplied ASSEMBLED and TESTED. **£29.0.0**
- (c) COMPLETE KIT to build the HF/TR3 together with the Mk. IV COLLARO "TRANSCRIPTION" TAPE DECK. **£30.15.0**
- (d) extra if we are required to wire up Deck Switch Banks.) **£34.10.0**
- (e) H.P. Deposit £7.0.0, and 12 months £2.10.5.
- (f) extra if we are required to wire up Deck Switch Banks.) **£36.0.0**
- (g) COMPLETE KIT to build the HF/TR3, together with the NEW TRUVOX Mk. VI TAPE DECK. **£39.10.0**
- (h) As above but HF/TR3 supplied ASSEMBLED and TESTED. **£41.10.0**
- (i) H.P. Deposit £7.18.0, and 12 months £2.17.11.
- (j) COMPLETE KIT to build the HF/TR3 AMPLIFIER with the BRENNEL Mk. V TAPE DECK. **£45.0.0**
- (k) As above but HF/TR3 supplied ASSEMBLED and TESTED. **£45.0.0**
- (l) H.P. Deposit £9.0.0, and 12 months £4.6.0.
- (m) THE WEARITE 4A DECK with assembled and Head Lift Transformer including WEARITE. **£55.0.0**
- (n) H.P. Deposit £11.0.0, and 12 months £4.0.8.

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 10 x 5in. LOUDSPEAKER—ACOS CRYSTAL MICROPHONE—and 1.000ft. SPOOL E.M.I. TAPE—ALL FOR £9.10.0. Carriage and Insurance 5% extra.

STERN RADIO LTD.

STERN'S presentation of MULLARD designs

MULLARD "5-10" MAIN AMPLIFIER

Designed to operate with the 2-valve Preamplifier. Output 10 watts and has additional power for Radio Tuner.

KIT OF PARTS **£10.00**
OR ASSEMBLED **£11.10**



MULLARD 2-VALVE PREAMPLIFIER TONE CONTROL UNIT

Suitable for all power Amplifiers requiring an input of up to 250 mV/ohms. Inputs for Crystal and Magnetic Pick-ups, Microphone, Tape. Separate Bass and Treble Controls.



KIT OF PARTS **£6.60** OR ASSEMBLED **£8.00**

THESE TWO UNITS PURCHASED TOGETHER ARE OFFERED FOR

KIT OF PARTS **£15.150** OR ASSEMBLED **£18.180**

MULLARD "3-3" AMPLIFIER

Ideal for small high quality installation, provides excellent reproduction up to 3-watts output. Inputs for Crystal Pick-ups and Radio Tuner.

KIT OF PARTS **£7.10.0** OR ASSEMBLED **£8.19.6**

Mullard "5-10" Amplifier Model 510/RC

A complete Amplifier, incorporating CONTROL UNIT, providing up to 10 watts high quality reproduction. Inputs for crystal pick-ups and Radio Tuner.

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

STEREO "3-3" MAIN AMPLIFIER

Comprises two MULLARD 3-3 Main Amplifiers on one chassis. Operates with MULLARD STEREO PREAMPLIFIER. Output power 6 watts. Inputs for Crystal Pick-up and Radio Tuner.

KIT OF PARTS **£10.0.0** OR ASSEMBLED **£11.15.0**

MULLARD STEREO PREAMPLIFIER

Suitable for Stereo or Monoaural operation with any Power-Amplifier requiring input of up to 250 mV/ohms. Inputs for Crystal or Magnetic Pick-ups, Microphone, Tape. Separate Bass and Treble Controls.



KIT OF PARTS **£12.10.0** OR ASSEMBLED **£15.0.0**

THIS STEREO PREAMPLIFIER IS OFFERED TOGETHER WITH

(a) One MULLARD "5-10" MAIN AMPLIFIER
KIT OF PARTS **£21.10.0** OR ASSEMBLED **£25.0.0**

(b) Two MULLARD "5-10" MAIN AMPLIFIERS.
KIT OF PARTS **£31.0.0** OR ASSEMBLED **£36.0.0**

(c) MULLARD "STEREO" 3-3 MAIN AMPLIFIER.
KIT OF PARTS **£21.10.0** OR ASSEMBLED **£25.0.0**

COMPLETE STEREO AMPLIFIER

Meets the many requests for a low priced but good quality Stereophonic Amplifier. Output power is 4 watts and suitable for Crystal Pick-ups.

KIT OF PARTS **£8.10.0** OR ASSEMBLED **£10.10.0**

THE "ADD-A-DECK" incorporating the NEW B.S.R.

"MONARDECK" and Matched Preamplifier

Carriage and Insurance 10/-
Deposit £3.12.0 and 12 months £1.6.2
Designed to operate through the Pick-up Sockets of the standard RADIO RECEIVER through which first-class results are obtained. It consists of a Twin Track Tape Deck, incorporating matched Pre-amplifier, and operates at 3in./sec. speed. Supplied assembled and fully tested on an attractive woodplinth, and only requires connections to mains supply and Pick-up Sockets, for which purposes "floating" leads are incorporated.

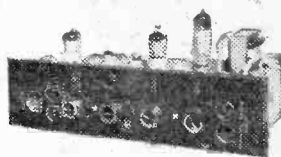
H.P. TERMS AVAILABLE ON EQUIPMENT OVER £9.
DESCRIPTIVE LEAFLETS AVAILABLE FOR ALL EQUIPMENT. PLEASE SEND S.A.E.

Dept. P.W. 109 FLEET ST. LONDON, E.C.4

Telephone: FLEET STREET 5812/3/4

TAPE AMPLIFIERS and PREAMPLIFIERS PRESENTED FROM MULLARD DESIGNS

MODEL HF/TR3 TAPE AMPLIFIER (Mullard Type "A" design) A very high quality Amplifier incorporating 3-speed treble equalisation, using the latest FERROXUBE POT CORE INDUCTOR. FOR COLLARO-TRUVOX-BRENELL-WEAR-ITE or MOTEK Tape Decks. has GILSEN Output Transformer. Includes separate Power Supply Unit.



KIT OF PARTS **£12.15.0**

OR ASSEMBLED **£16.10.0**

MULLARD TYPE "C" TAPE PREAMPLIFIER-ERASE UNIT

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



KIT OF PARTS **£14.0.0**

OR ASSEMBLED **£17.0.0**

(Excluding power unit £11.15.0 and £14.10.0 respectively)

MODEL HF/G2A TAPE AMPLIFIER

Completely self-contained and specifically designed to operate the GARRARD TAPE DECK. All input and output sockets, loudspeaker and Power Unit are contained on chassis which is constructed for direct attachment to Deck (see Model HF/G2A-D).

KIT OF PARTS **£11.0.0**

OR ASSEMBLED **£13.0.0**

Model HF/G2P Tape Preamplifier-Erase Unit

Identical to the HF/G2A but excludes Loudspeaker and output transformer (see Model HF/G2P-D).

KIT OF PARTS **£10.0.0**

OR ASSEMBLED **£11.15.0**

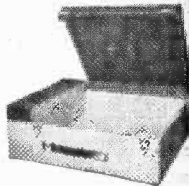
Mk.II "Fidelity" FM TUNING UNIT

An attractively presented Unit incorporating MULLARD PERMEABILITY TUNING HEART and corresponding Mullard valve line up.

FOR THE CONSTRUCTOR **£10.10.0** ASSEMBLED **£14.5.0**

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 **£4.7.6**

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

(c) 6in. P.M. SPEAKER 18/9 Carriage and Insurance 4/- extra

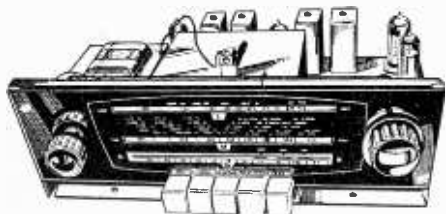
!! RECORD PLAYERS !!

THE LATEST MODELS ARE IN STOCK MANY AT REDUCED PRICES
SEND S.A.E. FOR ILLUSTRATED LEAFLET

- B.S.R. MONARCH UA8 4-speed mixer Autochanger with Crystal Pick-up **£6.19.6**
- THE NEW COLLARO MODEL RP594 4-speed Single Record Player. Studio Cartridge **£9.18.9**
- The COLLARO "CONQUEST" 4-speed Autochanger Studio Pick-up **£7.10.0**
- The COLLARO 4-speed Single Record Player. Studio Pick-up **£6.9.6**
- THE NEW B.S.R. Model UA12 in Stock. A4 "SPEED" MIXER AUTOCHANGER **£8.7.6**
- UA12 also available incorporating the B.S.R. STEREO Pick-up, plays L.P. and 78 Records. **£10.10.0**
- GARRARD MODEL TA/Mk.II 4-speed Player fitted high output Crystal Pick-up. **£8.10.0**
- GARRARD MODEL RC210. Autochanger 4-speeds. High output Crystal Pick-up. **£10.10.0**

Carriage and Insurance on each above, 5/- extra.

BRAND NEW AM/FM (V.H.F.) RADIOGRAM CHASSIS AT £13.6.8 (P. & P. 10/-)



Tapped input 220-225 v. and 226-250 v. A.C. ONLY.
Chassis size 15 x 6½ x 5½ in. high. New manufacture. 12 mths. guarantee.
Dial 14½ x 4 in. in black and yellow.
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Covers 1,000-1,900 M.; 200-500 M.; 88-98 Mc/s.
Valves E280 rect., ECH81, EF89, EABC80, EL84, ECC85.
Speaker and Cabinet to fit chassis (table model), 47/6.
10 x 6 in. ELLIPTICAL SPEAKER, 20/- to purchasers of this.

TERMS:—(Chassis) £4.16.8 down + 10/- carr. and 6 Monthly Payments of 30/-, or with Cabinet and Speaker £5.9.2 down and 7 Monthly Payments £1.12.2.

COSSOR/EMI 10in. TV tube type 108K. Brand new and boxed. ONLY 30/- (carr. 3/6).

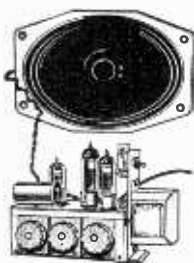
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50 SILVERED MICA AND CERAMIC CONDENSERS. 10/-.
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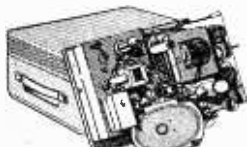
Cossor printed circuit 4-transistor amplifier; Garrard 45 r.p.m. battery player type BA1; speed control. Cabinet size 11 x 9 x 5½ in.; less than 8½ lb. inc. batteries. Requires two Ever Ready AD28 batteries. State colour—red/cream or blue/cream.



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PRICE for Recorder and Deck Assembly, as above (without Cabinet), £16.10.0 (10/- p. & p.). Cabinet available next month. Enquiries invited for any of the parts.

See additional advertisement on page 459

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All with Crystal Turnover Head Some dusty (but working) chassis at £10 (carr. 10/-).



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Practical Wireless

VOL. XXXVI, No. 643, SEPTEMBER, 1960

THE RADIO SHOW

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Contents

	Page
Editorial	389
Round the World of Wireless	390
Six Valve 9W Amplifier ...	392
Inexpensive P.A. Equipment ...	395
Using Absorption Wavemeters	398
On Your Wavelength ...	403
Microphone Pre-amplifier ...	404
Add-on Bridge Unit ...	407
Morse Practice Oscillator ...	411
Faraday Screen and Line Filter	
Static Elimination ...	413
Transistorised Ohmmeter ...	415
Low Drift FM Receiver ...	416
Precision Pick-up Arm ...	420
3 Valve Quality Amplifier ...	425
Combined Receiver and Signal Generator	430
Electronic Comparison Ohm- meter	437
Beginners' dB Meter ...	441
Trade News	445
Club News	449
Letters to the Editor ...	450

The Editor will be pleased to consider articles of a practical nature. Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2.

Owing to the rapid progress in the designs of wireless apparatus and to our efforts to keep 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.

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IT seems likely that this year's Radio Show will be more successful than its immediate predecessors; many innovations have been planned while several exhibits which have been absent in recent years will again be on show. So far as radio receivers are concerned, it seems that the emphasis will be upon portable, battery-operated, sets. The increasing use of transistors enables smaller receivers to be designed and gives longer battery life. The current trend is towards miniature receivers with colourful, attractive cases which women will find especially attractive.

At the recent British Exhibition in New York, great interest was aroused in British audio amplifying equipment which already enjoys great popularity in the United States. Most of the principal manufacturers will exhibit their goods at Earls Court and aerials, valves and other components will be included.

To many visitors, the main attractions at the exhibition will be the stands of the BBC and the ITA, both of which have planned the usual entertainments—with producers, technicians and stars at work in view of the public. Other large stands will be manned by the Royal Navy and the Royal Air Force and after three years' absence the Army returns with demonstrations by a Territorial unit of the Royal Signals (the 65th Signal Regiment, T.A.). The General Post Office stand has been devised to appeal to both technical visitors and laymen. For the first time since 1947, the London Metropolitan Police, a major user of electronic equipment, will also have a stand.

Many of our younger readers will be interested in obtaining information on possible careers in the radio industry; a radio servicing exhibit will show the prospective apprentice the type of work involved as well as illustrating to the public and radio dealers the uses of the latest test equipment used in radio repairs.

The 27th British National Radio Show will be held at Earls Court, London, from August 24th to September 3rd, with a preview for overseas visitors on August 23rd. Our stand at the show is No. 117 on the ground floor and we hope that readers attending the show will visit us there.

OUR QUERY SERVICE

ONCE again we must remind our readers of the rules of our Free Query Service. The followings points should be carefully noted:

- (i) We cannot undertake to answer technical queries over the telephone
- (ii) All queries must be accompanied by the query coupon from the current issue
- (iii) If a postal reply is required a stamped and addressed envelope must be enclosed with the query.

We must also point out that we cannot design circuits to readers' specific requirements. Nevertheless we shall continue to help readers as far as possible but it should be remembered that all information necessary for answering the query should be sent to us.

Our next issue, dated October, will be published on September 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 May, 1960, 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	Loa.
London Postal	778,955
Home Counties	731,196
Midland	540,445
North Eastern	585,405
North Western	506,526
South Western	440,137
Wales and Border Counties	265,238
Total England and Wales	3,857,905
Scotland	448,282
Northern Ireland	131,899
Grand Total	4,438,086

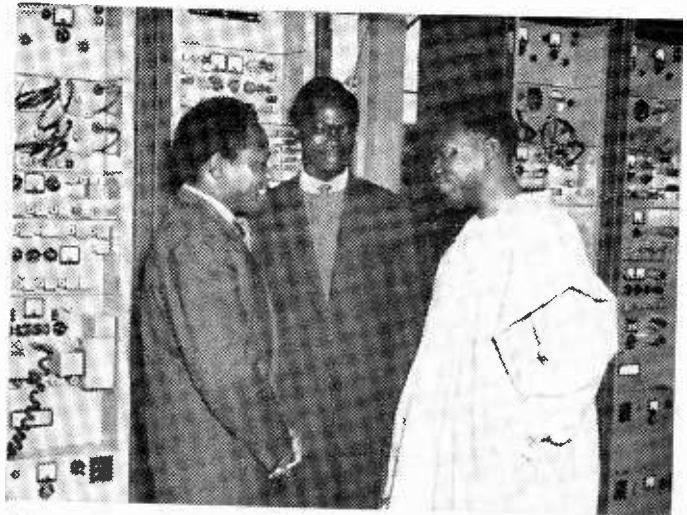
Radio Installation in H.M.T.S. "Monarch"

A COMPREHENSIVE radio communication installation in the G.P.O. cable-laying ship H.M.T.S. "Monarch" has recently been completed by Marconi's Wireless Telegraph Co. Ltd. Part of this installation is of unusual technical interest in that it is believed to make "Monarch" the first ship in the world to be equipped with HF transmitting equipment which embodies a main amplifier having no tuned circuits.

This facility is incorporated in a new equipment developed by the Marconi Company, the wide-band RF amplifier Type NT203. It provides a substantially constant power gain over the whole of the band 1.5Mc/s to 24Mc/s and therefore needs no retuning when the working frequency is changed. Two amplifiers are used in parallel without difficulty in H.M.T.S. "Monarch".

Communications circuit for Caribbean

THE world's most advanced inter-island and aeronautical tele-communications system was officially inaugurated in Barbados on June 10th, 1960, when the first call was made to Trinidad by the Federal Minister of Communications, the Hon. Andrew Rose. This £5,000,000 multi-channel



Nigeria's Minister of Communications, the Honourable Olu Akinfosile, recently visited Marconi's Chelmsford works. The illustration shows Chief Olu talking to two fellow Nigerians who are engaged in training courses at Marconi College.

VHF scheme was engineered in conjunction with and on behalf of International Aeradio Ltd. by Pye Telecommunications Ltd. and Ericsson Telephones Ltd. It provides modern automatic telephone and teleprinter services for islands operating in the Caribbean and gives instant, round the clock contact between any airport airline office and aircraft, irrespective of weather conditions.

Twelve separate and simultaneous voice channels have been provided, along with 12 to 18 teleprinter channels. The main route runs from Trinidad via Grenada, St. Vincent, St. Lucia, Dominica, Antigua and St. Kitts and by a link, through the All-American Cable and Radio Company, to St. Croix, Puerto Rico and on by co-axial cable to North America.

T.C.C. Agreement

AN arrangement has been made between the Telegraph Condenser Company Ltd. of the United Kingdom, and Sprague Electric Company of the U.S.A., whereby:—

(a) T.C.C. acquire the right to all Sprague United Kingdom patents and applications, together with the technical and engineer-

ing information necessary to exploit them.

(b) Sprague will make available to T.C.C. all its present research and technical information and engineering knowledge and for the next 21 years the two Companies will exchange research, development and manufacturing knowledge, extending beyond the field of capacitors and incorporating all the products of the two Companies.

BBC Appointments

THE following appointments have been announced by the BBC. Superintendent Engineer, Transmitters, Mr. W. E. C. Varley, Associate I.E.E., A.M. Brit.I.R.E., in succession to Mr. E. F. Wheeler who retired on June 15th after 36 years service. Assistant Superintendent Engineer, London Television Studios, Mr. M. H. Hall M.B.E. in succession to Mr. H. Walker who is retiring after thirty years with the BBC. Engineer-in-Charge, London Television Studios, Mr. W. D. Hatcher, B.Sc.(Eng.), A.M. Brit. I.R.E. who succeeds Mr. M. H. Hall.

E.M.I. Controlled Milling Machine

THREE years ago, a large British aircraft company

sought to solve the problem of economically producing the wide variety of components needed in small quantities in aircraft manufacture by the introduction of electronically controlled machine tools. The Company, Short Brothers and Harland Ltd., of Belfast has now been operating a Cincinnati vertical milling machine fitted with an electronic control system designed and manufactured by E.M.I. Electronics Ltd, for over 10,500 hours, working a double shift 16-hour day.

Short's have now placed an order with E.M.I. for another similar machine. The reduced turnaround time has considerably increased productivity in the department, and the scrap rate is less than 0.3 per cent.

Because they can be programmed from punched tape and require no marking out or expensive templates, E.M.I.-controlled machine tools are ideal for small batch production. Amendments to design drawings can be quickly incorporated in the control tape without the costly delays met in conventional systems.

Outer Space Temperature Research

THE radio telescope at Bonn University Observatory will shortly be used for an intensive investigation into the temperatures prevailing in interstellar gas. This new outer space research programme, under the direction of Professor Becker assisted by Herr Heinz G. Muller, is another example of new application for Travelling Wave Tubes manufactured by English Electric Valve Company Limited. Special dual channel amplifying equipment, using two low noise type N1017 Travelling Wave Tubes in cascade in each channel, has been supplied to the University by Marconi's Wireless Telegraph Company Limited.

The radio telescope, a parabolic mirror of 83ft diameter mounted on a pyramidal tower about sixty feet high, scans the sky picking up the cosmic continuum radiation emanating from galactic and extra-galactic radio sources under observation. The signals in the neighbourhood of the hydrogen line frequency (1420Mc/s) are amplified by one pair of travelling wave tubes, the other pair being used to amplify reference noise signals from a

resistor at a known temperature.

The outputs from the two amplifying channels are detected, integrated and compared and the effective cosmic temperature determined; from these, data contour maps are prepared. So accurate has the system proved in initial tests that a discrimination of 0.1°K has been achieved.

South Western Section Convention 1960.

ON 7th and 8th October, 1960, the South Western Section of The British Institution of Radio Engineers is organising a one-and-a-half-day Convention in the Bristol College of Science and Technology.

The Convention is planned to explore the technical potential of developments in electronics in the Aircraft Industry which it is thought could be of benefit to the Manufacturing and Process Industries. At the same time prominent members of these Industries have been invited to post their problems to experts in the Electronics field. In conjunction with the Convention, a small Exhibition will be held.

The Convention will be open to all interested persons and further particulars and Registration Forms may be obtained from the Hon. Secretary, South Western Section, The British

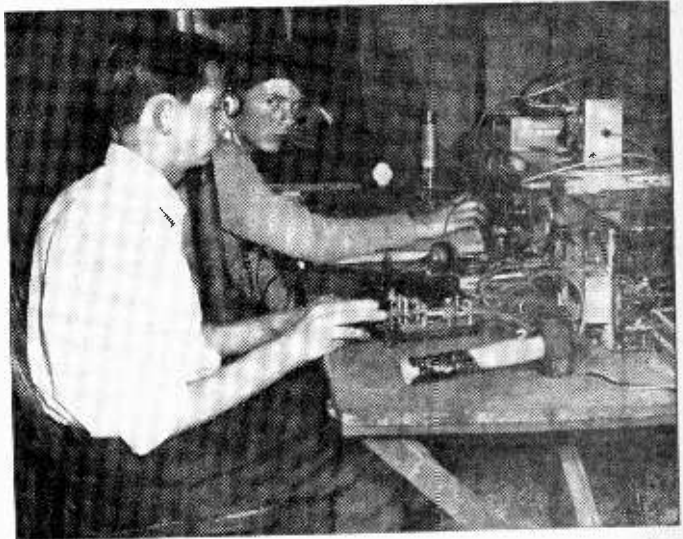
Institution of Radio Engineers, c/o The School of Management Studies, Unity Street, Bristol 1.

British Consumer Goods Display at Toronto

THE Board of Trade is sponsoring a display of British consumer goods at the Canadian National Exhibition in Toronto, which opens on August 24th and lasts until September 10th. The Board held similar displays last year and the year before at this exhibition, a popular annual event looked upon as both a national festival and an international trade fair.

The Council of Industrial Design has selected on the Board's behalf more than 200 examples of well designed products to go on a stand covering 2,000sq. ft. They include carpets, furnishing fabrics, high-class knitwear and woollen fabrics, furniture, kitchen equipment, leather goods, a lighting fitting, a radio set, sports goods, toys, cutlery and other wood and metal tableware. There will also be glassware and pottery selected from British products held in Canada.

The display is being designed by Leslie Goodday, A.R.I.B.A., M.S.A.I. An enquiry counter on the stand will be staffed by the U.K. Trade Commissioner's office in Toronto.



The above illustration shows members of the Southgate and Finchley Group of the Radio Society of Great Britain at their annual National Field Day in Trent Park, Cockfosters.

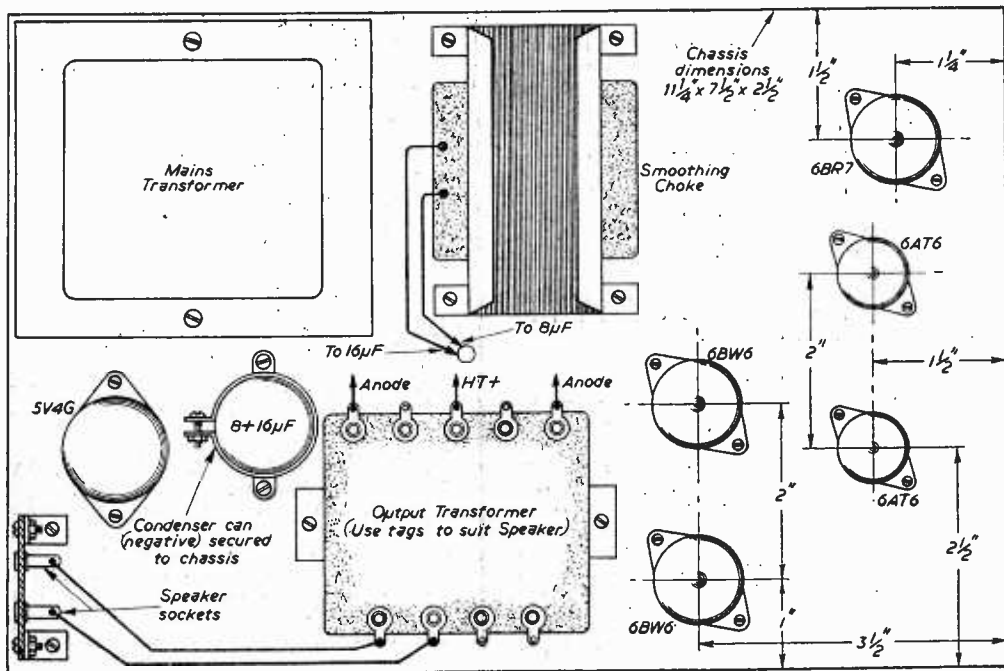


Fig. 2.—Above chassis layout.

Mains Transformer

The drop-through type of mains transformer also requires a cut-out, which can be made by starting with several holes at each corner, and then using a metal saw. All these large holes should be finished before fixing any parts. The upright type of transformer is equally satisfactory, and does not need a cut-out to hold it.

If the chassis does not have side runners, two pieces of wood should be cut to fit inside the chassis ends. That is, approximately 7 1/2 in. x 2 1/2 in. These will be required when making the case, to hold the ends.

When the large components have been bolted to the chassis, this should be arranged upside down so that wiring can be done underneath. It is wise to use blocks of wood to support it, or temporarily place it so that it rests in a box. Otherwise there is some danger of breaking the tag board of the output transformer, owing to the weight of transformers and choke. If a box is used to give support, this should be a little smaller than the chassis, so that the chassis rests on the edges of the box, with the transformers, etc., inside.

Wiring Details

Connections and parts underneath the chassis are shown in Fig. 3. The heater circuit is best wired first, leads being run close against the chassis. Small tags, for chassis connections, should be bolted securely in place when fitting the valveholders. All these points are marked "M.C."

Short, direct wiring is used in the first stage (6BR7 valve), and the lead from the input socket is screened. The metal braiding is pushed back

slightly, wrapped with tinned copper wire, and the joint soldered, the wire being used to connect the braiding to the chassis. A coaxial connector, or screened input jack, may be used instead of the insulated socket. The earth return (chassis) side of the input goes to the amplifier chassis, either by taking the lead to the terminal shown, or by means of the outer contact of the coaxial connector.

The two leads to the volume control are also screened as explained, both ends of the braiding being connected to the chassis. The introduction of hum, owing to long wiring, is much less likely in the later stages, and screening is not required there.

Matching

The two 100k resistors in the second 6AT6 stage should have their values matched to 5 per cent. The resistors do not need to be exactly 100k, provided they are of similar value. If these resistors are taken at random it is possible that they will be of rather dissimilar value, and this will cause unbalance in the input to the push-pull stage. The two 470k grid resistors wired to the 6BW6 valves are also matched to 5 per cent for the same reason.

It will be noted that the junction point of 25μF condenser, 100k resistor, 1M resistor, 3.3k resistor, and 0.01μF condenser must not be in contact with the chassis. With short, direct leads, an insulated supporting tag is scarcely necessary here. But care is necessary that the 25μF condenser is not a type with a metal can common to negative, as, if this were so, and the can were in contact with the chassis, one output valve would receive no signal.

Bias Resistor

The output bias resistor value of 120Ω is made up by wiring two 240Ω 1W resistors in parallel, these being attached to tags on the tag-board shown. Two such resistors are in some cases easily obtained, where difficulty may arise in buying a 120Ω 2W resistor. The single 120Ω resistor, would, of course, be satisfactory.

This tag-board also provides mounting points for some other components, as indicated. The indicator lamp is returned to the chassis. A separate mains switch is used, wired to the mains transformer primary, to avoid carrying mains leads near the volume control, and because this is often more convenient, as the volume control can be left at a pre-determined setting.

Mains Transformer and Choke

Surplus transformers and chokes may be obtained from many suppliers, and their use will reduce quite considerably the cost of building the amplifier. The heaters and lamp require 6.3V at 2A, with a separate 5V at 2A for the rectifier heater. Windings rated as able to deliver over 2A would be equally satisfactory, as there is no need to take all the current the winding can deliver.

For H.T., a 300-0-300V winding, rated at 120mA, is satisfactory. On full load, the voltage at the rectifier cathode will be around 265, so 250V may still be obtained with 15V dropped in the smoothing choke. A somewhat higher voltage will not matter. A lower voltage will reduce maximum

output slightly. If a 350V transformer is to hand, this may be used. The choke can then have a higher resistance. A winding rated at 125mA or 150mA will, of course, be satisfactory.

COMPONENTS LIST.

Valves:

6BR7, two 6AT6, two 6BW6, 5V4G.

Valveholders:

Two B7G, three B9A, one octal.

Fixed condensers:

Four 0.01μF 500VW, 0.1μF 350VW, 8 plus 8μF 340VW, 8 plus 16μF 450VW, three 25μF 25VW, 50μF 50VW.

Resistors, 1/2W:

1.5k, two 3.3k, two 47k, 100k, two 100k matched 5 per cent, two 220k, two 470k matched 5 per cent, 1M, 1.5M, two 240Ω 1W (or 120Ω 2W).

Sundries:

300/0/300V 120mA, 5V, 2A., 6.3V, 2A mains transformer for 200/250V. 120mA smoothing choke. 1M volume control with knob. On/off switch. Input and output sockets, etc. Elstone MR/7 output transformer. Chassis approx. 11 1/4in. x 7 1/2in. x 2 1/2in. Perforated metal approx. 12in. x 24in. Wood, etc.

(To be continued)

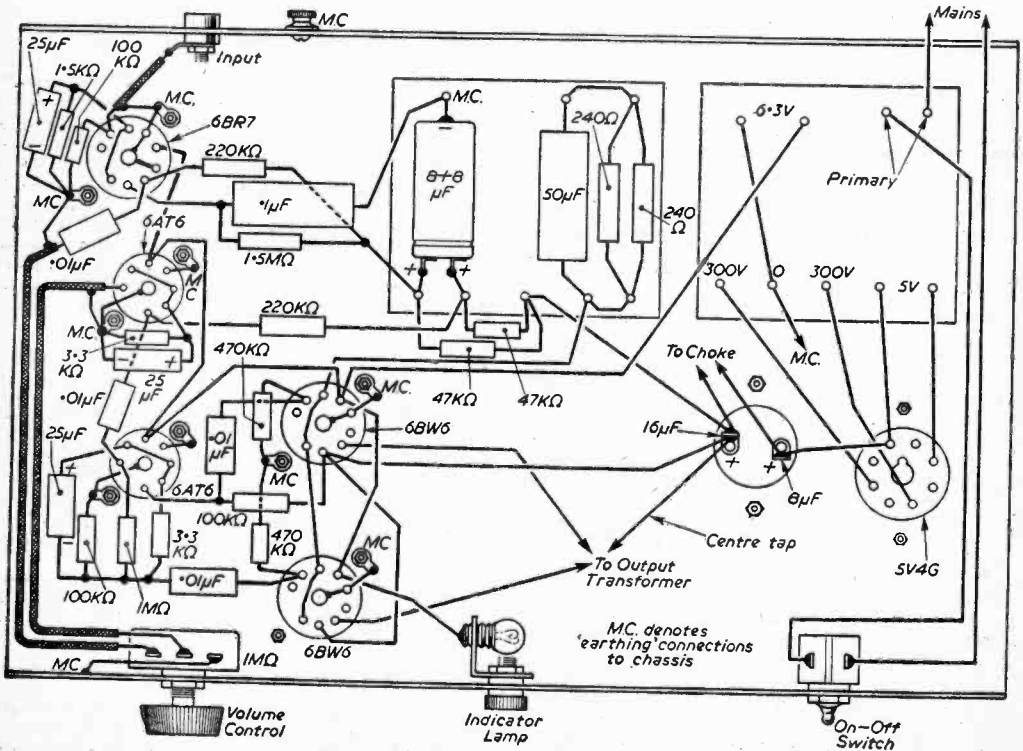


Fig. 3.—Underchassis wiring diagram.

Inexpensive P.A. Equipment

COMPLETE CONSTRUCTIONAL INFORMATION

By V. E. Holley

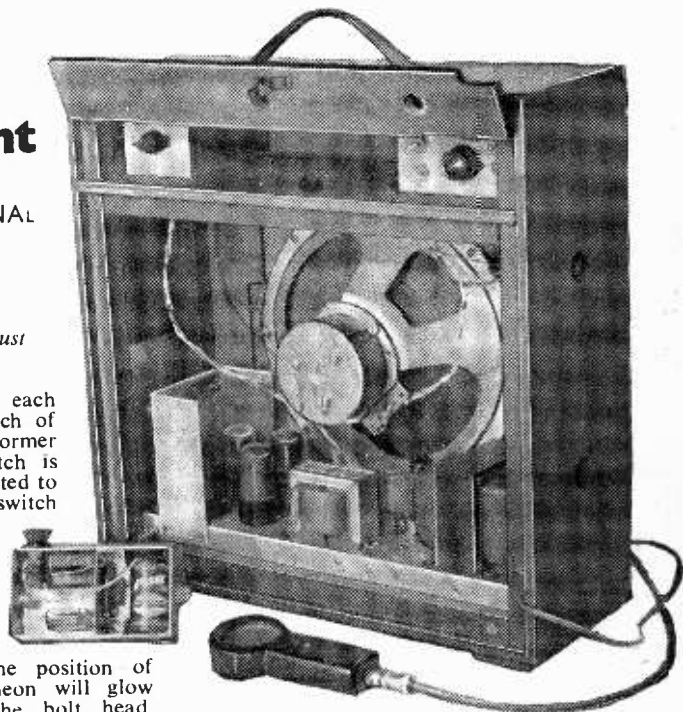
(Continued from page 302, August
issue)

AS it is a matter of chance at each connection to the mains which of the leads to the mains transformer becomes neutral, a two-way switch is provided so that C9 may be connected to either. The correct position for this switch is apparent from the reduced hum level but as this is in any case low, it is difficult to distinguish in noisy surroundings. A small neon indicator lamp is therefore connected to the "hot" end of C9 and its other connection taken to a 4B.A. bolt in the mains panel. If the position of the switch is not correct, the neon will glow when a finger is applied to the bolt head. Note that if a rotary switch is used it must be a 3- or 4-way so that one or two tags may be left unconnected between those used for mains connections; otherwise the switch will probably short circuit the mains when it is operated. If the neon indicator is of the type designed for direct connection to the mains, R15 may be omitted.

Speaker System

The output transformer has secondary windings for 3, 5, 8 and 15Ω and is suitable for supplying 15Ω speakers in parallel or 3Ω speakers in series. The latter arrangement was selected as 3Ω speakers are easier to come by at reasonable prices on the surplus market.

All the connections from the output transformer secondary are carried by way of an octal plug and 5-way cable to a load control panel. A 4-way switch is fitted here by means of which the correct tapping for the load may be selected. The output is then taken through the first speaker to a closed circuit jack on the side of the amplifier cabinet which permits the insertion in series of an additional speaker as required. In single speaker operation, large currents flow in this circuit and the closing action of the jack is therefore relied upon only for temporary disconnections in multi-speaker working. It is otherwise reinforced by a small shorting plug inserted into a parallel-wired socket. The wiring is shown in Fig. 2. It will be seen that the same plug, inserted in a different way, serves to short out the first speaker when required; socket D holds it when neither function is required. The plug is used in preference to a switch so that this control shall not be available to inexperienced operators.



The completed equipment in its case.

The amplifier is housed in a cabinet, together with one 10in. speaker. The second speaker is in a cabinet of the same size, shape, and construction and has a closed circuit jack for the connection of a third speaker in series if required. It is necessary of course, that all the speakers should be connected in phase. A 1½V battery should be applied to the speaker line; the resultant impulse will cause the cones to move and the direction of movement can be discovered by holding the finger lightly against each cone in turn. Connection should then be arranged so that all the cones move in or out together.

Open-Air Work

For open-air work, especially where it is necessary for announcements to be heard over considerable distances, speakers of the re-entrant type will be found most suitable. They are obtainable cheaply from surplus sources, with an impedance of 7.5Ω and will handle 8W with penetrating efficiency. Two may therefore be operated in series with the load control switch at 15Ω and internal speaker shorted out.

Re-entrant speakers are also useful for speech amplification in large halls. They are not very suitable for reproduction of music as the output falls off at the lower frequencies.

Construction

The layout was shown in Fig. 3. It is quite straightforward. The placing of the components is not at all critical but those which generate heat should

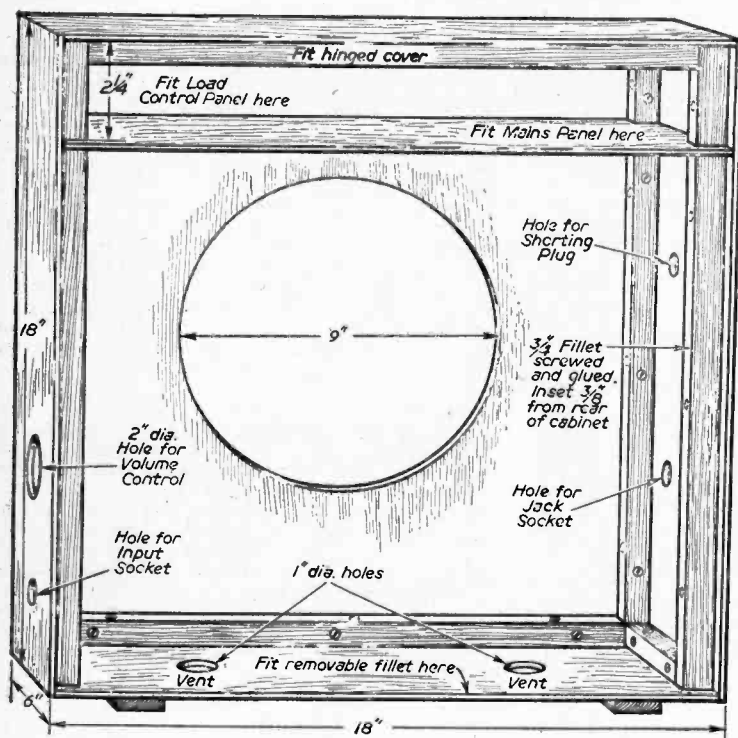


Fig. 5.—The cabinet for the amplifier and loudspeaker.

be given plenty of room. Attention must of course be paid to the rigidity of wiring and the secure anchoring of all components. Sheet aluminium not thinner than 16s.w.g. is recommended for the chassis, a plan of which was given in Fig. 4a. Note that one end is left open for ventilation. The input socket and volume control are mounted on a screen at one end so that the control should be well clear of floor level when in use. An octal socket is used for connecting the speaker network. The mains lead should be about 15in. long and fitted with a plug to suit a socket fitted inside the cabinet.

Testing

If when the completed amplifier is switched on, it is found that the feedback is positive, the connections to the anodes of V3 and V4 should be reversed. When proper operation has been secured, the voltage at the anodes and screens of these valves should be checked; it should not exceed 285 measured between these electrodes and the cathode and the bias should be 18-19V. Some alteration to the value of R16 may be necessary to achieve these figures.

Cabinet

The amplifier is housed in a cabinet 18in. x 18in. x 6in. which contains also one 10in. speaker and a small compartment at the top, fitted with a hinged lid and accommodating mains and load control panels; there is also space for stowing the mains lead, etc., when not in use. (Fig. 5). The cabinet

needs to be strongly constructed but no elaborate joinery is required. It can conveniently be made of $\frac{3}{4}$ in. 5-ply, the joints being held together initially with glue and panel pins and then strengthened internally by the addition of $\frac{1}{4}$ in. square wood fillets along the whole length of each joint and round the rear edges. The fillets should be glued and screwed into position except the one at the bottom rear, which should not be glued as it will need to be removed when fitting or removing the amplifier. The rear edge fillets should be recessed $\frac{1}{4}$ in. so as to receive the back, which is also of $\frac{3}{4}$ in. ply and, being screwed firmly into position, adds considerably to the strength of the case. The speaker aperture should be covered with steel wire mesh or some similar material — the tougher the better. Thin felt should be placed between the mesh and the cabinet to prevent "tizzing". Plenty of ventilation should be provided by cutting large holes in the back of the cabinet and covering them with wire mesh and a couple of 1in. holes in the bottom similarly covered, will provide underchassis ventilation. Some wooden feet should be added to raise the cabinet about $\frac{1}{2}$ in. above the surface on which it stands.

External Connections

External access must be provided for the volume control, the input and output sockets, and the speaker shorting plug and it is desirable in order to avoid damage in transit that all these fittings should be flush with the surface of the cabinet. A flushmounting coaxial socket is used for the input, which is then taken by a short length of screened lead and suitable plug to the socket on the amplifier. The output jack socket is mounted on a small aluminium plate screwed to the inside of the cabinet, a $\frac{1}{4}$ in. hole being cut in the cabinet side for the jack plug. The shorting plug is dealt with similarly. For the volume control, a 2in. diameter hole should be cut and covered on the inside with an aluminium plate having a $\frac{1}{4}$ in. hole located centrally through which the control spindle can be extended by means of a connector and a short length of $\frac{1}{4}$ in. brass rod. There is not room to fit a knob flush with the surface but an effective control can be made by soldering a 1in. length of 16s.w.g. wire across the end of the brass rod in the form of a letter T. The mains lead should be brought out at the bottom so that if someone should trip over it, the cabinet will not be upset. A hole must be provided in the back for screwdriver access to VR2.

Finishing

The completed cabinet may be rubbed down with glasspaper and painted a suitable colour and a collapsible carrying handle fitted at the top. The appearance can be enhanced by displaying the owner's business card or printed name and address behind a small sheet of perspex screwed to the front above the speaker aperture.

Fitting the Amplifier

The chassis is designed to be a snug fit between the horizontal fillets at the bottom of the cabinet. It needs to be attached very securely and the best method is as follows. Remove the heads from two 1½ in. wood screws and with a hacksaw cut new screwdriver slots. Make a cardboard template of the side of the chassis showing the exact positions

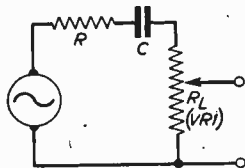


Fig. 6.—Equivalent circuit of crystal microphone.

of the holes A and B (Fig. 4a). Remove the rear horizontal fillet from the cabinet and with the aid of the template insert the headless screws into the front fillet in the correct positions so that they protrude ¼ in. Place the chassis in position; the headless screws should pass neatly into the holes A and B. Replace the rear fillet and at points corresponding roughly with the positions of the headless screws, drill two 3/16 in. holes through the fillet and the side of the chassis beyond. If two 1½ in. wood screws of suitable diameter are now inserted, they will have a self-tapping action as they enter the aluminium and will secure the chassis very firmly.

Operation

Used in conjunction with a microphone, the construction of which will be described next month, the amplifier has sufficient gain for many purposes with no pre-amplification. It will perform adequately for instance for announcements or speeches at social functions, sports meetings, etc., for the use of a vocalist in a dance band or for emphasising a solo instrument. It is quite free from hum and extraneous noises and the maximum gain is not sufficient to generate acoustic feedback unless the microphone is deliberately introduced to the front of the loudspeakers. It is thus practically foolproof and having been installed on the site, can be left in the hands of an inexperienced operator who is required only to switch the microphone on and off as necessary.

In other applications where the sound source is at a greater distance from the microphone, use is made of pre-amplifiers, of which a description will be given.

The amplifier can, with suitable input arrangements, be used with any type of microphone but for practical reasons the choice for portable equipment lies between the moving coil and crystal types. The former has the advantage of low impedance so that long, and sometimes unscreened, cables can be used without picking up hum or extraneous noise, but it is expensive and requires an input transformer, which is a further expense. Further, it often has a rather distressing overload characteristic. The crystal type on the other hand is cheap and robust, has a high output, is not easily overloaded and requires no transformer. With proper screening and earthing, it can be operated with up to 50 or 60ft of cable without difficulty. It is therefore the preferred type of instrument for this equipment.

Input Circuit

The crystal microphone may be regarded for practical purposes as an A.C. voltage generator having in series with its output a low resistance and a very small capacitance which is in fact the self-capacitance of the crystal (Fig. 6). It will be seen that as with any R/C coupling, if the full output in the lower frequencies is to be realised, the load must be high and 5M is a common value. For the best reproduction of speech, however, it is desirable to introduce some attenuation of the lower frequencies and this can be achieved satisfactorily by reducing the load to 2M. As this is the value of the volume control in the grid-circuit of V1, a crystal microphone is suitable for direct connection to the main amplifier.

Making a Mike

Suitable instruments can be obtained commercially from about 35s. upwards and while it may be desirable to have one of these for use on occasions when appearance is especially important, a very satisfactory mike can be made up at the cost of a few shillings from one of the crystal inserts available in the surplus market. The following describes the construction of a hand instrument, using a 2 in. round insert but the same technique can be followed for desk and stand models.

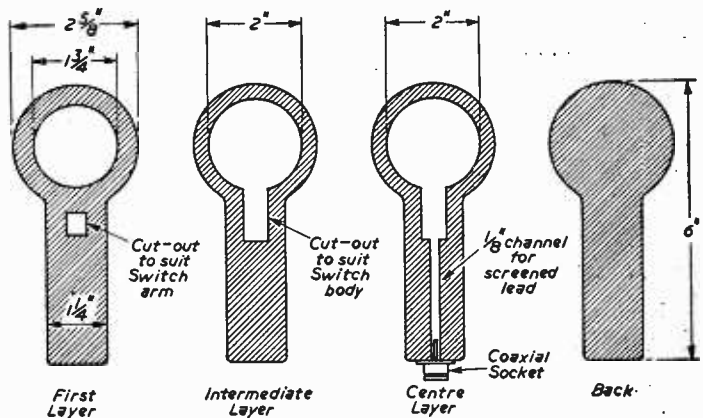


Fig. 7.—Making up the microphone case.

(To be continued)

Using Absorption Wavemeters

ACCURATE MEASURING METHODS

By M. Longdon

AN absorption wavemeter is an extremely simple piece of equipment, and requires no battery or mains supplies. With its aid the operating frequency or wavelength of oscillator, receiver, multiplier, and transmitter output stages can be determined. It does not produce any radio-frequency output itself (as, for example, does a mains or battery operated signal generator), but instead extracts energy from the circuit being tested.

One great advantage of the absorption wavemeter arises from the fact that its indication is always on the fundamental. That is, wavemeter and tested circuit will always be tuned to the same frequency, not possibly to a harmonic, as may arise with a signal generator.

Circuit

The simplest practical absorption wavemeter is shown in Fig. 1 and in this form it can be used for any of the tests described. For short wave use a single fixed coil will cover quite a wide band. Other bands can be covered by employing plug-in coils, the holder being attached to the tuning condenser. Alternatively, a separate wavemeter can be constructed for each band, as the cost is so small, especially if only two or three bands are to be covered.

Smooth or ribbed formers can be used for the coils. Ribbed formers approximately 1½ in. in diameter, as available for S.W. receiver coils, are satisfactory. Using these, 80 turns occupying about 1½ in. will cover approximately 1.2Mc/s to 3.6Mc/s. For 3Mc/s to 8Mc/s 35 turns occupying 1½ in. can be used, with 9 turns occupying 1½ in. for 8Mc/s to 24Mc/s. and 3 turns occupying 1 in. for 23Mc/s to 60Mc/s. Turns should be tight, cemented in place or resting in notches in the ribs.

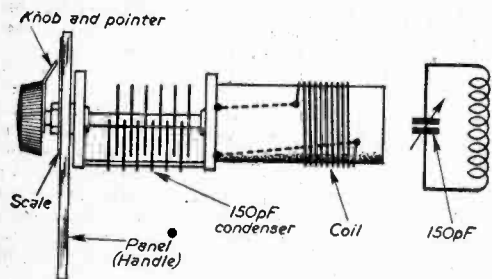


Fig. 1.—Simple practicable wavemeter.

Ready-made receiver and similar coils can, of course, be used. The tuning condenser can be of 100pF to 250pF capacity, though the coverage mentioned is for approximately 150pF.

The small panel in Fig. 1 serves merely to take the wavemeter scale, and to provide a "handle" by which the instrument can be held while tuning.

It is also feasible to build the wavemeter in a cabinet, with plug-in coils on top, or at one side.

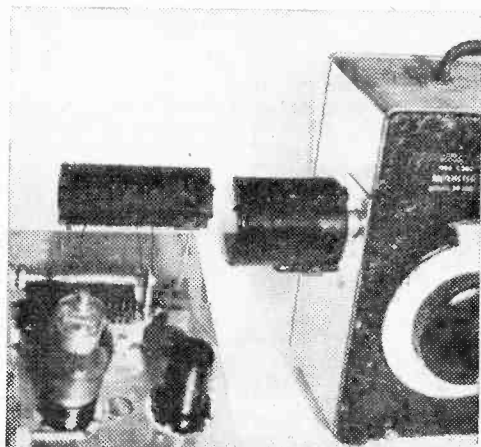


Fig. 2.—Using a wavemeter to check a receiver coil.

This form of construction is usual in high-class instruments which may receive much use, or possibly rough handling. A milliammeter or other indicating device may also be added. This is useful for some applications, and is described later.

Receiver Checking

When the absorption wavemeter has been calibrated, it can easily be used to show the wavelength to which a regenerative receiver is tuned. This allows dial readings to be marked up for home-constructed receivers. The wavemeter will, in fact, be a most useful means of quickly calibrating such receivers, or adjusting receiver coils.

To check a receiver, the wavemeter is placed so that its coil is fairly close to the receiver coil, and approximately in line with it, as shown in Fig. 2. The receiver regeneration or reaction control is then adjusted until the detector is just oscillating. When the wavemeter is tuned to the same wavelength as the receiver this oscillation will cease. This tuning point can be found by listening with the phones or speaker. The wavemeter reading can then be marked on the receiver tuning scale.

Accuracy

It is most convenient to adjust wavemeter and receiver tuning a little, keeping them in step, until the wavemeter indicates suitable round figures to transfer to the receiver scale. The most accurate readings will be obtained by keeping the wavemeter as far as possible from the receiver coil. But if reaction is not carefully adjusted, the wavemeter will cease to pull the detector out of oscillation, as the distance is increased.

To obtain an easy visual indication, a meter may be wired to the receiver, to show detector anode current, as in Fig. 3. Reaction is then adjusted, as

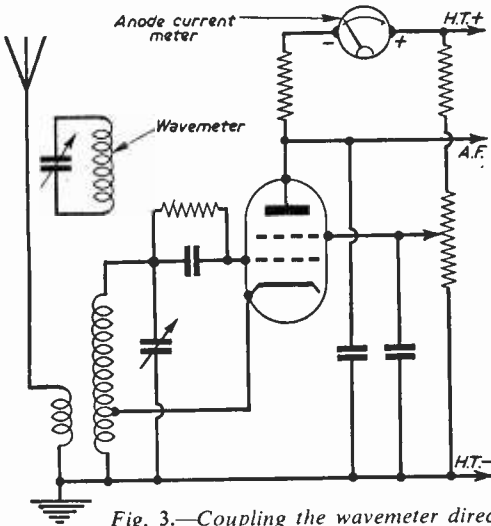


Fig. 3.—Coupling the wavemeter direct to a receiver.

already explained, and wavemeter tuning brought into resonance. The exact tuning point will be shown by the maximum rise in meter reading, as the wavemeter draws power from the oscillating circuit.

Wavemeter Calibration

If a calibrated regenerative receiver is available, the wavemeter scale can be marked up from this. The receiver is tuned to a suitable frequency, reaction adjusted as explained, and the wavemeter is tuned until the circuit is at resonance, as described. The receiver reading is then marked on the wavemeter scale.

If the receiver is not calibrated, it should be tuned to a station of known wavelength, and the wavemeter can then be adjusted to this wavelength. It is best to remove the receiver aerial, or use only a very short throw-out wire.

When a signal generator is available, this can be set to various frequencies, and the receiver tuned to the signal. The absorption wavemeter is then tuned to the receiver frequency, as described.

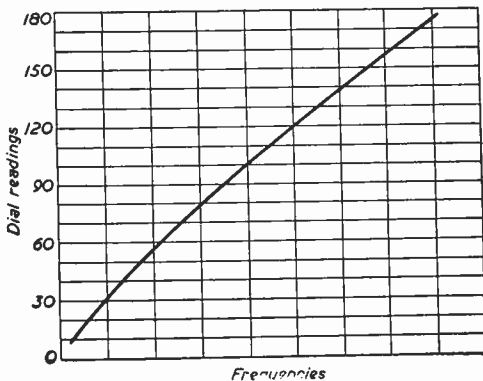


Fig. 4.—A calibration graph.

Calibration with a Superhet

Should a calibrated superhet be used, the wavemeter can be calibrated to agree with this by making up a temporary one-valve radio frequency oscillator. The superhet is tuned to a suitable frequency, and the oscillator is tuned until its note is heard on the receiver. The wavemeter is then tuned to the oscillator, a milliammeter in the H.T. circuit being used as an indicator.

When "round" figure wavelength or frequency readings are obtained, they can be marked directly on the wavemeter scale. But if broadcasting stations are chosen as a means of calibration, it is most convenient to draw up a graph by plotting frequencies against wavemeter dial readings, as in Fig. 4. Dial readings for "round" figure frequencies can then be found, and marked on the wavemeter scale. Calibrating from known stations can provide a very good degree of accuracy.

Once the wavemeter has been calibrated, care should be taken not to change the coil windings or otherwise modify it. It will then always be available for checking frequency or wavelength.

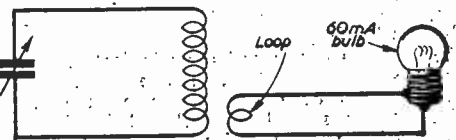
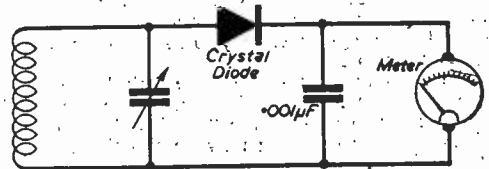


Fig. 5.—Wavemeters with indicators.

Resonance Indicators

An indicating device may be incorporated in the wavemeter, to show when tuning agrees with that of the circuit being tested. When such an indicator is added, the wavemeter can still be used in the same way as the instrument in Fig. 1.

Two types of indicators are shown in Fig. 5. The meter can be housed in the wavemeter case, and a 1mA instrument is convenient. When checking oscillator and transmitter circuits, the correct tuning point is that giving the highest meter reading. If a strong R.F. signal is present, the wavemeter should be kept far enough away to avoid overloading the milliammeter. If a very sensitive instrument is fitted, it is wise to add a switch and resistor, so that a shunt can be brought into circuit.

A low consumption bulb, coupled by a small loop of about two turns, will also serve as an indicator for small transmitters. Because of its simplicity, this method is popular with model control equipment. Changing the bulb will slightly modify tuning, so it is best to solder this item into circuit. The wavemeter coil should be kept as far from the transmitter coil as possible, as this gives most accurate indication with a bulb indicator.

The coils described are suitable for the circuits in Fig. 5. If it is desired to cover only a very

small tuning range, the tuning condenser can be 15pF to 25pF or so. For example, a wavemeter for model control transmitter tuning only could have 11 turns occupying 1½ in. on a ¾ in. diameter ribbed former.

The bulb meter can easily be carried, and is readily held in line with the transmitter coil, as shown in Fig. 6. If used as described, the indication it gives is sufficiently accurate.

Link Coupling

A wavemeter with large calibrated dial, or fitted with a milliammeter, may be too large to handle easily. Occasions also arise when it is awkward to bring the meter coil and receiver, oscillator or transmitter coil into line, or when the coil is difficult to reach.

When investigating circuits in these circumstances, a simple link coupling can be arranged between the equipment coil and wavemeter coil. The link can be made with a convenient length of insulated connecting wire or flex. About one turn is made round each coil, and the ends of the wire are joined. This introduces coupling between the two pieces of equipment, as shown in Fig. 7, and it is no longer necessary to have the coils near together, or in line.

The loop at each end of the link line should have the same number of turns. The loop will usually need to be near the "earthed" end of the coils, otherwise coupling may be too tight. With a transmitter or oscillator, particular care is needed not to overload the wavemeter.

Indicator

When the wavemeter has an indicator, tuning is for maximum deflection, as explained. If the wavemeter is of the type shown in Fig. 1, a milliammeter should be included in the anode circuit of the stage under test, as an indicating device. With transmitting equipment, this meter will often be present already. It is then only necessary to tune the wavemeter until a rise in meter reading shows that power is being drawn.

If the wavemeter is accurately calibrated and well made, a high degree of accuracy can be

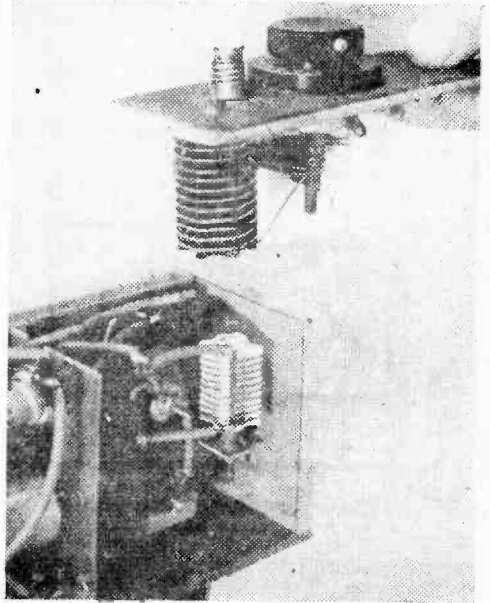


Fig. 6.—Using a bulb wavemeter.

achieved, especially when coupling to the circuit under test is loose. With transmitting equipment, it is particularly useful to investigate the harmonics present in crystal controlled or multiplier stages, or in the transmitter output. As harmonics will arise only at well-spaced intervals from the fundamental, even a simple wavemeter, calibrated with only moderate accuracy, will be extremely useful for locating them. For this type of work, a milliammeter is the best indicating device, and loop link connections to various circuits can be made as shown in Fig. 7, care being taken that the meter is not overloaded.

Calibrating a Generator

A home-constructed signal generator can be calibrated from the wavemeter, exactly as described for a transmitter. A milliammeter is included in the signal generator H.T. circuit, as an indicating device, if the wavemeter itself does not have an indicator of enough sensitivity to show resonance with the oscillator.

A grid dip meter may be calibrated directly from the wavemeter by placing the coils in line and tuning for maximum dip on the grid current meter.

With other than very low-powered transmitting equipment, the radio frequency field near a crystal oscillator, multiplier or output stage will be strong enough to give an indication on the wavemeter milliammeter, even if the coils are not in line, and in these circumstances the link coupling method need not be used.

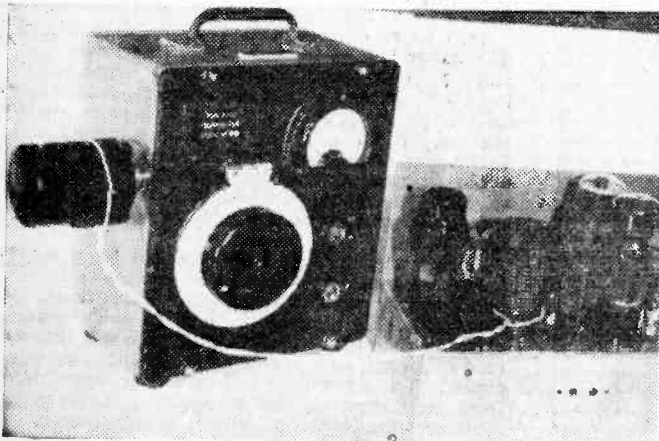


Fig. 7.—Using a loop link connection.

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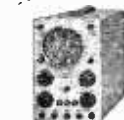
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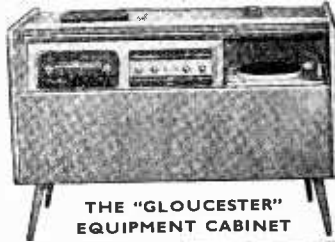
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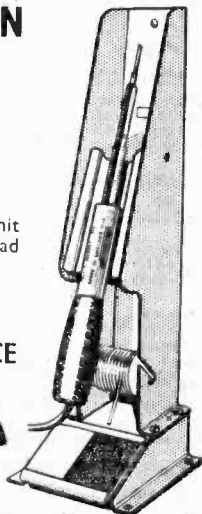
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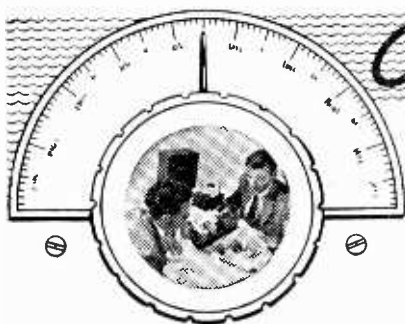
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On Your Wavelength

BY THERMION

them good news and bad—as, for instance, the declaration of war in 1914.

The latter days of Poldhu were to bring a triumph rivalling that of its first, for it was here that the Marconi-Franklin beam system was evolved which in 1924 revolutionised long-range radio communications and gave Britain a system which was technically years ahead of any other nation. The short wave beam stations which resulted from the initial Poldhu experiments are still in use to this day.

On a plane of more common experience it is perhaps of interest to recall that the coaxial cable which is an integral feature of every home television installation was derived from a development by C. S. Franklin in the course of his research work at Poldhu.

The granite column and some six acres of land along the cliff edge at Poldhu were given to the National Trust by the Company in 1937. The latest gift is the remainder of the Marconi Company's property in this area.

This tribute to Marconi's memory was received from the Marconi Company and it makes me think with regret that many of the early pioneers of radio—such as Hertz, Lodge and Fleming—have long been forgotten.

MY older readers will remember the early days of radio and the excitement of daily news of far reaching discoveries. Marconi is the name most easily recalled and it was with great interest that I learned of a private ceremony at Marconi House, London, on July 6th, when Lord Nelson of Stafford, Chairman of the English Electric Group, presented to the National Trust the title deeds of some 40 acres of land at Poldhu, Cornwall—the former site of the historic radio station. This station, which was built by Guglielmo Marconi, was the first to span the Atlantic with wireless telegraphy. The gift was accepted by Earl De La Warr, Chairman of the Trust's Estates Committee.

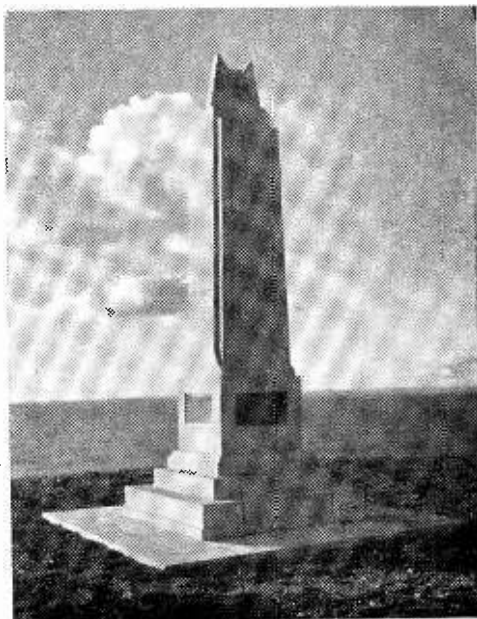
Also among those present at the ceremony were Sir Ronald German, Director General of the G.P.O., Sir Godfrey Ince, Chairman of Cable and Wireless Ltd., Mr. F. N. Sutherland, Managing Director of Marconi's Wireless Telegraph Co. Ltd. and Mr. C. S. Franklin of short wave beam radio fame. (Mr. Franklin, who joined the Marconi Company in 1890, was closely associated with Guglielmo Marconi and the Poldhu wireless station, and is very largely responsible for long-range radio communication as it exists today.)

Of Poldhu wireless station nothing now remains—it was dismantled as long ago as 1937—and a granite column is the only reminder of the momentous events which took place on this wind-swept cliff overlooking Mounts Bay in Cornwall.

Poldhu was the cradle of the Radio Age. Guglielmo Marconi, in 1900, chose the site to build a wireless station of a size never before thought possible. Its purpose was secret until, on December 12th, 1901, Marconi announced that signals from Poldhu had bridged the Atlantic and were being received by him at St. Johns, Newfoundland.

That news, in one dramatic moment, took wireless telegraphy out of the laboratory and into acceptance as a wholly practical new system of communication. As a side issue it confounded the many learned critics who had said that wireless waves would never reach beyond the horizon.

Thus, Poldhu first made the headlines—something it was destined to do at intervals throughout the thirty-four years of its life. For many years, as a commercial wireless station, it was looked on with especial affection by seagoing operators and those in faraway lands as the "old dependable" link with the homeland, bringing



The memorial on the cliff edge at Poldhu which commemorates Marconi's pioneering work at the station.

A Microphone Pre-Amplifier

A STABLE, HIGH GAIN DESIGN

By R. Hindle

A NEED arose to operate a good quality moving coil microphone through a typical high fidelity audio amplifier, but of course the gain of the amplifier was insufficient for this purpose and a separate microphone pre-amplifier was required. A 6BR7 was chosen for the purpose. This valve in a single stage is quite capable of providing a gain of 100 times, which is sufficient for the purpose. The microphone to be used was made by S.T.C. and in fact two different models had to be handled by the design, Model 4105A, which is a directional microphone, and Model 4035A, which has a wider angle of pick-up. These microphones have a low impedance and S.T.C. manufacture a microphone transformer, type 826/10, to match the microphones into a valve circuit.

Circuit

The circuit is given in Fig. 1. It will be seen that very few components are used, though the way that they are put together is important in an amplifier that has to deal with a signal of such a low amplitude as that from a good microphone, and so construction will be explained in some detail. The 6BR7 is operated in a conventional circuit with an anode load (R2) of 220k and a screen series resistor (R1) of 1.5M. As a result the anode current is well under 1mA and the 2.2k cathode bias resistor gives a bias of just under 2mA. As a matter of fact, the bias is not in any way critical because of the very small signal fed into the stage, and so there was no point in carefully calculating a value in theory and then hunting for a non-standard value. The cathode bypass capacitor is C2 and because it is necessary to ensure that no hum enters an amplifier working at such a low level of signal, this is made comparatively large—100 μ F 12VW. The screen bypass capacitor is C3. Note that there is a screen internal to the valve designed to screen the grid from the heater to prevent hum entering the circuit via this route; this screen is brought out to pin 6 which must be connected to earth. In this valve the heater itself is wound in the form of a double spiral to reduce hum.

The heater connections are shown to be "floating" in Fig. 1.

This is because the amplifier to be used had the centre-tap of the heater winding connected to earth and any earth at the pre-amplifier heater would short-circuit one half of the heater with disastrous results. If one side of the main amplifier heaters of the reader's installation is connected to earth it will still be better to leave the pre-amplifier heater floating, but care should be taken to see that pin (4) of the pre-amplifier is connected to the side of the main amplifier heater supply that is earthed. In this way, the live heater connection is kept remote from the grid. Nevertheless, it is better from the point of view of hum to connect the centre of the heater to earth rather than one side if possible. If no centre tap is provided an artificial centre tap can be made by fitting a wire-wound potentiometer across the heater, connecting the centre arm to earth having removed the connection from one side to earth, then adjusting the potentiometer for minimum hum. This method is, in fact, better than using a centre tap on the winding itself because a setting slightly off the centre found by adjusting whilst listening to results can cancel out hum arising from some other source. However in the present case, the centre tap earth on the main amplifier was quite satisfactory.

H.T. Decoupling

Another precaution taken in view of the fact that power is taken from the main amplifier is to prevent feedback of signal via the H.T. supply. This is provided for by fitting a two stage smoothing filter at the H.T. input represented by R4, C4 and R5, C5. There is no need to use chokes of course because of the very small current flowing. The arrangement of the connections to the input

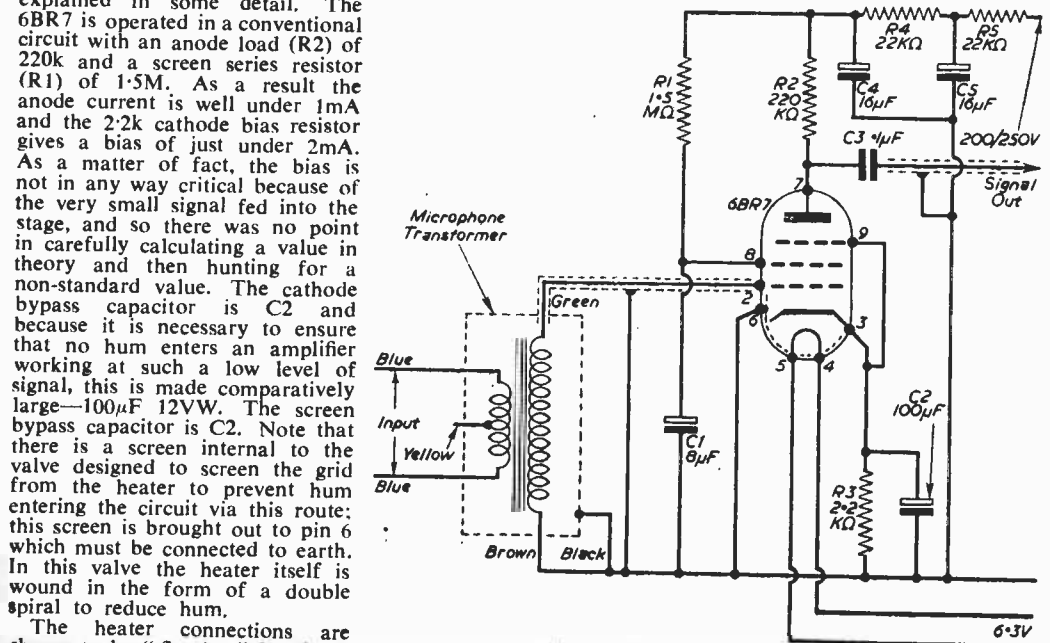


Fig. 1.—The circuit diagram.

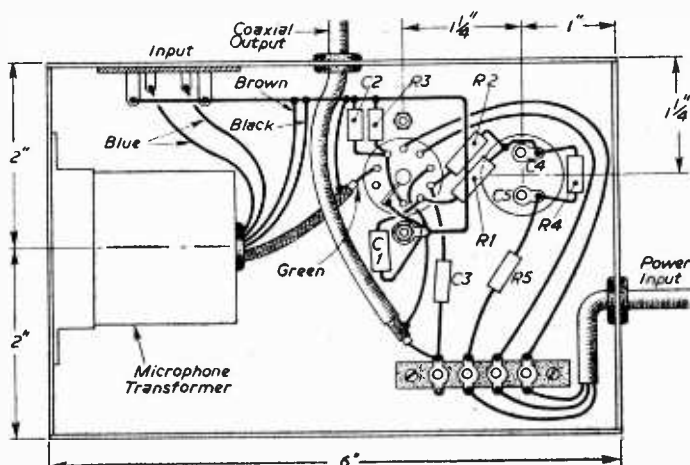


Fig. 2.—Chassis layout and wiring diagram.

transformer may look unnecessarily complicated and in theory this is so, but in practice great care has to be taken in this area to avoid the introduction of hum which is very difficult to avoid. Any kind of loop into which hum could be induced has to be avoided. This precaution is carried on in the method of construction to be described. The chassis is not used for earth connections; the earth bus-bar in fact is in contact with the chassis at only one point. The connections are more significant when the transformer is further away from the grid of the valve than in the present design, but it is as well to take these constructional precautions with audio designs at all times. A mere half inch of wire in the wrong place can play havoc with results.

Construction

The unit can easily be accommodated on a chassis 4in. X 6in. X 2½in. deep. The prototype was built, in fact, on a chassis exactly twice this size but it occupied only half of the available space. The reason for this was that there was a likelihood that a second similar pre-amplifier would have to be provided at a later date. Fig. 2 gives the underchassis layout and wiring. The transformer itself has no facilities for mounting but was held in a clip of the type used for large electrolytic capacitors. In order to avoid an undesired earth contact with the chassis the transformer case was wrapped with insulation tape where it was held in the clip.

The two smoothing capacitors, C4, C5, are contained in a single can mounted above chassis, but a tubular with wire ends is used underneath the chassis for C1. A tag-strip provides a convenient anchoring point for leads, but the few components involved in the design are not tag-board mounted; it is better to connect these direct to the appropriate valve pins and only when it is necessary to provide an anchorage for the remote end should a tagboard be used when working on a low signal level amplifier.

Twin Screened Input

Another constructional problem was in connection with the input socket for the microphone connection. It is customary with audio signals of

greater amplitude that are to be dealt with in the present case to use a single core in an outer screen (quite typically a piece of coaxial cable), but it is bad practice with low audio levels to use the screen of the cable as one side of the connection. Instead, both sides of the audio signal should be fed through a two-core cable with an outer screen even if inside the amplifier one side of audio signal is to be earthed. The screen of the cable should be looked upon in effect as an extension of the chassis and not a connection. The microphone base is wired therefore with twin core screened cable, but it is not easy to find in normal radio component sources a suitable two-pin plug and socket with screen. A component which is readily available is a four-pin type of small dimensions with the pins staggered to prevent insertion in any but the correct direction. The plug is on a small paxolin base with a metal shroud. On the shroud are small metal lugs which, when the leads are soldered inside the hollow pins with the cable through the shroud, are bent over the base to hold the two parts together. The two inners of the connecting cable are connected to two of the pins and the screen of the cable is soldered to both the remaining pins. A piece of tinned copper wire also connected to the screen was fed back through the shroud, wrapped round the narrow neck of the shroud after carefully filing the metal clean and soldered to make a sound connection tying the shroud to earth. This method is illustrated in Fig. 3.

One further precaution is necessary in constructing a unit such as this. Under no circumstances must the chassis be used for earth returns, particularly for A.C. In practice a bus-bar earth is used. This is a stout piece of tinned copper wire connected to the chassis at only one place, to a soldering tag mounted on one of the valveholder bolts. The other end of this bus-bar is supported by the two tags from the input sockets which are to take the earthy side of the input signal. The bus-bar is carefully preformed so that when soldered into place it runs clear of the valveholder, allowing room for the components which have to be soldered to the valveholder. The only earth that does not go to the bus-bar is the negative side of the smoothing capacitors C4, C5. These capacitors are in the aluminium can which is mounted above the chassis and therefore they are earthed through the mounting clip.

Transformer

The microphone transformer itself does not come into contact with the chassis. A lead is brought out to earth the case and this connection goes to the bus-bar. The can containing the transformer has a coat of paint but, to ensure that it does not contact the chassis, a layer of insulating tape is wrapped round the case where it is held in the clip.

The wiring of the amplifier is given in Fig. 2 and taking account of the points raised above, and particular care with the transformer connections, there should be no difficulty in ensuring good results. It will be noticed that as in this case the input signal goes to the primary of a transformer neither side is, in fact, earthed. So far as the output is concerned the signal is of quite reasonable amplitude and the precautions taken at the input side are not so important. Nevertheless care in screening should be taken. There is no need to carry the signal through a two-core screened cable, and in any case the main amplifier will have a coaxial input socket, so a piece of ordinary coaxial cable is used.

The first leads to be fitted when beginning to wire are the two carrying the heater current from the tag strip. These should run close together and also close to the chassis. Next connect valve base pin 9 to pin 3 and wire in the cathode bias resistor and capacitor, earthing to the bus-bar. Proceed now clockwise round the valve-holder. The H.T. end of the screen and anode resistors (both of the high stability type) go direct to the decoupling capacitor C4. R4 is self-supporting between the two connecting tags of C4, C5, and R5 is fitted from C5 to the tag strip. A six-way tag strip was used in the prototype just

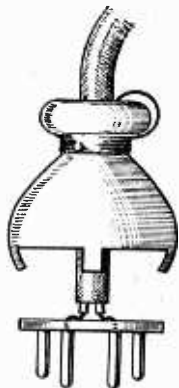


Fig. 3.—The input plug.

because it happened to be to hand, but only four tags are used, none of which is earthed. Finally the microphone transformer is mounted and connected up, the screen of the grid lead and the black and brown leads going to the earth bus-bar. The yellow connection is the centre-tap of the primary and is not used in the present application. The two blue leads are the microphone input connections. Three core mains lead is used for the power input. The chassis of the amplifier and the pre-amplifier are interconnected via the screen of the coaxial connector and this completes the circuit of the H.T. negative supply. When the two amplifiers are in their operating position in the cabinets it would be best to strap the chassis together with a stout piece of earthing braid.

COMPONENTS LIST.

- R1—1.5M $\frac{1}{2}$ W (high stab).
- R2—220k $\frac{1}{2}$ W (high stab).
- R3—2.2k $\frac{1}{2}$ W.
- R4—22k $\frac{1}{2}$ W.
- R5—22k $\frac{1}{2}$ W.
- C1—8 μ F 300VW (electrolytic).
- C2—100 μ F 12VW (electrolytic).
- C3—0.1 μ F 350VW.
- C4, C5—16 μ F + 16 μ F 350VW (electrolytic).
- V 6BR7 (with screened valve holder).
- Microphone transformer STC 826/10.
- Chassis, nuts and bolts, etc.

NEW PLAN FOR LOCAL RADIO STATIONS

THE following statement was made recently by Mr. C. O. Stanley, Chairman of the Pye Group of Companies: "We believe that sound broadcasting can benefit even more from a broadening of its basis than has television.

"The nature of sound broadcasting and its techniques offer possibilities different from television. I believe that the new trend of sound radio should be for local broadcasting and that important towns should have their own station designed to cater for the needs of their community and to re-establish the sense of civic pride which was once a more robust foundation of our national life.

"How can this be done? One way is to allocate VHF frequencies to each town and I know that frequencies can be made available for this purpose. But VHF sound broadcasting has a long hard pull to get real self sufficiency in this country.

"An investigation and study of the medium wave broadcast band has now been going on in Cambridge for a considerable time. The team working on this project are in the process of completing a remarkable plan which will permit a great new expansion of medium wave broadcasting. By using the most modern techniques in an area where they have been neglected they are showing that every town in England with a population of over 50,000 and every town in

Scotland over 40,000 may readily have its own medium wave broadcasting station at a modest cost of less than £20,000. These medium wave stations would operate from sunrise to sunset and in hours of darkness broadcasting would continue on a VHF transmitter.

"This plan will suggest that 18 important Scottish towns and cities can readily have a medium frequency allocation. The towns are:—

Aberdeen	Coatbridge
Dundee	Glasgow
Ayr	Hamilton
Kilmarnock	Motherwell and Wishaw
Dumfries	Edinburgh
Dunfermline	Perth
Inverness	Greenock
Airdrie	Paisley
	Stirling

"In addition we would suggest an allocation to each Scottish University for educational purposes and further allocations where special cases can be made.

"I think it is essential that these stations must be owned and run by local people who understand the needs and tastes of the towns they serve, and if this comes to pass something very creditable will have been added to our way of life."

An Add-on Bridge Unit

AN OSCILLOSCOPE AS A NULL INDICATOR

By D. A. Collins

AFTER building the 62A Oscilloscope, as described in these pages during Sept.-Oct. 1957*, the writer felt that it would be an advantage to have an add-on bridge unit. The

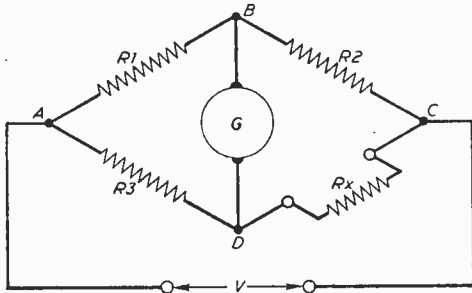


Fig. 1.—Basic Wheatstone bridge circuit.

unit described here is exceptionally cheap as it draws its energising voltage from the timebase of the oscilloscope and also employs the oscilloscope as a null indicator.

The Wheatstone Bridge

The basic circuit of the Wheatstone bridge is shown in Fig. 1. A voltage is applied across AC, and R2 is varied until the galvanometer connected across BD reads zero. The bridge is then said to be balanced, and the relationship between the resistances in the network is given by

$$R_2 R_3 = R_1 R_x$$

from which Rx can be found if the other three resistances are known. In practice, both R1 and R2 are made to vary simultaneously, and the resulting circuit is shown in Fig. 2. R3 is a standard resistance of high stability and close tolerance.

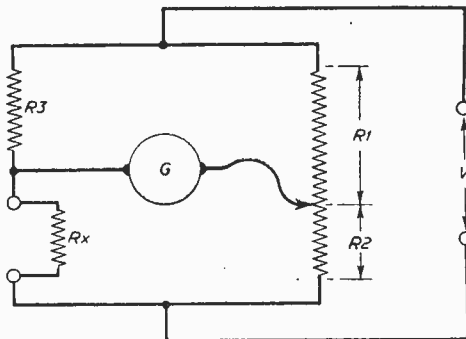


Fig 2.—Usual form of the Wheatstone bridge.

*These issues are now out of print—Editor

The De Sauty Bridge

The De Sauty bridge is given in Fig. 3. An alternating voltage is applied across AC, and R1 and R2 are varied for zero reading in the null indicator, when the relationship between the components is

$$C_x R_1 = C R_2$$

Once again Cx can be found if the other three component values are known. C is a standard condenser of close tolerance.

$$\text{Compare } C_x = \frac{C R_1}{R_2}$$

$$\text{with } R_x = \frac{R_3 R_2}{R_1}$$

This shows that as R1 and R2 vary, the calibration for capacity is the inverse of the calibration for resistance, i.e. a point marked 2 on the resistance scale will be marked 1/2 on the capacity scale. This means that the unit must be double calibrated, unless, by means of switching, and employing separate terminals for Cx and Rx, a single scale can be arranged. In the final circuit this has been done.

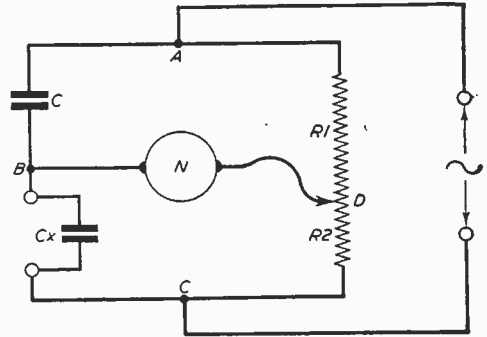


Fig. 3.—The De Sauty bridge.

The Final Circuit

The basic Wheatstone and De Sauty bridges are combined in the final circuit, which is shown in Fig. 4.

T1 is an interval transformer of ratio 5 : 1, the higher resistance winding being connected to the timebase supply. The writer found that there was a great latitude in the choice of T1, and it was found that an output transformer served just as well in this position. Resistor R6 is placed in the circuit to limit the current taken by the bridge network. If a large current is taken here, it will be found that the X-plates of the oscilloscope are robbed of driving voltage and the timebase will not scan the screen. A suitable value of R6 to begin with is 1k 1/2W. With some transformers R6 may not be needed at all. If the line does not extend across the face of the screen R6 is gradually increased in value until it does.

Switch S1 is a single pole, eleven way type. The contact marked M leaves the bridge open for matching purposes, in which case both sets of terminals are used. The switch S1 may be difficult to obtain and Fig. 5 indicates how a different type of switch with two banks is used in conjunction with a toggle switch. In fact, this is the final circuit adopted by the writer.

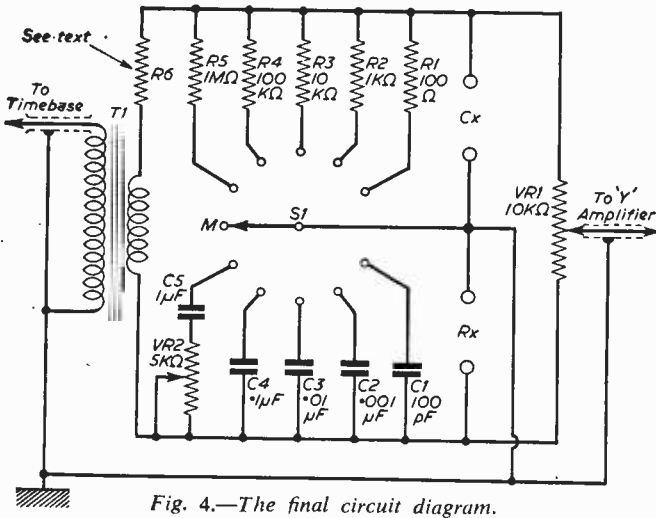


Fig. 4.—The final circuit diagram.

- COMPONENTS LIST.**
 VR1—10k wire-wound pot.
 VR2—5k wire-wound pot.
 R1—100Ω,
 R2—1.000Ω,
 R3—10k,
 R4—100k,
 R5—1M.
 R6—See Text.
 Note: R1-R5 are 1/4W high grade, low tolerance standards.
 C1—100pF.
 C2—0.001μF.
 C3—0.01μF.
 C4—0.1μF.
 C5—1.0μF.
 (All standard capacitors).
 T1 Intervalve transformer (5:1).
 S1 1-pole 11-way or 1-pole 6-way two bank switch.
 S2 Toggle switch (connected as a single pole change over switch).
 Terminals, sockets, chassis, etc.

Calibration

The instrument may be calibrated by measuring standard resistances and condensers, but it is usually sufficient to divide the scale up into about 50 equal divisions and then proceed as follows:
 No. of Divisions

$$N = \frac{(50 - \text{No. of Divisions})}{\text{No. of Divisions}}$$

and N, so found, is marked on the scale. For example, for a rotation of 30 divisions:

$$N = \frac{30}{50 - 30} = 1.5$$

and this is marked on the scale. Clearly, the centre of the scale will be marked 1, and this point should be checked by means of resistance standards so that accurate matching may be carried out. Care must be taken to see that the scale is not inverted. If it is found on testing that the scale is calibrated in reverse, the outer leads to VR1 must be reversed. It will be found that the ranges overlap considerably. This is an advantage since it enables the majority of measurements to take place so that the balance point is on the centre portion of the scale, which is the portion on which the bridge is most accurate.

The Power Factor

VR2, which is a 5k wire-wound potentiometer, provides a measure of the power factor of condensers measured on the 1μF range. Provided that a high frequency timebase setting is used the power factor control may be labelled 0 to 1 with a linear scale, and a suitable frequency range to use is from 1,000 to 5,000c/s. The method of use is as follows: on the 1μF range it may be difficult to obtain a sharp balance if the condenser being

measured is leaky. By rotating VR2, a variable amount of resistance is placed in series with the standard. This has the effect of allowing a sharper balance point to be obtained. Resistor VR2 should be wired so that it increases clockwise. The lower the power factor reading, the better the condenser.

Connection to Oscilloscope

A lead from the timebase is brought out to the front panel of the oscilloscope, and connection is made by means of a coaxial plug and socket, the outer braiding going to chassis in the bridge unit. (See Fig. 6.) The output from the bridge is fed to the Y amplifier.

All the components are mounted on a sheet of aluminium 9in. by 8in. and this housed in a suitable container 3in. deep.

(Continued on page 414)

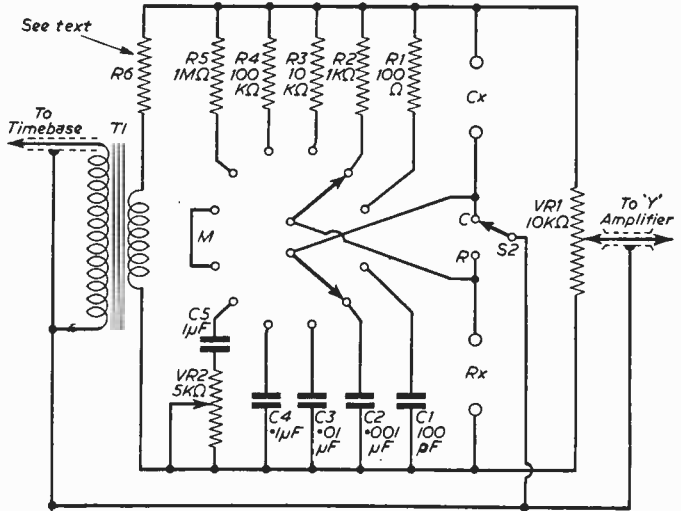


Fig. 5.—Alternative switching in the final circuit.

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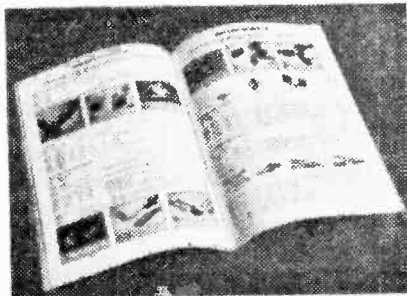
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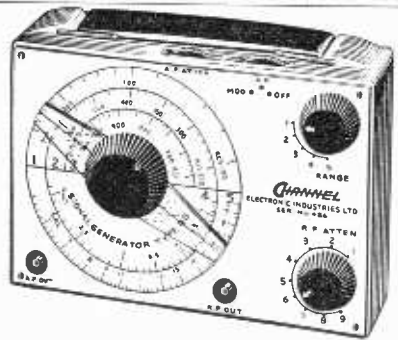
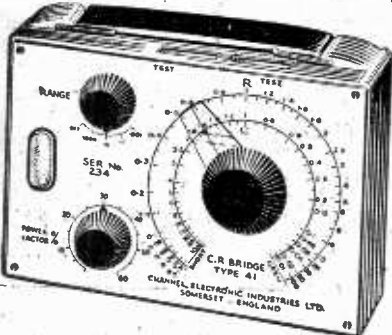
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6BR7 9/9	12AX7 7/-	DK36 7/6	EL33 10/-	PEN46 5/6	UF99 7/6
6BW7 8/-	12BA6 8/-	DL33 9/-	EL38 21/6	PL36 11/6	UL84 8/-
6EW7 6/6	18K7GT 5/6	DL35 10/-	EL41 8/6	PL38 14/6	UL84 8/-
6ED6G 22/6	12K9GT 11/6	DL82 6/-	EL42 8/6	PL81 9/6	URIC 8/-
6F7 14/6	12Q7GT 8/6	DL94 7/6	EL34 8/6	PL82 7/6	UY21 11/3
6F8G 6/6	12Z3 7/6	DL96 7/6	EM34 7/-	PL83 7/6	UY41 6/6
6F13 12/6	14S7 16/9	EAFC80 7/6	EM80 9/-	PL84 10/-	UY85 6/6
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A Morse Practice Oscillator

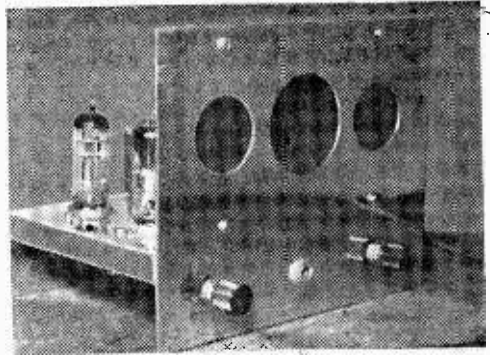
A SIMPLE CIRCUIT WITH LOUDSPEAKER OUTPUT

By D. Noble and D. M. Pratt

IT is the ambition of many interested radio experimenters at some time to become radio amateurs and to be able to transmit to other people with the same interest. Before a transmitting licence can be obtained one must pass the radio amateurs' examination, and also satisfy the Postmaster-General that one can send and receive Morse at not less than 12 words per minute. The technical knowledge required for the radio amateurs' examination may be readily obtained by reading text books and various articles in radio periodicals, or by attending a course of instruction at the local Technical College. The Morse test, however, is a little more awkward as it is required to practice sending and receiving Morse code in order to attain the required standard.

Much listening can be done over the air, but it is recommended that a friend be approached and practice actually done "across the table". Many of the radio clubs up and down the country hold special Morse classes and it is suggested that interested readers make enquiries.

One of the first essentials is to make something on which to practice the code. While an ordinary



The completed unit.

Morse buzzer and key is quite satisfactory, at most Morse test centres a valve oscillator is used as it produces a much more pleasant tone, and hence the Morse is easier to copy. It is proposed, therefore, to describe a Morse test oscillator which will fulfil the requirements of those wishing to learn Morse.

While a simple phase-shift oscillator (p. 135 June 1960 P.W.) may be used coupled into a suitable amplifier installation, a neater method is to build the complete practice set together with power supply, speaker and controls into a self-contained unit. This arrangement is particularly useful in the case of radio clubs which do not have their own permanent premises and in other applications where size is of major importance.

The oscillator unit described uses an EF80 as phase-shift oscillator, with a suitable output valve

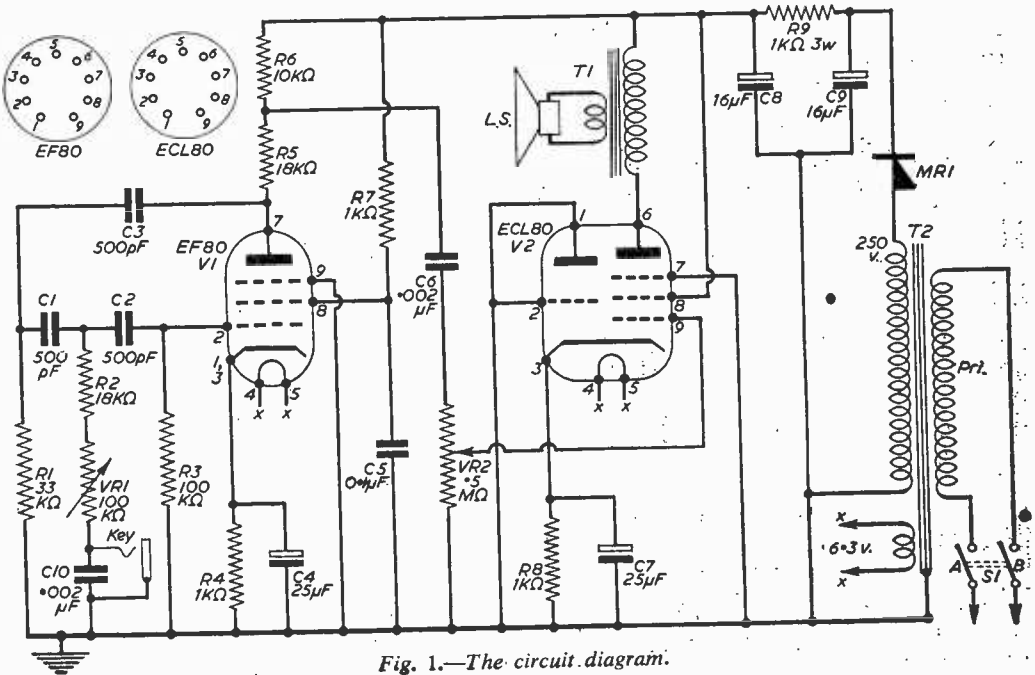
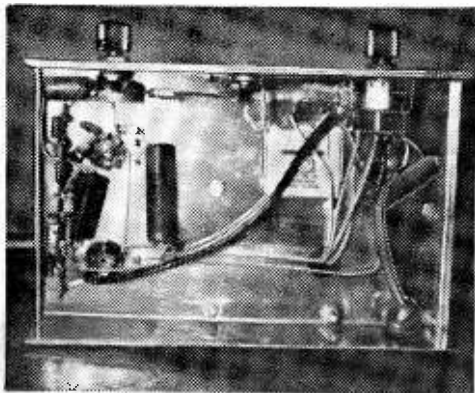


Fig. 1.—The circuit diagram.



Underchassis view.

—in this case an ECL80—chosen for its low heater consumption, its availability and its small physical dimensions. Unfortunately, the triode section of the valve would not operate as the oscillator, as it had no more than a fraction of the gain required to overcome the losses in the phase-shift network.

Power is provided from a small transformer and half-wave contact-cooled rectifier. The volume control VR2 is fitted with a two-pole switch connected in the mains supply to the unit. In series with the key jack is fitted a potentiometer VR1 which provides a useful variation of the oscillator tone.

The accompanying photographs show a typical layout of construction. In the prototype, a 7in. x 4in. elliptical speaker was used, and the chassis is 7in. x 5in. x 2in. with a front panel 7in. x 6in.

LIST OF COMPONENTS.

- R1—33k $\frac{1}{2}$ W.
- R2, R5—18k $\frac{1}{2}$ W.
- R3—100k $\frac{1}{2}$ W.
- R4, R7—1,000 Ω $\frac{1}{2}$ W.
- R6—10k, $\frac{1}{2}$ W.
- R8—1k, $\frac{1}{2}$ W.
- R9—1,000 Ω 3W, wire-wound.
- VR1—100k linear pot.
- VR2—500k log. pot. (with two-pole switch S1).
- C1, C2, C3—500pF.
- C4, C7—25 μ F, 25VW (electrolytic).
- C5—0.1 μ F, 400VW (paper).
- C6, C10—0.002 μ F 350VW (ceramic).
- C8, C9—16 μ F plus 16 μ F, 350VW (electrolytic).
- T1—Speaker transformer.
- T2—Mains transformer—250V, 50mA and 6.3V, 1A.
- V1—EF80.
- V2—ECL80.
- MR1—Contact-cooled rectifier—(18RA1-1-16-1).

BRITISH POSTAL EQUIPMENT

THE Management Council of the Consultative Committee for Postal Studies of the Universal Postal Union held a conference at Eastbourne from June 27th to July 9th. In connection with the conference, eight firms co-operated in staging an exhibition of British postal mechanisation equipment from July 5th-7th in the Grand Hotel at Eastbourne.

A new British export industry has been created by the Post Office. In their drive for mechanising all forms of mail handling, the G.P.O. have themselves developed a whole range of new mail handling devices in conjunction with a number of engineering firms.

Between them, the firms concerned are able to offer an integrated range of automatic mail handling equipment which will enable mail to be segregated into its proper categories, sorted and distributed with a minimum of human intervention. These firms combined, under the name "The Manufacturers of British Postal Equipment," to put on an Exhibition for the delegates to a Conference of the Universal Postal Union studying mail handling which was held at Eastbourne.

Britain is unique in having built up a complete industry in this field. The firms concerned, which include such well known companies as Elliott Brothers (London) Limited and Associated Automation Limited of the Elliot-Automation Group,

Vickers-Armstrong (South Marston) Limited, Sovex Limited and The Thrissell Engineering Company Limited, have produced a combined brochure showing the complete range of British postal equipment which has been sent to every postal administration in the world. Other companies co-operating in the Exhibition include Setright Registers Limited and Harrison and Sons of High Wycombe, who produce the special stamps used in the automatic mail handling process, and Waterlow and Sons. Already export orders have been received from Russia, Switzerland and Egypt and the Manufacturers say that they are very optimistic that a new export trade in automatic Post Offices will be built up as a result of the research work and initiative shown by the G.P.O. The occasion is also interesting in that the firms co-operated in the Exhibition and in the production of the Brochure are in many cases normally fiercely competitive one with another, but that in presenting themselves to overseas Postal Administrations they are doing so as an Industry although there is no formal association between them of any sort.

According to Brigadier K. S. Holmes, Director of Postal Services in the G.P.O., the recent advances in automatic mail handling constitute a very substantial advance in tackling a most difficult problem and, in his view, it was safe to say that in this field, Britain leads the world today.

Faraday Screen and Line Filter

Static Elimination

By R. FIELD

AN OLD IDEA REVIVED

WITH a highly sensitive receiver, such as may be used for long distance short wave or amateur band reception, the background noise caused by external static can be troublesome. It may limit the gain which can be employed, or over-ride a weak signal. Even when conditions are less severe, the general level of background noise is increased when static that has been picked up by the aerial is carried into the receiver.

Principle

One method of reducing the static coupled from the aerial is to introduce a Faraday Screen, as shown in Fig. 1. This screen is of a special type which permits electro-magnetic coupling between aerial coil and tuning coil, but acts as a low-impedance path to earth for electrostatic impulses. Such screens do not appear to be readily obtainable, but can be made fairly easily. For the earth lead, stout copper wire of about 14 or 16s.w.g. can be used. The thinner wires may be about 24s.w.g. To make such a screen, a piece of thin insulating material such as paxolin is wound with the 26s.w.g. wire, leaving about 1/32in. to 1/16in. between turns. The earth lead is then soldered along one edge of the board, and the wires upon one face of the board are cemented in position. When the adhesive is hard, the turns are cut away where they pass across the other face of the paxolin. This gives a screen like that in Fig. 1, consisting of parallel wires joined at one end only. The cut ends of the wires should not touch each other.

Perforated metal, metal gauze or mesh, or any kind of solid screen, cannot be used, because it would also provide electro-magnetic screening and thus prevent the required signals reaching the receiver.

In home-built receivers, it is sometimes possible to introduce the Faraday screen between aerial coupling and tuned coils, as shown in Fig. 1. This is particularly easy with short wave sets having fixed, self-supporting coils. For best possible

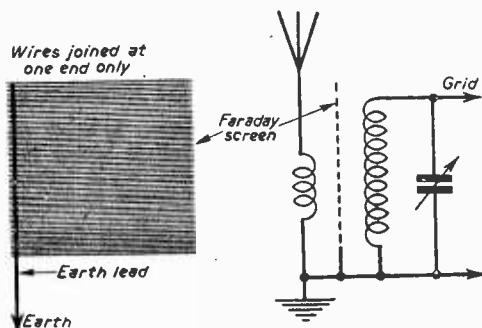


Fig. 1.—The Faraday screen and circuit.

results, the receiver can be screened, and the aerial circuit coupled in through an aperture, as described for the tuning unit in Fig. 2, but if the receiver layout prevents too much stray coupling between aerial and receiver circuits, this is not essential.

Tuning Unit

With many ready-made receivers it is almost impossible to add the Faraday screen internally. If so, it may be provided in a screened tuning unit, as shown in Fig. 2. This unit is made in a totally screened metal box having an aperture about 2in.

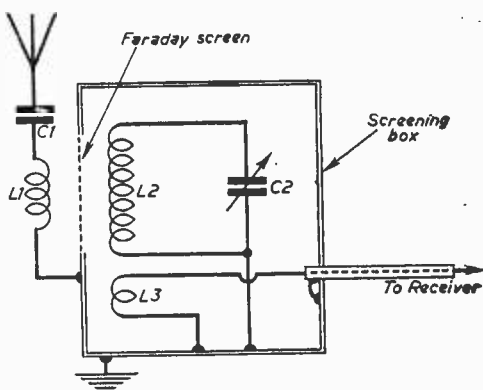


Fig. 2.—Faraday screen tuning-unit.

square, which is covered with the Faraday screen. The Faraday screen wires must not touch the metal box, but the paxolin can be bolted over the aperture, and the earth lead bonded to the box.

The coupling coil L1 is outside the box. Coil L2 is tuned to the required frequency band. Coil L3 is a small winding near the earthed end of L2, and is coupled by means of a screened lead to the aerial terminal of the receiver. This lead should not be longer than necessary. A few experiments to find the best number of turns for L3 may be required to obtain best input to the receiver, as this depends on the receiver coils. If no aerial condenser is present in the input circuit, a small fixed condenser of 25pF or so should be included in the lead from L3. C1 is also about 25pF to 50pF.

When listening on one particular band of frequencies, such as an amateur band, readjustment of C2 is scarcely necessary. If most attention is given to one band, L2 should have enough turns so that a small capacity (say 50pF) will suffice for C2. But if a number of bands must be covered, C2 will need to be 150 or 200pF. The turns on L2 are simply adjusted until C2 gives resonance on the desired bands. L1 can normally have one-third the number of turns on L2. L3 will usually be similar to L1. A dipole feeder can be taken to L1 by omitting the earth connection.

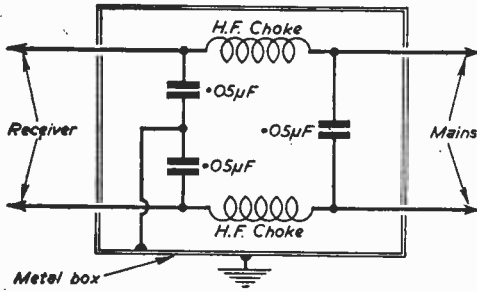


Fig. 3.—Mains line filter.

This unit also provides some rejection of image-frequency interference, which can be troublesome with the simpler type of superhet, at high frequencies (say over 25Mc/s).

Mains Circuit Filter

If static interference still remains when the aerial terminal of the receiver is shorted directly to earth on the receiver, the trouble is probably introduced from the mains. In this case, a line filter such as that shown in Fig. 3 will be very helpful.

If interference is not very severe, the bypass condensers alone may reduce it sufficiently. Mica, ceramic, or other condensers intended for high voltages and V.H.F. use are best. The capacity is not critical, and 0.005µF may easily be sufficient if most attention is given to the high frequency bands.

The chokes must be able to carry the required current, so that receiver type chokes are usually unsuitable. These chokes can often be wound with 24s.w.g. or similar wire, according to the current taken by the receiver.

The earth used for the metal screening box should be sound, and it may be worth while trying various earths, if interference persists.

Mains Transformer Screen

In some receivers, a screen exists between primary and secondary windings of the mains

transformer, as shown in Fig. 4. This may be of metal foil, and it does not form a completed turn, as this would act as a short-circuited winding. It is not unusual to find that this screen is unused. It should be wired to the receiver chassis, otherwise it cannot provide screening between mains (primary) and receiver (secondary) circuits.

If such a screen is not present, or if additional suppression is wanted, then R.F. bypass condensers can be added to the rectifier, as shown in Fig. 4. High-voltage condensers of moderate capacity, such as 0.01µF mica types, will be satisfactory. One condenser will probably be in parallel with a smoothing condenser, but it is still required because electrolytic condensers do not present a low impedance path for radio frequencies. Some receivers draw H.T. directly from the mains, and by-pass condensers of this kind will then be found particularly useful, if modulation hum exists. With the normal half-wave rectifier circuit, there will be only one rectifier anode connection, so only two bypass less condensers will be wanted, instead of the three in Fig. 4.

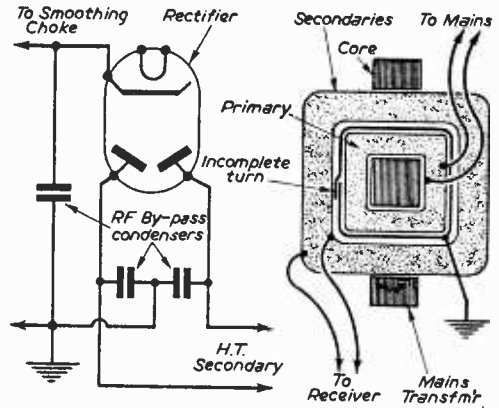


Fig. 4.—Transformer screen and rectifier bypass.

AN ADD-ON BRIDGE UNIT

(Continued from page 408)

Method of Use

The unknown resistance or condenser is connected to the appropriate pair of terminals and the timebase is switched on. The line on the screen will be tilted (and perhaps curved). Adjust VR1 until the line on the screen is horizontal. The scale is read. Suppose that the scale reads 2.3 and the range is 100k, then the unknown resistance is 230k ohms.

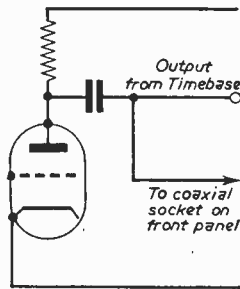


Fig. 6. — Obtaining an energising signal from a time base.

INDEPENDENT RADIO STATION

THE first independent local broadcasting station designed for use in Britain was demonstrated in the grounds of the Royal Show at Cambridge. The station is designed to serve any town in Britain and costs £15,000 complete. It uses two transmitters—a medium-wave transmitter broadcasting during daylight hours and a VHF transmitter broadcasting day and night.

The medium-wave transmitter is used during daylight hours to give immediate access to vast numbers of medium-wave receivers in homes and in cars. It closes down after sunset to avoid continental interference.

The VHF transmitter also radiates during daylight but continues throughout the hours of darkness. The station therefore has two channels during daylight and the Pye Company suggests that the VHF transmitter should be made available for educational and public service broadcasting as required during daylight hours.

Transistorised Ohmmeter

MAKING MEASUREMENTS UP TO 20M

By D. Kemp

IN experimental work it is sometimes necessary to measure resistances of very high value. This cannot be carried out with the usual type of multimeter unless a voltage of over 100 is used. Unless the experimenter has a very sensitive micro-meter, such values have either to be estimated or avoided. This article describes an ohmmeter to measure up to 20M with a 6V battery and an inexpensive 1mA f.s.d. meter.

Circuit

In the conventional ohmmeter circuit (Fig. 1) the highest resistance measurable depends on (a) the sensitivity of the meter and (b) the battery voltage. With a 1mA meter and 6V it would be 0.5M and the meter would then read 12 μ A. A

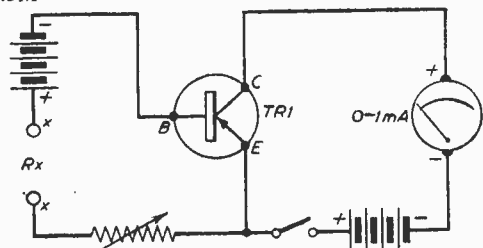


Fig. 1.—The basic circuit.

deflection smaller than this would be very difficult to see unless a large scale were used. In order to measure 20M a 25 μ A meter would have to be used, the cost of which is beyond most experimenter's means. There is however an alternative and that is to amplify the minute current and then measure it. The transistor can do this admirably and was chosen in preference to a valve which requires a large power pack.

The basic circuit for this is shown in Fig. 2. The small current flowing through the base emitter junction is amplified 40-60 times and causes a large deflection on the meter. The only fault is that the leakage current of the transistor, about 200 μ A, would deflect the meter even with no base current.

The modified circuit is shown in Fig. 3. B1 through R1 and R2 counteracts the leakage current. No switch is provided for B1 as when R1 is at maximum only 10 μ A is passed. The only other major difference is that the same 6V battery is used for both purposes instead of having two separate batteries.

Construction

The circuit is very flexible and may be altered to suit requirements. Either an increase in battery voltage or meter sensitivity will result in an

COMPONENTS LIST.

- R1—150k variable.
- R2—470 Ω .
- R3—500k variable.
- R4—56k.
- B1—1.5V.
- B2—6V.
- TR1 (see text).

increase in "maximum resistance". For example, with a 40 μ A meter and a 9V battery, measurements of up to 1000M are possible.

The unit may be enclosed in its own box or combined with a transistorised voltmeter to produce an electronic multimeter.

The transistor used in the prototype was an OC71 but any other transistor with a α' of 40-60 will do (the higher α' , the better).

Operation

First the unit is switched on and R1 adjusted until the meter needle rests at zero. Then terminals "x" are shorted together and R3 adjusted until the meter reads 1mA (f.s.d.). The base current flowing then is (1/ α')mA and, in the case of the OC71 is 1/40mA = 25 μ A.

This current is then amplified 40 times and results in a 1mA increase in collector current. Now, if a resistance "x" is introduced into the circuit the base current drops and consequently also the collector current, but by 40 times the amount.

Calibration

The value of "x" may be found by the formula

$$x = \left(\frac{V \cdot \alpha'}{C_c} \right) - R_T$$

where V is the battery voltage (in this case 6), α' is the amplification factor of the transistor, Cc is the collector current as shown on the meter and R_T is the total resistance of R₃, R₄ and the base-emitter resistance.

This method however is not advisable because of the difficulty of obtaining the exact values of α' and R_T. Also, α' not constant over a range of base currents. A far more accurate method is to form a graph or new scale for the meter by taking the readings from resistors of known value.

The uses of this unit to the experimenter are very wide. Apart from the obvious one of checking resistors with their markings obliterated, it can be used to test partially faulty insulators or the resistance of leaky condensers.

The resistance "x" must not be held with the fingers. The body resistance in parallel with "x" would bring any high resistance down to about 25k Ω , so giving a false reading.

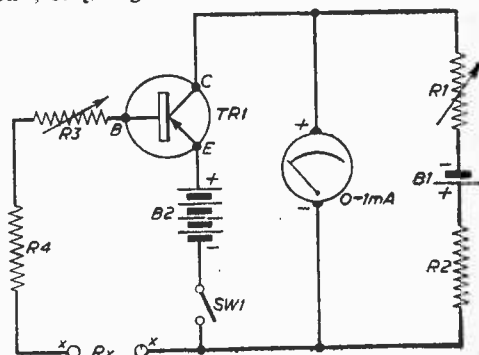
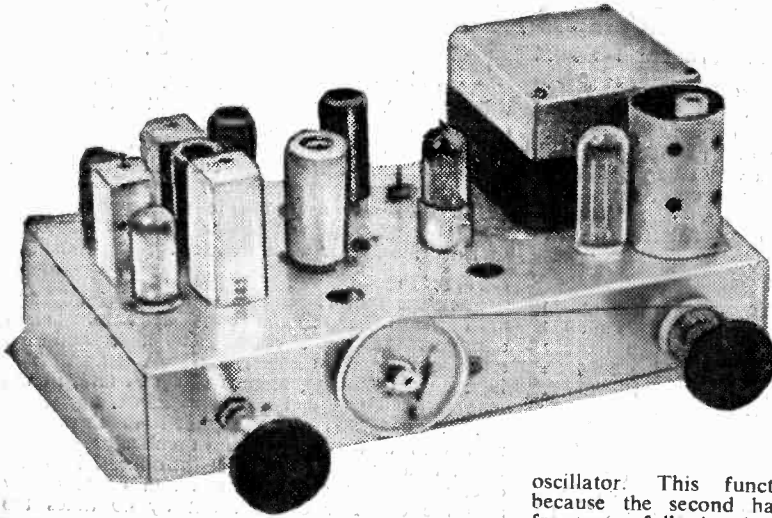


Fig. 2.—The final circuit diagram.

Low I

By E. H. Berny

TWO VERSIONS ARE I
R I



MANY listeners are now in areas of high field strength and are able to receive VHF/FM transmissions with relatively simple apparatus. This receiver is intended for general purpose reception in such conditions and with modification will give a very good account of itself in less favourable situations.

R.F. Stage

The circuit of the VHF section of the receiver is given in Fig. 1. The signal from the aerial is first applied to the grid of V1 via the coil L1. As this coil is heavily damped by the valve, there is no advantage in providing variable tuning, and it is therefore tuned to the centre of Band II by means

of its dust core. Valve V1 is arranged as a conventional R.F. amplifier and gives a worthwhile gain although its main purpose is to prevent radiation from the oscillator. This function is very important because the second harmonic of the oscillator frequency falls in the television Band III. In the anode circuit of V1 is the coil L2 by means of which the amplifier signal is transferred to the grid of V3. Coil L2 is also heavily damped and variable tuning is hardly worthwhile; it is accordingly slug-tuned to the centre of the three transmissions to be received.

Oscillator

One half of a double triode valve ECC81 is used as a local oscillator. This is the only variable tuned circuit in the receiver. The arrangement of the tuning capacitance is of interest. It will be seen that C11 and VC in parallel are together effectively in series with the parallel combination C12, C13, across L3. The result of this arrangement

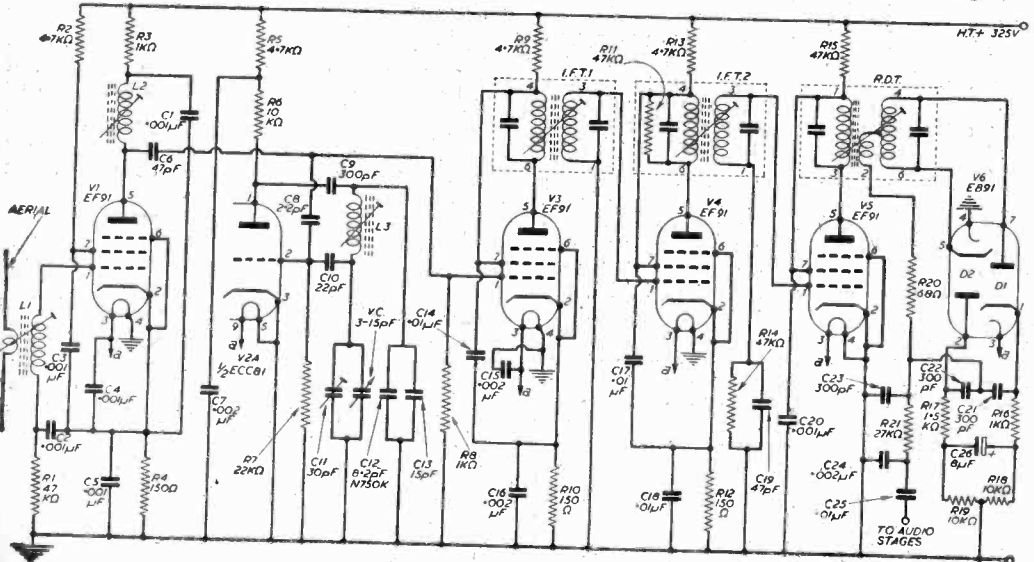


Fig. 1.—Circuit diagram of the VHF section.

Drift V.H.F. Receiver

DESIGNED—FOR FRINGE AREA AND LOCAL RECEPTION CONDITIONS

is that by suitable adjustment, a band-spread effect can be obtained, so that the stations to be received are distributed evenly over the whole range of VC. This makes tuning remarkably easy and dispenses with the need for a slow motion drive and tuning scale. Condenser VC should have a maximum capacitance of 15pF and the Jackson C.804, 3-5/15pF is suitable.

Oscillator Drift

Because the cold input capacitance of a valve is different from its capacitance when hot, every oscillator inevitably displays some drift in the first few minutes after switching on from cold. In this receiver, most of the drift has been reduced by the use of a ceramic base for V2, and by good ventilation. The remaining drift has been balanced out by the capacitor C12 which has a negative temperature co-efficient (N750K). Condenser C13 is a silver nica component, which for practical purposes has a co-efficient zero. The resulting stability is of a high order.

Mixer

A second R.F. pentode, V3, is employed as an additive mixer, the signal and oscillator frequencies being fed to its grid and combined within the valve to produce in the anode circuit the intermediate frequency of 10.7Mc/s. Condenser C8, by means of which the oscillator frequency is introduced, should be a high stability ceramic of 2.2pF but if such a component is not available, a suitable substitute can be made by twisting two pieces of thinly insulated wire together over a length of half an inch.

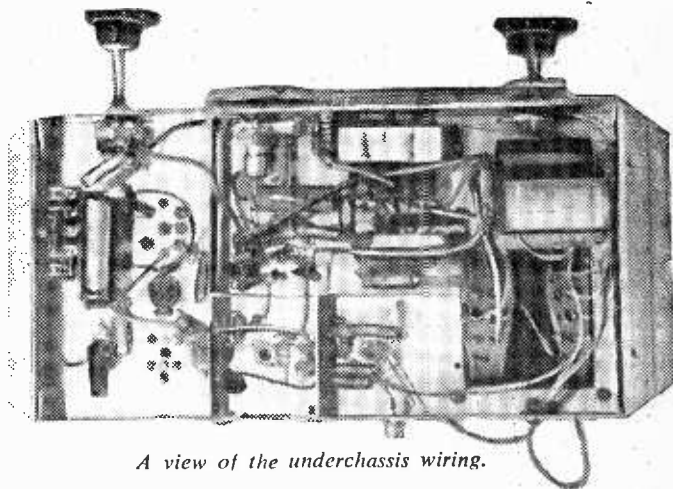
I.F. Amplifier

The I.F. amplifier may have one or two stages according to the performance required from the receiver. If it is to be used within 20 miles or so of the transmitter and reception conditions are reasonable, one will be sufficient and if the constructor has any doubt about the need for the second, the set can be completed without it: the chassis is designed so that it can be added later without difficulty.

In the first stage, V4 is arranged as a conventional I.F. amplifier. The only critical point about it is the capacitor C.18, which bypasses the cathode bias resistor: it must be a good quality tubular

ceramic, completely non-inductive, or there will certainly be instability. If there is difficulty in finding a suitable component of the required value, two smaller ones can be used so long as the total capacitance is not less than 10,000pF. In the anode circuit is the second I.F. transformer, which has a 47k resistor R11, across its primary to ensure adequate acceptance bandwidth. If only one I.F. stage is required, the ratio detector transformer should take the place of I.F.T.2 and R11 should be omitted. The wiring diagram for this arrangement is given in Fig. 7.

The second stage is arranged as a limiter. It adds considerably to the sensitivity of the receiver for distant reception and also provides additional protection against impulsive interference which is desirable under these conditions when the signal/noise ratio is less favourable.



A view of the underchassis wiring.

Demodulation

In the detector stage, the FM receiver differs entirely from its AM counterpart. The modulation, which up to this stage is expressed as variations of frequency, must be converted to variations of amplitude before it can be reproduced as sound. Of the several ways in which this can be done, the ratio detector has been selected because of its superior interference rejection properties.

The resistors R16 and R17 have been selected to produce the best balance for this purpose and should be 10 per cent or better as also should be R18 and R19. Crystal diodes such as GEX34 can be used in the ratio detector in place of a double diode valve but are more expensive and not quite so efficient. Also, they usually require some form of automatic gain control to limit the voltage applied to them if they are not to be damaged by overloading when the receiver is tuned to a nearby transmission.

De-Emphasis

In FM transmissions, the higher audio frequencies are emphasised at the transmitter. The emphasis is removed in the receiver by the low-pass filter R21, C24, having a time constant of 50µs.

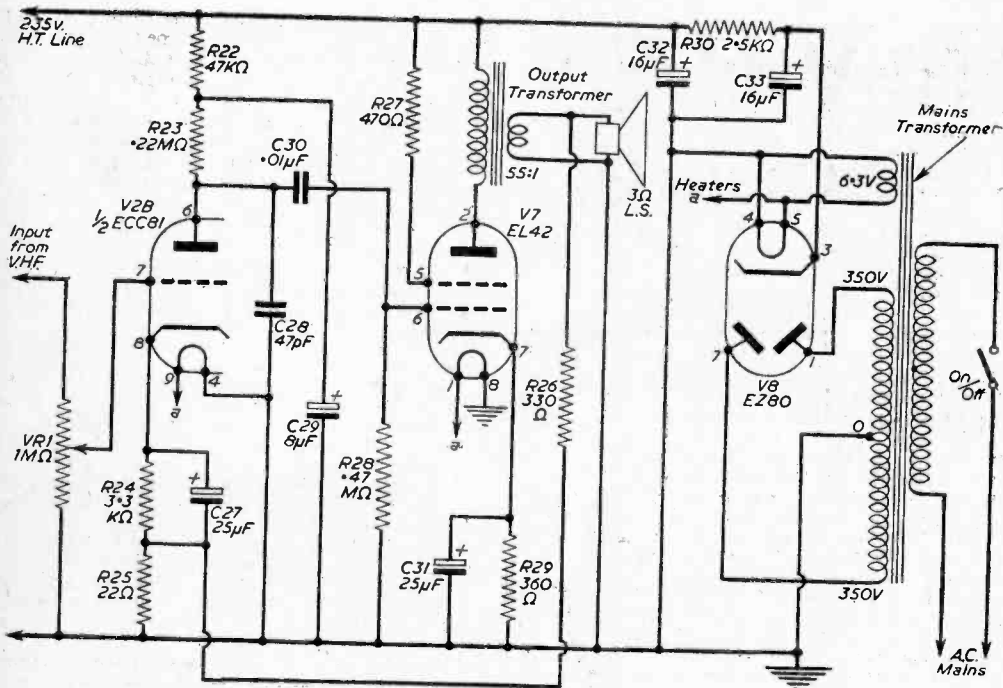


Fig. 2.—Circuit diagram of the AF stages and power pack.

A.F. Amplifier

The circuit of the remainder of the receiver is given in Fig. 2. The output stage uses a 2.5W pentode EL42 was selected in order to keep the total H.T. requirement within the 80mA available from the mains transformer which was to hand. It requires 11V peak on the grid for full output. Any other pentode or beam tetrode of approximately the same sensitivity can be employed provided the required extra current is available from the power pack. The optimum load for the EL42 is 9,000Ω and the output transformer should have a ratio of between 50 and 60:1 for a 3Ω speaker. The required bias resistor of 360Ω is easily found by measurement from a batch of 330Ω, 20 per cent components.

Negative Feedback

A moderate amount of negative feedback is taken from the secondary of the output transformer via R.26 to the cathode circuit of V.2(b). If when the receiver is completed and switched on, the feedback is found to be positive, the connections to either the primary or secondary of the transformer should be reversed.

Construction

The set is constructed on a chassis of 16s.w.g. aluminium 11in. x 6in. x 2in. as shown in detail in Fig. 3. There is room for all the components and construction is not difficult though VHF technique must of course be observed. It is very important that instability be avoided. Even a slight trace will have the effect of reducing the acceptance bandwidth of the receiver so that it will not be able to accept the deviations of the transmissions and there

will be non-linearity distortion in the detector stage. Reduced bandwidth will also show up minor random variations in oscillator frequency which would otherwise be of no consequence and frequent adjustments will be required to the tuning. This design is inherently very stable but in order to guard against the effects of minor differences in wiring and positioning of components as between one constructor and another, the chassis has been sectionalised so that the R.F., oscillator and mixer stages are efficiently screened from one another and from the I.F. amplifier.

Screens

The screens may be of 18 or 20s.w.g. aluminium to the measurements given next month and should be fitted close against the underside of the chassis. Cut-outs are provided for the only two connections which must pass beneath them, viz., C8 to pin 2 of V2 and the heater line between V2 and V6. The screens should be made and fitted to the chassis with bolts or self-tapping screws before wiring commences; their positions should be marked on the chassis for guidance when fitting components and the screens can then be removed and replaced when construction is practically complete.

Wiring

The constructor should make all the connections as short and direct as possible and should not make any attempt at orderly and symmetrical layout in the VHF section of the receiver. On the other hand, there is no need to go to extremes; shortening a wire by say 1/4in. will not have any effect and generally speaking 1/4in. is a reasonable length of connection to be aimed at where possible.

It should be noted that in the wiring diagrams, the wiring has been opened out and all the components are shown in a horizontal position. This has been done for clarity; in construction the connections should be short and direct and components will of course be mounted in the positions in which this aim is best achieved.

It is suggested that the mains transformer and other power pack components be mounted first and the valve heaters and their associated bypass capacitors wired up. Work can then commence on the R.F. stage and proceed stage by stage to the output, taking care to place all components clear of the screen positions as marked on the chassis. It is convenient to mount the H.T. dropping and decoupling resistors vertically; the screens can then be fitted and the H.T. rail run round above them to each stage in turn. Condenser C11 is conveniently mounted by soldering it to a solder tag bent at right angles and bolted to the chassis.

Ventilation

To minimise long term drift in the oscillator, vents are provided in the deck of the chassis and ventilation is provided through the bottom of the cabinet of which a description will be given later. Resistor R30 which is the greatest heat producer, is mounted vertically on a tag strip above a 1 1/4 in. hole in the chassis and inside a "chimney" about 2 in. high, made from an octal-valve screening can. In this position, it not only cools itself adequately by convection but also draws air through the chassis from below. Further assistance is provided by a heat deflecting screen in the cabinet.

Coils

The aerial coil, L1, is wound on a 1/4 in. former

having a 1/4 in. adjustable dust core. The grid winding is 3 1/2 turns of 20s.w.g. tinned copper wire, spaced rather more than one wire diameter and the aerial winding is one complete turn of 22s.w.g. enamelled. Coil L2 is three turns of the same wire on a similar former with the same spacing. Coil L3 is wound on a 1/8 in. former with a 1/4 in. core and consists of 4 1/2 turns of 22s.w.g. enamelled wire spaced one diameter. A convenient method is first to wind the wire closely on a slightly smaller former, putting on an extra turn. It can then be removed and slipped over the larger former where it will be a tight spring fit and the turns can then be adjusted for number and spacing. All the windings should be secured in position with cellulose cement.

Operation

The tuning drive is taken from the tuning capacitor by a 2 1/4 in. drive drum to a 1 1/4 in. drum mounted on the tuning spindle giving an almost 2:1 reduction. A projecting lug soldered to the smaller drum and a 4B.A. bolt located in the front of the chassis limit the angle of rotation to about 350deg and the stations are marked on the tuning knob in such positions that they come into tune when the appropriate mark is brought to the top. (The prototype has "L," "H," "W," and "3" engraved in white, corresponding to the Light, Home, Welsh and Third programmes). An old volume control with the body removed makes a good tuning spindle.

In the absence of modulation, there is nothing at all to be heard from the speaker and the pilot light is necessary to indicate that the receiver is switched on.

(To be continued)

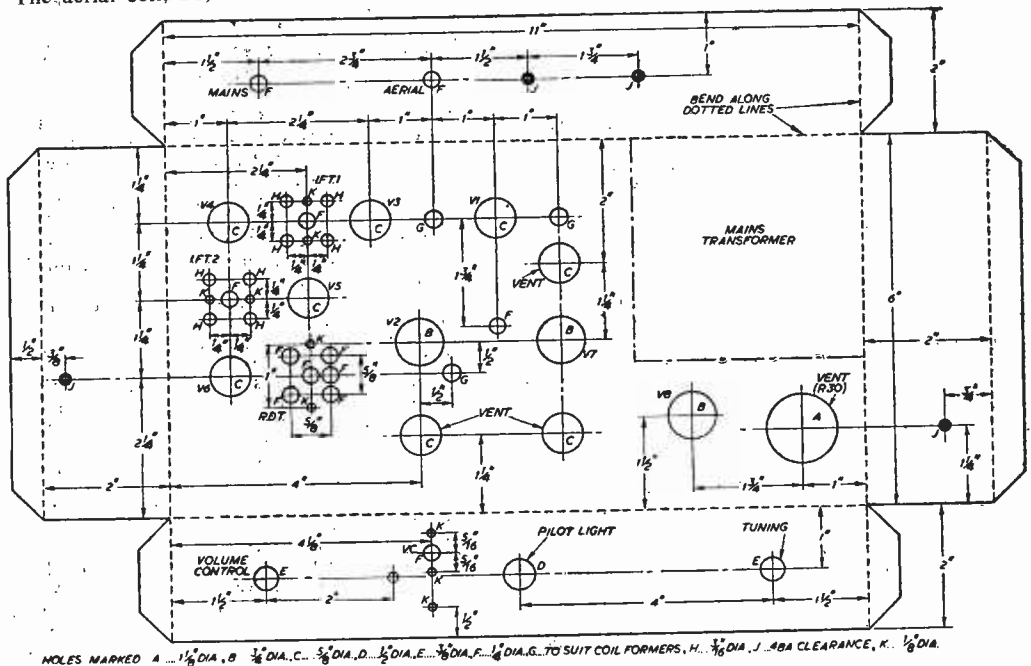


Fig. 3.—Plan of the chassis.

A Precision Pick-up Arm

AN INEXPENSIVE, LOW-WEAR UNIT FOR THE HIGH FIDELITY ENTHUSIAST

By N. A. BARGER

(Continued from page 330 of the August issue)

FOLLOWING the actual construction of the pick-up, we now come to the counterbalancing system. This is most important in pick-ups, with low pressures in the region of 2 grammes or less. The system I have used is very simple; a length of bolt screwed into the end of the arm, with a cast lead weight on it. Two nuts locate the weight. It is necessary, however, to fit the cartridge to the platform first. Protect the stylus by means of a piece of plastic sponge and tape (Fig. 9).

When the cartridge is fixed, and the $1\frac{1}{2}$ in. length of bolt in the end, pivot the arm in its sockets (Fig. 10) and add pieces of lead until the arm balances. (The pedestal should, of course, be screwed firmly to a piece of board).

Testing

When the arm balances, the freedom of movement can be tested. A piece of good quality note-paper, $\frac{1}{2}$ in. wide and 4 in. long, is held at one end by the thumb and forefinger. The other end bears against the cartridge platform adjacent to the stylus. Pressure against the platform exerted via the paper strip should cause the arm to move freely without bending the paper more than a fraction. If the arm tends to swing easier one way than the other, check the levels of the pedestal first. This tendency means inaccuracy in (a) cutting the stirrup, or (b) mounting the tube, or (c) cutting the pick-up arm slots and pivot holes. It is also caused by the mounting of the pedestal on a surface which is not level.



Fig. 9.—The counterbalancing system.

If good care has been taken with the work so far, however, with the base-board level, the embryo pick-up arm in its balanced state should be easily moved by the paper strip to any point in a horizontal plane, and remain there with no tendency to swing backwards, or inwards, if the pedestal and board are dead level. If this is so, then the success of the arm is assured, for all there is left to do is to install the conductor wires.

Pick-up Wires

For the stereo model, this is a light plastic covered and shielded wire carrying two conductor wires, obtainable from most electronic dealers. Tie the thread projecting from the hole in the rear

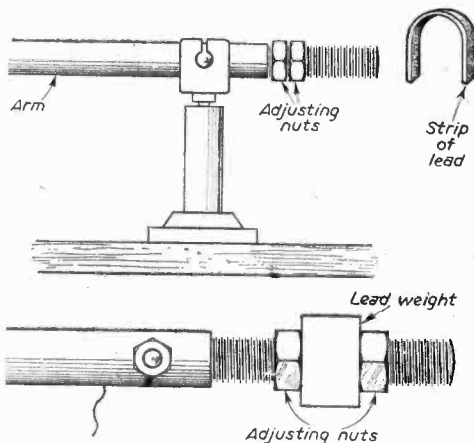


Fig. 10.—Finding the correct counterbalance weight.

of the arm to one end of about 10 in of this wire, and carefully pull it through the hole, down the tube, until it comes out the other end. Bare about $\frac{1}{4}$ in. of each of the two conductor wires, push the bare wire through the holes in each of 2 of the three connector tags supplied with the cartridge (if there are none, ask for them) and then solder. The copper shield is soldered similarly to the third tag. Then the tags are pushed on to the appropriate terminals of the cartridge—the copper braid one is for the middle terminal.

If the mono cartridge is used, then single conductor shielded wire is used.

Now, the other end is stripped of its outer plastic sheath exposing the copper braid, which in turn is stripped off, by making a hole in it and pulling through the conductor wires. The copper braid is then twisted tightly into a strand. The wires should be arranged with the earth braid in the centre and the two conductors on either side bare, about $\frac{1}{4}$ in. out of the hole. For mono wiring, then there will be one conductor only, of course.

Now take the pedestal by itself, and drill three holes as shown in Fig. 11a to take three 4B.A. bolts, long enough to project $\frac{1}{4}$ in. beyond the top of the pedestal (Fig. 11b). Make also three small brass tags to slip over the bolts, after they have been secured (Fig. 11c). These tags will take the connections from the conductor wires inside the pick-

up. Of course, if a mono cartridge is used, only two bolts will be needed.

Now cut three lengths of very thin wire (I have found the fine stranded silk covered wire used on radio coils ideal) each around 3in. long and coil

test for this movement using a strip of notepaper as before. Aim for 3 1/2 in. of free movement, which will be obtained generally when the three coils are extended slightly to one side, through their upright position to a position where they are extended slightly to the other side (see Fig. 13).

It is not necessary to obtain unimpeded movement of the arm over a wider arc than this. If this can be secured in your pick-up then it will perform in an extremely efficient manner indeed.

Template

It will be remembered that the really unimpeded movement of the arm took place over a distance of about 3 1/2 in. at the head. This means that the middle of the recorded material on a disc will be the point at which the pick-up arm is in the middle of its arc of free movement, i.e. when the connector coils above the pedestal are vertical, so arrange to mount the pick-up so that this occurs, but also remember that the stylus must overlap the turntable spindle by 1/4 in. An easy way to do this is to cut a disc of stiff paper to the size of a 12in. disc, and slip it on the turntable. Now, temporarily disconnect the leads from underneath the pedestal so that they will not be in the way. With the pick-up base securely on the motor board in a position where the head can be easily handled when in use, move the head until the stylus reaches a point 1/4 in. in front of the spindle (allow the pedestal to move until this situation is reached). Make a pencil mark at this point on the paper. Now, without moving the pedestal base, swing the arm until it reaches the outer edge of the paper disc. Make a mark with

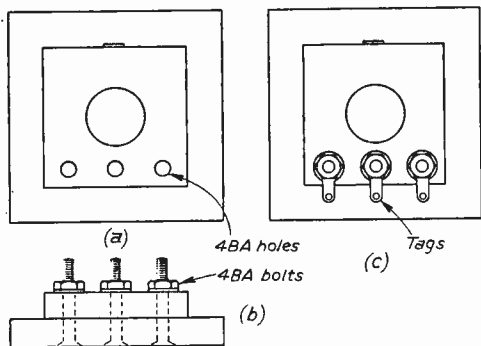


Fig. 11.—The pedestal terminal connections.

them over a 1/8 in. diameter rod as shown in Fig. 12a. Bare the ends of each coil carefully. Slip a 1/4 in. piece of sleeving over one end of each coil when the coils are made; lay them aside for a minute whilst you connect the conductor wires to the underside of the pedestal. The stereo cartridge will need two lengths approximately 2ft each of plastic covered shielded wire (single conductor type). The mono pick-up will need one length of wire (Note. all the diagrams refer to stereo versions; for mono versions use the only two connectors in all cases instead of three). Now solder the amplifier leads to the heads of the brass bolts. When this is completed you may proceed to the soldering of the three coil wires. The final appearance will be as shown in Fig. 13.

Unimpeded Movement

A word of warning.—The flexibility of these leads has the greatest possible effect on the freedom of movement of the arm. On a 12in. disc, the movement of the stylus will be about 3 1/2 in. in a horizontal direction across the disc. The coils, however, will move less than 1/4 in. but this movement must be unimpeded; the coiling of the wire and its flexibility should make this possible. However, set up the pick-up as before. balance it and

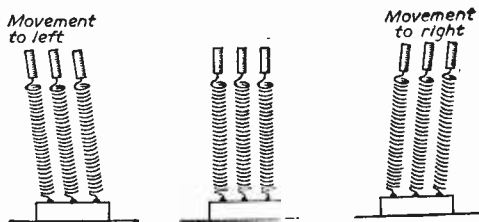


Fig. 13.—The three coils of flexible wire give complete freedom of movement to the pick-up arm.

a pencil where it occurs. Now move the pick-up gently inwards inch by inch, marking on the paper at intervals, until the centre point, 1/4 in. in front of spindle, is reached again. Now remove pick-up arm to a safe place; take the paper and join up the marks on it. This will make a line showing path traced by the pick-up stylus across a record. About 3 1/2 in. from the outer edge will be the extreme inner limit of recorded material. Make a mark where this is. Now you have a "map", of the pick-up path and the half way point. Between the outer edge of paper and the point of extreme limit of recorded material, is the point where the pick-up should be when its connector coils are upright, i.e. in the middle of its unimpeded arc of swing.

This "map" can be slipped on the turntable and used to mount the pick-up. Wedge the turntable so that it does not move. The stylus should be on this "half-way" point when the connector coils are vertical. (Arrange for this by rotating the pedestal base.) When this has been achieved, mark

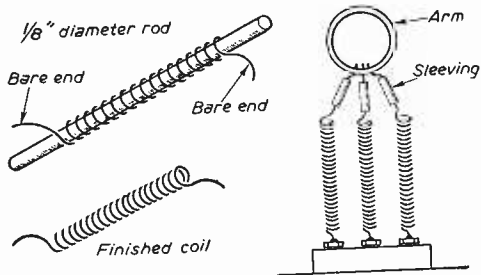


Fig. 12.—The flexible connections between the pickup and the pedestal terminals.

the position of the pedestal base on the motor board, remove the pick-up and in the centre of the rectangular mark bore a 1in. hole (to take the pick-up leads when re-soldered to the base of the pedestal. This can be carried out and the pick-up arm screwed to the motor board. A pick-up rest is a useful item here. It can be fashioned by plastic sheet bent to an "L" shape, with a groove in the top to take the pick-up tube, then screwed to a convenient place in the motor board.

Weighting

When all this has been carried out, the pick-up is ready for use. Re-balance it by adjusting the counterbalance weight, then add a $2\frac{1}{2}$ gramme weight (a small washer) to the pick-up platform with a contact adhesive to provide the pressure for the stylus. Fig. 14 shows an easy way to obtain

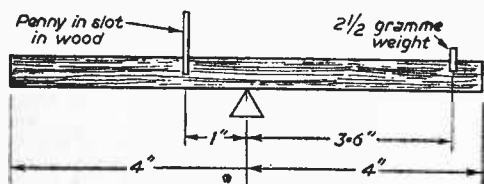


Fig. 14.—A method of obtaining a $2\frac{1}{2}$ gm. weight.

$2\frac{1}{2}$ grammes (a newish penny weighs about 9 grammes).

By calculation it is found that a penny placed 1in. from the point of balance of a small bar, will exactly balance $2\frac{1}{2}$ grammes placed 3.6in. away from the centre on the other side.

Hence, cut a $\frac{1}{2}$ in. x $\frac{1}{2}$ in. bar of hardboard 8in. long. Cut a small nick in it for the balance point (Centre point). Cut a slot also, above the nick and 1in. from it to hold the penny. Now cut a slot in the other 3.6in. from the centre point, to hold washers for testing.

Set up the bar on its pivot, insert a newish penny in the slot and then put washers in the other slot until you obtain a balance. These washers (or washer) will then weigh $2\frac{1}{2}$ grammes, and will be cemented to the cartridge platform just above the stylus point, but the arm must be in a state of balance before the washer is affixed. You could of course ask a friend who has a metric balance to weigh $2\frac{1}{2}$ grammes for you.

Now the pick-up is all set up in its correct position on the motor board. It may be, however, that the arm is too high or too low for the turntable. This can be attended to by the user by means of the grub screw, or packing under the pedestal.

Dynamic Balance

One final refinement; the user can "dynamically level" the pick-up for optimum performance in the following way. First of all ensure that the turntable motor board is level in two directions at right angles by means of a spirit level. Next a blank record will be required. If one is not available, one can be made by using a 12in. disc of hardboard, highly polished on the smooth side by

three layers of cellulose paint rubbed down each time and finished with metal polish and good wax to a smooth brilliant shine to simulate a smooth disc.

Put this disc on, set the turntable revolving and set the arm on the disc. Wherever you put it on the disc it should remain with no tendency to move in or out. If it has such a tendency, a little packing under the arm will counteract this. When you have achieved this steady tracking your pick-up is "dynamically balanced" and ready for superb performance and low wear.

Dynamic balancing "cleans up" the reproduction from records to a remarkable degree and is practised by most serious gramophone users. It is essential for good stereophonic reproduction from low-pressure pick-ups such as this.

SILICON TRANSISTOR PROGRESS

THE first year of full-scale production of high-frequency silicon alloy transistors has just been completed by Semiconductors Limited, and in this period increased demand and production improvements have allowed the prices of the two types to be reduced considerably.

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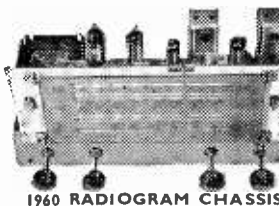
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A CIRCUIT FOR THE BEGINNER

By L. Baker

MANY amateurs will, at one time or another find use for an audio amplifier capable of good quality reproduction. This type of unit is especially useful for the reproduction of the large range of gramophone records which are now available.

Circuit

The circuit diagram of the amplifier is shown in Fig. 1. It will be seen that power for the unit is supplied by T1, the mains transformer working in conjunction with the full wave rectifier valve V3. The output from the rectifier is filtered and smoothed by C5, R7, and C4. The resistor R7 is a 5W wire-wound component. A L.F. choke could possibly be used with some little advantage in place of R7 if such a component was readily available. In the original model however, it was found that the wire-wound resistor was quite adequate for smoothing purposes and any additional smoothing by a L.F. choke was negligible. Transformer T1 also supplies the heater current for all three valves. The on/off switch S1 is

wired in the "live" lead to the A.C. mains. If a two-pole toggle switch is available this could be used in the S1 position thus isolating the mains completely from the equipment when the switch is in the "off" position. Valve V1 is the first audio amplifier. Input to the grid of V1 is via the audio gain control R1 and the bass/treble network consisting of R3 which is the bass control, R12 the treble control in conjunction with the network C1, C2, C3, R2, R4, and R5. The input to the audio gain control and to the grid of V1 is screened to minimise hum pickup. Valve V1 is a double diode triode 6AT6. In this circuit however, the diodes are not used and in construction, the connections for the diodes should be strapped together and earthed. To simplify the circuit diagram, the valve V1 is shown without the diodes. V1 is resistance/capacity coupled to V2, the output valve, which is a 6BW6. Resistor R8 is the anode load for V1 and the input to V2 is via C7 and R9. A grid leak for V2 is provided by the inclusion of R10. The filtered H.T. supply for the anode circuit of V1 and the screen circuit

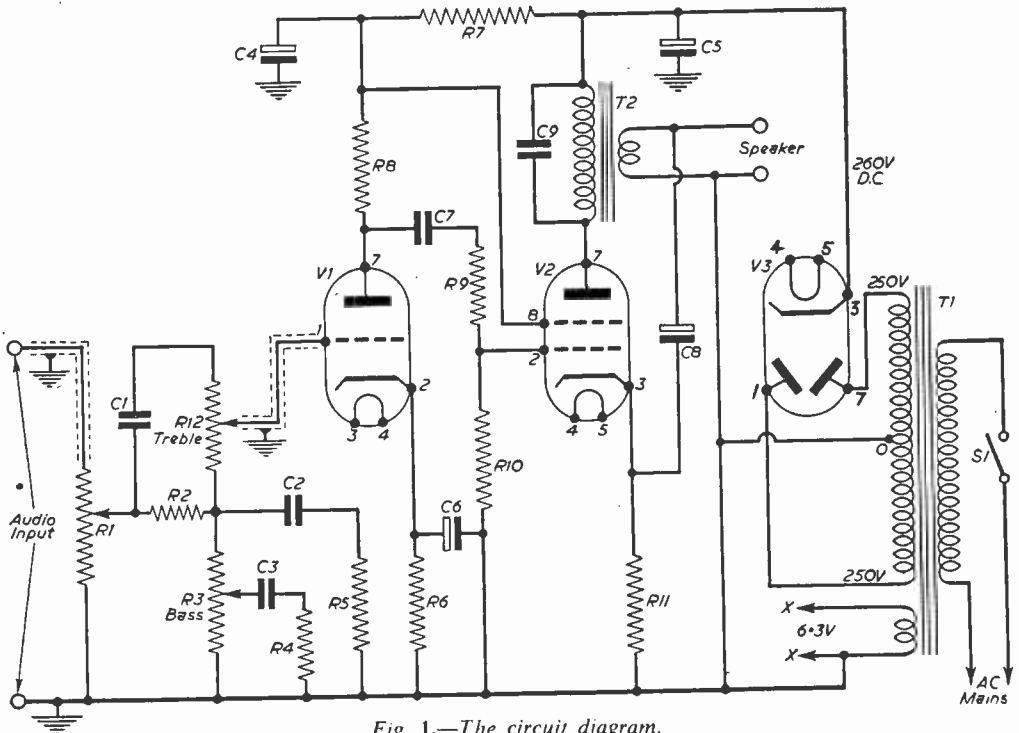


Fig. 1.—The circuit diagram.

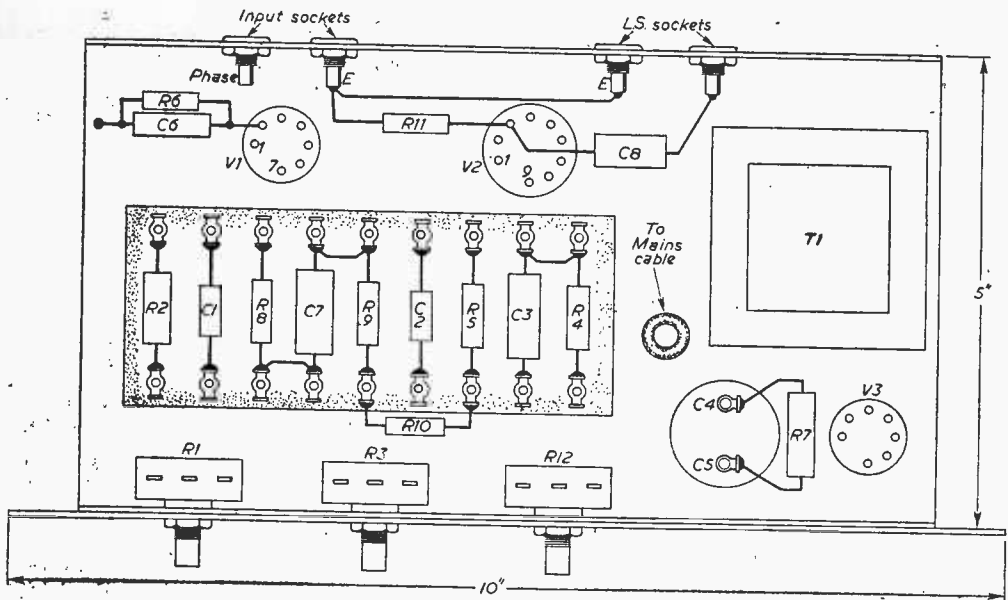


Fig. 2.—Underchassis wiring.

of V2 is taken from C4, while the unfiltered supply for the anode of V2 is taken from C5. Automatic bias for V2 is provided by R11. The H.T. consumption at full volume is approximately 40/50mA and the undistorted output is about 4W.

Construction

The chassis is made from 16s.w.g. aluminium and the dimensions are shown in Fig. 2. These dimensions are not at all critical and the intending constructor may care to vary them slightly to suit a chassis already to hand. From the illustrations it will be seen that the power supply is arranged at the right hand side of the chassis and that most of the smaller components are mounted on a 9-way tagboard, bolted to the chassis and held clear of the chassis by means of insulated sleeving on the mounting bolts. Insulated sleeves approximately $\frac{1}{4}$ in. long will suffice to prevent accidental contact with the chassis. The front panel which carries the on/off switch S1 is slightly longer than the chassis and is held to the chassis by the mounting bushes of R1, R3, and R12. If the constructor desires, additional securing of the front panel to the chassis can be provided by means of 4 B.A. nuts and bolts.

The valveholders for V1, 2, 3, the power transformer, the mounting lugs for T2 and the capacitors C4 and C5 should be spaced out as shown. If the chassis is to be made from flat material it is sufficient to have the back and front edges of the completed chassis 2in. high. The front panel and chassis should be then assembled so that the bottom edges of the chassis and panel are parallel. Holes for the mounting bushes of R1, R3, and R12 should be made, drilling through the front panel and chassis edge in one operation to ensure correct alignment. The apertures for

T1 and V1, V2 and V3 should be completed before finally assembling the chassis to the panel. It will be noted that C4/5 is one unit and that about approximately $\frac{1}{4}$ in. projects on the underside of the chassis. This part is secured to the chassis by means of a mounting clip supplied with the capacitor.

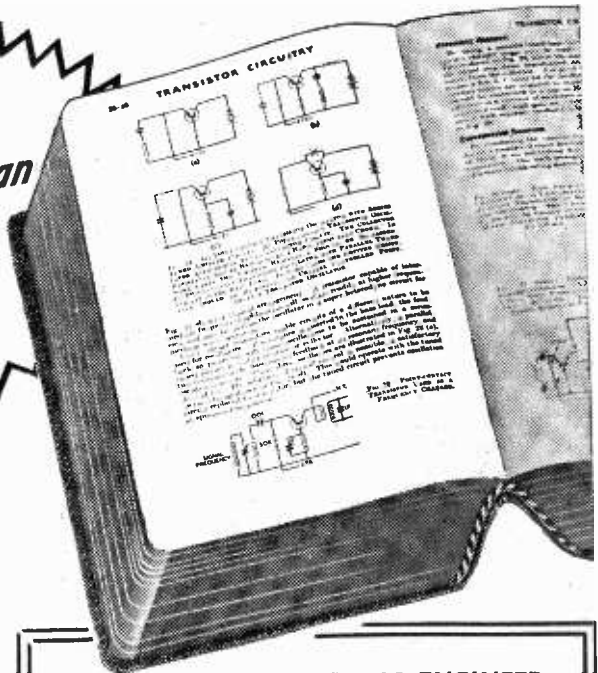
The valveholders, transformers T1, and T2, may then be assembled to the chassis. T1 should be very firmly bolted to the chassis to prevent vibration in operation. The input and output sockets should be assembled to the back of the chassis and S1 should be installed on the front panel. The tagboard can be made up as shown in Fig. 2 and when completed may be installed on the underneath of the chassis as shown. Resistor R7 should be soldered directly across the tags of C4 and C5. Capacitor C9 should be soldered directly across the primary connections of T2. One heater tag of each valveholder should be soldered to the chassis by fitting a soldering tag to the mounting bolt and soldering a short piece of stiff wire between this earth connection and one heater connection on the valveholder. The heater wiring may then be completed by wiring with heavy gauge stranded plastic insulated wire from T1 heater winding to all three valveholders. The wire should follow as direct a path as possible with sufficient slack to allow it to be pressed close to the chassis when the heater circuit is completed.

The centre tap of the power transformer should be earthed directly near to the transformer by means of a soldering tag under the fixing bolts of the valveholder V3. The A.C. H.T. connections should be wired directly to the anodes of the valve V3 by means of thin twisted flex.

The bias resistor and condenser for V1 are soldered between the cathode connection for V1

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and chassis. Likewise the bias capacitor and resistor for V2 are soldered between the cathode of V2 and earth. The unfiltered H.T. lead is taken from C5 through the hole in the chassis to the primary of T2. The other primary connection from T2 passes back through the same hole to the underneath of the chassis and thence to the anode connection on the valveholder of V2.

Input Circuit

The "live" input connection from the audio input socket should be made with a short piece of screened cable. This is fitted between the appropriate input socket and R1, the audio gain control. The screening or outer braid portion of the cable should be stripped back far enough at each end to make a connection and connected to the "earthy" end of R1. The lead from the slider on the treble control should consist of screened cable with the screening earthed as before.

The remainder of the wiring is simple and straightforward. Connection to the smaller components is made by soldering the appropriate wires to the tags on the tagboard. Use should be made of thin plastic insulated stranded wire for the remainder of the wiring. If a stock of different coloured wire is available then the connections can be colour coded using blue for grid, red for anode, yellow for screen and black for earth or chassis connections.

Testing

When all wiring has been completed and checked the amplifier may be tested. The loud-speaker should be plugged in and the mains lead connected to the mains. The switch S1 should be closed whereupon all three valves should light up. The warming up time for the unit is about 30 seconds after which the speaker should become "live" producing a slight hissing sound. Rotation of all three controls should be smooth and noiseless giving rise to no howling or crackling noises in the speaker. Touching the grid of V2 with a screwdriver blade should produce a sharp click in the speaker. Touching the "live" input lead to V1 should produce a loud hum in the loud-speaker. With the gain control turned fully down there should be no sound from the speaker on touching the input to V1. On first trial of the unit, beginners would be well advised to position the amplifier so that the underneath parts can be inspected while the power is on. There should be no signs whatsoever of overheating. After extended operation, the resistor R7 should be slightly warm to the touch (with the power switched off). It should not become so hot that it cannot be touched with the fingers. Likewise the power transformer should become only slightly warm after extended use.

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A record player may be tried by connecting

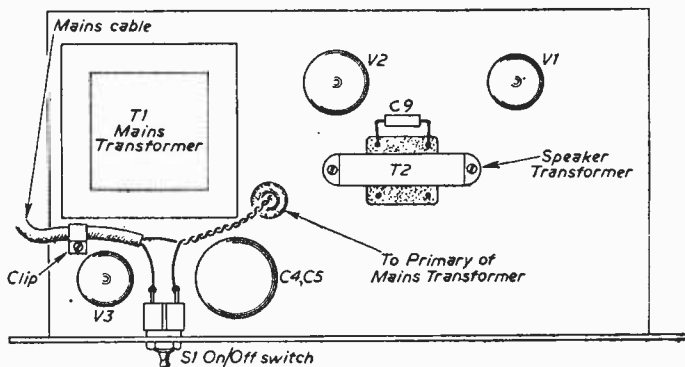


Fig. 3.—Plan view of the chassis.

LIST OF COMPONENTS

Resistors:

- (All resistors $\frac{1}{2}$ W except R7 and R11)
 R1, 3, 12 1M.
 R2 330k.
 R4 56k.
 R5 22k.
 R6 4.7k.
 R7 2k 5W (wire-wound).
 R8 100k.
 R9 10k.
 R10 680k.
 R11 270 Ω , 1W (carbon).

Valves:

- V1 6AT6.
 V2 6BW6.
 V3 EX80.

Sundries:

- 2 B7G valveholders.
 1 B9A valveholder.
 Mounting clip for C4/5.

Capacitors:

- C1 200pF.
 C2 0.002 μ F.
 C3 0.05 μ F.
 C4 32 μ F electrolytic 300VW.
 C5 16 μ F electrolytic 300VW.
 C6 30 μ F electrolytic 6VW.
 C7 0.01 μ F 200VW.
 C8 30 μ F 25VW.

T1 primary to suit mains or tapped.
 Secondary 250-0-250V 60mA 6.3V 2A.
 T2 see text.

Chassis, panel, nuts, bolts, washers, etc.

the unit to the input of the amplifier. With the gain control turned full up the reproduction from the speaker should be extremely loud since the full output power of the amplifier is some 4W. The operator should also have wide control over the tone of the resulting music or speech by manipulation of the bass and treble controls. It will be found that at full volume there will be very little appreciable distortion. Since the unit will be mostly used at half or less volume, the quality of the output will be very high and indeed far better than reproduction from the amplifier of the average household radio receiver.

2-TRANSISTOR POCKET RADIO

INCORPORATING MINIATURE SPEAKER, PRINTED CIRCUIT, AND FERRITE ROD

A wonderful little instrument which fits snugly into a breast pocket. Size 3 1/2 x 4 1/2 x 5 in. Tuneable over medium and long waves. Set of parts including ivory coloured case, 2 transistors, and all necessary components to complete same (less batteries—available anywhere at 10d.).

Plus All parts sold separately. 22/6 P. & P. 1/6. Point to point wiring diagram 1/6. free with kit. All transistors guaranteed 100%.



3-TRANSISTOR POCKET RADIO

INCORPORATING MINIATURE SPEAKER

Plus Germanium Diode & PRINTED CIRCUIT

Size 3 1/2 in. x 4 in. x 5 in. Incorporating Ferrite Rod Aerial. Two Surface Barrier Transistors and one Audio. Tuneable over medium and long waves.

To build Yourself 39/6 Plus 1/6 All parts sold separately. Circuit diagram 1/6, free with kit. All transistors guaranteed 100%.



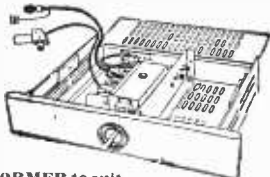
PUSH-PULL OUTPUT STAGE

Inclusive of transistors with input and output transformers to match 3 ohms speech coil, suitable for use with the above kit. Kit of parts including transistors. 19/6 Plus Post and All parts sold separately. Packing 1/6. Point to point wiring diagram 1/6, free with kit.

CHANNEL TUNER

Will tune to all Band I and Band III stations. BRAND NEW by famous manufacturer. Complete with PCC84 and PCF80 valve (in series) I.F. 16-19 or 33-38. Also can be modified as an aerial converter (instructions supplied).

Complete with knobs. 32/6 Plus 3/6 P. & P. HEATER TRANSFORMER to suit the above, 200-250 v.. 6/-.. Plus 1/6 P. & P.

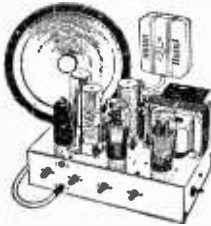


8-WATT PUSH-PULL AMPLIFIER

COMPLETE WITH CRYSTAL MIKE AND 8 in. LOUDSPEAKER

A.C. mains 200-250 v. Size 10 1/2 in. x 6 1/2 in. x 2 1/2 in. Incorporating 6 valves. H.F. pen. 2 triodes, 2 output pens and rectifier. For use with all makes and types of pick-up and mike. Negative feedback. Two inputs, mike and gram, and controls for same. Separate controls for Bass and Treble lift. Response flat from 40 cycles to 15 K/c.s..

+2db; down to 20 Kc/s. 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. 24.19.6 P. & P. 7/6 Or 20/- deposit Plus P. & P. 7/6, and 4 monthly payments of 23/-.



PORTABLE AMPLIFIER

On printed circuit for A.C. Mains 200/250 v. Size 4 in. x 3 in. with tone and volume control. Valves: ECL82 and EZ80. 39/6 P. & P. 2/6

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A.C. Mains 200-250 v. 21/- Plus 3/6 P. & P. D.C. Output 250 v. at 75 mA. Also 6.3 v., 2 amp. heater winding.

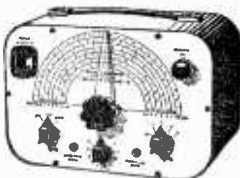
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I.T.V. Aerial less mounting bracket for External use, complete with 12 yds. of coaxial cable, 15/-; 4 element, 17/6. P. & P. on above, 3/6

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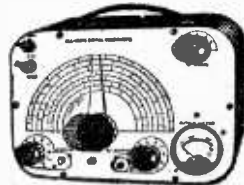


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Coverage 100 Kc/s to 100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Metal case 10 1/2 in. x 6 1/2 in. x 5 1/2 in. grey hammer finish Incorporating three miniature Valves and Metal Rectifier. A.C. Mains 200/250 v. Internal Modulation 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%.

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For both P.N.P. and N.P.N. transistors incorporating moving coil meter. In metal case size 4 1/2 in. x 3 1/2 in. x 1 1/2 in. Scale marked in gain and leakage. 19/6 Plus 2/6 Complete and ready for use. P. & P.

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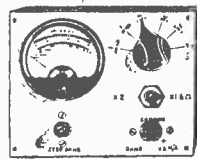
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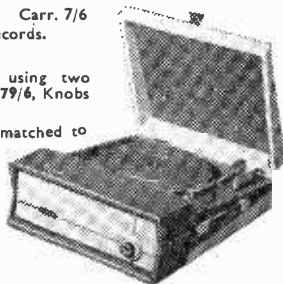
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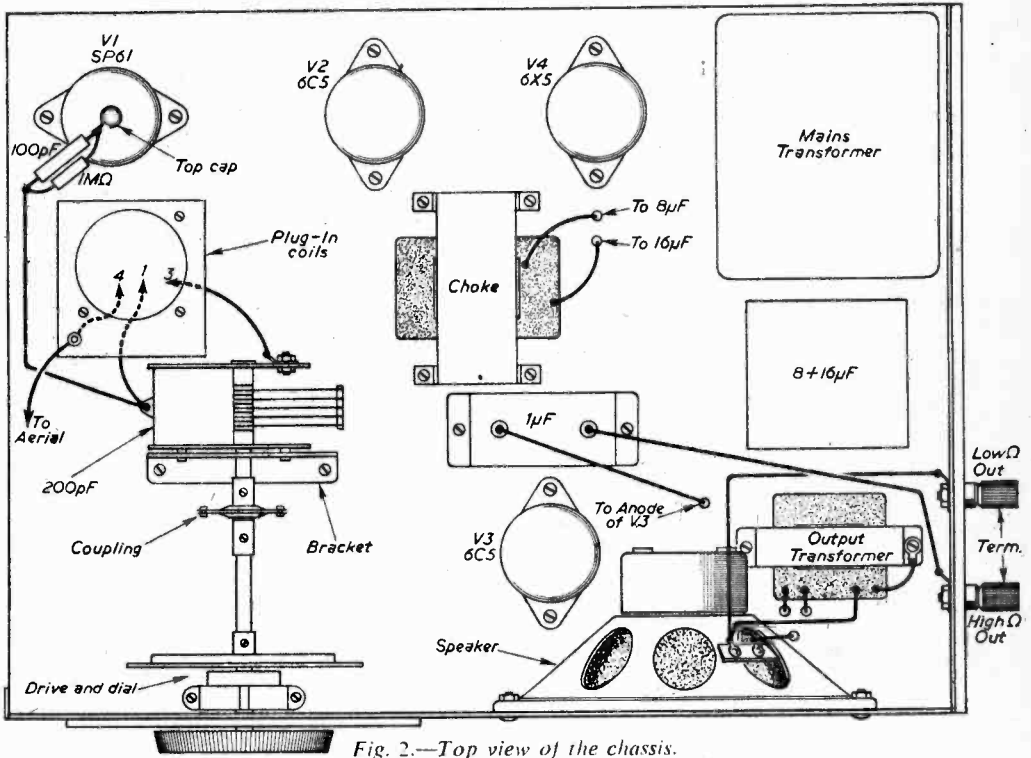


Fig. 2.—Top view of the chassis.

of other output transformers or speakers. It also means that the internal speaker can be used with another receiver, or for test purposes, if necessary.

To produce a R.F. signal, a test prod lead is connected instead of the aerial, and the regeneration control is advanced so that the detector oscillates. The unmodulated R.F. output may be used for aligning the I.F. stages of superhets, or any similar trimming or padding adjustment, with the aid of a tuning indicator. To obtain a modulated R.F. output, the Receiver/Oscillator switch is turned to the oscillate position, and the two A.F. stages then act as an audio oscillator, modulating the detector through the common 47k anode load resistor seen in Fig. 1. This signal will then be heard on a receiver being adjusted for alignment by ear, or by output meter. The tone can be adjusted to some extent by means of the volume control in the generator/receiver.

For testing audio frequency circuits, a test lead can be taken from the high impedance or low impedance output terminals, and applied to various points in the A.F. equipment, working back from the speaker. Turning the regeneration control to zero stops R.F. output.

Power Supply

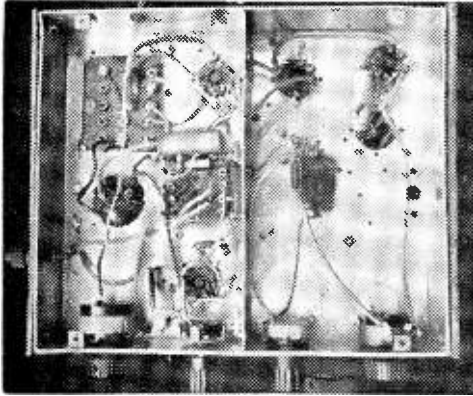
When a power supply is required for other equipment, the detector and A.F. stage heaters can be cut out by means of the heater switch. This leaves available approximately 250V smoothed H.T. at 60mA, and 6.3V at 2A. The

100k resistor serves merely to discharge the smoothing condensers. With external equipment taking only a small current, such as a radio tuner or pre-amplifier, the heaters in the generator/receiver can be left on. The output from the tuner or pre-amplifier may then be taken to the grid circuit of the first A.F. stage, to allow a working check of the tuner or other item, with reproduction through the generator/receiver speaker. A terminal point for this purpose can be provided and connected from the 0.5M volume control, if this is desired. The lead should be screened to avoid picking up hum. Alternatively, it is quite easy to clip the lead to the grid circuit, according to the number of A.F. stages required. For testing pick-ups or similar outputs, two A.F. stages will be sufficient, so that the connection to the 0.5M volume control is best. For very low level outputs, such as obtained from some microphones, all three stages will be preferable, and a screened lead should then be clipped on the detector cap. This should not be left permanently connected because of the stray capacity.

The circuit is shown in Fig. 1, and somewhat similar valve types, or actual alternatives, may be used in the A.F. and rectifier stages. In general, component values are not very critical. The two 0.01μF condensers should be mica, or of high quality as any leakage here will upset the A.F. stages. The coils are described later, and can be wound for any of the bands over which the set is to tune.

Above The Chassis

The layout is shown in Fig. 2, and a fairly large chassis is most convenient. A surplus chassis approximately 9in. x 11in. was used with the unwanted holes covered with an aluminium plate. The type with runners all round is recommended. The panel is of aluminium, 7½in. x 12in., with ½in. flanges bent to fit against the sides of the chassis. This strengthens the panel, and provides a support for the sides, which are 9in. x 7½in. At the rear corners, two angle pieces 7½in. long are fitted, and the sides are similarly bolted to



Underchassis view.

these. The side near the coil and tuning condenser should be left off until wiring to these items is completed. It is also easier to do the output transformer wiring before fitting the right hand side, which also carries the terminals for 6.3V, 250V, and high and low impedance outputs.

The layout is not very critical, provided connections in the detector stage, and including those to coil and tuning condenser, are short. Referring to Fig. 2 (1) is the grid end of the coils, (3) the earthed end, and chassis, and (4) the aerial connection. (The cathode tap lead (2) passes directly underneath the detector.) The plug-in coil holder is mounted on a piece of paxolin, so that the prongs clear the chassis, and this shortens leads to the tuning condenser. A small terminal from point (4) is used to clip on the aerial lead or prod connection.

The tuning condenser is fixed near the coil holder, with a flexible coupling and extension shaft from the tuning drive. The drive should be smooth, with an accurate scale or dial. Many different drives are obtainable, surplus and new. The cheapest is the small ball drive. Others, of more expensive type, will have dials or scales, and may be of two-speed ratio. A scale marked in frequencies or wavelengths is not suitable because it will generally be impossible to match any of the coils with these markings.

It is as well to leave the speaker off until most of the other constructional work and wiring up are finished. Note that one side of the speaker is returned to chassis, and that one set of contacts on the oscillate/receive switch interrupts the circuit

from the other speaker tag to output transformer, as in Fig. 1. The low impedance output terminal is wired to the transformer secondary. The Earth terminal, in contact with the chassis and shown in Fig. 3, acts as return for both low impedance and high impedance speaker outputs, as well as H.T. negative, when the equipment is used as a power supply. The 1µF condenser in Fig. 2 should be 350VW. or similar paper type (*not* electrolytic).

Below The Chassis

Wiring and components are shown in Fig. 3. The chassis used in the prototype had a central screen, but this is not necessary and tends to make wiring a little awkward. The terminals or tags of the mains transformer and large smoothing condenser project through apertures in the chassis.

The heater switch is fixed directly below the speaker, but above the chassis, two leads passing to it from the tag board. This switch must be so connected as to leave the rectifier operating.

The rear of the oscillate/receive switch is shown, this item being mounted on the front runner. One set of tags switches the speaker, as mentioned. The second set switches the output valve anode from speaker transformer primary to 47k resistor. The last set of contacts brings the detector anode circuit to the same 47k resistor, and also allows feedback to the first A.F. stage, to produce oscillation.

The output terminals fixed to the side are all above the chassis, but the common earth return terminal is below the chassis, and passes through

COMPONENTS LIST

Valves:

SP61, two 6C5, 6X5. 4 holders (1 Mazda Octal, 3 Int. Octal).

200pF tuning condenser. Dial and drive.

Fixed condensers:

100pF, 200pF, 0.005µF, two 0.01µF, 0.1µF, 1µF or similar 350VW paper, 8µF, 8-plus-16µF 350VW or similar.

Resistors:

1k, 2.2k, 6.8k, 22k, 33k, two 47k, three 100k, 470k, 1M.

25k pot. 0.5M pot.

3-pole 2-way switch.

Two on/off switches.

Mains transformer: 250-0-250V 60mA, 6.3V 2.5A.

60mA smoothing choke.

Output transformer ratio approximately 50 : 1.

3½in. 2/3Ω P.M. speaker.

Coils and holders, insulated terminals, knobs, etc.

the side runner. Insulated terminals are recommended, and identification marks should be placed near them.

A hole near the detector allows the cathode lead (2), and earth connection (3) to pass up to the coil holder. For 10m use, all leads in the detector circuit, including those to the 200pF and 0.1µF condensers, must be as short as possible.

(To be continued)



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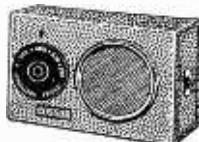
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ELECTRONIC COMPARISON OHMMETER

A ONE-VALVE CIRCUIT GIVING
A LINEAR SCALE

By A. R. Bidwell

(Continued from page 321 of the August issue)

THE previous article was concerned largely with the theoretical aspects of the design. We now deal with the final constructional details and the values of the resistors for the various ranges.

Notes

The accuracy of the unit is determined largely by the accuracy of the "known" resistances. If good quality high stability 1 per cent resistances are used, then this will suffice for most purposes. If

greater accuracy is required, specially calibrated resistances or potentiometers can be substituted.

To obtain accurate zero-setting, reduce the meter potentiometer to zero when the unit is warmed up. Return to maximum again before use. If C2 is of the can or metal cased type with negative taken to the metal, then this casing must be insulated from the chassis. Care must be taken when using the lower ranges to check that the resistance or component under test can accept the relatively high D.C. employed, i.e. 1Ω range—max. 1.5A; 10Ω range—max. 125mA; 100Ω range—max. 12mA; (all approximate values).

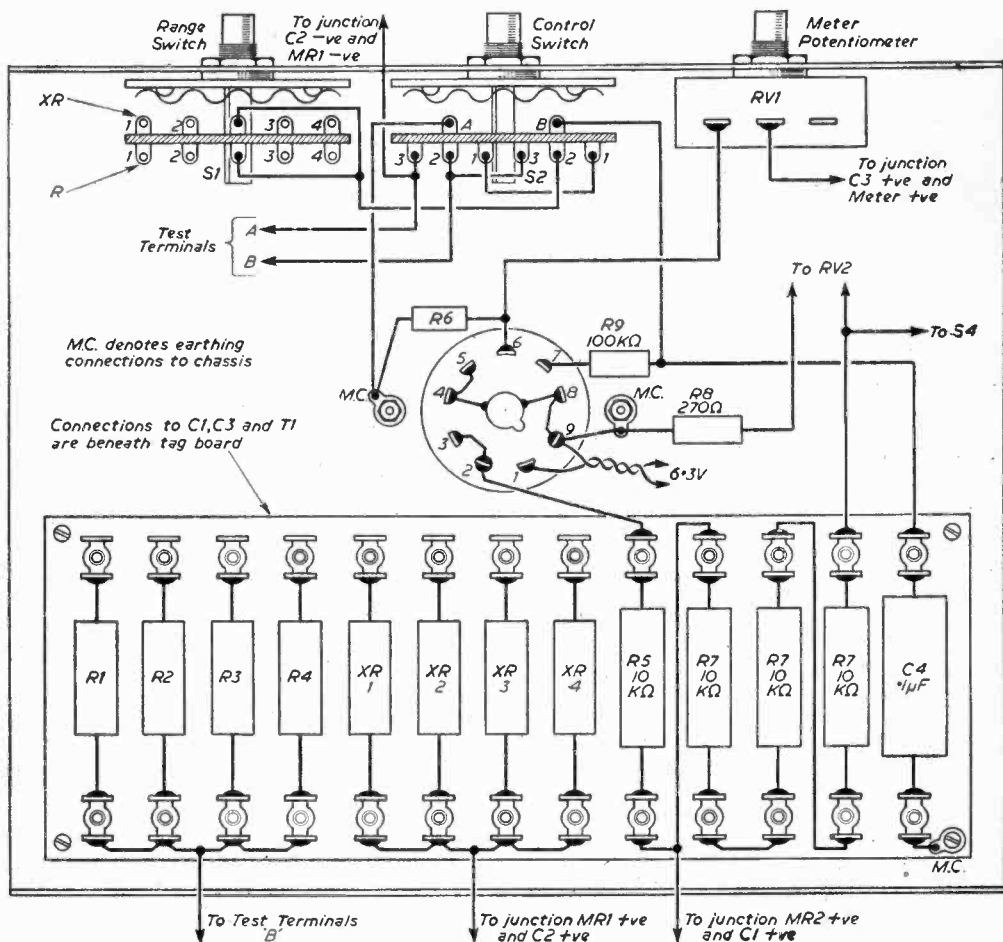


Fig. 7.—Underchassis wiring diagram.

The resistance under test should not be handled during measurement, more especially on higher ranges, as this will introduce errors.

The valve voltmeter described, using the cathode circuit, is remarkably free from drift (after the usual warming up period) and frequent zero adjustment is not necessary. If excessive drift is experienced, a replacement EF50 will very likely effect a cure.

It is possible, by using a two stage valve voltmeter and a low f.s.d. meter, to obtain a very useful "low ohms" reading meter or to reduce the current requirement for the existing low ohms scales i.e. less voltage drop would be required for f.s.d. Drift, however, becomes a difficulty with these conditions and very careful design is necessary.

Practical Details

As this unit is designed around the spares box, constructional details will vary according to the components at hand; but generally, a chassis dimensioned as in Fig. 5 (shown last month) will be quite suitable.

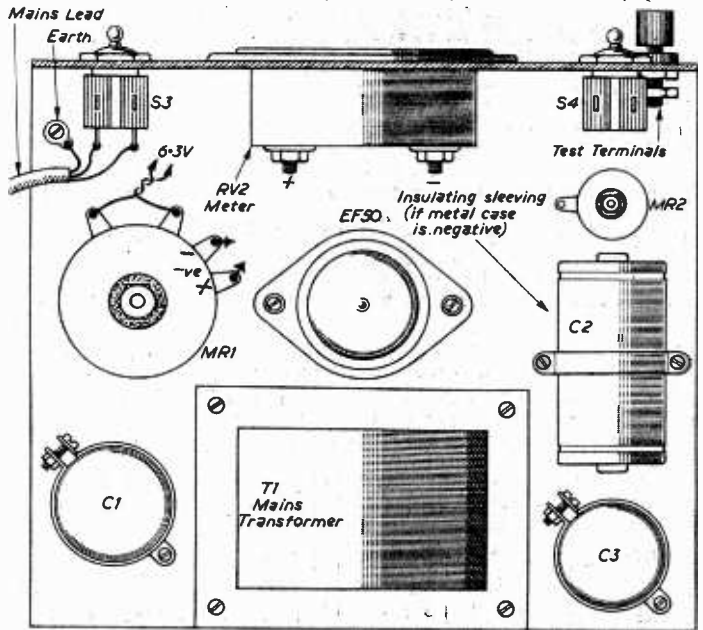


Fig. 8.—The chassis layout.

chassis in the manner of Fig. 8, although the choice of the mains transformer may necessitate slight rearrangement to suit. It should be remembered that condenser C2 must be insulated from the chassis (if it is metal cased). This can be done simply by sleeving with polythene and clipping in the usual way or by mounting it on paxolin or bakelite. The underchassis arrangement is shown in Fig. 7. A terminal board is a convenient and neat way of securing the resistors although it does hide other connections. Components can, however, be soldered directly to the valve base, switches, etc. without much difficulty if the terminal board is not desired. Resistor R9 should be wired directly to the grid pin as shown. During calibration it is convenient to solder flexible leads to the XR 1-4 terminal tags and run them to calibration potentiometers externally until fixed resistor values are determined.

Connections from components C1, C3 and T1 will be accessible under the chassis if drop-through types are used, and must therefore be wired before fixing the terminal board into position. Wiring between top chassis components has been omitted, but is evident from the circuit. The unit may be boxed in with sheet metal and "crackle" finished for effect, but whatever cover is decided upon, ventilation louvres or holes should be provided to dissipate the heat produced by the EF50.

SUGGESTED RESISTOR VALUES

Value of R1, etc.	Value and Type of XR1, etc.
1Ω	0-1Ω Hand wound, tapped coil.
10Ω	100Ω Potentiometer for calibration.
100Ω	1k Potentiometer for calibration.
1k	10k Potentiometer for calibration.
100k	1M Potentiometer for calibration.
1M	5-7M Resistors in series for calibration.
10M	50-70M Resistors in series for calibration.
50M	Not required Shunt 9V D.C. supply with 0-5Ω to give 2V output.

Note: the use of a 4-way switch for S1 as shown in the circuit diagram will enable four of the ranges given above to be used; and 8-way switch would enable all eight ranges to be incorporated.

The front panel layout was shown in Fig. 6. If the zero-set potentiometer RV2 is not available as a midget type, then a cut-out in the chassis below the meter will enable the standard size potentiometer to be used.

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A DECIBEL METER FOR THE BEGINNER

USEFUL FOR SIGNAL STRENGTH REPORTS

By B. Goodwin

MANY novices joining the ranks of short wave listeners will be anxious to contribute their share of signal strength reporting. Accuracy is important in this field if the report is to be of any value. scientific measurement will always be preferred to estimation by the ear.

The Circuit

The simple circuit in Fig. 1 is basically an A.C. voltmeter designed to give readings of the output power of a receiver. The capacitor C block H.T. (see Fig. 2) and must be of high capacity to minimize its impedance. Full wave rectification is obtained with germanium diodes and the meter is 0-1mA to be graduated in decibels.

The Decibel

For readers unfamiliar with this unit, the "decibel" is used to compare sound intensities and electrical power ratios. It is defined as ten times the logarithm of the ratio of two powers, and can be written:—

$$dB = 10 \log \frac{P_1}{P_2}$$

where P1 = input and P2 = output of an amplifier or attenuator.

This expression becomes less fearsome when the original reason for its adoption is considered.

Dealing with amplifier gains in the hundreds caused the power ratio $\frac{P_1}{P_2}$ to become astronomically large. Consider for example two amplifiers of gain 100 and 1,000. expressed in decibels, these would be 20dB and 30dB respectively. Should the two amplifiers be connected in series the total gain would be 50dB, a far more convenient figure than the product of (1000 x 100).

Added to this, difficulty was being experienced owing to the human ear responding logarithmically to different intensities of sound. An increase of loudspeaker output from 8—40mW would seem to the ear identical with the change from 40—200mW. since the power ratio is the same.

Thus by making the expression for gain logarithmic, calculations become easier and a convenient bridge was made between the twin sciences of acoustics and electronics.

Originally the unit was entitled the "bel" written as:—

$$\log \frac{P_1}{P_2}$$

This also proved too large however, so the decibel was introduced, hence the 10 in the first equation. A similar expression can be evolved when dealing with voltages, since

$$P = \frac{E^2}{R} \text{ then } dB = 10 \log \frac{(E_1)^2/R_1}{(E_2)^2/R_2}$$

and by a theorem of logarithms

$$dB = 20 \log \frac{E_1}{E_2}$$

The reader should note that as the decibel is based on a ratio of powers or voltages, a common reference power must be chosen when calibrating the meter.

Calibration

Power in any circuit can be best determined in terms of voltage across a load, this in turn being measured in terms of current.

The circuit in Fig. 2 employs this principle, the voltage drop across R1 the anode load producing a current in the meter M.

The value of this current can be varied by means of R1 and use of this facility will be made in designing the scale. Choosing 1W as the reference power to be represented by the mid-point of the meter scale, the value of R1 corresponding to a current in M of 0.5mA when the power in R1 = 1W must now be determined.

Considering the circuit in Fig. 2 for an output of 1W the voltage across the load can be calcu-

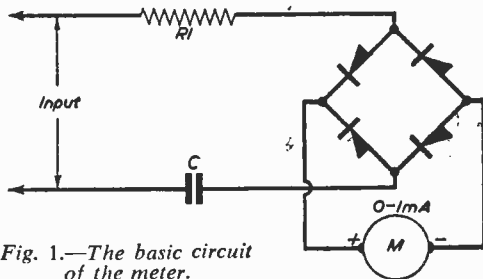


Fig. 1.—The basic circuit of the meter.

lated if the anode load is known as:—

$$P = \frac{E^2}{R} \quad \text{Therefore } E = \sqrt{P \times R}$$

Assuming the valve is operating under the manufacturer's condition the anode load can be found in the valve characteristic tables, for a 6V6 this would be 8,500Ω, thus:—

$$E = \sqrt{(1 \times 8,500)} \quad \text{Therefore } E = 92.2V.$$

Since E is the voltage applied across the meter, the value of R1 to give a current of 0.5mA can be found from:—

$$R = \frac{E}{I} = \frac{92.2}{0.5} = 184,400\Omega$$

A combination of resistors will be necessary to obtain this value, but although every effort should be made to obtain the correct resistance an error of 2,000Ω would still only be 1 per cent.

Having thus fixed a value for R1, the position on the meter scale for a series of wattages can be determined.

For 2W as before:—

$$E = \sqrt{P \times R} = \sqrt{(2 \times 8,500)}$$

Therefore E = 130V.

Since E is the voltage applied across the meter, then with a series resistance of 184.4k

$$I = \frac{E}{R} = \frac{130}{184.4k} \quad \text{Therefore } I = 0.706mA.$$

The decibel level above 1W, the reference power, can also be calculated since

$$dB = 10 \log \frac{P_1}{P_2} = 10 \log \frac{1}{2}$$

The result is therefore (+3)dB.

Similar calculations for other powers will result in Table I.

TABLE I		
dB	Power in Watts	I in mA
-9	0.125	0.076
-6	0.25	0.25
-5	0.316	0.28
-4	0.396	0.31
-3	0.5	0.35
-2	0.593	0.38
-1	0.794	0.44
0	1.0	0.5
+1	1.26	0.55
+2	1.685	0.65
+3	2.0	0.70
+4	2.52	0.79
+5	3.162	0.885
+6	4.0	1.0

The meter scale can now be re-marked according to Table I. The reader may prefer, however, to convert from milliamperes by consulting this chart.

Using the Meter

The meter must be applied across the transformer of the output valve, see Fig. 2, and the gain of the receiver turned to maximum. Should the

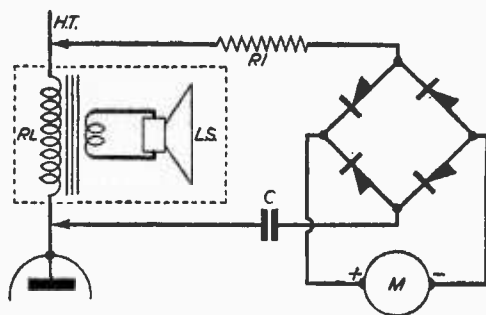


Fig. 2.—Using the meter.

signal be strong, muting of the speaker by substituting a resistor of equal impedance may be necessary; merely switching the speech coil out of circuit will upset the loading conditions of the valve, giving a false reading.

When reporting, readings should be accompanied with details of the receiver's valve line up, and type of aerial. If an R.F. signal generator with a variable output is available, the sensitivity of the receiver and therefore the approximate signal at the aerial can be determined. Short wave listeners thus equipped for scientific measuring will be of great service to the "Ham" world.

Short-wave Listeners' Log - I

NUMEROUS programmes in English from many parts of the world can usually be heard daily on the 25, 31 and 41m bands. As would be expected, these bands are generally of most interest during the late afternoon and evening.

Berne, Switzerland, usually provides a powerful signal on 31 and 41m bands, with news at 8.15 p.m., B.S.T. News comments at 7.45 p.m. from the Swiss station in the 41m band are also in English. Station calls, frequencies and wavelength are given regularly.

Radio Pakistan gives data at 8.30 p.m., using 7010kc/s in the 41m band, and may be heard in the 31m band. Belgrade, using a frequency near 7.3Mc/s may be well received with news at 7.45 p.m. and data on transmissions at 8 p.m. "The Voice of Indonesia" near 9.8Mc/s at 8.15 p.m. is an interesting and fairly easy station to log.

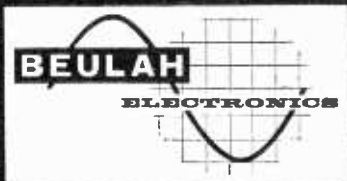
Good reception over long distances is often possible on these bands at this time of day, and Radio Peking using frequencies near 9.4kc/s and 7.1Mc/s can be clearly heard when conditions are reasonably good, at 8.35 p.m. Tuning around 9.5Mc/s at 8.45 p.m. should then bring in Radio Brazzaville, which may also be heard at 6.45 p.m. on 11.75Mc/s in the 25m band. Generally, South African news and reports can be heard at 6.15p.m. on 15.2Mc/s and 25.8Mc/s, in the 19 and 12m bands. Listening on the 17m and adjacent bands between about 8 p.m. and 10 p.m. will usually provide some Dx signals at good strength.

All India Radio, Delhi, can be well received with its programme continuing at 9.45 p.m., near 11.9Mc/s, and gives data at this time. This station may also be heard in the 17 and 31m bands around this time. News from Canada often provides a powerful signal at 9.30 p.m. around 17.8Mc/s in the 17m band. News from Sofia, Bulgaria, may be heard up to 9 p.m. on about 9.7Mc/s, or 30.9m.

A number of USA stations are usually well received. Of particular interest is the news in Special English, from WWSI, Washington, 9 to 9.15 p.m. in the 13m band. This would seem to have developed out of their earlier news items in Basic English, and to some extent this can be recognised by the vocabulary. "The Voice of America" can be well received on many frequencies, such as that near 25.9Mc/s, until 6.15 p.m. Schedules, frequencies, and stations are regularly announced. If necessary, the Special English news mentioned may be listened for around 9.5Mc/s in the 31m band.

If frequency checks are required, for receiver calibration, or to check a harmonic frequency spotter, it should be remembered that these are always available at 2.5Mc/s, 5Mc/s and 10Mc/s. (120m, 60m, and 30m). Reception on the various frequencies varies according to the time of day, but the transmissions can easily be identified by the 1-second pulses, interrupted at the minute, which resemble a clock ticking. The signal is modulated (a BFO is not required), data is announced regularly, and frequency accuracy is extremely high.

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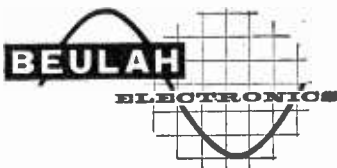
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MODEL AW-1U (in Kit Form).....	£13 18 6
Electronic Switch S-3U/F.....	£15 15 0
MODEL S-3U (in Kit Form).....	£9 18 6

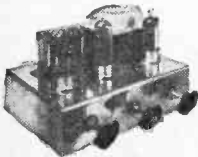
Premier RADIO

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4½ WATT AMPLIFIER KIT
MAY BE
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p. & p.



A new circuit for the home constructor requiring a good quality medium powered Amplifier for reproduction of Records or F.M. Broadcasts. For use with Loud-speakers of 3 or 15 ohms impedance. Technical Specifications: separate bass and treble controls. Valve line-up EF86, EL84, EZ80. Voltage adjustment for A.C. mains from 200-250 volt. Negative feedback. Size 7 x 5 x 2in., overall height 5in. Silver hammered finish Chassis. Instruction Book 1/-.

2-BAND RECEIVER

MAY BE BUILT FOR £5.10.0 plus 3/- packing and postage. This receiver uses the latest type circuitry and supplied complete with easy to follow point-to-point wiring diagrams, suitable for use on A.C. mains 200/250 v. When constructed the Receiver is housed in an attractive walnut finished Bakelite Cabinet or if required, Wooden Walnut Cabinet. Overall dimensions 12 x 6½ x 5½in. Instruction Books available separately. PRICE 1/-.



B.S.R. MONARCH UA8 4-SPEED AUTOCHANGER, £6.19.6
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Avantic SPA11. 10 watts (per channel) combined Stereophonic Amplifier and Pre-Amplifier. Dimensions 14½ x 8½ x 4in.
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BY WELL KNOWN MANUFACTURERS

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A high quality Amplifier and Tone Control based on the Mullard modified circuit, the Power Amplifier is built on a sturdy chassis and both Amplifier and Tone Control are bronze hammer finish. Brief technical details: Valve line-up EZ81, EF86, ECC83, 2—EL84, output 10 watts, output impedance 15, 7.5 and 4 ohms. Dimensions: Main chassis 10½ x 7½ x 6in. Dimensions Pre-amp. 10 x 4½ x 3½in.

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ATTACHMENTS for "18" Transreceivers. ALL BRAND NEW HEADPHONES, 15/6; HAND MICROPHONE, 12/6; AERIALS, 5/-; SET OF 6 VALVES 30/-.

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PACKARD-BELL AMPLIFIERS. Complete BRAND NEW with Valves, Relay, etc., etc., 17/6 each.

QUARTZ CRYSTALS. Types F.T.241 and F.T.243, 2-pin, ± Spacing. Frequencies between 5,675 Kc/s. and 8,650 Kc/s. (F.T.243) 20 Mc/s. and 38.8 Mc/s. (F.T.241), 54th Harmonic, 4/- each. ALL BRAND NEW. TWELVE ASSORTED CRYSTALS, 45/-. Holders for both types, 1/- each. Customers ordering 12 crystals can be supplied with lists of frequencies available for their choice.

QUARTZ CRYSTAL CASES (F.T.241/243) 10/6 per dozen. RECORDING BLANKS. New "Emidisc", ready for use. 13" 6/- each. Or 15 complete in metal case 4/-.

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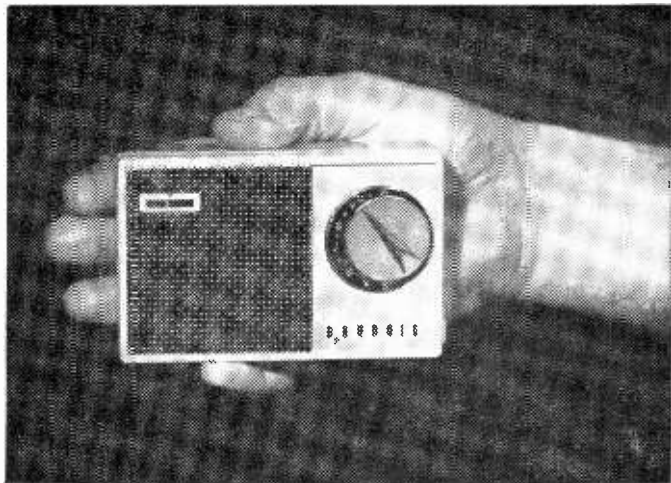
Trade News

NEW PRODUCTS AND DEVELOPMENTS

GRUNDIG POCKET RADIO

A NEW pocket radio is the smallest receiver produced by Grundig to date—the Micro Transistor Boy—weighs only 11½oz and is small enough to fit the average pocket or handbag. It has a high quality loudspeaker, a ferrite aerial, full medium wave coverage and a battery life of approximately 80h. The size is 4½in. x 3in. x 1½in. A miniature 9V battery with press-stud connectors is quickly and easily fitted. The Micro Boy is controlled by two thumb wheels, the first is the On/Off Switch and Volume Control, the second selects the station required.

The radio is available in two colours—a muted grey or flame—both with gilt, and a grey leather loop for carrying. A speaker enclosure containing a larger speaker is also supplied. This slides into the side to form a compact table or bedside radio. The price of these units complete is 25 guineas. The radio is manufactured by Grundig (Great Britain) Ltd., 39/41, New Oxford Street, London, W.C.1.



Grundig's latest pocket radio, the Micro Transistor Boy.

ELECTRONICS CONSTRUCTIONAL KIT

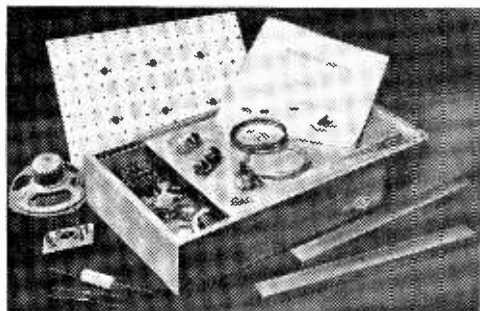
A NEW "do-it-yourself" electronics constructional outfit has been produced by Clarke-Smith Manufacturing Co. Ltd. and Griffin and George Ltd. The Griffin-Clarke-Smith "Mechtronics" apparatus enables pupils to assemble for themselves a large number of experiments and demonstrations illustrating many of the fundamental principles of electronics. The equipment can be used for both qualitative and quantitative work by individual pupils or groups. The complete set, type 97-100, contains valves, transistors, a photo-electric device, transformer,

CARTRIDGE HEATED SOLDERING IRON

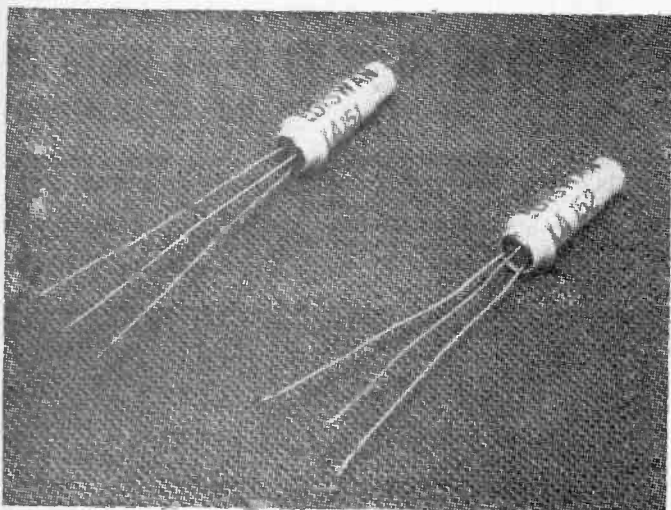
UNLIKE other soldering irons, the Quik-Shot does not require electricity, flame, blow-torch or external heat of any kind. The heat is provided by a patented cartridge which contains 10,000 calories of heat energy supplied by a thermic mixture sealed in a steel shell. The cartridge brings the copper tip up to 862deg F and maintains a steady soldering temperature for 6 to 8 minutes. Continuous soldering is achieved merely by replacing the used heat unit. Further information on the Quik-Shot may be obtained from Jenolite Ltd. (Engineering Supplies Division), 13/17 Rathbone Street, London, W.1.

STEREO RECORD PLAYER

ALL sizes and speeds of stereo and mono records can be played on the new stereophonic record player, Model CR.1800A, announced by Cossor Radio and Television Ltd. The two 6in. diameter loudspeakers have been built so that both can be moved away from the instrument to give a full natural sound effect. When the record player is not in use, the loudspeakers form the lid of the portable cabinet. A stereophonic crystal type pick-up head with turnover cartridge and incorporating two sapphire styli is used and separate volume, tone and balance controls are provided. Retailing at 28 guineas (tax paid), this record player has been produced by Cossor Radio and Television Ltd., 71 Endell Street, London, W.C.2.



The first ever "do-it-yourself" electronics kit, "The Mechtronics."



The new drift transistors from A.E.I.

TRANSISTORS FOR INDUSTRY

AMONG recent A.E.I. introductions for industrial use is a series of drift transistors for switching and communications purposes. In the switching category are the XA141, XA142 and XA143 with minimum f_x 's of 20Mc/s, 40Mc/s and 60Mc/s. For communications purposes the XA131, with a typical f_x of 100Mc/s is also available. Switching versions of the popular XA101 and XA102 are now obtainable, and are specially processed to provide high D.C. Beta's at high collector currents. The type numbers are XA151 and XA152. Further information is obtainable from *Associated Electrical Industries, Ltd., 155, Charing Cross Road, London, W.C.2.*

ADJUSTABLE FERRAMIC POT CORES

A RANGE of adjustable Ferramic T pot cores has recently been placed on the market by The Plessey Co. Ltd. These new cores are available in four grades of high stability Ferramic T material, which between them cover working frequency ranges of from 1kc/s-2Mc/s. Core diameters range from 14mm to 26mm and air gaps from 0.1mm to 0.4mm. There are facilities for inductance adjustment of up to 25 per cent. These pot cores are manufactured by *The Plessey Co. Ltd., Ilford, Essex.*

PHILIPS NEW AM/FM MODEL

MODEL 399U is a table A.C./D.C. model which will receive VHF/FM broadcasts virtually anywhere in the British Isles. It is housed in a dark brown plastic cabinet with an off-white front. This model incorporates six valves, and features of the receiver include an anti-radiation circuit, built-in aerials—with sockets for external aerials—and a large high-efficiency elliptical loudspeaker 6in. x 4in. The dimensions are: height 8½in., width 14in. and depth 7½in. The retail price is 19½ guineas (tax paid). It is manufactured by *Philips Electrical Ltd., Century House, Shaftesbury Avenue, W.C.2.*

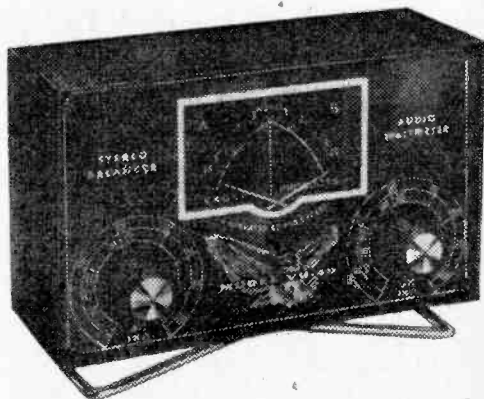
STEREO BALANCER AND AUDIO WATTMETER

A DEVICE from Eagle Products, Model VU-49, provides an accurate visual check on speaker output balance which makes balancing of unmatched amplifiers quite simple. The controls may be set to favour either channel to compensate for room acoustics, unmatched speakers, or listeners' preference. This model incorporates two independent movements, each being connected through a rectifying and compensating network to each stereo channel to provide a continuous comparison of speaker levels. Matched meter readings denote balanced outputs to the speaker systems. Model VU-49 is an accurate audio wattmeter for monitoring audio outputs. It is an ideal recording level indicator for tape recorders and other features of the audio wattmeter are of aligning A.M. and F.M. receivers and testing the frequency response of audio amplifiers. This model retails at 7 guineas, size 6½in. x 3½in. x 4½in., and is manufactured by *Eagle Products, Eagle Works, 32a Coptic Street, London, W.C.1.*

response of audio amplifiers. This model retails at 7 guineas, size 6½in. x 3½in. x 4½in., and is manufactured by *Eagle Products, Eagle Works, 32a Coptic Street, London, W.C.1.*

T.C.C. INSULATED CONDENSERS

AN entirely new range of insulated condensers has been announced by The Telegraph Condenser Co. Ltd. These condensers are of foil and paper dielectric non-inductively wound and impregnated with the T.C.C. "Visconol-X" compound which improves the performance of paper insulation by inhibiting ionisation and checking the fall in insulation resistance following temperature rises. The elements are housed in epoxy-phenolic resin bonded fibre-glass, with end seals of rock-hard setting "Plimoseal." Further details of these condensers may be obtained from *The Telegraph Condenser Co. Ltd., North Acton, W.3.*



Model VU-49, Stereo Balancer and Audio Wattmeter.

**"Basic
Electricity"**

LOTS & LOTS of

TINKERS, TAILORS,
SOLDIERS, SAILORS,
AIRMEN, APPRENTICES & *Ordinary Chaps*
like You and Me Are Learning
BASIC ELECTRICITY & BASIC ELECTRONICS



**"Basic
Electronics"**

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Why don't you too?

Read what HOBBIES WEEKLY says:—

- ◆ " . . . such a wonderful means of learning . . . "
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BASIC ELECTRICITY (5 PARTS) — BASIC ELECTRONICS (6 PARTS)
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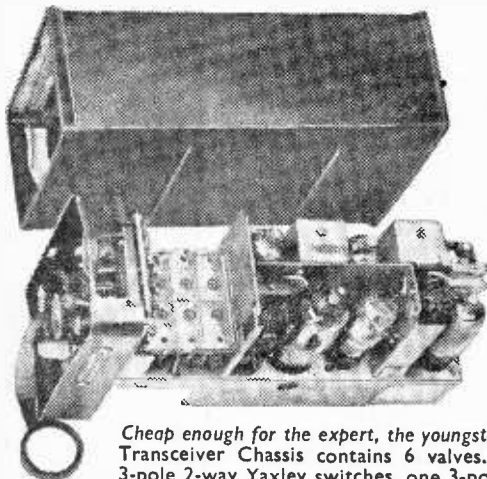
In preparation BASIC RADAR (5 PARTS) *Ready 1961*

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FANTASTIC UNREPEATABLE OFFER!



**No. 46 TRANSCEIVER CHASSIS
AND
2 PAIRS DLR5 MOVING COIL
HEADPHONES AND 2 THROAT
MIKES.**

ALL NEW AND UNUSED
WORTH AT LEAST £4.10.0

OUR PRICE **35/-** THE LOT
Carriage paid G.B.

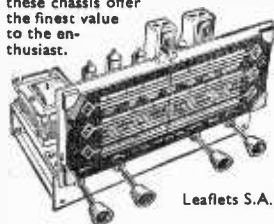
Cheap enough for the expert, the youngster or anybody to play with. Note gentlemen. The No. 46 Transceiver Chassis contains 6 valves. Two VP23, ATP25, HL23, DD; QP25, ATP4. Two 3-pole 2-way Yaxley switches, one 3-pole 3-way Yaxley switch, output and mic. transformers, 50 P.F. tuning capacitor and numerous useful resistors and capacitors. Build up is Superhetrodyne circuit I.F. 470 K/cs, 3 channel switching, crystal controlled. One switch removed to comply with Ministry regulations, no crystals. **WE CHALLENGE YOU TO BEAT THIS OFFER FOR PRICE!**

BUSHELL'S 46-52 BREARLEY STREET, BIRMINGHAM 19. ASTON CROSS 3556-7

KINGSMERE SUPPLIES LIMITED

Insured Post 1/-, over £2 Free. (Export extra.) MAIL ORDER HOUSE TERMS: Remit with Order or C.O.D. Single valves, post 6d. Cash refund guarantee!

Built to the highest specifications, these chassis offer the finest value to the enthusiast.



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ALL BRITISH RADIOGRAM CHASSIS. 3 WAVEBANDS 5 MULLARD VALVES
ECH81, EF89, EBC81, EL84, EZ80
Brand new and guar. A.C. 200/250 v. Short - Medium - Long Gram. P.U. High Q dust core coils. Latest circuit technique. AVC and neg. feedback. 4 watts. Chassis size 13 1/2 x 6 x 7 1/2 in. high. Aligned and calibrated ready for use. Quality at Low Cost. Chassis isolated. H.P. Dep. £5 and five monthly of £1.

OUR PRICE **£9.90**

Matched Speakers, Sin., 6 1/2 in., Bin., 17/6 ea. 10 in. 25/-.



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GARRARD 4-SPEED HIGH FIDELITY UNITS

Autochanger 121 Mk.11 £9.19.6
Single Player TA Mk.11 8 gns. } Price inc. plug-in, normal heads. Stereo hds. £2 ex.
Transcription 4 HF 17 gns.

BRAND NEW

OZ4	6/-	6BA6	7/6	6SJ7M	6/6
IR5	7/6	6BE6	7/6	6SN7GT	6/6
IS5	7/-	6C4	5/-	6U5G	7/6
IT4	6/-	6D6	6/-	6V6G	6/6
2X2	3/6	6F6G	7/6	6X5G	6/-
3Q5	9/-	6G6	5/6	12A7	8/-
3S4	7/6	6H6	3/6	12AU7	7/6
3V4	7/6	6I5	5/6	12AX7	7/6
5U4	7/6	6I6	5/6	12K7GT	6/6
5Y3G	7/6	6I7G	6/6	12Q7GT	6/6
5Z4G	9/6	6K6GT	6/6	25Y5G	9/6
6AC7	5/-	6K7G	5/-	35L6	9/6
6AG5	5/-	6K7M	7/6	35Z4	7/6
6AL5	5/6	6K8G	7/6	807	5/6
6AN6	5/-	6N7M	6/6	954	1/6
6AT6	7/6	6Q7G	7/6	956	2/6
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VALVES

Matched Pairs 1/- extra

DF96	9/6	EL41	9/-
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EAB80	8/6	EY51	9/6
EB91	5/6	EY86	10/-
EBC41	8/6	EZ40	7/6
EBF80	10/-	EZ80	7/-
ECC84	9/6	E1148	1/6
ECH42	10/6	HABC80	
ECL80	10/6		
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EF39	5/6	HVR2A	6/-
EF41	9/6	KT33C	10/-
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PLASTIC RECORDING TAPE

PCL82	11/6	7in. reel, 1,800 ft.	32/6	7in. reel, 1,200ft	21/-
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PY81	9/6	5in. reel, 850ft.	19/6	5in. reel, 600ft.	15/-
PY82	7/6	3in. reel, 225ft.	7/6		
PY83	9/6	Spare Plastic reels all sizes ... 3/-			
QP25	7/6	"Instant" Bulk Tape Eraser and Head De-fluxer, 200/250 v. A.C., 27/6. Leaflet, S.A.E.			
R3	9/-				
SP61	3/6				
UF41	9/-				

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24/6	IR5, IT4, IS5, 354 or 3V4.
29/6	DK96, DF96, DAF96, DL96.
29/6	6K8, 6K7, 6Q7, 6V6, 5Z4 or 6X5.
39/6	ECH42, EF41, EBC41, EL41, EZ40.
39/6	ECH81, EF89, EBC81, EL84, EZ80.
39/6	12K8, 12K7, 12Q7, 35L6, 35Z4.
39/5	UCH42, UF41, UBC41, UL41, UY41.
39/6	UCH81, UF89, UBC81, UL84, UY85.

25 FOAMCOURT WAY, FERRING, WORTHING, SUSSEX

Club News

REPORTS OF CURRENT ACTIVITIES

AMATEUR RADIO MOBILE SOCIETY

Hon. Sec.: G. E. Storey, 10 Avon Road, Sunbury-on-Thames, Middlesex.

On June 19th a Mobile Meeting was held at the U.S.A.F. Transmitter Site at Barford St. John, Oxfordshire. The Annual General Meeting was held on June 25th and was well attended. Eleven new members have enrolled during the last month.

BLACKWOOD AMATEUR RADIO CLUB

This is a newly formed club which will meet every Friday evening at 7-9.30 p.m. at the Blackwood Miners' Welfare Institute. It is intended to hold courses for the R.A.E. and G.P.O. morse test. Interested parties should contact Mr. P. M. Fulton, 36 Sunnybank Road, Blackwood, Mon.

BRADFORD AMATEUR RADIO SOCIETY

Hon. Sec.: Michael T. Powell, G3NNO, 28 Gledhow Avenue, Roundhay, Leeds 8.

On June 14th the club visited the Holme Moss TV station and on June 28th a meeting was held to arrange the syllabus for the coming session. Broadcasting House, Leeds, was visited by the club on July 12th and an informal evening was held on July 26th.

Future Events:

August 16th.—Informal Evening.
September 6th.—First meeting of the new session.
Meetings are held at 7.45 p.m. at Cambridge House, 66 Little Horton Lane, Bradford 5.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: F. C. Ward, 5 Uplands Avenue, Littleover, Derby.
Meetings are held at the College of Art, Green Lane, Derby.

Future Event:

August 14th.—Third annual mobile rally at Rykneld School.

HALIFAX AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Orden, Halifax.

On June 14th Mr. G. Sunter gave a lecture on "Workshop Practice". June 28th was an informal evening and on July 5th the club held a discussion on the arrangements for a demonstration station at the Halifax Agriculture Show to be held on August 12th, the call sign which will be used is G3MDW/A.

Future Events:

August 16th.—Informal Evening.
August 30th.—A talk by G3JKD on "Printed Circuits".
September 6th.—A recorded talk on "St. Pierre and Miquelon De-Expedition", by WIPFA given by G3LD.

INTERNATIONAL RADIO CONTROLLED MODELS SOCIETY

Hon. Sec.: R. F. Pratt, 87 Gloucester Road, Coventry Warwickshire.

On August 21st the I.R.C.M.S. will hold their annual contest for radio-controlled model aircraft at R.A.F. Wellesbourne, Mountford, near Stratford-on-Avon. There are three classes. Single Channel, Intermediate and Multi-channel. Prospective entrants should write to A. E. Newby, 56 Lime Avenue Leamington Spa, Warwickshire.

INTERNATIONAL SHORT WAVE RADIO

Hon. Sec.: Arthur E. Bear, 100 Adams Gardens Estate, London, S.E.16.

The Secretary has informed us that he would be pleased to send a specimen copy of "International Short Wave Radio" to any reader who may be interested.

LEEDS AMATEUR RADIO SOCIETY

Hon. Sec.: D. Dinsdale, 69 Spen Lane, Leeds 16.

The club's amateur radio station is G3BEW. At the Annual General Meeting on June 1st, Mr. W. Dixon was elected President and Mr. D. Tong, Chairman. Mr. W. Ripley was re-elected Treasurer and Mr. D. Dinsdale, Secretary. A new committee was also elected and a programme is being arranged for the 1960-61 session. The first meeting will be held on Wednesday, September 21st, at Swarthmore.

LIVERPOOL AND DISTRICT AMATEUR RADIO SOCIETY

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

Meetings are held every Tuesday at Gladstone Hall, Queen's Drive. On July 14th to 18th the Liverpool Show was held. On July 26th a talk was given on Electronics in Hospitals. At the Liverpool Show, separate H.F. and L.F. stations operated 24 hours per day and a special call sign, GB2LS, was used.

MITCHAM AND DISTRICT RADIO SOCIETY

Hon. Sec.: M. Pharrah, G3LCH, 1 Madeira Road, Mitcham.
The second 144Mc/s Field Day was held on July 3rd. Considerable interest is being shown in running a multi-operator entry in the next CQ DX contest. No final details have yet been arranged and further details will be given in due course.

Future Events:

September 23rd.—Talk by G3JG on "Single Sideband".
November 18th.—Talk by Collins Radio Co. on their equipment.

PETERBOROUGH AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: D. Byrne, G3KPO, Jersey House, Eye, Peterborough.

Meetings are held on the first Friday in each month at Peterborough Technical College. The "Bucket and Spade" party and Mobile Rally held at Hunstanton in July proved a great success and attracted over 60 licensed amateurs and SWL's from all over East Anglia. Members are now busy putting their new riverside HQ in order—it has been generously given for their use by a local benefactor.

THE READING AMATEUR RADIO CLUB

Hon. Sec.: R. G. Nash, G3EJA, "Peacehaven", 9 Holybrook Road, Reading.

The June meeting was well attended and VQ1WVR gave a very interesting talk on amateur affairs in his district, including a description of the national emergency arrangements in which they participate. This was followed by a junk sale for the benefit of Club funds. A 2m Field Day was held on July 3rd under call sign G3FKH and a good score was reached. At the meeting on July 30th a recorded lecture was given.

Future Event:

August 27th at 7.30 p.m.—A lecture on "Transmission Lines" by G3GHE.

COURSES OF INSTRUCTION, ETC.

BATTERSEA MEN'S INSTITUTE

Principal: G. A. Stevens, Latchmere Road, Lavender Hill Battersea, S.W.11.

A course for the Radio Amateurs' Examination will be held at the Spenser Park section of the Institute next session. Classes will be on Wednesday evenings from 7.30 p.m. to 9.30 p.m., commencing September 28th and the course will be arranged to enable students to sit the City and Guilds examination in May 1961. The fee for the session is £1 0s. 0d. for students over 21 with reductions for students under this age, and old age pensioners. There are also classes in General Radio and Short Wave Radio on Tuesdays and Fridays. A short wave club functions at the school.

GLASGOW FURTHER EDUCATION DEPARTMENT

Allen Glens School, Montrose Street, Glasgow.

During the 1960-61 session the following classes will be held. R.A.E. Course, Tuesday evening, 7-9.30 p.m., Theory. Thursday evenings, 7-9.30 p.m., Morse code. General Radio Course, Thursday evenings, 7-9.30 p.m., Theory.

Enrolment for both courses will be at the school during the week commencing September 12th, 7-9 p.m., Monday to Friday. The courses start the following week. The R.A.E. course is to prepare students for the Radio Amateurs' Examination to be held in May 1961. No previous knowledge of radio is necessary to either course.

WANSTEAD YOUTH CENTRE

Classes for radio amateurs, leading up to the examination for a transmitting licence and for general advancement in amateur radio knowledge, will be held at Wanstead Youth Centre. Classes will include Morse practice and are designed to help young people and adults to take up radio as a hobby. Enquiries concerning enrolment should be made to K. Smith G3JIX, 82 Granville Road, Walthamstow, London E.17 or The Warden, Wanstead Youth Centre, Nightingale Secondary School, Wanstead, on or after September 1960.

Letters to the Editor

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

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

A.C. OR A.C./D.C.?

SIR,—You commented some time ago on continental wiring and suggested some law to control the mains connections to avoid danger or risk of shock. I feel that the time is ripe for a law to be introduced to make it illegal to sell A.C./D.C. apparatus. As one side of the mains is joined to the chassis there is always the risk of contact with the mains with fatal results, and in these days, the sale of amplifiers, tape decks, record players and other odd items, some of which may be A.C./D.C. renders the assembly of a complete radiogram or tape recorder a very risky business, and I know several amateurs who have cried off from modern apparatus because it is difficult to obtain equipment which is reasonably "safe".—F. R. ALDIS (Newmarket).

RADIO PARTS

SIR,—I am 14 and wish to correspond with other amateurs.

Concerning Mr. Immelman's letter, I consider him lucky. In Germany there are no Government radio surplus or even spare parts where I live. This puts me back as the postage on things advertised in various magazines is fantastic. Also one wants to see what one is buying.

People ought to be thankful in Britain as where I live many a grumble comes from us amateurs when we have to fiddle around with the same old parts.—T. LAMB (64, O.M.Q., R.A.F. Bruggen, B.F.P.O.40, Germany).

TRANSISTORS v. VALVES

SIR,—I have been following, for several months, the Valves v Transistors controversy which has figured so prominently in recent issues. Some points raised by protagonists of valves, and by protagonists of transistors are quite sound, but nobody has presented quite such an ill-assorted set of reasons why he does not like transistors as your correspondent D. J. L. of Kenton.

I expect that many radio enthusiasts felt as strongly as I did when I read that there was "not enough information re transistors to make them really interesting." This is a complete misrepresentation of the facts since if your correspondent looked more carefully through his copies of "PRACTICAL WIRELESS," then he would see that there have been many advertisements which mention several excellent books on

the subject—and I dare say that if he browsed around his local radio parts shop, he would find an even greater range.

The technical information department of many manufacturers of semi-conductive devices are usually only too glad to help amateurs with information on the performance and circuit applications of their products. I suggest that he writes to one or two. For the cost of a 3d. stamp, and envelope and paper he would have, almost by return, a wide range of information—enough for anyone!

His second point, that the designs so far published are for the wrong class of reader is likewise, in my opinion, quite invalid. A quick glance through past issues of P.W. and other radio and sound magazines will show that the designs published so far include a tremendous variety of equipment, even down to a transistorised tape recorder/amplifier. Tone control circuits have been quite widely described in various magazines and papers—if D. J. L. cares to do a bit of "digging" for them, which may or may not be necessary; likewise "mid" or "Hi-fi" amplifiers. Many transistorised miniature radios give better quality of sound than do their mains counterparts—even at the 250mW level! The public wanted personal portables, and now they have them! They were never intended as Hi-fi sets. For anything like that you must employ larger loudspeakers and more substantial output transformers. The average 2½-in-3-in. speaker as used in respect has a cut-off round about 150c/s or so depending upon the make, so you cannot expect to have the lower frequencies reproduced as well—hence the rather shrill, but not unpleasant, tone of the average miniature.

One final point. Transistors are certainly not treated as toys in industry. One finds them in computers, guided missiles, servo-mechanisms, communications equipment, public address and scores of other applications, and transistorising has meant, in many cases a dramatic reduction in size and weight, and reliability under adverse conditions has been increased.—P. D. COKER (Exeter).

PRINTED CIRCUITS

SIR,—I had always accepted the common assertion that the removal of multi-contact components from printed circuit boards was impracticable, until I succeeded in removing one as the only alternative to throwing the board away.

I promised to align a friend's printed circuit transistor radio, built from a well-known and excellent kit. Finding the mixer-oscillator stage dead, I soon found that the oscillator coil carrying three windings and six pins had been inserted in the board the wrong way round. Throwing the set away was clearly out of the question, the coil must be removed somehow.

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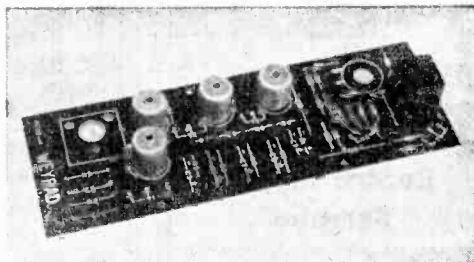
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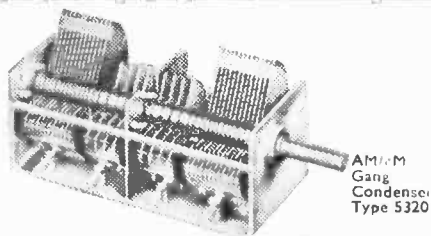
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I finally adopted the following method:—a small screwdriver was inserted between the coil base and the board, and the two pins between which this wedge was placed were bridged on the other side of the board by the bit of a 25 watt iron. As the solder on the pins melted it was found possible to lever them a little way out of the board with the screwdriver, and the solder was allowed to cool with the pins in this position. The other two pairs of pins were then treated in the same way, using a bent lever, since other components were in the way of the screwdriver.

In this way the coil was moved a little way out of the board, and was finally removed after this treatment had been repeated three or four times. The whole operation took about 15 minutes.

I fully expected the coil connections to be damaged by the repeated heating, and was worried that the foil might lift from the board. In fact neither of these things occurred, and the resoldering of the coil the correct way round cured the original trouble, and when the alignment was completed I considered that the set was the best portable radio I had ever heard.

Can it be that printed circuits and miniature components are much more robust than we have been led to believe?

I hope that this account may be helpful to others who find themselves in a similar predicament, and who are not keen on throwing a printed circuit board away because of one so-easily-made mistake.
—D. M. PAYNE (Norwich).

COIL WINDING

SIR,—I follow with extreme enthusiasm the articles in which coil windings for valve receivers are given for the reader who likes to amuse himself winding his own coils. However I have never come across a medium wave aerial and anode coil such as used in modern T.R.F. Receivers described.

I would be much obliged if any of your readers can give me hints or any information how to wind such coils for use with twin gang 0-0005 tuning condensers.—J. CONSIGLIO (31 Lytton Street, Glenroy, W9, Australia).

TRANSISTOR REFLEX RECEIVER

SIR,—I would like to apologise for the error that occurred in the February instalment of "A Transistor Reflex Receiver." The number of turns for L1, which should have been 43, appeared in print as 33.

Some readers in strong reception areas have written to express difficulty in winding L2 in this receiver so as to give the exact degree of sensitivity required. The following technique has been found to simplify this part of the construction.

Prepare a sleeve of thin card to fit the ferrite rod so that it will slide along freely. This should be half the length of the rod used. Wind 30 turns evenly along the whole length of this sleeve in an open spiral. Secure both ends of the coil by adhesive or other means. Place the tip of the coil over the end of the rod and move the sleeve on gradually while testing for results.

When the correct degree of sensitivity is reached, the sleeve should be secured at that point with Sellotape, whether it is fully on the rod or partly off it.

This method will save much time.—D. B. PITT (Nottingham).

GRID DIP OSCILLATOR

SIR,—Some queries have arisen about the Grid Dip Oscillator published in the August 1960 issue of "P.W."

I have already received a letter from a Scottish reader keen to build the G.D.O. but he had doubts about the diameter of the formers. These are Aladdin 0.3in. diameter.

Also I noticed an inadvertent error in the Coil Table. The frequency range of the VHF loop was marked "20-17Mc/s." This should of course have read "95-170Mc/s" (as indicated on the scale in Fig. 4).—K. SMITH (G3JIX).

INTERFERENCE

SIR,—I see my letter published in the March issue has caused some comments.

As regards Mr. Hutchins, I am well aware of International Frequency allocations, but how many countries have kept to them?

I have perhaps overdone the interference caused by morse. A lot depends on the Rx and local conditions as we all know. I notice Mr. Hutchins has nothing better to offer, unlike Mr. Hallahar who suggests the system of SSB. The whole fact of the matter of course, is that the medium waveband is too small. There will have to be some very, very big changes soon.—M. REYNOLDS (Nailsea).

19 SET

SIR,—There seems to be some confusion as to the various forms of W/S No. 19. I show some of the different forms below.

W/S 19 Mk 2.

The common one on the market. Fitted with P/B "NETT" button, NO RF gain, one-speed tuning, frequency drift not satisfactory.

W/S 19 Mk 3 (British).

Fitted with R.F. gain, switched "NETT," 2-speed slow motion tune, "A" on/off instead of "A only-All." Het. tone control 3,000-0-3,000c/s, C.W. filter in A.F. amp. less frequency drift, bias is different, spurious radiations less in TX, better R.F. coils, local oscillator circuitry altered. If used with 12V P.U. battery saving is greater than Mk 2.

W/S 19 Mk 3 (Canadian).

Same as British Mk 3 but fitted with "Flick Adjustment Control," even greater saving of battery but smoothing not as good as British Mk 3.

One word of warning, do not slacken off the flick screws, which are situated on both the "A Tune" and "PA Tune," more than $\frac{1}{4}$ a turn as these screws are very difficult indeed to put back into position if they are removed. — J. HEWSON (Chalfont-St.-Giles).

INFORMATION WANTED

SIR,—Could any reader please supply 2 Lissen 'PTZA' battery valves? I believe they were used in many Lissen Q.P.P. circuits including the 'Skyscraper 4'. I would be grateful to hear from anybody willing to dispose of 1 or more of these valves.—K. MUSCUTT (5 Tilbury Road, East Ham, London E.6.).

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Set of 4-Piece Two-way Screwdrivers in case. All Metal Plane. Junior Hack saw. 10/6. p. & p. 1/9.

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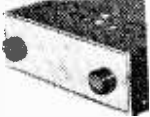
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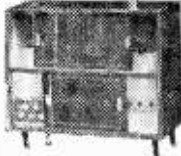
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4 150	100 25	1 1/2 x 1 W	1/1	1/1	15 20	20 450	1 x 3 C	3/1	3/1	100-300	275	1 1/2 x 4 C	1/1	4/1
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8 25	100 25	1 1/2 x 1 W/R	1/3	1/3	20 20	450 1 x 3 W	3/1	3/1	3/1	150+30	350	1 1/2 x 4 C	1/1	4/1
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8 200	100 275	1 1/2 x 1 W/R	1/1	1/1	30 30	150 1 x 1 1/2 P/B	1/1	1/1	1/1	16+18+4	275	1 x 2 C	2/6	2/6
8 250	100 275	1 1/2 x 1 W/R	1/3	1/3	35 35	150 1 x 2 C	2/6	2/6	2/6	16+18+15	275	1 x 2 C	2/6	2/6
8 275	100 350	1 1/2 x 2 P	1/6	1/6	35 35	150 1 x 2 W/R	1/1	1/1	1/1	16+18+15	450	1 x 3 P/S	3/6	3/6
8 450	150 150	1 1/2 x 1 W/R	1/3	1/3	35 35	150 1 x 3 P	1/1	1/1	1/1	20+80+20	250	1 1/2 x 2 P	1/1	1/1
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12 150	250 25	1 1/2 x 1 T	1/1	1/1	40 40	150 1 x 2 C	1/1	1/1	1/1	32+32+8	250	1 x 2 C	2/6	2/6
12 275	250 25	1 1/2 x 1 W	1/3	1/3	40 40	275 1 x 2 C	1/6	1/6	1/6	32+32+25	250/25	1 x 3 C	2/1	2/1
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20 150	500 6	1 1/2 x 1 C	1/6	1/6	50 50	200 1 x 2 P	1/1	1/1	1/1	40+80+20	150	1 x 2 C	1/1	1/1
20 430	500 6	1 1/2 x 1 T	1/6	1/6	50 50	250 1 x 2 P	1/1	1/1	1/1	40+40+12	275	1 x 2 C	2/6	2/6
25 12	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 2 P	1/1	1/1	1/1	40+40+20	275	1 x 2 P	3/1	3/1
25 15	500 12	1 1/2 x 1 M	1/4	1/4	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 C	1/6	1/6	50 50	275 1 x 3 PC	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 T	1/3	1/3	50 50	275 1 x 3 C	1/6	1/6	1/6	40+40+20	300	1 x 2 P	3/1	3/1
25 50	500 12	1 1/2 x 1 W	1/3	1/3										

SELENIUM RECTIFIERS

F. W. BRIDGE	H.T. Types H.W.
6/12 v. 1a... 3/11	150 v. 40 m.a. ... 3/9
6/12 v. 2a... 6/11	250 v. 50 m.a. ... 3/10
6/12 v. 3a... 9/9	250 v. 60 m.a. ... 4/11
6/12 v. 4a... 12/3	250 v. 80 m.a. ... 5/11
6/12 v. 6a... 15/3	250 v. 250 m.a. ... 12/9
6/12 v. 10a... 25/9	CONTACT COOLED
6/12 v. 15a... 35/9	250 v. 30 m.a. H.W.
24 v. 2a... 14/9	6/11. 250 v. 75 m.a.
24 v 15 a... 29/9	F.W. 'Bridge' 9/11.

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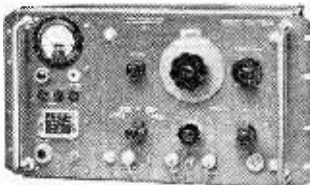
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Suitable polished veneered walnut carrying case for above 39/8.

RELAYS. Carpenters' Type, Polarised. 2 times 9,500 turns at 1,685 ohms, 19/6. Miniature Moving Coil Differential Type. Single pole 2-way, or centre stable. Two coils each 350 ohms. Minimum operating current 140 micro-amps, nominal 400 micro-amps maximum 8 milli-amps. Two way contact current 100mA at 50 v. A.C. or D.C. Size 1 1/2 x 1 1/2 in. approx., 19/6. Miniature Type G.E.C. 670 2M 2B H/D M1095, 7/11.

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 300-0-300 v. 100 m.a. 6.3 v. 2 a. 5 v. 2 a. 11/9
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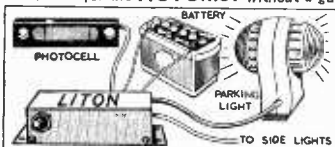


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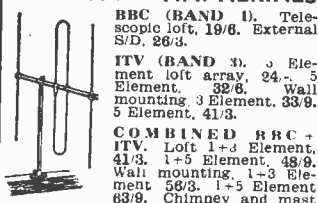
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1.5 v.	75 v.	150 ma.	750 ma.
3 v.	150 v.	300 ma.	1.5 amp.
15 v.	300 v.	1.5 amp.	7.5 amps.
30 v.	600 v.	3 amps.	15 amps.
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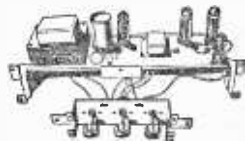
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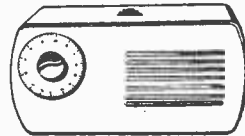
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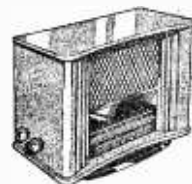
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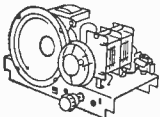
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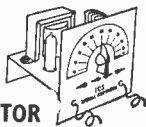
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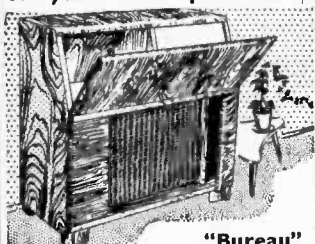
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by F. J. Gamm



Contents Include Simple Steering Control Gear: A Single-valve Super-regenerative Receiver: A Two-valve Transmitter for Radio Control: Control Box: Wavemeter, Interference, Layout: Obtaining a Second Channel Using the "Mark/Space" System: A Proportional Steering Circuit and Reversible Sequence Engine Control Gear: Radio-controlled Boat using a Glow-plug Engine and an Electric Motor in the Power Unit: A Six-valve Super-heterodyne Receiver for Model Control: A Single-valve Crystal-controlled Transmitter: Radio Control for Model Aircraft (Sequence System): Tuned Reeds and Audio Control: More About Model Actuators: Tuning Model-control Transmitting Aerials: A Bulb Model-control Frequency Meter: An Auto-switch for Model-control Transmitters: A Radio-controlled Model Battleship: Building a Radio-controlled Model Aircraft.

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