A POCKET TRANSISTOR RECEIVER

PRACTICAL WIRELESS

1/3

JULY
1958

EDITOR: F.J.CAMM

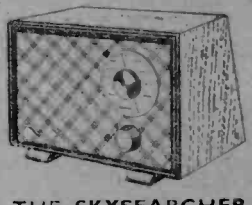
Contents

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.

ALL-MAINS AMPLIFIER

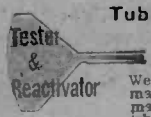
Powerful three-valve Mains amplifier ideal for dances, parties, etc. Complete less chassis, cabinet and speaker (available if required)—data 1/6 (free with parts). Price 19/3, plus 2/6 post and insurance.



THE SKYSEARCHER

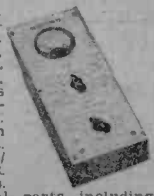
This is a 2-valve plus-metal receiver set useful as an educational set for beginners, also makes a fine second set for the bedroom, workshop, etc. All parts, less cabinet, chassis and speaker, 19/8. Post and ins., 2/6. Data free with parts or available separately, 1/6. **3-valve battery version also available at the same price.**

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.

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.

FOUR ITEMS FOR PRICE OF ONE

This set of modern T.V. parts is equally suitable for modernising an old televisor or for building into a new one. Suitable for wide angle 14in. or 17in. tubes using E.H.T. or 12-14 kV. The four items comprise: (1) Line output E.H.T. transformer. (2) 70° scanning coils on ferrite yokes. (3) Width control with ferrite core. (4) Frame output transformer. With these parts we also give free, complete circuit diagram of a modern televisor which uses them. We offer the whole lot at the price of the Line output transformer only, namely, 57/6, plus 2/6 post and insurance.

THIS MONTH'S SNIP

Unit No. R3206

This is a double unit of unique construction being hinged at front and opening up into two sections for accessibility of components. It contains a wealth of components, only a few of which are:—15 moulded international octal valveholders; 3 carbon pot. meters; 1 I.F. strip suitable T.V., 2 glass diodes, 4 crystal diodes, 1 P.O. relay, 2 12-way plugs and sockets; 1 delay line; 1 11-position Yaxley switch; 1 P.O. jack; approx. 100 resistors, wire wound, carbon and high stability; approx. 50 silver mica and ceramic condensers and a wealth of nuts, bolts, clips, screen wire, pot. locks, tag strips, tag boards, knobs, valve top caps, etc.—everything useful to the home constructor. Unused but a little soiled—absolute gift at 12/6 (the nuts and screws it contains would cost this), plus 3/6 carriage.

The "CRISPIAN" Portable Radio

A 4-valve truly portable battery set with very many good features as follows: Ferrite rod aerials, low consumption valves, superhet circuit with A.V.C. ready-built and aligned chassis if required, beautiful two tone cabinet covered with I.C.I. rexine and Tygan. Guaranteed results on long and medium waves anywhere. All parts, including speaker and cabinet are available separately or if all ordered together the price is £7/15/- complete, or 35/- down and 7 payments of £1/0/0, post and ins. 3/6, ready-built chassis 30/- extra. Instruction booklet free with parts or available separately, price 1/6.

COIL PACK SNIP

Covers the Medium Waveband 200-550 metres and two short wavebands 35-120 metres and 13-42 metres, for 465 k/c. I.F. Extremely well made, supplied complete with diagram of connections. Only 9/6, plus 1/6 post and insurance.

ELECTRICAL SNIPS

Power Switching Kit

Rotary Q.M.B. for power and lighting circuits, facilitates switching for a multitude of different applications, heavy duty contacts for breaking up to 15 amps. A.C., each insulated for well over 1,000 v.

Applications include:

Simultaneous on/off switching of up to 11 circuits.
Simple changeover or changeover and off of up to 11 circuits.
Phase switching of transformers and motors, star to delta, etc.
Transmitter switching CW-MCW-RT.
Emergency switching from mains to stand-by equipment.

The switches are quite easy to assemble and can be altered indefinitely. Overall size approximately 12in. x 4in. diameter, extremely robust with a positive rotary snap action, really beautifully made and complete with control knob. 27/6 plus 2/6 postage.

Install Those Extra Power Points

3 core cable 7.029 (15 amps.) 500 v. grade—a big purchase enables us to sell this at 37/6 per coil (50 yd.), carriage 7/6.

Voltage Divider Transformer

In every Lab or Workshop from time to time there is a need for a little more or a little less voltage. Our voltage divider transformer will fill this need; it has 14 similar windings joined auto-wise and to change the voltage simply join it across the number of windings which conveniently divide it. Thus if existing voltage is 12 and you wish to try 10 and 11 or 13 and 14, then connect existing winding across first 12 sections, you will then be able to take out up to 14 v. in one volt steps. Voltages of up to 100 can be divided and currents up to 10 amps. can be passed. A robust transformer weighs approximately 9 lb. Size 4½in. x 4in. x 4½in. Price 27/6, plus 2/6.

Solenoid Auto Starter

For ¼-¾ h.p. D.C. motor or other circuit which requires starting resistance. This is an automatic solenoid operated contactor, the three solenoids come in in succession and progressively cut out starting resistance. £2/15/0, carriage and insurance 10/-.

Auto Transformer

Totally enclosed, primary 200-250 v., secondary 110-120 v. rated 200-250, 27/6 carriage and insurance 2/6.

Screened Cable

Rubber-covered flexible with metal braiding, ideal for microphone or gramophone extension, 4d. per yard, 30/- per 100 yd.

Remote Control Contactor

Double pole, rated for 30 amps. D.C. but suitable for much higher current on A.C. magnetic arch blowouts and asbestos arch shields. Coil wound for 220 v. D.C. but take turns off and it will be suitable for A.C. or if you prefer, work off A.C. with rectifier. Many applications such as remote switching of motors, banks of lamps, banks of heaters; etc., etc. Energising coil can be operated off Thermostat, Toggle Switch, Push Button or our vacuum delay switch. Size overall is 10in. x 8in. x 4½in. Original cost probably over £5, our price 27/6 each plus 3/6 carriage and insurance.

Dimmer or Regulator

Total resistance 1,000 ohms, maximum current of .58 amps. This is a beautiful unit which uses a 32 position stud switch, resistance is divided into 31 sections each approx. 30 ohms. In ventilated metal case, size approx. 7in. x 7in. x 5½in. with wall mounting brackets and large control knob. 15/- plus 2/6 post and insurance.

REAL BARGAINS

500 Microamp Moving Coil Meter

Flush mounting. Scale marked 0-500 microamps. 17/6 plus 1/6 post and ins.

Flexible Spindle Coupler

For ¼in. spindle insulated and or aligned. 2/6 each.

Slider Resistor

1,000 ohm with insulated knob and locking device. 1/9 each.

Standard Volume Controls

With good length spindle, less switch, 2/-. With single pole switch, 3/3. With double pole switch, 3/9. All popular values.

.3 Amp Vitreous Dropper

Total resistance of main section 500 ohms with tappings marked 200v., 225v. and 250v., also insulated separate winding of 100 ohms. 3/6 each.

Close Tolerance Micas

Up to 100 pF, 6d. each; 9d. each; 500-800 pF, 1/- each; 1,000-5,000 pF, 1/3 each; all one or two per cent. tolerance. 110-500 pF,

Power Chokes

.02H, 5 amp.,	15/-	1.5H,	200 mA.,	10/-
10H, 200 mA.,	17/6			
5H, 200 mA.,	15/-	3H,	100 mA.,	10/-
3H, 200 mA.,	12/-	9H,	100 mA.,	10/-
14H, 200 mA.,	20/-	20H,	10 mA.	5/-

E.H.T. Transformers

Standard 50 c.p.s. Mains input secondary 3,000 volts tapped at 2,500, 2,200, 1,900 volts. All at 20 mA. Also low voltage secondaries 2 v. at 1.5 amp. 4 v. at 1 amp. 25/- plus 2/6 carriage and insurance.

Vibrator Transformer

Primary 12 v. centre tapped, secondary 250-0-250 v. 100 mA., 20/- each, 70 mA. 15/- each. Ditto but 6 v. 70 mA, 12/6. All plus 1/6 post and insurance.

Unused and Boxed Valves

American list, others in stock. Send us your enquiry or order C.O.D.

1A4	9/-	6C4	6/6	6TH8	12/-
1A6	9/-	6C6	6/6	6U5	8/6
1A7	12/6	6C8	5/-	6V6	9/6
1C5	12/6	6D6	6/6	6X5	7/6
1D7	9/-	6F5	9/6	6Z5	15/-
1F6	12/6	6F6	7/6	7A7	9/6
1H5	10/-	6F8	9/6	7C7	9/6
1LD5	3/6	6G6	7/6	7V7	9/6
1T4	7/6	6H6	2/6	7Y4	8/6
1R5	7/6	6J5	5/-	25Y5	10/-
1S5	7/6	6J7	6/-	25Z4	9/6
1T5	8/-	6K6	7/-	25Z6	10/6
2A5	12/6	6L5	9/-	27	10/-
2A6	12/6	6L6	9/-	28D7	3/6
2A7	12/6	6L7	10/6	36	10/-
2X2	4/6	6N7	8/6	39/44	10/-
3A4	7/-	6P8	9/-	41	9/6
3A5	7/-	6Q8	9/-	42	8/-
3S4	8/-	6Q7	9/-	43	10/-
3V4	9/-	6R7	9/-	57	10/-
5Y3	8/-	6SA7	8/-	58	10/-
5R4	9/6	6SC7	9/-	71	9/6
5U4	8/-	6SH7	8/-	75	12/6
5Z3	15/-	6SJ7	9/6	78	8/6
5Z4	9/6	6SK7	6/-	84	8/6
6A7	12/6	6SL7	8/-	89	12/-
6A8	10/-	6SN7	7/6	807	6/6
6B4	5/-	6SQ7	9/-	1625	10/6
6B8	4/-	6SS7	9/-	954	3/6

We wish to remind customers that with the new postage rates the minimum postage on a parcel is now 1/6. Orders for lightweight items which total over £3 will be sent post free, otherwise sufficient must be included to cover postage. Also where a postage and insurance figure is specifically mentioned then this must be included regardless as these items have to be sent separately.

Latest AVO Testmeter

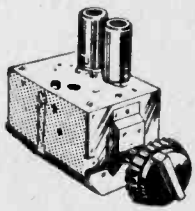
Can be yours for only 10/- deposit and 19 payments of 10/- weekly. Like all AVO meters it is a very fine instrument: it has a sensitivity of 10,000 ohms per volt and 19 most useful ranges as follows—D.C. volts 0-1,000 (seven ranges), A.C. volts 0-1,000 (five ranges), D.C. Current 0-1 amp. (5 ranges), resistance 0-2 megs. (2 ranges), (complete with test leads). Immediate delivery. **Cash prize £9.10.0—non-callers please add 3/6 post & ins.**

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

Medresco Hearing Aid

As supplied by National Health, completely over-hauled and in good working order with six months' guarantee. Only £2.15.0 plus 2/6 post and ins. Complete with carphone and *new* ear plug but not batteries, these can be supplied as an extra for 5/- per set.

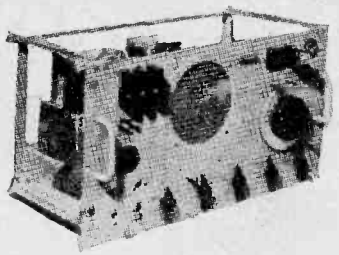
Instructions showing how to convert to pocket radio available free if requested.



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, 79/6. With knobs 3/6 extra, post and insurance 2/6.

SHORT WAVE COMMUNICATIONS RECEIVER R.208. ONLY £6.19.6



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 ins. then 14 weekly payments of 10/- each.

More Real Bargains

7 Valve 5 Waveband superhet chassis, H.F. stage and magic eye. Unused but may be slightly soiled and need servicing—less valves, power pack and tuning scale. Contains really fine coil pack which alone would cost twice what we are asking for the whole unit. Price with circuit diagram, £2.15.0. Carriage and insurance 7/6.

4 Valve Superhet chassis, long and medium wave complete with valves, but not scale. Unused but slightly soiled and may need servicing (no data available). 29/6, plus insurance 3/6.

10 Valve superhet 1½ meter ex Government but unused, complete with valves, easily converted for Band III, 39/6, carriage and packing 7/6.

Isolation Transformer 150 watt, mains in, isolated mains out, makes servicing safe, 29/6.

Filament Transformer 6.3 volt 3/4 amps, tapped primary, 8/6.

Transistor suitable A.F. or low R.F., new tested, O.K. most circuits, 6/6.

Midget output Transformer, standard pentode matching, 4/6.

Midget output Transformer special for battery sets, pentode matching, 4/6.

14in. T.V. Cabinet by famous maker cost over £4 to make, new and perfect, 15/-, carriage 4/6.

Metal rectifier 250 v. 60-80 milliamps, ideal for mains set or instrument or to replace that expensive valve, 4/6.

Constructors parcel, 5 valve superhet chassis, 15 x 15 x 2 with three waveband glass scale, pulleys, drive head, etc., 9/6, plus post and insurance 1/6.

Toggle switch, standard metal body, type with round dolly, fixing ring and on/off indicating plate, 1/3 or 12/- doz.

Weymouth Coil pack, long medium and two short, 19/6.

Thin paxolin panels size 8in. x 5in. 2/6 doz.

Midget I.F. coils 465 k/cs but with feed back winding for economy circuits, 6/6 pair.

Mains Transformer standard 230 v., input, 250-0-250 at 80 mA, 6.3 v. at 5 mA, 12/6.

Out of Seasonbargain. Enough waterproof heating element to make an average size blanket, normally sold at 15/-, price complete with illustrated data, 9/6.

50 Assorted resistors, well mixed and useful values ¼ and ½ watt, 5/- for 50.

Ditto but 1 watt, 6/6 for 50.

.1 mFd 350, small tubular metal cased condensers made by dubilier, 2/6 doz.

Loudspeaker 8in. energised field, 9/6, carriage 3/6.

6ft. Unbreakable Mains Lead. Type of lead fitted to electric razors makes fine lead for test meters and any other devices where subject to continuous bending. Twin figure eight construction, soft cream P.V.C. covered. Normally costs 2/- per yard —we offer three leads for 2/-.

Welding transformer 12v.-50 amp continuous rating—intermittent rating for spot welding—exceeds 2,000 amps, 45/-, carriage and packing 5/-.

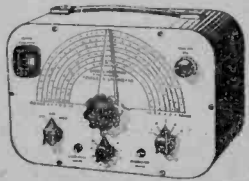
Hand Magneto Generator as used on telephones, 9/6.

Magneto Bell also operates off mains through stepdown transformer, 3/-.

Cathode Ray Tube VCR517, 7/6, carriage, etc., 3/6.

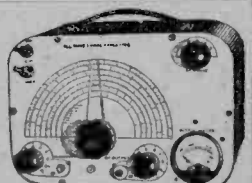
Thermal delay vacuum relay with book of interesting circuits, 4/6.

SIGNAL GENERATORS



23/- deposit and 6 monthly payments of 21/6. Cash £8.19.6. Post and Packing 5/- extra.

Coverage 100 Kc/s-100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Metal case 10in. x 6½in. x 5½in., grey hammer finish. Incorporating three miniature valves and Metal 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. Incorporating magic eye as output indicator. Accuracy plus or minus 2%.

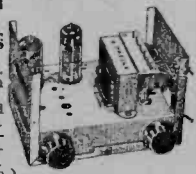


25/- deposit plus P. & P. 5/- and 4 monthly payments of 21/6. Cash £4/19/3 plus P. & P. 5/-.

Coverage 120 Kc/s. 8½ Mc/s. Metal case 10in. x 6½in. x 4½in. Size of scale, 6½in. x 3½in. 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 continuous 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%.

CONVERT TO I.T.A. FOR ONLY 25/- deposit plus P. & P. 5/- and 4 monthly payments of £1/5/6. Cash £5/17/- plus P. & P. 5/-

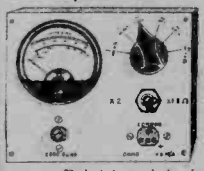
ANY T.V. (except Philips Bristol area or Valley Area, Wales) WITHIN 35 MILES OF I.T.A. TRANSMITTER. ALL CHANNELS NO ALTERATIONS TO SET.



Complete with built-in power supply. 200-250 v. A.C. mains. Crackle finish case 5½in. long, 3½in. wide, 4½in. high incorporating gain control and band switch. Illus. with cover removed. Complete installation comprises "Converter," Wolsey 3-element I.T.A. outside or loft aerial. 35ft. I.T.A. lead. two plugs. (Wolsey 5-element 10/- extra.)

"CONVERTER" only £3/19/6 plus P. & P. 2/6.

AC/DC POCKET MULTI-METER KIT



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

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

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

4-VALVE ALL-DRY SUPERHET PORTABLE KIT

incorporating Ferrite rod aerial Medium and long waves. In grey leatherette. Size 9in. x 7in. x 6in. Valve line-up: 1T4, 1R5, 1S5, 3V4. Complete kit of parts (less batteries).

£5.19.6 Plus Post & Packing 3/6.

PORTABLE AMPLIFIER

Size 6½in. long, 5in. high, 2½in. deep. Will suit any type of crystal pick-up. Output approx. 2 watts. Incorporating ECC83 double triode, Cossor 142BT output pentode and contact-cooled rectifier. Fully isolated mains transformer for 230/250 AC mains. Bass, treble, and volume controls.

49/6 Plus P. & P. 3/6

5in. SPEAKER with O.P. TRANSFORMER purchased with the above, 18/6, plus P. & P. 1/6.

COLLARO MIXER 4-SPEED AUTOMATIC CHANGER

Model 457 Type "O" Pick-up. Size 12in. x 13½in. Minimum clearance above baseboard 5in., below 2½in., 10 records. A.C mains. 230-250 v., turnover crystal head. Brand new, fully guaranteed (suitable for use with the above amplifier).

£8.19.6 Plus P. & P. 5/-. or 25/- deposit, plus P. & P. 5/-, and 7 monthly payments of £1/5/0.

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

23 HIGH STREET, ACTON, LONDON, W.3

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

EXCLUSIVE OFFER OF THE R.107

THE ARMY'S FINEST COMMUNICATIONS RECEIVER

Just purchased from the Ministry of Supply, this magnificent 9 valve 3 Wave-band receiver gives World Wide Reception over a coverage of 1.2-17.0 Mc/s (18-25 metres), taking in several important Amateur Bands, Shipping Band, and part of the Medium Wave Band, including the B.B.C. Light Programme, sensitivity is 1 micro-volt on CW, and 2-6 micro-volts on RT. The controls include a Bandwidth Switch ("Wide" or "Narrow"), choice of A.V.C. and B.F.O., Audio Filter, R.F. Gain, Aerial Trimmer. Has built-in Output Stage with Internal Speaker, which can be switched out to use Headphones. Uses normal international Octal Valves. Incorporates A.C. Mains Power Unit for 100-250 volts, and Vibrator Pack for 12 volts D.C. In Grey Metal Case size 24" x 13" x 17". These sets are used, but in very good condition, thoroughly checked and aerial tested before despatch.

COMPLETE, READY TO SWITCH ON

£8-19-6

(Carriage 20/- England and Wales, rest of U.K. extra)

S.A.E. for Illustrated Leaflet.

COLLINS TCS TRANSMITTERS. Special offer of these famous American Transmitters. Frequency Range 1.5-12.0 Mc/s in 3 bands. Employs 7 valves. 2 of 1625 in P.A. Stage, 1625 buffer and 1625 modulator stage, 3 of 12A6 in Oscillator stage. Radio Telephone or Radio Telegraph. Provision for VFO or Crystal Control 4 Crystal positions. Has Plate and Aerial Current meters. IN BRAND NEW CONDITION. ONLY £12.10.0 (carriage, etc., 15/-).

COMMUNICATIONS RECEIVER R.1155.—The famous Bomber Command Set Covers 18.5-7.5 Mc/s, 7.5-3.0 Mc/s, 1,500-600 Kc/s, 500-200 Kc/s, 200-75 Kc/s. Late Model "B" fitted with Super Slow Motion Tuning. Slightly used, but in First-class Condition, aerial tested before despatch. 14-page booklet supplied giving circuits and notes, etc. (or available separately 1/3). ONLY £7/19/6 (carriage 10/6).

A.C. MAINS POWER PACK & OUTPUT STAGE.—In black metal case. Enables receiver to be operated immediately by just plugging in. WITH built-in speaker. £5/5/-. LESS speaker, £4/10/- (carriage 5/-).

6 v. VIBRATOR PACKS. Output approx. 130 v. at 30 mA., fully filtered and smoothed. Complete. ONLY 12/6.

R1155 SUPER SLOW-MOTION TUNING ASSEMBLY. As used on all late model 1155s. Easily fitted to "A" sets, etc. ONLY 12/6.

EHT TRANSFORMERS. 5.5 kV. (Rect.) with 2 v. 1 a., 7/9/6. 7 kV. (Rect.) with 2 v. 1 a., 8/9/6. 2.5 kV (Rect.) with 2-0-2 v. 1.1 a., 2-0-2 v. 2 a. (for VCR97 tube, etc.), 42/6 (postage 2/- per trans.).

POCKET VOLTMETERS.—Read 0-15 volts and 0-300 volts A.C. or D.C. BRAND NEW AND UNUSED. ONLY 18/6.

CRYSTALS. British Standards 2-pin 500 kc/s, 15/-. Miniature 200 kc/s and 465 kc/s, 10/- each.

ROLA 6½in. P.M. SPEAKER. Mounted in grey crackled metal cabinet 9in. x 9in. x 4½in., with volume-control. Ideal for use with receiver, or as extension. BRAND NEW. ONLY 27/6. (Post 2/6).

MAINS ISOLATING TRANSFORMER. Manufactured by Vortexion. Fully shrouded. Will provide true 1 : 1 ratio from nominal 230 v. Primary. Rated at 100 watts. BRAND NEW. ONLY 22/6. (Post 2/6).

HARRIS ELECTRONICS

(LONDON) LTD.

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

(Phone TERminus 7937)

Please include carriage costs on ALL items.

(Open until 1 p.m. Saturdays. We are 2 mins. from High Holborn (Chancery Lane Station) and 5 mins. by bus from King's Cross)

R.S.C. BATTERY CHARGING EQUIPMENT

ASSEMBLED CHARGERS

6 v. 1 amp	19/9
6 v. or 12 v. 1 amp	27/9
6 v. 2 amps.	29/9
6 v. or 12 v. 2 amps	33/9
6 v. or 12 v. 4 amps	58/9

Above ready for use. Carr. 3/6. With mains and output leads.

SELENIUM RECTIFIERS F.W. BRIDGE TYPES

6/12 v.	1 a.	4/11	L.T. Types H.W.
6/12 v.	2 a.	9/9	2-6 v. 1 a., 1/11
6/12 v.	3 a.	11/9	6-12 v. ½ a. H.W. 2/9
6/12 v.	4 a.	14/9	H.T. Types H.W.
6/12 v.	6 a.	19/9	150 v. 40 mA. 5/9
6/12 v.	10 a.	25/9	250 v. 50 mA. 5/9
6/12 v.	15 a.	35/9	250 v. 250 mA. 11/9

BATTERY CHARGER KITS

Consisting of Mains Transformer. F.W. Bridge. Metal Rectifier, well ventilated steel case. Fuses. Fuse-holders. Grommets, panels and circuit. Carr. 2/9 extra.

6 v. or 12 v. 1 amp	22/9
6 v. 2 amps.	25/9
6 v. or 12 v. 2 amps	31/6
6 v. or 12 v. 4 amps	53/9

BATTERY CHARGER KIT

Consisting of F.W. Bridge Rectifier, 6/12 v. 5 a. Mains Trans. 0-9-15 v. 6 a. output and Ammeter, 49/9. Post 3/9.

ASSEMBLED CHARGER

6 v. or 12 v. 2 amps.

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

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

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

Assembled 6 v. or 12 v. 4 amps.

Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved blue hammer finish. Fused and ready for use with mains and output leads. Carr. 4/6. Credit Terms: Deposit 30/- and 4 monthly payments. 13/-.

75/-

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

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

TOP SHROUDED DROP THROUGH

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

FULLY SHROUDED UPRIGHT

250-0-250 v. 60 mA, 6.3 v. 2 a, 5 v. 2 a. Midget type 2½-3-3in.	17/6
250-0-250 v. 100 mA, 6.3 v. 5 a, 5 v. 3 a.	28/9
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.	23/9
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a.	26/9
300-0-300 v. 130 mA, 6.3 v. 4 a, 6.3 v. 1 a, for Mullard 510 Amplifier	35/9
350-0-350 v. 150 mA, 6.3 v. 4 a, 5 v. 3 a.	33/9
350-0-350 v. 150 mA, 6.3 v. 2 a, 6.3 v. 2 a, 5 v. 3 a.	35/9
425-0-425 v. 200 mA, 6.3 v. 4 a, C.T. 6.3 v. 4 a, C.T., 5 v. 3 a. Suitable Williamson Amplifier, etc.	49/9

FILAMENT TRANSFORMERS

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

JUNCTION TRANSISTORS

Brand new R.F. type 17/6. A.F. 7/6.

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

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

EX-GOVT. SMOOTHING CHOKES

250 mA. 20 H 230 ohms	19/9
250 mA. 5 H 50 ohms	12/9
150 mA. 10 H 100 ohms	11/9
150 mA. 6-10 H 150 ohms Trop.	6/9
120 mA. 12 H 100 ohms	9/9
100 mA. 5 H 100 ohms	3/11

CHARGER TRANSFORMERS

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

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c/s.

120 v. 40 mA, 5-0-5 v. 1 a.	15/9
90 v. 15 mA, 4-0-4 v. 500 mA.	9/9

SMOOTHING CHOKES

250 mA. 5 H 100 ohms	12/9
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

OUTPUT TRANSFORMERS

Midget Battery Pentode 66:1 for 3S4, etc.	3/9
Small Pentode, 5,000 Ω to 3 Ω	3/9
Small Pentode 7/8,000 Ω to 3 Ω	3/9
Standard Pentode 5,000 Ω to 3 Ω	4/9
Standard Pentode, 7/8,000 Ω to 3 Ω	4/9
10,000 Ω to 3 Ω	4/9
Push-Pull 10-12 watts 6V6 to 3 Ω or 15 Ω	15/9
Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15 Ω	16/9
Push-Pull EL84 to 3 or 15 Ω	16/9
Push-Pull 15-18 watt, 6L6, KT66	22/9
Push-Pull 20 watts, sectionally wound 6L6, KT66, etc., to 3 or 15 Ω	47/9

MAINS TRANSFORMERS

Manufacturers' surplus. Primaries 200-250 v. 50 c/s. 375-0-375 v. 150 mA. 6.3 v. 4 a. C.T. 6.3 v. 1 a. Fully shrouded. 23/9.
325-0-325 v. 100 mA. 6.3 v. 2.5 a, 5 v. 2 a. Drop through type, 18/9. Postage on either type 2/9.

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, SP61, 6V6G. Selectivity and quality are well up to standard, and simplicity of construction is a special feature. Point-to-point wiring diagrams, instructions and parts lists, 1/3. Maximum building cost £1/1/3, including attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 6½ x 5½in.

EX-GOVT. DOUBLE WOUND STEP UP/STEP DOWN TRANSFORMERS. 10-0-100-200-220-240 v. to 5-0-75-115-135 v. or REVERSE. 80-100 watts. Only 12/9, plus 2/9 post. 10-0-100-200-220-240 v. to 5-0-110-122-133-148 v. or REVERSE. 200 watts. 35/9, plus 7/6 carr. Both 50 c.p.s.

EX-GOVT. MAINS TRANSFORMER. Primary 0-110-120-200-210-220-230-240-250 v. 50 c.p.s. Secs. 275-0-275 v. 100 mA. 6.3 v., 7 a, 5 v. 3 a. Govt. rating, 22/9. Following with 230-250 v. primaries, 400-0-400 v. 200 mA, 5 v. 3 a, 5 v. 2 a, 19/9; 230-0-230 v. 100 mA, 12.6 v. 1.5 a, 5 v. 2 a, 11/9; 12.6 v. 3 a, 5 v. 3 a, 9/9. Postage 2/9 on any type. Primary 115-230 v., 24 v. 15 a, A.C., 10 a, D.C. (after rectification), 79/6, carr. 7/6. Conservative Govt. rating.

EX-GOVT. CASES. Size 14-10-8in. high. Well ventilated, black crackle finished, undrilled cover. IDEAL FOR BATTERY CHARGER OR INSTRUMENT CASE, OR COVER COULD BE USED FOR AMPLIFIER. Only 9/9, plus 2/9 postage. Size 8½ x 13½ x 6½ ins. with undrilled well ventilated cover, finished in stoved grey enamel. Suitable for charger or instrument case. 7/9, plus 2/9 post.

EX-GOVT. VALVES (NEW)

1R5	7/9	6J5	5/9	ECC91	4/9
1T4	7/9	6J6	4/9	EF80	7/9
1S5	7/9	6V6G	7/9	EB91	4/9
3S4	8/9	6X4	6/9	EF91	8/9
5Y3G	8/9	6X5GT	8/9	EL32	3/9
5U4G	8/9	6L6G	11/9	KT44	8/9
5Z4G	9/9	807	7/9	KT61	9/9
6K7G	5/9	12A6	7/9	EZ90	6/9
6S.J7GT	6/9	15D2	4/9	EL34	10/6
6SLGT	8/9	35Z4GT	8/9	FW4/500	9/8
6SN7GT	8/9	MH4	4/9	SP61	2/9
6AT6	7/9	ECC83	9/9		

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, 46/8.

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 c/s. **SUITABLE FOR ALL BATTERY RECEIVERS** normally using 2 v. accumulator. Complete kit of parts with diagrams and instructions, 49/9, or ready for use, 59/6.

MINIATURE MOTORS. 24/28 v. D.C. or A.C. made by Hoover Ltd., Canada. Size only 2½ x 1¾in. Spindle 1¼in. long, ¼in. diam. Brand New, 9/9.

HEADPHONES. Brand new. Low resistance. Only 6/9 pr.

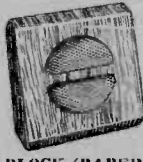
EX-GOVT. 50 WATT SPEECH AMPLIFIERS. For normal 200-250 v. A.C. mains. Complete with hand 'mike' with good length of lead and all valves. Ready for use in wood transit cases. Only 9 Gns., carr. 15/-.

TANNOY RE-ENTRANT 8 WATT SPEAKERS. For use with above, 27/6 ea.

EXTENSION SPEAKERS

Ready for use in walnut veneered cabinet.

6½in. 2-3 ohms, 29/11.
8in. 2-3 ohms, 35/9.
Very limited number



EX-GOVT. METAL BLOCK (PAPER) CONDENSERS.

4 mfd. 350 v., 2/9; 4 mfd. 1,000 v., 4/9; 8 mfd. 500 v., 4/9; 10 mfd. 500 v., 3/9;

SPECIAL OFFERS: Electrolytics: 32-32-32 mfd. 250 v. Dubilier small cans, 2/9 ea. 150 mfd. 450 v., 3/9. Small .0005 mfd. 2-gang, 4/9 ea. Westinghouse Rectifiers 250 v. 250 mA, 7/9. **CO-AXIAL CABLE.** 75 ohm, ½in. 8d. yd. Twin-Screened Feeder 11d. yd.

ELECTROLYTICS (current production) NOT EX-GOVT.

Tubular Types		Can Types	
8 mfd. 450 v.	1/9	16 mfd. 350 v.	1/11
8 mfd. 500 v.	2/6	16 mfd. 450 v.	2/9
16 mfd. 350 v.	2/3	32 mfd. 350 v.	2/11
16 mfd. 450 v.	2/9	32 mfd. 450 v.	4/9
16 mfd. 500 v.	3/6	100 mfd. 450 v.	4/9
32 mfd. 350 v.	3/9	8-8 mfd. 450 v.	2/9
25 mfd. 25 v.	1/3	8-16 mfd. 450 v.	3/11
50 mfd. 12 v.	1/3	16-16 mfd. 450 v.	4/11
50 mfd. 25 v.	1/6	32-32 mfd. 350 v.	4/9
50 mfd. 50 v.	1/9	32-32 mfd. 450 v.	5/9
100 mfd. 12 v.	1/9	100-100 mfd. 350 v.	5/9
100 mfd. 25 v.	2/3	100-200 mfd.	
1,500 mfd. 6 v.	1/6	275 v.	6/9
3,000 mfd. 6 v.	3/9		

VALVES

Guaranteed All Tested Before Dispatch

AC6PEN	6/6	ECH81	9/-	FW4/500	10/-	PX25	12/6	UCF80	23/-	1H5GT	10/6
AC/TH1	34/9	ECL80	13/6	GZ32	12/-	PY80	9/-	UCH42	10/6	1L4	6/6
ATP4	3/6	ECL82	12/6	H30	5/-	PY81	10/-	UCH81	11/5	1LD5	3/6
AZ31	12/6	EF22	8/6	HL23DD	8/6	PY82	8/6	UCL82	23/-	1N5	10/6
C8L31	24/4	EF36	6/-	K40N	9/-	PY83	10/-	UCL83	25/9	1R5	8/-
CCH35	24/4	EF37A	12/-	KF35	8/6	PZ30	20/11	UF41	10/6	1S4	10/6
CL33	20/2	EF39	6/6	KK32	23/-	PEN4DD	27/10	UF85	10/6	1S5	7/6
CY31	17/5	EF40	13/6	KT24	5/-	PEN4VA	15/	UF89	10/6	1T4	7/6
DAF96	10/6	EF41	9/9	KT33C	10/-	PEN25	5/-	UL41	10/6	1U5	7/6
DF96	10/6	EF42	14/-	KT36	27/10	PEN44	27/10	UL44	27/10	2C26	1/6
DH63	9/-	EF50	4/-	KT55	12/6	PEN45	27/10	UL46	24/4	2X2	4/6
DK96	10/6	EF54	6/-	KT66	15/-	PEN46	7/-	UL84	11/6	3A4	7/-
DL96	10/6	EF55	10/-	KTW61	8/-	PEN220A	4/-	UU6	20/11	3D6	5/-
DM70	3/6	EF80	9/-	KTW63	7/6	PENA4	15/-	UU8	27/10	3Q4	9/-
EA50	1/6	EF85	9/-	KTZ41	8/6	QP21	7/6	UU9	8/6	3Q5GT	9/6
EABC80	10/-	EF86	14/6	ME91	7/6	R16	27/10	UY41	8/6	3S4	8/-
EAC91	7/6	EF89	10/-	MH41	7/9	R19	13/6	UY85	10/-	3V4	9/-
EAF42	10/6	EK32	8/6	MSP4/5 PIN	12/6	SP41	3/-	VP2B	8/-	4D1	3/-
EB34	2/-	EL32	5/6	MSP4/7 PIN	12/6	SP61	3/-	VP13C	3/6	5R4GY	9/6
EB41	9/6	EL33	20/2	N37	18/1	SP220	3/11	VP23	6/6	5U4G	8/-
EBC33	7/6	EL38	27/10	N78	12/6	T41	24/4	VP41	8/6	5Y3G	8/-
EBC41	10/6	EL41	10/6	OZ4	5/6	TH2	9/-	VR105/30	8/-	5Y3GT	8/-
EBF80	10/6	EL42	12/-	P61	3/6	TP25	27/10	VR116	4/-	5Z4G	10/-
EBF89	18/1	EL84	10/6	PCC84	10/-	U10	10/6	VR150/30	9/-	6A7	13/-
EBL21	24/4	EM80	10/6	PCF80	13/6	U12/14 (DW4500)	8/6	VU120A	3/6	6A8G	10/-
EBL31	24/4	EM81	11/6	PCF82	12/6	U22	8/-	VU39 (MU 12/14)	8/9	6AC7	6/6
EC91	7/6	EY51	13/6	PCL82	14/6	U37	27/10	VU111	2/6	6AG5	5/6
ECC84	10/3	EY86	13/6	PCL83	14/6	U45	15/-	W77	8/6	6AK5	6/6
ECC85	9/6	EZ40	9/-	PL38	27/10	U50	9/-	W729	13/6	6AL5	6/6
ECF80	13/6	EZ41	10/-	PL81	16/-	U329	14/6	X65	12/6	6AM6	9/-
ECF82	12/6	EZ80	8/9	PL82	8/6	U403	17/5	X78	22/3	6AQ5	7/6
ECH21	24/4	EZ81	11/10	PL83	11/6	U404	11/10	X79	11/6	6AT6	8/6
ECH35	10/6	EZ90	8/-	UBC41	10/-	U801	31/4	Y63	9/-	6AU6	10/6
ECH42	10/6	E1148	2/-	UBF80	9/6	UABC80	10/6	Z309	9/6	6B4	5/-
				UCC84	20/11	UAF42	10/6	Z309	9/6	6B8G	4/-
						UB41	9/6	Z359	9/6	6BA6	7/6
						UBC41	10/-	Z759	9/6	6BE6	8/-
						UBF80	9/6	1A3	3/6	6BG6G	24/4
						UCC84	20/11	1A5GT	6/-	6BH6	16/-
						UCH42	10/6	1A7	12/6	6BJ6	9/-
						UCH81	11/5	1C2	11/6	6BR7	11/6
						UCL82	23/-	1C5GT	12/6	6BW6	8/6
						UCL83	25/9	1D5	12/6	6BW7	10/-
						UF41	10/6	1D6	12/6	6C4	7/-
						UF85	10/6	1H5GT	10/6	6C5GT	6/6
						UF89	10/6	1L4	6/6	6C6	5/-
						UL41	10/6	1LD5	3/6	6C8G	5/-
						UL44	27/10	1N5	10/6	6CD6G	31/4
						UL46	24/4	1R5	8/-	6CH6	7/6
						UL84	11/6	1S4	10/6	6D6	5/-
						UU6	20/11	1S5	7/6	6F1	13/6
						UU8	27/10	1T4	7/6	6F6G	7/6
						UU9	8/6	1U5	7/6	6F6M	7/6
						UY41	8/6	2C26	1/6	6FI3	14/-
						UY85	10/-	2X2	4/6	6FI5	14/-
						VP2B	8/-	3A4	7/-	6G6G	4/6
						VP13C	3/6	3D6	5/-	6H6	2/6
						VP23	6/6	3Q4	9/-	6H6GT	2/6
						VP41	8/6	3Q5GT	9/6	6J5GT	5/6
						VR105/30	8/-	3S4	8/-	6J5M	6/6
						VR116	4/-	3V4	9/-	6J6	6/-
						VR150/30	9/-	4D1	3/-	6J7G	6/6
						VU120A	3/6	5R4GY	9/6	6J7M	9/-
						VU39 (MU 12/14)	8/9	5U4G	8/-	6K6GT	7/-
						VU111	2/6	5Y3G	8/-	6K7G	5/-
						W77	8/6	5Y3GT	8/-	6K7GT	7/-
						W729	13/6	5Z4G	10/-	6K7M	6/9
						X65	12/6	6A7	13/-	6K8G	8/6
						X78	22/3	6A8G	10/-	6K8GT	10/-
						X79	11/6	6AC7	6/6	6K25	20/11
						Y63	9/-	6AG5	5/6	6L6G	9/-
						Z309	9/6	6AK5	6/6	6L7	7/6
						Z359	9/6	6AL5	6/6	6N7	7/6
						Z759	9/6	6AM6	9/-	6P28	27/10
						1A3	3/6	6AQ5	7/6	6Q7GT	9/-
						1A5GT	6/-	6AT6	8/6	6SA7GT	8/-
						1A7	12/6	6AU6	10/6	6SG7	7/6
						1C2	11/6	6BH6	16/-	6SH7	6/-
						1C5GT	12/6	6BJ6	9/-	6SJ7	8/6
						1D5	12/6	6BR7	11/6	6SK7	6/-
						1D6	12/6	6BW6	8/6	6SL7GT	8/-
								6BW7	10/-	6SN7GT	7/6
								6C4	7/-	6SQ7	9/3
								6C5GT	6/6	6U4GT	14/-
								6C6	5/-	6U5/6G5	8/6
								6C8G	5/-	6U5G	8/6
								6CD6G	31/4	6U7G	8/6
								6CH6	7/6	6V6G	7/-
								6D6	5/-	6V6GT	7/-
								6F1	13/6	6V6M	8/6
								6F6G	7/6	6X4	7/6
								6F6M	7/6	6X5G	7/-
								6FI3	14/-	6X5GT	7/-
								6FI5	14/-	6/30L2	12/6
								6G6G	4/6	7B7	8/6
								6H6	2/6	7C5	8/-
								6H6GT	2/6	7C6	8/-
								6J5GT	5/6	7D6	13/6
								6J5M	6/6	7H7	9/-
								6J6	6/-	7Q7	9/-
								6J7G	6/6	7S7	9/6
								6J7M	9/-	7Y4	8/6
								6K6GT	7/-	8D2	2/9
								6K7G	5/-	9BW6	11/6
								6K7GT	7/-	9D2	3/6
								6K7M	6/9	10F1	27/10
								6K8G	8/6	12A6	6/6
								6K8GT	10/-	12AH8	11/6
								6K25	20/11	12AT6	10/6
								6L6G	9/-	12AT7	9/-
								6L7	7/6	12AU6	10/6
								6N7	7/6	12AU7	7/6
								6P28	27/10	12AX7	8/6
								6Q7GT	9/-	12BA6	9/-
								6SA7GT	8/-	12BE6	10/-
								6SG7	7/6	12BH7	11/6
								6SH7	6/-	12C8GT	8/-
								6SJ7	8/6	12H6GT	3/-
								6SK7	6/-	12J5GT	4/6
								6SL7GT	8/-	12J7GT	10/6
								6SN7GT	7/6	12K7GT	8/6
								6SQ7	9/3	12K8GT	13/6
								6U4GT	14/-	12Q7GT	8/6
								6U5/6G5	8/6	12SC7	1/6
								6U5G	8/6	12SG7	7/6
								6U7G	8/6	12SH7	5/6
								6V6G	7/-	12SJ7	8/-
								6V6GT	7/-	12SK7	6/-
								6V6M	8/6	12SL7	8/-
								6X4	7/6	12SN7GT	17/6
								6X5G	7/-	12SQ7	8/9
								6X5GT	7/-	14S7	14/6
								6/30L2	12/6	15D2	7/9
								7B7	8/6	19BG6G	24/4
								7C5	8/-	20D1	16/-
								7C6	8/-	20F2	27/10
								7D6	13/6	20P1	27/10
								7H7	9/-	20P3	20/11
								7Q7	9/-	20P5	20/11
								7S7	9/6	25A6G	11/6
								7Y4	8/6	25L6GT	10/-
								8D2	2/9	25Y5	9/6
								9BW6	11/6	25Y5G	9/9
								9D2	3/6	25Z4	9/6
								10F1	27/10	25Z5	10/-
								12A6	6/6	25Z6	10/-
								12AH8	11/6	30F5	11/6
								12AT6	10/6	30FL1	11/6
								12AT7	9/-	30P4	21/7
								12AU6	10/6	30P12	12/6
								12AU7	7/6	30PL1	12/6
								12AX7	8/6	35L6GT	9/6
								12BA6	9/-	35W4	8/6
								12BE6	10/-	35Z4GT	8/-
								12BH7	11/6	35Z5GT	9/-
								12C8GT	8/-	42	8/-
								12H6GT	3/-	50C5	11/6
								12J5GT	4/6	50CD6G	31/4
								12J7GT	10/6	50L6GT	8/6
								12K7GT	8/6	75	11/6
								12K8GT	13/6	77	7/6
								12Q7GT	8/6	80	8/6
								12SC7	1/6	142BT	3/6
								12SG7	7/6	185BT	34/9
								12SH7	5/6	210DDT	4/6
								12SJ7	8/-	210VPT	3/6
								12SK7	6/-	807	6/6
								12SL7	8/-	954	2/-
								12SN7GT	9003	955	4/9
									17/6	956	3/6
								12SQ7	8/9	9001	5/6
										9003	5/6
										9004	5/6
										9006	5/6

MAINS TRANSFORMERS

3 Way Mounting Type.

MT1
Primary: 200-220-240 v. Secondaries: 250-0-250 v. 80 m/A 0-6.3 v. 4 amp., 0-4 v. 2 amp. Both tapped at 4 v. 21/9 each.

MT2
Primary: 200-220-240 v. Secondaries: 350-0-350 v. 80 m/A 0-6.3 v. 4 amp., 0.5 v. 2 amp. Both tapped at 4 v. 21/9 each.

MT3
Primary: 200-220-240 v. Secondary 30 v. 2 amps. Taps at 3 v., 4 v., 6 v., 8 v., 9 v., 10 v., 15 v., 18 v., 20 v., 24 v., 21/9 each. Postage and Packing please add 2/- per transformer.

As MT1 and MT2 above but 100 m/A No. 4 volt Taps, 25/9 each.

Our new 1958/9 Catalogue is now ready—fully illustrated—a boon to all amateurs and service engineers. Send 1/- in stamps for your copy.

HEATER TRANSFORMERS—Primary 220/240 volts

2 volt ½ amp.	5/-	4 volt 3 amp.	10/-
2 volt 3 amp.	8/3	5 volt 2 amp.	10/-
4 volt 1½ amp.	5/6	6.3 volt ½ amp.	5/6
6.3 volt 1½ amp.	6/9		
6.3 volt 3 amp.	10/-		
12 volt ¾ amp.	5/9		

OUTPUT TRANSFORMERS
5,000 ohms to 3 ohms 40 m/A, 4/6 each. 10,000 ohms to 3 ohms 30 m/A, 4/6 each. 5,000 ohms to 3 ohms 60 m/A, 5/- each. Universal output Transformer 18 ratios available. Optimum loads 3,000 ohms to 12,000 ohms. Speech Coil Impedance 2.5 ohms, 12.5 ohms and 15 ohms, Current 40 m/A, 5/9 each.

L.F. CHOKES (Clamp Construction)
20H, 250 ohms 60 m/A, 6/- each. 10H, 200 ohms 90 m/A, 9/3 each.

TRANSFORMERS FOR BATTERY CHARGERS—Primary 220/240 volts
6-12 v. 1 amp., 13/6. each. 6-12 v. 3 amp., 18/- each. 6-12 v. 4 amp, 21/- each.

SMALL MAINS TRANSFORMERS, Type TE6
Suitable for Television Convertors, etc.
Specification: Primary: 230 v. 50 c/s; Secondary 1: 250 v. 40 m/A; Secondary 2: 6.3 v. 1.5 A.
Overall Size: Clamp construction 3.9in. x 2.4in. x 2in. Over Windings. Fixing Centres: 3.3in.
Price 15/-

Complete Kit of Parts for "Mini 7" £10/10/-.
" " " " " 4 Valve Battery Portable £7/7/-.
" " " " " Alpha TRF Set £5/10/0/-.
" " " " " Teletron Companion £4/8/6.

LOUDSPEAKERS ELIPTICAL TYPES

6" x 4" Plessey	19/6
7" x 4" Goodman	19/6
7" x 5" Goodman	19/6
8" x 5" Elac	25/6
10" x 6" Plessey	25/6

All Brand New 2 to 3 ohms Speech Coil.

PUBLICATIONS

No. 138. HOW TO MAKE AERIALS FOR TV. (Band 1 and 3) and V.H.F. (Band 2). Data for all Channels. Ten different designs for local and fringe areas, each, 2/6.

No. 140. TELEVISION SERVICING FOR BEGINNERS. ★ 40 pages of information, each 4/6

No. 142. MODERN TV CIRCUITS AND FAULT FINDING GUIDE. ★ Many interesting Circuits included, each 4/6

Reprint No. 5. TV FAULT FINDING. Profusely illustrated with Photographs taken from a Televisor Screen, ea., 5/-

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No. 99 One Valve Receivers 1/6

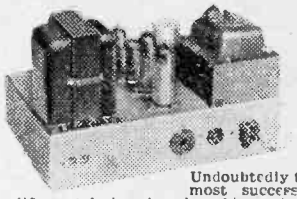
No. 104 Three Valve Receivers 1/6

All publications plus 4d. each postage.

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

1958 NEW LOOK MULLARD DESIGNS FOR THE "Hi-Fi" ENTHUSIAST

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 and 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 UNIT

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 **£6.10.0**
Alternatively, we supply ASSEMBLED and TESTED **£8.0.0**
(Carriage & Insurance 5/- extra.)

Please enclose S.A.E. if ILLUSTRATED and DESCRIPTIVE LEAFLETS are required; alternatively, the COMPLETE ASSEMBLY MANUALS, containing component Price Lists and Practical Drawings, etc., are available at 1/6 each.

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 and TESTED **£8.0.0**
(Carriage & Insurance 5/- extra.)

NOTE Only NEW HIGH GRADE Components and MULLARD VALVES are supplied with these Kits—We do NOT use "Surplus or Cheap" components.

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**

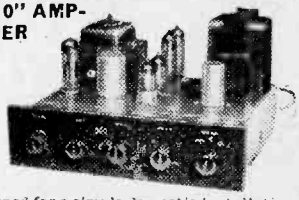
(b) The COMPLETE KIT OF PARTS to build the "5-10" MAIN AMPLIFIER and the 2-STAGE PRE-AMPLIFIER-CONTROL UNIT **£15.15.0**

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

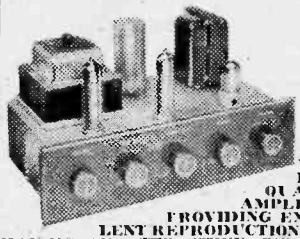
THE NEW COMPLETE MULLARD "5-10" AMPLIFIER



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 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. £6.15.0 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"



A VERY HIGH QUALITY AMPLIFIER PROVIDING EXCELLENT REPRODUCTION AND HAVING AN ATTRACTIVE PERSPEX FRONT PANEL.

COMPLETE KIT OF PARTS **£7.10.0**
(plus 6.6 coverage and insurance).
Alternatively supplied ASSEMBLED and FULLY TESTED **£8.19.6**
(plus 6/6 coverage and insurance).

The complete specification is available for 1/6. 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, valves and a PARMEKO OUTPUT TRANSFORMER.
We also include switched inputs for 78 and L.P. records, plus a radio position. Extra power to drive a Radio Tuning Unit is also available.

THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION

The Portable Case will also accommodate almost any make of Autochanger 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.

RECORD PLAYERS

The Very Latest Models are in Stock.
MANY AT REDUCED PRICES!!!
TRANSCRIPTION UNITS — AUTO-CHANGERS, 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 **£7.19.6**

- The latest COLLARO 4 SPEED "MIXER" AUTO-CHANGER — Complete with the Studio "O" Pick Up **£7.19.6**
(Also available with the low gain Studio "P" Pick Up for £8.15.0.)
- 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 output Crystal Pick Up is available separately for £1.12.6.)
Carriage and Insurance on above Units 5/- ex.

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.

109 & 115 FLEET ST., LONDON, E.C.4.
Telephone: FLEet 5812/3/4.
CORRESPONDENCE

PRACTICAL WIRELESS

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

VOL. XXXIV, No. 619, JULY 1953

COMMENTS OF THE MONTH

BY THE EDITOR

Editorial and Advertisement Offices :
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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.*

 PRACTICAL WIRELESS *incorporates "Amateur Wireless."*

The Stereophonic Sound Experiment

THE recent BBC experiment in stereophic sound was interesting, regarded as an experiment, but in our view it failed to demonstrate that it was worth the trouble and effort involved. Very few listeners will go to the trouble and expense of having the two perfectly matched loudspeakers which are necessary. It was almost impossible to detect any worth-while difference between it and the ordinary sound programme. Now that the experiment has been tried it will be interesting to see whether it will be carried further and to learn from the BBC the conclusions its engineers have reached. In our view, most receivers to-day have reasonable quality of reproduction and few listeners have any complaint on that score. The need, therefore, for stereophonic sound with the extra expense involved is almost non-existent. In our view the BBC transmissions are so good that this refinement in any case is unnecessary.

"BEGINNER'S GUIDE TO TELEVISION"

READERS will remember that our series of articles entitled "Beginner's Guide to Radio" were republished in book form a couple of years ago, and it rapidly ran through three large editions ; a second impression of the third edition is now being printed. Our companion journal, *Practical Television*, published a similar series entitled "A Beginner's Guide to Television" and, as with the radio series, there has been an insistent demand for the TV series in the more permanent form of a book. "The Beginner's Guide to Television" will therefore be published on July 17th at 7s. 6d., by post 8s. 3d. Readers who wish to obtain a copy of this companion volume should order a copy from their booksellers without delay. If you wish to reserve a copy direct, you should send the remittances to the Book Department, address as on this page.

"THE PRACTICAL PHOTOGRAPHER"

WITH every issue of our companion journal, *Practical Mechanics*, there is presented each month a 16 full-page pull-out supplement entitled *The Practical Photographer*, and readers who add photography to their hobbies will find this supplement packed with informative and well-illustrated articles on every aspect of photography. *Practical Mechanics* costs 1s. 3d. every month. Incidentally, *Practical Mechanics* celebrates its 25th birthday with the October issue this year and the event will be signalised by a special number.

THE RADIO SHOW

OUR Stand Number at the forthcoming Radio Show, which takes place from Wednesday, August 27th, to Saturday, September 6th, at Earl's Court, is 108, ground floor. Where we shall be glad to welcome all readers visiting the show.—F. J. C.

Our next issue, dated August, will be published on July 4th.

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 March, 1958, in respect of receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland. The numbers include Licences issued to blind persons without payment.

Region	Total
London Postal	1,045,632
Home Counties	1,048,535
Midland	772,764
North Eastern	1,004,602
North Western	750,417
South Western	648,272
Wales and Border Counties ...	402,995
Total England and Wales ...	5,673,217
Scotland	703,475
Northern Ireland	179,655
Grand Total	6,556,347

New U.S. Sputniks

THE latest American Sputniks will speak only when spoken to, Dr. Henry L. Richter, research director at Jet Propulsion Labs., Temple City, California, reported recently. The high-power (60-milliwatt) transmitter in Explorer II will send information to IGY stations only on receipt of a code signal. The action will be somewhat similar to the IFF (Identification, Friend or Foe) equipment of the last war.

Only IGY stations will have the code needed to key the satellite transmitter, Dr. Richter said. Information will be recorded on a miniature tape recorder between IGY stations, for complete transmission on code command.

The low-power transmitter in Explorer II will operate continuously as in the first U.S. satellite.

Obituary

THE death has occurred at the age of 66 of Mr. S. B. Smith, a pioneer of radio direction finding. He retired from his position with Marconi's Wireless Telegraph Company in 1956 after a career with the company extending over 44 years.

Mr. Smith joined the technical staff of the company in 1912 in the test department. During the first world war he spent some two years in Egypt investigating the technology of radio direction finding, and it is with this branch of radio that his name was associated for much of his later career.

In 1919 he joined the research department under another notable Marconi pioneer, the late G. M. Wright, and continued his D.F. investigations. Later he took a leading part in designing the first Adcock direction finding equipment to be produced commercially, by which spectacular advances were made in D.F. techniques.

Audio in the Radio Show

THE Radio Industry Council reports a very satisfactory response to its announcement that there is to be an audio section in the Radio Show, Earls Court, this year (August 27 to September 6). More than 30 manufacturers have signified interest, and planning of the section is proceeding.

Electronic Show for Sweden

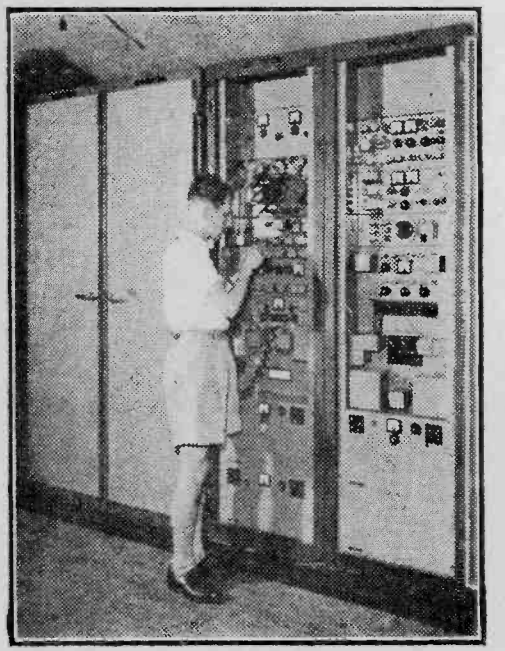
THE Radio and Electronic Component Manufacturers' Federation, whose exhibition at Grosvenor House and Park Lane House, London, W.1, closed on Thursday, April 17, announces that it is organising an exhibition of British electronic components to be held in the Ostermans Marmorhallen, Stockholm, from September 29 to October 3 next.

Marconi Radio Telephones for Jamaica

AN order has been received by Marconi's from the Jamaica Telephone Company for a total of eight Type HM100 V.H.F. multi-channel radio equipments to provide a link between Kingston and Montego Bay.

The order was preceded by a comprehensive radio survey of the routes for which the equipment has been ordered and also of potential routes to St. Ann's Bay. Mandeville, Highgate and Palisadoes Airport.

The radio link will be effected via three intermediate terminals, at Cooper's Hill, Christiana and Kempshot, at which full demodulation facilities are available. The installation, which will operate in the 150-230 Mc/s band, will be equipped initially with 24 telephone channels although the equipment will provide double this number when required.



This illustration shows the neat, compact appearance of the Marconi HM100 installation (see Marconi Radio Telephones for Jamaica).

Fading

RADIO fading is caused by a layer of electrically charged gas which, at times, extends to 12 miles below the ionosphere. According to a report by Hugh Odishaw, executive secretary of the U.S. National Committee for the International Geophysical Year, conclusive evidence to this effect has been obtained from rocket experiments conducted as part of the IGY.

New Ship-shore Service from North Foreland

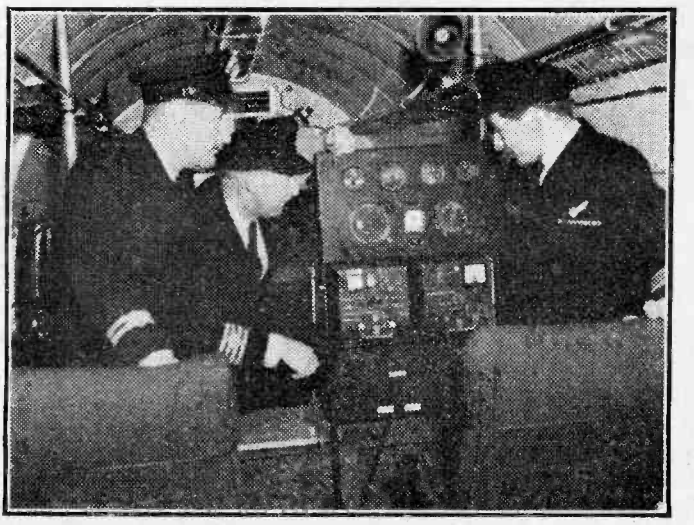
WORK has started on providing a new V.H.F. ship-shore service which will be opened about the end of August, 1958. This service will provide radio-telephone communication between suitably equipped ships in the sea areas around North Foreland and any telephone subscriber in the United Kingdom. The shore equipment will be installed at, and calls handled by, the existing post office coast radio station at North Foreland. It is expected that the radius of the service area will be about 40 miles over a continuous sea path. The range will be partly dependent upon the height of the ship's aerial and radiated power, but the latter is limited to 20 watts by international agreement.

The equipment at the coast station and on ships will comply with internationally recommended technical characteristics and will use frequency modulation. A specification has been agreed in the United Kingdom for ship station equipment in accordance with these characteristics. Two separate channels will be provided at the coast station—a single-frequency calling channel on 156.8 Mc/s, and a two-frequency traffic channel using 161.9 Mc/s for transmission and 157.3 Mc/s for reception. These frequencies were internationally agreed at the Hague Maritime V.H.F. Radiotelephone Conference for services of this kind.

New Equipment for Gatwick

GATWICK AIRPORT will have the first of a new series of magnetic tape recording installations for the principal airports of the Ministry of Transport and Civil Aviation. These installations of the Multi-channel Automatic Recording System (M.A.R.S.), manufactured by British Communications Corporation Limited, will replace the film type recorders originally used by Air Traffic Control and represent a considerable advance in technique and economy.

It was not found practical to record more than one communications channel on one film. This involved the provision of a complete recorder for every channel to be recorded. The films, which represented each about eight hours of single channel recording, could not be salvaged or used a second time, and involved continuous expenditure. With magnetic tape many channels may be recorded on a single tape, and the Ministry will be using installations some of which have as many as seventeen channels. The Gatwick installations has provision for eight speech channels, a time signal channel and a spare channel and may be expanded still further, should the growth of communications require it. After retention for the thirty days required by I.C.A.O., tapes may be erased and re-used.



A Viking aircraft which toured European countries to demonstrate the Marconi Doppler Navigator.

Demonstration Tour of Doppler

A VIKING aircraft used for the demonstration of Britain's first commercial Doppler navigation system made a Continental tour, during which the equipment was convincingly demonstrated to representatives of Governments, the airlines and the aircraft industries in Paris, Rome, Zürich, Stockholm, Amsterdam, etc.

New Zealand Radio Links

THE New Zealand Post Office has awarded a further large contract to Marconi's Wireless Telegraph Company Ltd. for the supply of four multi-channel V.H.F. radio links. The order, which has an approximate value of £90,000, is consequent upon the satisfactory performance of Marconi radio-link equipment which for the past few years has been in operation between Hamilton and Paeroa. It was obtained for Marconi's by their agents in New Zealand, Amalgamated Wireless (Australasia) Ltd.

In all, 16 terminals Type HM100, 14 repeaters Type HM150, twin-stack Yagi aerial arrays, special aerial securing steelwork, spares and a comprehensive amount of test equipment is to be supplied. The New Zealand P. & T. will be carrying out the installations.

Beginner's Guide to Radio

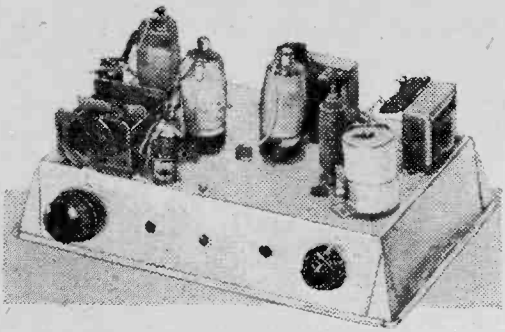
THE Royal National Institute for the Blind is to publish in Braille Mr. F. J. Camm's Beginner's Guide to Radio.

A Beginner's Constructional Course—III

A NEW SERIES WRITTEN ESPECIALLY FOR THE AMATEUR

By E. V. King

4.—USE OF THE VOLUME CONTROL



THIS type of receiver is designed so that there is a certain feed-back effect between V1 and V2, that is why no screening is used. This reaction effect is controlled by the use of the volume control, especially when it is advanced far over. By the way, if your control works in reverse, simply change over the connections to the outside tags.

Just before the oscillation point is the most sensitive setting for the receiver when distant reception is required. To get a more accurate setting for the volume control the value of R3 may be adjusted to suit your particular valves and wiring. The value given for R3, however, is a good one, and there is no need to alter it unless you are most particular about long distance work. Generally speaking R3 should be of such a value that when the vanes of the gang condenser are one-third in the set will just oscillate when the volume control is turned full on. To tell if the set is oscillating gently rotate the tuning knob about this one-third position. Heterodyne whistles mean the set is oscillating.

If the set does not oscillate reduce the value of R3 to 100k and try again. If necessary, reduce R3 to zero and use a piece of wire. If this is not effective solder a short length of plastic covered wire to C5 and a similar length to C6; bend these two wires so that they are near together for about ½in. of their length. They act as a very small condenser. Adjust their distance apart by trial and error to obtain satisfactory reaction. In some cases they may have to be gently twisted together (not connected, however).

If the set oscillates too soon, i.e., the set oscillates when the volume control is only half way, it means you are not able to make use of the available amplification (without reaction) of V1. So make sure all grid and anode leads to V1 and V2 are short. Make sure that the leads to C5 and C6 are short and as far apart as possible. Make sure your valves are mounted as shown and not closer together. When all this has been done, and not before, increase the value of R3 to 330k or more as required.

Do not get the idea that this is an old-fashioned reaction type receiver. No reaction is used until

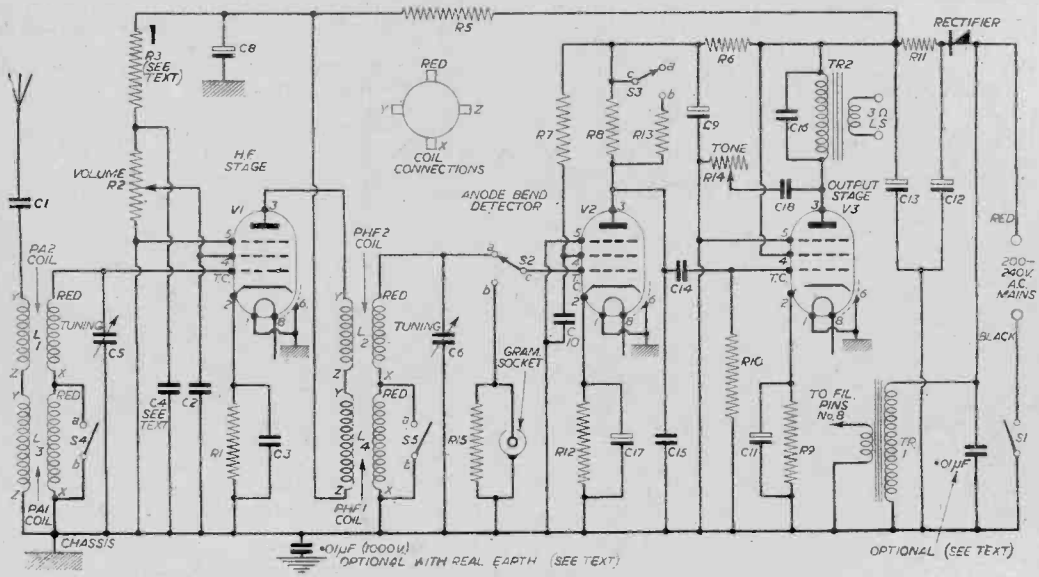


Fig. 23.—Circuit of the receiver as it should now appear.

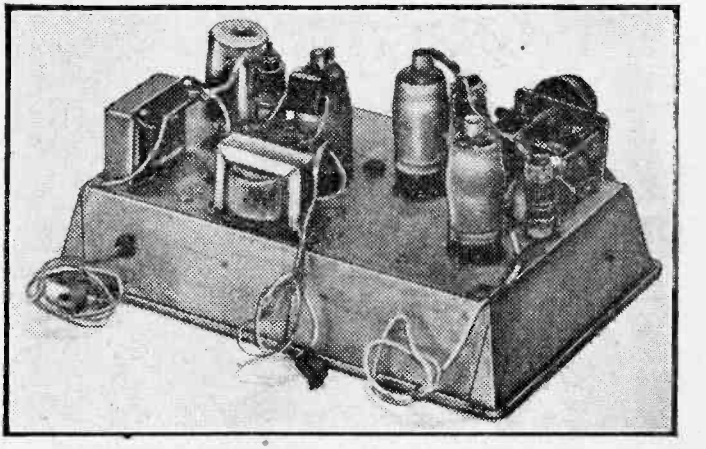
the extreme end of the volume control travel is reached. Up to that point the volume control is of the ordinary type.

Do not alter R3 until you have trimmed the receiver very carefully. If in doubt put back the 220k resistor and start again.

Elimination of Hum

The author has much experience with youth work and he has found that one of the biggest troubles the beginner faces (apart from reading resistors wrongly and inability to wire from a theoretical diagram) is his not knowing how to set about the elimination of hum from his loudspeaker.

When this receiver is finally completed there will be no audible hum two feet from a 5in. speaker, a little only from a 10in. However, the set is not yet completed, especially will the leaky grid detector pick up hum on the top cap of V2. This detector is very sensitive, but later another type will be used (a modification) which will cut out this "pick-up" on V2. At the moment if you bring your finger within 1in. of V2 top cap loud humming will result. This is a good test for the sensitivity of the receiver. This grid will pick up hum from any local electric field (near-by transformer, motor, etc.). A good way to overcome the trouble is to make a cocoa tin shield, fixing the lid to the base around V2 holder and cutting a slot down one side for the lead to the top cap. The author in the prototypes did not find this necessary unless he used a 12in. speaker which accentuated the hum.



Rear view of the receiver in its present stage.

If your receiver hums and you do not know for sure where the trouble lies proceed as follows: Short with a piece of wire top cap V3 to chassis. If set still hums then the trouble lies in the smoothing circuits. C12 and C13 and associated components. If the hum stops then repeat the procedure with V2. If the hum still carries on but stopped when grid of V2 was shorted the trouble lies in the V1 wiring itself or the leads to C14. Is the filament wiring properly insulated? If, as is most likely, the hum stops, then the trouble lies in the tuned grid circuit of V2. Is lead X of PHF2 open circuit? To test earth coil side of C7. If humming stops this coil is open circuit. If humming continues then the trouble is pick up on V2 grid and screening will be necessary until the next modification is added.

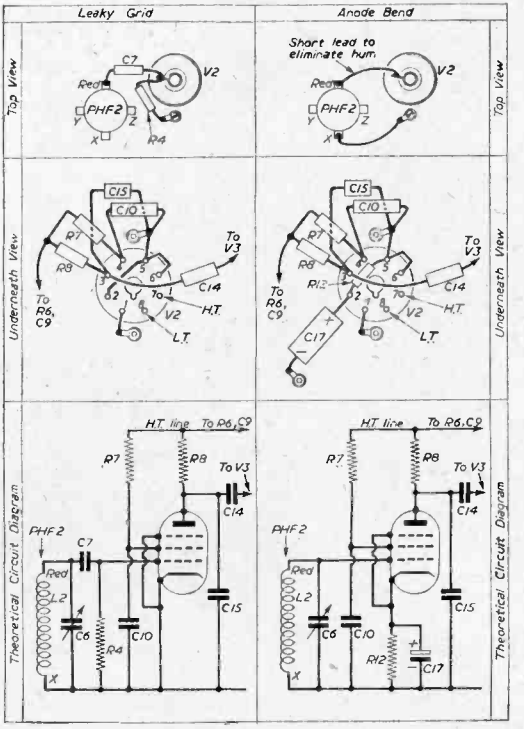


Fig. 24.—Grid leak and anode bend detector stages.

Modulation Hum

If hum is introduced into the V1 circuit it will not show itself until it has a signal on which to superimpose itself, i.e., it modulates a signal. This hum is tunable and only occurs when a carrier is being received and is especially noticeable just before the oscillation point when R2 is advanced.

Modulation hum is one of the most difficult and tricky problems of receivers with the chassis connected to mains. If you have this tunable hum proceed as follows:

1. Place a .01 μF condenser between metal rectifier black tag and chassis (a 1,000v. condenser is preferable).

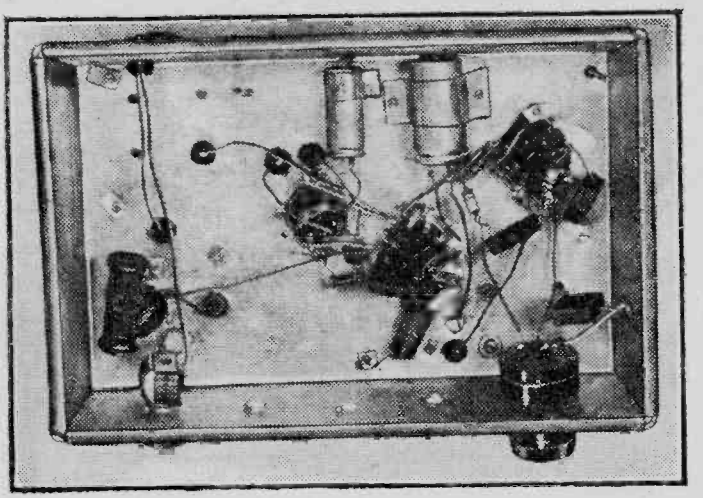
2. If the trouble is not cured try the effect of a similar condenser across the resistor R11.

3. Try various values for C1, small ones such as 50 pF.

4. Try effect of series resistors or chokes (coils) in the aerial lead. Try a .01 μF from chassis to a real earth, i.e., water pipe.

The author found no troubles from modulation hum save on one prototype and this was completely cured by method 1 above.

Having now got the receiver working satisfactorily you are ready to carry out various modifications, the first of which will be anode bend detection.



Underside view of the chassis.

Anode Bend Detection

The SP 41/61 is not an ideal valve to use with this method of detection, but it is proposed to use it for the following reasons. (1) This type of circuit (see Fig. 24) provides a low reactance path for 50 cycle mains hum through the tuning coil to earth. Condenser C7 prevents this happening with leaky grid detection. The hum is, of course, picked up by the top cap and leads connected to it. Thus screening is not necessary with anode bend detection. (2) It provides less damping on the tuning coil, and thus provides better selectivity. Stations of nearly the same wavelength are thus separated more easily. Tuning and trimming, however, become more tricky and a large knob or slow-motion mechanism are desirable. (3) A point of very great importance to the beginner is the switching used for gram/radio. With anode bend it is possible to get reasonable reproduction using only a simple switch changing the valve to an L.F. amplifier. With leaky grid this is more difficult as a bias resistor and condenser have to be switched in for gram. Details of this more complicated switching will be given next month so that readers may choose which system they prefer. Leaky grid detection is more sensitive, that is probably its only advantage.

Wiring Alterations for Anode Bend Detection (Valve 2)

Remove the small condenser C7 and the grid leak R4 (this is used later in the pick-up circuit). Connect the red tag of the PHF2 directly to the T.C. of the valve V2. There is now a low reactance path between this grid and earth, via the coil, for all low-frequency currents, i.e., hum. Verify that C6 is still connected to the red tag.

Underneath, change the value of R7 from 1M to 680k and remove the earthing wire from valve pin 2. Earth this to a soldering tag via a 10k resistor (R12). Connect also the red tag of the electrolytic capacitor (C17) to pin 2 and earth the negative side to chassis. Underview of these alterations can be seen in Fig. 24.

The rest of the circuit remains the same. Check the wiring carefully with the theoretical diagrams given in Figs. 23 (ignore the switching arrangements pro tem) and 24. Note in Fig. 24 of R7 for the leaky grid detection is 1M and for the anode bend 680k.

Parts required for this month's modifications are as follows:

R 13.—22 k. ½ watt resistance (red, red, orange). New anode load for V2 when S3 is put to pick-up. Thus changes the working conditions from rectifier to amplifier.

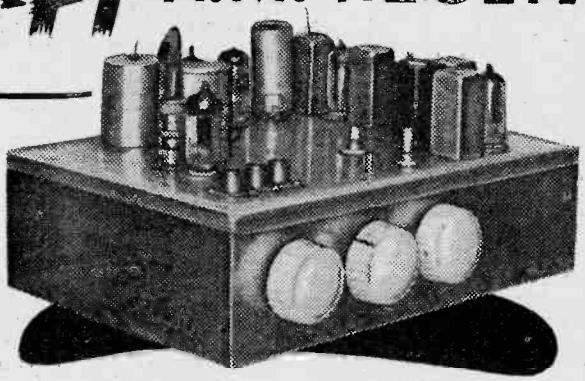
R7.—formerly 1 M., now 680 k. (½ watt).

R12.—10 k. ½ watt resistance (brown, black, orange). This provides a good negative bias on V2 grid so that it rectifies in accordance with "anode bend" principles. It also provides bias when switched to gram.

C 17.—Bias Electrolytic, 25 volt working, 12 to 25 mfd. This provides a steady bias on V2 grid by acting as a "reservoir" or "smoother" to the cathode current voltage drop across R12.

(To be continued)

A Hi-Fi A.M. RECEIVER



How to Make a Self-contained High-quality Receiver, Using a Mullard 5-10 Amplifier for the Output Section. Full Cabinet Constructional Details Will be Given in Subsequent issues

By R. Couvela

(*Continued from page 293, June issue*)

THE "Gram-radio" switch should preferably be one of the "make-or-break" type, i.e., the wiper makes contact with the new tag before leaving the previous one when the switch is used.

The Scratch Rejector Circuit

Gramophone pick-up scratch is a noise which is very difficult to eliminate as it extends in frequency from about 2 kc/s to about 10 kc/s. Accordingly, the only means of eliminating it is by suppression of those frequencies, so a filter is incorporated, made up of R54, C40 and C39. C39 is a variable capacitor, and C40 is used to limit the lowest value of it.

When C39 is at minimum setting, the cut-off occurs at about 20 kc/s, and this has no effect on the performance. As C39 is increased in value, so the cut-off frequency is reduced.

At first sight, it may seem undesirable to place such a high resistance as R54 in the grid circuit of V11, but it must be remembered that this valve is being used as a cathode follower, and, as such, its input impedance is very high (in this case, about 10 megohms), so that R54 will have a negligible effect.

The Cathode Follower Output Stage

This valve, V11, is included as a means of coupling the signal from the above circuit to any one of a wide range of load values. The valve is an Osram L77, used as a cathode follower with an H.T. of 250 volts. Biasing is by normal D.C. cathode follower action, and, as a result, this valve takes a very small anode current, due to the high value of R55.

It should be noted that this valve will act as a limiter in the event of the application of an excessive signal. This characteristic is useful in some ways, as it helps to protect the audio amplifier and sound output equipment, but it should always be borne in mind that it will distort any signal input of more than a few volts. This fact is not of importance under normal operation, as the full power output is obtainable from an input signal of 600 mV.

Housing the Receiver

The original design of the audio frequency output chassis is very difficult to fit into a cabinet which will be pleasing to the non-technical observer: accordingly, the layout has been modified in the present design in order to overcome this difficulty. It must be stressed that no alterations have been made to the signal handling circuit.

The modification which has been made is that the power supply circuit has been taken off the main chassis and mounted in its own compartment. The effect of this is beneficial in some respects, as it places a considerable distance

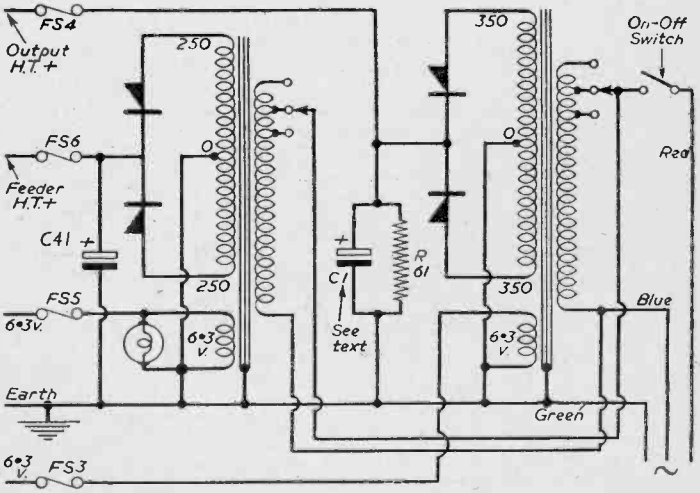


Fig. 3.—Circuit of the power supply.

between the output transformer and the mains transformer.

This, however, has one effect which could be inconvenient, in that both H.T. and L.T. must be fed by cable. The author used a single three-core T.R.S. cable for this purpose, one side of each supply being earthed. The difficulty could be better overcome by using a four-core cable, or, better still, two separate two-core cables. Suffice it to say that the prototype, using the first method, showed no signs of suffering from this arrangement when compared with a model built exactly to specification.

In order to allow the chassis to be shortened, all the valves were moved 1in. farther from the output transformer end of the chassis, and the main tagboard was transferred to the other side of the valves. This modification does not require any alteration to the wiring arrangements, which are simply transferred to the other side.

In order to counteract any possible increase in hum due to the cable, C2 was increased to 120 μF. Apart from this modification, the circuit is as specified, and is given in Fig. 2 for reference.

Power Supply

Two mains transformers are used, one to supply the amplifier chassis, and the other to supply the feeder. There is no reason why the complete receiver should not be fed from one transformer, provided that it is of ample rating, and that a resistance or other form of dropper is used to supply H.T. to the feeder.

In the existing receiver, the power pack is housed in the base of the cabinet. This position was chosen mainly to give the maximum possible distance between the mains transformers and the output transformer. The distance thus achieved obviates the need for special precautions to be taken in the construction of the mains transformer, and a cheaper model than the one specified may be used with little loss. The arrangement also provides a weight in the bottom of the cabinet which prevents it from being top heavy.

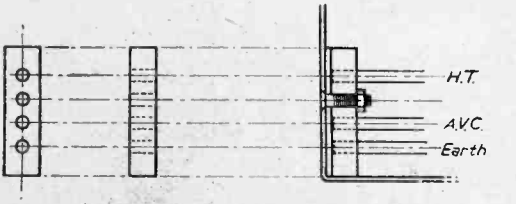


Fig. 6.—Construction of the bus-bars.

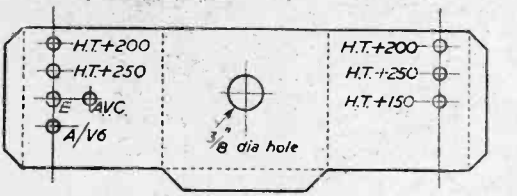


Fig. 7.—Screen for feeder chassis.

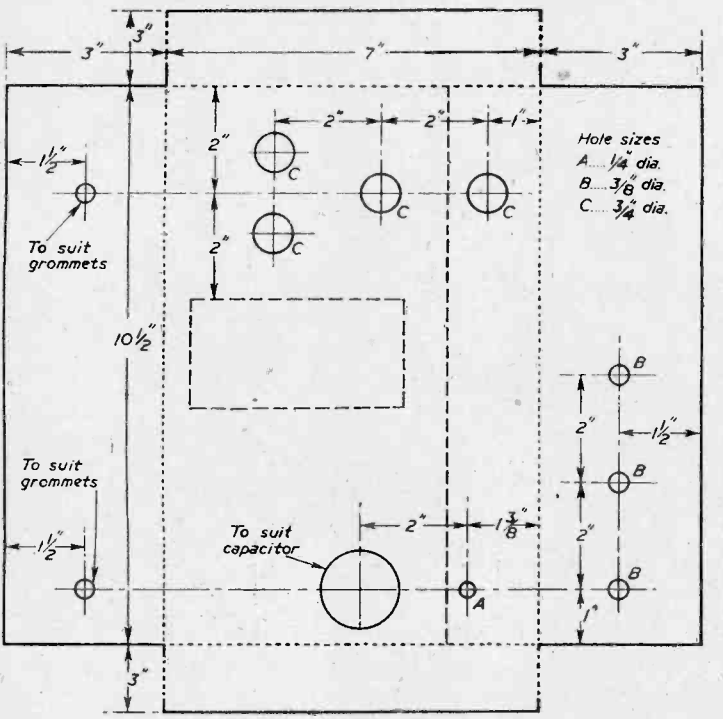


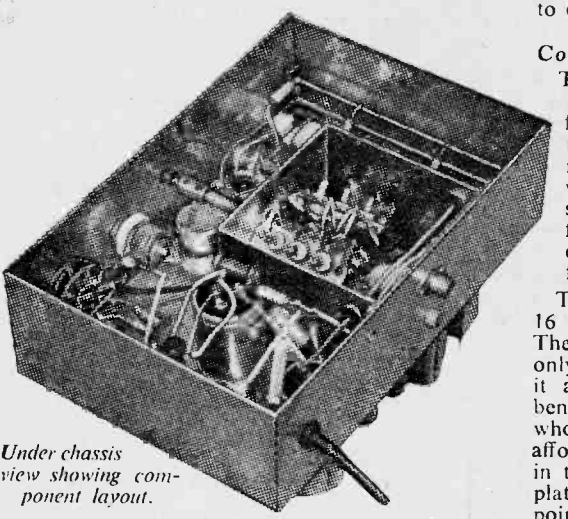
Fig. 4.—Output chassis main dimensions.

The only disadvantage of this position is the difficulty of ventilation, and for this reason it was decided to fit metal rectifiers to the prototype. In order to allow for a higher voltage drop on the metal rectifiers than is to be expected from a valve, the H.T. winding specification of the transformer supplying the audio chassis was increased to 350-0-350 volts. In order to allow for increased hum due to metal rectifiers, C1 was increased to 120 μF.

The other transformer has an H.T. winding of 300-0-300 volts, to supply the feeder chassis. The L.T. winding of 6.3 volts also supplies the pilot lamp. The H.T. for the feeder is fed to a 300 μF smoothing capacitor, from which it is supplied to the chassis. Here it is passed through a dropping chain, which is designed to give the correct value of H.T. voltage to each valve. Each tap on the chain is smoothed by a large electrolytic capacitor.

On the end of the dropping chain is the stabiliser valve, V12, a QS150/15, which gives

150 volts stabilised H.T. to the oscillator of the frequency changer. It should be noted that V12 is a cold cathode tube, and will strike immediately on switching on, due to the use of metal rectifiers.



Under chassis view showing component layout.

Until the rest of the set warms up, V12 will be the only valve conducting, and its anode voltage will be high, causing it to conduct 30 mA. As this valve has a maximum current rating of 15 mA, this is obviously undesirable, and the simplest (and cheapest) way out of this difficulty is by placing V13, a double diode 6AL5 (D77), in the cathode circuit of V12. Thus, V12 is prevented from conducting current until V13 has warmed up, and V13 will warm at the same time as the rest of the circuit, so no harm can result when current flows.

Another difficulty is introduced by the above arrangement, in that, while warming up, all valves and electrolytic capacitors will have full H.T. on the anodes, etc., at a higher value than is normally present. In order to reduce this, R60 has been placed across V13, so that before V13 warms up, V12 will conduct 15 mA only, through R60, thus slightly reducing the static H.T. voltage.

In practice, a delay will be observed between switching on and V12 striking, due to the charging time of the capacitors. Similarly, a delay will be noticed between switching off and the extinction of V12, and this will serve as adequate warning that the H.T. retains a substantial potential for some time after switching off, and before working on the circuit the capacitors should be discharged, preferably through a 1,000 ohm resistor.

For this reason, R61 is provided in the audio chassis H.T. supply, the feeder chassis being able to discharge through R47, VR48.

Construction of the Output Chassis

The main dimensions for this unit are given in Fig. 4. Notable omissions are the fixing holes for the transformer, and most of the 6 B.A. holes. The transformer details are not as shown, as these will vary according to which make of output transformer is used, as specified in the Mullard booklet. The 6 B.A. fixing holes are not shown, as they are most easily drilled on assembly, and marked off from the component to be fitted.

The most suitable gauge of metal to use is 16 s.w.g. aluminium, or 18 s.w.g. tinned steel. The aluminium should be used by anyone with only the normal home construction facilities, as it affords comparitive ease of drilling, cutting, bending, etc. The steel may be used by anyone who has suitable facilities for metalwork, and affords the advantage that it can be soldered in the corners and at the junctions to the screen plates. Similarly, wires may be soldered at any point to the chassis, although this fact is not of great value in the present instance. Note that all scratched or cut surfaces should be tinned over to prevent corrosion.

The earthing bar used in the prototype was a 6 B.A. brass threaded rod. This may be fixed

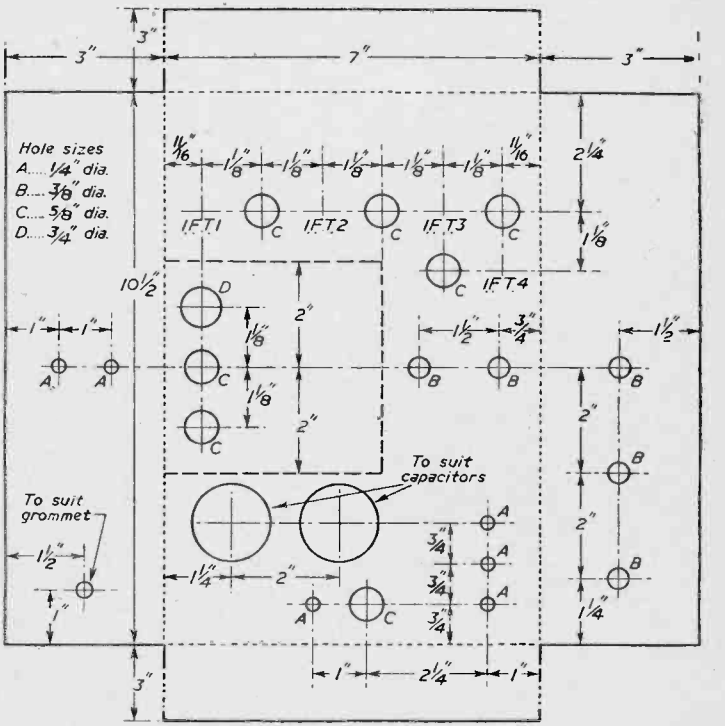


Fig. 5.—Drilling details for the feeder unit chassis.

at one end (preferably that nearest the input terminal) by a pair of nuts and the other end may be passed through a grommet in the side panel. This method affords the advantage of rigidity and ease of fixture over the method officially recommended. It should be noted that the bar should preferably be tinned at the points to which wires are to be soldered before assembly.

The tag-strip for the main section was mounted on 1in. spacers made up from lengths of tube with long bolts through them to allow the electrolytic capacitors to be mounted underneath.

The use of a plug and socket outlet for the loudspeaker is not necessary in this application of the unit, although it might be considered convenient to make use of such equipment in both this case and also for the power supply in order to allow the chassis to be detached from the rest of the receiver. In the case of the prototype, an external plug socket outlet was used only in the case of the loudspeaker outlet, in order to facilitate the change to an alternative external loudspeaker.

The wires supplying the power and output lines, and also the input coaxial, should be made of at least sufficient length to allow the chassis to be operated when standing on the top of the cabinet.

The spindle lengths should be half an inch for the knobs used on the prototype. This is the length measured from the end of the mounting thread. It may be found useful to reduce the length of thread protruding from the chassis by the use of two fixing nuts, one on each side of the chassis panel.

No method of fixing the chassis to the cabinet is suggested, as it was not considered necessary, as the knobs will prevent the chassis from moving very far.

The Feeder Chassis

This unit is very similar in construction to the unit described here. The overall dimensions of the chassis are, of course, the same, and also the knob positions.

No 6 B.A. fixing holes are shown, for various reasons, in addition to those mentioned above. Firstly, the orientation of the valves is important, particularly in the I.F. strip, where the anode and grid leads should be kept as short as possible by correct positioning of the valve base. Accordingly, no holes have been shown, and they should be drilled on assembly, as the various makes of valveholders sometimes have different fixing positions relative to the pin numbers.

A similar situation exists for the I.F.T.'s, which should be positioned in the same way. It should be emphasised here that these instructions are not intended to be completely foolproof for the beginner, but rather for the guidance of the amateur who has had a little experience in these matters. It would obviously be foolhardy for a complete beginner to attempt to build this receiver, although the instructions and drawings given here are as full as space permits, and are intended to give every reasonable assistance.

No fixing holes are shown for the screen, as this should be fitted in such a way as to provide a clear operation of the tuning switch.

(To be continued)

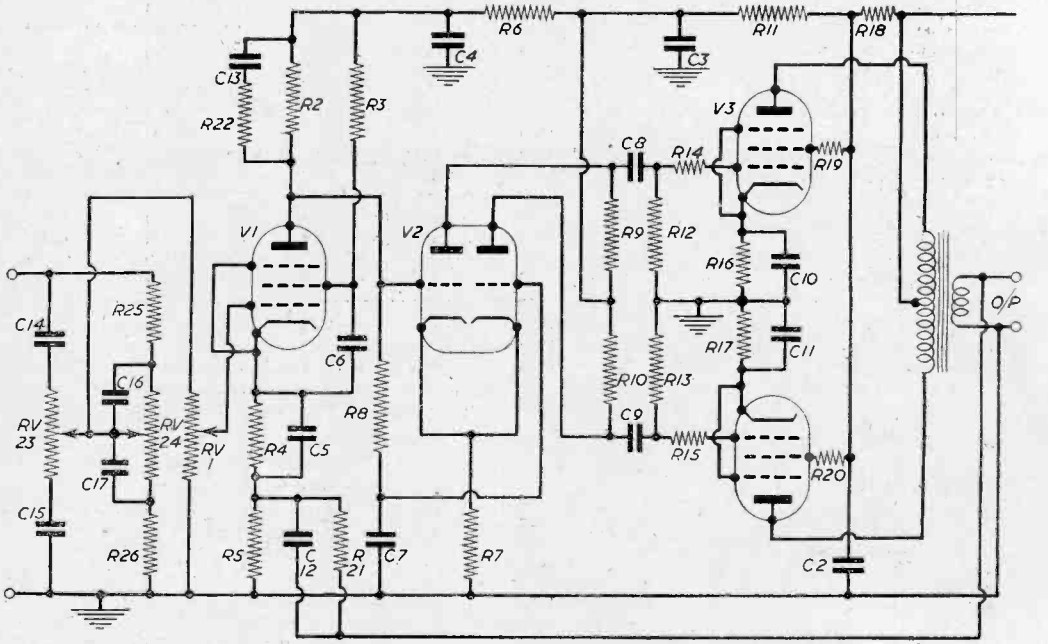
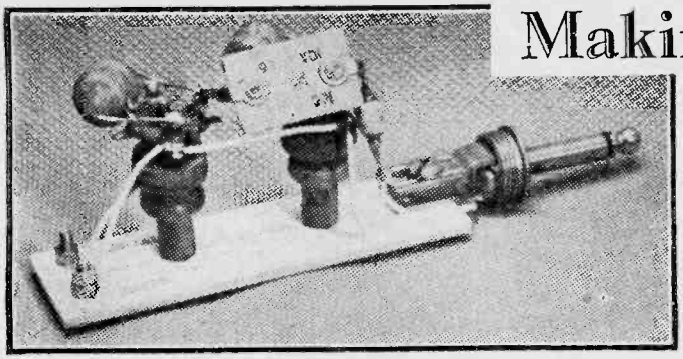


Fig. 2.—The Mullard 5-10 amplifier which the author used in this receiver. If any other amplifier is used the cabinet to be described will have to be modified.



Making a Radio Jack

Record Radio Programmes at High Quality on your Tape Recorder with this Accessory.

By B. E. Wilkinson.

ALTHOUGH the output of a crystal receiver is very small, it is well known that the quality of reproduction is very good. Coupled to a quality amplifier, a receiver of this nature will give very good results, better in fact than some commercial superhets. I had for some time contemplated building a radio jack and using it to feed my tape recorder (a Grundig 700L), as I noticed that normally when recording from the radio all gain controls had to be held down almost to a minimum to avoid overloading. As this indicated that there was considerably more power available than was necessary, I felt that a radio jack might work and, if it did, the quality of recording should be improved. The first experiments with a home-wound coil, variable condenser and rather cheap crystal diode were not a great success as far as quality and volume was concerned. The selectivity was poor, especially at night, when breakthrough of foreign stations was almost continuous. Ultimately I adopted a simple band-pass circuit shown in Fig. 1. I discarded the cheap crystal diode and replaced it by a GEX34, and results were excellent. When building a radio jack one has a choice between a compact preset unit, which plugs easily into the appropriate tape recorder input, and a unit incorporating a twin ganged tuning condenser (C1 and C2) capable of variable tuning over either the long or medium waveband. I decided in favour of a preset unit for the medium waveband, tuned to the West of England Home Service on 285 metres, and a larger variable unit to cover the long waveband. The former unit is shown in the illustration.

LIST OF COMPONENTS

Insulating material for base (3½ x 1) inches.
Coils (2 off) Weyrad HA3.
Tuning Condensers (2 off) 60 pF.
Coupling Condenser 100 pF.
Crystal Diode (GEX34).
Jack Plug—standard type.
6 B.A. nuts and bolts for terminals (2 off).

Constructional Data

The unit is constructed upon a base of some suitable insulating material. Tufnol, Perspex, or even a piece of thin plywood, are admirable, though I used two pieces of 1/16in. thick Polystyrene stuck together. The base (Fig. 2) is 3½in. long × 1in. wide, and has holes drilled as indicated. The holes for the aerial and earth terminals are for 6 B.A. clearance, as are the two holes to support the coils. The hole to take the jack plug is not given as this depends upon the plug used. In the case of recorders not using standard jack plugs, the appropriate type should be obtained. The two coils used are Weyrad HA3 type. There are two windings on each coil, and only the small winding (red and yellow tags) is used. Projecting from the centre of the piece of tufnol carrying the four tags is a brass screw, by which the position of the dust iron core can be varied. The coils are available at a price of 3s. 9d. each from the Weymouth Radio Co., Ltd., Crescent Street, Weymouth, Dorset. The tuning condensers are 60 picofarads (pF) each, while the coupling condenser is 100 pF. Finally, as far as components are concerned, the crystal diode is a GEX34, available from any good radio store.

Fig. 3 shows the wiring of the unit. The two coils are mounted similarly so that red and green tags lie along the longitudinal axis of the base, with the green tags away from the jack plug. Referring to the first coil in the circuit as L1

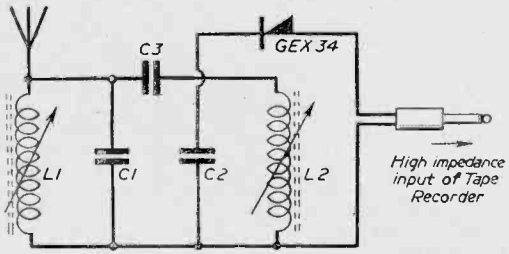


Fig. 1.—Theoretical circuit of the radio jack.

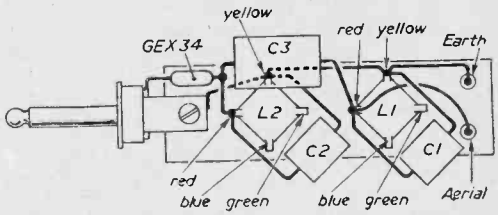
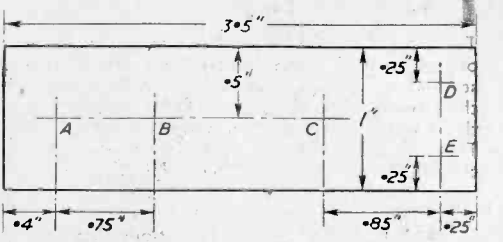


Fig. 3.—Wiring details.

(farther from the jack plug), and the other coil as L2, the wiring is as follows. C1 across red and yellow tags L1, and C2 across red and yellow tags L2. 100 pF condenser (C3) connected between red tags L1 and L2, yellow tags of L1 and L2 joined directly and taken to earth terminal and also to one side of jack plug. Crystal diode connected between the red tag of L2 and free side of the jack plug, while the aerial terminal is connected to the red tag of L1. The unit is now complete, and ready for adjustment. It should be plugged into the appropriate input on the tape recorder (the high impedance input) and played through the "gram reproduce" circuit. If the recorder does not possess this facility a recording can be made and monitored with a headset. Failing this the receiver can be made to feed an A.F. amplifier to effect adjustment. I found that when I first plugged the unit in *nothing* happened. This I subsequently discovered was due to the output of the diode receiver being reversed. All that was necessary was to reverse the connections to the radio jack.

When one has set the system up and is able to listen to the receiver by one of the methods mentioned above, the aerial should be connected to the red tag of L2, and iron core adjusted until the Home Service is received at its best. It may be necessary for receiving other Home Services to use larger tuning condensers, as the variation of inductance by means of the iron cores is not great. Once the best position has been found with L2 the aerial is then taken to its correct terminal, and L1 adjusted until the station is once again clear. A drop of hot paraffin wax on the



Drill A to take jack plug. Drill B,C,D and E 6BA clearance

Fig. 2.—Details of the "chassis."

adjusting screws will hold them secure, and the unit can now be slid into a small case or used as it stands.

Finally, one or two points concerning the operation of the receiver. I found it unnecessary to use an earth. Twenty feet of aerial, some 15ft. from ground level, gave adequate volume for listening, and recordings made were very clear indeed. The condenser usually connected between crystal diode output and earth had the effect of cutting down the volume considerably, and since it affected the tone but little I omitted it. If breakthrough of foreign stations occurs at night to a limited extent a 100 pF condenser in series with the aerial may block it.

Pye Announce New V.H.F. Transmitter

THE Pye PTC 3600 1 kW V.H.F. transmitter is a medium power communications equipment which has been designed primarily for airport ground-to-air operations and also for teleprinter and V.F. point-to-point links. The frequency range from 118 to 136 Mc/s is continuously covered. It is basically a two-unit transmitter and the r.f. and modulator sections are assembled in self-contained cubicles which are combined into a composite equipment for R/T service.

A feature of the transmitter is the ease and rapidity with which it is possible to set it up on any frequency in the range. Due to this, one transmitter can be used as a stand-by for several others.

The transmitter may be remotely controlled, and is fully protected against damage due to overloads or maladjustments. In the event of a fault in the equipment or in the aerial system, a recycling protection circuit will switch the transmitter on up to three times in succession, and if the fault persists after the third time the transmitter will remain off until the fault is rectified.

The cabinet is finished in Admiralty grey with chrome styling. Behind the two front doors of the cabinet are 19in. panels on which all the operating controls are fitted. Preset controls are concealed by removable front panels. All valves, relays and fuses are accessible from the front of the unit; doors are provided at the rear to facilitate inspection and maintenance. The safety of operating personnel is ensured by interlocking gate switches which disconnect dangerous voltages when the doors are opened or the detachable panels removed. All power supplies are provided with bleeders but, as a further safeguard, all high voltage condensers are automatically discharged when the front panels are removed or the rear doors opened.

Valves and components have been chosen and rated to achieve a high standard of reliability and, as a result, the transmitter may be operated unattended in tropical climates. Forced, air-cooled tetrodes are used in the r.f. output stage and radiation-cooled triodes in the modulator. Filtered cooling air is circulated through the cabinets and is discharged by a fan at the top. All chassis are cadmium plated; transformers and chokes are vacuum impregnated.

Mullard Assists Oxford University

THE Mullard Company has made an offer to Oxford University of £50,000 payable over a ten-year period towards the cost of the new college which it is proposed to develop to meet the need for more university places and particularly for more scientists and engineers. The Hebdomadal Council has warmly welcomed this offer and has expressed its appreciation of the interest shown by the Mullard Company in the new project.

In his speech to Convocation in October, 1957, the Vice-Chancellor referred to the proposal which had previously been approved by the Hebdomadal Council for establishing a new college and providing it with proper buildings and an adequate endowment. This new college would replace, so far as undergraduates are concerned, the present St. Catherine's Society and the buildings of the Society would be available as a post-graduate centre. It is proposed that when fully developed, the college should accommodate 400 students, of whom up to half would be scientists, mathematicians or engineers.

Standard Musical Pitch

DETAILS OF AN INTERESTING SHORT-WAVE BROADCAST WHICH HAS MANY USES

ONE of the lesser known services of the National Bureau of Standards is the broadcasting of a musical tone of standard pitch—middle "A" at 440 cycles per second—over its short-wave stations WWV (Beltsville, Maryland) and WWVH (Maui, Hawaii). These broadcasts make standard pitch available day and night throughout the United States and over much of the world. Since a short-wave receiver is all that is needed, easy access to standard pitch is thus provided for piano tuners and amateur and professional musicians, as well as for makers of musical instruments.

A 600-c/s tone is also broadcast. This, together with the 440-c/s tone, is used by scientists, electronics engineers and manufacturers in the measurement of short intervals of time and for calibrating instruments and devices that operate in the audio and ultrasonic frequency ranges. Both the 440- and the 600-c/s tones are obtainable from an electronic, crystal-controlled oscillator and are accurate, as transmitted, to better than 1 part in 100,000,000.

The two frequencies are broadcast alternately, starting with 600-c/s on the hour for 3 minutes, interrupted 2 minutes, followed by 440-c/s for 3 minutes and interrupted 2 minutes. Each 10 minute period is the same except that WWV is off the air for 4 minutes beginning at 45 minutes after each hour; and WWVH is silent, in addition, for a 34 minute period each day beginning at 1900 hours G.M.T. 8 p.m. British Summer Time.

To provide greater assurance of reliable reception, transmissions from the NBS stations are made simultaneously on several standard broadcast frequencies. WWV broadcasts on 2.5, 5, 10, 20 and 25 Mc/s and WWVH broadcasts on 5, 10 and 15 Mc/s.

In America, A = 440-c/s has been accepted as standard pitch since 1925. Initially, this value was agreed upon by the Music Industries Chamber of Commerce as a useful compromise among the various pitches chosen arbitrarily by different musical groups. In 1936 the same pitch standard was adopted by the American Standards Association giving it the status of an industrial standard.

Three years later the International Federation of the National Standardizing Associations (ISA) (now the ISO—International Organisation for Standardization) sponsored a conference in London. France, Germany, Great Britain, Holland and Italy sent delegates, and the United States and Switzerland sent official messages. Six of the seven countries independently proposed A = 440-c/s as the standard and the conference adopted it unanimously. The same standard was again endorsed by the International Organisation for Standardization (ISO) in 1953; and was accepted as an ISO recommendation in 1955.

The National Bureau of Standards maintains the A = 440-c/s standard as the one on which general agreement has been reached. The musical merits of any particular standard are, of course, outside its province.

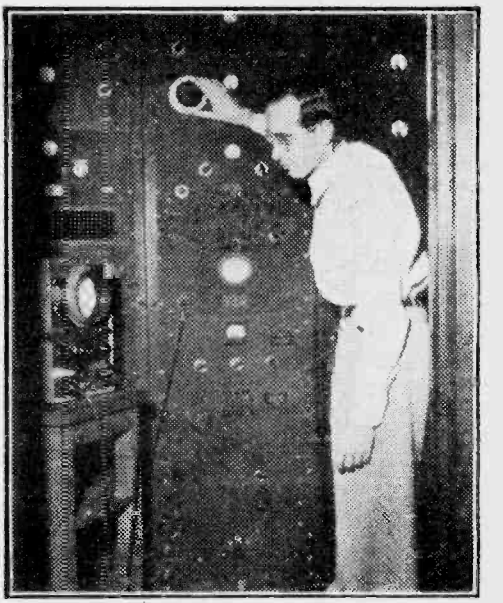
Earlier Pitch Standards

Previous standards of pitch were defined in terms of the frequency of a particular tuning fork or bar, or the length of a specified vibrating air column (organ pipe). Since the sound frequencies generated by these devices vary with the surrounding temperature, it is necessary to specify the temperature at which comparisons with these standards should be made.

In 1859 the "Diapason Normal" was defined in terms of a standard tuning fork deposited by the French Government at the Paris Conservatory of Music. The vibration frequency of this fork was stated to be 435-c/s when measured at the then standard laboratory temperature of 15 deg. C. When R. Koenig (1880) made a careful determination of the frequency, it proved to be 435.45-c/s at 15 deg. C. and to have a thermal coefficient of −0.0486-c/s per deg. C. Thus the fork would really have the defined standard frequency at slightly over 24 deg. C.

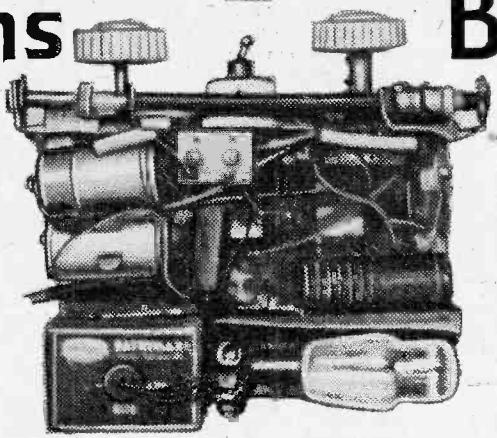
An international congress in Vienna in 1891 adopted the French definition of the Diapason Normal, and it acquired the name of "International Pitch." Great Britain and the United States apparently did not attend this meeting, though A = 435-c/s was used as a standard by a number of musical groups and instrument makers after its adoption by the Vienna congress.

(Continued on page 364)



An engineer adjusts the transmitter for the standard musical pitch.

A Mains Battery Portable



An A.C./D.C. Set With Stabilised Power Supply Enabling it to be Plugged in Anywhere Without Adjustment Where 200-250 Volt Mains Exist. Also Containing Automatic Switch-over from Mains to Battery if the Power is Cut Off.

By G. Keating

(*Continued from page 275 June issue*)

ALL the resistors are of the ½/½ w range. The 0.1μF 150v. tubular paper condensers were a midget type obtained from a local retailer (about ½in. × ⅜in.) and difficulty may be experienced in obtaining small enough condensers. However C11, C12, C16, C17, C18 and C22 could probably be replaced by 10,000pF ceramic types as these are very small. C3, C4 and C24 should be kept at 0.1μF even if small capacitors are not available. Any I.F.T.s may be used within the size limit given although the originals were only 1⅜in. high, and as it will be difficult to adjust the top cores when the receiver is completed it is recommended that this should be done before the L.T. battery is installed. Even then only 1¼in. clearance exists so a short tool will be useful. All other adjustments can be made afterwards without difficulty. The chassis should be marked out first and all holes drilled; a ⅜in. jiffy punch was used for all large holes, it being followed by a chassis cutter where necessary. The resultant ⅜in. × ⅛in. washers should be saved and as many as possible are used on the bush of the cord drive spindle to bring it as far forward as possible so that the drum and drive cord clear the components. Care should be taken to ensure this, when wiring up.

It should also be noted that many components are connected to filament pins and the circuit diagram should be carefully followed for these, as some are connected to F+ and some to F—.

Small fixing holes (⅛in.) should be marked out from the actual components and are not shown except for coils and T3. Most components are mounted on the back of the front panel with spindles, tags, etc., protruding through. Holes have been marked to take leads from L3, L4, T3, R21, etc., and these should be wired up first. Next the remaining resistors and condensers should be mounted and connected as near to the appropriate position as possible. Common sense will enable this to be done quite easily and care should be taken not to omit the relevant components from the top half of Fig. 1; the power pack proper is constructed later. R20, C19, C20, C21 are mounted behind the panel on or near R21. Similarly C14, C15 and C16 are mounted on or near L3 and L4. The wave-change switch deserves mention: since the original was all metal, it was insulated from the chassis by clamping it in its mounting bracket, by means of two Paxolin washers. The bracket is a piece of scrap aluminium of convenient size, roughly as shown in Fig. 4. The bracket is mounted over a large hole (1⅛in. was used in the original), so that the tags and connecting wires do not short on the chassis. It should be wired up first whilst fixed to the bracket, and then the bracket is fixed to the chassis. The constructor is recommended strongly to copy out the component list and, when wiring up, to cross off each component as it is wired in and after completion to check the whole circuit from the diagram. In this way he will avoid any errors. (In checking through the prototype the author found no less than three errors, despite the fact that he thought he had been very careful!) The plan of the receiver is as shown in Fig. 5. The Ferrite rod aerial is mounted in two aluminium brackets (Fig. 6), and it is desirable to cut away the front panel so that as much of the aerial as possible is clear of surrounding metal. This should be done after the rest of the receiver is completed. The loudspeaker is mounted in the cabinet so that the magnet fits into the gap left for it in the middle of the plan partly above the DF96, T1 and the DK96. This should be measured after the receiver is completed, as much depends on the type of loudspeaker used. The cabinet is best built around the receiver because of this, and it is suggested that it is made in three sections: (a) loudspeaker baffle, base and sides; (b) top and dial (⅛in. plywood); (c) back (Fig. 7). The power supply section will now be dealt with.

Power Supply

The relay is mounted on the rear panel, underneath the VR105/30, with the connections pointing towards the H.T. battery. The octal valveholder is used as a tag panel (pins 1, 4, 6 and 8 have no connections to the valve and may be thus used). R11 and R8 are mounted in this way,

and since R11 runs hot it is mounted on longish wires and bent clear of any other components. R9 and R10 are mounted on the relay tags. (R9 is connected directly between the voltage stabiliser and the relay.) The bias components R6, R7, R13, C6, C7 and C24, together with C1 are also mounted on or near these components, which should be wired up before the compartment for the H.T. battery is finally fixed.

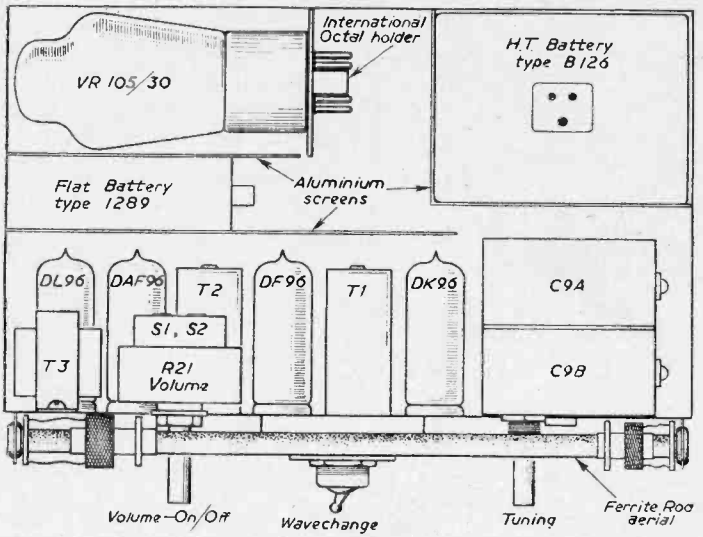
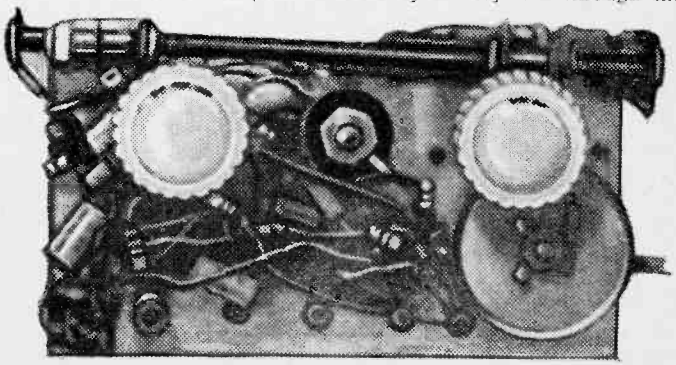


Fig. 5.—Layout of the receiver. The chassis measures 4in. by 2¾in.

Red and black flex should be used for the battery connections and it should be noticed that most of components in the power supply are not earthed to the chassis. This particularly applies to C8A and B which, together with C5A and B are mounted by spring tool clips on to a Paxolin panel which is in turn mounted by two "Meccano" angle brackets behind the front panel above the tuning condenser C9A and B. The aluminium can of C8A and B is thus insulated from the chassis and it must be remembered that a wire must be taken from the tool clip to the VR105/30 pin 2 to form the negative connection. It may be difficult to obtain C5A and B and, as its value is not particularly critical, it may be replaced by any component of reasonable size (at least 8 μF × 8 μF 150v.). The top panel can be fixed by a nut to the bush of the wavechange switch and a piece of stiff wire forms the pointer which protrudes through a 3½in. slot in the top panel directly above the portion of nylon dial cord between (1) and (2) in Fig. 3. The dial is made from two strips of good white paper glued along either side of the slot. About 3½in. × ½in. should prove adequate. For the Medium-wave section, starting from left to right, ¼in. should be marked off as 500m and then, taking ½in. for 50m. the marking should be continued down to 300m at every 50m. Before this the scale is not quite linear, and should be marked out from actual stations using the 247m Light programme to mark the 250m point and Radio Luxembourg on 208m for the 200m point. (The receiver should be most carefully aligned so that all stations between 300m and 500m are in their correct position before marking out the lower half of the dial). When the Medium-wave dial is finished the Long-wave dial may be started by marking 1500m opposite 400m Medium-wave and then with the Light programme set to this point the rest of the dial is marked off from stations. As there are far fewer stations on the Long waveband and as they spread over much more of the dial, satisfactory marking is easily attained. The dial may be marked in Indian ink and covered with polythene, etc., to protect it, but this is a matter left to the individual, as is the decorating of the cabinet.

Alignment

Alignment is quite straightforward, and the following details are given: Connect an aerial directly to the top of L1 and try to tune in the local station with the tuning control. The cores of T1 and T2 are carefully adjusted for maximum volume, the volume control is turned down as the circuits are aligned. If the local station is not heard, patience will soon put this right: all the cores should be checked to see that they are all in by the same amount (about half-way), although it may be necessary to screw out the diode core farther than the rest, as there is more capacity across this circuit. The author found no difficulty at all in finding the local station in this manner. Once the I.F.T.s are aligned the rest of the process is simple. The Medium waveband is aligned first and the core of L3 (L3 and L4 may be adjusted through the



A plan view of the finished receiver.

pointer slot with the dial in position), is adjusted together with the tuning until, say, Brussels on 484m is correct, the Third programme 464m, the North Home Service 434m, Hilversum 1 402m, London Home Service 330m, Hilversum 2 298m should all be checked and with a good external aerial, connected as advised, will all be heard. Radio Luxembourg should be adjusted to just above the bottom of the dial by C9B trimmer and the above stations again checked. The process should be repeated until the constructor is sure they are all correct. The aerial is now removed and the local station is tuned in. This time the M.W. coil should be slid along the Ferrite rod at the High wavelength end, and the trimmer on C9A adjusted at the Low wavelength end. When the reader has roughly aligned the aerial circuit the oscillator circuit should be checked in case the removal of the external

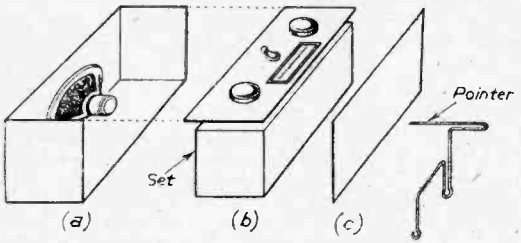


Fig. 7.—How the cabinet is made up, and the dial pointer.

aerial has altered this. With patience a high standard of alignment can be achieved by repeating the adjustments at either end of the scale. When the reader is satisfied with the alignment on the Medium waves, the set is switched to Long wave and the Light programme adjusted by L4 core to coincide with Hilversum 1 (402m) on the Medium wave. The L.W. coil should be slid along the Ferrite rod to bring this in at

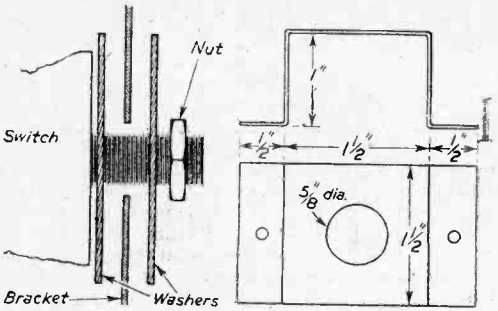
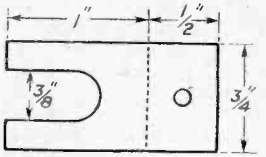


Fig. 4.—Details of wavechange switch mounting.

maximum volume. The author found that trimmers across L2 and L4 were unnecessary although constructors could fit them if they so desire. If these instructions are rigorously followed anyone, without previous experience of superhets. will be able to achieve good results. Of course,

Fig. 6.—Details of the brackets for mounting the Ferrite rod aerial.



if signal generators, etc., are to hand the constructor will naturally use these in preference to the method described, but the above was written so that anyone may make the set without instruments and with the minimum of tools.

Standard Musical Pitch

(*Continued from page* 361)

In many places the pitch standards in actual use were strongly influenced by the way large, permanently installed pipe organs were tuned. Yet, of all the mechanical devices used to generate musical frequencies, the vibrating air column of the pipe organ is the most sensitive to changes in temperature. Their frequency would therefore depend on what the temperature happened to be when they were adjusted to conform to the standard fork in the Conservatory at Paris. Since the advent of better heating systems and air conditioning, the temperature at which most musical instruments are used today (in the United States, at least) is better represented by 20 deg. C. (68 deg. F.) than by the temperature of 15 deg. C. (59 deg. F.) associated with the Diapason Normal. Luckily, an organ pipe tuned to A = 435-c/s at 15 deg. C. will actually be tuned almost exactly to A = 440-c/s at 20 deg. C.

Advantages of Present Standard

From a technical point of view, the present standard of musical pitch, as maintained by the Bureau, has the advantage that it is free from the vagaries of the material objects (tuning forks, organ pipes) that embodied past standards. Thanks to modern electronic techniques for generating and stabilising oscillations, a tone is produced that for all practical purposes is independent of the temperature of the surroundings.

This would apply, of course, to any musical frequency that might be chosen. It happens, however, that the 440-c/s frequency stands in a very simple relation to other frequency standards maintained by the Bureau and can therefore be produced with a minimum of additional equipment. A tone of 435-c/s, for example, would require a somewhat more complicated technical arrangement.

In changing over to standard pitch, little or no alteration is necessary in adjusting instruments tuned to the older standard. Instruments tuned by string tension and the open vibrating air columns of pipe organs present no problems at all. Woodwinds can be corrected partly by the tuning adjustment of the instrument and partly by the breath control of the player; and changes required in the reed stops of the organ are within the range of the instrument's tuning adjustments.

Single Track Stereo Sound

HOW TO USE A STANDARD TAPE RECORDER FOR "3-D" SOUND EFFECTS

By A. M. St. Clair

EVERYONE who has seen the picture "Around the World in Eighty Days" must have been impressed by the extraordinary realism of the sound effects. Shots, animal noises, wind sounds—they didn't come from the centre of the screen, or from some ill-defined point at the front of the hall, they came from all directions, from the point where the event concerned was actually taking place. Footsteps moved with the walker. A full, natural three-dimensional illusion was produced. And yet all the "effects" were recorded on a single sound-track.

The apparatus at the heart of this extraordinary technical achievement is the "Perspectasound" Integrator, manufactured in this country for Todd-AO presentations by the Rank Organisation. It is worth describing here because its principles are applicable by the amateur experimenter to the production of really good 3-D recordings which can be played back via an ordinary tape-deck. This article, therefore, will give a brief description of the professional apparatus, and suggestions for adapting the principles to amateur use.

On the recording side, the output from several microphones is taken via a mixer to a single recording head. "Eighty-Days" uses three channels, but two is quite adequate for home use. The sound from each source is "labelled" before recording by adding to it a marker or sub-carrier signal whose frequency is below the response of the reproducing amplifier. For professional use, the frequencies chosen are 30 c/s, 35 c/s and 40 c/s. These markers are being recorded all the time, along with the signal; and it is arranged that the strength of each marker is always proportional to the strength of the signal being received by its associated microphone. The playback amplifier is provided with a separate output stage for each channel. These output stages are, by means of a novel and ingenious circuit, electronically volume-controlled; the volume level is set by means of the strength of the respective marker signal.

It will be seen from the above description that if the three output stages are arranged to feed three loudspeakers whose positions are relatively the same as the positions of the three microphones used to record the sound, then each speaker will reproduce the sound originally "heard" by the corresponding microphone, and the resulting distribution of sound will approximate closely to the original presentation.

The thoughtful reader will have noticed that the system as outlined has one snag. In the case where more than one microphone is strongly energised, but with different signals—e.g., a solo violin is close to one mike, and the accompanying piano to the other—then the outputs will not be differentiated. In practice, the adverse effect of this flaw is not so serious as might be imagined, since the dynamics of a performance will rarely cause the equal energising of several microphones simultaneously to occur for more than brief instants of time. However, it is a flaw, and it is overcome in professional apparatus by relatively complex and expensive means. In the procedure suggested for amateurs in this article, it is evaded by simplifying the whole recording process, and by placing the variables concerned under the control of the operator. Incidentally, considerable scope is thereby introduced for the exercise of artistic taste.

Reproduction

Fig. 1 is a block schematic of the integrator in its three-channel professional form. The output from the playback head, or from the photocell where optical sound recording is being used, is fed to a preamplifier to raise the level to a suitable value for operating the apparatus which follows. The signal at this stage consists of the output of all three mikes, together with the three marker signals. The preamp feeds a high pass filter and a low pass filter. The former passes all the signal, but not the markers. The latter attenuates the signal, but allows the markers to pass. The audio signal is amplified and fed to the three output stages, whose inputs are in parallel. The L.P. filter is followed by three tuned circuits which separate the markers from each other, which are in turn followed by three rectifiers, each producing a D.C. voltage proportional to the marker concerned. These voltages are used in the special circuit already referred to for the

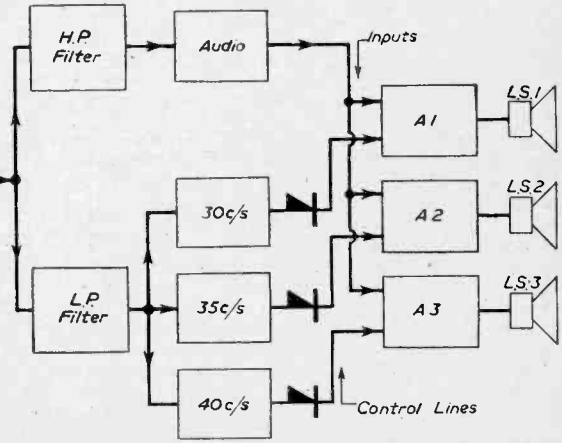


Fig. 1.—Block schematic of a professional form of single track recorder.

automatic control of the volume of the output stages. Thus it will be seen that if only the 30 c/s marker is present, only the output stage A.1 will be operative, and the other two speakers will be silent. This corresponds to a recording condition where only the microphone related to the A.1 output was energised, and similar considerations apply to the other channels.

Fig. 2 shows the special output stage used. The valve employed is the EK90, normally considered a frequency-changer. A pair in push-pull will give quite adequate volume for most purposes, but of course further amplification may be added if desired. This valve has been selected because, although it is capable of handling a large signal, D.C. voltage changes on its oscillator grid will give a practically linear volume controlling effect. Variable-mu valves are not suitable for this type of circuit, not only because of their low signal-handling capacity, but also because the relation between bias volts and output is not linear.

Amateur Adaptation

For an amateur stereo-sound outfit using these principles, two units are required; an integrator, through which the output from an ordinary tape-deck will be replayed, and a recording control panel. The integrator to be described will possess two channels, which will give extremely natural "solid" sound—the recent BBC stereophonic tests were on two channels—but of course you may use three or even more, if you are willing to construct apparatus of the necessary complexity. All channels will be identical with the exception of the marker frequency. The recording control panel described, also for two channels, will enable tapes to be recorded from the radio, from records, or from a "live" performance. In it the complicated devices used for differentiating or splitting up the sound into channels are replaced by the skill and individual taste of the operator.

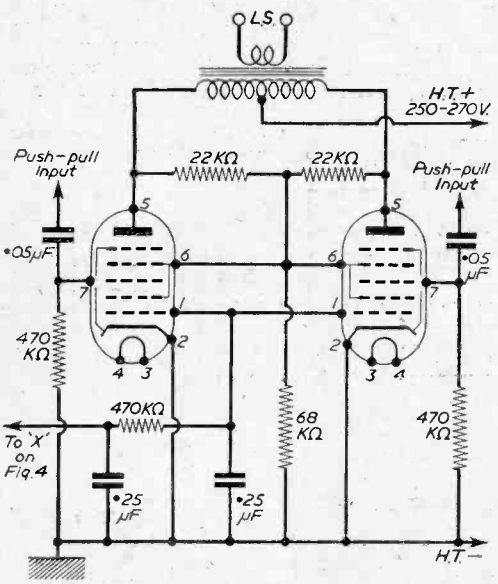


Fig. 2.—Circuit of the output stage of the recorder.

The preamplifier of Fig. 1 will normally be all or part of the existing tape-deck amplifier. The low-pass filter is shown in Fig. 3. This filter has a −3 dB down point at about 60 c/s, and a slope of approximately 24 dB per octave; it is designed to operate out of a low impedance and into a high one—e.g., from the secondary of an O/P transformer to a valve grid. This is ideal for our purposes, since we can connect this filter in place of the usual speaker of the tape-deck amplifier, and take its output straight to the tuned

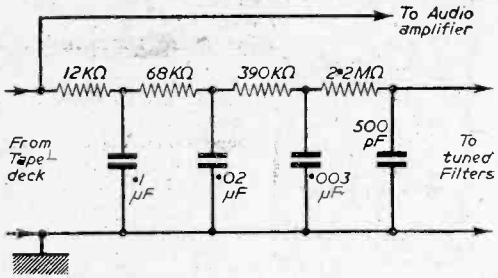


Fig. 3.—The low-pass filter which is employed.

marker-separating circuits. If it is desired to operate the low-pass filter from an earlier stage of the tape-deck amplifier, care should be taken to select a low-impedance point, such as a cathode; to feed it from a high-impedance point, a simple cathode follower should be interposed.

For simplicity the high-pass filter will be omitted. Instead the coupling components of the audio amplifier feeding the controlled output stages must be modified to ensure that practically no marker frequencies appear in the audible output. The amplifier itself can be very simple. A double triode, with the first half operating at somewhere near maximum gain and the second wired as a phase-splitter, will normally be adequate. The selection of coupling components to achieve suppression of the carriers is best accomplished by trial and error; lower values of coupling condenser and grid resistor than usual will be required. Of course, if you wish to use a linear amplifier and a separate high-pass filter, you may do so, and will achieve slightly better results at the expense of a more complex apparatus.

The actual circuit used for the sub-carrier tuned filters in the professional equipment is shown in Fig. 4. It will be seen that they are three-stage band-pass filters. With the values given, they are most efficient; but, if it is felt that they are too elaborate, they may be simplified considerably. If widely separated marker frequencies are used, good results may be obtained even with single tuned circuits. The 30 henry chokes may be quite small affairs, since they carry no D.C. The full-wave output rectifier may readily be replaced by a simple half-wave circuit, when there will be no need for a tapping on the final choke. The tuning of these filters is accomplished by varying the condensers, which should therefore be made up of a number of small condensers wired in parallel.

(*Continued on page 369*)

The output stages should be exactly as in Fig. 2. Tests should be made with a signal applied to the input lead and a source of variable D.C. to the control lead, that these stages are capable of variation from fully on to almost cut-off by means of a swing of about 20 volts on the control lead without running into distortion except perhaps at almost inaudible levels of output.

The Oscillators

The recording control panel consists of two oscillators, one for each marker frequency, together with a level control for each frequency and a mixer. The oscillators are simple affairs, one valve each being sufficient. They may be R.C., L.C. or transformer coupled at the choice of the constructor, dictated probably by the contents of the spares-box. The only requirements here are that the outputs should be reasonably pure sine-waves, since any harmonics will pass the filtering effect of the special coupling components in the audio feed amplifier, and that the ouputs should be approximately equal. It is recommended that the marker frequencies chosen, which will be the frequencies of the two oscillators, should be 25 c/s and 40 c/s, since these figures give easy separation with relatively simple tuned circuits in the integrator, an arrangement which permits a certain amount of frequency-drift without destroying the operation of the whole system.

It is not necessary to tune the oscillators accurately to any specific frequencies. Assure yourself, either by calculation or measurement, that the chosen frequencies are approximately achieved, and then tune the integrator marker-separation circuits to the oscillators as built. In this way you do not know what the exact frequencies of your sub-carriers are, but you don't care either. The integrator will respond to the oscillator frequencies by reason of its adjustment.

The two controls of the recording panel should be brought out to two large knobs, one on the right and one on the left. That on the right should control the frequency which corresponds, in the integrator, to the right-hand loudspeaker, and vice versa. Since it is necessary to record the marker frequencies on the tape simultaneously with the required signal, the output of this unit must be injected at a suitable point in the recording amplifier. A suitable point is obtained as shown in Fig. 5, by lifting the earthy end of a grid resistor and inserting an additional small resistor. The stage in which this is done, and the value of the additional resistor, depend upon the fact that the output stages require a 20 volt swing for control. A few feet of test-tape should be recorded containing nothing but a single marker frequency—i.e., with one recording control panel knob fully up and the other fully down—and then replayed via the integrator, with a high-resistance voltmeter monitoring the rectified output of the appropriate tuned filter. This should be repeated, varying the point of injection and the value of the injection resistor, until an output of 20 volts D.C. is obtained from the rectifier. If the value of additional resistor is more than one-tenth of the value of the original grid resistor with which it is in series, you must either select another injection point from which greater amplification is available, or you must increase the output from the control oscillators. In case of difficulty in obtaining sufficient control voltage, either at all, or without introducing audible carrier hum into the output, it is worth trying the effect of transformer-coupling the rectifiers to the marker-separating tuned circuits. In this way, a considerably greater D.C. control voltage can often be obtained.

Recording

In making a recording, one sets up the tape machine in the normal way, but in addition attaches the recording control panel. In this way, either or both of the marker frequencies may be superimposed upon the recording. If the right-hand knob is turned fully up, what is at that moment being recorded will, on being replayed via the integrator, be reproduced by the right-hand speaker, and likewise for the left-hand knob and the left-hand speaker. Both knobs fully up will mean replay at full volume from both speakers; left fully up and right half up, and the sound will appear to come from a point rather nearer to the left-hand than to the right-hand speaker, and so on. Thus, if you wish to make a recording of an orchestral broadcast, and you decide that you wish the effect to be that of an

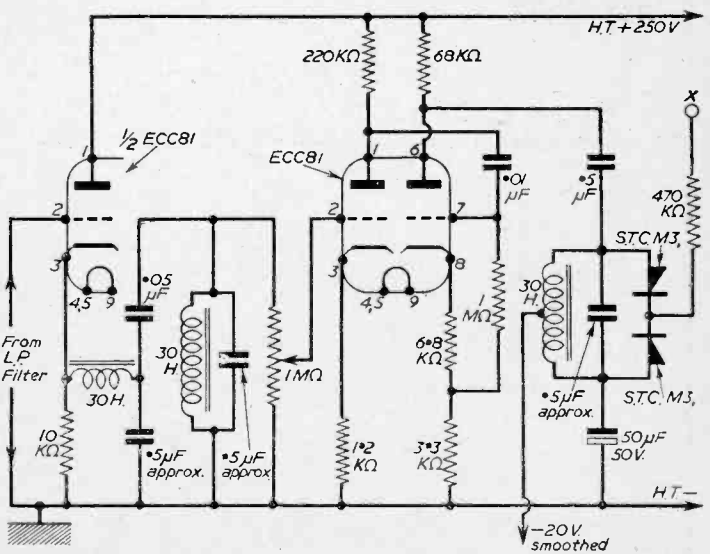


Fig. 4.—The professional circuit of the sub-carrier filter unit.

orchestra having the brass in the centre, the woodwind slightly to the right of this, the violas slightly to the left, the double-basses at the extreme right, the percussion at the extreme left, and the violins occupying the space from the centre to the extreme left, you must listen carefully to the broadcast as it unfolds, and operate the controls accordingly.

Of course, the better you know the music concerned, the better you are equipped to do this sort of thing; the ideal way to work in the case of orchestral recording is with a pocket score and a plan of the orchestra. But when it comes to re-recording from gramophone records, the case is greatly simplified, since you can rehearse to your heart's content, and continue erasing and re-recording until you have exactly the effect you desire. In the case of a "live" recording, you can follow a performer, say a singer or a violinist, as he moves about; and the same applies to the making of a tape intended as the sound-track to a film.

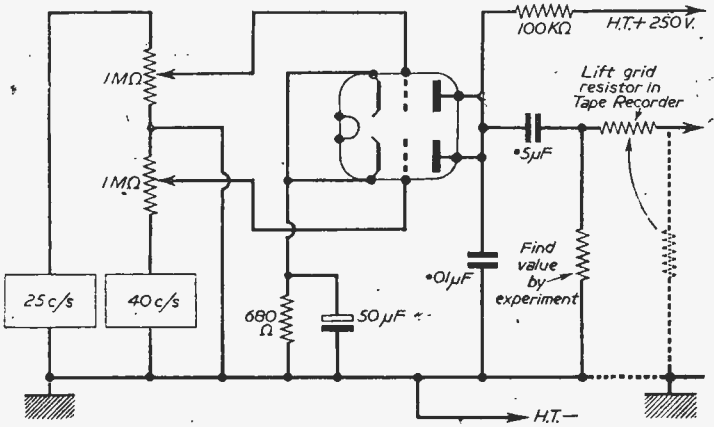


Fig. 5.—How the marker unit is connected to an existing tape recorder.

In playing back, everything is quite automatic. Your work is done when you have made the recording—the integrator will do exactly as you instructed it to when you operated the recording control panel. Don't expect to make perfect recordings first shot; excellence comes with practise.

The Speakers

The siting of the speakers is a matter for experiment. It will depend largely upon the acoustics of the room in which the apparatus is operated, but about 6ft. apart is normally optimum. The speakers must, of course, be phased correctly. If the effect is wrong, try reversing the connections to one speaker. It is sometimes a good thing to leave the normal speaker of the tape-recorder connected, as well as the two stereo-speakers; if this is tried, the original speaker should occupy a central position between the other two, and be as far to the rear as possible. However, in order to do this, it will be necessary to prevent the marker signals from reaching this speaker.

In fact, many tape-recorders have so small a response to frequencies below 50 c/s that it may not be essential to take any special steps for this purpose; this is the case where you have taken your output to the integrator from an earlier cathode, and where the later stages of amplification in the tape amplifier tend to "lose" the lower frequencies.

The apparatus described in this article requires some care and thought in setting up, and some skill in operation, but where the constructor is willing and able to supply these, the results will amply repay him.

Pye Stereo Records

FOR the first time in this country—and we believe in the world—Pye Records announce regular issues of both classical and "pop" records which have been stereophonically recorded.

As we go to Press it is announced that the first issues will be available before this copy is on sale. The public will be able to buy stereo on 12in. and 10in. records playing at 33⅓ r.p.m., and 7in. records playing at 45 r.p.m.

These records carry two signals cut in the walls of the record groove which are inclined at 45 deg. to the record surface. They are played with a specially designed stylus in what is called the "45/45" stereo system. The two signals are amplified separately and reproduced through two separate loudspeakers.

There will be nothing difficult about buying or playing the new stereophonic records. They are very similar in appearance to ordinary L.P. records and the equipment on which they are played is no more complicated than the conventional record player.

In the field of "pop" stereo discs the technique offers a wide range of new effects. For example, groups can be split up and repositioned, or even be made to move in all directions whilst playing. It will be some time before all the various possibilities for retaining the listener's interest have been explored in this respect.

We understand that the first releases of stereophonic records by the Pye Group will include performances by Sir John Barbirolli and the Hallé Orchestra, Ralph Downes at the organ of the Royal Festival Hall, London, Karl Haas and the London Baroque Ensemble, Larry Adler, the Pro Arte Orchestra, Marion Ryan, Tony Osborne and many others.

On Your Wavelength

BY THERMION

You Must Have Norms

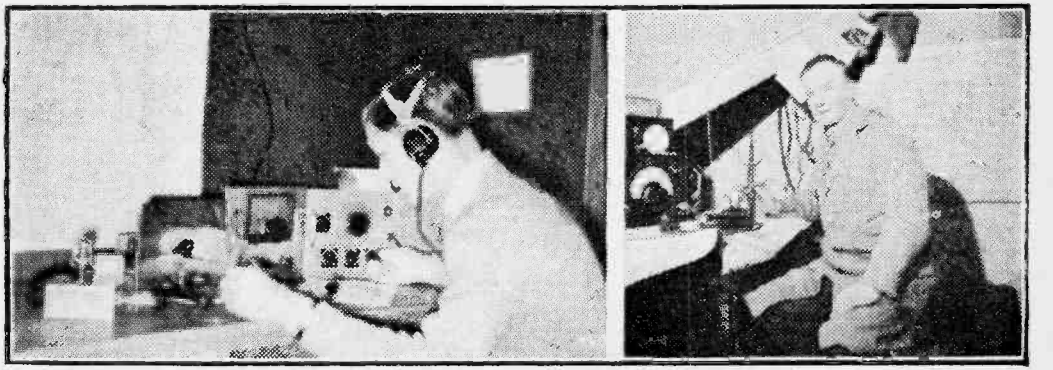
MY recent strictures on the BBC method of adopting their own standards of pronunciation which are often contrary to all dictionaries have brought forth some lively correspondence. My remarks on the attempts to give Kensington drawing room pronunciations to surnames have been a particular target for critics, but I am quite unrepentant. If a man's name is Onions it should be pronounced Onions and not O'nyons. If a man's name is Death, it should not be pronounced De'ath. We must observe some standard, even in these slip-shod days, and the attempt by the Chelsea types to impose their own particular methods needs to be carefully watched. The BBC seems to encourage it both on sound and television. In their titles on TV they will often adopt the stupid practice of not using capital letters for the initials of people's names. The title appears as "programme directed by john brown." If everyone is going to be allowed to pronounce and spell words as they wish, and to abrogate the rules of grammar and orthography, we might just as well abolish the teaching of grammar altogether and let people do as they like. I do not like and shall not cease to criticise this sloppy and slip-shod method which the BBC permit. They are setting a very bad example.

Showers of Shacks

I HAVE received many photographs from my readers showing their radio dens, and I publish two of them below. Others will appear from time to time. Each photograph published earns a guinea. Unfortunately, many of those submitted are not suitable for reproduction. Where possible, send the negatives, so that we can take enlargements for retouching purposes. Send, if you can, a few details of the den and what it contains. Some of the reasons given for erecting the den are amusing. Here are a few of them: "I built it to get away from the wife's nagging." "The wife objected to me using earphones," "The kids are always in the way," "I hate listening to women's chatter, often of the most trifling character," "I prefer to be alone," "I don't like the BBC programmes," "I thoroughly enjoy the amateur's chatter," "She threatened to leave me unless I cleared my clutter away, now she complains that she is lonely."

Music Publisher's Viewpoint

I WAS chatting to a music publisher the other day, one who specialised in "pop" numbers. He tells me that for every number published which shows a good return there are at least a dozen which scarcely pay for the engraving of the plates. He also says that the life of popular numbers is too short. Indeed this is confirmed by the Luxembourg programme. "Top Twenty" which is radiated every Sunday night between 11 and 12. A few numbers hang on for three or four months, during which they climb from the bottom to the top, or the top to the bottom and then fade out. He complained that "pop" singers were increasing and multiplying like germs and that their popular life was at the most a couple of years. Just think of the names that were popular two years ago, but are heard no more. From my own point of view, these singers of the merest trash and tripe cannot fade out fast enough. He expressed the view that the old style of balladic music sung by the stars of variety of yesteryear had a much longer life and sold in much larger quantities, some indeed have become classics. Such as "The Man Who Broke the Bank at Monte Carlo," "Two Lovely Black Eyes," "Daisy Bell" (which has become almost immortal), "Little Dolly Daydream," etc.



(Left) Mr. Marment's den situated in his garden. (Right) Mr. B. Johnson converted his attic to form a cosy den, as seen here.

A Pocket Trans

THIS little receiver is a self-contained two-transistor set having three stages of amplification. It is housed in a plastic container measuring 4in. × 3in. × 1¼in. The circuit employed ensures good sensitivity and selectivity, and yet without the annoying whistle of a regenerative circuit. The size and cost of the set will suit most home constructors' pockets and it

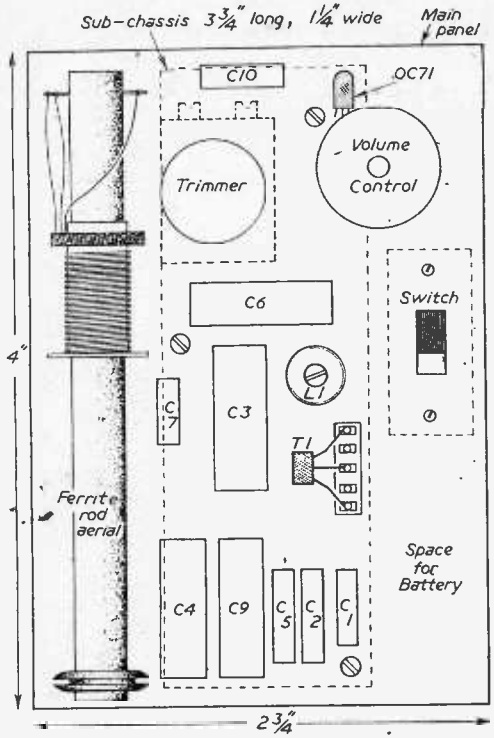


Fig. 2.—General layout.

should be noted that there are no knobs protruding from the set, merely leads to the earpiece and the optional aerials.

The Circuit

The circuit employed is a "reflex" circuit having a stage of R.F. amplification prior to the crystal detector. Signals picked up by the Ferrite rod aerial are fed to the base of the transistor T1. The amplified R.F. is then coupled to the detector

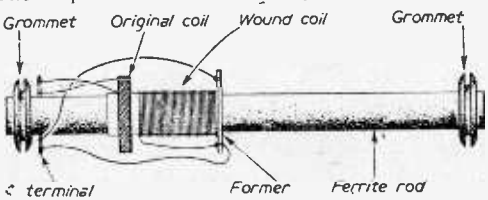
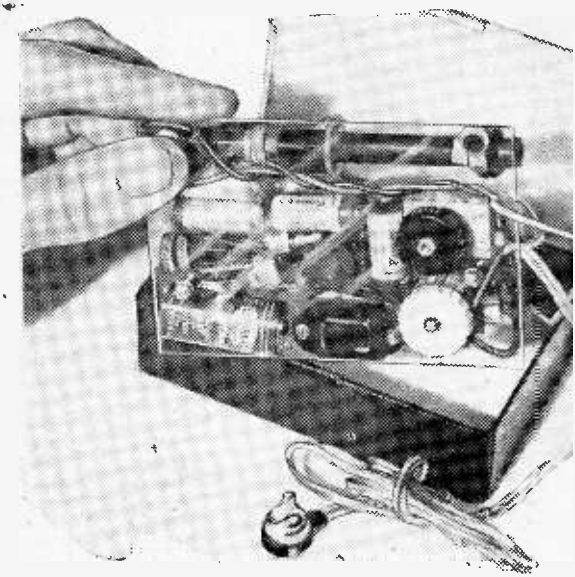


Fig. 3.—Details of the aerial.



D1 through C1. The detected audio is then returned to the base of T1, to be amplified once more, through C3. The audio output is developed across R4, and C6 feeds the audio signal to T2 for final amplification. The output is loud enough for most purposes, although further

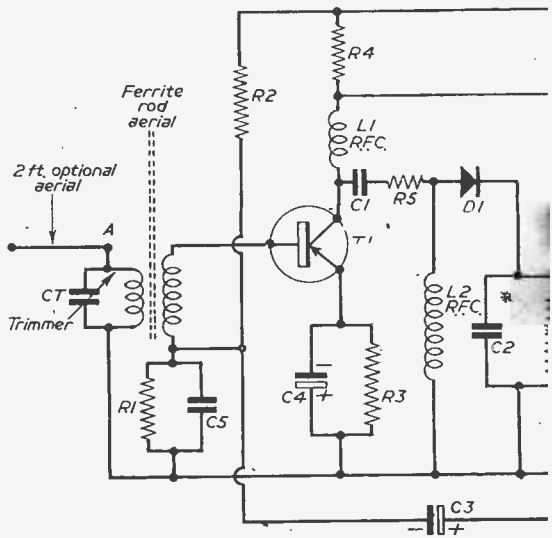


Fig. 1.—Theoretical circuit of the

...ston Receiver

A TWO-TRANSISTOR SET UTILISING A REFLEX ARRANGEMENT

By W. K. Hsu

amplification may be added. R9 is the load for T2 and high-impedance phones or earpiece should be used. L1 prevents R.F. signals from appearing across R4, and L2 allows no A.F. to reach D1. Both L1 and L2 are essential for the operation of this receiver. R1, R2 supplies base current for T1, and R6, R7 supplies that for T2. These offer the advantage that only a single battery is required. R3 and R8 are the usual stabilising emitter resistance and C4, C9 bypass any A.C. developed across them. C7, C8, C10 may, in certain cases, be omitted.

Construction

The whole assembly can be built on a detachable panel and sub-chassis assembly, and all wiring may be completed prior to fitting in the containing box. Only the volume control, a surplus hearing aid type, trimmer tuning condenser and the rod aerial and switch are mounted on the main panel; the rest of the components are distributed on the sub-chassis as indicated. An additional close winding of 45 turns of 32 gauge enamel copper wire is added on the same former. The ends of the new coil are secured on the edge of the former with punched holes and soldered on the same terminals as shown.

Both the panel and chassis are of 1/16in. thick transparent Perspex material. In Fig. 2 only the knobs are above, the rod and sub-chassis are under the panel.

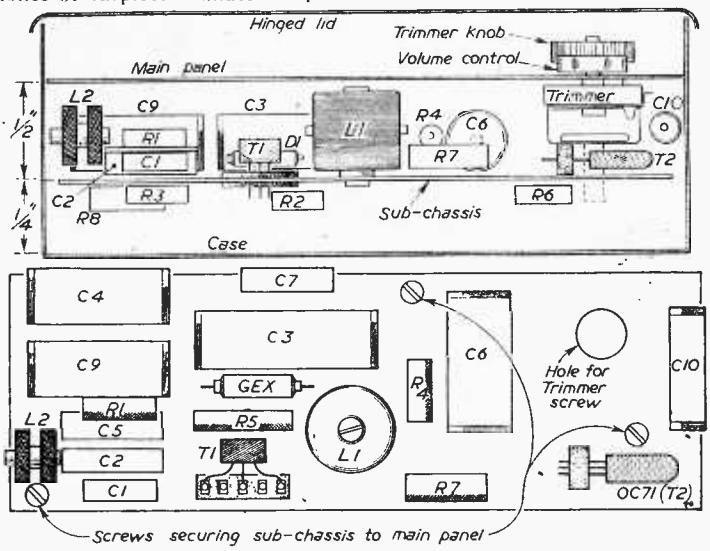
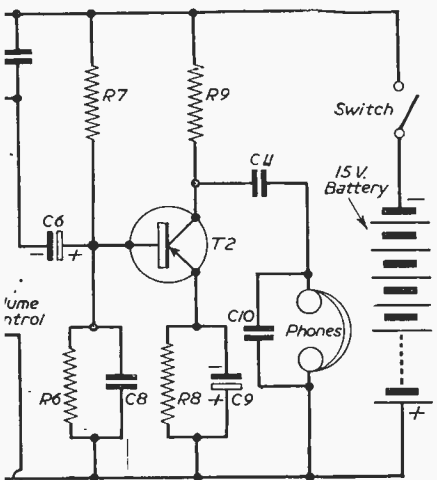


Fig. 4.—Side view of the set, and details of the sub-panel.

The components shown are all secured on the sub-chassis by passing their leads through drilled small holes of ⅛in. diameter. R3, R6, R8 and R2 are positioned on the other side of the sub-chassis. Most wiring can be done on the chassis before bolting on to the main panel. The R.F. chokes L1, L2 and Ferrite frame should be positioned so that each is at right-angles to the other. A most suitable substitute for L1 is the potted coil of a disused 465 kc/s miniature I.F. transformer. The coil and its terminals should be carefully removed from the transformer. The



...ceiver described above.

LIST OF COMPONENTS

C1, C7—0.001 μF.
C10, C2, C5, C8—0.005 μF.
C11, C3, C6—12 μF (Plessey CE257 12 v. D.C. electrolytic).
C4, C9—50 μF 6 v. D.C. electrolytic.
R1—10 K. R2—68 K.
R3—1 K. R4—5 K.
R5—82 Ω. R6—5.6 K.
R7—250 K. R8—180 Ω.
R9—4.7 K.
All resistors are ½-watt rating.

L1—0.5 Mh ("two π") Radio Clearance Ltd.,
L2—4.5 Mh - or Lasky's Radio.
CT—Trimmer, volume-control 10 K case.
Ferrite rod aerial Teletron F.R.M.
T1—R.F. transistor (red yellow spots) or others.
T2—OC71 or A.F. transistor (red spot)
D1—GEX34.
Transistor sockets, switch, Henry Radio type.

From Henry's Radio

All resistors and capacitors are obtainable from Radio Clearance Ltd.

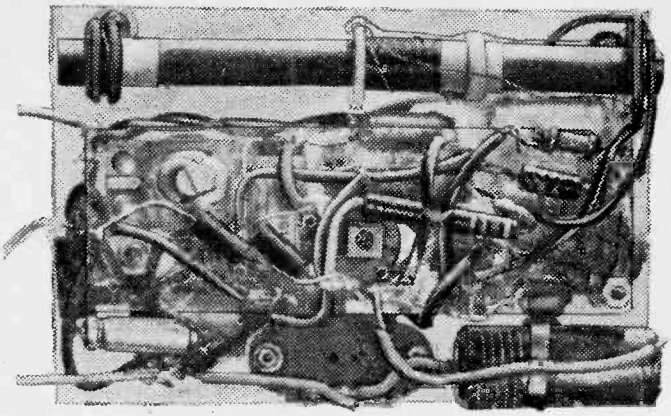
pot offers a good means of screening and the centre hole for convenient mounting.

The battery used should be placed on the other side of the sub-chassis, near the switch. An Ever Ready type B144 hearing aid battery is used.

Theoretical Circuit

The switch is mounted near the volume control and alongside it the battery.

At initial testing a short throw-out aerial of a yard in length should be connected to the point on the theoretical diagram marked "A." If the coil on the aerial rod is set to the centre of the rod the Home Service of the BBC will be found on the "tight" end of the trimmer, and Light programme at the "slack" end.



A view of the receiver without the case.

Resistors in Parallel

MOST readers of these pages will know how to calculate the values of resistors in parallel. With pencil and paper, with a slide rule, or with an abac or table, finding the answer is not a formidable problem, and proposing a new method needs some justification. The fact is, using the sum of the reciprocals method just does not give an immediately obvious answer; and getting the right result from a table (if one is handy at the right moment) tends to depend on having some rough approximation in mind to check against. Even the "product over sum" formula, for two resistors, is not easy mental arithmetic.

How can one arrive quickly at a rough approximation? Luckily, for equal values the answer is easy. Two resistors of the same value come out at half the value of one of them; and, similarly, three of the same value give the answer one-third. The final fraction has the number of equal resistors as its denominator, in fact. The suggested method merely extends this principle.

Imagine this situation. You have in position a 10 megohm resistor which you do not want to unsolder, and you wish to try 2.5 megohms in its place. In other words, you want to reduce the value to a quarter of the original. Obviously, on the foregoing principle, you could add three more 10 megohms, making four in all. But since you know that the three which are added would total one-third of the common value, the procedure can be cut short by adding 3.3 megohms, or one-third of the initial value, in the first place. Similarly, if you want to arrive at 1 megohm, or one-tenth of the original value, you would add one-ninth. In other words, you make the denominator of the fraction you are adding one less than the number of times the first resistor exceeds the wanted value.

A Formula

If we care to dignify this trick of mental arithmetic with a formula, we may say:

$$Ru = \frac{1}{m-1} \times Ri$$

where Ri is the initial value, m is its ratio to the wanted value, and Ru is unknown.

The formula works even if the final resistance is more than half the original value. For instance, if we start with 12 K., and want to obtain 9 K., the ratio is 1⅓. Subtracting 1, and putting the result as a reciprocal, the missing value is 1 over ⅓, or three times the original value—that is, 36 K.

The opposite problem can also be tackled. Given two resistors in parallel, how does one arrive at their combined value? The answer again is to look at the ratio of their values.

If one resistor is the same as the other, the result is one half. If one is twice the other, the combined value is two-thirds of the lower one; if one is three times the other, the answer is three-quarters. And so on. The simplest rule here is to take the number of times the higher resistance exceeds the lower; the final value is that fraction of the lower value whose numerator is the ratio of their values, and whose denominator is one plus that value.

In algebra:

$$Ru = \frac{h}{h+1} \times Ro$$

where h is the ratio, and Ro the lower resistance.

So that if we are given 10 and 39 ohms, the higher value is roughly four times the value of the lower, and the combined value is four-fifths of the lower; that is, 8 ohms. For 10 K. and 15 K., the answer is 1⅔ over 2½, or three-fifths of the lower, which is 6 K.

Dealing with rough fractions in this way is well suited to estimating. Imagine, on the other hand, using the "product over sum" method for 27 K. and 56 K. (ratio approximately 2, answer two-thirds or 18 K.). Discovering the denominator to be 83 K., and arriving at 1,512 K. for the numerator, one is faced with the task of dividing 1,512 by 83. This produces an aswer of 18.2. Obviously, for most applications, the difference in accuracy is not worth the effort expended.—D. H. HOLDING, M.A.

Servicing Radio Receivers

ACE TRANSISTOR PORTABLE MODEL TR257

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

HAVING now obtained a reasonable understanding of the A.F. application of transistors from last month's article on the Cossor Record Player, we extend the scope a little this month to embrace R.F. application in the consideration of a fully transistorised receiver.

The Ace transistor portable is designed for operation on the M.W. and L.W. bands over the range of 190 to 550 metres and 1,100 to 2,000 metres respectively on its inbuilt aerial. Provision is available for the connection of an external aerial and an external battery, the former greatly extending the range of pick-up and the latter resulting in economy of operation when the receiver is used indoors and the portable feature is not an essential consideration. The internal battery is a single lightweight, Ever Ready PP1, which gives about 150 hours of playing. The playing time is extended to about 800 hours by the use of an external Ever Ready PP8. The receiver can, if desired, be connected to a 6-volt car battery, or to a 12-volt car battery by way of an extra adaptor. For use in a car, the normal car aerial serves admirably to convey signals to the external aerial socket.

Known as the "Courier," the set is housed in a two-tone leathercloth case with plastic trim and handle. Even though of truly portable make-up, good reproduction is secured by way of a relatively large speaker, having dimensions 7in. × 4in., into which the output stage can feed a maximum of 0.25 watt.

The Circuit

Seven transistors and a germanium diode go to make up the circuit, full details of which are given on the next page. The first transistor, V1, is arranged as a self-oscillating additive mixer. Here the base of the stage is common to the input and output circuits from the point of view of the oscillator signal. The oscillator is a tuned-collector circuit, feedback taking place between the associated tuned circuit and the coil in the emitter circuit. Oscillator band-switching is achieved quite simply by changing over of the trimmers; on L.W. a 200 pF capacitor is connected in parallel with the L.W. trimmer.

The 470k resistor connecting the base to the negative side of the supply provides a starting current for the oscillator initially, but when oscillations commence a D.C. bias is developed across this resistor and associated 0.01 μF capacitor connected between the base and the ferrite aerial winding. This not only results in limiting and non-linearity which is the requirement of a mixer, but the self bias also acts as an automatic stabilising device for the stage. The stage, from the D.C. point of view, is arranged in the grounded-emitter mode by way of the emitter oscillator coupling coil and series-connected 3.3k resistor.

The appropriate windings on the ferrite aerial are selected by the wavechange switch sections, and the signal selected by the aerial section of the tuning gang is fed to the base of V1 through the 0.01 μF coupling capacitor. The non-linear operation of V1 results in the mixing of the oscillator and the incoming signals in the usual manner, and the 470 *kc/s I.F. signal* is developed across the first I.F. transformer (IFT 1), the primary being tapped to avoid damping by the collector circuit. V1 is of the Ediswan-Mazda range of junction transistors—Type XA102—being suitable as oscillator/mixer up to 2 Mc/s.

The I.F. Stage

The I.F. signal is amplified by two grounded-emitter stages, V2 and V3, using Ediswan-Mazda Type XA101 transistors. These are designed for use as I.F. amplifiers up to frequencies of 500 kc/s. Both I.F. transformers, IFT 2 and IFT 3, feature tapped primaries not only to resolve the matching problem, but also to facilitate the connection of neutralising circuits by way of the 5 pF capacitors wired between the tops of the primaries and the base circuits of V2 and V3. It must be remembered that the grounded-emitter mode is much after the style of a grounded cathode triode, and that to avoid the stage operating as a tuned-base tuned-collector oscillator (synonymous to a tuned-grid tuned-anode triode) some form of neutralising is called for.

The I.F. stages are stabilised with regard to their working points by resistive potential dividers in the base circuits in conjunction with

the resistors in the emitter circuits. The emitter resistors are decoupled at I.F. to prevent degeneration, while the base circuit of V2 is decoupled at A.F. so as to "hold-off" voltage fluctuations at A.F. due to the relatively heavy current variations in the push-pull output stage. Additional A.F. decoupling is given by the 100 μF capacitor and the 470-ohm resistor in the supply line directly after the output stage. R.F. and I.F. decoupling is secured by the 0.01 μF capacitor between chassis and the A.F.-decoupled supply line. It will be seen that this is effectively in parallel with the 100 μF capacitor.

The Detector and A.F. Amplifier

The type GD3 germanium detector, V4, is D.C. coupled to the base of the grounded-emitter A.F. amplifier stage, V5. The diode is connected to the base so that the rectified signal current is applied in the forward direction between the base-emitter junction. Under this condition, therefore, the bias applied to the base-emitter junction is dependent on the strength of the I.F. signal. So as to maintain this constant, which is essential to stabilise the working point of V5, and to endow the circuit with A.G.C., a D.C. connection is made from the emitter of V5 to the emitter of the first I.F. amplifier V2.

The operation is as follows: should the signal rise an increased current is caused to flow in V2 emitter resistor by way of the 100 ohm coupling resistor which biases V2 nearer cut-off and so reduces its amplification—rather like the more conventional valve A.G.C. system. Conversely, should the signal fall the amplification of the I.F. amplifier is increased. Thus, an A.G.C. compensating effect results, which is also valid to some degree in the stabilising for progressive reduction in battery voltage.

The Driver and Output Stages

The signal current in the collector circuit of V5 is capacitively coupled (note the large value capacitor used) to the base of the grounded-emitter driver stage V6. This stage is stabilised by the resistive potential-divider in the base circuit and the resistor in the emitter circuit.

The signal current in the collector circuit is abstracted by the driver transformer T1 and fed in push-pull mode to the bases of the grounded-emitter push-pull transistors V7 and V8. The collectors are wired across the primary of the centre-tapped output transformer and the loudspeaker is connected across the secondary winding. Negative feedback is applied over the driver and output stages from the secondary of the output transformer to the base of the driver valve through the 100-ohm resistor.

A test link is provided in the common collector circuit of the output transistors for the introduction of a current meter. The quiescent collector current is adjusted to put the output stages into class B mode by the 2k variable preset resistor in the base circuit.

The A.F. amplifier and driver transistors are by Ediswan-Mazda, Type XB102, while two Ediswan-Mazda XC101's, specially developed for class B operation, are adopted in the output stage.

Servicing Notes

In common with almost all transistorised portables, the Courier features a fully printed circuit. When replacing a component on such circuits it is usually advisable to cut the connecting wires of the faulty part so as to leave small lengths of the original wires protruding through the panel for ease of connection of the replacement part. A miniature soldering iron of some 25 watts is recommended so as to avoid damaging the adjacent components, printed wiring and panel. A large iron invariably results in a blob of solder shorting adjacent wires or connecting tags, and prolonged heat in an endeavour to remove the short usually ends up in a burnt panel. If a solder short of this kind occurs, it can be cleared with little difficulty by means of a small stiff brush when the solder is in a molten state—a salvaged tooth-brush serves admirably. Before the actual soldered connection of replacement parts, the heat application can be considerably reduced by first tinning the wires protruding from

(*Concluded on page 380*)

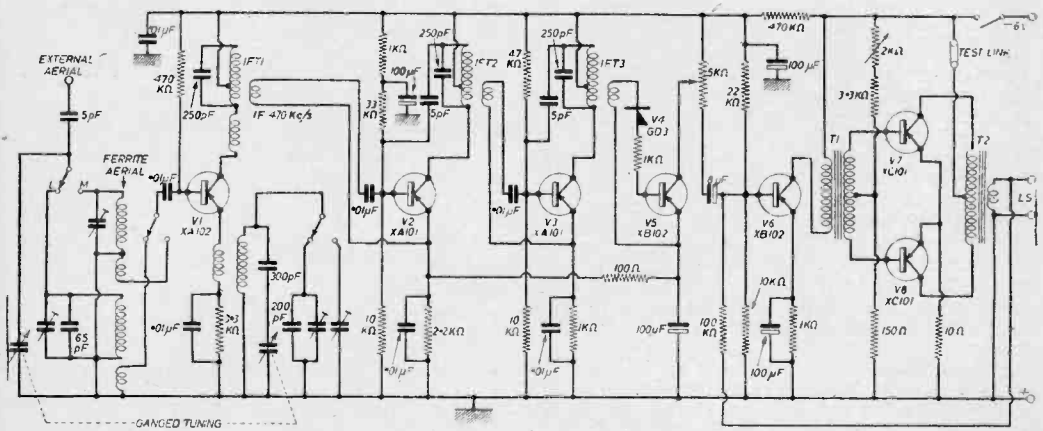


Fig. 1.—Circuit of the Ace transistor portable.

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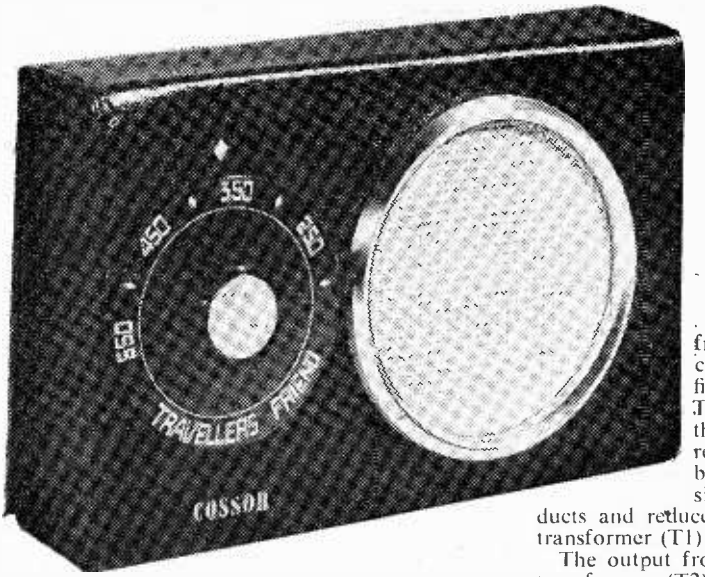


Cossor Model 561

DETAILS OF THIS INTERESTING POCKET PORTABLE RECEIVER

THIS little receiver is typical of the form which is being adopted for modern "pocket" sets. The term is perhaps not quite correct, as the set merely fits into a large coat pocket and is bulky, but compared with the smallest valve type of "pocket" set, the dimensions may definitely be called miniature. In the case of the set under review, the actual receiver is housed in a leather case with press-stud fastening and the necessary battery is included. One or two sets which have been marketed under the term "pocket sets" have consisted of two parts, the batteries being a separate packet.

From a general design point of view the receiver consists of a printed circuit chassis on to which are mounted the four transistors and I.F. transformers, and the circuit which is incorporated is shown on the next page. This page carries a view of the chassis without its case, from which it will be seen that the speaker forms quite a large part of the set, and this is mounted next to the tuning condenser so that when the dial is fitted a neat layout is obtained as shown in the picture at the beginning of these notes.

The loudspeaker need not be used, however, and a neat earplug is provided fitted to a plug and a jack on the receiver enables the listener to plug in the earpiece and this cuts out the loudspeaker as will be described later.

The Circuit

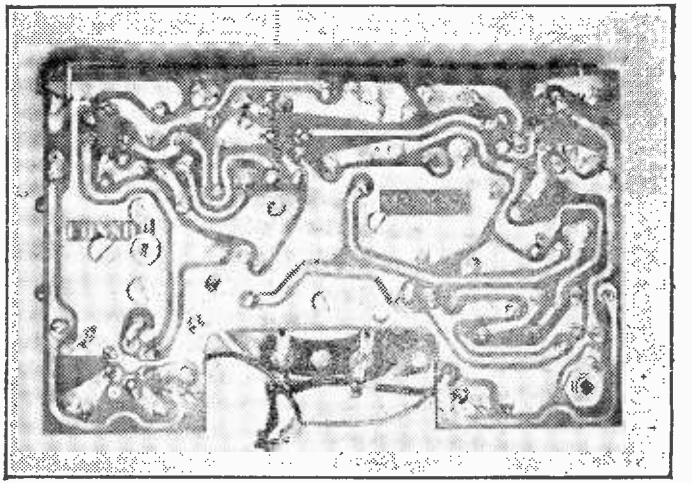
A ferrite rod aerial carries the Medium-wave aerial winding which is fed into a self-oscillating frequency changer (TR1), in the collector circuit of which is the first I.F. transformer feeding TR2. The diode W1, also connected to the collector, is a separate A.G.C. receiver, and is biased off by the battery voltage until a strong signal is received, when it conducts and reduces gain by shunting the first I.F. transformer (T1) and thereby reducing its Q.

The output from TR2 is fed to the second I.F. transformer (T2) and this is taken to the next transistor, TR3. The I.F. is 470 kc/s, and the output from TR3 is fed to the third transformer, and thence to diode W2 which acts as the detector. The A.F. signal developed across VR1 is fed back to TR3, VR1 acting as a smooth volume control. TR3 now acts as an A.F. amplifier, and the audio output is fed to the TR4 and thence to the loudspeaker.

In addition, the D.C. component developed from W2 is fed as A.G.C. voltage to TR2. Thus it will be seen that there are two A.G.C. systems in this neat little receiver

Loudspeaker or 'Phone

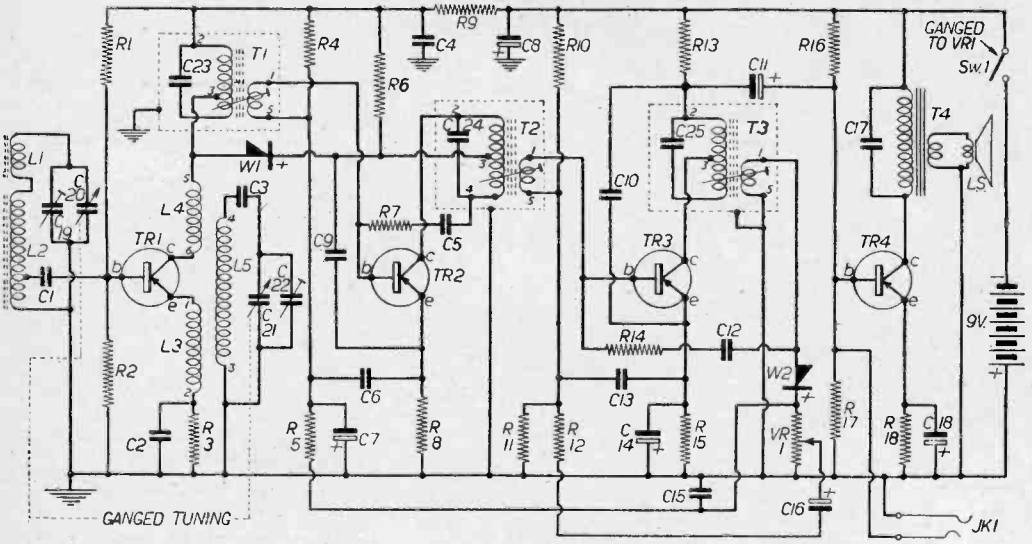
The base of TR4 is taken to one side of a jack, the other side of which is connected to the earth lines and thus as a suitable 'phone or ear-



The printed circuit "chassis" of the Cossor portable.

piece is plugged into the jack. TR4 is rendered inoperative, which not only silences the loudspeaker but also reduces battery current.

We have submitted this small receiver to test over a period of weeks and found that it fulfils the makers' claims and that its quality did not vary as the voltage dropped. It is an ideal personal receiver, but, of course, it cannot be expected to have the same high quality of reproduction as a larger receiver.



Circuit of the Cossor 561 receiver.

SERVICING ACE PORTABLE

(*Continued from page 376*)

the panel and the component connecting wires themselves. Small hooks can be formed on the wire ends so as to hold the components in position during the soldering process. A quick touch with a hot iron is all that is then necessary to obtain a good electrical connection.

After a printed circuit has several times been removed from a cabinet it often happens that a fracture occurs on one of the printed wires. This may well be revealed by the receiver cutting on or off as the printed panel is subjected to stress. Sometimes it is difficult to locate the position of the fracture by visual means, but finger pressure applied in turn to various sections of the panel soon brings the trouble to light. The connection is best repaired by soldering a small piece of 5-amp fuse wire across the fracture; a blob of solder serves the same purpose, of course, but has been found to be less reliable. It should be noted that a coating of varnish is invariably given to printed circuit, and this must be carefully removed from a faulty section before a good soldered joint can be made.

Generally speaking, transistor receivers are reasonably reliable, possibly more so than valve circuits in which considerably higher voltages and currents are present. When a fault occurs, however, consideration is immediately given to the condition of the transistors themselves. They are not easily tested in-situ, as are their valve counterparts. With the small voltages and currents present in the circuits, the limits given in design and the possible partly exhausted condition of the battery, meter readings made while the set is switched on, possibly with a meter of slight inaccuracy, may do more to bewilder the operator than assist him.

Apart from complete breakdown, it is best to remove suspect transistors from the circuit, or transistors from a suspect stage, and check the associated resistors and capacitors individually. Later, substitution tests may be performed, particularly of electrolytic capacitors, if found necessary. With the condition of the associated parts checked, the transistor should next be checked, preferably by substitution. If this is not possible, however, it can be wired into a test network with a milliammeter in the collector-base circuit in series with a 4.5-volt battery, with battery negative to collector (most important). With zero emitter current, the collector current in a junction transistor should be in the region of 20 microamps, or possibly less. This should rise to a milliamp or so by applying about 1 mA to the emitter-base circuit from a 1.5-volt battery by way of a 1.2k resistor. If this does not happen, bearing in mind that the emitter-base junction has to be biased in the forward direction (i.e., battery postive to emitter), the transistor is faulty.

When replacing or removing transistors heat from the soldering iron should be by-passed by gripping the connecting wires, between the transistor and iron, with a *cool* pair of long-nosed pliers. Failure to observe this simple rule is liable to ruin a good transistor, all of which are very heat sensitive.

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NOTE.- It is essential to use mains primary types with T.V. receivers having series-connected heaters.

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5Y3	8/6	6X4	7 6	ECH42	10 6	PCF82	11 6
5Z4	10/6	6X5	7 6	ECL82	12 6	PCL82	11 6
6AM6	8/6	12A6	7/6	EF39	7 6	PEN25	8 6
6B8	5/6	12AHS	10/6	EF41	10 6	PL82	10 6
6BE6	7/6	12AT7	9/6	EF50	5 6	PY80	10 6
6BH6	10/6	12AU7	9.6	EF50 Sylv.	8 6	PY81	10 6
6BW6	10/6	12AX7	9 3			PY82	10 6
6BW7	8/6	12BE6	10.6	EF80	10 6	SP61	5 6
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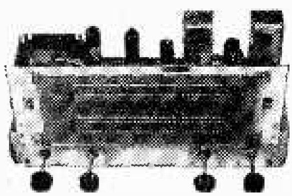
6F6	7/6	12Q7	8/6	EL84	10 6	UF41	10 6
6H6	3/6	35Z4	9/6	EY51	12/6	UL41	10 6
6J5	6/6	80	10/6	EZ40	10 6	UY41	10 6
6J6	7/6	954	1 6	EZ81	11 6	U22	10 6
6J7	8/6	EA50	1 6	E1148	1,6	X79	10,6
6K6	6 6	EABC80	10 6				
6K7	5/6						



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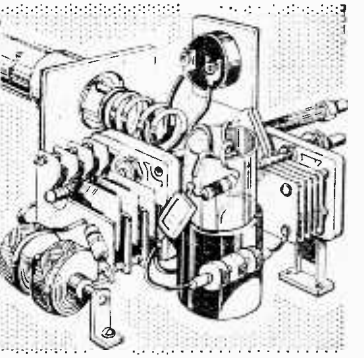
SHORT-WAVE SECTION



SUPERHETERODYNE CONVERTERS

By A. W. Mann

THERE is a marked difference between the usual type of so-called all-wave receiver and one which has been specially designed and built exclusively for short-wave reception. With the exception of some of the more expensive post-war models which include in their design an extensive frequency coverage and some form of band spread tuning and are built on communication receiver lines, the average four-band receiver is but a compromise. In several instances a very good compromise indeed.

The all-wave type receiver was, in fact, designed as a compromise instrument and in itself is by no means a straightforward designing job.

Incidentally several pre-war designs if modified on communication receiver lines would equal and in some instances surpass the performance of certain popular priced communication receivers of American design which were produced in pre-war years.

The modification of commercially-built chassis is not a job which can be undertaken in a slap-happy manner as many have found to their cost, especially in the case of ex-service equipment.

Provided that space is available much can be done to widen the scope and usefulness of standard all-wave type chassis by a knowledgeable amateur.

It may be, and in fact sometimes is, the case that having achieved some degree of success on the short-wave bands the operator feels the need of a more flexible receiver and one in which the various wave bands have a wider coverage on the tuning dial. This applies especially to the higher frequency bands.

It is also desired to cover a wider range of frequencies as for example every wave band from a little below ten metres up to the bottom of the medium-wave band.

The Non-technical Listener

So far as the non-technical listener is concerned the answer to the problem is to replace the existing receiver with a band spread multi-band receiver of modern design in which for preference electrical band spread facilities are incorporated.

This type of receiver will have the tuning dial calibrated in Mc/s and with the names of some of the most reliable short-wave broadcasters also with some indication as to the various amateur bands.

If a communications type receiver is favoured it is most likely that only the amateur bands will be calibrated. The "all-bands" type of listener, however, finds his requirements met in the most satisfactory way by a general purpose communications type receiver.

If the ranges below ten metres are not required a model L or N type R1155 together with a suitable power pack is worthy of consideration. All R1155 models, however, have their tuning dials calibrated in Megacycles and kilocycles.

The Technical Listener

The technically minded listener with a leaning towards home-construction can, however, solve the problem for a modest outlay and in the bargain retain and utilise his existing receiver provided that the valves are not getting towards the end of a useful life. If so the question of replacement should be considered.

Superhet Converters

While the usefulness of the superhet converter has never been in doubt the flexibility and overall efficiency of a soundly designed and constructed one even of the simpler type has not in the main been appreciated to the full.

The technically minded listener can by means of a suitable converter extend his receiving range and so cover frequency bands which previously were barred to him. He will also benefit from the increased sensitivity and selectivity made available by such a combination.

Converters now coming back into favour are being extensively used by the amateur transmitting fraternity for two metre work and as a means of extending the tuning range of existing receivers. However, some prefer to use a ten metre converter with certain pre-war communication receivers which were by no means as efficient on that band as was expected.

Some of the earlier commercial model superhet converters were by no means as efficient as they should have been. There were exceptions and among them a model produced by National. Results with home-constructed types were very good but much depended on their soundness of construction and correct operating procedure. Suitability of layout being, of course, an important factor.

Failure on the part of home constructors to obtain satisfactory results with superhet converters both of the simple and more advanced types is due in the many instances to layout or construc-

tional faults. Operating procedure can, however, be a little difficult when a separately tuned oscillator section is used. The application of correct voltages and a little practice will soon provide the necessary know-how.

One does not, however, require an elaborate instrument to achieve success as the following remarks will prove.

Super DX

In 1936 R. D. Everard won the *Wireless Magazine* DX listening contest by a considerable margin, and to substantiate his claim sent a large box of QSL cards and letter verifications which took some hours to sort and check.

Bob was an all-band listener and his phenomenal log of verified transmissions included 529 American amateur 'phones which embraced all districts several times over, a feat in itself, plus 48 Canadian amateur 'phones, several commercial 'phones and also amateur 'phones in Africa. Finally, commercial 'phones in Canada, and a mixed bag of all three types in several parts of Asia. Australia, Central America, South America and the West Indies, plus the SS Queen of Bermuda, and off Greenland the schooner Moresey.

From the foregoing it will be realised that Everard was an outstanding DXer who studied reception conditions and was fully aware when and where to listen, and that he spent a considerable time tuning for DX.

Few would care to attempt to emulate such a performance; some may, on reading this, have visions of the receiver he used and place it in the super communications class.

He did not use headphones but a loudspeaker exclusively, and far from being a communication receiver the receiving apparatus used was a simple autodyne battery-type converter incorporating an R.I. short-wave coil unit coupled on to an A.C. Murphy medium-long-wave receiver which at the time was several years old.

Receiving conditions during that period differed greatly from those of to-day. Broadcast transmitters were of low power. The standard of receiver efficiency was high, but the number of short-wave broadcast stations on the air was but a fraction of the total now listed and working daily schedules. Consequently interference while not unknown was less severe, and of more importance, the deliberate and systematic jamming now so prevalent, absent.

This practice, which is ruining to some extent the reception of world wide broadcasting, will not improve so long as short-wave listeners co-operate by sending reports concerning reception to the instigators of it. The general rule should be to ignore requests for reports and steer clear of any competitions used as bait.

In spite of the somewhat congested state of some sections of the various wave bands, from the foregoing details one is safe in assuming that with modern valves and circuit arrangements the short-wave converter of to-day is an ideal short-cut to improving the flexibility of existing A.C. and battery-type receivers at low cost. In a future article the subject of suitable circuits will be discussed in detail.

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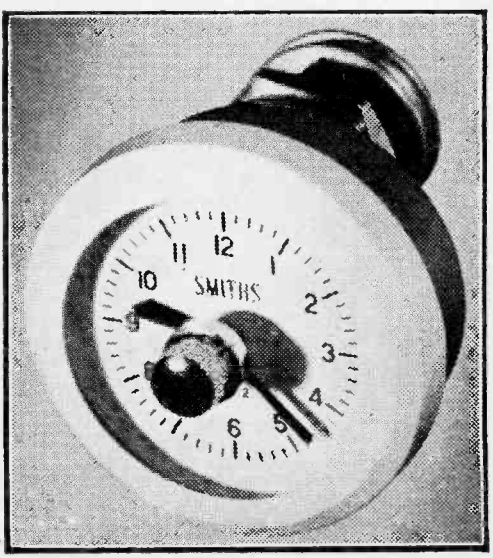
The complete indicator is encased in a light die-cast alloy body to which is attached the aluminium drive pulley. The unit is safeguarded against ingress of dust, etc., and weighing only sixty-two grams can be easily fitted to a tape deck. All standard lengths of tape can be accommodated by the Tape Position Indicator, and dial presentation, colour of hands and bezel are considered according to individual requirements. —Price on application to Smith's Industrial Instrument Division, Chronos Works, North Circular Road, N.W.2.



The Smith Tape Position Indicator showing drive and dial face, with reset knob.

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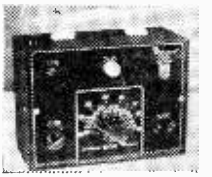

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TRANSISTORS in Practice

8.—AUDIO OUTPUT STAGES

By R. Hindle

(*Continued from page* 282, *June issue*)

OPTIMUM power is given by

$$P_L = \frac{Ic(E-0.5)}{2} = 20 \cdot \frac{4.5}{2} = 45 \text{ mW.}$$

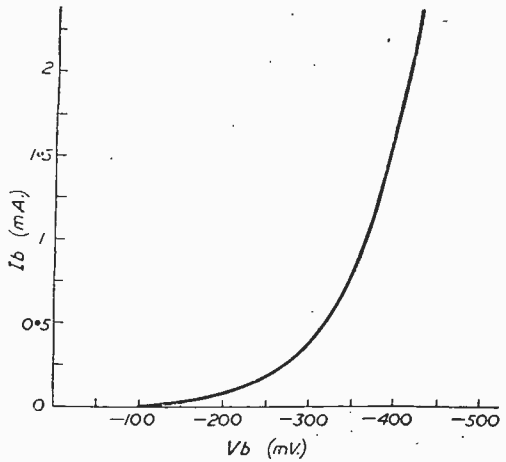

Fig. 43.—*Input characteristic.*

Optimum Load

The optimum load will be approximately

$$R_L = \frac{E^2}{2\,Pout} = \frac{36 \times 1{,}000}{2 \times 45} = 400\ \Omega.$$

Using a 3 ohm speaker, therefore, the output transformer ratio will be $\sqrt{\frac{400}{3}}:1 = 11.5:1$. R3 will be made 33 ohms to give a drop of $33 \times 20 = 660$ mV.

Looking now at Fig. 42 it will be seen that for a collector voltage of 5, and with 100 mW dissipation a base current of .25 mA is called for. Fig. 43 gives the input characteristic for the OC72 (actually for Ec=1 volt) and this is used as a guide to the base voltage which is seen to be 280 mV. for .25 mA. This is measured with regard to the emitter, which itself is 660 mV. above the base line. R2 has to drop 280+660 mV.=940 mV., therefore. A potentiometer current of 1 mA. will be reasonably economical and will swamp the base current, so R2 should be 940 ohms. R1 must drop the remaining 5.06 volts of the supply and it carries the potentiometer current as well as the base current of .25 mA., making 1.25 mA. in all. This indicates a resistance of 4,050 ohms. To use standard values R2 is scaled up to 1 KΩ and R2 should be about 4.2 KΩ, but this is not an easy value so the next higher standard value, 4.7 KΩ is actually used. This means a slight reduction in power output, but it allows for the resistors used being at the extreme of the tolerance range. This safety margin is desirable as the design was to take the transistor to the limit of permissible dissipation and it means that the constructor can safely set up his circuit without the use of a meter if such is not available.

Fig. 44 repeats the circuit of Fig. 41 and uses the same component designations but also reproduces the audio amplifier circuit previously developed to show the method of interconnection. The values calculated above are marked in the illustration. C1 is made 10μF but C2 will have to be much higher in value because of the low resistance that it has to bypass and, in fact, it is made 100μF. A suitable output transformer could be bought. For instance, Belclere NX1931 is a push-pull transformer with a ratio of 6+6:1 so overall it would be near enough for the purpose and it happens to be designed for push-pull power output from large transistors so that it is likely to be of use later, but for the present purpose it was considered an unjustifiable expense and instead the output transformer that will be needed for the push-pull circuit using OC72 transistors (the next step in this series of designs) is used. This transformer, also by Belclere, No. BN1827, is the one that will be used then and it has a ratio of 4.9 -4.9:1. The centre-tap connection is not used, so the effective ratio for this purpose is 9.8:1.

Construction

So very few components are involved in this output stage that the method of construction is of the simplest. The whole of the circuit, in fact, is built on a single tag strip which has six tags between two earthed tags. The transformer is so small that it is supported by its connecting leads to the tagstrip, but these leads should not be cut too short as the component will be needed again for the push-pull circuit next to be described, which will be suitable for permanent use giving the optimum efficiency.

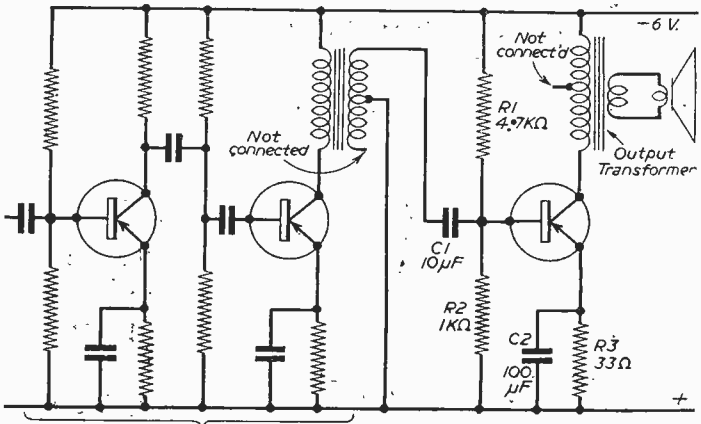

Fig. 44.—*Circuit of the complete amplifier.*

The tagboard can be screwed on to the main chassis and C1 goes directly to the transformer already mounted on the main chassis. Fig. 45 gives the wiring. The transistor is the last component to connect to the strip and then the heat shunt method previously described is used, the leads being connected and soldered whilst being held with pliers in contact with the metal so as to conduct heat away from the body of the transistor.

The constructor can set this chassis up independent of the main amplifier if he has a meter to monitor the collector current. Connect a 3 ohm speaker across the appropriate output leads and take the earth and minus 6 volt leads to a 6 volt battery as previously specified for the receiver, but insert the meter in one of the leads and set it to read currents

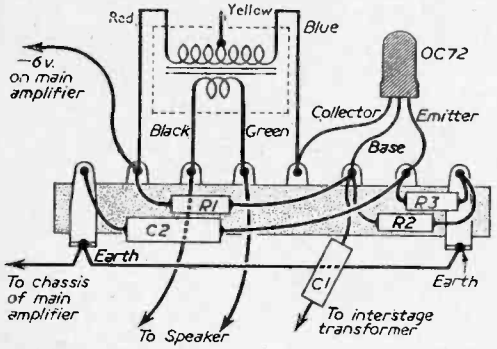

Fig. 45.—Wiring diagram of the audio stage.

up to something above 20 mA. The speaker should click when power is connected and the current reading should be approximately 20 mA. In the prototype the reading was actually 18 mA. which shows a slight margin of safety.

The constructor need not worry if he has no suitable meter so long as he has carefully checked his wiring and the size of his components. In particular he must see that the battery is connected the right way round. He will hear the click when connecting power as an indication that all is well. If a source of audio signal is to hand it can be fed to the input, though of course the gain will be comparatively low.

Now the output chassis can be connected to the main receiver chassis taking the input, C1, to the appropriate input socket, i.e., the one that is not connected to earth in Fig. 17. It will be found to give quite an appreciable increase in power output. In fact one of the most surprising things about the work with transistors is that it is seen how little power is needed in practice to give tolerable speaker strength.

Constructing Transistor Sets

The constructor will appreciate that transistor circuitry lends itself to a different and simplified method of construction compared with past convention. The metal chassis type of make-up almost universally used in the past by manufacturer and home constructors alike can be expected to be superseded, and indeed manufacturers have turned their attention in the past few years to printed circuit construction, a method now finding its way into the home constructor market. Of course, the best method for mass construction in the factory is not necessarily the best for the "one off" needs of the constructor, and perhaps it would be regrettable if the freedom of the constructor to use his own judgment with regard to some aspects of design were to be cramped because he had to accept a standard printed circuit, which by its very nature has to be standardised to a high degree and produced in quantity to make it reasonable in price. Printed circuits will undoubtedly have a place in the home constructor scheme of things in the future but they are not an unmixed blessing and many of the benefits without its disadvantages so far as the home constructor is concerned can be derived from tagboards. A technique can be evolved using such tagboards that is very closely akin to printed circuitry whilst permitting quite a degree of flexibility. This was found to be the case for the Class A single-ended output stage previously described, but the method used there is a little too simple to be practicable for some more complex circuits. Before proceeding to the next stage in design, therefore, which will be the Class B push-pull output circuit, some thought is given to constructional methods.

The two-stage transistor amplifier previously described had the circuit here repeated at Fig. 46 and this is a convenient unit to consider for the revised method of construction because almost any practicable transistor receiver must include such a circuit. As an alternative to the tagstrip used for the Class A unit the easily available tagboards with soldering tags down each side of the board were considered and, in fact, these boards are very useful when developing special circuits. They are not very elegant, however, for units that are to be made up and used more or less permanently and consequently

(Continued on page 391)

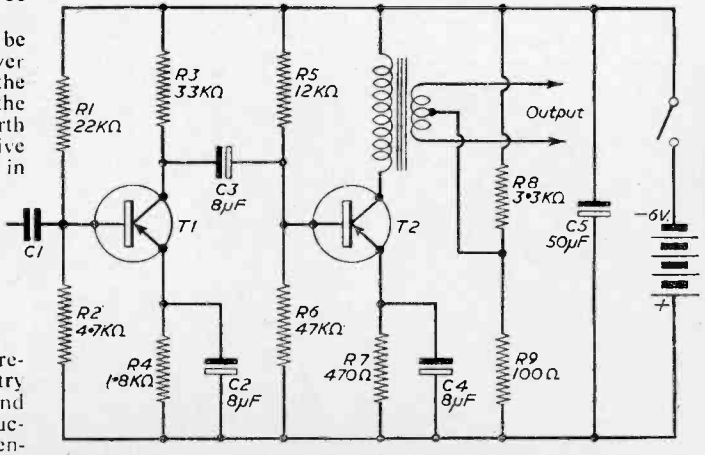

Fig. 46.—A two-stage audio amplifier with output base potentiometer.

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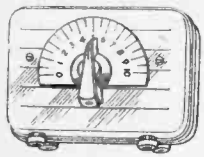

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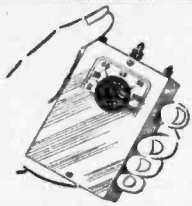

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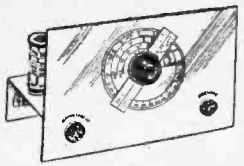

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6BE6	7/-	19AQ5	7/6	ECC85	9/6	MH4	6/-	UF89	9/-
6BH6	9/-	25A6G	13/6	ECF80	10/6	MU14	9/-	UL41	8/9
6BJ6	7/-	25L6GT	8/6	ECF82	11/-	N18	7/6	UL44	22/6
6BR7	8/6	25Z4G	9/6	ECH21	16/9	PCC84	9/-	UL84	8/6
6BW6	7/6	25Z6GT	9/-	ECH35	10/-	PCF80	10/-	UR1C	12/6
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READERS RADIO

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special tagboards have been developed for the purpose, so designed that the components fall into logical positions according to the circuit diagram. This is real miniaturisation and spacing has been allowed for very small components to take full advantage of the features of transistor equipment; these include the latest subminiature electrolytics that are filtering through now on to the home constructors' market. The complete board is only $1\frac{7}{8} \times 3\frac{1}{4}$in. Specimens were made up by Osmor who, no doubt, would make them available to constructors if there were a demand for them. Fig. 47 indicates the layout of the board and the positioning of the components. It will be noticed that in this method of construction the small components can be mounted on either side of the board so that where components should cross—say one is laterally across the board and one is lengthways, they can be put on opposite sides of the board where they can lie flat along the surface, making for a very slim unit. The transformer that feeds the output circuit using push-pull transistors which are mounted on a separate board, is held in place simply by its connecting wires passing through the two mounting holes in the board. When driving the Class B output stage the secondary centre-tap of this transformer goes to the output transistor base bias potentiometer. This potentiometer is included in Fig. 46, being R8 and R9, and is the only difference between the circuit as given in that illustration and the circuit originally given in Fig. 15 (Dec. 1957 issue).

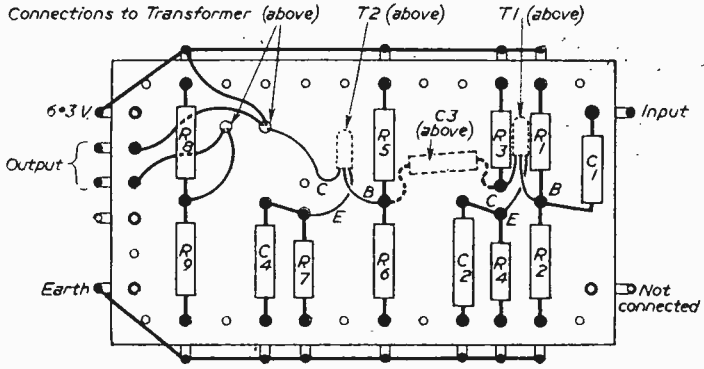


Fig. 47.—Tagboard layout of the audio amplifier.

The method of construction, using these boards, is to mount the resistors and capacitors first, bending the end wires at right-angles to the component so that they are just as far apart as the two tag positions that the component has to bridge. The wires are then passed through the holes where the appropriate tags are riveted to the board, until the component fits snugly against the board, the end wires then being wrapped round the tags, surplus wire cut off and solder run in. Fig. 48 illustrates this. The miniature transformer is then mounted, passing the connecting wires through the two holes in the board and drawing them reasonably tight (not too tightly or they may be pulled away from the transformer) and the leads shortened as necessary so that they will hold the transformer in place before soldering them to the appropriate tags. The transformer actually sits on top of the board, i.e., on the reverse side from the small components. Then the busbars are soldered down the side of each row of tags at the edges of the boards and to the tags at the ends as indicated in the wiring diagram. Finally the transistors themselves are mounted by soldering to the appropriate tags. The technique of using a heat shunt previously described in this series is used, i.e., the leads of the transistor are held in the metal jaws of a pair of pliers placed between the body of the transistor and the tag whilst the soldering iron is applied and are continued to be so held for a short time after removal of the iron until the joint has cooled down. In the first instance, whilst testing, it will be as well perhaps to leave the full length of the transistor connecting wire and just solder these on temporarily. When satisfied that the panel is working correctly these wires may be shortened, leaving about $\frac{1}{2}$in. The transistor will now lie flat on the board and the leads can be soldered into permanent position with careful use of the heat shunt technique. The tagboard can now be fixed at right-angles to a flat baseboard which will serve the purpose of interconnecting the various boards of this type that will make up the complete equipment being constructed.

Fig. 48.—A method of fixing components.

Class B Push-pull Output Stage

It will be seen now why the diversion has taken place to describe the tagboard form of construction. The Class B circuit is to work with the audio amplifier and will have application much more widely than the little receiver that is the subject of this series. Consequently similar methods of construction will be adopted. The audio stage is the more complicated, however, and consequently determines the sizes of boards to be used. A second board could be designed for the output stage, but conveniently it would be made the same size as the audio amplifier board so instead an identical board has been used.

When designing the Class A amplifier the point was made that the optimum theoretical efficiency for that type of circuit was 50 per cent. The theoretical maximum for Class B working (and this refers to valves as well as transistors) is 78.5 per cent. This means that, in practice, a Class B transistor amplifier can convert something like three quarters of the power drawn from the battery by that stage into audio power to deliver to the speaker.

(To be continued)

TRANSMITTING TOPICS

MORE ON THE SIMPLEST TRANSMITTER

By O. J. Russell, B.Sc.(Hons.), G3BHJ

OVER many years, a number of errors and blind alleys are encountered which repeat with each generation of new amateurs. A previous article included a hypothetical example of some of these, and while it is unlikely that one beginner would encounter them all as in our composite example, one or other of these stumbling blocks is likely to be encountered by almost any new amateur. In fact the amateur becomes fully fledged when he has met, struggled with and overcome a number of such faults. The best plan is to adopt some systematic "training course" of experimentation that will illuminate the tricky points.

Consider the straightforward crystal oscillator, a great deal may be learned by using an artificial aerial of some kind, without ever inflicting needless Q.R.M. on the air. Even if an amateur band crystal is not to hand, an odd surplus crystal may be used in trying out the circuit provided a non-radiating artificial aerial load is used. A receiver in the shack will in any case enable the note to be monitored from the small leakage of R.F. direct from the oscillator. The average crystal oscillator for, say, 7 Mc/s, will usually operate with crystals of between, say, 6 Mc/s to 8 Mc/s, so that even the lack of an amateur band crystal need not prevent initial "pre-air" trials from being carried on.

THE SIMPLEST TRANSMITTER WAS DESCRIBED IN OUR ISSUE DATED APRIL, 1958

Artificial Aerial

The type of artificial "aerial" that may be used can vary from a simple resistance up to a very complex device. The simplest "indicating" artificial load is the old standby, a light bulb. Fig. 1 illustrates a simple oscillator with a lamp coupled inductively to it. Naturally the bulb chosen depends on the R.F. output of the oscillator. Thus "flea-power" oscillators (and V.H.F. triplers and similar low-level stages) may be coupled to the 0.04 amp bulbs used in certain cycle lighting equipments. A flash-lamp bulb of 4.5 volts and 0.2 amps would be used where about a watt of R.F. was expected, and pilot bulbs of the 6.3 volt 0.3 amp class where a couple of watts is expected. In the higher ranges of power outputs, motor cycle and car bulbs may be used, until, of course, one comes to the use of the domestic lighting bulbs for the larger transmitters. An important point to consider is the effective load resistance of the bulb. Thus the low current 0.04 amp bulb at 4.5 volts is effectively 110 ohms when hot. Note the "when hot," as the cold resistance of a bulb is around one-tenth of its hot resistance. A light bulb as a power load therefore is not a constant impedance under varying loading conditions, and is not recommended for setting up loading conditions for an output circuit feeding a matched line unless this is borne in mind.

However, the simple "lamp load" has one advantage, as it gives an immediate indication by alteration in intensity of illumination of the amount of R.F. transferred. A very useful exercise is to vary the number of turns on the pick-up loop and find by experiment how this reacts upon the power transfer, closeness of coupling required and plate current of the crystal oscillator. To do this the coupling coil should be made so that it can slip snuggly over the

(Continued on page 395)

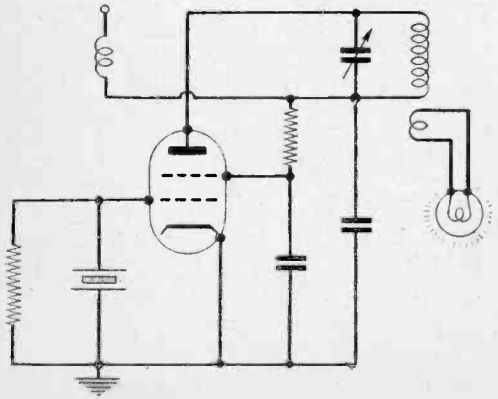


Fig. 1.—An inductively coupled lamp load is one of the simplest output indicators.

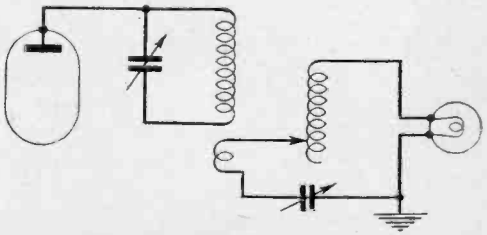


Fig. 2.—A series tuned artificial aerial circuit using a lamp bulb as a combined load and power output indicator.

"cold," that is the "earthy," end of the tuned plate coil of the crystal oscillator. Be sure that the bulb chosen is capable of dissipating the R.F. output that the oscillator will give. There is no need to try to select a special bulb, however, as two, three or even more flash-lamp bulbs in series or parallel will handle up to about four watts, say the output from a crystal oscillator consuming some six or seven watts. Alernatively, two or three 6.3 volt pilot bulbs will load up without burning out on oscillators of up to some nine or ten watts. Small car bulbs may be used from about 5 watts upwards.

If a number of bulbs are used the experiment of running them both in series and parallel may be tried. This will indicate how the coil size and coupling are affected with variation of load impedance. Thus a single 4.5 volt 0.2 amp bulb has a hot resistance of nominally 22.5 ohms. Thus

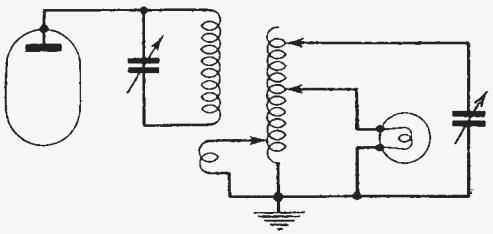


Fig. 3.—A parallel tuned artificial aerial using a lamp bulb as load and indicating device.

three in series will be 67.5 ohms, while three in parallel will be 7.5 ohms. It is necessary, of course, to use a lamp load capable of dissipating the full available R.F. output of the oscillator, as only in this way will the oscillator be fully loaded. Merely waving a low-power lamp and one turn loop near the anode coil will, of course, indicate the presence of R.F., but not of loading and coupling effects in the range of greatest interest.

Loading

The operator will soon discover that the crystal oscillator is sensitive to loading even more than a conventional P.A. Thus overloading will actually stop the oscillator oscillating, while slight retuning will also be needed from the unloaded state to give the best output at the fully loaded condition. Also monitoring of the note when keying the oscillator will reveal that attempts to extract the last ounce of R.F. from a crystal oscillator may introduce chirp. Also, while a crystal oscillator when running may be loaded up, when the oscillator is keyed it may be very sluggish in picking up if too heavily loaded. With loading at a critical value it may indeed hover on the verge of oscillation before slowly sliding into oscillation. The cure is to slacken off the loading so that the oscillator will key cleanly and certainly.

With crystals of low activity one will not be able to load to anything like the extent that one can with an "active" crystal. Running at excessive power levels may also cause instability due to crystal heating and even cause crystal fracture. A low-consumption bulb in series with the crystal is often used to give an indication of crystal current. This is purely an indicating rather than a protective device, as should one really exceed the fracturing current of the crystal, it will be damaged before the lamp filament burns out . . . unless it is a very low current bulb. The "death mark" of a whiteish patch on the surface of a crystal overloaded to failure is characteristic. With a series bulb one can of course tune the oscillator for an indication which by experience is known not to grossly overheat the crystal. In the same way, excessive power inputs to crystal oscillators should be avoided.

Coupled Circuits

Having experimented with a simple lamp load, more advanced coupling circuits may be used. These simulate the operation of aerial tuning units of the usual types. Thus in Fig. 2 we have a series tuned circuit link coupled to a crystal oscillator, and in Fig. 3 a parallel tuned circuit. These are shown used with a lamp as loading. Here again there is a very wide scope for experiment with coil sizes, taps for loading, and link coil coupling to the transmitter and also to the parallel tuned coil of Fig. 3.

To give an example, the circuit of Fig. 2 will be found to give a wide range of conditions giving good transfer of energy. What will be noticed, is that the tuning of the load circuit to resonance may actually require much less coupling of the link coil to the crystal oscillator anode circuit to give good loading. Ideally one should exploit this by using as few turns as possible on the link coil, and coupling it tightly to the oscillator anode, rather than using a larger coil loosely coupled. Some indeed may prefer to operate with loose coupling. The auxiliary aerial circuit should preferably be earthed, say to the chassis earth line of the oscillator, but this will not affect energy transfer. With a real

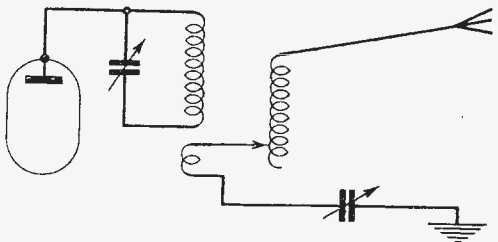


Fig. 4.—The series tuned Marconi aerial corresponds to the artificial aerial equivalent shown in Fig. 2.

aerial a series tuned circuit may float unearthed with a centre-fed type of aerial and feeder . . . or indeed be earthed as with a Marconi system (Fig. 4). A Marconi aerial in fact needs a really good outside earth of low resistance.

With the parallel tuned circuit, one end of the tuner may be earthed as shown, which is the equivalent of single end feeding of a single wire "end on" aerial (Fig. 5). However, the centre of the parallel tuned coupler may be earthed to the oscillator chassis (Fig. 6), which

is the equivalent of a symmetrically fed aerial or twin wire feeder system as in Fig. 7. It should be noted that the parallel tuned circuit offers a considerable flexibility of adjustment. It has two link coils for a start, and furthermore taps for the bulb load. In addition with both the parallel and series circuits, the L/C ratio of the tuned circuit may be adjusted by using more or less of the tuning coil and readjusting the tuning condenser to restore resonance. After experimenting with all these variables, the beginner will obtain a facility with tuning sytems that will make loading up an actual aerial child's play.

With the parallel circuit, the simplest method of proceeding is to use a fixed link at the aerial tuning unit for a start. With the bulb load

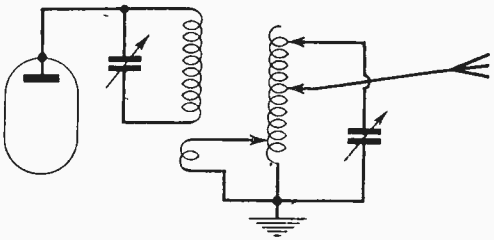


Fig. 5.—The end fed parallel tuned aerial system is the real life equivalent of the artificial aerial of Fig. 3.

tapped across a turn or two of the tuning coil, the link coil coupled to the transmitter anode circuit may be adjusted for optimum transfer. If necessary several link coils may be tried. When transfer or coupling is high, it will be found that tuning the aerial condenser will react sharply upon the plate current measured in the crystal oscillator. If the lamp load is only tapped across a very little of the tuning coil, resonance on the aerial tuning circuit may be needle sharp.

It will be found possible with heavy loading to "flatten" the tuning of the "artificial aerial"

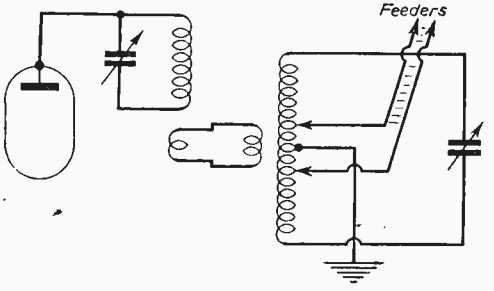


Fig. 7.—Radiating aerials with twin wire feeders are fed in this manner from a parallel tuned circuit.

tuning ciruit. In the same way when a real aerial is loaded into the aerial tuning network, a range of loading conditions ranging from light loading and sharp tuning to heavy loading and flat tuning will occur. Depending upon the nature of the load particularly its impedance, efficient transfer may be achieved according to circumstances with moderately sharp tuning, or may require very "flat" tuning. A whole range of L/C ratios may be run through once a lamp load has been initially resonated, by adjusting the number of turns in the tuning coil and retuning with the variable tuning condenser.

Radiating Aerial

Such experiments with a simple lamp load have prepared the way for loading a radiating aerial system. Generally it will be found well worth while to experiment with various numbers of coil turns and aerial or feeder tapping points to determine how the aerial feeder current can be raised to a maximum. However, this operation cannot be carried too far with a simple

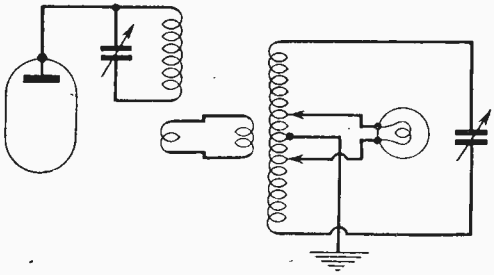


Fig. 6.—The artificial aerial parallel tuned circuit arranged to simulate a parallel tuned twin wire feeder system.

crystal oscillator type rig, as if the oscillator is loaded too heavily, it will either stop oscillating or prove slugish or even chirpy in keying. Moreover, an actual radiating aerial may provide several points of difference from a simple lamp load. Thus a high-impedance voltage position end fed wire may prove sensitive to changes in its impedance due to the wind swaying it near the building. This may react quite appreciably on the loading, so that in a high wind the aerial current and transmitter anode feed may vary in sympathy with the swinging aerial. Some variation of this type particularly with end fed aerials is often noticed by many amateur transmitters. In fact the writer encounters a wind effect of this nature on more than one aerial, even ones fed by twin feeders, and in a high wind the TX plate current meter and aerial current meters swing appreciably due to the slight change in loading.

In addition depending on local circumstance it may be found that due to errors in length or other causes, a radiating aerial may be difficult to load up satisfactorily. In some cases the loading is roughly the same whether series or parallel feed is used. In fact in some cases the aerial tuner coil losses may account for much of the radiated power. One cure is to shorten or lengthen the aerial or feeder system so as to avoid such awkward "in between" cases. With multiband aerial systems, resonance on some bands may be "in between" cases due to compromise lengths of feeder being specified. The cure is to add an eighth wave length of feeder to the existing feeder length on the waveband.

Programme Pointers

Our Critic, Maurice Reeve, Reviews Some Recent Programmes

A REMARKABLE feature of the radio entertainment world is the rise of the "presenter," or "introducer," of an item to a status often comparable with that of the artist himself, and sometimes even in excess of it. "So and so introduces such and such" a feature, or "Thursday's Child," introduced by George Spratt. It is indeed extraordinary. Both rank equals.

By no stretch of the imagination can such a gentleman be ranked in importance to the artist or group of artists giving the show, be they ever so humble. Usually entertainers, but very often public events, they appear as the result of a life's work and great fame in their particular line. Or, with events, they are front-page news, as with sporting contests. But it is the "introducer" who gets sometimes an equal share of the limelight with the "turn" he is introducing—there is no need for me to mention by name any of the several whose glamorous portraits have formed the cover of the "Radio Times," itself a recognition of this of the first magnitude.

Radio Personalities

It seems all wrong. All honour, one might say, to anyone these days who can "do well" for himself and bring the brass home. But when it comes to listening in to "My Man Friday" because Bill Sowerbutts is introducing it, then we have to readjust ourselves to an entirely new—and I venture to suggest wrong—standard of values. Bill Sowerbutts—a sobriquet that thinly disguises the lady or gentleman to whom I am referring—may be, and often is, a charming person, photogenic and a thoroughly live wire. But all they possess otherwise is an excessive gift of the gab and the ability to talk on and on about nothing in particular. Surely something slightly more than these charms is needed before one should be allowed to graduate as a "radio personality"—not that many of them are exactly senior wranglers of the entertainment world.

Music

One of the most magnificent symphony concerts in years was that on the Third given—or as the Americans so much more objectively and accurately style it, "played"—by the Philharmonic Orchestra—leader Hugh Bean—under Klemperer. Clara Haskil played Mozart's symphony in B Minor with the utmost perfection, and the orchestra Sibelius No. 4 and Strauss's Don Juan and Till Eulenspiegel. It was an evening of music *in excelsis*, perfect in creation and interpretation.

"The Man From Lucca" was a radio portrait of Puccini. Puccini's music is not only known in every opera house of the world, but in every restaurant where music helps the entrée down as well. Cinemas, music halls, concerts; all are as familiar with "One Fine Day" and "Your Tiny Hand is Frozen" as with any tunes one could name. But does anyone know of "The Man from Lucca"? Where is Lucca? What are Lucca? as the girl said when asked whether she liked Brahms. Surely the title of a programme should give some sort of clue to its character and content; this one could have only to a handful of the intelligentzia.

It was a very good programme, for the most part sung and played with gusto and skill. Artists: Fred Fairclough, Paul Whitsun-Jones, Leslie Moorhouse, David Maklowe, Joan Hammond and Charles Craig. BBC Northern Orchestra, conductor Stanford Robinson. Narrator, Noel Johnson. Written by Colin Shaw.

It was a treat to hear the repeat from February, 1954, of Sir John Gielgud's "Ivanoe," by Chekov, again with Irene Worth, Paul Rogers and Rosemary Harris. The BBC need only cater for twenty-six weeks' broadcasting every year if it was all of this quality.

Records

"Down Your Way"—with Franklin Englemann—is, I imagine, just another excuse for hearing bits of light classical favourites and an odd verse of a popular song, etc. As we get so much of this every week and several times every day, one has to wonder whether "your piece of music is really necessary." But whether it is or is not, one cannot deny that Mr. Englemann makes a charming host, or companion, down your way. He has all it takes both to make himself welcome there and with us at home.

Disraeli—I beg pardon, the Earl of Beaconsfield, K.G.—attained considerable eminence as a novelist long before he bought up the Suez Canal shares or thought it might be good fun being Prime Minister and highly regarded by Queen Victoria.* Largely autobiographical, it contains brilliant portraiture of the manners, society and, above all, the politics of the day. The serial went with brilliant speed every Sunday evening, and was the first, to my knowledge, freed from the trammels both of narrator and incidental music. What a relief it was!; what a dreadful encumbrance they have been in previous ones! Allan McClelland was a first-rate Conningsby.

* "Conningsby" was his finest novel.

Open to Discussion

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

A Switched F.M. Tuner

SIR,—It has been pointed out that unfortunately a mistake appeared in the circuit valves given for the above tuner. C6 was given as 10,000 pF instead of 1,000 pF. This was my mistake and appeared on the original circuit I supplied.

I apologise for any inconvenience caused.—P. MICHAEL (Croydon).

Male-female Separation

SIR,—I have been wondering if the separation of male voice from a female voice is possible on the radio or not; maybe readers will understand by a little experiment which follows:

I had a set with two loudspeakers on the sides of the cabinet which I did not like because sound did not seem to be coming to you while you sat in front of the set, so I put them facing each other in opposite corners of the room, at the same time I put a type of change-over-switch made by myself out of a spare bell push which, when pushed connected one speaker and when released connected the other, that way I could hear female voice from one corner and a male voice from the other.

Is it not possible, that loudspeakers may be designed which will only take female or male voices individually. Definitely there must be some difference in the output of male and female voices. Maybe some reader would like to throw some light on the subject.—M. OMAR (S.W.5).

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.

Echoes on Tape

SIR,—With reference to the letter on the above I have found a solution for this. In the attic of my father's house I constructed a tunnel 1ft. square. This tunnel is 30ft. long with a T-piece on the end. The arms are each 6ft. long. In the end of one of the arms there is a 10in. speaker and an earphone. In the other arm I have fixed a tweeter unit and a 6in. speaker. Where the two arms join the long one I have placed in the centre a reflector which is removable. The reflector consists of two glass plates set at 45 deg. The microphone is positioned at the end of the long arm. The sides of the tunnel are made of hardboard.

My echo tunnel has been working for two years quite satisfactorily. I do not know whether it works at shorter lengths than 25ft.—J. D. F. HEWSON (Chalfont St. Giles).

Record Speeds

SIR,—Reading Mr. Watts' letter in the May issue, brings to mind a unit in a radiogram which I serviced recently. The radiogram was for use on 200-250 v., 50 c.p.s. or D.C. When used on D.C. mains, the B.S.R. 3-speed unit was fed from a unit in the bottom of the cabinet: this had two 50CD6G valves in a cathode-coupled multivibrator, and the two anode leads were the two halves of a push-pull transformer winding. The output voltage was taken from the secondary winding of the transformer.

A potentiometer was fitted on the chassis which varied the frequency of the oscillator and hence the motor speed.

Hoping Mr. Watts can make use of the information and develop a suitable unit for his equipment.—J. S. BURTON (Beeston).

Wrong Record Speeds

SIR,—With reference to the letter of G. F. Watts of Edgware who discussed wrong record speeds in a letter of the May issue of PRACTICAL WIRELESS, may I add a few comments?

The behaviour of the ear is complex because it is a non-linear device and this leads to many interesting results in the field of subjective acoustics. It is possible that Mr. Watts has a record player which simply does not play back records at the speed at which they were recorded, but another factor which Mr. Watts may have neglected is that pitch is not solely dependent on the frequency of the note.

Pitch depends on the frequency, loudness and overtone structure of the sound. The frequency would be altered by an incorrect turntable speed, the overtone structure is fixed by recording, but the third factor, the loudness, is a variable and may, of course, be altered by the volume control of the player.

If the intensity of the sound output for the player is not equal to that at the microphone in the recording studio then the pitch of the reproduced sound will not be as recorded. Assuming that the record speed is correct Mr. Watts may be able to obtain more realistic reproduction by setting the volume control to give this correct level of output. The volume setting will of course be constant throughout the duration of the record and will vary from record to record

(*Continued on page* 403)

(depending on the taste and skill of the recording engineer).

The fact that Mr. Watts has attempted both to speed up and slow down his turntable indicates that this is probably the trouble as the sound recording studios would rigidly control the speed of their recording and that if Mr. Watts' turntable speed were incorrect it would almost certainly be always too low or too high.

I hope the suggestions may help Mr. Watts and other Hi-Fi enthusiasts to obtain greater enjoyment from their equipment.—ROLAND DEWSLEY (Keele).

Stereo Reproduction

SIR,—Mr. Williams, in his letter on stereophonic reproduction (May issue), seems to have overlooked one or two points. A completed stereo system, although as he says necessitates twin amplifiers and speakers, need be no more cumbersome than a modern Hi-Fi system; it could in fact be built into existing bookshelves with care.

The spacing of the speaker is a matter of trial and error. During the recent BBC stereo test I found the best distance was 6½ft., but it could probably vary with room size, and the distance the listener sits from the speakers.

He also has the wrong impression regarding speech and single instruments, if the amplifiers are working at the same sound level, the sound (of a single violin or piano for example) would appear to come from a position midway between the two speakers, a single speaker in the same position could not possibly give such an impression of depth and reality.—W. H. REVENING (Billericay).

SIR,—I was interested in the letter in your May issue on this most important subject. I agree entirely with Mr. Williams, and I feel that this is only a manufacturer's stunt. After all, how can you make sound "stand out"? With pictures it is quite different and the optical arrangement arising from two separate images (in many cases with greatly increased separation between the two pictures) and our two eyes, which are masked from each other when looking through the viewer, cannot be compared with any possible type of sound recording which is played back into the air at a distance from the listener. Using headphones is a completely different matter, and it might be possible to obtain stereo effects in this way and then you are getting to the same idea as stereo vision. But it will be found that two loudspeakers playing in the same room, no matter how far apart they are, cannot give true stereophonic sound as both ears hear the two reproductions, and the result must be a mixture of the two. It would be interesting to hear what other readers feel about this, and I might mention that I have been to a demonstration of stereo reproduction on tape and find my ideas set out above are confirmed, and I get just the same result (at least to my ears) with a speaker in each room to provide delay in the two reproductions. In fact I am inclined to think that in my own home this gives better results, due to the slight echo effect on the distant speaker, which has a separate control so that the output may be adjusted to bring the sound from it to the listening point in the other room with just that extra volume to make it ride slightly above the speaker near to me.—H. G. W. (N.W.).

Tag Boards

SIR,—In your March issue Mr. Youall asks about tag boards. I always use these, but not in the manner recommended by the makers. I use them in pairs, mounting the components between the two. In many sets this offers advantages over the type of tag strip which consists of two brackets with tag strips mounted across them. They are too narrow for one thing, and mount vertically for another. By using ordinary single tag strips and mounting these apart you can adopt any desired spacing, and in some cases can mount them on a paxolin board so that it becomes a complete "plug-in" unit. A single fixing screw will hold the assembly to the chassis and thus it can easily be mounted or removed.—H. OLIVER (Penge).

Correspondents Wanted

SIR,—I am 12 years old and have been interested in radio for about four years now. I read your magazine with growing interest and think it excellent. I would like to correspond with someone of about my own age and of the same interests. I am very interested in ham wireless and correspond with one.

I possess an eight waveband superhet, covering 13 m. to 50 m. short wave. It also covers the medium and long waves. I listen mostly to the 40 m. band and keep a log of the things or should I say Q.S.O.S. I hear.—IAN HUNTON (15, Stephenson Street, Failsworth, Manchester).

SIR,—I am 15 years of age and interested in amateur radio (receiving only) and wish to correspond with any amateurs of the same age.—B. STEVENSON (75, Millend Road, Cherry Hinton, Cambridge).

SIR,—I am 27 years of age and would like to correspond with an enthusiast who is interested in radio and television servicing as a whole.—YOUAB G. TAMRAS (House No. K.2, Civil Cantonment, Habbaniya, Iraq).

TAPE ECONOMISER—CORRECTION

The words "input" and "output" were inadvertently transposed in Fig. 2 of the above article in our June issue. If they are interchanged this diagram will then correspond with the circuit diagram Fig. 1.

News from the Trade

VENNER SILVER-ZINC ACCUMULATORS

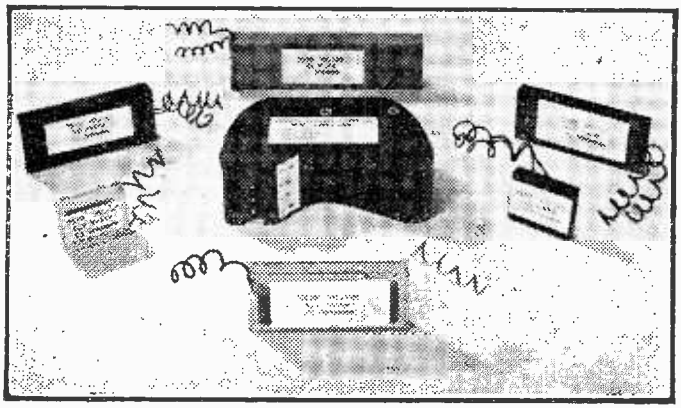
THE Type HT125 cell has been produced to meet the need for a small, light, rechargeable battery of any desired voltage capable of providing power requirements in a wide range of applications. The design is based upon the production of strips of from one to ten cells which can be arranged in any desired form before potting in resin. The user can therefore be offered a battery which is hermetically sealed and that will fit into the odd space which so often is all that is available for the power supply.

The Venner HT125 cell has a nominal capacity of 0.125 ampere hours, being suitable for discharge over a range of currents from 10 to 500 milliamps. This discharge range meets the requirements of many transistor applications and also current requirements too high for small dry cells.

Charging can be carried out either by constant current or constant potential systems, and it is recommended that high voltage units should be charged on constant potential. No topping up or maintenance is required.

A single cell weighs ½oz. and measures 1⅛in. × 1¼in. × 9/32in. The size and weight ratio improves as the number of cells in a battery increases since the thickness of potting resin remains sensibly constant. As an example a ten-cell, 15 volt nominal unit weighs 2½oz. and measures 4⅜in. × 1¼in. × 7/16in., a ratio of weight and size reduction of approximately 30 per cent.

Cells or batteries normally have flying leads for take off connections but, if circumstances justify, threaded terminals or solder pins or tags can be fitted. Special fixing arrangements embodying inserted tubes or bushes can be included. The Venner HT125 cell is the first of a range of similar cells which will be introduced to meet the rather specialised requirements which are now developing in the electronics field. —Venner Accumulators Ltd., Kingston By-pass, New Malden, Surrey.



A group of Venner silver-zinc accumulators.

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"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 412. OSMOR RADIO PRODUCTS LTD., Sth. Croydon, Surrey.

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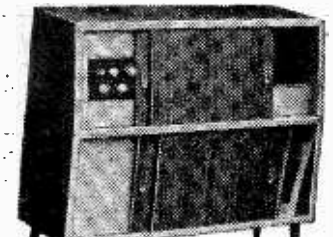

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