

BUILDING AN AMATEUR COMMUNICATIONS RECEIVER

PRACTICAL ^{1/3} WIRELESS

JUNE
1957

EDITOR: F.J. CAMM



*Making an
Electronic
Timer*

CERAMICS

for all electronic applications

Silvered Ceramic Condensers cover a variety of useful shapes, including Pearls, Discs, Beads and Tubes, and have many applications in R.F. circuits — particularly where ultra-high frequencies are present, when their low inductance and excellent power factor are of special advantage. A wide choice of negative and positive temperature co-efficients permits the temperature compensation of other components, and frequency stabilisation of tuned circuits.

HI-K CERAMIC DISCS

for decoupling purposes in T.V. and spark suppression in small electrical apparatus—extremely low inductances. Up to 10,000 pF at 500 v. D.C. working. Finished in a moisture-resisting compound that does not soften or crack up to 100°C.

LOW-K TUBULARS

with the choice of four temperature co-efficients and a wide range of capacity values, serve many purposes in general circuitry.

HI-K TUBULARS

combine high capacity with small physical size: used widely as by-pass condensers in T.V. and other H.F. receivers where low inductance is of special value.

LOW-K PEARLS

of up to 10 pF capacity and LOW-K DISCS of up to 50 pF. with high negative temperature co-efficient permitting compensation of other components and frequency stabilisation in tuned circuits.



THE TELEGRAPH CONDENSER CO. LTD

RADIO DIVISION: NORTH ACTON • LONDON • W.3 • Telephone: ACORN 0061

HIGH FIDELITY AT REALISTIC COST!

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Range 12" Unit
14,000 gauss
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Unit. 16,000 gauss
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High Fidelity
Amplifier
Price £25

Ready to assemble
Cabinets from
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TV and Record Storage
Cabinets
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HOME RADIO OF MITCHAM

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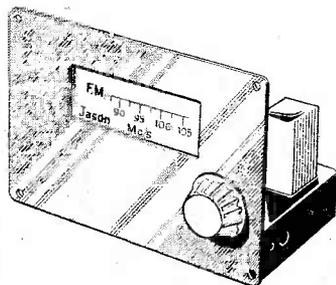
Official Stockists for **EDDYSTONE** components and receivers and **PANDA** transmitters.

SUMMER DAYS AHEAD—have a gay holiday with the **HIWAYMAN** All-dry battery portable. 4 valves and high efficiency Ferrite rod aerial. Medium and Long Waves. Full constructional details and price list. **PRICE 1/6.** Total building cost approx. **£7.10.0.**



THE "JASON" F.M. TUNER KIT

The most successful Home Constructor design ever produced. Build yours today and enjoy the thrill of Hi-Fi crystal clear reception. All parts standard and in stock. Full constructional data including point-to-point and price list. **PRICE 2/-.**



PVC MULTIWAY CABLES

Per yard, 3 way, 9d.; 5 way, 2/6; 7 way, 2/9; 8 way, 3/-; 12 way, 3/6. All colour coded.

Limited quantity Single Screened Mic. Cable, best quality, 6d. yard. Please add sufficient postage.

TSL F.M. TUNER. Ready built with magic eye and own power pack, **£17/10/-.** The Stirling F.M. Tuner, **£13/13/-.** Detailed leaflets on request. **SPECIAL OFFER.** New contemporary pattern Tygan speaker material. Any size cut at 3/- per sq. ft. S.A.E. for pattern.



HI-FI ENTHUSIASTS

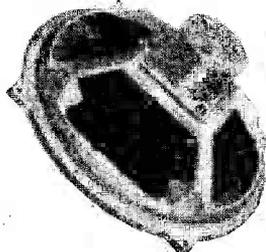
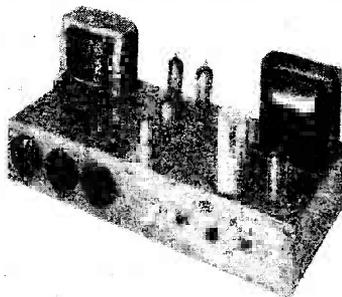
You will fit a "B.J." arm eventually—why not start right and do away with tracking error **NOW.**

B.J. Arm, **£3/2/11.** Shell, **£1/4/2.** S.A.E. for leaflet.

MULLARD 5 VALVE 10 WATT

Quality Amplifier and Pre - amps. Full Constructional Details including F.M. Tuner and Price List, 3/6

Parts stocked also for Mullard "A" and "B" Tape Amplifiers.

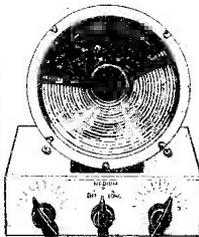


WB HF1012

High fidelity at realistic cost. 10in. die-cast unit, 12,000 gauss magnet. Response 30 c.p.s. to 14,000. 10 watts. Universal speech coil, 3, 7 and 15 ohms. **£4/19/9** (plus 2/- post).

REPANCO "THREE DEE"

The THREE-DEE is a new Dual Range Radio with bandpass tuning using a crystal diode and 3 transistors. Amazing loudspeaker reception and low running costs from a 7½ volt battery supply. Designed for local station reception the "THREE-DEE" is ideal for caravan installation, bedroom, workshop or second radio set. Chassis size 6in. x 4in. x 2in. Full constructional data, 1/- post paid.



MAGNETIC RECORDING TAPE

A by-return service of all types and sizes. E.M.I., BASF, Scotch Boy, Simon, Ferrovoice, MSS, AGFA, Ferrograph, Puretone, C.O.D. or C.W.O. S.A.E. for full list.



PRECISION-BUILT COMPONENTS

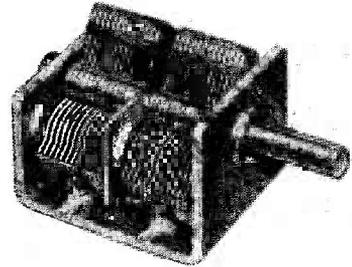
JACKSON "O" GANG CONDENSER

Miniature model in 1 or 2 gang, capacities up to 365 pf swing, front area $1\frac{3}{8}$ in. x $1\frac{17}{32}$ in., including sweep of vanes, length 1 Gang 1 in., 2 Gang $1\frac{3}{4}$ in., Spindle $\frac{1}{4}$ in. dia. x $\frac{3}{4}$ in. long.

Aluminium vanes, cadmium plated steel chassis.

Price

1 Gang 7/6 2 Gang 11/6



CAT. No. 5250

**IT'S RELIABLE IF IT'S
MADE BY JACKSONS!**

Please write for illustrated catalogue.

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KINGSWAY . WADDON . SURREY

Telephone : CROydon 2754/5



**INDICATOR UNIT
TYPE 18A**
Unit contains VCR517 Cathode Ray 6in. tube, complete with Mu-Metal screen, 3 EP50, 4 8P61 and 1 5U4G valves, 9 wirewound volume controls and quantity of resistors and condensers. Offered **BRAND NEW** (less relay) at 67/6. Plus 7/6 carr. "Radio-Constructor" scope circuit included.

**B.S.R. RECORD
CHANGERS**
Very latest type "March". 3-speed with HGP37 crystal turnover pick-up. Plays mixed records. Brand new and guaranteed. Listed at £16/10/- £7/19/6. carr. paid.
B.S.R. 4-SPEED
Plays mixed records.
£8/15/- P/P 3/6.

**TRANSMITTER/
RECEIVER**
(Army Type "17" Mk. II)
This well-known R/T Transceiver is offered complete with Valves, High Resistance Headphones, No. 3 Handmic and Instruction Book all contained in wooden cabinet.

Frequency : 44.0 to 61.0 Mcs.
Approximate Range : 3 to 8 miles.
Variable Tuning.
Power Requirements : Standard 120 v. H.P. and 2 v. L.T.

Ideal for Civil Defence and Intercommunications.
59/6 BRAND NEW
Calibrated Wavemeter for same, 10/-.

TRANSISTORS

Junction Type P.N.P.
British Manufacture

Red Spot. 80K/cs A.F. 10/-
Blue Spot. 16 Mcs. Mixer and Fre. Changer ... 15/-
White Spot. 2.5 Mcs. R.F. and I.F. amp. 20/-

All Transistors Tested and Guaranteed.
N.B.—Red Spot is similar to Mullard OC71.

PRE-SELECTED SEVEN TRANSISTOR PUSH-PULL PORTABLE SUPERHET

Just switch to your favourite Station. No tuning, no aerial or earth. Pre-select 3 stations. Complete with all components and seven Transistors, 7 x 4 Elliptical speaker, Teletron Superhet Coils and I.F.T.s. Powered by 71 v. dry battery which lasts for months. 150 Milliwatts output. All the above with Circuits, etc.

£9.17.6. Carriage paid.
Or with Matched Mullard OC72s (200 Milliwatts Output) and 7 x 4 Elliptical High Resistance Speaker 30/- extra.
Suitable Plastic Cabinet, easy to assemble, 18/6.
Call and hear demonstration model working.

'EAVESDROPPER' THREE TRANSISTOR PERSONAL PORTABLE. No Aerial or Earth Required. Pre-selected 2-station Receiver.

We can supply all the components for building the above set as per "Radio Constructor" with Plastic Case for 77/6. Complete with Acos Mike, 90/-. Complete with Min. Hearing Aid, 82/6.

TRANSISTOR PUSH-PULL AUDIO AMPLIFIER (150 Milliwatts Output)

Build this Push-Pull Amplifier which is ideal for Crystal or Magnetic Pick-Up Amplification, Baby Alarm, Microphone Amplifier, etc. Powered by 6 volt Dry Battery lasting for months. Complete Kit of Parts including 4 Transistors and all Components with Circuit (less Speaker), £4/10/-.

SEND STAMPS FOR NEW 1957 128-PAGE CATALOGUE
OPEN MONDAY to SAT. 9-6. THURS. 1 o'clock.

HENRY'S RADIO LTD.

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TEL.: PADDINGTON 1008-2, 0401

**TRANSISTOR SIGNAL
TRACER**
Complete Kit with 2 Transistors. Components, Phones and Plastic Case, 42/6.

62A INDICATOR UNIT
Containing VCR97 with Mu-Metal Screen. 21 valves : 12-EP50, 4-8P61, 3-8A80, 2-8B34 Plus Pots, Switches, H.V. Cond., Resistors, Muirhead 8/M Dial, Double Deck Chassis and Crystal. **BRAND NEW ORIGINAL CASES, 67/6. CARR. FREE.**

RF24, 10/-; RF25, 12/6;
RF26, 25/- **BRAND NEW WITH VALVES. Carr. 2/6.**

**TRANSISTOR SQUARE
WAVE GENERATOR**
Complete Kit with 2 Transistors. Components, Plastic Case and Circuit, 25/-.

**MINIATURE I. F. STRIP
TYPE "373" 9-72 MEG.**
Brand new miniature I.F. Strip size 10in. x 2 1/2in. x 3in. High. Valve line-up 2-EP92, 3-EP91 and EB91. With circuit.
Complete with valves, 42/6.

**F.M. CONVERTER
UNIT 88/100 Mc/s.**
Containing 6 valves—2 6BA6, EB91, VR137, 2-EP54. Two I.F. stages and separate local oscillator, graduated Vernier tuning. Just plug in to your radio and obtain good listening on F.M. Voltage required 250 v. 50M/A and 6.3 v. 2 amps. £7/19/6.

COMPLETE KITS OF PARTS for the "HI-FI" ENTHUSIAST

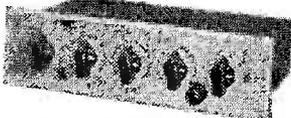
The MULLARD "5-10" MAIN AMPLIFIER



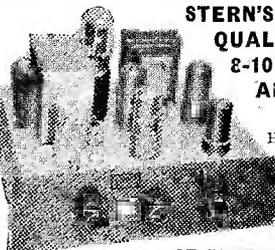
This is the very latest design and needs no recommendation from us. Our Kit is complete to Mullard's specification, including the latest GILSON ULTRA LINEAR OUTPUT TRANSFORMER and the entire MULLARD Valve line up. ALL SPECIFIED COMPONENTS are supplied. **PRICE OF COMPLETE KIT OF PARTS £11.10** (Plus 5/- carr. & ins.)

STERN'S "Fidelity" PRE-AMPLIFIER-TONE CONTROL UNIT

"A design for the music lover"



Briefly it has inputs for all types of MICROPHONES, HIGH and LOW GAIN PICK UPS and a RADIO TUNING UNIT. It incorporates (a) GRAM EQUALISING CONTROL, (b) STEEP-CUT FILTER, (c) Continuously variable BASS and TREBLE CONTROLS and a variable OUTPUT CONTROL which enables its use with any type of Amplifier. **PRICE OF COMPLETE KIT OF PARTS £6.60** (Plus 5/- carr. & ins.). WE ALSO OFFER IT ASSEMBLED, READY FOR USE, £8.00.



STERN'S "HIGH QUALITY" 8-10 WATT AMPLIFIER

Has power supply for Radio Tuning Unit.

PRICE OF COMPLETE KIT OF PARTS (Plus 5/- carr. & ins.) **£7.10.0.**

SUPPLIED ASSEMBLED and READY FOR USE **£9.10.0.**

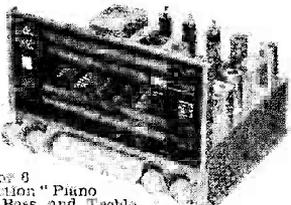
Provided one of the most popular models yet offered to the HOME CONSTRUCTOR. Provides excellent reproduction up to 8 watts, employing 6V6's in push-pull incorporating negative feedback. Provides for use of both 3 and 15 ohm speakers.

THE full SPECIFICATION and PRACTICAL BUILDING INSTRUCTIONS for these Units are available for 1/8 each. SPECIAL PRICE REDUCTION. We supply the two complete kits—Mullard 5-10 and "Fidelity" Pre-amplifier—for £16.16.0. We also supply both fully assembled and ready for use for £19.19.0.

MODERNIZE YOUR OLD RADIOGRAM

- ★ THE LATEST A.M./F.M. RADIOGRAM CHASSIS.
- ★ A NEW 4-SPEED AUTOCHANGER.

The NEW ARMSTRONG PB. 409 A.M./F.M. Radiogram Chassis



"A chassis for those who want the highest quality." A 3 valve line up employing the latest MULLARD preferred-type valves. ● Provides complete coverage of the V.H.F., F.M. Transmissions plus the Short, Medium and Long Wavebands. ● Has Push-Pull Output with Negative Feedback, for 8 watts peak output. ● Quick Action "Piano Key" Selector and separate Bass and Treble Controls. ● "Magic Eye" Tuning Indicator. ● Dimensions 13in. x 9in. x 8in. high. Dial size 11in. x 5in. **PRICE £29.8.0.** TERMS: Credit £7.7.0 and 9 monthly payments of £2.14.0 (Plus 6/- carr. & ins.). H.P. £14.14.0 and 12 monthly payments of £1.7.3. SEND S.A.E. FOR ILLUSTRATED LEAFLET.

STERN'S NEW "Fidelity" COMBINED AM, FM

Radiogram Chassis. A genuinely hand-made chassis providing really high quality on both Radio and Gram.



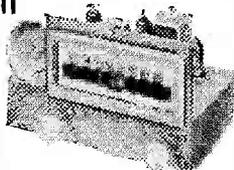
PRICE **£26.15.0** (Plus 7/6 carr. & ins.). TERMS: Credit Deposit £6.14.0 and 9 monthly payments of £2.9.0. H.P. Deposit £13.7.6. and 12 monthly payments of £1.4.10. BRIEFLY IT HAS:— An 8 valve line up incorporating the latest MULLARD preferred-type valves. ● Provides complete coverage of the V.H.F./F.M. waveband plus the SHORT, MEDIUM and LONG waves. ● Has EL64's in Push-Pull with negative feedback of 8 watts output. ● Employs "Piano Key" Selector Switches and a Variable Tone Control. ● Contains Gram input socket for both Crystal and Magnetic Pick-ups. ● Provides for use of either 3 or 15 ohm Speakers. ● Has "Magic Eye" Tuning Indicator. ● Dimensions 13in. x 9in. x 8in. high. Dial size 11in. x 5in. SEND S.A.E. FOR ILLUSTRATED LEAFLET.

RECORD PLAYERS THE VERY LATEST MODELS ARE OFFERED AT GREATLY REDUCED PRICES

- TRANSCRIPTION UNITS. ● 3 and 4 SPEED AUTOCHANGERS. ● AUTOCHANGERS with MANUAL CONTROL POSITION. Send S.A.E. for ILLUSTRATED and DESCRIPTIVE LEAFLET.

STERN'S "F.M." TUNING UNIT

A 5-valve Tuner incorporating the latest Mullard Permeability Tuning Heart and a "Magic Eye" Tuning Indicator.



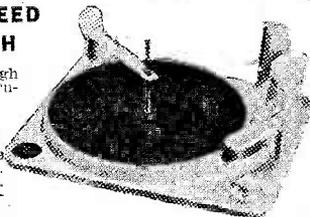
PRICE ASSEMBLED £14.10.0. AND READY FOR USE: (Plus 7/6 carriage and insurance). TERMS: (a) Hire Purchase: Deposit £7.5.0 and 9 monthly payments of 18/4. (b) Credit: Deposit £3.12.6 and 9 monthly payments of £1.6.7.

THE COMBINED A.M./F.M. TUNER is precisely similar in appearance to the above and incorporates 7 valves. It provides complete coverage of F.M. Transmissions and MEDIUM WAVEBAND giving a good selection of foreign stations.

PRICE **£18.18.0** TERMS: (a) Hire Purchase: Deposit £9.9.0 and 10 monthly payments of £1.1.0. (b) Credit: Deposit £4.15.0 and 9 monthly payments of £1.14.7.

AN EXCEPTIONAL "CASH ONLY" OFFER £7.19.6

THE NEW 4-SPEED B.S.R. MONARCH



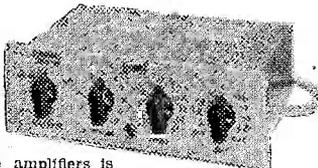
● Complete with High Fidelity Crystal Turn-over Head which incorporates separate stylus for L.P. and 78 r.p.m. records. ● A "MIXER" Unit that will autochange on 7in., 10in. and 12in. records of same speed. ● Incorporates the Manual Control position.

Expressly developed for very high quality reproduction of Grams. Records and particularly suitable for high quality reproductions of the F.M. transmissions. Two models are available:

(a) The "COMPACT 5-2" A Two-stage high sensitivity Amplifier having SEPARATE BASS AND TREBLE CONTROLS and designed to give up to approx. 5 watts with very pleasing quality. PRICE **£6.6.0.** (Plus 5/- carr. & ins.)

(b) The "COMPACT 5-3" A Three-stage version of the "5-2" model but in this case having an additional stage and incorporating Negative Feedback. PRICE **£6.16.0.** (Plus 5/- carr. & ins.)

STERN'S "COMPACT 5" AMPLIFIERS



CALLERS ONLY

We have in stock various designs for HOME CONSTRUCTORS including F.M. Tuners, A.M./F.M. Tuners, Midget Battery Portable, Mains Units, etc., etc.

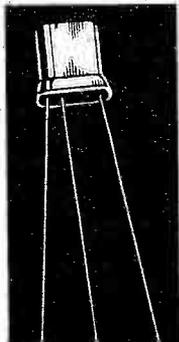
A separate POWER SUPPLY UNIT to operate with these amplifiers is available for £2.10.0. Has additional supply available for Radio Tuner, etc.

STERN RADIO LTD. 109 & 115 FLEET STREET, LONDON, E.C.4.

Telephone: FLEET 5812 3/4

TRANSISTORS

You have been waiting for a R.F. Transistor at a reasonable price. Here it is!



Lasky's now offer you a genuine R.F. Transistor, P.N.P. Junction Type, suitable for medium and low frequency oscillators, frequency changers, and I.F. amplifiers (up to 2 Mc/s), **21/-** at only

Double spot—yellow and red.

Also **AUDIO** P.N.P. Junction Type suitable for high gain and low frequency amplifiers, and for output stages up to 250 milliwatts, only **10/-**

Double spot—yellow and green.

Post Free.

Special prices for 6 and over.

★TESTED AND GUARANTEED EFFICIENT
★HERMETICALLY SEALED and unaffected by temperature variations

Full operating data and circuit diagrams for a simple receiver, superhet, T.R.F., multi-vibrator, relaxation oscillator, audio amplifier, oscillators, signal tracers, etc., etc., supplied with each Transistor.

LASKY'S RADIO

NEW MINIATURE 200 milliwatt TRANSISTOR AMPLIFIER KIT

for construction on a Printed Circuit

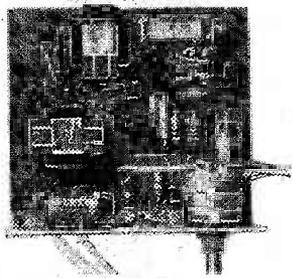
Size: 3½" x 3½". Height can be under 1". Uses our new hermetically sealed Transistors and operates from 6-volt battery.

FULL DETAILS
CIRCUIT DIAGRAM &
SHOPPING LIST, 1/-
post free.

COMPLETE KIT
including 4 Transistors,
all brand new components,
latest T.C.C. miniature condensers,
printed circuit and full instructions, **86/6** Post Free.

Demonstrations at either of our addresses.

All components available separately.



Mullard Transistors
OC70, 21/-; OC71, 24/-;
OC72, 30/-.

Brimar Transistors
TS1, 18/-; TS2, 21/-; TS3, 24/-;
TP1, 40/-; TP2, 40/-.

PLEASE ADDRESS ALL MAIL ORDERS TO HARROW ROAD

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370, HARROW ROAD, PADDINGTON, W.9.
LADbroke 4075 and CUNningham 1979.

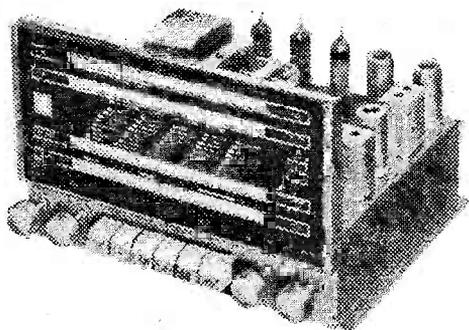
A NEW *Armstrong* AM/FM RADIOGRAM CHASSIS

Specialists in high quality reproduction for over 20 years

PB 409

ARMSTRONG quality at an economical price

- ★ 9 valves—6 watts peak output Within 2dB, 20-20,000 cps at 4 watts (double normal room volume)
- ★ Full VHF band (88-108 Mc/s) plus Long, Medium and Short
- ★ Push-Pull Output with Negative Feedback
- ★ Quick-action "Piano-Key" selectors
- ★ Independent Bass and Treble controls
- ★ "Magic Eye" tuning
- ★ Latest Mullard preferred-type valves



28 GUINEAS DIMENSIONS: 13" x 9½" x 8" high

ARMSTRONG WIRELESS & TELEVISION CO. LTD.
WARLTERS ROAD, LONDON, N.7. NOR 3213

Post this coupon for descriptive literature and details of Hire Purchase, Home Trial facilities and Guarantee. BLOCK CAPITALS PLEASE.

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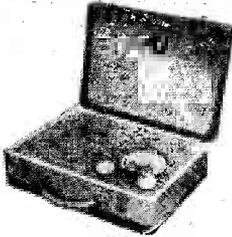
We have been making replacement radiogram chassis for nearly 25 years and have concentrated exclusively on the requirements of those who want the best. This is your guarantee of first-class performance and reliability. We shall be pleased to give you a full demonstration of this and other models at our Warlters Road Showroom (open 9-6 weekdays and Saturdays).

CHASSIS ASSEMBLY



Three-colour 3-waveband scale covering standard Long, Medium, and Short wavebands, scale pan, chassis punched for standard 5-valve superhet, pulley driving head, springs, etc., to suit. Scale size 14 x 3 1/2 in. Chassis size 15 x 5 1/2 in. x 2 1/2 in. deep.

FINEST BATTERY PORTABLE



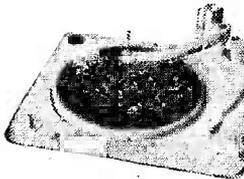
Ferrite rod aerials, low consumption valves, superhet circuit with A.V.C., ready-built and aligned chassis. If required, beautiful two-tone cabinet covered with I.C.I. Rexine and Tygan. Guaranteed results on long and medium waves anywhere. All parts, including speaker and cabinet. Price is £7.15.0 complete or £1.15.0 deposit and 7 monthly payments of £1. post and ins. 3/6. ready-built chassis 30/- extra. Data 1/6.

CRYSTAL MICROPHONE

Miniature crystal type has high gain and is suitable for all purposes — tape recorders — amplifiers. Price 4/3, post and ins. 9d.



SENT FOR £1.10.0 DOWN



4-SPEED & 3-SPEED

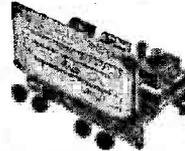
Gramophone Auto-changer
Latest types by all famous makers are invariably in stock at competitive prices. B.S.R. Monarch, Garrard, etc. Latest models from £8.10/- or deposit £1.10/- and 8 payments of £1, plus 5/- carriage and insurance.

T.V. SET FREE

Everyone who buys a copy of our new publication "The Easier to Build 13 Channel T.V." stands a fair chance of winning the set. The price of the publication is only 3/6, fully illustrated.

ORGANTONE PARCEL 39/6

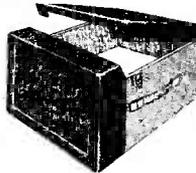
Here is an opportunity to build a fine set at a low figure, the parcel contains all the essential parts as follows:—



Punched and prepared chassis with scale pan—coloured glass dial with flying cushions—drum drive and spindle—mains transformer—volume control—tone control—5-valve holder—circuit diagram and instructions. Limited quantity only for 39/6 plus 3/6 post & ins.

AMPLIFIER CASE 62/-

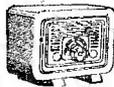
A robustly made cabinet in the modern style of two tone fabrics, will comfortably house speaker and amplifier in the end compartment and has uncut motor board for tape recorder or record changer, lacquered fitting and plastic handle. Price 62/-, carriage and ins. 7.6.



THIS MONTH'S SNIP

We are offering an out-of-season bargain—14 yards of waterproof electric blanket element, enough to make a full size blanket; normally we sell at 20/- but for a few weeks the price is only 15/-, post free, complete with illustrated data.

TRANSISTOR RECEIVER 19/6

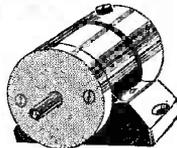


Makes ideal bedroom radio, uses one transistor and one crystal diode complete less case 19/6, case 5/- extra, post & ins. 1/6.

FREE — MOVING COIL METER — FREE !!

To all who purchase our "science" parcel we will give a 2 1/2 in. 30 ma meter free of charge. The science parcel consists of: (a) Vacuum delay switch, original cost 3 shs. (b) Siemens high speed relay. Price over £2 each. (c) Sniperscope (9 infra-red cell), these cost over £5. These three items and the free gift for only £1.

MAINS MOTOR



Powerful electric motor, size 3 in. long by 2 1/2 in. diameter, with speed variator suitable for operation on/off standard A.C. mains. Ideal for driving fan model, car heater, dryer, etc., etc. Don't miss this snip, 12/6, plus 2/- post and insurance. *Stand not included.*

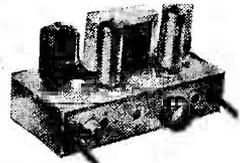
MULLARD AMPLIFIER "510"

A Quality Amplifier designed by Mullard. Power output exceeds 10 watts. Frequency response almost flat from 10 to 20,000 C.P.S. For use with the Aco's "Hi G" and other good pick-ups. Made up and ready to work is £12.10.0 or £1.10.0 down and 8 payments of £1.10.0, plus 10/- carriage and insurance.

YOURS FOR 30/- DOWN



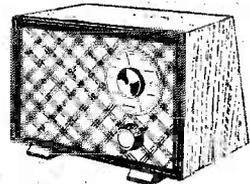
THE PICTURE MASTER BAND III CONVERTER



To-day's best value in Band III converters suitable for your T.V. or money refunded. Complete ready to operate. 49/8 non-mains or 79/6 mains, post and insurance 3/6.

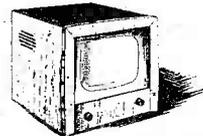
THE SKYSEARCHER

An all mains set for 19/6



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

14" T.V. CABINET



14 in. T.V. cabinet of the latest styling made for one of our most famous firms—beautifully veneered and polished—limited quantity—19/6 each. Carriage and packing 3/6 extra.

"CHIMELITE"



It is a hall light as well as a double chime and you can make it in a couple of evenings for the total cost of only 19/6 including instructions, post, etc., 2/- data available separately price 2/-.

ELECTRONIC PIONEERING EQUIPMENT, LTD.

Post orders to E.P.E., LTD., Dept. 7, Sutton Road, Eastbourne.

266, London Road, Croydon. Phone: CRO. 6558 Half day, Wednesday.

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

152-3, Fleet Street, E.C.4. Phone: FLEET 2933 Half day, Saturday.

29 Stroud Green Rd., Finsbury Park, N.4. Phone: ARCHWAY 1049 Half day, Thursday.

249, Kilburn High Road, Kilburn. MAIDA Vale 4921.

R.S.C. BATTERY CHARGING EQUIPMENT

ASSEMBLED CHARGERS

6 v. 1 amp. 19/9
 6 v. or 12 v. 1 amp. 25/9
 6 v. 2 amps. 29/9
 6 v. or 12 v. 2 amps. 33/9
 6 v. or 12 v. 4 amps. 59/9
 Above ready for use. Carr. 3/6.
 With mains and output leads.

HEAVY DUTY KIT

12 v. 30 amp. Suitable for Garage or firm with a number of vehicles. Mains input 200/250 v. 50 c/s. Outputs 12 v. 15 amp. twice. Consists of Mains Trans. 2 Metal Rectifiers. 2 Meters, 4 Fuses, 4 Terminals, 2 Rheostats and circuit. Only 9 gns., carr. 15/-

BATTERY CHARGER KITS

Consisting of Mains Trans. former, F.W. Bridge, Metal Rectifier, well ventilated steel case, Fuses, Fuse holders, Grommets, panels and circuit. Carr. 2/9 extra.
 6 v. or 12 v. 1 amp. 22/9
 6 v. 2 amps. 25/9
 6 v. or 12 v. 2 amps. 31/6
 6 v. or 12 v. 4 amps. 53/9

BATTERY CHARGER KIT

Consisting of F.W. Bridge Rectifier 6/12 v. 5 a. Mains Trans. 0.8-1.5 v. 6 a. output and ammeter. 49/9. Post 3/-

ASSEMBLED CHARGER

6 v. or 12 v. 2 amps.
 Fitted Ammeter and selector and selector plug for 6 v. or 12 v. Louvred metal case, finished attractive hammer blue. Ready for use. With mains and output leads. Double Fused. Carr. 3/9 **47/9**

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



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. Double fused. Louvred steel case with stoved blue hammer finish. **75/-**

Ready for use with mains and output leads. Carr. 3/9

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

Interleaved and impregnated. Primaries 200-230-250 v. 50 c/s Screened. **TOP SHROUDED DROP THROUGH**
 250-0-250 v. 70 mA, 6.3 v. 2 a, 5 v. 2 a, ... 16/9
 350-0-350 v. 100 mA, 6.3 v. 2 a, 5 v. 2 a, ... 18/9
 250-0-250 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a, ... 22/9
 300-0-300 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a, ... 22/9
 350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a, ... 22/9
 350-0-350 v. 100 mA, 6.3 v. 4 a, C.T. 0-4-5 v. 3 a, ... 23/9
 350-0-350 v. 150 mA, 6.3 v. 4 a, 5 v. 3 a, ... 29/9

FULLY SHROUDED UPRIGHT
 250-0-250 v. 60 mA, 6.3 v. 2 a, 5 v. 2 a, Midget type 24-3-3in. 17/6
 350-0-350 v. 70 mA, 6.3 v. 2 a, 5 v. 2 a, ... 19/9
 250-0-250 v. 100 mA, 6.3 v. 4 v. 4 a, C.T. 0-4-5 v. 3 a, ... 26/9
 250-0-250 v. 100 mA, 6.3 v. 6 a, 5 v. 3 a, for RJ355 conversion ... 31/-
 300-0-300 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a, C.T. 0-4-5 v. 3 a, ... 26/9
 300-0-300 v. 100 mA, 6.3 v. 4 v. 4 a, C.T. 0-4-5 v. 3 a, ... 27/9
 300-0-300 v. 130 mA, 6.3 v. 4 a, 6.3 v. 1 a, for Mullard 510 Amplifier ... 35/9
 350-0-350 v. 150 mA, 6.3 v. 4 a, 5 v. 3 a, 350-0-350 v. 150 mA, 9 v. 2 a, 6.3 v. 2 a, 5 v. 3 a, ... 35/9
 425-0-425 v. 200 mA, 6.3 v. 4 a, C.T. 6.3 v. 4 a, C.T., 5 v. 3 a. Suitable Williamson Amplifier, etc. 49/9
 450-0-450 v. 250 mA, 6.3 v. 6 a, 6.3 v. 6 a, 5 v. 3 a, ... 69/9

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

SMALL POTTED MAINS TRANSF.
 Removed from New Ex-Govt. units, Primary 0-200-250 v. Secs. 250-0-250 v. 60 mA, 6.3 v. 2 a, 5 v. 2 a. Size 3 1/2 x 4 1/2 x 3 1/2. **11/9**

ELIMINATOR TRANSFORMERS
 Primaries 200-250 v. 50 c/s ... 14/9
 120 v. 40 mA, 5-0-5 v. 1 a, ... 15/9
 90 v. 15 mA, 4-0-4 v. 500 mA, ... 8/9

CHARGER TRANSFORMERS
 All with 200-250 v. 50 c/s Primaries:
 0-9-15 v. 1 a, 11/9; 0-9-15 v. 3 a, 16/9;
 0-3-9-17 v. 3 a, 17/9; 0-9-15 v. 5 a, 19/9;
 0-9-15 v. 5 a, 23/9.

SMOOTHING CHOKES
 250 mA 5 H 100 ohms ... 12/9
 150 mA 7-10-250 ohms ... 11/9
 100 mA 100 H 200 ohms ... 8/9
 60 mA 10 H 350 ohms ... 5/9
 60 mA 10 H 400 ohms ... 4/11

OUTPUT TRANSFORMERS
 Midget Battery Pentode 66-1 for 354, etc. 3/9
 Small Pentode, 6,000 to 30 ... 3/9
 Small Pentode 78,000 to 30 ... 3/9
 Standard Pentode, 5,000 to 30 ... 4/9
 Standard Pentode, 78,000 to 30 ... 4/9
 Push-Pull 10-12 watts 6V6 to 30 or 150 ... 15/9
 Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 150 ... 16/9
 Push-Pull 15-18 watts, 6L6, KT66 ... 22/9
 Push-Pull 20 watts, sectionally wound 6L6, KT66, etc., to 3 or 150 47/9

MANUFACTURERS' SUPPLIES MAINS TRANSFORMERS Primaries 250-250 v. 50 c/s. Fully shrouded upright mounting 425-0-425 v. 150 mA, 6.3 v. 3 a, 5 v. 3 a, 29/11. post 2/9. Drop Through Chassis type, 250-0-250 v. 70 mA, 6.3 v. 2.5 a, 11/9.

SPECIAL OFFERS: Electrolytics.
 32-32-32 mfd. 250 v. Dubilier small can 2/9 ea. 150 mfd. 450 v. 3/9. Small .0005 mfd. 2-gang, 4/9 ea. Westinghouse Rectifiers 250 v. 250 mA. 7/9.

EX-GOVT. TRANSSES, 230/250 v. 50 c/s. HEAVY DUTY OIL FILLED suitable for electric welding or soil heating. Output 12 v. 80/100 amps., 26-18-6. Carr. 7/6.

EX-GOVT. SMOOTHING CHOKES
 250 mA, 5 H 50 ohms ... 12/9
 150 mA, 10 H 100 ohms ... 11/9
 150 mA, 6-10 H 150 ohms Trop. ... 6/9
 100 mA, 5 H 100 ohms ... 8/11

EX-GOVT. E.I.T. SMOOTHING CONDENSERS. 102 mfd. 5,000 v. Cans, 2/9; 1 mid. 2,500 v. Bakelite Tubulars, 3/3.

EX-GOVT. METAL BLOCK (PAPER) CONDENSERS
 4 mid. 500 v., 2/9; 4 mid. 1,000 v., 4/9; 4 mid. 300 v., 6/9; 8 mid. 500 v., 4/9; 10 mid. 500 v., 4/9; 4 mid. 400 v. plus 2 mfd. 250 v., 1/11.

EX-GOVT. ELECTROLYTICS. Removed from unused equipment. 8-18 mfd. 50 v., 1/3; 1,500 mfd. 5 v., 1/9; 100 mfd. 350 v. with clip, 6d.

EX-GOVT. DOUBLE WOUND STEP UP/STEP DOWN TRANSFORMERS. 10-0-100-200-220-240 v. to 5-0-7.5-11.5-13.5 v. or REVERSE. 30-100 watts. Only 11/9, plus 2/9 post. 10-0-100-200-220-240 v. to 9-0-110-122-138-148 v. or REVERSE. 200 watts. 35/8, plus 7/6 carr.

EX-GOVT. CASES: Size 14-10-8 1/2 in. high. Well ventilated black crackle finished, undrilled cover. IDEAL FOR BATTERY, CHARGER OR INSTRUMENT CASE. OR COVER COULD BE USED FOR AMPLIFIER. Only 9/9, plus 2/9 postage. Size 8 1/2 x 10 1/2 x 6 1/2 ins. with undrilled well ventilated cover, finished in stoved grey enamel. Suitable for charger or instrument case, 7/9, plus 2/9 post.

EX-GOVT. VALVES (NEW)

1J4	7/9	EF39	5/9	EF80	7/9
1S5	7/9	6V6G	7/9	ED91	8/9
354	8/9	6X4	6/9	EP34	4/9
5V3G	8/9	6X5GT	7/9	EL32	3/9
5U4G	8/9	6L6G	11/9	EL91	5/9
5Z4G	8/9	807	7/9	KT44	8/9
6K7C	5/9	12A6	7/9	EZ89	8/9
6S7GT	6/9	15D2	4/9	EZ83	9/6
6BL6T	9/9	25Z4G	9/9	EL84	10/6
6SN7GT	8/9	ME4	4/9	SP61	2/9
6AT6	7/9	OC83	9/9	8524	8/9

EX-GOVT. UNIT RDEL. Brand new, cartoned. Complete with 14 valves, including 5Z4, E.H.T. rectifier, Transformer, Choke, etc. Only 29/9, carr. 7/6.

ELECTROLYTICS (current production) NOT EX-GOVT.

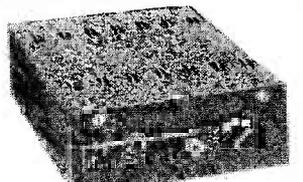
Tubular Types	Can Types
8µF 450 v. ... 1/9	16 mfd. 350 v. ... 1/11
8 mfd. 500 v. 2/6	16 mfd. 500 v. 2/9
16µF 350 v. ... 2/3	16µF 450 v. ... 2/9
15µF 450 v. ... 2/9	32µF 350 v. ... 2/11
16µF 450 v. ... 3/9	32 mfd. 450 v. ... 4/9
32µF 350 v. ... 3/9	100 mfd. 450 v. ... 4/9
25µF 25 v. ... 1/3	64 µF 450 v. ... 2/9
50µF 12 v. ... 1/3	8-16µF 450 v. ... 3/11
50 mfd. 25 v. ... 1/6	16-16µF 450 v. ... 3/11
50µF 5 v. ... 1/9	32-32µF 450 v. ... 4/9
100 mfd. 12 v. 1/9	100-100mfd. 350v. 4/9
100 mfd. 25 v. 2/3	64-120 mfd. 350v. 7/9
3,000 mfd. 6 v. 3/9	100-250 mfd. 50 v. 7/9
6,000 mfd. 6 v. 3/9	275 v. ... 6/9

Many others in stock.

MUNTS WOLDSLEIGH CONDENSERS. .005 mfd. 400 v., .01 mfd. 400 v., .04 mfd. 500 v., 5/6 doz. (one type), .1 mfd. 350 v., 8d. ea., .5 mfd. 500 v., 1/8 ea.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5 1/2 x 4 x 2 in. approx. Completely replaces batteries supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s. is available. Suitable for all battery operated receivers requiring 1.4 v. and 90 v. This includes latest low consumption types. Complete kit with diagrams, 39/9. or ready for use, 46/9.



Type BM2. Size 8 x 5 1/2 x 2 in. Supplies 120 v. 80 v. and 60 v., 40 mA and 2 v. 0.4 a to 1 amp. fully smoothed. Thereby completely replacing both H.T. batteries and T. 2 v. accumulators. When connected to A.C. mains supply 200-250 v. 50 c/s. **SUITABLE FOR A.L. BATTERY R.C.I.T.**

VERS normally using 2 v. Accumulator. Complete kit of parts with diagrams and instructions 49/9. or ready for use 59/6.

EXTENSION SPEAKERS
 Ready for use in walnut veneered cabinet.
 8in. 2-3 ohms, 35/9.
 Very limited number.



H.T. ELIMINATOR AND TRICKLE CHARGER KIT. Input 200-250 v. A.C. Output 120 v. 40 mA. Fully smoothed and rectified supply to charge 2 v. accumulator. Price with 10 v. red metal case and circuit, 29/6. Or ready for use, 8/9 extra.

T.V. CABINETS. Leading manufacturers surplus. Attractive designs. Walnut veneered, with doors for 15, 16, or 17in. Tube, 23-19-6. Carr. 7/6.

MINIATURE MOTORS. 24/28 v. D.C. or A.C. made by Hoover Ltd., Canada. Size only 2 1/2 x 1 1/2 in. Spindle 1 1/2 in. long, 1/4 in. diam. Brand New, 9/9.

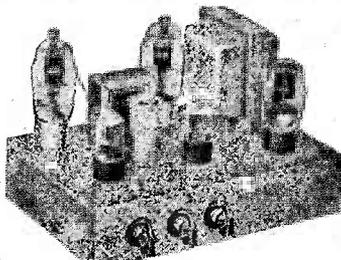
VOLUME CONTROLS with long (1 1/2 in. diam.) spindle all values less switch, 2/9; with S.P. switch, 3/9; with D.P. switch, 4/6.

R.S.C. A8 ULTRA LINEAR 12 WATT AMPLIFIER

NEW 1956 Model High-Fidelity Push-Pull Amplifier with "Built-in" Tone Control. Pre-amp stages, High sensitivity. Includes 5 valves (807 outputs). High quality sectionally wound output transformer, specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. **INDIVIDUAL CONTROLS FOR BASS AND TREBLE** "Lift" and "Cut". Frequency response ± 3 db. 30-30,000 c/c's. Six negative feedback loops. Hum level 71 db. down. ONLY 70 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pickups and practically all microphones. Comparable with the very best designs.

For STANDING or **LONG-PLAYING RECORDS**. For **MUSICAL INSTRUMENTS** such as **STRING BASS, GUITARS, etc.** **OUTPUT SOCKET** with plug for 300 or 600 ohm speaker. 1.5 A. For supply of **RADIO FEEDER UNIT**. Size approx. 12-9-7in. For A.C. mains 200-230-250 v. 50 c/c's. Outputs for 3 and 15 ohm speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Unapproachable value at **£7-15-0**, or factory built 45/- extra. Carriage 10/-.

If required louvred metal cover with 2 carrying handles can be supplied for 17/6. Additional input socket with associate Vol. Control so that two different inputs such as Gram and "Mike" or Tape and Radio can be mixed, can be provided for 18/- extra. Guaranteed 12 months. **TERMS** on assembled two input model: **DEPOSIT** 25/6 and nine monthly payments 23/4.



12 GNS.

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/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, 807, GZ33. Separate Bass and Treble controls are provided. Minimum input required for full output is only 12 millivolts so that **ANY KIND OF MICROPHONE OR PICKUP IS SUITABLE**. The unit is designed for **CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS, GUITAR, STRING BASS, etc.** For standard long-playing records. **OUTPUT SOCKET PROVIDED** for 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/c's. A.C. Mains and has outputs for 3 and 15 ohm speakers. Complete kit of parts with fully punched **ONLY** chassis and point-to-point wiring diagrams and instructions. If required extra metal cover as for A8 can be supplied for 17/6. The Carr. 10/- amplifier can be supplied, factory built with 12 months guarantee, for £12-19-6. **TERMS**: **DEPOSIT** 23/11 and 9 monthly payments of 23/11.

10 GNS.

SUPERHET FEEDER UNIT

Design of a high quality Radio Tuner Unit (specially suitable for use with any of our Amplifiers). V. Detector A.V.C. Variable Percentage modulation of the Transmitter can be handled without distortion. The W. Ch. Sw. incorporates Gram position. Controls are Tuning, W. Ch. and Vol. Only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required for amplifier. Size of unit approx. 9-6-7in. high. Simple alignment procedure. Point-to-point wiring diagrams, instruction and priced parts list with illustration. 2/6. Total building cost, £4-15/-. For descriptive leaflet send S.A.E.

LINEAR L45 MINIATURE 45 WATT QUALITY AMPLIFIER.

Suitable for use with Garrard, B.S.R. or any other record-playing unit, and most microphones. Total negative feed-back 12 db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c/c's. Output for 2 ohm speaker. Three miniature Mullard valves used. Size of unit only 6-5-6in. high. Chassis is fully isolated from earth. Output for 2-3 ohm speaker. Guaranteed 12 months. Only £5-19/6. Or Deposit 22/- and five monthly payments of 22/-. Send S.A.E. for illustrated leaflet.

P.M. SPEAKERS.

2-3 ohms. Suitable for use with above A8 or A7 amplifiers. Flac 7 1/2 in. elliptical, 19.9. Celestion 6 1/2 in. with high flux density magnet, 19.9. 12in. Plessey, 29/11. 12in. Plessey with high flux density magnet, 47/9. The latter is especially recommended for use where practicable. It will handle twice the output of the amplifiers.

LINEAR 'DIATONIC' 10 WATT HIGH FIDELITY PUSH-PULL ULTRA LINEAR AMPLIFIER.

For 200-230-250 v. 50 c/c's. A.C. Mains. Valve line-up ECC83, ECC83, EL84, 6L4, EZ81 miniature Mullard unit has self-contained Pre-amplifier-Tone Control stages and separate Bass and Treble Controls. Independent "Mike" and Gram input sockets are provided. Total harmonic distortion only 0.25% at 6 watts. Due to use of latest miniature components of proved reliability size is only 16-8-8ins. Output Matchings for 3 and 15 ohm speakers. Finished in attractive stoved Blue-Grey hammer. Only 12 GNS. or Deposit 26/9 plus 10/- carr. and 9 monthly payments of 26/9. Send S.A.E. for full details.

M.E. SPEAKERS

2-3 ohms, 8in. R.A. Field, 600 ohms, 11.9.

R.S.C. 45 WATT A5 HIGH-GAIN AMPLIFIER

A highly sensitive 4-valve quality amplifier for use at 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 pickups and practically all mikes. Separate Bass and Treble Controls are provided. These give full long-playing record equalisation. Hum level is negligible being 71 db. down. 15 db. of negative feedback is used. H.T. of 300 v. 25 mA. and L.T. of 6.3 v. 1.5 A. is available for the supply of a Radio Feeder Unit, or Tape Deck pre-amplifier. For A.C. mains input of 200-230-250 v. 50 c/c's. Output for 2-3 ohm speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with Blue hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £4-15/-, or assembled ready for use 25/- extra, plus 3/6 carr. Or Deposit 22/6 and 5 monthly payments of 22/8 for assembled unit.



12 GNS.

LT45 HIGH QUALITY TAPE DECK AMPLIFIER.

For ALL Tape Decks with High Impedance, Playback and Erase Heads, such as Ready For, Vane, Truvox, etc. for Use ONLY Colliaro, Brenell, etc. Type of Deck should be stated when ordering. Output is 4 1/2 watts. For 2-3 ohm Carr. 7/6 speaker. For A.C. Mains 200-250 v. 50 c/c's. Positive compensated identification for recording level by Magic Eye. Recording facilities for 15 7/8 or 3 1/2 in. per sec. Automatic equalisation at the turn of a knob. Linear frequency response of ± 3 db. 50-11,000 c/c's. Negative feedback equalisation. Minimum hum. High output with completely non-fatiguing and distortionless reproduction. Sensitivity is 15 millivolts. Any kind of crystal microphone is suitable. Only 2 millivolts minimum output required from Recording head. Provision is made for feeding a P.A. amplifier. Unit can also be used as a gram-amplifier requiring input of 0.75 v. Illustrated leaflet 6d. Special price quoted for above with Deck.

R.C.A. 20 WATT RE-ENTRANT SPEAKERS.

15 ohms or 600 ohms matching. For Outdoor work. Only 8 GNS. P.M. SPEAKERS. All 2-3 ohms, 5in. Goodmans, 17/9. 6in. Goodmans water type, 16/9. 8in. Rola, 19/9. 10in. Elac, 26/9. 12in. Plessey, 29/11. 10in. W.B. "Stentorian" 3 or 15 ohm type-HF1012 10 watts, hi-fidelity type. Recommended for use with our A8 amplifier, 24/10/9. 12in. Plessey 15 ohms 10 watts, 59/6.

PLESSEY DUAL CONCENTRIC 12in. 15 ohm HIGH-FIDELITY SPEAKER

with built-in tweeter (completely separate elliptical speaker with choke, condensers, etc.) provides an extraordinarily realistic reproduction when used with our A8 or similar amplifier. Rated 10 watts. Price complete, only £5-17/6.

COAXIAL CABLE 75 ohms; 8in. 8d. yard. Twin Screened Feeder, 11d. yard.

SELENIUM RECTIFIERS

6/12 v. 1a.	4/11	L.T. Types H.V.
6/12 v. 2a.	8/9	6-12 v. 1/2 a. H.W. 2/9
6/12 v. 3a.	11/9	H.T. Types H.V.
6/12 v. 4a.	14/9	150 v. 40 mA. 3/9
6/12 v. 6a.	19/9	250 v. 50 mA. 5/9
6/12 v. 9a.	25/9	500 v. 80 mA. 7/9
6/12 v. 15a.	35/9	250 v. 150 mA. 9/9
	35/9	250 v. 250 mA. 11/9

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

For 230-250 v. 50 c/c's. Mains Input. Appearance and Specification, with exception of output wattage, as A5. Complete Kit with diagrams, 23/15/-. Assembled 22/6 extra. Carr. 3/6.

TEN SKYFOUR T.R.F. RECEIVER

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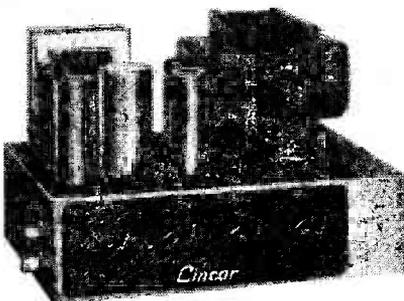
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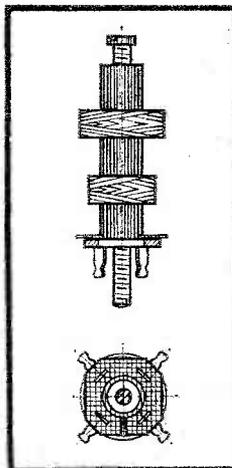
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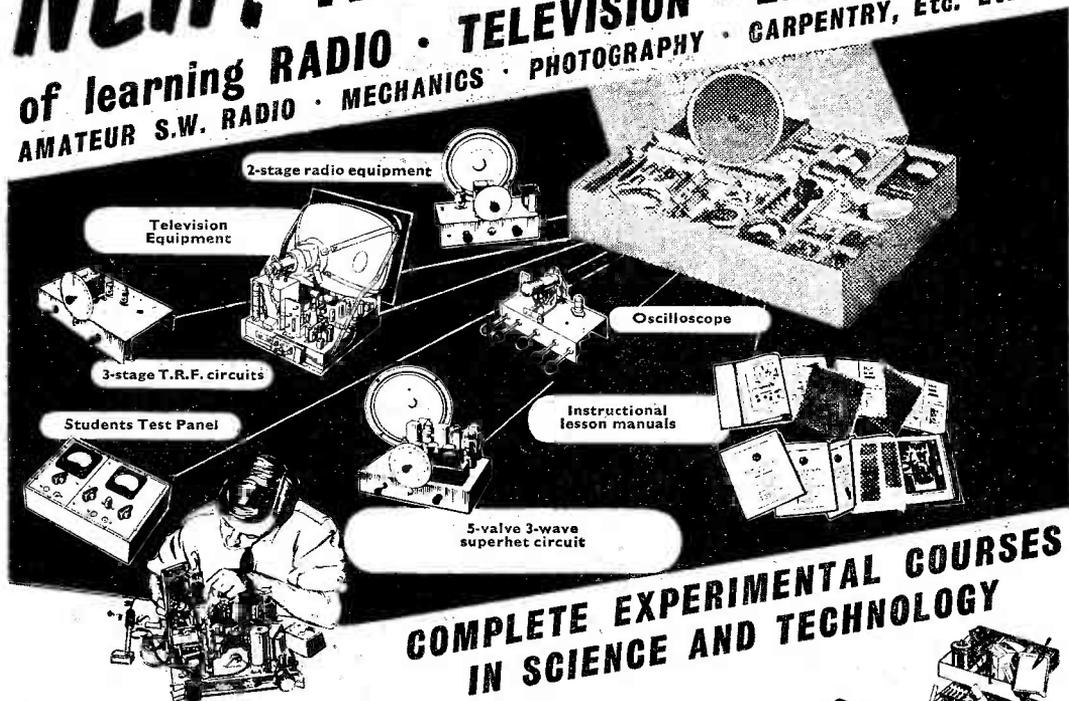
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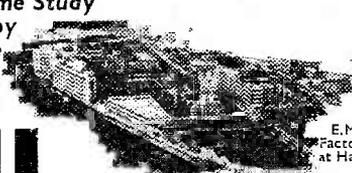
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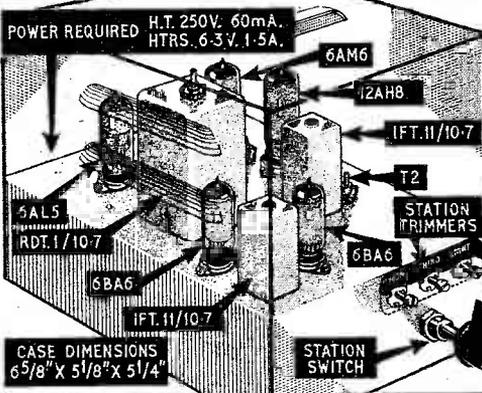
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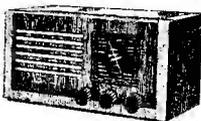
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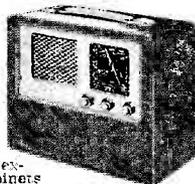
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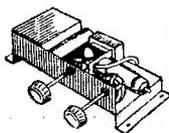
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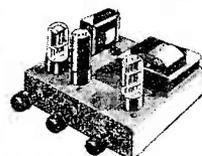
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PRACTICAL WIRELESS

EVERY MONTH
VOL. XXXIII, No. 606, JUNE, 1957

EDITOR: F. J. GAMM

25th YEAR
OF ISSUE

COMMENTS OF THE MONTH

BY THE EDITOR

PROGRAMME CHANGES

SIR IAN JACOB recently announced some drastic changes in BBC programme policy, mainly concerned with sound broadcasting. There was, however, an impression that Sir Ian was straining for effect and that the real motive for the change was to save money on sound, with the object of improving the TV programmes so that they could compete more equitably with I.T.V. Support for this view is provided by the statement that these changes will cost less and provide better value for money. The main change is in the Third Programme which is to be cut from five hours daily to three. This is not, nor was it intended to be, a popular programme in the true sense of the term. Some of the matter broadcast was artificial high-brow stuff, written by Chelsea poseurs with an assumed air of erudition. In so far as we are now to suffer two hours less of this sickly would-be clever type, we are in favour of lopping off two hours from the Third Programme, if other and better material cannot be found. The BBC is overcrowded with weird people dressed in the true untidy Chelsea style with dirty shirts, unshaven faces, suede shoes, the inevitable horn-rimmed glasses and vacuous expressions. They are all comparatively young, and few of them have any literary experience. One wonders how it is that they were selected for the job. There needs to be considerable change in BBC personnel. People of ripe experience in the entertainment field and in the realms of literature should be employed, and there should be an immediate enquiry into the undoubted overstaffing of the BBC and the lack of liaison between the various departments, which have become sealed water-tight departments, operating in a little world of their own. The money Sir Ian wishes to save would be promptly forthcoming by such staff reductions and rearrangements. It is true that the blame for this does not attach to Sir Ian. It was Reith who set the standard for the BBC, and it is difficult now to upset it. When Sir Ian said that in the shortened programme there will be room for all that is truly worthy of inclusion, he was making the tacit admission that two-fifths of it at present is not fit for inclusion. The Third Programme has been allowed to amble through the last 10 years as the Cinderella of broadcasting and no one at the BBC has taken very much interest in it, with the result that weird problem plays have been allowed to pollute the programme.

Another change is that the Home Service and the Light Programme are for part of the day to operate together, and will be jointly planned. Programmes must "be designed for relaxation and entertainment," a rather belated discovery.

The competition of I.T.V. has proved that competition has an improving value, and prevents sterility.

The effect has been felt not only on the television programmes but also on sound. — F. J. C.

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

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Our next issue, dated July, will be published on June 7th.

Round the World of Wireless



Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of February, 1957, in respect of receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland. The numbers include licences issued to blind persons without payment.

Region	Total
London Postal	1,187,588
Home Counties	1,184,517
Midland	912,076
North Eastern	1,186,758
North Western	891,391
South Western	742,957
Wales and Border Counties ...	470,366
Total England and Wales ...	6,575,653
Scotland	847,111
Northern Ireland	194,564
Grand Total	7,617,328

Radio and TV Sales for February

RETAILERS' sales of radio and television sets and radiograms in February, while showing a fall compared with January, were above those for February, 1956, according to the monthly survey of the British Radio Equipment Manufacturers' Association.

Television receiver sales during February were 94,000, an increase of 16 per cent. over February, 1956, but a decrease of 21 per cent. compared with January, 1957. Sales of radiograms were 24,000, which was an increase on the previous February of 60 per cent., but a decrease on January of 11 per cent. Radio receiver sales at 78,000 showed an increase of 18 per cent. on February, 1956, but a decrease of 9 per cent. by comparison with January this year.

The proportion of hire purchase and credit sales for both radiograms and television receivers rose from 51 per cent. in January to 52 per cent. in February. For radio receivers the percentage remained unchanged at 34.

New E.M.I. Company

ELECTRIC AND MUSICAL INDUSTRIES LTD. announce that, in order to co-ordinate all their record activities in this country, a new company has been formed under the title of E.M.I. Records, Ltd., and Mr. C. H.

By "QUESTOR"

Thomas has been appointed managing director.

The new company will be responsible for the production, manufacture, marketing and distribution in Great Britain and the export to overseas territories of E.M.I. label records: "His Master's Voice," Capitol, Columbia, M.G.M., Parlophone and Regal-Zonophone.

New Sound System Aids Works Control

A NEW bulkhead microphone control unit, specially designed to meet the requirements of the many factories and machine plants where a high noise level makes the use of normal communication methods unsuitable, is being marketed by Communication Systems, Ltd.

The equipment has widespread applications throughout industry and is likely to prove particularly suitable where mechanical processing has to be closely controlled over a wide area. Steel rolling mills, car body factories and hard-board processing plants are but a few obvious examples.

Retiring Engineer-in-Chief, Cable and Wireless, Ltd., Joins Marconi's

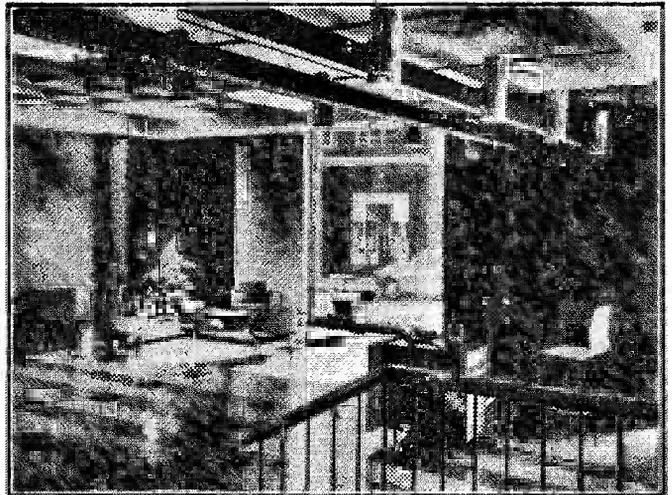
MARCONI'S WIRELESS TELEGRAPH CO., LTD., announce that Mr. J. A. Smale, C.B.E., A.F.C., B.Sc., M.I.E.E., having retired from the post of engineer-in-chief of Cable and Wireless Ltd., became technical consultant in telecom-



Mr. J. A. Smale

munications engineering to Marconi's, with effect from April 1st, 1957.

Mr. Smale's association with Marconi's began almost 40 years ago, for he joined the company in 1919. In 1921 he was responsible for the installation in the City of



A 'discussion' corner for clients at the new Mullard Electronics centre off Tottenham Court Road.

London of the first central telegraph office for wireless circuits, while by 1924 he had designed and tested equipment for frequency-shift keying, which, after further intensive development work originated by Mr. Smale in 1937, is still the principal system in use to-day for long-distance wireless telegraphy.

Fish-finding from a Helicopter

TESTS carried out by Pye Marine, Limited, in conjunction with Grosvenor Air Charter, during the last two months

would part from the helicopter if it became entangled with a submarine object, thereby endangering the aircraft.

New Factory for Airdrie

THE building of a new 45,000 square feet factory at Martin Street, Airdrie, for Pye Scottish Telecommunications Ltd., was officially started in March, when the ceremony of cutting the first sod was performed by the Provost of Airdrie during the afternoon.

The new factory, where, it is

gan Crucible Company, Limited, whose products range from the carbon brushes used in vacuum cleaners, hair-driers and refrigerators, to the special graphite blocks which are to be used in the Dounreay atomic reactor.

Its installation follows three years' study and evaluation by the Morgan Crucible investigation team on the particular problems which the computer would be called upon to solve.

It is estimated that the machine will pay for itself in a maximum of five years, even if present plans for its use are not expanded.

Wireless Telegraphy Regulations

THE following three sets of regulations were laid before Parliament on March 7th, 1957:

Wireless Telegraphy (Control of Interference from Ignition Apparatus) Amendment (No. 1) Regulations, 1957.

Wireless Telegraphy (Control of Interference from Electric Motors) Amendment (No. 1) Regulations, 1957.

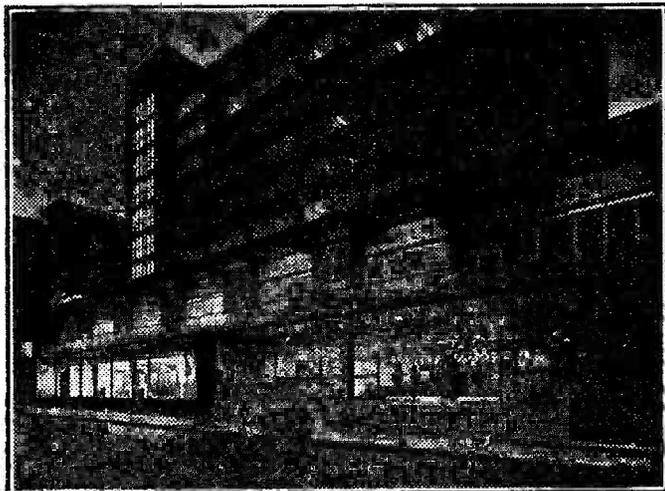
Wireless Telegraphy (Control of Interference from Refrigerators) Amendment (No. 1) Regulations, 1957.

They extend to the Channel Islands and the Isle of Man the existing regulations giving the Postmaster-General power to control interference to radio and television reception from ignition systems, electric motors and refrigerators. They came into force on May 1st, 1957.

Richard Arbib Elected Chairman of R.E.C.M.F.

RICHARD ARBIB, Chairman and managing director of Multicore Solders, Ltd., has been elected chairman of the Radio and Electronic Component Manufacturers' Federation. He entered the radio industry in 1929 in the electrical reproducer department of H.M.V. At the age of 25 he was appointed advertising manager of that company. During the last twenty years he has been largely responsible for the development of Multicore Solders, Ltd.

Mr. Arbib has been a member of the Council of the R.E.C.M.F. for many years and has represented that Federation on the Exhibition Organising and Public Relations Committees of the R.I.C. for more than 10 years. He is also a member of the R.E.C.M.F. Exhibition Committee.



The new Mullard House at night, showing the 88 ft. long glass windows and the main entrance. This magnificent building was officially opened in April at Torrington Place.

have resulted in a novel method of echo-sounding from the air which is likely to have a wide application in salvage work, mine detecting and fish-finding.

During the recent tests a Pye "Fishfinder," fitted in a Westland helicopter, was flown over and indicated a number of submerged objects in the English Channel. The method employed was as follows: a "Fishfinder" in the cabin of the helicopter was attached by a cable to a transducer housed in a specially designed, bomb-shaped submarine body. This was towed on, or just below, the surface of the water at speeds up to 50 knots. In order to transmit the signal from the submarine body to the helicopter, considerable problems of cable strain had to be overcome. For safety reasons a "weak link" was provided which would break at a predetermined stress, so that the submarine body

anticipated, between 400 and 500 people will be employed, is being constructed by Scottish Industrial Estates, Ltd., for the Board of Trade, who will in turn sell it to Pye, Ltd. It will permit a four-fold expansion of the present activities of Pye Scottish Telecommunications at Airdrie. It will be ready for occupation in March of next year.

British Computer Enters New Field

WIDER industrial use of electronic computers throughout Britain is foreshadowed by the news that a standard production line model has been put into daily use for purely routine accounting work.

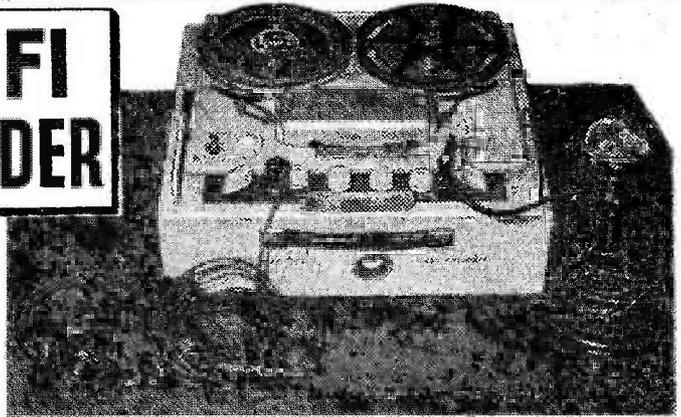
The machine is the Hec General Purpose Electronic Computer, made by the British Tabulating Machine Company, Ltd., and it has been installed in the Battersea, London, headquarters of the Mor-

THE P.W. HI-FI TAPE RECORDER

A NEW EFFICIENT DESIGN WHICH HAS BEEN EXHAUSTIVELY TESTED

By B. L. Phillips

(Continued from page 182, May issue)



Construction

THE cabinet is made from five-ply wood. The dimensions are given in Fig. 7 and is essentially a "box," 4in. deep, 14in. long, and 16in. wide. Along the front of the cabinet there is a 1in. plywood strip, and two 2in. strips either side of the cabinet. These latter two are for the tape-deck to rest on. The cabinet base must have a 3in. by 3in. square cut out just below the EL84s for ventilation. Above this, the 2in. wide strip on this side has a 1in. by 3in. cut out in it, also for ventilation purposes. The exact dimensions, will, of course, depend on the type of tape deck used. Four rubber feet are fitted, one in each corner of the cabinet.

Chassis

This is made out of two sheets of 18 s.w.g. aluminium, cut and bent as in Fig. 6. One sheet is bent to house the EL84s, and the remaining sheet is

bent into an elongated "L" shape to house the remaining valves. No definite measurements are given for the space between each valve base: a symmetrical layout is the ideal one. The two chassis bolt together, making one complete chassis, on which every component is mounted, apart from the power pack and output transformer. The controls are mounted on a hardboard panel, supported on the chassis by three aluminium brackets. Reference to Figs. 5, 6 and 8 will give all the mounting details.

In the prototype design the hardboard control panel was covered with a dark red material, which gave a finished appearance to it. On the chassis there is a screen between the phase inverter valve base, and the magic-eye (see Fig. 6). One point which requires clarifying is the mounting of the magic-eye. In Fig. 5 it will be seen that the 6U5 valve faces in the opposite direction to the remaining valves. This is so the "face" of the valve will peep into the hole

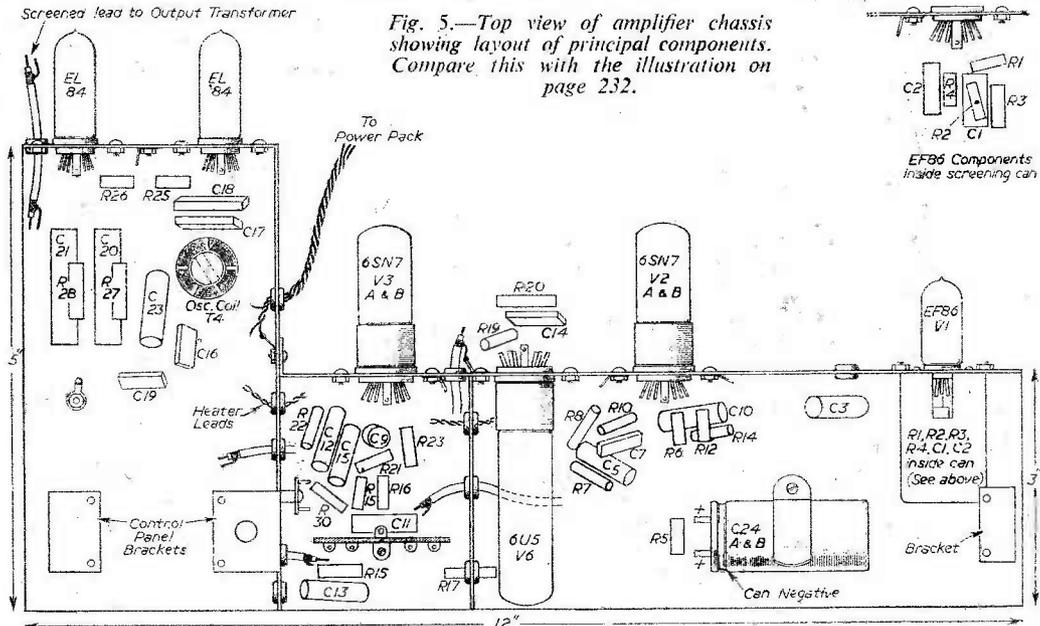
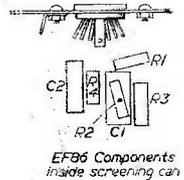


Fig. 5.—Top view of amplifier chassis showing layout of principal components. Compare this with the illustration on page 232.



EF86 Components inside screening can

in the front of the cabinet, when the chassis is inserted. Thus it is advisable to drill the magic-eye hole in the cabinet, only after the exact location of the "eye" on the cabinet front is known. To keep the light out of the surround of the indicator a black paper tube may be placed over it.

Component Placing in Cabinet.

The output transformer is mounted in the left-hand side of the cabinet, behind the EL84's. Screened leads of sufficient length to enable the chassis to be removed, are connected to the transformer. The filament transformer is mounted on the right-hand side of the cabinet. Just forward of this is mounted the rectifier. One end is bolted into the cabinet side, the other mounted on a small bracket. The smoothing choke is mounted, again on the cabinet side, with its stampings at right angles to the mains transformer. The smoothing capacitors (C22(A) and (B)) can be mounted either as shown in Fig. 7 or on top of the smoothing choke, supported by its own wiring, depending on the type of capacitor used. The leads from the power-pack, namely, H.T.+, H.T.-, filament leads, should be tightly twisted and of a fair length to allow the chassis to be removed for servicing, etc.

Wiring

All the components associated with the EF86 are wired as shown in Fig. 5, and a discarded I.F. can

of ample dimensions is placed over the components completely to screen them and the valve base. The can bolts on to the chassis side over the valve base. A small slit is cut in the uppermost-side of this can to allow the grid and anode leads to be brought out. The filament and H.T. - supplies are brought to the valve base underneath the can. This screen is essential, and must not be missed. All the leads shown on the circuit diagram (Fig. 1) with a dotted outline are screened leads.

This screening must be used and earthed to chassis as near the valve it is connected to as possible. Coaxial type flexible cable is suitable, or thin, screened single-core lead is ideal. Single point earthing for the three early amplifier stages *must* also be used to avoid earth loop hum currents and feedback. Incidentally, any "dead" and unused switch contacts can be used admirably as anchor points for odd components; for instance, capacitor C3. One end of this capacitor goes to one tag on the treble lift control VR2, while the other end goes to a "dead" contact on the switch, and then to the screened anode lead of the EF86. A metal screening can also be placed over the EF86 valve itself; this is optional and need only be fitted if the valve is picking up stray hum from the mains transformer.

Circuit Notes

The two phase inverter load resistors, R23 and

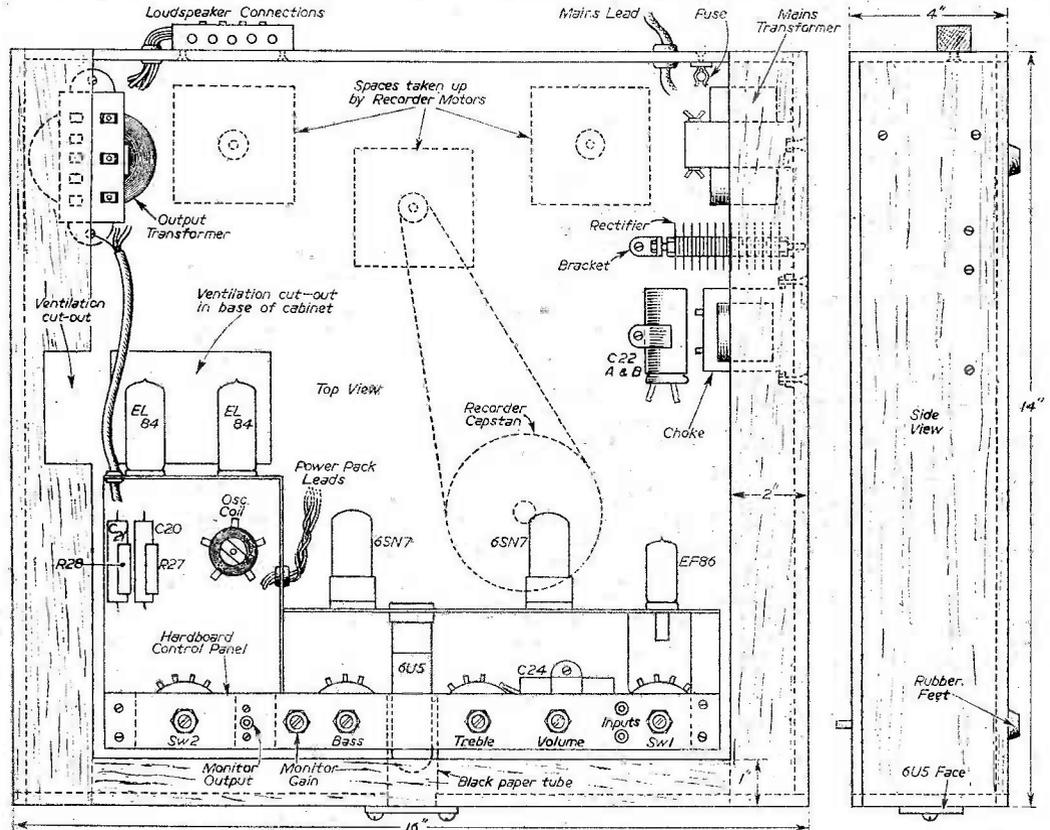


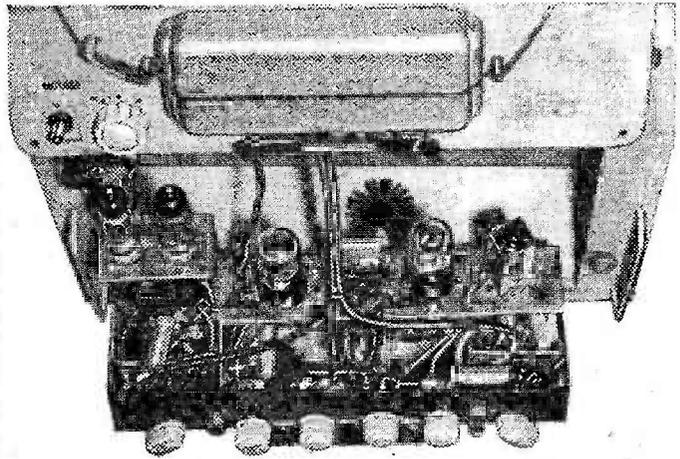
Fig. 7.—Top and side view of cabinet, showing chassis in position. The "face" panel for the controls is not shown here (see Fig. 8).

R30, must be matched to within one per cent. of their nominal value. Most component dealers will match two out of a number on an ohmmeter at no extra cost.

The negative feedback resistor (R29) is 20 K Ω for a 15 Ω loudspeaker, and 15 K Ω for a 2 to 3 Ω speaker. One side of the output transformer secondary is returned to chassis as shown, the other end of the winding going to this resistor. This resistor is mounted on top of the transformer tag panel. The feedback resistor can only be connected to one side of the secondary to give negative feedback. If the connection is reversed, the feedback will be positive. The way to find the correct connection is to connect the speaker and the resistor to the "15 Ω " tag, earthing the "O" tag. If, when playing a record through the amplifier, the noise level of the system seems higher than it should be, the connection of the resistor must be reversed. If, on the other hand, the quality appears satisfactory, the connection is correct. Sometimes the incorrect connection will cause the amplifier to oscillate at, or slightly above, audio frequency. Briefly, the correct connection of feedback will reduce the gain of the unit slightly, but improves the fidelity enormously and vice versa.

constant value for every tape-deck. In the prototype, this resistor was found to be 220 K Ω , but the method to find the value is given below:

First connect a resistor of 100 K Ω in this position



A view of the recorder out of its case, showing amplifier layout.

Tests

Before testing the amplifier, there is an important note about the R.F. bias feed to the record head of the recorder, via resistor R24. The actual value of this resistor depends entirely on the recording head characteristics, and, therefore, will not be a

so that it can be readily removed and substituted for another value, i.e., not soldering it.

Now check that no shorts exist on the H.T. and heater supplies, insert all the valves and connect the mains, neutral side to chassis. All valves should glow, and the magic-eye "face" should be illuminated. Make sure the loudspeaker is in circuit, and that both switches are in the "playback" position. Increase the volume control to maximum, the only sound coming from the loudspeaker should be the

Note: Fixing holes marked \oplus are for standard small bolts

Holes marked A, B etc. are bolted to its companion with the same prefix

Hole for Monitor Output Socket

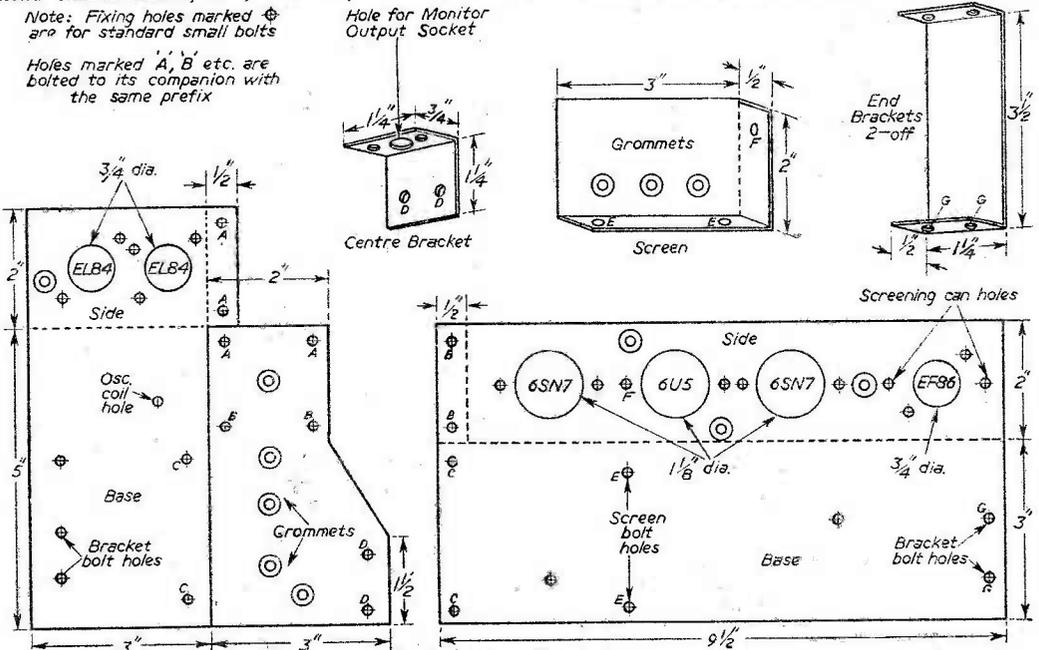


Fig. 6.—Chassis drilling details.

"hiss" of valve noise. No appreciable amount of mains hum should be present. Connect a gramophone pickup to J2 input, and test the amplifier by playing a suitable record. If all seems well, the recorder can now be tried. Short out input J1, with a coaxial plug (inner and outer connected together), but leave the gramophone pickup in J2. Switch both switches to "record," set the tape deck

Amplifier Facilities

As will be seen, the amplifier can be used for gramophone reproduction direct, microphone direct, by operating switch S1 to "f.c.," apart from recording and reproducing from magnetic tape. It can be used in quite large halls, feeding two or more loudspeakers suitably connected for correct matching. In conclusion, the author would like to express his

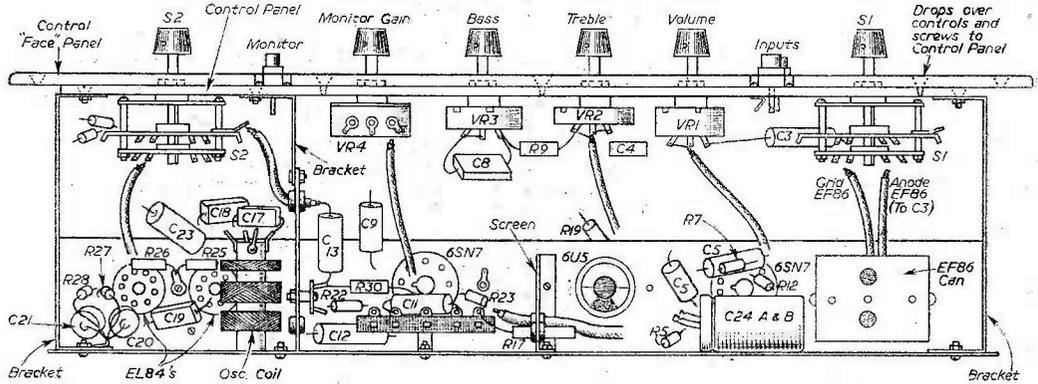


Fig. 8.—Front view of chassis, showing general layout of components and controls.

in motion, and increase the volume control until the magic eye segments just meet on loud passages. This is the correct-recording level. Inserting a pair of medium impedance headphones into J3, and increasing the "monitor gain" control, will allow audible monitoring of the signal.

Now replay the tape, not forgetting to remove the pickup to prevent shunting the tape signal. If the playback sounds muffled (the recording should be made with bass and treble controls at maximum), then the bias resistor R24 should be increased by 50 K Ω , and the test repeated until the playback sounds satisfactory. On the other hand, if the response sounds "crackly," insufficient bias is reaching the head. Decrease the 100 K Ω to 50 K Ω , and repeat test. This second test will also show whether the erase head is working correctly. If the two recordings appear one on top of the other, and sound "crackly" or very low in volume, then the oscillator circuit should be checked for incorrect connections, etc.

If the above method of tests are conducted systematically, the correct bias level is soon found.

When all is correct when recording direct off a record, the microphone can be connected to J1 and tests made. The microphone should be a crystal type, with a screened lead. To keep hand capacity effects down, any metal parts on the microphone casing must be connected to the screening of the cable. This will also keep the hum level down to a very low figure.

Loudspeakers

As the equipment is capable of reproduction of the highest quality, a good make of speaker is advised in a suitable cabinet. The larger the speaker baffle area, the better is the bass response. On the input side any crystal microphones are suitable, as long as they are sufficiently bonded and screened. Most types of pick-ups can be used, but inclusion of the appropriate compensation circuit should be included in the pick-up circuit.

thanks to the staff of the Harris Institute Physics Laboratory, Preston, for their help in supplying testing facilities.

Northern Polytechnic Lectures

LAST year following the Audio Fair the Northern "Poly" ran a most successful series of lectures on High Quality Reproduction. A similar course is to be run this year.

This course will start on May 13th and will take place on each Monday and Thursday, 6.30-8.30 p.m. for five weeks (with the exception of Whitsun week). The fee for the course will be £1 1s.

High Quality Sound Reproduction

1957:

May 13th: *Amplifier Design*—D. H. Busby (G.E.C.).

May 16th: *Electro-Acoustics*—E. H. Jones, B.Sc., A.M.I.E.E., A.M.Brit.I.R.E. (Northern Polytechnic).

May 20th: *Loudspeakers*—R. L. West, B.Sc., A.M.Brit.I.R.E. (Northern Polytechnic and Hi Fi News).

May 23rd: *F.M. Transmission and Reception*—R. S. Roberts, Scn. M.I.R.E., M.Brit.I.R.E. (Northern Polytechnic and Hi Fi News).

May 27th: *Pick-ups and Hearing Aids*—S. Kelly (Technical Editor, Hi Fi News).

May 30th: *Disc Recording and Reproduction*—Dr. G. F. Dutton, Ph.D., D.I.C., A.M.I.E.E. (E.M.I.).

June 3rd: *Electrostatic Loudspeakers*—P. J. Walker (Acoustical Mfg. Co.).

June 6th: *Magnetic Tape Recording and Reproduction*—J. F. Doust (M.S.S. Recording Co.).

June 17th: *Stereophonic Reproduction*—F. H. Brittain (G.E.C.).

June 20th: *The Complete Reproducing System*—Percy Wilson (Technical Editor *The Gramophone*).

Radio Components Show

DETAILS OF THE EXHIBITS AT THE 1957 R.E.C.M.F. EXHIBITION

AS was to be expected the emphasis this year was on printed circuitry and transistorised apparatus. The number of exhibits was greater than last year and it is, of course, impossible to deal with everything in a journal of this size. Accordingly we can only pick out some of the items which will be of interest to the home constructor rather than the manufacturer. Readers will remember that this show is intended primarily for the Trade and many of this year's exhibits were duplicated at the Audio Fair which was also held in April. Details of some of the exhibits here will be found on page 242.

Sub-miniature Components

The design of sub-miniature components has recently been stimulated to a great extent by the increasing use of transistors and the trend towards the personal-type receiver. As a result, the Wireless Telephone Company Limited, one of the principal suppliers of I.F. transformers and radio frequency coils, has now commenced production of a new range of single tuned, sub-miniature, intermediate frequency transformers (5/8in. diameter by 11/16in. high), oscillator and Ferrite aerial coils. These new components, approved by Messrs. Mullard Limited for use with transistors OC45 and OC44, are equally suitable for conventional-sized receivers as well as for midget sets. Moreover, they are also available for use with transistors made by other manufacturers.

The type ST side trimming 470 kc/s transformer has been designed as a standard general purpose radio I.F. transformer with high performance and a degree of mechanical stability necessary for portable and automobile type receivers. It offers the advantages of side trimming, yet is still a lightweight miniature I.F. transformer of high efficiency, housed in a screening can 13/16in. square by 2 1/16in. high. A number of different methods of mounting are available suitable for printed circuits and conventional chassis: these include "plug-in," spring clip and yoke arrangements.

On the G.E.C. stand a hydrogen thyratron, the GHT.2 was of particular interest. This valve is the first of a new range which incorporates the new barretter-controlled hydrogen-replenisher system. This system, which is patented, automatically replaces the hydrogen "cleaned up" during life and compensates for variations in the supply voltage and ambient temperature. The resultant effect is to increase the life expectation of the valve and simplify the supply circuits.

Three magnetrons were shown, a MAG.7, a MAG.8, and a CV.2380, the latter is a miniature magnetron on a B7G base and is intended as a pulse test source at "X" band.

A number of audio valves were shown among which was the new KT.88. This valve is an output beam pentode with an anode dissipation of 35 W. It is primarily designed for use in the output stage of an audio-frequency amplifier in which two valves will provide up to 100 watts.

Condensers

Jackson Bros. showed a new miniature variable

twin condenser, designed especially for transistorised receivers, it is shown on page 236. The two gangs give maximum capacities of 208 pF (front) and 176 pF (rear). The cadmium-plated steel frame is 1 1/32in. long and has a frontal area of 1 3/8 in. x 1 17/32 in. This includes the sweep of the aluminium vanes. The spindle is 1/4 in. diameter by 3/8 in. long, the air gap .0085in., and the insulation ceramic. Priced at 9s. 6d., this new miniature component weighs only 2 1/2 oz.

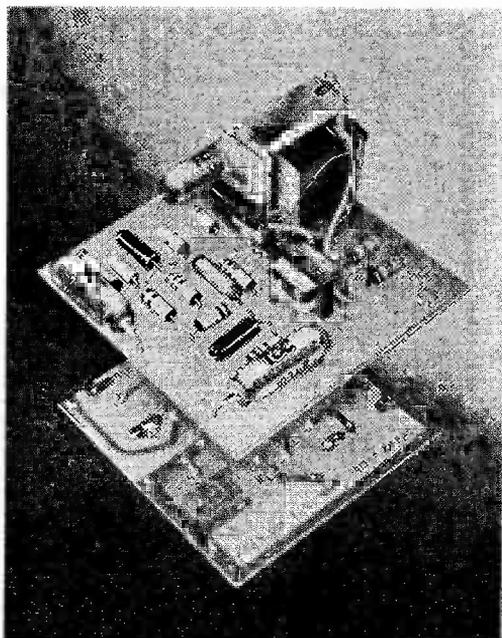
A new addition to the Mullard range of concentric air-dielectric trimming capacitors made its first appearance at the Exhibition.

This new capacitor (Type E7879) has general characteristics similar to those of the well-established type 7864/01, but has the important advantage of a greatly increased capacity range of 4-60 pF. This makes it particularly valuable in car radio applications, where a trimmer of extended range is often essential to cater for the widely differing input conditions imposed by the diversity of aerial design and location on the vehicle.

The remainder of the range of concentric trimming capacitors was also shown, together with Mullard precision variable capacitors.

Semi-conductor Devices

Among the range of semi-conductor devices exhibited were two Mullard 100-volt sub-miniature diodes, types OA91 and OA95, shown for the first



A 200 m/watt transistorised amplifier on a printed circuit by T.C.C.

time. Both are of all-glass construction and intended primarily for industrial applications.

Newcomers to the Mullard transistor range now in quantity production are the OC44 and OC45 R.F. p-n-p junction transistors. The OC44 is designed for use in converters and mixer oscillator circuits, while the OC45 is intended for use as an I.F. amplifier in amplitude modulation receivers.

282 and 283 are for printed circuit applications. Tappings can be provided on all models if required.

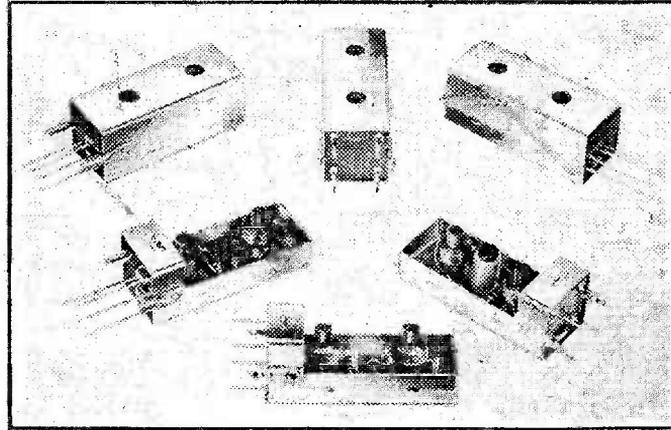
Providing the circuit facilities of variable potentiometers, but occupying little more space than fixed resistors, the new Egen Types 170, 171 and 172 sub-miniature pre-set rotary potentiometers have many applications where the use of a normal variable control would be impracticable. They are light in weight, easily adjusted and have a power rating of 1/10 W., while the contact pressure of the nickel-silver wiper assembly ensures maintenance of the original setting under normal use.

Type 170 is designed for independent mounting, while Type 171 is intended for printed circuits and Type 172 is provided with leads for supporting in the wiring.

Representing the ultimate in simplicity and space saving, the new Egen sub-miniature pre-set potentiometers Types 173, 174, 195 and 196 provide the circuit facilities of variable potentiometers with the convenience of self-supporting mounting.

Types 173 and 174 have carbon tracks, with a power rating of 1/4 W., the former for printed circuits and the latter for supporting in the wiring. Types 195 and 196 are similar to Types 173 and 174, respectively, but are wire-wound, with a power rating of 1/4 W.

A prototype of a new Egen hearing aid control, Type 194, of 1/4 in. diameter, was exhibited, its main feature being an exceptionally low noise value. This control is suitable for use with normal and transistor circuits.



The new Wireless Telephone Co. type ST side trimming 470 kc/s transformers. The three models at the rear show the different methods of mounting.

The OC70 and OC71 A.F. transistors, which now have greatly improved ratings, were also seen.

Silicon Junction Rectifiers

SenTerCel 1/2 amp. Silicon rectifiers, which have been available in experimental quantities for some months, went into full production on February 1st, 1957. Outstanding advantages are high temperature performance and the large output in relation to size and weight. Operation at ambient temperatures up to 100 deg. C. is permissible and the rectifiers, each of which weighs only 0.045 oz. are smaller than a conventional 1/2 watt resistor. Three types are in full production—RS22A for a maximum peak inverse voltage of 150, RS21A for a maximum (P.I.V.) of 100 and RS20A for 50 volts maximum (P.I.V.). The devices are hermetically sealed for long life and stable characteristics.

Other SenTerCel rectifiers, in the pre-production stage, were also exhibited. These include 1 amp. and 5 amp. devices.

Potentiometers

A new range of 1 1/2 in. diameter Egen carbon potentiometers are now available with or without an alternative standard or heavy duty switch. Types 181, 183, and 243 are for normal use, while Types 281,

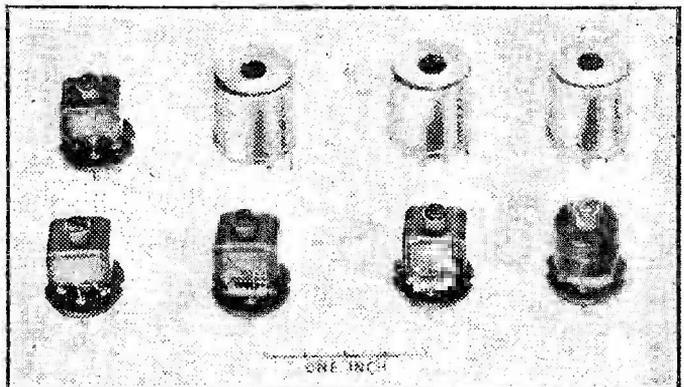
282 and 283 are for printed circuit applications. Tappings can be provided on all models if required. Providing the circuit facilities of variable potentiometers, but occupying little more space than fixed resistors, the new Egen Types 170, 171 and 172 sub-miniature pre-set rotary potentiometers have many applications where the use of a normal variable control would be impracticable. They are light in weight, easily adjusted and have a power rating of 1/10 W., while the contact pressure of the nickel-silver wiper assembly ensures maintenance of the original setting under normal use.



Sub-miniature electrolytic capacitor, aluminium encased with wire terminations. Size: 1/4 in. diam. x 1 in. long. By Dubilier.

T.C.C. Capacitors

The wide selection of capacitors by T.C.C. included new and established products. Of particular interest was an entirely new range of P.T.F.E. dielectric Capacitors in tubular



A selection of the new range of single tuned, sub-miniature I.F. transformers and oscillator coils, developed by the Wireless Telephone Co.

construction. They extend to .2 μ F, and above this capacity the construction is in metal boxes with ceramic bushings.

These capacitors are suitable for working at 200 deg. C., and have exceptionally high I.R. and low P.F., and are intended for use where high working temperatures preclude the use of other plastic film or paper dielectrics.

As an extension to the existing range of T.C.C. tantalum electrolytic capacitors, a series of miniatures has been developed, primarily for use with aircraft instruments and sub-miniature transistor circuitry.

Also shown were low-leakage high-quality electrolytics for use with grid coupling in L.F. amplifiers; sub-miniature electrolytics for transistor circuits and hearing aids; silvered micas in Plimoseal finish to comply with RCS.132 Category A Class H1 requirements; miniature lead-through ceramics intended for direct soldering through, or on to, a chassis or sub-assembly; tubular ceramic pulse-feed capacitors for working up to 5 kV.; metallised polystyrene capacitors of exceptional electrical properties for tuned filter units, etc. Printed circuits: As leading producers of printed circuits, T.C.C. showed many types, among which were battery/mains receivers, TV sub-chassis tuner units and filters, and inductors and low-value capacitors for F.M. printed integrally with the circuits.

Concurrent with printed circuits in T.C.C. production, new ranges of paper dielectric and electrolytic capacitors have been developed for their specific use. The capacitors are vertically mounted and have pre-tinned and surface-preserved terminations making them suitable for dip-soldering.

Dubilier Capacitors

A standard range of paper, mica and electrolytic capacitors complying with latest Service and industry specifications was shown by Dubilier, and in addition the following specialities:

Mica dielectric low-power transmitting capacitors and pulse-forming networks having reduced weight and dimensions, with the elimination of liquid filling and suitable for pan-climatic conditions.

Terylene dielectric capacitors in metal tubes with ceramic end seals having reduced dimensions, suitable for operation up to 125 deg. C. with high insulation resistance.

Sub-miniature electrolytic capacitors (see page 235) with excellent characteristics for printed circuit and transistor applications, also electrolytic capacitors having special features for printed circuits.

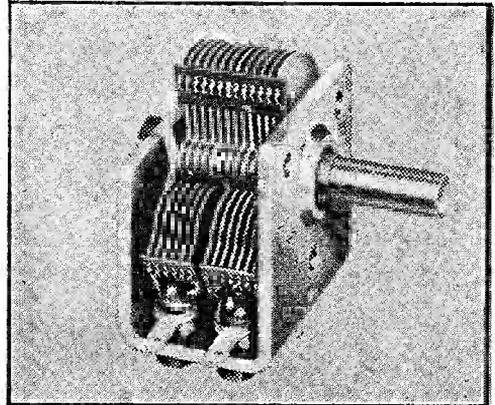
A complete range of devices meeting B.S.S. requirements for the suppression of electrical interference on all radio and television wavebands; also radio-frequency suppression chokes rated up to 6 amperes.

A new insulated carbon resistor, Type BTA, having reduced dimensions and improved characteristics, maximum rating 1 watt 500 volts at 70 deg. C., also carbon track potentiometers for normal and printed circuit application and a metal-cased miniature control.

Gramophone Apparatus

Collaro were exhibiting their well-known AC456 record changer, and in addition an entirely new four-speed record changer, which has several unique features and was being shown for the first time. Also shown were the Collaro four-speed gramophone unit AC4/564 and a new junior four-speed unit.

Another interesting exhibit was the new high-fidelity tape transcriber (Mark III). This is designed on transcription quality principles for live recording, recording from F.M. broadcasts and reproducing pre-recorded tapes. A twin-track model, fitted with four heads, it runs at 3 $\frac{1}{2}$ in., 7 $\frac{1}{2}$ in. and 15in. per second. Operation and braking are mechanical, performed without rubber belts or solenoids; control buttons are foolproof, as after the depression of any control



A new Jackson Bros. gang condenser, the "00."

all others are interlocked, and to start them once more a stop control must be operated.

To prevent unintentional erasure of pre-recorded tape, a safety slide must be moved before the 'record' button can be depressed.

A special pause control enables the operator to record only those parts of the programme he requires. By pressing the pause button towards the front of the transcriber, the tape is stopped from going through the heads, leaving the machine in the "on" position, and the motors still running. Immediately pressure on the button is released, passage of the tape through the heads is resumed.

Another new exhibit was the four-speed gramophone transcription unit, Model 4T200. The new type four-speed mechanism ensures absolutely uniform speed, with reproduction free from frequency modulation. The heavy turntable is fitted with a ground and lapped spindle running on to a ball which takes the total thrust and results in correct speed with no detectable "wow" or "rumble." The studio transcription arm is of tubular metal, having very low resonance, plays 16in. records, and can be fitted with any of the famous "Studio" crystal cartridges. Model 4T200 can also be supplied less pick-up arm.

Loudspeakers

The complete range of Stentorian loudspeakers from 2 $\frac{1}{2}$ in. to 18in. in diameter now incorporate the patented cambric cones, providing a quality of reproduction not otherwise obtainable at many times the price. Also models HF.1012 (10in.), HF.912 (9in.), HF.816 and HF.812 (8in.) are fitted with universal impedance speech coils, providing instantaneous matching at 3, 7.5 and 15 ohms.

Outstanding additions are an 8in. P.M. unit fitted with a 16,000 gauss Alcomax magnet (type

(Continued on page 274)

AN ELECTRONIC TIMER

A USEFUL ACCESSORY FOR MANY SWITCHING APPLICATIONS
By Allen James

THE circuit about to be described has been in use for some time by the author as an automatic porch light switch. It has saved much fumbling in the dark for keys, etc., and has also cut down on electricity bills, due to the fact that the light was often accidentally left burning. In use the unit was mounted on the wall inside the porch, and the micro-switch was mounted underneath the door mat; when anyone stood on the door mat the timing cycle commenced and the light came on. When that person left the door mat the light would switch itself off, after the timing cycle was complete. The time cycle in the author's case was approximately two minutes. If, however, the micro-switch is still depressed when the two minutes are completed then the circuit will reset itself and continue timing for a further two minutes.

stabiliser V1 will strike and pass about 20-40 mA for a fraction of a second, which is enough to operate relay "A." The contacts "A1" close and hold "A" relay on until C2 is nearly discharged; when C2 is removed from the H.T. line the voltage across R1 and the "B" relay is reduced to about 60 volts or less, so

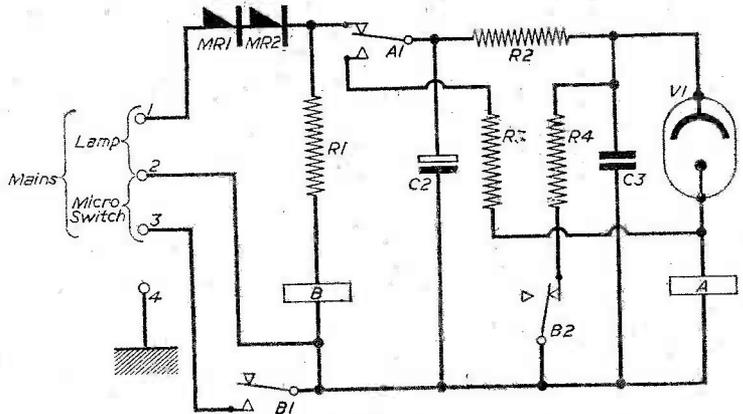


Fig. 1.—Circuit of the timer. If required all resistor values can be reduced by half and the value of C3 doubled for the same timing range.

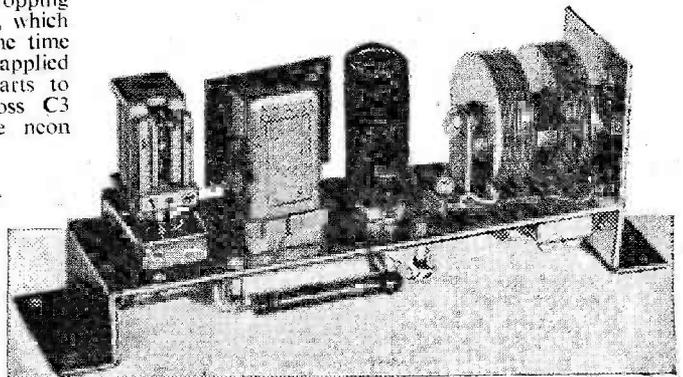
Circuit Description

The circuit is shown with the relays in the de-energised position. On completing the circuit between "B" relay de-energises, "B2" contacts remove the metal rectifiers and its voltage dropping resistor R1, "B1" contacts then close, which holds the "B" relay on; at the same time "B2" contacts open. H.T. is also applied across R2 and C3, therefore C3 starts to charge up; when the voltage across C3 is high enough (100-150 volts), the neon

"B" relay de-energises, "B2" contacts remove the metal rectifiers and its voltage dropping resistor R1, "B1" contacts then close, which holds the "B" relay on; at the same time "B2" contacts open. H.T. is also applied across R2 and C3, therefore C3 starts to charge up; when the voltage across C3 is high enough (100-150 volts), the neon

LIST OF COMPONENTS

- C2—4 μ F 450 v. D.C. (T.C.C.).
- C3—4 μ F 350 v. (see text).
- R1—(See text).
- R2—3—10 M Ω } watt (Dubilier).
- R3, R4—10 K Ω } watt (Dubilier).
- MR1, MR2—RM2.
- "A" Relay—1,700 Ω H.S.
- "B" Relay—500 Ω -5 K Ω G.P.O.
- V1—OA3, OB3, 90C1, etc.



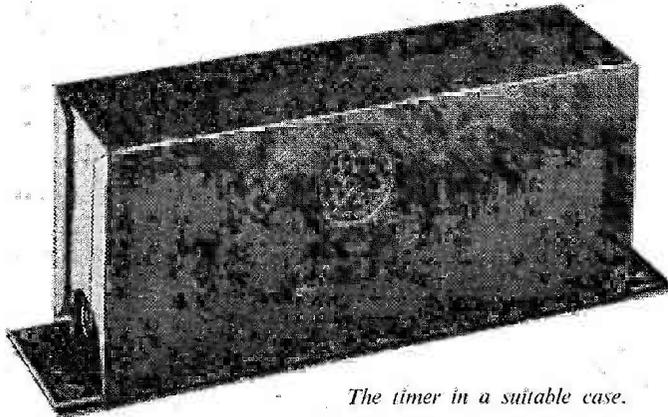
Another view of the timer.

the timing capacitor C3, the "A" relay then de-energises. If, however, tags 2 and 3 are still shorted, then the circuit will continue for another time cycle.

any type of relay, the G.P.O. type being particularly suitable. Various types having coil resistances of between 100 Ω and 5 KΩ have been used, the one with the 5 KΩ coil being retained in the interests of economy. C3 should have a fairly good insulation resistance, the one used in the circuit was a small metallised paper capacitor which was found to have a resistance of 2,000 MΩ at 120 volts. The timing resistor R2 was made up of three 10 MΩ resistors in series, but a 30 MΩ could be used if available.

Other Uses

The circuit has many other uses, such as switching on or off various electrical equipment, timing processes, photographic developing and printing, etc. The writer has also toyed with the idea of using it as the basis for an electronic clock. Most uses entail alteration of the timing cycle.



The timer in a suitable case.

The value of R1 is dependent upon the type of relay used and the following formula will give the approximate value:

$$R1 = \frac{(250 - VR) RR}{VR}$$
 Where RR is the relay coil resistance in ohms and VR the working voltage of the relay in volts; a 4.5 w. wirewound resistor should be used here.

In the original circuit V1 was a neon stabiliser, type 90C1. However, almost any stabiliser can be used in this position, and the writer has tried an OA3, an OB3 and a VR150/30, with complete success. Relay "A" is of the high speed type and has a coil resistance of 1,700 Ω; almost any small current relay can be used here, and there is an excellent one

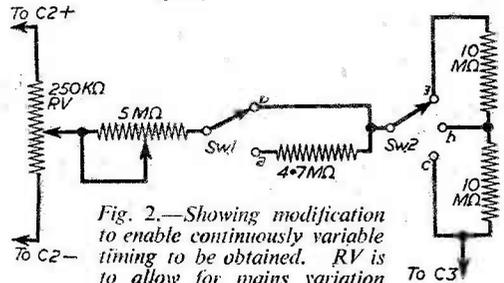
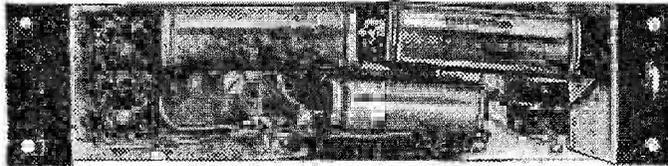


Fig. 2.—Showing modification to enable continuously variable timing to be obtained. RV is to allow for mains variation and is adjusted for "20 seconds" when the timing controls are set at "20 seconds."



Underside of chassis view.

on the government surplus market which operates on a current of .05 mA. Relay "B" can be of almost

TABLE SHOWING TIME RANGES FOR FIG. 2

Sw.1 Position	Sw. 2 Position	Time Range
b	c	0.5-20 secs.
a	c	20-40 secs.
b	b	40-60 secs.
a	b	60-80 secs.
b	a	80-100 secs.
a	a	100-120 secs.

This is quite simple, for the time in seconds is given by R2 x C3, where R2 is in megohms and C3 is in microfarads. For those who require a continuously variable time from about half a second to 120 seconds, reference should be made to Fig. 2, the components in Fig. 2 being placed in the main circuit in lieu of R2. The timing range can be extended—in the writer's case three minutes was about the longest and is dependent on the leakage current through C3; the shortest was approximately a tenth of a second, and is dependent on the operating time of the relays, and the ionisation and de-ionisation time of the neon used.

All the timing cycles given throughout this article are accurate, having been timed with a stop clock, but it may be found that they will vary slightly if different types of relays and neons are used. However, the unit can be calibrated and the calibration should stay reasonably accurate for a long time.

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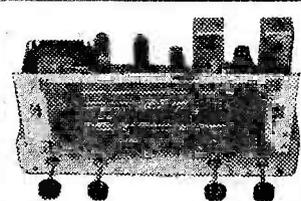
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Table with columns: All Boxes, VALVES, New & Guaranteed. Lists various valve types and their prices.



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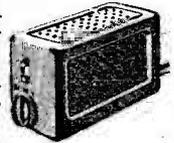
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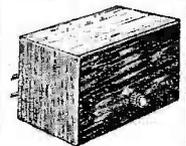


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On Your Wavelength

BY THERMION

Awards for Technical Writing

THE Radio Industry Council every year awards up to six premiums of 25 guineas each to the writer or writers of articles published between January and December in any one year which, in the opinion of the Council's panel of judges, are likely to enhance the reputation of the industry and focus the attention of people throughout the world on Britain's leadership in the fields of radio, television and electronics. The awards are made for articles published at home or abroad in papers which can be bought by the public on bookstalls. A wide sphere of journals is thus embraced by the scheme. One of the 25-guinea premiums will be open to articles published in manufacturers' journals with an overseas circulation. Articles published in journals circulated exclusively to members of a trade and journals of professional institutions or learned societies will not be eligible.

Any writer will be eligible who is not paid a salary wholly or mainly for writing and not earning 25 per cent. or more of his income from fees for articles or from book royalties. Where an article is by two or more authors, each must be eligible under the above terms and the award of 25 guineas will be made jointly. Any number of articles may be submitted.

The R.I.C. has always been a progressive trade institution and I congratulate it for its efforts to encourage young scientists to set their thoughts and the results of their experiments on paper.

Political Broadcasts

AFTER joint consultations with the Government and the Opposition, the following arrangements for Party Political Broadcasts in the fifteen months April 1st, 1957, to June 30th, 1958, have been made by the Corporation and the Authority, in conjunction with the Independent Television programme companies.

There will be two series of Party Political Broadcasts:

- (1) Sound:
- Government, 5.
 - Opposition, 4.
 - Liberal, 1.
- (2) Television:
- Government, 5.
 - Opposition, 5.
 - Liberal, 1.

The duration of the sound broadcasts will normally be fifteen minutes. They will be given as hitherto at 9.15 p.m. in the BBC's Home Service. They will be repeated, in sound only, at the end of the BBC's television programme.

The television broadcasts will again be transmitted simultaneously in the BBC and Independent Television programmes. Their duration will be twenty-five minutes for two each of the Government and Opposition broadcasts, and fifteen minutes for

the remainder. The broadcasts will be given at 10 p.m.

Judging from past political broadcasts, and the bitterness which was imparted into them, I should like to see them abolished altogether. Few people change their political views as a result of speeches whether made on the platform, in the press, on radio or TV. The man that has the last say on TV or radio has the advantage. I do not like to hear political ranting and jockeying for position. If you agree that your views are not changed by being talked at, you must agree with me that the basis for such broadcasts vanishes. My party, right or wrong, is the order of the day.

The Electronic Wrist Watch

I EXAMINED the other day an American wrist watch operated by a tiny battery which runs the watch for one year. The battery is circular and about the same size as the ordinary mainspring barrel. It is buried in ceramic, so I was unable to pull it to pieces to determine how it was made. The battery showed the full 1.5 volts and imparts quite a healthy kick to the balance, which is directly impelled by the battery and thus drives the watch, unlike the ordinary watch where the balance is driven by the mainspring. There is no lever as in an ordinary watch, and the swing of the balance ratchets the train of gears. Thus has electronics brought about a major horological development. The tiny coil is wound from finer wire than I have ever seen, and it is placed in the balance wheel. Such watches, I understand, are already on sale in this country.

With these miniature batteries, no larger than a 6d. piece, transistors, midget resistances, speakers, coils and condensers, it should surely be possible now to develop a really personal pocket receiver. There is undoubtedly a demand for it.

That Extra Quid

I DO not think that many people will object to paying the extra pound for a TV licence. It is still the cheapest form of entertainment, and viewers have been getting something for nothing for several years. There was no case for increasing the sound licence, since the revenue (£1 per licence) yielded adequate money to maintain the BBC. Too much money in a Government sponsored entertaining authority encourages inefficiency, and it cannot be said that the BBC is run with the same commercial efficiency as an ordinary commercial enterprise which has to account to its shareholders each year and make a profit or go bankrupt.

Tenth Edition

Practical Wireless Service Manual

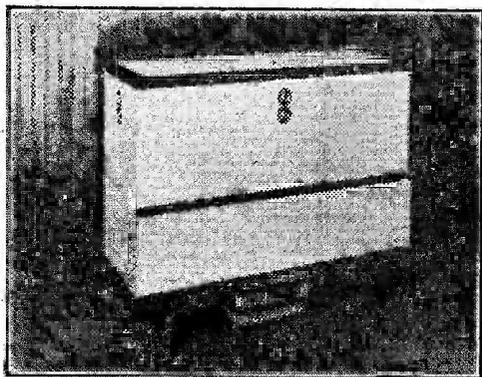
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The Audio Fair

AN ACCOUNT OF SOME OF THE EXHIBITS
AT THIS YEAR'S HI-FI EXHIBITION

THIS year's audio fair was even larger than the previous, and it shows that the principle of audio engineering is catching a greater hold on the imagination of the public. Whereas some time ago the listener or gramophone fan was satisfied with more or less what might be termed average reproduction, many to-day spend a considerable amount of money on special amplifiers and associated equipment in the category now known by the term "Hi Fi." Certain manufacturers now specialise in the production of amplifiers and pre-amplifiers designed to give very high quality outputs, many of which are so good that the majority of users fail to do justice to them with the particular speaker or speaker assembly which they employ. At the Audio Fair one is able to hear reproductions at



The new G.E.C. periphonic loudspeaker.

their best from amplifiers, gramophone reproducers, tape recorders and speakers, and this year there were over 50 exhibitors.

Stereophonic reproduction was well represented by E.M.I. and others, and in this brief report we can, of course, only just cover the many exhibits.

Amplifiers

In the amplifier category an interesting exhibit was a model by Thermionic Products and shown on page 243. Apart from the unusual assembly—note the valves sunk below chassis and the tray with carrying rod—the specification is very impressive. Rated at 10 watts, this has the exceptionally low noise level of -95 db. "C" core laminations are used for the transformers and there are four input sockets with sensitivities ranging from 20 to 100 mV. The control unit has eight selectors covering various types of record as well as microphone and radio, and the treble and bass controls are continuously variable. The price is £37 10s., plus £1 for the carrying tray if desired.

On the Leak stand there were two new amplifiers and a new pre-amplifier styled by Lonsdale-Hands. Another important feature on this stand was the reduction in price. The TL/12-Plus, a successor to the popular TL/12, is now £9 9s. cheaper than its predecessor, namely £18 18s. instead of £28 7s. This has a noise level of -84 db. and requires 125 mV. for 12 watts output.

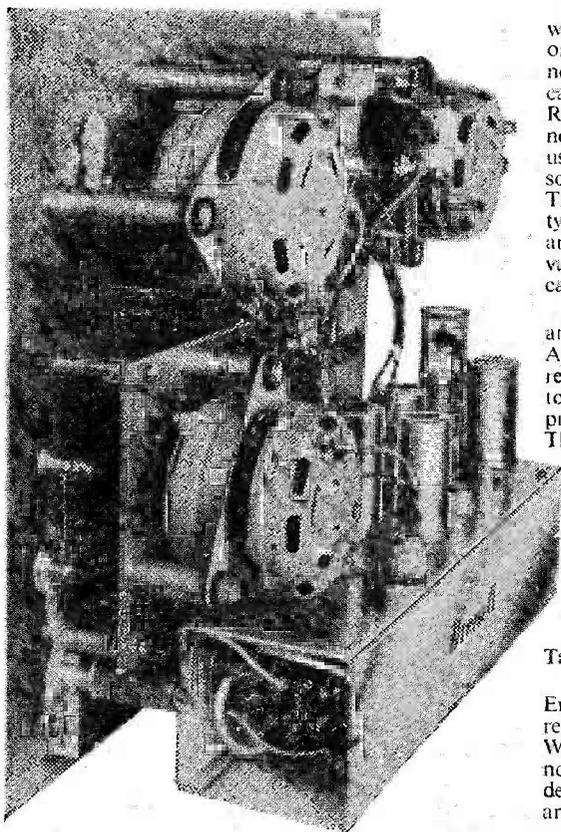
The Leak "Point One" new version now costs £25 14s. instead of £34 7s. This is a 25 watts model with a noise level of -83 db. Both this model (which is ultra linear) and the previously mentioned amplifier are designed for use with the Vari-Slope III pre-amplifier.

Other amplifiers were shown by Pye, Mullard, etc.

Tape Recorders

A new representative at the Fair was the Brenell Engineering Company, whose deck, readers will remember, was originally used in the PRACTICAL WIRELESS recorder published some time ago. They are now able to supply a complete recorder or separate decks, and the illustration on the left shows the deck and the neat pre-amplifier assembly attached.

Among the many features are three recording speeds (3 $\frac{1}{2}$, 7 $\frac{1}{2}$ and 15 i.p.s.) with speed change above



A Brenell tape deck with the amplifier attached.

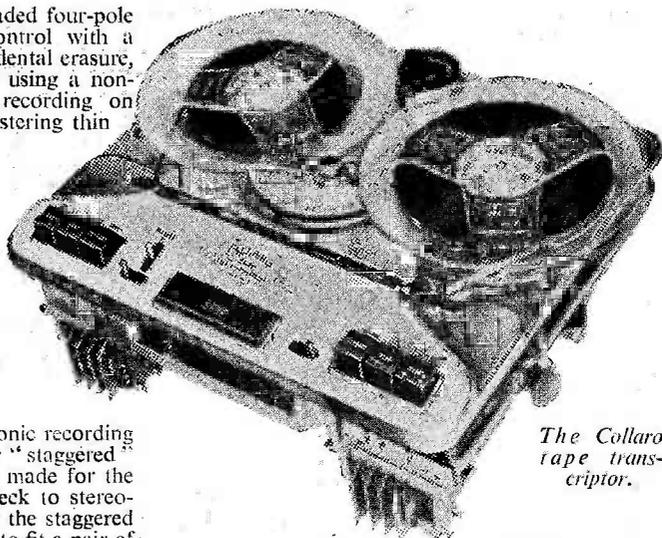
deck—the use of three high quality shaded four-pole motors, an ingenious interlocking control with a safety device positively preventing accidental erasure, a new flywheel and capstan assembly using a non-magnetic steel capstan, twin track recording on 8 $\frac{1}{2}$ in. reels with an indicator plate registering thin as well as standard tape. An optional extra is an accurate digital revolution counter.

In addition to the foregoing, the Mark IV also includes all the well-proved Brenell features such as drop-in tape loading, instant stop without tape spillage, forward or reverse tape transit in 45 seconds for the normal 7 in. spool and azimuth head adjustment.

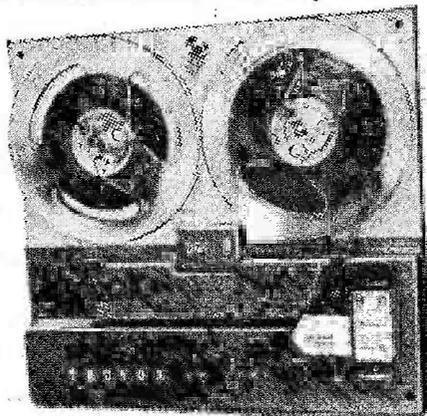
In the development of this Mark IV deck, Brenell engineers have been aware of the great interest in stereophonic recording in America, using either "stacked" or "staggered" heads. Provision, therefore, has been made for the purchaser to convert any Mark IV deck to stereophonic recording at any later date. If the staggered principle is used all that is necessary is to fit a pair of additional heads—the holes for which have already been provided in the main plate.

Designed specially for use with the Mark IV deck—but also suitable for other makes with suitable characteristics—is the new Brenell pre-amp unit. Fitted immediately below the deck and attached by two screws only, this unit is a fine example of compact design and high performance. Using five valves (including magic eye recording level indicator) and special circuitry comparative tests have shown that this unit is remarkably efficient. For stereophonic recording using staggered heads two of these units can be mounted together.

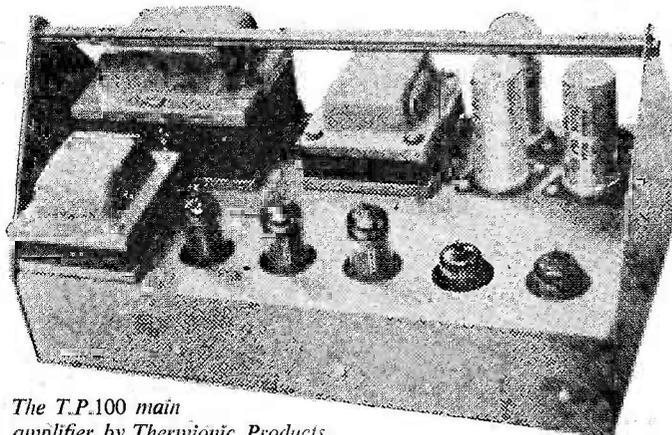
Among the many other



The Collora tape transcriber.



The Truvox tape deck Mark IV.



The T.P.100 main amplifier by Thermionic Products.

exhibits may be mentioned that of Mullard, which included valves and transistors as well as the popular amplifier and new transistorised amplifiers and associated equipment. A strong point was made regarding the supply of OC72 transistors in matched pairs for use in Class B push-pull output stages, and the new OC16 p-n-p alloy type power transistor which is of metal construction and is designed for use in A.F. amplifiers, switching circuits and pulse oscillator circuits.

Gramophone Reproducers

Among the record reproducers may be mentioned the high quality Model X2005, by E.M.I. This is a table-type three-speed reproducer incorporating an eight-record auto-mechanism, a three-valve amplifier; a turnover crystal cartridge pick-up and a high flux 10 $\frac{1}{2}$ in. elliptical speaker. It delivers a generous output of remarkable quality for such a compact model. The well-proportioned cabinet is attractively finished in polished sapele lined with sycamore.

Dynatron Radio were showing a hi-fi V.H.F. 13-valve radiogram, producing instantaneous selection of the BBC V.H.F. programmes at the turn of a switch and incorporating the latest four-speed record changer with variable reluctance pick-up and vented air loaded speaker system. They also displayed their V.H.F. tuner unit which is used by the BBC and relay organisations both as a

main and a monitor receiver. In this, constant stability has been obtained by a perfected system of automatic frequency correction and four correctly tuned channels are provided by a rotary switch. It has a Foster-Seeley detector with two limiter circuits.

A New Pick-up

The new Philips Transcription Magnetodynamic Pick-up and Arm (Type NG 5400) is of unique design. It is a development which embodies a new principle in pick-up technique exclusively pioneered by Philips. The output to be expected from this high-sensitivity transducer is of the order of 20 to 25 mV. and is strictly linear with needle-tip velocity. Careful design of the cantilever ensures a good vertical compliance and needle talk is reduced to a minimum. The unusual construction of this pick-up was made possible by the development of "Ferroxdure"—a lightweight, high coercive material. A thin rod of this material, diametrically magnetized and with the cantilever attached to one end, forms the readily

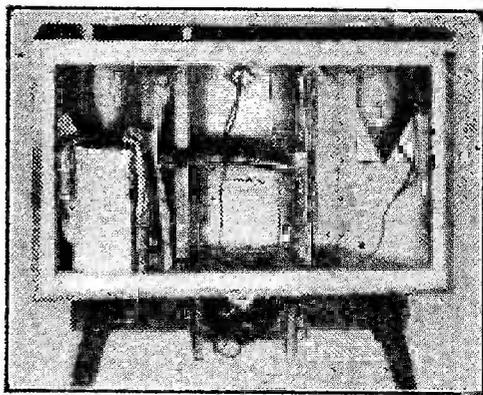


Here the two speakers are mounted in the G.E.C. periphonic assembly.

removable armature system. The rod is held by two bearings between the ends of a mu-metal yoke carrying the coils and is free to rotate about its axis. The yoke and coils are resin moulded and the whole assembly is mu-metal screened.

A New Loudspeaker

Although various types of speaker were to be seen, probably most interest was aroused by the new G.E.C. assembly which was shown to the public for the first time. A Press demonstration had been given a few weeks before the show, and we were able there to see various specific demonstrations of the new arrangement and to hear something of its design. Unlike any other speaker assembly on the market, the actual units are mounted *outside* the cabinet. The complete assembly is shown at the top of page 242 and although the G.E.C. are prepared to sell this they will supply constructional details so that constructors may make it up for themselves. Basically, it consists of two of the G.E.C. small metal cone speakers mounted one inside the other, as



Interior of the G.E.C. periphonic speaker.

shown in the illustration on left. They are as close to each other as it is possible to get them and they work out of phase; that is, one diaphragm goes out as the other goes in. The structure holding these two speakers is suspended below the cabinet, as shown in the rear view at the top of this page. The inside of the cabinet merely contains damping material and lengths of stiffening material to prevent "drumming," and to improve results (although not essential) "presence" units are mounted on the upper part of the cabinet. They may be seen in the front view on page 242. The complete cabinet shown will cost 60 gns. without the two speakers, but it could be made up by a constructor from Weyroc or heavy ply for about £10 or £15. It is an interesting design and shows yet a further attempt at obtaining high-fidelity reproduction, although in our opinion the amplifier, even after looking round the Fair, still appears to be the weak link in the chain. From the point of view of those who are interested in this branch, we did not see a single amplifier which was direct-coupled throughout, and no manufacturer appears to make a complete cross-coupled amplifier such as is now very popular in hi-fi circles in America and which we have been using for some time.

PRACTICAL TELEVISION MAY ISSUE NOW ON SALE PRICE 1s. 3d.

Stereoscopic or 3-D television is the main topic of the current issue of our companion paper now on sale. This development was produced primarily for use at Harwell, but the principles involved, as will be seen from the article referred to, have possibilities for future entertainment purposes. This issue also contains a report on the Television Society's Exhibition, and details of some of the transistorised apparatus which was on show.

Further notes are given on the construction of a Multi-Range Test Meter, whilst for those wishing to start a Television Servicing Department there is an article by a Service Engineer dealing with the various points which have to be considered.

On the subject of Servicing there is also an article on the dangers and risks which arise when servicing A.C./D.C. receivers, or normal A.C. receivers which in many cases to-day adopt the transformerless or A.C./D.C. technique.

Starting a Service Department

NOTES BY A SERVICE ENGINEER FOR THOSE WHO WISH TO START A SERVICING BUSINESS

By F. E. Apps



IN very many cases, radio sets, etc., can be serviced at the customer's house, but in many other cases, especially where obscure, intermittent at long intervals, and replacement faults have to be investigated, it is very necessary that the set be serviced in a properly organised and efficient radio service department. The objective of this article is to advise, and assist readers who are starting a service station, or those who are already running one, but are not satisfied with its organisation and efficiency. I shall deal only with a small service department, but the principles stated will apply to larger departments.

A small service department may be taken, for the purposes of this article, to be a department that deals with approximately a dozen sets a week. I am not including television sets, which are catered for in a similar article in *Practical Television*.

The Workshop

Fig. 1 gives a general layout of a small workshop, and includes a boxing and unboxing position, a service engineer's bench and a bench for "soak test" jobs. A "soak test" job is a set that has varying periods of intermittency, and requires

to be left running until the fault appears. This is very necessary, as it is a waste of time waiting for a fault to occur. The service engineer can be getting on with another job, but at the same time keep an eye on the "soak test" job, for the fault to happen.

If unskilled labour is available, a boy or a young trainee, for instance, he can be used for the unboxing and reboxing part of the business, and also be instructed to clean up chassis and cabinet, not forgetting dials. It is advisable to have a small blower motor or vacuum cleaner handy to this position for cleaning up chassis.

The keeping together of all bolts, knobs, etc., of sets that are removed from their cabinets, is essential. They should be placed in a box, labelled with the make and serial number. It is surprising, the number of sets I have come across that have been returned from service with bolts missing, and in some cases even the wrong knobs. In the latter case many house-

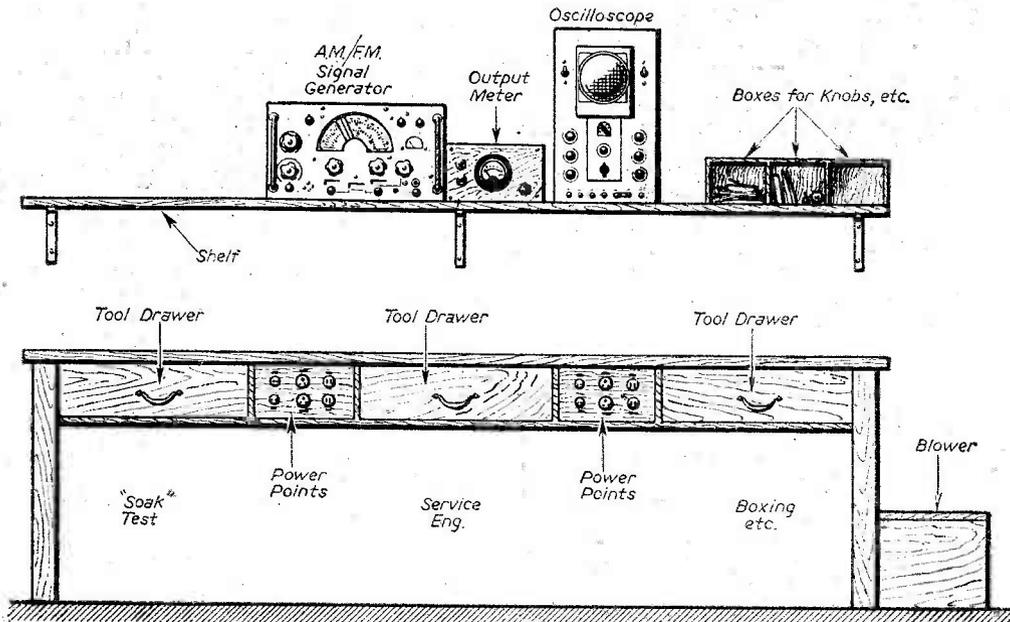


Fig. 1.—A suggested layout for the workshop.

proud customers will take a very dim view of this, and it will probably mean loss of any further business.

Instruments Required

In a service department certain instruments are absolutely necessary for efficient servicing.

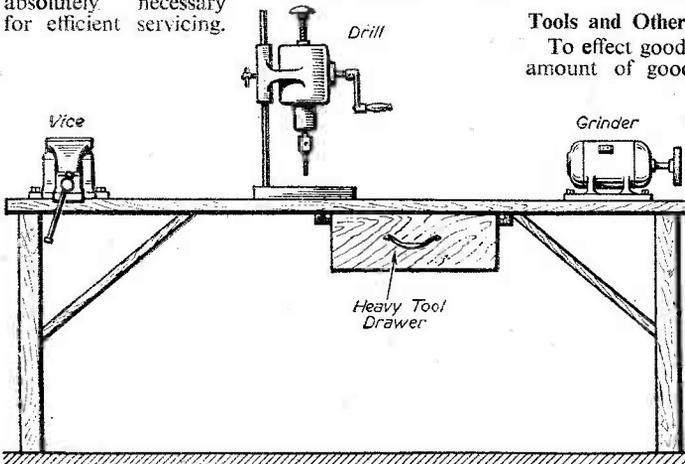


Fig 2.—A suggestion for the work-bench.

In the three following lists, "A" is the absolute minimum, "B" is a list for those who can afford to spend more on testing equipment, and "C" is "laboratory style."

"A." 1. Multirange meter, 20,000 ohms per volt.
2. A.M./F.M. signal generator.
3. Small output meter.
4. Centre zero A.C. meter.

"B." Same as "A," with:—

1. Oscilloscope.
2. Small capacity bridge.
3. Valve voltmeter.
4. Multi-impedance output meter (in place of A3).

"C." Same as "A" and "B" with/or:—
Capacity inductance bridge (in place of B2).
"Q" meter.
B.F.O.
Megger.
Distortion meter.

Of course, some readers may wish to have extra instruments in either list according to their various needs, but these three lists are what the writer, who has years of service experience, has generally found necessary.

A point regarding these instruments; most of them are costly and it behoves the owner or manager of the service department concerned to see that unskilled personnel are not allowed to use them, except under supervision. If you have trainees or boys employed, any old type meter that is available should be used by them.

Components and Spare Parts

All components and spares, such as resistors, paper condensers, electrolytics, should be kept separately, in either boxes or lockers, and a check should be taken at frequent intervals to ensure that stocks are up to date. After a short period of running a service department, one gets a good idea of the

minimum amount of stock required to keep the station going. Overstocking is money lying idle, but understocking is bad for business, as it often means keeping customers waiting for sets whilst awaiting delivery of components required.

Tools and Other Equipment

To effect good service work on radio sets a proper amount of good tools should be available. Most service engineers have their own set of tools, but it is advisable to see that the following are available for use in the workshop (Fig. 2):

A vice.

A small electric drill (bench-mounted type).

Hacksaws.

Small electric grinder.

Complete set of drills.

Complete set of B.A. taps and dies.

Tank cutters for B7G, B9A, etc.

Shears.

A 1-200 watt heavy duty soldering iron (for chassis soldering).

Small soldering irons for bench work.

Complete set of trimming tools for different makes of trimmers.

In this list of tools required any, of course, may be omitted, according to the amount and type of servicing being done. If car radios are likely to be serviced it would be necessary to have a 12-volt car accumulator, or if not, a unit could be made up to run off the mains to supply the necessary power. Circuitry for this type of unit has appeared from time to time in this and other journals, so I do not propose to include it.

Other Requirements

A complete stock of service sheets and information is essential to rapid and good service. A lot of time can be wasted searching for a suspected component

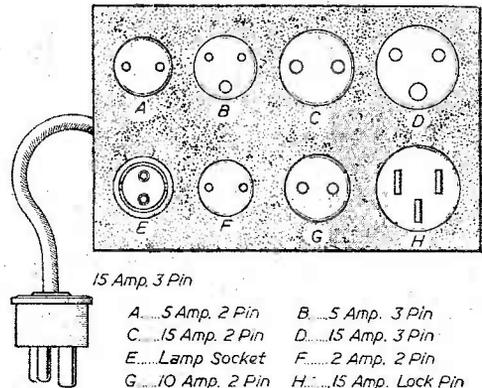


Fig. 3.—Details of a suggested power panel.

in a set that is new to one. With the circuit and component layout in front of you it is only a matter of moments to mark the spot. All service sheets and information should be kept in box files.

(To be continued)



FOR VALVES GUARANTEED ALL TESTED BEFORE DISPATCH

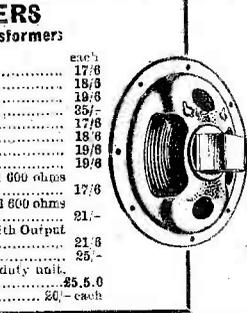
Table listing various vacuum tube types and their prices, including 6Z4, 6AC7, 6A7, 6BE6, 6BE7, 6BE8, 6BE9, 6BE9A, 6BE9B, 6BE9C, 6BE9D, 6BE9E, 6BE9F, 6BE9G, 6BE9H, 6BE9I, 6BE9J, 6BE9K, 6BE9L, 6BE9M, 6BE9N, 6BE9O, 6BE9P, 6BE9Q, 6BE9R, 6BE9S, 6BE9T, 6BE9U, 6BE9V, 6BE9W, 6BE9X, 6BE9Y, 6BE9Z, 6BE9AA, 6BE9AB, 6BE9AC, 6BE9AD, 6BE9AE, 6BE9AF, 6BE9AG, 6BE9AH, 6BE9AI, 6BE9AJ, 6BE9AK, 6BE9AL, 6BE9AM, 6BE9AN, 6BE9AO, 6BE9AP, 6BE9AQ, 6BE9AR, 6BE9AS, 6BE9AT, 6BE9AU, 6BE9AV, 6BE9AW, 6BE9AX, 6BE9AY, 6BE9AZ, 6BE9BA, 6BE9BB, 6BE9BC, 6BE9BD, 6BE9BE, 6BE9BF, 6BE9BG, 6BE9BH, 6BE9BI, 6BE9BJ, 6BE9BK, 6BE9BL, 6BE9BM, 6BE9BN, 6BE9BO, 6BE9BP, 6BE9BQ, 6BE9BR, 6BE9BS, 6BE9BT, 6BE9BU, 6BE9BV, 6BE9BW, 6BE9BX, 6BE9BY, 6BE9BZ, 6BE9CA, 6BE9CB, 6BE9CC, 6BE9CD, 6BE9CE, 6BE9CF, 6BE9CG, 6BE9CH, 6BE9CI, 6BE9CJ, 6BE9CK, 6BE9CL, 6BE9CM, 6BE9CN, 6BE9CO, 6BE9CP, 6BE9CQ, 6BE9CR, 6BE9CS, 6BE9CT, 6BE9CU, 6BE9CV, 6BE9CW, 6BE9CX, 6BE9CY, 6BE9CZ, 6BE9DA, 6BE9DB, 6BE9DC, 6BE9DD, 6BE9DE, 6BE9DF, 6BE9DG, 6BE9DH, 6BE9DI, 6BE9DJ, 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TV Fault Finding.—Profusely illus. with photographs taken from a TV screen. Price 5/-.
The Eavesdropper.—A miniature transistor receiver for local station reception. Price 1/8.
Frequency Modulation Tuner Unit.—For fringe and local area reception, price 2/-.
Collaro Rim Drive Electric Gramophone Unit, Model 3354, fitted pick-up STUDIO "T" 3-speed, 26.18.6 each. Postage 5/-.
Tadley Switches assorted. All unused. Many with long locating spindles. Ideal for making up, special switch Units, 9/- doz.
Toggle Switches. Brand new, various types. Single pole, Double pole, etc., 12/- doz.
Marconi Type Metal Strip Dropper Resistance. 3 voltage tappings. App. Sin. long. 2/6 each.
Filament Transformer. 230 v. Input with 2 x 6.3 v. Secondary Windings, 7/8 each.
Oscillator Band Filter. Designed to reject the Band I B.C. signal when break through is noticeable, 10/- each.
Portable Case 81 x 81 x 4 1/2 in. Gray finish, rexine covered, complete with chassis, dial, and speaker fret, 25/- each.
Solon Instrument Irons all voltages, 24/- each.

TV Fault Finding.—Profusely illus. with photographs taken from a TV screen. Price 5/-.
Tyann Soldering Iron. 40 watts, standard voltage ranges, weight app. 4 ozs. The perfect small soldering instrument. Price 1/8 6/9 each.
Metal Rectifiers, 12 v. 1/2 amp. 1/8 each, 250 v. 45 mA 6/9 each, 250 v. 75 mA 7/8 each, 12 v. 1 amp. 5/3 each, 12 v. 2 amp. 9/- each, 12 v. 5 amp. 13/9 each.
T.S.L. Lorenz LEH 65" Treble Speaker, 8/8 6/9 each.
Breadboard Converter now available from stock. Detailed List by return. Price £7.7.0 converts most sets to I.T.A. at I.F. frequency.
HEATER TRANSFORMERS, 230 v. INPUT
2 x 2.5 a. 8/3 each
4 x 3 a. 10/- each
6.3 v. 1.5 a. 6/9 each
12 v. 75 a. 5/9 each
1 v. 1.5 a. 5/8 each
5 v. 2 a. 10/- each
TRANSISTORS
Red spot for audio stages. PNP type, 10/- ea.
Blue spot for RF up to 1-6 mc/s, 15/- ea.
SCOPE TUBES
Type 81P1, removed from USA equipment. Complete with base and screens. 15/- each. Post 2/6.
HEADPHONES
Type CLR 120 ohms, 7/8 pair.
Type DHR, 4,000 ohms, 18/- pair.
High Resistance type, 13/8 pair.

LOUD SPEAKERS All PM Types less Transformers

Table listing various loudspeaker models and their prices, including WATERHOUSE 5in. Unit, PLEESLEY 6in. Unit, R. & A. 8in. Unit, ELECTRONA 8in. Unit, GOODMANS 6in. Unit, GOODMANS 8in. Unit, GOODMANS 4in. x 7in. Unit, PLEESLEY 5in. Unit, GOODMANS or ELECTRONA 8in. Unit, BAKER BELLHURST, 12in. heavy duty unit, 15 ohms speech coil 20 watts, 5in. Mains Energised Speaker.



APEX TUNED FILTER UNIT. A crossover box for use with combined or separate Band I and Band III aerias. The unit is completely shrouded. 7/8 each.
TELETRON FERRITE ROD. Long and medium wave, 12/9 each; Medium wave, 8/9 each.
TELEDIOTOR TRANSFORMERS TYPE T68 Small Mains Transformer suitable for Television Converters, etc. Specification:
Primary: 230 v. 50 c/s.
Secondary: 1: 250 v. 40 mA.
Secondary: 2: 6.3 v. 1.5 A. 15/-
CLYDON TURRET TUNER Conversion to I.F.E. (no patterning). Nine versions covering three major I.F. Bands, 10 mc/s, 16 mc/s, 88 mc/s, and 3 valve heater supplies (4.5 v., 100 mA), and 200 mA). Send for full descriptive leaflet, 27.7.0 each.
WEARITE P. COILS
Wearite "P" coils, full range available, 3/- each.
EXPLOSION GUARD
For 17in. Tube. Overall size 17 1/2 in. x 12 1/2 in. 7/- ea., post 3/-.
FOCUS UNITS
12in. tube type 12.6 ea. Both fitted with 17in. tube type 15.5 ea., varrier adjustments.

PUBLICATIONS, ETC.

Table listing various publications and their prices, including No. 134, P.M. Tuner Construction, No. 135, How to make aerias for T.V. (Bands 1 and 2) and V.I.F. (Band 2), No. 145, All-dry battery Portable Construction, No. 160, A comprehensive valve guide, Book No. 2, No. 121, A comprehensive valve guide, Book No. 1, No. 105, Radiofolder "A", No. 125, Practical Transistors and Transistor Circuits, No. 140, T.V. Servicing for Beginners, No. 142, Modern T.V. Circuitry and General Fault Finding Guide, Mailout "High Quality Reproduction", "Valve Manual of the Tube Deck", (Please include id. postage per copy).

BAKELITE KNOBS
Large Panel Good Quality.
Type 4K1 Cream, 1 1/2 in. diameter, Spring Acting, Fluted Grip.
Type J12 Brown, 1 1/2 in. diameter, Spring Acting, Fluted Grip.
Type J13 Brown, 1 1/2 in. diameter, Spring Acting, Plain Grip. (This one has White Ring on Knob Face.)
All have a small finger flange to avoid marking cabinets. Offered at a Fraction of original cost. Price 6d. ea., 5/- doz., any types.

OUTPUT TRANSFORMERS

Universal Type. 18 ratios available, 6/3 each.
Standard 5,000 ohms to 3 ohms 40 mA, 4/8 each
Standard 10,000 ohms to 3 ohms 40 mA, 4/8 each
Super 5,000 ohms to 3 ohms, 30 mA, 4/8 each
Midjet 5,000 ohms to 3 ohms, 30 mA, 3/8 each
CONTACT COOLED RECTIFIERS
Half Wave
125 v. 50 mA, 5/-
250 v. 50 mA, 8/-
250 v. 85 mA, 10/-
Full wave
250 v. 75 mA, 9/-
250 v. 125 mA, 11/6
S.T.C. RECTIFIERS
RM1 4/8, RM2 5/8, RM3 7/8, RM1 18.6, RM5 20/-
PENCIL RECTIFIERS
K225 4/8, K240 6/-, K345 6/8, K250 6/8, K260 7/8, K3100 11/-
VIBRATORS
4 Pin U.X. Base, 12 v. and 6 v., 8/3 each.
Acrylic Aerarial semi air spaced co-axial cable. Centre core stranded suitable for band III I.F. 8d. yard.
A large selection of miniature type "A" volume controls now available. Values 5k, 10k, 20k, 100k, 1 meg., 1 meg., 5 meg., 2 meg., Less switch 2/8 each, single pole 3/8, double pole 4/8.

Large stocks of aerias (send for lists).
No. 121, Aerarial 3 element Model 701 in 30-c. Composite Aerarial band I-III (2 and 10 channels) model 826 ct. complete with chimney lashings, etc. 25.5.0.

All these and many other interesting radio and TV components are listed in our CURRENT CATALOGUE which is available to you now. Send 1/- in stamps for your copy.

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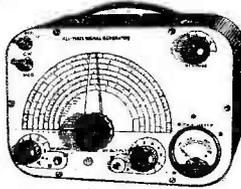


103 LEEDS TERRACE WINTOWN STREET LEEDS 7.

TERMS: Cash with order or C.O.D. Postage and Packing charges extra, as follows: Orders value 10/- add 1/-; 20/- add 1/6; 40/- add 2/-; £5 add 3/- unless otherwise stated. Minimum C.O.D. fee and postage 3/-. All single valves postage 6d. Personal Shoppers Monday-Friday 9 a.m. to 5 p.m.

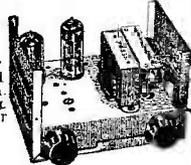
SIGNAL GENERATOR

Coverage 120 Kcs-280 Kcs, 300 Kcs-900 Kcs, 600 Kcs-2.75 Mc/s, 2.75 Mc/s-8.5 Mc/s, 6 Mc/s-28 Mc/s, 16 Mc/s-53 Mc/s, 24 Mc/s-84 Mc/s. Metal case 10in. x 6in. x 4in. Size of scale, 6in. x 3in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent., modulated or unmodulated R.F. output continuous variable 100 milli-volts. C.W. and mod. switch, variable A.F. output and moving coil output meter. Grey hammer finished case and white panel. Accuracy plus or minus 2%. £4 19/6 or 34/- deposit and 3 monthly payments 25/- . P. & P. 4/6 extra.



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Battery operated, comprising 2 valves, 2 valve holders, tuner, coil, resistors, condensers and volume control. **9/6** Plus Point to point wiring diagram 1/-, free with kit. P. & P. 1/6.

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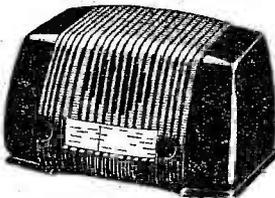
approx. size 6in. x 2in. incorporating 2 valves, contact-cooled metal rectifier, bass and treble lift controls **39/6** Plus and double wound mains transformer 230-250 v. P. & P. 3/6. 6 1/2 in. P.M. SPEAKER & O.P. TRANSFORMER, if purchased with the above 18/6. Plus P. & P. 1/6.

COLLARO 4-SPEED AUTOMATIC CHANGER

Model 466 (suitable for use with above amplifier). A.C. mains. 200-250 v. turnover crystal head. Brand new, fully guaranteed **£8. 19. 6** Plus P. & P. 5/-

T.R.F. KIT in PLASTIC CABINET

3 valve plus metal rectifier, A.C. mains 200-250 v. Medium and Long waves. In pastel blue or brown. Valve line-up: 2 VR65s and VT52. Size 15 1/2 in. long by 9 in. high by 7 in. deep. **£3. 19. 6** P. & P. 4/6.



Point to point wiring diagram 1/6. Free with Kit.

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MAINS TRANSFORMER, Primary 110-250. Secondary 0-120-180-230 v. 60 mA. 6.3 v. 2 amp. 10/6. P. & P. 2/-
3 M.P.D. 450 V.A.C. can size 2in. x 3in. 1/3 each, 12/- doz.
P.M. SPEAKERS, closed field, 6in., 16/6; 8in., 18/6; 10in., 25/-; 12in., 25/- . P. & P. on each 2/-.

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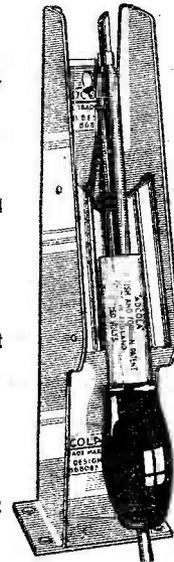
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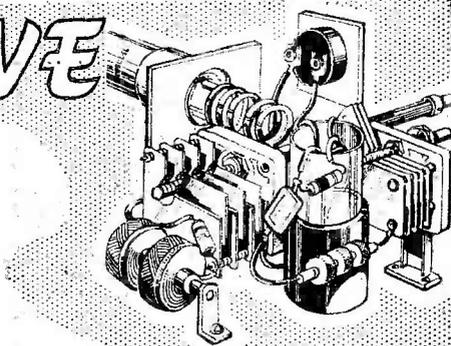
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BIET

SHORT-WAVE SECTION

SHORT-WAVE TRANSPOSED DOUBLET AERIALS

By A. W. Mann



MUCH has been written as to the merits and demerits of the horizontal transposed doublet aerial. Even so, it appears that some measure of confusion still exists.

Looking through some old papers recently, the author recalled a long-drawn-out and heated discussion relative to this type of aerial in the correspondence pages of an overseas radio publication. The controversy started after the publication of a DX log sent in by a reader. Among others were listed several exotic call-signs. In a footnote the correspondent mentioned that the receiver was a home-constructed mains two-valve receiver, and the aerial a horizontal transposed doublet.

I happened to know that his receiver was a very efficient one, that he was located in an interference free area, and had more than sufficient space to erect doublets and other forms of aerial to textbook specifications. Also, that his aerial could be tuned to resonance according to requirements.

Being an all-bands listener, due attention was paid to scheduled short-wave broadcast transmissions

Being aware as to the broadside directive properties of the horizontal divided doublet, he carried out a compass check after studying a great circle map, and erected his aerial masts according to his findings. This assured maximum signal pick-up from stations to which the aerial was directive which, when tuned in, could be peaked by means of the aerial tuner unit (Fig. 1 will make this clear).

Different Types

At Fig. 1 the transposed horizontal doublet is shown running north to south. As it possesses broadside directive properties, the field pattern shows that when erected as outlined it will be directive east and west (Fig. 2).

The twin feeders may be transposed by means of transposition blocks as in Fig. 1, or by the use of twisted feeder cable (Fig. 3).

Fig. 4 shows an end-on doublet, the directivity of which is less marked. It provides best reception in line with the aerial from the direction of the feeder end as shown by the field pattern at Fig. 5.

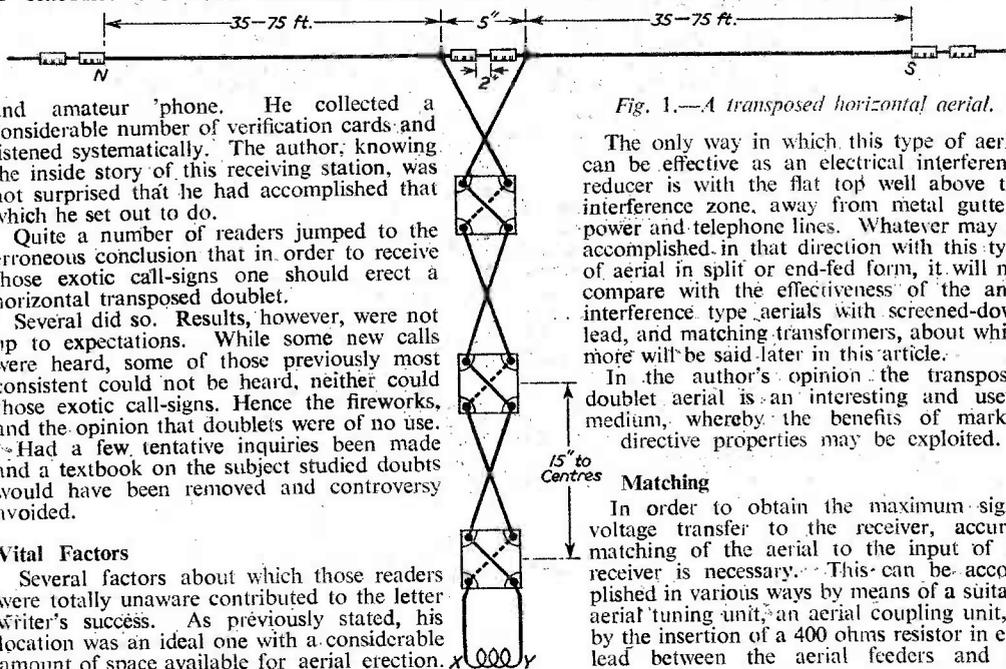


Fig. 1.—A transposed horizontal aerial.

The only way in which this type of aerial can be effective as an electrical interference reducer is with the flat top well above the interference zone, away from metal gutters, power and telephone lines. Whatever may be accomplished in that direction with this type of aerial in split or end-fed form, it will not compare with the effectiveness of the anti-interference type aerials with screened-down lead, and matching transformers, about which more will be said later in this article.

In the author's opinion the transposed doublet aerial is an interesting and useful medium, whereby the benefits of marked directive properties may be exploited.

Matching

In order to obtain the maximum signal voltage transfer to the receiver, accurate matching of the aerial to the input of the receiver is necessary. This can be accomplished in various ways by means of a suitable aerial tuning unit, an aerial coupling unit, or by the insertion of a 400 ohms resistor in each lead between the aerial feeders and the

and amateur phone. He collected a considerable number of verification cards and listened systematically. The author, knowing the inside story of this receiving station, was not surprised that he had accomplished that which he set out to do.

Quite a number of readers jumped to the erroneous conclusion that in order to receive those exotic call-signs one should erect a horizontal transposed doublet.

Several did so. Results, however, were not up to expectations. While some new calls were heard, some of those previously most consistent could not be heard, neither could those exotic call-signs. Hence the fireworks, and the opinion that doublets were of no use. Had a few tentative inquiries been made and a textbook on the subject studied doubts would have been removed and controversy avoided.

Vital Factors

Several factors about which those readers were totally unaware contributed to the letter writer's success. As previously stated, his location was an ideal one with a considerable amount of space available for aerial erection.

aerial and earth terminals of the set. (Fig. 3.)

Where provision is made in the receiver for doublet coupling this method should be used.

Indoor Doublet Aerials

As outlined in a previous article, the horizontal doublet can be adapted for indoor use and erected in the roof space. In this case, however, textbook dimensions cannot be adhered to due to space limitations. In order to get the maximum amount of wire strung up it will be necessary to bend the arms of the flat top. This, however, is an advantage and enables directive properties to be applied to intermediate compass points.

In the case of indoor doublets of this kind the listener should erect twin systems at right-angles to one another and make provision for relay switching. The relay should, however, be fitted at a point where it is easily accessible in case the contacts stick at any time.

This may not happen, but when the relay is mounted up in the roof space it can only be attended to at some inconvenience.

Gain

There may be some readers who rather question the amount of gain due to broadside directivity. A

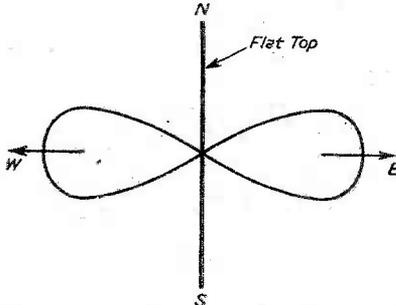


Fig. 2.—The polar diagram of the aerial in Fig. 1.

relay controlled twin doublet arrangement will remove all doubts.

The indoor system used by the author provides a gain of from three to four R strengths, and appears to be sharply directional. So much so, that switching from one to the other a signal can be entirely lost or considerably weakened, depending, of course, on the geographical relation existing between the transmitter and receiver.

Unless one is in a position to erect an outdoor or indoor horizontal doublet to a desired compass bearing as taken from a great circle map, or unless the space available happens to coincide with ones requirements (which by the way seldom is the case), the author would not advise the listener to erect this type of aerial, because as mentioned in the early part of this article blind spots will be encountered.

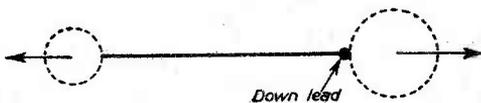
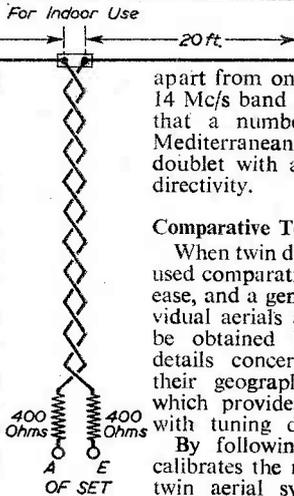


Fig. 5.—Polar diagram for the aerial in Fig. 4.



For example, if the aerial is directive east and west it may appear, for instance, that apart from one or two European phones the 14 Mc/s band is dead. Yet it is quite possible that a number of transmissions from the Mediterranean area might be heard using a doublet with approximately north and south directivity.

Comparative Tests

When twin doublets placed at right angles are used comparative tests can be carried out with ease, and a general idea as to coverage of individual aerials and the system collectively can be obtained by systematically logging the details concerning all transmissions heard, their geographical location and the aerial which provides the strongest signal together with tuning dial readings.

By following this method one not only calibrates the receiver, but to some extent the twin aerial system. Where only a single transposed doublet is in use some standard of comparison should be available. A vertical rod aerial erected at not less than roof height, and, if possible higher, will prove to be satisfactory.

If some form of quick change-over is desirable this may be carried out by a relay or suitable switch. The idea in mind is not to check comparative strengths

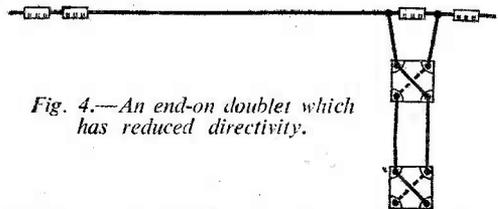


Fig. 4.—An end-on doublet which has reduced directivity.

but to definitely locate the blind spots or areas from which transmissions received using the vertical aerial are unheard when switched to the doublet.

Details of such tests as entered in the log book are often very illuminating and instructive.

While the horizontal transposed doublet functions most efficiently on the frequency to which it is cut and on certain harmonics of that frequency it should not be regarded as a one frequency aerial which is entirely inefficient when used on other frequencies.

There are limits beyond which it is definitely inefficient, but so far as the short-wave listener is concerned there is a wider tolerance factor than some imagine. (Continued on page 274.)

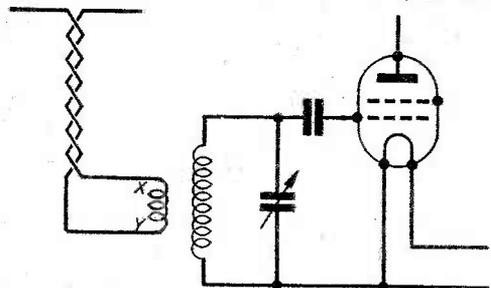
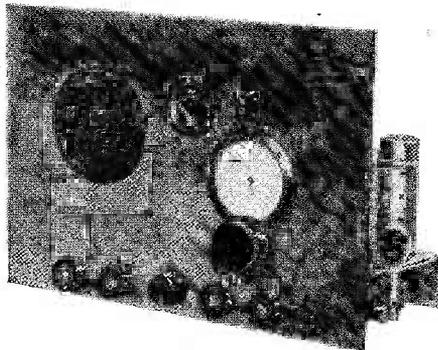


Fig. 6.—Method of doublet coupling.

An Amateur Communications type Receiver

By F. G. Rayer



THIS receiver combines the merit of reasonably low cost with a very high standard of performance, and is suitable for use on any waveband between 16 and 2,000 metres, giving results much superior to those of the usual type of "all wave" superhet. An added advantage is the ease with which it lends itself to modification in the number of stages employed, or bands tuned, so that it can be constructed and used in a simplified form, initially. For example, one I.F. stage, with the I.F. filter, may be omitted, together with the R.F. stage and first A.F. stage, these being added later. This should be of particular help to beginners who may feel a little hesitant about employing the full circuit at once. It also allows the set to be made to work quickly, and reduces to a minimum the chance of any difficult or unidentified fault arising, especially if the coils for one waveband only are fitted first, as is recommended to avoid any error in wavechange switch wiring.

Octal 6.3-volt valves are used throughout the receiver section in view of their robustness and the ease with which they may be obtained. The circuit is shown in Fig. 1, and reference to it will make a number of points in the design clear.

Selectivity and second-channel rejection are not adequate with the usual type of superhet (bearing in

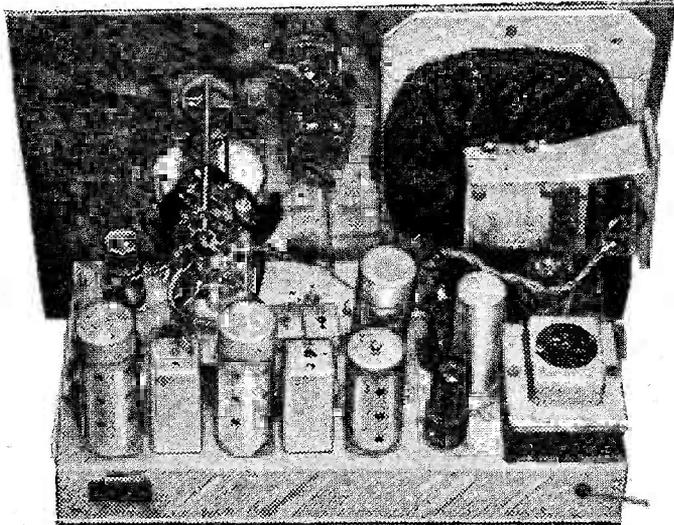
mind the purpose in view), especially on the higher frequencies, or shorter wavelengths. Second-channel interference may be reduced by using a high intermediate frequency, but the adjacent channel selectivity of such I.F. stages is relatively low, so that a second frequency-changer and further I.F. stages are necessary. The alternative is to retain a normal I.F. and use a selective R.F. stage. This is so here, and means that ordinary 465 kc/s oscillator coils and I.F. transformers are employed, avoiding any possible difficulty in obtaining these items. A number of communications receivers of high cost and efficiency use a similar arrangement.

To secure high adjacent channel selectivity, an I.F. filter consisting of two coupled I.F. transformers is used, making 10 tuned circuits in all (excluding the oscillator). As the degree of selectivity provided by this arrangement does not permit musical programmes to be reproduced well, due to sideband cutting, a High/Low I.F. switch is provided. At the low position selectivity resembles that of the usual five- or six-valve domestic receiver, and this is satisfactory for much general listening, especially on long and medium waves.

A double-diode is used for detection and A.V.C. and this avoids the positive cathode delay voltage arising when a D.D.T. valve is employed in this position, and which results in the A.V.C. action being absent at low signal levels. With the double-diode, no such delay voltage is developed, the cathode being at earth potential. As a result, A.V.C. comes into operation with even weak signals. This, combined with three controlled stages, gives a very satisfactory A.V.C. action indeed. A.V.C. is not applied to the mixer, since this tends to interfere with best operation on high frequencies.

Controls

Separate R.F., I.F. and A.F. gain controls are fitted, and allow operation to be adjusted to suit conditions. There is seldom any need for all controls to be anywhere near maximum, and turning back the R.F. and I.F. gain is particularly useful in reducing background noise and valve hiss. For normal listening these controls can be left, volume being adjusted by the A.F. control in the usual way. But with

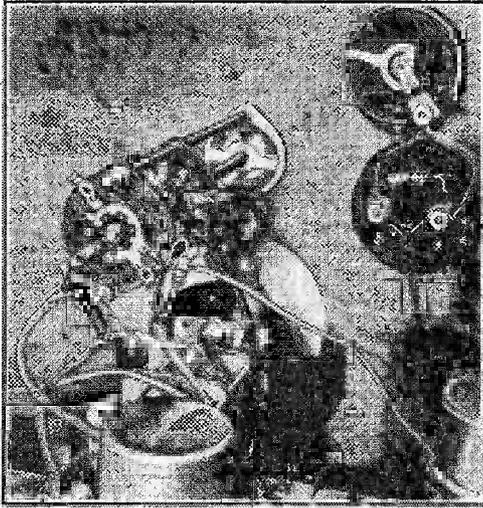


A view of the set from the rear.

difficult stations their benefit will become apparent.

Since maximum sensitivity requires exact alignment of all tuned circuits, panel trimmers are fitted for R.F. and F.C. tuned circuits. Since five wavebands are present, the use of two variable trimmers in this way avoids the need for no less than fifteen pre-set trimmers while also assuring maximum efficiency. Again, in practice, it will be found that these panel trimmers can be left at a midway setting, and results

Numerous other dials and drives to that illustrated can be purchased, some with mechanical bandspread tuning devices and some with blank scales for marking by the constructor. The use of these is a matter of personal preference. The degree dial, combined with a logging book, does enable transmission times, etc., to be noted, together with readings for those bands and stations of interest. It thus has much to recommend it.



A view of part of the rear of panel.

will then resemble those obtained with trimming by presets initially adjusted. But with weak signals a slight adjustment of the panel controls will very greatly increase volume. Since exactly similar settings are not retained throughout all bands, this shows that efficiency is higher than with separate pre-sets for each band. This, and the great simplification mentioned, amply justifies the two extra panel controls.

A tuning meter is fitted in the anode circuit of the I.F. stage not under manual control, and is very helpful in securing accurate tuning and in adjusting the panel trimmers when this is necessary. This meter also simplifies alignment of the I.F. stages, since it is only necessary to adjust all the I.F.T.s for maximum signal as shown by the meter. Variations inaudible to the ear are easily seen and exact peaking of all circuits is thus possible. The meter will similarly respond to any increase in signal strength from external causes, such as an improvement in aerial or earth or fading of the signal, which will cause the pointer to move as the A.V.C. compensates. Though long-distance reception is possible with no aerial or a short indoor wire, the benefit of a good aerial will become very apparent if meter readings are compared on a few stations, one aerial being tried, then the other.

A high-class reduction drive is essential for easy tuning, and should, for preference, be of dual-ratio type. Since no dial with all bands marked in wavelength or frequency is obtainable, an ordinary degree scale is used, and stations may be logged with this.

Components

None of the parts is of a type difficult to obtain. All fixed resistors can be of $\frac{1}{2}$ -watt rating, except the 270-ohm bias resistor, where a 1-watt component is necessary. All the $.1 \mu\text{F}$ by-pass condensers are of 350-volt tubular type. Any $.25 \mu\text{F}$ or $.5 \mu\text{F}$ tubulars to hand can be used for cathode and SG by-pass, but not for A.V.C. line decoupling, or the time-constant will become rather long.

The valves may be metal, G or GT types. The efficiency of actual specimens varies slightly, together with the degree of screening, and it was found necessary to use valve-screening cans round R.F. and I.F. valves to maintain stability with optimum adjustment.

Dust-cored I.F. transformers are used, though air-cored types would do in 1st and 4th positions. The two transformers forming the I.F. filter are small potted components, and this type of coupling was found very effective. In common with all other parts, many advertisers can supply these.

The 3-gang condenser is a standard component. The two panel-operated trimmers are midget variable condensers of short-wave type, the actual maximum capacity being about 50 pF. An extension spindle is necessary for the aerial circuit trimmer.

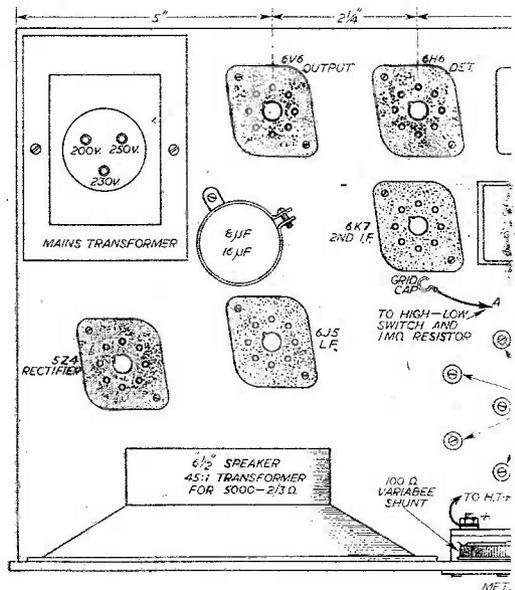


Fig. 2.—Top

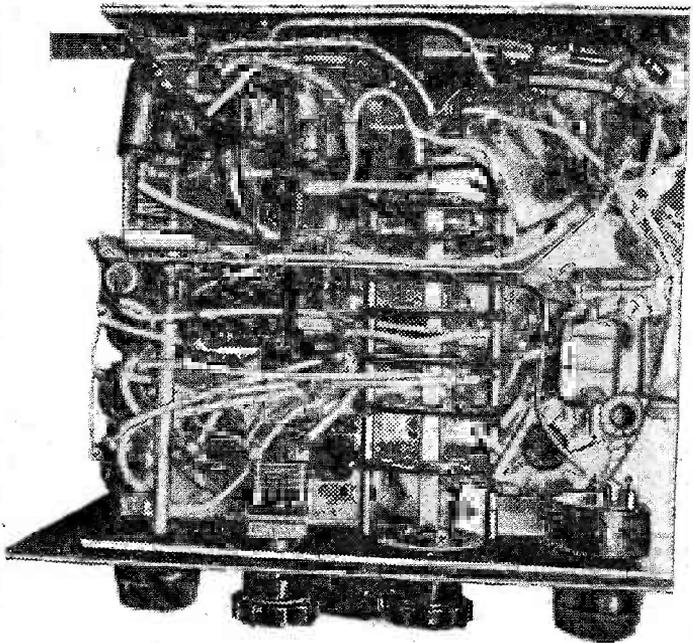
The wavechange switch needs to be of the type with a separate wafer for each pole, and it is supported by a small sub-panel separating aerial and F.C. circuits, which also provides a mounting for the aerial trimmer. With this arrangement, no instability need arise here. Reference to Fig. 1 will show how the six wafers are used, and a 5-way switch provides for five bands, allowing continuous tuning coverage. Aerial, H.F. and oscillator coils of manufacture other than those listed would be satisfactory, and in each instance the padder capacity must be of the value the maker specifies.

A mains transformer with 6.3-volt 3-amp winding will operate the valves (excluding rectifier) and up to two dial lamps. The rectifier requires a 5-volt 2-amp supply. H.T. is obtained from a 250-0-250-volt 80 mA winding.

Tuning Meter

This is of ordinary moving-coil type and has to give full-scale reading when no signal is applied. To arrange this, a wire-wound preset resistor or potentiometer is connected in parallel with the meter and initially adjusted for full-scale reading with no signal. The actual rating of the meter is of no importance provided it is not greater than the anode current of the last 6K7, which will be about 6 to 8 mA, according to the valve and exact com-

ponent values. A 1 mA meter was employed, but a 2 mA or 5 mA model would be equally satisfactory. As the latter would be of rather lower resistance, the



Some of the switch wiring.

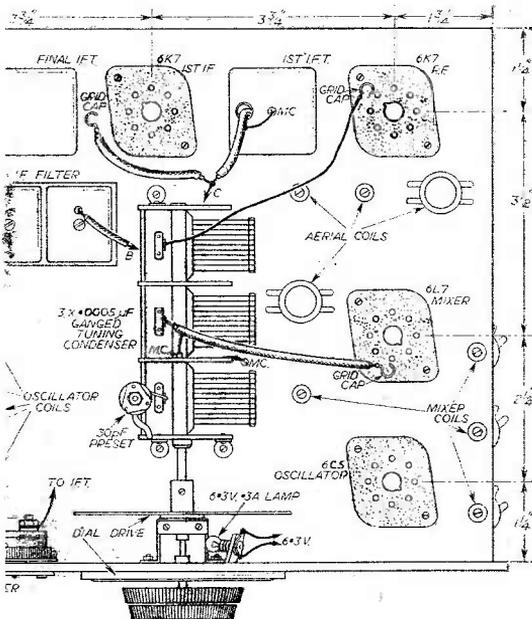
adjustable shunt could also be reduced in value when using them to make adjustment less critical. Alternatively, one or more fixed resistors can be wired in parallel with the meter and the 100 ohm variable adjusted for full-scale deflection afterwards. If the meter pointer tends to go right off the scale, then the overall shunt value must be reduced in resistance. Alternatively, if a full-scale reading is not had, the shunt value is too low or the meter is one of too high rating.

It will have been observed that no B.F.O. is shown in Fig. 1, but this can readily be added. If there is no desire to listen to I.C.W. Morse, then its inclusion is, of course, pointless.

Chassis

This item requires to be of stout gauge to avoid wobble, and should be at least 16 s.w.g. The layout of components on top will be seen from Fig. 2, and the distances between valveholder centres which are given will enable the parts to be suitably positioned. If the valveholders actually used do not have the key-ways in line with the fixing holes, then they should be rotated accordingly if the wiring plan is to be followed exactly.

If a cabinet of a type affording support for the panel is not to be used, then panel brackets are desirable. With the usual tuning drive it will be necessary to raise the gang condenser on pillars or to employ sleeves on long bolts for mounting. This,



of chassis layout.

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We stock all the components for the Amplifiers described in the Mullard Tape Recording Booklet. This booklet is available from Mullard Ltd. or from us.

Two units are described in the Booklet. **AMPLIFIER TYPE A** is a complete Tape Amplifier with a single EL84 Output Valve. **AMPLIFIER TYPE B** is a combined recording amplifier and play-back pre-amplifier and is intended to feed into an existing main amplifier for play-back.

TAPE AMPLIFIER TYPE A

RESISTORS.—LAB Kit of all fixed resistors to correct tolerance and one potentiometer. 35/6.

Note.—These kits are made up for Brenell and Collaro tape decks and include R21 for 15 ohm speakers. An exchange voucher is enclosed for use if requirements are otherwise.

CONDENSERS.—Kit of 30. 33/-. We make these up for the Brenell and Collaro Decks. Please state when ordering if Truvox or Lane deck is being used. All condensers are available separately. Full details are given in our free list.

VALVES.—EF88 Mullard 2/4. Alternative 15/-. ECC83 Mullard 19/6. Alternative 10/-. EM81 Mullard 18/1. EL84 Mullard 16/-. Alternative 12/-. OAF1 Diode, Mullard 6/-.
OSCILLATOR COILS.—Brenell 8/-. Truvox 6/9. Lane 10/-.

PLUGS AND SOCKETS.—Set of speaker, record head, erase head, input and power plugs and sockets. 31/-. All available separately. See our list.

VALVEHOLDERS.—BM9/U 10d. XM9/UC1 1/7.

SWITCHES.—Specialist Switches. Set of 3. 32/3.

TAG BOARDS.—Bulgin C120 1/3. C125 2/3. Note.—Four C125 are required, not two as stated in the Mullard Booklet.

CERAMIC STAND-OFF INSULATOR. 1/-.

KNOBS.—Bulgin K370. Black 1/6. White 2/-.
ESCUTCHEON FOR EM81.—Plastic 2/6.

CHASSIS.—Denco. Fully drilled. With cover plate 31/6.

OUTPUT TRANSFORMER.—Elstone OT3 21/-. Gilson WO787 25/6. Partridge SVO1 60/-.
SUNDRIES KIT.—Contains all wire, flex, nuts, bolts, sleeving, grommets, solder, etc. 8/-.
COMPLETE KITS.—All above items as listed with alternative valves.

KIT A.—With Elstone Output Transformer £13.15.0.

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KIT C.—With Partridge Output Transformer £15.15.0.

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THE FOUR WATT TRIPLE-TONE.—This amplifier has the unique feature of three independent tone controls. Treble, Middle and Bass. The response can thus be varied to suit any requirements. Handles 78, 45 and 33 records with equal clarity.

VALVES: 6SN7GT, 6X5GT.

OUTPUT: 4 watts. Matched for 2-3 ohms.

SIZE: 8in. x 4in. x 4 1/2in. high.

INPUT VOLTAGE: For A.C. Mains of 200 to 250 v. Chassis fully isolated from the mains.

PRICE: £6.19.6. Credit Terms. Deposit 19.6 and seven monthly payments of £1.0.0.

THE TRIPLE-TONE MAJOR.—This amplifier incorporates a Push-Pull output stage and three independent tone controls for Treble, Middle and Bass. A separate microphone stage is included, and there are separate volume controls for this and for the gram input. Mains and output transformers are fully shrouded. Power is available to operate a tuner unit.

VALVES: 6SN7GT, 6SJ7GT. Two 6V6G. 5Z4G.

OUTPUT: 12 watts. Output can be set for 15 or 2-3 ohms.

SIZE: 12in. x 7in. x 6 1/2in. high.

INPUT VOLTAGE: For A.C. Mains 200-250. Chassis is fully isolated from the mains.

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TAPE AMPLIFIER TYPE B

RESISTORS.—LAB Kit of all fixed resistors to the correct tolerance and one potentiometer. 31.9. All kits are made up for the Brenell and Collaro Decks. If requirements are otherwise an exchange voucher is enclosed.

CONDENSERS.—Complete Kit 35/-. Made up for the Brenell and Collaro Circuits. Please state when ordering if required for Truvox or Lane Deck. All condensers are available separately. Full details in our free list.

OSCILLATOR COILS.—Brenell 8/-. Truvox 6/9. Lane 10/-.
VALVES.—EF88 Mullard 2/4. Alternative 15/-. EM81 Mullard 18/1. EL84 Mullard 16/-. Alternative 12/-. OAF1 Diode Mullard 6/-.
VALVEHOLDERS.—McMurdo BM9 U 10d. XM9/UC1 1/7. XM9/UG1 2/3.

PLUGS AND SOCKETS.—Set of record head, erase head, input and power plugs and sockets. 31/6. All available separately. Details in list.

SWITCH.—Specialist Switches. 16.6.

TAG BOARDS.—Bulgin C120 1/3. C125 2/3.

CERAMIC STAND-OFF INSULATOR. 1/-.

KNOBS.—Bulgin K370. Black. 1/6. White. 2/-.
ESCUTCHEON FOR EM81.—Plastic 2/6.

CHASSIS.—Denco. Fully drilled with cover plate. 31/6.

SUNDRIES KIT.—Contains all nuts, bolts, wire, sleeving, solder, etc. 7/6.

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VALVE.—Mullard EZ81. 11/10.

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SWITCH.—Bulgin DP. S237, 5/-.

VOLTAGE SELECTOR PANEL.—Clix VSP330/0, 2/-.

FUSEHOLDER.—Belling Lee L675, 2/6.

FUSE.—250 ma., 6d.

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W0930/6, 20/-.

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The one you require enclosed if available in a dozen assorted of our best choice. **10/6**



Chassis Cutters with Keys

The easiest and quickest way of cutting holes in sheet metal. The cutter consists of three parts: a die, a punch and an Allen key. The operation is quite simple. Prices incl. key: Size (in.) 13/8; 1 1/2; 1 3/4; 1 7/8; 1 3/4; 1 7/8; 1 3/4; 1 7/8; 2; 2 1/8; 2 1/4; 2 1/2; 2 3/4; 3; 3 1/4; 3 1/2; 3 3/4; 4; 4 1/4; 4 1/2; 4 3/4; 5; 5 1/4; 5 1/2; 5 3/4; 6; 6 1/4; 6 1/2; 6 3/4; 7; 7 1/4; 7 1/2; 7 3/4; 8; 8 1/4; 8 1/2; 8 3/4; 9; 9 1/4; 9 1/2; 9 3/4; 10; 10 1/4; 10 1/2; 10 3/4; 11; 11 1/4; 11 1/2; 11 3/4; 12; 12 1/4; 12 1/2; 12 3/4; 13; 13 1/4; 13 1/2; 13 3/4; 14; 14 1/4; 14 1/2; 14 3/4; 15; 15 1/4; 15 1/2; 15 3/4; 16; 16 1/4; 16 1/2; 16 3/4; 17; 17 1/4; 17 1/2; 17 3/4; 18; 18 1/4; 18 1/2; 18 3/4; 19; 19 1/4; 19 1/2; 19 3/4; 20; 20 1/4; 20 1/2; 20 3/4; 21; 21 1/4; 21 1/2; 21 3/4; 22; 22 1/4; 22 1/2; 22 3/4; 23; 23 1/4; 23 1/2; 23 3/4; 24; 24 1/4; 24 1/2; 24 3/4; 25; 25 1/4; 25 1/2; 25 3/4; 26; 26 1/4; 26 1/2; 26 3/4; 27; 27 1/4; 27 1/2; 27 3/4; 28; 28 1/4; 28 1/2; 28 3/4; 29; 29 1/4; 29 1/2; 29 3/4; 30; 30 1/4; 30 1/2; 30 3/4; 31; 31 1/4; 31 1/2; 31 3/4; 32; 32 1/4; 32 1/2; 32 3/4; 33; 33 1/4; 33 1/2; 33 3/4; 34; 34 1/4; 34 1/2; 34 3/4; 35; 35 1/4; 35 1/2; 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Transformers for Transistors

DETAILS OF EX-GOVERNMENT COMPONENTS WHICH MAY BE USED By F. G. Rayer

THE coupling transformers used in transistor circuits have different characteristics from those employed with valve receivers, and specially made components of suitable type are rather expensive. It will be found, however, that some ex-Service transformers will give good results. In general, components with a ratio of about 1:10 and with a fairly high inductance, but relatively low D.C. resistance, will be satisfactory for inter-stage use. Such transformers may in some cases be to hand, as they have no application in ordinary valve receivers. If not, then the types quoted here may be obtained from J. E. Annakin, 25, Ashfield Place, Otley, Yorks, and probably other suppliers of ex-Service equipment.

tappings to find that giving best volume. Results are not quite so good as when a proper coupling transformer is used, but are a worthwhile improvement on simple resistance coupling.

If the transformer has a very generous winding, it is worthwhile trying only a part of the whole as the first transistor load. The most important characteristics are a reasonably low D.C. resistance with fairly high inductance. This is more easily found in large transformers than in midget types.

This method can also be used for output matching with some phones. The transformer mentioned will also work well in this circuit position. If the phones are of high or medium impedance, no step-down transformer is required.

In simple circuits to be made at low cost the usual permanent magnet moving-coil speaker with an output transformer intended for triode valves will operate quite well. If the transformer has several alternative windings each can be tried in turn to find which gives best results.

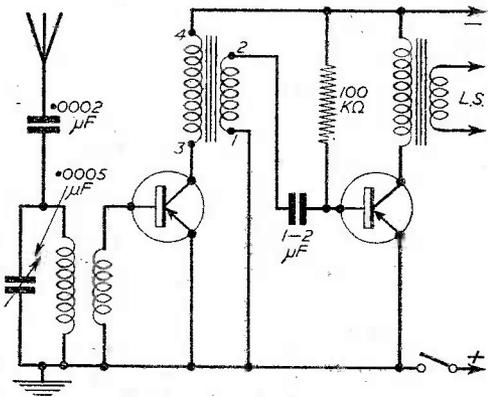


Fig. 1.—Transformer coupled two-stage receiver.

Audio Oscillator

A transistor audio oscillator is so simple and has such a wide application that the circuit shown in Fig. 3 is worth noting. Transformers with relatively small windings, which would be quite useless in valve equipment, will operate well here. One suitable component is the ex-Service 10K/574 transformer, and the connections given are for this. If other transformers are tried, primary should be wired between emitter and battery positive, and secondary between collector and phones. If no oscillation is obtained, leads to one winding can be reversed. If oscillation still fails to arise, the transformer is unsuitable.

Pitch can be adjusted by wiring a variable resistor in parallel with one winding. When the phones are removed the circuit is switched off. For amplifier and receiver testing the phone sockets are shorted if phones are not available, and the audio signal is taken from the .005 μF condenser via a test lead and prod.

Fig. 1 shows one of the simplest two-transistor receiver circuits with transformer coupling, and the numbering given is that for the CG-4300-3 10K/11100 ex-service part. It should be kept in mind that a step-down ratio is required if other transformers are tried. The same method of coupling can be used if the first transistor acts as amplifier for the audio-frequency output of a crystal-diode detector, as is often so in this kind of circuit.

The value of the coupling condenser is in no way critical, but the capacity must be large—not under 1 μF. The battery voltage can depend upon volume required, and the type of transistor. Adequate results for bedside loudspeaker listening, with a fairly good aerial and earth, can be expected with a 3 volt supply.

Auto-Transformers

A somewhat similar circuit is shown in Fig. 2, and can be tried with any ex-Service or other multi-ratio output transformer. Here, the condenser lead should be tried upon various

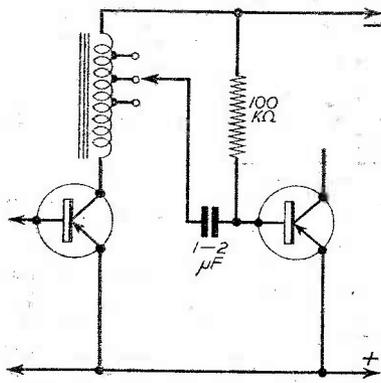


Fig. 2.—Auto-transformer coupling.

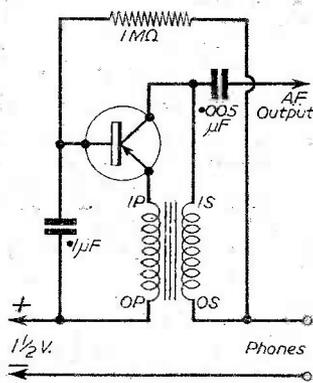


Fig. 3.—An audio oscillator.

The R.1155 Communications Receiver

SOME REPLIES TO READERS' PROBLEMS

SEVERAL Queries have been raised by readers concerning the modification of this receiver described in our issue dated September, 1956, and the following additional notes are therefore offered.

The 270Ω resistor and the 1,000Ω resistor mentioned are in the M.F. circuits, the junction of these resistors being connected to one of the potentiometers in the top left-hand corner (viewed from the front). It is incidental that the 1,000Ω resistor is connected to one side of the rear volume control as this is the H.T. negative line. The lead and the two resistors mentioned should be removed.

R3 is a 1 K. resistor, which is connected across the two outer terminals of the rear volume control and is mounted on a tag strip underneath the chassis almost directly beneath the volume controls.

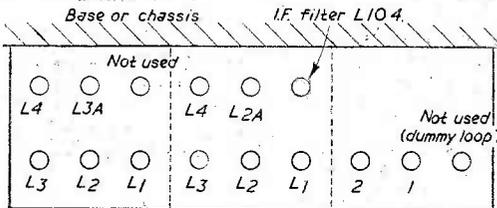
With reference to realignment, it is not a particularly easy task to realign a set of this nature, and it should not be attempted unless it is certain that the set really requires it. It should be pointed out that the cores of the coils and I.F. transformers have been sealed, and no attempt should be made to force them as this will only result in breaking the cores.

Instructions for releasing the cores are as follows:
 1. *Iron dust cores (large).* Soak a piece of cotton wool in methylated spirit and place on top of the core. Set light to it and allow to burn out. The core should now be eased gently. If it is still tight, repeat the process.

2. *Iron dust cores (small).* These are the tuning coils. Place receiver on its back, and in this position the side of the coil base will be presented uppermost, and the cores will be seen. Pour a little white spirit on each core and allow at least half an hour for it to soak thoroughly before attempting to move the core. If the core is still tight allow a little longer, using a little more white spirit if necessary.

Alignment Instructions

(a) *I.F.* The I.F. of the receiver is 560 Kc/s. Tune the three I.F. transformers for maximum, starting

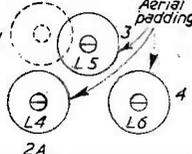


OSCILLATOR SECTION.

MIXER SECTION

R.F. SECTION.

I.F. filter No.1 inside can.



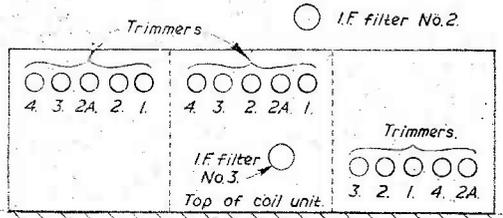
Front of panel

The layout of the coils. The tuning adjustments will be found in the next column.

at the I.F. transformer feeding the detector and working backwards towards the frequency changer. The bandwidth is 4.6 Kc/s at 6 db. down.

(b) *Heterodyne oscillator.* This operates at 280 Kc/s which is half the I.F.

Inject 560 Kc/s into the receiver C.W. (i.e., no modulation). Switch on the heterodyne oscillator and tune for zero beat. The variable capacitor has a screwdriver slot and is accessible through a hole in the front panel. If it will not tune correctly follow



Identification of the trimmers.

the tuning instructions given in the second part of the article.

(c) *R.F. circuits.* These should be re-aligned in the order as set down below. If the receiver in question does require alignment, presumably the discrepancy is not very great and in this case there is no objection to feeding in signals via the aerial socket.

Range	Frequency coverage	Trimming frequency	Padding frequency
1	18.5-7.5 Mc/s	18 Mc/s	8 Mc/s
2	7.5-3 Mc/s	7 Mc/s	3.5 Mc/s
3	1,500-600 Kc/s	1,400 Kc/s	650 Kc/s
4	500-200 Kc/s	500 Kc/s	210 Kc/s
5	200-75 Kc/s	200 Kc/s	80 Kc/s

For the positions of the trimmers and the coils, see the diagrams. It should be pointed out that the diagrams actually refer to a model R.1155N in which a band covering 3 Mc/s-1.5 Mc/s (known as Range 2A) is incorporated to the exclusion of Range 5. Whether any differences exist with regard to coil and trimmer positions or whether 2A is merely substituted for 5 is not known for certain, but it should not be too difficult to discover this by experiment.

(d) *I.F. rejector filters.* Tune receiver to 500 Kc/s and inject 500 Kc/s into the receiver and tune all the filters for minimum output.

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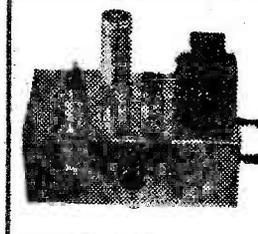
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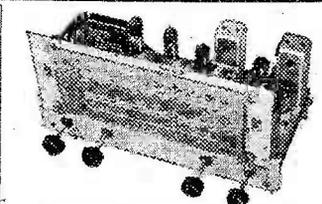
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907	8/6	EB84	10/6	EV31	10/6
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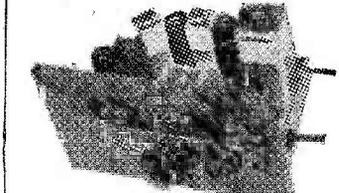
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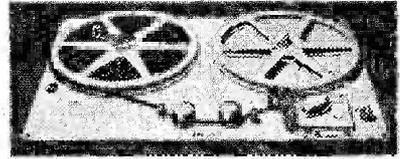
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Transistor Circuit Applications

A SELECTION OF USES TO WHICH TRANSISTORS MAY BE APPLIED

By Edward Deron

FROM the amateur experimenter's point of view perhaps the immediate reactions to the appearance on the market of increasing numbers of transistors are the possibilities of constructing miniature economical receivers and amplifiers working from low-voltage sources. Another aspect of the situation which may be of even more importance, however, is the interesting number of

All we will say is that with suitably chosen components current, voltage or power gain can be obtained from the circuit of Fig. 1. Current gains as high as 50 times with a low load and voltage gains as high as 1,000 times with a high load are possible. The maximum power gain may be of the order of 35 db.

In order to obtain the high input impedance necessary for many applications, another transistor used in the grounded collector configuration (corresponding to a cathode follower valve circuit) can be used to precede the amplifier of Fig. 1. This has a high input impedance, perhaps 50-100 K Ω , and a low output impedance ideal for matching into the base of the grounded emitter circuit. As with the cathode follower the voltage gain is less than one, but a high current gain and power gain is possible. With the OC71 current and power gains of 40-50 times can be obtained. Fig. 2 shows an amplifier of high input impedance with an over-

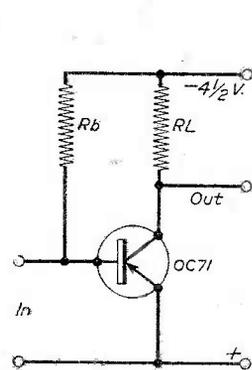


Fig. 1.—An amplifier.

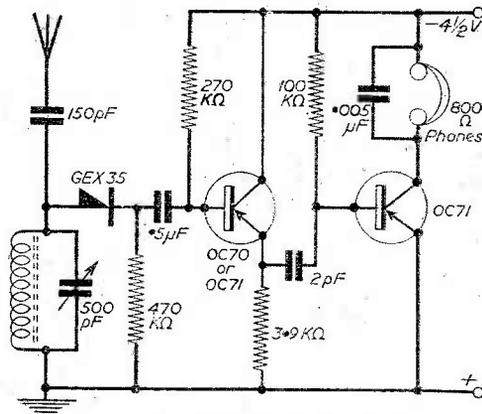


Fig. 2.—Detector and audio amplifier.

small pieces of test equipment in the form of oscillators, pulse generators, etc., which are possible and which do not each require expensive power packs with their transformers, rectifiers and smoothing networks. A few circuits will be described operating from a 4½-volt grid bias battery which, in consequence of an average current drain of only 1 mA or so, has a life almost the same as the shelf life. The circuits to be described are for *p* or *p* junction transistors, but could apply to any type of transistor if suitable modifications of circuit parameters were made where appropriate.

Audio Amplifier

First of all we will consider briefly the simple amplifier shown in Fig. 1, using a Mullard OC71. This is a grounded emitter arrangement and will be seen to be similar to the familiar grounded cathode configuration of a triode valve; the collector load (RL) corresponding to the anode load of a valve and resistor Rb limiting the current bias to the base, corresponding to the negative voltage bias supplied to the grid of the valve. The main feature of the grounded emitter circuit is its low input impedance, a few hundred ohms, and its high output impedance, tens of thousands of ohms. The various impedances are, unfortunately, dependent upon the load and source impedance, and can all be calculated by consideration of the equivalent circuit, but it is not proposed to deal with this here. Interested readers can refer to various textbooks on these items.

all gain greater than 45 db. A crystal detector can be connected as indicated, a suitable medium wave coil consisting of 120 turns of 9/45 Litz on a bobbin designed for a "screw in" dust iron core. The current drain is about 3 mA from the 4.5-volt battery.

R.C. Oscillator

As mentioned before, the main purpose of this article is to suggest methods of generating various waveforms useful for general test purposes. Perhaps the most useful signal possible for testing audio

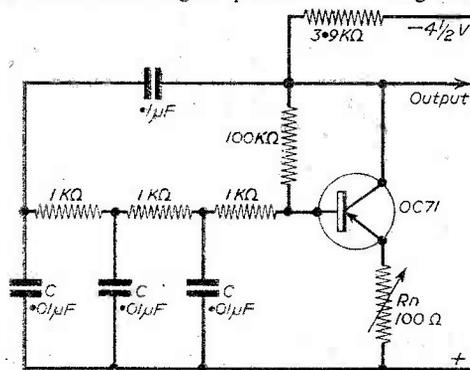


Fig. 3.—15 Kc/s phase shift oscillator.

amplifiers is the sine wave generator and a simple R.C. phase shift oscillator will be described which will operate from a 4½-volt battery with a current drain of ½ mA. A sine wave voltage of about 2 volts peak to peak is generated.

The circuit of the device is shown in Fig. 3. The CR phase shift network can be altered for any required frequency and below about 10 Kc/s the

amplitude. About 25Ω would be suitable if a fixed resistor were used.

This device is very small and can be housed in a case of suitable size to take the battery. Fig. 4 shows a possible arrangement. The size of the upper section is controlled by the sizes of the switch and potentiometer; all the other components take

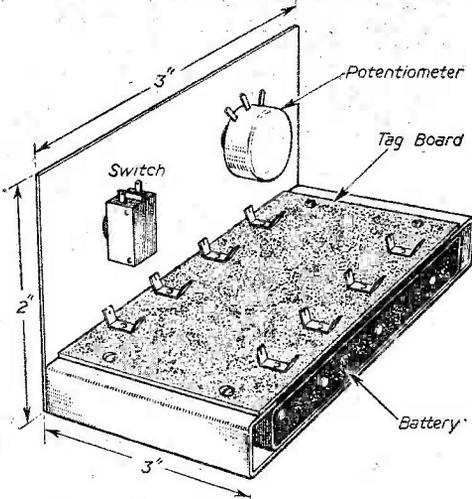


Fig. 4.—Chassis for R.C. oscillator.

values for C and R can be calculated from the formula

$$f \approx \frac{1}{15CR}$$

At higher frequencies the situation is complicated by the internal phase shift of the transistor. With the values shown in Fig. 3 the oscillation frequency was 15 Kc/s. It is important to remember that current is being fed back to maintain oscillations and that the resistors should be kept low and the capacitors increased for lower frequency operation. The purpose of the negative feedback potentiometer Rn is to restrict the amplitude of oscillation and prevent clipping of the waveform, and its value should be adjusted for a good waveform of the required

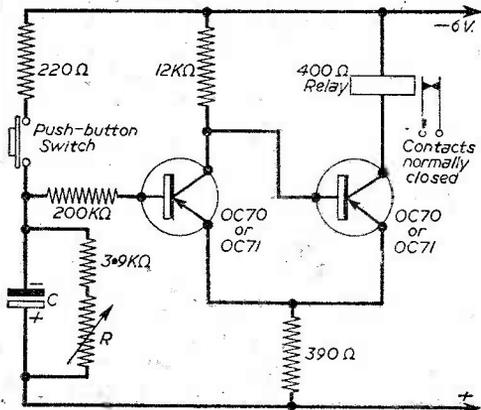


Fig. 6(a).—Photographic enlarging timer.

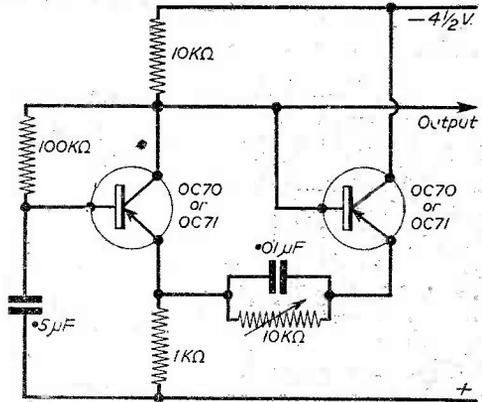


Fig. 5.—Square wave or pulse generator.

relatively little room and can be conveniently mounted on a tag board as indicated.

As the current drain is only about ½ mA the battery will last for months (or years).

Square Wave and Pulse Generator

In some respects a square wave generator is more suitable for checking A.F. equipment than the sine wave generator. The circuit to be described is a type of free running flip-flop or relaxation oscillator which can be adjusted to give truly square waves —i.e., equal mark/space ratio, or to give pulses of various widths and p.r.f.'s.

Fig. 5 shows an arrangement which will produce square waves at about 500 c/s. The variable resistor can be set for truly square waves which will have an amplitude of about 3½ volts peak-to-peak. The 0.01μF condenser improves the shape of the wave but does not contribute to the oscillator mechanism which is controlled by the charge and discharge time of the 0.5 μF condenser.

The frequency can be varied by altering the
(Continued on page 265)

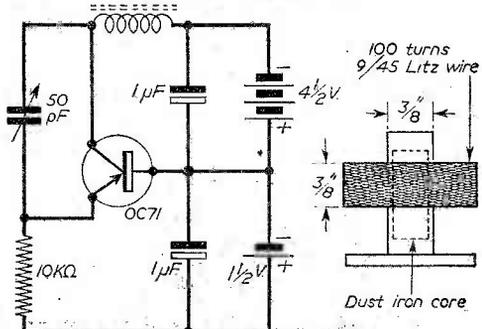


Fig. 6(b).—1 Mc/s oscillator.

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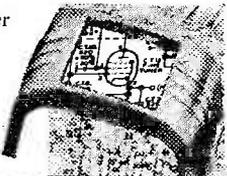
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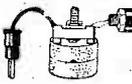
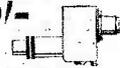
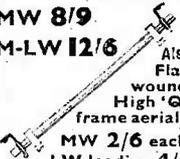
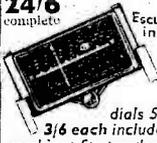
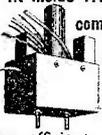
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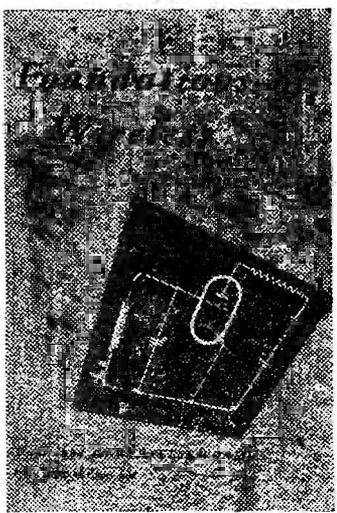
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circuit parameters, particularly the 100 k Ω and 0.5 μ F network associated with the first transistor. The 10 k Ω variable resistor can be readjusted to give sharp pulses of various widths down to 100 μ S or less.

Since the response of the transistors may be expected to fall off rapidly at frequencies above

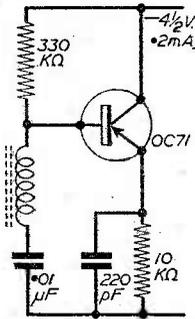


Fig. 7.—This shows a circuit for an oscillator for R.F. working.

about 30 Kc/s the maximum fundamental frequency which will give reasonably good square waves may be about 1,500 c/s. (fundamental and 10 odd harmonics). The chassis shown in Fig. 4 will house this device.

An interesting variation of this circuit can be used as a photographic enlarging timer. This is shown in Fig. 6 (a). When the push-button switch is closed C charges to -6 volts, the first transistor conducts, the second one is cut off and the relay is

released. As the charge on C decays through R and the base emitter circuit the first transistor will reach a point when conduction will cease and the bias thus applied to the second transistor will cause it to conduct, so operating the relay and switching off the enlarger. With R=100 k Ω and C=100 μ F (6 volt working) the delay times are 2-20 seconds and with C=1,000 μ F (6 volt working) they are 20-150 seconds.

High-frequency Oscillator

Although the frequency response of the junction transistors described is limited to the audio range for normal amplification they can be induced to give useful gain as R.F. amplifiers in the Long and Medium wave bands when used in the grounded base configuration (corresponding to the grounded grid triode valve). Their use as high frequency oscillators, however, is far more promising and they can be made to oscillate at frequencies up to five times the cut-off frequency (up to about 2 Mc/s with an OC71). The following circuit is of an oscillator operating at 1 Mc/s and is of the L.C. phase shift variety. Fig. 6(b) gives the circuit diagram together with an outline sketch of the coil. The variable condenser is adjusted for adequate oscillation and a good waveform but its value is not critical. For a 465 Mc/s oscillator the coil could consist of 300 turns of No. 42 g. S.C.C. enamelled wire on a similar former.

Another form of simple oscillator which will work readily at 465 Kc/s is shown in Fig. 7.

News from the Clubs

SCUNTHORPE AMATEUR RADIO SOCIETY

Hon. Sec. : J. Stace, 38, Skippingdale Road, Scunthorpe, Lincs

AT the recent A.G.M. the following were elected :

Chairman : T. J. Wright (G3HRP); Secretary : J. Stace (G3CCH); Treasurer : I. W. Rhyder (G3JWR).

Recent events have included a lecture and film demonstration on the manufacture of CRT's, by Messrs. Mullard Ltd.

Lectures have been arranged to supplement beginners' studies for the RAE.

THE WARRINGTON AND DISTRICT AMATEUR RADIO SOCIETY

Asst. Sec. : P. E. Smith, 35, Victoria Avenue, Grappenhall, Nr. Warrington, Lincs.

AT the Annual General Meeting of the Society officials for the year 1957 were elected. The secretary for this year is John Mather, whose address is :

28, Chapel Road, Penketh, Nr. Warrington, Lincs.

During the new year the society will continue to meet on the first and third Thursday in each month at the Royal Oak Hotel, Bridge Street, Warrington, at 7.30 p.m. A course on radio fundamentals, and slow Morse, has been started. Two further items on the agenda are a Junk Sale, and a talk on Communication Receivers; the dates will be announced later.

STOURBRIDGE AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec. : A. K. Davies, 48, Church Avenue, Amblecote, Nr. Stourbridge, Worcs.

A GOOD attendance has been maintained at recent meetings. In January a sale of gear was highly successful and in February two films on "Electronics" were shown. Each Tuesday evening the transmitting members hold an organised "net" on 1.8 Mc/s.

ROMFORD AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec. : F. Simmons (G2FWJ), 15, Globe Road, Romford.

AT the recent A.G.M. the following officers were elected :

Chairman : R. F. Stevens (G2BYN); Hon. Sec. : F. Simmons (G2FWJ); and Treasurer : J. C. Perry (G3EBF).

A programme of lectures and visits has been arranged and the Society's station has been re-equipped to permit all band operation.

Meetings are held every Tuesday at 8.15 p.m. at RAFA House, Carlton Road, Romford, and visitors will be welcome.

Further information can be obtained from the Hon. Sec.

THE SLADE RADIO SOCIETY

Headquarters : The Church House, Erdington, Birmingham, 23.

PROGRAMME : Second quarter, 1957.

May 10th—"The 64,000 ohm question." ? ? ?

May 24th—"Supply of Electric Power to Moving Machinery," by Mr. P. N. Williams (Member).

June 7th—Election of General Secretary followed by "Mapping the Galaxy," a talk on Radio astronomy by Dr. R. S. Donogh, of Salford College, Birmingham.

June 21st—"R.F. Coil Design," by Mr. Reynolds, of Repanco Ltd., Coventry.

CRAY VALLEY RADIO CLUB

Hon. Sec. : S. W. Coursey (G3JJC), 49, Dulverton Road, London, S.E.9.

THE April meeting of the Cray Valley Radio Club was devoted to a demonstration of the latest techniques in stereophonic sound arranged by the General Electric Company Ltd.

The club caters for all aspects of amateur radio, and applications for membership are invited.

NORTH KENT RADIO SOCIETY (G3ENT)

Hon. Sec. : David W. Wooderson (G3HKX), 39, Woolwich Road, Bexleyheath, Kent.

AT the meeting on March 28th, Alan Swindon, G3ANK, gave a very interesting talk on his activities from Aden as V99AS.

For-coming events :

May 23rd—Discussion on final arrangements for National Field Day.

June 13th—Discussion on N.F.D. results.

June 27th—Talk by Rowley Shears, G8KW, on GELOSO equipment and on Mobile Operation.

All meetings are held at 8 p.m. in the Congregational Hall, Chapel Road, Bexleyheath (near the Clock Tower). Further details from the Hon. Sec.

TRANSMITTING TOPICS

FURTHER POINTERS ON THE V.F.O.

By O. J. Russell, B.Sc., A.Inst.P. (G3BHJ)



SOME further aspects of V.F.O. operation may be of interest to readers. While the use of stabilised H.T. lines is now common, it sometimes happens that there is not enough output with, say, a 90-volt neon (or even a 150-volt neon) stabilised H.T. line. It is, of course, very poor practice to run the V.F.O. at any more than a minimum input, as stability is highest at low inputs. In some cases, however, it may be needed to run at higher inputs. One method—short of using neons in series to give a higher stabilised

operating in the 1.8 Mc/s region, and in some cases the V.F.O. may operate on 1.2 Mc/s or even 900 Kc/s for 3.5 Mc/s operation. It is, admittedly, desirable *not* to have the V.F.O. operating on the actual transmitter output frequency. Generally, however, the use of a 3.5 Mc/s V.F.O. oscillation frequency does not matter in a multiband rig, as on the H.F. bands all stages are multiplying immediately following the V.F.O., so that on the H.F. bands where V.F.O. stability is really critically important no trouble need arise.

Stability

It is necessary also to state that operating the V.F.O. on very low frequencies does not necessarily improve stability. In the case of "high-C" oscillators, the stability is *only* increased (as far as output frequency of the transmitter is concerned) if the tank circuit capacities are proportionately increased. If this is done, then the valve capacity variations due to heating and reflected load variations will become a proportionately less amount of the tuning capacity change and the percentage frequency shift and drift will become less. Under these circumstances, a lower frequency of V.F.O. operation may be beneficial. In the case of the Clapp oscillator, increasing the tuning circuit capacitance may actually deteriorate frequency stability, as the critical factor is the ratio of the tuning capacity to the grid and cathode condenser capacities. The solution, therefore, is not to increase the tuning capacity values, but to increase the values of the grid and cathode condensers. This, of course, is precisely our earlier advice about the Clapp circuit, namely, that the grid and cathode condensers should be as large as possible. Depending upon the coil efficiency it may or

(Continued on page 269)

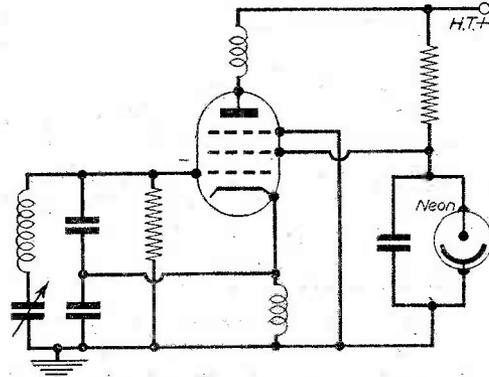


Fig. 1.—Feeding the screen only from a neon stabiliser enables higher output to be obtained.

H.T. line—is to run the *screen* only from the stabilised line. The anode may be taken to a higher voltage line, such as the unstabilised supply line, so that the anode input power is increased. This often gives the benefits of complete stabilisation of the V.F.O. line plus increased output due to the higher anode potential (Fig. 1).

However, generally it is not advised that the V.F.O. be run at high inputs. The lowest input feasible is desirable, so that drift, instability and valve heating are minimised. In any case the use of a buffer stage between the V.F.O. and the first multiplier or driver stage is desirable. The cathode follower type of isolating buffer (Fig. 2) is often used to provide a high degree of isolation between the V.F.O. and the driver stages. Incidentally, in an attempt to get high stability, many amateurs operate the V.F.O. upon the lowest possible frequency. Thus, many rigs with output on 3.5 Mc/s, use a V.F.O.

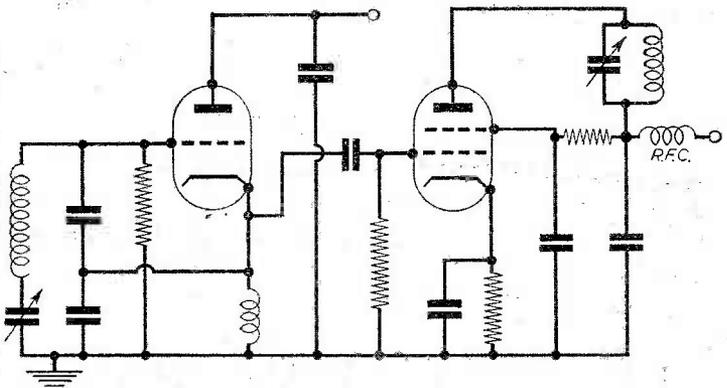


Fig. 2.—A cathode coupled buffer stage minimises "pulling" of the oscillator.

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145	61-8AC7	12-8-0P17	12-8-6XGT	6-6-12-8KGT	14-3-10LGT	8-8-D12	10-8-EC82	10-8-EY10	10-8-MU14	8-6-10-10	10-6-V1S492A	2-8
147	12-8-0A3S	61-8-6F22	10-8-8Z4A	12-6-12-8JGT	8-8-57	8-8-D32	5-8-EC88	8-8-EY86	10-8-N77	5-8-R12	10-6-VMP41	15-8
102	9-1-0A1S	5-1-0F23	12-8-8Z5	12-8-12-8A7	8-6-53	8-8-D77	6-8-EC85	8-8-EZ85	8-8-N142	10-8-S06	12-6-VP27	12-6
118	11-1-8A3S	7-8-0G6	6-8-630L	15-1-12-8T	7-8-61BT	12-6-DAC32	11-1-EC831	5-8-EZ40	8-8-N190	10-8-SP47	15-1-VP47	15-8
114	6-8-8AL5	6-8-8F63	2-8-7A7	12-8-13-8OT	7-8-91SPT	15-1-1A91	7-8-EC82	7-8-EZ41	10-8-N134	9-8-SP41	3-6-VP30	7-8
111D3	6-8-8AM5	5-1-8H6M	3-8-707	8-1-12-8H7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7
11N3	61-8-AM6	9-1-8J3C	6-1-703	8-1-12-8H7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7
1N5	11-1-8A65	7-8-10S3TG	5-8-704	8-1-12-8H7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7
1R5	3-8-8A08	10-1-10S3TG	8-1-7H7	8-1-12-8H7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7
185	7-8-8AT6	8-8-8A6	5-8-7Q7	8-1-12-8H7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7
1F4	7-8-8B1	6-1-8J7C	8-1-7Y7	8-1-12-8H7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7
1U5	7-8-8B7	10-1-8K7G	5-1-7Y4	8-1-12-8H7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7	8-1-8A7
2A3	12-8-8B8G	4-1-8K7GT	6-1-8A8	12-8-1A7	10-8-1210LF	3-1-DH77	3-8-8B42	10-8-10-10	10-8-10-10	10-8-10-10	10-8-10-10	10-8-10-10
2C6	6-1-8B3M	4-1-8K8G	8-1-8D3	9-1-1A87	14-1-807	6-8-DK32	12-8-8B42	10-8-10-10	10-8-10-10	10-8-10-10	10-8-10-10	10-8-10-10
2D13C	7-8-8BA6	7-8-161D3	10-1-9D2	3-1-19H1	10-1-868A	12-8-DK81	8-1-10-10	10-8-10-10	10-8-10-10	10-8-10-10	10-8-10-10	10-8-10-10
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3A4	7-8-8B9	6-1-8L7M	8-1-10C2	13-1-30L1	12-8-854	15-1-DH63	8-1-10-10	10-8-10-10	10-8-10-10	10-8-10-10	10-8-10-10	10-8-10-10
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8B7	8-8-8B97	10-1-8N7	8-1-10E9	11-8-10E9	11-8-10E9	12-8-DL33	9-8-10-10	10-8-10-10	10-8-10-10	10-8-10-10	10-8-10-10	10-8-10-10
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304	8-1-8B97	8-8-8Q7GT	9-1-10F13	17-8-37	7-8-7475	7-8-DL94	8-1-10-10	10-8-10-10	10-8-10-10	10-8-10-10	10-8-10-10	10-8-10-10
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3V4	6-8-8C6	6-8-8S67	6-8-12A87	8-1-30C1	12-8-10066	6-1-DM70	8-8-10-10	10-8-10-10	10-8-10-10	10-8-10-10	10-8-10-10	10-8-10-10
5U4	8-1-8C8	8-1-8S7	6-1-12A8	10-8-30F5	15-1-AC8PEN	6-8-EL148	2-1-8F94	5-1-10-10	6-8-PL83	11-8-11-8	11-8-10-10	4-8
5V4	10-1-8C9	12-8-8S7	8-1-12A75	10-8-30F11	15-1-ACVHL	EA30	2-1-8F93	10-8-10-10	6-8-PL83	11-8-11-8	11-8-10-10	4-8
5X4	10-1-8C10	10-8-8K7	5-8-12A7	8-8-30L1	12-8-8DD	15-1-BA76	9-8-8F89	8-8-10-10	6-8-PL83	11-8-11-8	11-8-10-10	4-8
6V3	7-8-8CB	6-8-8S7GT	8-1-12A7	7-8-30F12	13-8-ACCP4	8-1-BA8C9	7-8-8F85	7-8-10-10	6-8-PL83	11-8-11-8	11-8-10-10	4-8
3V4	10-1-8D3	6-8-8S7GT	7-8-12A87	9-1-31	7-8-1A59	10-1-EA91	9-1-8F78	12-8-10-10	6-8-PL83	11-8-11-8	11-8-10-10	4-8
3Z3	12-8-8F1	15-1-8S7	7-8-12B46	9-1-33A	13-8-AP4	7-8-EA143	10-8-8F89	10-1-10-10	6-8-PL83	11-8-11-8	11-8-10-10	4-8
3Z4	8-8-8FG	6-8-8G4GT	14-1-12B63	10-1-40	-ATP4	3-8-EB34	2-1-8F93	10-8-10-10	6-8-PL83	11-8-11-8	11-8-10-10	4-8
6A8	10-1-8F7	10-8-8U3G	7-8-12E1	30-1-35/31	18-8-AZ31	12-8-EB41	8-1-8F93	5-8-10-10	6-8-PL83	11-8-11-8	11-8-10-10	4-8
6A87	8-1-8F8	10-8-8V7	8-8-12H6M	3-1-33A3	11-1-B309	9-8-EB91	6-8-EL32	5-8-10-10	6-8-PL83	11-8-11-8	11-8-10-10	4-8
6A88	10-1-8F12	9-1-8V8G	7-1-12V5GT	4-1-33Z3	10-8-EL64	7-8-EB41	10-8-EL42	11-1-11-11	6-8-PL83	11-8-11-8	11-8-10-10	4-8

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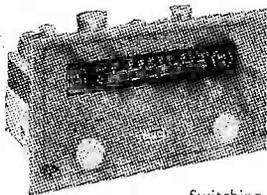
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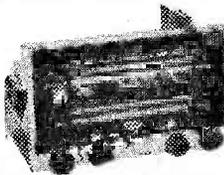


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may not be possible to increase the Clapp grid and cathode condenser sizes when the frequency of operation is made lower. In fact, due to the rather large coil sizes required for Clapp oscillators operating below 1.8 Mc/s it may not be possible to make these compact enough for V.F.O. construction. The "remote-control" unit offers one possible way out, but a 900 Kc/s Clapp oscillator coil—if it is to be of any advantage—must be a rather large object, and difficult to keep mechanically rigid and stable. There is, therefore, usually very little point in making a Clapp V.F.O. operate on a very low frequency for the point of enhancing the stability of an amateur bands TX. For low frequency operation, of course, the L.F. Clapp can easily be made stable enough, without difficulty. The point of importance is, however, that the *proportional* stability of a low-frequency Clapp oscillator is by no means necessarily better than a high-frequency Clapp. Thus, in general, the "low-C" type of oscillator is rather a different proposition from the "high-C" oscillator.

Hum

One problem that occasionally crops up is oscillator hum. In some cases this is due to the use of an H.T. supply that is not sufficiently smoothed, or to an unstabilised H.T. line. In a few cases Clapp and ECO types of V.F.O. may be prone to hum through heater-cathode leakages, and some specimens of valve may produce hum and others not. Also, some types—especially miniature types—may be more prone to hum troubles from heater-cathode leakages than other types. Very slight hum levels at the V.F.O. may be accentuated in following stages, as shown in Fig. 3. Just as the percentage modulation of an R.F. signal applied to a Class B linear type of amplifier may be increased or decreased according to

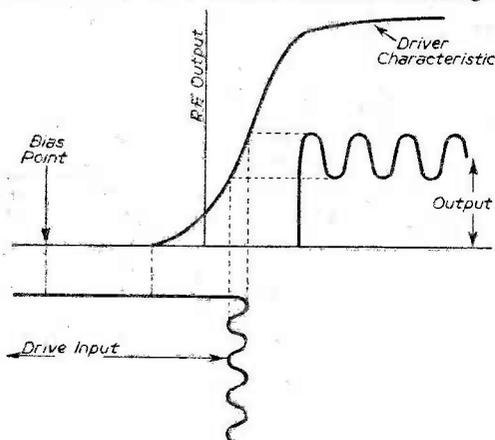


Fig. 3.—A small amount of V.F.O. hum modulation may be accentuated by a driver stage heavily biased.

circumstances, so can a small amount of V.F.O. hum modulation be accentuated or decreased. In Fig. 3 we see that the V.F.O. output is applied to the grid of a buffer stage that is biased to beyond cut-off. Only the tips of the V.F.O. waveform are really amplified, so that the small hum percentage is greatly exaggerated. Conversely, if the waveform were applied at such amplitude as to drive the amplifier into limiting, the hum modulation would be virtually

suppressed in the amplifier output (Fig. 4). It is possible, therefore, for a V.F.O. that gives a pure clean D.C. note by itself to sound very rough after passing through an amplifier that accentuates the hum modulation. In addition, a buffer or multiplier stage supplied with H.T. that is insufficiently smoothed can introduce hum modulation. Even if this hum modulation is small, it can be accentuated in following stages. Generally, of course, if the stages are well driven, hum is not accentuated; in fact, it is usually suppressed. Should drive fall off, however—as may happen when trebling to 21 Mc/s—then hum may "inexplicably" appear! While the obvious solution is the use of adequate filtering and smoothing of H.T. supply lines, it is possible for very small traces of hum to be accentuated successively stage by stage in the manner explained above, so that the final signal contains a very noticeable hum content. A stage that has accidentally been heavily over-biased is one potent cause of such effects, and the operation of drivers and multipliers at reasonable values of drive and bias should enable a clean signal to be radiated.

Calibration

One thorny point is the calibration of the V.F.O. scale so that frequencies may be accurately read off. There is no difficulty in obtaining calibration points. Thus, a 100 Kc/s crystal oscillator may be used to give 100 Kc/s points. In fact, a 100 Kc/s crystal is not essential, as Droitwich is maintained on 200 Kc/s to a fundamental precision of a few parts in one hundred million—effectively a few cycles at 100 megacycles! The second harmonic of a tuneable 100 Kc/s oscillator may thus be zero-beat tuned to Droitwich on 200 Kc/s, and *maintained* there by monitoring on a broadcast receiver, while the high harmonics of the 100 Kc/s oscillator are used to calibrate the V.F.O. If a 100 Kc/s crystal oscillator is used, the Droitwich transmitter enables it to be zero beat to an accuracy of N.P.L. standard! In fact, an old B.C.L. receiver fitted with a "magic eye" or similar type of visual tuning indicator provides a means of setting up the 100 Kc/s to far better than a cycle precision. The very slow beats—of several seconds period—can be observed on the visual tuning indicator, so that the 100 Kc/s oscillator can be adjusted to a small fraction of a cycle. The injection of the right level of signal, i.e., about equality with Droitwich level at the receiver enables a good visual indication of beat note. Thus, if Droitwich is much stronger than the injected local signal, there will hardly be any additional reaction on the tuning indicator. With the local signal swamping the receiver there will again be scarcely any visible beating effect. The local signal injection—as from a small wire from the output loosely coupled to the receiver aerial—should give about the same level as Droitwich for optimum beating effect. Be warned, however, about the experience of one amateur in an area of high field strength from Droitwich. To get enough signal he hung the 100 Kc/s output wire near his transmitter feeders so as to radiate enough 200 Kc/s harmonic for good pick-up on the broadcast receiver. Some little time passed in fascination at the way he could produce a rapid signal flutter with low beat notes, and reduce this to a several seconds up and down "fade" as the two signals were almost exactly synchronised. The next day the neighbourhood rang with comments on the extraordinary fading effects noticed on the

Long Wave programme, and the amateur was thankful that he did not become connected with the responsibility for this novel form of B.C.I. in the minds of the neighbours!

With due precautions in mind, therefore, the initial 100 Kc/s calibration points may be obtained. With only a 100 Kc/s standard, however, one can obtain 50 Kc/s calibration points by simply monitoring the V.F.O. second harmonic. Twenty Kc/s points might be obtained by monitoring the V.F.O. fifth harmonic and zero beating with 100 Kc/s marker points. The tenth harmonic might even be used if a receiver tuning to the 35 Mc/s region is available. This enables the V.F.O. dial to be calibrated at 10 Kc/s points when using a 100 Kc/s frequency standard. Care should be taken to avoid spurious resonance points that might be caused by receiver oscillator harmonics beating with high harmonics of the V.F.O.

Incidentally, it is possible to make a self-excited calibration oscillator for the 100 Kc/s region. If this oscillator is held to zero beat on its second harmonic with the 200 Kc/s long wave Droitwich transmitter, it is then possible to obtain an accuracy equivalent to a crystal calibrator. However, care must be taken to ensure an accurate zero beat, and some form of visual indicator is desirable to permit of setting to within a fraction of a cycle of zero beat. Audible setting to zero beat is a little too crude for accurate setting to frequency of what is virtually a temporary "standard" oscillator.

The technique of zero setting is, of course, important. The receiver B.F.O. should *not* be used in the zero-beat setting. The B.F.O. may be used to locate the position of the required 100 Kc/s harmonic. Then switch off the B.F.O. and tune the V.F.O. under test until it is zero beat with the selected 100 Kc/s harmonic. A reasonable balance of signal strengths from the 100 Kc/s harmonics and the V.F.O. frequencies should be maintained. It is, in any case, bad practice to operate with large inputs. This, by overloading, may create spurious beat effects in the receiver giving rise to zero beatable whistles at all sorts of odd positions on the receiver. Such odd and unwanted effects are best avoided by operating with small inputs to the receiver. Incidentally, owners of wavemeters such as the Class D and the BC 221 types, will be able to locate faint additional whistles due to self-generated higher harmonics. Thus, on the Class D, in addition to the main "Zero" and "100 Kc/s" position calibration "pips," a weaker "pip" can generally be located at "50 Kc/s" and even weaker pips at $33\frac{1}{3}$ and $66\frac{2}{3}$ divisions due to higher harmonics internally generated, beating with one another. These additional "pips" in the Class D form a useful check upon the dial linearity, and are so weak that they cannot be readily confused with the strong fundamental check points at "Zero" and "100 Kc/s" on the vernier frequency dial. However, spurious "pips" created in a monitoring receiver by overloading effects due to strong signal injection may cause trouble.

Generally, of course, the V.F.O. on its fundamental and lower harmonics will generate a "swamp" signal on a normal communications type receiver. However, the 100 Kc/s check points from the crystal oscillator will, in general, be fairly weak. The solution is obvious. Couple the 100 Kc/s check oscillator output into the receiver by fairly close proximity to a short length of screened lead with a microscopic capacity coupling. This should give strong but not

"swamp" injection of 100 Kc/s marker points. Some adjustment may be necessary to give comfortable strength for these marker pips, particularly when monitoring the higher harmonic positions. The V.F.O. should be well away from the receiver pick-up to begin with, as it is likely to give a really strong signal input, at any rate on fundamentals.

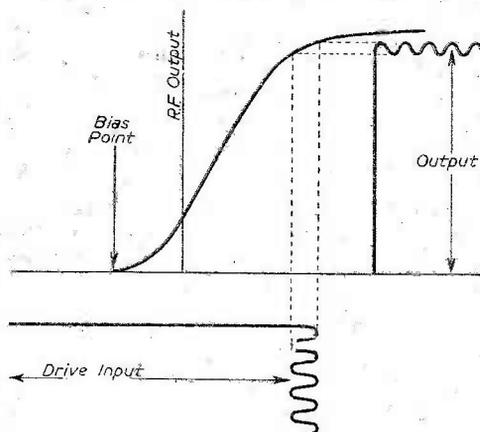


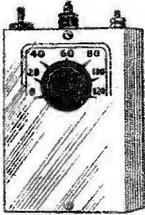
Fig. 4.—A well driven stage may suppress hum modulation.

It is inadvisable to have anything resembling an "aerial" attached to the receiver, even if only a few inches of wire, as external carriers may cause confusing beats. The best solution is to use a piece of screened coax, with only an inch or so of bare wire at its free end as a start. This generally will pick up enough V.F.O. energy without being "coupled" in any other way to the V.F.O. For 100 Kc/s marker points to be located certainly throughout the spectrum, an actual capacity coupling of a pF or so may be needed.

With care, it is possible to calibrate the V.F.O. dial to a high degree of accuracy, although 10 Kc/s calibration points are the most that need be marked. However, it is not difficult to estimate frequencies to 1 Kc/s on a V.F.O. dial with only the 10 Kc/s divisions marked. However, previously details were printed of a method, the historic "method of transversals" originally used for sextant calibrations which enables readings to be taken directly to 1 Kc/s from a dial calibrated at 10 Kc/s check points. With care in construction and the avoidance of thermal effects, a V.F.O. may be held to high accuracy if a vernier corrector condenser is used to set the frequency "spot on" from time to time with a suitable 100 Kc/s crystal standard marker point. In addition, the W.W.V. frequency standard transmissions may be used, not only as crystal check points for the 100 Kc/s standard oscillator, as, indeed, may the Rugby frequency transmissions also; but it is possible to use the 15 Mc/s W.W.V. transmission as a direct check point for a V.F.O. Thus the fourth harmonic of 3.750 Mc/s falls precisely at 15 Mc/s and gives a direct check point on the V.F.O. calibration. This is a convenient check frequency, involving no awkward fractional parts, unlike the seventh harmonic frequency in the 3.5 Mc/s band which falls on the 25 Mc/s standard frequency transmission from W.W.V. The 15 Mc/s harmonic check also provides a check frequency on the eighth harmonic for the 1.875 Kc/s calibration point.

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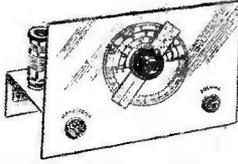


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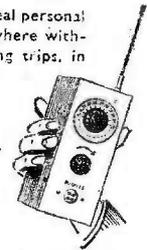


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6K8gt	9/3		5/11	ECC85	9/3	PY81	8/3
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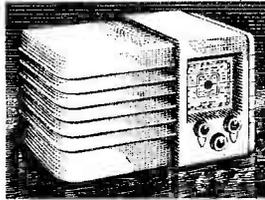
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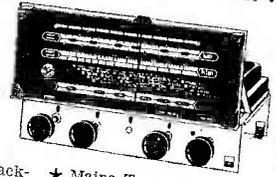
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R109A RECEIVERS. 8 valve superhet using 5 x ARP12's and 3 x AR6's covering 2-12 Mc/s. Contains vibrator pack and 3 $\frac{1}{2}$ " speaker and operates from 6 volt battery, consumption 14 amps. Housed in metal case 13in. x 12in. x 11in. Complete with valves and circuit. Aerial tested and in very good condition. £4.7.6. Carr. paid.

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TESTMETERS. American, 1,000 ohms per volt, 20 ranges. 0-5,000 v. A.C. and D.C., D.C. m/A and amps., ohms, and dB. In polished wooden case, 6 $\frac{1}{2}$ x 8 $\frac{1}{2}$ x 4 $\frac{1}{2}$ in. Complete with leads and instructions. Guaranteed O.K. 55.19.6.

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Using a "High Cycle" Transformer on 50 c/s Mains

MAKING USE OF A SURPLUS COMPONENT FROM THE 1355 RECEIVER

By J. Stebbings

THERE are many uses for a low-voltage A.C. supply, apart from meeting the power requirements of a radio unit. Among those employed by the writer are for a battery charger, supplying small surplus motors, garage lighting, and a model

diagrams that this centre tap and one side of the 6.3 volt winding were earthed to solder tags connected to the tops of two of the mounting pillars. There was also a bare wire connecting the tags.

It was intended to use the H.T. winding as a primary across the 50 c/s mains; and before this could be done the two pillars were unscrewed and the earthing tags unsoldered, leaving the ends of the wires free. The pillars were then replaced without any tags. A sheet of paxolin was cut and drilled for attaching to the four bottom pillars, and on this was screwed a tag strip for nine connections. The 500 ohm resistor was removed from the existing top tag board. The nine wires A to J were then lengthened where necessary and connected to the new tags giving the circuit shown in Fig. 4. On connecting the 240 volt A.C. mains to the ends A and B of the H.T. winding 20 volts output was obtained from the original 80 volt winding and 3 volts from the two filament windings connected in series. The voltage of either one or both of the filament windings

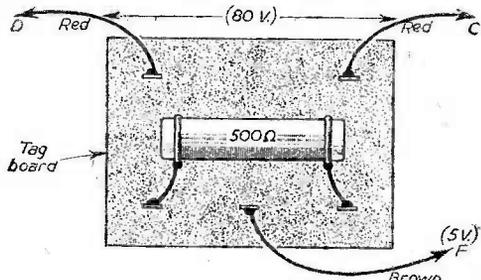


Fig. 1.—Top view of transformer showing tag board.

railway. There must be many other experimenters who have had lying idle for some time the "high cycle" power transformer from an A.M. 1355 Receiver. One of these transformers was recently successfully converted for an input of 240 volt 50 c/s

A.C., and an output which could be varied as required from 17 volts to 23 volts in steps of 1½ volts. In case there are those who have disposed of their transformers as being useless, perhaps it should be mentioned that 1355 Receivers may now be bought over the counter for as little as ten shillings complete with power unit and most of the valves.

Dismantling

Fig. 1 shows the top of the transformer on which is mounted a large 500 ohm ceramic resistor. The transformer is mounted on four hexagonal pillars which in turn are secured to the chassis with 4 B.A. screws. Fig. 2 shows the view of the underside after removal from the chassis. Before unscrewing, all the leads not lettered in the figure were cut off short and those bearing letters (G and J excepted) were traced and cut as long as possible to allow plenty of wire for new connections.

The original circuit is shown in Fig. 3. The input was 80 volts and secondary windings supplied 5 volts for the filaments of the 5U4G power rectifier and 6.3 volts for the receiver SP61 valves. The H.T. winding probably had a voltage of about 500 on each side of the centre tap. It will be seen from the

TABLE I.

Input	Connections	Output from	Output voltage
240 v. A.C. to A and B	D to E and F to G	C and H	17
"	D to G	C and H	18½
"	None	C and D	20
"	D to H	C and G	21½
"	D to H and F to G	C and E	23

could be added to or subtracted from the 20 volts according to whether the windings were connected in phase or out of phase.

Connections

Table 1 gives the connections required for various output voltages. The values given are approximate to the nearest half volt owing to the limitations of

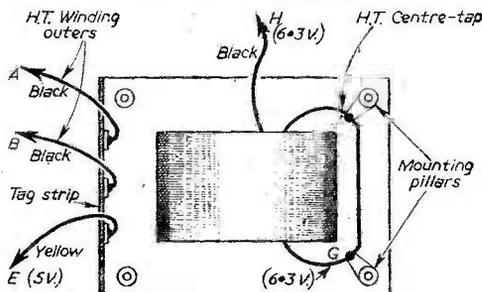


Fig. 2.—Bottom view of transformer showing original wiring.

the writer's voltmeter, but they were taken under a load of about 1 amp. Regulation appeared to be good up to a load of nearly 3 amps. and no overheating was experienced.

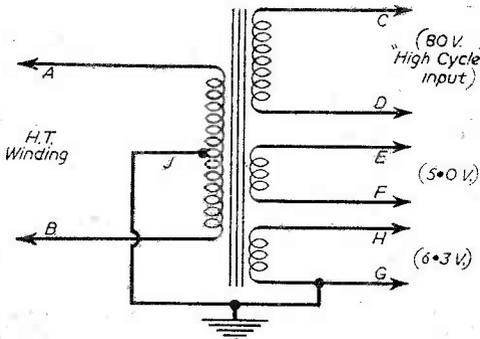


Fig. 3.—Original connections of windings.

The centre tap J of the H.T. winding could be used for an input of 120 volts A.C. with perhaps a greater temperature rise for the same output and inferior regulation. Another use which has not

been tried would be as an auto. transformer 240/120 volt or 120/240 volt. It is suggested that the power in this case be limited to about 50 watts.

As a safety precaution the core of the transformer

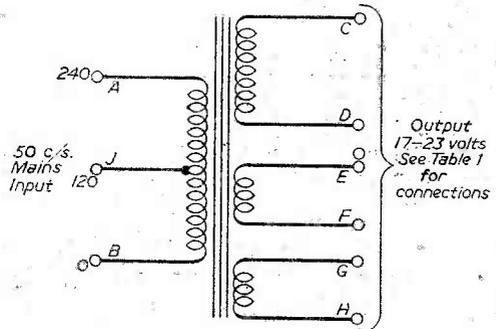


Fig. 4.—New connections for 50 c/s mains.

and one side of the output were connected to the mains earth. Input and output fuses were also employed.

RADIO COMPONENTS SHOW

(Concluded from page 236.)

T.816), which has been specially designed faithfully to reproduce the middle and higher frequency range. This is also available with the patented cambric cone as an all-purpose unit (type HF.816). A further important advance is model HF.1214, a 12in. unit incorporating a 14,000 gauss Alcomax magnet with a handling capacity of 15 watts, fitted with mid-range frequency stabilisers and when used in conjunction with models T.816 or the WB. tweeter units, provides exceptional quality of reproduction at very low cost. Of similar design is model HF.1514, a 15in. unit with a handling capacity of 25 watts.

The WB. display included the famous Stentorian 10in., 12in. and 15in. concentric duplex models, and separate tweeter units types T.10 and T.12, which have been specially designed for use in conjunction with existing P.M. speakers and have a frequency range of 3,000 to 17,000 c.p.s. A suitable crossover network is available at very reasonable cost.

The WB. 12 quality amplifier has been still further improved, to include the most recently developed valves and a most advanced circuit design with a specially designed Whitely ultra linear output transformer. Switched pick-up matching is incorporated in an extremely flexible, compact and easily mounted pre-amplifier tone control unit. Both units are attractively styled and finished in hammered gold.

Recently introduced is the WB. V.H.F./F.M. tuner, designed to receive frequency modulated signals in the international band from 88 Mc/s to 108 Mc/s and to perform with excellent results even in fringe areas. Permeability tuning and temperature-controlled circuits give rock-steady tuning with no drift.

The ready-to-assemble range of cabinets include the popular Hi-Fi console, corner and rectangular

bass reflex models. Of particular interest is a new Hi-Fi console, which will accommodate practically any make of record player, amplifier, pre-amplifier, control unit, radio tuner and loudspeaker, where space limitations prevent the use of a separate speaker system. The cabinet is also available with record storage instead of the speaker chamber. These cabinets are all finished in highly polished walnut veneer, or in white wood and are supplied packed flat, being easily assembled in a few minutes using only a screwdriver.

SHORT-WAVE SECTION

(Concluded from page 250.)

By means of a suitable tuning unit this type of aerial can, in the electrical sense, be lengthened or shortened within certain limits.

Coupling

Many readers of this section I am aware build their own short-wave receivers. When using plug in coils as in the case of straight regenerators and T.R.F. receivers, and perhaps superhets, use the recognised method of doublet coupling as shown at Fig. 6.

Experimental Doublets

It may be that some readers wish to experiment with doublets out of doors with electrical interference in view. What little success might be achieved in that direction will call for a flat top above the interference zone with the run of the aerial at right angles to the interference.

This may result in the aerial being directive in undesired directions. A very unsatisfactory compromise at best.

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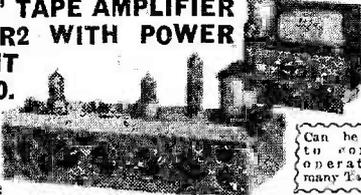
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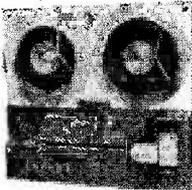
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TRANSRECEIVERS. Type "18" Mark II. TWO UNITS (Receiver and Sender) complete in Metal Case. Six Valves; Microammeter, etc., etc. Less External Attachments, £4 10s.

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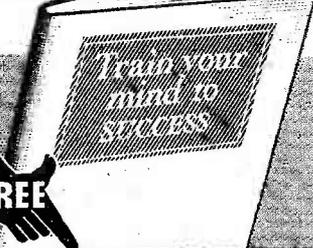
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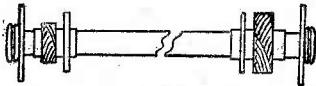
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6BA6	7/6	12U7GT	7/6	EAF42	10/6	EY93	9/6	UBC41	8/9
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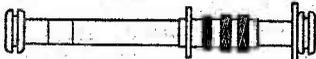
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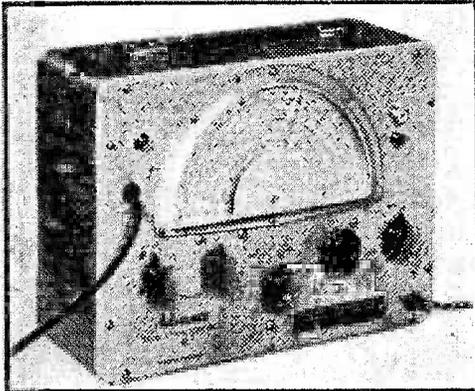
News from the Trade

ADVANCE WIDE BAND SIGNAL GENERATOR TYPE 62

ANOTHER new Advance Signal Generator is announced. The Type 62 is a remarkable little instrument designed for the serviceman and covers all the sound broadcasting, V.H.F. and TV broadcasting frequencies used in the U.K., together with all intermediate frequencies. An exceptionally wide frequency range of 150 kc/s to 220 Mc/s. Facilities are provided for amplitude modulation, together with

available in production quantities from a British manufacturer.

The "Cub," which has a frequency range of 20 to 60 Mc/s, has been designed for very high frequency applications where space is at a premium, and can be soldered directly to miniature switches or into printed circuits. It is particularly suitable for frequency synthesising in transmitters and receivers and for use in guided missiles. Without oven control this new crystal gives a frequency tolerance of ± 0.005 per cent. over a range -55 deg. C. to $+105$ deg. C.—Cathodeon Crystals Limited, Linton, Cambs.



The new Advance wide-band signal generator, type 62.

an A.F. output, and an excellent attenuator which can be relied upon. This instrument is in the Advance tradition and is listed at £32 10s. 0d.—Advance Components Ltd., Roebuck Road, Hainault, Ilford.

NEW MARCONIPHONE V.H.F./A.M. RECEIVER.

MARCONIPHONE announce a new 6-valve A.C. mains table receiver, Model T56A, for V.H.F. and A.M. long/medium band reception, offering first-class all-round performance and high quality sound reproduction, at a very attractive price.

Special features of Model T56A include a new 6-valve circuit developed for high sensitivity, two inbuilt aerials (A.M. Ferrite rod and V.H.F. dipole), and a printed circuit in the V.H.F. chassis for greater reliability and consistency of performance.

Normally the two inbuilt aerials will be found sufficient for excellent reception on both V.H.F. and A.M. bands, although provision is, of course, made for external aerials in difficult locations.

Housed in a moulded cabinet, neatly-styled in maroon, with a contrasting cream escutcheon, Model T56A will blend with any home furnishing scheme—conventional or contemporary.

The price of Model T56A is 22 guineas (tax paid).—The Marconiphone Co. Ltd., Hayes, Middx.

NEW CATHODEON CRYSTAL

CATHODEON CRYSTALS LIMITED, a member of the Pye Group of companies, announces a completely new sub-miniature crystal, the Cathodeon "Cub."

This is the first time that such a small high performance crystal (.517in. x .421in. x .171in.) has been

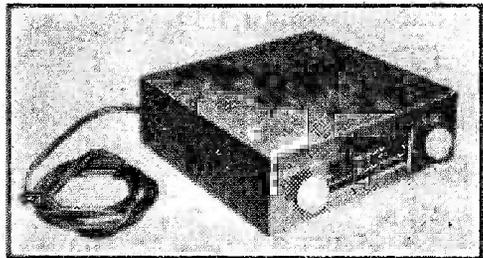
THE "STIRLING" F.M. TUNER

THE "Stirling" F. M. Tuner is designed to be used either with a radio set having sockets for the connection of a pick-up or because of its flat shape and small size, 7½ in. x 7½ in. x 2½ in., to be installed in a radiogram. The Tuner contains its own power supplies, and the on/off switch is arranged also to switch the pick-up through to the set when the tuner is not in use.

There are only four external connections—a three-core mains input cable, a co-axial aerial socket, pick-up input terminals and tuner output terminals. The mains input is 200/250 volts A.C.

The "Stirling" F. M. Tuner employs three valves and two crystal diodes. The R.F. and oscillator stages use an ECC85 valve in the same circuit employed so successfully in the "Stirling" Television Converter. Two 10.7 Mc/s I.F. stages are provided, using high-slope pentode valves, which give the tuner a high overall sensitivity and make it suitable for areas of low signal strength. The second I.F. stage includes a limiting circuit which, in conjunction with a Ratio Detector, gives considerable protection against interference.

Tuning is by means of copper slugs mechanically moved within the R.F. and oscillator coils by means of a specially designed screw mechanism. The main tuning knob drives this mechanism direct and is connected by a drive cord to the dial, which has an

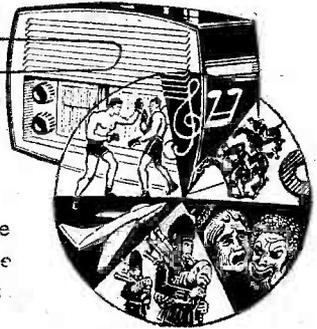


The Stirling F.M. tuner.

open scale calibrated from 86 to 100 Mc/s. Temperature compensated condensers are used in the tuning circuit and these, in conjunction with the inductive tuning, give good temperature stability.

The "Stirling" F.M. Tuner has a polished wooden cover, brown plastic front escutcheon, white control knobs and the dial calibration is gold. Price 13 gns. inc. P.T.—S. E. Opperman Ltd., Stirling Corner, Boreham Wood Herts.

Programme Pointers



THE current series of "On the Spot" programmes has just concluded with two very interesting analyses of "Cost and Controversy in the Health Service," and "Shops and the Public." This is a good and well produced programme and its resumption should be pleasurably awaited. Wynford Vaughan Thomas, Edward Ward and Colin Willis, with Robert Reid introducing, cross-question practitioners and experts in various trades and professions in an easy, yet intelligent and entertaining manner. There is always something to learn on such subjects and when we are "taught" it free from "BBC-itis"—a complaint which some programmes have caught to an alarmingly dangerous degree—listening is always a pleasure.

"Pied Piper"

Neville Shute's "Pied Piper" was a charming novel of a dear old gentleman who, trying to get back home from France when the "real" war broke out in 1940, found himself turned in to a sort of "river line" down which children and others found their most likely avenue of escape, lacked some of its savour as a radio play in Kenneth Langmaid's adaptation. Cyril Shaps as the Pied Piper—John Howard—was most appealing, but the part seemed a little bit bigger than life, or the book.

The "Third"

Yet again is the air thick with rumours that the "Third" is to close down. Why should it? Surely, if because it doesn't pay, the answer lies in amalgamation. Cut out the wasteful repeats, of indifferent items, and the worse than obnoxious repetitiousness of programme announcing and signing-off, and plenty of time could be found for the best of the "Third" within the framework of the other two. Also, scrap the titles "Home" and "Light," which are indistinguishable from "good" and "bad," anyway, and call them "First" and "Second," which terms would denote "class," as on the railways. Again, if three programmes are persisted in, then label them "First" "Second" and "Third" with all the dross of the present "Home" and "Light" going into the "Third" (class).

The terms "Home" and "Light" are misnomers, anyway. All can be had "at home": it is silly to infer that the "Light" cannot, which the titles do. Programmes could be classified and listed into firsts, seconds and thirds, just as the weather map divides the country up into Hebrides, Malin and Rockall, etc. This list should be published regularly so that no one would be left in any doubt as to which programme their special choices would be in. At present there is much confusion, especially regarding repeats.

I hope the "Third" stays, but, as a contemporary said recently (referring to a "Light" item, the name of which I will not repeat), "if the 'Third' goes and

Our Critic, Maurice
Reeve, Reviews Some
Recent Programmes

'that' remains, then heaven help the sailors on a night like this."

Talks

What might have been an enthralling talk became something of a trial for listeners. Alexander Kerensky was Russian Prime Minister after the first Russian Revolution, which overthrew the Czarist tyranny in March, 1917, until he was in his turn destroyed by Lenin the following October. In conversations with Leonard Schapiro, Mons. Kerensky gave what was entitled "The February Revolution Re-considered." But his English was so hesitant and rudimentary that the programme inevitably lacked sparkle and savour.

"Winter on Ice" was "a comparison of the life and work of the advance parties of the two British Antarctic Expeditions during the past year." It was a fascinating half-hour, made memorable by some recordings on the spot of a penguin rookery and of life in winter quarters. The genial introducer was Donald Milner.

Any Questions

In a recent edition of "Any Questions," Mr. Malcolm Muggeridge, than whom this stimulating and entertaining programme knows no more penetrating, objective or wittier mind, answered a question which was, as memory serves, "Why is one of our most famous humorous journals less funny than it used to be." He concluded a delightful summary with the query "Could anything be funnier than the *Radio Times*?" and closed with the gorgeous relation of how his journal decided to do a parody on their, apparently, visible contemporary. As the appointed staff were all working their hardest on the project, someone rushed in and said "They've beaten us to it." He was pointing to an item in the Third programme in the then current issue: "The place of the potato in English folk-lore"!! I do hope that the "Third," "Any Questions" and Mr. Muggeridge each continue their radio careers for many years to come!

Documentary

"The Stalin Myth," was one of the better documentary serials the BBC composes on all sorts of subjects of historical or contemporary interest. Letters and speeches are read by actors whose voices are calculated to add verisimilitude to the proceedings. Villains hiss and snarl, whilst heroes possess a benignity worthy of the archangels: the whole being bound together by a narrator of impeccable neutrality. This one was admirably produced by Laurence Gilliam.

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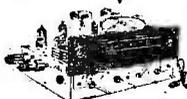
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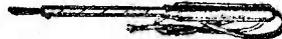
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Open to Discussion



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

The Direct-coupled 10-watt Amplifier

SIR,—We have had numerous requests for curves for the direct-coupled 10-watt push-pull amplifier (January, 1957). These have now been taken in our laboratory, and the results have shown that with both bass and treble in full "lift" position the response of the amplifier is dead straight from 50 cycles to 10 Kc/s, the level being about 4 db down at 10 cycles, and 6 db down at 30 Kc/s, also at 50 Kc/s 10 db down. With the controls both set at "cut," 23 db at 10 cycles, 13 db at 100 cycles, 13 db at 20 Kc/s and 33 db at 50 Kc/s. The bass control is "ineffective" at 2 Kc/s (3 db down at 1 Kc/s), whilst the treble is "ineffective" at 100 cycles and 3 db down at 800 cycles.

It will be seen, therefore, that the amplifier is, on frequency coverage, one that is definitely high-fidelity, the distortion at 1 Kc/s 10 watt is approximating to one per cent.—(For and on behalf of Kendall & Mousley). JAMES S. KENDALL (Birmingham).

"Mini-Set" (March Issue)

SIR,—We have received a number of enquiries concerning the connections for the aerial and oscillator in the "Mini-Set," and should like to confirm that the modifications as shown below have proved quite satisfactory.

The position and switching arrangements for C1 and C2 are not easily understood, and the primary connections (tag 1 and tag 2) for QO8 and QO9 are shown in the printed circuit as being connected together. In our illustration we have shown these separately switched. Another point we should like to mention, viz.: C7 is shown with an associated trimmer C6, whereas C3 is not shown with a trimmer.

We trust the above points will be of some assistance to intending constructors of the "Mini-Set."—OSMOR RADIO PRODUCTS, LTD. (Croydon).

Stereophonic Recording

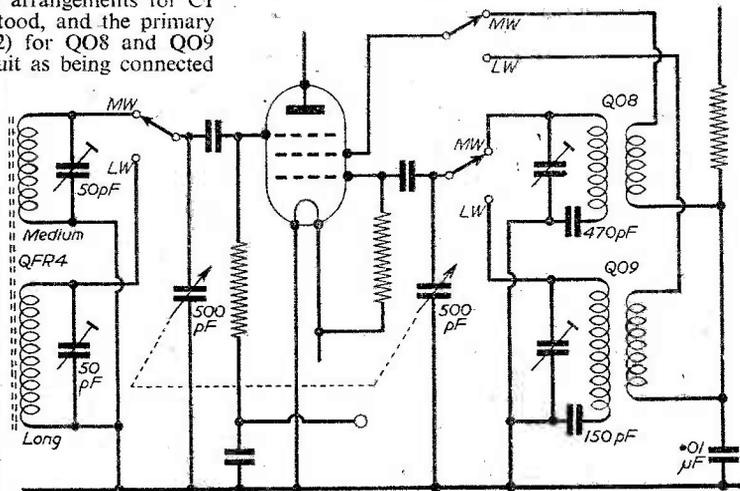
SIR,—I was delighted to see the heading Stereophonic Recording, in your April issue. There was a reply to my letter published in January. Unfortunately,

I was soon to be disappointed. Mr. De'ath had obviously taken his time in writing this letter, but I feel it could have been used to a far greater advantage had he spent a few minutes in reading my letter a second time. Amongst other things he would have learned the difference between stereophonic reproduction from tape and a method of reproducing music from gramophone records. A reader who wrote to me from South America did not appear to have had any difficulty in understanding the brief description of my recorder.

I was once told by one of the leading radio manufacturers that the only real way of listening to stereophonic sound was through head phones. There is a lot of truth in this statement, but in these days

such an idea would be regarded as out of date. Two spaced speakers then are the first essentials. As these speakers are brought together the stereo effect becomes less and less, but without doubt there is still a small effect by using two speakers, one at either end of a small cabinet. Reproduction from any tape recorder can be improved by the use of a good external speaker as I think anybody would agree, but surely, when one goes out to make a recording, such a speaker is generally left at home. If, however, it is desired to play back part or the whole of the recording on the spot, the internal speaker is used. In a similar way my two internal speakers serve their purpose.

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.



The Mini-Set modifications referred to in the letter from Osmor Radio Products.

I would like to refer to the uses of a stereophonic recorder, but first let us refer to a single channel instrument. These uses can be divided under two headings. "Live Recordings" and "Other Recordings": "Live Recordings"—the use of a microphone and "Other Recordings"—direct from a wireless set or gramophone. Are we to assume from Mr. De'ath that the majority of tape recording enthusiasts only fall under the second heading? I think not. Let me now sub-divide "Live Recordings." This could fall into two classes "Dictation" and "The Rest." I need not elaborate on "Dictation," but surely anything that falls under "The Rest" could be recorded to greater advantage with a stereophonic recorder. A studio? Yes, of course, that is the ideal condition, but does that not also apply to single-channel recordings? I am sorry, Mr. De'ath, but I believe that this is a new outlook to which many experimenters may direct their thoughts.

Personally, I have recorded musical concerts, dance bands and straight plays. A well-known musician once stated that even a single piano seemed to "live" if recorded under stereophonic conditions. I am looking forward to the day when the BBC might start twin-channel transmissions, but without that my recorder will still have its use.

I have attended several demonstrations of stereophonic reproduction of sound over the past few years. These varied from symphony concerts to musical comedy, and from horses trotting down a street to aeroplanes flying overhead. Unfortunately, it is sad to have to say that I have not heard anything in this country to compare with a demonstration I heard on the Continent.

I was not aware that I had had the pleasure of meeting Mr. De'ath, although he appears to know me personally. I would, therefore, have expected him to notice the error in printing my initials as J. S. I shall nevertheless be looking forward to meeting him at the next Radio Show.—J. TREVOR GILBERT (Knowle).

A Transformer for a Single Valve Output Stage.

SIR.—I should like to point out what may possibly be a small error in the February issue of PRACTICAL WIRELESS.

Page 842—near bottom of right-hand column—two equations are given:

$$\phi = \frac{E \times 100,000,000}{4.44 F t} \text{ and with values inserted}$$

$$\phi = \frac{9.8 \times 10,000,000}{4.44 \times 50 \times 100} = 44,000.$$

The answer 44,000 being approximately correct to the second equation, we seem to have lost an "0" from the original 100,000,000! I, at least, can't see where it has gone though I don't profess to be a mathematical genius. I should like to know where. If a "0" has been left out though, surely it throws a lot of the succeeding calculation out? i.e., the graph on page 846 (Fig. V).

It is the type of article I should like to see much more of in your magazine.—E. C. NOLAN (Bristol).

[The error you point out is a simple typographical but unfortunate one of omitting a nought when inserting the values in the equation concerned. The evaluation given, 44,000, is correct for the correct statement of values. As shown, the equation evaluates

as 4,400 lines and this indeed would invalidate the calculations that follow. Your comment on the article is appreciated.—N. P. F.]

The Suppression of Interference

SIR.—In your article, in the February issue, dealing with auto-interference with car radio, you say to suppress the generator interference a 0.1 μ F condenser between the field terminal and earth will suffice.

This may suppress interference, but will do untold damage to your voltage regulator. The correct suppression of a generator is the D terminal of the unit to earth, a 0.5 μ F or 1 μ F being suitable.

Working as I do, engaged daily with car radio and electrical problems, I have had recently a popular make of automobile with a fibre glass body (this included wings and bonnet) to fit a radio and also carry out suppression of interference. As this may be a general material for future cars, readers may find the following of interest.

After carrying out normal suppression, which included coil: 1 μ F condenser from sw. to earth, distributor: a 10,000 ohm suppressor, as close to the cap as possible in the coil lead; plugs: a 10,000 ohm suppressor in each of the six plug leads as close to the plug tops as possible; dynamo: a 1 μ F condenser from the D terminal to earth.

Upon trying this the medium wave was fair on station, but the long wave 1,500 metres was inaudible, this was with a modern telescopic whip aerial, fed from the set by a coaxial cable screening earthed either end on to metal, which was chassis and engine and a part of the dash panels. So I began the long and interesting task of removing the unwanted noises. I finished up with the following: each plug lead screened to within an inch of either end, and all six and the coil lead screened in the same manner earthed to a common point. Radio set, power-pack and all metal parts bonded together with 2in. copper braid; the other small things such as clock, wiper motor, etc., were suppressed by a 0.1 μ F from the feed to earth. I found to make the performance even better, an under-car aerial was the final touch, fitted to the near side away from exhaust, brake levers, etc., and fed by a coaxial cable earthed either end; interference on station was nil, off-station was negligible.

But if I had to do this to every car what would be the price of installation and what for the future, if car manufacturers use this body for cheapness, strength and finish as general? Finish on the bodies is superb and make no mistake about it, the strength is there also, so a toast to the fibre glass car body and a headache for the car radio designer.—G. B. GRANT (Birmingham).

[I wish to thank readers for pointing out the slip in my recent article, "Suppression of Interference." Quite rightly the "field" terminal of the dynamo must not be used but the "D" or charging terminal.—W. B. C.]

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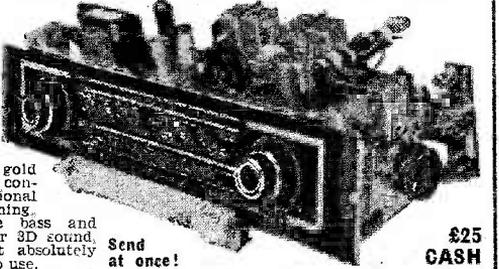
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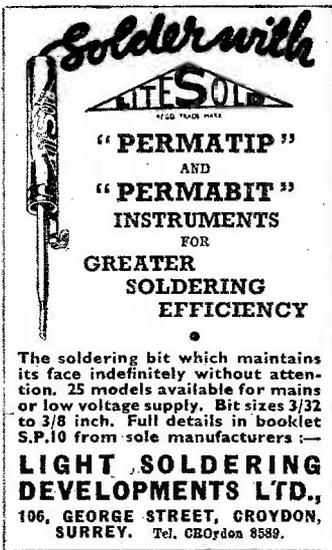
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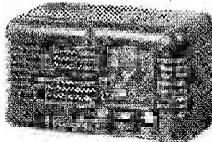
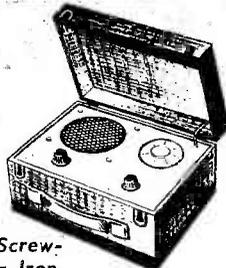
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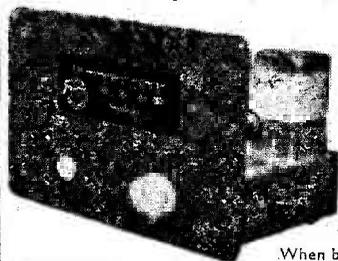
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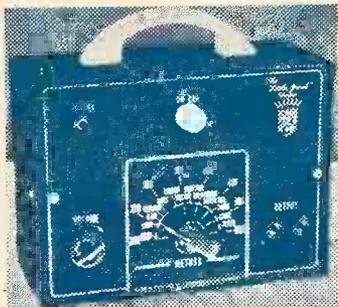
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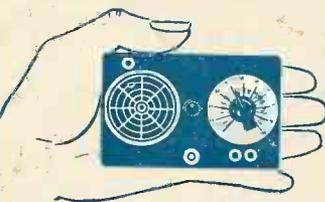


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