FEBRUARY
1962

Practical WIRELESS

2/-

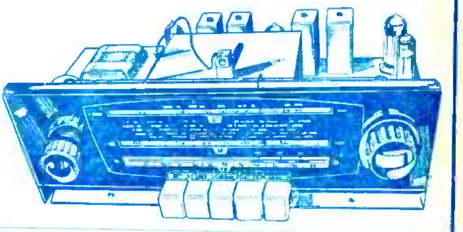
ELECTRONIC DIGITAL COUNTER with Geiger-head

16m TO 175m TRANSISTOR S.W. TUNER

MIDGET MAINS SUPERHET

BRAND NEW AM/FM (V.H.F.) RADIOGRAM CHASSIS AT £14 (Carriage Paid)

A.C. ONLY. Chassis size 15 x 6¾ x 5½in. high. New manufacture. Dial 14½ x 4in. in black and gold.
Pick-up. Ext. Speaker. Ae., E., and Dipole Sockets. Five push buttons—OFF L.W., M.W., F.M. and Gram. Aligned and tested O.P. Transformer. Tone Control. 1,000—1,900 M.; 200-500 M.; 88-98 Mc/s. Valves EZ80 rect., ECH81, EF89, EABC80, EL84, ECC85.
Speaker and Cabinet to fit chassis (table model). 47/6 (post 2/6).
10 x 6in. ELLIPTICAL SPEAKER, 20/-, to purchasers of this chassis.
TERMS:—(Chassis) £5 down and 5 Monthly Payments of £2, or with Cabinet and Speaker £5.10.0 down and 6 Monthly Payments of £2.
Cheap Room Dipole 10/-. Feeder 6d. yard.

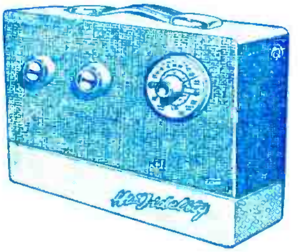


THE "CANTATA" 6-TRANSISTOR AND DIODE PORTABLE

COMPLETE KIT FOR ONLY

£7.19.6

(post 3/6)

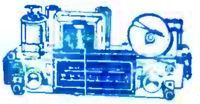


★ 500mW push-pull output. ★ Ferrite rod aerial.
★ Car aerial socket and coil. ★ M.W. and L.W. full coverage.
★ Operates on two 4.5v cells. ★ Printed circuit board 8¼ x 2¾in.
★ All holes drilled and component positions marked on reverse side of board.
★ Booklet of full instructions 2/6 for 16p. (refunded on purchase of kit).
★ Size 9 x 3¾ x 7in. ★ 8 x 2¾in. P.M. high quality speaker.
★ Attractive Vinair covered cabinet, two tone.
★ Two batteries 5/6 the pair.
★ High Sensitivity. ★ Good selectivity.
★ Mullard transistors OC44, 2 x OC45, OC81D, and 2 x OC81.
★ Top grade Weymouth Radio Coils and transformers.
★ Alignment service if required 17/6 (inc. post).
★ Write for list of prices.
★ All parts supplied separately.
★ Note the total cost—no extras at all.
★ Built in two hours.

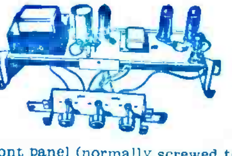
BATTERY ELIMINATOR. For 4 Low Consumption Valves (96 range). 90 v. 15mA. and 1.4 v. 125mA, 42/6 (2/6 post). 200-250 v. A.C. Size 5¾ x 3¾ x 2in. Also for 250 mA. 1.4 v. and 90 v. 15 mA at same price.

AUTOMATIC RECORD CHANGERS. ALL 4-SPEED WITH TURN-OVER CRYSTAL CARTRIDGE (carr. 5/- extra). Latest UA14, £7.10.0. Collaro C.60 Studio model, plays any records, 7-12in. only £7.15.0. Motor board for UA8, UA14 or Collaro 3/6 (post 1/6). Both UA14 and C.60 fitted monaural cartridge but wired for stereo.

BEREC BATTERY RADIO IN MAKERS' CARTON. Valves DK96, DF96, DAF96, DL96. Two Short Wavebands 2.5 to 7 Mc/s and 6.5 to 17 Mc/s. Cabinet 12 x 7¼ x 6in. ONLY £5 (2/6 p. & p.); MW and SW £5.4.0 (plus 2/6 p. & p.).



SELF-POWERED VHF TUNER CHASSIS. Covering 88-95 Mc/s. Mullard permeability Tuner, Dims. 10½ x 4½ x 5in. high ECC85, EF91, EF91 and 2 diodes. Metal Rectifier. Mains transformer. Fully wired and tested. Only £7.14.0 (carr. pd.). Room dipole 10/-. 300 ohm twin feeder, 6d. yd. Tuner without power pack £6.14.0 (carr. paid).



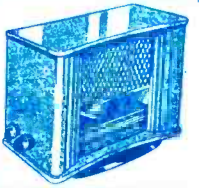
PUSH-PULL AMPLIFIER £4.15.0

(4/- Carr.)

Brand new 200-240 A.C. mains Bass, treble and vol. controls. With valves EZ80, ECC83 and 2-EL84 giving full 8 w. Chassis 12 x 3¼ x 3¼in. With o.p. trans. for 2-3 ohm speaker.
Front panel (normally screwed to chassis) may be removed and using as "flying panel". Stereo version 2 x 4 w. same price.

COMPLETE V.H.F./A.M. RADIO FOR £12.10.0

(carr. paid)



Brand new set, in superb walnut cabinet (size 19 x 8¼ x 14¼ in. high). Covering 80-100 Mc/s. 16-49 M., and 200-500 M. Mains trans. 200-250 v. with 2 tappings. Ferrite rod aerial for A.M. Controls: volume on/off, tone, tuning, w/change. Gram and ext. speaker position provided. Valves 12AT7, 12AH8, 6BJ6, EABC80 6BW6 and metal rectifier. Fully guaranteed. Today's Value £20.

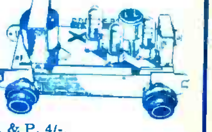
COLLARO STUDIO TAPE TRANSCRIPTOR. 3 MOTORS, 3 SPEED. 1¼, 3¾ and 7½ I.P.S. Push buttons. £10.17.6 (10/- carr.) incl. spool.

SUPERIOR GRAMOPHONE AMPLIFIER
3 valves, 4 watt

13¼ x 7¼in. (2¾in. front to back). 3 front controls, bass, treble, vol./on-off. 6½in. circ. or 8 x 5in. speaker; UY85, UF80 and UL84. Mains trans. 200-240ac; "gold" fret front. ONLY 70/- (p.p. 3/6).

GRAMOPHONE AMPLIFIER
With 5in. SPEAKER Baffle 12½ x 6in. EZ40 and EL41. Tone and Volume On/Off switch. Two Knobs. Ready to play. Useful for Stereo. ONLY 57/-, post 3/-.

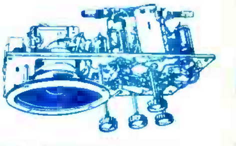
3-VALVE AMPLIFIER (INC. RECT.). 2½ watts. ECC83, ECL82 and EZ80. Controls, volume bass and treble. On/off switch. Overall size 10 x 4 x 4½in. over valves. Mains and O.P. trans. and 6½ x 4½in. Celestion speaker. Suitable for microphone input and for guitar amplifier. A.C. only.



70/- P. & P. 4/-.

MAINS OPERATED RADIO CHASSIS AND AMPLIFIER OF FAMOUS MANUFACTURE

Chassis 10 x 5½ x 4in. front to back. Valves: UBC41, UCH41, UF89, UL84 with metal rectifier. 5in. speaker. Ferrite rod aerial. Tone, vol. and gram. position. Covers L. and M. waves. Limited quantity at only £6 (5/- carr.) complete with small dial. Unused and in working order.



UNREPEATABLE OFFER OF AM-FM CHASSIS AT ONLY £9.9.0 carr. pd.

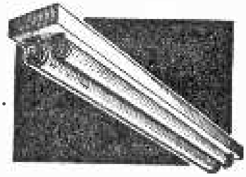
A small quantity of Printed Circuit chassis by famous manufacturer. Valves UY85, UCH81, UF89, UABC80, UL84 and UCC85. O.P. trans. for 2-3 ohm speaker. Chassis 14 x 7 x 7in. Front controls concentric, left—Vol. and Tone; right—W/c and Tuning. "Gold" centre knobs provided. 2-dial bulbs. Sockets, AE; E; Ext. sp; P.U. Mains isolating transformer free. Covers Long, Med., VHF (87-101 Mc/s). Unused slightly tarnished, but not dirty; New Mullard Valves; not our manufacture, so no guarantee. Dial in gold and brown, size 13 x 3½in.

Send 6d. (stamps will do) for 20 page illustrated catalogue. All New Goods. Delivered by return. (C.O.D. 2/- extra).
ALL ITEMS GUARANTEED 12 MONTHS—B.V.A. VALVES 3 MONTHS.—CLOSED SATURDAY.

GLADSTONE RADIO "SCALA", CAMP ROAD, FARNBOROUGH, HANTS.

(See other advertisement on page 918) Farnborough 3371

Fluorescent Lighting

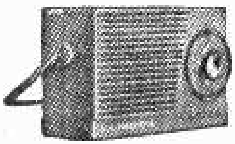


Complete lighting fittings. Built-in ballast and starters—stove enamelled white and ready to work. Ideal kitchen, workshop—anywhere.
Twin 20 approximately 27in. long complete with two 20W tubes, **49/6.**
Single 40 approximately 4ft. long complete with one 40W tube, **39/6.**
Inductor 80 approximately 5ft. long complete with one 80W tube, **49/6.** Carriage and insurance up to 150 miles **7/6**, up to 250 miles **8/6.**
21in. Miniature complete with 13 watt tube. Ideal for showcase or position where miniature fitting is required. Complete with latest ⅝in. diameter tube. **49/6 each.**
Circular. Complete with 40 watt tube, **£4.19.6.**
Carriage and ins. 7/6 any type.

Smallest Possible 2-gang

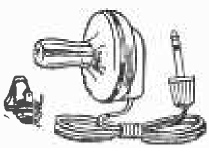
With built in trimmers, polystyrene cased, size only 1 x 1 x 7/16in., price **12/6.** Smallest IF and oscillator to match, **21/-.** P.P. input and P.P. output transformers, **12/6.** Circuit diagram free with any of above.

Transistor Set Cabinets



Very modern cream cabinet, size 5½ x 8 x 1¾in. with chrome handle, tuning knob and scale. Price **7/6**, plus 1/6 postage and packing.
Special quotations for quantities.

Miniature Earphones



For Transistor Circuits or Deaf Aid
Very lightweight and easy to wear, cord almost invisible, good quality production of music and voice, complete with miniature plug and socket, ready to use—correct impedance OK for red spot and similar transistors. Crystal and Magnetic, **9/-.** Post and insurance 1/-.

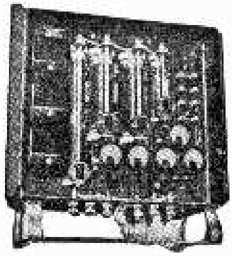
SPECIAL TV SNIP!

BRAYHEAD TURRET TUNER
With valves **39/6**
Less valves **19/6**
Both plus 2/6 postage and insurance.

TRANSFILTERS

Save alignment problems and improve performance. Use instead of I.F. transformer. Complete with circuit 8/6 each.

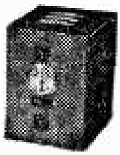
CHARGING SWITCHBOARDS



Type A. 550 w. 18 v.—contains three reverse current relays, one voltmeter rated 25 v. f.s.d., one main ammeter rated 40 amps. f.s.d., one secondary ammeter rated 15 amps, f.s.d. and two secondary meters rated 20 amps. f.s.d., one 2 ohm variable resistor, one 11 ohm variable resistor and two 1.2 ohm variable resistors. Complete in metal case 2ft. 6in. x 2ft. 8in. approx. Price **£2.15.0**, carriage and ins. 15/-.
Type B. 1260 w. 50 v., 0.12 amps—contains one 14 ohm variable resistor and four 1 ohm variable resistors, one main ammeter rated at 40 amps. f.s.d., four secondary meters rated at 20 amps. f.s.d. and one voltmeter rated at 50 volts, and two reverse current relays. Complete in metal case—size approximately 2ft. 6 in. x 2ft. 8in. Price **£4.15.0**, carriage 15/-.
Connecting Leads for these switchboards with Nifam plugs **30/-** each.

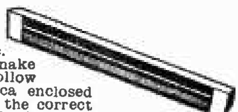
BATTERY CHARGER BARGAIN

Components Would Cost More



Car Battery Charger—ready-made high output battery charger in stove enamelled sheet steel louvred case. New, complete and ready to work. Rated at 12 v. 5 amps. and variable rate selector for trickle charging, also a meter to show charging rate. Suitable for 230/250 A.C. mains. Special snip price of **65/-**, plus 3/6 post and ins.

INFRA-RED HEATERS



Make up one of these latest type heaters ideal for bathroom, kitchen, bedroom, etc. They are simple to make from our easy to follow instructions—uses silica enclosed elements designed for the correct infra-red wavelength (3 microns). Price for 750 watt element and instructions **15/6**, plus 2/6 post and insurance.

LIMITED QUANTITY ONLY!

Waterproof heater wire. 16 yds. length, 70 watts. Self regulating temperature control. **10/-.** Post Free.

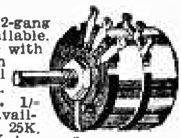
THIS MONTH'S SNIP!

"SUNVIC SIMMERSTAT" HEATER REGULATOR, suitable to control elements or heaters up to 2,500 watts on A.C. The unit which is a ceramic body with bakelite case comprises a thermostat, adjustable for various temperature settings and in addition there is a heater coil so that the thermostat can be used as an intermittent make or break (simmerstat arrangement), thus giving complete control. **SPECIAL SNIP PRICE** of this unit is **12/6**, plus 1/6 postage and insurance.
COPPER CLAD ELEMENT, 1,500 watts, 230 volts. 2ft. long, **17/6** each. Post 2/6. Ideal for convector heater, which could be controlled by the above.

"Dim and Full" Switch

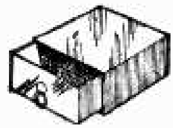
Particularly useful for controlling photoflood lamps which have only a short life at full brilliance. This switch has three positions; the first position puts two lamps in series at half brilliance for setting up, the second position is off and the third position full brilliance for the operation shots. Also useful for controlling night lights, heaters, etc., etc. Price **3/9** each, post 9d. Circuit diagram included.
Ditto but without the off position, i.e. d.p.d.t., 10 amp. **2/9.**

Morganite Potentiometers



Single and 2-gang types available, standard size with good length spindle, all new and boxed.
Single types. 1/- each, values available: 5K, 10K, 25K, 50K, 100K, 250K, 1 meg., 2 meg.
Gang type 3/- each—values available: 5K ± 5K, 100K ± 100K ½ meg. ± ½ Meg. 2 meg. ± 2 meg.

Component Storage Drawers



Stout board construction, these drawers are ideal for small parts. Supplied complete with simple erection instructions—**1/6** each or 12 drawers each 6 x 2¼ x 6½in., **13/6**, post 2/-

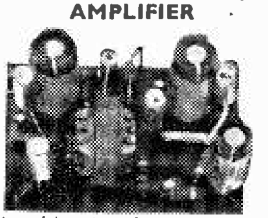
Yaxley Switches

1 Pole 3 Way	1/6
1 Pole 5 Way	3/-
1 Pole 8 Way	2/6
1 Pole 12 Way	3/-
2 Pole 2 Way	2/6
2 Pole 4 Way	3/-
2 Pole 6 Way	2/6
2 Pole 12 Way	4/6
3 Pole 3 Way	1/6
3 Pole 6 Way	3/6
4 Pole 4 Way	3/-
6 Position Shorting	3/-
6 Pole 3 Way	2/6
6 Pole 3 Way	3/6
8 Pole 2 Way	3/-
9 Pole 3 Way	3/6
12 Pole 2 Way	3/-

All parts for the "P.W. CITIZEN" available

Price as one parcel or separately, please send for list.

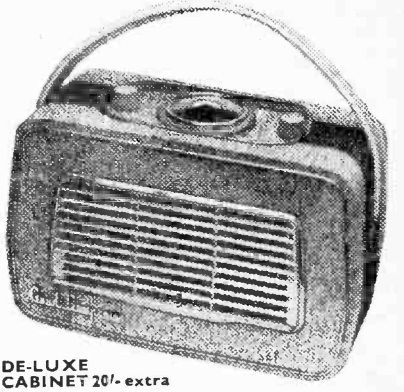
750mW TRANSISTOR AMPLIFIER



4 transistors including two in push-pull—input for crystal or magnetic microphone for pick-up—feed back loops—sensitivity 5 m/v—output 1 watt peak into 35 ohm speaker. Speakers available. Price **52/6.** Postage and Insurance 2/6.

A NEW LOOK FOR The "GOOD COMPANION"

CAR RADIO & PORTABLE



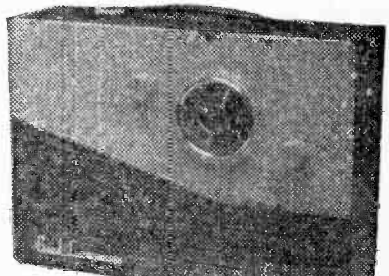
DE-LUXE CABINET 20/- extra

One of the finest of its kind available. !The design is the combined efforts o our technicians and of those of several of the leading manufacturers in the country, and the resulting set has a performance as good as, if not superior to, those selling at £20 and more—*It has the eight transistor set performance.* Features include **American Philco R.F. transistors and Mullard A.F. transistors**—Q.P.P. output giving 750 mW—full coverage on Medium and Long—very fine tuning arrangement—excellent reception of difficult stations like 208—variable feed-back control—full tonal qualities—really superior looking cabinet size 11 x 8 x 3in. approximately—car aerial attachment—several months' operation from battery costing only 3/6.
Circuit employs six transistors and two diodes, it incorporates all latest refinements, and oscillator. I.F. Transformers are pre-aligned so no instruments are necessary. Anyone who can solder competently can make this set. The instructions are fully comprehensive with plenty of illustrations. Service is available in the unlikely event of your getting into difficulties. All components fully guar.

Price of all components and Standard Cabinet or with De Luxe Cabinet £1 extra. **£9.19.6** **Post and Insurance 5/- Battery 3/6 extra.**

MK. 2 uses latest ceramic transfilters in place of the normal I.F. transformers. This saves alignment problems and improves performance. **Price 10/- extra.**

AGENTS wanted to build up our Companion Receivers. Send addressed envelope for full particulars.



STANDARD CABINET

The "POCKET COMPANION" is now ready!

This is without doubt the most modern and best pocket set available. It uses the very latest I.F. transfilters, Philco R.F. transistors, airspaced tuning condenser in Superhet circuit covering M.W. and L.W. Complete building cost £6.15.0. Battery 2/-. Post and Ins. 2/6. Data free with parts or separately 2/6.

MOST AMAZING BARGAIN!

All components for the

IMPROVED PIMPERNEL

5 Transistor Radio

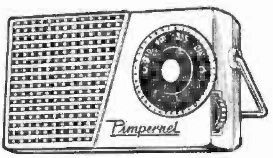
that works really well!

ONLY

69/6

Postage and Insurance 2/6

Battery 2/-



This remarkable little receiver uses 5 transistors and 2 diodes. 3in. Moving Coil Speaker, Tuning Condenser, Volume Control with On/Off switch, latest type circuitry giving excellent station separation and ample volume at good tone. Push-pull output circuit ensures long life from PP4 battery.
All components included for Medium Wave operation in handsome plastic case with carrying handle as illustrated.

Demonstrations at all branches

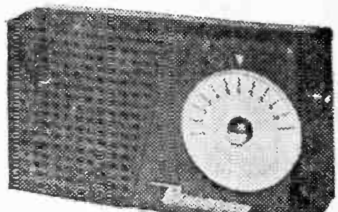
Circuit diagram FREE with parts or 2/- separately.

OPTIONAL EXTRAS

All components and switch for Long Waves	8/6
Motif "Pimpernel"	2/-

THE POCKET "4"

Proved without doubt the easiest of all to make!



Circuit comprises 2 HF transistors reflexed to equal 4 stages. Permanent germanium diode and high gain AF output stage, fitted with miniature speaker, proper tuning condenser, volume control and in case with handle as illustrated (less monogram), completely portable. No **aerial or earth required.**
Pocket 4 uses 3 transistors and 1 diode, price **42/6**, plus 2/6 post and insurance.
Pocket 5 uses 4 transistors and 1 diode and has feedback control, price 55/-, plus 2/6 post and insurance.
Prices are for medium wave models; long or medium versions 6/6 extra.

GOOD RESULTS EVERYWHERE

Nothing can be more disappointing than to find that despite care in making up, your radio just will not work or needs a long high aerial and water pipe earth. We can prove good results in all areas and we guarantee all components for 12 months. Hundreds of testimonials received. Send in confidence. Plans free with parts, or separately 1/6. Demonstrations at all branches.

ELECTRONIC PRECISION EQUIPMENT LTD.

post orders are dealt with from Eastbourne, so for prompt attention please post your orders to 66 Grove Road, Eastbourne, marked Department 7. Callers may use any one of the Companies below.

266 London Road, Croydon.	**29 Stroud Green Rd., Finsbury Park, N.4.**	**520 High Street North, Manor Park, E.12.**	**42-46 Windmill Hill, Ruislip, Middx.**	**246 High Street, Harlesden, N.W.10.**
Phone: CRO 6558	Phone: ARChway 1049	Phone: ILFord 1011	Phone: RUIslip 5780	Phone: ELGar 4444
Half day Wednesday	Half day Thursday	Half day Thursday	Half day Wednesday	Half day Thursday

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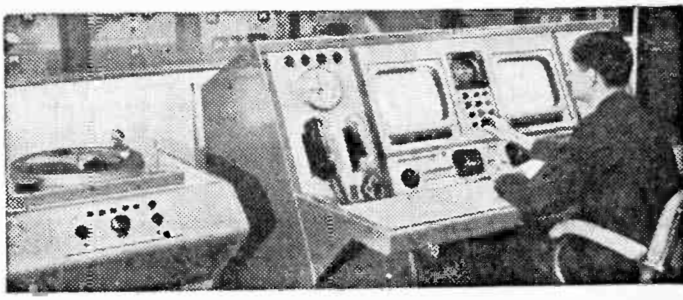
Practical Radio Courses

Gain a sound up-to-professional-standards knowledge of Radio and Television as you build **YOUR OWN** 4-valve T.R.F. and 5-valve superhet radio receiver, Signal Generator and High-quality Multimeter. At the end of the course you have three pieces of permanent and practical equipment and a fund of personal knowledge and skill. ICS Practical Radio courses open a new world to the keen Radio amateur.



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GREAT OBSOLETE VALVE LIST

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- A30D 9/6
- A50A 9/6
- A50N 12/6
- A70B 12/6
- A70C 17/6
- A70D 17/6
- AC/PEN 23/3
- AC/HL 15/-
- AC/ME 15/-
- ACP4 16/6
- AC/SPI 12/6
- AC/SG 10/6
- AC/52PEN 23/3
- AC/52 18/6
- AC/SXV17 16/6
- AC/TP 30/-
- AC/THI 18/6
- AC/VPI 15/-
- AC2HL 10/6
- AC/2PEN 17/6
- AC3 10/6
- AC4 10/6
- AC5/PEN 10/6
- AC5/PEN-DD 12/6
- AG8 10/6
- AGX2270 10/6
- AL1 8/6
- APP4A 8/6
- APP4B 17/6
- APV4 8/6
- ARP38 5/6
- ARTH2 5/6
- AS4120 12/6
- ATH43 10/6
- ATP4 5/-
- AW2 5/-
- AW3 5/-
- AW6 5/-
- AZ1 18/7
- AZ2 18/7
- AZ11 18/7
- AZ31 9/6
- AZ50 12/6
- B21 15/-
- B36 15/-
- B65 7/6
- BR201 10/-
- BR1050-50 10/-
- BU200 10/-
- C1 12/6
- C1C 12/6
- C5PENDD 18/6
- C10B 8/6
- C20C 8/6
- C23B 8/6
- C36A 12/6
- CBL1 21/-
- CL4 21/-
- CY1 16/6
- CY1C 16/6
- CY32 11/-
- CV1092 5/6
- D4 5/-
- D41 10/6
- CV140 10/6
- D42 10/6
- D43 10/6
- D63 5/-
- D433 10/-
- DA41 10/6
- DAR10 8/6
- DC/HL 10/6
- DC SG 10/-
- DD-PEN 18/6
- DD13s 16/6
- DD41 12/6
- DD101 10/6
- DD207 10/6
- DD620 10/6
- DD4020 10/6
- DDL-4 8/6
- DDT2 8/6
- DDT13 10/6
- DET19 5/6
- DH76 5/-
- DH101 8/-
- DL63 16/-
- DL72 12/6
- DL82 12/6
- DL810 10/6
- DN41 7/6
- DC20 10/6
- DC25 10/6
- DS 8/-
- DW2 12/6
- DW4/500 16/6
- EAB1 9/-
- EB4 9/-
- EB34 1/6
- EBC3 18/6
- EBC33 5/-
- EBC81 8/-
- EBF11 9/-
- EBL21 18/6
- EC31 5/6
- EC50 6/-
- EC52 5/6
- EC53 5/6
- EC54 5/6
- EC90 13/-
- ECC31 5/6
- ECC32 5/6
- ECC33 8/6
- ECH3 18/6
- ECH34 5/-
- ECH35 5/-
- EE50 4/-
- EF5 5/-
- EF6 10/-
- EF8 16/6
- EF9 18/6
- EF11 18/6
- EF37A 11/-
- EF39 6/6
- EF50 5/-
- EF51 5/-
- EF54 5/-
- EK2 8/6
- EK32 8/6
- EL2 5/-
- EL3 5/-
- EL31 5/-
- EL32 5/-
- EL33 12/6
- EL34 15/-
- EL35 18/6
- EL37 18/6
- EL38 18/6
- EL50 10/6
- EM1 12/6
- EM4 12/6
- EN31 32/-
- EZ2 9/-
- EZ3 9/-
- FC2 15/-
- FC4 15/-
- FC13 15/-
- FC13C 15/-
- FW4/500 8/6
- GT1C 8/6
- GTD4B 10/6
- GTD4C 10/6
- GU1 22/-
- GZ32 10/-
- H13 12/6
- H30 12/6
- H42 12/6
- H63 12/6
- H141D 12/6
- HD24 10/6
- HP4101 10/6
- HP4106 10/6
- HP4115 10/6
- HL13 15/-
- HL13C 15/-
- HL23 15/-
- HL41 18/-
- HL41DD 18/-
- HL42DD 18/-
- HL46 18/-
- HL133DD 21/-
- HL1320 21/-
- HVR2 18/-
- HVR2A 7/-
- HW/30 18/6
- K23B 8/6
- K30G 8/6
- K30K 8/6
- K40N 8/6
- K50M 12/6
- K70B 12/6
- K80B 12/6
- KBC32 10/6
- KB/Z 10/6
- KCF30 10/6
- KF35 7/6
- KK2 10/6
- KK32 10/6
- KT2 5/-
- KT24 10/-
- KT31 18/-
- KT33 10/-
- KT33C 10/-
- KT35 18/6
- KT36 28/-
- KT41 17/6
- KT42 22/-
- KT44 12/-
- KT45 12/-
- KT55 12/-
- KT66 12/6
- KT71 12/6
- KT74 12/6
- KT76 12/6
- KTW63 5/6
- KTZ41 7/-
- KTZ63 7/-
- L12 6/-
- L21 6/-
- L42 6/-
- L63 6/-
- LP2 6/-
- LP4 6/-
- LP220 8/-
- LV136 10/-
- ME41 12/-
- ME91 12/-
- MH4 7/6
- MH41 8/6
- MH41 (5 Pin) 14/6
- MH4105 10/6
- MHL4M 6/-
- MKT4 (5 Pin) 14/6
- MKT4 (7 Pin) 14/6
- ML4 7/6
- ML6 7/6
- MPT42 18/-
- MS/PEN (5 Pin) 12/6
- MS/PEN (7 Pin) 12/6
- MS/PEN-4 (7 Pin) 18/6
- MS/PEN B 18/6
- MSP4 (5 Pin) 12/6
- MSP4 (7 Pin) 10/6
- MU1 8/-
- MU14 8/-
- N14 18/6
- N16 18/6
- N17 18/6
- N41 17/6
- N108 18/6
- N145 18/6
- NR54 18/6
- O54B 7/-
- OA4 6/-
- OC3 9/-
- OD3 8/-
- OM1 9/-
- OZ4 9/-
- P2 7/-
- P2 (4 Pin) 7/-
- P220 9/-
- P220A 9/-
- P240 9/-
- P22A 7/-
- P41 9/-
- P215 9/-
- PA20 9/-
- PC/PEN (5 Pin Side Terminal) 18/6
- PL33 18/-
- PM2 7/-
- PM2A 7/-
- PM2B 7/-
- PM2HL 12/-
- PM2M 9/-
- PM3 9/-
- PM3A 9/-
- PM4 9/-
- PM4DX 12/-
- PM5B 9/-
- PM12M 9/-
- PM22A 10/-
- PM22D 10/-
- PM24A 10/-
- PM24M 10/-
- PM25 10/-
- PM202 10/-
- PM220 10/-
- PM2419 10/-
- PP3/250 8/-
- PP4 9/-
- PP5/400 10/-
- PP13A 9/-
- PP35 9/-
- PP3521 9/-
- PT-10 10/-
- PT230 (4 Pin) 6/-
- PT230 (5 Pin) 9/-
- PV30 8/-
- PY31 15/-
- PY32 14/-
- PZ30 18/-
- PEN4VA 15/-
- PEN4VB 17/6
- PEN25 15/-
- PEN36C 23/-
- PEN40DD 23/-
- PEN44 23/-
- PEN45 18/-
- PEN46 18/-
- PEN220A 22/-
- PEN428 22/-
- PEN453DD 22/-
- PENA4 17/6
- PENDD 1360 (7 Pin) 22/-
- PENDD 4020 22/-
- PT4 17/6
- QP21 6/-
- QP22B 6/-
- QP25 12/6
- QP230 12/6
- R3 9/-
- RG1 35/-
- S11A 9/-
- S11D 9/-
- S-130 10/-
- S215VM 9/-
- SD6 7/-
- SD20 9/-
- SD61 9/-
- SP2 9/-
- SP4 12/6
- SP4 (5 Pin Met) 12/6
- SP4B 12/6
- SP13 12/6
- SP13C 12/6
- SP22 12/6
- SP41 12/6
- SP42 12/6
- SP130P 12/6
- SP132 12/6
- SP141 12/6
- SP210 12/6
- SP215 12/6
- SP220 12/6
- SP1320 12/6
- SP2220 12/6
- SS210 12/6
- ST11 12/6
- SU25 10/6
- SU2150 10/6
- SU2150A 10/6
- T4D 10/6
- T31 10/6
- T40 10/6
- TDD2A 12/6
- TDD13 12/6
- TDD25 12/6
- TH13C 12/6
- TH21C 12/6
- TH30C 12/6
- TH2321 12/6
- TP22 12/6
- TP23 12/6
- TP26 12/6
- TP1340 12/6
- TP2620 12/6
- TSE4 12/6
- TSP4 12/6
- TT4 12/6
- TT11 12/6
- TT12 12/6
- U16 9/6
- U17 9/6
- U19 25/-
- U21 8/-
- U22 8/-
- U23 12/6
- U31 9/6
- U33 18/6
- U35 18/6
- U47 9/-
- U50 6/6
- U52 6/6
- U74 8/-
- U76 6/-
- U81 12/-
- U84 15/-
- U201 15/-
- U251 12/-
- U282 18/6
- U309 18/6
- U339 14/-
- U403 15/-
- U4020 9/-
- UAF41 11/-
- UB41 10/-
- UBL21 18/6
- UCH11 18/6
- UCL11 14/6
- UM34 16/-
- UR1C 16/-
- UR3 16/-
- UU7 15/-
- UU8 23/-
- UU30/250 18/6
- UU60/250 (4 Pin) 18/6
- UY11 15/-
- UY31 15/-
- V914 12/-
- VL8631 11/-
- VM84B 12/6
- VO4 12/6
- VP2 10/-
- VP2B 10/-
- VP4 12/6
- VP4A 18/6
- VP4 (5 Pin) 10/6
- VP13A 12/6
- VP22 8/6
- VP23 5/6
- VP41 5/-
- VP102 10/6
- VPTA 10/6
- VPT4 10/6
- VR19 9/-
- VR53 7/6
- VR55 8/6
- VR56 8/6
- VR75 8/6
- VR91 8/6
- VR92 8/6
- VR116 8/6
- VR135 8/6
- VR136 8/6
- VR137 8/6
- VR505 8/6
- VR10530 8/6
- VT25 6/-
- VT61 6/-
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- VT105 6/-
- VT109 6/-
- VT119 6/-
- VT136 6/-
- VT202 6/-
- VT203 6/-
- VU39 6/-
- VU111 6/-
- W21 (4 Pin) 9/-
- W21 (7 Pin) 12/-
- W61 12/-
- WD40 12/-
- WT40 15/-
- X24 21/-
- X41C 14/-
- X61 10/-
- X71M 12/-
- X8G 5/-
- Y63 6/-
- Z14 6/-
- Z21 6/-
- Z31 8/6
- Z63 7/6
- Z66 15/-
- Z90 12/-
- Z8159 12/-
- Z8160 12/-
- 1A4E 6/-
- 1A5GT 6/-
- 1A6 12/-
- 1C5 10/-
- 1C5GT 12/-
- 1D6 10/-
- 1F5 10/-
- 1F5G 10/-
- 1F6 10/-
- 1F7 10/-
- 1G6GT 16/-
- 1LA6 12/-
- 1LB4 10/-
- 1LC6 10/-
- 1LD5 4/-
- 1LE3 9/-
- 1Q5 9/-
- 1S4 9/-
- 1W4 9/-
- 1W4/350 14/6
- 1W4/500 14/6
- 2A3 8/6
- 2A5 8/6
- 2D4A 8/6
- 2D4B 8/6
- 2D13 8/6
- 2D13A 8/6
- 2D13C 12/6
- 2-P 22/-
- 2X2 4/6
- 2X2/879 9/6
- 3D6 5/-
- 3L36 8/-
- 4D1 8/-
- 4THA 12/-
- 4TP 12/-
- 4TPB 12/-
- 4TSA 12/-
- 4TSP 12/-
- 5B/25/M 16/-
- 5U4G 6/-
- 5Y3 6/-
- 5Z3 10/6
- 5Z4 9/-
- 6A3 10/6
- 6A4 10/6
- 6A6 10/6
- 6A6G 10/6
- 6A7 10/-
- 6A8GT 8/6
- 6AB5 8/6
- 6AB7 8/6
- 6AC7 3/-
- 6AG5 4/-
- 6B4 5/-
- 6B5 5/-
- 6B7 6/-
- 6B7M 7/6
- 6B8G 5/-
- 6BAG 7/6
- 6BG6G 21/-
- 6C4 5/-
- 6C5 6/-
- 6C5G 6/-
- 6C6 6/6
- 6C8 12/-
- 6C8G 12/-
- 6CH5 8/-
- 6CJ5 9/-
- 6D1 7/-
- 6D6 5/6
- 6D8 6/6
- 6D8G 6/6
- 6F1 18/6
- 6F5G 9/-
- 6F6G 7/-
- 6F7 7/-
- 6F8 9/-
- 6F8G 9/-
- 6F11 16/-
- 6F12 3/6
- 6F13 11/-
- 6F14 12/-
- 6F15 14/-
- 6F32 10/-
- 6G6 5/-
- 6G6G 5/-
- 6H6 3/-
- 6H6GT 3/-
- 6GH7 6/-
- 6J5 5/-
- 6J5GT 5/-
- 6J7 7/-
- 6J8 9/-
- 6J8G 7/-
- 6J86 12/-
- 6K6 8/-
- 6K7 4/-
- 6K7G 4/-
- 6K8G 10/6
- 6K25 18/-
- 6L5G 18/6
- 6L7 6/6
- 6L7G 6/6
- 6L18 12/-
- 6L19 18/6
- 6LD20 14/-
- 6N1 9/-
- 6N7 7/-
- 6N7GT 7/-
- 6N7M 7/-
- 6P1 12/-
- 6P25 11/6
- 6P26 17/6
- 6P28 18/6
- 6Q7G 6/6
- 6RY 9/-
- 6R7G 9/-
- 6SA7 8/-
- 6SC7 7/-
- 6SF7 8/-
- 6SFY 11/-
- 6SG7 8/-
- 6SH7 8/-
- 6SJ7 8/-
- 6SJ7GT 8/-
- 6SK7 6/-
- 6SK7M 6/-
- 6SQ7GT 9/-
- 6SYG 8/-
- 6SS7 8/-
- 6T8G 12/-
- 6U5G 7/-
- 6U7G 8/-
- 6U8G 8/-
- 6V6GT 7/-
- 6W7G 9/-
- 6X5 6/-
- 6X5G 6/-
- 6X6 6/-
- 6Y6 6/-
- 6Z5 8/6
- 6Z5/12Z5 8/6
- 7A3 17/6
- 7A7E 11/-
- 7B8 14/-
- 7C5 7/-
- 7C6 7/-
- 7D3 9/-
- 7D7 9/-
- 7D8 9/-
- 7K7 11/-
- 7N7 11/-
- 7Q7 11/-
- 7Y4 6/6
- 8A1 6/6
- 8D2 3/-
- 9A1 9/-
- 9D2 4/-
- 10D1 11/-
- 10F14 11/6
- 10P14 18/-
- 12A6 5/-
- 12A8 8/-
- 12AH7 7/-
- 12AM76GT 12/-
- 12BE6 9/-
- 12C8 9/-
- 12J5 4/-
- 12J5GT 4/6
- 12J7 9/-
- 12K7 5/-
- 12K8 11/-
- 12SA7 7/6
- 12SC7 8/-
- 12SF7 8/-
- 12SG7 6/6
- 12SJ7 7/6
- 12SK7 5/-
- 12SL7 9/-
- 12SQ7 9/-
- 12SR7 8/-
- 12SS7 8/-
- 12Z3 8/6
- 13SPA 12/-
- 13VPA 12/-
- 14B6 12/-
- 14H7 18/6
- 14N5 12/6
- 15A2 8/6
- 15D2 8/6
- 18 8/6
- 19 8/6
- 19X3 8/6
- 20F2 18/6
- 20P1 18/6
- 20P4 18/6
- 25A6G 10/-
- 25L6 10/-
- 25Y5 10/-
- 25Y5G 10/-
- 25Z4 9/6
- 27 8/6
- 28D7 6/-
- 30FF 7/-
- 30LT 7/-
- 30P4 11/-
- 31 12/-
- 33 12/-
- 34E 12/-
- 35 18/-
- 35A5 17/6
- 35E 17/6
- 35ZA 17/6
- 35Z5 8/-
- 36 9/-
- 39/44 11/-
- 40 11/-
- 40SUA 14/-
- 41 12/-
- 41E 12/-
- 41MDG 12/-
- 41MHF 12/-
- 41MHL 12/-
- 41MLF 12/-
- 41MP 12/-
- 41MPG 12/-
- 41MPT 12/-
- 41MRC 12/-
- 41MTL 12/-
- 41MTS 12/-
- 41MXP 12/-
- 41STH 12/-
- 42 11/-
- 42MPPEN 17/6
- 42MPT 11/-
- 42/OT 17/6
- 42OTDD 11/-
- 42SPT 11/-
- 43 9/6
- 44 8/6
- 44SU 10/-
- 45 10/-
- 46 10/-
- 47E 10/-
- 47MG 10/-
- 50A5 11/-
- 55S 11/-
- 56 11/-
- 57 11/-
- 61 11/-
- 61BT 11/-
- 61SPT 11/-
- 62BT 11/-
- 63SPT 9/-
- 70LY 8/-
- 71A 8/-
- 75 8/-
- 76 8/-
- 77 8/-
- 78 8/-
- 79 8/-
- 80 9/-
- 83 12/-
- 84 12/-
- 85AI 18/6
- 87 12/-
- 89 12/-
- 117Z6GT 12/-
- 154V 9/-
- 164V 9/-
- 202DDT 16/6
- 202PT 16/6
- 202STH 16/6
- 202VPB 16/6
- 203THA 16/6
- 210DG 16/6
- 210LF 16/6
- 210VPA 16/6
- 215SG 16/6
- 220HPT 16/6
- 220PT 16/6
- 220T 16/6
- 230PT 16/6
- 302 10/6
- 304 10/6
- 354V 8/6
- 402/PEN A 18/6
- 402P (7 Pin) 18/6
- 431U 8/6
- 451U 8/6
- 565 8/6
- 566 8/6
- 615-3T 8/6
- 774 8/6
- 807 7/6
- 832 8/6
- 879 8/6
- 884 8/6
- 956 3/-
- 1130 8/6
- 1701 8/6
- 1881 8/6
- 2050 8/6
- 2051 8/6
- 2101 8/6
- 2151 8/6
- 2220TH 18/6
- 4066A 17/6
- 4687 10/6
- 4687A 10/6
- 6153H/05 12/6
- 7193 8/6
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- 8012 12/6
- 9002 12/3
- Barreters 101-GEC 14/6
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COSSOR 108K 10-in. New & boxed, 15/-, plus 6/- P. & P. 75K 10-in. New & Boxed, 15/-, plus 6/- P. & P.

Ion trap magnets to suit the above, 2/9, 3d. P. & P.

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DON'T FORGET HARVERSONS FOR ALL YOUR COMPONENT NEEDS

Limited advertising space prevents us from displaying all our stocks, but we have almost everything that the home constructor is likely to need. It will pay you to ask us first, our prices are very favourable!

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We have vast stocks of all types of modern valves—All at bargain prices

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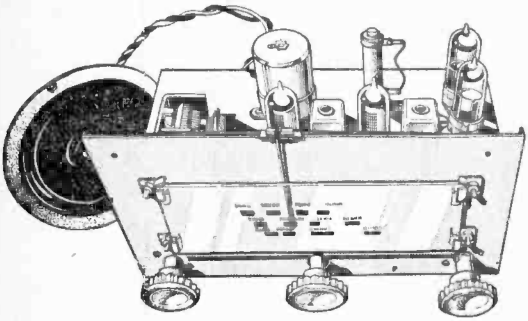
PLEASE TURN OVER FOR ADDRESS AND MORE BARGAINS

2 BAND SUPERHET CHASSIS with Speaker

ONLY £4.19.6

Plus 6/6 Post & Packing.



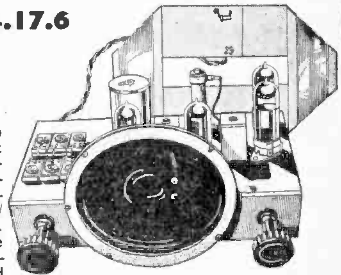
A quality 4 valve AC/DC superhet chassis made by a world famous manufacturer. Long and Medium wave coverage. Fitted with a cord and drum reduction tuning drive and attractive illuminated glass dial (size 6½ x 2½in.). Controls: Volume on/off, tuning and wave change. The receiver is self-powered, employing a mains dropper and a valve rectifier. Chassis dimensions 6½ x 9 x 5½in. high. Supplied complete with a good quality 5-inch loudspeaker, valves (UCH42, UAF42, UL41, UY41), AC/DC mains input lead, ivory knobs, etc.

DON'T HESITATE, ORDER NOW! This unbeatable bargain is bound to sell out quickly at only £4.19.6, plus 6/6 post and packing.

4 STATION PRESET CHASSIS with Speaker

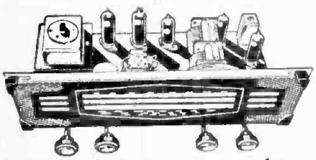
ONLY £4.17.6

Plus 6/6 P. & P.



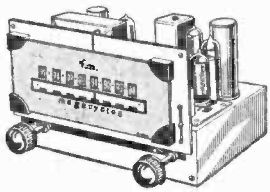
A compact, 4 station preset mains transportable receiver for operation from AC/DC mains. Two simple controls, volume on/off and 4 position station selector. The latter is set to Light Programme (Long Wave), Third Programme, Home Service and Light Programme (Medium Wave), but may of course be adjusted to alternative selections if required. A frame aerial with throw-out extension is supplied, making this receiver ideal as a general purpose transportable set for the home. A fully smoothed power supply is provided from AC/DC mains input by a mains dropper and a valve rectifier. The good tonal qualities are assisted by the provision of a quality 5in. speaker, which is ready-mounted on the chassis (this is easily detachable if alternative positioning is required). Valve line up, UCH42, UAF42, UL41, UY41. This chassis (size 9 x 6½ x 5½in. high) is supplied complete with valves, knobs, mains lead, aerial, etc. It is beautifully made by a famous maker, and is a first-class buy at the rock bottom price of only **£4.17.6**, plus 6/6 post and packing.

A.M. RADIOGRAM CHASSIS



A chassis of distinction, by a famous maker. Covering Long, Med. and Short Waves, plus gram position. this chassis (size 15½ x 7 x 6½in. high) incorporates the latest circuitry, using fully delayed A.V.C., and negative feedback. Controls: Tone, Vol. On/Off, W/Change (L.M.S. and Gram), Tuning. Tapped input 200-250 v. A.C. only. An attractive brown and gold illuminated dial with matching knobs, make this one of the most handsome, in addition to being one of the best performing chassis yet offered. Complete with valves (ECH81, EF89, EBC81, EL84, EZ81), knobs, output transformer, leads, etc. OUR PRICE ONLY **£9.19.6**
4/6 post plus & packing.

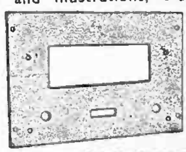
HARVERSONS' F.M. TUNER



At last a quality F.M. Tuner Kit at a price you can afford. Just look at these fine features which are usually associated with equipment at twice the price.

★ F.M. Tuning Head by famous maker. ★ Guaranteed Non-drift. ★ Permeability Tuning. ★ Frequency coverage 88-100 Mc/s. ★ OA81 Balanced Diode Output. ★ Two I.F. Stages and Discriminator. ★ Attractive maroon and gold dial (7 x 3in. glass). ★ Self powered, using a good quality mains transformer and valve rectifier. ★ Valves used ECC85, two EF80's, and EZ80 (rectifier). ★ Fully drilled chassis. ★ Everything supplied, down to the last nut and bolt. ★ Size of completed tuner 8 x 6 x 5½in. ★ All parts sold separately. **£4.19.6** Plus 8/6 P.P. and Ins. Circuit diagram and illustrations, 1/6, post free.

NOW AVAILABLE A robust cabinet made from heavy gauge metal which has been specially designed to house the above F.M. Tuner. Beautifully finished in a choice of glossy hammer green, or hammer grey enamel, or black crackle. The front panel (illustrated) has holes for control spindles, and apertures for tuning dial and magic eye. PRICE **25/-** P. & P. 1/9. (Front panel only 10/6, P.P. 9d.).



SPECIAL OFFER

MIDGET 2 GANG CONDENSERS

Polystrene cased, with built-in trimmers. Size 1 x 1 x $\frac{7}{16}$ ins. Not used, but removed from printed circuit boards.

UNBEATABLE VALUE 2 for 9/-
P. & P. 1/-

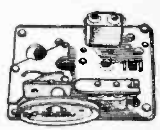
MAINS PORTABLE SOLDERING IRON

Probably one of the most outstanding soldering instruments yet produced, this iron has a detachable handle which can be placed over the bit and barrel, enabling it to be carried in complete safety even when hot. The provision of an extremely stable 30w element makes this ideal for transistor and all similar lightweight applications. Brand new in P.V.C. bag, with lead and plug. ONLY 18/9, plus 1/3 P. & P.

MINIATURE EARPHONE WITH CORD SUB-MINIATURE PLUG AND SOCKET

A deaf aid type earpiece of top grade quality. Gives an exceptionally crisp reproduction of both speech and music. Brand new and fully guaranteed. Two types available. CR-5 high impedance crystal, MR-4 low impedance magnetic. Either type. ONLY **7/6** Plus 1/- P. & P.

F.M. TUNER HEAD



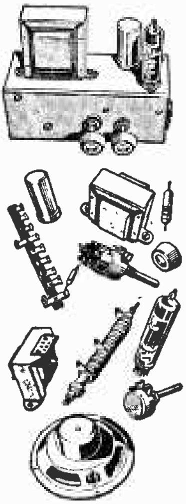
A permeability tuned tuner head by a famous maker, supplied without valve (ECC85) 18/6 plus 1/9 P. & P. Valve 8/6 extra.

HARVERSON SURPLUS CO. LTD.

Introducing

HARVERSON'S Monaural Amplifier Kit

39/6



In response to numerous requests from delighted purchasers of our "SUPER STEREO KIT" we have produced a "MONAURAL AMPLIFIER" on similar lines.

★ A UCL 82 valve provides a triode amplifying stage, and a pentode output stage (3 watts), enabling good amplification and sparkling reproduction to be combined with physical compactness (amplifier size, 7 x 3½ x 5½in. high).

★ Modern circuitry design, good quality O.P. transformer (to match 3Ω) keep hum and distortion to a low level.

★ The controls, volume on/off, and tone, are complete with attractive cream and gold knobs.

★ The amplifier has a built-in fully smoothed power supply, using a good quality mains transformer (A.C. mains only) and metal rectifier.

★ All you need is supplied including easy to follow instructions which guarantee good results for the beginner and expert. All components, leads, chassis, valve, knobs, etc., are first grade items by prominent manufacturers.

OUR PRICE Plus 4/6 Post and Packing. **39/6**

5in. LOUDSPEAKER TO SUIT 14/6 —EXTRA
ALL PARTS SOLD SEPARATELY

THE HARVERSON 6 TRANSISTOR & DIODE SUPERHET KIT

A first class 2 wave band transistor superhet in kit form.

★ Printed circuit panel (size 8⅛ x 2¾ins.)
★ 3 Pre-aligned I.F. Transformers.
★ Output Transformer.
★ 5 inch 5 Ω Speaker.
★ High gain Ferrite rod aerial.
★ First grade G.E.C. transistors.
★ Car aerial socket.
★ Push/Pull output.

All parts down to the minutest item with simple instructions. ONLY

£6.19.6 Plus 2/6 P. & P.

Cabinet to Suit (if available) 15/- extra.

BARGAIN MONTH FOR TRANSISTORS

POWER		GET15	9/-
OC36	10/-	GET15 (matched pr.)	16/6
OC44	9/-	GET102	7/6
OC45	8/-	XA103	8/6
OC71	5/-	PXA101	9/6
OC75	6/6	PXA102	9/6
OC76	6/6		
OC78	6/6	DIODE	
OC78D	6/6	OA81	3/-

Please add 6d. postage for each transistor.

TRANSISTOR SPEAKER

Western Electric 3Ω or 80Ω speaker. Size 2¼ x 11/16in. deep. 12/6 p.p. 1/-.

SUPERHET CHASSIS—less Valves & Cabinet

Modern AC/DC chassis with printed circuit and ferrite rod aerial. Although not completely built, the main components are mounted. L. & M. wave coverage. 4 valves (UBF89, UCL83, UCH81, UY85). Everything supplied except valves and cabinet. With speaker and simple instructions. **£3.6.6** plus 3/6 P. & P.

COIL and TRANSFORMER SET FOR TRANSISTOR SUPERHET

3 I.F. Transformers, one oscillator coil, one driver transformer, and wound ferrite aerial (Med., Long and aerial coupling) 28/6 complete, post 1/-. 6 transistor printed circuit board to match 8/6, post 9d. Circuit diagram 1/6 extra.

CONDENSER/RESISTOR PARCEL

50 mixed P.F. Condensers and 50 mixed Resistors. An assortment of useful valves. All popular sizes—all new—a must for the serviceman and constructor ONLY **10/-** P. & P. 1/-

THE HARVERSON COMPLETE F.M./V.H.F RECEIVER KIT £6.19.6

AT LAST—A COMPLETE F.M RECEIVER IN KIT FORM!

Specially designed with the home constructor in mind, this kit enables the construction of a completely self-contained V.H.F. receiver, at fraction of the normal cost of comparable equipment. This is basically a quality self-powered F.M. tuner plus 2 separate audio amplifier stages, and output transformer and speaker.

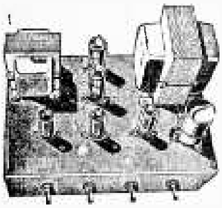
★ F.M. Tuning Head by famous maker.
★ Guaranteed Non-drift.
★ Permeability Tuning.
★ Frequency coverage 88-100 Mc/s.
★ OA81 Balanced Diode Output.
★ Two I.F. Stage and Discriminator.
★ Self powered using a good quality mains transformer and valve rectifier.
★ Valves used ECC85, two EF80's, ECL82 and EZ80 (rectifier).
★ Fully drilled chassis.
★ Good quality speaker.
★ Well designed output transformer.
★ Attractive maroon and gold glass dial.
★ Two output stages (using ECL82).
★ Everything supplied, down to the last nut and bolt.
★ Compact size.
★ All parts sold separately.

OUR PRICE **£6.19.6** Plus 4/6 P. & P.

83 HIGH STREET, MERTON, S.W.19

CHErrywood 3985/6

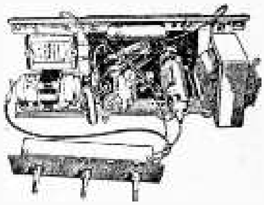
14 WATT HI-FI AMPLIFIER KIT



A kit designed to meet the exacting requirements of the audio enthusiast, yet remain within the price range of the average constructor. A stylishly finished monaural amplifier with an output of 14 Watts from 2 EL84's in push pull. Super reproduction of both music and speech (Frequency response ±3dB c/s-60 Kc/s with negligible hum.) Separate inputs for mike and gram allow records and announcements to follow each other and make this amplifier ideal for small halls, youth clubs, etc. Fully shrouded Ultra Linear output transformer (to match 3-15Ω speaker), and fully shrouded mains transformer (these alone are worth over £3.10.0). 2 independent volume controls, and separate Bass and Treble controls are provided, giving good lift and cut. Valve line up 2 EL84's, ECC83, EF86 and EZ80 rectifier. All parts down to the last nut and bolt, including valves, knobs, heavy gauge metal chassis finished in glossy hammer green enamel, mains and output transformers finished to match.

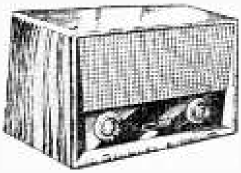
P. & P. 6/6 (simple instruction booklet 1/6, free with kit). ONLY **£6.19.6**

QUALITY RECORD PLAYER AMPLIFIER KIT



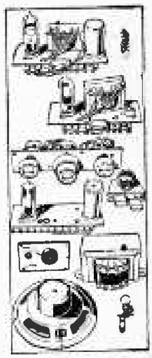
A top quality record player amplifier in kit form. This amplifier (which is used in a 29-gn. record player) has a printed circuit and has an internal fully smoothed power supply (input AC/DC Mains) using a mains dropper and contact cooled rectifier. A flying panel is supplied accommodating BASS, TREBLE AND VOLUME — ON/OFF controls. 2 valves (UL84 and UF89) and linear output transformer give crisp reproduction from all records at 4 watts. Our price for the complete kit of parts (including valves) ONLY **59/6** plus P. & P. 6/6. Simple instructions 1/6. (Free with kit).

SUPER TABLE RADIO CABINET



A very fortunate purchase allows us to offer this quality table radio cabinet for only 18/6 (this cabinet cost the manufacturers 35/- each to make). The positions of the controls make it ideal for housing our 6 TRANSISTOR SUPERHET KIT described opposite. Beautifully finished in walnut and tygan. OUR PRICE ONLY **18/6** Plus 1/6 P. & P. ins.

SUPER STEREO KIT MK. II



A kit of ready-built units only requiring interconnection. Comprising two midget 3W amplifiers, push button switch, transformer, control unit (bass, treble and vol.), power pack, two speakers, indicator light valves (ECL82, EZ80 range), and comprehensive instructions.

£3.19.6 Plus 6/6 P. & P.

E.M.I. 4-speed Player and P.U.

Heavy 8¾in. metal turntable. Low flutter performance 200/250V shaded motor with tap at 80V for amplifier valve filament if required. Turnover LP/78 head.

PRICE 89/6 Plus 4/6 P. & P.

VALVES

WE HAVE 20,000 IN STOCK—ALL AT BARGAIN PRICES. See our list in December "Practical Wireless", write, phone or call for your requirements Don't miss our bargain OBSOLETE VALVE LIST—turn back to page 878

SPECIAL OFFER . . .

6 TRANSISTOR RADIO

IN KIT FORM

Special offer. Limited quantity only of new ex-manufacturers' parts to make a 6 transistor 2 wave band superhet chassis. Ideal for portable or table radio. All parts including transistors, ferrite aerial, printed circuit, etc., but EXCLUDING speaker and cabinet. Few Only. **£4.19.6** P. & P. 2/6

Simple instructions 1/6 (Free with kit).

SPECIAL OFFER

54-in LOUDSPEAKER SILKS

Heavily woven in ivory and gold. Original price 35/- per yard length. OUR SPECIAL PRICE, 13/6 per yard length. P. & P. 1/6.

TAPE DECKS

B.S.R. Monardeck (single speed) 3¾in. per sec., simple control, uses 5¾in. spools. £7.5.0, plus 5/6 carr. and ins. (tapes extra). COLLARO STUDIO DECK £10, plus 5/6 carriage and ins. (tapes extra).

CRYSTAL MIKES

T.S.L. Stick Mike............22/6
ACOS (latest model)......18/6

PLESSEY SPEAKER

8 x 5 inch 8Ω Speaker. Large Pot ....12/6, P.P. 1/6

HI/FI STEREO MONAURAL AMPLIFIER

A 5 valve HI/FI amplifier with switched stereo/monaural operation. Output 3 watts per channel, provision for bass and treble speakers on each. Volume and tone controls fitted both channels. All housed in stylish blue/grey metal case, with gold finished knobs and trimmings. **£9.19.6** Plus 4/6 P. & P.

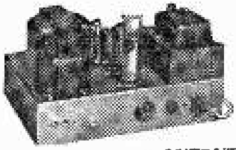
PUSH-BUTTON TRANSISTOR SWITCH

A 3 push-button switch, specially designed for transistor radios. Button functions provided are on-off, long and medium wave. The back of switch is also equipped with a rack for mounting a Ferrite Aerial. Easily worth 15/-. OUR PRICE ONLY **5/6** P. & P. 1/-.

STERN'S MULLARD DESIGNS

Designed by MULLARD—presented by STERN'S strictly to specification

COMPLETE KIT OF PARTS MULLARD "5-10" MAIN AMPLIFIER

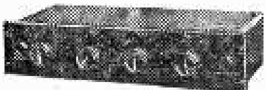


For use with the MULLARD 2-valve pre-amplifier with which undistorted power output of up to 10 watts is obtained. We supply SPECIFIED COMPONENTS AND NEW MULLARD VALVES, including PARMEKO MAINS TRANSFORMER and choice of the latest Ultra-Linear PARMEKO or the PARTRIDGE Output Transformer.

COMPLETE KIT OF PARTS (PARMEKO Output Trans.). **£10.0.0**

Alternatively we supply ASSEMBLED and TESTED. **£11.10.0** INCORPORATING PARTRIDGE OUTPUT TRANSFORMER, £1.6.0 EXTRA.

MULLARD'S PREAMPLIFIER TONE CONTROL UNIT



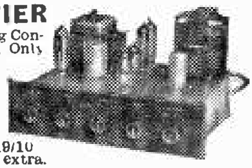
Employing two EF86 valves, and designed to operate with the MULLARD MAIN AMPLIFIERS, but also perfectly suitable for other makes.

PRICE COMPLETE KITS OF PARTS **£6.6.0** ASSEMBLED AND TESTED **£8.0.0**

Supplied strictly to MULLARD'S SPECIFICATION and incorporating:

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

COMPLETE MULLARD "5-10" AMPLIFIER



The popular and very successful complete "5-10" incorporating Control Unit providing up to 10 watts high quality reproduction. Only Specified Components and new MULLARD VALVES are supplied including PARMEKO MAINS TRANSFORMERS and choice of the latest PARMEKO or PARTRIDGE ULTRA-Linear Output Transformers.

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

H.P. Dep. £2.6.0, 12 months at 17/-. Dep. £2.14.0 12 months at 19/10

ABOVE incorporating PARTRIDGE OUTPUT TRANS. £1.6.0 extra.

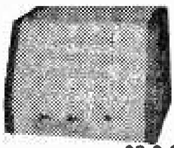
COMPLETE MULLARD "3-3"

THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION PROVIDING EXCELLENT REPRODUCTION OF UP TO 3 WATTS OUTPUT

COMPLETE KIT OF PARTS **£7.10.0** OR ASSEMBLED and TESTED **£8.19.6**

(plus 6/6 carriage and insurance) H.P. Terms: Deposit £2.0.0 and 8 months at £1.0.0. Complete to MULLARD'S SPECIFICATION including Mullard valves and a PARMEKO OUTPUT TRANSFORMER.

STERN'S INTER-COMM BABY ALARM



A small versatile Unit employing the new MULLARD ECL86 valve and designed to provide two (or three) way conversation up to extreme distances. Operates from A.C. mains 200 to 250 Volts.

PRICES . . . MASTER UNIT and ONE EXTENSION

KIT OF PARTS **£6.17.6** ASSEMBLED AND TESTED **£8.0.0**

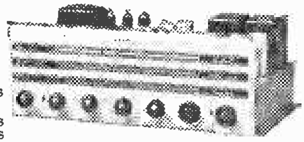
Consists of a MASTER UNIT, size only 8¼ x 5¼ x 6in. and ONE EXTENSION (a second extension may be added to any time). The Master Unit incorporates switching and power supply and with the chassis completely isolated from the mains is operated in absolute safety. Cases covered in quality leatherette.

ARMSTRONG RADIOGRAM CHASSIS

FULL RANGE IN STOCK, please enclose S.A.E. for descriptive leaflets

STEREO 12 (MK. 2)

(Illustrated)



£44.15.0

Deposit £9.0.0, 12 months at £3.5.7

The most complete chassis ever produced, combines AM and FM Tuners, a Stereo Control Unit and two High Fidelity Amplifiers in one compact unit, provide a total of 16 watts for both mono and stereo. Other features include: inputs for tape recording, play back, pick-ups and stereo radio (should this come about); separate wide range bass and treble controls and balance control.

STEREO 55 £33.15.0

Deposit £6.15.0, 12 months at £2.9.6

A junior version of the Stereo 12 Mk. 2 providing ten watts output, five watts from each amplifier and covering the VHF and Medium wavebands.

COMBINED ORDER PRICE REDUCTIONS

(a) The KIT OF PARTS to build both the "5-10" Main Amplifier and the 2-valve PRE-AMP CONTROL UNIT H.P. Dep. £3.7.0 and 12 months at £1.2.9.......... **£15.15.0**

(b) The "5-10" and the 2-stage PRE-AMP both ASSEMBLED and TESTED H.P. Dep. £3.16.0 and 12 months at £1.7.8.......... **£18.18.0**

with PARTRIDGE O/PUT TRANSFORMER £1.6.0 extra

RECORD PLAYERS

The Latest Models are in stock, many at reduced prices.

Send S.A.E. For Illustrated Leaflet.

THE NEW GARRARD "AUTO-SLIM" 4-speed Autochanger with Crystal Pick-up **£8.10.0**

COLLARO "JUNIOR" 4 SPEED SINGLE RECORD PLAYER with separate Crystal Pick-up Carriage and Insurance 5/- **£3.15.0**

Above Pick-up separately for £1.6.6

The NEW COLLARO C60 4-speed Autochanger unit with Studio "O" Pick-up...... **£7.19.6**

The E.M.I. 4-speed Single Record Player with crystal Pick-up **£6.9.6**

B.S.R. MODEL UA14. A 4-speed mixer Autochanger with Crystal Pick-up **£7.10.0**

Available incorporating the B.S.R. STEREO Pick-up, plays L.P. and 78 Records **£8.13.10**

GARRARD MODEL TA/MkII 4-speed Player fitted high output Crystal Pick-up.. **£8.10.0**

GARRARD MODEL RC210. Autochanger 4-speeds. High output. Crystal Pick-up.. **£10.10.0**

Carriage and Insurance on each above 5/- extra.

SPECIAL CASH OFFER

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

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

The Amplifier consists of a 2-stage design incorporating 3 modern B.V.A. valves and has separate BASS and TREBLE CONTROLS.

The Portable Case will also accommodate almost any make of Autochanger and is attractively finished in Mushroom Grey Rexine.

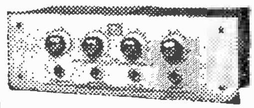
WE ALSO SUPPLY SEPARATELY—

(a) The 2-stage (plus Rectifier) AMPLIFIER **£4.2.6**

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

(c) 6½in. P.M. SPEAKER 18/9. Carriage and Insurance 4/- extra.

MULLARD FOUR CHANNEL MIXER UNIT



Self powered with Cathode follower output. Incorporates Two inputs for MICROPHONES One for CRYSTAL PICK UP and a fourth for RADIO or TAPE

Complete Kit of Parts **£8.8.0**

Assembled and Tested **£10.0.0**

TERMS: Deposit £2 and 12 months at 15/-.

MODEL I.L. one microphone Input matched for moving coil or Ribbon Mike. £1.17.0 extra.

JUBILEE MK. 2 £31.15.0

Deposit £6.7.0 12 months at £2.6.7

A Hi-Fi mono chassis giving eight watts push-pull output and covering VHF, medium and long bands. Tape recording and play back inputs.

AF208 £23.15.0

Deposit £4.15.0 12 months at £1.14.10

An AM/FM chassis providing 5 watts output and covering the full VHF and medium wavebands. Tape recording and playback inputs.

STERN RADIO LTD.

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

Telephone: FLEET STREET 5812/3/4

Stern's "fidelity" TAPE RECORDERS

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

For truly "Hi-Fi" Recordings

EACH MODEL INCORPORATES THE MODEL HF/TR3 MK.II TAPE AMPLIFIER (Described below)

MODEL CR3/S Incorporates the COLLARO "STUDIO" TWIN TRACK 3-speed Deck, operating at 1⅞in., 3¾in. and 7½in. speeds **£39.10.0**
H.P. Terms: Deposit £7.18.0 and 12 months at £2.17.11.

MODEL TR3/Mk.VI Incorporates the New TRUVOX Mk. VI TWIN TRACK 2-speed Tape Deck operating at 3¾in. and 7½in. speeds **£44.0.0**
H.P. Terms: Deposit £8.16.0 & 12 months at £3.4.7.

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

The MODEL HFG/2R PORTABLE TAPE RECORDER

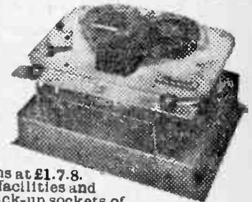
(Original Price £33.0.0)

FOR ONLY 22 gns.

H.P. Dep. £4.14.0. 12 months at £1.13.9. *(Carr. and Ins. 10/- extra).* Incorporates THE LATEST GARRARD "MAGAZINE" TAPE DECK and a HIGH QUALITY AMPLIFIER which is entirely based on the very successful MULLARD TYPE "A" DESIGN and specifically developed to operate the GARRARD DECK. Price INCLUDES SUPPLY OF THE GARRARD TAPE MAGAZINE and 4in. SPOOL of DOUBLE PLAY TAPE. Comprises a Twin Track Recorder operating at 3¾in/sec. speed and providing up to 1 hour 10 mins. playing time. Truly "Portable", weighs only 22 lbs. Outstanding features are excellent performance and simplicity of operation.

THE 'ADD-A-DECK'

Incorporating GARRARD "MAGAZINE" TAPE and the MATCHED MODEL HF/G2P PRE-AMPLIFIER



Supplied on ONE CHASSIS (as illustrated) READY FOR USE **18 Gns.**
(Carr. & Ins. 10/- extra.)
Price includes Garrard Magazine and a 4in. Spool Double Play Tape
H.P. Deposit £3.16.0, and 12 months at £1.7.8.
Provides complete tape recording facilities and designed to operate through the pick-up sockets of the standard type of RADIO RECEIVER, or an AMPLIFIER, from which really first class reproduction is obtained. It consists of a Twin Track Deck connected to the Pre-amplifier and operates at 3¾in/sec. speed providing up to 1 hr. 10 mins. playing time.

ADD "HI-FI" TAPE RECORDING TO YOUR EXISTING AUDIO INSTALLATION WITH

MULLARD TYPE "C" TAPE PRE-AMPLIFIER—ERASE UNIT

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

KIT OF PARTS **£14.0.0** Deposit £2.16.0. 12 mths. at £1.0.6 — OR ASSEMBLED **£17.0.0** Deposit £3.8.0 12 months at £1.4.11
(Excluding power unit £11.15.0 and £14.10.0 respectively.)

"SPECIAL COMBINED ORDER" PRICES

(a) The COLLARO "Studio" Deck with the Model "C" Preamplifier and POWER SUPPLY UNIT ASSEMBLED AND TESTED **£29.10.0**
Deposit £5.18.0. 12 monthly payments of £2.3.3
(b) As above but the TYPE "C" Unit and POWER UNIT supplied as COMPLETE KIT OF PARTS **£26.10.0**
Deposit £5.6.0. 12 monthly payments of £1.18.10
(c) The TRUVOX Mk.VI Deck (incorporating Pause Control and Rev. Counter) with the Model "C" PREAMPLIFIER and POWER UNIT ASSEMBLED AND TESTED **£35.0.0**
Deposit £7.0.0 and 12 months at £2.11.4
(d) As above but the Model "C" PREAMPLIFIER and POWER UNIT supplied as a COMPLETE KIT OF PARTS **£31.10.0**
Deposit £6.6.0. 12 monthly payments of £2.6.2
(e) The BRENELL Mk.V Deck with the Model "C" PREAMPLIFIER and POWER UNIT. ASSEMBLED and TESTED **£46.0.0**
Deposit £9.4.0 and 12 months at £3.7.6
(f) As above but the Model "C" PREAMPLIFIER and POWER UNIT supplied as a COMPLETE KIT OF PARTS **£43.0.0**
Deposit £8.12.0. 12 monthly payments of £3.3.1
(g) The WEARITE MODEL "4" DECK with ASSEMBLED and TESTED Model "C" PRE-AMPLIFIER AND POWER UNIT incorporating WEARITE HEAD LIFT TRANSFORMER, Etc. **£56.0.0**
Deposit £11.4.0 and 12 months at £4.2.1
(Carriage and Insurance on above is 10/- extra.)

BUILD A HIGH FIDELITY TAPE RECORDER

◀ LIKE THIS **for £35.0.0**
Deposit £7.0.0
12 months at £2.11.4

FOR THIS WE SUPPLY

★ Complete Kit of Parts to Build the HF/TR3 Tape Amplifier.
★ The New Collaro "Studio" Tape Deck.
★ Portable Carrying Case (as illustrated).
★ Rola/Celestion 10 x 6in. p.m. Loudspeaker.
★ ACOS Crystal Microphone and 1,200ft. Spool E.M.I. Tape.

Alternatively for those who prefer another make of Tape Deck—we will supply precisely as above—but in place of the Collaro "Studio" Deck. We will include:
The Truvox Mk. VI Deck **£40.10.0**
Deposit £8.2.0, 12 months at £2.19.5.

For Constructors with their own cabinet—WE OFFER—
(a) COMPLETE KIT to build the HF/TR3 Amplifier together with the COLLARO "STUDIO" DECK **£26.0.0**
Deposit £5.4.0. 12 monthly payments of £1.18.2
(b) As above but with the HF/TR3 supplied ASSEMBLED and TESTED **£29.10.0**
Deposit £5.18.0. 12 monthly payments of £2.3.4
(c) COMPLETE KIT to build the HF/TR3 together with the TRUVOX Mk. VI TAPE DECK........ **£31.10.0**
Deposit £6.6.0. 12 monthly payments of £2.6.2
(d) As above but with HF/TR3 supplied ASSEMBLED and TESTED........ **£35.0.0**
Deposit £7.0.0. 12 monthly payments of £2.11.4
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(f) As above but with HF/TR3 supplied. ASSEMBLED and TESTED........ **£45.10.0**
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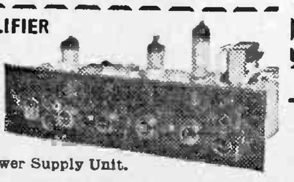
(Carriage and Insurance on each above is 10/- extra.)

HF/TR3 MK.II TAPE AMPLIFIER

(Mullard Type "A" design)
A very high quality Amplifier incorporating 3-speed treble equalisation, by the latest FEROXCUBE POT CORE INDUCTOR. FOR COLLARO-TRUVOX-BRENELL WEARITE Tape Decks, has GILSEN Output Transformer. Includes separate Power Supply Unit.



KIT OF PARTS **£13.13.0** H.P. Deposit £3.8.0 and 12 months at £1.4.11. OR ASSEMBLED **£17**

STERN RADIO LTD.

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OC19	48/-	OC77	10/-
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OC44	11/-	OC78D	8/-
OC45	10/-	OC81	8/-
OC70	6/6	OC84	11/-
OC71	6/6	OC170	13/6
OC72	8/-	OC171	14/6
OC72pr	16/-	OC201	12/6
OC73	16/-	OC202	36/-
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A SPECIAL OFFER OF SIX MULLARD TRANSISTORS

1 OC44, 2 OC45, 1 OC81D, 2 OC81. Only 37/6 set.

EDISWAN TRANSISTORS

XA104 12/-, XA103 10/-, XB102 6/6 ea.

RECORDING TAPE

Special Offer of Top quality recording tape, 3¼in. spool 200ft, 5/3, 5in. spool 600ft, 13/9, 5¾in. spool 850ft, 18/6, 7in. spool 1200ft, 23/-. Extra-play tape, 3¼in. spool 300ft, 7/-, 5in. spool 900ft. 21/-, 5¾in. spool 1275ft, 26/6, 7in. spool 1800ft, 37/6. Empty spools, 3¼in., 1/6, 5in., 2/-, 7in., 3/-.

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RM1 5/3, RM2 6/9, RM3 7/6, RM4 13/6, RM5 19/6, 14A86 19/6, 14A97 19/6, 14A100 19/6, LW7 17/6, 18RA 1-1-16-1 6/-, FC31 (14RA 1-2-8-3) 22/6, FC101 (14RA 1-2-8-2) 16/6.

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High Resistance Phones, 4,000 ohms, 13/6 pair.

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All brand new

2½in. square EMI 18/6
4in. square Elac Tweeter 12/6
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12in. round Plessey 29/6
6in. x 4in. Plessey 19/6
7in. x 4in. Plessey 19/6
8in. x 5in. Celestion 19/11
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STENTORIAN HF 1012

10in. die-cast unit, incorporating 12,000 gauss magnet. Handling capacity, 10 watts. Frequency response, 30 c.p.s.-14,000 c.p.s. Bass resonance, 35 c.p.s.

Total price, £5.2.6

MARTIN RECORDAKIT

Model C for Collaro Studio Deck. Amplifier 8311/V assembled and tested with 5 BVA valves, controls, switches, transformers, knobs and full instructions. £11.11.0.

Smart 2 tone leatherette covered wooden case and 9 x 5in. high quality loudspeaker, type C6659/V. £5.5.0.

Circuit diagram, full instructions, shopping list, etc., 3/6 ea.

Collaro Studio Deck, £12.12.0.

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★ **UA14**
Four speed motor. Magidisc selector enabling 7, 10 and 12in. records to be selected automatically. "Flu-Fi" turnover crystal cartridge. Attractively styled in cream and grey. Suitable for A.C. mains, 100/125 v. 50 cycles. Unit plate. £6.19.6

★ **Garrard Autoslim**
The latest 4-speed automatic Record Changer from Garrard-Autoslim, £9.0.0.

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★ **EMI 985**
4-speed Turntable Unit complete with Pickup. An extremely reliable and inexpensive Unit suitable for Record Players and Radiograms; a heavy 86in. dia. Metal Turntable with low flutter performance, 5-position switch, 4 speeds and off, ivory finish with red T/T mat. 89/6.

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4-speed single player. Diecast aluminium pick-up with GC2 cartridge. Automatic stop. 9½in. dia. turntable. £8.10.4

All components for the 'Practical Wireless' Blue Prints—"Mini-Amp", "Tutor", "The Citizen", available from stock. Please send stamped addressed envelope for detailed price lists.

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D.C. or A.C. Resistance ohm: 10K ohms. Will also measure decibels.
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A new version in a re-designed cabinet with carrying strap, complete kit of parts, £7.19.6. Detailed price list available on request.

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A 2-band 6-Transistor Superhet for long and medium waves, 2-colour case, 10 x 7½ x 3¼ins. £10.19.6. Send for comprehensive manual and parts list, 3/6.

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TERMS: Cash with Order or C.O.D. Postage and Packing Charges extra. Single valves 9d., Minimum Parcel Post charges 2/-. Please include sufficient postage with your order. Minimum C.O.D. fees and postage 3/6. These Postal Rates apply to U.K. only. For full terms of business see inside cover of catalogue. Personal Shoppers 9 a.m. to 5 p.m. Mon. to Friday, Saturday 10 a.m. to 1 p.m.

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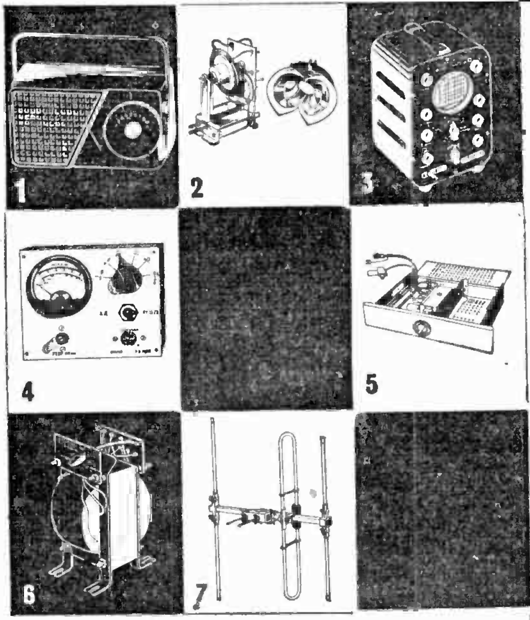

1. 3-TRANSISTOR POCKET RADIO with MINIATURE SPEAKER, FERRITE ROD, and 2 GERMANIUM DIODES. The only 3 transistor radio available at the price. Build it in 1 evening! Tunable over M/L waves. Complete with easy-to-follow instructions and all components (less batteries obtainable anywhere 1/3). 27/6. P. & P. 2/6. (All parts available separately.)
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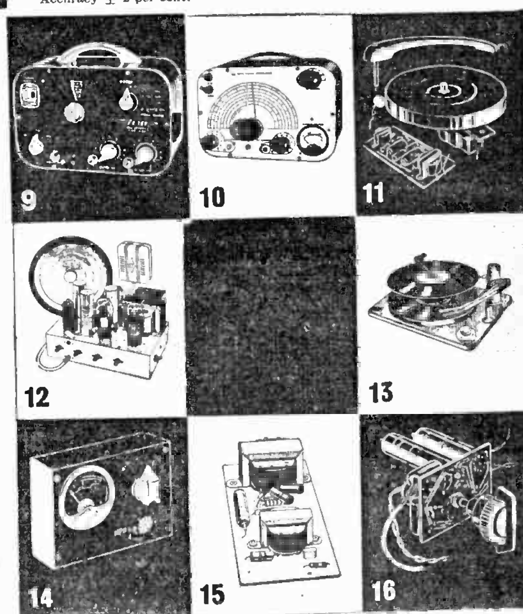
7. WOLSEY 3-ELEMENT FOLDED DIPOLE. I.T.V. Aerial less mounting bracket for external use, complete with 12 yds. of coaxial cable, 15/-, P. & P. 4/-.
9. SIGNAL GENERATORS. Cash £6.19.6 or 25/- deposit and 6 monthly payments of 21/6. P. & P. 5/6. Coverage 100 kc/s to 100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Case 10 x 6½ x 5¼in. Three miniature valves and Metal Rectifier. A.C. mains 200/250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent. Modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch, variable A.F. output. Magic eye as output indicator. Accuracy ± 2 per cent.



10. SIGNAL GENERATORS. Cash £4.19.6. P. & P. 5/6. Coverage 120 kc/s to 84 Mc/s. Case 10 x 6½ x 4½in. Size of scale 6½ x 3½in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent, modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch variable A.F. output and moving coil output meter. Accuracy ± 2 per cent.

11. BATTERY RECORD PLAYER AND AMPLIFIER. 45 r.p.m. "Star" motor "Acos" crystal pick-up, 3 transistor push-pull amplifier complete with transistors. Output 500 milliwatts, 49/6. P. & P. 4/-.

12. 8-watt PUSH-PULL 5 VALVE AMPLIFIER. A.C. mains 200-250 v. Size 10½ x 6½ x 2½in. 5 valves. For use with all makes and type of pick-up and mike. Negative feed back. Two inputs, make and gram. and controls for same. Separate controls for Bass and Treble lift. Response flat from 40 cycles to 15 kc/s. ± 2 db; 4 db down to 20 kc/s. Output 8 watts at 5 per cent total distortion. Noise level 40 db down all hum. Output transformer tapped for 3 and 15 ohms speech coils. For use with Std. or L.P. records, musical instruments such as guitars, etc. Suitable for small halls, £3.19.6 P. & P. 6/-. Crystal mike to suit 15/-, P. & P. 2/-. 8in. P.M. Speaker to suit 12/6, P. & P. 2/-.

13. B.S.R. MONARCH UA8 WITH FUL-FI HEAD. 4-speed, plays 10 records 12in., 10in., or 7in. at 16, 33, 45 or 78 r.p.m. Intermixes 7in., 10in. and 12in. records of the same speed. Has manual play position: colour, brown Dimensions: 12½ x 10½in. Space required above baseboard 4½in. below baseboard 2½in. Fitted with Ful-Fi turnover crystal head. £6.19.6, P. & P. 5/6 With Stereo Head £7.19.6. P. & P. 5/6.

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16. PORTABLE AMPLIFIER. On printed circuit for A.C. Mains 200/250 v: Size 4 x 3in. with tone and volume control. Complete with Valves. ECL82 and EZ80. Output 2 watts. 39/6, P. & P. 3/-.

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

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

ALL ENQUIRIES S.A.E.
GOODS NOT DISPATCHED OUTSIDE U.K.

A 6-TRANSISTOR RADIO FOR ONLY £7.19.6

The "Leeco"—a compact pocket portable. Carefully designed and precision built to give sharp station selection and good fidelity. Size only 4¾" x 2¾" x 1¼". Built-in Aerial, 6 transistors plus 1 diode and thermistor. 2½" P.M. Speaker and socket for earphone. Supplied complete with 9V. battery in attractive presentation box. Optional extras: Miniature earphone 6/6. Plastic cover 2/6. P. & P. 2/6.

CF-221 HETERODYNE CRYSTAL CONTROLLED FREQUENCY METERS

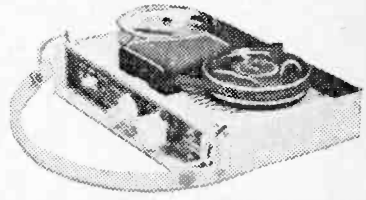
Frequency range: 125 Kc/s to 20 Mc/s. Calibration. Individual Calibration Books and numerous Crystal Check Points. Accuracy: 0.01% or 25 cycles. Power supplies: 6 v. and 135 v. batteries. Size 14 x 10½ x 9½in. Weight 43 lbs.

Offered at the ridiculous price of only **£16** CARR. PAID.

ANOTHER RELDA SPECIAL!

PORTABLE TAPE RECORDERS

Weight only 2½lbs. Operated by standard dry batteries. These beautiful machines are supplied complete with earphone for monitoring or playback, ultra sensitive microphone and ready for immediate use. S.A.E. for further details.



ONLY **£11.19.6**

P. & P. 3/6.

SF-20 RADIO HEADPHONES

Hi-impedance-2,000 ohms-general use headset. Black and ivory plastic cased electro-magnetic units with adjustable headband for comfortable fit. Individual listening for all types of applications. Individually packed, with flexible cord attached. 14/6. post paid.

ONLY **60/-** Per Set P. & P. 4/-

PORTABLE TRANS/RECEIVER SETS

Consisting of trans/receiver covering 7.4-9 Mc/s range up to 10 miles, complete with 5 valves headphones, microphone, junction box and 6ft. telescopic aerial. Only requires 120 v. and 3 v. dry battery.

TWO FOR £6. Post Free.

BATTERIES 20/- per set.

ALL TRANSISTOR 2-STATION INTERCOM & BABY ALARM

MODEL TI. 302

10 Gns. Complete with battery and 60ft. of wire.

An intercom system for both calling and conversing, operated from a single battery. Ideal Baby Alarm. Brief spec: 3 transistors, 200 mW output. 2½in. speakers etc., etc. S.A.E. for further details.

TRANSISTOR SET "MUST"! TUBULAR BAFFLE EXTENSION SPEAKER MODEL ST.30

Designed for use with transistor radios etc. Complete with 12ft. extension cord, fitted with miniature plugs. Size 9½in. x 3½in. dia. As fully described January issue. ONLY 57/6. P. & P. 2/6.

12v. VIBRATOR PACK. (Supply Unit No. 9.) As used with P.C.R. Receivers giving 250 v. output at 80 mA. Fully smoothed. Size 10 x 8 x 6in. ONLY 25/- Each. P. & P. 5/-.

INSTANT VALVE FILAMENT TESTER, MODEL VT-41.

Pocket-size, battery operated.

Gives Instant Check of: All radio valves;* All TV valves;* All TV and Radio fuses; Circuit continuity; All Pilot lamps. Has built-in miniature 7- and 9-pin valve straighteners and battery test.

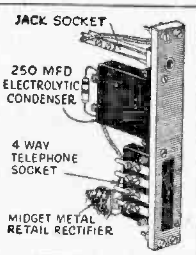
*International Octal, B.8, B.9, B.7. Battery and Mains types.

Beautifully styled—precision made. Supplied complete. Fully guaranteed.

ONLY 30/-. Post Paid.

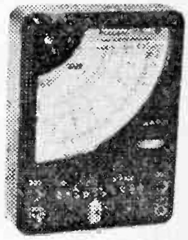
19 SET Mk. III POWER SUPPLY. With 2 dynamotors. H.T.31. 12 v. input, 250 v. output at 125 mA. H.T.32. 12 v. input, 490 v. output at 60 mA. DON'T MISS THIS BUY! ONLY 25/-. P. & P. 5/-.

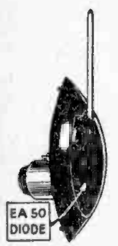
OPERATORS UNIT. Fantastic Bargain, exceptional offer! As illustrated. 3/6. POST PAID.



EP.10K MULTI-METER

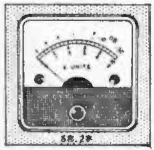
10,000 O.P.V. on BOTH A.C. and D.C.
Ranges: D.C. Voltage: 0-6-30-120-600-1,200 v. (10,000 o.p.v.).
A.C. Voltage: 0-6-30-120-600-1,200 v. (10,000 o.p.v.).
D.C. Current: 0-120μA, 0-12-300 mA.
Resistance: 0-20K, 0-2 Meg. (150 ohm, 15K at centre scale).
Capacitance: 0.005 to 0.15μF (at A.C. 6 v.).
Decibels:—20 to ±63db (600 ohms 1 mW., odbm = 0.775 v.).
Accuracy: D.C. voltage and current ±2% f.s. A.C. Voltage ± 4% f.s. Resistance ±3% of total scale length.
Size: 4½in. x 3½in. x 1in. Complete with test leads, battery and instructions.
ONLY **£5.19.6.** Post Paid.





"BOAT SHAPE" AERIALS. Ideal model control aerial. Complete with 3-pin connector and EA50 diode. Must be tried at 2/6 EACH P. & P. 1/-.

MINIATURE CLEAR PLASTIC PANEL METERS



"S" METER MODEL SR. 2P. Standard "Ham" Signal strength indicator. Calibrated in "S" units from 0-8 with scale terminating in + 10 to + 30 db calibrations. Additional full scale calibrations of 0-5 + 0-10 in linear scale divisions. A "must" for radio amateurs for conversion of any Communication Receivers with A.V.C. action to give calibrated signal strength action. 35/-.

VU METER MODEL VR. 1P. Calibrated and damped in accordance with standard VU Meter Practice. Upper scale reads—20 to +3VU. Lower scale 0-100% modulation. Uses precision carbon film multiplier resistor and full wave rectifier. 42/6.

DC MICROAMMETERS Model MR.25 0 to 50 uA. 39/6
Model MR.250 0 to 500 uA. 32/6
DC MILLIAMMETER Model MR.21 0 to 1mA 27/6
All models individually Boxed and Fully Guaranteed. P. & P. 2/6 each.

PORTABLE MAINS SOLDERING IRON MODEL SPI

30 watts. Designed on an entirely new principle for lightweight applications. Highly stable heat characteristics ensure long life and safety in use. The Model SPI features a removable handle that may be used to cover the tip and barrel to permit the iron to be carried safely even while hot. Supplied complete with Vinyl bag, mains lead and plug. All for only 18/9.

V.H.F. MOBILE AERIAL and base, with PYE connections, 27in. overall, as used by Taxis, Police, etc., 7/6.

U.S.A. WHIP AERIALS 12ft. 10/-.

COMPLETE HEADPHONE and MICROPHONE ASSEMBLY 10/-. P. & P. 3/6.

MAIL ORDERS TO
(DEPT. P.), 32a COPTIC STREET, LONDON, W.C.1

Relda Radio Ltd

CALLERS WELCOME AT
87 TOTTENHAM COURT ROAD, LONDON, W.1 MUS 9606

RELDA OFFERS THE GREATEST VALUE IN MINIATURE COMPONENTS FOR THE 'KIT FAN'

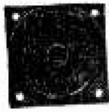
MAINS 3 AMP. DP/DT TOGGLE SWITCH with on/off plate. 4/- each.

LAPEL MICROPHONE M178

Precision engineered Crystal Microphone—for lapel or hand use. Only 1½in. diameter. Exceptionally sensitive. Chrome plated case and clip includes 5ft. shielded cable. Only 17/6.

TRANSISTOR SPECIAL! 5K. EDGEWISE MINIATURE VOLUME CONTROL MODEL K2. 16. with switch and ivory knob. As used in all miniature transistor radios. 4/6 each.

P217A. MINIATURE 2½in. SPEAKER.



A miniature Hi-Fi speaker that outperformsallothers. Designed to meet today's requirements for transistor, miniature and sub-miniature applications. Size 2½in. sq. x 1in. deep. Voice coil impedance: 8 ohms. Freq. range: 150-5000 c/s. Power: 200mW. 16/6.

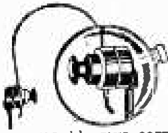
No. 7 MOVING COIL MICROPHONE INSERTS. Ultra sensitive. As used in many Govt. Microphones! Size 1½in. dia. x 1¼" deep. Brand new and guaranteed. 6/6 each.

HOOVER ROTARY TRANSFORMERS

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

Only 10/6 each. P. & P. 2/-.

HI-FI HEADPHONES



These miniature Hi-Fi phones use high quality permanent magnetic speakers with regulated voice coil. The soft rubber ear moulds give correct spacing for optimum acoustic load. Each unit has a built-in miniature Hi-Fi transformer to ensure the finest music and voice reproduction. Supplied free is a small transformer unit which steps impedance up to 4000 ohms. Only 15/-. P. & P. 2/6.

JUST ARRIVED!

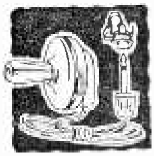
9V. BATTERY CHARGER & A.C. ELIMINATOR MODEL LA.6P

A "MUST" for every transistor set owner!

Save those batteries during the winter by running your transistor set direct from A.C. Mains. Reactivate all your old 9V batteries.

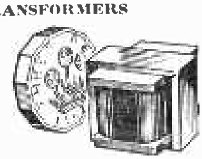
Unit contains neon indicator and standard battery connections with nearly 2 yards of mains lead and plug. Also snap cord for connection to set.
LIMITED QUANTITY OFFERED FOR THE FIRST TIME IN THIS COUNTRY! **29/6** P. & P. 1/6

MINIATURE EARPHONE



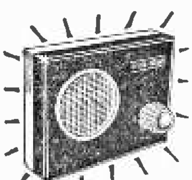
A really sensitive dynamic earphone of exceptionally fine quality. Provides clear reproduction of music as well as speech. Fully Guaranteed and complete with transparent ear insert, 3 feet cord, sub-miniature plug and socket.
CR-5 High imp. crystal
MR-4 Low imp. magnetic **8/-** Each Post 1/-

SUB-MINIATURE TRANSFORMERS



Here is outstanding value in transistor transformers consisting of one Driver Transformer and one Output Transformer. Ideal pair for miniature transistor portables, etc.
Driver Model LT44: Primary: 20k. Secondary: 1k. Centre Tapped. Ratio: 5 : 1.
Output Model LT700: Primary: 1.2k. Centre Tapped. Output: 3.2 ohms. Ratio: 2 : 1. Complete with detailed instructions. Only 9/6 per pair. P. & P. 1/6.

SUPER TRANSISTOR RADIO With Miniature Speaker.



Simple instructions enable anyone to build this miniature radio. Gives reception over the entire broadcast band. Each kit is supplied with all latest miniature parts including:
★ two transistors ★ ferrite rod ★ speaker ★ coloured plastic case ★ step by step illustrated instructions. Size 4 x 3 x 1in.
ONLY **27/6** P. & P. 1/6. Battery 1/- ex.

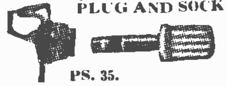
★ Made available owing to public demand! ★

CRYSTAL MICROPHONE INSERTS MODEL MC.1.

Precision disc type crystal microphone cartridge. Output:—53dB, Response: 100—6,000 c.p.s. PRICE 6/6.

MINIATURE DP/DT SLIDE WAVE-CHANGE SWITCH 2/6 each.

SUB-MINIATURE PLUG AND SOCKET



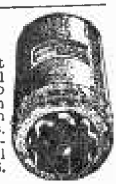
PS. 35.

Two-way bakelite barrel Jack plug only 1in. long. Socket only ¾in. long. 3/6 per pair. Post paid.

CH.305 CHROME MINIATURE PLUGS AND SOCKETS
Size: plug barrel 1", socket ¾". These will give your equipment that expert finish! 3/6 Per Set.

SLIM RADIO PLUGS AND SOCKETS
Two-way, black bakelite, solder terminal PLUG and STURDY standard SOCKET. 5/6 per pair. Post Paid. Panel mounting, neat finish.

AERIAL VARIOMETERS

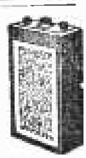


These magnificent instruments will enable you to receive maximum signal strength on all S.W. receivers. Precision, calibrated control 12/6. P. & P. 2/6.

SPARE VALVE KIT

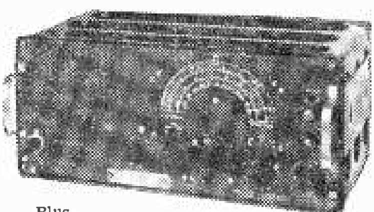
Here's a gift for all 38 and 18 Set owners! Case containing 4 ARP12 & 1 ATP4 valves. Only 10/- P. & P. 2/6.

ACCUMULATORS.



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

PYE COMMUNICATION RECEIVERS



World coverage on these famous Communication Receivers. They are the simplest type to use yet bring in stations that will amaze you. The ideal domestic receiver for medium wave during the day with Amateur stations at night. **All have been converted to 230 v. A.C. mains and are guaranteed to work immediately.** Incorporate Wave Switch. Audio gain aerial trimmer, high and low tone control, station locking device, aerial and earth inputs, speaker output sockets, etc. Size 17 x 8 x 9½in. Black crackle finish front panel. On demonstration at 87 Tottenham Court Road.

P.C.R.2. Medium and long waves and 6-23 Mc/s. Less speaker.
P.C.R. Medium and long waves and 6-18 Mc/s. With speaker.
(All the above P.C.R. Receivers Have been completely reconditioned).

ONLY £8.19.6 EACH TYPE

Plus Carriage 10/6 ★ Order Early!

MAIL ORDERS TO
(DEPT. P.) 32a COPTIC STREET, LONDON, W.C.1

Relda Radio Ltd

CALLERS WELCOME AT
87 TOTTENHAM COURT ROAD, LONDON, W.1 MUS 9606

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

REALISM AT INCREDIBLY LOW COST, CAN BE ASSEMBLED IN HALF AN HOUR
The Recorder incorporates the Latest Collaro Studio Tape Transcriptor. The Linear LT45X High Quality Tape Amplifier listed £12.12.0 High Flux P.M. Speaker listed 30/-, empty Tape Spool, a Reel of Best quality Tape listed 22/6, and a Handsome Portable carrying Cabinet with latest attractive two-tone polychrome finish, size 18 x 13 x 9in. high, listed £4.10.0, and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£80 class. S.A.E. for leaflet.

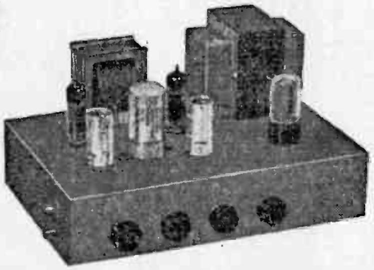
25½ GNS.

Carr. 17/6

H.P. TERMS. Deposit £5.7.6 and 12 monthly payments of 2 gns. Cash price if settled in 3 months.

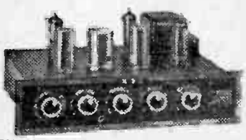
HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

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



Two input sockets with associated controls allow mixing of "mike" and gram. as in A10. High sensitivity. Includes 5 valves, ECC83, ECC83, EL84, EL84, 5Y3. High Quality sectionally wound output transformer specially designed for Ultra Linear operation and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut". Frequency response +3 D.B. 30-30,000 c/cs. Six negative feedback loops. Hum level 60 D.B. down. ONLY 23 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs. For **STANDARD or LONG PLAYING RECORDS** For **MUSICAL INSTRUMENTS** such as **STRING BASS, GUITARS, etc. OUTPUT SOCKET** with plug provides 300 v. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12-9-7in. For A.C. mains 200-250 v. 50 c.p.s. Output for 3 and 15 ohms speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Only **8 Gns.** Carr. 10/-
(Or factory built 51/- extra).
If required louvred metal cover with 2 carrying handles can be supplied for 18/9. **TERMS ON ASSEMBLED UNITS. DEPOSIT 24/9, and 9 monthly payments of 24/9.** Send S.A.E. for illustrated leaflet detailing Ready-to-assemble Cabinets. Speakers. Microphones, etc., with cash and credit terms.

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



A complete set of parts for the construction of a stereophonic amplifier giving 5 watts high quality output on each channel (total 10 watts). Sensitivity is 50 millivolts, suitable for all crystal stereo heads. Ganged Bass and Treble Control give equal variation of "lift" and "cut". Provision is made for use as straight (monaural) 10 watt amplifier. Valve line-up ECC83, ECC83, EL84, EZ81. Outputs for 2-3 ohm speakers. Point-to-Point wiring diagrams and instructions supplied. Send S.A.E. for leaflet. **8 Gns.** Full constructional details and price list 2/6. Carr. 10/-.
Kit can be supplied assembled, ready for use, for 59/6 extra.

TELEVISION RECTIFIERS 250 v. 200 mA. small size. Only 6/9 each.

COLLARO CONQUEST 4-SPEED AUTO-CHANGER, with high fidelity Studio pick-up. Latest model. For 200-250 v. 50 c.p.s. A.C. mains. Our price **£6.19.6.** Carr. 5/6.

COLLARO RC 457 4 SPEED MIXER AUTO-CHANGERS. Turnover Studio Pick-up head, for 200-250 v. A.C. **£7.19.6.** Carr. 4/6.

THE SKYFOUR T.R.F. RECEIVER. A design of a 3 valve long and medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.F. stage and low distortion detector. Valve line-up 6K7, SP61, 6V6G. Selectivity and quality excellent. Simple to construct. Point-to-Point wiring diagrams, instructions and parts list, **1/9,** maximum building costs **£4.19.6,** inc. attractive Walnut veneered wood cabinet 12 x 6½ x 5½in.

GL3A MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with any single or auto-change unit. Output for 2-3 ohm speaker. For 200-250 v. A.C. mains. Size 11½ x 2½ x 2½in. Controls: Vol. and Tone with switch. Only **59/6.**

R.S.C. BATTERY CHARGING EQUIPMENT

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

HEAVY DUTY CHARGER KIT 6/12 v. 6 amps. variable output. Consisting of Mains Transformer 0-200-230-250 v.: F.W. (Bridge) Selenium Rectifier: Ammeter, Variable Charge Rate Selector Panels, Plugs, Fuses, Fuseholder and circuit, **59/6.** Carr. 4/6.

DEAF AID EARPIECES. Low Impedance with lead, **8/9.** High Impedance Crystal **8/9.**

MICROPHONE INSERTS. Crystal type **6/9.**

SOLDERING IRONS. 230-250 v. 30 watts. First quality. For Radio work, **19/9.** Spare elements and bits available.

Assembled 6/12v. 4-5 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 finished. Fused and ready for use with mains and output leads. **69/9** Carr. 5/- Terms: Deposit **13/3** and 5 monthly payments 13/3. 6/12 v. 3-4a., all facilities as above. **59/9,** carr. 3/9.

ASSEMBLED CHARGERS
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 **49/9** Carr. 3/9

BATTERY CHARGER KITS
Consisting of Mains Transformer. F.W. Bridge, Metal Rectifier, well ventilated steel case. Fuses. Fuse-holders, Grommets, panels and circuit. Carr. 3/6 extra.
6v. or 12v. 1 amp.......... 24/9
As above, with Ammeters 32/9
6 v. 2 amps.............. 25/9
6v. or 12v. 2 amps......... 31/6
6 v. or 12 v. 2 amps. inclusive of Ammeter........ 42/9
6 v. or 12 v. 4 amps......... 49/9
6 v. or 12 v. 4 amps. with Ammeter and variable charge rate selector 59/9

CHARGER AMMETERS. 0-.15 a., 0-3 a., 0-4 a., 0-7 a., 0-25 a., 0-60 a. 8/9.

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

Interleaved and Impregnated. Primaries 200-230-250 v. 50 c/s. Screened
TOP SHROUDED DROP THROUGH
250-0-250 v. 70 mA, 6.3 v. 2 a, 5 v. 2 a.. 17/9
350-0-350 v. 80 mA, 6.3 v. 2 a, 5 v. 2a.. 18/9
250-0-250 v. 100 mA, 6.3 v. 2 a, 6.3 v, 1 a 21/9
250-0-250 v. 100 mA, 6.3 v. 3.5 a, C.T. .. 19/9
250-0-250 v. 100 mA, 6.3 y. 4 a, 5 v. 3 a.. 25/9
300-0-300 v. 130 mA, 6.3 v. 4 a, 6.3 v. 1 a, for Mullard 510 Amplifier 29/9
300-0-300 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a.. 26/9
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a.. 26/9
350-0-350 v. 100 mA, 6.3 v. 4 v. 4 a, C.T. 0-4-5 v. 3 a.. .. .. 26/9
350-0-350 v. 150 mA, 6.3 v. 4 a, 5 v. 3 a.. 29/9

FULLY SHROUDED UPRIGHT
250-250 v. 60 mA, 6.3 v. 2 a, 5 v. 2 a, Midget type 2½-3-3in. 17/11
250-0-250 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a.. 27/9
300-0-300 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a 27/11
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a 27/11
350-0-350 v. 150 mA, 6.3 v. 4 a, 5 v. 3 a.. 35/9
425-0-425 v. 200 mA, 6.3 v. 4 a, C.T. 6.3 v. 4 a, C.T., 5 v. 3 a 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. 1.5 a twice, 17/6.

OUTPUT TRANSFORMERS
Midget Battery Pentode 66:1 for 3S4, etc. 3/9
Small Pentode, 5000 ohms to 3Ω .. 3/9
Small Pentode 7/8.000Ω to 3 3 .. 3/9
Standard Pentode 5,000Ω to Ω Ω .. 5/9
Standard Pentode 7/8,000 to 3Ω .. 5/9
10,000Ω to 3Ω 5/9
Push-Pull 8 watts, EL84, or 6V6 to 3 ohms or matched to 15 ohms .. 9/9
Push-Pull 10-12 watts to match 6V6 or EL84 to 3-5-8 or 15 ohms 19/9
Following types for 3 and 15Ω speakers:
Push-Pull 10-12 watts 6V6 or EL84 .. 18/9
Push-Pull 15-18 watts, 6L6, KT66 .. 22/9
Push-Pull for Mullard 510 Ultra Linear 29/9
Push-Pull 20 watts, sectionally wound, 6L6, KT66, 807, etc. 49/9

MIDGET MAINS
Primaries 200-250 v. 50 c/s.
250 v. 60 mA, 6.3 v. 2 a 11/9
250-0-250 v. 60 mA, 6.3 v. 2 a. 12/9
Both above size 2½ x 2½ x 2½ins.

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

PARMEKO POTTED TYPES
200 mA, 12 H 100 ohms 16/9
120 mA, 30 H 200 ohms 16/9
120 mA, 8 H 50 ohms 13/9

CHARGER TRANSFORMERS
All with 200-230-250 v. 50 c/s Primaries: 0-9-15 v. 1½ a. 11/9; 0-9-15 v. 2 a, 14/9; 0-9-15 v. 3 a, 16/9; 0-9-15 v. 5 a, 19/9; 0-9-15 v. 6 a, 23/9; 0-9-15 v. 8 a, 28/9.

AUTO (Step up/Step down) TRANS. 0-110/120-230/250 v. 50-80 watts, 13/9; 150 watts, 27/9. 250 watts, 39/9

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

R.S.C. (Manchester) Ltd. HULL, LIVERPOOL, LEEDS, BRADFORD, MANCHESTER

R.S.C. A12 STEREOPHONIC AMPLIFIER KIT WITH TWIN SPEAKERS

A complete set of parts to construct a good quality Stereo amplifier with an undistorted output total 6 watts. For A.C. mains input of 200-250 v. Outputs for matched 2-3 ohm speakers. Sensitivity 130 m.v. Ganged Vol. and Tone Controls. Preset balance control. Full instructions and point-to-point wiring diagrams supplied.

4 Gns. Carr. and pkg. 5/-

STEREO EQUIPMENT OFFER- Comprising A12 Kit, 2 matched 8in. L/Speakers, and Acos T/O Stereo head suitable most pickups. **£6.19.6** Carr. 7/6.

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

ACOS CRYSTAL MICROPHONES. Mic40 stand or desk. Listed 35/-. Only 27/9. 39-1 Stick type. Listed 3 gns. Only 39/6.

R.S.C. 10 WATT ULTRA LINEAR HIGH FIDELITY AMPLIFIER A10

A highly sensitive Push-Pull high output unit with self-contained Pre-amp. Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 db. down. Frequency response ±3 db. 30-30,000 c/s. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used EF86, EF86, ECC83, 807, 807, GZ33. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 millivolts so that **ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE.** The unit is designed for **CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS,** etc. For use with Electronic **ORGAN, GUITAR, STRING BASS** etc. For standard or long-playing records. **OUTPUT SOCKET PROVIDES** L.T. and H.T. for a **RADIO FEEDER UNIT** An extra input with associated vol. control is provided so that two separate inputs such as Gram. and 'Mike' can be mixed. Amplifier operates on 200-250 v. 50 c/cs. A.C. Mains and has output for 3 and 15 ohm speakers. Complete kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required perforated cover with carrying handles can be supplied for 19/9. The amplifier can be supplied, factory built with EL34 output valves and 12 months guarantee, for 14 Gns.

11 Gns. Carr. 10/-

TERMS: DEPOSIT 33/9 and 9 monthly payments of 33/9.
Suitable microphones and speakers available at competitive prices.

FULL RANGE OF LINEAR AMPLIFIERS ALWAYS IN STOCK.

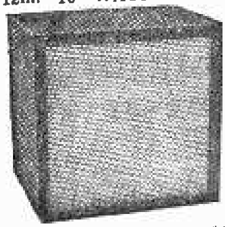
COLLARO JUNIOR 4-speed single player units and Hi-Fi crystal pick-up with turn-over head, £3.19.6.

B.S.R. UA8 4-SPEED AUTO-CHANGERS with Hi-fi turnover pick-up head, £6.19.6. Carr. 5/-.

Jason FMT1 V.H.F/FM Radio Tuner design. Total cost of parts including valves, Tuning dial, Escutcheon, etc. £6.19.6.

LINEAR L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER. Suitable for use with any record playing unit, and most microphones. Negative feed-back 12db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c/cs. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 7-5-5½in. high. Guarant'd for 12 months. Only £5.19.6. Send S.A.E. for illustrated leaflet. Terms: Deposit 22/6 and 5 monthly payments of 22/6.

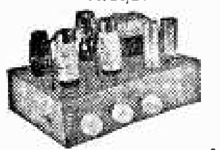
12in. 10 WATT HIGH QUALITY LOUD-SPEAKER IN POLISHED WALNUT FINISHED CABINET



Gauss 12,000 lines. Speech coil 3 ohms or 15 ohms. Only £4.19.6 Carr. 5/-. Terms: Deposit 11/3 and 8 monthly payments of 11/3.

12in. 20 WATT HI-FI LOUD-SPEAKERS IN CABINETS. Size 18 x 18 x 10in. Finish as above. Terms: Deposit 17/9 and 9 monthly payments of 17/9. Only £7.19.6. Carr. 8/6.

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



A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest high fidelity pick-up heads, in addition to all other types of pick-ups and practically all 'mikes'. Separate Bass and Treble Controls are provided. These give full long-playing record equalisation. Hum level is negligible being 71db. down 15db. of Negative feedback is used. H.T. or 300 v. 25 mA. and L.T. or 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape-Deck pre-amplifier. For A.C. mains input of 200-230-250 v. 50 c/s. Output for 2-3 ohm speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with Blue hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £4.15.0. or assembled ready for use 25/- extra. plus 3/6 carr.; or Deposit 22/6 and 5 monthly payments of 22/6 for assembled unit.

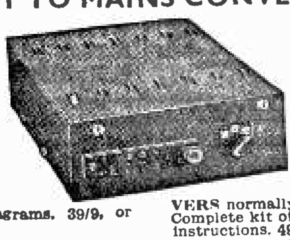
R.S.C. PORTABLE GUITAR AMPLIFIERS. (For 200-250v. A.C. Mains) **Junior 5 watts High Quality output.** Separate Bass and Treble "Cut" and "Boost" controls. Sensitivity 15 m.v.. Twin inputs. High Flux 8in. Loudspeaker "built-in". Handsome, strongly made Cabinet (size approx. 14 x 14 x 7in.) finished in attractive and durable policrome, and fitted carrying handle. Terms, Deposit £1 and 9 monthly payments of £1. **£8.19.6** Carr. 10/-

Senior 10 watts High Fidelity output Separate Bass and Treble "Cut" and "Boost" controls. Twin separately controlled high gain inputs so that two instruments such as Guitar and String Bass can be used at the same time. Two loudspeakers are incorporated, a high Flux 12in. for Bass notes and a 7 x 4 in. elliptical for Treble. Cabinet is well made and finished as Junior model. Size approx. 18 x 18 x 9in. **15 Gns.** H.P. Terms. Deposit 34/9 and 9 monthly payments of 34/9. Carr. 10/-
Super Hi-Fi 15 Watt. All facilities as 10 watt. Cabinet size 18 x 18 x 10ins. Terms: Deposit £2.11.6, and nine monthly payments of 51/6. Cash 22 gns. Carr. 12/6.

R.S.C. BASS REFLEX CABINETS, JUNIOR MODEL. Specially designed for W.B. HF1012 Speaker, but suitable for any good quality 10in. speaker. Acoustically lined and ported. Polished walnut veneer finish. Size 18 x 12 x 10in. Handsome appearance. Ensure superb reproduction for only £3.19.6.
STANDARD MODEL. As above but for 12in. speakers. Size 20 x 15 x 13in. Especially recommended for Plessey Dual Concentric Speaker, £5.19.6. Suitable legs with brass ferrules, 25/- per set of 4.
PLESSEY DUAL CONCENTRIC 12in. 15 ohms HIGH FIDELITY SPEAKER (12,000 lines) with built-in tweeter (completely separate elliptical speaker with choke, condensers, etc.) providing extra-ordinarily realistic reproduction when used with our A11 or similar amplifier. Rated 10 watts. Price only £5.19.6.
P.M. SPEAKERS. 2-3 ohm. 2½in. Perdio 21/9. 5in.. 17/9. 6½in.. 16/9. 8in.. 19/9. 8 x 5in. 25/9. 10in. 26/9. 10 x 6in. 29/9. 12in. 29/11. 10in. W.B. "Stentorian" 3 or 15 ohms type HF1012 10 watts. hi-fidelity type. Recommended for use with our A11 Amplifier. £4.12.9. 12in. R.A. 3 ohms 10 watts (12,000 lines). 59/6.
TWEETERS. Plessey 3Ω 19/9, 15Ω 25/9.
HI-FI CRYSTAL PICK-UP HEADS. (Turnover type with sapphire stylus.) Acos. Standard replacement for Garrard B.S.R. and Collaro. 19/9. Acos. Stereo-Monaural 49/9. Ronette Stereo/Monaural 59/6.
R.S.C. EQUIPMENT CABINET. Dimensions and outer appearance identical with Standard Bass Reflex Cabinet. Top hinged. Bass board adjustable. Will take Tape Deck or Player Unit, and Amplifier plus F.M. or A.M./F.M. Unit. Only 6 gns.
SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner Unit (specially suitable for use with any or our Amplifiers). Delayed A.V/C. Controls are Tuning, W/Ch. and Vol. Only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size of unit approx. 9-6-7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustration, 2/6. Total building cost £4.15.9. For leaflet send S.A.E.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

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



Type BM2. Size 8 x 5½ x 2½in. Supplies 120 v. 90 v. and 60 v., 40 mA. and 2 v. 0.4 a. to 1 amp. fully smoothed. Thereby completely replacing both H.T. batteries and L.T. 2 v. accumulators when connected to A.C. mains supply 200-250 v. 50 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.

LINEAR TAPE PRE-AMPLIFIER Type LP/1. Switched Negative feedback equalisation. Positions for Record 3in. 3¾in.. 7½in. and Playback, EM84 Recording Level Indicator. Designed primarily as the link between a Collaro Tape Transcriptor and a high fidelity amplifier, but suitable for almost any Tape Deck. Only 9 gns. S.A.E. for leaflet.

TERMS: C.W.O. or C.O.D. No C.O.D. under £1. Post 1/9 extra under £2. 3/3 extra under £5. Open 9 to 6. Weds. until 1 p.m., except Manchester open all week. Trade supplied. S.A.E. with all enquiries.

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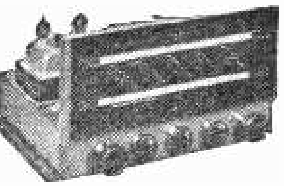
ARMSTRONG AF208 AM/FM RADIOGRAM CHASSIS



★ Full VHF Band (87-108 Mc/s and Medium Band, 187-570M) ★ 7 Valves ★ 5 Watts Output ★ 15db Negative Feedback ★ Separate wide range Bass and Treble Controls ★ 2 Compensated Pick-up Inputs ★ Frequency Response 30-22,000 c.p.s. ±2db ★ Tape Record and Playback Facilities ★ Continental Reception of Good Programme Value ★ For 3, 7½ and 15 ohm speakers. Send S.A.E. for leaflet.

PRICE **22 GUINEAS** Carr. Free

LATEST "EMI" 4 SPEED SINGLE RECORD PLAYER

Acos Hi-Fi Pick-up for LP. and/or 78. 7, 10 and 12in. records. Silent motor, heavy turntable, auto stop. Complete on Baseplate.

Special offer **£6.5.0** post free.

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SINGLE-PLAYER BARGAIN

Ready-built, complete with BSR TU9 4-speed gram pick-up unit. Handsome portable case. 3-watt amplifier with 2 valves and speaker. List price £12.12.0. OUR PRICE £9.9.0. Post 4/-. Fully guaranteed in manufacturer's sealed cartons.

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3V4	7/6	6SJ7M	6/6	EBF80	10/-	MU14	9/-
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6H6	3/6	12Q7	6/6	EF92	5/6	UBC41	9/6
6J5	5/6	35L6	9/6	EL32	5/6	UCH42	9/6
6J6	5/6	35Z4	7/6	EL41	9/6	UF41	9/6
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DK96, DF96, DAF96, DL96, 8/6 each or 27/6 set.
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NEW ELECTROLYTICS **FAMOUS MAKES**

TUBULAR		TUBULAR		CAN TYPES	
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2/350V	2/3	100/25V	3/-	32/350V	4/-
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16/450V	3/-	8+8/500V	5/-	32+32/350V	5/-
16/500V	4/-	8+16/450V	3/9	32+32/450V	6/-
32/450V	3/9	8+16/500V	5/6	32+32+32/350V	7/-
25/25V	1/9	16+16/450V	4/3	50+50/350V	7/-
50/25V	2/-	16+16/500V	6/-	64+120/350V	11/6
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C.R.T. BOOSTER TRANSFORMERS

For Cathode Ray Tubes having heater cathode short circuit and for C.R. Tubes with falling emission. Full instructions supplied.

Type A. Optional 25% and 50% Boost. 2V or 4V or 6.3V or 10.8V or 13.3V. Mains input. 12/6

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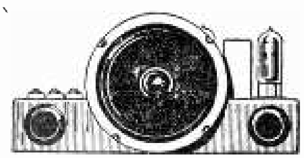
Type B. Mains input. Low capacity. Multi output 2, 4, 6.3, 10 and 13V. Boost 25% and 50%. This transformer is suitable for all TV tubes, 21/- each.

COMPLETE RADIO £4.19.6 post free



4 Mullard valves, 5in. speakers, frame aerial. 4 pre-set stations. 1 long, 3 med. wave. **Superhet Circuit.** Size 9 x 6 x 5¼in. high. Tested ready for use. 200/250 v. A.C.—D.C. Mains.

MAINS TRANSFORMERS 200/250 v. A.C.
Postage 2/- each transformer.
STANDARD, 250-0-250, 80 mA, 6.3 v. 3.5 a. tapped 4 v. 4 a. Rectifier 6.3 v. 1 a 5 v. 2 a or 4 v. 2 a. 22/6 ditto, 350-0-350 .. 29/6
MINIATURE 200 v. 20 mA, 6.3 v. 1 a. .. 10/6
MIDGET, 220 v. 45 mA, 6.3 v. 2 a. .. 15/6
SMALL, 220-0-220, 50 mA, 6.3 v. 2a .. 17/6
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GENERAL PURPOSE LOW VOLTAGE, 2a, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24, 30 v. 22/6
AUTO TRANSFORMERS. 150 w. .. 22/6
0, 120, 200, 230, 250 v., 500 w. .. 82/6

O.P. TRANSFORMERS. Heavy Duty 50 mA, 4/6. Multiratio, push-pull, 7/6. Ditto, 10 w., 15/6. Miniature, 3S4m etc., 5/9. **L.F. CHOKES** 15/10H. 60/65 mA. 5/-; 10 H. 85 mA, 10/6; 10 H., 150 mA, 14/-.

TELEVISION REPLACEMENT Line Output Transformers from 45/- each, New Stock

and other timebase components
Most makes available
S.A.E. with all enquiries.

FULL WAVE BRIDGE SELENIUM RECTIFIER: 2, 6 or 12 v. 1½ amp., 8/9; 2 a., 11/3; 4 a., 17/6. **CHARGE TRANSFORMERS.** Tapped input 200/250 v. for charging at 2, 6 or 12 v., 1½ amps., 15/6. 2 amps., 17/6; 4 amps., 22/6. Circuit included. **4 AMP CAR BATTERY CHARGER** with amp meter Leads, Fuse Case, etc., for 6 v. or 12 v., 69/6.

BOOKS list S.A.E.

40 Circuits for Germanium Diodes 3/-
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Complete with Garrard TA MKII Stereo unit and self contained quality stereo amplifier, size 14¼" wide x 17" deep x 8¼" high. Brand new in maker's box with full instructions and guarantee. OUR PRICE £12.10. Carriage and Insurance, 10/-.
Suitable for use with any two 3 ohm loudspeakers.

LOUDSPEAKER P.M. 3 OHM. 2½, 3, 4in. 19/6. 5in. Rola, 17/6; 8in. Plessey, 19/6. 7in. x 4in. Rola, 18/-; 6½in. Rola, 18/6. 10 x 6in. 27/6. 10in. Rola, 30/-. 4in. Tweeter, 25/-. 12in. R.A. 30/-; 13½ x 8in. 45/-.
STENTORIAN HF1012. 10in. 3-15 ohms, 10 w.. 95/-.

BAKER SELHURST LOUDSPEAKERS

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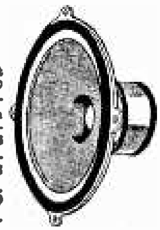

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12in. Stereo, 12w., 35-16,000 c.p.s. .. £8
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15in. Auditorium, 35 w., Bass. 20 c.p.s. to 12 Kc/s. £15

TWIN GANG TUNING CONDENSERS. 365 pF. miniature 1in. x 1¼in. x 1¾in., 10/-. 500pF Standard with trimmers, 9/-; midget, 7/6; with trimmers, 9/-
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SINGLE 25 pF, 50 pF, 75 pF, 100 pF, 160 pF, 5/6. Solid dielectric 100, 300, 500 pF, 3/6.
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CERAMIC CONDS. 500 v., 0.3 pF to 0.01 mfd., 9d.
SILVER MICA CONDENSERS. 10% 5 pF to 500 pF, 1/-; 600 pF to 3,000 pF, 1/3. Close tolerance. (± 1 pF) 1.5 pF to 47 pF, 1/6. Ditto 1% 50 pF to 815 pF, 1/9; 1,000 pF to 5,000 pF, 2/-.

465 kc/s SIGNAL GENERATOR Total cost 15/-. Uses B.F.O. Unit, ZA 30038 ready made. POCKET SIZE 2½ x 4½ x 1in. Slight modifications required, full instructions supplied. Battery 7/6 extra 69V+1½V. Details S.A.E.

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Wavechange "MAKITS". Wafers available: 1 p. 12 wafer. 2 p. 6 wafer. 3 p. 4 wafer, 4 p. 3 wafer. 6 p. 2 wafer. 1 wafer, 8/6; 2 wafer, 12/6; 3 wafer, 16/-; additional wafers up to 14, 3/6 each extra.

Toggle Switches, s.p., 2/-; d.p., 3/6; d.p.d.t., 4/-. Ex. Gov. s.p.d.t., 1/-.

CRYSTAL MIKE INSERT
by Acos 8/6
Precision engineered.
Size only 1½in. dia. x ¼in.

ACOS CRYSTAL MIKE 40 .. 25/-
DE LUXE STICK MIKE .. 35/-

Valveholders. Pax. int. oct., 4d. EA50, 6d. B12A. CRT, 1/3. Eng. and Amer. 4, 5, 6, and 7 pin, 1/-. MOULDED Mazda and int. oct., 6d.: B7G, B8A, B8G, B9A, 9d. B7G with can, 1/6. B9A with can, 1/9. Ceramic EF50, B7G, B9A, int. oct., 1/-. 7BG, B9A cans, 1/- each.

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RADIO COMPONENT

Our written guarantee with every purchase. Bus 133 or 68 pass door S.R. Station Selhurst

Volume Controls

Long spindles. Midget 5 K ohms to 2 Meg.
No. Sw. 3/- D.P.Sw. 4/6
Linear or Log Tracks.

80 ohm CABLE COAX

Semi-air spaced ¼in. Stranded core. 40 yds. 17/6. 60 yds. 25/- **6d. yd.**
Fringe Quality Air Spaced. **1/- yd.**

TRIPLEXERS Bands I, II, III 12/6
COAX PLUG .. 1/- **LEAD SOCKET** .. 2/-
PANEL SOCKETS 1/- **OUTLET BOXES** 4/6
BALANCED TWIN FEEDER yd. 6d. 80 or 300 ohms.
DITTO SCREENED per yd. 1/6. 80 ohms only.
WIRE-WOUND POTS. 3 WATT. Pre-set Min. TV Type. All values 10 ohms to 25 K., 3/- ea. 30 K., 50 K., 4/-. (Carbon 30 K., to 2 meg., 3/-.)
WIRE-WOUND 4 WATT Pots. Long Spindle. Values, 50 ohms to 50 K., 6/6; 100 K., 7/6.
PHILIPS TRIMMERS. 30 pF 1/-.
TRIMMERS, Ceramic. 30, 50, 70 pF., 9d.; 100 pF., 150 pF., 1/3; 250 pF., 1/6; 500 pF., 750 pF., 1/9.
RESISTORS. Preferred values. 10 ohms to 10 meg., ¼ w., 4d.; ½ w., 4d.; 1 w., 6d.; 1½ w., 8d.; 2 w., 1/-.
HIGH STABILITY. ½ w., 1%, 2/-. Preferred values. 10 Ω to 10 meg. Ditto 5%, 100 Ω to 5 meg., 9d.

WIRE-WOUND RESISTORS 25 ohms—10,000 ohms
5 watt 1/3
10 watt 1/6
15 watt 2/-
12.5K to 50K 10w 3/-

AMERICAN "BRAND FIVE" PLASTIC RECORDING TAPE

			Spare Plastic Reels	
Double Play	7in. reel, 2,400ft	60/-		
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Long Play	7in. reel, 1,800ft	35/-		
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"Instant" Bulk Tape Eraser and Head Defluxer, 200/250 v. A.C., 27/6. Leaflet. S.A.E.

Radio Screwdriver 5 in. 6d.
Neon Mains Tester Screwdriver, 5/-
Solder Radiograde, 4d. yd., ½lb. 5/-.
Black Crackle Paint. Air drying, 3/- tin.

HIGH GAIN TV PRE-AMPLIFIERS
BAND I B.B.C.
Tunable channels 1 to 5. Gain 18db. ECC84 valve. Kit price 29/6 or 49/6 with power pack. Details 6d. (PCC84 valves if preferred.)
BAND III I.T.A.—Same prices. Tunable channels 8 to 13. Gain 17dB.

Paxolin Panels, 10 x 8in., 1/6.
Miniature Contact Cooled Rectifiers. 250V 50mA, 7/6; 250V 60mA, 8/6; 250V 85mA, 9/6; 200mA, 21/-; 300mA, 27/6.
Selenium Rect. 300V 85mA. 7/6.
Coils. Wearite "P" type. 3/- each. Osmor Midget "Q" type, adj. dust core, from 4/- each. All ranges.
Teletron D.W.R. L. and Med. T.R.F. with reaction, 3/6.
Ferrite Rod Aerials. M.W., 8/9; M. and L., 12/6.
Osmor Ferrite Rod Aerials. L. and M. for transistor circuits, 10/- each.
Ferrite Rods, 8 x ⅜in., 2/6.
H.F. Chokes, 2/6. **Osmor QC1,** 6/9.
T.R.F. Coils, A/HF, 7/- pair; HAX, 3/-. Repanco DRR2, 4/-. DRX1, 2/6.

Aluminium Chassis, 18 s.w.g. Plain, undrilled, 4 sides, riveted corners, lattice fixing holes, 2½in. sides, 7 x 4in. 4/6; 9 x 7in., 5/9; 11 x 7in., 6/9; 13 x 9in., 8/6; 14 x 11in., 10/6; 15 x 14in., 12/6; 18 x 16 x 3in., 16/6.
Aluminium Panels, 18 s.w.g., 12 x 12in. 4/6; 14 x 9in., 4/-; 12 x 8in., 3/-; 10 x 7in., 2/3. 8 x 6in., 2/-.

AUTOCHANGER ACCESSORIES
Suitable player cabinets (except 4 H.F.) 49/6
Amplifier player cabinets (except 4 H.F.) 63/-
2-valve amplifier and 6½in. speaker 95/-
3-valve amplifier and 6½in. speaker 105/-
Wired and tested ready for use with above.

CRYSTAL SET BOOKLET. 1/-.
CRYSTAL DIODE G.E.C., 2/-. **GEX34.** 4/-. **OA81,** 3/-.
HIGH RESISTANCE PHONES. 4,000 ohms, 15/- pr.
MIKE TRANSF. 50 : 1, 3/9 ea.; 100 : 1, Potted, 10/6.
SWITCH CLEANER. Fluid squirt spout, 4/3 tin

JASON FM TUNER COIL SET, 29/-. H.F. coil, aerial coil, oscillator coil, two i.f. transformers 10.7 Mc/s, detector transformer and heater choke. Circuit and component book using four 6AM6, 2/6. **Complete Jason FMT.1 Kit.** Jason chassis with calibrated dial, components and 4 valves. £6.5.0.

JACKS. English open circuit, 2/6. Closed circuit, 4/3. Grundig type, 3 pin, 1/3.
JACK PLUGS. English, 3/-. Grundig, 3 pin, 3/6.
Wirewound Ext. Speaker Control, 10Ω, 3/-.
ALADDIN FORMERS and cores. ¼in., 8d.; ⅜in., 10d.
0.3in. **FORMERS** 5937 or 8 and cans TV1 or 2, ½in. sq. x 2½in. or ½in. sq. x 1½in., 2/- with cores.
SLOW MOTION DRIVES. Epicyclic ratio 6-1, 2/3.
SOLON IRON, 25W, 200V or 230V, 24/-.
MAINS DROPPER. 3 x 1½in. With adjustable sliders. 0.3A, 1,000 ohms, 4/3; 0.2A, 1,000 ohms, 4/3.
LINE CORD. 0.3A 60 ohms per foot, 0.2A 100 ohms per foot. 2-way, 1/- per foot; 3-way 1/- per foot.
MIKE TRANS. 50-1, 3/9; 100:1, potted, 10/6
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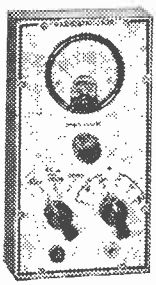

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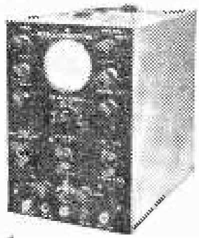

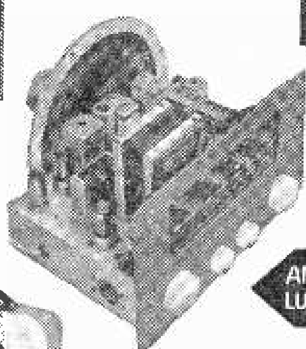

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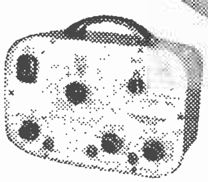
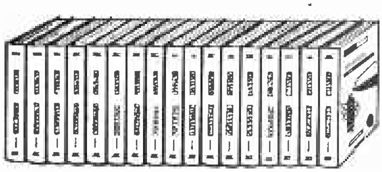


SIGNAL GENERATOR



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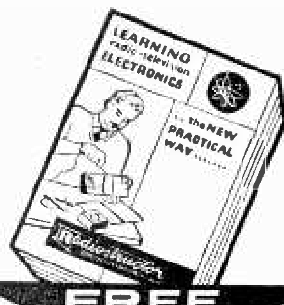

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Practical Wireless

Vol. XXXVII No. 660 FEBRUARY, 1962.

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Contents

Wired Wireless and Commercial Radio

IT seems only a short time ago that the "wired wireless" was as prominent a topic for conversation as 625-line TV is today, and yet little has been heard of it since. Surely the idea deserves much greater attention and, in fact, the time is fast approaching when a practical application of this form of transmission, in its fullest sense, must be found. Sending a radio signal over a wire is, in fact, what is meant by the term "wired wireless", and one very well-known application of this is the employment of voice-operated carrier systems, over coaxial cables, on the trunk telephone systems. By this means hundreds of simultaneous telephone conversations can be carried on a single cable, without interaction.

A really practical development of this form of radio, would be that in which the normal house wiring systems, which after all, are in effect "networked" and serve the majority of homes in the country, could be used to carry not only normal radio programmes, but commercial or sponsored radio, as well as television on various channels. It would not be a very great step to make these systems of such a type that coin-operated selecting devices could be incorporated to provide not only revenue but various forms of 'exclusive' programmes. Both the telephone system and the lighting services in this country are operated on a national basis, and therefore there would be no difficulty about using the existing wiring. The actual development of a technique which would permit the use of all forms of broadcasting, including what we now know as V.H.F., or F.M., together with television, should not present insurmountable difficulties. It would, of course, limit programmes to each country and perhaps render unnecessary such developments as resulted in the superhet receiver. It would also remove many difficulties, not the least of which would be the fringe area, the need for interference suppressors, and last, but by no means least, the mass of unsightly decorations on our roof tops. (The forthcoming television development on Bands IV and V will lead to greater congestion on our roof tops and it appears highly probable that the Pilkington Committee will recommend some form of "wired wireless" or "carrier wireless" for sound only to enable commercial sound programmes to be inaugurated.)

There may be a limit to the number of transmissions which could be dealt with in this manner, and perhaps the inclusion of television may complicate matters, but surely this is one very good ground for development of radio, and the day must come when radio and television programmes will form part of the domestic service supply systems, taking their place with the electric light, water and other essential services.

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

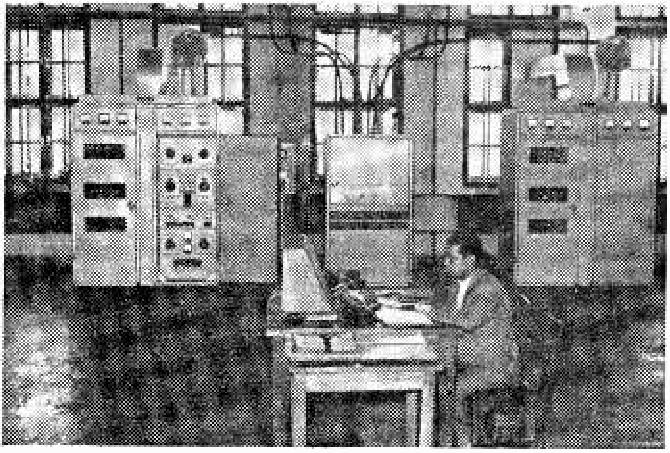
Round the World of Wireless

POTENTIAL AND CURRENT NEWS

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of October, 1961, in respect of wireless receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland. The numbers include Licences issued to blind persons without payment.

Region	Total
London	679,407
Home Counties	635,399
Midland	463,496
North Eastern	494,695
North Western	427,159
South Western	374,467
Wales and Border Counties	218,547
Total England and Wales	3,293,170
Scotland	361,335
Northern Ireland	114,603
Grand Total	3,769,108



These two independent sideband transmitters and aerial exchange were installed in a station outside Ankara, Turkey.

Sweden Orders Eighty-two Transmitters

THE Royal Board of Swedish Telecommunications has placed another order for sound and television broadcasting transmitters with Marconi's Wireless Telegraph Company Limited.

The new contract calls for the supply of 21 vision transmitters, 21 sound transmitters, 40 frequency-modulated sound transmitters and a considerable quantity of programme input, paralleling, feeder and ancillary equipment.

The transmitters are intended to augment Sweden's already extensive television and VHF frequency modulated sound broadcasting systems by providing first-class reception in the northern area and in what are at the moment fringe areas throughout the country. Deliveries, at the request of the Royal Board of Swedish Telecommunications, are to be spread over the next four years.

Transmitter for Satellite Communications Project

A CONTRACT for the supply of a transmitter for use by the GPO in satellite communication experiments, to be carried out next year in co-operation with the American authorities, has been awarded to Standard Telephones and Cables Limited.

The equipment will be installed in a room built into the 85ft diameter steerable aerial now being erected at a site on Goonhilly Down, in Cornwall. The transmitter will operate in the 2000Mc/s communication band, and will deliver a frequency-modulated output of 10kW.

Additional items to be supplied by the company include power equipment for the transmitter and a water-to-air heat exchanger unit.

The present programme calls for the whole transmitter to be installed on the site and fully operational by April, 1962. An active repeater communication satellite to be launched by the U.S.A. authorities will enable tests to be conducted on television transmission and two-way speech communication between Cornwall and the American ground station at Rumford, Maine.

Communications Transmitters in Turkey

AS part of its programme of technical assistance to member countries of the Central Treaty Oganisation, the British Government have presented radio communications equipment to Turkey. Two independent sideband transmitters. aerial exchange, and matching transformers were among the pieces of equipment presented, and these were made by Marconi's.

The installation is at a transmitting station outside Ankara, Turkey.

Royal Navy Order

THE Admiralty has awarded a contract for the supply of a number of 500W medium-frequency/high-frequency independent sideband communication transmitters to Marconi's Wireless Telegraph Company Ltd., together with high-stability master oscillators and remotely controlled aerial matching units.

Weather Radar Orders

THE new duplicate version of the Type E190 airborne weather radar, which is a product of Ekco Electronics, has been ordered by Short Brothers and Harland Ltd. for installation in ten of their new Belfast air freighters. This equipment employs a dual transmitter/receiver and indicator system, in keeping with the current practice of duplicating essential services which are the subject of mandatory requirements. Fully "fail-safe" conditions are thus provided. either transmitter/receiver operating with either indicator unit.

Ekco airborne weather radar is also to be installed in the de Havilland Comet 4 airliner recently ordered by King Saud of Saudi Arabia.

VHF Sound Broadcasting Station for Northern Ireland

THE BBC's new VHF sound broadcasting station at Londonderry which is on the same site as the BBC's television station at Sherriffs Mountain was brought into service on 23rd October. This is one of the twenty-one new VHF satellite stations so far approved for extending the coverage of the VHF sound service to over 99% of the population of the United Kingdom.

Londonderry radiates the Northern Ireland Home Service on 92·7Mc/s, the Light Programme on 88·3Mc/s, and the Third Programme together with Network Three on 90·55Mc/s. The signals are horizontally polarized, which means that receiving aerials should be horizontal. The programmes are fed by Post Office cable from a special receiving site at Glenderowen where they are received by radio from the BBC's VHF station at Divis.

The new station brings the BBC's VHF sound broadcasting service within reach of some 120,000 additional people in the counties of Londonderry and Tyrone.

4th Jamboree-on-the-Air

FROM 00.01 hours GMT on Saturday, 21st October until 23.59 hours GMT on Sunday, October 22nd radio hams from forty countries all over the world took part in the Boy Scouts' 4th Jamboree-on-the-Air.

In this country alone there were over forty stations operating. One of these was in the recently opened Baden-Powell House in South Kensington.

This year Scout stations were on the air in Australia, Canada and the Philippines. In previous years contact has been made with Scouts in America, Canada, Holland, Sweden, Finland, Germany, Bermuda, France, Norway and New Zealand.

Changes in Times of International Time Signal

FOR over one hundred years, the Royal Greenwich Observatory has been responsible for providing exact time signals for a wide variety of users both at home and abroad.

In recent years this service has become increasingly important in various fields of scientific research where extreme accuracy is essential.

In order to provide the various users with more frequent opportunities for checking the time. on 1st December, the daily transmissions from Rugby were increased from two to four.

This means that the transmissions on the low frequency of 16kc/s until recently radiated at 10 a.m. and 6 p.m. are now superseded by signals at 3 a.m., 9 a.m., 3 p.m. and 9 p.m. There is, however, no change in the form of the signals.

To ensure a world-wide coverage, the 10 a.m. and 6 p.m. broadcasts have also been transmitted on short wave. This service is continuing, but the times have been changed to 9 a.m. and 9 p.m.

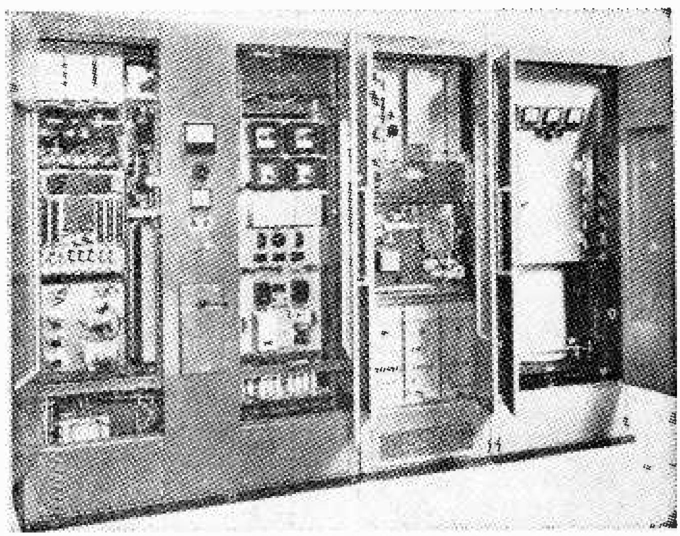
The transmissions from Rugby are proving to be indispensable to users all over the world. Such persons as marine surveyors and scientists engaged in tracking artificial satellites will undoubtedly find the new and more frequent transmissions of great value.

Ten High Power Short Wave Transmitters

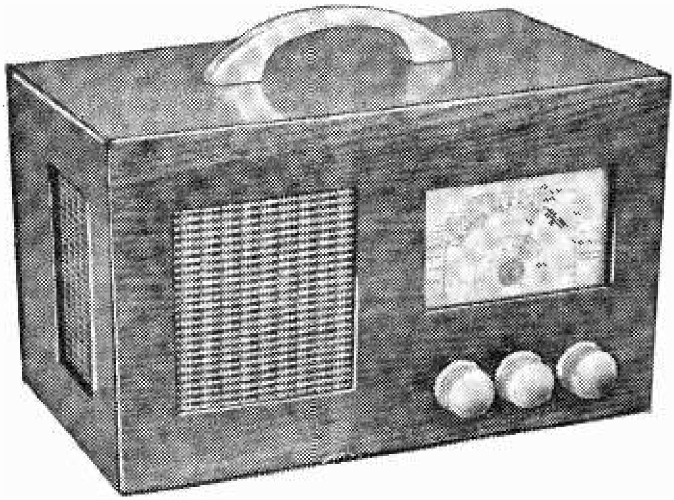
THE British Broadcasting Corporation has placed an order with Marconi's Wireless Telegraph Company Ltd. for the supply and installation of ten high-power (250kW) short-wave sound broadcasting transmitters of a new type which, when they come into service, should very materially improve overseas listeners' reception.

Six of these transmitters will be installed at the "Voice of America" relay station at Woofferton. Two more will go into service at the BBC station at Rampisham and the remaining two at Daventry.

The transmitters are specially designed to combat the ever increasing amount of interference experienced by overseas listeners on the short waves. This is achieved by employing a method of modulation which cuts through the interference to bring the signal to the listener. Intensive experiments have shown that the use of this trapezoidal modulation, as it is called, gives an intelligibility at the receiving end which could only otherwise be brought about by more than doubling the transmitter power—that is, in this instance, from 250kW to 550kW. The overall efficiency of the new type of transmitter is approximately double that of the older equipments supplied to Rampisham and Daventry.



A transmitter of the type to be supplied by STC to the GPO for use in satellite communication experiments. On the left is the power control cubicle (double width), with the drive unit in the centre and the klystron power amplifier cubicle on the right. This transmitter operates in the 2000Mc/s communication band, and will deliver a frequency-modulated output of 10kW.



A HIGHLY SENSITIVE DOMESTIC RECEIVER

midget mains SUPERHET

By V. E. Holley

THIS receiver will perform satisfactorily in most parts of the country. Though small in size, its overall sensitivity is above average and unless reception conditions are very unfavourable it will work quite well on two or three feet of wire as a "throw-out" aerial. The valves, which at first sight may seem an odd assortment, have been selected (as will be explained) for low cost and high performance.

Aerial Circuit

Referring to Fig. 1, the signal from the aerial is passed first through the I.F. rejector, L1, C1, which is an iron-cored inductor tuned to the intermediate frequency. It will be found useful in coastal areas where morse transmissions around 500kc/s are apt to find their way into the I.F. amplifier; in other areas it will probably not be required and can be omitted. The filtered signal passes via the switch S1 to the appropriate aerial coil and thence via S2 to the grid of the first valve.

Output Stage

In order to economise in the bulk, weight and cost of the power supply, a Mazda octal valve SP61, is used in the output stage. This valve can be obtained very cheaply indeed and although intended for R.F. amplification it makes a very satisfactory small power valve. It has a high slope and an output of one watt can be obtained in return for a modest signal at the grid. Grid and cathode resistors are 1M and 150Ω respectively.

If the greatest gain is required in the output stage the resistor R16 can be by-passed by an electrolytic capacitor of 100μF and this will increase the sound output. The output transformer in the anode circuit should have a ratio of about 70:1 for a 3Ω speaker and can be of the type usually described as "small pentode."

Negative Feedback

The SP61 is a very efficient amplifier of radio frequencies and it is necessary to arrange that any such frequencies reaching it shall be excluded from the output. Accordingly, frequency selective negative voltage feedback is taken from the anode via the capacitor C21, to the cathode circuit of V3.

Second Negative Feedback

If maximum overall gain is not required, a second negative feedback loop, effective at all frequencies, can be formed by connecting a resistor of from 200 to 1,000Ω between points X and Y in Fig. 1.

Power Supply

The total H.T. current in the absence of a signal is 35mA at about 220V, while the valve heaters and dial lamp need approximately 0·15A at 6·3V. This is supplied by a miniature mains transformer, the high voltage half-wave secondary of which feeds a metal rectifier, DRM1. A contact cooled rectifier is equally suitable. The rectified current is taken first through a fuse, which is in fact a 6·3V. 0·15A bulb; though not essential. this is a useful safeguard against the consequences of short circuits, catastrophic failure of capacitors, etc. Smoothing is provided by the capacitors C22, C23 and C24, and the resistors R17 and R18. This double stage arrangement gives good smoothing with negligible voltage drop, an important point if as in the prototype, the transformer voltage is only 220. The values of these resistors must be adjusted according to the output of the transformer-rectifier combination so that the H.T. line voltage in the receiver is 220±10 in the absence of a signal. Miniature transformers do not usually have tapped primaries so the mains supply voltage must also be taken into account.

Components

The tuning scale and the gang condenser must be selected for compatibility if the transmissions are to be received at the points indicated on the scale. The coils may be any standard dust-cored components covering the long and medium wavebands and the trimming and padding capacitors should be of the values recommended by the

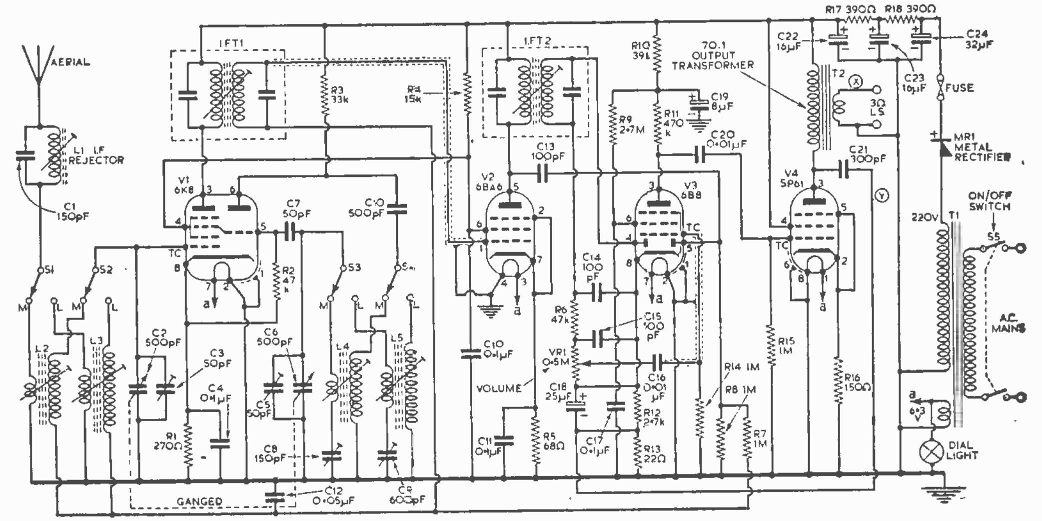


Fig. 1—The circuit of the receiver.

LIST OF COMPONENTS

Resistors (½W unless otherwise stated)

- R1 270Ω
- R2 47k
- R3 33k
- R4 15k (1W)
- R5 68Ω
- R6 47k
- R7 1M
- R8 1M
- R9 2·7M
- R10 39k
- R11 470k
- R12 2·7k
- R13 22Ω
- R14 1M
- R15 1M
- R16 150Ω
- R17 390Ω 1W
- R18 390Ω 1W
- VR1 0·5M with switch

Capacitors (350VW unless otherwise stated)

- C1 150pF
- C2, C6 2-gang, 500pF with 1½in. drive drum
- C3 50pf trimmer
- C4 0·1μF
- C5 50pF trimmer
- C7 50pF
- C8 150pF padder
- C9 600pF padder
- C10 0·1μF
- C11 0·1μF
- C12 0·05μF
- C13 100pF
- C14 100pF
- C15 100pF
- C16 0·01μF
- C17 0·1μF
- C18 25μF electrolytic, 25VW
- C19 8μF electrolytic
- C20 0·01μF
- C21 300pF
- C22 16μF electrolytic
- C23 16μF electrolytic
- C24 32μF electrolytic

Valves

- V1 6K8, octal base
- V2 6BA6, B7G base
- V3 6B8, Octal base
- V4 SP61, Mazda octal base

Transformers

- Mains—220V, 40mA, ½-wave; 6·3V, 2A
- Output—Pentode type, 70 : 1
- I.F.—1 pair, 465kc/s

Dial light 6·3V, 0·15A
Fuse 6·3V, 0·15A bulb
Rectifier 250V, 50mA, half-wave, DRM1 or contact-cooled
Coils standard iron-cored, aerial and oscillator for long and medium-wave bands
Switch 4-pole, 2-way

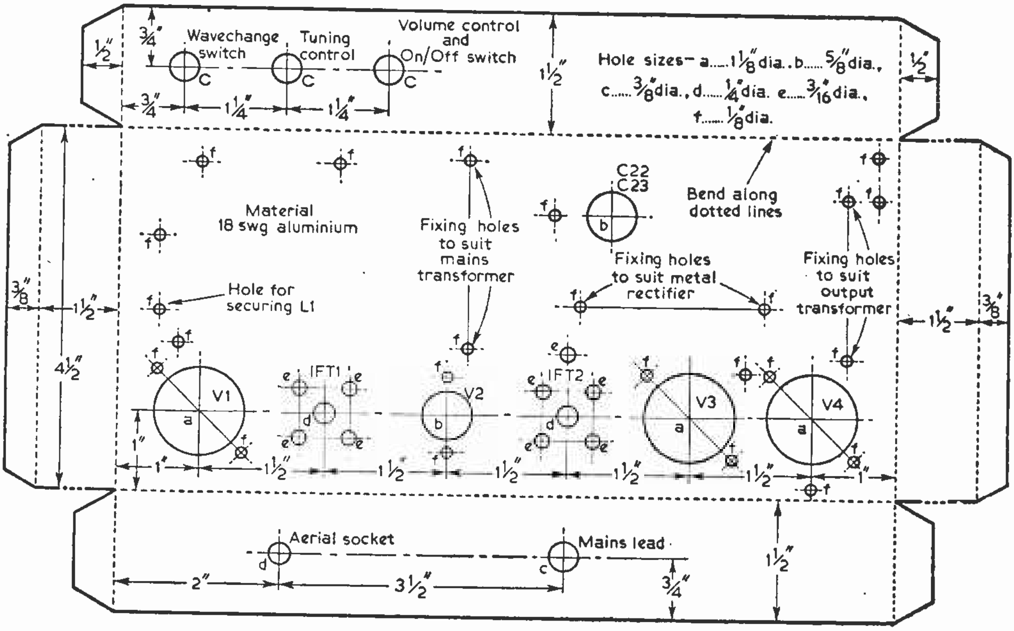
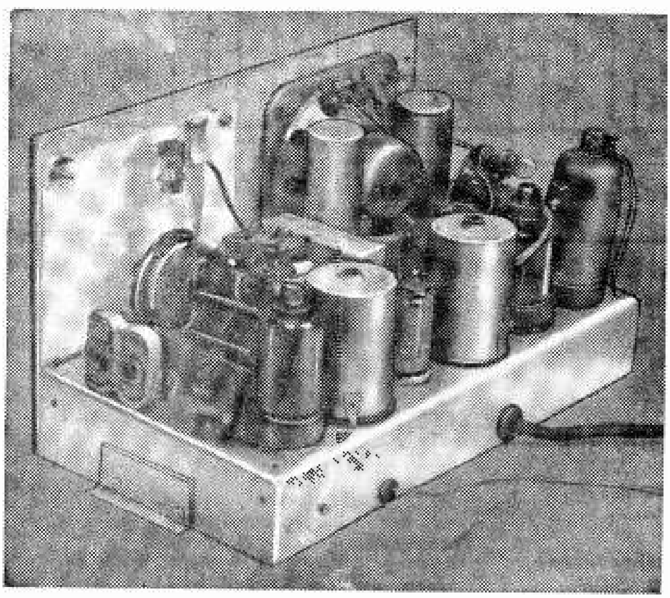


Fig. 2—The drilling details of the aluminium chassis.



The completed receiver without the cabinet.

makers. The values given in Fig. 1 are fairly typical and may be used in the absence of more authoritative information. Most manufacturers feature a suitable I.F. rejector coil in their range, either with or without the parallel fixed capacitor, C1.

Construction

The receiver is constructed on a chassis of 18s.w.g. aluminium sheet, 9½in. x 4½in. x 1½in. (Fig. 2).

Tuning Drive

The tuning drive can be made from an old volume control. Remove the body and fit to the rear of the spindle a brass coupler in which a groove has been cut for the drive cord. Holes must, of course, be cut in the chassis for the cord to pass up to the drive drum and down again.

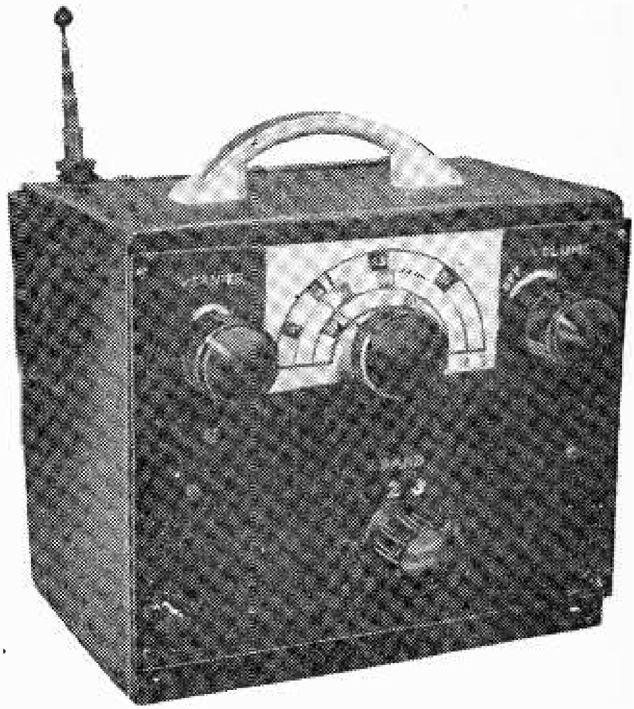
The resistors may be ½W except for R4, R17 and R18, which should be of 1W rating and, because the H.T. comes on through the metal rectifier before the valves are warmed up and ready to receive it, all the capacitors should be 350VW except for C18, for which 25VW working will be adequate.

Mains Transformer

The mains transformer must be a miniature type and it is convenient though not essential that the tuning condenser be semi-miniature. All other components can be standard. The trimmers C2 and C16 should be fitted to the top of the gang condenser, which also carries a bracket for the dial light.

(To be continued)

16m TO 175m



TRANSISTOR S.W. TUNER

A UNIT DESIGNED TO BE USED WITH A SEPARATE AMPLIFIER

By
F. Neville Hart

NOW that short-wave transistors have become about as cheap as valves and there are coils on the market for frequencies as high as the VHF bands, the simplicity of transistor circuits opens up an attractive field for the experimenter.

The set described here is a portable tuner which can be plugged into any amplifier, such as a tape recorder, or radio provided with 'gram' input terminals. It has a 3ft 6in. telescopic chromium plated aerial fixed in a 3-ply, leather cloth-covered cabinet, which was built to house the set. The construction of this is not described as readers may have their own ideas on carpentry.

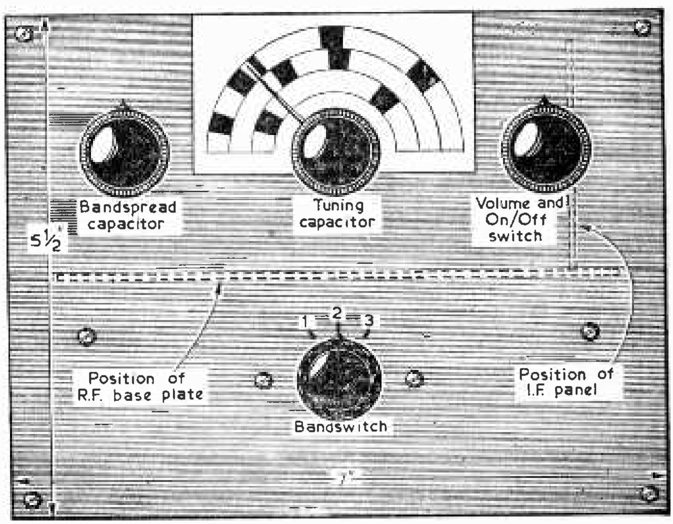


Fig. 1—The front panel layout.

COMPONENTS LIST

Resistors (all $\frac{1}{2}$W)

R1	15k	R9	8·2k
R2	2·2k	R10	1·2k
R3	1k	R11	680Ω
R4	2·2k or 3·3k (see text)	R12	22k
R5	10k	R13	4·7k
R6	2·2k	R14	3·9k
R7	1k	R15	1k
R8	68k		

Capacitors:

C1	0·01 μF	C11	56pF
C2	0·001 μF	C12	0·1μF
C3	0·01 μF	C14	0·1μF 12VW
C4	0·003μF	C15	18pF
C6	0·01 μF	C16	0·1 μF 12VW
C7	750pF	C17	25μF or 50μF 12VW
C8	8μF 12VW elec.	C18	8μF 12VW elec.
C10	0·25μF 150VW	C19	0·25μF 150VW

(C5, 9 and 13 are inside the I.F. cans)

VR1 5k potentiometer
Tr1, 2 OC170
Tr3 OC45
Tr4 OC45

D1 WG4B, OA81 or equivalent
VC1 Jackson "00" three gang 208-176-208pF
VC2 Three gang bandpass 30pF (or 2 gang, see text)
TC1-8 30pF beehive trimmers

Tuning coils (Repanco)

Range 1—
- Aerial type XTA31 blue mauve spots
- R.F. type XTF32 blue black spots
- Oscillator type XOT33 blue brown spots

Range 2—
- Aerial type XSA34 red yellow spots
- R.F. type XSF35 blue yellow spots
- Oscillator type XOS36 blue red spots

Range 3—
- Aerial type XSA37 blue green spots
- R.F. type XSF38 blue white spots
- (Oscillator uses range 2)

I.F. transformers—2 XT26 and one XT27 (465kc/s) 2 blue spots, 2 green spots
A battery plug for 7·5V battery
Extending Aerial; 9-pole 3-way wafer switch, 2in. in diameter (H L Smith Ltd, 287 Edgware Road, W2)

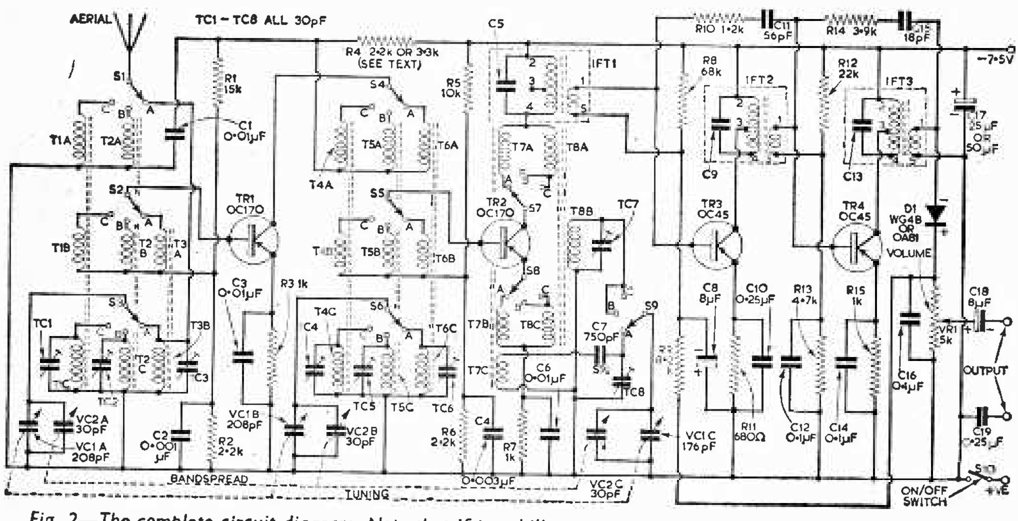


Fig. 2—The complete circuit diagram. Note that if instability occurs in the R.F. Stage, C4 should be reduced in value from 0·003μF to 0·001μF.

Frequency Coverage

The coverage is approximately from 16m to 175m, in three ranges, using a nine-pole three-way switch with three wafers. A number of these are obtainable as "surplus," but switch makers will make them up for about 15s. each.

Any I.F. coils for use with transistors can be employed, but since the short-wave tuning coils are made by Repanco, the use of their I.F. coils is described here. Although an R.F. stage rather complicates adjustment and trimming, it assists the rejection of second channel interference and gives better selectivity and volume.

The set compares favourably with the author's battery superhet with R.F. and two I.F. valves. Volume depends upon the amplifier following, but the output part of a transistor radio using driver and push-pull OC72's gives sufficient volume in the author's caravan, where, indeed, most of the construction was carried out.

Aerial

Although its own aerial is normally used, pick-up can be improved by using a longer aerial.

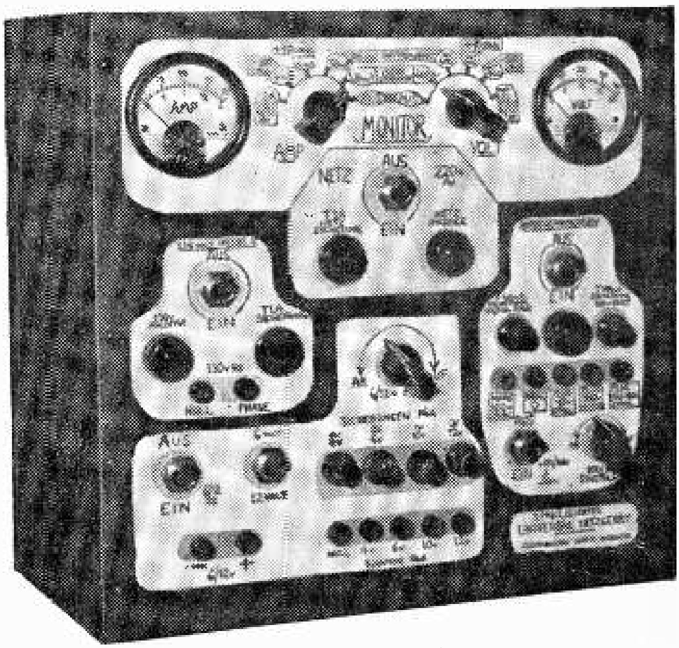
(To be continued)

Experimenter's POWER-PACK

THE FINAL DESIGN AND CIRCUIT

(Continued from page 824 of the January issue)

By M. L. Michaelis



The author's unit

THE power unit is extremely versatile, giving outputs of almost all types normally required in the experimenter's workshop. Whilst the unit is definitely advanced in nature, and thus not advisable for the the beginner, it is felt that it will meet a long-felt requirement for the more experienced constructor, who, once he has built it, will find virtually all of his power supply problems solved in one.

The outputs provided are the following:—

(a) *A stabilised H.T. output, continuously variable from 120V to 350V, at a nominal maximum current of 100mA.*

This output can thus be used for virtually any H.T. requirements, from battery-valve circuits requiring 120V H.T. at the one extreme, to mains-valve circuits requiring the higher voltages up to 350. Stabilisation is such that the remaining effective internal impedance is about 50Ω, so that in most cases several pieces of apparatus can be fed without mutual interference.

(b) *An unstabilised H.T. output of about 300V, fully independent and capable of supplying some 50mA.* This is intended for operating various pieces of apparatus, such as a valve voltmeter or a test oscillator, etc., at the same time as the experimental circuits being worked on are being fed from the main stabilised H.T. supply.

(c) *Two neon-stabilised output voltages, one at plus 90V and the other at minus 100V, relative to earth (chassis).* These are capable of being loaded up to about 1mA each. Their purpose is for providing facilities for any bias-bleeder chains that may be required in advanced experimental circuits, and to this end they may be used together or independently.

(d) *A.C. heater outputs at 4V, 6·3V, 10V and 12·6V.* All are rated at 4A maximum continuous loads. By simultaneous loading at various of these voltages, the total current must not exceed 4A.

(e) *Low-voltage D.C. output at a maximum of 18V and a maximum of 2A.* This output is intended for a variety of uses. It is not stabilised, but it is fully smoothed, and is variable by means of a variable wire-wound resistance. It can be used for the following purposes:—

heating battery valves of 1·4V or 2V type;

heating mains valves with D.C. in circuits requiring this;

charging accumulators (anything from a single 2V cell to a 12V car-battery);

feeding transistorised apparatus. On account of this last envisaged use, the positive pole of the supply is earthed, and not the negative pole, as is otherwise more usual. This does not in any way impair the other uses named.

(f) *An output at 110V A.C. up to about 100W.* for feeding any 110V apparatus that may come in for attention. (It is assumed that the power unit is to be built for 230/250V mains, but if readers' local mains have other voltages, then it is merely necessary to purchase transformers with the appropriate primary windings.

A comprehensive system of indicator pilot-lamps, fuses and other protective measures are incorporated, and a definite orderly plan has been devised and followed in the allocation of switch-functions. These features will all become apparent in the course of the circuit description below.

Checking Output

A multi-purpose monitor system is built-in, for metering any of five important voltage outputs and any of five important current outputs. Two moving-coil meters are used, with suitable switching, shunts and multipliers. One meter functions as voltmeter and the other as current meter. Any one voltage and any one current may be displayed at any one time. The meter may be switched on to voltages and currents on load, and this process does not disturb the functioning of the power unit. Thus if all five outputs are simultaneously loaded, the meters may be switched successively to read off all circuits in turn, without disturbing them.

All outputs are fully independent. Thus, for example, the low-volts D.C. output may be connected to charge accumulators, and at any time the other sections of the power supply used for feeding electronic circuits. After checking for correct charging current, the meters may be switched over to monitor the H.T. and other circuits being used. At any time the meters may be switched momentarily back to the accumulators on charge, to check that charging is still correct. This is only one example of possible simultaneous uses of the power supply, so that in actual fact the power supply serves the purpose of several smaller power units. This represents a considerable saving in space and expense, compared to the actual construction of the equivalent range of separate power units.

Heat

Attention has been given to the question of adequate heat dissipation. This has been successfully achieved whilst at the same time satisfying the apparently contradictory requirements of maintaining as compact a form as possible. In the author's unit the front panel is approximately one foot square, and the cabinet is 6in. deep. To make the best possible use of the space available, the usual chassis construction has been rejected in

COMPONENTS LIST

Resistors ($\pm$20% unless otherwise stated)

R1	22k 10W	R16	10k 2W ±5%
R2	82k 10W	R17	33k 2W ±5%
R3	820k 2W	R18	82k 2W
R4	820k 2W	R19	1·8k 6W
R5	6·8k 2W	R20	5Ω w.w. ±1%
R6	1M 2W	R21	5Ω w.w. ±1%
R7	18k 2W	R22	100k 2W ±5%
R8	18k 2W	R23	100k 2W ±5%
R9	185Ω ±5% w.w., 5W	R24	100k 2W ±5%
		R25	100k 2W ±5%
R10	100k 1W	R26	5k 2W ±5%
R11	100k 1W	R27	Shunt
R12	220k 1W	R28	Shunt
R13	1M 1W	R29	150Ω 1W
R14	82k 2W	R30	150Ω 1W
R15	150k 1W	R31	Shunt

(R20 to R31 are in the meter circuits to be described)

Condensers

C1, C2 8μF metallised paper, 500/750 VW
Alternatively, C1 and C2 can be 8μF 500VW electrolytics (as on the circuit diagram)
C3 8μF 450VW electrolytic
C4 8μF 450VW electrolytic
C5, C6 0·1μF 500VW paper
C7 0·02μF 1000VW high insulation
C8 0·1μF 500VW paper
C9 8μF metallised paper 350/500 VW
C10 0·1μF 500VW paper
C11, C12 25μF 350VW electrolytic
C13, C14 1000μF 35VW electrolytic

Variable Resistors

VR1 100k 1W lin.
VR2 10Ω w.w. lin., 25W
VR3 1k w.w. lin., 5W

Valves

V1 EL34
V2 ECC83
V3 90C1 neon (90V)
V4 90C1 neon (90V)
V5 108C1 neon (100-108V)
V6 90C1 neon (90V)
D1 Four E250C130 selenium elements (see text)
D2 Selenium E250C50 (see text)
D3 Selenium B300C75 (see text)
D4 Copper oxide E12C2000 (see text)

Switches

S1 Single pole toggle
S2 Double pole toggle
S3 Double pole toggle
S4 2-pole/2-pole on/on toggle
S5 Single-pole double-throw toggle
S6 Single-pole toggle
RLY1 Three-phase A.C. relay 2A, 10-12V coil, 400V contacts
MS1, MS2 Meter wafer switches 2-pole, 6-way, break-before-make

Sundries

Two mains transformers as specified in text
Eight panel-fuses, single hole, insulated
Three pilot lamps: two red, one green
Two bulbs 6·2V 0·3A
One bulb 10V 0·2A
Fourteen insulated wanderplug-sockets
Two moving coil meters as specified
One octal, one noval, four B7G valveholders (ceramic)
Four pointer knobs
One yard tagstrip
Bolts, wire, sleeving, etc.
Sheet aluminium, wood, screws, etc.
Mains lead (3 core) and 3-pin plug

See Components List for resistor wattages

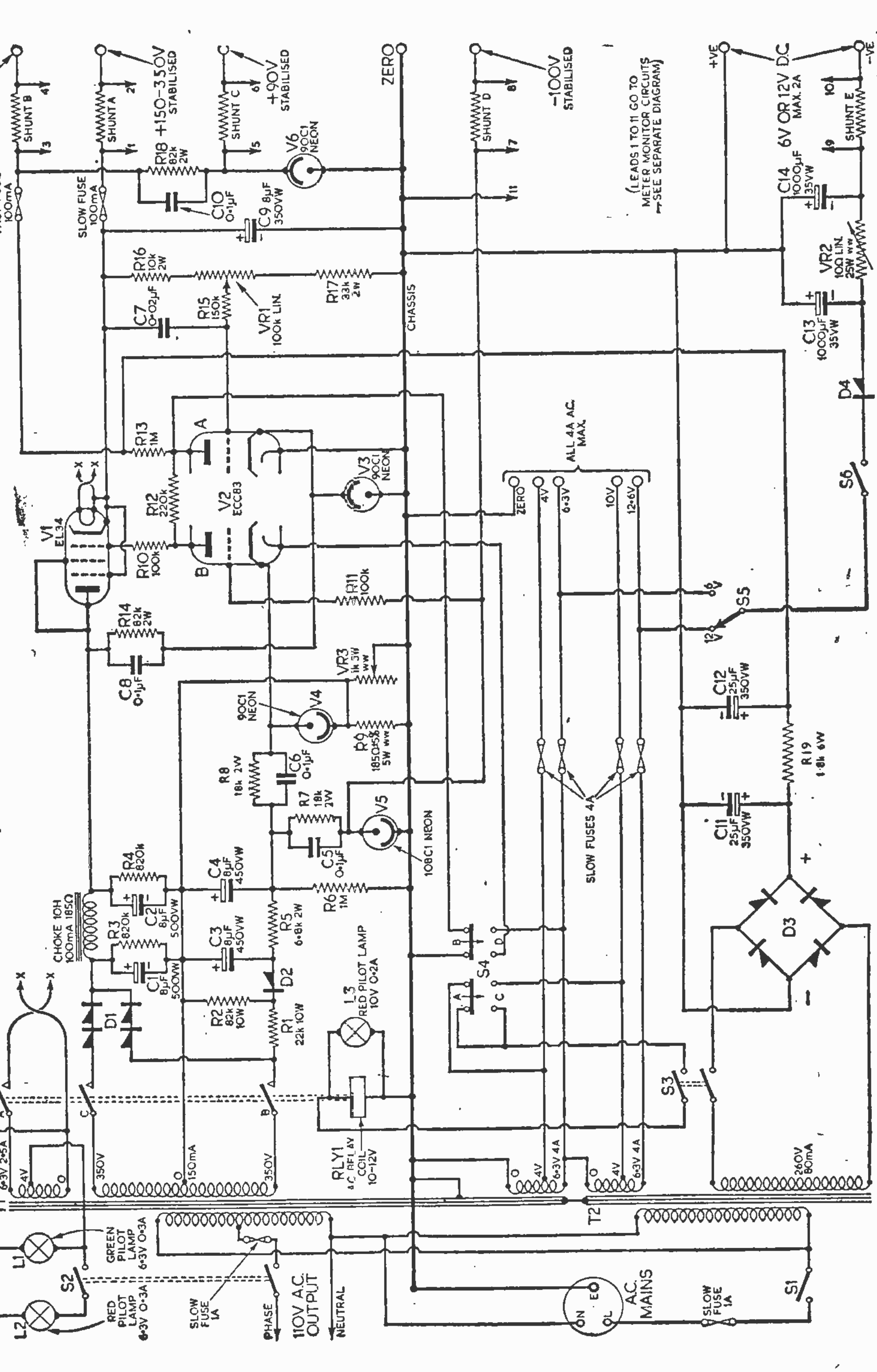
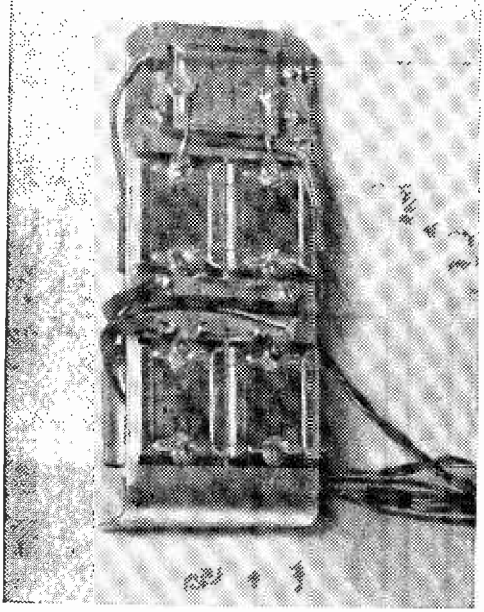


Fig. 6—The complete circuit diagram of the power-pack.

Notes:—The mains transformers used should have primary windings to suit the local mains voltage, or, alternatively, 10-0-200-220-240V primary windings (the latter is to be preferred). The primary winding of T1 will in any case require a tap at 110V if a 110V A.C. output is to be provided from the power-pack. The rectifier symbols follow convention and the 'bar' of the symbol represents the end of the rectifier which becomes positive when A.C. is applied.

favour of a "spatial-construction". This latter form of construction is more difficult than conventional chassis construction, but has the advantage of complete utilisation of the available cabinet space, thereby reducing the size of a unit by at least a factor of two. However, the layout of the whole circuit is in all respects fully non-critical, so that those constructors who can tolerate a larger final size of unit may use the normal chassis form of construction, with any convenient layout. Adequate insulation is more important than any particular layout.



Front view of the rectifier sub-chassis.

Procedure

The "spatial-construction" consists of building the unit in the form of several sub-units. A wooden cabinet is used, with two sides, top, bottom, front panel and back. Any one of these six pieces of wood is independently removable, by means of loosening the appropriate screws. Construction is started on the basepiece of the cabinet, on which all larger components are mounted and wired up (transformers, etc.). In the case of the power unit here described, the next step was to make a small bracket-chassis on which the metal rectifiers and associated circuitry were mounted. This rectifier-unit was then also mounted on the basepiece. When all the wiring of the basepiece was complete, all points to be connected to other components not on the basepiece were wired to suitably positioned tagstrips. The next stage was to make the front panel, on which all outlets, switches, fuses, lamps, controls, etc., were mounted and wired up. A sub-unit containing the low-volt D.C. rectifiers and smoothing was also mounted on this. All points to be connected elesewhere were again taken to tagstrips. The third stage was then to make a small chassis containing all the valves and associated circuitry, and mount this on the right-hand side panel of the cabinet, again taking all points to be connected elsewhere to a suitably positioned tagstrip. The fourth stage was then to mount the few remaining components (in this case the A.C. relay, the smoothing choke and the output condenser) on the left-hand side panel. Nothing is mounted on the top-piece or the back of the future cabinet.

Inter-wiring

Four separate sub-units have now resulted, on four pieces of the future cabinet. These are now laid on the workbench in such a position relative to each other that (a) all parts of all of them can be reached comfortably for repairs and alterations, and (b) they are nevertheless as close as possible to their proper relative positions in the final asembled cabinet. The units are now interconnected by neat bunches of insulated wires, of the correct lengths, running between the tagstrips of the various units. After completion of this work, the power unit is electrically complete, and may be switched on and tested. If all is found satisfactory, the four sub-units and the top-piece of the cabinet are screwed together with wood-screws, to form the cabinet. All cable-bunches are neatly tucked away in positions where they cannot chafe or otherwise be damaged. After cutting suitable ventilation holes in the back panel, this is screwed on too. It remains to label all items externally on the front panel and to paint the cabinet as desired, and the power unit is then ready for service.

Interlocking

The geometrical arrangement of the components on the four sub-units is such that complete spatial interlocking (without, however, touching and shorting of components) is achieved within the cabinet after assembly. The arrangement used by the author satisfies some further points, too:—

(a) All valves are immediately accessible for quick replacement if ever required. Thus the valve chassis is at the rear, reached as soon as the back is removed, without further dismantling.

(b) All components generating much heat, principally the transformers, choke and valve chassis, are mounted at the rear, so that they induce a strong convection current through the generous ventilation holes in the rear panel, and do not heat up the rest of the circuitry unnecessarily.

(c) The build-up otherwise avoids horizontal layering, and stresses vertical channelling, to give full freedom to convection cooling; the author's prototype has been on non-stop operation for periods of up to one week without the slightest indication of undue heating.

The detailed building plans to be given will bear out these points, but it must be borne in mind that *considerable* modifications may be necessary according to the actual shapes and sizes of components individual constructors may purchase or have available. For this reason it was stated above that this type of construction is more difficult than a conventional chassis. It is absolutely essential that the constructor should collect all essential components together, and then sit down and very carefully envisage the complete final construction.

(To be continued)

TRANSMITTING TOPICS

A CLASS "A" MODULATED MINIATURE VALVE TRANSMITTER

By
Amateur Transmitter

THE transmitter described here is a single, compact unit with its own modulator and power supplies, and is constructed on a chassis 7½in. x 11½in. x 2½in. *Send/Receive* switching is incorporated, so that it is only necessary to add a receiver to obtain a complete table-top type of station. There is no need for an aerial change-over relay, or separate control of the receiver. Instead, the one control on the transmitter provides complete change-over from transmit to receive, and this is found very convenient when working.

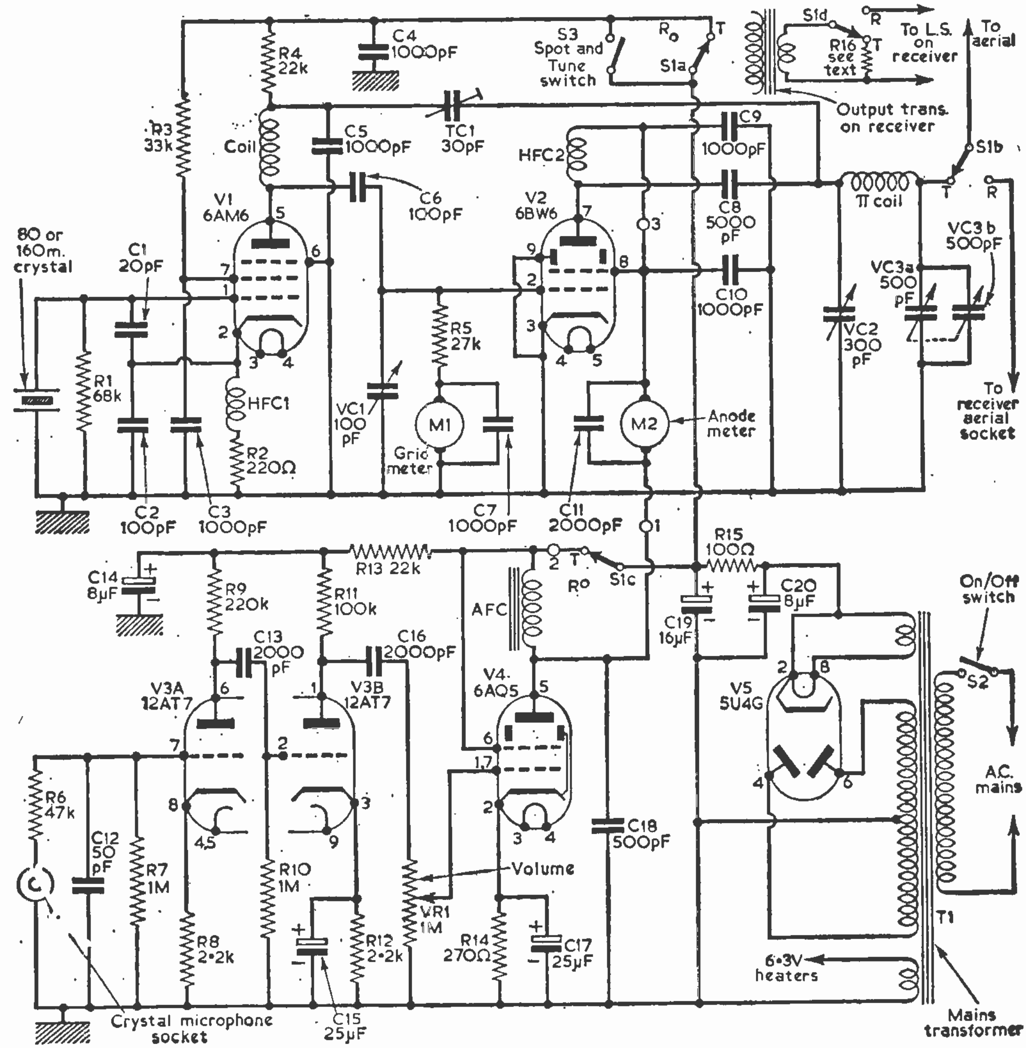


Fig. 1—The complete circuit diagram of the transmitter.

The circuit is shown in Fig. 1. The *Spot and Tune* switch applies H.T. to the oscillator only. This allows the transmitter frequency to be located exactly with the receiver, so that the latter can be tuned to the same frequency. It also permits tuning up the transmitter for suitable grid current, and shows where the signal will fall, compared with other stations which may be working. If a VFO is used, it allows the transmitter to be netted on another transmitter frequency, ready to answer a call.

Switching

The *Send/Receive* switch applies H.T. to oscillator, modulator and P.A., and connects the aerial to the transmitter. When in the transmit position it disconnects the receiver speaker, to silence this. When the switch is turned to "Receive" the aerial is connected to the receiver, the speaker is in operation, and the transmitter H.T. supply is off.

The 6AM6 oscillator will operate at fundamental frequency, or as a doubler. This permits 2-band working with one crystal. Two crystals will give four operating frequencies in two bands. Grid drive when operating as a doubler is almost the same as when working on the fundamental.

The 6BW6 will run at up to 10W input, which is of course the maximum permitted on the 160m band. It was found generally best to load to an input of about 40mA and this resulted in 9 and even 9-plus reports, with a correctly coupled dipole. An end-fed aerial, preferably correctly tuned at the transmitter, would give almost similar results.

Modulation

A high-gain double triode is used in the modulator, so that a crystal microphone may be employed. With 250V on anode and screen grid, the 6AQ5 has a power output approaching 4·5W and reports or monitoring indicate that good modulation and speech quality can be expected. When a class-A stage is operating normally, the anode never swings completely to zero voltage. This means that over-modulation in a downward direction (which must always be avoided) cannot arise. It will be found that attempts to increase the modulation too far will cause distortion due to overloading of the audio amplifier. This will be apparent on a simple monitor, whereas over-modulation may not. For this reason it was decided not to add a P.A. condenser and resistor dropper, such as may be used with class-A modulators. This change might make over-modulation possible, and was not felt necessary, after testing the circuit as in Fig. 1.

The transmitter requires approximately 100mA at 250V, so a large receiver or amplifier type transformer will suffice. Heaters consume 1·5A at 6·3V. The rectifier was a 5U4G, which needs 5V at 3A, but 5R4, 5V4 and similar rectifiers are

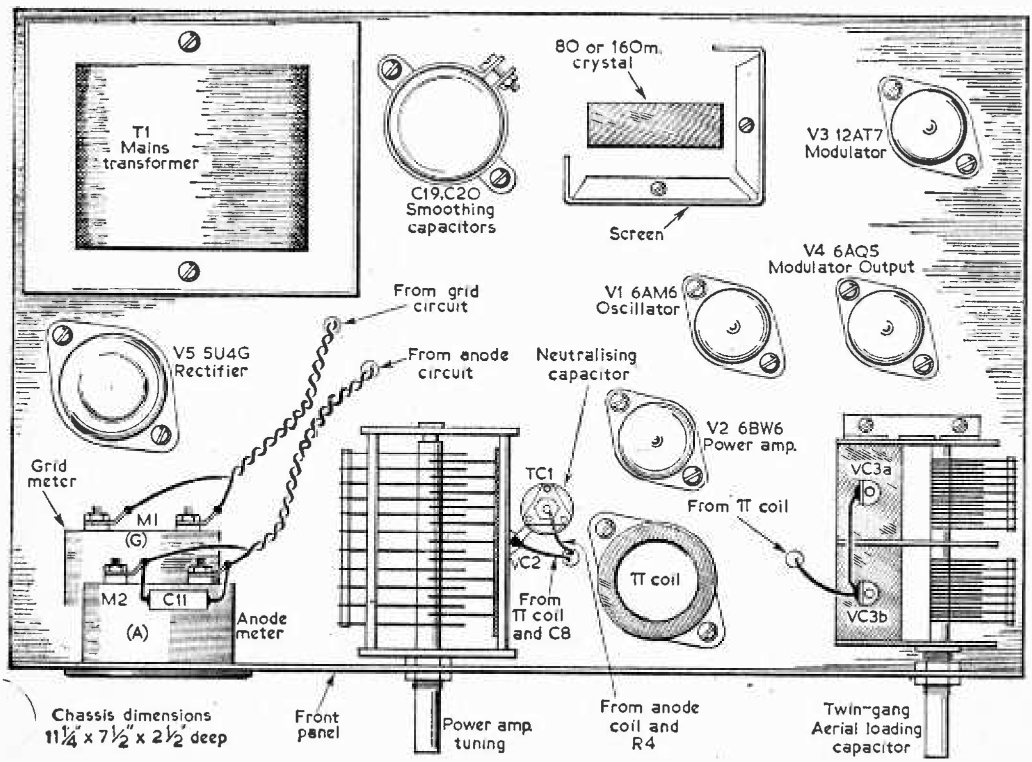


Fig. 2—The above-chassis wiring.

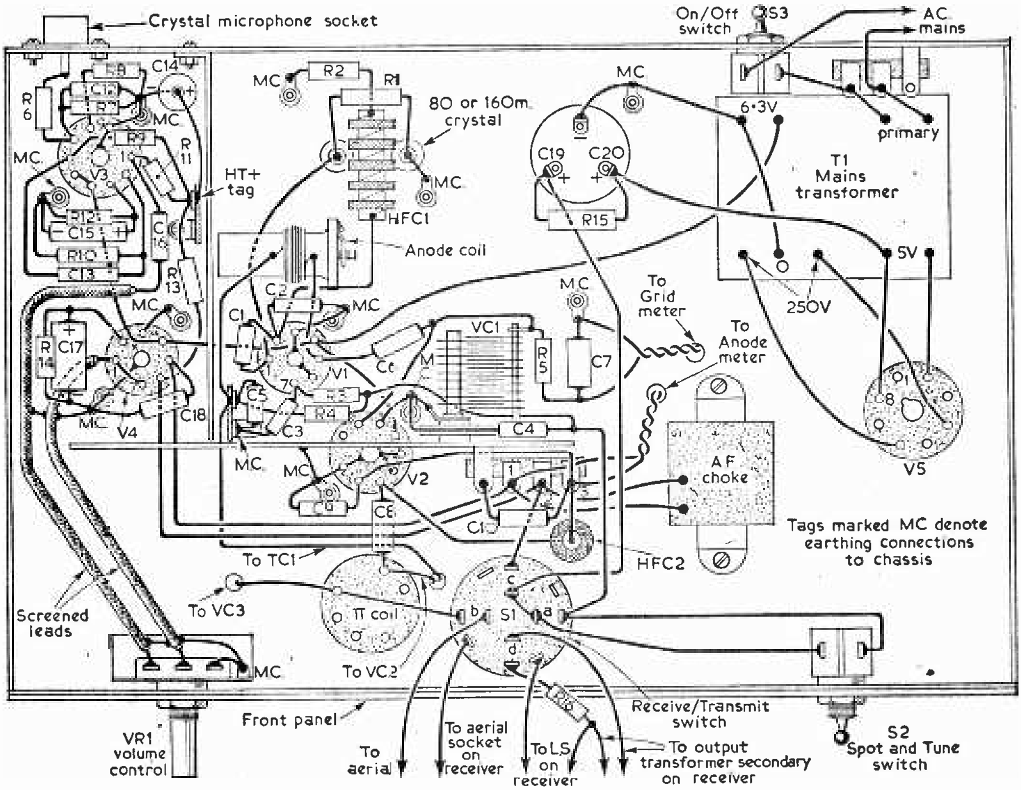


Fig. 3—The underchassis wiring.

equally suitable. No separate mains switch was used because the transmitter and receiver were controlled from a single switch. The transmitter heaters run continuously, in the usual way.

Chassis Layout

This is shown in Fig. 2 and is not very critical. The P.A. tuning condenser should best be at least 200pF, or it may be necessary to modify the number of turns on the π coil, when changing from one type of aerial to another. (A surplus condenser was used here.) The 30pF air-spaced neutralising condenser is soldered to the fixed plates tag. The other lead from the 30pF condenser passes through the chassis to the junction of the oscillator anode coil, 22k resistor, and 1000pF condenser.

For aerial loading a 2-gang broadcast type receiver condenser has sections wired in parallel. A short lead passes from the coil to the fixed plates.

A simple screen round the crystal holder was found useful as some of the valves are quite near. It is preferable to use valve screens over the 6AM6 and 12AT7.

It is necessary to meter both grid and anode current, and this can be done with two separate instruments, or with a single meter and 2-way switch, as will be described next month. The meters, or meter and switch, occupy the left of the panel.

Underchassis Wiring

Fig. 3 shows all components and wiring. The space is divided into sections for the modulator, oscillator, and output stages. Heater wiring is completed before mounting the screens, which are notched to allow the heater connections to pass. These leads should run close against the chassis.

The modulator is built in the small section near the microphone socket. An insulated tag bolted to one screen serves as a H.T. anchor point. Two screened leads pass round the end of the other screen, to the volume control. Externally, a screened lead should be used for the microphone, to reduce R.F. pick-up and avoid hum. The 47k resistor and 50pF condenser provide some R.F. filtering.

A speaker output transformer was found to be satisfactory for the modulator A.F. choke. A reasonably large transformer, rated to carry about 100mA, is required. A component intended for mains pentodes is suitable.

The second screen passes across the 6BW6 valveholder, which is so positioned as to have grid tags behind the screen, and anode and g3 tags in front. Sufficient is cut from the screen to clear the holder.

(To be continued)

Improving Broadcast Receivers

By K. Berry

A SMALL INVESTMENT IN A FEW NEW COMPONENTS WILL REJUVENATE AN OLD SET

(Continued from page 853 of the January issue)

IN all of the additional R.F. circuits described last month, no extra AVC voltage was used, i.e. in all the circuits which were given, the AVC was applied either to the original frequency changer or to the new amplifier. This is in fact completely satisfactory except where the receivers are operated very close to a transmitter—under these circumstances some overloading could occur. This possibility could be eliminated by always applying the AVC voltage to the R.F. stage (see Fig. 6, last month).

It is perhaps worth mentioning that whilst the circuits given in Figs. 3 and 5 were untuned, it is very easy to include a single, fixed-tuned circuit which will have the result of increasing the R.F. gain at (and close to) the resonant frequency of this tuned circuit whilst retaining the general increase in gain over the whole band. This will thus enable any particular desired frequency to receive extra amplification—e.g. a circuit tuned to 208m would give a considerable increase in gain for reception of Radio Luxembourg.

If it is desired to fit such a tuned circuit, it should be connected between the grid of the R.F. stage and the 10k grid leak resistor.

Components

Components values are given only for those components shown in the circuit which are additional to those already in the receiver. The valve recommended is an EF92.

If the layout of the receiver will allow it, extra gain may be obtained in the circuits given in Figs. 3 and 5 by using an EF91 or EF80. In this case, the screen is taken straight to H.T.+ and the cathode resistor should be reduced to 150Ω. Since these valves give a very high gain it might be necessary for the H.T. supply to the R.F. stage to be decoupled—a resistor of 2·7k in series with the supply to the anode and screen, with a 0·1μF capacitor to chassis should suffice.

Increased I.F. Gain by Additional I.F. Stage

A typical superhet I.F. stage is shown in Fig. 7. This is shown again in Fig. 8 with the addition of another stage of amplification preceding the original I.F. stage. This additional I.F. stage may be mounted directly on the receiver chassis; alter-

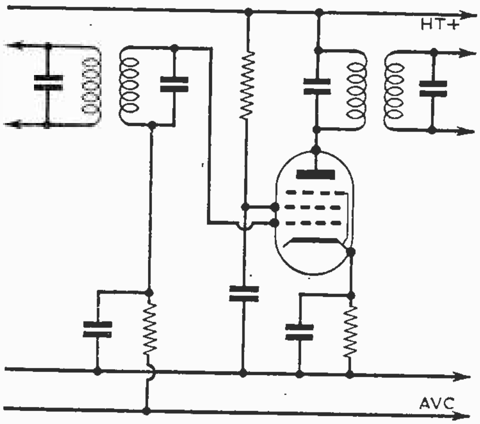


Fig. 7—Circuit of a typical superhet I.F. stage.

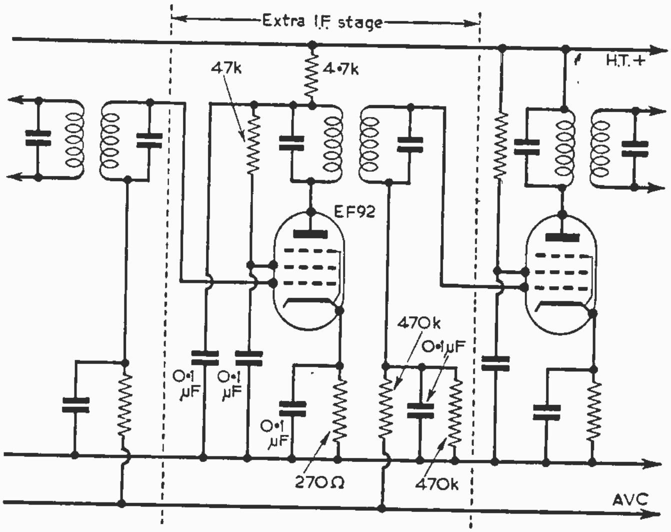


Fig. 8—The circuit of Fig. 6 with the addition of an extra I.F. stage.

natively it may be mounted on a small sub-chassis which is in turn bolted to the main chassis.

This new I.F. stage is controlled by the set's AVC, thus no overloading problems should occur. The normal techniques associated with the R.F. wiring must be employed if instability is to be avoided, i.e. short, direct leads—anode and grid leads kept away from existing "hot" wiring, etc.

Components

As previously, component values are given only for those components shown in the circuit which are additional to those already in the receiver. Once again the valve recommended is an EF92. The use of an EF91 or EF80 here should not be attempted as neither of these valves has a vari-μ characteristic, thus preventing the use of AVC.

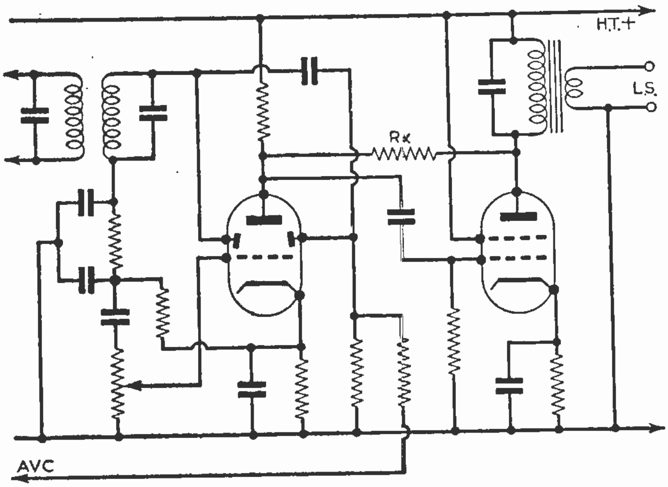


Fig. 9—A typical audio output stage with a resistor Rx added to give negative feedback.

Improving the Frequency Response of the Audio Stage

This is a very simple modification, and in the author's opinion, the most worthwhile one. Most commercial domestic receivers have a triode L.F. stage followed by a pentode or beam tetrode output stage: It is not usual to employ negative feedback, and "tone correction" is effected by shunting the primary of the output transformer with a capacitor. This sometimes has a fixed resistor in series with it, or sometimes a potentiometer which serves as a "tone" (or top-cut) control. The average receiver of this type has a considerable excess of audio gain, and this can be reduced considerably by the use of negative feedback. This will result in reduced distortion and improved frequency response—particularly at the L.F. end.

In Fig. 9 is shown the L.F. side of a typical domestic receiver. This receiver has fixed "tone correction" by means of the capacitor across the primary of the output transformer. Shown connected between the anodes of the L.F. and output valves is a resistor, Rx. This is the only additional component required for this modification, but a considerable improvement is effected.

Tone controls

It will normally be found that "tone" controls of the top-cut variety operating on the primary of the output transformer will be virtually inoperative when feedback is applied in this manner (or indeed in any manner). The reason for this is that negative feedback tends to "straighten out" the frequency response of an amplifier whilst the effect of the "tone control" is to distort the frequency response so that the net result is that the influence of the tone control will be very much reduced.

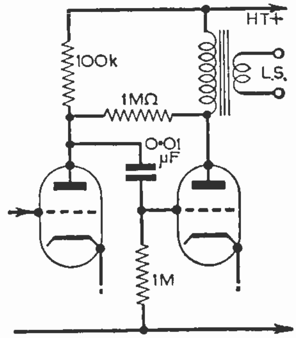


Fig. 10—This circuit shows how the extra feedback resistor forms the upper part of a potential divider (see text).

Potentiometer

The method of operation of the feedback circuit is shown in Fig. 10. It will be seen that the feedback resistor forms the "upper" part of a potentiometer which divides the output of the valve. The "lower" part of the potentiometer is formed by the anode load of the previous valve and the grid leak of the output valve in parallel. The exact value of Rx will depend on how much gain can be "thrown away" and the values of the anode load of the previous valve and the grid leak of the output valve. As a rough guide, the ratio of the potentiometer should be about 10:1, so if for example, the anode load is 100k and the grid leak resistor is 1M, the shunt value of these is 91K: hence the feedback resistor Rx will be about 10 × 91k = 910k. The nearest value to this in 20% resistors would be 1M.

Applying Feedback

It must be emphasised that applying feedback in this manner will result in reduced A.F. gain, so if your radio has no gain to spare—do not try this. If there is no gain to spare, it is possible to obtain more by removing the existing double diode triode and fitting a pentode valve in its place. The diodes can be replaced by germanium crystal diodes. ■

BY THERMION

Experimental Hardships

IT is surprising what a lot of time can be wasted when you are carrying out experiments and are not in a position to have parts properly checked before use. I recently heard of an engineer who was a keen radio experimenter and who owned both R and C bridges with which he used to check all components before using them. The one big thing he lacked, however, was a valve tester. He tells me that he was carrying out some experiments with a new instrument in which were three double triode valves. He wired them up and commenced his tests, only to be met with failure. Altogether, he tells me, he spent nearly three weeks on this circuit, the valves in use having been removed from a piece of equipment which was working satisfactorily. To sum-up, after fruitless endeavours, he removed the valves for some fresh wiring, and apparently replaced them in different sockets. The circuit worked! The difficulty had been due to one of the triodes being low emission, and of such a character that it failed to work in one stage only. It was one of the high-mu triodes, and he found later that in the particular stage in which it had originally been plugged, it would not oscillate. It functioned quite well elsewhere and is, in fact, still in use as an audio amplifier, but it will not oscillate in that particular circuit. I suppose a good valve tester would have revealed the fault and prevented so many wasted hours, but I think there is a moral here, and that is, not to rely on a first test, but to either change all the parts or have them tested, especially if it is some new arrangement which has not before been used or tried out.

Printed Circuits

My comments, some time ago, about the printed circuit have brought many letters and I think it is true to say that opinion is equally divided. I had many interesting suggestions sent to me as to mending or repairing them and it would certainly appear that broken foils are a keen source of trouble. One manufacturer suggested that cracks should not be bridged over, but a new length of wire should be used for the entire run of the broken conductor. One very interesting suggestion was made by a reader to simulate the printed circuit board in ordinary wiring, and I have tried this out and certainly think that it has merits. He takes a sheet of paxolin and drills it to suit the particular layout in which he is interested. First of all he draws out the layout and wiring, arranging for all earth connections, for instance, to be in one line, and so so. The wire ends of resistors and condensers are then passed through the very small holes which he has drilled in the sheet and a wire run along the other side of the board to tie together all parts which are linked in the circuit. In this way he finally has an insulated board on which the components are on one side, and all connections on the other, and he tells me that testing is facilitated, the final construction is much neater, and the set can be practically prefabricated. I must admit that I tried out the idea and certainly found it had its merits.

In the U.S.A.

Do the Americans take their radio more seriously than we do in this country? I am prompted to ask this after seeing an American magazine, sent to me by one of my friends who has left this country. With the magazine he also sent two or three "men only" types, and some domestic (home) magazines. I am greatly struck by the large amount of space which is devoted to radio in these magazines, one having about five pages on the subject of loud-speakers. It is a most exhaustive account of the development of this "beast" in all parts of the world, and gives some details which I had not seen in print before.

The amount of space which is devoted to radio, in all of these magazines, leads me to think that they are much more radio-minded in America, and as a result this must lead to a much greater development in the art. Current market items do not, however, seem to bear this out, and there are not so many items on the American market which cannot be seen here, although they are more advanced in such things as colour television. Of course, with all the channels which are available in every part of their country, I suppose the man-in-the-street must be more radio minded, but I would have thought this increased public interest would have led to much greater developments.

Considering how lacking in general knowledge the majority of people are here, I think we have done a really good job in both the radio and the television fields, although I still would like to see someone come along with something new in the way of aerials. After all, the unsightly mess on the roofs of houses both here and in the U.S.A. will grow still worse as more channels are opened, and some new "receptor" covering from centimetric to long wavelengths would earn a pretty penny for the inventor and the blessings of every householder.

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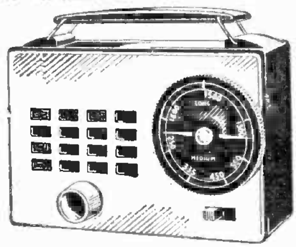

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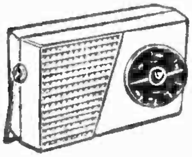

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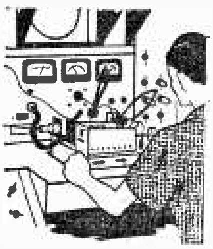

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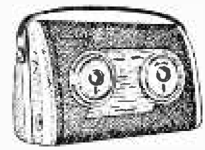

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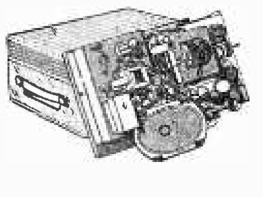

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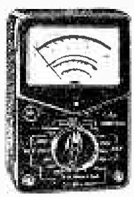

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All about CATHODE FOLLOWER circuits

By E. McLoughlin

PRINCIPLES AND USES OF THIS TYPE OF CIRCUIT

(Continued from page 808 of the January issue)

THE last example of the use of cathode followers which we discussed in the January issue was in circuits where pulses of high voltage are required, for example, in the synchronisation of timebases.

Calculations

In all high-amplitude uses, it is very simple to decide whether a certain combination of valve, R_K and H.T. voltage, is capable of handling an intended signal. Let Vn be the peak negative signal amplitude. Then the grid leak (Fig. 6, last month) is returned to a point at about *plus* Vn to chassis. It follows that the cathode will also rise to about plus Vn (just a little more). By Ohm's Law, the current flowing in R_K is then easily calculated. This represents the "resting" anode current of the valve, and must not exceed the rated value for the valve used. Furthermore, let Vp be the peak positive signal amplitude. The sum of Vp and Vn must not exceed one half of the rated H.T. voltage of the valve used. The H.T. voltage chosen should thus be double the peak-to-peak signal, or more, within the rating of the valve, and the smallest possible value for R_K be chosen which neither causes the anode current rating of the valve to be exceeded, nor lies below about 50 times the reciprocal of the mutual conductance. It is desirable to make R_K as small as tolerable within these limits, because the voltage fluctuation with further external loading is then as small as possible. *Normal* operating anode current ratings, and *not* peak values, should be consulted in the above design procedures.

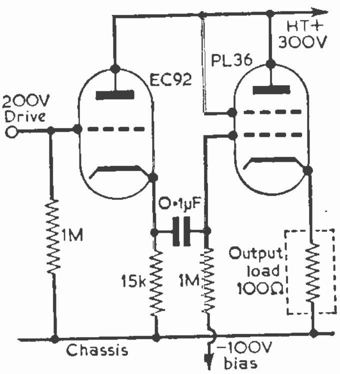


Fig. 7—100W pulse-power cathode follower.

It should be mentioned that the signal frequency response of a normal cathode follower is virtually linear over the entire *video* spectrum, *including pure D.C.*, and goes right up to many megacycles.

Cathode Followers as Signal Generator Output Stages

As the output stage of an Audio or R.F. Signal Generator, one often finds a cathode follower. The reason lies in most cases in the use of the property that the output voltage is largely independent of the exact value of the external load resistance connected. This enables an output calibration to be made for the signal generator which can be relied upon to hold, with tolerable accuracy, for the most varied external loads connected. We are thus mainly concerned with 1:1 voltage-transfer cathode followers here, with their typical high value of R_K of about 10,000Ω to 20,000Ω, or more.

Power-output cathode followers are normally not in question for signal generators, at any rate for audio and broadcast R.F. signal generators. But, for extreme VHF signal generators, such as are used for the high television channels, as well as for video-waveform test-signal generators, where maintenance of accurate waveform is essential, new factors play a role, which necessitate the use of a power cathode follower in many of these cases. If any disturbance is made in a electrical circuit, then the effects of that disturbance are not felt immediately at all other parts of the circuit, but spread out with the velocity of light or less. In particular, if we have a length of coaxial cable, and switch on a signal at the input end, it is not present at once at the output end, but only after a time corresponding to a definite speed of travel of the signal down the cable, which is of the approximate order of the velocity of light. Now, this high speed means that, for reasonable lengths of cable, and audio or broadcast radio frequencies, signal transfer down the cable may be considered, for all intents and purposes, instantaneous. But at very high frequencies, such as are met in modern television techniques, the transit time of even a

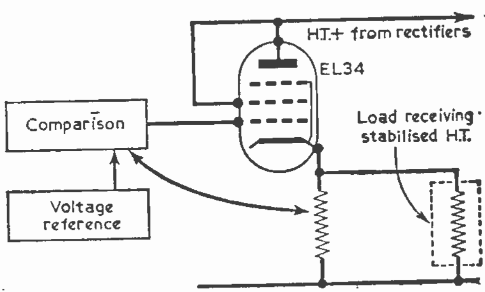
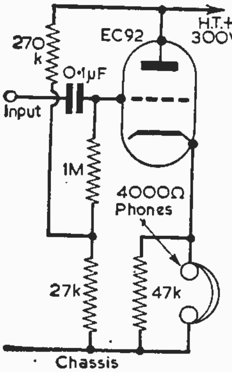


Fig. 8—H.T. voltage stabiliser.

few inches of cable is an appreciable fraction of a cycle. If impedances are not properly matched at all cable/apparatus junctions, a partial reflection giving signals travelling in the opposite direction to that intended occurs as well as loss of power. Reflections from separate ends of a cable will not be in phase, on account of the transit time. Moreover, the phase difference will depend upon the



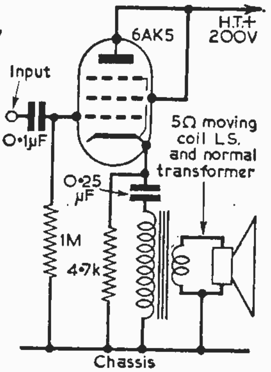


Fig. 9 (left)—Circuit of a "safe" output stage for 'phones using a cathode follower.

Fig. 10a (right)—Simple cathode follower output stage.

frequency of the components of a complex waveform. The net result will be a complete change in the waveform. It is thus essential to match a television waveform signal generator output to the intended load, and thus one finds power cathode followers in many cases in such apparatus.

The Pulse Power Cathode Follower

It is indeed possible to obtain very considerable power out of specially designed cathode followers. If we take a valve of high mutual conductance and having a pulse cathode capable of one amp or so peak current (although, of course, the mean current rating is much smaller), such as are found among modern line-output valves in television receiver circuitry, then short pulses of high power can be generated with such a valve connected as a cathode follower. Let us assume a typical mutual conductance of 10mA/V, giving an output impedance, as cathode follower, of 100Ω. Using

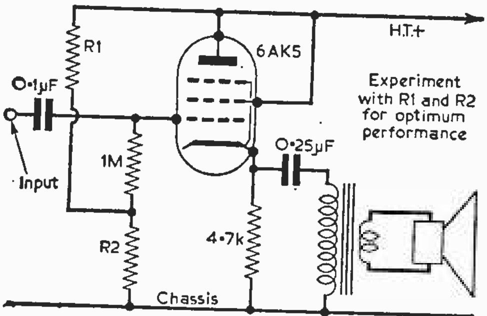


Fig. 10b—Improved cathode follower output stage. R1 is 220k, R2 is 100k, and the H.T.+ is 200V.

a drive of 200V to give an output signal of 100V in the matched condition with a 100Ω cathode load, we just run up to the permissible 1A peak anode current. The output power realised in the external 100Ω load is then given by 1A × 100V; i.e. 100W. Let us assume, typically, that the maximum mean current rating of the valve is 100mA. Then the peak 100W condition may be operated only for one tenth of the total time. For example, one 100W output pulse, lasting a tenth of a second, is permissible once every second. In between times the valve would be resting at its set D.C. operating point, and we can now consider where this will have to lie. At the pulse-peak, when 1A anode current is flowing, the grid-cathode signal will be virtually zero. Thus the grid will be at the same voltage as the cathode, i.e. 100V positive. We are using a 200V positive drive, and thus the D.C. resting point will have to be with the grid at 100V negative to chassis. In other words, the valve is heavily cut off when no signal is present, and thus we see that the pulse power cathode follower is a special case of a Class-C amplifier.

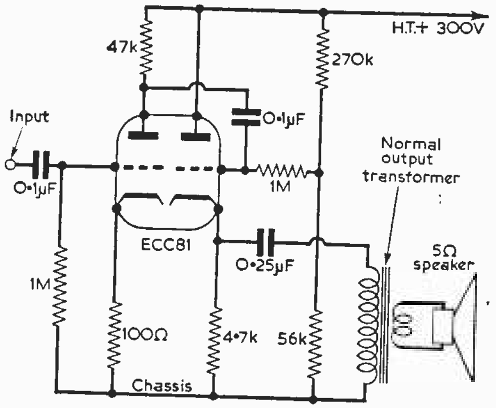


Fig. 11—A double triode cathode follower output stage.

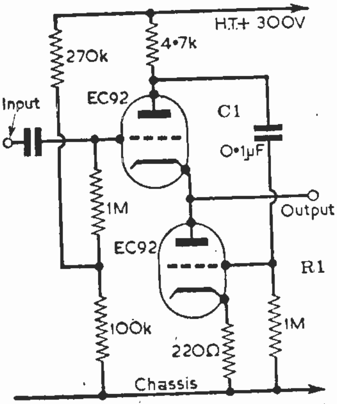
Cathode Follower Drive

The drive for such a power cathode follower naturally consumes no appreciable power, it is a pure voltage drive. Nevertheless, just in case grid-current flows at the pulse-peaks, the drive can be from a smaller cathode follower, this time in 1 : 1 transfer circuit with the usual high RK. Fig. 7 shows a typical complete circuit. The chief use of such a circuit is for firing grid-controlled hydrogen thyratrons in large radar installations, which consume considerable power at the grid. It is also known to the author that such a system has been used to modulate the output stage of a transmitter. The power output cathode follower supplies the entire H.T. power for the P.A., simply by making the P.A. itself take the place of the cathode load. Such modulation circuits, also known as series-modulation, are used in several pulsed radar transmitters.

Finally in this group, it should be pointed out that the usual H.T.-stabiliser circuits using a series-regulator valve (such as in several designs recently published in this magazine) are virtually a special form of D.C. power cathode follower. Redrawing the circuit of such a stabilised power supply in the form of Fig. 8 immediately brings out this point.

Continuous Power (Class A) Cathode Followers

These are the true members of the "power" class of cathode follower, in that they can supply output power, say at audio frequency, in much the same way as a conventional output stage delivering power from the anode circuit.



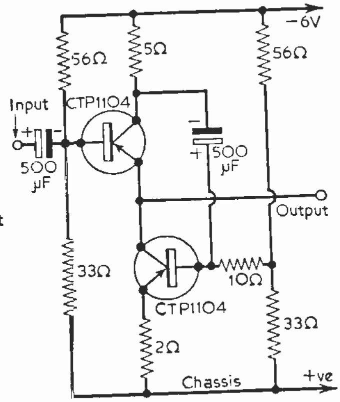


Fig. 12 (left)—A White cathode follower.

Fig. 13 (right)—The transistor equivalent of the White cathode follower (or all resistors increased by the same factor).

It is little known by experimenters that sometimes considerable advantages are to be gained by using an output stage feeding a loudspeaker or headphones in the form of a cathode follower. The first and obvious advantage is that the problem of isolation of the phones from the H.T. voltage is automatically absent (Fig. 9).

The second great advantage is apparent in circuits requiring a small monitor-speaker, but where for reasons of power economy or heat dissipation limits, a conventional output valve is undesirable. In such cases, constructors have often used simple A.F. triodes or R.F. pentodes, frequently with relatively poor results because of the very high anode matching impedances generally required in such circuits, which cannot always be realised with normal loudspeaker transformers. Much improved results are often possible using the same valves as cathode followers, with the normal loudspeaker transformer primary forming R_K. In many cases the D.C. resistance of the transformer primary is sufficient to set a proper D.C. operating point of the stage without further attention to the matter. Fig. 10a shows a typical circuit example which the author has had in operation for a long time. A tiny 6AK5 R.F. pentode strapped as triode cathode follower delivers over 50mW into a small moving coil loudspeaker. The circuit is a small addition to an oscilloscope, to monitor the Y-signal audibly. There was not room, nor spare H.T. power, nor heat dissipation facility, for operating a conventional audio output stage. But this tiny cathode follower output stage draws only some 5 or 6mA H.T. current.

High Impedance Loudspeakers

Those experimenters still possessing large moving-iron loudspeakers of formers days in their junk boxes, having coil impedances of some few hundred ohms, may like to try one direct as cathode load, without transformer, in such a cathode follower output stage. Any small R.F. pentode can be used, strapped as triode. In many cases the constructor will very likely be astonished at the results. Apart from good volume, the tone is generally much better than with the same speaker used in an anode circuit, as the extremely low internal impedance of the cathode follower damps the unpleasant resonances of this type of loudspeaker to a high degree. It is even worthwhile, just for this last reason, trying a conventional output valve such as the 6V6 or the EL84 as a cathode follower. In such a case, however, it is necessary to pay special attention to the correct D.C. operating point, so that the valve does not run at low or excessive anode current. The D.C. resistance of the transformer winding or speaker coil in the cathode circuit must equal the normal cathode bias resistor of the valve used. If it is less than this, then an appropriate series resistor must be used to make up the difference. If it is a little more, that does not matter much, as long as it is not excessive.

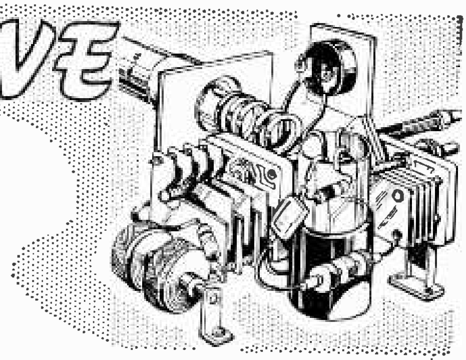
Naturally, the voltage drive required by a cathode follower output stage is high, being about 10 to 100V in most cases. Thus, the audio amplifier preceding the stage will have to have higher gain than is otherwise normal. An extra triode stage can often provide this gain. It is often convenient to use one triode of a double triode to give this extra gain, and the other as the cathode follower. In this way, a valve such as the ECC81 can replace a conventional output valve (see Fig. 11), the rest of the audio amplifier being unchanged. In the case of the author's 6AK5 output cathode follower of Fig. 10a the necessary drive was present anyway, as the Y-deflection of the tube in the oscilloscope requires a similar drive, so that sufficient voltage to drive the cathode follower was present at the Y-amplifier output.

The White Cathode Follower

Fig. 12 shows a further development of the cathode follower principle, to give even lower internal impedance. It is possible to achieve an impedance of a few ohms with this circuit, so that *in principle*, a moving coil speaker would match direct without transformer into it. This is true in practice, too, but the power output is then poor in comparison with the H.T. consumption and size of the valves. This is simply because of the restriction that the valves may not be permitted to run up to the necessary anode current. Thus using a PL36 triode-strapped in each position, only 50mW is possible into a 15Ω moving-coil speaker.

(To be continued)

SHORT-WAVE SECTION



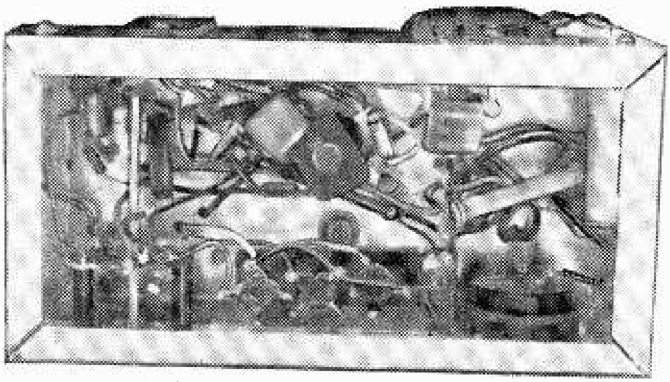
A PRACTICAL PRE-SELECTOR

By A. Sydenham

(Continued from page 833 of the January issue)

IN the previous article, the circuit was described and it now remains to assemble the complete unit and build a cabinet for it. It may then be tested.

A diagram that shows practically all the chassis drilling is given in Fig. 4, the coil mounting apertures being those required for the coils specified. Should the tuning capacitor contact the coil bases when in position, washers should be fitted to provide clearance. Alternatively, the coils may be fitted to a rectangular piece of paxolin held by spacers. Most of the wiring can be made so short that small items are easily suspended in the leads and the orientation of the coils and valveholders assists in this respect. Electrolytic condensers C9/C10 and C11 are held against the chassis by clips.



Underchassis view of the pre-selector.

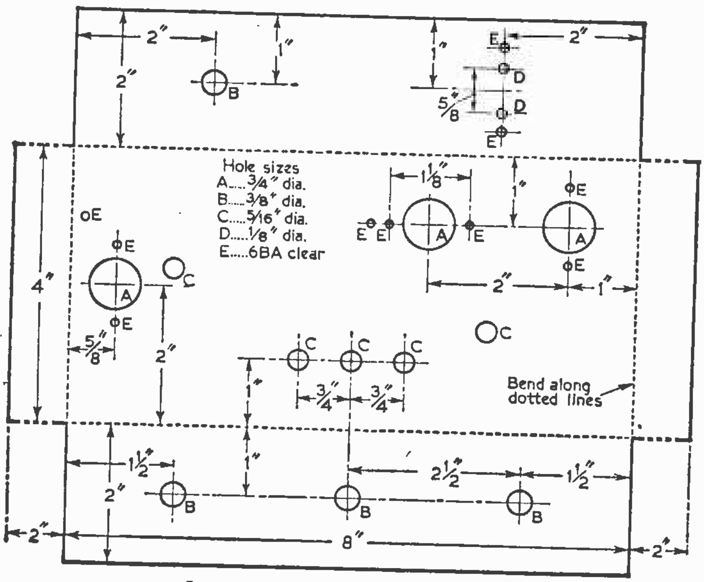


Fig. 4—The chassis drilling diagram.

Assembly

The front panel is secured to the chassis by means of the nuts securing VR1 and S1/S2 and reference to Fig. 5 will show the locations of the various apertures. The tuning condenser spindle also projects through the front panel and a coloured warning lens is fitted to the lower central aperture. It will be found when the panel is firmly bolted in position that the assembly slopes backwards slightly and this not only brings the controls to a more convenient operating height but also improves the general appearance. Mitred sections of quadrant glued firmly to the panel edges further assist in this respect.

Wiring

Use of a soldering iron with a pencil bit is essential and modern miniature resistors and condensers are needed to avoid congestion of sub-chassis components. The use of differently coloured sleeving will also assist final checking considerably.

The Cabinet

The simple design is shown in the semi-exploded diagram of Fig. 5 and may easily be made from ¼in. plywood held together with reinforcement strips, pins and glue. Strips of veneer (obtainable from some model supplies shops) may be glued using Bostik No. 1 adhesive to the edges where joins appear if desired, and the finish may be chosen to suit one's personal taste. The prototype is lacquered in ivory. The slots cut in the sides serve as carrying handles and also provide

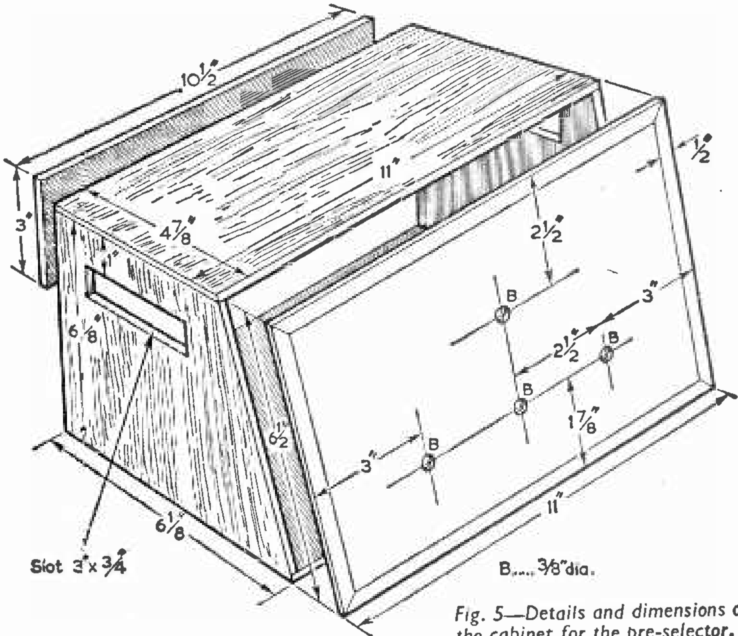
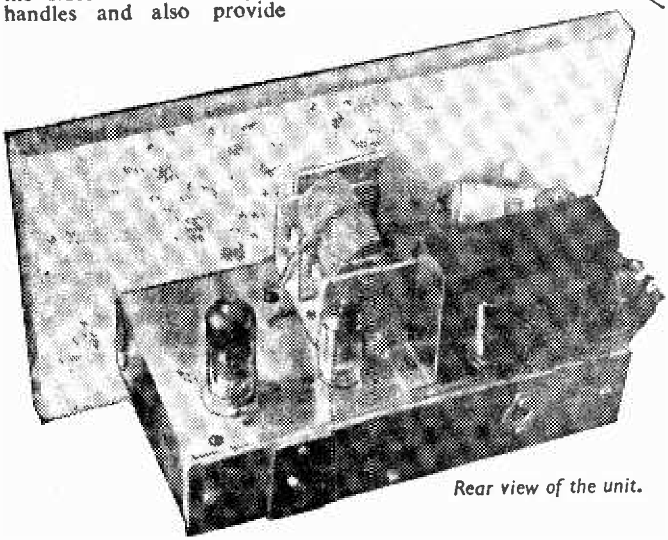


Fig. 5—Details and dimensions of the cabinet for the pre-selector.



Rear view of the unit.

ventilation as cool air is convected from the rear. Four small rubber feet may also be fitted.

Using the Pre-selector

When the unit has been completed and checked the aerial and earth leads should be removed from the receiver with which it is to be used and plugged instead into the sockets provided for them on the pre-selector.

A length of coaxial cable should then be prepared, aerial and earth plugs being fitted at one end (the braiding being connected to the earth plug) and a coaxial plug at the other. This lead should then be plugged into the appropriate sockets on each piece of apparatus. Control VR1 on the pre-selector should now be set to "off" and the wave-change switch turned to position 4. The main receiver should then be switched on and adjusted to receive a transmission in a band also available to the pre-selector. The receiver should now act normally, since the aerial is effectively connected to it direct. The pre-selector may then be switched on and allowed to warm up when its wavechange switch may be rotated to select the appropriate band in use. The received signal should now improve in strength considerably and, as the tuning control of the pre-selector is adjusted, it may be found necessary to back off the sensitivity control, VR1, to avoid overloading. A little practice will soon reveal the best method of use but it should be remembered that too strong a signal fed to the receiver may bring the AVC circuit into action too strongly. Once the user has familiarised himself with operation of the unit it may be calibrated.

When it is desired to use the main receiver on its own it merely becomes necessary to turn the wavechange switch, S1/S2, to position 4 and rotate VR1 to "off" when the indicator lens will become dark. By then, however, the advantages of R.F. gain will have been made apparent.

(Continued on page 942)

THIS UNIT WAS ORIGINALLY DESIGNED FOR USE WITH A SIMPLE GEIGER HEAD, BUT IT WILL OPERATE SATISFACTORILY FROM ANY SUITABLE INPUT SOURCE

By A. Cole

A DIGITAL

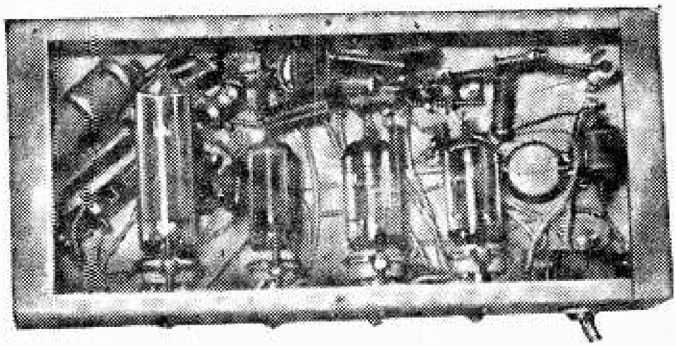
COUNTER

WITH the reintroduction of frequent atomic bomb tests recently, it is an interesting—and possibly useful—occupation for the electronically minded experimenter, to monitor the degree of radioactivity in the air, rainwater, drinking water, or any other samples of interest. Contrary to common belief, this is neither difficult, nor does it require any unusual or expensive circuit components, except for a suitable small Geiger tube. There are some excellent small tubes on the market now, available in the United Kingdom from Messrs. Mullard. The author uses a tube of type number MX146. These small tubes have the great advantage that they require only about 450 to 500 operating voltage, which is easily obtainable from ordinary mains transformer/rectifier circuits.

For checking atmospheric radioactivity, etc., a pure counting of the pulses is required, and the present article describes a suitable automatic electronic counter, giving a direct numerical display of the result on a type of digital relay used by the GPO for counting telephone calls and easily obtainable for about 15s. to £1 at many surplus stores.

The digital counter unit may, of course, also be used for any other appropriate purpose. It will count accurately the number of times a voltage of at least plus 10 is switched on into the input. It does not react when this voltage is switched off again, but counts one more when it is switched on again, and so on. So long as this voltage is 10 at least, and positive, and capable of delivering a current of about 1mA, it does not matter exactly how large it is. Thus a morse key and battery in series connected to the input can be used for manual counting of large numbers of small articles, without the need to keep the numbers in one's head, with consequent danger of error. With a relay wired to contacts on the space bar of a typewriter, the unit can be used to count the number of words in a piece of typescript. But for all such uses, the circuit could probably have been a lot simpler: the main use is in conjunction with a Geiger counter, and for this purpose the circuit features have primarily been developed, as will be seen below. Above all, the unit is designed to be as fast as possible, and free of any grid-current-blocking so that two pulses following very rapidly one after the other are both counted individually. The actual resolution achieved in the author's unit is better than 15 counts per second at the upper limit, which is far greater than the pulse-rate ever obtained with the type of Geiger tube specified with atmospheric radioctivity. In fact, the *normal* atmospheric count with this tube is about 20 counts per minute, i.e. only about one count every three seconds on the average. But these counts are fully irregular—

Internal construction of the digital counter unit.



there may suddenly be many close together, and then for a long time absolutely none, yet it is virtually impossible for a whole minute to pass without any counts at all.

Principle of the Digital Counter Circuits (see Fig. 1)

This is a four-valve triggered pulse-amplifier circuit. V1 is the input amplifier, comprising two stages:—V1A is an earthed-grid input stage, meeting the three requirements (a) freedom of feedback, (b) keeping the same signal polarity (positive), and (c) good gain, so that the stage is over-driven, giving very steep output pulses to V1B, which is a cathode-follower decoupling V2 from V1A as far as feedback is concerned. V1B also returns the signal to low impedance, and now delivers a good steep pulse of at least 100V amplitude. The tiny value of C3, the coupling condenser to V2, differentiates this pulse, so that only a very brief but very steep spike of about 100V is applied to the grid of V2A.

Valve V2 is a monostable multivibrator, the purpose of which is to provide a good squarewave pulse of current, starting exactly at each 100V "trigger" spike from V1, and lasting about one twentieth of a second, which is the optimum switching-time for the counter relay. V2A is normally cut off, because its grid is on a bleeder chain from the low voltage at the anode of the normally conducting section V2B down to a variable negative bias from VR1. The other section, V2B, is, as just stated, normally conducting

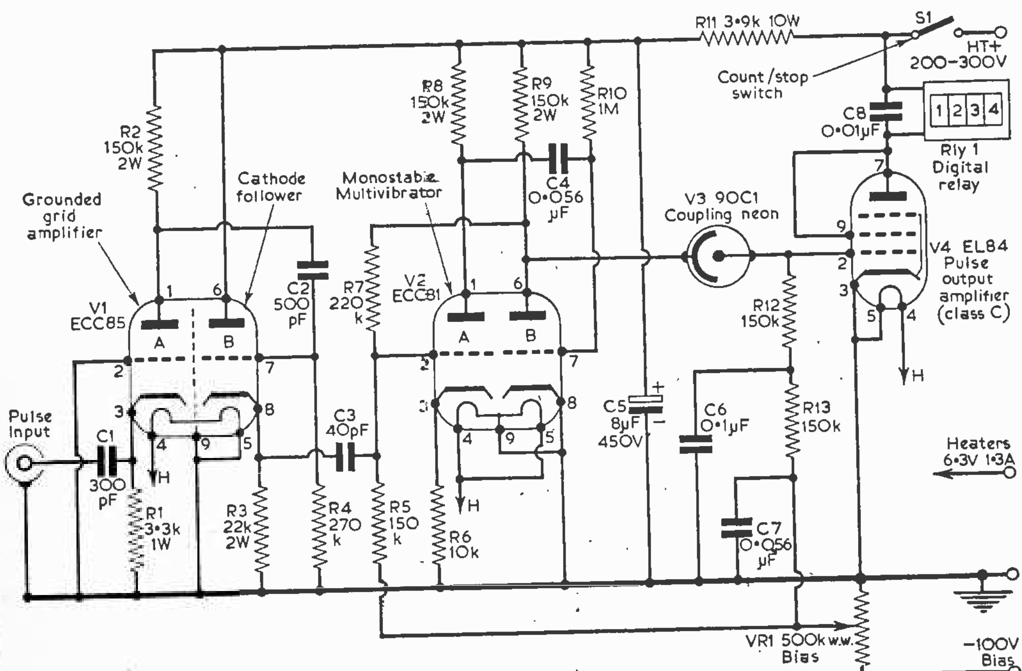


Fig. 1—The circuit of the digital counter. (All resistors are 1W rating except where stated.)

heavily because its grid leak is returned to H.T. positive. This condition is perfectly stable for any length of time until the circuit is suitably disturbed. This disturbance is the short positive 100V spike applied to V2A grid. This lifts it to cut-on and above, which causes an equivalent voltage drop at the anode, which is fed via C4 to the grid of V2B, thus tending to cut off V2B. This causes the anode potential of V2B to rise, which is fed as a further rise to V2A grid on the bleeder. The net result is that the formerly cut-off V2A has suddenly been tuned hard on, and the formerly conducting V2B has been cut off.

Maintenance of this new condition depends upon maintenance of the signal at V2B grid, which remains only as long as C4 is charging via R10. As soon as C4 has charged sufficiently, which takes about one twentieth of a second, V2B cuts on again, and reverses the procedure back to the previous stable state with V2A cut off and V2B conducting, until the next trigger spike arrives. The net result is thus a positive-square-wave pulse of about 100V amplitude and about one twentieth of a second duration at V2B anode.

V4 is a class-C amplifier, i.e. the bias-point is beyond cut-off, applied via R12 and R13 from VR1. In the normal, stable, resting state of V2, with V2B anode at a low voltage because of the heavy conduction of V2B, the voltage difference between V2B anode and V4 grid is not sufficient to strike the neon tube V3; thus V4 is fully disconnected from V2 and resting, cut-off. But during the temporary change-over position of V2, when V2B is cut off and thus the anode voltage high, the neon V3 is struck, driving V4 grid heavily positive. The surge of anode current in V4 moves the digital relay RLY1 one unit on. As soon as V2 reverts to the stable condition, V2B anode potential falls again and the neon V3 extinguishes. V4 grid returns at once to beyond cut-off, and anode current ceases instantaneously. This sudden stoppage of anode current could cause high inductive voltage peaks across the coil of RLY1, if C8 were not there. Thus it is essential not to omit C8, as otherwise the relay could be damaged by flash-over in the coil. On the other hand, do not make

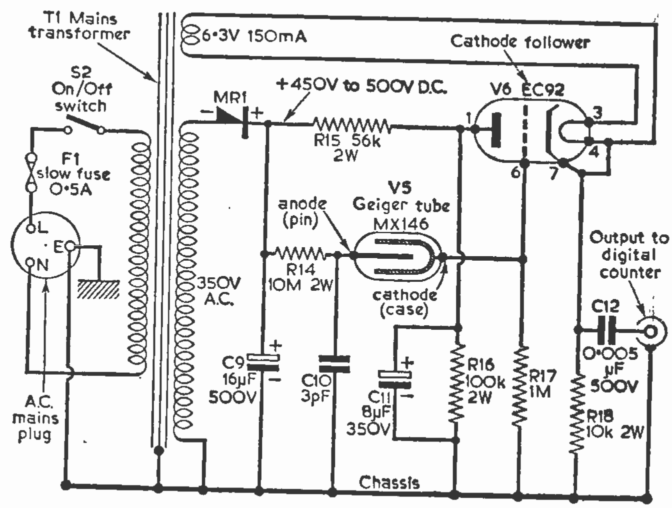


Fig. 2—The circuit of the Geiger head.

COMPONENTS LIST

Resistors (All ±20% Carbon):

R1	3·3k 1W	R10	1M 1W
R2	150k 2W	R11	3·9k 10W
R3	22k 2W	R12	150k 1W
R4	270k 1W	R13	150k 1W
R5	150k 1W	R14	10M 2W
R6	10k 1W	R15	56k 2W
R7	220k 1W	R16	100k 2W
R8	150k 2W	R17	1M 1W
R9	150k 2W	R18	10k 2W
VR1	500k Pot. 1W (w.w.)		

Condensers:

C1 300pF ceramic 500VW
C2 500pF ceramic 500VW
C3 40pF ceramic 500VW
C4 0·056µF paper, 500VW
C5 8µF 450VW electrolytic
C6 0·1µF paper, 500VW
C7 0·056µF paper, 500VW
C8 0·01µF paper, 500VW
C9 16µF 500VW electrolytic
C10 See text next month
C11 8µF 350VW electrolytic
C12 0·005µF ceramic 500VW

Valves:

V1 ECC85
V2 ECC81
V3 90C1 (neon)
V4 EL84
V5 MX146 Geiger Tube (Mullard)
V6 EC92
D1 Metal rectifier 350V A.C./25mA D.C.

Sundries:

Three B9A valveholders, ceramic
Two B7G valveholders, ceramic
Two coaxial plugs and connecting lead
One digital relay, GPO, approximately 2000Ω/25mA (Service Trading Co., 47–49 High Street, Kingston-on-Thames, Surrey.)
Two toggle switches on/off, single pole
One panel fuse, complete
Chassis material, wire, solder, tagstrips, bolts, sleeving, etc.
Test tubes, rubber cork.
Power supply (preferably stabilised) 200-300V/100mA 6·3V 1·3A A.C. (heaters)
Bias supply: about (—100)V on above power unit, or otherwise a small 90V H.T. battery
Mains lead and plug

C8 appreciably larger than specified, as this would then destroy the steepness of the current rise at the start of each pulse, possibly leading to erratic counting. It is of interest to discuss why a neon, V3, is used to couple V2 to V4 instead of the usual coupling condenser. The reason is simple. The signal from V2 is of such a high amplitude that V4 is driven from beyond cut-off right up to heavy grid current by it, and such grid current would charge any coupling condenser heavily and very rapidly during the pulse. After termination of the pulse, this would leave V4 at a correspondingly greater negative voltage at the grid than the intended operating point. This would have the result that the circuit would be more or less blocked at V4 for any pulse coming in subsequently before the coupling condenser had discharged, and would also block the circuit at V2A grid, because the excess negative voltage at V4 grid would react via VR1 and R5 to pull down V2A grid too. The neon thus prevents the amplifier blocking when working at counting-rates approaching the limit of resolution. The alternative method of preventing grid-current blocking of amplifiers handling large signal amplitudes, namely the insertion of grid-stoppers, is not usable here, because it causes signal loss due to voltage drop across the stoppers, and thus makes the anode current rise in V4 too slow for stable counting.

It should be mentioned in passing, that the use of neons as coupling elements in amplifiers receives far too little attention by experimenters. They have a number of advantages over condensers. In a normal class-A audio frequency amplifier, the coupling neons would be permanently struck, and thus represent D.C. coupling and theoretically freedom of all gain variation with frequency. Such an amplifier would amplify D.C., could have many stages, yet use otherwise conventional A.C.-amplifier circuitry with a single common H.T. supply on which all stages run in parallel as usual. And, as seen above, neon-coupling is free from blocking on transients. Of course, the value of cathode resistors, etc. would have to be modified in such an amplifier. But the principle is clear, and might interest more experienced constructors.

Returning to the digital counter circuit. A supply of about minus 100V is required on the bias line input (the exact value is not critical, but should be stabilised preferably—if the constructor has no power unit supplying this output in addition to normal H.T. and heaters, then a small 90V H.T. battery will serve the purpose excellently. This battery may be very small, as the current drain is only about a fifth of a milliamp (but do not forget to switch this battery off after use). The actual value of optimum bias taken to V2A and V4 is quite critical, and also dependent on the H.T. voltage used. The circuit operates excellently with any H.T. voltage between 200 and 300, but requires a different bias value with each H.T. voltage. Consequently the potentiometer VR1 has been incorporated, to set the bias to the optimum value. This potentiometer should be used more or less as a reaction control is used on a simple radio. Bias should first of all be increased until counting stops altogether even when the Geiger-head is supplying pulses at the input, and should then be reduced sufficiently to be quite certain of counting all pulses received. It is too difficult to make this adjustment with the mere 20 pulses per minute of the normal atmosphere, and thus it is advisable to place an alarm clock with luminous figures, or a pocket-watch with substantial luminous figures, near the Geiger tube. The radioactive content of any such luminous paint is sufficient to raise the counting rate of only 20 per minute right up to possibly several hundred per minute, which is sufficient to make bias adjustments conveniently.

At the slower counting rates, the bias setting is not in the least critical. If too high, counting stops altogether and if too low, then V4 runs at heavy anode current which will soon destroy it. Between these two points lies at least one third of the travel of VR1, and slow counting is equally good at any point within this range. But if fast counting is desired, e.g. when checking the radioactivity of luminous paints, or possibly X-rays from poor or defective television cathode-ray tubes, it will be found that if the bias is set too far below the critical value, many counts will be missed.

(To be continued)

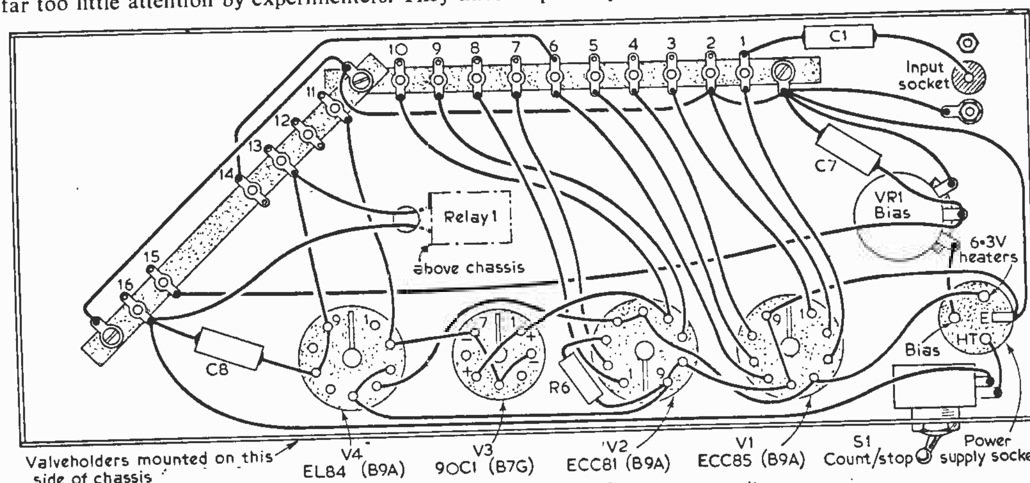


Fig. 3a—The underchassis wiring of the counter unit.

Faults in Transistor

ALIGNMENT AND CIRCUITRY

By J. Christy

TRANSISTOR superhets usually have two intermediate frequency stages, and faults in these may cause lack of sensitivity, or oscillation and other troubles. The I.F. amplifier should be able to provide a very high gain, and if it does not do this, good reception of distant or weak stations will be impossible.

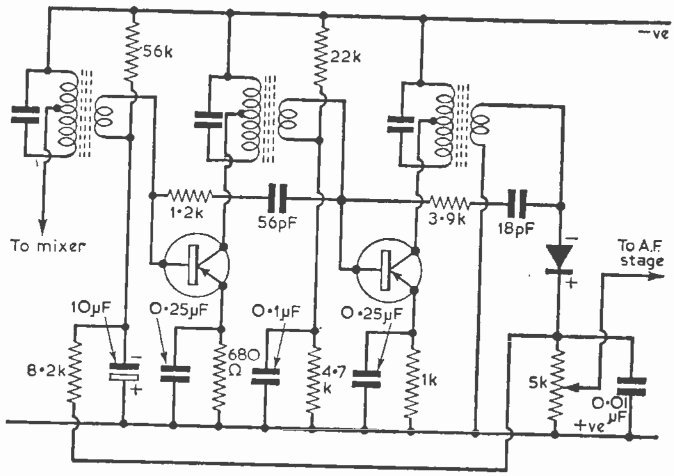


Fig. 1—A typical transistorised I.F. amplifier circuit.

Alignment

Correct alignment of the I.F. transformers is easily achieved. If a signal generator is available, this may be set to the correct intermediate frequency (often 470kc/s) and coupled to the I.F. amplifier at a convenient point. If the circuits are out of tune, a fairly strong input may be needed, or it may be necessary to take the generator output directly to one of the transformers, a small isolating condenser being included in circuit. However, if the alignment is approximately correct, a very small signal will suffice. Merely placing the end of the generator prod or output lead a few inches from the mixer collector circuit should then give enough coupling.

When receivers have the popular type of push-pull output stage, battery current depends directly on the volume of the audio signal. If the generator is delivering a modulated output, a 15mA or similar meter in one battery lead is thus a convenient means of checking for maximum output.

When a good output is being obtained, when the I.F. stages are aligned approximately, the input from the signal generator should be reduced. Accurate adjustment is then easily achieved.

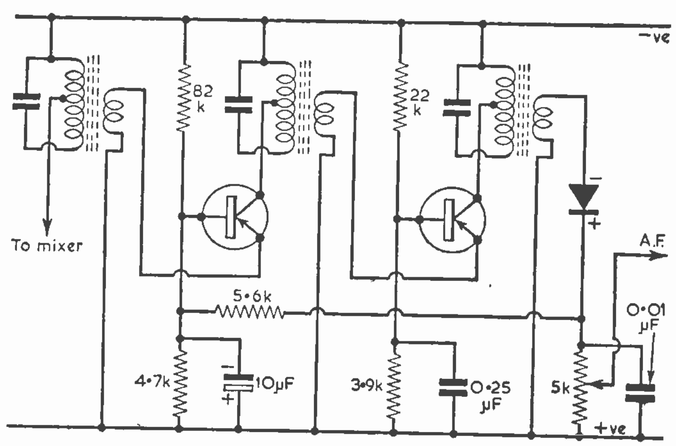


Fig. 2—An I.F. amplifier in which the transistors are used in the common base mode.

An insulated tool (made from an ebonite rod, for example), is used to adjust the I.F. transformer cores. They are simply screwed in or out, as needed, to obtain best results. Each core should have a fairly sharp tuning point.

If no generator is available, a local station should be tuned in, and the cores adjusted for best results. A *weak* station should then be found, with the audio volume control at maximum, and final adjustments should be made.

If all cores are in a reasonable position, it should generally be possible to align the aerial and oscillator stages satisfactorily, even if the I.F. does not fall exactly at 470kc/s, or the correct frequency; if the frequency is much in error, correct ganging of aerial and oscillator circuits may be impossible.

When the I.F. transformers are adjusted without the aid of a signal generator, check that no core is fully in, or too far out. If one of the cores is not in the correct position, all of the cores should be readjusted by an approximately similar amount, and the stages are then realigned for best results at the new frequency.

I.F. Stages

Neutralisation

Neutralisation is generally required, to maintain stability. In Fig. 1, the 1·2k resistor with 56pF condenser, and the 3·9k resistor with 18pF condenser form the neutralising circuits.

The values required can only be varied by a very small amount, if sufficiently accurate neutralisation is to be achieved. The values also depend on the transistors, and are a function of the transformer ratio. This means that with a given circuit, neutralisation can only be ensured if the transistors, I.F. transformers, and values in the neutralising circuits are as specified.

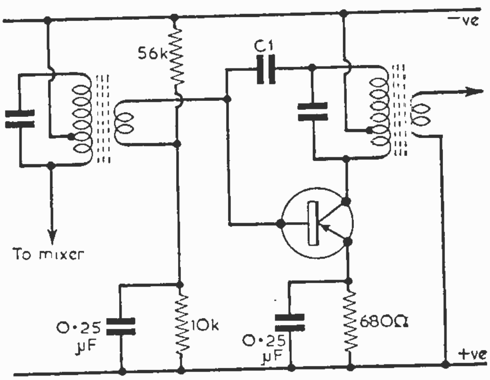


Fig. 3—An alternative neutralisation circuit.

As accurate values are so necessary, components of 2% tolerance may be specified. Individual 5% or wider tolerance components could be suitable, but other samples might be too far from the correct value, so that neutralising is incomplete. The overall feedback is small, and can easily be modified by stray capacity in wiring, especially if leads are long, or base and collector wires are close together.

If the receiver breaks into oscillation when the I.F. transformers are being adjusted for maximum sensitivity, this indicates instability in this section. This oscillation may appear as a continuous whistle or heavy background hiss, or it may only arise when tuning through a weak station. If the instability ceases on tuning in a powerful signal, so that AVC reduces gain, or if it ceases with one or more I.F. transformers only very slightly de-tuned, its cause is probably not serious.

Common Base Circuit

A typical I.F. amplifier of this type is shown in Fig. 2. The gain can be expected to be less than with the common emitter type. This circuit is given because it will be found in some receivers. Each base is supplied through a potential divider, and is earthed to intermediate frequencies by the condeners wired from the base to the positive line.

The emitters are connected directly to the transformer secondaries, these components being designed for this type of circuit.

Decoupling

In Fig. 1, each emitter resistor is by-passed with a 0·25μF condenser. In midget sets, lower values, such as 0·1μF or 0·04μF, may be encountered. These lower values usually give an increased possibilty of instability, which may show as oscillation, motor-boating, or whistles on weak signals only. In such cases, it may be worth increasing the by-pass values. This can easily be done by temporarily wiring a larger capacity condenser in parallel with the existing condenser. If this cures the trouble, the larger value may be permanently incorporated.

In Fig. 1, the first I.F. transformer secondary is decoupled by the 10μF condenser. A large value is required here, as audio frequencies will be present in the automatic volume control line from the diode. Such condensers may deteriorate, and need replacing when they no longer offer a low-impedance path for intermediate frequencies. If so, a 0·1μF or similar condenser may be shunted in parallel.

In the second stage, a 0·1μF condenser is used, in parallel with the 4·7k resistor. Midget receivers may use 0·04μF here, but 0·1μF or 0·25μF can often be more suitable. If the I.F. stages are unstable, the capacity can be temporarily increased, to see if results improve, as already mentioned.

Modified Neutralising and By-passing

In some circuits, neutralisation is obtained by using a small capacity, C1 in Fig. 3, from transformer to base. The value will depend on the transistor, but may be in the region of 5pF. Such small capacities are sometimes obtained by means of twin insulated wires, or a twin-lead wire, reduced in length until the required value is reached.

When the neutralising condenser is in this position in the circuit, its value is not influenced much by the transformer ratio, but will depend on the transistor, and position of the I.F. transformer primary tap.

In some circuits, by-pass condensers are not taken to the earth line afforded by the battery positive circuit. Instead, the by-pass condensers for any

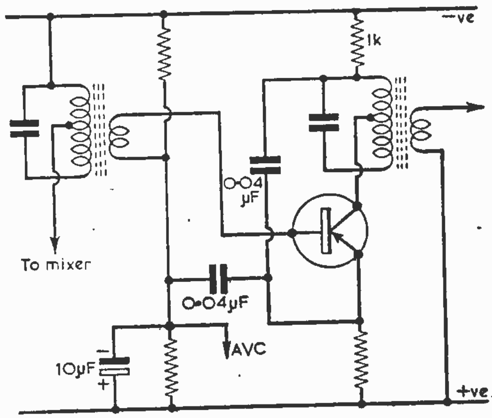


Fig. 4—An example of a circuit in which the by-pass condensers are taken to the emitter of the transistor instead of to the positive line.

stage are taken to the emitter of the transistor, as in Fig. 4. This can be a little confusing, if not expected, but otherwise the circuit is practically the same as that in Fig. 1.

Diode Detector

Receivers of this type use a diode, as detector, and to provide AVC. If this diode has a low efficiency, good results will never be achieved. If no means of testing the diode are to hand, and it is suspected, it should be replaced by a new one such as the OA81 or GEX58.

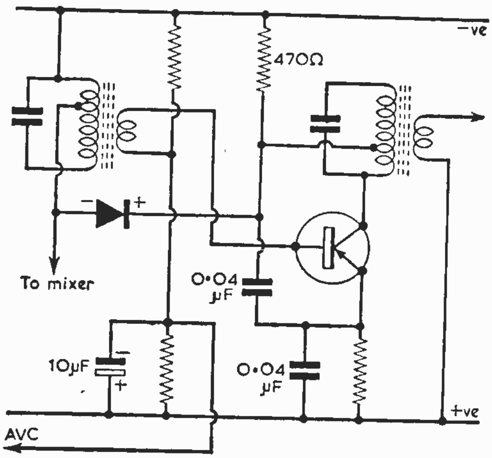


Fig. 5—The typical circuit arrangement for a damping diode.

The diode must be wired in the right way round, as shown. When signal strength increases, an increased positive voltage is developed at the positive end of the diode (Fig. 1). This is transferred to the first I.F. stage, through the 8·2k resistor, and makes the base voltage more positive, reducing amplification. This provides some measure of AVC (Automatic Volume Control) action, but the effect is much less than with most valve receivers.

If the set is stable on loud signals, but unstable on weak signals, this probably arises from the AVC action, as already explained. That is, the instability is not severe, so that the reduced gain on a strong signal temporarily clears the fault.

Some receivers employ a damping diode, in addition to the AVC diode. One method of connecting this is shown in Fig. 5. The collector current through the 470Ω resistor results in the positive end of the damping diode being slightly positive, and the diode has little effect on the mixer I.F. transformer, but, when signal peaks exceed the damping diode potential, the diode conducts, loading the transformer and reducing gain. This gives increased AVC efficiency, and in particular avoids overloading on very strong signals.

Reflexed Amplifier

A circuit similar to that in Fig. 6 is used in some receivers. Here, one transistor acts as both I.F. and A.F. amplifier. This gives improved results, from a given number of transistors, but is somewhat less effective than the use of separate transistors.

In this circuit, the first I.F. transformer secondary is by-passed to the emitter (see Fig. 4) by the 0·01μF condenser. Instability at intermediate frequencies may arise from this condenser being defective or disconnected. The primary of the second transformer is similarly decoupled to the emitter. The values used (0·01μF) are rather small, but cannot very well be much increased, because they are in parallel with the audio signal, and thus reduce top response.

After detection in the normal way, by the diode, the signal passes from the 5k volume control slider, through the 6μF condenser and 3·9k resistor, and the secondary of the I.F. transformer, which has negligible impedance at audio frequency. The transistor then acts as an A.F. amplifier, and the A.F. signal is developed across the 1·2k resistor.

A large emitter by-pass capacity (50μF) is required, as this stage is acting as an amplifier at audio frequencies, as well as intermediate frequencies.

Oscillation at audio frequency is not very likely. The stage can be tested at A.F., if necessary, by temporarily disconnecting the diode, and feeding in an A.F. signal from an outside source.

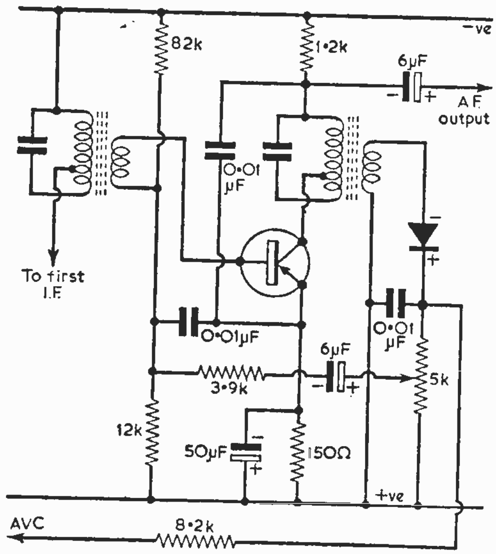


Fig. 6—A reflexed circuit—here, one transistor is used to amplify both I.F. signals and A.F. signals.

After any of the points described have received attention, it should be possible to adjust the I.F. transformer cores for best results.

If it is necessary to connect the generator directly to the receiver, this may be carried out by taking a 0·01μF or similar isolating condenser to the base of the first transistor (the mixer). If the generator signal is taken to a transformer or collector circuit, the core will probably need slight readjustment after the generator lead is removed.

The transistors used in such stages should have a cut-off frequency of 5Mc/s or higher, so reliable transistors, designed for such purposes, should be employed. General lack of sensitivity may arise from poor transistors in these stages. ■

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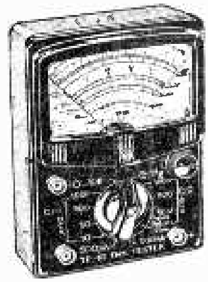

2,000 O.P.V. MODEL TP-10. Reads A.C. & D.C. Volts up to 1,000; D.C. Current to 500mA; Resistance to 1 Meg; Capacitance to 1μF; Decibels from —20 to +36; Output jack for Audio Measurements. Size 3¼in. x 5in. x 1¼in.

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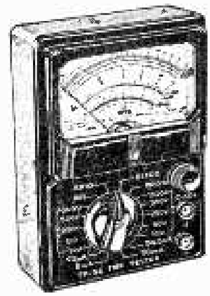
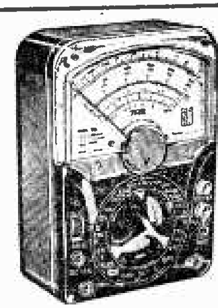


20,000 O.P.V. Model TP-5S. Reads voltages up to 1,000 D.C. at 20,000 ohms per volt and A.C. at 1,000 o.p.v.; D.C. Current to 500mA; Resistance to 10 Megs.; Capacitance to 0.1μF; Decibels from —20 to +36. Size 3¼in. x 5in. x 1¼in.

£5.19.6



30,000 P.O.V. Model 500. Volts to 1,000 D.C. at 30,000 O.P.V., A.C. at 20,000; 12 Amps D.C. Current; 60 Megs Resistance; —20 to +56 Dbs; Internal buzzer short circuit warning. Size 3⅛in. x 6⅛in. x 2¼in.

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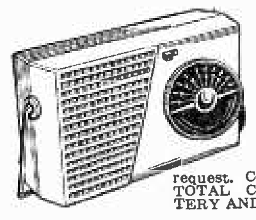

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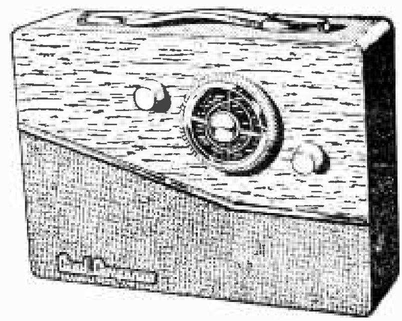

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This switch is made by *The Plessey Co. Ltd., Ilford, Essex.*

Trade News

NEW WIDE RANGE OF 1·5W ZENER DIODES FROM G.E.C.

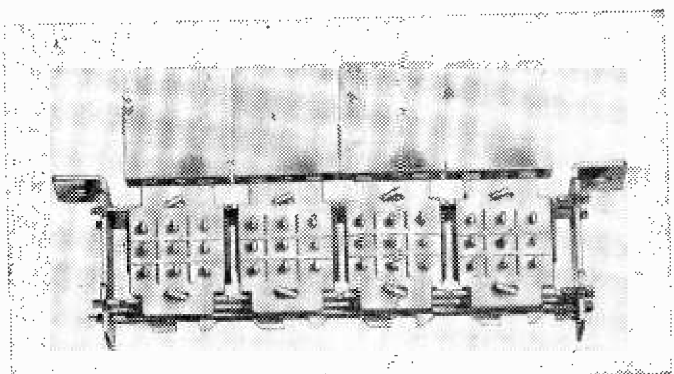
THE SZA/C series of silicon zener diodes made by the General Electric Co. Ltd., formerly of ±10% tolerance, now has a nominal tolerance of ±5% and ranges from 5·6V to 33V. Maximum mean power dissipation at 40°C is 1·5W and the diodes are enclosed in a double-ended case with wire leads and a threaded base.

The diodes are numbered SZ56A to SZ91A and SZ10C to SZ33C with nominal zener voltages of 5·6V to 33V, graded according to the international preferred values of the 10% increment series.

The General Electric Co. Ltd., Semiconductor Division, School Street, Hazel Grove, Stockport, Cheshire.

MINIATURE PUSH BUTTON SWITCH

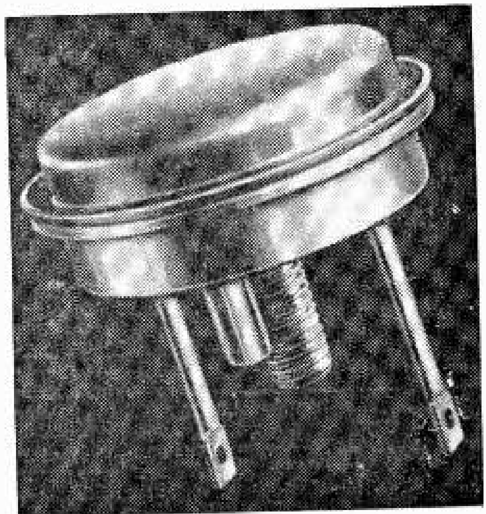
THE Plessey Company Limited announces the introduction of a miniature push button switch which is available with one to twelve buttons. The switch is of a compact design which makes it highly suitable for inclusion in small domestic radio receivers, tape-recorders, etc. Each button can provide up to 6-pole change over switching per side, giving a possible total of 12 poles per button.



A new push button switch from the Plessey Co. Ltd.

NEW TRANSISTORS

THE NKT 501-504 series of transistors, recently announced by Newmarket Transistors Ltd., are very high current, high power, pnp alloy-junction germanium components, designed for amplification, control and switching applications in the industrial and services field.



One of the new range of transistors from Newmarket Transistors Limited.

There are four types, ranging from the NKT501, a high-voltage, very high-current transistor with a voltage rating of 60, to the NKT504, a medium-voltage, high-current transistor with a voltage rating of 30.

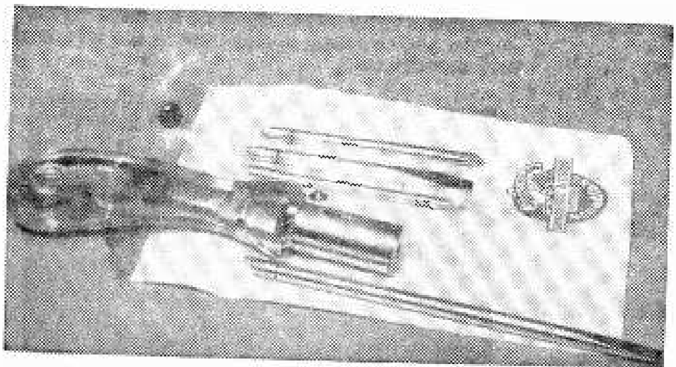
The distinguishing features of the NKT 500 range are the very high current ratings (up to 25A), a guaranteed minimum current gain of 12 at the maximum rated collector current, high power rating and voltage ratings of 60 and 30. The low saturation voltage results in low-self dissipation when used for switching applications. The drive voltage for peak collector current is low and distortion is minimised by controlled beta fall off.

These transistors are manufactured by *Newmarket Transistors Limited, Exning Road, Newmarket, Suffolk.*

MULTI-BLADE RATCHET SCREWDRIVER

A MULTI-BLADE ratchet screwdriver has been added to the Darwins Tool Division range of J. Stead and Company Limited.

The screwdriver has an amber plastic pistol-grip handle and it is supplied in a plastic wallet with four blades: electricians' type; engineers' type, and Nos. 1 and 2 cross-point types. The latter two blades are of special use to the amateur TV enthusiast who services his own or his friends' TV sets, since cross-headed screws are often found in the chassis construction of TV receivers.



A multi-blade ratchet screwdriver made by J. Stead and Co. Ltd.

The complete screwdriver with four blades costs 19s. 6d. from most hardware and tool dealers. Replacement blades can be obtained at 2s. 3d. each. *J. Stead and Co. Ltd., Manor Works, Cricket Inn Road, Sheffield 2.*

MINIATURE SOLDERING TWEEZERS

A NEW type of soldering instrument has recently been developed to meet the need for precision soldering in laboratories and on production lines with micro-miniature circuits modules, diodes, transistors, relays, etc.

Designed, developed and manufactured in the U.K. by Oryx Electrical Laboratories Ltd., the instrument is in the form of a pair of tweezers having separate heating elements to both tips. The elements operate at up to 554°F tip temperature from 6V supply.

Light to handle and requiring only minimum finger pressure, these tweezers provide unobstructed view at all times for close precision soldering. These soldering tweezers are marketed in the U.K. by *W. Greenwood Electronics Ltd., 667 Finchley Road, London, N.W.2.*

CERAMIC-CASED TUNNEL DIODES

THE operating frequency of tunnel diodes has been raised by a technique of miniature ceramic encapsulation developed by Standard Telephones and Cables Limited.

The extremely small size of these new devices and their tab-ended configurations, have reduced their inductance to such an extent, that a typical limiting frequency of oscillation of 900Mc/s is now attainable.

A single version, known as the JK30A, is now in production. It is being followed by a new version incorporating a matched pair of tunnel diodes and forming a single integral unit having three tabs. These units are matched for peak current and capacitance and are intended for applications in the computer field. They may be used in high speed logic and counting circuits or as the thresh-hold amplifier/gate at the input of a pulse amplifier. *Standard Telephones and Cables Limited, Connaught House, Aldwych, London, W.C.2.*

5-DIGIT VOLT/OHM METER

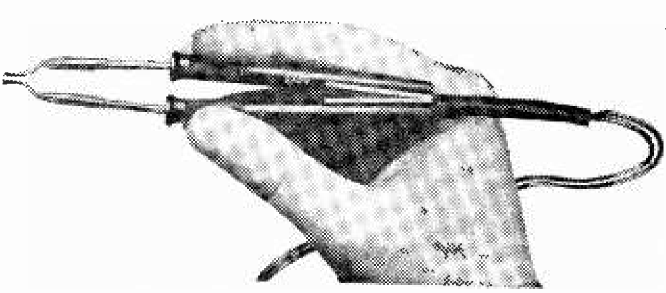
A NEW addition to the Ferranti range of digital instruments is the type D201, 5-digit volt/ohm Meter. This instrument, which makes extensive use of semiconductor, elements, has been designed to measure D.C. voltage and resistance over a wide range to an accuracy of better than 0·03% of reading of ±3 digits, whichever is the greater.

The voltage range is 0·0001 to 1000V D.C. and the resistance range 000·01Ω to 1299·8k. The ranging is automatic on both inputs, except for the most sensitive range in each instance, which is selected by a "divide by 10" switch. D.C. current can be measured from full scale readings of 1·9999μA to 1·9999mA after slight modification to the instrument. The conversion time is normally 250 milliseconds—irrespective of reading—and the input impedance is 4·44M on all ranges, although this can be increased to 10M if required.

Servicing of the instrument has been simplified by using detachable sub-units which are easily maintained, printed circuit cards being used for the transistor circuitry.

The instrument is housed in a cabinet measuring 20in. × 15in. × 14in. and weighs 35lb approximately. A rack mounted version is also available.

The type D201 meter is made by *Ferranti Ltd., Ferry Road, Edinborough 5, Scotland.*



Oryx soldering tweezers

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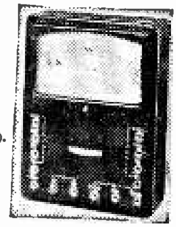

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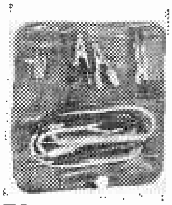

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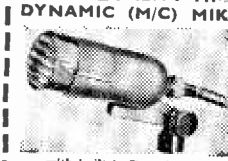

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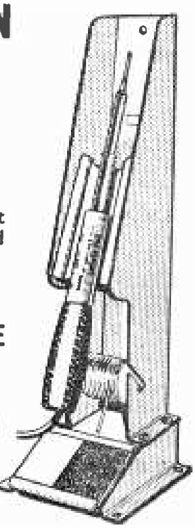

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Complete range of Caby Test Meters, prices 54/-, 97/6, 130/-. S.A.E. for Descriptive Leaflets.

Short-wave Listeners' Log

THE choice of a suitable receiver is not always easy, as prices and specifications vary so much. With home-built receivers, improvements and additions can, of course, be made. There are also a number of current communications receivers available, and full details of these can be obtained from the makers. The price is generally quite high.

When a ready-made receiver of high efficiency, at relatively low cost, is required, a second-hand, used, or surplus model is probably the only choice. Brief details of some of the most popular and suitable receivers of this kind are given here.

R1155. About 16½in. × 9in. × 9in. Seven valves, plus two in unused direction-finding circuit, and magic eye tuning indicator. BFO (beat frequency oscillator for C.W. morse) Needs separate power pack and output stage for speaker. Many cover 17-4000m, with gap between 100 and 200m, but other coverages available. Frequency calibrated dial.

R1224A. About 19in. × 14½in. × 9½in. Battery 5-valver: R.F./F.C./I.F./DET/output, tuning 30-300m in 3 bands. Charts for numbered dial.

CR100 and B28. About 16in. × 16½in. × 12¼in. Ten to 5,000m in 6 switched ranges. Frequency calibrated and logging scale. Eleven octal valves. Internal power pack. Controls: Tuning, band-change, pass-band (6,000-100c/s) crystal filter, aerial trimmer, H.F. gain, A.F. gain, BFO, function switch, on/off switch, and noise limiter on some models.

CR150. About 16½in. × 17in. × 13½in. Double superhet model. 5-150m in 5 switched bands. Noice limiter, crystal calibrator, S-meter. Small triode output stage. Separate power unit.

AR88D. About 19¼in. × 19¼in. × 11in. About 9·5 to 550m in 6 switched bands. Twelve valves, plus rectifier and voltage regulator, full communications facilities. Internal power supply. Companion models with different coverage.

HRO. About 17in. × 11¼in. × 8½in. Nine general coverage plug-in coil units over 10 to 6,000m. In some cases special coil units giving bandspread tuning over amateur bands are available. Numbered dial tuning. Ten UX type valves, but octal valves in later models. Separate power pack. BFO, S-meter and full communications facilities. Some models have fewer coils.

Collins T.C.S. About 13in. × 11in. × 11in. For use with companion transmitter, 25 to 200m. Octal valves. May be run from separate rotary generator.

BC312. About 18in. × 10¾in. × 9¼in. Nine valves, covering 17 to 200m. BFO and other facilities. Intended for 12V accumulator supply.

Any of these receivers will provide very good results. The band coverage available may be important, as some receivers have a more limited short wave coverage than others. Those sets which include normal long and medium wave bands will provide very good long-distance reception, on these bands, in addition to covering S.W. bands. Receivers which require a separate power unit, or are intended for accumulator or battery running, are not suitable when a single, self-contained set, for A.C. mains operation, is required. In all cases a separate, moving-coil permanent magnet speaker is necessary.

Actual models naturally vary somewhat in age, condition, and exact details, but it is nearly always possible to obtain a reasonably complete specification in advance.

A brief description of features which will be found in detailed specifications should be helpful. Those generally present are as follows:

Pass-band Selector

A control giving variable selectivity, typically from 100 to 6,000c/s, in a high-grade set. The very high degrees of selectivity can only be used for C.W. (morse) reception, as a rule.

Function or Operation Switch

A control bringing the AVC in or out, possibly bringing the BFO in, for C.W. reception, and leaving the receiver standing by with heaters on but H.T. off.

H.F. or R.F. Gain

Control of the R.F. stage or stages, and possibly the I.F. stages.

A.F. Gain

The usual type of audio volume control.

BFO Pitch

Control adjusting the pitch of the beat frequency oscillator, to give best results through interference when receiving C.W. (morse).

Crystal Filter or Phasing Control

This allows adjustment of a crystal filter, giving high selectivity, and allowing an interfering C.W. signal to be rejected or reduced.

Aerial Trimmer

A control, frequently panel operated, allowing the first circuit to be trimmed manually, to compensate for stray aerial capacity.

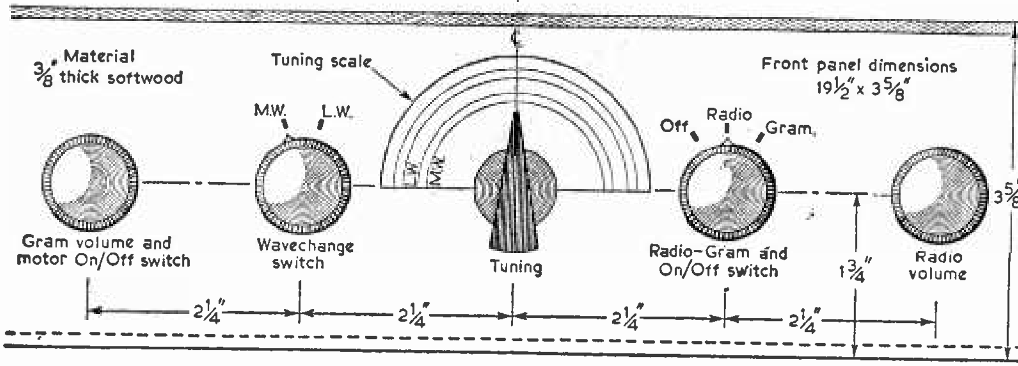

Fig. 24—The layout of the front panel of the radiogram.

Wiring the three sections of the CITIZEN together, to form the complete radio or radiogram

(Continued from page 817 of the January issue)

LAST month, the construction of a cabinet for the 'Citizen' was described; it now remains to describe the mounting and inter-wiring necessary when the units are incorporated in the cabinet. The cabinet described last month was designed to provide a modern housing for the 'Citizen' and a battery record player to make a complete battery-operated radiogram. However, for those readers who require only a battery operated radio set, the wiring needed to connect the 'Mini-Amp' to the two units of the 'Citizen' will also be described.

Wiring for the radiogram

Before this can be carried out, the 'Citizen' must be tested and aligned as described in the December issue (on pages 718 and 719). It is very important that the units should work correctly before starting to mount them in the cabinet.

The control panel of the radiogram is shown in Fig. 24. From this it can be seen that six control knobs are provided. There are: a 'gram volume and 'gram motor on/off switch (this switch ensures that the 'gram motor cannot be left running when the radio is in use); a wavechange switch; a tuning condenser; a three-position switch for radio/gram change-over and (in the third position) radio off switch, and a radio volume control.

(Continued on page 941)

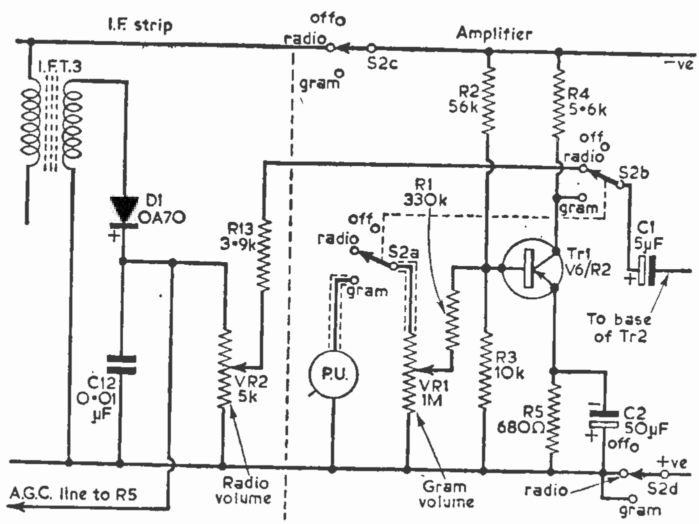

Fig. 25—The theoretical diagram of the connections needed for wiring the units as a radiogram.

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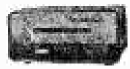
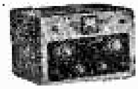
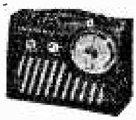
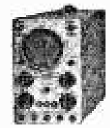

F.M. TUNER


S.33


S.88

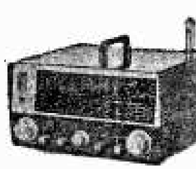

DX-40


UXR-1


OS-1


SSU-1


AG.9U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(Continued from page 938)

The effects of the switching can be seen from the circuit in Fig. 25. This shows the output from the 'Citizen' and the input stage of the 'Mini-Amp' and the associated inter-connections. It should be noted that a separate 9V battery is used for the motor of the 'gram deck to prevent interaction and an unduly short battery life.

Modification to the 'Citizen'

The only modification required is the replacement of a fixed resistor by a variable type. The resistor concerned is R10 (the I.F. amplifier on the 'Citizen' blueprint) and this is replaced by an equivalent wire-wound potentiometer to form the radio volume control (VR2 in Fig. 25).

The actual interwiring required in the 'gram cabinet is shown in Fig. 26. This is a view of the underside of the motor-board and front panel of the cabinet (note that it does not show all of the underside, but only the section where wiring is present). Note that the connection between the two

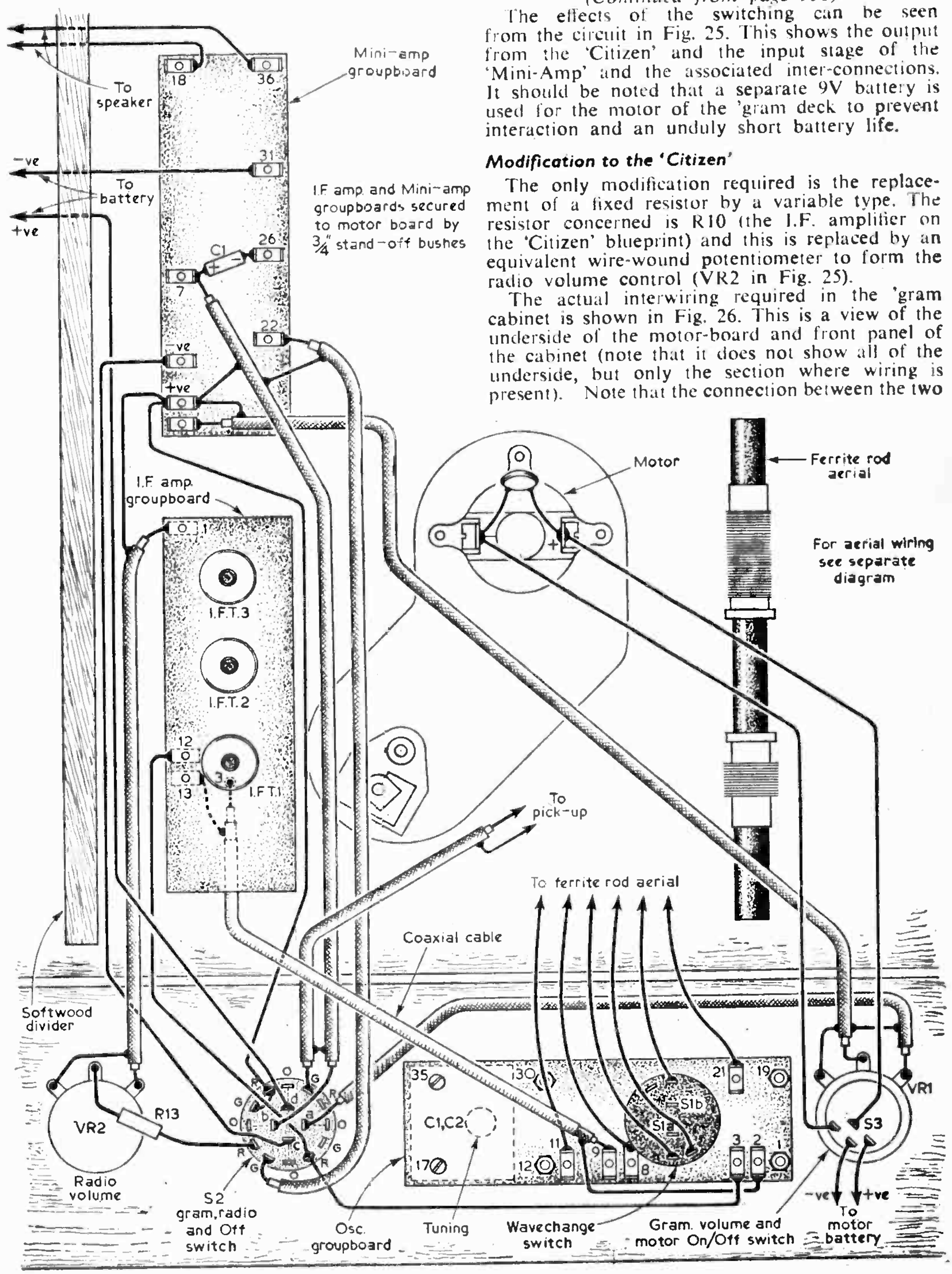

Fig. 26—The radiogram wiring.

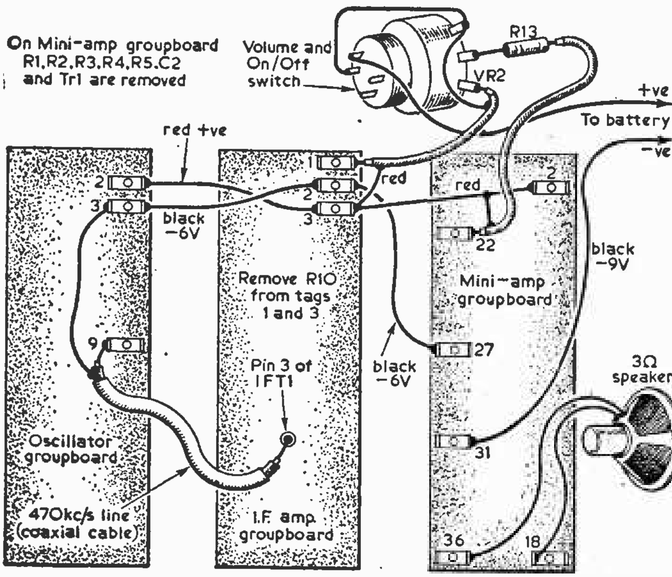

Fig. 27—The interwiring for the tree sections as a radio.

as good as they were before mounting the units in the cabinet and the alignment procedure may be gone through again now that the units are occupying their final positions. The alignment was described in detail in the December issue on pages 719 and 720—it starts at the side-heading 'The Alignment'.

The 'Citizen' without the gram unit

The interconnection for using the 'Citizen' with the 'Mini-Amp' to form a superhet radio set are shown in Fig. 27. The three group boards are shown viewed from the tag sides and not from the riveted sides. As in the radiogram, it is necessary to replace R10 on the 'Citizen' with a variable resistor — see Fig. 28. Since the 'Citizen' gives a high-level output, certain components can be removed from the 'Mini-Amp' and these are listed in Fig. 27. (They are R1, R2, R3, R4, R5, C2 and Tr1.)

As in the radiogram, the connection between the two group boards on the 'Citizen' which carries the I.F. signals is made of coaxial cable to reduce the capacity which the interconnection places across the I.F. output coil.

When the three units have been mounted in the cabinet (which may be of any form) the alignment should be carried out again. ■

group boards on the 'Citizen' which carries the I.F. signals is made of coaxial cable to reduce the capacity of this link. The wiring of the ferrite rod aerial windings is not shown since it was given earlier (Fig. 17 on page 718 of the December issue). The three tag-boards are mounted by the means of stand-off bushes as stated in Fig. 26. A diagram of the mounting of the oscillator section of the 'Citizen' was given in Fig. 22 in the January issue.

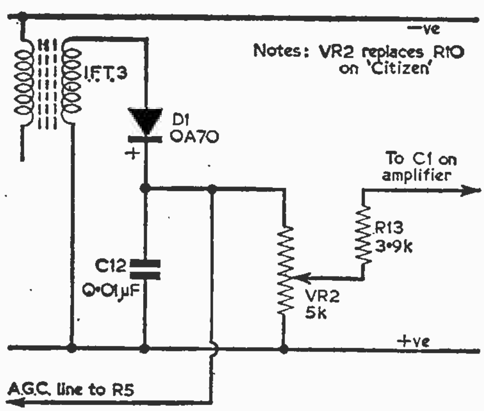

Fig. 28—The circuit of the radio wiring. Note that R4 has been removed.

The inter-wiring can be carried out and then checked most carefully—if, for example, the battery feeding the 'Citizen' and 'Mini-Amp' were wired incorrectly, the transistors would be ruined.

Following this check, the unit can be switched on and tested. Results from the radio may not be

SHORT-WAVE SECTION

(Continued from page 923)

Conclusion

Although the unit described is an efficient one it is open to improvements. It would not be difficult, for example, to tune the grid circuit of V1 to improve sensitivity and the spare section of C6 could be employed in this connection, aerial coils being mounted in front of V1 for this purpose above chassis.

V1 Substitute

A valve of different type may be used for V1 if desired provided it has variable-μ characteristics and that attention is paid to the basing which might well be different. A metal rectifier may also be used in place of V3 if preferred and in some cases it might be possible to link the receiver AVC line to the pre-selector. ■

NOTE—The isolating transformer, T1, should not be omitted or exchanged for a heater transformer, neither should the pre-selector be used in conjunction with a receiver of the A.C./D.C. class or danger to life might result.

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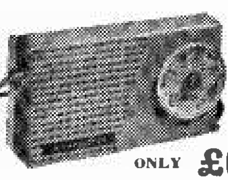

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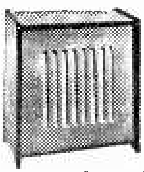

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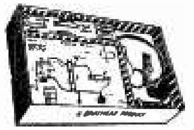

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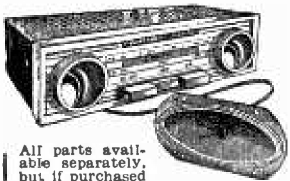

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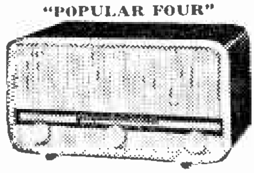

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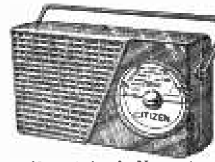

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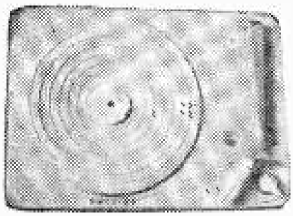

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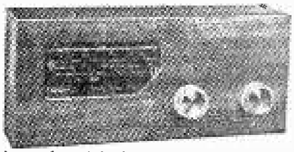

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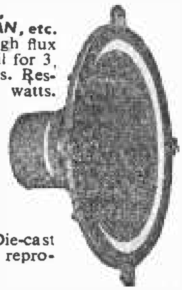

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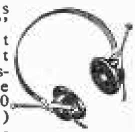

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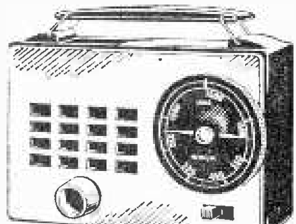

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The CONDENSER

This article is expressly written for a particular type of amateur constructor: the beginner who, though perhaps familiar with condensers and their use in practice, may not yet know what a condenser actually is, how it functions as it does and why.

By
S. R. Vella

BEFORE explaining what constitutes a condenser, we have to distinguish between a conductor and an insulator. A conductor allows electricity to pass through it, while an insulator does not. For example, copper, silver and most metals are conductors; while air, mica, glass, paxolin are insulators. A conductor allows electricity to pass through it by virtue of its free electrons (the electrons in its atoms' outer shells).

The Dielectric

When two conductors are separated by an insulator, we have what is called a capacitor or condenser—a device capable of storing electricity. The insulator separating the two conductors, which might be a vacuum, air, glass etc., is called the dielectric. For the purpose of discussion, let us imagine the two conductors constituting our condenser in the form of two separated metal plates to which are connected suitable lengths of flexible wire so that we can connect them in a circuit as will be explained later on. This arrangement (Fig. 1) constitutes the simplest form of condenser.

It should be noted that the capacity of the condenser (i.e.. the ability to store electricity) in Fig. 1 is very small, the condenser being made up simply of two relatively small metal plates with air as the dielectric.

The capacity of a condenser depends on:
(1) the area of the plates.
(2) the distance between the plates.
(3) the material of the dielectric.

The capacity of a condenser increases as the area of the plates is increased and the distance between them is diminished. In practice, the dielectric is very rarely air. It is usually either mica or paper. Fig. 2 shows the theoretical representation of a condenser.

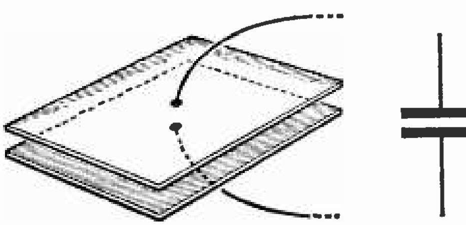


Fig. 1 (left)—The simplest form of condenser, or capacitor.

Fig. 2 (right)—The theoretical circuit symbol for a condenser.

Storage of Electricity

We have stated above that a condenser is a device capable of storing electricity. But how exactly is this effected we ask? Why and where is electricity stored in the condenser?

Let us try to visualise what happens when we connect our condenser to a battery. This is shown in Fig. 3. Free electrons from plate 1 will be attracted to the positive side of the battery, thus leaving plate 1 with a deficiency of electrons i.e. positively charged. The electrons attracted from plate 1 of the capacitor to the positive side of the battery will appear (after flowing through the battery) on the negative side. This surplus of electrons or negative charge will therefore also

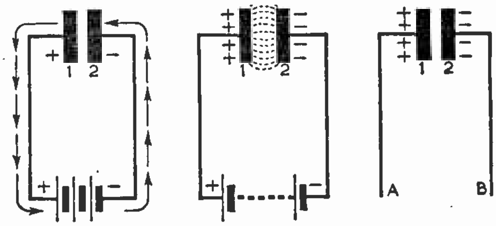


Fig. 3 (left)—When a condenser is connected to a battery, it becomes charged, as shown.

Fig. 4 (centre)—The charged condenser—the electric field between the two plates is represented by the lines from one plate to the other.

Fig. 5 (right)—Even if the battery is removed from the circuit, the condenser remains charged.

appear on plate 2 of the condenser since this is directly connected to the negative side of the battery. We may now say that the condenser is charged; and the situation is represented in Fig. 4. In other words, we may say that what actually happened during the charging process is a flow of electrons from plate 1 to plate 2 as indicated by the arrowed path in Fig. 3. The electrons on plate 2 try to move further on and reach plate 1 but they are impeded by the dielectric which is a non-conductor (insulator). This tendency of the electrons to reach plate 1 from plate 2 across the dielectric exerts a kind of pressure, force or strain on the dielectric. We call this the dielectric strain. When a condenser is charged, an electric field is set up between the two plates. This electric field is represented in Fig. 4 by a number of hypothetical lines from one plate to the other. These lines are as imaginary and hypothetical as the lines of force representing the magnetic field around a magnet.

It is interesting to ask what would happen if the battery were removed from the circuit after the condenser is fully charged. This is shown in Fig. 5. The negative charge on plate 2 can in no way reach plate 1. It is prevented from doing so by the dielectric in one direction and by the fact that the circuit is open (between A and B) in the other. Therefore plate 1 retains its positive charge and plate 2 its negative charge. The resulting accumulated energy from the charging process is stored in the electric field. This potential energy is ready to be released as soon as a conducting path between A and B is provided.

The Charging Cycle

Fig. 6 reproduces the charging cycle. Essentially, the circuit is the same as that of Fig. 3. The only additions are a switch and a sufficiently sensitive centre-zero current measuring device. Current flow is here assumed to be identical with flow of electrons. Hence the direction of flow is from the negative to the positive terminal of the battery.

A. Capacitor Uncharged

This is the initial stage of the cycle. The switch is open. Thus the battery is not yet connected across the capacitor. The meter cannot indicate any current flow.

B. Capacitor charging

The switch is closed with the result that the battery is connected across the capacitor. Current flows until the condenser plates are charged to practically the same potential as the battery. We have discussed the charging process above, and the result is a positive charge on A and a negative charge on B. The centre-zero ammeter shows a flow of current (indicated by arrows). This flow ceases and the pointer returns to the zero position in the centre when the condenser is fully charged. In the present case, the charging (indicated by a sharp to-and-fro kick of the pointer) is instantaneous as, for simplicity's sake, no resistance has been provided for the condenser to charge through.

C. Capacitor charged

The switch is opened. The condenser retains its charge (theoretically, at least). Again, the meter cannot indicate any current flow.

D. Capacitor discharging

The battery is removed and instead a direct path is provided by a conductor (or a resistance). The switch is closed. The surplus of electrons on plate B rush out to meet the positive charge on plate A until both charges cancel out each other and the condenser is uncharged once again. The ammeter this time deflects to the left thus showing that during discharge the direction of current flow is in the opposite direction to that during the charging of the condenser.

After the condenser is completely discharged, the pointer returns to the zero position; we are back again to where we started (Fig. 6a) and the whole cycle can be repeated over again.

A Condenser Blocks D.C. but not A.C.

We have said that a condenser blocks D.C. because of the dielectric which is an insulator. Now keeping this in mind, let us consider Fig. 7. When the switch is thrown to position 1, the lamp lights for a very brief interval and then remains extinguished. This is due to the charging current. The same thing happens again with the switch in position 2. This time it is due to the discharging current. If, however, we could flick the switch from position 1 to position 2 very rapidly, say 50

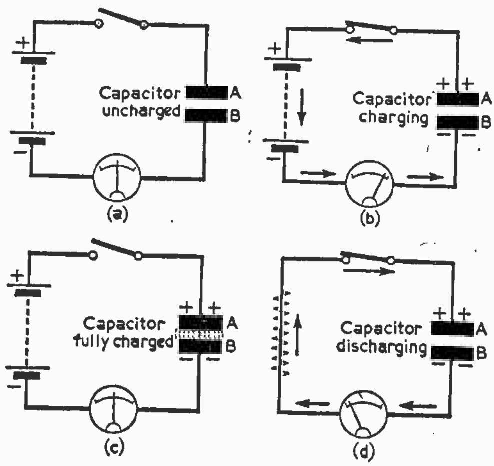
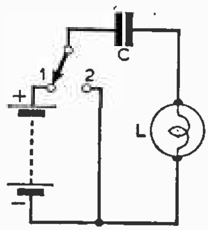


Fig. 6 (a to d)—The condenser charging cycle (see text).

times per second, the lamp would be lit and extinguished at the same frequency; but we would not be able to perceive this and the lamp would appear to be continually lit just as if the condenser were not there at all. Why is this? The reason is that the current is no longer direct but pulsating. Fig. 8a and 8b help us to understand this more



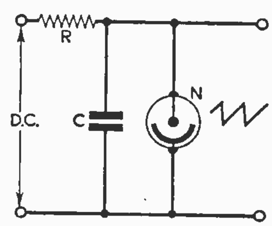


Fig. 7 (left)—A switched circuit which shows the effects of applying A.C. to a condenser.

Fig. 9 (right)—The circuit of a simple neon relaxation oscillator.

easily. In the first case, a 1-pole 4-way rotary switch is provided. The wiper, rotating in a clockwise direction, successively makes contact with the four positions. Notice the crude triangular waveform with a positive peak above and a negative peak below the zero axis.

(Continued on page 949)

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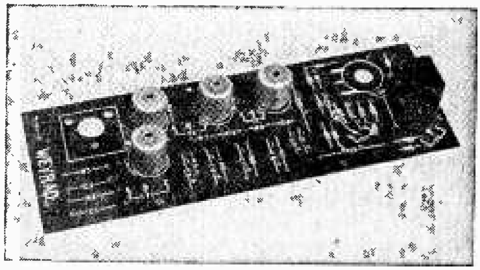

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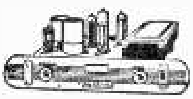

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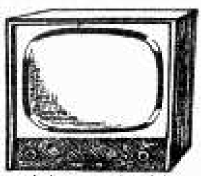

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(Continued from page 946)

Fig. 8b provides a smoother rise and fall by the insertion of other batteries supplying intermediate potentials. This waveform is nearer the familiar sine wave. In actual fact, an alternating voltage is produced by a coil rotating in a magnetic field at constant speed, the amount of voltage induced at any instant being proportional to the speed at which the coil cuts the magentic lines of force. One cycle represents one complete revolution. Moreover, the speed of rotation determines the frequency of the alternating voltage.

Another important point with respect to Fig. 8b is that the faster the switch rotates, the brighter the lamp lights; just as if the resistance offered by the condenser is progressively diminished. This brings us to the important concept of Reactance.

Reactance

Although, as explained above, the condenser does not block A.C., it offers a resistance to it, as is shown by the fact that the battery voltage (supplying the lamp) has to be much higher than the actual voltage across the lamp. The reactance of a condenser is the resistance it offers to alternating current at a given frequency. Reactance (Xc) is measured in ohms. The formula is:

$$Xc = \frac{1}{2\pi fc}$$

Where f = frequency in c/s.
c = capacitance in Farads.

Reactance, therefore, is inversely proportional to the frequency and the capacitance.

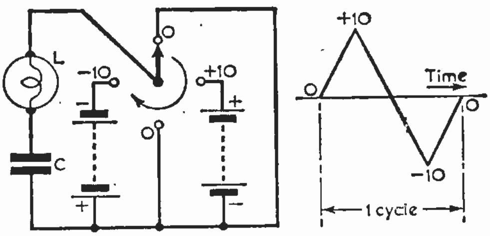


Fig. 8a—Using a rotating switch to give a crude form of A.C.

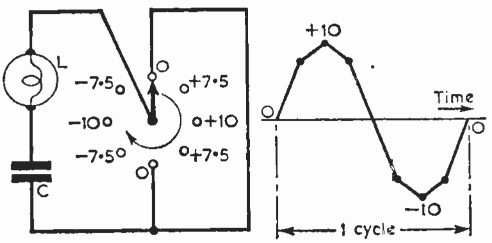


Fig. 8b—If more batteries are added to the circuit of Fig. 8a, a smoother waveform is obtained.

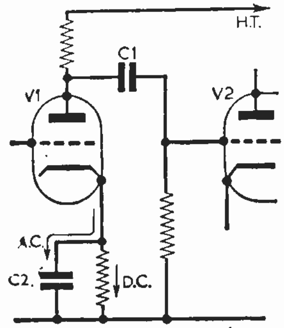
If the capacitance is constant, the higher f is, the lower Xc is. The reactance of a 2μF condenser at 50c/s is 1591Ω. But at 100kc/s, it is 0·795Ω.

If the frequency is constant, the higher C is, the lower Xc is. The reactance of a 2μF condenser at 50c/s is 1591Ω. But the reactance of a 10μF condenser at 50c/s is 318Ω.

Therefore, reactance is lowered either by increasing the frequency or by increasing the capacitance.

The Condenser in Use

The peculiarities of the condenser are put to practical use in all kinds of circuitry, from the simplest crystal set to the most complex of electronic computors. Fig. 9 shows the circuit of a simple relaxation oscillator. The condenser C is charged through R. As soon as the voltage across C is equal to the striking voltage of the neon lamp N, C is discharged through it. The process of charge and discharge is repeated over and over again as long as D.C. continues to be supplied.



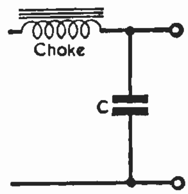


Fig. 10 (left)—Resistance-capacity coupling between valves.

Fig. 11 (right)—An H.T. smoothing circuit.

Two other important and common uses of the condenser are shown in Fig. 10 where we have resistance-capacity coupling between V1 and V2. The coupling condenser C1 prevents the D.C. voltage present at the anode of V1 from reaching the grid of V2 and driving it positive, while at the same time allowing the A.C. signal to reach the grid of V2 for further amplification. The bias condenser C2 bypasses the fluctuating A.C. signal component which prefers to pass through the condenser rather than through the resistance, the capacitance of the former being chosen so that its reactance is much lower than the value of the resistance. The purpose of bypassing the A.C. signal is to maintain a steady D.C. bias voltage at the cathode of the valve.

The condenser C in the choke-input smoothing circuit (Fig. 11) filters out any trace of A.C. ripple which manages to pass through the choke. (The choke offers a high resistance to A.C. while it allows D.C. to pass through it quite easily; its function is opposite that of the condenser).

It has not been possible here to give more than a few basic applications of the condenser in common circuits. The constructor will no doubt be able to find other uses for himself by carefully studying the various circuits which appear in every issue of " Practical Wireless ". ■

The BASS Reflex Cabinet

THEORY AND PRACTICAL DESIGN

By J. B. Dance

(Continued from page 850 of the January issue)

LAST month, the theoretical aspects of the bass reflex cabinet were given; some details on construction were also given and it was stressed that to achieve good results, care must be taken to ensure that the cabinet is strong and rigid. If the cabinet walls are allowed to flex, then the sound output will be coloured by cabinet resonances.

Damping

The cabinet should be at least partially lined with a coating of heavy felt to subdue resonances —about ½in. in thickness. The felt should not be thick enough, however, to damp sound waves at frequencies below about 200c/s. It is probably wise not to use too much felt at first, as the amount can always be increased later, if desired.

No allowance should be made for the volume of the felt when calculating the cabinet volume. It is the low frequency response which is affected by the cabinet volume and low frequency sound waves can travel through the felt to the walls.

It is usual to place a piece of expanded aluminium (which is sometimes given a gold coloured finish) over the loudspeaker and vent openings, but care should be taken that this will not produce an irritating rattle when the loudspeaker is producing sound of one particular frequency.

If a piece of cloth is used to cover the grill openings, it is important to use a type of cloth which presents little resistance to the sound waves. Closely interwoven threads should be avoided. Cotton or plastic cloth which is very loosely woven and which has hard threads is ideal.

Finish

It is well worthwhile taking great care over the finish of the cabinet so that one can take a pride in its appearance as well as its acoustical characteristics. A very neat finish can be obtained by staining the wood to the desired colour and then applying a solution of shellac in methylated spirit carefully. The shellac solution should be allowed to dry and several more coats may be applied to give the finished article a high polish.

Testing

The ultimate and most important test for any loudspeaker system is undoubtedly that of the human ear and the amount of satisfaction obtained by the owner and his friends. Nevertheless there are some measurements which can be carried out.

It is worthwhile to measure the loudspeaker impedance-frequency characteristic at low frequencies with the unit mounted in its cabinet. The apparatus for measuring this characteristic was given in Fig. 3, last month but an A.C. voltmeter should be connected across the output terminals of the amplifier. Using low power, values of the voltage and current passing to the loudspeakers at various frequencies between about 25c/s and 200c/s can be found and the impedance at each frequency can be calculated from Ohm's law. The impedance should then be plotted against the frequency as in Fig. 1 (last month).

When the loudspeaker is mounted in a well designed cabinet, the characteristic should no longer look like that of Fig. 1 (last month). The one large peak at the fundamental resonant frequency of the loudspeaker should have completely vanished and two much smaller peaks on either side of the original peak should be found. If the original peak is still present, the cabinet has not been tuned correctly. The characteristic should be replotted with blocks of wood of about 100cu.in. in volume placed inside the cabinet. If it is impossible to remove the peak due to the loudspeaker resonance by raising the frequency in this way, the characteristic should be plotted with the vent reduced in size by a piece of wood. This will lower the frequency at which the cabinet resonates.

If peaks other than the two already mentioned are found in the response curve of frequency between about 80c/s and 150c/s, they are probably caused by standing waves in the loudspeaker cabinet. The area of the walls covered by the damping felt should then be increased until they vanish. It is not possible to remove standing waves completely at very low frequencies, but it is possible to remove them from the loudspeaker resonance curve.

Results

The performance of a correctly designed bass reflex cabinet system at low frequencies is much better than that of the more common and cheaper methods of mounting loudspeakers. Some of the advantages are listed below:—

(1) Improved bass response. The bass range may be improved by several dB over a range of nearly two octaves when compared with the same loudspeaker mounted in a closed cabinet or on a very large baffle.

(2) The impedance curve will be much flatter and hence the frequency response curve will be much more level in the low frequency region.

(3) The cone will vibrate with a much smaller amplitude when the input is at the resonant frequency of the loudspeaker than it would if the loudspeaker were mounted in an open cabinet. This will result in reduced distortion at the same power output, or alternatively more power will be available for the same degree of distortion.

(Continued on page 961)

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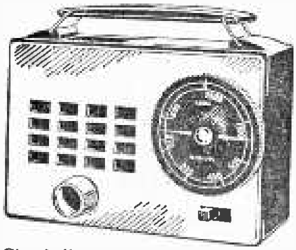

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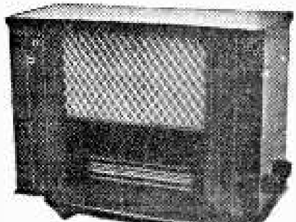

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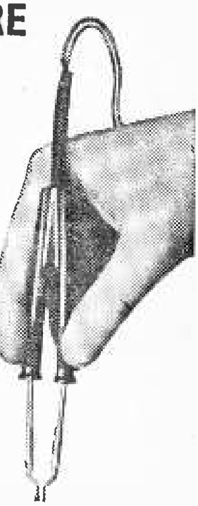

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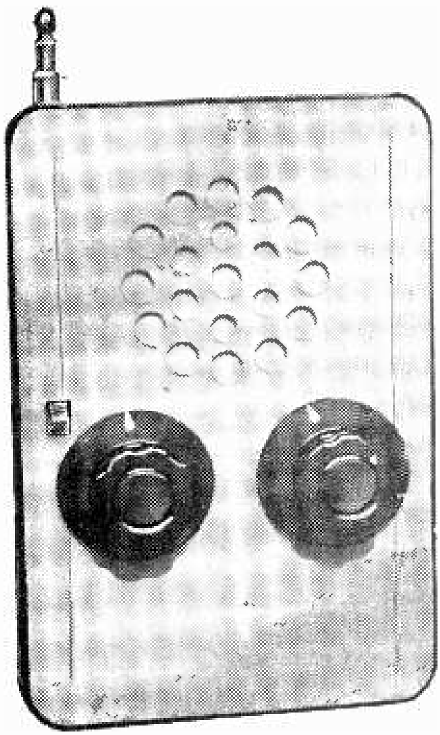
(Continued from page 798 of the January issue)



P.W. MINUETTE

By F. G. Rayer

HAVING carried out the constructional work described last month, the detector stage can then be built up complete, and tested. Counting the tags from the top (in Fig. 4, last month), connections can be checked as follows: 1, Collector, H.F. Choke, lead 5; 2, Base, lead 2; 3 Emitter, 10k (R3), 500pF pre-set condenser (C1), tuning condenser frame and battery positive; 4, H.F. Choke, 5·6k (R1), 0·25μF condenser (C5); 5, 0·1μF condenser (C2), 10k (R3) and 100k (R2) resistors, lead 3 from ferrite slab.

The 500pF pre-set is held in position by soldering one of its tags directly to tag 3. All the transistor leads can be left long, but should be covered with sleeving. The transistor can be added last, the joints being quickly made, and the iron removed.

Testing

If desired, this part of the receiver can be tested with phones. To do this, connect the phones from the free end of the 0·25μF condenser (C5), to the tuning condenser frame, marked M.C. in Fig. 4. Take a lead from the 50k regeneration control to battery negative.

Smooth regeneration, right up to oscillation point, should be obtained with the 50k control. If oscillation cannot be obtained, screw down the 500pF pre-set slightly. If oscillation is too violent, unscrew this condenser. The correct setting is not very critical, and should allow adequate, yet smooth, regeneration with any battery supply of 4½V to 9V. If a regeneration winding has been added to an existing slab or rod, it might be necessary to adjust the position of this winding, to secure satisfactory results. If no regeneration at all can be obtained, the winding may have been reversed in error.

Reproduction in the phones should be free from distortion, and of reasonable volume. When the receiver is adjusted for maximum sensitivity, tuning is sharp, and both controls should be operated carefully together. The regeneration control should never be merely turned fully clockwise (as if it were a volume control) as this will not give satisfactory reception.

Audio Amplifier

This is built as a separate unit. A piece of paxolin is shaped as shown in Fig. 4, so as to clear the tuning condenser, regeneration control, and leave space for the battery.

Small holes are drilled, and the resistors and other parts are placed with their leads through the holes, as shown in Fig. 4. The reverse side of the audio panel is shown in Fig. 5.

The colour coding of the driver transformer T1, and output transformer T2 applies to the transformers listed. Other driver and output transformers would be equally satisfactory, and the maker's connecting data should be followed. The leads pass straight down through small holes, and are bent over. A little adhesive under the transformers will hold them to the panel, in conjunction with the leads. Leave the two secondary leads of the output transformer free, for connecting to the speaker.

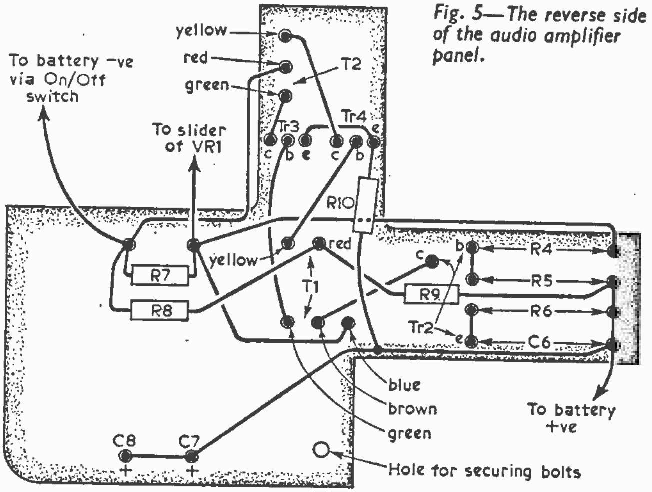


Fig. 5—The reverse side of the audio amplifier panel.

Lead Lengths

All transistor leads can be left quite long, as mentioned, but the soldered joints should still be made quickly. Cover all wires, including the ends of resistors, with sleeving. A few inches of thin flex are used for battery connections, terminating with the appropriate positive and negative clips.

When the audio amplifier panel is finished, it is placed in the position shown in Fig. 4. Two short bolts hold it there, with spare nuts so as to obtain about ¼in. space between the audio panel and the receiver panel.

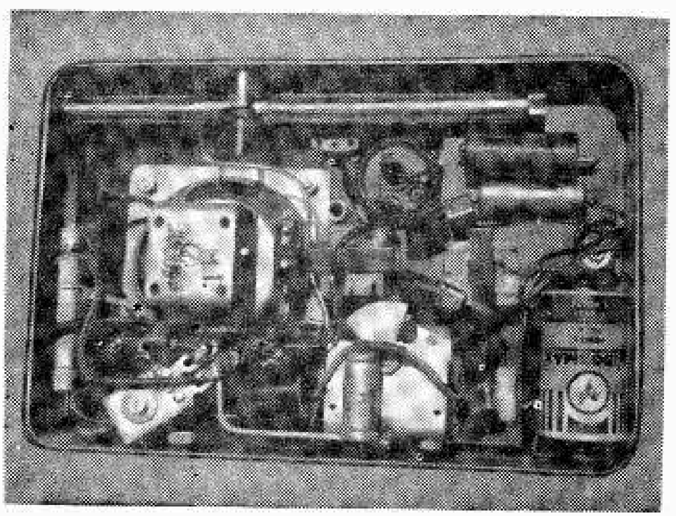
Connections

The leads shown in Fig. 5 can then be connected to their correct points: one lead goes to the switch (battery negative); a second lead passes to the 50k regeneration control; transistor Tr2 base, which is joined to the 33k and 10k resistors (R4 and R5), goes to the 0·25μF condenser (C5), and, finally, a lead connects the battery positive side of the circuit to M.C., or the frame of the tuning condenser.

After connecting speaker and battery, the receiver can be tested. Reproduction should be clear and distinct. No further adjustments should be necessary, if the 500pF pre-set has been adjusted as described. If a meter is included in one battery lead, the resting (quiescent) current (no signal) should be around 5mA. This should rise to about 8mA to 15mA on peaks, with average speech or music, according to volume.

Case and Rod

A piece of silk or other thin material about 4in. square is placed over the speaker, and held with adhesive. Fit the threaded bush for the back screw, tightening it securely. The control knobs are removed, together with the nut of the 50k potentiometer, and one screw of the tuning condenser. The receiver is then inserted in the case, and the nut and screw replaced, and tightened. Pointer knobs of reasonable size will be best for tuning.



Rear view of the 'Minuette'.

The aerial rod has a bracket to take two 6B.A. bolts, with ½in. spacers, or spare nuts, between bracket and case, as shown in Fig. 4. A clearance hole is drilled in the case above the top of the rod. An insulated lead passes from the rod to the fixed plates of the tuning condenser. A small terminal on the side of the case would do for an external aerial connection instead.

Equivalents

The circuit will work satisfactorily with transistors of similar type, including surplus transistors in proper condition. Tr1 must be an R.F. transistor, or regeneration may not be obtained. Tr2 is an audio amplifier, and other types may need a change in value of R4, R5 or R6. Tr3 and Tr4 are best a matched pair for push-pull output. Some transistors may need

(Continued on page 962)

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FAULTS IN VHF/F.M. RECEIVERS 4–Transistor Sets

By G. J. King

(Continued from page 826 of the January issue)

SEVERAL of the more common faults in the final stages of VHF/F.M. receivers were dealt with last month, but a confusing symptom is the presence of hum and distortion. The treble-diode-triode valve (see Fig. 9, last month) often produces the above symptom, particularly that type of valve which is designed for A.C./D.C. operation, such as the UABC80. One complaint in this respect was that hum and distortion occurred, on F.M. only, a little while after the receiver has been switched on. It was discovered that the fault was fairly consistent and that it could be almost cleared by detuning. Replacing the valve cleared the trouble completely, but a subsequent check on a valve tester failed to reveal the trouble.

This is one of those cases where a faulty valve can only be discovered by substitution. Once the faulty stage has been located, quite a lot of time can often be saved simply by substituting the associated valve before detailed tests are carried out.

If distortion is present on both A.M. and F.M., attention should be given to the common A.F. stages. A typical cause of such trouble is a leak in the A.F. coupling capacitor (C58 in Fig. 9). This puts a positive voltage on the grid of the output valve and causes it to pass much more anode current than is good for it. The valve thus becomes very hot and the voltage across the cathode bias resistor rises above that given in the service manual.

Similar distortion, particularly at high volume levels, should lead to a check of the A.F. amplifier load resistor, such as R24 in Fig 9. If this goes high in value the distortionless output of the stage is considerably limited.

Balance

Severe distortion on F.M. only, which can be reduced by detuning slightly, is often caused by unbalance in the ratio detector. This may be due to one of the ratio detector diodes going out of balance. Some sets use germanium crystal diodes for the ratio detector instead of the diodes in a multi-electrode valve. These are more prone to unbalance effects; in fact, one of the crystals may go open-circuit completely. This not only causes severe distortion but it also considerably reduces the output on F.M.

The ratio detector can be balanced by applying an amplitude-modulated F.M. I.F. signal (usually at 10·7Mc/s) to the control grid of the last I.F. valve and recording the output either on the speaker or on an output meter connected across the speaker or across a resistor connected in place of the speaker. The resistor should have a value equal to the impedance of the speaker which it is to replace.

The signal generator should be accurately adjusted to the F.M. I.F., after which the core in the ratio detector winding of the transformer (e.g., L29 in Fig. 9) should be carefully adjusted for minimum output. The ratio detector is in correct balance when it does not respond to an amplitude-modulated signal. In practice, however, there is usually some residual frequency-modulation of the generator signal so zero output is rarely accomplished.

A series on VHF/F.M. receivers would be incomplete without reference to combined F.M./A.M. models using transistors, and the remainder of this series will be devoted to such sets.

There is no doubt now that transistors are going to take the place of valves in almost all types of electronic equipment of the domestic category. Industry is already using vast quantities in special instruments, control systems, computers and the like, and there has also been an almost complete changeover from valves to transistors in the popular A.M.-only portable sets.

Noise and Reliability

The new alloy diffusion technique has made the manufacture of VHF transistors possible. These, which are able to operate up to 200Mc/s, are finding their way into VHF/F.M. receivers and television sets. A fully transistorised television turret is already available.

Apart from the smaller power requirements and resulting improved efficiency, transistors are also proving to be far more reliable than valves. This means that, while, in the past, transistors were employed essentially for miniaturisation, their use in the future will also be for reliability, and for that reason they will be exploited on an increasing scale in equipment which, by reason of its nature, does not particularly require to be made smaller, such as television receivers, radiograms, audio and hi-fi amplifiers, tape recorders and so on.

For the present we will concentrate on the transistorised VHF/F.M. set. In Fig 11 is shown the circuit of the VHF tuner of such a receiver. The two transistors are of the alloy diffused type and the circuit is based on the popular Perdio Portable, Model 95 which uses a total of nine transistors and five crystal diodes and is designed for A.M. and F.M. reception.

Common Base Mode

Transistors Tr1 and Tr2 are operated in the common base mode. That is to say the base is earthed to the signal while the input signal is applied to the emitter. The collector is loaded in the usual way with the tuned circuits, across which the output signal is developed.

This arrangement, of course, is analogous to the valve earthed grid circuit, where the grid is earthed so far as the signal is concerned and the input signal is applied to the cathode circuit and the anode loaded with a tuned circuit across which the output signal is developed. For those not fully conversant with transistors, it should be noted that a transistor can be likened to a triode valve in certain respects, with the base being equivalent to the grid, the emitter to the cathode and the collector to the anode.

Transistor Tr1 is the R.F. amplifier for VHF. The aerial signal is coupled through C1 to the wide-band input circuit comprising L1 and C2. The loaded Q of this circuit is quite low, so the circuit responds to the whole of Band II. The base is held at chassis potential (earth) so far as the signal is concerned by C3 (it should be noted that battery negative is, in fact, the chassis or earth line, this being the opposite to the circuitry in most transistor portables).

Biasing

The base of Tr1 is biased by the potential divider formed by R1 and R2 across the battery and thermal stability is maintained by the emitter resistor R3. Coil L2, C4 and C5 form the collector tuned load, and the R.F. tuning section of the gang C5 is coupled to the oscillator counterpart in the usual way. The capacitor, C6, connected between the emitter circuit and base provides a degree of feedback.

The amplified signal is fed to the frequency-changer stage, Tr2, through C7. In this particular receiver, it will be seen that the signal can either be applied to a conventional aerial socket from an outside aerial or, in good signal areas, from a simple telescopic rod aerial.

For the sake of completeness and to help newcomers to transistor circuits achieve a better understanding on the basis of comparison, the equivalent valve earthed-grid R.F. amplifier is given in Fig. 12.

The Frequency-Changer Stage

Transistor Tr2 performs the dual functions of local oscillator and mixer, and for this reason the stage is often called a "self-oscillating mixer". Again, the input signal is applied to the emitter, but this time across L3. The base is connected to chassis through C8 and is biased by the potential divider R4 and R5. The emitter resistor, R6, provides thermal stability (to prevent thermal runaway) and C9 gives a little feedback. Further feedback is provided by C10.

The oscillator tuned circuit comprises L4, C12 and C13, and is coupled to the collector through C11. C12 is the oscillator section of the tuning gang which is ganged with the R.F. section. Capacitors C4 and C13 respectively are R.F. and oscillator trimmers.

10·7Mc/s Intermediate Frequency

The stage is caused to oscillate at the frequency governed by the tuned load described above by regenerative feedback provided by C14, between emitter and collector.

The collector is also loaded by the tuned circuit L5, which forms the primary of the I.F. output transformer, L6 being the secondary across which the coupled I.F. signal is developed for feeding to the I.F. stages of the receiver. In common with most F.M. receivers, the intermediate-frequency is 10·7Mc/s which, of course, is obtained by the VHF signal heterodyning with the oscillator signal in Tr2.

When the receiver is switched to "F.M.", switch S1 is closed, so that the VHF tuner section is working normally, but when the set is switched to "A.M." S1 is open. This, of course, cuts off col-

(Continued on page 961)

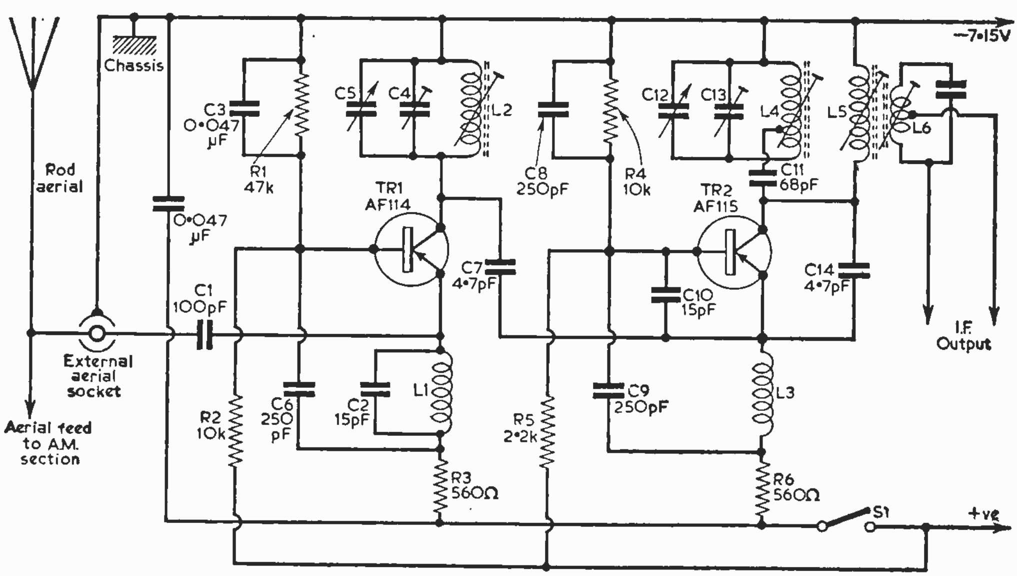


Fig. 11—The VHF section of a combined F.M./A.M. transistorised portable set.

(Continued from page 958)

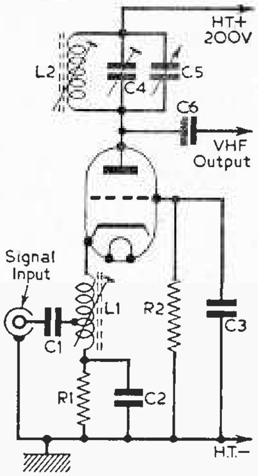


Fig. 12—The valve equivalent of the R.F. stage in Fig. 11. Here, R1 is for bias and R2 is the grid return resistor.

lector current on Tr1 and Tr2, but it will be noted that the bases remain biased since the bottom ends of the potential dividers, R2 and R5, are connected to the battery side of S1. This is done to prevent damage to the transistors, which might otherwise occur owing to a rise in base voltage.

Tracing Faults in the VHF Section

The VHF section is often built into a self-contained screened box, and intermittent troubles on VHF/F.M. due to poor connections, dry joints and so on occur equally in transistor units as they do in valve units. However, owing to the cool operation of transistors, frequency drift is not so troublesome as it is with valve circuits, but printed circuits and inter-connections still give trouble, and should be investigated as described in previous articles should intermittent symptoms on VHF/F.M. develop.

The alignment of a transistorised VHF tuner is sometimes more important than in valve units, for if the I.F. or oscillator alignment is misplaced by a small amount, the local oscillator may fail over a section of the tuning range.

Aerial

Excessive "noise" on F.M. when a station is tuned in should lead to a check of the aerial system for, although the new VHF transistors are endowed with remarkably good noise figures, one is often tempted with a portable to use the smallest aerial possible, and while this is perfectly in order in areas of reasonably high signal where there is little local shielding, something better is required in shielded locations.

If the VHF section fails completely, and the set operates normally on A.M., there is every possibility that the VHF tuner is faulty. This can be proved speedily by switching the set to "F.M." and injecting the F.M. I.F. from a signal generator across L6, for example. If the output from the speaker is loud and clear, then the tuner is definitely faulty. If there is no output, attention should be directed to the F.M./A.M. changeover switching.

In most cases of VHF unit failure, apart from dry joints and poor connections, the local oscillator section is to blame. This invariably gives rise to a "hiss" when the set is switched to "F.M." and the volume control turned up full and, in some cases, there may be a sudden restoration of signals at certain settings of the tuning gang.

Readings

Much information on the operation of the transistors can be obtained by measuring the voltage across the emitter resistors (R3 and R6 in Fig. 1). The voltages will be low normally, not much more than one volt, so a low reading voltmeter is essential, and to avoid loading the circuits unduly the voltmeter should also have a fairly high resistance or sensitivity. A 20,000Ω/V meter with a full-scale deflection on the "low volts" range of 2·5V to 5V is ideal.

Tests are best made with meter positive connected to battery positive. With the negative lead connected to Tr1 emitter a reading of around 0·85V would indicate that the transistor is passing collector current. On the same electrode of Tr2, the reading should be about 1.1V. Zero voltage would indicate either that the transistor is open-circuit or that the negative supply to the collector is missing. This supply should next be checked, if necessary, by connecting the negative of the meter to the collector. The voltage here should be almost equal to the negative line voltage, since the collector loads are of low resistance, though it may not be equal to the battery voltage owing to the voltage dropped across decoupling and filter resistors in the negative circuit from the battery to the VHF tuner. A value of about 7V is typical for VHF collectors.

The base voltage can also be checked by connecting the meter negative to base (positive still connected to battery positive). Base bias for VHF transistors is around 1V though it may be slightly higher on the frequency changer when oscillating properly.

If the voltages deviate substantially from the above examples, the feed components should first be checked for continuity and value, and if normal, the associated transistor will, in most cases, be found responsible. ■

The BASS Reflex Cabinet

(Continued from page 950)

(4) The radiation resistance will be greater at low frequencies, and therefore the power will be more efficiently transferred to the surrounding air. When compared with a similar loudspeaker mounted in a closed cabinet, a power gain of about 3dB might be expected, as half of the power from a loudspeaker in a closed cabinet is wasted by being trapped in the cabinet. In actual practice the gain may be greater than 3dB when a bass reflex cabinet is used owing to the more efficient transfer of energy to the air.

The only possible disadvantage of the use of a bass reflex cabinet is that if the amplifier feeding the loudspeaker contains any hum, this will sound much more prominent than before, but the remedy for this is obvious.

Care should be taken not to obstruct the vent or the front of the loudspeaker; at the loudspeaker resonant frequency the sound is radiated almost entirely from the vent.

The frequency response should extend down to half the loudspeaker resonant frequency or less; with conventional mounting, the bass output from a loudspeaker is almost negligible below its resonant frequency. ■

Club News

REPORTS OF CURRENT ACTIVITIES

AMATEUR RADIO MOBILE SOCIETY
Hon. Sec.: G3FPK, 79 Murchison Road, London, E.10.
At this year's Radio Hobbies Exhibition in London, the society had their own stand, manned entirely by A.R.M.S. members.

BRADFORD RADIO SOCIETY
Hon. Sec.: M. T. G. Powell, G3NNO, 28 Gledhow Avenue, Roundhay, Leeds 8.
The society's last spares sale in 1961 was held on November 28th. On December 12th, the development of time measurement was discussed by W. Barton, and amateur receiver construction was the subject of the lecture given by D. M. Pratt at the meeting on January 2nd.
Future Events:
January 30th—Use of simple test gear, by D. G. Enoch.
February 13th—Field-day discussion and informal meeting.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: F. C. Ward, G2CVV, 5 Uplands Avenue, Littleover, Derby.
The society's Open Night on December 13th was also appointed as the management committee meeting. On December 20th, members enjoyed the Annual Christmas Party. As there was no meeting on 27th December, those members who wanted to joined in a 160 metre net instead. Yet another surplus sale was held at the first meeting of the new year, on January 3rd.
Future Events:
January 10th—The year in retrospect—an opportunity for members to see some of the activities of 1961 in photograph form.
January 17th—A selection of communication receivers will be shown for members to compare.

GUILDFORD AND DISTRICT RADIO SOCIETY
Hon. Sec.: J. R. Barker, G3PDX, 35 Banders Rise, Merrow, Guildford.
All the entrants for the car treasure hunt, held on October 1st, managed to complete the course. The proposed 2-metre equipment for the club net, was the subject of a talk given by Harry Mead at the meeting on October 12th. It was at this meeting that the society decided to enter the MCC top band contest, and so on November 11th, 12th, 18th and 19th, the club took an active part in the contest, using the call sign G3FZC. On October 24th the club visited the Dorking group for a ragchew and films.
Four club members took part in the RSGB top band contest which was held on November 11th and 12th.

DUDLEY AMATEUR RADIO CLUB
Hon. Sec.: S. E. Plumtree, G3OSP, 11 Wallows Wood, The Straits, Lower Gornal, Dudley, Worcestershire.
On October 13th, members payed an outside visit to attend a demonstration of closed circuit television, hi-fi, tape recorders and audio equipment, and to see a film show.
A committee meeting was held on 20th October and another was held on 3rd November. On November 10th, members enjoyed a film show and on December 8th the Christmas dinner was held.

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY
Hon. Sec.: A. Roninson, G3MDW, Candy Cabin, Ogden, Halifax, Yorkshire.
Recent activities have included a talk on 2 metres by G8CB and a demonstration of hi-fi and stereo. On December 13th members took part in a ragchew.
Future Events:
January 10th—Informal meeting.
January 24th—Tape recorders.

PETERBOROUGH AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: D. Byrne, G3KPO, Jersey House, Eye, Peterborough.
At the annual general meeting of the society, on the 3rd November, S. Hunting was elected president, C. J. Guscott was elected chairman, and D. Byrne was elected secretary and treasurer.

ROTHERHAM RADIO CLUB
Hon. Sec.: S. J. Scarbrough, 25 Crawshaw Avenue, Sheffield 8.
During November members took part in the MCC top band contest. In December the club's own Annual Competition for the G3KUH shield was held.
The annual general meeting was held on January 3rd.

SALISBURY AND DISTRICT SHORT WAVE CLUB
Hon. Sec.: E. J. Spicer, 43 Vale View Road, South Newton, Salisbury, Wiltshire.
Arrangements have been made for the club to show a series of films, fortnightly to members, and the first of these were shown on November 21st. Taped lectures are also a fortnightly attraction, and morse classes are given most weeks.

SILVERTHORN RADIO CLUB
Hon. Sec.: K. Marley, G3EIO, 17 Luctons Avenue, Buckhurst Hill, Essex.
Meetings are held every Friday at 8 p.m. at the South Chingford Community Centre. A club station is operated at constructional meetings on alternate Fridays.

SPEN VALLEY AMATEUR RADIO SOCIETY
Hon. Sec.: N. Pride, 100 Raikes Lane, Birstall, Nr. Leeds.
The society's Brains Trust was held on December 20th and the meeting on January 3rd was taken up by a ragchew.
Future Events:
January 17th—Electronic timing devices, by S. Marsden.
January 31st—Safety in the shack.

WANSTEAD AND WOODFORD RADIO SOCIETY
Hon. Sec.: K. Smith, G3JIX, 82 Granville Road, Walthamstow, London, E.17.
At every Tuesday evening meeting, G3JIX gives a lecture on the requirements of the G.P.O. Radio Amateur's Examination.
The "constructional project" at the moment is a C-R bridge, and each member is constructing one from the same basic design.

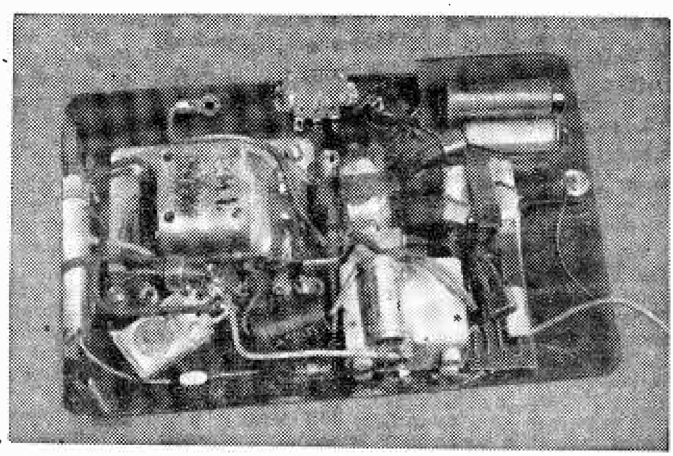
P.W. MINUETTE

(Continued from page 954)

values other than 220Ω for R9 and 5Ω for R10, to obtain full gain and distortion-free reproduction.

Miniature H.F. Choke

A miniature H.F. choke can be made by taking a ferrite slug and winding several hundred turns of fine gauge wire upon it. For good results, there is little latitude in resistor values, but condenser values are less important. Typical possible values, with marked values in brackets, are: 0·1μF to 0·5μF (0·1μF); 0·25μF to 6μF (0·25μF); 1μF to 6μF (2μF); 6μF to 50μF (30μF).



Another view of the set.

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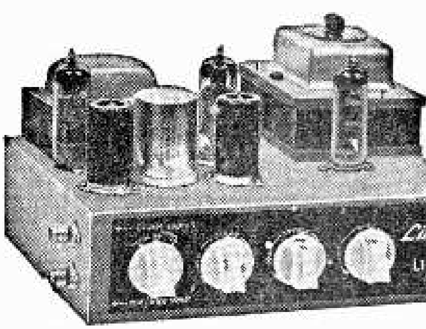

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1U5	5/9	6J4GT	9/9	35Z4GT	6/9	ECC85	7/9	MX40	9/6	UAF42	8/3
3A5	9/-	6V6G	4/6	35Z5GT	8/3	ECF80	7/6	N18	7/-	UB41	8/6
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Letters to the Editor

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

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

CORRESPONDENTS WANTED

SIR,—I am a regular reader of PRACTICAL WIRELESS. I am very much interested in the radio technology and have started my own shop of radio repairs. I would like to correspond with any radio technician from anywhere. I will answer all the letters received promptly.—B. S. GULSHAN, Falcon Radios, Kota JN, India.

VALVE-TRANSISTOR SHORT-WAVER

SIR,—I have been gratified that so many people have enquired about the above receiver described in the July issue of PRACTICAL WIRELESS. A large proportion of these are concerned with the winding of the coils. These few notes should remove any difficulties.

L3 consists of 10 spaced turns over 2in., tapped at 5 turns and 7½ turns. The latter figure unfortunately appeared in the issue as 2½ turns.

Extensions to any of the coils to cover different wavebands is possible, only at the expense of losing other sections of the frequency spectrum. No experiments have been carried out which concern the fixing of a fourth coil.

The actual positions of the coils on the baseboard or chassis are not important as the three coils each carry their own reaction winding and aerial section.—P. K. CRIPPS (Liverpool).

RECORD 'WOW'

SIR,—With reference to the article by L. E. Higgs in the September issue on record player faults, may I suggest that the fault of wow and slurring owing to records being warped can very simply be cured. The seven-inch records seem to be the chief offenders. If eight strips of Sellotape, about ½in. x ¼in. wide, are placed at 45° intervals across the driving serrations, making certain they are clear of the run-oft grooves, it will be found that even a badly warped record does not skid. I do this to every record regardless of its condition and have consequently had no trouble.—W. D. HESELTINE (Wallsend-on-Tyne).

VINTAGE MODELS

SIR,—I was very interested in the letter in the December issue, by Mr. Mansell, as I too think that some of the old radios in true reproduction were very good indeed. I am sure anyone who has not heard one, tuned in to a good concert, would be very much surprised by the good quality obtained.

I have a very old tuned R.F. set which first had come from Chicago, U.S.A., 1931 to 1932, and was called the Zenith Autovox. This set had five tuned stages of H.F. and double push-pull output stages. These, working into a 15in. energised loudspeaker, resulted in a very powerful output and the quality of reproduction was amazing.

I have recently had to rebuild the set as the old valves gave out and could not be replaced. The set is still working well and it will pull in any station on a short piece of wire as the aerial, and the tuning is very selective.—D. J. FORWARCH (Watford).

L.F. INSTABILITY

SIR,—I should like to report an interesting case of L.F. instability and its cure, in the hope that it may be of interest to others who may come across a similar unexplained fault.

The circuit was a simple mains amplifier, with a push-pull output stage fed from two audio stages (EF86's; one strapped as a triode and acting as phase splitter for the push-pull output stage). When switched on a very loud hum was experienced and the usual cursory tests failed to disclose the cause. Eventually the two EF86's were removed but the hum still persisted. The phase splitter had just a single resistor to the H.T. line and there was adequate smoothing (60μF). It was eventually found that a large electrolytic from the anode of the phase splitter to earth stopped the hum and finally the cure was a simple resistor (10k) between the anode resistor and the H.T. line, with a 32μF condenser to earth. — F. G. ROBERTS (Torquay).

SOLDERING TRANSISTORS

SIR,—I should like to pass on a small hint which others may not have seen and which I feel is very important for those who are building the latest types of miniature transistor sets. As most readers now know these components are easily damaged, or even completely ruined, in the act of soldering them into a set. Fitting a heat sink is one very good idea, but I have met cases where the compactness of the set is such that there was no room to fit the shunt unless the leads were left extremely long. In addition whilst the heat shunt may protect the actual component being soldered there is also the risk that nearby parts may be damaged by the radiated heat from a soldering iron. Therefore, when constructing this small type of receiver I have found it a good idea to wind a length of ordinary copper wire, not heavier than 24s.w.g. round the bit and to draw off the remaining two inches, this giving in effect a two inch projection to the bit of thin copper and I find that it carries just sufficient heat to melt the very fine printed circuit solder without risk of damage. I even dispense with heat sinks when using this iron. —F. WALTERS (Hampstead).

MISCELLANEOUS

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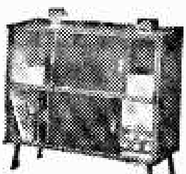

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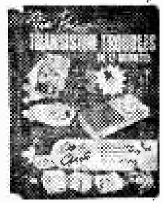

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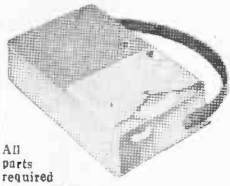

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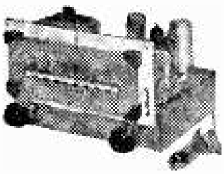

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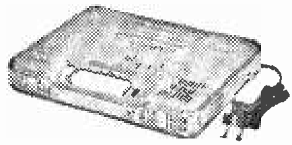

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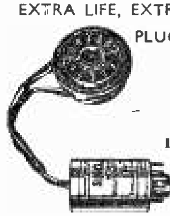

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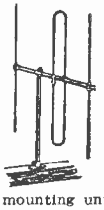

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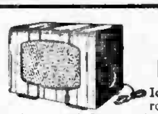

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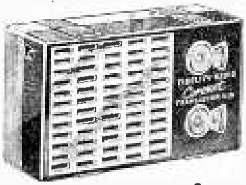


Inc. Battery

£9.19.6 Reg. Post 2/6

6-TRANSISTOR MEDIUM & LONG WAVE POCKET RADIO

- Size 2¾ x 4¾ x 1¼in.
- Quality Push-Pull Speaker Output.
- Guaranteed for 12 months.
- Phone and Tape Sockets.
- Carrying Case.

ALL BRITISH DESIGN AND CONSTRUCTION

Attractive Two-tone Moulded Cabinet. Very sensitive. Ideal present for any occasion. Built and Ready to Use.

AVO-7 MULTIMETER

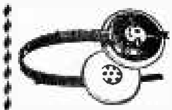
Famous AVO Multimeter. Reconditioned and fully Guaranteed.

Supplied with batteries, test leads, instructions. At the NEW LOW PRICE

£11.10.0
Reg. Post 5/-.

● LEATHER CASE 30/- EXTRA ●

CRYSTAL LAPEL MICROPHONE
Ideal for portable tape recording, etc. 17/6. P.P. 1/-.



4000 Ohm Headphones
Lightweight very sensitive.
12/6. P.P. 1/-.

RECORD PLAYER AMPLIFIER

- 2-watt output.
- Ready built with Valves and 8 x 5 Speaker, Tone and Volume controls. Printed circuit.

75/- P.P. 2/-

Ideal for Portable Record Player.

- UA8 4-speed Record Changer, ideal for above. £6.19.6. P.P. 3/6.

STEREO AMPLIFIER

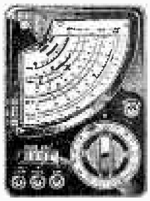
BARGAIN OFFER

- 2 watts per channel.
- Full tone, balance and volume controls.
- Complete with sockets, dials, etc

97/6 P.P. 2/6

Suitable Speakers, 9 x 5in., 49/6 pair. UA14 Stereo Deck, £8.19.6. P.P. 3/6.
READY BUILT AND TESTED

POCKET TESTER



MODEL TE10

Volt-Ohm-Milliameter ★Size 4½x3¼x1½in. Over 20 Scales.

10,000 ohms/volt

Price, inclusive of Test Prods, Battery and instructions.
£5.19.6 P.P. 1/6
Top Quality Meter—Fully Guaranteed.

Also **Model 200H**, 20,000 ohms/volt. Same size
SEND FOR DETAILS OF COMPLETE RANGE OF METERS. | **£6.19.6** P.P. 1/6.

POCKET IRON

★ Pocket Soldering Iron, 220/250 v. A.C./D.C. 30 watts, complete with mains plug, case, etc. Handle unscrews to cover element, enabling iron to be carried in pocket. 18/6. P.P. 1/-.

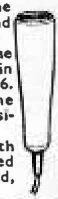
Telephone Adaptor

★ Ideal for recording telephone conversations. Supplied with screened cable. Fitted rubber sucker. 14/-. P.P. 9d.

CRYSTAL MICROPHONES

PRICES DOWN FULLY GUARANTEED

ACOS 39-1. Stick Microphone with screened cable and stand (list 5 gns.), 32/6, P.P. 1/6.
ACOS 40 Desk Microphone with screened cable and built-in stand (list 50/-), 15/-, P.P. 1/6.
ACOS 45 Hand Microphone with screened lead, very sensitive, 25/-, P.P. 1/6.
100 C Stick Microphone with muting switch and screened cable, detachable desk stand, cord, etc. 39/6. P.P. 1/6.



1 WATT TRANSISTOR AMPLIFIER
★ EMI 4-Transistor Amplifier with speaker, tone and volume controls. Ready assembled for use with crystal pick ups. 7½ to 9 volt operated. 89/6. P.P. 1/6.

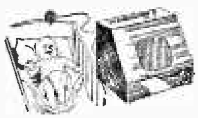
BATTERY RECORD PLAYER
★ 6—7½ volt Garrard Turntable with crystal pick-up. Plays 45 r.p.m. Ideal for above amplifier. 65/-. P.P. 1/6.

3-TRANSISTOR AND DIODE PERSONAL POCKET RADIO

Quality Output on Personal Earphone. A simple to build local station radio with personal earphone output. Built-in Ferrite Aerial and Battery lasting 9 months. Size 4¾ x 3 x 1¼in.

ALL PARTS
37/6 P.P. 1/6

BABY SITTER



ALL TRANSISTOR BABY OR INVALID ALARM

NOW HOUSED IN ATTRACTIVE GOLD HAMMER FINISH PORTABLE CABINET
Battery operated, push-pull, 400MW output. Low impedance microphone enables unit to be used up to 200 yards. Output on quality speaker.
★ GUARANTEED for 12 MONTHS and 100% SAFE.
★ Microphone is placed within 10ft. of baby; twin flex is taken to amplifier unit and placed in any room required.
COMPLETELY BUILT & TESTED.
£5.10.0 P.P. 2/6
★ **Used All Night, Every Night.** Battery Life 3 to 4 months.

Transistor 2-Way Intercomm

10 Gns.

Unit Sizes 3¾ x 1¾ x 3¼in. (Approx.)

- 2-way Talking.
- Internal Buzzing System
- Full Volume Control
- Long Life Built-in Battery

Built-in 2¼in. Speakers housed in attractive moulded cabinets. Supplied in presentation carton. Complete with Battery and 60 ft. wire.

- **Fully Guaranteed and Tested** ●

SPECIAL OFFER

COMPLETE SET OF PARTS FOR "P.W." CITIZEN AS PER DEC./JAN. EDITIONS OF "PRACTICAL WIRELESS."

79/6 P.P. 1/6

TRANSISTORS

We Stock Transistors and Components for Every Purpose. Enquiries Welcomed

FROM **3/6**

1st GRADE—FULLY GUARANTEED
SEND FOR LATEST PRICE LISTS

COMPLETE SET OF PARTS FOR "P.W." MINI-AMP AS PER NOVEMBER EDITION OF "PRACTICAL WIRELESS"
65/- P.P. 1/6
★ Suitable Battery Record Player 65/-. P.P. 1/6.

Henry's Radio Ltd

5 HARROW ROAD - LONDON W.2

Opposite Edgware Road Tube Station
OPEN MON. to SAT. 9-6, THURS. 1 o'clock
Telephone PADdington 1008/9.

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OUR SPECIALITIES
Transistors, Valves, Quartz, Crystals, Components at Competitive Prices. Let us quote for your circuit.

Practical Wireless

—BLUEPRINT— —SERVICE—

ALL OF these blueprints are drawn full-size and although the issues containing descriptions of these sets are now out of print, constructional details are available free with each blueprint except for the PW Monophonic Electronic Organ and the PW Roadfarer.

The Index letters which precede the Blueprint Number indicate the periodical in which the description appeared. Thus PW refers to PRACTICAL WIRELESS; AW to *Amateur Wireless* and WM to *Wireless Magazine*.

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

SPECIAL NOTE

THE following blueprints include some pre-war designs and are kept in circulation for those constructors who wish to make use of old components which they may have in their spares box. *The majority of the components for these receivers are no longer stocked by retailers.*

Title	*Number*	*Price*
CRYSTAL SETS		
Junior Crystal Set	PW94	2/-
Dual-wave Crystal Diode	PW95	2/6
STRAIGHT SETS		
Battery Operated		
Modern One-valver	PW96	2/6
All-dry Three	PW97	3/6
Modern Two-valver	PW98	3/6
SUPERHETS		
A.C. Band-pass Three	PW99	4/-
A.C. Coronet-4	PW100	4/-
A.C./D.C. Coronet	PW101	4/-
The PW Pocket Superhet	—	5/-
MISCELLANEOUS		
The PW 3-speed Autogram	—	8/-
The PW Monophonic Electronic Organ *(No constructional details are available with this blueprint)*	—	8/-
The PW Roadfarer *(No constructional details are available with this blueprint)*	—	5/-
TELEVISION		
The PT Band III converter	—	1/6

Title	*Number*	*Price*
A.C. Fury Four	PW20	2/6
Experimenter's Short Wave	PW30a	2/6
Midget Short Wave Two	PW38a	2/6
Band-Spread Three (Battery)	PW68	2/6
Crystal Receiver	PW71	2/-
Signet Two (Battery)	PW76	2/6
Simple S.W. One-valver	PW88	2/6
Pyramid One-valver	PW93	2/6
BBC Special One-valver	AW387	2/6
A One-Valver for America	AW429	2/6
Short-Wave World Beater	AW436	3/6
Standard Four Valve S.W.	WM383	3/6
Enthusiast's Power Amplifier	WM387	3/6
Standard Four Valve	WM391	3/6
Listener's 5-Watt Amplifier	WM392	3/6

QUERY COUPON

This coupon is available until 7th February, 1962, and must accompany all queries in accordance with the notice on our "Letters to the Editor" page.

PRACTICAL WIRELESS, FEBRUARY, 1962

Published on the 7th of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, London, W.C.2, and printed in England by WATMOUGHS LIMITED, Idle, Bradford; and London. Sole Agents for Australia and New Zealand: GORDON & GOTCH (A/sia), Ltd., South Africa and Rhodesia: CENTRAL NEWS AGENCY, LTD. Subscription rate including postage for one year: Inland £1.9.0. Abroad £1.7.6 (Canada £1.5.0.). Registered at the General Post Office for the Canadian Magazine Post.

★ RANGER 3 ★

NO EXTERNAL AERIAL OR EARTH—3-TRANSISTOR and 2 DIODES

Personal Pocket Radio with 5 stages giving clear reception on medium wave, amateur top band and shipping. No station overlap.

Size 4¾ x 3 x 1¼in.

All Components
79/6 P.P. 1/6
Everything Supplied

- Easy to follow instructions with pictorial layout free on request.
- Reception of Radio Luxembourg guaranteed.

ANNOUNCING A COMPLETELY NEW 6-TRANSISTOR POCKET SUPERHET RADIO

THE "CAPRI" POCKET SIX

Size only 4½ × 2¾ × 1¼in.

REALLY POCKET SIZE !

- ★ Full medium wave tuning—preset light on long wave.
- ★ 6 Mullard transistors and diode.
- ★ Push-pull output.
- ★ Printed circuit construction.
- ★ High flux speaker.
- ★ Fitted earphone/record socket.
- ★ Moulded two-tone cabinet with mesh grille.

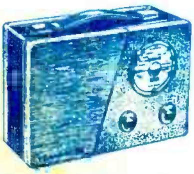
A REMARKABLE EASY TO BUILD POCKET RADIO GIVING OUTSTANDING RESULTS

● **Fully Descriptive Leaflets on request** ●

TOTAL COST OF ALL PARTS £7.10.0 P.P. 2/-
Battery 2/6 extra

"TRANSFIVE" PORTABLE

MEDIUM AND LONG WAVE PORTABLE RADIO



Size 8½ x 6½ x 3½in.

- 325mW Push-Pull Output on 5-inch Speaker.
- Pictorial Building Plans.
- Easy to Build Printed Circuit.
- Carded Components.
- 5 Mullard Transistors and diode.

AFTER SALES SERVICE and FULLY GUARANTEED

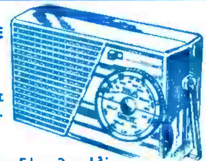
● Full coverage on Medium and Long wavebands. Excellent quality with full station separation. Car aerial socket.

TOTAL COST OF ALL PARTS
£6.19.6 P.P. 2/6
NO EXTRAS TO BUY

● **BUILDING PLANS & PRICES FREE ON REQUEST** ●

"QUINTET"

MEDIUM AND LONG WAVE POCKET LOUDSPEAKER RADIO



- 250mW Push-Pull Output.
- Plainly marked Printed Circuit Board and Carded Components.
- 5 Mullard Transistors and diode.
- Illustrated Plans.

A new printed circuit design fully tunable on both wavebands. Guaranteed reception of Continental and local stations including Luxembourg, anywhere with full station separation. Fitted Car Aerial & Earpiece Sockets

Size 5¼ x 3 x 1¾in.

TOTAL COST OF ALL PARTS
£5.10.0 P.P. 2/-
NO EXTRAS TO BUY

VERY EASY TO BUILD AND USE.
After Sales Service and Guarantee
All Parts Sold Separately

● **Illustrated Instructions FREE ON REQUEST** ●

P.W.-6 SUPERHET

Now available the modified version of the previously advertised P.W.-6 Transistor Medium and Long Wave Superhet. Cabinet Size now 5¾ x 3¾ x 2in.

ALL PARTS SOLD SEPARATELY
● **DETAILS ON REQUEST**
TOTAL COST OF ALL PARTS
£8.10.0 P.P. 2/-

TRANSISTOR PORTABLE TAPE RECORDER

Size 6 x 8¼ x 2¾in.

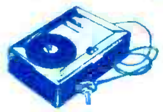
12 Gns.

- Over 1 hour play/record.
- Quality Reproduction on Built-in Speaker.
- Fast Rewind—Full Volume Control.

SUPPLIED COMPLETE WITH MICROPHONE, BATTERIES, PERSONAL PHONE AND TAPE.

★ RANGER 2 ★

All Parts
59/6
P.P. 1/6

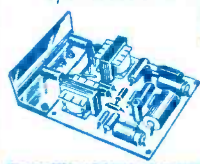


PERSONAL POCKET RADIO

● Two Transistor Two Diode fully tunable over medium waves. Good reception of Radio Luxembourg. Size 4¾ x 3 x 1¼in. **No extras to buy.**

● **PICTORIAL PLANS AND DETAILS FREE ON REQUEST**

3/4 WATT 4 TRANSISTOR AMPLIFIER



- 1 watt peak output.
- ±3db 70c/s to 12 kc/s.
- Output to 3 ohm speaker.
- 9 volt operated.

Built and Tested
69/6 P. & P. 1/6

Details on request.

A printed circuit high gain amplifier size 4 x 2¾ x ¾in. using Mullard OC71/OC81D and 2-OC81 Transistors. Ideal for Intercomm., Record Player, Tuner Amplifier or any application requiring a quality and reliable amplifier.

● *CONTESSA* ●

6 TRANSISTOR MEDIUM AND LONG WAVE SUPERHET

DETAILS

- High "Q" Internal Ferrite Aerial.
- Car Radio Adaptation and AVC
- "Hi-Fi" Quality Speaker.
- Slow Motion Fingertip Tuning with Station names clearly marked.
- 425mW Push-Pull Output.
- 6 "Top-Grade" Ediswan Transistors.
- New Type Printed Circuit with all components marked.
- Full Medium and Long Wave Tuning.

TOTAL COST OF ALL PARTS
£10.19.6 P.P. 3/6
● **NO EXTRAS TO BUY** ●

● Attractive Rexine Covered Cabinet Red/White or Blue/White, 10 x 7½ x 3½in.

UNBEATABLE IN PERFORMANCE AND APPEARANCE

Employs the latest techniques. Double tuned IF's, AVC and first-grade components are standard features. Excellent tone, sensitivity and selectivity on both wavebands guaranteed.

● **THE BEST OBTAINABLE** ●

Descriptive Leaflets on request.

COMBINED PORTABLE AND CAR RADIO

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Send 1/- Stamp for New Illustrated Price Lists
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