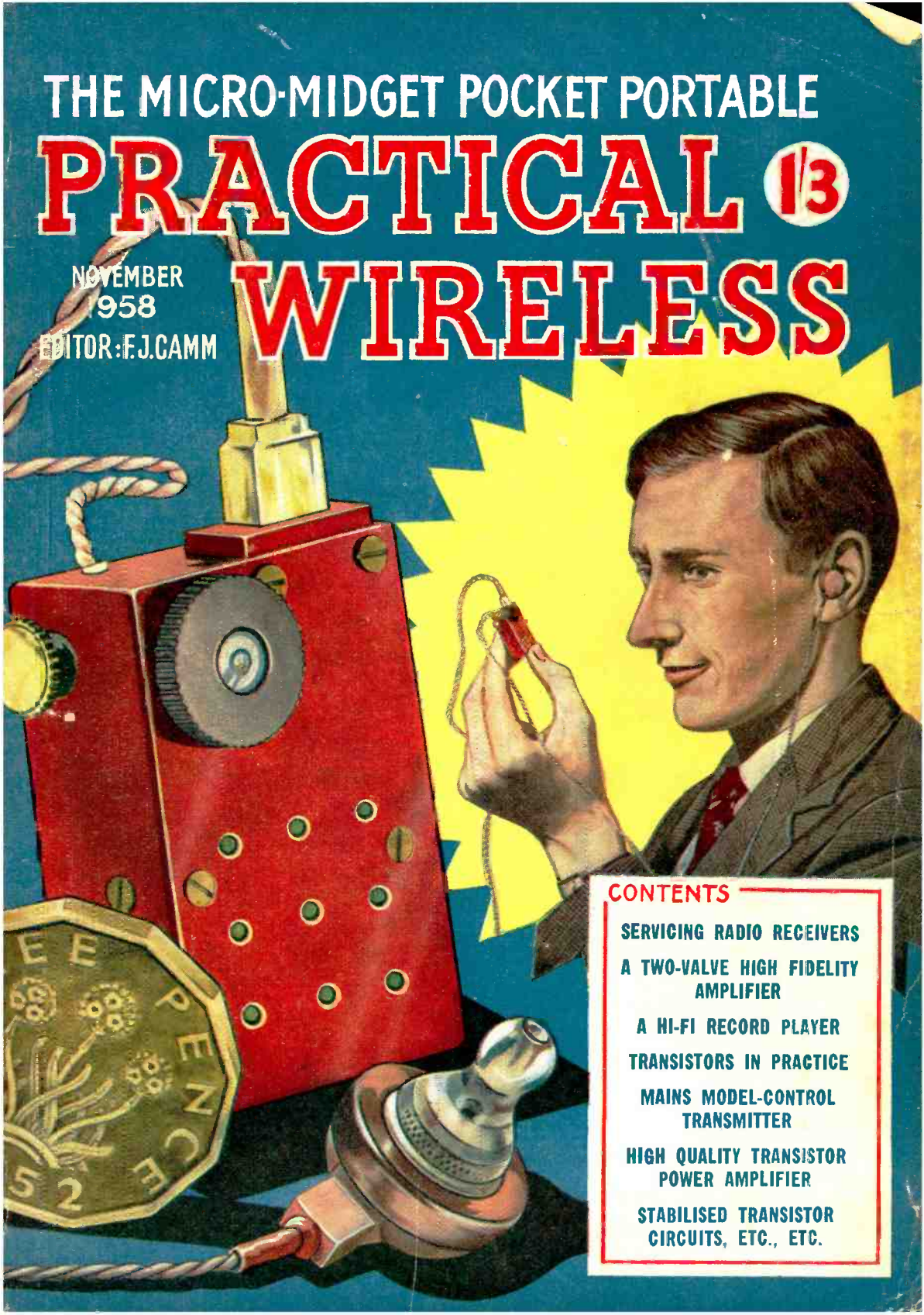
THE MICRO-MIDGET POCKET PORTABLE

PRACTICAL WIRELESS

1/3

NOVEMBER 1958

EDITOR: F.J.CAMM



CONTENTS

RETURN-OF-POST SERVICE

R.L.D. CONSTRUCTION KITS

Introducing a new range of construction kits for the home constructor. All kits are absolutely complete and are supplied with the fullest possible instructions.

R.L.D. KIT NO. 1. CRYSTAL SET. A modern crystal circuit built into a small plastic cabinet. KIT 18/- post free. Less headphones.

R.L.D. KIT NO. 2. TRANSISTOR AMPLIFIER FOR CRYSTAL SETS. A simple transistor amplifier which can be added to any crystal set. The addition of this amplifier will increase the volume in the headphones several times. No soldering required in this kit. KIT 27/6d. post free.

R.L.D. KIT NO. 3. TRANSISTORISED CRYSTAL SET. An up-to-date crystal circuit followed by a transistor amplifier built into a small plastic case. KIT 43/6d. post free. Less headphones.

HEADPHONES. Brand new (not ex-Govt.) light-weight high resistance headphones at 16/6d. per pair. plus 1/- post.

Instruction sheets for any kit 6d., plus 3d. post.

JASON FM TUNER KITS

We can fully recommend these kits as being the best of all the F.M. Kits available. Construction is easy and results are first class.

Our kits are really complete, the instruction book, all components, valves and small items such as nuts, bolts, wire and solder being included. There is definitely nothing else to buy. All items are available separately if required and detailed lists are available free. Instruction books for either tuner are available at 2/3 each, post free.

VARIABLE TUNING. Kit includes well-made chassis assembly with glass scale and hammer finish front panel. **PRICE £6.19.6** post free. Credit Terms—Deposit 19/6 and seven monthly payments of 20/-.

MERCURY SWITCHED TUNER. All three BBC programmes at the turn of a switch. Kit includes the front-end unit already built and tested.

PRICE £9.19.0 post free. Credit Terms—Deposit £1.10.0 and seven monthly payments of £1.7.0.

BRAUN TRANSISTOR PORTABLE

Ready built (not a kit). This new transistor Pocket Portable is highly sensitive and gives excellent reproduction. In grey plastic case, size 6" x 3½" x 1⅝". Fully tunable over medium and long waves. Six transistors are used with a printed circuit. Price £20.9.6. Credit Terms. Deposit £3.2.0 and seven monthly payments of £2.14.6. Illustrated leaflet available.

MULLARD TAPE AMPLIFIER TYPE "C"

This tape amplifier is designed for use with Collaro, Brenell, Truvox, Wearite and Lane decks. It consists of a recording amplifier and play-back pre-amplifier the output of which is fed into an existing amplifier when playing-back. Instruction Manual for this is available from us free together with our fully detailed price list. Please enclose 4d. for postage.

LOUDSPEAKERS

GOODMANS.—Axiom 300, 12in.	... ...	£11. 5.9
Axiette 8in.	... ...	£6.19.9
Tre-bax Tweeter	... ...	£6. 4.0
XO5900 Crossover unit	... ...	39/-
WHITELEY.—HF1016 10in.	... ...	£8. 0.0
HF1012 10in.	... ...	99/9
T10 Tweeter	... ...	84/-
CX3000 Crossover unit	... ...	30/-
WHARFEDALE.—Bronze 10in. FSB	... ...	£5.11.9

GRAMOPHONE EQUIPMENT

BSR MONARCH RECORD CHANGER. Latest four-speed model. £8.12.6. Credit Terms. Deposit £1.4.6 and seven monthly payments of £1.4.0.

COLLARO "CONQUEST". Latest Collaro model with Studio Pick-up. £9.19.6. Credit Terms. Deposit £1.10.6 and seven monthly payments of £1.7.0.

SINGLE RECORD PLAYERS

GARRARD TA MK II.—Four-speed. Very well made player fitted with Garrard GC2 cartridge. £9.15.8. Credit Terms. Deposit £1.10.2 and seven monthly payments of £1.6.6.

GARRARD 4SP.—The latest Garrard four-speed player unit. Fitted with Garrard GC2 Crystal Pick-up. £8.1.9. Credit Terms. Deposit £1.4.3 and seven monthly payments of £1.2.6.

COLLARO 4 564.—Four-speed unit, fitted with the well-known Studio Pick-up "G" or "P." £9.7.0. Credit Terms. Deposit £1.9.6 and seven monthly payments of £1.5.6. Special Offer of the same unit fitted with "T" (High output) Pick-up only. £7.19.6. Credit Terms. Deposit £1.5.6 and seven monthly payments of £1.2.0.

BSR TU9.—Four-speed motor with separate Pick-up fitted with BSR TC8 cartridge. £4.15.0. Credit Terms. Deposit £1.5.0 and three monthly payments of £1.6.8.

COLLARO JUNIOR.—Four-speed motor with separate Pick-up. The Pick-up is an ACOS model and is fitted with the HGP59 cartridge. £4.13.6. Credit Terms. Deposit £1.3.6 and three monthly payments of £1.6.8.

TRANSCRIPTION UNIT

COLLARO 4T/200.—Four-speed with transcription Pick-up. £19.10.0. Credit Terms. Deposit £2.18.0 and seven monthly payments of £2.12.0.

LATEST AVO TEST METERS

AVO METER MODEL 8 MARK II

The latest version of this finest of all test meters is now available from stock. 50 microamp movement (20,000 ohms per volt). Eight DC Voltage, Seven DC Current, Seven AC Voltage, Four AC Current and three ohms ranges. Fully detailed literature available free. Price £23.10.0. Credit Terms. Deposit £3.9.0 and seven monthly payments of £3.3.0. **Leather carrying case, £3.0.0.**

AVO MULTIMINOR

A new and very attractive pocket size instrument at a modest price. Movement is 100 microamps (10,000 ohms per volt). Six DC Voltage. Five AC Voltage. Five DC Current and two ohms ranges. Descriptive leaflet available free upon request.

Price £9.10.0. Credit Terms. Deposit £1.8.0 and seven monthly payments of £1.6.0. **Leather carrying case, 32/6.**

AMPLIFIER KITS

MULLARD 510 and GEC 912 PLUS

We carry full stocks for all versions of these popular Amplifiers and our price lists are available free.

MULLARD 2 VALVE PRE-AMPLIFIER

Latest Mullard circuit for use with the 510 Amplifier. Booklet giving full details now available 1/3 post free.

Complete Kit, including drilled chassis and control panel, £6.12.0. Credit Terms. Deposit 19/- and seven monthly payments of 19/-.

COSSOR 2 VALVE AMPLIFIER

Ready built, supplied with valves, speaker and separate tweeter for home assembly on baffle or in cabinet. Complete instructions included. £9.15.0. Credit Terms. Deposit £1.9.6 and seven monthly payments of £1.6.6.

TRANSISTORS

MULLARD. Audio, OC70 21/-, OC71 24/-, OC72 30/-. OC72 matched pairs 60/-.
EDISWAN. RF, XA101 35/-, XA 102 40/-. Audio, XB101 21/-, XC101 matched pairs 60/-.
SURPLUS. RF, Yellow/Red, 21/-. Audio Yellow/Green 7/6d. All transistors post free.

CREDIT TERMS are available over three or seven months. Deposit—Three months 6/- in the £. Seven months 3/- in the £. Service Charge—Three months 5% (10/- minimum). Seven months 10% (20/- minimum).

TERMS OF BUSINESS.—Cash with order or C.O.D. Postage extra under £3. We charge C.O.D. orders as follows. Up to £3, postage and C.O.D. fee minimum 2/8. Over £3 and under £5, C.O.D. fee only 1/6. Over £5 no charge.

WATTS RADIO (MAIL ORDER) LTD.

54 CHURCH STREET, WEYBRIDGE, SURREY. Telephone : Weybridge 4556

PLEASE NOTE. POSTAL BUSINESS ONLY FROM THIS ADDRESS.

Band III Converter

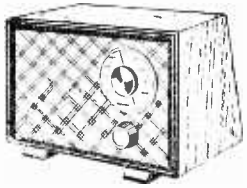
Suitable Wales, London, Midlands, North, Scotland, etc. All the parts including 2 EF80 valves, coils, fine tuner, contrast control, condensers and resistors. (Metal case available as an extra.) Price only **19/6**, plus 2/6 post and insurance. Data free with parts or available separately **1/6**.

Please send two more kits, the one you sent last week is performing magnificently.

We receive this sort of letter every day of the week, so if you have hesitated because you thought our kits too cheap you need hesitate no longer.

All-Mains Amplifier

Powerful three-valve mains amplifier ideal for dances, parties, etc. Complete, less chassis, cabinet and speaker (available if required)—data **1/6** (free with parts). Price **19/6**, plus 2/6 post and insurance.



The Skysearcher

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

A.C./D.C. Multimeter Kit

Ranges: D.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. A.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. D.C. milliamps 0-5, 0-100, 0-500. Ohms 0-50,000 with internal batteries. 0-500,000 with external batteries. Measures A.C./D.C. volts. D.C. current and ohms. All the essential parts including metal case, 2in. moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions, price **19/6**, plus 2/6 post and insurance.

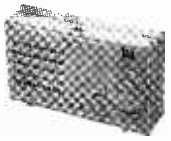
50 More T.V. Service Sheets

Readers already possessing our service sheets numbers 1-100 will be glad to know that 101-150 are now ready, price **10/-**, post free.

The Saturn Spin Drier

A Spin Drier will not only make Washing Day much less of a burden but will also prevent that damp atmosphere created by wet clothes drying indoors. The Spin Drier illustrated is the famous Saturn which, although quite small, actually holds as much washing as the larger floor standing type. The big advantage of the Saturn is that it can be stood on the draining board, rinsed washing from the sink is put into it and the water spun out back into the sink—no mess, no special emptying and, being light, it can easily be put into a cupboard or stood on a shelf. Your Wife or Mother will be really pleased with one of these. Price **£21 17 6**, or **£1** deposit and 22 weekly payments of **£1** each.

The Transidine Superhet



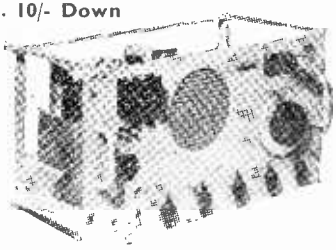
As described in this journal, including six transistors, TCC printed circuit, ferrite rod aerial, cabinet, speaker and all parts for medium and long wave operation—only **£11/19/6**, or with Pye Goldtop transistors, **£12 19/6**.

Medresco Hearing Aid

As supplied by National Health, completely overhauled and in good working order with six months' guarantee. Only **£2 15 0**, plus 2/6 post and ins. Complete with earphone and *new* ear plug but not batteries, these can be supplied as an extra for 5/- per set.

Superior model—new—higher gain—and self-contained batteries—**£10/10/-**, or **10 -** deposit and 22 weekly payments of **10 -**.

Short Wave Communications Receiver R203. 10/- Down



This is a super short wave receiver covering 5-30 metres (10-60 Mc/s). Uses 6 valves. Has R.F. stage, 2 I.F. stages B.F.O., etc. Muirhead instrument drive, two internal power packs, mains and battery vibrator pack. Complete with own P.M. speaker. Provision for phones and speaker muting. Complete in metal transit case; size approx. 24 x 18 x 12in.; weight 70lb. Suitable A.C. mains, 100-250 and 6 volt battery. In perfect condition, practically unused. Tested before despatch and guaranteed. Handbook free with each. Price **£6/19/6**, carriage and insurance 15/-. Or **10/-** deposit plus 15 - carriage, and 15 weekly payments of **10 -**.

SEE OUR DOUBLE PAGE ADVERT OVERLEAF

for addresses, etc.

R1155 for Spares

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

Record Player

Fitted with latest 4-speed autochangers which will take the new stereo cartridge—Hi-gain hi-fi amplifier with three controls—ultra modern cabinets with L.C.I. coverings. Price **£17/17/-**, or **£3** deposit and 32 weekly payments of **10/-**. Carriage and insurance 7/6—non auto models from **£10/10/-**.

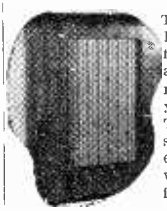
Cabinets

Similar to illustration for amplifiers—**£3/5 -**, plus 5/- carriage and insurance.

Amplifiers

Ordinary hi-gain hi-fi, **£4/4/-**. Stereo, **£8/8 -**.

This Month's Snip Somweave



This really lovely loudspeaker fabric we offer at half price, namely **7/6** per yd., 48" wide. This is also very suitable for covering plain wooden cases for portables.

Yaxley Switches

3-pole, 2-way	1/3
12-pole, 2-way	1/6
3-pole, 3-way	1/6
9-pole, 3-way	2/-
2-pole, 4-way	2/-
6-pole, 4-way	2/6
4-pole, 5-way	2/6
2-pole, 6-way	2/6
1-pole, 7-way	2/6
1-pole, 12-way	2/6
6-position shorting switch	2/-

Double-pole mains switch for attaching to Yaxley switches 1/6 Discount of 10% allowed where a dozen of one type ordered. Special quotes 144 or over.

Ganged Pots. for Stereo, etc.

Made by Morganite, these are a first class control, unfortunately only linear types are available, in the following values: 5K+5K, 50K+50K, 100K+100K, ¼ Meg.+¼ Meg., 2 Meg.+2 Meg. All in original cartons, price 3/- each, special quotes for quantities.

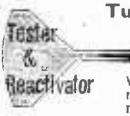
Beginner's Superhet

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

Transistor Timer

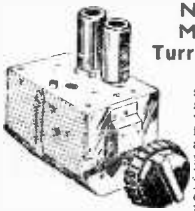
All the parts for making transistorised Enlarging or Process Timer with constructional details £2 10 -, plus 2/6 post and ins.

Tube Tester and Re-Activator



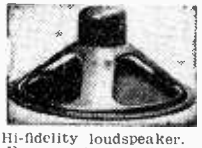
We can supply all the main components for making this unit which will not only test Cathode Ray Tubes but also will re-activate them, supplied complete with full instructions. Price £3, plus 2/6 post and ins.

Now 2 Models Turret Tuner



Brand new stock, not surplus, with coils for Band I and III complete with valves. Model 1 I.F. output 33/33 Mc/s. Series heaters Model 2 I.F. output 16/19 Mc/s. Parallel heaters. With instructions and circuit diagram, 7/6. With knobs 3/6 extra, post and insurance 2/6.

Speaker Bargain



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

Sapphire Needles

Unrepeatable bargain—new and perfect—two types available: miniature E.M.I. and Standard (trailer). Sale price 1 - each or 10 - doz.

Latest A V O Testmeter

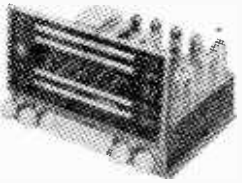
Can be yours for only 10/- deposit and 19 payments of 10/- weekly. Like all AVO meters it is a very fine instrument: it has a sensitivity of 10,000 ohms per volt and 19 most useful ranges as follows—D.C. volts 0-1,000 (seven ranges), A.C. volts 0-1,000 (five ranges), D.C. current 0-1 amp. (5 ranges), resistance 0-2 megs. (2 ranges) (complete with test leads). Immediate delivery. **Cash price £9/10 0.**

FREE GIFT.—All purchasers will receive Range Extender scale and data which add: capacity 0-1 mfd., in two ranges. Inductance 0-100 henrys, etc., etc.

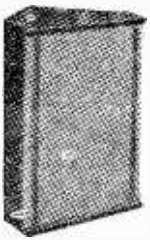
Avo Prodclips

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

Dulci AM/FM Radiogram



Chassis Model H.3. This has three wave bands, F.M. 87-101 Mc/s, Medium Wave 187-540 metres and Long Wave 1,000-2,000 metres, uses 7 of the latest miniature valves and built-in ferrite aerial. "Why not modernise your Radiogram, get the best from modern records with this hi-fi 4 watt output chassis." The price of the H3 is £20/17 - or £1 deposit and 22 weekly payments of £1. Four waveband model, £24/6/8 (H.4), or push-pull output. £29/3/10—all available on terms.



Cabinet for Hi-fi Speaker System

Acoustically designed bass reflex cabinet made by W.B. "STENTORIAN." Price £9/9 -, or 20/- deposit and 19 weekly payments of 10/-. Choice of several others available. Call or write for list. Add 5 - carr.

Dulci DPA10 Amplifier

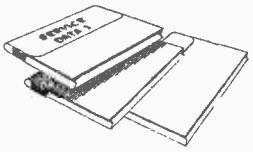
Made by the Dulci Company. It is laboratory designed and is of the highest fidelity, has superb reproduction and complete freedom from hum, high output sensitivity, 10-watt output and ample feed-back all combined to give a truly linear output. Uses all-glass miniature valves, including two EL84's in push-pull. Price £12 12/-, or £1 down and 26 weekly payments of 10 -.

Stereo Eight

New dual channel pre-amp. by Dulci. Designed with every refinement for the connoisseur. Cash price £23 10 -.

Simplex Transistor Kit

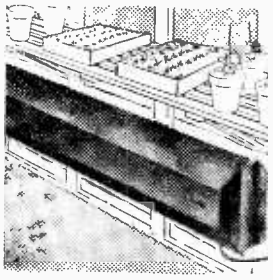
Makes ideal bedroom radio, uses one transistor and one crystal diode. Complete less case 19/6, case 5/- extra, post and ins. 1/6.



Service Data

100 service sheets, covering British receivers which have been sold in big quantities and which every service engineer is ultimately bound to meet. The following makers are included: Aerodyne, Alba, Bush, Cossor, Ekco, Ever-Ready, Ferguson, Ferranti, G.E.C., H.M.V., Kolster Brandes, Lissen, McMichael, Marconi, Mullard, Murphy, Philco, Philips, Pye, Ultra. Undoubtedly a mine of information invaluable to all who earn their living from radio servicing. Price £1 for the complete folder.

Instantus Heater

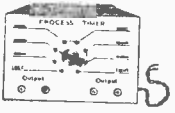


Convector heater, 1 kW. rating, 4 ft. long, made from heavy gauge sheet steel (galvanised). Can be used for greenhouse, workshop, aviary, etc., etc. Price £2/10/-, or with thermostat, £4/19/6, carriage 5/-. GUARANTEED 5 YEARS.

2 KW MODEL. Free standing thermostatically controlled, £3/19/6.

500 WATT MODEL. For very small greenhouses, 32/6. Carriage 5/-.

Process Timer for 15/-



Make a time delay switch to work off mains (A.C. or D.C.), all the parts (less case). Price 15/-, post and ins. 2/6.

Channel Converter

A really super converter with exceptionally high gain, trouble free in operation, uses two valves and has the following controls: Fine Tuner, Band Switch, On/Off Switch which also controls the T.V. receiver, no alterations necessary to the T.V. When ordering please specify the channels required. Price £7/10/-, plus 5 - carriage and insurance, or 10/- deposit and 15 weekly payments of 10 -.

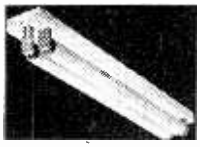
ELECTRONIC PRECISION EQUIPMENT LTD.

66, GROVE ROAD, EASTBOURNE, SUSSEX

This is the correct address for post orders, and for prompt attention please mark your envelope Dept. 7.

Also add enough for postage.

Fluorescent Lights



These are complete fluorescent lighting fittings. Built-in ballast and starters—stove enamelled white and ready to work. Ideal for the kitchen, over the work-bench and in similar locations.

Single 40. 4ft. 3in. long, uses a 40 watt tube.

Twin 20. Uses 2 20 watt standard tubes.

Price for either type **39/6**, with tubes. Carriage and ins. up to 150 miles 5/6, up to 250 miles 7/6.

Don't Be Caught Like This

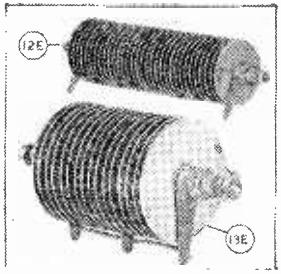
Car Starter Charger Kit

All parts to build 6 and 12 volt charger which can be connected to a "flat" battery and will enable the car to be started instantly. Kit comprising the following :

Mains Transformer	22/6
5-amp. Rectifier	17/6
Regulator Stud Switch	3/6
Resistance Wire	2/-
Resistance Former	2/6
Mains on off Switch	2/6
0-5 amp. Moving Coil Meter	12/6
Construction Data	1/6

Or if bought all together price is **52/6**, plus 3/6 post and packing.

Rectifier Bargains



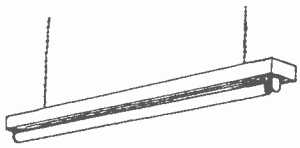
Selenium rectifier type 12, 500 v. ½ A. half-wave, easily rebuilt into full wave or multiple type, contains 30 35 mm. discs. Price **8/6**, plus 1/6 post. Type 13, 36 volt 9 amp. easily rebuilt into six full wave charger rectifiers suitable for 6 or 12 volt batteries at 3 amps, contains 24 84 mm. discs.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

Pullin Series 100 Test Set

Undoubtedly a most useful instrument by a firm long famous for fine instruments, entirely redesigned, it has a square movement with diacon plastic cover, this makes for a brighter more readable scale, extra scale length and wider angle of vision. With the test set is included a pair of combined test prods and crocodile clips, also a stand for inclining the meter at the best reading position. Ranges A.C. Volts : 0-10, 0-25, 0-100, 0-250, 0-500, 0-1,000, ditto D.C. A.C. Current; 0-100 mA, D.C. Current; 0-2.5, 0-10, 0-100, 0-500 mA. Resistance : 0-1 M. and 0-10 K. **£12 7/6.**

FREE GIFT.—All purchasers of the above item this month, will receive the Series 100 Range Extender scale and data which add : capacity 0-1 m.f. in two ranges—inductance 0-100 henrys and many others.

The Inductor 80



80 w. 5ft. fluorescent fitting with a 5-year guarantee —latest type (choke) control gear—absolutely quiet in operation—all steel batten type construction stove enamelled white—suitable for direct mounting or for suspending. Will last a lifetime. Type A, 250-240 v. price **39/6.** Type B, variable for 200-250 v., price **45/-**, carriage and insurance up to 150 miles 5/6 ; up to 250 miles 7/6. Tubes, latest type which give more light for same electricity, daylight or natural to your choice, **14/9** each—no extra carriage if ordered with fitting.

Gram Into Tape Recorder

Convert your Record Player or Radiogram into a Tape Recorder. Can be fitted in a few seconds and then you have immediately all the facilities afforded by a normal Tape Recorder, i.e., record, playback, erase, rewind, etc. As illustrated. Price with pre-amp. only **£7 10/-**, or **10 -** down and 16 weekly payments of **10 -**.

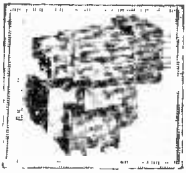
Super Sensitive (2,000 O.P.V.) Multimeter Kit

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

Some Unrepeatable Bargains

Metrosils. Voltage sensitive devices which decrease resistance exponentially as voltage increases. We have type APW 5746 which is sensitive in the mains voltage range—price 2/6 each, six for **12/-**.

London Relay. 200/220 volts A.C. operated coil, four sets change over heavy duty, contacts, **17/6.**



BTH Silicon Diodes. 2/6 each, six for **12/-**.

Wire Ended Neon Lamp. Midget size as used in mains tester, dozens of applications. 2/- each.

3½in. Moving Coil Meter. Flush mounting, really beautifully made by G.E.C., two types available, one centre zero 500-0-500 mA., the other standard 1 mA. fsd., scales need re-lettering, brand new and unused, **37/6**, plus 2/- P. & I.

Install Those Extra Power Points. Big purchase 7.029 3-core cable enables us to offer this at a real bargain price of **37/6** per 50 yd. coil ; 100 yd. coil **75/-**, carriage free.

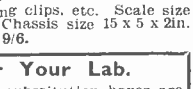
Hi-fi Snip. Massive (weight approximately 8 lb.), output transformer by Parmeko, primary 4,000 ohm centre tapped, secondary 15 ohm, unrepeatable at **17/6**, plus 2/6 post.

Electrolytic Condenser 500 mfd. 50 v. with mounting clip, **2/3.**

Siddeck Fuses. 5 amp. or 15 amp., **1/6** each, **15/-** dozen.

28,000 volt Mica Condenser. 0.001 mfd., size approximately 3½ x 3½ x 2¾in., **15/-** each.

Chassis Bargain



Three-colour 3-waveband scale, scale pan, chassis punched for standard 5-valve superhet, mounting clips, etc. Scale size 14½ x 3¼in. Chassis size 15 x 5 x 2in. deep. Price **9/6.**

For Your Lab.

Resistance substitution boxes are great time savers and you really cannot have too many of them, here then, is an opportunity to acquire these at a very low rate. Our R.S. kit available for only **8/6**, plus 1/6 postage, comprises a 50 w. precision variable resistor 0-100 K., six 2-3 watt fixed resistors, one 6-position switch, one pointer knob and one ordinary knob and instructions. This unit when made up will give an infinite variability over the range 100 ohm to 2 meg.

Connecting Wire

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

For convenience of callers all items advertised may be obtained from the following companies.

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

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

TRANSFORMERS

MAINS POWER TRANSFORMER. 15/9. 350-0-350 v. 250 m.a. 6 v. at 5 a. 4 v. at 5 a. 4 v. at 2 a. Centre tapped. Drop through type. Post 3/9.

MAINS POWER TRANSFORMER. 9/9. 350-0-350 v. 250 m.a. 6.3 v. at 5 a. 6.3 v. at 4 a. 22 v. at .3 a. 4 v. centre tapped. Post 3/9.

MAINS TRANSFORMER. 5/9. 280-0-280 v. 80 m.a. 6 v.-4 v. heaters. 200-250 v. Prim. Post 2/3.

MAINS TRANSFORMER. 3/9. 350-0-350 v. 80 m.a. 12 v.-4 v. heaters. 200-250 v. Prim. Post 2/3.

O.P. TRANSFORMERS. 1/3. Salvage, guaranteed. Std. size. 2-5 ohms. Post 1/-. 20 for £1. Carr. 5/6.

FOCUS MAGNETS

ELAC FOCUS MAGNET. 5/9. 35-38 mm. Permanent magnet. Salvage. Post 1/9.

ELAC FOCUS MAGNET. 12/9. Brand new. 35-38 mm. Post 1/9.

PLESSEY FOCUS MAGNET. 3/9. 35 mm. Permanent magnet type. Salvage. Post 1/9.

FRAME OUTPUT TRANSFORMER. 3/9. To match low impedance coils. Post 1/3.

VISCONAL CONDENSERS. 5/9. .1 at 7KV. working and .001 at 12.5 KV. Post 6d.

RECTIFIERS. 2/9. 250 volt. 100 m.a. Full or half wave. Salvage Post 1/3.

I.F. TRANSFORMERS. 1/- Pair. 465 kc/s. Tested. Post 9d.

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1/9. ½ megohm. New, boxed. Long spindle. Post 1/-.

1/3. 20K. ohms. Unused. Short spindle. Carbon. Post 1/-.

2/6 DOZ. Asstd. ; parcel of volume & tone controls, from working chassis. Post 1/9.

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CO-AX CABLE. 6d. YARD. Good quality. Cut to any length. Post on 20 yds., 1/6. 45/- per 100 yards. Post 3/6.

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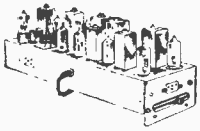

SOUND & VISION STRIPS. 10/6. S/het. Takes 6-EF91, 1-6D2, 1-6F14. Valves extra. Not tested. Post 2/6.

SOUND & VISION STRIP. PLESSEY. 25/6. S/het. Takes 6-6F1, 2-6D2. Valves extra. Tested. Post 2/6.

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TIME BASE. 4/9. Incl. scanning coil, focus unit, line trans. etc. ; less valves. Bargain. P. & P. 3/6.

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PLATED, WHIP ANTENNAE. 50" long, collapses to 11". 1 hole fixing. Post 1/-.

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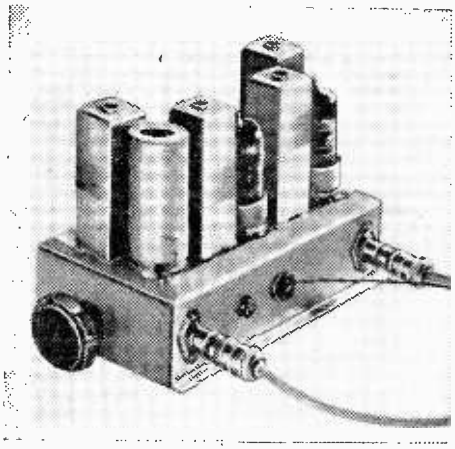
FREQUENCY CONTROL **F.M.-TUNER-V.H.F.**



- ★ Switch tuning, single pole switch.
- ★ Hi-Fi Cathode Follower.
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- ★ Two High Gain I.F. stages.
- ★ Low noise earthed grid R.F. stage.
- ★ Double interference limiting.
- ★ 6 Valve Circuit, using double valves.
- ★ Midget construction on chassis 3in. x 5½in.
- ★ Single hole installation.
- ★ Alignment service.

And **DIOMATIC FREQUENCY CONTROL.** Which adds up to the most remarkable unit you have seen on the market. We may be boasting but we believe that this circuit developed in our laboratory over a period of many months, gives the most effective control of an F.M. Tuner so far devised.

A direct coupled amplifier is fed by the error signal developed across the ratio detector and the amplified output changes the bias on a voltage sensitive capacitor. This diomatic control element tunes the local oscillator and reduces the error. An over-all feedback of 30 dbs. round the loop ensures that the station is in tune from the moment of switching on and gives very improved interference rejection properties for the complete tuner.

All parts and valves, **£7.19.6,** less valves, **£6.5.0.** Alignment service, **10/6.**

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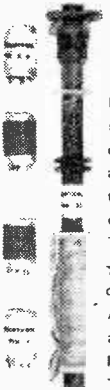
MINIATURE TRANSISTOR SUPERHET COIL KIT,



42/-

470 k/c.

I.F. Transformers & Osc. coil, in screening cans ¾in. x ¾in. dia. Dual wave Ferrite rod aerial 5¼in. x 5/16in., dia. For the TRANSIDYNE printed circuit Superhet. ★ 6 Transistors. ★ P.P. output. ★ A.G.C. ★ Reflex. Full constructional folder, **9d.** All component parts available from advertisers.

Push-pull and single ended Tape oscillator coils available for most decks at **8/6** each. Bias rejector coils and top lift Inductors. Dual range and Xtal diode coils, etc. Lists, **6d.**

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LOOK! BUILD THIS POCKET RADIO FOR ONLY 37/6

AT LAST! In response to many requests we now present the **HIGH EFFICIENCY PENTODE "SKYPOCKET,"** a beautifully designed precision **POCKET RADIO.** No radio knowledge needed!—EVERY SINGLE PART TESTED BEFORE DESPATCH: **our simple, pictorial plans take you step-by-step.** This set has a remarkable sensitivity due to painstaking design. Covers all medium waves 200 to 550 Metres. Size only 5¼in. x 3in. x 2in. in Strong, Transparent case with panel, cover and ivorine dial. A really personal-phone, pocket-radio **WITH DETACHABLE ROD AERIAL.** Self-contained all-dry battery operation. Average building time 1 hour. **Total Building Cost—including Case, High Efficiency Pentode Valve, etc., in fact, everything down to the last nut and bolt—ONLY 37/6, with plan.** Postage, etc. 2/-. C.O.D. 2/- extra. (Parts sold separately. Priced Parts List & Plans, 1/6.) **Demand is certain to be heavy—so SEND TODAY!**

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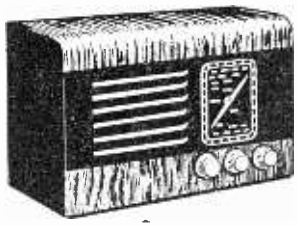
Build this exceptionally sensitive high efficiency Pentode radio. Uses unique assembly system and can be built by anyone **without any radio knowledge whatever** in 45 minutes. Handsome black-crackle steel case with specially made black and gold dial with stations printed. Size of radio only 6¼in. x 5in. x 3in. Covers all Medium and Long waves—uses only one all-dry battery. H.T. consumption only 1 to 1.5 mA. Uses personal phone. Ideal for Bedroom, Garden, Holiday, etc. **Many unsolicited testimonials. Mr. Norton, of Oxted, writes:** *Yesterday evening on the Medium waveband I counted 32 separate stations: I am very pleased with the set, which is well worth the money.* **BUILD THE "SKYROMA" NOW! Total building cost—everything down to last nut and bolt—47/6** (Postage, etc., 2/-)**—with full set of clear, easy-to-follow plans.** (Parts sold separately. Priced Parts Lists & Plans, 1/6.) C.O.D. 2/- EXTRA.



MAY BE BUILT FOR 107/6

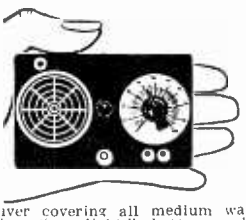
Total building cost including choice of beautiful walnut veneered cabinet or ivory or brown bakelite. **This is the lowest possible price consistent with high quality. No radio knowledge whatever needed . . . can be built by anyone in 2-3 hours,** using our very simple easy-to-follow diagrams. The terrific new circuit of the **"OCEAN-HOPPER"** covers all medium and long waves with optional negative feedback, has razor-edge selectivity, and exceptionally good tone. Price also includes ready drilled and punched chassis, set of simple easy-to-follow plans—in fact, everything! All parts sparkling brand new—no junk! Every **single part tested before despatching.** Uses standard octal-base valves: 6K7G high-frequency pentode feeding into 6J5G anode-bend detector **triode,** coupled to 6V6G powerful output beam-power tetrode, fed by robust rectifier. For A.C. Mains, 200-250 volts (low running costs—approximately 18 Watts!). Size 12in. x 6in. x 5in. **Build this long range powerful midget NOW. All parts and set of plans, £5.7.6.** (Post and packing 3/6.) Parts sold separately. Priced Parts List & Plans, 1/6. C.O.D. 2/- EXTRA.

Build This TWO-TRANSISTOR POCKET SET For Only 47/6!

FEW ONLY AT 95/-!

NEW in maker's sealed cartons!—limited quantity of the famous 4-speed record player units, exceptionally easy to fix, with lightweight pick-up, incorporating "Acos" crystal turnover head and separate sapphire styli for Standard and Long-playing. With full instructions and fixing plans. **Unbeatable price 95/-,** plus 3/6 Post, Packing, etc. C.O.D. 2/- extra. **RUSH YOUR ORDER NOW — BEFORE IT'S TOO LATE!**

WE'VE DONE IT AGAIN! . . . our design department in response to a great many requests have designed this **"SKY PIXIE" Vest-Pocket TWO-TRANSISTOR PLUS DIODE RADIO** which gives a superb performance. It is highly sensitive. Size only 4¼in. x 3¼in. x ¾in., the weight under 7 ozs.!—yet it is a **THREE-STAGE** receiver covering all medium waves, working entirely off a tiny "pen-light" battery, which costs 6d.—fits inside the case—and lasts many months. Uses personal phone and has push-button **LUMINOUS** On/Off Switch. Every part tested before despatch! **SPECIAL STEP-BY-STEP PLANS for ABSOLUTE BEGINNERS. Total building cost including case, transistors, etc.,—everything down to the last nut and bolt—ONLY 47/6 with plans,** Postage, etc., 2/-. C.O.D. 2/- extra. (Parts sold separately. Priced parts list & Plans, 1/6). As the building cost is absolutely "rock-bottom" (it might increase later) **DEMAND WILL BE VERY HEAVY—RUSH YOUR ORDER TODAY!**



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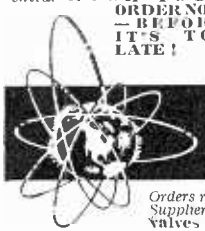

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All for A.C. Mains 200-250 v., 50 cc/s. Guaranteed 12 months.

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6 v. 2 amps. 29/9
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6 v. or 12 v. 4 amps. 56 9
Above ready for use. With mains and output leads. Carr. 3/6.

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6/12 v. 3 a. 11 9
6/12 v. 4 a. 14/9
6/12 v. 6 a. 19/9
6/12 v. 10 a. 25/9
6/12 v. 15 a. 35/9

L.T. Types H.W.
2-6 v. 1 a. 1/11
6/12 v. 1 a. H.W. 2/9

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250 v. 50 mA. 5/9
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Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case, finished attractive hammer blue. Ready for use. With mains and output leads. Double Fused.

Only Carr. 3 9 **49/9**

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. Louvred steel case with stoved blue hammer finish. Fused **75/-** and ready for use with mains and output leads. Credit Terms: Carr. 4/6. Deposit 14/11 and 5 monthly payments 14/11.

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TOP SHROUDED DROP THROUGH

250-0-250 v. 70 mA. 6.3 v. 2 a. 5 v. 2 a.... 16 9
350-0-350 v. 80 mA. 6.3 v. 2 a. 5 v. 2 a.... 18 9
250-0-250 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.... 23 9
300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.... 23/9
350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.... 23 9
350-0-350 v. 100 mA. 6.3 v. 4 a. 4 a. C.T. 0-4-5 v. 3 a. 23 9
350-0-350 v. 150 mA. 6.3 v. 4 a. 5 v. 3 a.... 29/9

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250-0-250 v. 100 mA. 6.3 v. 6 a. 5 v. 3 a. for R1355 conversion ... ... 31 -
300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.... 26/9
350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.... 26 9
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350-0-350 v. 150 mA. 6-3 v. 4a. 5v. 3a.... 33 9
350-0-350 v. 150 mA. 6.3 v. 2a. 6.3v. 2 a. 5 v. 3 a. 35 9
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All with 200-230-250 v. 50 c/s Primaries: 0-9-15 v. 1½ a. 11/9; 0-9-15 v. 3 a. 16/9; 0-9-15 v. 5 a. 19 9; 0-9-15 v. 6 a. 23/9.

SMOOTHING CHOKES

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

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Midget Battery Pentode 66:1 for 3S4, etc. 3/9
Small Pentode. 5,000Ω to 3Ω 3/9
Small Pentode 7/8,000Ω to 3Ω ... 3/9
Standard Pentode 5,000Ω to 3Ω ... 4/9
Standard Pentode. 7.8,000Ω to 3Ω ... 4/9
10,000Ω to 3Ω 4/9
Push-Pull 10-12 watts 6V6 to 3Ω or 15Ω 15/9
Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15Ω 16/9
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Primaries 200-250 v. 50 c s.
12 v. 40 mA, 5-0-5 v. 1 a. 15/9
90 v. 15 mA, 4-0-4 v. 500 mA. 8/9

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STAAR GALAXY 4-SPEED MIXER AUTO-CHANGER. A precision manufactured unit with a motor which virtually eliminates "wow" and rumble. Fitted pick-up with dual sapphire tipped stylus. For 200-250 v. A.C. mains. Limited Stocks. Only **£4-19-6** Brand New, cartoned. Carr. 4/6

PORTABLE CABINETS. High Quality Finish. Rexine covered. Attractive design. Inside measurements: 17in. x 12½in. x 8½in. high. Clearance above baseboard 5¼in. Below 2¼in. **6/9** each.

SPECIAL OFFER. Above cabinet. LG3 Amplifier, Staar Record Changer and 6½in. P.M. Speaker. Only **11 GNS.** Carr. 7/6.

THE SKYFOUR T.R.F. RECEIVER. A design of a 3-valve Long and Medium wave 230-250 v. A.C. Mains receiver with selenium rectifier. It consists of a high gain H.F. stage and low distortion anode bend detector. Power pentode output is used. Valve line-up 6K7, SP8L, 6V6G. Selectivity and quality are well up to standard, and simplicity of construction is a special feature. Point-to-point wiring diagrams, instructions and parts lists, 1 9. Maximum building costs **£4.19.6.** including attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 6½ x 5¼in.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. 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 portable receivers requiring 1.4 v. and 90 v.** This includes latest low consumption, types.

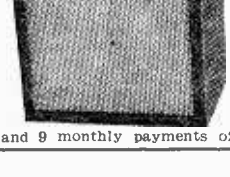
Complete kit with diagrams, 39/9, or ready to use. 46/9.

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

LINEAR 12 watt HIGH FIDELITY AMPLIFIER with SEPARATE PRE-AMPLIFIER

Valve line-up ECC83, EF86, ECC83, EL84, EL84, EZ81. Frequency response ±3 d.b. 30-25,000 c.p.s. Sensitivity 2.5 m.v. at 'mike' input; 25 m.v. L.P. Gram.. 20 m.v. 78 r.p.m. Gram.; 35 m.v. Radio. Filter 9 Kc/s and 5 Kc s. Turnover. 4 position equalisation (tone compensation) switch and separate input sockets. Separate Bass and Treble controls. Bass +9 d.b. to −9 d.b. Treble +9 d.b. to −9 d.b. Pre-amp. size 11 x 4½ x 2½in. Front plate 12 x 3½in. Main amplifier 9 x 7 x 6in. Chassis finished stoved gold bronze. For operation on 200-250 v. 50 c.p.s. A.C. mains. Power supply at 4-pin socket available for Radio Tuner. H.T. 250 v. 35 mA. L.T. 6.3 v. 1.5 a. This unit is designed for use with high quality ancillary equipment to provide sound realism in the home. **15 GNS.**

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



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

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

ACOS CRYSTAL 'MIKE' INSERTS. Approx. ¼in. square. Fly lead connections. Only 5/11 each. Brand New. Round type approx. 1¼in. diam. Ex-equipment, tested. 4 11 each.

AM/FM RADIOGRAM

By leading manufacturer. Brand New, Cartoned with guarantee. 4 wavebands including V.H.F. Auto-changes at 3 speeds. Hi-fi duo-point sapphire stylus pick-up. For 200-250 v. A.C. mains. **29½ Gns.** Limited stocks at a fraction of normal price. Credit Terms. Deposit **£6.19.6** and 9 monthly payments of 3 gns. Carr. 10 -.

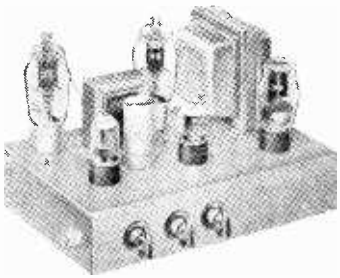
COMPLETE AUTO-CHANGE RECORD PLAYERS. 4-SPEED. By well-known manufacturer. Hi-fi crystal pick-up. Matched amplifier and speaker. Attractive, well finished rexine covered cabinet. For 200-250 v. A.C. mains. Brand New. Cartoned. Limited number. List price well over £20. **15 Gns.** Carr. 10 -.

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

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

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

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/cs. Six negative feed-back loops. Hum level 71 db. down. ONLY 70 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and practically all microphones. Comparable with the very best designs.



For **STANDARD or LONG - PLAYING RECORDS.** For **MUSICAL INSTRUMENTS** such as **STRING BASS, GUITARS,** etc. **OUTPUT SOCKET** with plug provides 300 v. 20 mA. and 6.3 v. 1.5a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12-9-7in. For A.C. mains 200-230-250 v. 50 c cs Outputs for 3 and 15 ohm speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Unapproachable value. at £7 15/- or factory built 45/- extra. Carriage 10/-.

£7-15-0

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

TERMS on assembled two input model : **DEPOSIT** 25/6 and nine monthly payments 25/6.

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

COLLARO RC54 3-SPEED AUTO-CHANGERS with Studio pick-up. Brand new. For 110 v. 50 c.p.s. A.C. mains. Price with 110 v. to 200-250 v. Auto Trans. only **£6/19/6.** Carr. 5/6.

COLLARO CONQUEST 4-SPEED AUTO-CHANGER with high fidelity Studio Pick-up. Latest model. Brand new. Cartoned. For 200-250 v. 50 c.p.s. A.C. mains. Our price **£7/19/6.** Carr. 5/6

COLLARO 4-SPEED SINGLE PLAYER with separate pick-up, as fitted RC457. For 200-250 v. A.C. mains. **£4/10/0.** Post 3/9.

PICK-UP ARMS complete with Hi-Fi turnover crystal head. Acos GP54. Limited number brand new, perfect at approx. half price. Only **35/9.**

LG3 MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with above or any other single or auto-change units. Output for 2-3 ohm speaker. For 200-250 v. 50 c.p.s. A.C. mains. Overall size 6¾ x 4¼ x 2¼in. Controls : Vol. and Tone with switch Guaranteed 12 months. Only **55/9.**

SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner Unit (specially suitable for use with any of our Amplifiers). Delayed A.V.C. employed. The W.Ch. Sw. incorporates Gram position. Controls are Tuning, W.Ch. and Vol. Only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size of unit approx. 9-3-7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustration. **2/6.** Total building cost **£4/15/-.** For descriptive leaflet send S.A.E.

LINEAR L45 MINIATURE 4.5 WATT QUALITY AMPLIFIER. Suitable for use with Collaro, B.S.R. or any other record playing unit, and most microphones. Negative feed-back 12 db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c cs. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 6-5-5¾in. high. Output for 2-3 ohm speaker. Guaranteed for 12 months. Only **£5 19 6.** Send S.A.E. for illustrated leaflet. Credit Terms. Deposit **22/6** and 5 monthly payments of **22/6.**

LINEAR 'DIATONIC' 10-14 WATT HIGH FIDELITY PUSH-PULL ULTRA LINEAR AMPLIFIER. For 200-250 v. A.C. mains. Valves ECC83, ECC33, EL84, EL84, EZ81 miniature Mullard. Self-contained Pre-amp. Tone Control stage, and separate Bass and Treble Controls. Independent ' Mike ' and Gram input sockets are provided. Output Matchings for 3 and 15 ohm. speakers. Only **12 GNS.** : or Deposit **26/9** plus 10/- carr. and 9 monthly payments of **26/9.** Send S.A.E. for leaflet.

LINEAR STEREOPHONIC 3 + 3 WATT AMPLIFIER

Output 6 watts when not used with stereo head. For 200-250 v. 50 c.p.s. A.C. mains. Ganged controls. Volume and Tone with switch. Outputs matched by preset balance control. For use with 2 matched 3 ohm speakers. Only requires connecting to Pick-up speakers and mains point. Sensitivity 200 m.v. Supplied with guarantee and instructions.

Only **£6-19-6**

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

A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest high-fidelity pick-up heads, in addition to all other types of pick-ups and practically all ' mikes '. Separate Bass and Treble Controls are provided. These give full long-playing record equalisation. Hum level is negligible being 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/cs. Output for 2-3 ohm speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with Blue hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £4/15/-, or assembled ready for use 25/- extra, plus 3/6 carr.; or Deposit 22/6 and 5 monthly payments of 22/6 for assembled unit.

LINEAR LT45 HIGH QUALITY TAPE DECK AMPLIFIER. With " built in " power pack and output stage. For Tape Decks with High or Low Impedance. Playback and Erase Heads, such as Lane. Truvox, Collaro, Brennel. etc. For A.C. Mains 230-250 v. 50 c/cs. **Linear frequency response of ± 3 db. 50-11,000 c/cs.** Negative feed-back equalisation. Illustrated leaflet 6d.

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

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

A highly sensitive Push-Pull high output unit with self-contained Pre-amp. Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 db. down. Frequency response ± 3 db., 30-30,000 c cs. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves All components are chosen for reliability. Six valves are used. EF86, EF86, ECC83, 807. 807. GZ33. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 millivolts so that **ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE.** The unit is designed for **CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS,** etc. For use with Electronic **ORGAN, GUITAR, STRING BASS,** etc. For standard or long-playing records. **OUTPUT SOCKET PROVIDES** L.T. and H.T. for a **RADIO FEEDER UNIT.** An extra input with associated vol. control is provided so that two separate inputs such as Gram and ' Mike ' can be mixed. Amplifier operates on 200-250 v. 50 c cs. A.C. Mains and has output for 3 and 15 ohm speakers. Complete kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required cover as for A8 can be supplied for **18/9.** The amplifier can be supplied factory built with 12 months' guarantee. for **£13.19.6. TERMS : DEPOSIT 36/9** and 9 monthly payments of **31/9.**

11 GNS. Carr. 10/-

LINEAR 50 WATT HIGH FIDELITY AMPLIFIER. Sensitivity 25 millivolts for full output. Suitable for any kind of microphone or pick-up. Output matchings for 3 and 15 ohm speakers. Brand New. Guaranteed 12 months. For 200-250 v. A.C. mains. Only **19 gns.** Carr. 15/-. Or Deposit **3 gns.** and 9 monthly payments of **42/3.** Twin handled cover available at **25/-.** Send S.A.E. for descriptive leaflet.

RTC 12in. SUPER HI-FI 25 LOUD SPEAKER UNIT. With mechanical damping device. A 25 watt 15 ohm precision built moving coil unit with 17,000 line Alcomax magnet. Frequency range 25-20,000 c.p.s. Designed to provide life-like reproduction in large halls, theatres, cinemas, etc. Only **12 gns.** or Deposit **28/9** and 9 monthly payments of **28/9. R.C.A. 20 WATT RE-ENTRANT SPEAKERS,** 15 ohms matching. For Outdoor work. Only **8 GNS. P.M. SPEAKERS.** All 2-3 ohms, suitable for use with LG3, L45, A5 or A7 amplifiers. 5in. Goodmans, 17/9. 7 x 4in. Elliptical Elac., 19/9. 6¼in. Goodmans, 17/9. 8in. Rola, 19/9. 10in. R.A., 27/9. 10 x 6in. Elliptical Goodmans. 29/9. 12in. Plessey, 29 11. 10in. W.B. " Stentorian " 3 or 15 ohms type HF1012 10 watts. hi-fidelity type. Recommended for use with our A8 Amplifier. £4 10/9. 12in. Plessey 3 ohms 10 watts. (12,000 lines). 59/6.

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

ACOS HGP59 Hi-Fi Crystal Cartridges. (Turnover type with sapphire stylus.) Standard replacement for Carrard and B.S.R. Only **19/9.**

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

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

Terms : C.W.O. or C.O.D. No C.O.D. under £1. Post 1/9 extra under £2 ; 2/9 extra under £5.
All goods supplied subject to terms and guarantee as detailed in current catalogue.
Open 9 to 5.30 ; Sats. until 1 p.m. Catalogue 6d. Trade supplied. S.A.E. with all enquiries.

RADIO SUPPLY CO. (LEEDS) LTD.

Mail Orders to 29/31 Moorfield Rd., Leeds 12.
Callers to Maude St. (*Opp. Parish Church School*). Leeds 2.

The Popular Stern's "fidelity" TAPE RECORDER for truly "Hi-Fi" Recordings

THEY INCORPORATE

- Choice of the latest COLLARO TRANSCRIPTOR DECK or The NEW TRUVOX MK. IV DECK
- The model HF TR3 "fidelity" AMPLIFIER. (Described below)
- ROLA CELESTION 10in. x 6 P.M. Speaker
- 1,200 reel EMI tape.
- ACOS Crystal Microphone.

PRICE INCORPORATING

COLLARO LECK Mk IV CREDIT SALE. Dep. £12.8.0 and 9 monthly payments of £4.10.8. H.P. TERMS. Dep. £24.15.0 and 12 monthly payments of £2.5.11. **£49.10.0**

PRICE WITH TRUVOX DECK INCORPORATING REV. COUNTER. CREDIT SALE. Dep. £13.2.6 and 9 monthly payments of £4.16.3. H.P. TERMS. Dep. £26.5.0 and 12 monthly payments of £2.8.8. **£52.10.0**

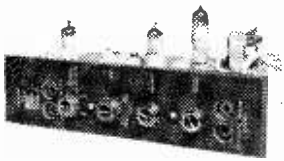
BEFORE CHOOSING YOUR TAPE RECORDER YOU SHOULD HEAR THIS MODEL—TRULY "Hi-Fi" RECORDINGS ARE OBTAINABLE and it is comparable to much higher-priced Recorders. Alternatively send S.A.E. for ILLUSTRATED LEAFLET.

(Plus £1/10/0 carriage and insurance, of which £1 is refunded on return of Packing Case.)

THE MODEL HF/TR3 TAPE AMPLIFIER

INCORPORATING

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



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

PRICE FULLY ASSEMBLED & TESTED. **£16.10.0**

CREDIT SALE. Deposit £4.2.6 and 9 monthly payments £1.10.3. **HIRE PURCHASE.** Deposit £8.5.0 and 10 monthly payments of 18/7.

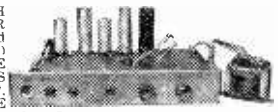
A very high quality Amplifier based on the very successful TYPE "A" design completed in the MULLARD LABORATORIES. ONLY NEW HIGH GRADE COMPONENTS are incorporated including MULLARD VALVES and a GILSON OUTPUT TRANSFORMER . . . other features are—Magic Eye Recording hand indicator—Effective Tone Control—Monitoring and Extension Speaker Sockets—Has own Power Supply and can be used as independent Amplifier for direct reproduction of Gram Records or from Radio Tuner. Overall size 11in. x 6in. x 6in. Can be supplied for use with Truvox—Collaro—Lane—Brenell or Motek Decks. Please specify which.

Send S.A.E. for leaflet or 1/6 for the complete Assembly Manual.

STERN'S TAPE PRE-AMPLIFIER & ERASE UNIT

STERN'S MODEL HF TRI.P—A completely assembled Pre-amplifier with own Power Supply. Can be supplied correctly matched for use with Truvox or Collaro Decks and incorporates Recording Level Indicator and Monitoring facilities. Please send S.A.E. with any enquiry.

IF YOU HAVE A HIGH QUALITY AUDIO AMPLIFIER (such as our Mullard 5-10 and associate 2-valve Pre-amplifier) and wish to add TAPE Facilities—ALL YOU NEED IS —THE ABOVE H.F. TRI.P UNIT together with a TAPE DECK. PRICE **£11.10.0** (Plus 5/- carr. and ins.)



WE OFFER YOU . . .

(a) THE HF/TRI.P. PRE-AMPLIFIER together with the COLLARO MK. IV TAPE DECK (see note) . . . **PRICE . . . £32.10.0 . . . CREDIT . . .** deposit **£8.2.6** and 9 monthly payments of **£2.19.7 . . . H.P. . . .** deposit **£16.5.0** and 12 monthly payments of **£1.10.1.**

(b) THE HF/TRI.P. together with the TRUVOX MK. IV DECK (Incorp. Precision Rev. Counter) . . . **PRICE £38.0.0 . . . CREDIT . . .** deposit **£9.10.0** and 9 monthly payments of **£3.9.8 . . H.P. . . .** deposit **£19.0.0** and 12 monthly payments of **£1.15.8.**

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

HOME CONSTRUCTORS

WE MAKE SPECIAL PRICES FOR COMBINED ORDERS

(a) THE COLLARO MK IV DECK (SEE NOTE) and the HF/TR3 AMPLIFIER (Assembled and Tested). **CASH PRICE £36.0.0**

CREDIT SALE. Deposit **£9.0.0** and 9 months of **£3.6.0. HIRE PURCHASE.** Deposit **£18.0.0** and 12 months of **£1.13.4.**

(b) Precisely as in (a) above but the HF/TR3 AMPLIFIER supplied as COMPLETE KIT OF PARTS. **CASH PRICE £32.10.0**

(c) THE TRUVOX MK. IV DECK and the HF/TR3 AMPLIFIER supplied Assembled and Tested. **CASH PRICE £38.10.0**

CREDIT SALE. Deposit £9.12.6 and 9 months of **£3.10.7. HIRE PURCHASE.** Deposit **£19.5.0** find 12 months of **£1.15.8.**

(d) Precisely as in (c) above but HF/TR3 AMPLIFIER supplied as COMPLETE KIT OF PARTS. **CASH PRICE £35.0.0**

(e) TRUVOX MK. IV DECK (Incorp. Precision Rev. Counter) and the HF TR3 AMPLIFIER. Assembled and Tested. **CASH PRICE £41.10.0**

CREDIT SALE. Deposit £10.7.6 and 9 monthly payments of **£3.16.1. HIRE PURCHASE.** Deposit **£20.15.0** and 12 monthly payments of **£1.18.6.**

(f) Precisely as in (c) above but HF/TR3 AMPLIFIER supplied as COMPLETE KIT OF PARTS. **CASH PRICE £38.0.0**

(g) The PORTABLE CASE—ACOS CRYSTAL MICROPHONE—ROLA 10 x 6 SPEAKER and 1,200 ft. reel PLASTIC TAPE. ALL FOR **£9.0.0**

CARRIAGE and Insurance on any above is 10/- extra.

Note.—Messrs. Collaro supply the Transcriptor with the Deck Switches unwired. We will complete this wiring at **£1.0.0** charge or alternatively supply a Wiring Diagram with Deck.

TERMS ARE NOT AVAILABLE WHEN KIT OF PARTS IS SUPPLIED

TAPE EQUIPMENT IN STOCK

- COLLARO MK. IV TRANSCRIPTOR DECK. **£24.0.0**
  CREDIT SALE. deposit **£6.0.0** and 9 monthly payments of **£2.4.0. HIRE PURCHASE.** deposit **£12.0.0** and 12 monthly payments of **£1.2.3.**
- TRUVOX MK. IV TAPE DECK **£27.6.0**
  CREDIT SALE. deposit **£6.17.0** and 9 monthly payments of **£2.10.0. HIRE PURCHASE.** deposit **£13.13.0** and 12 monthly payments of **£1.5.4.**
- TRUVOX MK. IV DECK (Incorporating Precision Rev. Counter). **CREDIT SALE.** deposit £7.12.3 and 9 monthly payments of **£2.15.10. HIRE PURCHASE.** deposit **£15.4.6** and 12 monthly payments of **£1.8.3.** **£30.9.0**
- PORTABLE CARRYING CASE (as illustrated), accommodates HF TR2 Amplifier and available for Truvox or Collaro Decks **£5.0.0**
- High Output ACOS CRYSTAL MICROPHONE **£1.15.0**
- 10in. x 6in. P.M. LOUDSPEAKER **£1.10.0**
- 7in. x 4in. P.M. LOUDSPEAKER ..... **16/9** and **19/6**
- 1,200 ft. reels E.M.I. or SCOTCHBOY TAPE..... **£1.15.0**

We also have a special line good quality Plastic Tape, 1,200 ft. reels at 21/-.

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

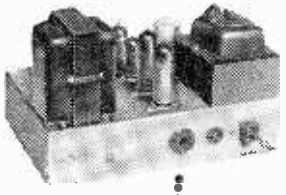
STERN RADIO LTD.
109 & 115 FLEET ST., LONDON, E.C.4
Telephone: FLEET STREET 5812/3/4

AMPLIFIERS PRE-AMPLIFIERS

FOR THE "HI-FI" ENTHUSIAST

MULLARD DESIGNS FOR THE HOME CONSTRUCTOR

THE VERY POPULAR MULLARD "5-10" MAIN AMPLIFIER



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

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

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

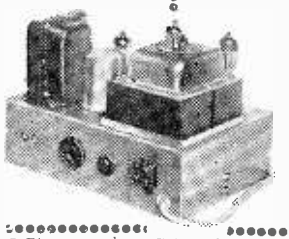
MULLARD'S NEW 2-STAGE PRE-AMPLIFIER TONE CONTROL

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

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

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

THE NEW MULLARD 3-3 MAIN AMPLIFIER



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

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

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

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

SPECIAL PRICE REDUCTIONS . . .

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

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

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

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

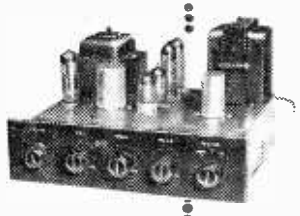
CREDIT : DEPOSIT £3.15.0 & 9 Monthly Payments of £1.7.6. H.P. : DEPOSIT £7.10.0 & 9 Monthly Payments of 19 -.

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

CREDIT : DEPOSIT £4.15.0 & 9 Monthly Payments of £1.14.7. H.P. : DEPOSIT £9.9.0 & 12 Monthly Payments of 17 6.

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

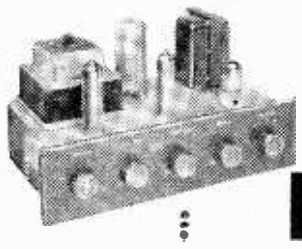
THE NEW COMPLETE MULLARD 5-10 AMPLIFIER



Designed for a simple domestic installation with Genuine High Quality reproduction up to a maximum of 10 watts. Separate BASS and TREBLE Controls are incorporated with switched inputs for 78 and L.P. Records plus Radio Tuning Unit.
We incorporate SPECIFIED COMPONENTS and NEW MULLARD VALVES. We also give the purchaser the choice of two of the best ULTRA-LINEAR OUTPUT TRANSFORMERS made—first the the latest by PARMEKO, LTD., and also the latest by PARTRIDGE (£1.6.0 extra). We also supply the PARMEKO MAINS TRANSFORMER, and this has extra power available to supply a Radio Tuning Unit. The Control Unit can easily be detached from the Amplifier Chassis for use in a remote position.
COMPLETE KIT OF PARTS (PARMEKO Transformer) **£11.10.0** Alternatively we supply ASSEMBLED AND TESTED **£13.10.0**

Credit Sale : Dep. £3.7.6 and 9 Monthly Payments of £1.4.11. H.P. Terms: Dep. £8.15.0 and 8 Monthly Payments of 19/3. Send S.A.E. for ILLUSTRATED LEAFLET or 1/6 for the COMPLETE ASSEMBLY MANUAL.

THE NEW COMPLETE MULLARD 3-3



THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION

COMPLETE KIT OF PARTS **£7.10.0** Alternatively supplied ASSEMBLED and FULLY TESTED **£8.19.6**
(plus 6/6 coverage and insurance)

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

STERN RADIO LTD.

STERN'S FOR STEREO

DULCI'S NEW "STEREO EIGHT" DUAL CHANNEL PRE-AMPLIFIER

CASH PRICE **£23.2.0**

A VERSATILE UNIT EQUIPPED WITH EVERY REFINEMENT FOR STEREO OR NORMAL "Hi-Fi" REPRODUCTION

CREDIT SALE: Deposit £5.15.6 and 9 months of £2.2.4 (plus 7/6 carr. ins.) HIRE PURCHASE: Deposit £11.11.0 and 12 months of £1.1.5. This unit can be supplied to correctly operate with our very popular MULLARD "3-3" and "5-10" MAIN AMPLIFIERS (described opposite). For Stereo reproduction TWO Main Amplifiers are necessary but for normal "Hi-Fi" reproduction the "Stereo Eight" is also perfectly suitable to operate with ONE Main Amplifier and the second Main Amplifier can then be added at any time thus transforming a standard "Hi-Fi" installation over to Stereo.

WE OFFER

(a) The "Stereo Eight" PRE-AMPLIFIER with ONE "3-3" MULLARD MAIN AMPLIFIER **£30.10.0**
(b) The "Stereo Eight" PRE-AMPLIFIER with TWO "3-3" MULLARD MAIN AMPLIFIERS **£37.10.0**
(This provides Stereo reproduction of max 6 Watts output)
(c) The "Stereo Eight" PRE-AMPLIFIER with ONE "5-10" MULLARD MAIN AMPLIFIER **£34.0.0**
(d) The "Stereo Eight" PRE-AMPLIFIER with TWO "5-10" MULLARD MAIN AMPLIFIERS **£44.10.0**
(This provides for Stereo reproduction up to 20 Watts output)
(e) The "Stereo Eight" with the DULCI DPA.10 POWER AMPLIFIER **£35.14.0**
(f) The "Stereo Eight" with TWO DULCI DPA.10 POWER AMPLIFIERS **£48.6.0**
(Provides up to 20 Watts output)
(g) The "Stereo Eight" with the DULCI SP.41 STEREO POWER AMPLIFIER. This comprises Two MAIN AMPLIFIERS on one chassis and produces up to 8 WATTS output **£35.14.0**

OTHER STEREO EQUIPMENT IS AVAILABLE . . . INCLUDING . . .
● The ROGERS STEREO CONTROL UNIT **£18.10.0**

Or supplied with
TWO ROGERS "CADET" AMPLIFIERS **£38.10.0**
● The DULCI "STEREO TWO" TWIN CHANNEL PRE-AMPLIFIER **£9.9.0**
● The DULCI SP.41 STEREO POWER AMPLIFIER **£12.12.0**
● B.J. STEREO PICK-UP CARTRIDGE with DIAMOND STYLUS **£7.7.0**
The BJ Arm for this Cartridge is £5.12.5 extra.
● COSMOCORD "ACOS" STEREO CARTRIDGE with DIAMOND STYLUS **£7.15.2**
The GARRARD ARM for this Cartridge is £5.17.6 extra.

A fully descriptive leaflet is available but please enclose S.A.E. HIRE PURCHASE and CREDIT SALE TERMS ARE AVAILABLE.

RECORD PLAYERS

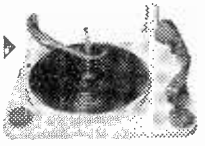
THE VERY LATEST MODELS ARE IN STOCK

MANY AT REDUCED PRICES ! ! !

TRANSCRIPTION UNITS—AUTOCHANGERS, SINGLE RECORD PLAYERS.

Send S.A.E. for ILLUSTRATED STOCK LIST.

A FEW CASH BARGAINS



● The latest **BSR MONARCH 4 SPEED "MIXER" AUTO-CHANGER.** Entirely complete with Crystal Pick Up **£6.19.6**
● The latest **COLLARO 4 SPEED AUTO-CHANGER**—Complete with the Studio "O" Pick Up. (Also available with the low gain Studio "P" Pick Up for £8.1.5) **£7.19.6**
● The latest **COLLARO 4 SPEED SINGLE RECORD PLAYER** complete with Studio "O" Pick Up **£6.19.6**
● The **COLLARO "JUNIOR" 4 SPEED SINGLE RECORD PLAYER**, complete with separate Crystal Pick Up **£4.10.0**
(This high ouput Crystal Pick Up is available separately for £1.12.6.)
Carriage and Insurance on above Units 5 - ex.

A SPECIAL CASH ONLY OFFER ! !

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

ALL for ONLY **£8.7.6** (plus 7/6 carr. & ins.)

The Amplifier consists of a 2-Stage design incorporating 3 modern B.V.A. valves and has separate BASS and TREBLE CONTROLS. The Portable Case will also accommodate almost any make of Auto-changer and is attractively finished in Maroon and Grey Rexine.

WE ALSO SUPPLY SEPARATELY—
(a) The 2-Stage (plus Rectifier) **AMPLIFIER** **£4.2.6**
(b) The **PORTABLE CARRYING CASE** **£3.17.6**
(c) **P.M. SPEAKER** **18/9**
Carriage and Insurance 4/- extra.

109 & 115 FLEET ST., LONDON, E.C.4
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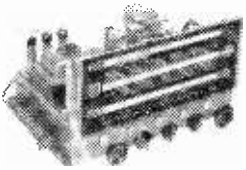
TO MODERNISE YOUR OLD RADIOGRAM

THE NEW ARMSTRONG "JUBILEE"

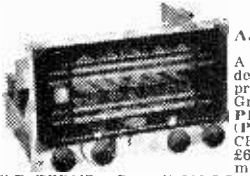


A.M./F.M. RADIOGRAM CHASSIS

PRICE £30.9.0
(Plus 7/6 carr. and ins.)
CREDIT SALE: Deposit £7.12.3, 9 Months at £2.15.10.
HIRE PURCHASE: Deposit £15.5.0, 12 Months at £1.8.2.

Messrs. Armstrong have always been associated with very high-class equipment, and this chassis is undoubtedly one of the best they have ever produced.

MAIN FEATURES
- 6 watts push-pull output with negative feedback.
- 9 valves and 2 diodes.
- Full F.M. band (87-108 mc/s) plus medium and long waves.
- Automatic frequency control on F.M.
- Adjustable Ferrite rod aerial on A.M. bands.
- Tape playback and record facilities.
- Two compensated pick-up inputs.
- Frequency response 30-22,000 cps. +2 dB.
- Separate wide-range bass and treble controls.
- Output impedance for 3-, 7½- and 15-ohm SPEAKERS.
- Tuning indicator.
- Provision for booster unit for low output pick-ups.
- A satinised brass dial escutcheon and veneered facia board is available.
- Size of chassis 12in. x 8in. x 7in. high.



DULCI MODEL H4

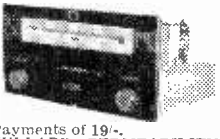
A.M./F.M. RADIOGRAM CHASSIS

A 4-waveband Receiver designed for first-rate reproduction of Radio and Gram.

PRICE £24.6.6
(Plus 7/6 carr. and ins.)
CREDIT TERMS: Deposit £6.2.0 and 9 Monthly Payments of £2.4.7.

H.P. TERMS: Deposit £12.3.3 and 12 Monthly Payments of £1.2.7.

BRIEF SPECIFICATION
- Covers Short, Medium, Long and F.M. wavebands.
- Employs full A.V.C.
- The latest 7-valve line-up.
- For 3- or 15-ohm P.M. speakers.
- "Magic Eye" tuning indicator.
- Excellent tone range up to 4 watts output.
- Internal aerial for local stations.
- Overall size 12in. x 8¼in. x 7¾in. high
- A Good Quality Chassis and well recommended.



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

PRICE £15.0.0
(Plus 5/- carr. and ins.)
CREDIT SALE: Deposit £3.15.0 and 9 Monthly Payments of £1.7.6.
HIRE PURCHASE: Deposit £7.10.0 and 9 Monthly Payments of 19/-.

Incorporates the latest MULLARD PERMEABILITY TUNING HEART and the corresponding MULLARD VALVE LINE-UP comprising ECC85, 2 type EF85s (or EF89s), EM84 Tuning Indicator, plus 2 type O.A.79s Germanium Diodes. A really first-class Tuner, very attractively presented and comparable to many offered at much higher prices. Power consumption is only 1.5 amps at 6.3 volts and 25 m a at 250 volts.

HOME CONSTRUCTORS! YOU CAN BUILD THIS TUNING UNIT FOR ONLY £11.0.0 (Plus 5/- carr. & ins.) Please send S.A.E. for fully descriptive leaflet, or the Assembly Manual is available for 1/6. This contains easily followed PRACTICAL DIAGRAMS together with relative instructions.

HOME CONSTRUCTORS

A RANGE OF "EASY TO ASSEMBLE" PREFABRICATED CABINETS

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

PRACTICAL WIRELESS

EVERY MONTH EDITOR : F. J. CAMM 26th YEAR OF ISSUE

VOL. XXXIV, No. 623, NOVEMBER 1958

COMMENTS OF THE MONTH

BY THE EDITOR

STEREO SOUND

MUCH interest was aroused at the Radio Show by the demonstrations of stereo sound in the Audio Hall. It must be remembered, however, that those demonstrations were held almost under laboratory conditions and the public should be reminded that the quality of sound reproduction depends as much on the acoustical properties of the room in which stereo sound sets are installed, as upon the sets themselves. The acoustical properties of rooms vary considerably and depend, of course, not only on the size and the height of the room, but upon the furnishings and the location of the set. These are important factors to bear in mind and whilst admitting that stereo sound is an important advance, too much must not be expected of it for those reasons. Also it adds to the cost of the set.

OUR MICRO-MIDGET

THE three transistor Micro-Midget receiver, the construction of which is described in this issue, is believed to be the smallest receiver in the world. Two of them can be housed in a matchbox, yet comfortably operate a small loudspeaker when used with an aerial and earth, and when used in conjunction with a deaf aid earplug, gives really adequate volume. The battery is incorporated in the set and it is the size of a sixpence in diameter, yet adequate when the receiver is used normally to power it for about three months.

THE "P.W." AND "P.T." LECTURE

THE lecture at Caxton Hall, Westminster, sponsored by this journal and our companion journal *Practical Television*, takes place on January 22nd, 1959, at 7.30 p.m., when I shall take the chair. Admission is by ticket only. The hall holds 500 people and applications for tickets will be dealt with in strict rotation. This film show is being arranged in conjunction with Mullard Limited and we are inviting as guests members of the Institute of Practical Radio Engineers, who must apply to the Secretary of that body for tickets and not to us. There will be an interval for refreshments which are provided free.

It will, of course, be an entirely different show from last year. The films will deal with the principles of the transistor and the manufacture of junction transistors, with a final film entitled "The Conquest of the Atom" in Eastman Colour. Applications for tickets should be made now, marking your envelopes "Caxton Hall" in the top left-hand corner.

COMBINED RADIO AND TV

IT is a straw showing the tendencies of design that this year at the Radio Show several manufacturers exhibited combined sound and TV receivers. This is, of course, an inevitable development. Separate receivers occupy too much space in these days of small houses, flats and rented rooms. The magnitude of the TV audience today is such that customer demand can provide sufficient orders to encourage all set manufacturers to market combined receivers.—F. J. C.

Our next issue, dated December will be published on November 6th

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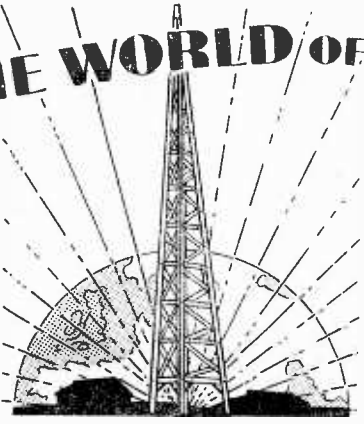
CONTENTS :

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

ROUND THE WORLD OF WIRELESS



By "QUESTOR"

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of July, 1958, in respect of wireless receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland. The numbers include Licences issued to blind persons without payment.

Region	*Total*
London Postal	1,028,128
Home Counties	1,031,770
Midland	760,358
North Eastern	952,748
North Western	730,272
South Western	634,864
Wales and Border Counties ...	395,253
Total England and Wales ...	553,393
Scotland	675,389
Northern Ireland	178,143
Grand Total	6,386,925

Sandale V.H.F. Station

THE V.H.F. station at Sandale in Cumberland, which came into service on August 18th, is the first V.H.F. station in the world to radiate four simultaneous programmes from a single area. The effective radiated power on each service is 120 kW, making a total of 480 kW in the aerial system.

Centenary of First Trans-Atlantic Message

AUGUST this year saw the centenary of the first trans-Atlantic telegraph message, for it was in August, 1858, that a communication link between the old and new worlds was first established. They were hand tapped, now replaced by high speed automatic techniques.

Convention on Transistors

AN International Convention on Transistors and Associated Semi-Conductor Devices—planned, as previously announced, by the Radio and Telecommunication Section of The Institution of Electrical Engineers, will be held from May 25th to 29th, 1959.

Price Reduction

PHILIPS ELECTRICAL LTD. have reduced the price of the Model X61V (V.H.F. car radio) from 49 gns. to 39½ gns.

Stereo Sound

THE BBC is testing the EMI Percival system of stereophonic sound and it is possible that within the year, if the tests prove successful, manufacturers will produce receivers and adaptors for receiving stereo radio broadcasts.

New BBC Tests

THE BBC is experimenting with the medium wave and V.H.F. third programme transmitters, which will be used for one channel and the television sound transmitters for the other. Listeners will be able to take part in the experiments. The television transmitters will, of course, carry the right-hand channel.

Radio Cabinet Styling Exhibition

FOLLOWING the success of last year's initial venture, a second cabinet styling exhibition is being arranged by the British Radio Equipment Manufacturers' Association.

This will be held in the South Hall, Victoria Halls, Bloomsbury Square, London, W.C.1, from October 7th to the 9th this year.

Its purpose is to enable suppliers at home and overseas to show radio manufacturers the products, materials, techniques and styling currently available, and also under development, for use in the exterior design of radio and television receivers, radiograms, record players and other sound reproducing equipment. The suppliers will be able to form an assessment of the future needs of the industry in receiver design, and to examine the potential market for cabinets.

Brit.I.R.E. Announces 1957 Premier Award Winner

THE Council of the British Institution of Radio Engineers has announced that the premier award for the most outstanding paper published in the Brit.I.R.E. Journal during 1957—the Clerk Maxwell Premium—is to go to T. B. Tomlinson, B.Sc., Ph.D., A.M.Brit.I.R.E., for his paper "Principles of the Light Amplifier and Allied Devices." Dr. Tomlinson's paper was based on the work carried out at the Research Laboratories of the General Electric Company; he is now with Computer Developments Ltd.

The "P.T." and "P.W." Film Show

THE P.T. and P.W. film show takes place at Caxton Hall on 22nd January, 1959 at 7.30 p.m. Admission is free by application to the offices of this journal for admission tickets. The programme, of course, is entirely different from last year. The hall accommodates the maximum of 500, so early application is necessary (see leader in this issue.)

Chillerton Down

ITA state that the opening during August of the seventh transmitting station at Chillerton Down, I.O.W., has now roped in an extra viewing public of 3,750,000 people in the south of England.

Vurnhope Soon

IT is expected that the next ITA station will be opened in Vurnhope, in north-east England,

in January, 1959. Mendleshen to service East Anglia, will probably be opened towards the end of 1959.

Show Attendances

THE following data shows this year's attendances at the Radio Show in comparison with the two previous years :

	1958	1957	1956
Wed.	19,128	20,637	21,986
Thurs.	32,373	31,434	33,010
Fri.	28,687	25,987	27,013
Sat.	42,185	40,944	43,982
Mon.	27,300	31,317	35,410
Tues.	32,523	37,399	34,641
Wed.	39,571	40,923	37,904
Thurs.	41,327	34,961	37,259
Fri.	26,976	27,746	27,459
Sat.	38,756	39,107	41,938
	328,826	330,455	340,902

Radio Amateur Emergency Network

THE Sussex branch of the British Red Cross Society wishes to hear from members interested in their Radio Amateur Emergency Network Scheme, particularly from those who hold transmitting licences. Readers should get in touch with the British Red Cross Society, 143, High Street, Lewes.

H.P. Rules Eased

THE new h.p. rules announced by the Board of Trade reduce the down payment on television and radio sets from one-half to one-third of the full price. This reduction also applies to record players and tape recorders.

Goods Traded In

THE fair value of anything traded in by a customer can be counted towards the first payment in a hiring agreement. Rent paid in advance can be claimed if agreements are ended. Goods three years old may be hired without payment of rent in advance For new goods on hire only four months rent instead of nine need be paid in advance.

Club Reports

WILL secretaries of radio and television clubs please note that their reports should be prepared in the following form: title of club; name and address of secretary; meeting place; times and frequency of meetings; report of the previous month's happenings; dates of future events. Reports should not be more than 300 words in length and be written on one side of the paper only. Radio club reports should be received in this office not later than the 12th of each month.

"A Beginner's Guide to Television"

"A BEGINNER'S Guide to Television" (a companion volume to "A Beginner's Guide to Radio") is now available at 7s. 6d., by post 8s. 3d., from the Book Department who will, if requested, send a complete catalogue of our technical books.

Stereo Sound

COSMOCORD inform us that they have installed a stereophonic sound testing unit for the purposes of study of the problems involved in the development of such equipment. Additional staff have been engaged for the purpose.

"Practical Mechanics" Silver Jubilee

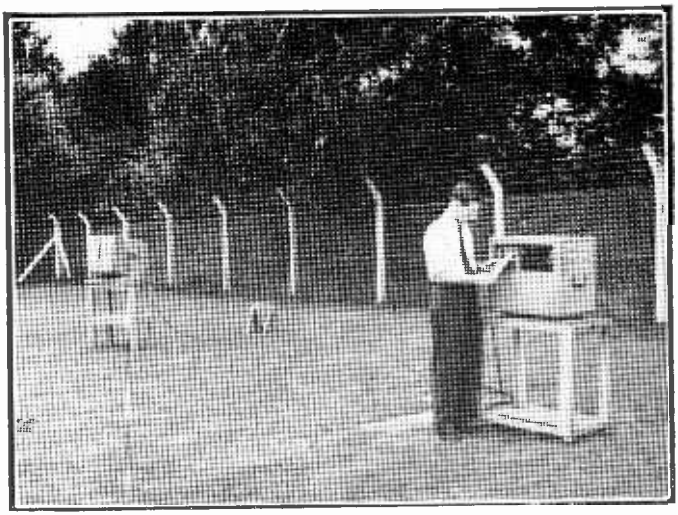
OUR companion journal, "Practical Mechanics," celebrates its 25th birthday with the October issue. It was the second of our series of practical journals to be founded. PRACTICAL WIRELESS, of course, being the first.

"Practical Television" Also!

NEXT year sees the Silver Jubilee of our companion journal, "Practical Television," which, founded in September, 1934, suspended publication during the war and was carried on as a monthly supplement in this journal. It reappeared as a separate publication in April, 1950, when the Paper Control was removed.

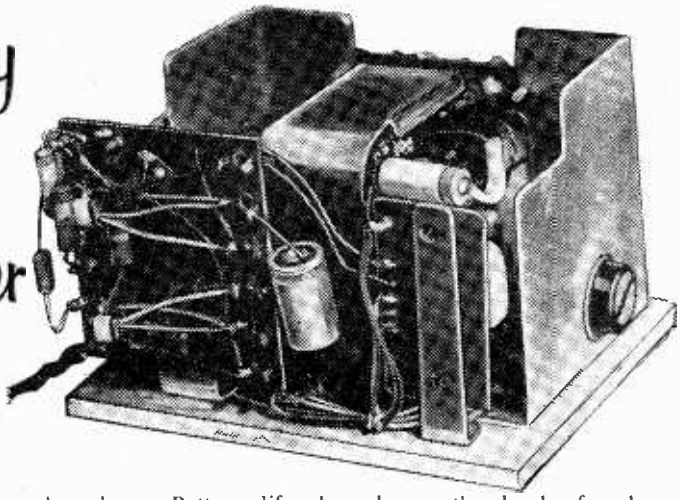
"EVA"

A NEW instrument known as "EVA" is announced by Marconi: it is intended for measurement of the speeds of guided weapons, projectiles, rockets, aircraft and ground vehicles. The initials stand for Electronic Velocity Analyser, and it was shown recently at Farnborough. The machine greatly simplifies the computation of performance figures. It can check speeds up to 3,000ft. per second. It gives a continuous graphical representation of events which are recorded against a reference of calibration pips which occur every one-tenth of a second on recording paper.



Showing the new instrument known as "EVA" (Electronic Velocity Analyser) for measuring speeds of guided missiles. (See paragraph on this page.)

A High Quality Transistor Power Amplifier



SUITABLE FOR CAR RADIO AND DOMESTIC PURPOSES

By A. J. Short

THE amplifier described below has been designed to provide a means of obtaining good quality musical reproduction at the high volume usually associated with large, valve operated equipment. The unit is compact, 6in. × 5in. × 4in., and operates from a 12 volt D.C. supply. Gain is adequate to operate directly from a modern lightweight crystal pick-up and the input impedance is reasonably high, about 30,000 ohms, to facilitate this. The power output will easily drive a 15 ohm 12in. loudspeaker in a large room. Provision has been made in the design to operate the output stage from more powerful alternative driver stages if desired.

The amplifier operates ideally from a 12 volt car accumulator and would provide an excellent output unit for a high quality car radio. When used for domestic purposes, the unit will run for several hours from dry batteries, eight type U2 cells being connected in series for this purpose. Battery life depends on the level of volume employed, the quantity of current drawn depending to a large degree on the volume level.

The circuit is divided into three stages, a grounded collector input stage, to provide amplification and to match the high impedance of the pick-up into the low input impedance of the second, or driver, stage. The driver stage in this circuit is the limiting factor in the maximum power obtainable and has been designed to compromise between high power, economical running and low noise. The output stage is composed of two large power transistors operated in Class "B" feeding into a massive output transformer. Details for the manufacture of this transformer are provided for those wishing to construct this component. Apart from making the former for the winding, the transformer can be hand wound and constructed in a single evening. The whole amplifier is embraced in one overall negative feedback loop, a second loop covers the first stage only and a third loop embraces the driver and output stages only. This arrangement results in a good degree of linearity of response.

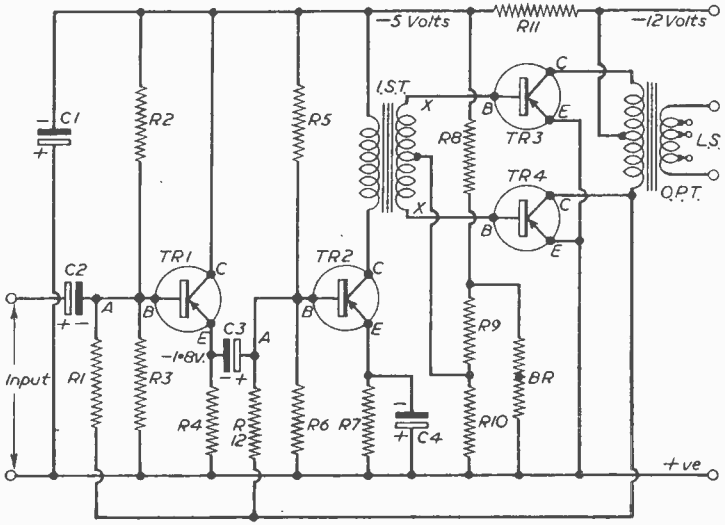
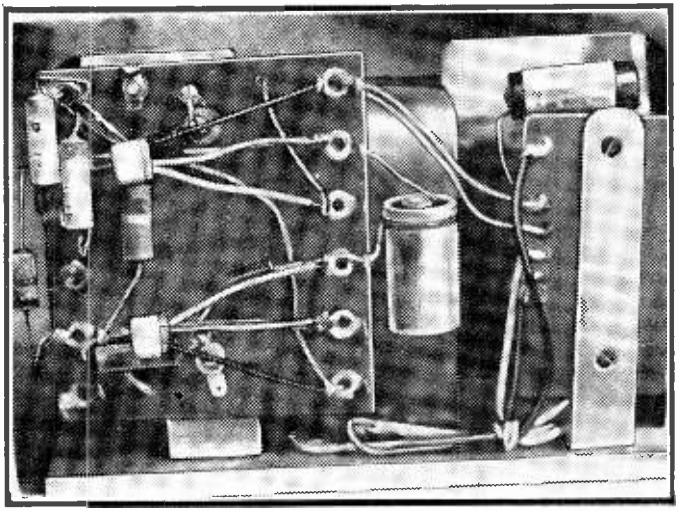


Fig. 1.—The circuit diagram.

Circuit Analysis

1. *The Input Stage.*—The circuit diagram is shown in Fig. 1. The grounded collector input stage has been designed around the high gain Goltop transistor type V10/50B. The requirements for this stage were: (a) Current gain: (b) high impedance input for use with standard pick-ups: and (c) high quality reproduction.

These requirements have to a degree been met in the grounded collector configuration. current gain with this transistor being about 75, the



A view showing the wiring of the transistors.

input impedance being the emitter resistance multiplied by the transistor β gain. in parallel with the base bias resistors. less that due to the negative feedback loop. giving in the prototype a total of about 30,000 ohms, this being a workable figure with high impedance pick-ups. Linearity with this stage is of an extremely high order due to the large amount of inherent negative feedback developed across the emitter resistor.

The main objection to the use of this method of operation is. that the low output impedance of the grounded collector stage matches too closely the low input impedance of the next stage; giving an ineffectual swamping of the non-linear input characteristic of this transistor. In this amplifier the above defect has been accepted and combatted by the large amount of negative feedback employed, but an alternative method would have been to include a large series resistor in the interstage coupling as a swamp resistor. Readers wishing to employ this as an additional refinement will remember that the inclusion of this resistor with the coupling condenser will constitute a very fine phase shifting network which. with a large amount of overall negative feedback employed. may tend to produce instability and oscillation.

2. *The Driver Stage.*—A Goltop transistor type V10/30A is employed as a grounded emitter driver to provide current amplification and to operate at a sufficiently high level to current drive the bases of the two output transistors. The quiescent current drawn by this stage must be such that when fully modulated. the drop to zero must be sufficient current change to provide the requisite drive to the base of the output transistor to produce the desired output current peak; at the same time. during the inverse half cycle. the doubling of the current through the driver must not exceed the maximum current rating for that transistor.

In this circuit a quiescent current of 5.0 mA was chosen to provide a comfortable listening

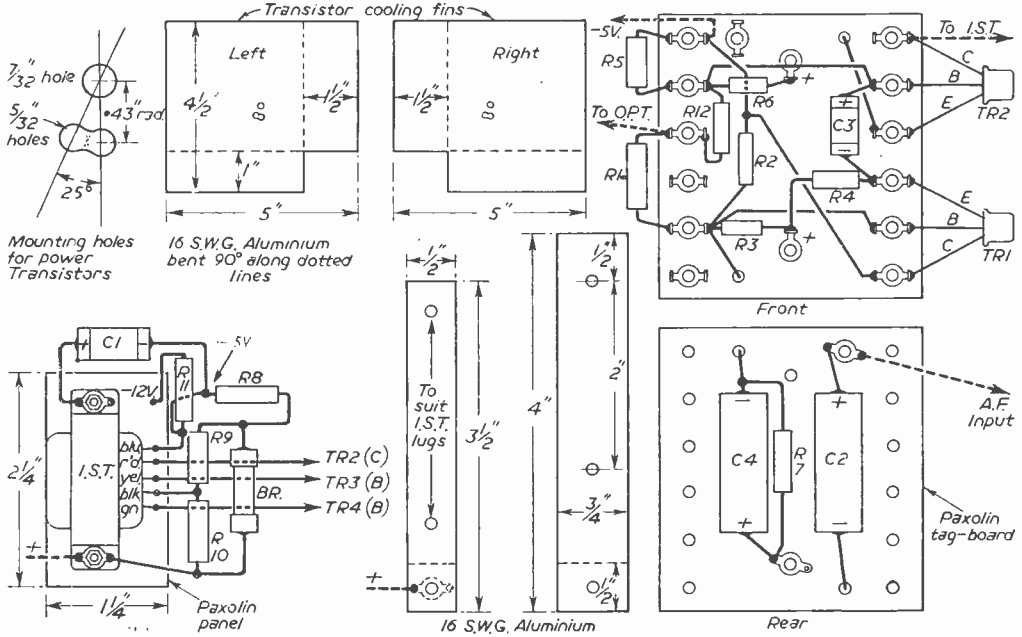


Fig. 2.—Transistor and component mountings. The brackets for the sub-chassis are shown bottom centre.

LIST OF COMPONENTS

R1—10 MΩ ¼ w.
R2—100 kΩ ¼ w.
R3—100 kΩ ¼ w.
R4—2.2 kΩ ¼ w.
R5—4.7 kΩ ¼ w.
R6—2.2 kΩ ⅛ w.
R7—300 Ω ⅛ w.
R8—1 kΩ ⅛ w.
R9—330 Ω ⅛ w.
R10—33 Ω ⅛ w.
R11—600 Ω ¼ w.
R12—270 kΩ ⅛ w.
Br.—Brimistor Type CZ9A.
C1—25 μF 25 v. wkg.
C2—100 μF 6 v. wkg.
C3—25 μF 25 v. wkg.
C4—100 μF 6 v. wkg.
TR1—Goltop V10/50B.
TR2—Goltop V10/30A.
TR3 & TR4—Goltop V30/20P.
I.S.T.—Repanco Inter-stage Transformer Type T.T.4.
O.P.T.—See Text.

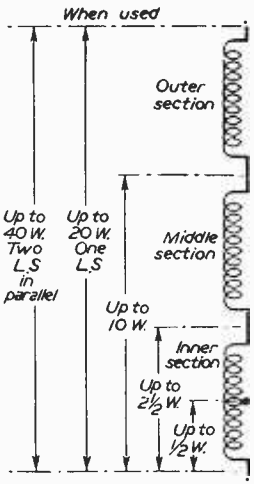


Fig. 3.—Winding data for the output transformer.

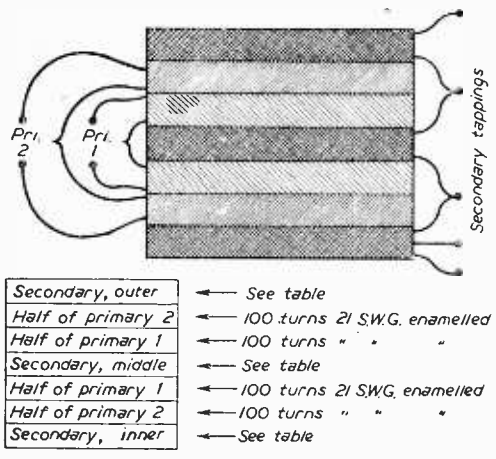
TRANSFORMER SECONDARY WINDING Fig. 3.		
For 15 Ω L.S.s	For 6 Ω L.S.s	For 3 Ω L.S.s
100 turns 21 s.w.g.	66 turns 20 s.w.g.	45 turns 20 s.w.g.
100 turns 21 s.w.g.	66 turns 20 s.w.g.	25 turns 40 s.w.g.
50 turns 21 s.w.g.	33 turns 20 s.w.g.	22 turns 20 s.w.g.
50 turns 21 s.w.g.	33 turns 20 s.w.g.	22 turns 20 s.w.g.
TOTALS 300 turns	198 turns	134 turns

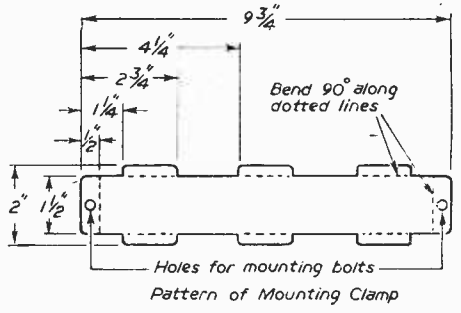
output with minimum work by the transistor. There is left a comfortable reserve of current rating available if it should be desired to operate this stage at a higher level. Readers will remember that such working at a higher level will result in consequent loss of β gain in this stage.

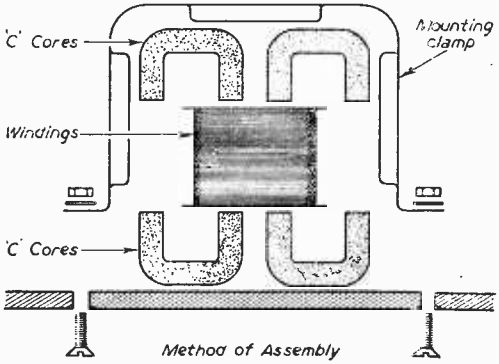
3. *The Output Stage.*—An orthodox Class "B" output stage employing two Goltop V30/20P power transistors is employed in this amplifier. Three aspects of this stage warrant individual consideration, they are: (a) The temperature stabilisation of the working point of the standing current; (b) the cooling fins and heat sinks employed to prevent thermal run away, shown in Fig. 2; and (c) the output transformer, shown in Figs. 3, 4 and 5. In general, the output stage conforms to standard practice in this field, although it may be compared with the transformerless output stages advocated by Messrs. Mullard and others. The present circuit was preferred in this on grounds of adaptability, the output transformer being of the "universal" type, and the circuit requiring a single untapped 12 volt supply.

(*a*) *Temperature stabilisation.*—Readers will be aware of the large temperature coefficient inherent in the characteristics of a transistor. In order to stabilise the working point of the output stage, a component having a large negative temperature coefficient is introduced and used to control the working point. A Brimistor type CZ9A, which has a large negative temperature coefficient and a suitable working range, is "tapped down" by a potentiometer network to provide the base bias current.

(To be continued)







Figs. 4 and 5.—Constructional details of the output transformer.

Servicing Radio Receivers

COSSOR BATTERY PORTABLES—MODELS 551 AND 552

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

BOTH these models feature four valves of the low-consumption all-dry range and almost identical circuits. Model 551 is a small cabinet version with the controls mounted on the top, while Model 552 takes the form of an attaché case. The cabinets are covered with a Lionide material and a substantial handle is featured for ease of carrying.

The recommended batteries are Ever Ready type B126 for H.T. and Ever Ready type AD35 for L.T. The larger, more economical Ever Ready type AD4 can, however, be used as an alternative in the later versions of Model 551. The battery consumption is 10 mA H.T. and 125 mA L.T. and a full 200 mW of audio is fed to the 5in. high-gauss permanent magnet loudspeaker. The valve line-up is DK96 frequency changer, DF96 I.F. amplifier, DAF96 detector, A.G.C. and audio-frequency amplifier and DL96 output.

Both models are two-band—M.W. 188-548 metres (1,594-547 kc/s) and L.W. 1,100-1,850 metres (272-162 kc/s)—and feature waveband selection, tuning and volume controls, but on Model 551 the on/off switch is combined with the volume control and incorporated in the lid of Model 552. Internal aerials are featured in both models, a ferrite rod type in Model 551 and a loop aerial in the lid of Model 552.

The Circuit

The full circuit is shown in Fig. 1 and this is built on a composition board carrying printed wiring, as is current practice in the design of small portables of this nature. The aerial windings, L1 and L2, are tuned by the aerial section of the tuning gang C19, and the signals selected are fed to the signal grid of the DK96 (V1). On L.W. L1 and L2 in series form the inductance,

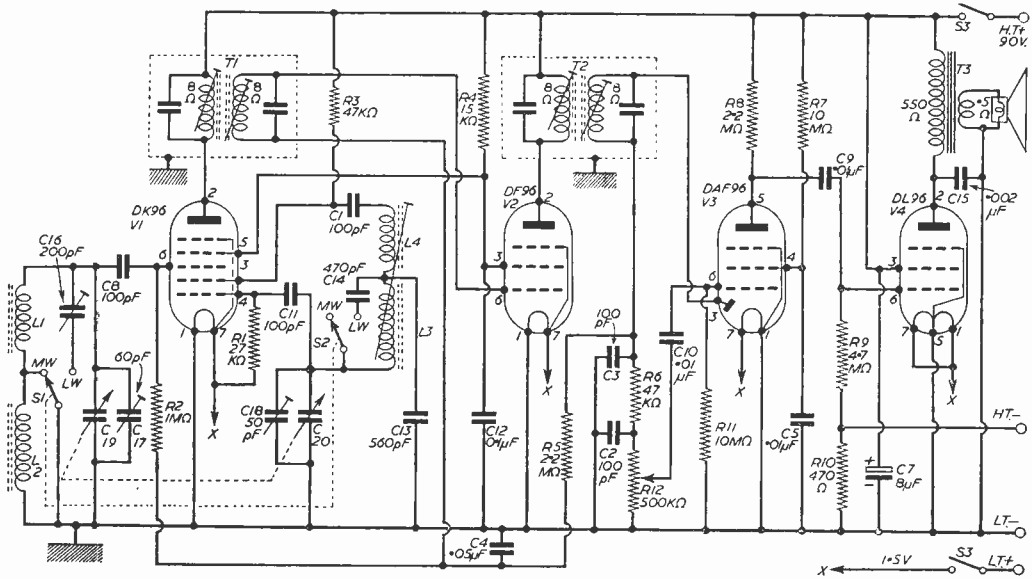


Fig. 1.—Circuit diagram of Cossor Models 551 and 552.

the aerial circuit being trimmed by C16, while on M.W. L1 section only is utilised and C17 serves as the trimmer. C8 acts as a coupling and isolating component which prevents the A.G.C. bias applied through R2 from being short-circuited.

The tuned circuit of the local oscillator comprises L3/L4 and C20. The required decrease in frequency on L.W. is secured by the switching in of C14. The oscillator is designed to work at 470 kc/s above the signal-frequency so as to produce across the windings of the first I.F. transformer T1 a 470 kc/s I.F. signal. The only trimmer associated with the oscillator is C18.

From T1 the I.F. signals are fed to the control grid of the DF96 valve (V2), are amplified by this valve and redeveloped across the windings of the second I.F. transformer T2. From here they are taken to the signal diode in V3 which serves to demodulate them and produce the A.F. content across the load resistor R12, which is also the volume control. R6, C2 and C3 are filter components which rid the A.F. signal of any I.F. component which may be present after detection.

The D.C. component of the I.F. signal is filtered by R5 and C4 and then used as A.G.C. bias, it

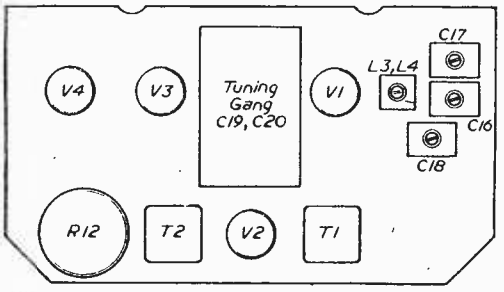


Fig. 2.—Top view of the printed board, showing the position of the trimmers and major components.

being applied to the control grids of the first two valves. If the signal increases for any reason then the A.G.C. bias increases in proportion, and since this is negative at the valves the overall gain of the receiver is reduced accordingly. In this way the gain of the receiver is controlled automatically to cater for a diversity of signal conditions.

The volume control taps off the required level of audio signal and this is fed to the control grid of V3 through the coupling capacitor C10. The A.F. signal is thus amplified by the pentode section of V3 and in amplified form is developed across the load resistor R8 in the anode. The signal at this point is now at a suitable level to drive the output valve V4, and is fed to the control grid through capacitor C9.

Instead of the H.T. negative lead being connected direct to the chassis, it is connected in series with the 470-ohm resistor R10. There thus occurs across this a volts drop, which is negative at the H.T. end of the resistor. The value selected for R10 provides a potential of value suitable for biasing the output valve, and this is achieved by returning the grid of the valve to the H.T. negative point through the grid resistor R9. The first two valves are biased by the A.G.C. system, as we have already seen, and the pentode of V3 is biased by reason of grid current through the 10 megohm resistor R11.

Servicing Notes

Extreme caution should be observed to avoid damaging the printed wiring when the board assembly is removed from the cabinet. In the case of Model 551, after removing the control knobs, the back of the cabinet and the batteries, the board assembly can be withdrawn by unscrewing the two nuts securing the panel to the top of the cabinet and freeing the rod aerial mounting so that it is clear of the cabinet when the assembly is withdrawn.

In the case of Model 552, the two 4 BA nuts which hold the printed-wiring board to the cabinet must be removed, as also must the on/off switch, batteries and control knobs. The frame aerial can be removed by removing the four wood screws in the corners of the lid.

Printed Circuit

When replacing small components on a printed board it is often best to cut the connecting wire as close as possible to the faulty part so that a reasonable length of lead is available protruding from the circuit for the connecting and soldering of the replacement part. It is desirable to employ a miniature soldering iron of about 25 watts rating, and perform the soldering process as rapidly as possible so that the circuit or component is not overheated. A heat shunt should be used where prolonged heat is required; a pair of long-nose pliers held so as to grip the component wire as close as possible to the component serves this purpose during the time that the heat is applied to the join.

Small gauge 60 tin/40 lead resin-cored solder should always be used. A small magnifying glass helps to locate fractures in the printed wiring which are not easily visible to the unassisted eye. Other items of use for servicing printed circuits are small diagonal wire cutters, tweezers of various sizes and a small wire brush for clearing surplus molten solder from the board when it is necessary completely to extract the defective component. This is necessary with such things as large wattage resistors, transformers, valveholders, chokes and similar parts.

Complete failure of the receiver should lead first to a check of the batteries. If the frequency changer valve is well up to standard, the receiver will continue working when the H.T. and L.T. fall as low as 60 volts and 1.2 volts respectively. Below these voltages the set will not receive signals, but will appear to be lively and slight microphonic effects will occur on tapping valves V3 and V4—the lack of results being caused by failure of the local oscillator.

Exactly the same symptoms will result if the DK96 valve is of low emission and the batteries are just a little below their full rated value; if the emission of the DK96 is very low, then the receiver will not work at all, of course, even with new batteries, but it will seem to be lively and distinct clicks will be heard in the loudspeaker when the wave-change switch is operated.

(*Continued on page* 694)

A Two-valve Hi-Fi Amplifier

EXCELLENT FOR ALL ORDINARY PURPOSES

By T. W. Dresser

THE amplifier to be described has a low power output, a frequency response over an extended range that is more than adequate, and the noise level is appreciably low. The cost is well within the means of most quality enthusiasts. To quote figures, the frequency response is level within 2 decibels from 30 cycles to 15 kc/s, the signal to noise level is rather better than 60 decibels at full output, and the distortion does not exceed 0.75 per cent. at 1,000 cycles and is approximately 3 per cent. at 50 cycles per second. The maximum output is 2 watts for an input of 1 milliwatt (into 600 ohms, for the pendantic).

The Rectifier

Three valves are used and, further to cheapen the cost, the rectifier is a 6 × 4 with high cathode to heater insulation, the heater operating on a 6.3 volts supply. In this way, one transformer winding is dispensed with, as the rectifier heater can be wired to the same L.T. winding as the other valves. The mains transformer has three windings only, then one 6.3 volt at 2 amps for the heaters, 275-0-275 volts for the H.T., and the normal 200-230 volt primary, of which there are a number available in the dealers' advertisements in this journal.

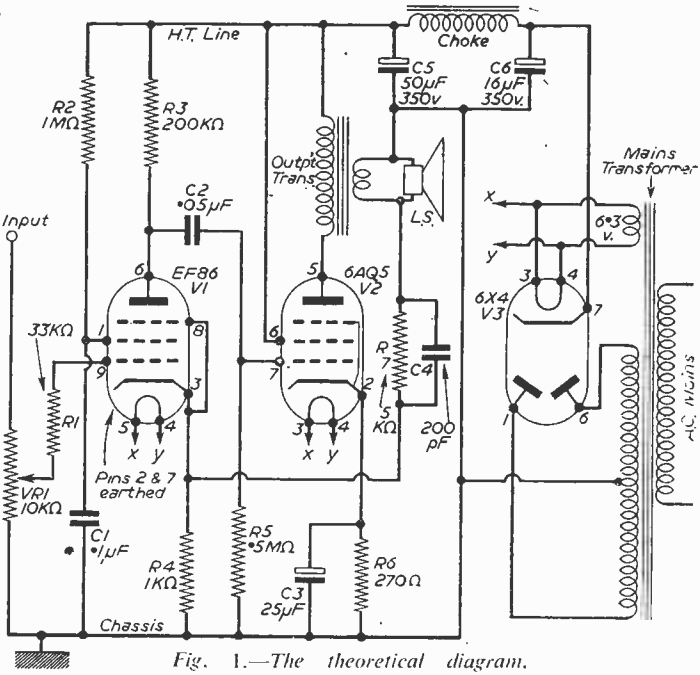


Fig. 1.—The theoretical diagram.

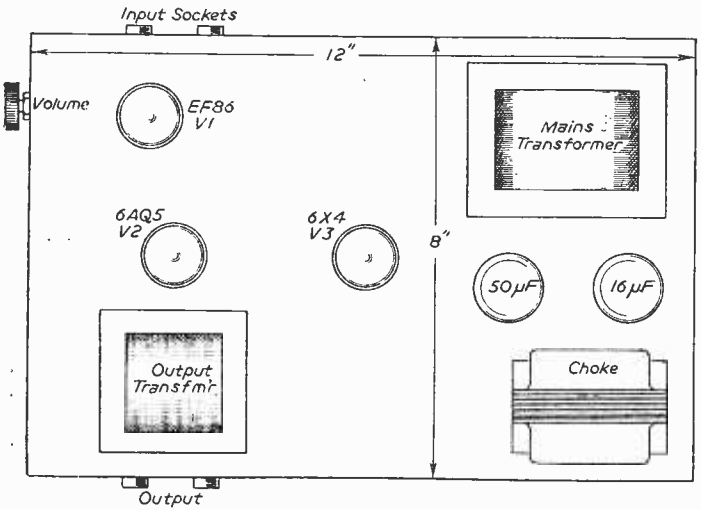


Fig. 2.—An above chassis view.

The other two valves are a EF86 and a 6AQ5, both miniature types fitting B7G bases and connected in a conventional R.C. arrangement. Negative feedback is applied to the cathode of the first valve from the secondary of the output transformer, and the volume control forms part of the input circuit of this valve. The H.T. smoothing circuit is somewhat unusual in that much larger filtering capacitors than usual are used. The change is intentional and assists substantially in keeping hum and ripple in the signal circuits down to a very low figure.

High Grade Output Transformers

As with all high fidelity apparatus, it is essential to use

a really high grade output transformer with this amplifier, though not necessarily as complicated a type as the Williamson. The ratio will depend, of course, upon the impedance of the speaker voice coil, but where this is the normal 2-3 ohms, a standard pentode output transformer will suit admirably

Aluminium Chassis

The amplifier is built on an aluminium chassis measuring 12in. × 8in. × 2.5in. deep, which can either be bought ready made or bent from sheet metal of fourteen or sixteen gauge. The components and valves are laid out as shown in Fig. 2, an above chassis view, and Fig. 3, which shows the under chassis layout.

No particular precautions are necessary in the building beyond those normally taken in constructing audio gear, and it is unlikely that any unusual snags will arise as both the circuit and the layout are quite straightforward. In the theoretical diagram, Fig. 1, all the valve pins have been numbered for the reader's convenience, and all that should be necessary, before putting the amplifier into use after construction is finished, is a quick check over of the wiring and connections.

In conclusion, the constructor will find this an excellent amplifier for all ordinary purposes, particularly if it is used with an 8in. speaker of good make such as the Wharfedale or the G.E.C. metal cone type, mounted in a thoroughly "damped" re-entrant cabinet. The output can be increased to a little over 4 watts by substituting a 6BW6 for the 6AQ5. In this case the valveholder will also have to be changed from a B7G to a B9G to accommodate the new valve.

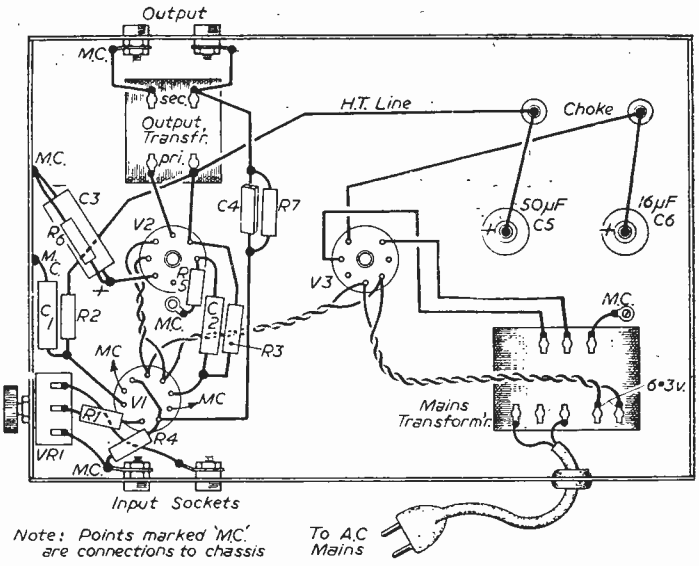


Fig. 3.—Showing the under chassis layout.

COMPONENTS LIST

Mains transformer : 6.3 v. at 2 amps.
275-0-275 v. at 75 m/a.
Pri. : 200-230 v. 50 c/s A.C.
Smoothing Choke : 15 Henrys (not critical).
Electrolytic capacitors : 16 mfd. 350 v. wkg.
50 mfd. 350 v. wkg.
25 mfd. 25 v. wkg.
Fixed condensers : 0.1 mfd.
0.05 mfd.
200 pfd.
Resistors : 1 megohms
200 K ohms.
33 K ohms.
5.0 K ohms.
1.0 K ohms.
270 ohms.
0.5 megohms.
Potentiometers : 10 K ohms.
Valveholders : 3 B7G types.
Chassis : 12in. x 8in. x 2.5in. aluminium.
Terminals, wire, etc.
Output transformer (see text).

SERVICING RADIO RECEIVERS

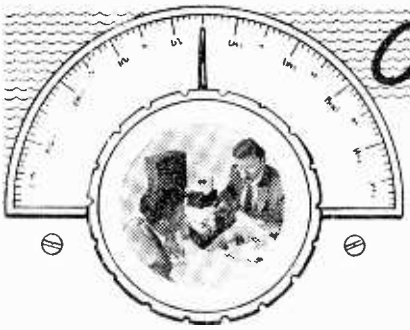
(*Continued from page* 692)

It often pays to replace a frequency changer valve which has low emission so as to avoid frequent replacement of the batteries. But on no account should an L.T. battery exceeding 1.5 volts be connected in an endeavour to get the set working with a low emission frequency changer, for this practice will ruin all the other valves.

Low volume and distortion which is not caused by partially exhausted batteries may well be caused by value increase of R8 or R7 or by impaired insulation in C9. The latter cause will result in increased current in V4, which will eventually ruin the valve and increase the rate of discharge of the H.T. battery. If C7 goes open-circuit there will be a possibility of A.F. instability, giving rise to a howl from the loudspeaker, when the H.T. battery nears the end of its life, that is, when its internal resistance rises.

The I.F. transformers are adjusted for maximum output when a modulated signal of 470 kc/s is injected into the M.W. connection of the aerial coil or loop. Transformer T2 should be adjusted before transformer T1.

The medium waveband is aligned first by injecting a signal at 1,500 kc/s, tuning the set to 200 metres and adjusting trimmers C18 and C17 in that order for maximum output. Next, the receiver and generator should be tuned to 500 metres (600 kc/s) and while the gang is rocked slightly from side to side the core in L3 should be adjusted for maximum output. Accurate calibration of the long waveband is possible only when the M.W. circuits are adjusted correctly. The alignment point is 1,000 metres (300 kc/s), at which wavelength C16 is adjusted for maximum output. The position of the trimmers and major components on the printed board are shown in Fig. 2.



On Your Wavelength

BY THERMION

That Word "Up"

HAVE you ever pondered on the importance of that word "up" to conversation and literature? A Scotsman goes up to London, a Londoner goes up to Scotland; you get up in the morning; you tell people to shut up; you ask people what they are up to; you give up; dry up; drive up; you tell a horse to gee-up; you pull up, draw up and so on. Now the BBC is allowing speakers to say "met up." The slipshod style permitted on the radio, in view of the BBC pose as a purist on orthography, is scandalous. Mr. Fowler must turn in his grave. The clichés which are permitted are also a source of annoyance. That cliché "it may well be" which was flogged to death by Anthony Eden, who is a notoriously bad speaker anyway, is a further source of irritation to those who believe that English should be spoken undefiled.

In announcing some disaster it was not uncommon for the speaker to say, "it may well be that the Germans have sunk 12 of our ships," when the proper word was "ill." Another aspect of this problem is the way in which the BBC permits singers and others to give negro pronunciations to our words. Do becomes "dew," what becomes "waht," boss becomes "barse" and so on. The films add their influence to this pollution of the mother tongue, and, with the wide diversity of nationalities now permitted to featherbed themselves in this country, I am wondering what sort of a language we shall be speaking in ten years' time. I suppose a cross between pidgin English, back slang, negro, Yankee, and choctaw.

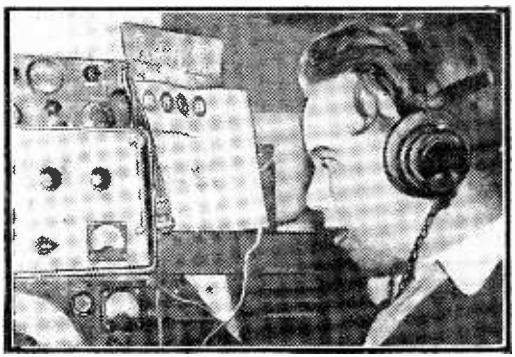
At the Show

MY apologies to all those readers whose visits to the stand to see me did not coincide with mine. I was, however, able to have chats with a fair number of readers, including those who came to eviscerate me, but went away as converts. It was a good show, even though the exhibits this year did not disclose any great surprises. The accent was on sound. I am yet to be convinced that this is a worthwhile change in technique, and whether the public in general will appreciate the difference. However, it seemed to attract a good deal of attention, but I suspect that it would appeal mostly to the hi-fi and quality merchants, who unfortunately are in the minority.

It was a better arranged show in every respect and the catering arrangements were excellent. The attendance was only slightly down on last year, for inexplicable reasons, but interest in the amateur side of radio and TV was stronger than ever. Colour TV demonstrations were absent and only one firm showed a projection TV receiver. Transistors and printed circuits abounded, although the price of transistors is tending to increase prices of complete receivers. There is no doubt, however, that its development will bring the eventual decline of the valve, the prices of which have been maintained at an unjustifiable high level for far too long.

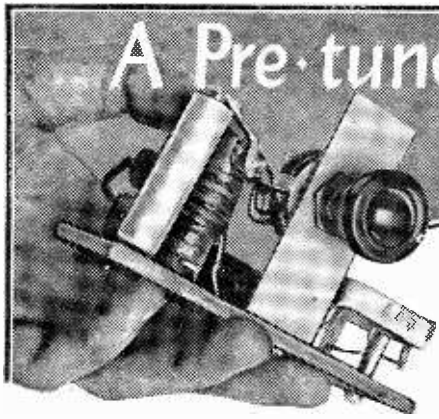
Jamming

INTERNATIONAL SHORT WAVE CLUB has taken up with the Soviet Union and the Chinese People's Republic the question of jamming of radio transmissions which the Governments of those countries feel that their peoples should not listen to. If this is allowed to continue, short wave listening and DXing will become impossible. The International Short Wave Club has received a letter from Moscow, the text of which has been communicated to Governments and the United Nations. Here is a quotation from the letter: "It seems to me that attention must be directed to those stations who tend to aggravate the jamming by the nature of some or all of their broadcasts. The Soviet Union says that it is not against all foreign broadcasts. The important thing is are they friendly in spirit? Do they tend to promote friendship? We cannot assist in the spreading of unfriendly transmissions which prevent the truth and sow discord among nations." Would not another interpretation be that the Soviet Union does not wish its peoples to know the truth, which would show up their own propaganda in some cases to be a pack of lies? The plain fact is, however, that jamming has become a menace, although what the solution to it is in these days when international agreements mean nothing, I do not know.



John Swingewood of Stourbridge, in his shack, operating his R1155A.

A Pre-tuned Transistor Feeder



By J. Gray

AN UNUSUAL DETECTOR UNIT

ITS independence of power supplies makes the simple crystal diode type of tuning unit very useful, but volume is not always sufficient. This is particularly so when the amplifier employed does not provide very high gain, or when factors such as the distance of local stations, or the impossibility of providing a good aerial, result in a poor output from the tuner. A transistor tuner largely overcomes these difficulties, as it can give enough volume in circumstances which make the crystal diode tuner useless. It is thus suitable for the simpler type of amplifier, or when an efficient aerial cannot be provided. It can be used with any battery or mains equipment, as it operates from a single 1½ v. cell. Quality of reproduction is satisfactory for the purpose in view—namely, extending the scope of

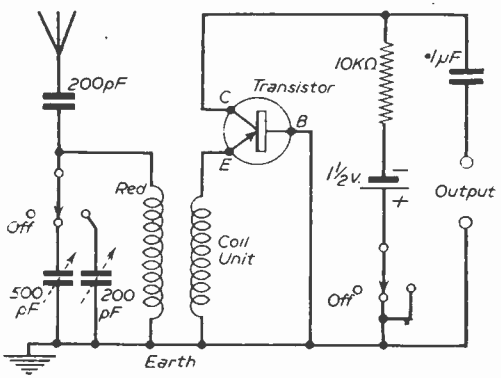


Fig. 1.—The tuner circuit.

an amplifier so that it can be used for listening to local radio programmes.

The circuit, shown in Fig. 1, was intended for the reception of 276 metre and 464 metre (Home and Third) transmitters, but the value of the pre-set condensers can be modified to make other stations tunable. If any station near 200 metres is required, one pre-set must be of much lower value (100 pF maximum), as the minimum to which a 200 pF or 500 pF component may be adjusted is too high. This difficulty can be overcome either by using a twin 500 pF pre-set and removing some plates, if necessary, or by choosing values which will allow the local stations to be tuned in. No difficulty will arise if it is remembered that the minimum capacity of the larger type of pre-set condenser is quite high, so that a condenser with a smaller total

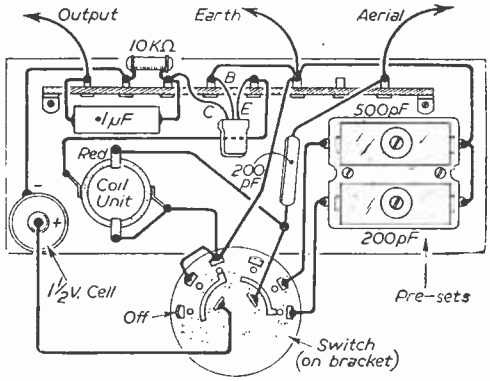
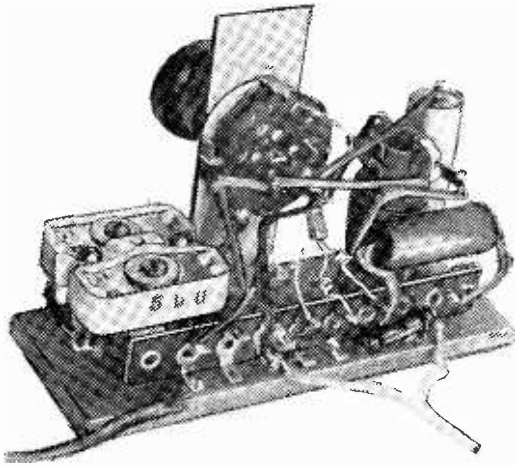


Fig. 2.—The complete wiring diagram.

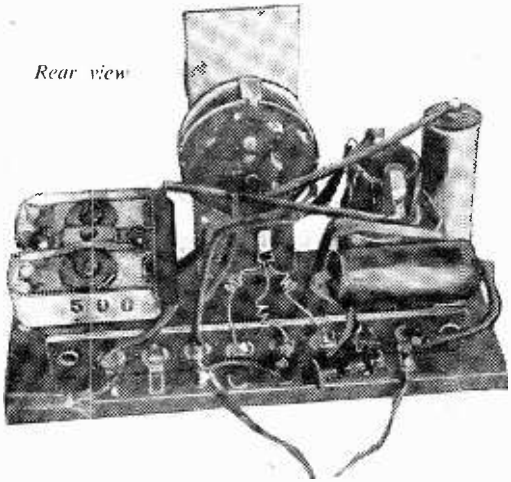
capacity is required for any station under 300 metres or so.

A single switch provides "Off," "Home" and "Third" positions, automatically tuned. The Light Programme could be provided for instead.

(*Continued on page* 699)



Showing a three-quarter view of the feeder.



by adjusting tuning, or using a 4-way switch, with an additional tuning condenser.

A Wearite PHF2 coil is used, the reaction winding serving for emitter coupling. A transistor type tuning coil would also be satisfactory, and can be used instead if available. The transistor employed was of the inexpensive PNP type. The red spot indicates the Collector lead. The Base lead is centrally placed, with the Emitter lead farthest from the red spot. Correct wiring is absolutely essential.

Switch and Building

A 2-pole, 3-way rotary switch is required, one pole providing on/off switching. A 2-way switch

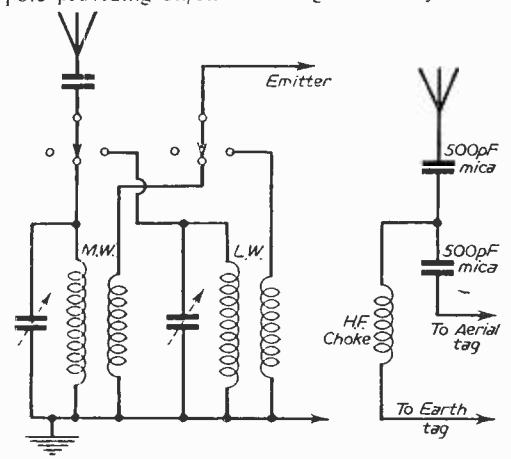


Fig. 3.—(Left) Dual-wave switching. Fig. 4.—(Right) Modulation hum filter.

with "Off" position is equally suitable, or a 3- or 4-pole switch with the unrequired contacts left disconnected. The switch is mounted on a bracket so that its bush is 1½in. from the small baseboard, which is 4½in. × 1¾in. A tag strip, fitted to brackets bolted in place, provides connecting points. All parts and wiring will be seen from Fig. 2, the back of the switch being shown so that tag connections are clear. The twin pre-sets are mounted on long bolts, with stand-off sleeves. The aerial circuit tag of the PHF2 coil is identified by a red marking, and the other tags are wired as indicated.

The 200 pF aerial condenser is satisfactory for many average aerials of moderate length. If a very short aerial is used, this condenser may be omitted. But if a long aerial is available, and selectivity is not sufficient, a smaller capacity should be fitted. This is also necessary in areas of high signal strength, where the transistor is overloaded.

As the 1½ v. battery lasts months, with normal use, a single cell is soldered directly into position, the zinc case being negative. Situated at the corner of the baseboard, it can easily be renewed. A large clip screwed in place could be used to hold the cell, with a small clip for the brass cap, but good contact must be assured to avoid back-

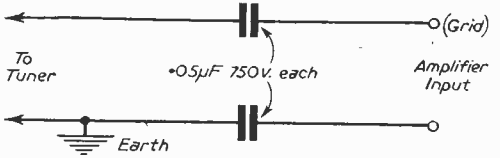


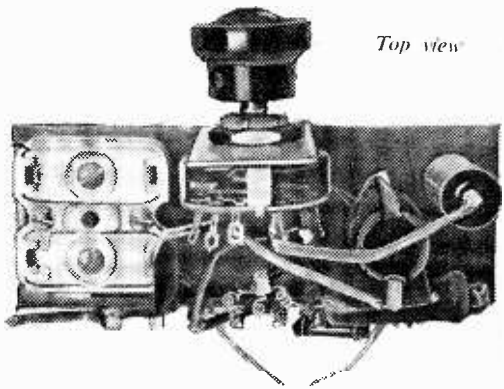
Fig. 5.—A.C./D.C. amplifier isolating circuit.

ground noises. The transistor leads are left full length, and soldered to the tags as shown. These joints should be made quickly, with a really hot iron which should be removed instantly the solder has run. Heating will damage the transistor.

For Long Waves

In some areas satisfactory reception of the Light Programme is only possible by tuning to the Long Wave transmitter (1,500 metres). In these circumstances, the circuit in Fig. 3 may be used. A 3-pole switch is required, one pole switching the aerial circuit, one the emitter coupling windings, and the remainder for on/off purposes as before. If two M.W. stations are required, in addition to the L.W. transmitter, then two M.W. coils, each with its pre-set, can be employed. An alternative is to use a 4-pole

(*Continued on page* 702)



A High Quality Record Player

No. 2—MAKING THE CABINET

(*Concluded from page 598 of the October issue*)

By N. B. Jones

AS stated last month, the four valves and the terminal blocks are the only components to be mounted on the top of the chassis, but there is ample room underneath for the other components, including the mains smoothing choke. It is not advisable to mount the smoothing condenser C12/13 on the top of the chassis, even though there is room for it, because the heat dissipated by the output and rectifying valves will damage it.

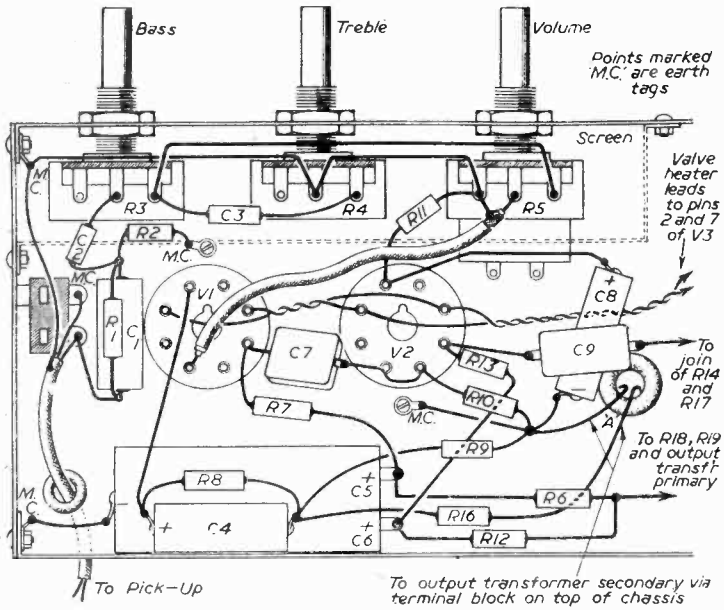


Fig. 1.—(Above) The wiring diagram of the first and second stages. (Right) Showing the completed player.

First and Second Stages

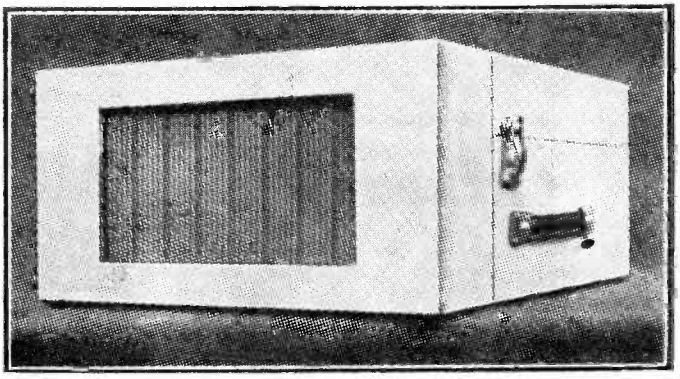
Fig. 1 shows a wiring diagram of the first and second stages. The connections to the mains on-off switch (S1 and S2) on the volume control have been omitted for clarity. The wires to the output transformer are taken through grommet "A" and go to a terminal block on the top of the chassis. The components for the tweeter (C10 and R19) are mounted directly on to the output transformer primary.

Note.—The screen round the tone control has been shown as a dotted line so as not to become confused with the wiring.

Output and Rectifying Stages

The wiring diagram of the output and rectifying stages is shown in Fig. 2. All the wires (seven in all) to the mains transformer secondary are taken through the grommet "B." The twisted pair of wires going through grommet "C" are from the mains on-off switch (S1 and S2) and go to the mains transformer primary. The connections to the rectifier (V4) are as follows:—

Pins 2 and 8: Heaters (5 v.).



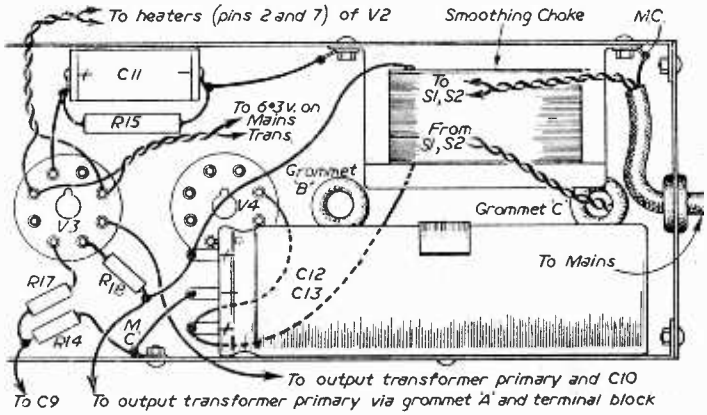


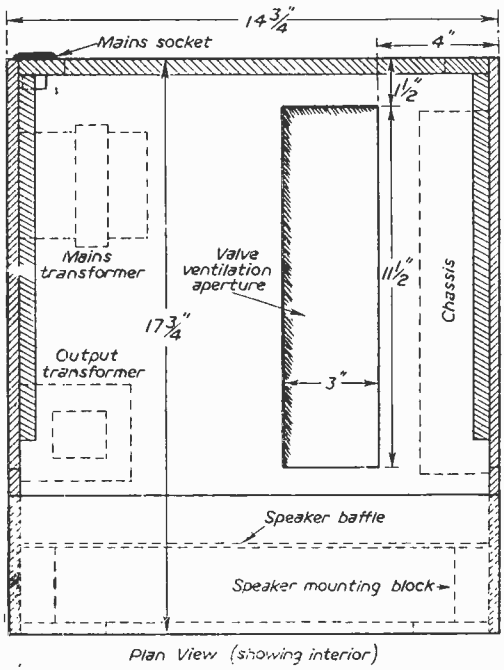
Fig. 2.—The wiring diagram of the output and rectifying stages.

Pins 4 and 6: High tension (350 v. secondary).

All connections to the mains and output transformers are made via terminal blocks on the top of the chassis.

Connecting Up

When completed, the amplifier may be connected up to the pick-up and the speaker. If there is fierce oscillation from the speaker when the amplifier has warmed up it is an indication that the feedback is functioning in reverse. This may be rectified by reversing the connections to the output transformer secondary and the amplifier should then be perfectly stable.



The Cabinet

No detailed account of the actual construction of the cabinet has been given because the diagrams are self-explanatory. The cabinet is made up as a closed box and when the glue has dried completely (after 24 hours), the lid is carefully sawn off. This ensures a perfect fit.

The speaker and ventilation apertures are then cut out (see Fig. 3) and it is advisable to use a very fine pad-saw blade for this, because with a coarse blade the plywood tends to rip and a very rough edge results. A piece of expanded aluminium 11in. × 6½in. is fitted in position for the speaker fret and is secured by ⅛in. screws at 3in. intervals along its edge.

The next stage is to glue a piece of hardwood 12½in. × 2½in. × ¾in. on the top of the cabinet in the position as shown in Fig. 4 to give a firm mounting for the speaker, the top of which is screwed to this wood. From the centre of a piece of hardboard 14in. × 7¼in. an ellipse is cut to match the cone of the speaker. The piece remaining becomes the speaker baffle and is fitted in the position as shown in Fig. 4. It should be a very tight fit. When in position, glue is applied liberally all round the edges, thus bonding it firmly to the sides, top and bottom of the cabinet. The motor-board runners are then fitted, being two pieces of ½in. × ½in. block, 12in. long glued and pinned in position.

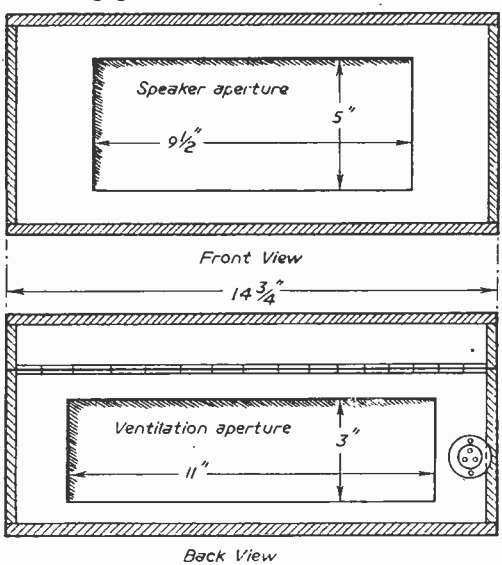


Fig. 3.—Details of the speaker and ventilation apertures.

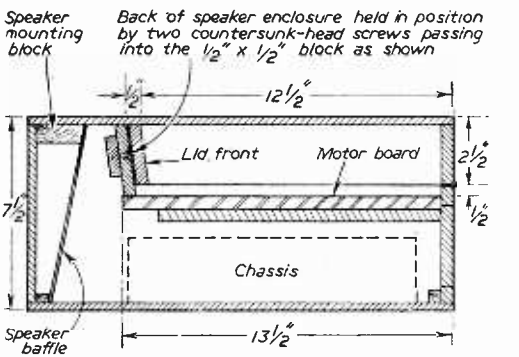


Fig. 4.—Longitudinal cross-section of the cabinet showing full details of the construction.

Covering

The cabinet is now ready for covering, and by far the best material to use for this purpose is rexine. This gives a very attractive appearance and is quite durable. Scotch glue applied hot is the best method of fixing to use. When the covering has been completed it should be left for at least 24 hours in a warm atmosphere to dry out completely.

Finishing

The cabinet is now completed and it only remains to fit a handle, the remaining two pieces of expanded aluminium, four rubber feet and the mains input socket. When these have been fitted the amplifier, speaker and transformers may be screwed in position.

Note.—The tweeter is fastened on to the speaker fret by means of two pieces of enamelled copper wire which are doubled over, passed through the holes in the expanded aluminium and then twisted together on the back of the insert, thus tightening it up against the aluminium. The lead to the tweeter is a short length of twin screened wire which is taken via a small hole in the hardboard baffle to the output transformer.

LIST OF MATERIALS REQUIRED

2 pieces ½in. ply, 14½in. 17½in. (Top and bottom).
2 pieces ¾in. ply, 17½in. 7in. (Sides).
1 piece ¾in. ply, 14in. 7in. (Front).
1 piece Parana pine, 14in. 7in. ⅛in. (Back).
1 piece hardwood, 12½in. 2½in. ¾in. (Speaker mounting).
1 piece ⅛in. hardboard, 14in. 7½in. (Speaker baffle).
1 piece ¾in. ply, 14in. 2½in. (Lid front).
1 piece ¾in. ply, 14in. 2¾in. (Back of speaker enclosure).
2 pieces ½in. block, 12in. long (Motor-board runners).
Lengths of ½in. block for reinforcing the corners where the joins are made and for securing the back of the speaker enclosure.
2 yds. of 36in. wide rexine.
1 recessed three-pin mains socket with plug (Bulgin).
1 sheet of expanded aluminium 24in. × 12in.
1 piece ½in. ply, 13½in. 14in. (Motor-board).
rubber feet, 2 lid fasteners, 1 handle, 1 lid stay and 1 14in. length of piano hinge.

Motor Unit

The unit that was used in the original player is the Garrard model 4SP, and nothing need be said of the excellence of this unit which has the added advantage of being fully tropicalised. This has proved to be a great asset in the player because, as stated previously, considerable heat is generated by the output and rectifying valves, and a unit which has not been treated thus may give trouble after a short period of time.

When the motor-board has been screwed in place, a lid stay is all that is required to make a really professional job of the player.

(*Continued from page* 699)

switch, one pole being retained for the pre-sets. Only one M.W. coil is then necessary.

Amplifier Connections

With battery-operated amplifiers, or A.C. amplifiers drawing both H.T. and heater current from a transformer, the earth lead in Fig. 2 is connected to the amplifier chassis (or input socket internally wired to the chassis). The output lead in Fig. 2 is taken to the grid input socket of the amplifier. A short, direct lead is necessary, especially with mains equipment, or hum and instability may arise. If so, then this lead requires screening, the braiding being bonded to the chassis.

Modulation hum sometimes proves troublesome. If it is present, an improvement may be obtained by wiring a .05 μF. 750 v. condenser in parallel with the mains, at the amplifier, or from each main to earth. If not, the modulation hum filter shown in Fig. 4 is effective when the trouble arises from mains-frequency induction or power-leak into the aerial. The H.F. choke should be of good quality, preferably screened, and of dual-wave type. A 10K resistor may be used instead if the trouble is only slight.

Modulation hum rises in volume when a station is tuned in, and may thus be distinguished from general hum, which may arise from A.C. induction into the output circuit of the tuner. With the latter, the hum level remains unchanged with aerial disconnected or no station tuned in.

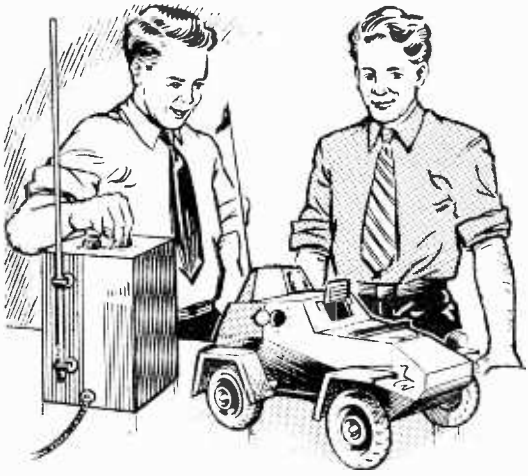
With A.C./D.C. amplifiers, or A.C. amplifiers deriving H.T. directly from the mains, the isolating circuit in Fig. 5 must be used, unless isolating condensers are already present in the amplifier. These condensers should be right up at the amplifier input sockets. It is not wise to rely on the .1 μF condenser in the tuner, to isolate this side of the circuit; as the tag and one lead of the condenser will then be "alive" to the mains. With equipment of A.C. D.C. type, the chassis side of the circuit should be taken to the low-potential ("earthed") main, as this offers maximum safety and freedom from modulation hum.

The pre-sets are adjusted to the desired stations. Any change to the aerial or earth system will make re-trimming necessary.

Mains Model-Control Transmitter

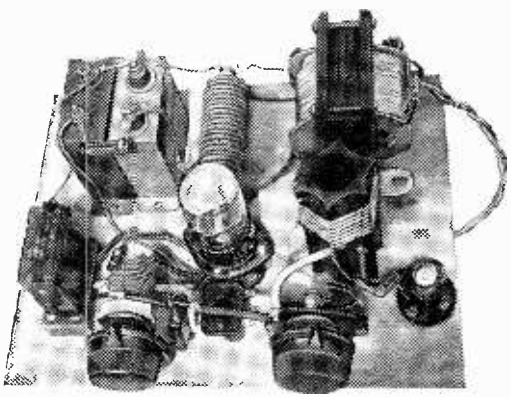
SUITABLE FOR USE INDOORS AS WELL AS OUT-OF-DOORS

By F G. Rayer



THIS equipment serves several purposes and is mains operated to avoid the need for batteries. The output is sufficient to control a model at short range. so that it can be employed indoors. when setting up and testing such equipment. It is also suitable for short-range control of a model out-of-doors. when mains are available. as when near a house. It is crystal-controlled. as this overcomes the difficulty associated with getting a home-built transmitter in the specified band. As access to a correctly tuned transmitter or wavemeter is not necessary. this makes it ideal for a constructor working alone. If made as described. it is quite impossible to make the equipment radiate outside the band. If tuning is incorrect. it ceases to operate

The output can thus be used to calibrate a wavemeter. which can afterwards be employed to get any model-control transmitter of the usual tunable type on to the correct frequency. In addition. the output can be taken by a link winding to a further power-output stage. thus giving a full-power. crystal-controlled signal ideal for operating models in the garden. or where mains are available.



Top view of the transmitter.

The Circuit

The circuit is shown in Fig. 1 and is very straightforward. A single 6SN7/GT serves as oscillator upon the fundamental crystal frequency. and frequency-multiplier. The cathode circuit is interrupted for keying. to control the model. or to insert a meter to set up the oscillator initially. It is. however. possible to get it operating without a meter. For low power. a 125 v. H.T. secondary is sufficient. and this will enable some types of eliminator transformer to be used. This voltage avoids any danger of severe shocks from the H.T. circuit. For more output, up to 250 v. can

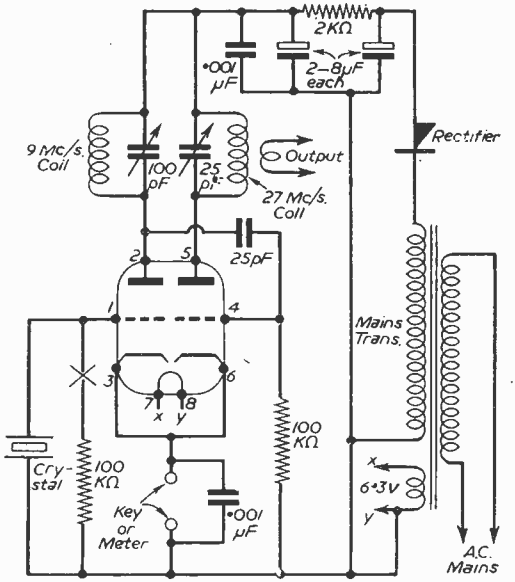


Fig. 1.—The theoretical circuit.

be used. obtained from any small mains transformer. Output will also be slightly increased if a short-wave H.F. choke is added at the point marked "X." in series with the 100 K. resistor. These considerations only arise when the oscillator is used out-of-doors. for controlling a model. and some increase in output is wanted. It is not desirable to derive H.T. directly from the mains. as this does not make possible isolation from the mains supply. as with a transformer with H.T. secondary. If a 250/0/250 v. transformer is used. one 250 v. tag is taken to rectifier negative and the second 250 v. tag is left discon-

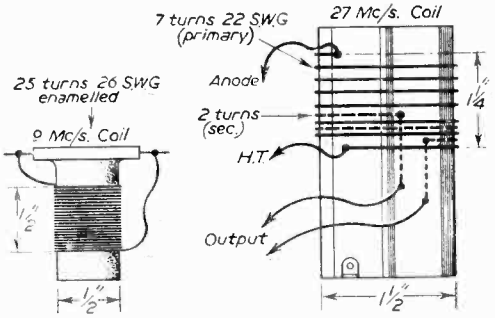


Fig. 2.—Winding details of the coils.

nected, the centre-tap going to the H.T. negative line.

A 9 Mc/s crystal is used, but a 6.75 Mc/s one, with frequency-multiplying by 4, could be used, if to hand. A 13.5 Mc/s crystal, with doubling, would also provide a 27 Mc/s output. If such crystals are used, the first anode coil must be wound to suit. The coil described for this position is for 9 Mc/s only and cannot be tuned to harmonics of this frequency. For this reason winding details should be followed correctly. With fewer turns, and condenser open, the crystal (if active) may oscillate with the anode circuit tuned to 18 Mc/s, with the danger that the final circuit may be tuned to 36 Mc/s. This is impossible if the coils are made as shown.

The two 100 K resistors should be of ½-watt rating, and the 25 pF condenser of mica type. The value of the smoothing condensers is not important, while the small H.F. by-pass condenser can be .0005 μF to .1 μF. The half-wave metal rectifier can be of any current rating over 20 mA, and of 125 v. or 250 v. type. Or a 250 v. rectifier can be used with either 125 v. or 250 v. H.T. winding.

Coil Windings

Fig. 2 makes these clear. The lower-frequency winding has turns side by side, and the ends may be secured with wax or cotton. The coil should not be varnished, painted or dipped in wax. Small formers of this diameter are readily available. The coil is air-cored. If a dust core is present in the former, it must be removed.

The second coil is fairly large, as this gives more R.F. output than very small coils. The former is 1½in. over the ribs and notched approximately six turns to the inch. Bare or enamelled wire is satisfactory for the seven turn winding. The two-turn loop should be of cotton-covered wire (about 24 s.w.g.) to avoid any

(Continued on page 707)

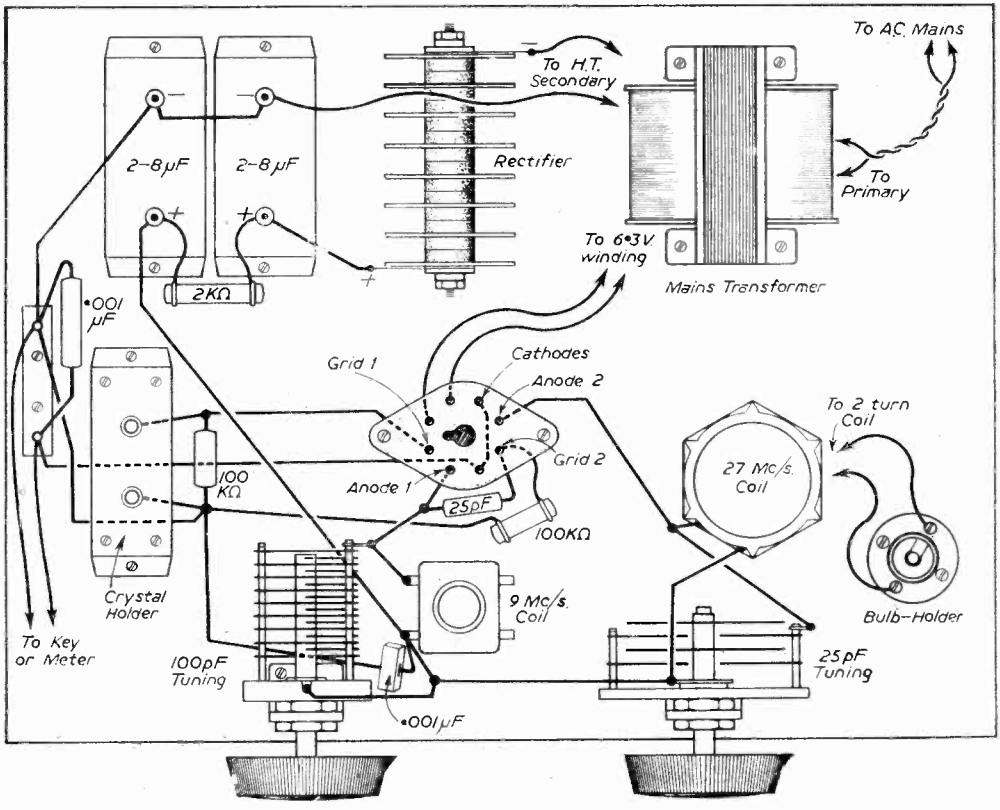


Fig. 3.—The wiring plan.

possible short to the H.T. circuit. Ends are left long enough to reach the various connecting points.

Construction

In the present instance a baseboard simplifies work, and 7in. × 9in. × ⅜in. thick is satisfactory. Long screws and spacing pieces about 1in. long support the valveholder. All wiring is shown in Fig. 3. If connections for a 6SN7/GT are looked up elsewhere it must be noted these will be for the underside of the holder, and therefore opposite to those in the diagram. Lengths of wire may be soldered to the tags before fitting the valveholder.

No mains on/off switch is provided. If wanted, a suitable one may be included in the mains flex. One heater secondary tag is wired to the H.T. negative line at the transformer: e.g., to one end of the H.T. secondary. (Or to "0." with a 250/0/250 v. secondary.) If a 250 v. H.T. supply is provided, the usual care should be taken to avoid shocks, and bare parts must not

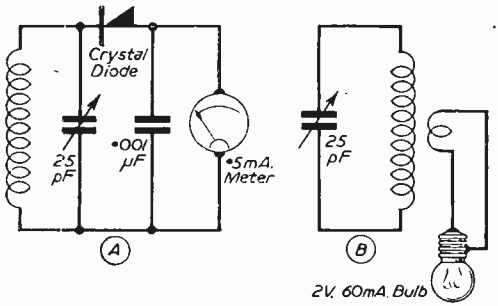


Fig. 4.—Wavemeter circuits.

be touched. The key is in the H.T. negative circuit for maximum safety.

For use as a frequency oscillator, no aerial is wanted, and the output loop is taken to a bulb holder, as in Fig. 3. A .06 amp. bulb is inserted. These are obtainable, in 6 v. rating, for cycle-dynamo rear lights, and this will do for 125 v. or 250 v. H.T. A .06 A. 2 v. battery-set dial-light bulb may be used for 125 v. H.T., but may blow with a 250 v. supply. An ordinary torch bulb is not satisfactory.

A meter reading up to about 10 mA is included by wiring to the tags shown, if 125 v. H.T. is used. For 250 v. H.T., a 20 or 25 mA meter is necessary. When the valve has gained operating temperature, the 100pF condenser is rotated until the meter reading falls, showing oscillation has begun. The 25pF condenser is then tuned for maximum brilliance of the bulb. The meter can then be removed, the tags being shorted with wire if a key is not employed. Greatest output is that giving maximum brilliance, and both condensers can be carefully adjusted for this.

Wavemeter Circuits

Two wavemeter circuits are shown in Fig. 4, and either can be calibrated, then used to adjust tunable transmitters. That at "A" can be placed near the oscillator and tuned until the meter shows maximum deflection. The dial or pointer reading is then noted, being the 27 Mc/s setting. The coil can be 13 turns of 20 s.w.g. bare wire, 1¼in. long and 1in. in diameter, self-supporting, or 11 turns on a 1in. diameter ribbed former can be used. Once the wavemeter is calibrated it must not be modified, or calibration will be lost. To set a tunable transmitter on frequency, the wavemeter dial is adjusted to the correct reading and the transmitter is tuned until the meter shows maximum output.

The type at "B" uses a low-current bulb as indicator. The bulb in the oscillator holder should be removed, and the wavemeter coil held in line with the 7-turn oscillator coil, an inch or so away. The wavemeter is then tuned for maximum brilliance, the coil being moved away a little from the oscillator coil, as necessary, so that the bulb is extinguished immediately the wavemeter is tuned off resonance. To use this type of wavemeter for adjusting a tunable transmitter, it is held near the tank coil, and the transmitter is tuned for maximum brilliance. If the tank coil cannot be reached, a loop of one or two turns should be made in the lead from transmitter to aerial and the wavemeter held near this.

The importance of keeping model-control transmitters inside the permitted band cannot be emphasised too strongly, as the harmonics from a wrongly-tuned transmitter can cause interference to TV receivers over a wide area.

In the event of a rather low H.T. voltage being used, with an inactive crystal, oscillation may not arise at all, so that the cathode current does not dip. A poor crystal of this kind may be made to oscillate by including the H.F. choke mentioned and increasing the H.T. voltage. An average crystal will oscillate with 100 v. H.T. or less and no choke. If the unit is employed to control a model, one end of the loop winding is taken to H.T. negative, and the other to the aerial. Indoors, an 18in. aerial should be ample, but it can be increased to 8ft. or so out-of-doors.

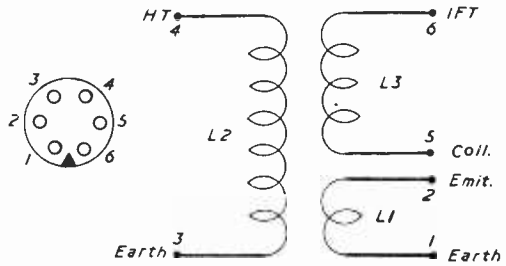
If the oscillator is used as an exciter for a full-power transmitter, the loop is taken to a twin-flex feeder, which terminates in a similar loop, inductively coupled to the tuned circuit of the amplifier grid. The length of this feeder (within reason) is of no importance. Back-coupling between final tank circuit and the oscillator must be avoided, however, or oscillation may persist at frequencies other than 27 Mc/s. With such a power-output stage, the H.T. voltage, or other ratings, must be adjusted so that the maximum permitted power is not exceeded.

If any modification, such as changing the aerial, or removing the indicator bulb, is made, then the final tuned circuit of the oscillator should be adjusted to compensate for this. In all cases adjustment is for maximum output, as shown by wavemeters such as those in Fig. 4. Alternatively, two turns of 20 s.w.g. or similar wire may be wound about 1in. in diameter, and the ends soldered to a .06 amp. bulb. The loop is then held a few inches from the final coil, and the 25pF condenser adjusted for maximum brilliance of the bulb.

A Six Transistor 2-Wave Pocket Superhet

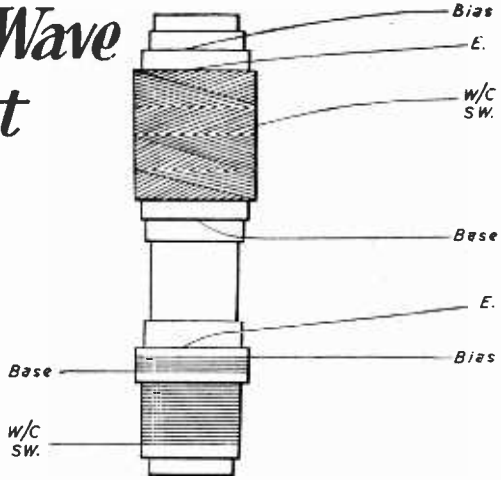
WITH reference to the receiver published under the above title in our August issue, the author specified an oscillator coil which was designed for use with the Plessey W condenser, whereas the circuit specified the use of the Jackson "00" tuning capacitor. The Wireless Telephone Company, Ltd., Hallamgate Works, Crookes Road, Sheffield, 10, designed a new oscillator coil, specifically to work with the Jackson "00" gang, and we feel that this will prove more satisfactory. This change of oscillator coils will necessitate a change in the values of certain capacitors and resistors when using oscillator coil W.T.499 as detailed below:

C7	200 pf close tolerance
C8	220 pf
CN2	18 pf
RN2	3.3 K



Oscillator coil.

The author of the article intended, with the long-wave aerial coils, AE1, that an aerial coil should be supplied so that the constructor can fit it on to a Ferrite slab supplied by Repanco Ltd. The Wireless Telephone Company Ltd. state that they are unwilling to supply aerial coils in this way, as for optimum performance it is necessary for the coil to be matched to the particular Ferrite slab on which it will be used. They have therefore designed a complete L.W./M.W. Ferrite aerial coil assembly on a 4in × $\frac{5}{8}$in × $\frac{1}{8}$in. Ferrite slab which has been matched to the Jackson "00" gang. Appended are details of



Ferrite aerial coil assembly.

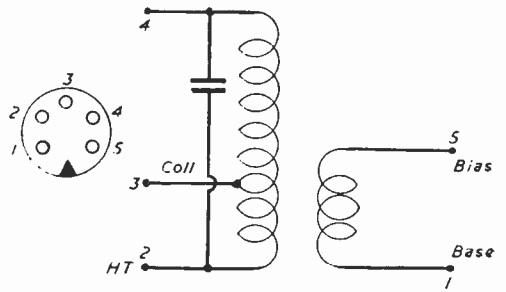
components supplied by the company named for the six-transistor two-wave band pocket receiver:

Ferrite Aerial Coil Assembly. Part No. W.T.500.
For operation with Jackson "00" gang condenser.
Frequency coverage: Long wave 150-300 kc/s: medium wave 545-1,580 kc/s.
Size: 4in. long × $\frac{5}{8}$in. wide × $\frac{1}{8}$in. thick.
Price: 12s. 6d. each, including postage and packing.

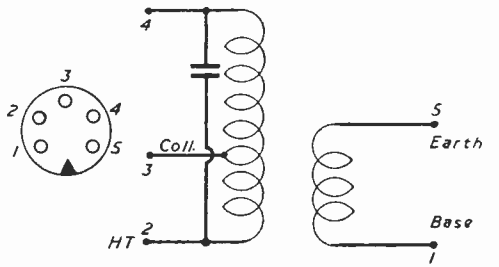
Oscillator Coil. Part No. W.T.499.
For operation with Jackson "00" gang condenser.
Colour code: Yellow.
Size: $\frac{5}{8}$in. diameter, unscreened.
Price: 8s. each, including postage and packing.

1st and 2nd I.F. Transformer. Part No. W.T.501. (2 off required).
I.F.: 470 kc/s-480 kc/s.
Colour code: White.
Price: 8s. each, including postage and packing.

3rd I.F. Transformer. Part No. W.T.502.
I.F.: 470 kc/s-480 kc/s.
Colour code: Blue.
Price: 8s. each, including postage and packing.
Terms: Cash with order. Trade enquiries for quantities invited.



1st and 2nd I. F. transformer.



3rd I. F. transformer.

Tracking the Superhet

THE FINAL STAGE IN BUILDING A RECEIVER

By G. J. Gordon

THE chief difference between a superhet receiver and T.R.F. receiver lies in the fact that the superhet employs a signal generator whose frequency is varied in step with the signal-frequency circuits as the tuning control is rotated over the band. The signal generator

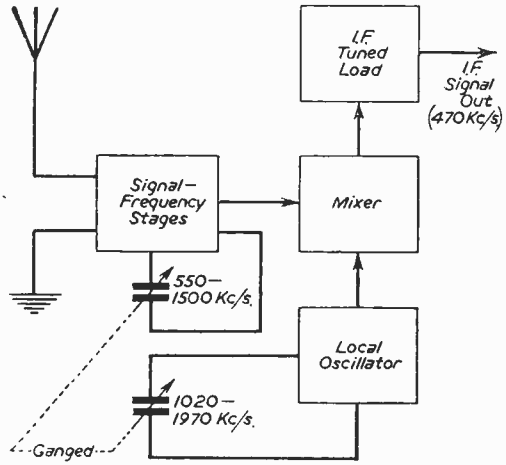


Fig. 1.—Block diagram of the frequency-changer section of a superhet receiver, showing the range of frequencies to be covered by the signal-frequency and oscillator circuits.

is known as the local oscillator, and the signal which it produces is fed to a mixer stage along with the required signal picked up by the aerial system. The two signals thus become intermodulated, or mixed, and present at the output of the mixer are not only the oscillator signal at frequency f_o and the signal at frequency f_s, but also signals at the sum and difference frequencies ($f_s + f_s$) and ($f_o - f_s$). It is the signal at one of these frequencies which is selected by the tuned load of the mixer and applied to subsequent stages for further amplification.

The sum or difference frequency selected is known as the intermediate frequency (I.F.) and the amplifiers which serve to increase the strength of the I.F. signal are known as intermediate frequency amplifiers.

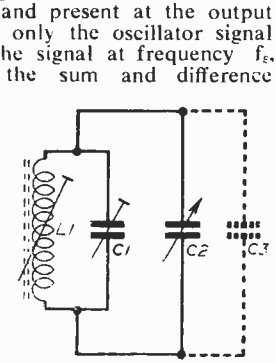


Fig. 2.—A simple tuned circuit, in which C1 is the trimmer, C2 the tuning capacitor and C3 the representative stray capacitances.

The I.F. signal eventually ends up at the detector stage where it is demodulated in the normal way so as to extract the audio-frequency (A.F.) content.

The intermediate-frequency remains constant irrespective of the setting of the receiver's tuning control, which means, of course, that the I.F. amplifier stages can be spot tuned to one particular frequency—470 kc/s being the I.F. selected on most modern A.M. equipment, while 10.7 Mc/s represents the I.F. of almost all F.M. receivers of current design.

Oscillator Ganging

As an example, the oscillator circuit of a receiver whose signal-frequency circuits tune over the range of 550-1,500 kc/s will tune over the range of 1,020-1,970 kc/s—thus maintaining the 470 kc/s I.F. difference over the whole band. The I.F. is in this case equal to $f_o - f_s$. The block diagram in Fig. 1 will provide a quick understanding of the process.

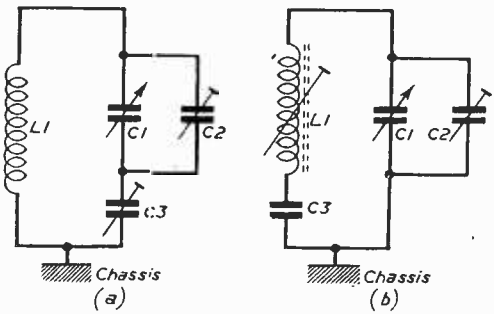


Fig. 3.—Two methods of padding the oscillator. In both cases C3 is the padding capacitor, but is adjustable in (a) and critically valued at (b). In the latter case adjustment is made by the dust-iron core in the oscillator coil.

While it is a relatively simple matter to arrange the tuned circuits of the signal and oscillator stages so that the I.F. difference is secured at one particular frequency, it is far more difficult to arrange for this difference in frequency to be maintained at all points on the tuning dial. It will be understood, of course, that the tuning capacitor associated with the signal-frequency circuits is ganged to the capacitor section which serves to tune the oscillator. If R.F. stages are incorporated, then there is an additional variable capacitor section which is also ganged to the other two sections. In this case, however, it is not unduly difficult to keep the two sections concerned with the signal-frequency in step since the range of frequencies covered is the same for both circuits.

Tracking of the oscillator tuning was at one time accomplished by the oscillator tuning capacitor having a value lower than the other signal-frequency sections, and having a capacitance variation law with respect to the other sections which ensured the two frequencies being held apart reasonably constantly over the whole band.

The idea now, however, is to employ a tuning gang having sections of identical value and law, and maintaining the difference in tuned frequency by the inclusion of a fixed or pre-set capacitor in the oscillator tuning circuit. This arrangement is known as padding, and will be found to be adopted in most of the receivers the service technician and experimenter are called upon to handle.

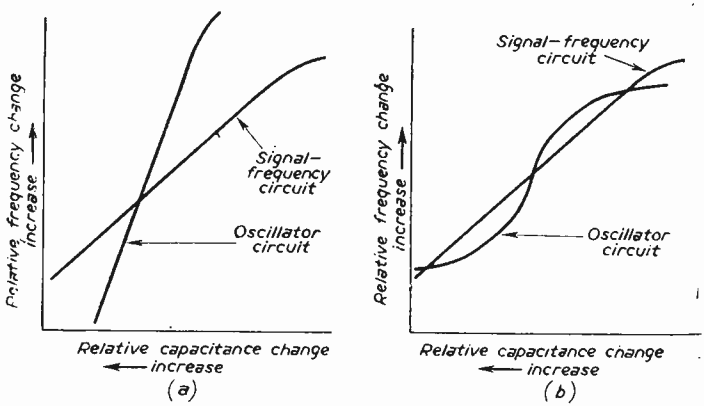


Fig. 4.—Tracking error without padding (a) and with padding (b).

The Need for Padding

Before we delve too deeply into the practical aspect of padding, let us briefly investigate the theoretical implications. In Fig. 2 is shown a simple tuned circuit which may well be found in the signal-frequency stage of any broadcast receiver. L1 is the aerial or R.F. coil, C1 the associated trimmer and C2 the variable capacitor (the signal-frequency section of the tuning gang). The capacitance C3 shown in broken-line is meant to represent the combined stray and circuit capacitances which are inevitably present in all circuits.

Let us imagine that L1 and C1 are adjusted in relation to C3 so that rotation of the tuning capacitor C2 from minimum to maximum capacitance changes the tuned frequency from 1,500 to 500 kc/s (200 to 600 metres), as would be the case on a receiver tuned to the medium-wave band. Then suppose that we have another tuned circuit of identical make-up, even to the extent of the stray capacitances C3. As would be expected, if the tuning capacitors of the two circuits are ganged and controlled from a common spindle the frequency will change perfectly in step at both circuits with rotation of the spindle.

Unfortunately, this ideal representation of tracking is rarely obtained in practice owing to the virtual impossibility of securing like values for C3. With two signal-frequency circuits, however, the coils, trimmers and tuning capacitors can be accurately matched and the stray capacitances can be kept near enough the same to avoid large tracking errors, but there are real problems involved when it comes to ganged oscillator and signal-frequency circuits.

Difference in Inductance

Apart from the considerable difference between the stray capacitances in the signal-frequency and oscillator circuits, which we will investigate in more detail later, the higher oscillator frequency is secured by the use of an inductance of smaller value than that used in the signal-frequency stage. This upsets the balance completely as would well be imagined.

The actual change in capacitance across the *tuning coil* (oscillator or signal-frequency) as the tuning gang is rotated from one end to the other may be in the region of 4 : 1, as would be achieved, for instance, by a fixed value of 80 pF across the coil made up of strays and the trimmer and a tuning capacitor with a value of 20-400 pF. It should be noted that when the gang is set for minimum capacitance, this is never zero capacitance.

An important point is that the change in frequency is equal to the square-root of the change in capacitance across the *tuning coil*. Thus, with a capacitance change in the ratio of 4 :1 the frequency will double from that value obtained with the gang at maximum capacitance when it is adjusted to minimum capacitance.

As this reasoning applies equally to both the signal-frequency and oscillator tuned circuits, it will be realised that the I.F. difference between them can be secured only at one particular setting on the dial. For example, if the circuit constants are selected and adjusted so that the 470 kc/s difference is accurate at the low-frequency end of the dial with the signal-frequency at, say, 500 kc/s and the oscillator frequency at 970 kc/s, at the high-frequency end of the dial the signal frequency will increase to 1,000 kc/s and the oscillator frequency to 1,940 kc/s, giving a tracking error of 470 kc/s at this end of the band. The error increases progressively, of course, from the low-frequency to the high-frequency end of the band.

Difference in Capacitance

The change in capacitance as seen by the tuning coils when the tuning gang is rotated is, as we have seen, considerably influenced by the value of the circuit strays and the trimmer across the coil. We have seen that if the tuning gang increases to a maximum of 400 pF, a capacitance change of 4:1 and a frequency change of 2:1 are obtained when the gang is swung from one side to the other and when the fixed mini-

mum value of capacitance across the coil is 100 pF.

If the fixed minimum value of capacitance as seen by the coil with the gang at minimum capacitance is 25 pF, as may be accomplished by careful wiring so as to keep the value of C3 (Fig. 2) as low as possible, and the gang increases to a maximum of 400 pF, as in the former case, then a capacitance change of 16:1 and a frequency change of 4:1 will be secured by rotating the gang over its range.

In the first case the circuit may tune from 500 to 1,000 kc/s (2:1 frequency change), and in the second case from 500 to 2,000 kc/s (4:1 frequency change). This remarkable difference in frequency coverage arising simply from a reduction of the stray capacitances—experimenters please note! Obviously, two such circuits could not be ganged successfully.

Padding in Practice

The effect of the stray capacitances can be neutralised so that the range of one circuit can be balanced with respect to that of another and, in the case of a superhet, so that the I.F. difference between the oscillator and signal-frequency circuits can be secured over the band, simply by the inclusion of a padding capacitor in *series* with the tuning capacitor or coil.

The idea is illustrated in Fig. 3. At (a) the padding capacitor C3 is interposed in series with the tuning capacitor C1 and the trimmer C2, while at (b) the padding capacitor C3 is included in series with the coil. Both methods are adopted in practice, and while a trimmer is often used as a padding capacitor in the arrangement at (a), a critically valued fixed capacitor is invariably adopted in the arrangement at (b), and the padding adjustment being made in this case by adjusting the inductance of the coil by means of a dust-iron core.

At the high-frequency end of the band the value of the padding capacitor is large in comparison with C1 and C2 so its presence tends very little to modify the total capacitance of the circuit as seen by the coil, and it is at this end of the band that the trimmer C2 and stray capacitances, in relation with the inductance of L1, tune to the required frequency.

At the low-frequency end, however, the combined value made up of strays, C1 and C2 is too large to tune to the frequency for accurate tracking, but the presence of C3 in this case reduces the total capacitance as seen by the coil and so allows the oscillator circuit to tune as required to track reasonably well with the signal-frequency circuit.

The diagrams in Fig. 4 show at (a) how the tracking deviates relative to the centre of the band without padding and at (b) how the inclusion of a padding circuit modifies the tuning law of the oscillator circuit so as to bring it closer to that of the signal-frequency circuit. The lower portion of the oscillator circuit curve is bent towards the signal-frequency circuit curve by reason of the padding capacitor, while the bend at the other end of the curve is somewhat affected by the trimmer capacitor.

Adjustment

From the foregoing discussion the reader should now have a reasonable idea as to how the tuned circuit adjustments relating to the signal-frequency and oscillator circuits of a superhet receiver are accomplished in practice. The circuit in Fig. 5 gives the basic features of a frequency changer stage, in which L1 is the oscillator coil and L2 the aerial coil.

The receiver is tuned first to an alignment point at the high-frequency end of the band, that is with the tuning gang set towards minimum capacitance, and the oscillator trimmer C2 adjusted for maximum signal. The signal can be obtained either from a station of known frequency, such as Radio Luxembourg, or from a calibrated signal generator: frequency accuracy being essential in order to establish the correct frequency point on the receiver's tuning dial. The aerial trimmer C5 is then adjusted for maximum sensitivity (output) at the same frequency.

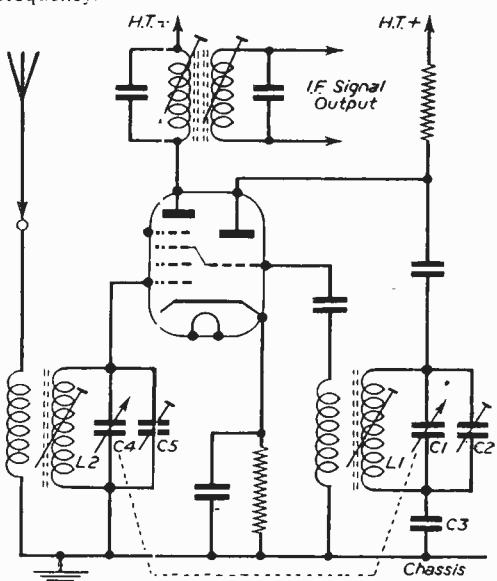


Fig. 5.—A basic frequency changer circuit.

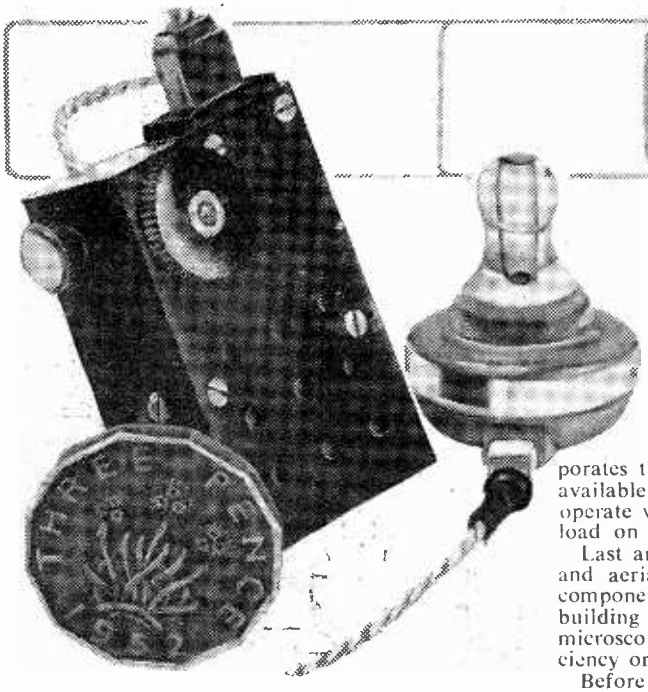
The receiver is next tuned to an alignment point at the low-frequency end of the band, and the core in the oscillator inductance adjusted for maximum output. It is next endeavoured to secure a further improvement in sensitivity at this frequency by adjusting the core in the aerial coil L2.

As each adjustment affects the other it is necessary to repeat the procedure a number of times, first at one end of the dial and then at the other, until the tracking error is as small as possible, it then being a function of the design of the circuits

Padding and trimming adjustments are incorporated for each band, but, for the sake of simplicity and to avoid the complication of band switching, the adjustments pertaining to a single band only are given in the circuit of Fig. 5.

The Mic

PROBABLY THE SMALLEST RECEIVER I
POCKET RECEIVER IS CAPA



THIS really midget receiver, measuring only 1⅜in. × ⅞in. × ⅜in., or rather less than half the size of a matchbox, has been made possible by the production of really midget components.

In this Lilliputian space is accommodated the 3-transistor, 4-stage, T.R.F. circuit using resistance capacity coupling. The power supply is one of the comparatively new mercury cells only 7/16in. in diameter and 3/16in. high. It should run the set for about 2½ months if used for an hour each day.

The set makes use of permeability tuning and, although designed for use with a deaf-aid earpiece, we found under test that it worked a small speaker at a comfortable volume. It can be built for about £4. It incorporates the sub-miniature transistors now readily available at a reasonable price and which operate well at low voltages and throw very little load on to the resistances and condensers.

Last and least in size comes the minute switch and aerial socket made by Fortiphone. These components, so often the stumbling blocks when building micro-receivers, have been reduced to microscopic dimensions without any loss of efficiency or robustness.

Before going any further it must be pointed out that this is not a suitable project for the average beginner, although those who have built small receivers before should have no trouble, so long as they follow the instructions carefully.

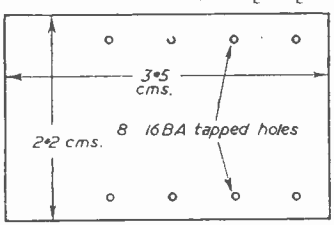


Fig. 2.—Base drilling details.

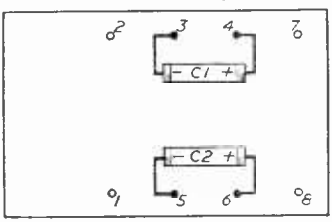


Fig. 3.—The condensers.

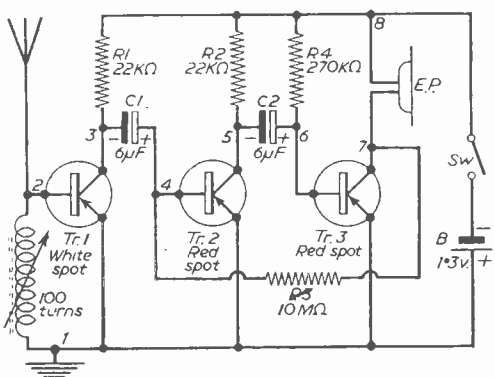
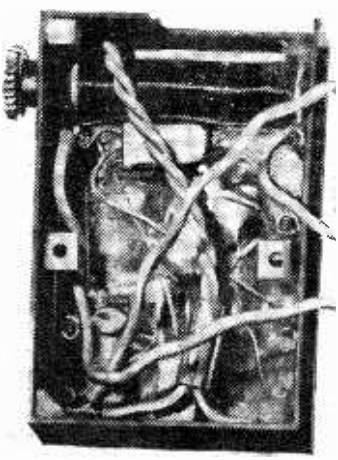


Fig. 1.—Showing the circuit diagram.

The Circuit

The circuit diagram is shown in Fig. 1. As is apparent it consists of three transistors and remarkably few auxiliary components. The set was designed using a minimum, and at first sight there seem to be several important ones missing. This,



Top view, showing

-Midget

THE WORLD, THIS AMAZING 3-TRANSISTOR
OF OPERATING A LOUDSPEAKER

however, is due to the use of so-called invisible components.

The signal, picked up by the short aerial, is tuned by the variable inductance L. This coil is designed to have sufficient self-capacity to make a tuning condenser unnecessary. The signal is fed from the coil directly into the first transistor, thus saving the space taken up by the usual coupling components. This transistor serves two purposes, first it demodulates the R.F. signal and then amplifies the resultant A.F. The amplified signal is then passed, via C1, to Tr2 for further A.F. amplification. This transistor receives its base bias via R3 which, being taken from the collector of Tr3, applies positive feedback. This considerably increases the gain, and saves using a fourth transistor. The bias for this transistor is also partly supplied by its own collector leakage. The A.F. is now resistance-capacity coupled into the output transistor Tr3 which is biased by R3. The output from Tr3 is directly coupled into a high impedance, hearing-aid type earpiece, thereby avoiding the space taken and the power losses of an output transformer. This earpiece is also of interest as it is very much smaller even than the usual hearing-aid type, and thus fits in well with the small scale of the rest of the receiver. If desired the usual size may be used or even 1 kilohm headphones, in which case slightly more volume will be obtained, but there is plenty to spare anyway.

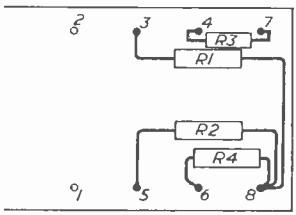


Fig. 4.—Resistance mountings.

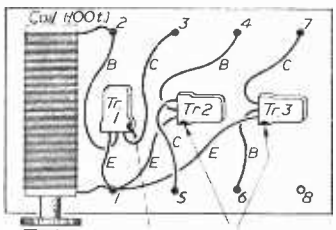


Fig. 5.—The transistors and coil.

Internal layout.

Construction

To make the constructional directions simple to follow, each connection point in the receiver has been given a number which is printed in both the circuit and wiring diagrams. It is a simple matter to refer from one to the other, and to check the wiring when it is completed.

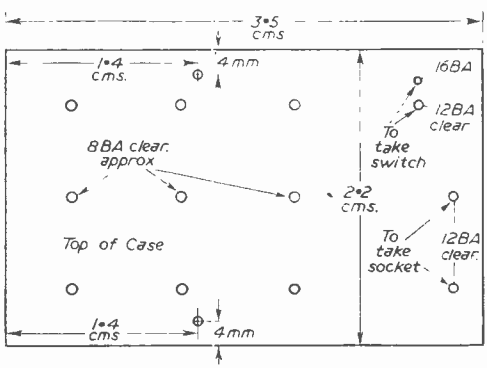
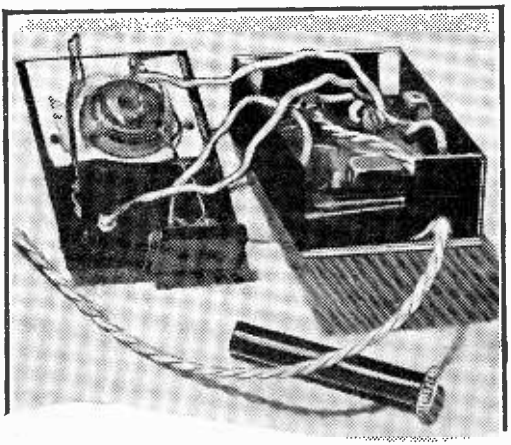


Fig. 6.—The top drilling details.



End view of receiver, showing the tuning rod removed from the coil.

The set is built upon a small piece of plywood, which also serves as the base of the case. The finest grade available should be used and should have a thickness of a sixteenth of an inch or less. The dimensions of this chassis are 3.5 × 2.2 cm. Using a 16 B.A. tapping bit, drill four holes on opposite rims as shown in Fig. 2. Now screw in the eight 16 B.A. ¼in. screws with a fine watchmaker's screwdriver. If the screws are held lightly with a pair of tweezers, this job is nothing like so hard at it may sound. To clarify the instructions, the wiring diagram has been split up into several stages, each stage showing how to wire in a different set of components, starting with the condensers. Do not deviate from this plan, as you will find trouble in placing all the components: further, more instability could result.

The wiring of the electrolytics is shown in Fig. 3. They must be connected round the correct way for the set to operate, the black tip indicates the negative end. Before proceeding any further, cover the condensers and their wires with a single layer of Sellotape. This will prevent short circuits when the other components are added and makes it unnecessary to use insulating sleeving.

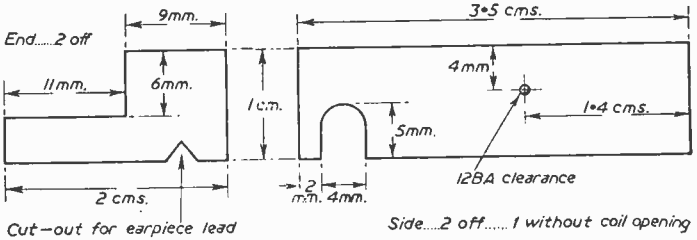
On top of this layer of Sellotape lay the resistances, winding the thin connecting wires tightly round the screws and trimming off the surplus with a pair of scissors or fine wire clippers. Ensure that the wires are wound tightly round the screws so that when the solder is added a good contact is made. The ideal tool for this is a pair of tweezers, preferably the type with long, thin tips. This last stage is shown in Fig. 4.

Another layer of Sellotape must now be added before the transistors are connected as in Fig. 5. Do not bend the leads from the transistors less than 2 mm. away from the transistor case as this can cause internal damage. A final layer of Sellotape should then be laid.

When the transistors are in place, the coil may be constructed and added. You will need a thin piece of ferrite rod or iron dust core approximately 9/10in. long. I used the core from a scrapped coil. Around this wind a couple of turns of paper and glue the ends together so that the rod will just slide in and out without slipping. Now wind on about 100 turns of wire side by side and cover with a layer of Sellotape or glue to keep the turns in place. If, having done this, the rod appears too loose, stick a piece of thin Sellotape on to it. To the end of the piece of ferrite is glued a wrist watch winding knob, this is the knob that is used for tuning the receiver. As is mentioned above, no tuning condenser is used as the coil has sufficient self capacity to tune itself.

The coil is now ready to be glued into its place beside the transistors as in Fig. 5. A good make of glue should be used as the coil may have to take a little strain.

The connections can now be soldered. Because of the mode of construction, this can all be done in one operation. A soldering iron with a very fine bit is required and several very good makes are now on the market. For the prototype one of the Litesold range was used. Wait until the iron has reached its maximum heat and make the joints as quickly as possible, covering each screw with a thin layer of solder. Do not let the top of the soldering iron too near the transistors themselves as this may result in permanent damage.



Figs. 7 and 8.—The end and sides of the case.

Your set is now ready for testing. Connect

COMPONENT LIST

C1—6 μf. 6 v.w. } G. W. Smiths Ltd., Lisle Street, London, W.C.2
C2—6 μf. 6 v.w. }

R1—22 kilohm } Hearing-aid types essential.
R2—22 kilohm } G. W. Smiths.
R3—10 megohm }
R4—270 K or 220 K }

L—See text.

Tr1—White spot } Almost any surplus suppliers.
Tr2—Red spot }
Tr3—Red spot }

Earpiece and cord—Either type T—600 ohms with Ph.14 plug and cord—Fortiphone (Subminiature) or Henry's Radio standard 1,000 ohm impedance earpiece with cord.

Switch : Two way Subminiature—Fortiphone.

Battery : Mallory Cell No. RM400 from P. C. Worth's, 1, Binny Street, Oxford Street, W.1.

The specified components must be used.

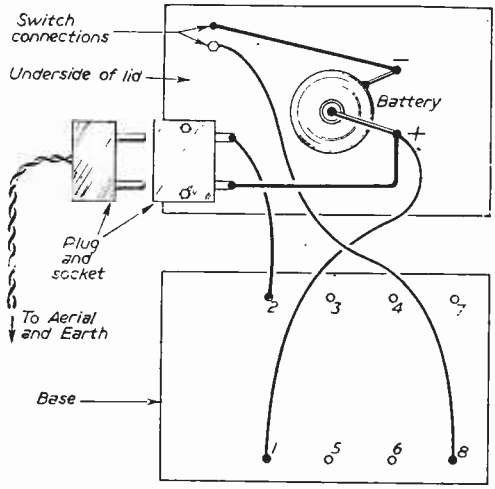


Fig. 9.—Wiring connections between the top and base.

an aerial to pin 2 and an earth to pin 1 and your headphones or earpiece to pins 7 and 8. An ordinary 1.5v. battery should be connected to pins 1 and 8, with the positive side to pin 1. Do not solder the battery as this will make it difficult to remove when the permanent battery is fixed in. With everything connected, move the rod slowly in and out of the coil until a signal is heard; if you hear nothing then either one of the components is faulty, or there is an error in the wiring. With a reasonable aerial you can expect a really strong signal from this set, despite its small size. In fact, when tested in the PRACTICAL WIRELESS office, it was found possible to drive an 8in. loudspeaker to a very good volume.

The Lid

The top of the cabinet and the sides are made from thin celluloid sheet. In the prototype 1/50in. thickness was used and was found quite strong enough. The celluloid may be painted any colour you like. The best finish is given by painting on the inside so that the colour shows through but cannot be scratched off. The dimensions and drilling of the lid are shown in Fig. 6. The two holes in the top right-hand corner are to take the switch, which is made by Fortiphone; below these are the holes for the aerial and earth socket, which is also made by Fortiphone under part number 14Bk/X/27CL. This socket is polarised, that is the two pins are of different diameter to prevent the plug from being inserted the wrong way round. In this application, however, the way in which the wires are connected to the socket is unimportant. The nine holes to the left of this are purely for decoration and their positioning is a matter of personal choice. They should be backed by a piece of coloured paper or material to give a professional finish. The switch and socket must now be fixed on to the case; the socket is bolted on by means of two 12 B.A. nuts and bolts and the switch is held in place by a single nut screwed into the centre spigot, which is also one of the two connecting points. As may be seen in the photograph showing the interior, the battery is also fixed to the lid. Two small plates should be made with insulating material on one side; these plates are connected to wires and are held to the opposite sides of the battery by a small clip made from steel wire. The whole assembly is Sellotaped to the lid.

The ends of the case are shown in Fig. 7. One end has no controls and is 2 cm. × 1 cm. high. The other end has a cut-out section to accommodate the switch and the dimensions for this are shown in the diagram. Fig. 8 shows how the sides are made: the rounded-off slot is to take the piece of ferrite and should be on one side only. The 12 B.A. clearance hole is to take a 12 B.A. braket, which can be seen in the photograph. I may either be ordered from a hardware shop or home-made. The purpose of this bracket is to hold the lid on to the rest of the case.

Before the walls of the case are glued into place, the connections from the lid to the chassis must be made. These are shown in Fig. 9 and are self-explanatory. This diagram also shows the aerial and earth plug and socket.

Now, using a strong, fast-drying glue, stick the sides of the case on to the base. The sides are reinforced and held in place by short lengths of matchstick glued into each corner. If the sides are now not level, true them up carefully with a piece of flour grade sandpaper.

Your receiver is now ready for use. Screw down the lid and test the set as before. If you wish to feed the set into a loudspeaker use a transformer with a primary resistance of 250 ohms and a turns ratio of approximately 9 : 1. This will correctly match the output from the set to the 3 ohm voice coil of the speaker.

You will find that in most areas the wireless requires no earth and only a few feet of aerial.

A "COLOUR" ORGAN

AN INSTRUMENT WHICH PROVIDES A COLOUR ACCOMPANIMENT TO MUSIC

By R. F. Johnson

A MINIATURE colour organ, which, when connected to a wireless receiver, translates sound into colour to produce an accompaniment of coloured lighting for any radio programme, is described here. Its built-in screen glows in dancing hues as pleasing to the eye as music is to the ear.

Automatic Circuit

The circuit is entirely automatic: the predominant pitch of the music alone determines the colour. Low notes bathe the screen with a deep red, the middle register shows in varying shades of green, while a brilliant blue responds to the high notes of the flute or violin.

With present-day receiver valves it is an easy matter to obtain sufficient audio-frequency power to light several miniature lamps. It only remains then to provide colour screens for the lamps and to connect them in a simple frequency network designed to separate the "tones" and feed the power to the proper lamps at the proper time.

Frequency Network

An examination of the circuit (Fig. 1) shows that the amplifier and power-supply connections are standard. The frequency network, shown at the right of the diagram, is the only unusual part of the entire circuit. It is fed through a standard speaker-coupling transformer (T2) designed to work into an impedance of 30 ohms.

Frequencies below 300 cycles are passed by the first section of the network, which consists of an inductance (L1) and a red lamp (B1) connected in series. The inductance, shown in cross-section in Fig. 2, is made by winding 1,500 turns of No. 34 silk-enamel wire on a paper tube ⅛in. in diameter, and 2½in. long. A laminated core made up of straight iron wires is placed in another tube that is a snug fit inside the coil form. By sliding the core in and out, the inductance of the coil may be varied between wide limits.

Series Resonant Circuit

Although the second section is a series resonant circuit peaked at 500 cycles, it is so designed that frequencies as low as 250 cycles and as high as 750 cycles are passed. The circuit consists of a four-microfarad paper condenser (C4), an inductance (L2), and a green lamp (B2), all connected in series. The condenser may have a

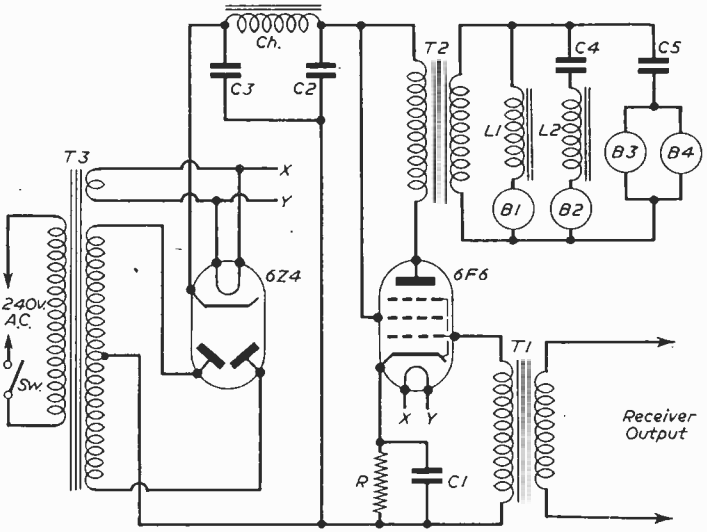


Fig. 1.—Circuit diagram for wiring the colour organ.

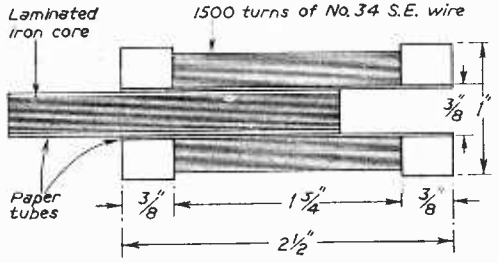


Fig. 2.—Details of network inductances (L1-L2).

LIST OF COMPONENTS

T1—Standard coupling transformer, 3 : 1 ratio.
T2—Speaker coupling transformer.
T3—Mains transformer, 325-0-325 100 mA., 6.3 v. 2.5 a.
C1—Tubular electrolytic condenser, 10 mfd., 50 v.
C2 and C3—Dual electrolytic condenser, 4 mfd.
C4—Paper condenser, 4 mfd.
C5—Paper condenser, 2 mfd.
CH—Filter choke, 30 henrys.
L1 and L2—Network inductances (see text).
R—Resistor, 500 ohm, 2 watt.
B1—Torch bulb, 3.2 volt.
B2, B3 and B4—Dial lamps, 6 volt.

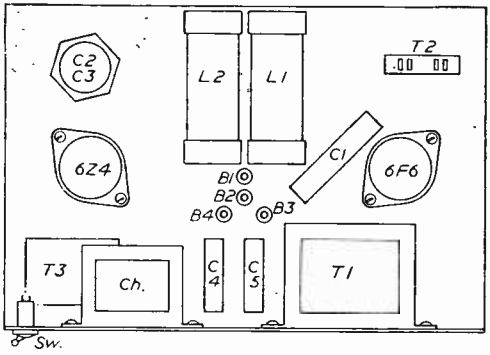


Fig. 3.—Underside of chassis showing disposition of components.

low-voltage rating, L2 is indentical with L1, B2 in the circuit is a 6-volt dial lamp.

The third network section passes only those frequencies above 600 cycles. It is made up of a two-microfarad condenser (C5), and two blue lamps (B3 and B4). These are 6-volt dial lamps connected in parallel. The use of two blue lamps is necessary to get a good balance of colour.

Due to the overlapping of the frequency ranges, notes between 250 and 300 cycles will cause both the red and green lamps to glow, while frequencies between 600 and 750 cycles will light the green as well as the blue bulbs. This blending gives the intermediate tone and mixtures.

Optical System

The optical system is extremely simple. It consists of a wedge-shaped sheet metal reflector (Fig. 5) and a rectangular translucent screen made of ground glass or tracing paper, housed together with the chassis in a small cabinet (measurements according to requirements). The lamp sockets are mounted on the chassis so that the bulbs themselves are at the rear of the reflector (Fig. 4).

The two blue lamps should be placed side by side at the extreme rear; the green and red lamps directly in front of the blue. The colour screens are made of coloured Perspex sheeting formed into small cylinders to fit over the lamps.

Although the placement of parts is not critical, the arrangement shown in Figs. 3 and 4 is suggested as the most convenient layout. The underside of the chassis shows clearly the construction and placement of the network inductances. The sockets placed immediately below these coils may be of the standard type used on illuminated dials, or may be taken from a string of Christmas tree lights.

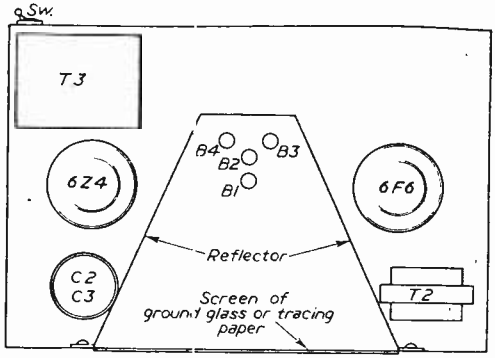


Fig. 4.—Top of chassis layout.

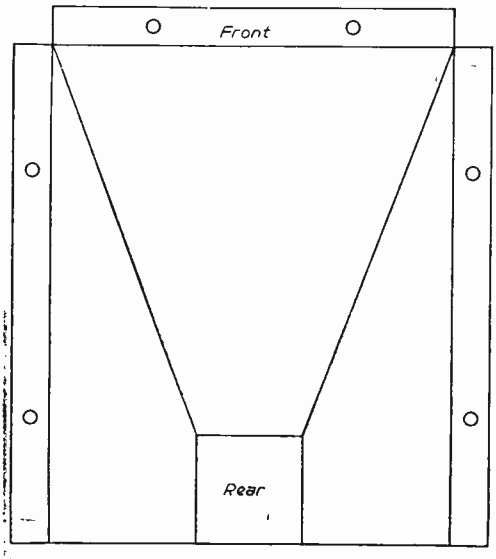


Fig. 5.—Details of reflector, measurements according to requirements.

Operation

In operation, the primary of the input transformer (T1) is connected across the primary of the speaker-coupling transformer of the receiver (in parallel with the speaker circuit). To adjust the network, decrease the receiver volume until the lamps glow at a little less than normal brilliancy. Then set the movable cores of the inductances so that the load appears to divide among the lamps according to the frequency of the signal. Bass notes should cause the red lamp to light up brightly, but should have little effect on the others. The average speaking range should cause the green light to grow strongly, while only high notes affect the blue lamps. No adjustment is provided for the latter: they will take care of themselves if the other two are adjusted properly.

If the network connections are made correctly and the constants given are followed, the average set builder should have little difficulty in adjusting the network. It is important, however, that the network specifications be followed to the letter. In experimenting with the completed organ, you will find that the best colour combinations are obtained from music of the classical or semi-classical type.

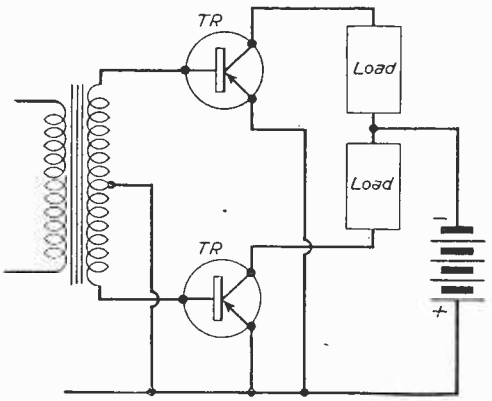
TRANSISTORS in Practice

No. 10.—"SINGLE-ENDED" PUSH-PULL CIRCUIT

By R. Hindle

(*Continued from page 450 of the August issue*)

IT has been seen in previous articles that the transistor is a comparatively low resistance device and consequently lower load resistances are needed than is the case with valves. The output transformer is always a nuisance in any design, adding to its cost and size and increasing the losses and distortion. The possibility of using speakers of conventional speech coil impedance with single output transistors was mentioned previously, but it was seen that these would be suitable only at output levels unlikely to be met with in ordinary battery receivers. It is unlikely that single output transistors will be used in practicable receiver designs because these would have to be operated in Class A, which is most wasteful of battery power. Class B will be used for the sake of economy and essentially push-pull operation is needed because, roughly speaking, one transistor is needed to handle each half-cycle of the signal.



Push-pull operation requires a collector to collector load of four times that needed for a single transistor (a transformer ratio of twice that for a single transistor) making it very high for a speaker speech coil to be wound to suit, and there is the additional complication that a centre-tap to the speech coil would be required.

Parallel connected transistors would reduce the load needed, but this would be equivalent to using a larger single transistor and, as before, Class A connection would be essential, thus again losing the advantage of the economy of Class B working. There would be difficulty in getting two transistors sufficiently nearly matched to need exactly the same conditions of working also, so each would be set up to give less than its maximum. What is wanted is a push-pull circuit so that Class B operation is practicable, but providing parallel output so that the benefits of a low load value can be derived.

Normal Push-pull Circuit

Fig. 1 gives the basic circuit normally used for push-pull operation. The trimmings of base bias and stabilising circuitry are omitted for the

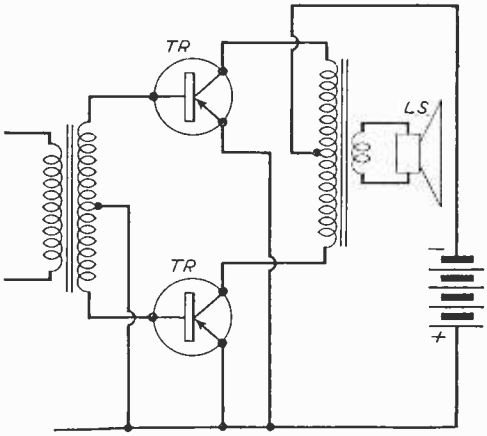
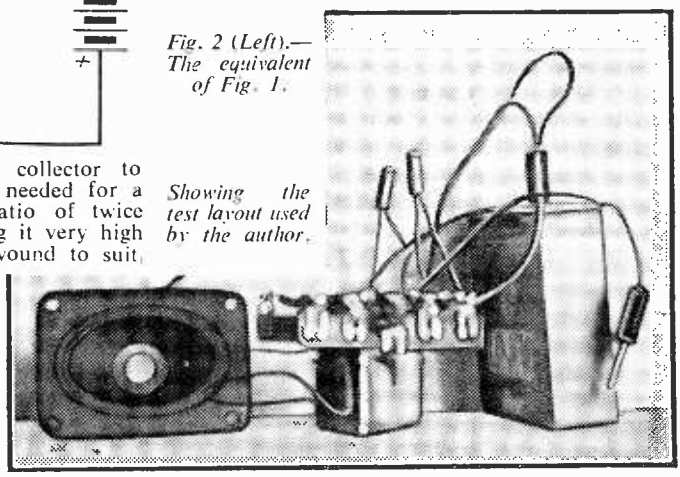


Fig. 1.—Basic circuit. Double-ended push-pull.

sake of simplicity, but it will be appreciated that the mode of operation, whether Class A or Class B, depends on the base bias provided. It will be noticed that the input signal to the two transistors is effectively in series, one signal being of opposite phase to that at the other collector. If Class A bias conditions are present each transistor accepts the whole of the signal and amplifies it: if Class B operation is set up each transistor takes only one-half of the input signal and

(*Continued on page 721*)

Fig. 2 (Left).—The equivalent of Fig. 1.



Showing the test layout used by the author.

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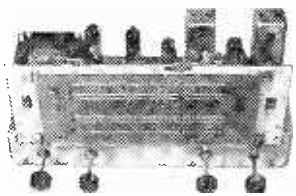

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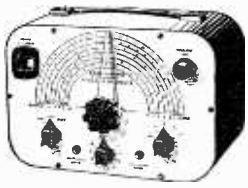

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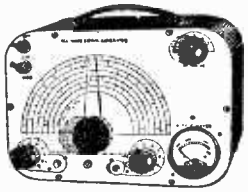
Coverage 100 Kc/s-100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Metal case 10in. x 6¼in. x 5¼in., grey hammer finish. Incorporating three miniature valves and Metal Rectifier. A.C. Mains 200/250 v. Internal Modulation of 400 c.p.s. to a depth of 30%; Modulated or unmodulated R.F. output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



25/- deposit plus P. & P. 3 - and 4 monthly payments of 21/6. Cash £4/19 6 plus P. & P. 5/-.

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

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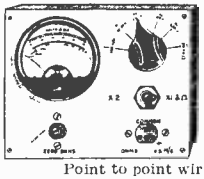

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1F1	8/6	6BW7	8/–	12K8GT	12/6	EBC41	10/–	NI9	8/–
1F3	7/6	6C10	9/–	12Q7GT	8/–	EBF80	9/6	PCC84	9/–
1FD1	8/6	6CH6	7/–	16A5	9/–	ECC81	8/6	PCF80	10/6
1FD9	7/6	6D2	6/9	25A6G	10/6	ECC82	7/6	PCF82	10/6
1L4	6/6	6F12	7/–	25L6GT	7/6	ECC83	8/6	PL38	22/6
1P1	9/–	6J5G	5/6	25Z4G	8/6	ECC84	10/6	PL82	9/–
1P10	7/6	6J5GT	6/6	35L6GT	9/–	ECF80	10/6	PY81	8/6
1P11	8/–	6J7GT	8/6	35W4	8/6	ECF82	10/6	PZ30	17/6
1R5	8/–	6K7G	5/6	35Z4GT	8/–	ECH42	10/–	U52	8/–
1S5	7/6	6L6G	10/6	5763	10/6	ECH81	8/–	U76	8/–
1T4	7/6	6Q7GT	8/6	D77	6/9	ECL80	13/6	U78	7/–
1U5	7/–	6SL7GT	7/6	DAF91	7/6	EF37A	9/–	UBC41	8/6
3A5	10/6	6SN7GT	8/–	DAF96	9/–	EF41	9/–	UCH42	10/–
3Q4	8/–	6V6G	7/6	DF91	7/6	EF80	8/6	UF41	8/6
3S4	7/6	6V6GT	7/6	DF96	8/6	EF91	7/–	UL41	10/–
3V4	8/–	6X4	7/–	DH76	8/–	EF92	5/6	UY41	7/6
5U4G	8/6	6X5GT	7/6	DH77	7/6	EL38	22/6	W76	8/–
5Z4G	9/6	7S7	8/6	DH142	8/6	EL41	10/–	W142	8/6
6AK6	6/6	8D3	7/–	DH150	10/–	EL84	9/6	X17	8/–
6AL5	6/9	12AH8	10/6	DK91	8/–	EY51	12/6	X18	9/6
6AM6	7/–	12AT6	8/6	DK96	9/–	EZ40	8/–	X142	10/6
6AT6	7/6	12AT7	8/6	DL92	7/6	EZ80	8/–	X150	10/–
6BA6	7/6	12AU7	7/6	DL94	8/–	EZ81	8/–	Z77	7/–
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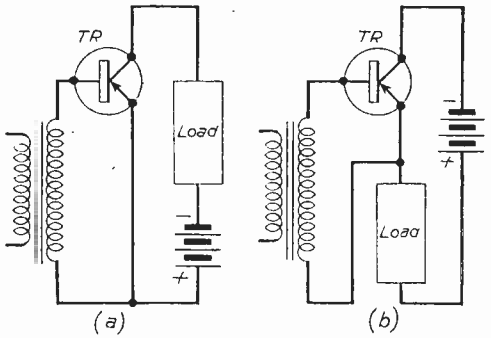


Fig. 3.—Alternative forms of single transistor output.

amplifies that. In both cases the signal is added in series in the output transformer, so that in the case of Class A the two signals augment each other, whereas in the Class B case each transistor subscribes one-half of the signal which combine in the output transformer to make up the complete signal.

Load Shown as Square Box

The transformer is required only to match the speaker impedance to the transistors in basic theory, though in practice it is used also to provide the centre-tap, and so it can be considered as replaced by two loads, as given in Fig. 2, the battery going to the centre-tap between the two loads. The load is shown as a square box because its nature is not important to the present issue. The needs for Class B, apart from the D.C. need for the appropriate bias current, are that the input signal should be presented to the two transistors in such a way that they can each select one-half cycle and the output circuit must be such that the two outputs from the transistors add in correct phase.

Fig. 3 gives two ways of drawing the same single transistor output stage. It does not really matter which side of the battery the load is placed; in both (a) and (b) the load and battery are in series and across the transistor from collector to emitter, whilst the input signal is across the transistor from base to emitter. Note that if the input went to the bottom of the load in (b), however, the circuits would not both operate in the same manner. In that case the output signal would be in series with the input signal giving the equivalent of a cathode follower circuit.

Two Versions Combined

At Fig. 4 the two versions given in Fig. 3 are combined, each being fed from a separate secondary on the same input transformer. Two separate batteries are shown, so that the two transistor circuits are quite independent except that they are fed from a common signal source. Now if the transformer secondary windings are connected in the correct phase the signal in the upper load from left to right will be in the correct phase to add to that appearing in the lower load also from left to right. This being so, there is no reason why the two loads should not be connected together as shown by dotted lines, so that the two loads become one as redrawn in Fig. 5. Looking at this now it will be seen that the conditions for push-pull are satisfied, in that signals of opposite phase are fed to the two transistors and a load in which the two output signals can be added is provided, but with the special result that a two terminal load instead of a centre-tapped load is needed. The price that has had to be paid for this advantage is that the input transformer must have two balanced secondary windings instead of a single centre-tapped winding and that two battery supplies (or a centre-tapped supply) are required, each of which must have a voltage equal to that required for the more conventional circuit. In other words, the input signal is still much as it was, but the output is in parallel and the power is supplied in series, whereas in Fig. 1 the outputs are in series and the power is fed in parallel. The doubling of the battery voltage in this way does not increase the actual power taken, of course, the battery now supplies only half as much current as before.

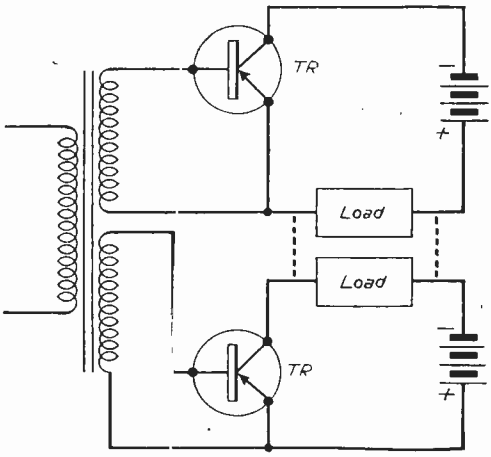


Fig. 4.—Combination of two forms in Fig. 3.

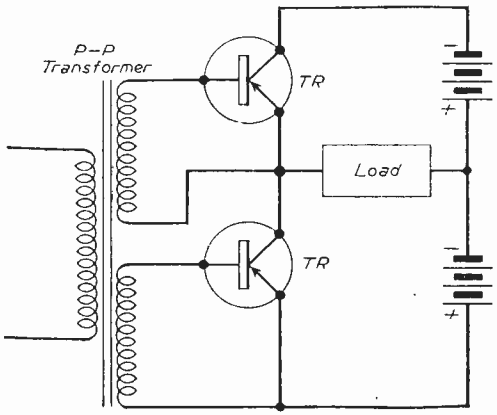


Fig. 5. Basic circuit. Single-ended push-pull.

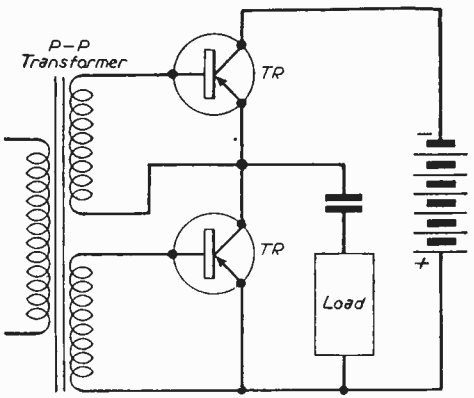


Fig. 6.—Alternative form of single-ended push-pull.

Centre-tapped Speech Coils

Centre-tapped speech coils can be provided on speakers, of course, but by eliminating the centre-tap the provision of suitable speakers has been made much easier. It remains to enquire about the resultant load conditions. Assuming Class B conditions it can be considered quite simply that when one transistor is working the other is cut off and vice versa. This is not strictly accurate because in practice it is found that such operation introduces "cross-over" distortion and so it is customary to bias each transistor so that during its quiescent half-cycle it is, in fact, drawing a slight current which has the effect of reducing such distortion. This practical point does not invalidate the simple theory, however, so consider the half-cycle when the upper transistor is operating and the lower one is cut off. The load now sees only one transistor. Similarly, during the other half-cycle the load sees only one transistor. At any instant of time, therefore, there is in effect one transistor working into the load and it follows that the load must be the same as a single transistor working alone would require. But this is only a quarter of what is wanted by two transistors working in the usual push-pull circuit and so the load required has been reduced by a factor 4, a very appreciable difference from the point of view of the speaker manufacturer.

Large Value Capacitors Across Battery

The battery has a low impedance to audio signals and can, in fact, be considered zero from the point of view of simple theory. In practice, this condition is ensured by putting a large value capacitor across the battery. This being so, it is impossible for an audio signal to exist across the battery and consequently it is immaterial to what part of the battery the side of the load remote from the transistors is connected, at least from the audio signal point of view. Fig. 6 shows the load being returned to the positive end of the battery, which is normally earthed. This is quite satisfactory except that the load is normally a D.C. as well as an A.C. path. It has the effect of loading the lower transistor from a D.C. point of view and upsetting the conditions of working. Consequently a feed capacitor has been introduced to block the D.C. The battery must still be twice that required for the circuit in Fig. 1 in voltage and, in fact, the voltage distribution across the transistor settles to the point where the junction between the emitter of the upper transistor and the collector of the lower transistor is more or less at a potential midway across the battery. It may be an advantage to have an untapped battery in a small receiver even at the expense of an extra capacitor. Apart from the change in the load circuit, conditions in Figs. 5 and 6 are identical.

Practical Design

It is necessary in this type of circuit as in others to introduce stabilising circuits to cover variations in ambient temperature and to a limited extent in manufacturing spreads of characteristics. These take exactly the form of any other audio circuits, except that the two transistors must have separate emitter resistors which, for equivalent stability, must be 1.15 times the value needed for a common emitter resistor such as is often used in the type of connection represented in Fig. 1. The emitter resistors can be bypassed to avoid feedback effects if desired. Again, either method of connecting the load can be used. The actual load required in any given case depends, as was previously seen, on the power output for which the circuit is being designed. Fig. 7 gives the circuit. *(To be continued)*

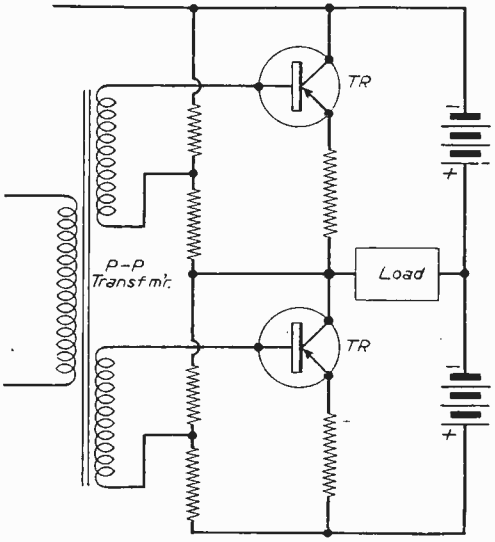


Fig. 7.—Single-ended push-pull with stabilising components.

Stabilised Transistor Circuits

D.C. FEEDBACK ARRANGEMENTS TO STABILISE THE WORKING POINT

By "Waveguide"

TO say that transistors, in terms of current gain, are graded into categories like eggs, is an exaggeration, but a few do show large deviations from the standard average of their type. The close tolerances of radio valve manufacture are not, as yet, paralleled in the transistor field, where the attainment of uniformity awaits the development of some form of transistor more advanced than the triodes now in use. The advantages of transistors in many applications, however, outweigh their present shortcomings, and there are methods available by which the effect of these and other variations can be reduced.

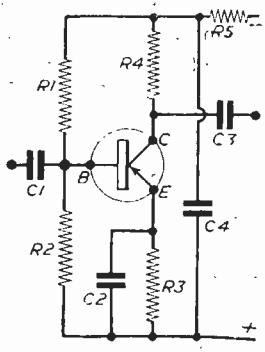


Fig. 1.—Stabilised amplifier stage employing a P-N-P junction transistor.

Reasons for Stabilisation

Transistors give their most consistent performance in stabilised circuits, where feedback is used to maintain a relatively stable working point. The latter, of course, is the quiescent point on a load line drawn on the transistor curves, or the condition at the middle of the range of collector voltage swings. Shifts of the working point are caused not only by the running down of batteries in portable equipment, but also to a considerable extent by the increase of current which accompanies a rise of temperature. There is also the disparity between transistors nominally of the same type, as already mentioned, which makes a self-adjusting circuit especially suitable.

The increase of current produced by a rise of temperature varies the properties of a transistor, and also increases the voltage drop across a load resistor until the peaks may begin to flatten on one half-cycle. In a low-level stage the internal or junction temperature of the transistor will only slightly exceed the surface temperature, but in output stages there will be an appreciable temperature rise, the difference between the internal and ambient temperatures widening with any addition to the power dissipation.

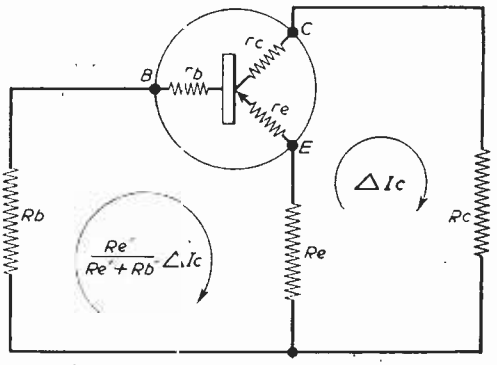


Fig. 2.—A simplified diagram to illustrate the negative feedback from collector to base.

In any electrical device, a soldering iron, for example, the temperature will rise until the heat can escape at the same rate as it is being produced, but in a transistor a rise of temperature further increases the collector current and this will usually increase the rate of heat production. As a result "thermal runaway" may occur, but it is unlikely at low voltages.

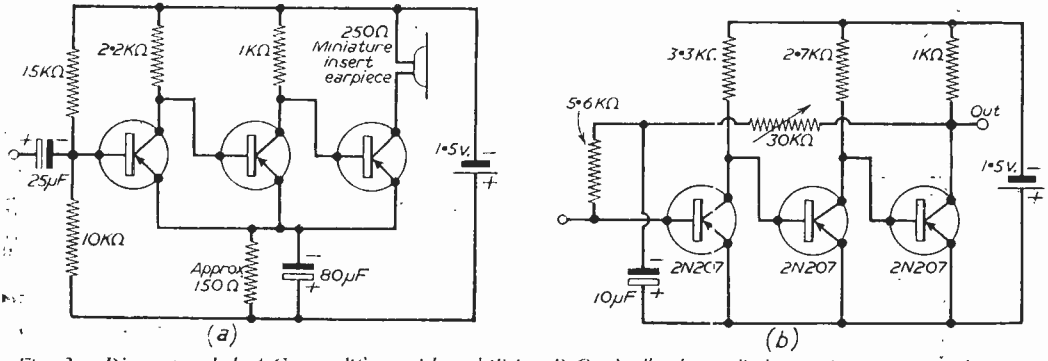


Fig. 3.—Direct-coupled A.C. amplifiers with stabilising D.C. feedback applied over three stages, to prevent drift in the quiescent conditions. Circuit (a) is similar to that described as the "World's Smallest Amplifier." Both circuits worked satisfactorily with transistors of the OC71 type.

Power Transistors

When the output power is large, special cooling arrangements have to be provided. The collector is no longer insulated from the case of the transistor, but is, instead, put into good thermal and electrical contact with it, and the transistor is clamped to, say, a 3in. square of 16 s.w.g aluminium.

A transistor can work in either the grounded-base or grounded-emitter arrangement, with only a capacitor connected to the base, i.e., with no direct current in the base lead, but the quiescent collector current then consists entirely of amplified leakage current which varies exponentially with temperature. The basic leakage is the small reverse current of the collector junction, but owing to the blocking capacitor in the base lead this has to be supplied entirely from the emitter. The transistor then makes evident that it is more than merely two P-N junctions in opposition by amplifying the leakage into a substantial current. A rise of 10° C in junction temperature will at least double this collector current.

If the circuit is now modified to apply a small direct current bias to the base through a resistance, this bias will be amplified possibly 30 or 40 times, augmenting the collector current, and so reducing the proportion of it which is temperature dependent, but the variation with temperature will still be large.

D.C. Feedback

The remedy is to reduce the D.C. amplification of the transistor. This can best be done

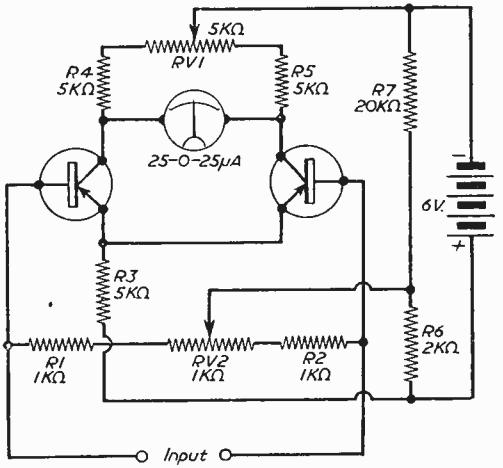


Fig. 4.—Transistorised microammeter employing a balanced D.C. amplifier.

by including a resistance in the emitter lead, by-passed for A.C. by a condenser, and by reducing the resistance in the base circuit as far as possible, which seems to favour a grounded-base arrangement.

However, a multi-stage amplifier with R-C coupling requires a simultaneous current and voltage gain in its stages, and so the grounded-emitter arrangement has to be used, with relatively large resistances in the base circuit. The inclusion of an emitter resistance nevertheless gives a considerable improvement of stability. The feedback can be analysed into two loop currents which subtract in the emitter lead $Rb = \frac{R_1 R_2}{R_1 + R_2}$ as in Fig. 2. Here, as we are concerned only with changes in the currents and voltages, we may omit their actual values, which permits the negative and positive supply lines to be merged, and a potential divider in the base circuit to be replaced by a single equivalent resistance. Similarly the internal resistances of the transistor which apply are the incremental or slope resistances re and rb.

A rise in temperature will increase the current from the emitter to the collector, and also the voltage drop across the emitter resistance, Re'. This voltage change also occurs across the base resistance Rb', and introduces a component of base current, $\frac{Re'}{Re' + Rb'} \triangle Ic$ towards the collector, but as the actual base current is in the opposite direction, this represents a decrease in base current. This decrease will be amplified α' times, so the increase $\triangle Ic$ in collector current will be less than the maximum that the temperature change could produce by an amount, $\frac{\alpha' Re'}{Re' + Rb'} \triangle Ic$

The above is a linear analysis, and it ignores the emitter junction variation with temperature which also contributes to the rise in collector current, but this effect is small when there is an emitter resistance, Re, many times larger than the resistance of the forward-biased emitter junction.

The factor by which the D.C. amplification is reduced is called the factor of stability and is

$$K = 1/\left\{1 + \alpha' \frac{Re'}{Re' + Rb'}\right\}$$

A reduction in D.C. amplification of five times ($K = 1/5$) is quite practicable. The emitter resistance Re can be chosen to drop about a volt, sufficient to make negligible the effect of the emitter junction variation with temperature.

A decoupling resistor as shown in Fig. 1 will also improve the stability, but is much less effective than the emitter resistance because there has to be a reduction of voltage between the collector and base and this implies a similar reduction of feedback.

The base B (Fig. 1) is a fraction of a volt more negative than the emitter E, and so has the same polarity as the collector C, relative to the base. Nearly all of the emitter current flows to the collector, but a small part passes to the base lead. Any increase of base current results in a much larger increase of collector current. In other respects there is a resemblance to a thermionic valve, a signal input voltage to the base giving rise to an amplified inverted version at the collector.

Direct-coupled Amplifiers

Direct-coupled amplifiers such as those of Fig. 3 are made practicable by applying sufficient D.C. feedback overall to prevent drift. Ideally,

(Continued on page 729)

the D.C. amplification should be reduced to unity, but it may not be possible to apply enough feedback to do this. The load resistances have to be chosen to give a suitable bias to the following stage. The only advantage of direct-coupling is a reduction in the number of components required, enabling a more compact amplifier to be constructed. The signal-handling capacity and gain are both lower than with R.-C. coupling, and there is a risk of slow relaxation oscillations in some cases.

If it is necessary to stabilise an amplifier without reducing the D.C. amplification, as in a transistorised microammeter, this can be managed by using a balanced circuit as in Fig. 4, in which "push-pull" feedback is applied for stabilising without reducing the sensitivity to a direct current input. RV1 adjusts the zero, while proper adjustment of RV2 ensures that there is no shift of zero on short-circuiting the input terminal. Using matched transistors with $\alpha' = 15$, the scale becomes 4-0-4 μA approximately, but gains higher than this can be obtained.

The transistors are preferably matched, and their temperatures equalised by means of a common "heat sink" consisting of a metal block. The need for this precaution is easily demonstrated, for the microammeter can be deflected full-scale merely by resting a finger on one of the transistors. More than one balanced stage can be employed, with the "push-pull" feedback applied overall, possibly with an extra transistor in the feedback loop.

Combined Stabilisation

In the case of R.F. stages, the writer has found it possible to use combined stabilising arrangements for a number of stages, thus enabling fewer components to be used, as in the superhet tuner unit shown in Fig. 5. There is no A.V.C. The self-oscillating frequency-changer works best with a high resistance in the base circuit and does not require the stabilising arrangement used in other stages.

Output stages are often Class B push-pull to economise in battery consumption while obtaining a substantial output. The use of by-pass condensers has to be avoided in such stages, since rectification occurs and would charge a capacitor to a voltage at which serious distortion would be produced. An emitter resistance will therefore give some A.C. feedback. For this reason there is often no attempt at stabilising a Class B output stage. A thermistor can, however, be used for temperature compensation, shunting the lower resistor of the potential divider used to provide bias for the avoidance of cross-over distortion.

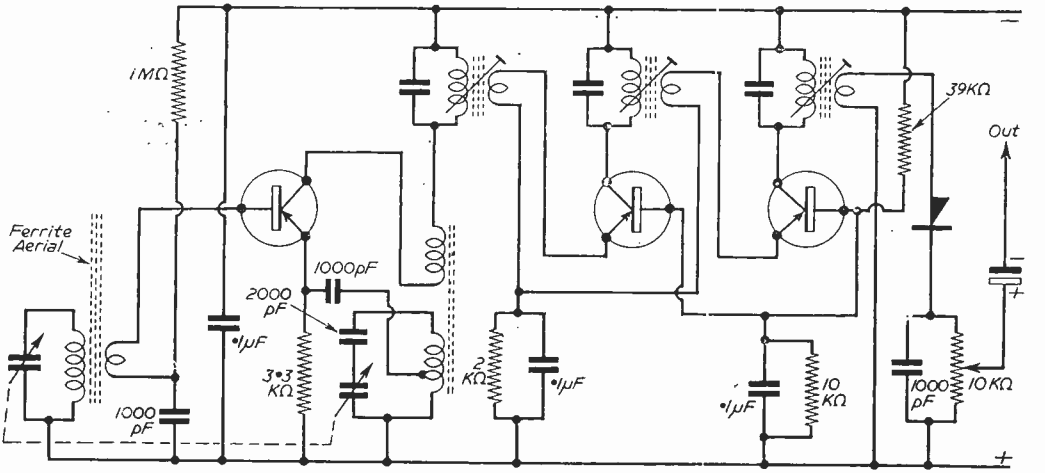


Fig. 5.—Superhet tuner with a combined stabilising arrangement for the two I.F. stages to economise in components.

Stereophonic Sound: Further Transmissions

DURING Record Week in May, the BBC broadcast two experimental transmissions in stereophonic sound, and many listeners reported that by using two receivers they had obtained an impression of spaciousness and perspective in the reproduction. In view of the success of that experiment and the widespread interest in recent developments in stereophonic recordings on tapes and on discs, the BBC is now carrying out a further series of experimental transmissions.

The Third Programme transmitters, both medium-wave and V.H.F., are used for one channel of the transmission and the BBC television sound transmitters for the other (without interrupting the Trade Test Transmissions on vision).

It is desirable that both channels should have similar technical characteristics. Since this is not likely to be possible in every case under the conditions of the experiment, true stereophony may not be achieved; but a realistic impression of spaciousness should be obtained. In particular, the stereophonic effect will be modified, in parts of the country remote from London, by differences in length and technical characteristics of the lines connecting the transmitters with the London studio.

The Silver Jubilee Radio Show

THE MARQUIS OF DONEGALL GIVES HIS IMPRESSIONS

LORD BRABAZON, opening the Silver Jubilee Radio Show, drew attention to the fact that Britain was the first country to have wireless at sea. We can link up that statement with a primitive exhibit, contrasting strangely with highly complicated pieces of apparatus, on the Royal Navy stand at Earls Court.

The exhibit was a replica of the first ship's radio set, designed by Captain H. B. Jackson, and carried on a naval vessel in 1897.

We have started our tour of the show with the navy—indeed, what better point of departure, both in chronology and prestige, could you find? In command of the stand was Lt.-Commander A. W. P. H. Fleet who served as wireless telegraphist in Admiral Beatty's flagship, H.M.S. Lion, in the First World War.

Stereo Steals the Glory

It is obvious that, except as concerns the incorporation of V.H.F. into television sets, television has had to climb down from its pinnacle and cede first place to stereo, or 3D, sound reproduction. In this 25th Radio Show, stereo is everywhere. V.H.F. is rated next in importance. Television, *per se*, is the "also ran," because transistor portables crowded it out for third place in the public interest.

Galling as it may be for TV, it can only enter the stereo field at present as one of the channels when the BBC puts on experimental transmissions. This was done successfully last May and it is possible that further experimental broadcasts will be carried out between 11 a.m. and noon every other Sunday morning, starting in October. Recordings at first and, later, live studio programmes.

It is hoped eventually to transmit stereo programmes from a single V.H.F. transmitter. When this happens, twin amplifiers and loudspeakers, as used for stereo tapes and discs, will be used.

[*See Editorial Comment on Stereo Sound in this issue*—ED.]

Printed Circuits and V.H.F.

Continuing our tour of the show, we note that the printed circuit is almost universal, even in radiograms such as Argosy's six valve, A.M./F.M. G 59 at 69 guineas.

Most table radios are A.M./V.H.F. receivers and V.H.F. has often taken the place of the short waveband. This drives me to the conclusion that I am not alone in becoming increasingly bored with the short waves: it would seem that the only programmes that Moscow—in every conceivable language and on every inch of the dial—doesn't wreck, is the voice of America from Tangier.

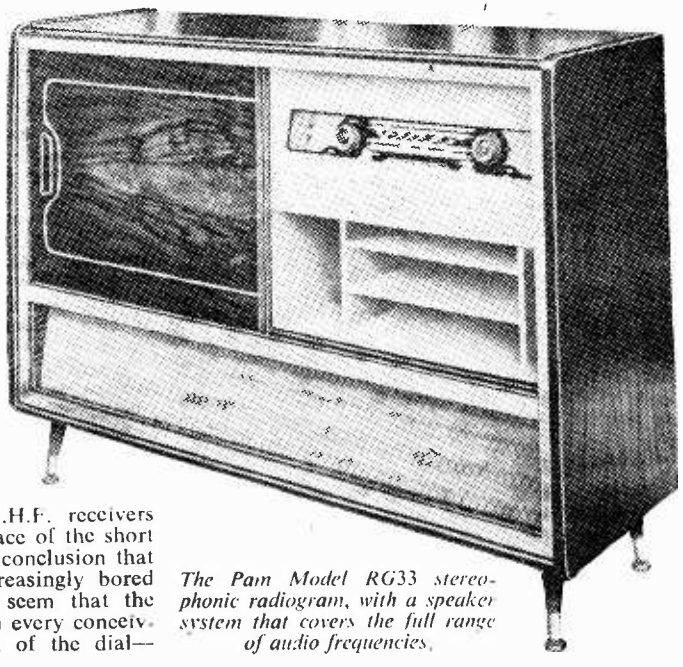
We see some very attractive table models. There are still some sets with A.M./V.H.F. that include short wave, usually provided with a magic-eye tuning indicator and good speaker system. These sell at about 45 guineas.

Again, for listeners prepared to ignore foreign stations, we find two types of V.H.F.-only receivers—the small transportable and the table model or console.

Near-universal V.H.F. has come just in time. All was well when I acquired my first superhet in 1929—you could almost count the European broadcasting stations on the fingers of two hands. But it was not long before wavelengths became swamped. In 1950 "Copenhagen 1948" went hopefully into force having to ignore the many countries that refused to co-operate. By 1958 the BBC, especially on the east coast, is often BBC-plus three foreign stations.

V.H.F. offers the ideal solution. Its short range has the advantage that, no matter how crowded the band may become, interference from foreign stations will never again achieve the pre-V.H.F. bedlam. And our old pal, the vacuum cleaner—not to mention the electric blanket—seems to have been effectively gagged. (I recall the blanket because it took the G.P.O. experts three months to find one that was completely blotting out reception in a whole block of flats where I lived in 1943. They were just in time to save the old lady from incineration!)

(*Continued on page* 733)



The Pam Model RG33 stereophonic radiogram, with a speaker system that covers the full range of audio frequencies.

Among these V.H.F. receivers, we note the Pam TR 30 at 45 guineas (three speaker, four waveband, seven valve, press-button wavechange); the Ekco de Luxe, six valve, A 274; the McMichael, Pye and Ultra TV sets with V.H.F.

Ferranti show us a 14in. transportable with V.H.F. at 59 guineas.

Many other TV sets incorporate V.H.F. The Marconiphone has a separate V.H.F. section with high sensitivity (and 10.7 Mc/s I.F. is fitted). G.E.C. and Pam have twin speakers for High Fi reproduction of TV and V.H.F. Regentone introduces its changeover to full printed circuit.

Transistor Portables

We are also struck by the number of transistor portables as typified by Pam and Vidor. In fact, most makes now have transistor sets. Perdio were alone last year with a pocket portable comparable to my (American) Zenith. This year Vidor have one with six transistors incorporating the long and medium bands.

Vidor also offer a table model six transistor set in polished wood, presumably for houses without electricity, at 26 guineas, medium and and long wavebands.

Perdio, who pioneered the pocket radio in this country, have increased their range and much improved the appearance of their midgets. Their cheapest has come down to 13 guineas, with the luxury model at 22 guineas. A feature of Perdio midgets is that, with a special telescopic aerial and bracket, they can be used as instantly detachable car radios.

With the elimination of the short waveband, the Roberts—which I regard from very long experience of travelling with one all over the world, as on the top line of its class—has come down to 9⅝in. × 6 5/16in. × 4 3/16in. at 23 guineas. (Six transistors and one germanium diode, with battery life stated to be 800 hours.)

Harping back to transistor portables, we come across the Pye model P 150BQ. This is well in the midget class being 3⅝in. × 6⅜in × 1¼in. A very good looking little set with five transistors —medium waveband, plus pre-set Light programme, at 18 guineas.

Next, we have the shoulder-strap "Ever-Ready"—the "Leader"—which weighs just under 5lb. with battery, at 21 guineas. (Long and medium waves.) At 33 guineas, Ever-Ready's "Emperor" (14in. × 6in. × 11in.), with carrying handle, is F.M./A.M.; V.H.F.—piano-type selector keys.

Larger Radios

Turning to the larger radios, we are most impressed by the T69DA Marconiphone which seems most reasonable at 18½ guineas. It is an A.M./V.H.F. table receiver, A.C./D.C., with inbuilt A.M. and V.H.F. aerials, six valve superhet circuit. No short wavebands, and the cabinet is moulded plastic in maroon with ivory grille.

Bush, as usual, have a wide range of attractive sets, particularly the V.H.F. only model 90A, at 17 guineas, with built-in dipole.

The R.G.D. 418 radio gramophone at 147 guineas is a fine looking piece of furniture: nine valves, V.H.F./F.M. with five speakers and stereophonic sound extension with stereo conversion kit as an extra.

R.G.D. do a much cheaper V.H.F./F.M. radiogram with the low-long look, the 202, at 58 guineas.

Slightly cheaper, at 55 guineas, Sobell display their F M G 59 V.H.F./F.M. radiogram:—six valve, three wave—long, medium and F.M. This is a cabinet-type in walnut, 33½in. high, as opposed to the long-low trend.

Stereo Gramophones

Decca, having coined the word stereogram—which may well find its way into the Oxford Dictionary—show a large number of them. Their star performer is the S R G 300, at 105 guineas. They say wisely: "If it's stereo, it must be *true* stereo!" Decca's is extremely good —and so it ought to be considering that they were among the very first to pioneer it.

The S R G 300 has three speakers, with cross-over, two extension speakers; V.H.F./F.M. and long and medium wavebands. The motor is a Garrard four-speed auto-changer which can also be operated manually. Pick-up heads for monaural and stereo. At 33 guineas Decca's 66 V.H.F./F.M. and A.M. table radio is very good value; as is also Philco's 3764 Phonorama at 58 guineas. It incorporates V.H.F. and facilities for dubbing on to or playing back tape and for reproducing A.M. transmissions from an A.M. tuner.

We see that the famous Philips Magic Box has grown legs at 50 guineas. Their Minigram includes V.H.F. at 69 guineas.

Tired as we all are of humping sets about from one corner to another, the David Joel "Finger Touch Trolley" at £4 17s. 6d. is very welcome. It has a rubber top to grip the set and, rolling on Shepherd ball-castors, it practically takes off across the room at the slightest push.

Open to Discussion

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

Licences for ex-Government Transmitting Equipment

SIR,—It is apparent from enquiries received by the Post Office from persons wishing to use Government surplus transmission equipment, especially "Walkie-Talkie" sets, that there is uncertainty among both prospective users and radio dealers about the need for licences. I hope the information given below will be helpful to your readers.

Section 1 of the Wireless Telegraphy Act, 1949, provides that "no person shall establish or use any station for wireless telegraphy or install or use any apparatus for wireless telegraphy without a licence in that behalf granted by the Postmaster General." Any person who does so is guilty of an offence under that Act.

Any person who intends to use Government surplus transmission equipment must, therefore, obtain a licence. I am afraid that in the majority of cases the technical characteristics of the equipment, including the frequency bands in which it works, are such that the Postmaster General would not be able to grant one.—J. EVANS (G.P.O.) Deputy Relations Officer.

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.

Frequency Coverage of the RF24

SIR,—In reply to Mr. W. E. Jones (September issue) concerning the RF24 unit, the ranges are as follow:

1. 20-23 megs.
2. 21-24 megs.
3. 23-27 megs.
4. 27-30 megs.
5. 27-30 megs.

} Using an I.F. of 8.5-9 megs.

The I.F. output is centred around 8 megs.

A useful modification is to short the R.F. and mixer stages of range 2 with 120 pF fixed condenser and to shunt the oscillator trimmer with a fixed condenser of 30 pF. This modification alters the coverage of range 2 to cover the 20 metre band. The unit may now be used as a converter on 20, 15 and 10 metres.

The power supply needed is 6.3 v. at 1.8 amps. and 250-300 volts at 15 milliamps.—J. BEDDOWS (Bloxwich).

A S.W. Portable Battery Two—Correction

WITH reference to this article on page 533 of the September issue of P.W., the C.G. and S.G. connections to the first valve should be reversed.

Pentode as I.F./A.F. Amplifier

SIR.—The use of an indirectly heated pentode (such as a 6B8) in a dual rôle of I.F. and A.F. amplifier is fairly well known and has been included in at least two circuits published in your paper in the last decade. Can any of your readers say if they have ever used such a battery valve as an IT4 in this way?

It also occurs to me that it might be possible to use such a valve as an R.F., I.F. and A.F. amplifier and again comments from any reader would be appreciated.

The advent of the transistor would seem to toll the knell of the valve portable but I would be interested to have details of any valve portable set powered by an accumulator and containing its own mains charger which some of your readers may have constructed.—W. H. REES (Bushey).

Unusual Phenomenon

SIR.—*Re* Mr. Astbury's letter in the September issue of PRACTICAL WIRELESS.

Recently between 11.30 a.m. and 12.15 p.m. on the short wave 35 metre band I heard the call sign in morse G.B.Z. continuously. One night between 8 p.m. and 9 p.m. the same signal came through on the 40 metre band.

Could somebody please explain this call sign?—J. CHESTERS (Tamworth).

An Obscure Fault

SIR.—I recently constructed a 7 transistor portable, push pull output. I can receive the Light, Home, Third and Hilversum. Volume is ample, tone good.

Now for the fault. I switch on and only a hissing noise can be heard for 10 minutes, then I can listen to the Light. Another 10 minutes later I can receive the Home, and later on I can tune in the Third and Hilversum.

I wonder if any other reader has come across the same trouble?—J. NELSON (Essex).

TV Sound on Radio

SIR.—In "Open to Discussion" in your September issue, Mr. B. K. Middleton explained how he heard TV sound. I have had the same experience although slightly different. In my case I have a two valve battery set using

(*Continued on page 737*)

plug-in coils. One night I was changing coils when I heard BBC TV sound. I pulled out the aerial expecting it to stop but instead of stopping the sound became much louder. I then put another coil in and it stopped instantly.—D. WICKHAM (Mitcham).

SIR.—I was very interested in Mr. Middleton's letter on this subject in the September issue.

After constructing an amplifier I decided to test it with a high-impedance microphone connected between earth and the grid of the input valve. On turning up the volume I was surprised to hear the BBC Light programme. When the same was tried with other microphones of varying impedance other stations were received. If, however, I used a carbon or crystal mike nothing similar ocurred.

I then constructed a transistor pre-amp. similar to that described in the February issue of PRACTICAL WIRELESS. Connecting a moving coil mike, I heard music, which turned out to be BBC TV sound.

It now seemed certain to me that the microphones were acting as coils, especially as the same did not happen with carbon mikes.

I should like to thank the editor and staff of PRACTICAL WIRELESS for producing such an interesting and instructive magazine.

I should also like to ask for correspondence with radio enthusiasts of my own age, which is 16.—W. D. MERCER (Quinton).

SIR,—Answering B. K. Middleton (September issue) I too have received the BBC TV, using a 2 red spot and cheap diode (*cathode to base*) I think that the transistors could be damaged in the (unintentional) circuit.

I made up the transformer coupled circuit described by F. G. Rayer in June 1957 issue, with slight differences as follows:

Using a single-wound coil (home-made).

Adding a cheap diode connected to top of the coil.

4,000 ohm 'phones.

.0005 T/C across the coil. 1½ volts.

By shorting the coil across (accidentally in my case) I started to tune and about ¼in. up the T/condenser received the BBC TV sound. It was not exactly ear-splitting but loud enough to determine that it was TV and not radio.—A. MCDONALD (London, S.W.1).

Transistorised Crystal Set

SIR.—I have recently completed the transistorised crystal set, described by Mr. King, in the editions of PRACTICAL WIRELESS from October 1957 to January 1958.

Although I found that the circuit incorporating one transistor produced good results, the addition of a second transistor caused an unbearable amount of distortion in the final sound. This made listening impossible.

This fault was remedied by earthing the emitter of the second transistor via a resistor of about 500 ohms resistance. Volume was further increased by fixing a 10 microfarads, 25 volt condenser in parallel with this resistor.

In spite of this modification the volume was found to be inadequate for loudspeaker reception especially of the Light programme.—J. S. KEEN (Westcliff).

"Tape Economiser"

SIR.—While Mr. Bennett's statement regarding the "Tape Economiser" (Open to Discussion —September 1958) is correct, i.e., the frequency response of a tape recorder is a junction of two parameters—tape speed and gap width—the limit he quoted does not seem compatible with the gap width. Wher the gap width is equal to the wavelength of the recorded signal, the playback head output would be zero with the 0.002in. gap, and a tape speed of 7½in./sec., mentioned by Mr. Bennett, the cut-off frequency would be 3,750 c.p.s. The output would, in fact, begin to fall off below this value, but even this is low compared with the 16 kc/s mentioned. To achieve an upper frequency limit of 16 kc/s, would require a gap width of .00046in., which is approaching the generally accepted value of half a thou.—B. S. WILKINSON (Exeter).

[*The author writes: "It appears that the printer made an error when setting up the type, for the gap dimension of the heads. It should be* 0.0002*in. and NOT as printed, i.e.* 0.002*in.*"]

Simplicity Transistor Two

SIR.—I have just completed the building of "The Simplicity Transistor Two" (PRACTICAL WIRELESS September 1956, pp. 450-451). This is my first attempt at transistors and I got results from this circuit immediately it was finished and coupled up to an outside aerial of about 21ft. The output is remarkably loud and clear both on music and speech as far as my requirements are concerned. I got all my components from advertisers in PRACTICAL WIRELESS.—J. RODGER (Grangemouth).

No Long Waves?

SIR.—As one who has been interested in radio since 1935 in the R.A.F. and in industry, I ask why do certain manufacturers include long waves into obviously low-priced receivers? There is no programme value in this band that cannot be got on M.W. Why not make a simple RX just M.W. only. If there is to be band No. 2 make it S.W., where the extra complication would at least give extra interest and programme value; specialist sets could have, as they do, all sorts of frequency coverage. It is as if there were in this country a phobia about long waves. Marconi is dead. We are now in the hands of another generation, in fact, the second since his time.—M. A. BUSHELL (Gravesend).

Six Transistor Set Power Supply

SIR.—With reference to the Six-transistor 2-wave Pocket Superhet described in the August/September editions of PRACTICAL WIRELESS. I have a suggestion about the power supply.

It is possible to obtain a 2 v. accumulator, size, 1in. × 1⅛in. × ⅜in. It is of the nickel/iron (Nife) type, with a caustic electrolyte. It

is sealed in plastic. leakage is nearly impossible, and they are made for electric cigarette lighters by "Magnatex" Ltd. It is my opinion that it could be used in place of the mercury cell (two, if necessary). with a slight alteration. The accumulators have the advantage of being rechargable, and it may even be possible to get smaller ones. 100 hour rate is 50 mA.—A. SPARK (Clapham).

Closed Shop Attitude

SIR.—I agree wholeheartedly with N. Benson (PRACTICAL WIRELESS, August) on the "closed shop" attitude of the manufacturers over tape decks.

I have just completed my own deck, an undertaking which took many weeks of correspondence with negative results. Ultimately I got what I required from one maker by inferring I had one of their decks which had got damaged.—I. ROBERTSON (Morayshire).

Another Odd Effect

SIR.—With reference to Mr. D. A. Newell's letter in the September issue of PRACTICAL WIRELESS, the cawing sound he describes was indeed coming through the mains. It is a 900 c/s note, lasting .44 sec., repeated once per second. Its purpose is the control of sodium lamps. and consequently can be heard every night at lighting-up time. There are three "batches" of pulses, the final pulse finishing the third "batch" is a continuous note. These "batches" operate a relay in the lamp and this turns the lamp on. At dawn, a continuous signal turns them off. Provision is made to turn certain ones on and off in the middle of the night *separately* (without affecting the lamps on the main road which stay on all night). In by-roads, however, the lamps are clock controlled, by a time switch, which is electrically wound (so it doesn't stop if the mains supply fails). These have automatic lighting-up time compensation, and do not require attention.—MR. A. SCARGILL (Leeds. 6).

Reproduction

SIR.—With regard to record players with elliptical speakers and reproduction, I find the reproduction on a portable radio. receiver with a 5in. circular speaker, and exactly the same recording as reproduced on my record player which has a two-stage amplifier and a 7 × 4in. elliptical speaker totally different. To quote. I listen to the record programmes on Radio Luxembourg and with a short indoor aerial I get pretty good reception. with no fades, drift or interference, yet I buy the same recording and get entirely different results, i.e., percussion is definite, and the response constant all round. True the broadcasters may use 45s but most of my new records are 78s. and the station could use very expensive pick-up equipment, and all I have is an autochanger, two-stage amplifier and elliptical speaker contained in one case measuring 1ft. 4in. × 1ft. 3in. × 9in.—R. G. HANN (Dorset).

News From the Clubs

BRIGHTON AND DISTRICT RADIO CLUB
Hon. Sec. : Mr. R. Purdy, 37, Bond Street, Brighton, 1, Sussex.

TUESDAY, Oct. 7th.—Films No. 1 and 2 in the series dealing with the manufacture of "Brook" electric motors.

Tuesday, Oct. 14th.—"Fundamentals" Part 4, a short talk by Mr. H. R. Henly on "Valve Amplifiers." Also a Morse Class will be held.

Tuesday, Oct. 21st.—Recorded Lecture.—Title to be announced.

Tuesday, Oct. 28th.—Annual General Meeting.

All meetings start at 8 p.m. and finish at 10.30 p.m.

TEES-SIDE AMATEUR RADIO CLUB
Hon. Sec. : A. L. Taylor (G3JMO), 12, Endsleigh Drive. Acklam Middlesbrough. Yorks.

AT the Middlesbrough Horticultural and Handicraft Show the club put on three stations and secured contacts in the U.K., Spain, Italy, France, Portugal, Germany, Sweden, Finland and Hungary.

The top band 80 metre station supplied by G3LXG/A was in constant use, and made many contacts with mobiles, as well as with G3MUM, "Twinkle toes" of Redcar, who as many will know, operates his rig with his foot under considerable handicap.

G3KBD/A on QRP and G3AWL/A on his Panda/AR88 set-up roped in the "DX." G3AWL comes from Wingate in Co. Durham, some distance away.

We displayed, amongst other things, the licence granted to T. S. G. Seaward, G4K1, in 1913. Incidentally, at that time "T.S.G." was a minor, and the licence was issued to his father! G4K1 visited us, but is not very active at present.

The show was well patronised on a fine day and the help given by the Corporation staff and the support of hams and listeners from Middlesbrough, West Hartlepool and surrounding districts was most encouraging.

Station activities :

November 7th.—Discussion on forthcoming events.

N.B.—A dinner is planned for early December. More news in next month's issue but to those who can come—keep your Saturday nights free! This space next month will give full details. Open to all. Visitors welcome.

November 21st.—A tape recorded lecture will be given.

Both the above at Settlement House, Newport Road, Middlesbrough at 8 p.m.

GLASGOW AMATEUR RADIO COURSE

THE Amateur Radio Courses run by Glasgow Corporation Further Education Dept. at Allan Glens School in Montrose Street, Glasgow, for 1958-59, will be as follows :

AMATEUR RADIO COURSE (C. and G.). For those wishing to sit for the radio amateurs' examination held by the C. and G. in May, 1959.

Theory instruction will be given on Tuesday nights from 7.00 to 9.30 p.m., by Mr. A. M. Fraser (GM3AXX), and morse instruction on Thursday nights from 7.00 to 9.30 p.m. by Mr James Sey (GM8MJ).

AMATEUR RADIO COURSE (GENERAL). For those wishing a more generalised course in the principles and theory of radio. Instruction will be given on Thursday nights from 7.00 to 9.30 p.m.

No previous knowledge is assumed for either course, the fee for each being £1. The courses started on Sept. 16th and 18th.

FEDERATION OF BRITISH TAPE RECORDING CLUBS
Hon. Sec.: R. Penfold, 48, Holbrook Lane, Coventry.

THIS Federation has been recently formed to provide facilities for tape recorder owners so that they can meet under the auspices of the club for discussion and matters of mutual interest, and to encourage the formation of new tape recording clubs.

PRESTON AMATEUR RADIO SOCIETY
Hon. Sec. : G. Lancefield (G3DWQ), 35, Brixton Road, Frenchwood, Preston, Lancs.

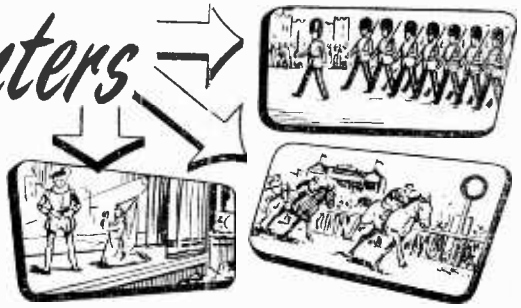
THE Preston Amateur Radio Society is exhibiting at the Hobbies Exhibition which is being organised by the Rotary Club of Preston, and held at the Public Halls, Preston, from October 15th to 18th, 1958 (inclusive).

The amateur radio stand will feature a display of radio gear, literature, etc., and a working amateur station. The station will operate on all bands 160 to 10 metres during the afternoons and evenings, using the call sign GB3PRS. Contacts will be welcomed and acknowledged by special QSL card.

October 15th : Meeting cancelled. Opening day of Hobbies Exhibition. October 29th : Visit to Rediffusion at Inskip, near Preston.

All meetings commence at 7.30 p.m. with morse practice until 8 p.m. Fruiterers Club, High Street, Preston.

Programme Pointers



OUR CRITIC, MAURICE REEVE, REVIEWS SOME RECENT PROGRAMMES

The Skin

THE postponed programme, *The Skin*, was wonderfully interesting and amusing. Acted by a distinguished panel of radio stars, it gathered into forty-five minutes about as much material both grave and gay as seemed possible. What women will do in the "sex war" is, apparently, nobody's business. Written and produced by Nesta Pain, she is to be congratulated on a programme as diverting as it was revealing.

Does the Team Think?

Does the Team Think? is a light-hearted version of *The Brains Trust*, as the composition of the panel will establish. With McDonald Hobley in the chair, Messrs. Jimmy Edwards, Ted Ray, Tommy Trinder and Larry Adler discussed such questions as "Do men pay enough attention to their dress?" "What does the team think of 'do-it-yourself'?" "Which personal quality in men is most attractive to women?" "Is the best English spoken in Dublin?" "Appoint four life peers," etc. Good questions in any programme. The cracks were thrown about with quick-fire precision, and many of them were very funny. The programme is from an idea of Jimmy Edwards. A good one.

The Hireling

L. P. Hartley's dramatic novel, *The Hireling*, made an excellent play, adapted and produced by Barbara Bray. Poor Leadbitter, plying a car for hire, falls in love with Lady Franklin, who employs him. Feeling unrequited he runs the vehicle into a smash and gets killed. Noel Johnson and Clare Austin were the chief protagonists.

The Europeans

The Europeans, adapted by Richard Bebb from Henry James's early novel, was another good play. A brother and sister, whose almost sole capital asset is charm, visit relations in Boston. The comings and goings and the pairings off, made fascinating and amusing listening. The various types were exceedingly well taken off by Irene Worth, Robert Eddison, Wm. Sylvester, Russell Napier, Margaret Wedlake and others.

What Do You Know?

What Do You Know? justifies its continued popularity, with Franklyn Engelmann as one of the best of chairmen. It is probably the most intelligent as well as entertaining of the quiz games, never too highbrow nor yet playing down. It always keeps a pleasantly even keel. It is strange how comparatively few points the final contestants and "brains of Britain" usually score.

Return to Stepney Green, written and narrated by Bernard Kops, marked a young playwright's return to the place of his birth. His impressions of it were given on a number of recordings, and by a large cast of well-known people. It might well form the prototype of a series. Producer, Eileen Capel.

A Quiet Corner, adapted by Basil Ashmore from the German of Sudermann—author of that famous war horse of so many star actresses including Gladys Cooper—"Magda"—made a powerful play. Based on the familiar theme of the Baron tempting the schoolmaster's wife—whose mistress she had formerly been—by means of offering him lucrative preferment on his estates, it made the less painted the characters much more vividly and went into their hearts to greater depths than most plays of the type usually do. The four chief characters were beautifully played by Marjorie Westbury, Hermione Hannen, Marius Goring and Howard Marion-Crawford.

Memories

The Gertrude Lawrence Story, written by Roy Plomley and produced by Michael North, followed the pattern set by previous examples and brought back vivid memories of that most glamorous star. One could truthfully say that she was irreplaceable.

These Foolish Things, produced by Pat Dixon and introduced by Roy Plomley, came from an idea by Nancy Spain. It is a strange show: never wildly funny; never really boring. Various recorded noises are heard and the members of the panel, all well known, tell of memories which the recordings have awakened.

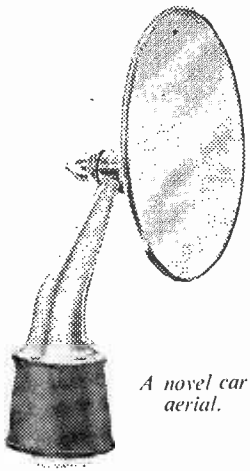
Darwin Centenary

The Voyage of the Beagle was a Darwin centenary documentary commissioned by the BBC Overseas Service. Commencing and concluding with some good contemporary songs well sung by Ewan McColl, collected by A. Harridine, and plus some of the birds from *Desert Island Discs* (or others sounding very like them), it seemed a programme likely to prove of average interest to the average listener. It was well produced by D. Cleverdon and Ian Lubbock was very good as the young Darwin, as was Hugh David as the *Beagle's* captain.

News from the Trade

NOVEL CAR AERIAL

A REALLY new accessory has not been introduced to car owners in this country for some time, but Delta-Swift (Motor Accessories) Ltd., of Sheffield, have made up for this lapse with a really attractive and efficient car radio aerial. This is an aerial with a difference. It is also a high quality wing mirror . . . a true dual purpose accessory. Thoroughly tested, in various parts of the country, in conjunction with a model G76V Philips car radio, it has proved to give good reception under all conditions.



A novel car aerial.

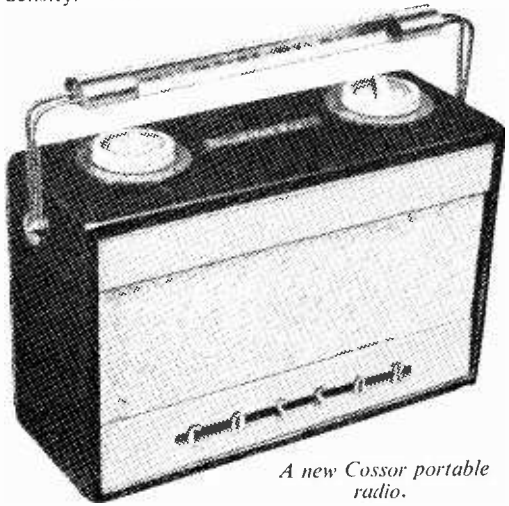
A NEW COSSOR PORTABLE RADIO

COSSOR RADIO & TELEVISION LIMITED, Highbury Grove, London, N.5, announce Model 569 the "Transistor Six"—a new portable with a difference. In addition to normal operation out of doors or in the home, a simple socket for connection to a car aerial enables Model 569 to be used inside a car or a caravan.

This extremely sensitive portable has six transistors powered by standard UII dry cells so ensuring an extremely long life for the batteries. A printed circuit is employed for dependability in operation and weight and space reduction.

Model 569 is a superheterodyne receiver operating on long and medium wavebands. A push-pull output stage provides approximately 300 mW to a 7in. elliptical speaker of high flux density. The receiver is fitted with a built-in Ferrodyne aerial and provision is made for connection to a car aerial enabling it to be used in either a moving or stationary vehicle.

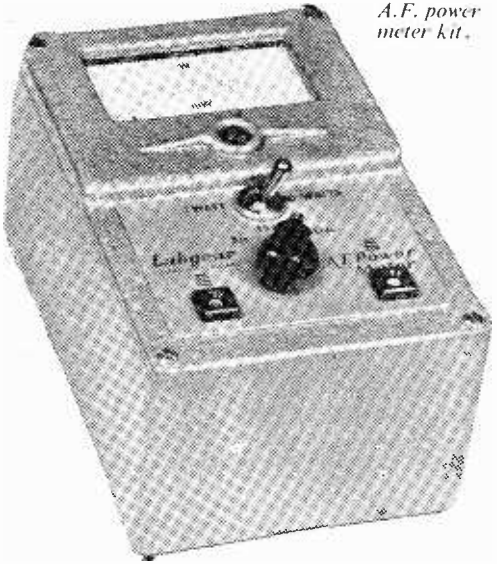
A novel feature to assist station selection is introduced. Station names and wavelengths are engraved inside the transparent handle and tuning to the desired programme is simplified.



A new Cossor portable radio.

A.F. POWER METER KIT

U.T.M. LTD., P.O. Box 11, Cambridge, announce the introduction of a very interesting and inexpensive piece of test gear which is being marketed in kit form. It is an A.F. power output meter which will be found most useful for checking hi-fi equipment, tape recorders, public address installations, cinema amplifiers, as well as the A.F. stages of radio and television receivers.



A.F. power meter kit.

The unit is excellently engineered in printed circuit form, enabling anyone to construct it quite quickly with little or no experience. The printed circuit does, of course, greatly reduce the possibility of wiring errors.

Two ranges are incorporated in the standard model covering 1 watt FSD and 10 watts FSD. Accurate measurements down to 25 m/w's may be made. A built-in load is incorporated and three values may be selected by the switch on the front panel, namely 3 ohms, 15 ohms and 600 ohms, which caters for all normal requirements.

RECEIVERS & COMPONENTS

"OSMOR NEWS." Information and circuit available for the following: Push-pull bias Osc. Coil, **7/6**, as supplied to several tape recorder manufacturers. New Band I/III tunable Rejector. "P.W." Consul Car Radio. "R.C." 1-valve S. Waver. Transistor Regenerative Circuit. See page 698. OSMOR RADIO PRODUCTS LTD., Sth. Croydon, Surrey.

MIDDLESBROUGH. Largest stocks on N.-East coast. Radio, TV components, FM Kits, Gram. Cabinets, Tape Decks, Leak Amplifiers, Valves, etc. Callers only. PALMERS, 106, Newport Road. (Phone: 3096.)

AMAZING OFFER.—Originally £40-£100 each. Ekco, Pye, H.M.V., Marconi, Philips, Murphy, etc., 9-10in. Televisions, complete, not working, **50/-** each; carriage paid; immediate dispatch; 12in., **£5/5/-**; 15in., **£9**; Philips 17in. Projection Televisions, **£9/15/-**. TOMLINS, 127, Brockley Rise, London, S.E.23.

FM-AM CHASSIS

PUSH-PULL OUTPUT — 7 VALVES
HIGH SENSITIVITY — GRAM INPUT
7" x 5" FULL VIEW SCALE
AFC—AVC—GUARANTEED
REDUCED TO **£14**

BEL SOUND PRODUCTS CO.
Marlborough Yard, N.19 *Tel.: ARC* 5078
20 mins. West End

MAINS FROM 12v. CAR BATTERY, American Dynamotor Unit, runs 200/250 AC/DC radios, televisions, tape recorders, etc., from 12v. car battery, continuous duty, perfect, cost £25. **80/-**; s.a.e. full details. SCIENTIFIC PRODUCTS, Cleveleys, Lancs.

TELEVISIONS, 9in. models, **£7/10/-**; 12in. models, **£13/10/-**; 12in., 5-channel models, **£19/10/-** each, all working, carriage paid. Send for list. TOMLINS, 127, Brockley Rise, Forest Hill, S.E.23. (FOR 5497.)

ANNAKIN

Control Units No. 2 (for 19 sets). With red pilot lamp ; 3P, 3W, 3B switch ; 4P, 2W, 3B switch, pointer knobs, plugs, sockets, in a handy metal case. New. **2/6** ea., post 1/9.
Thermocouple Unit Type 4. A glass bulb with 3 cm. pickup wires and thermocouple enclosed. 2 wires out to octal base. New, **2/6** ea., post 11d.
Projector Lamps. 250 v. 500 w. prefocus. class A.1. Best makes. New. Boxed. **7/6** ea., post 1/-.
Valves. EF37, **6/-**. EF50, **2/-**. EF36, **3/6**. 2C34. New. Boxed, **3/-**. VR65, **1/-**. CV118. New, **2/-** (post 6d.).
Mains Transformers. 230 v. In. 12 v. 1½ A., 6 6. post 1/6.
Selenium Rectifiers. ½ w. C.T. 600 v. 10 mA., **5/-**. post 1/-.
Block Condensers. 6 mfd., 400 v., **3/-** ea., post 1/6. 8 mfd., 400 v., **4/-** ea., post 1/6. 0.1 mfd., 5 kv., **1/-**, post 1/9.
Vibrator Pack for No. 22 Set. 12 v. In. 250 v. and 500 v. out. **£1** ea., carriage 6/6.
Resistors. Carbon. 80 ohm. 10in. long, for Aerial matching. Morganite. **2/6** ea., post 1/-.
Thermostats. Sunvic. Individually calibrated between 75-80 deg. C. Not adjustable. **4/-**, post 9d.
Microswitches. SPDT. **4/-** ea., post 9d.
Carbon Pile Voltage Regulators, with powerful 24 v. 40 ohm electromagnet, **3/6** ea., post 1/9.
Most of previous bargains are available except Rec. No. 71 and Amplifier No. 165. Above prices mainland only. Money back guarantee. Send S.A.E. for Lists.
25 ASHFIELD PLACE, OTLEY, YORKS.

RATES : 5/6 per line or part thereof, average five words to line, minimum 2 lines. Box No. 1/- extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Wireless," Tower House, Southampton St., Strand, London, W.C.2.

PETHERICK'S RADIO SUPPLIES

9A Westcombe, Bideford, N. Devon.

TRANSISTORS.—Red Spot 8/6. Yellow/Green 9/-. White Spot **15/-**. Yellow/Red **20/-**. **CRYSTAL DIODES 1/-. SURPLUS VALVE BARGAINS 6K7G 4/6. 6J5G, EL32, EF36,** all 3/9 each. **ELECTROLYTICS** 450 volt 8 Mfd. 2/-, 16 3/-, 32 4/3, 8 x 8 3/9, 8 x 16 4/6, 16 x 16 5/3, 32 x 32 6/-. **ALL SENT POST FREE.** List sent on request.

LOUDSPEAKER repairs, all makes, reasonable prices; prompt delivery; 25 years' experience with Rola, Goodmans, Magnavox, Celestion. Dept. P.W., SOUND SERVICE RADIO, 80, Richmond Rd., Kingston-on-Thames. (KIN. 8008.)

RESISTORS — CONDENSERS. — 100 new, unused wire ended Resistors, ½, 1, 2 watt, etc., mixed, useful values, plus 25 Condensers, moulded Mica, etc., **10/-**, post free ; c.w.o. British Isles only. WHITE, The Briars, Needingworth, St. Ives, Hunts.

METERS (NEW BOXED M.O.S.)
Ammeters, 6" round, switchboard mounting, moving iron, 50 cycles, A.C. scaled 0-50. Price **£4**, postage 3/6. Ammeters 2" round, moving coil, complete with shunt, 5 m/a basic movement. Scaled 0-20, price **10/6**, postage 1/6. Voltmeters, moving coil 2" round, 10,000 ohms resistance, scaled 0-50. Price **10/6**, postage 1/6. Voltmeters, 2½" round, moving iron, 50 cycles, scaled 0-300. Price **17/6**, postage 1/6. Cheap Radio & Electrical Components. S.A.E. list. **SPEED ELECTRICS, Eastwood, Notts.**

TELEVISIONS NEEDING ATTENTION. 9in.-10in. models, **£4/10/-** each. 12in. models, **£6/6/-** each. 15in. models and Philips Projection models **£11/10/-** each; immediate despatch; carriage paid. BARKERS, 325, Brockley Road. S.E.4. (TID 6752.)

P. HARRIS ORGANFORD DORSET

POWER UNITS, Input 190/250v. A.C., output 1,200v., 200 m/a smoothed. 1 cwt., **£6** (20/-); Input 12v. D.C., output 300v. 260 m/a smoothed, with hash filters relay for remote starting, **35/-** (7/6); Input 6v. D.C., output 250v. 80 m/a smoothed, with hash filters, **35/-** (7/6). **RC.221 CRYSTALS,** 1,000 kc/s octal base. **20/-** (1/6). **MILLIAMMETERS,** 2in., 0/30 or 0/100 m.c., **12/6** (2/6). **T.B.S. TRANSMITTERS,** 60/80 mc/s, new, less valves, **£4.10.0** (15/-). **T.B.S. RECEIVERS,** new, less valves, 115v. A.C. **£4.10.0** (15/-). **MODULATION TRANSFORMERS:** E.T.4336 driver, **15/-** (3/6) ; Woden, 85 watts, audio, **40/-** (7/6) ; Marconi, 200 watts, **65/-** (10/-). **TRANSMITTING TRANSFORMERS,** Filament, Plate, Audio, over 200 different types, send for list. **METAL RECTIFIERS,** 24v. 6 a., **20/-** (3/6). **STEP-DOWN TRANSFORMERS,** Double Wound Enclosed, G.E.C., 250 watts, **40/-** (5/-). **D.S.T. 100 RECEIVERS,** with valves, **£18/10/-** (20/-). **P.O. RACKS,** de luxe, channel sides drilled both sides, 36 in. high, **40/-** (10/-). **MICRO AMMETERS,** 2½ in., 0/500, **20/-** (2/6) ; 0/1,000, **20/-** (2/6). **TR.1196 UNITS :** Receivers, Type 25, valved, **20/-** (5/-) ; Transmitters, Type 86, valved, **20/-** (5/-) ; Power Unit, Type 87, 15/- (5/-) ; Power Unit, Type 301, 15/- (5/-) ; Smoothing Unit, Type 5, **10/-** (5/-). **TRANSMITTING VARIABLE CONDENSERS,** 25 µµF, 35 µµF, 50 µµF, 100 µµF, all **7/6** each (1/6). **VALVES:** 807, **6/-** ; 6LS metal, **12/6** ; AL-60, 15/- ; DET-12, **20 -** ; DA-41, **20/-** ; RK-34, **2/6.**

COMMUNICATIONS RECEIVERS R88. 2-20 Mc/s with Power Unit 12 volt D.C. or 230 volt A.C. Mains.
SWITCHBOARDS. P.O. mobile type AD-1240 (3-6-9), Universal Call 10-line, Magneto 10-line.
FIELD TELEPHONES. Types D, F, L and EE8.
WIRELESS SET 19—with all ancillary equipment including Rotary Plus Vibrapack Power Unit, R.F. Amplifier, etc.
WIRELESS SET 31—Manpack Walkie-Talkie 40-48 Mc s.
WIRELESS SET 58—Canadian Walkie-Talkie 6-9 Mc,s.
WIRELESS SET 88—Walkie-Talkie 4-Channel 40/42 Mc's.
R.C.A. TRANSMITTERS CRV52093—60-80 Mc/s. Power Supply 115 volts A.C.
R.C.A. RECEIVERS CRV46068-A—60-80 Mc's. Power Supply 115 volts A.C.
MARCONI RECEIVERS B28/CR100—60 Kc's. to 30 Mc/s (Gap 420-500 Kc's) 230 volt A.C.
HALLICRAFTERS RECEIVERS S-27 and SX36.
Morse Keys 2/6 each. **Magslip Hunters, 3 inch, 6/6** each.
NATIONAL HRO SPARES. "I.F." Transformers **12/6** each. We have a large variety of the following. Please ask for lists. Switches, toggle and wafer. Fuses, various types and values. Jack Plugs and Sockets. Capacitors, fixed and variable. Ball-races. Potentiometers, Transformers. Rectifiers, Vibrator, sync and non-sync. Uniselectors. Relays. Carbon brushes for generators and dynamotors.
H.P. or Credit Facilities on all goods. Carriage and packing extra.
S.A.E. for Lists.

R. GILFILLAN & CO., LTD.

National Provincial Bank Chambers, 29, South Street, Worthing, Sussex.
Tel. : Worthing 8719 or 30181.

SOUND RECORDING

TAPE/DISC/TAPE Transfer, 1,800ft. LP new tape, **37/6.** Mixer Units for quality work. SOUND NEWS, 10, Clifford St., London, W.1.

MISCELLANEOUS

AT LAST ! A Tape Recorder you can afford. E. C. KINGSLEY & CO. See our display advertisement on page 706.

SERVICE SHEETS

SERVICE SHEETS for sale and hire. Radio/TV. S.A.E. enquiries. J. PALMER, 32, Neasden Lane, N.W.10.

ENGINEER has complete range Radio/TV Service Sheets, 4/- each. S.A.E. State model No. required; c.w.o. L. BRENNER, 23, Meadway Close, Barnet, Herts.

SERVICE SHEETS, Radio, T.V., 5,000 models. List **1/-**; s.a.e. enquiries. TELRAY, 11, Maudland Bk., Preston.

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S.A.E. enquiries. NEW VALVES, Guaranteed 3 months, return of post (ECH21, N30, U37, 6BG6G, EL38, GZ34, EF86, EL34, EL37, 6LD20, 6L1, 12C8, 15/- each) (ECC81, EL84, EZ80, ECC83, KCF30, KF35, PL82, 10/- each). GZ32, ECF80, 13/- each.

JOHN GILBERT RADIO

20, Extension Shepherds Bush Market, London, W.12. Phone : SHE 3052.

Satisfaction or Money Back Guarantee
If returned unused within 7 days

Last few Staar Galaxy Auto-changers mounted on streamlined high-finish case, as shown, to make complete add-on Player, which will play any 10 Records through your Radio or Amplifier, 200/250 v. (Post 4/6.) **STAAR GALAXY SPARES.** 100s available, low prices, including motors, rubber idler pulleys, tone-arms. S.a.e. list. **£5-15-0**

4-SPEED RECORD PLAYERS
Consisting latest Collaro turntable (200/250 v. A.C.) with Staar Galaxy one hole mounting lightweight dual sapphire xtal pickup. **69/-**
As above but fitted with latest ACOS GP65 dual sapphire cartridge 75 -.

AM/FM 6 VALVE CHASSIS, famous make, strongly built, beautifully designed with 12 x 3in. black and translucent gold dial, 6 latest valves, 200/250 v. A.C., an unrepeatable offer at **£11.19.0.** (Carr. 4/-).

GUARANTEED T.V. TUBES !

(EX EQUIPMENT)

12in. (MW31-74, CRM121, etc.)	£5. 5.0
14in. (MW36-24, CRM141, etc.)	£4.10.0
15-16in. (CRM152B., 41-1, etc.).....	£5. 0.0
17in. (MW43/64 CRM171, etc.)	£5.15.0

(All guaranteed 6 months.) (Carr. & ins. 12/6)

TRANSISTORS.—Red Spot L.F. (up to 800 kc/s). 7/-. Red/yellow output, 10/-. White Spot R.F. (up to 2.5 Mc/s), 14/-.

IRON SELENIUM RECTIFIERS
12 v. 1a, 5/- ; 12 v. 2a, 7/6 ; 12 v. 3½ a, 9/6 ; 250 v. 60 ma, 5/- ; 250 v. 250 ma, 9/6 ; 500 v. 50 ma, 6/6 ; 500 v. 150 ma, 9/6 ; 1,000 v. 40 ma, 8/6. **Contact cooled** 250 v. 50 ma, 7/- ; 250 v. 250 ma, 19/6; 250 v. 500 ma. 23/6.

AUTOCHANGER PLAYERS
Complete kit to make 4-speed player consisting Staar Galaxy changer, 2 valve amplifier, 6in. speaker and attractive portable case, absolutely amazing value, carriage 5/-. **£10-19-0**

GUARANTEED RADIO VALVES
24-HOUR SERVICE

1R5	7/6	6SG7M	5/6	ECC31	9/6	EZ80	7/6
1S5	7/6	6SJ7M	7/-	ECC32	9/-	HVR2A	5/-
1T4	6/6	6SK7GT	6/-	ECC81	7/6	KTW63	6/-
5U4G	6/6	6SN7GT	5/9	ECC82	6/6	MU14	9/-
5Z4G	9/-	6U4GT	12/6	ECC83	8/6	N78	8/-
6AC7	5/6	6V6G	6/-	ECC84	9/9	P61	2/6
6AL5	5/6	6V6M	6/6	ECC85	9/-	PCC84	9/-
6AM6	6/9	6X4	6/-	ECF80	12/-	PCC85	11/6
6BA6	6/6	7B7	7/6	ECF82	11/-	PCF80	9/6
6BE6	6/6	7C6	7/6	ECH42	9/3	PCF82	11/-
6C4	4/9	12AT7	7/6	ECL80	12/6	PEN25	5/-
6C6	4/6	12AU7	6/6	EF36	4/-	PL81	13/6
6CH6	11/-	12AX7	8/6	EF37	7/-	PL82	9/-
6D6	4/6	12K7GT	6/6	EF39	5/-	PL83	11/-
6H6	2/-	12Q7GT	7/-	EF50(A)	4/9	PY80	8/-
6J5M	5/-	25L6GT	8/6	EF50(B)	3/6	PY81	8/6
6J5GT	4/6	35Z4GT	7/6	EF54	4/-	PY82	8/9
6J5G	3/-	80	7/6	EF80	7/6	PY83	8/6
6J7G	5/-	83	7/6	EF85	7/-	SP4B	9/6
6K7G	4/6	807(BR)	8/9	EF89	9/6	SP61	2/6
6K7GT	5/6	EA50	1/6	EF91	6/9	U22	7/6
6K8G	7/6	EB34	1/6	EL32	4/6	U52	6/6
6L6G	8/-	EB91	5/6	EL84	9/6	UY41	8/-
6Q7G	9/6	EBC33	7/-	EY51	10/3	VP41	6/-
6SA7M	7/-	EC52	5/-	EY86	15/-	Z66	9/6

For full list of valves, etc., send

S.A.E. FREE LIST. 500 SNIPS

We would like to thank some of our customers, who were inconvenienced by the inefficiency of an ex-employee, for the patience and co-operation they have afforded us in completing their orders.

All items less 5% and post free for a dozen. Post 1/3 in £1. Min. 9d. No C.O.D.
10,000 SNIPS FOR CALLERS.

TECHNICAL TRADING CO.
350/352, FRATTON ROAD
PORTSMOUTH

FOR SALE

100 BAYS of brand new adjustable steel Shelving, 72in. high x 34in. wide x 12in. deep; stove enamelled, dark green; sent unassembled; 6-shelf Bay, **£3/15/-**; sample delivered free; quantity discounts. N. C. BROWN, LTD., Eagle Steelworks, Heywood, Lancs. (Tel.: 69018.)

MAINS RADIO IN YOUR CAR, complete unit, runs 200/250 AC/DC radio, television, tape recorders, etc., from 12v. battery, perfect, cost £25, **80/-**, stamp full details. SCIENTIFIC PRODUCTS, Cleveleys, Lancs.

GUIDE TO HIGH FIDELITY SOUND. Send 4d. stamps for this illustrated catalogue of Hi-fi Chassis, Cabinets, etc. Gram. bargains, Kits and "no interest" easy terms available. M. RICHARDS, Radio and T.V. Service, Carvoza Rd., Truro, Cornwall.

PLASTIC RECORDING TAPE as new.

7" reels, 1,200ft., **16/9** ; 5½", 850 ft., **12/6** ; 5", 600ft., **11/-**, p. & p. 1/3 each.
EMPTY PLASTIC REELS. 7", **2/10** ; 5½" x 5", **2/8**, post free. Guaranteed satisfaction.

A. MARSHALL & SON (METALS), LTD.,
18 Cricklewood B'way., London, N.W.2.
Gladstone 0161-2.

POWER IN PACKETS.—New stock of H.T.s arrived inc. 162 x 12 x 3v., **10/3**; 64 x 87 x 4½, **10/9**; 67½v., **4/6**; 22½v., **2/4**; 120v., small, **2/4**, etc. Send 1/- for new 20-page catalogue (refunded on 1st purchase), showing Telephone Gear, H.T.s, Condensers, Test Meters, Nife Cells, Files, and dozens of items not usually available. DIGGINS, 129/133, Radnor St., Hulme, Manchester, 15.

AMERICAN MAGAZINES. Year's subscription. "Audiocraft." **32/6**; "Radio Electronics." **35/6**; "Audio." **35/-**. Specimens **4/-** each. Full catalogue free. WILLEN LTD. (Dept. 401), 9, Drapers Gardens, London, E.C.2.

CRYSTAL MICROPHONE INSERTS with exceptionally high output (Cosmocord Mic.61, guaranteed newly made and boxed, **15/6**, post free. RADIO-AIDS LTD., Dept. P. 29, Market St., Watford, Herts.

RECTIFIERS, 2/9. 250 volt 100 m.a. Full- or half-wave. Salvage guaranteed. Why hunt for those obsolete rectifier valves when you can cheaply replace with a modern selenium rectifier? P. & P. 1/3.
GANG CONDENSERS, 1/9. 2- and 3-gangs 500 pF. Standard. Salvaged. Tested. P. & P. 1/3.
VALVE SCREENING CANS, 1/- doz. Latest midget type. Aluminium. 2in. high x 2in. dia. Postage on 1 doz., 6d.
DUKE & CO. (Dept. D.11),
621-3, Romford Rd., Manor Park, E.12
ILF 6001-3

CABINETS, ENCLOSURES AND EQUIPMENT
Write for NEW Catalogue.
A. L. STAMFORD
Dept. Z29,
84 Weymouth Terrace,
London, E.2.

FOR SALE *(Continued)*

ENTHUSIASTS CATALOGUE that will make your eyes pop out, **1/6.** No order too small. 8in. Speakers, **26/1C**; 10in., **30/6.** LAVLO ELECTRICS, 8, Albert Terrace, Whitehaven, Cumb.

R 107 Communications Receiver. 20, Willian Way, Letchworth, Herts.

WANTED

URGENTLY REQUIRED, new Radio, Television, or Industrial Valves. Also old and obsolete types. Cash prices offered for any quantity. Write, call or phone: MIT 6202, 201, Streatham Road, Mitcham, Surrey.

ALL TYPES of Valves wanted. PL81, ECL80, EY51, U25, PCF80, PZ30, U801, etc., etc., best cash price by return. STAN WILLETTS, 43, Spon Lane, West Bromwich, Staffs. (Tel.: WES 2392.)

WANTED, Transreceiver TR1985, 1986 and 1987; Receivers B28, BC312; Green mark sub-assembly Units, 10P 2390, 10R/2391, 10D/2521; Power Supply Units, type 381; Rotary Transformers 10K/1957, Rotary Transformer, type BD77. R. GILFILLAN, 7, High St., Worthing. (Tel.: 3713.)

WANTED by retail organisation, Quantities Electrical, Radio Gear, Instruments. New or Surplus. Anything considered. Cash awaiting. 22, Lathom Avenue, Morecambe.

WANTED VALVES

All types for prompt cash. Must be new. State quantity.

WILLIAM CARVIS LTD.
103, North Street, Leeds, 7.

PUBLIC APPOINTMENTS

EXAMINERS (Unestablished) required for Aeronautical Inspection Service, Radar and Wireless Divisions, at R.A.F. Units at Carlisle, Stafford, Henlow, Bedfordshire and in the Gloucester and Wiltshire area.

Also vacancies for TECHNICAL GRADE III (Radio) unestablished, at No. 90 Group, R.A.F. Medmenham, Bucks, for assistance in installation, design and technical investigation of R.A.F. Radio/Radar communication, navigation and approach aids.

Quals.: C. & G. Intermediate Group certificate in telecommunications engineering or equiv. theoretical knowledge with experience in industry or Services. Commencing salary age 28 and over £705 p.a. on scale £625-£820 (Men). Prospects of promotion and establishment. Age up to 55 years. Applications to Air Ministry, C.E.4h, Cornwall House, Stamford Street, London, S.E.1, or any Ministry of Labour & National Service office, quoting Borough 1540 1545.

SITUATIONS VACANT.

YOUNG, EXPERIENCED MEN, between 18-20, required to train as electronic engineers. Apply: JENNINGS ORGAN CO., Unity Works, Dartford Rd., Dartford, Kent.

(Continued overleaf)

EDUCATIONAL

FREE! Brochure giving details of Home Study Training in Radio, Television, and all branches of Electronics. Courses for the Hobby Enthusiast or for those aiming at the A.M.Brit.I.R.E., City and Guilds, R.T.E.B., and other Professional Examinations. Train with the college operated by Britain's largest Electronics organisation. Moderate fees. Write to E.M.I. INSTITUTES, Dept. PW26, London, W.4.

EASY MATHEMATICS COURSE for Radio/T.V. Write: TUTORIALS, 200, Buchanan Street, Glasgow, C.1.

INCORPORATED Practical Radio Engineers home study courses of radio and TV engineering are recognised by the trade as outstanding and authoritative. Moderate fees to a limited number of students only. Syllabus of Instructional Text is free. The "Practical Radio Engineer." journal, sample copy 2/-, 6,000 Alignment Peaks for Superhets. 5/9. Membership and Entry Conditions booklet, 1/-, all post free from the SECRETARY, I.P.R.E., 20, Fairfield Road, London, N.8.

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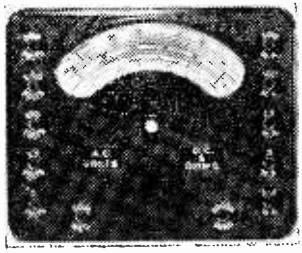

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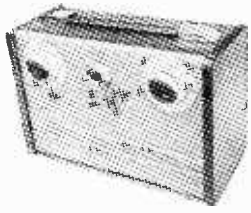

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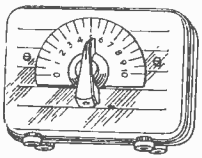

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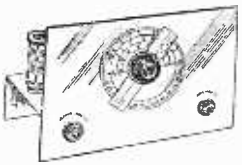

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All the following blueprints, as well as the PRACTICAL WIRELESS numbers below 94, are pre-war designs, kept in circulation for those amateurs who wish to utilise old components which they may have in their spares box. The majority of the components for these receivers are no longer stocked by retailers.

AMATEUR WIRELESS AND WIRELESS MAGAZINE

STRAIGHT SETS

Battery Operated

One-valve : 2/6
B.B.C. Special One-valver AW387*

Mains Operated

Two-valve : 2/6 each
Consoelectric Two (D, Pen), A.C. AW403

SPECIAL NOTE

THESE blueprints are drawn full size. The issues containing descriptions of these sets are now out of print, but an asterisk denotes that constructional details are available, free with the blueprint.

The index letters which precede the Blueprint Number indicate the periodical in which the description appears. Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the Blueprint (stamps over 6d. unacceptable) to PRACTICAL WIRELESS, Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

No. of Blueprint

SHORT-WAVE SETS

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MISCELLANEOUS

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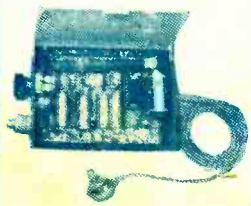

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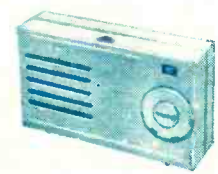

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