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This range of Stentorian loudspeakers, incorporating the patented cambric cone, was developed to provide reproduction that takes full advantage of the television and V.H.F. sound transmissions and high fidelity recordings now available. The cone of the loudspeaker is made from uncured cambric and bonded pulp, the whole being completely cured together and made into one composite cone.

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8" H.F.816*	16,000 gauss	£6.10.6	T.816	16,000 gauss	£6.3.9
8" H.F.812*	12,000 gauss	£3.19.6	T.12 tweeter	16,000 gauss	£12.12.0
8" H.F.810	10,000 gauss	£2.19.0	T.10 tweeter	14,000 gauss	£4.4.0
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10" Unit H.F. 1016. 16,000 gauss. Instantaneous matching at 3, 7.5 and 15 ohms. Handling capacity 10 watts. Frequency response 30 c.p.s. to 15,000 c.p.s. Bass resonance, 35 c.p.s.

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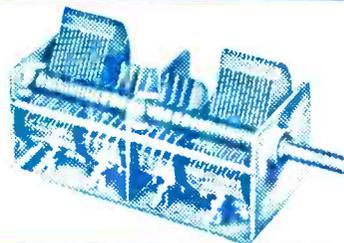
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1T4	4/-	6I5GT	4/6	12AT6	9/-			DF33	10/6	EF80	6/-			KL32	10/6	UBC41	9/6
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2D21	8/6	6K7GT	10/6	12A7	9/6	50L6GT	9/-	DF92	7/-	EF86	11/-			KL35	9/6	UBF89	8/6
2X2	5/-	6K8GT	12/6	12AX7	9/6	61BT	17/6	DF96	9/6	EF89	10/-			KT2	7/6	UCC85	10/-
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3Q4	8/-	6L1	15/6	12BE6	9/6	62BT	17/6	DH63	10/6	EF92	5/9			KT33C	10/-	UCL81	9/-
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3V4	9/-	6L19	21/-	12K7GT	8/6	78	12/6	DH107	13/6	EL31	12/6			KT44	13/6	UF41	9/-
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5U4G	4/6	6/30L2	10/-	12Q7GT	8/6	85A2	12/6	DK91	9/-	EL33	12/6			KT61	18/6	UF80	9/-
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5Z3	10/-	6N7GT	7/6	12SC7	8/6	18SBT	32/-	DL33	9/-	EL38	23/9			KT71	9/-	UL41	8/-
5Z4G	10/-	6M1	10/6	12SH7	4/-	303	7/6	DL35	12/6	EL41	10/6			KT74	12/6	UL44	24/6
6A7	18/6	6M2	10/6	12SJ7	4/-	304	7/6	DL92	8/6	EL42	10/6			KT76	12/6	UL46	21/6
6A8	10/-	6P1	17/6	12SK7	8/-	305	7/6	DL94	9/-	EL81	14/9			KT101	25/-	UL84	9/6
6A8B	9/-	6P25	19/6	12SQ7	11/6	328	7/6	DL96	9/6	EL84	7/-			KTW62	7/6	U06	20/11
6A18	9/6	6P28	26/-	12SN7	17/6	329	7/6	EAS0	2/-	EL85	10/6			KTW63	7/6	U07	15/6
6AK8	7/6	6Q7GT	10/6	12Z3	15/-	807	7/6	EABC80	7/6	EL90	8/6			KTZ41	8/-	U08	26/6
6AL5	6/-	6S7G	7/6	13D3	12/6	955	4/-	EAC91	7/6	EL91	5/-			KTZ63	10/-	U21	15/6
6AM5	5/-	6SH7	6/6	14H7	12/6	5763	17/6	EAF42	10/-	EM80	10/-			L63	4/9	U41	7/6
6AM6	4/-	6S17	5/6	14R7	12/6	9002	7/6	EB41	7/6	EM81	10/-			LN309	15/-	U45	7/6
6AN5	7/6	6SK7	7/6	14S7	21/-	9003	7/6	EB91	5/-	EY51	8/6			LZ319	12/6	VP28	17/6
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6AQ8	9/3	6SN7GT	5/6	15D2	23/9	AC5/PEN	25/-	EBF80	9/6	EY84	10/6			MHD4	17/6	W17	8/6
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6B16	7/6	7B7	8/-	20P3	23/-	ACVP1	17/6	ECC34	5/-	FC2	21/-			N19	8/-	X65	23/9
6BR7	15/-	7C5	8/-	20P5	22/6	ACVP2	17/6	ECC35	8/-	FC13	17/6			N37	18/6	X31	9/6
6BW6	8/6	7C6	8/-	25L6GT	9/6	AC2/PEN		ECC40	21/-	FC13C	21/-			N78	17/6	X78	21/-
6BW7	6/6	7D5	15/-	25Y5	10/-	AC2	21/-	ECC81	8/-	FW4,500	10/-			N108	18/-	X79	21/-
6BX6	6/-	7D6	15/-	25Z4	9/6	AC2		ECC82	9/6	FW4,800	10/-			N142	9/6	Y61	10/6
6B77	7/6	7D8	15/-	25Z5	9/6	PENDD21		ECC83	9/6					N147	18/6	Y63	9/-
6C4	6/-	7H7	8/-	25Z6	10/6	AZ1	15/6	ECC84	9/6					N150	10/-	Y64	21/6
6CC5GT	8/-	7K7	10/6	25Z7	10/6	AZ31	10/6	ECC85	9/6					N153	11/6	Z21	12/6
6C6	6/6	7Q7	11/6	30	13/6	B36	21/-	ECC91	5/6					N309	11/6	Z63	7/6
6C9	12/6	7R7	12/6	30C1	12/6	B65	8/6	ECF80	12/6					GZ34	13/6	Z66	19/6
6C10	12/6	7S7	10/6	30F5	11/6	B152	8/6	ECF82	12/6					H30	5/6	Z77	4/9
6CD6G	27/6	7Y4	7/6	30FL1	10/6	B309	9/6	ECF81	12/6					H63	9/6	Z152	8/6
6D1	8/-	8D3	4/-	30L1	11/6	B329	9/6	ECF82	12/6					H93	9/6	Z19	7/6
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6D3	15/-	10C1	18/-	30P2	11/6	B719	9/6	ECH35	21/-					HL92	6/6		
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Stern's "fidelity" TAPE RECORDERS

**BEFORE YOU BUY
— YOU SHOULD
HEAR THESE**

**RECORDERS. THEY ARE COMPARABLE
TO THE MUCH HIGHER-PRICED MODELS**

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 leaflets.

MODEL CR3/S Incorporates the new COLLARO "STUDIO" TWIN TRACK 3-speed Deck H.P. Terms: Deposit £7-18.0 and 12 months of £2-17.11. **\$39.10.0**

MODEL CR3/T Incorporates the very popular 3-speed COLLARO Mk. IV "TRANSCRIPTOR", Deck which has both upper and lower tape tracks. H.P. Terms: Deposit £9-10.0 and 12 months of £3-9.8. **\$47.10.0**

MODEL TR3/Mk.VI Incorporates the New TRUVOX Mk.VI TWIN TRACK 2-speed Tape Deck H.P. Terms: Deposit £9-18.0 and 12 months of £3-12.7. **\$49.10.0**

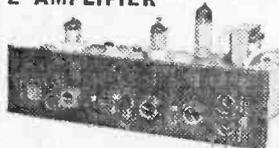
All prices quoted provide for the COMPLETE RECORDER including CRYSTAL MICROPHONE and 1,200 ft. Spool of Tape.

Each Model Incorporates the highly successful HF/TR3 Amplifier (described opposite) thus ensuring truly "Hi-Fi" record and playback facilities.

TAPE AMPLIFIERS and PRE-AMPLIFIERS PRESENTED FROM MULLARD DESIGNS

MODEL HF/TR3 TAPE AMPLIFIER

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



OR ASSEMBLED **£16.10.0**
KIT OF PARTS **£12.15.0** H.P. Deposit £3-6.0 and 12 months at £1-4.2.

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

The "Hi-Fi" link to add full tape recording facilities to High Fidelity home installations. Incorporates PEROXUBE POT CORE PUSH FULL OSCILLATOR and 3-speed treble equalisation by PEROXUBE POT CORE INDUCTOR FOR WEARITE-COLLARO-TRUVOX or BRENELL TAPE DECKS. (state which when ordering). Includes separate power Supply Unit. OR ASSEMBLED KIT OF PARTS **£14.0.0** H.P. £3-8.0 Deposit and 12 months £1-4.11. **£17.0.0**



(Excluding power unit £11.15.0 and £14.10.0 respectively).

FOR THE HOME CONSTRUCTOR SPECIAL 'COMBINED ORDER' PRICES

- (a) The COLLARO "STUDIO" TAPE DECK and our Mullard Type "C" PRE-AMPLIFIER and POWER Unit Assembled and Tested. **£29.10.0**
H.P. Deposit £5-18.0 and 12 months £2-3.3.
- (b) As above but TYPE "C" PRE-AMPLIFIER supplied as complete KIT OF PARTS. **£26.10.0**
- (c) The COLLARO Mk. IV TAPE DECK and the MULLARD TYPE "C" PRE-AMPLIFIER and Power Unit assembled, tested. **£35.0.0**
H.P. Deposit £7, and 12 months £2-11.4.
- (d) As (c) but Type "C", as COMPLETE KIT OF PARTS. **£32.0.0**
- (e) The TRUVOX Mk. VI DECK and the assembled Type "C" Pre-amplifier and Power Unit. **£40.0.0**
H.P. Deposit £8-0.0, and 12 months £2-18.8.
- (f) As above but Type "C" as complete KIT OF PARTS. **£36.10.0**
- (g) The BRENELL Mk. V DECK and the assembled Type "C" PRE-AMPLIFIER and POWER UNIT. **£46.0.0**
H.P. Deposit £9-4.0, and 12 months £3-7.6.
- (h) As (g) but Type "C" as complete KIT OF PARTS. **£43.0.0**
- (i) THE WEARITE 4A DECK with TYPE "C" assembled and tested. **£56.0.0**
H.P. Deposit £11-4.0, and 12 months £4-2.1.
(Carriage and Insurance on above quotes 10/- extra.)

- (a) COMPLETE KIT to build the HF/TR3 Amplifier, together with the COLLARO "STUDIO" DECK. **£25.10.0**
- (b) As above but with HF/TR3 supplied ASSEMBLED and TESTED. **£29.0.0**
- (c) COMPLETE KIT to build the HF/TR3, together with the Mk. IV COLLARO "TRANSCRIPTOR" TAPE DECK. **£30.15.0**
- (d) £1 extra if we are required to wire up Deck Switch Banks.) H.P. Deposit £5-16.0, and 12 months £2-2.8. **£34.10.0**
- (e) TESTED but HF/TR3 supplied ASSEMBLED and TESTED. H.P. Deposit £7-0.0, and 12 months £2-10.5. (£1 extra if we are required to wire up Deck Switch Banks.)
- (f) COMPLETE KIT to build the HF/TR3, together with the NEW TRUVOX Mk. VI TAPE DECK. **£36.0.0**
- (g) As above but HF/TR3 supplied ASSEMBLED and TESTED. **£39.10.0**
H.P. Deposit £7-18.0, and 12 months £2-17.11.
- (h) COMPLETE KIT to build the HF/TR3 AMPLIFIER with the BRENELL Mk. V TAPE DECK. **£41.10.0**
- (i) As above but HF/TR3 supplied ASSEMBLED and TESTED. **£45.0.0**
H.P. Deposit £9-0.0, and 12 months £3-6.0.
- (j) THE WEARITE 4A DECK with assembled and tested HF/TR3 Amplifier including WEARITE Head Lift Transformer. **£55.0.0**
H.P. Deposit £11-0.0, and 12 months £4-0.8.
Carriage and Insurance on each above is 10/- extra.

EACH OF THE ABOVE CAN BE SUPPLIED IN A PORTABLE CASE THIS FORMING A COMPLETE PORTABLE PRE-AMPLIFIER. FULL DETAILS ON REQUEST.

Attractive PORTABLE CASE is available to accommodate the TRUVOX or COLLARO TAPE DECKS and we offer it, together with ROLA/CELESTION 10 x 6in. LOUDSPEAKER—ACOS CRYSTAL MICROPHONE—and 1,200ft. SPOOL E.M.I. TAPE—ALL FOR £9-10.0, Carriage and Insurance 5/- extra.

A LARGE PURCHASE OF BRAND NEW AND FULLY GUARANTEED TRUVOX and GARRARD TAPE EQUIPMENT

ENABLES THESE OUTSTANDING PRICE REDUCTIONS



The "MODEL HF/G2R" PORTABLE TAPE RECORDER (Original Price £33.0.0) **FOR ONLY 22 gns.**

H.P. Dep. £4-14.0. 12 months £1-13-9. (Carr. & 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

The "MODEL TK/MkIV" PORTABLE TAPE RECORDER (Original Price £49.10.0)

FOR ONLY £36.10.0 Price includes a 7" spool of EMI tape!
H.P. Dep. £7-6.0. 12 months £2-13.6 (Carr. and ins. 10/- extra). Incorporates the Truvox MkIV Tape Deck, Rola/Celestion 9 x 5 in. Loudspeaker and the Truvox Type "K" Amplifier specifically developed by Truvox Ltd to correctly operate their MkIV Tape Deck. As a result we are able to present a highly perfected tape recorder providing sound reproduction which truly justifies the title "High Fidelity".



MAGAZINE and a 4in. SPOOL OF DOUBLE PLAY TAPE. Comprises a Twin Track Recorder operating at 3in/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.

A Twin Track Two Speed model operating at 3 and 7 1/2 in/sec. speeds and incorporating Magic Eye Indicator, Safety Button. (Prevents accidental erasure). Ext. Speaker output, tone and volume controls.

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

STERN RADIO LTD.

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. PRICE COMPLETE KIT (PARMEKO Output Trans.)



Alternatively we supply ASSEMBLED and TESTED £11.10.0

ABOVE INCORPORATING PARTRIDGE OUTPUT TRANSFORMER. £1.6.0 EXTRA

MULLARD'S PRE-AMPLIFIER 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.



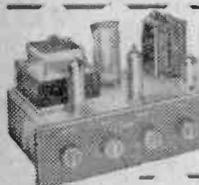
KIT OF PARTS £11.10.0 OR ASSEMBLED and TESTED £13.10.0

HIRE PURCHASE (Assembled Amp. only). DEPOSIT £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

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Supplied on ONE CHASSIS (as illustrated) READY FOR USE

(Carr. & Ins. 10/- extra).

Price includes Garrard Magazine and a 4in. Spool Double Play Tape.

H.P. Deposit £3.16.0, and 12 months of £1.7.8.

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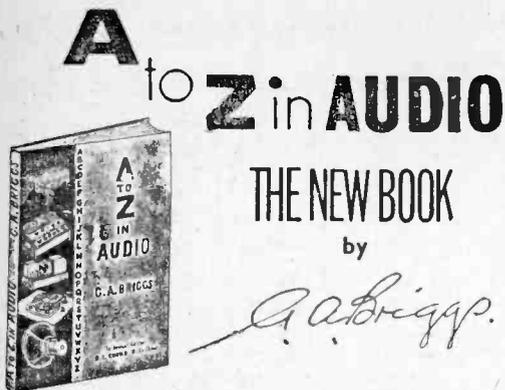
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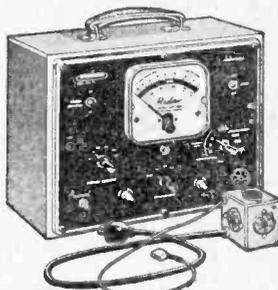
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- Measures Resistance up to 100 Megohms ● Clears leaks by pressing a button ● Heater Current measurement 0-0.5A and 0-2.5A Linear Scale ● Adjusts heater current to ensure accurate Emission Test ● Portable for field or bench service.

BRIEF SPECIFICATION

Tests: Filament Continuity, Heater Current, Inter-Electrode Insulation, Final Anode Beam Current, Heater-Cathode Leakage, 4-stage Reactivation by New Pulsing Method. Universal socket fits all tubes. E.N.T. Probe. Measures: 0-25 Volts A.C., 0-500 Volts D.C., 0-25 kV., 0-100 Megohms, 0-250 microamps.

200-250 Volts A.C. Mains. Size 1 3/4 in. by 10 in. Weight 14lb.
List Price £27 OUR PRICE £17.17.0

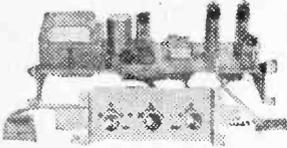
Plus 9/- P. & P.

For ADDRESS and 3 pages of more STUPENDOUS BARGAINS PLEASE TURN OVER

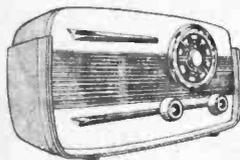
DEPT.
P.W.2

HARVERSON SURPLUS CO. LTD.

MONAURAL AMPLIFIER



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



HARVERSON SUPERHET 4 KIT

A medium and long wave superhet, incorporating two I.F. stages modern B9 valves (UCH81, UBF89, UCL83, U785), built-in ferrite rod aerial. All you need supplied from theoretical wiring diagram to last nut and bolt (main components ready mounted), including an attractive contemporary styled cream plastic cabinet with gold trimmings. Size 11 1/2 x 4 1/2 x 6 1/2 in.

PRICE £6.12.6 Post 3/6.

SLOW MOTION TUNERS

500-500 Twin gang condensers with geared slow motion drive. 3/6 ea. 36/- per doz. P. & P. 6d.

WIRE WOUND POTS

12 Wire wound Colvern Pots—all different values P. & P. 9d. 10/6

STEREOPHONIC AMPLIFIER

£5.10.0

Complete with 2 Loudspeakers

Plus 4/6 P. & P.

This is a compact amplifier embodying the latest features and giving a high standard of reproduction, with ample volume. Supplied complete with valves (ECL82, ECL82, EZ80), panel, knobs, etc., and two specially selected 3Ω matched loudspeakers. Few only at such a low price. Don't risk disappointment. Order now.

BATTERY CHARGER RECTIFIERS

12 v. 1 amp.	5/-
12 v. 2 amp.	8/-
12 v. 3 amp.	10/-
12 v. 4 amp.	14/-
12 v. 5 amp.	16/-
P. & P. 6d.	

TRANSISTOR RECORD PLAYER CASE

A few only—Transistor record player cases in light grey cloth—complete with motor board. Size: 12 x 8 x 6 in.

P. & P. 1/9.

TRANSISTOR BARGAINS

ALL MULLARD FIRST GRADE

OC71	8/-
OC72	12/-
OC72 Matched Pair	25/-
OC45 Green Spot	15/-
OC45 Blue Spot	15/-
OC44	15/6
OA41 Diode	3/6

Postage on all above 6d.

SPECIAL OFFER

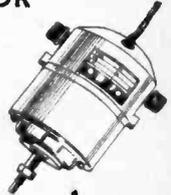
DON'T MISS THIS

MULLARD O.C.76 10/6
MATCHED PAIR £1.0.0

Post and packing 6d.

1/6 H.P. MOTOR

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



COSSOR C.R.T. SNIP

108K 10-inch. New and boxed 15/-, plus 6/- P. & P.
75K 10-inch. New and boxed 15/-, plus 6/- P. & P.

18/6

each.

ION TRAP MAGNETS

To suit the above, 2/9 each. P. & P. 3d.

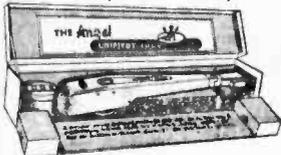
THIS MONTH'S BARGAIN!

SUPERHET CHASSIS £4.19.6 P. & P. 3/6

Complete and ready for your cabinet, 4 valve superhet chassis, complete with valves, ferrite aerial, dial and knobs. Valve line-up—UCH81, UBF89, UCL83, UY85. Long and Medium wave coverage.

GRAM & TAPE EQUIPMENT BARGAINS

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



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

PICK-UP CARTRIDGE BARGAINS

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

P. & P. 1/-.

RECORD CHANGERS

GARRARD	
RC 98 Mk. 4H. 4-speed autochanger	£16.10.0
RC 120/D Mk.2	£9. 0. 0
RC 120 Mk.4D	£9. 0. 0
RC 120 Mk.4H	£9. 0. 0
RC 121 Mk.1	£11.0. 6
RC 121 Mk.4H	£11.0. 6
RC 121/40 Mk.2	£11.0. 6

COLLARO	
RC 54 4-speed autochanger	£6.19. 6
RC 594	£7.19. 6
Conquest	£6.12. 6
Challenger	£7.19. 6

B.S.R.
Monarch UAB 4-speed autochanger' £6.19. 6
TUB 4-speed single player less pick up £2.10. 0
NOTE: Any of the above with Stereo Cartridge and Fittings, 16/- extra. Carriage and ins. on each of above 5/- extra.

TAPE DECKS

LATEST B.S.R. MONARDECK (single speed) 3 1/2 in. per sec. simple control, uses 5 1/2 in. spools £7. 5. 0
plus 5/6 carriage and insurance (tapes extra).
TRUVOX MARK III TAPE DECK. New and Boxed £10.6. 6
Plus 6/- carr. and ins. (tapes extra).

SPEAKER FRET

Super quality heavily woven fret. 54 in. wide. Usually 50/- per yard PRICE 12/6 per yard. P. & P. 1/-.

CYLDON 12 CHANNEL TURRET TUNERS

New purchase offered at still lower price. I.F. 33-38 Mc/s. Complete with PCC84 and PCF80 valves and 8 sets of Coils for 5 Band 1 Channels and 8, 9, 10 Band III. New and unused. Value over £7. OUR PRICE, post paid 32/6

MIDGET I.F. TRANS & COILS

A Pair of midget 465 kc/s I.F. transformers, plus LW and MW coils. PRICE 10/- per set. P. & P. 1/9. Set of I.F. transformers for transistor superhet. 12/6. P. & P. 1/9.

CONDENSER/RESISTOR PARCEL

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

ONLY 10/-

83 HIGH STREET, MERTON, S.W.19

CHerrywood
3985/6/7

HARVERSONS SUPER STEREO KIT

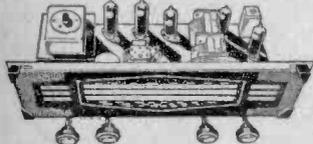
The product of a renowned maker, this stereo amplifier is composed of "ready-built" units, only requiring interconnection. This system has the advantage of being adaptable to fit any cabinet. Each unit is made from first-grade components, and valves used (ECL82, EZ80 range) are genuine Mullard. The comprehensive instructions supplied make the simple interconnection of units easy even for the novice.

THE KIT COMPRISES...

TWO MIDGET AMPLIFIERS each of 3W output, good reproduction from both your stereo or monaural records. Both amplifiers complete with well-designed O.P. transformers providing perfect matching 3-7Ω speakers, and have remote bass, treble and volume controls. Size 5" x 2½" x 3" high (each amplifier).

CONTROL UNIT, is a flying panel with three 2-gang pots, enabling the bass, treble and volume controls of each amplifier to be conveniently positioned. Supplied with attractive cream and gold knobs.

A.M. RADIOGRAM CHASSIS



A chassis of distinction, by a famous maker. Covering Long, Med. & Short Waves, plus gram position, this chassis (Size 15½ x 7 x 6½ in. high) incorporates the latest circuitry, using fully delayed A.V.C., and negative feedback. Controls: Tone, Vol., On/Off, W/Change (L.M.S. & 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, EB81, EL84, EZ81), knobs, output transformer, leads etc. **OUR PRICE ONLY £9.19.6** plus 4/6 post & packing.

SEPARATE POWER PACK with valve rectifier, midget size (5" x 2" x 3¼" high.)

ISOLATED MAINS TRANSFORMER of robust construction may be mounted independently.

VOLTAGE SELECTION PANEL. Fitted with the "valve base" type of mains 1/p selector and a channel output socket.

ONE SPEAKER, a quality 5-in. speaker. (Note: The 2nd speaker may be purchased from us for 14/6 extra.)

CREAM DOUBLE PUSH BUTTON SWITCH of neat design gives positive on/off switching.

INDICATOR LIGHT. Provides visual indication of equipment operating and is complete with gold-finished escutcheon

59/6

PLUS 6/6 POST & PACKING

E.M.I. 4 SPEED STEREO PLAYER
To suit the above
£6.12.6
Plus 5/- carr.

GUARANTEED VALVES ★ NEW and BOXED PROMPT DESPATCH ★ Post 6d. per valve extra

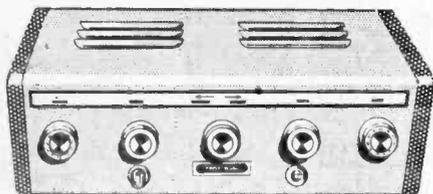
ACHLDD	EBL81	22/-	EL81	15/9	KTW61	6/-	PEN46	6/6	UBC41	8/6	W21	11/9	3R4GY	9/-	8F13	13/-	6U5/6U5	12/6	E8	8/6	30L1	18/6		
AC/P	9/3	EC031	7/-	EL84	8/6	KTW63	7/-	PEN38322/-	UBF90	3/9	W76	7/-	8U4G	6/3	6F15	13/-	16/-	12C8	8/6	30P4	19/-			
AC/P	7/-	EC081	7/6	EM84	8/9	KTZ41	8/3	PEN220A	UC084	10/-	W77	8/-	3V4	10/9	6F17	11/9	6U5G	8/-	12E1	3/6	30P12	11/9		
AC/P	7/-	EC082	7/-	EM80	9/3	MH41	6/6	3/9	UC085	10/6	W79	9/9	5Y3G	7/8	6F33	16/6	6U7G	8/-	12H6	3/3	30P16	9/-		
AC/GEN	EC083	8/6	EM81	9/6	ML4	8/-	PEN45DD	UC090	18/6	X22	16/9	5Y3GT	7/8	6E66	2/3	6V6G	5/6	12T5GT	2/9	30P11	11/9			
DD	25/9	EC084	9/3	EY51	9/3	MS4B	16/-	25/-	UCH42	9/9	X110	18/9	5Z4G	8/8	6E6GT	2/3	6V6VGT	7/3	12J7GT	10/-	35L6GT	9/9		
AC/GEN	6/-	EC085	9/-	EY86	9/3	MSP4/5	7/-	PEN44	14/6	UCH81	9/9	X101M	11/6	6Z4M	9/8	6J8GT	4/6	6X4	7/-	12K7GT	7/-	25Y5	9/3	
AUVP1/59/3	ECF80	11/3	EZ40	7/7	MSR4/7	7/-	PEN12M	7/6	UCL82	15/6	Y93	8/8	6A7	10/6	6J9M	6/6	6X6G	6/6	12K8GT13/-	35W4	7/-	35Z4GT	7/6	
ATP4	9/3	EOP82	12/3	EZ41	7/-	MV8/PEN	9/2	25/-	UP41	3/8	Z309	7/-	6AC7	6/-	6J7G	6/-	6J8GT	6/6	6X0L2	11/9	12M87	7/4	42	7/6
AZ1	9/8	BOH21	22/-	EZ80	6/6	MX40	16/-	8P41	2/9	UP85	8/8	Z359	7/-	6AG5	5/3	6J7M	8/8	7B8	9/9	12H87	5/8	35Z3	15/6	
AZ21	11/2	ECH42	9/8	EZ81	6/6	NX37	18/6	8P81	2/9	UP89	9/8	1A3	8/-	6AK5	6/-	6K7G	8/9	7B7	8/-	12S37	5/8	35Z5GT	8/6	
B36	14/-	ECH81	8/6	EZ90	1/9	N78	18/6	8P4/5	9/9	UL41	9/8	1A5GT	5/6	6AL5	6/-	6K7M	8/3	7B8	5/8	12K87	5/8	50C5	10/9	
CHL31	22/9	ECL80	9/3	EL148	1/9	N78	18/6	8P4/5	9/9	UL41	9/8	1A5GT	5/6	6AL5	6/-	6K7M	8/3	7B8	5/8	12K87	5/8	50C5	10/9	
CH35	22/9	ECL82	9/9	EL148	1/9	N78	18/6	8P4/5	9/9	UL41	9/8	1A5GT	5/6	6AL5	6/-	6K7M	8/3	7B8	5/8	12K87	5/8	50C5	10/9	
CL4	11/9	EF92	8/6	PC13	5/-	N399	28/-	SP47	9/9	UL46	25/-	1C2	11/-	6AM5	11/9	6K8G	7/-	7C5	7/8	12SNT	7/6	50C6G	2/6	
CL33	18/-	EF96	4/6	GT1C	25/6	PE1	3/3	DDD13C	7/7	UL64	8/6	1C5GT	11/9	6AQ5	7/-	6K7GT	5/6	7D6	12/6	14/-	50L6GT	2/6	28/6	2/6
CV31	15/9	EF37A	1/4	GZ22	11/-	PC084	8/6	TH233	17/6	U6	18/6	1D6	11/9	6AT8	8/-	6K8GT	6/8	7C9	8/6	12S17GT	2/6	28/6	2/6	
CV73	9/9	EF39	5/8	H80	4/6	PCF80	9/-	TP22	7/6	U8	25/-	1D6	11/9	6AU8	9/9	6E25	18/6	7Q7	8/6	12BQ7	8/-	75	10/9	
CS4	7/-	EF40	18/6	H63	9/3	PCF82	11/9	TP25	25/-	UY1N	11/9	1HGT	10/-	6B9G	3/9	8L1	14/6	787	9/-	15D2	7/3	80	8/-	
DAF96	8/2	EF41	9/3	HL23DD	8/-	PCL82	11/6	U10	9/9	UY21	11/9	1H7	14/6	6B9G	7/-	8BA8	7/8	7Y4	8/6	18AQ5	9/-	142BT	3/3	
DP96	8/6	EF42	10/3	HL22	8/-	PCL83	13/6	U14	8/-	UY41	7/-	1L4	9/-	6B9G	3/9	6B9G	2/8	8L3M	8/6	8D3	2/6	19BG6G	3/6	
DH03	11/6	EF60	3/9	HL43	3/3	PL38	14/6	U16	11/9	UY86	6/8	1N6	9/9	6B9G	28/-	8L7G	7/9	9D3	3/3	20D1	6/-	210DPT	4/3	
DH101	11/6	EF60SYL	3/9	HM309	22/-	PL36	14/6	U17	11/9	VP13C	3/3	1R5	7/-	6BH8	8/6	6L18	10/3	10C1	11/9	20F2	25/-	210VPT	3/3	
DK96	8/6	EF68	9/9	K40N	8/6	PL81	11/9	U22	7/6	VP23	6/-	184	9/9	6B16	5/6	6L19	13/-	10C2	16/9	30L1	25/-	83	9/9	
DL46	3/6	EF64	5/6	KP36	8/6	PL82	8/6	U25	12/6	VP41	8/-	185	9/9	6BRT	11/9	6N7GT	7/-	10F1	14/6	30T1	25/6	30L	9/9	
DL145	9/3	EF55	9/3	KP32	20/8	PL83	11/6	U26	11/9	VP133	14/-	184	9/9	6B9G	8/6	6P25	25/-	10F9	14/6	9P25	25/-	30Z	9/9	
DM70	7/-	EF80	7/6	KLL32	8/-	FX35	11/9	U37	25/-	VP33	14/-	2C28	1/3	6BW7	8/-	6Q7G	7/6	10L1	8/-	90P4	25/-	304	9/9	
DN41	10/6	EF85	7/6	KW2	2/6	PY80	7/6	U45	14/-	2P	25/-	2P	25/-	6C4	3/9	6Q7GT	9/-	10LD11	9/9	90P5	25/-	305	9/9	
EA50	1/3	EF86	11/6	K72	4/6	PY80	7/6	U45	14/-	2P	25/-	2P	25/-	6C4	3/9	6Q7GT	9/-	10LD11	9/9	90P5	25/-	305	9/9	
EABC80	8/6	EF89	8/6	KT24	4/8	PY81	8/-	U50	7/6	VR105/30	2X2	4/-	6C5GT	6/-	68A7GT	7/8	10F13	16/8	25A6G	9/9	306	9/9		
EAP42	9/6	EF91	5/6	KT32	9/8	PY82	6/8	U76	7/6	7/8	3A4	6/8	6C8	6/8	68G7	7/8	10F14	16/8	25B6GT	9/9	307	9/9		
EB34	1/8	EF91(BVA)	KT380	8/-	PY83	8/-	U76	7/6	7/8	3A4	6/8	6C8	6/8	68G7	7/8	10F14	16/8	25B6GT	9/9	307	9/9			
EB41	8/6	EF92	4/8	KT36	28/-	Z330	18/6	U39	11/9	VR150/30	3B4	4/6	6C31	2/8	68H7	6/8	12A6	6/-	25Y4	9/-	904	1/9		
EBK33	6/8	EL42	4/8	KT65	10/3	PEN44D	U403	15/6	U39	11/9	VR150/30	3B4	4/6	6C31	2/8	68H7	6/8	12A6	6/-	25Y4	9/-	904	1/9	
EBCA1	8/9	EL33	13/-	KT61	9/8	PEN44	U404	10/6	U404	10/6	VR120A	3/8	3Q5GT	9/-	6C8E	9/9	68L7GT	7/8	12AU7	7/8	278A	18/6	5763	10/9
EBF90	9/-	EL38	24/8	KT63	7/6	PEN44A	U601	28/-	U403	15/6	VR150/30	3B4	4/6	6C31	2/8	68H7	6/8	12A6	6/-	25Y4	9/-	904	1/9	
EBF99	8/-	EL41	9/8	KT66	10/-	PEN44	U403	15/6	U403	15/6	VR150/30	3B4	4/6	6C31	2/8	68H7	6/8	12A6	6/-	25Y4	9/-	904	1/9	
EBL21	22/-	EL42	9/8	KT68	21/-	PEN25	5/6	UAF42	8/8	U111	2/8	4D1	9/-	6F6M	13/-	6U4GT	11/3	12BA7	6/8	30P11	9/9	9006	5/-	

HARVERSON SURPLUS CO. LTD.

83 HIGH STREET, MERTON, S.W.19.

CHerrywood 3985/6/7

HI-FI STEREO/MONAUROAL AMPLIFIER



It is with great pleasure that we are able to offer an amplifier of this quality, (it will satisfy the most discerning enthusiast) at a price which places it within the reach of most people. This being the product of a company famed as a specialist in the audio HI-FI field it is made to very exacting standards.

It is designed for stereophonic reproduction from records, or tape, and monaural reproduction from records, tape, microphone, radio tuner etc. Setting the STEREO/MONAUROAL control to stereo operation divides the amplifier section into two 2 valve HI-FI amplifiers, whilst switching to the monaural position reunites these into a quality push pull amplifier.

The unit is self powered by an internal power pack, employing valve rectifier and mains transformer. The latter has a tapped input (200-210, 220-230, and 240-250 volts A.C.50 cycles only) and is double wound, providing complete isolation from the mains. This enables the amplifier to be used in conjunction with any equipment in perfect safety.

Five controls are provided in addition to an on/off switch, VOLUME I, TONE I, STEREO/MONAUROAL switch, TONE II, and VOLUME II. Both volume controls are calibrated to assist in securing perfect balance, and the tone controls are so designed that clockwise movement increases the treble response, whilst turning anti-clockwise causes the bass to predominate.

The complete unit is mounted in a stylish hammer finished metal case, stove enamelled in glossy tone grey and slate blue. The cabinet front panel is equipped with a white on/off switch, red indicator neon with gold escutcheon, cream and gold name plate, five gold and white knobs and a cream and gold strip running full length above the knobs bearing the control names. On the back are the stereo and monaural inputs, mains voltage selector, and loudspeaker terminals. Matching is provided for a 3 ohm and 15 ohm speaker, for each channel. This enables the use of a bass speaker and tweeter on each channel, provided that one speaker has 15 ohm and the other speaker has 3 ohm impedance.

Unrepeatable at this price.

OUR PRICE

plus 4/6 post & packing.

£9.19.6

YET ANOTHER HARVERSON AMPLIFIER SCOOP FOR ONLY 21'-

PLUS 6/6 P.P. & INS.

Owing to a fortunate purchase, we are able to supply these amplifiers at a fraction of the price normal for comparable equipment. Although not new, these units are in good condition, and represent a first class buy. Originally made for a relay wireless company, they are built to strict specifications by a prominent maker.

BASICALLY EACH UNIT COMPRISES . . .

R.F. AMPLIFIER, using a 10F3 valve, all contained in a screening box.

AUDIO AMPLIFIER, employing a 10P14 valve, and giving good reproduction at 3 watts.

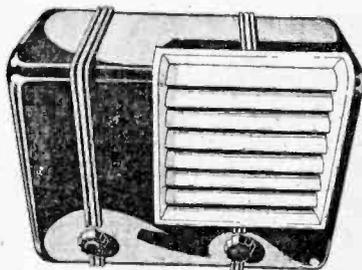
POWER PACK both the R.F. and the Audio amplifier are fed by a common internal fully smoothed power supply. This is provided by a tapped mains dropper (input 200/250 volts AC/DC), and a U404 rectifier valve.

INPUTS. Inputs are supplied for AC/DC mains, crystal pick-up, and six pre-set channels.

SPEAKER. A good quality 15 Ω permanent magnet 8-inch round speaker is fitted.

CABINET. All the above are housed in an attractive brown bakelite case, with cream speaker slats. (Case size 14" x 11½" x 6"). The applications to which these amplifiers can be put are limitless, for apart from the obvious use as a gram amplifier (2 can be used for stereo) they can be adapted for countless other uses e.g. baby alarms, inter-coms, guitar amplifiers, etc.

OUR PRICE, in full working order including **ONLY 21/-** plus 6/6 post & insurance.



◀ Please turn back for another 2½ pages of Bargains

PORTABLE RADIOPHONES MODEL MK II

Brand New British Army Portable Transmitter Receivers.

Designed for reliable voice intercommunication operating up to 10 miles depending upon obstructions and elevation. The combined Transmitter Receiver covers the whole frequency range between 7.4 Mc/s. and is fully variable on both Transmitter and Receiver. Simple and a delight to operate as all controls are mounted on the front panel of the set and clearly marked. Operates from standard dry batteries 3 v. L.T. and 120 v. H.T. Incorporates 5 valves: R.F. Amplifier, I.F. Amplifier, Second Detector, Output and Power Amplifier.

All sets are supplied complete with all accessories comprising dynamic sound powered headphones, electro magnet supersensitive microphones, fit. aerial, junction box, battery connection details and full circuit diagram.

PRICES:

80/- EACH (P. & P. 4/-).
TWO FOR £8.00 (Post Free).
Batteries 20/- per set.

BC-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 10 1/2 x 3 1/2 in. Weight 33 lbs.

Offered for the first time at **£25 CARR.** the ridiculous price of only **PAID.**

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.



COMMAND TRANSMITTERS Complete with all valves, crystal case. 3.4 Mc/s. 45/-, 4.5.3 Mc/s. 45/-, 5.3.7 Mc/s. 45/- P. & P. 3/6 each.

COMMAND RECEIVERS 6.9.1 Mc/s. 80/-, P. & P. 3/6 ea.

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WIRELESS SET No. 10 Incorporates TX/RX covering 2-8 Mc/s (37.5-150 metres), and intercom. amplifier, 500 microamp check and tuning meter, circuit and instruction book. ONLY 55/-, Carr. 10/-.

ACCUMULATORS. 2 volts 16 A.H. (unspillable). Ideal for 6 and 12 volts supply, etc. Brand new. Original cartons. Size 4 1/2 x 7 1/2 x 2 1/2. 5/6 each. P. & P. 1/6. 3 for 15/-, P. & P. 3/6. 6 for 27/8. P. & P. 5/-.



MINIATURE MODEL MOTOR

A really high-speed precision motor with 101 uses: Model control fan, saw buffer, etc. Operates from standard battery (3-6 volts). Complete with full instructions at only 5/- each. Post 1/-, 2 for 10/-, post free.

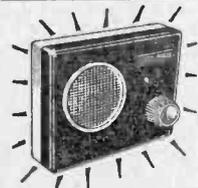
R.C.A. COMMUNICATION RECEIVER AIR-88 LF. Range: 73-550 kc/s and 1.48-30.5 Mc/s. Undoubtedly the finest communication receiver ever produced for service and laboratory use. Now Relda's exclusive purchase enables you to obtain this Rolls-Royce of communication receivers at the lowest price ever offered. Fully guaranteed. FEW ONLY £37.10.0, carr. 50/-.

SPARE VALVE KIT - a gift for all 38 and 18 Set owners. Case contains 1 in. 4 ARP12 & 1 ATP4 valves etc. Only 10/- P. & P. 2/6.

MICROPHONES. BRAND NEW. Throat magnetic, 4/8; Throat carbon 3/8; No. 8 carbon with switch 6/8; No. 1 moving coil 7/8. Crystal mike 22/8.

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These miniature HI-FI phones use high quality permanent magnetic speakers with regulated voice coil. The soft rubber gear 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.



SIGNAL GENERATOR Model SWO-300 150 kc/s-300 Mc/s. Frequency Range: 150 kc/s-150 Mc/s on fundamentals (6 bands), 150 Mc/s-300 Mc/s on harmonics. Calibration Accuracy within +/- 1 per cent. Modulation internal and external. Attenuation: To -40db. Output: Facilities for high and low. Power Supply: Internal 230 v. A.C. Size: 7 x 10 x 5 in. Complete with test leads and instruction manual. ONLY £14.18.6. Carriage 5/6.



Fully Guaranteed.

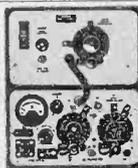
OSCILLOSCOPE MODEL 74

This basic scope represents one of the finest buys we have ever made! Contains Brilliance, Focus, Gain and 2 speed time base controls. Separate X plate terminals. Signal Generator modulated at 2 frequencies 150-255 Mc/s. Complete with 12 valves, VCR 139A tube, internal A.C. power pack, and complete circuit and technical details.

ONLY 97/6 Carr. 12/6.

PORTABLE TRANS/RECEIVER No. 18

A self-contained Trans/Receiver for Telephone and C.W. Range approx. 10 miles. Freq.: 6-9 Mc/s. (50-33.8 metres). Valve line-up: 3 ARP-12, 2 AR-8, 1 ATP4. Complete with aerial, H.T. and L.T. meter and all accessories. Weight 20 lbs. Size 8 x 10 x 17 in. ONLY 80/-, Carr. 10/-.



T.C.S. RECEIVER. 1.5 to 12 Mc/s. 7-valve superhet, built like a dream. Panel controls: R.F. Gain, A.F. Gain, C.W. Pitch, band-switch, mod.-C.W. switch, power switch, ground and aerial posts, M.O. or crystal frequency switch, speaker jack, card holder to log 30 stations, hand vernier tuning knob turning a large etched calibrated plate behind hair lined window, anti-backlash rears used. 90% complete, store solled, offered at ONLY £5.10.0. Carr. 10/-.

Exciting New Product Exclusive to RELDA

TELEPHONE PICK-UP COILS

MODEL FC-8 Induction Pick-up coil enabling conversations to be picked up without tapping of wires or special telephone circuits. No electrical connections! Simply place telephone on the pick-up platform and connect lead to the input of any medium gain amplifier or direct to any tape, disc, or wire recorder. The coil is electrostatically shielded to minimise hum pick-up. Brand new complete with fit. shielded cable. FC-8 only, 18/- plus 1/6 p. & p.



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SENSATIONAL NEW 1961 DESIGNS-- LOW PRICES ★ PICTORIAL STEP-BY-STEP PLANS

THE NEW "LISBON" TRANSISTOR SET

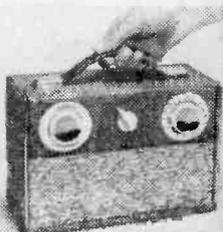
Build the miniature highly sensitive "LISBON" design. This is a pocket 2-stage transistor set not much larger than a matchbox. Excellent clear reception covering all medium waves and working for months and months off a tiny 14 or 3 volt battery costing only 3/6. A very simple set build and an excellent introduction to transistor circuitry. Everything can be supplied down to the last nut and bolt including, **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS FOR ONLY 19/6**, plus post and packing 1/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.



"MAJORCA" 7 TRANSISTOR RADIO

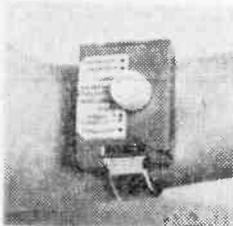
Build this sensitive valve radio. **£10.19.6**

"MAJORCA" superhet portable with Car Radio aerial attachment. An exceptionally high quality design giving remarkable tone with push-pull output. Can be built for **ONLY £10.19.6**, including everything down to the last nut and bolt and **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS**. Post and packing 3/6 (C.O.D. 3/- extra). Parts sold separately.



OUR NOVEL WRIST RADIO

Our engineers have designed this novel Wrist Radio using latest transistor technique. Size only 1 1/2 x 1 x 3/4 in. "Featherweight" yet gives clear, crisp reception over all medium waves. Tiny battery lasts months and months costing only 4d. No case — anyone can build it in an hour or two using our **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS**. All parts can be supplied including case and strap **FOR ONLY 22/6**, plus post and packing 1/6 (C.O.D. 2/- extra). Parts sold separately priced parts list 1/-.



THE NEW "FLORIDA" VALVE RADIO

This sensational "FLORIDA" model is one of our most sensitive valve radios. It is a highly compact self-contained miniature push button base, valve pocket radio at absolutely rock bottom building cost. Covers all medium waves with very latest circuitry bringing in stations from all over Europe without fuss. Size only 1 1/2 x 2 1/2 x 1 1/4 in. A fascinating pocket radio. We can supply all the parts including beautiful 2-tone case and **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS**, screws, caps, etc. Can be built for the exceptionally **LOW PRICE OF 27/6**, plus post and packing 1/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.

27/6



OUR NEW 4 STAGE "MINUETTE"

Build this newly designed "MINUETTE" 4-STAGE transistor set in very strong ready drilled **ULTRA-MODERN CASE**, size only 6 x 3 1/2 x 1 1/2 in. Uses three transistors and diode and **SELF CONTAINED LOUDSPEAKER**. Very sensitive, ideal for office, bedroom, holidays, etc. Months and months of listening off an sd. battery. Can be built **FOR ONLY 39/6**, including **PROPER CASE**, miniature speaker etc. **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS**, etc. plus post and packing 1/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.

39/6



THE NEW "MONTE-CARLO" RADIO

One of our new, exciting designs, the "MONTE CARLO" is a powerful, all name, miniature table radio with the latest trimmings, gold insert knobs, special remarkable plastic rubber, etc. The amazing circuit covers all medium and long waves with good selectivity (variable tone and output), includes ready drilled and punched chassis, standard set base valves, etc. All the parts can be supplied including **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS**. Everything down to the last nut and bolt **FOR ONLY £5.15.0**, plus post and packing 3/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.

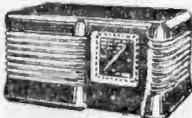
£5.15.0



THE TIME TESTED "OCEAN HOPPER"

Build the long range, powerful rugged now! The "OCEAN HOPPER" is a very well tested all name standard radio design in Ivory bakelite. The price is the lowest possible consistent with high quality. No radio knowledge whatever needed. Can be built by anyone in two hours. The terrific new circuit of the "Ocean Hopper" covers all medium and long waves, has razor edge selectivity and exceptionally good tone. **PARTS TESTED BEFORE DESPATCH**, size 12 x 6 x 3 in. Uses standard octal base valves with low running costs, excellent 18 watts. Can be built **FOR ONLY 98/6**, including everything down to the last nut and bolt and **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS**. Post and packing 3/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.

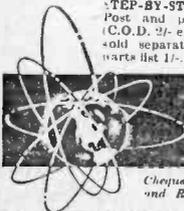
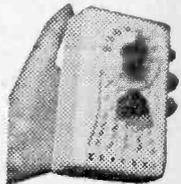
98/6



THE ULTRA-MODERN "GOLD-STAR"

The exciting De Luxe "GOLD STAR" pocket radio in beautiful moulded plastic case is a highly sensitive, self-contained set covering all medium waves. Uses modern miniature button base valve and "Denoc" high efficiency coil. **EXCEPTIONALLY EASY TO BUILD** the case is supplied ready drilled. Size of radio only 4 1/2 x 2 1/2 x 1 1/4 in. We can supply all the parts including case, **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS**, etc. for **ONLY 37/6**, plus post and packing 2/- (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.

37/6



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Cheques accepted. Cash on delivery 2/- extra. Please print name and address in block letters. Send tags to Schools, Universities, Government and Research Establishments. Complete range of components and valves stocked. Record no C.O.D. abroad. **DEMONSTRATIONS DAILY AT WORK**

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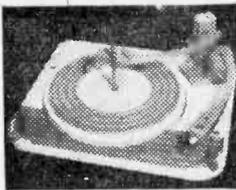
BRAND NEW RECORD CHANGERS

ONLY £8.15.0 BRAND NEW! the latest 4-speed Autochanger, B.S.E. UA14, as illustrated, few only. OUR PRICE £8.15.0. P.P. 3/6.

BRAND NEW! the B.S.E. 4-speed Autochanger, UA8, few only left. OUR PRICE £6.15.0. P. & P. 3/6.

BRAND NEW! the COLLARO Junior 4-speed record player. OUR PRICE 75/-. P. & P. 3/6.

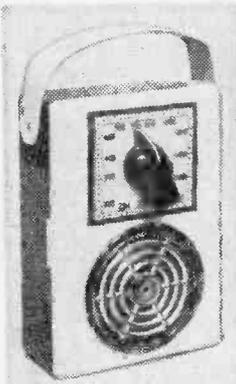
BRAND NEW! COLLARO "Conquest", 4-speed Autochanger. OUR PRICE £7.15.0. P. & P. 3/6.



THE NEW 3-STAGE "RIO"

Our fabulous new 3-STAGE MINIATURE **27/6** LOUDSPEAKER

DESIGN THE "RIO" covers all medium waves including Home, Light, etc. Very reliable and lightweight. Works for months and months off a 4d. battery. Can be assembled in an hour or two. All parts can be supplied including miniature speaker and everything down to the last nut and bolt with SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS for ONLY 27/6, plus post and packing 1/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.



"SKYROMA" VALVE SET

The "SKYROMA" design is an old favourite and is a highly sensitive valve set with provision for adding a further stage. An exceptionally efficient radio using a unique assembly system and can be built by anyone without any radio knowledge whatever in an hour or two. Handsome BLACK CRACKLE STEEL CASE with specially made BLACK AND GOLD DIAL WITH STATIONS PRINTED. Size of radio 6½ x 6 x 3in. Covers all medium and long waves. H.T. consumption only 1-2mA. Ideal for bedroom, garden, holidays, etc. Total building cost down to the last nut and bolt including SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS, ONLY 39/6, plus post and packing 2/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.



THE FAMOUS "CABY" TEST METERS

In moulded case. Prices include Test Prods, Batteries, Instruction Book. FULLY GUARANTEED. Also measure db. Accuracy: A.C., 3 per cent, D.C., 2 per cent.

- A-10 **£4.17.6** plus 2/6 P.P.
 - B-20 **£6.10.0** plus 2/6 P.P.
- C.O.D. 2/- extra.



A.10—2K ohms/v. on A.C. and D.C. volts (10, 50, 250, 500 and 1000 v.); 10K and 1M ohms; 1 mA, 25 mA and 250 mA, D.C. Size: 6½ x 3½ x 1½in. Weight 17 ozs.
 B.20—10K ohms/v. on 0.5 v. and 2.5 v.; 4K ohms/v. on 10, 50, 250, 500 and 1000 v., A.C. and D.C. Resistance, 2K, 200K, 2M and 20M-ohms; D.C. current, 100 microA, 2.5 mA, 25 mA, 250 mA. Size: 6½ x 3½ x 2½in. Weight 24 ozs.

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Whether you plan to have your own business, to become an electronics engineer, to take up a career in industry, or to brush-up your knowledge and study new developments, transistors, etc., an I.C.S. Course will help you to success. You learn at home in your own time, under expert tuition. Moderate fees include all books.

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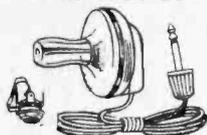
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INTERNATIONAL CORRESPONDENCE SCHOOLS

MINIATURE EARPHONES



For Transistor Circuits: Very light weight 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 9/- Magnetic 9/- Post and Insurance 1/-.

SUB-MINIATURE COMPONENTS FOR TRANSISTOR SETS

- Push-pull o.p.t. and driver 17/6 pair (500 milliwatt), 12/6 pair (300 milliwatt).
- 3 I.F. transformers and oscillator and circuit 23/6.
- Ferrite aerial with coils for medium and long wave and circuit 7/6.
- Smallest possible electrolytics 1/9 each, 1 mfd, 2 mf, 4 mfd, 8 mf, 10 mfd, 20 mfd, 30 mfd, 50 mfd, 100 mfd.
- Smallest 1/2 watt resistors 5d. each all popular values.
- Miniature 0.1 mfd., 1/-, 0.05 2.04 9d., values up to 0.025 6d. each.
- Miniature slide switch 2/-.
- Pots edgewise control 3/6, less switch.
- Transistor holder 1/6 each.
- Set of 6 transistors for superhet in original packets guaranteed Mullard OC44, OC45, OC45, OC71 matched pair OCT2, £3.10.0. the set.
- Set of 6 all first grade includes matched pair 45/-.
- Oscillator and 2 I.F.—new American High Gain 35/-.
- Red Spots 3/6.
- White Spots 3/9.
- Surface barriers 25 mc/s 9/6, 50 mc/s 12/6.
- Diodes 1/-, sub miniature 2/6.
- 3in. Speakers 3 ohm 18/6.
- 3in. Speakers 30 ohm 18/6.
- 2 1/2in. Speakers 3 ohm 19/6.
- Elliptical Speaker, 7" x 4", 3 ohm or 35 ohm 19/6.

1 Watt Transistor A.F. Amplifier

Four transistors on printed circuit all wired up ready for immediate use—excellent performance from pick-up microphone or H.F. input. £4.12.6. post and insurance 1/6.

Crystal Mike by Acos



Model 39/1, this is ideal for tape or general amplifiers, complete with screened lead, 39/6. plus 1/- post.

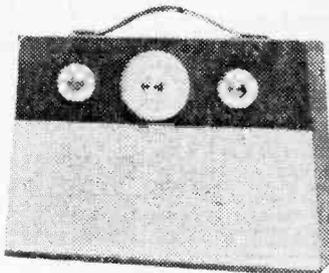
Transistor Set Cabinet



Very modern cream cabinet, size 5 1/2 x 3 x 1 1/2 in. with chrome handle, tuning knob and scale. Price 7/6, plus 1/6 postage and packing.

INTRODUCING THE "REAL COMPANION"

CAR RADIO/PORTABLE



Now available is a modern receiver quite easy to make up and with all the features of sets being sold at twice the price. The circuit has been well tried and proved and will perform well all over the country. Here at Eastbourne, recognised as a bad reception area, performance on the Light, Home and many Continental Stations including Luxemburg, is extremely good. Demonstration Models can be heard at Eastbourne and our London address.

NOTE THESE FEATURES

- ★ 400/500 mw. Output Push-pull.
- ★ 6 First Grade Transistors.
- ★ Latest Type Superhet Circuit.
- ★ Medium and Long Wave.
- ★ Internal Ferrite aerial litz wound.
- ★ High "Q" coils.
- ★ Latest type printed circuit with components plan.
- ★ Slow motion tuning.
- ★ Car aerial attachment.
- ★ Two-tone cabinet.
- ★ High flux elliptical speaker.
- ★ Size 11 x 8 x 3 in. approximately.
- ★ Easy to follow instructions.
- ★ 12 month guarantee all components.
- ★ No technical knowledge required.
- ★ Service available at moderate charges.

ORDER IN CONFIDENCE

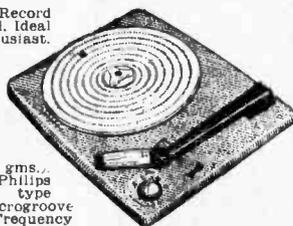
Money returned in full if parcel not up to expectation and returned unopened. Price complete, less battery, £9.19.6. Battery 3/6, plus carriage and insurance 7/6.

POCKET TRANSISTOR SUPERHET

As PRACTICAL WIRELESS, November, now available as complete kit with printed circuits, everything except battery. PRICE £6.19.8.

PHILIPS TRANSCRIPTION UNIT

Phillips AG 200 Record Player, 4 speed, ideal for the enthusiast.



Pick-up arm wired for stereo, fine adjustment on all four speeds. Continuously variable pick-up weight (2.12 gms.). Supplied with Philips Hi-Fi crystal type AG3019 for microgroove and 78 r.p.m. Frequency response 30-15,000 c/s. Pick-up lifting and lowering device. Individually balanced heavy turntable. Muting switch. Can be used with any amplifier or radio set. Complete with monaural pick-up £10.10.0. or 2 gms. deposit and 29 fortnightly payments of 10/-. Available also with stereo head diamond or sapphire stylus. Prices on request.

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.



Stop Freeze ups!

Wrap our heater wire around the pipes in your loft, to prevent freeze-ups. Complete heater wire suitable for up to 50ft. of pipe, 10/- post free. With instructions.

Speaker Bargain



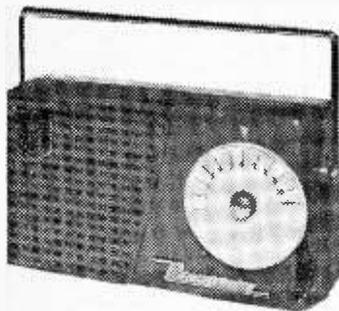
12in. Hi-fidelity loudspeaker. High flux. Permanent magnet type with standard 3 ohm speech coil. Will handle up to 12 watts. Brand new by famous maker. Price 32/6, plus 3/6 post and insurance.

Miniature Microphone

American made. Dynamic type. real bargain at 2/6, plus 6d. postage.



TRANSISTOR LOUDSPEAKER POCKET RADIOS



NOW AVAILABLE WITH FIRST GRADE TRANSISTORS

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 52/6, plus 2/6 post and insurance. Pocket 5 uses 4 transistors and 1 diode and has feedback control, price 67/6, plus 2/6 post and insurance.

RESULTS GUARANTEED

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. Read just a few of the hundreds of testimonials we have received from constructors who have made these sets. Send in confidence. Money refunded if parts or guarantees not up to your expectations. Plans free with parts or separately 1/6. More details S.A.E.

READ THESE TESTIMONIALS!

Mr. Graham, Birchington-on-Sea.
"The Pocket 4. I must say that it is all you say of it. The stations roll in, and good volume too."
Mr. T. Bell, London, S.W.11.
"I have made up one of your 55/- transistorised radios and I am very pleased with the results."
Mr. A. J. Simmonds, Welling, Kent.
"I purchased from you a week ago the Pocket 4 Transistor Kit. I put it together last night in 1 1/2 hours; on switching on the set, I was right on Radio Luxembourg. I must say thank you, because not only has the set a very attractive appearance, it also behaves fantastically."

Mr. N. Elliott, Pontypool.
"I have completed the assembly of your Pocket 4 radio and am pleased to say that it works from the first switching on."
Mr. F. Jackson, Ickenham, Middx.
"I have built the Pocket 4 and am more than pleased with the results."
Mr. G. Bamford, Ramsgate.
"I find this set even better than you claim it to be and most certainly up to your usual standard of quality. I feel that nobody could fail to build it and get results. Even the first-time-ever novice, as our circuit diagrams and instructions are so clear and precise."

ORIGINALS MAY BE SEEN AT THIS OFFICE

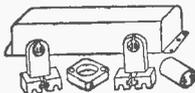
Mr. R. Belt, Newcastle-on-Tyne.
"I have built your Pocket 5 Transistor set I am very pleased with it."
Mr. R. Morse, Birchington-on-Sea.
"I knew nothing whatever about radio but I have just made up your transistor set from the kit of parts you sent. I am happy to say that it works perfectly and does all you claim of it. As you see, I live a good way from London, yet the B.B.C. comes in quite loud. The little set can be heard working in a good-sized room. Quite a number of other stations can be heard at night time with quite good separation. Wonderful value for money."

A.C./D.C. Multimeter Kit

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



Fluorescent Light Bargain



Kit of parts comprising: choke, two lamp holders, starter holder and starter, 40 watt, 19/6, 80 watt, 23/6. Plus 2/- post and insurance.

The Taylor Meter Model 127A



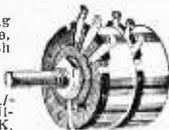
A pocket size meter but with a big scale and a sensitivity of 20,000 Ohms per volt D.C., therefore an ideal unit for television servicing — robustly made and complete with leads and probes—20 ranges as follows:
D.C. current 50 microamps, to 1 Amp.
D.C. voltages—0-1,000 volt in seven ranges (25 KV.) with external probe, optional extra.
Volts A.C.—0-2,500 in six ranges.
Ohms—0-20 meg. Ohm in three ranges (self-controlled). Self-contained, 3 1/2 in. movement. Price £10 or 10/- deposit and 23 fortnightly payments of 10/-. Non-callers add 5/- carriage and insurance.

Yaxley Switches

1 Pole 3 Way	1/8
1 Pole 3 Way	1/8
1 Pole 5 Way	2/-
1 Pole 12 Way	3/-
2 Pole 2 Way	2/6
2 Pole 6 Way	2/6
2 Pole 8 Way	3/6
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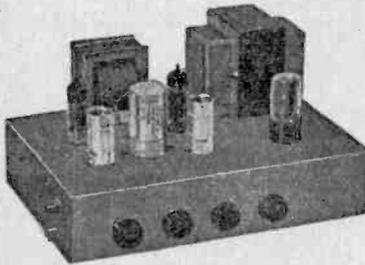
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0-110/120-200/230/250 v. 150 watts 27/9.
MICROPHONE TRANSFORMERS
120:1 high grade, clamped, 8/8; 120:1 Potted. Mu-metal screened, 9/9.

R.S.C. A12 STEREOPHONIC AMPLIFIER KIT

A complete set of parts to construct a Stereo amplifier with an undistorted output total 4 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. Only good quality components and latest high grade valves used. Exceptionally realistic reproduction can be obtained at ample volume for the home, as can be demonstrated in typical surroundings at our County Arcade premises. A really sensational offer.

4 Gns.

STEREO EQUIPMENT OFFER.
Comprising A12 Kit, 2 matched 8in. L/Speakers and Acos 7YO Stereo head with sapphire stylus suitable most pick-ups. Carr. 7/6

PICK-UP ARMS complete with HI-FI turnover crystal head. Acos GP04. Limited number brand new, perfect, at approx. half price. Only 35/8.

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

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

A highly sensitive Push-Pull high output unit with self-contained Pre-amp, Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 db. down. Frequency response—3 db. 30-30,000 c/s. A specially designed sectionally wound ultra linear output transformer is used with most 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, THEATRE, 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. mixed. A.C. Mains and has output for 3 and 15 ohm speakers. Complete kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required cover as for A8 can be supplied for 18/9. The amplifier can be supplied, factory built with 12 months' guarantee, for £13.19.6.

1 Gns.

Carr. 10/-
TERMS: DEPOSIT 31/9 and 9 monthly payments of 31/9.

FULL RANGE OF LINEAR AMPLIFIERS ALWAYS IN STOCK.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5 1/2 x 4 1/2 x 2 1/2 approx. Completely replaces battery supplying 1.4 v. and 2 amp. where A.C. mains 200-250 v. 50 c/s is available. Suitable for all battery portable receivers. Dimensions 1.4 v. unit 90 v. This includes latest low consumption types. Complete kit with diagrams. 39/9, or ready to use, 48/9.

LINEAR L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER. Suitable for use with any record playing unit, and most microphones. Negative feed-back 12 db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 7.5-5 1/2 in. high. Guaranteed for 12 months. Only £5.19.6. Send S.A.E. for illustrated leaflet. Terms. Deposit 22/6 and 5 monthly payments of 22/6.

R.S.C. 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 leads, 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 quality. Hum level is negligible being 71db. down. 15db. of Negative feedback is used. H.T. or 300 v. 25 mA. and L.T. of 6.3 v. 1.5 a, is available for the supply of a Radio Feeder Unit, or Tape-Deck pre-amplifier. For A.C. mains input of 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Chassis 4 1/2 in. high. Kit is complete in every detail and includes 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

Junior 5 watts High Quality output. Separate Bass and Treble 'Cut' and 'Boost' controls. Sensitivity 15 m.v. Twin inputs. High Flux 6in. Loudspeaker 'built-in'. Handsome strongly made Cabinet (size approx. 14 x 14 x 7in.) finished in attractive and durable oilcolor, and fitted carrying handle. H.P. Terms. Deposit £1 and 9 monthly payments of £1.

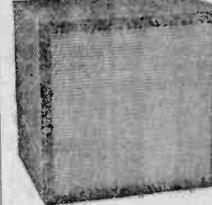
£8.19.6

Senior 10 watts High Fidelity output. Separate Bass and Treble 'Cut' and 'Boost' controls. Twin separately controlled high gain inputs so that two instruments such as Guitar and String Bass can be used at the same time. Two loudspeakers are incorporated, a high Flux 12in. for Bass notes and a 7 x 4 in. elliptical for Treble. Cabinet is well made and finished as Junior model. Size approx. 18 x 18 x 18in. H.P. Terms. Deposit 24/9 and 9 monthly payments of 34/9. Both models for 200-250 v. Carr. 10/- A.C. mains.

15 Gns.

SPECIAL TRANSISTOR OFFER.
TS1 Brimar. Brand new. Perfect. 3 for 10/9

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



Gauss 12,000 lines, Speech coil 3 ohms or 15 ohms. Only 24.19.6 Carr. 5/-
Terms: Deposit 11/3 and 6 monthly payments of 11/3.

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

R.S.C. JUNIOR BASS REFLEX CABINETS. Specially designed for W.F. 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.

SENIOR MODEL for 12in. speakers, £6.19.6. Suitable legs with brass ferrules, 25/- per set of four.

PLESSEY DUAL CONCENTRIC 12in. 15 ohms HIGH FIDELITY SPEAKER (12,000 lines) with built-in tweeter. Completely separate elliptical speaker with choke condensers, etc.) providing extraordinarily realistic reproduction when used with our A8 or similar amplifier. Rates 10 watts. Price only £5.19.6. **H.M. SPEAKERS.** 2-3 ohm 21in. Perdio 21/9. 5in. 17/9. 6in. 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 HF12. 12 watts. High fidelity type. Recommended for use with our A8 Amplifier, £4.10.8. 12in. Plessey 3 ohms 10 watts (12,000 lines). 59/6.

TWEETERS. Plessey 30 10/9, 15p 25/9. **HI-FI CRYSTAL PICK-UP HEADS.** Turnover type with sapphire stylus). Acos. Standard replacement for Garraro and B.S.R. B.S.R. Ful-ii, Garrard GC2. 19/9. B.S.R. Stereo/Monaural 59/11. **G4.4 MINIATURE 2-3 WATT GRAM AMPLIFIER.** For use with any single or auto-change unit. Output for 2-3 ohm speaker. For 200-250 v. 50 c.p.s. A.C. mains. Over-all size 1 1/2 x 2 1/2 x 2 1/2 in. Controls: Vol. and Tone with switch. Guaranteed 12 months. Only 59/6.

SUPERIET FEEDER UNIT. Design of a high quality Radio Tuner Unit (specially fitted) suitable for use with any of our Amplifiers. Delayed A.V.C. employed. The W.Ch. Sw. incorporates Gram position. Controls are Tuning, W.Ch. and Vol. only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size of unit approx. 9-6-7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustration. 2/6. Total building cost £4.15.0. For descriptive leaflet send S.A.E.

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

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

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

H.S.R. LAS 4-SPEED AUTO-CHANGERS with Stereo/Monaural pick-up head, £7.19.6. Carr. 5/-
TERMS: C.W.O. or C.O.D. No C.O.D. under £1. Post 1/9 extra under £2. 2/9 extra under £5. S.A.E. with all enquiries.
Open 9 to 6. Weds. until 1 p.m. Free applied.
Mail Orders to 29-31 Moorfield Road, Leeds 12.
Callers to 5 and 7 County (Mecca) Arcade, Briggate, Leeds 1 and 8-10 Brown Street (Market Street), Manchester 2, or 56 Morley Street (next to Majestic Ballroom), Bradford.

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(Manchester) Ltd.

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AC/P1	2/6	DL71	8/1	EL84	7/6
ACV4	7/1	DL72	7/6	EL85	10/1
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	4/1	DL94	6/1	ESU208	8/1
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AR8	5/1	E1524	6/6	EZ80	6/6
ARDD5	2/1	EA50	1/6	EZ81	6/1
ARP3	3/1	EAC91	4/6	FW4/500	6/6
ARP4	3/6	EB34	1/6	GZ32	9/1
ARP12	2/9	EB91	3/9	H30	5/1
ARP24	3/6	EBC33	5/1	H63	3/6
ARP21	5/6	EBC91	4/6	HL2K	3/1
ARP34	4/6	EC52	3/1	HL23	6/1
ARTH2	7/1	ECC32	4/1	HL3DD	8/1
ATP4	2/9	ECC81	5/6	HL41	4/1
ATP7	5/6	ECC82	6/6	HL41DD	8/1
AU1	5/1	ECC83	7/1	KBC32	5/1
AU4	5/1	ECC84	7/1	KF35	5/1
AV3	4/1	ECC85	7/9	KT2	4/1
AZ	8/1	ECC91	4/1	KT31	8/1
BL63	6/1	ECL80	8/1	KT32	8/1
BT45	4/6	EF22	7/3	KT33C	4/9
BT9B	4/6	EF32	5/1	KT44	6/3
CY31	1/16	EF36	3/6	KT63	6/1
D1	3/1	EF37A	8/1	KT	11/1
D41	3/3	EF39	4/3	KT241	9/1
D42	4/1	EF50	2/6	KTW62	7/6
D77	4/3	EF54	3/3	KTW63	6/1
DA30	12/6	EF55	6/1	L30	4/1
DAF86	8/1	EF70	4/1	MH4	3/6
DAF91	6/1	EF80	5/6	MHL4	3/9
DD41	4/1	EF85	6/10	ML4	4/1
DETS	15/1	EF86	9/1	ML6	6/1
DET19	2/6	EF89	7/9	MPT42	5/3
DET20	2/6	EF91	3/6	MS/PEN	6/1
DF70	9/1	EF92	4/6	N34	8/1
DF72	7/6	EF95	7/6	NR15A	3/1
DF91	3/3	EL32	3/9	NT37	3/1
DF96	8/1	EL33	8/1	(4033A)	10/1

OD3	5/1	TH41	9/1	3E29	6/1	
P5	4/1	TP22	11/1	(829B)	60/1	
P41	4/1	TP25	15/1	3Q5GT	9/1	
P61	2/3	TT11	3/1	3V4	7/3	
PCC84	7/1	U17	5/1	4A1	4/6	
PCC85	8/1	U18	6/6	4D1	2/6	
PCF80	7/1	U27	8/1	5U4G	5/1	
PCF82	8/1	U52	5/1	5Y3GT	6/1	
PCL82	8/6	UL41	7/1	5Z3	8/6	
PEN25	4/6	UL84	7/6	5Z4G	8/1	
PEN46	5/1	UL85	7/1	6A6	5/1	
PEN65	6/6	UU9	5/6	6AB7	4/1	
PEN220A	3/1	V226	5/1	6AC7	3/1	
PENDD/		V248A	4/1	6AG5	3/6	
	1360	9/6	V2D33B	8/1	6AG7	6/1
			PL81	7/6	6AJ7	4/3
			PL82	8/1	6AK5	6/9
			PL83	7/9	6AK6	7/6
			PM24A	3/1	6AK7	8/1
			PM4DX	3/1	VR105/30776	6AM6
			PT25H	7/6	VR150/30713	6AT6
			PX4	19/1	VS110	4/1
			PY81	7/1	VT25	8/1
			PY82	8/1	VU39	6/1
			QP21	6/1	VUI11	3/3
			QP25	5/3	VUI20	3/1
			QP230	7/6	VUI33A	3/1
			QQV06-40	WJ1 4 pin	6E5	5/1
					6E6	7/1
			QS75/20	6/9	W31	7/1
			QS95/10	6/9	Y63	5/1
			QS108/45	6/9	Y66	8/1
					Z31	6/1
			QS150/15	6/9	IA3	6/1
					IA5GT	5/1
			R3	6/9	IC5GT	7/6
			R10	12/6	ID8GT	6/1
			RL21	25/1	IE7GT	7/6
			RL37	3/6	ILD5	3/6
			RK34	2/6	IR5	6/1
			SP2	4/1	IS5	5/9
			SP4B	7/6	IT4	4/1
			SPI3C	4/6	2A3	8/1
			SP21O	4/1	2A5	8/1
			SP41	2/6	2A6	7/1
			SP61	2/1	2034	2/6
			STV280/40	12/1	2D4A	4/1
					2X2	4/1
			SU2150A	4/9	3A4	5/1
			T41	7/1	3B24	3/1

6L6G	6/6	12SR7	6/1	1619	5/1
6L34	4/6	15D2	6/1	1625	6/1
6N7G	5/9	15R	5/1	1626	4/6
6N7GT	6/1	21B6	9/1	1629	4/6
6Q7G	6/1	30	5/1	4120	4/1
6R7G	6/1	35Z	30/1	7193	1/9
6S4	5/1	35Z4	5/1	5475	5/1
6SA7	6/1	35Z4GT	7/1	8010AR	22/6
6SC7G	5/6	39/44	6/1	8013A	25/1
6SC7GT	6/1	53A	3/1	9001	4/6
6S6G	5/1	58	6/1	9001	4/6
6SH	5/1	59	6/1	9003	5/6
6SH7	4/6	71A	4/6	9004	4/1
6S17G	5/9	75	8/1	9006	4/1
6S7G	5/3	77	6/1		
6S7GT	6/6	78	7/1	Cathode	
6S8	6/1	80	6/3	Ray Tubes	
6S9	6/1	82	8/1	3BP1	25/1
6SR7	6/6	8M	12/1	5BP1	35/1
6SS	6/1	84	8/1	5CP1	42/6
6SF5	8/1	85A1	12/1	5F97	45/1
6V6G	5/6	89	6/1	5B7	40/1
6V6GT	6/1	210LF	3/1	12DP7	60/1
6X4	5/1	210VPT	6/1	VCR97	15/1
6X5GT	6/6	7 pin	2/6	VCR138	30/1
6X6G	80/1	217C	17/6	VCR139A	35/1
6Y6	8/1	446A	14/1	VCR258	35/1
7	7/1	705A	17/6	(with scanning coil)	45/1
7A	6/6	715B	97/6	Photo	
7C	3/1	723A/B	8/6	Tubes	
80	8/1	801	6/1	G5T6	12/6
12A6	5/1	803	22/6	931A	50/1
12AH7	7/1	805	30/1	807AMER	Special
12AT7	5/6	807A	7/1	Valves	
12A7G	6/1	807B	7/1	213	3/6
12AX7	7/1	807C	8/1	3A/1481	45/1
12C8	3/1	808	8/1	31/170E	£35
12E1	22/6	813	67/6	30/192E	£37.10
12H6	2/1	815	40/1	30/1	£37.10
12J5GT	3/6	816	30/1	30/1	£37.10
12K8GT	9/1	829A	30/1	723AB	45/1
12SA7	7/6	832	15/1	723AB	50/1
12SC7	4/6	843	7/6	726A	27/6
12SG7	6/6	861	15/1	931A	50/1
12SH7	3/1	866A	12/6	ACT25	40/1
12S17	6/1	827A	35/1	CV691	60/1
12SK7	4/1	930	8/1	KR3	45/1
12SL7	7/1	954	2/1	VX710	15/1
12SN7	8/1	956	2/1	WL417A	15/1

AND MANY OTHERS IN STOCK, INCLUDING CATHODE RAY TUBES AND SPECIAL VALVES. All U.K. Orders below 10/-, P. & P. 1/- over 10/-, 1/6; Orders over £2, P. & P. free. C.O.D. 2/- extra. Overseas Postage extra at cost.

Marconi CR-100 Communication Receiver. 60 kc/s to 30 Mc/s, in very good condition, £25. Carriage 30/-.

T.C.S. Receivers. Made by Collins of U.S.A. In fully guaranteed working condition. 1.5-12 mcs. Line up: 12SA7 (1), 12SQ7 (1), 12A6 (2), 12SK7 (3). Power requirements 12 v. L.T., 225 v. H.T. £11.10.0. Carriage 12/6.

Specially Built Power Pack for the above. 230 v. A.C. mains, including 6X5GT valve, £3.10.0. Carriage 5/-.

Transmitter/Receiver No. 22. 2 mc. to 8 mc. Built almost exactly as No. 19 set but much more economical in battery consumption. Complete in fully working condition with power pack for 12 v., Headgear and Microphone assembly and Key. £9.19.6. Carriage 15/-.

Brand new original spare parts for AR88 Receivers. Please write your requirements.

Low Resistance Headphones, brand new. Balanced Armature DLR, 7/6. P. & P. 1/-.

Telephone Handset. Standard G.P.O. type, new, £1. P. & P. 1/6.

S.C.R. 522 Receivers (BC624) 100-156 Mc/s, including all valves, 25/-, P. & P. 5/-.

H.T. Chokes made by Bendix Radio (U.S.A.), 3 Henrys 0.600A D.C. 25 ohms D.C. resistance 18,000 v. R.M.S. 60 cycle test, £1.12.6. P. & P. 6/-. Ditto 10 Henrys 250 A D.C. 90 ohms resistance 1,500 v. R.M.S. 60 cycle test, 16/6. P. & P. 3/6. Carbon Inset Microphone, G.P.O. Type 276. P. & P. 1/-.

Filament Transformers. Primary 0-190-210-230-250 v. 50 C. Sec. 1 2.5 v. C.T. at 10 amps., 2.25 v. C.T. at 10 amps.; 3 10.5 v. C.T. at 11 amps., 3.000 v. insulation. Price £2.19.0. P. & P. 5/-.

Variometers for W/S No. 19 Fully tested and working, 12/6. P. & P. 2/6. Primary 0-190-210-230-250 v., 50 C. Sec. 1 10 v. C.T. at 4.5 amps.; 2 10 v. C.T. at 4.5 amps., 4,000 v. insulation £1.16.0. P. & P. 5/-. Primary 230 v. 50/60 c. 67 v. amp. Sec. 1 6.3 v. 1.6 amps.; 2 6.3 v. C.T. 3 amps.; 3 6.3 v. C.T. 3 amps.; 4 6.3 v. C.T. 3 amps. £1.12.0. P. & P. 5/-.

Driver Transformers. Primary 500 ohms imp. Sec. to match two 805 in push-pull, £1.7.6. P. & P. 5/-.

Vibrator Unit. 12 v./160 v. 35 mA. Exceedingly well filtered and smoothed, excellent for car radios. New, including 6X5G valve and vibrator, 17/6. P. & P. 5/-.

Complete Set of Strong Aerial Rods (American). Screw-in type MP49. 50. 51. 52. 53, total length 15ft 10in., top diameter 0.615in., bottom diameter 0.185in., together with matched aerial base. MP37 with ceramic insulator, ideal for car or roof insulator, £2.10.0, post free.

Marconi SIGNAL GENERATOR. TF144G. 85 kc/s, 25 Mc/s. Made up to new standard. £70 delivered free.

U.H.F. SIGNAL GENERATOR TYPE T.S.14. 3,200-3,370 mc/s, power measuring range 20-200 mW, R.F. output power -20 to -100 dbm below 1mW. Power supply 115W A.C. Price £15. Carriage 15/-.

VACUUM CONDENSER. 32,000 v., 50pF, 12/6. P. & P. 3/1.

AR 88 D RECEIVER, £50. AR 88 LF, £47.10.0. Fully reconditioned. Completely rebuilt with PVC wiring, 88S.

ROTARY CONVERTOR UNIT. Input 11.5/12.5 v. D.C. Output 200wA L.C. £2. P. & P. 15/-.

MINIATURE RELAYS. Changeover 12-30 v. D.C. supply, 5 amps contacts 5/-, P. & P. 2/1.

PRF-SET DOUBLE POTENTIAL METERS 2 x 3,000 ohms linear 4 w, 5/-, P. & P. 1/6.

COMPLETE V.F.O. UNIT from TX53. Freq. range in 4 switched bands from 1.2-17.5 mc/s. Two V.T. 501s as oscillator and buffer, 807 as driver, two 5J30s as voltage stabilizers. Output sufficient to drive two 813s in parallel. Slow motion drive directly calibrated in mc/s. Provision for crystal control, metering of buffer and driver stage. Power requirements 400 v. and 6.3 v. D.C. Can also be used as low power transmitter. In excellent condition with valves and circuit diagram. £6. P. & P. 15/-.

P. C. RADIO LTD.
170 GOLDHAWK RD., W.12
Shepherds Bush 4946

**BUILD IT YOURSELF!
THE FAMOUS COSSOR**



(Traveller's Friend) Transistorised

£7.19.6 POCKET RECEIVER
P. & P. 2/-
in leatherette case

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

LABGEAR OUTPUT METER

£2.19.6 Complete Kit
P. & P. 2/-

At last a Meter at the right price for the home constructor. An accurate. Audio Power Output Meter. Two ranges 25mW to 1W and 1W to 10W. Accuracy 5% matched for 3, 15, 600 ohms with inst. and tech. data. New 3in. 0-1mA meter.



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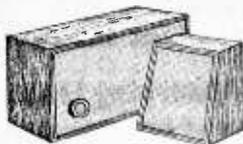
FERGUSON VHF/FM TUNER

This F.M. adaptor is completely self-contained and can be fitted to any A.C. mains radiogram or radio with P.U. sockets. Valves 2-EF80's, ECF80. Input 200-250v. A.C. range 80-98 Mc/s. **£13** Greatly Reduced
P. & P. 2/-
LIST PRICE 18 gns.

YOUR EXISTING RADIOGRAM OR RECORD PLAYER CHANGED TO STEREO BY OUR STEREO ADAPTOR

Tech. Data 2 valves EF80 and EL84. Switch control for Stereo and Mono Dual volume and tone control. Output 3ohms, suitable for use with Acos GC/71, GP/73 and Garrard GC/10. Complete with wiring diagram. **£2.19.6**
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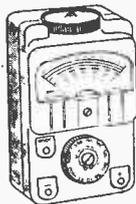
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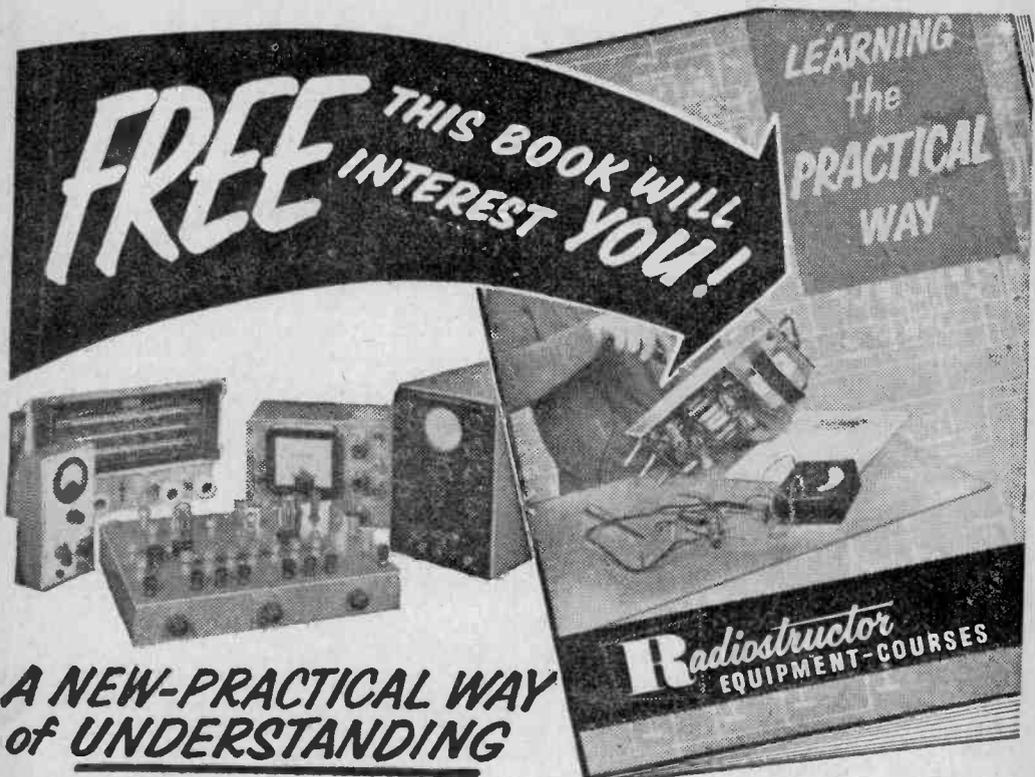
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Practical Wireless

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THE "ROADFARER"

IN every copy of this month's issue will be found a free blueprint for our latest receiver—the "Roadfarer". This receiver is a completely self-contained battery-operated portable with several novel features. In addition to the reception of the medium and long-wave stations this set will also receive the F.M. transmissions on the VHF bands. Further, although completely transistorised, this receiver has its own built-in power section which enables it to be plugged into the mains to reduce the use of the batteries when in the home and so give greater economy. Making use of the printed circuit technique, the design will be found simple to build.

In conjunction with several manufacturers, we are offering prizes for the best constructional work carried out by readers. A panel of judges has been formed from representatives of the firms whose products are used in the receiver, and they will judge the neatness and soundness of the constructional work. Details of this competition are given on page 1090. The Committee's decision on all matters connected with the competition will be final.

1961 Audio Festival

FROM April 6th until April 9th the annual show devoted to audio apparatus will be held. This year it is to be known as the International Audio Festival and it will be held at the Russell Hotel, London. This particular exhibition is devoted to all apparatus in the field of high-quality sound, and includes tape-recording equipment and loudspeakers, in addition to a very wide range of amplifiers and associated equipment. This year there will be over 70 exhibitors, and following previous years' plans a number of small booths will be sited in the main section, whilst upstairs various rooms will be given over to each of the exhibitors where demonstrations will take place, free from interference with one another. There is no charge for admission to this exhibition, admission being by ticket obtainable from your local dealer. The hours of opening will be from 11 a.m. to 9 p.m. and an attendance in the region of 50,000 is expected. It should be noted that the final day of the show is a Sunday which will do much to increase the attendance.

Radio Components Show

THE Radio Components Manufacturers' Exhibition will open in its new guise for the first time at the end of May. As readers will probably remember this has previously been held at Grosvenor House each year, and the amount of space which was available has apparently steadily become less, and in 1959 it was announced that a new venue would have to be found and that for future shows a two-yearly interval would be chosen. On May 30th the exhibition will open at Olympia and will include many items which have not previously found a place in this show, as now electronics is included and thus items found in computers and similar apparatus will be exhibited. The show will be held from May 30th to June 2nd, at Olympia.

Our next issue, dated May, will be published on April 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 December, 1960, in respect of wireless receiving stations situated within the various Postal regions of England, Wales, Scotland and Northern Ireland. The numbers include Licences issued to blind persons without payment.

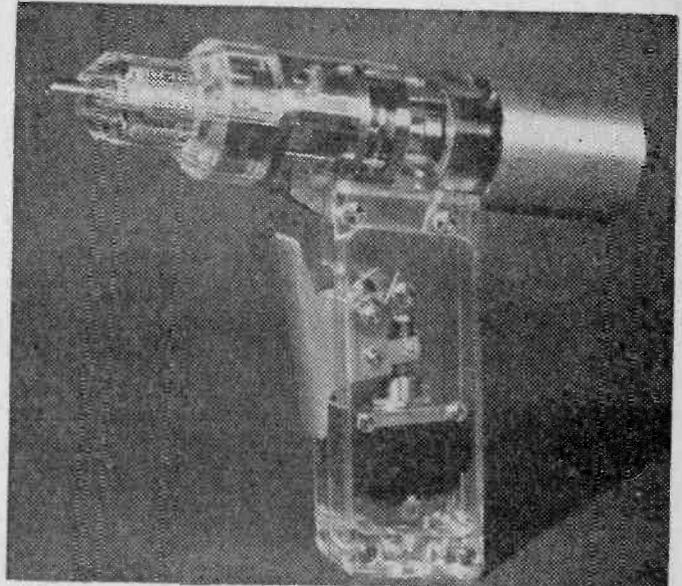
Region	Total
London Postal	726,005
Home Counties	677,093
Midland	495,334
North Eastern	544,805
North Western	471,042
South Western	406,095
Wales and Border Counties	242,728
Total England and Wales	3,563,802
Scotland	400,936
Northern Ireland	122,427
Grand Total	4,087,165

Electronic Engineering Exhibition

THE North East Electronic Engineering Exhibition 1961 was held in the City Baths Hall, Northumberland Road, Newcastle upon Tyne, from Tuesday, February 28th, to Thursday, March 2nd, inclusive.

The Exhibition was opened by the Rt. Hon. Viscount Ridley, C.B.E., D.C.L., D.L., J.P.

The main objects of the Exhibition were to give local industrialists the opportunity of seeing the latest products and of discussing their requirements with experts; to inform the public in general of the important part that electronics is playing in local industry and daily life, as well as of the considerable contribution made by North East firms which manufacture components essential to all forms of electronic apparatus; to show the exceptionally attractive career prospects in electronic engineering—and particularly the various training facilities available at the University and Technical Colleges in the North East; to attract electronic firms to the North East in order that full use can be made of the local training facilities and so that young technicians do not have to seek employment outside this region; and, to educate the student, the potential student and the general public in the North East.



This reset motor assembly, designed by Marconi apprentice John Palmer won for him the Premier Award in the 1961 Physical Society Award.

Stereo Music Festivals

A SERIES of Magnavox Stereo Music Festivals are being held this year on a national basis. The first of 1961 was held on February 1st and the second at Stoke Newington Town Hall, London. A new Magnavox demonstration stereo record—specially pressed in the U.S.A.—will be used for the first time in this country at the festival.

New Appointments

FOLLOWING the regrouping of the Marconi Company's Aeronautical Division in new premises at Basildon, Essex, the following staff changes have been made: Mr. F. Wheeler, formerly sales and contracts manager, has been appointed deputy manager; Mr. G. P. Parker becomes manager. Engineering, Co-ordination; Mr. G. E. Beck, chief engineer (Navigational Aids) and Mr. L. R. Mullin, chief engineer (Airborne Communications). Other new appointments are Mr. J. H. Gill, service manager; Mr. E. Swinney, systems manager; Mr. B. J. Infield, sales manager; Mr C. A. R. Mackley, contracts

manager. The manager of the Aeronautical Division is Dr. B. J. O'Kane.

Radio and Radar for New Tankers

FIVE large new turbine tankers being built for Mobil Tankships Company Ltd. of Bermuda are to be fitted with radio equipment and radar supplied by Associated Electrical Industries Ltd.

The first of them, the 48,500 ton Mobil Enterprise, is due for completion in mid-February this year.

Their radio equipment is being supplied by the Marine Department of A.E.I. Telecommunications Division. The main radio M.F. and H.F. transmitters are new designs by this department and have a carrier power of 600W. The emergency assembly is also of a new design and is capable of W.T. communication on working frequencies in the 405/525kc/s band in the event of mains power failure as well as for the usual distress purposes.

Other equipment being supplied includes a general purpose receiver, direction finding apparatus, two portable lifeboat equipments per ship and a VHF

tranceiver for pilotage use.

A.E.I.'s Electronic Apparatus Division are supplying the latest type of radar, the Escort 601. Mobil Enterprise will also carry an A.E.I. Radio Officer.

Physical Society Awards

FOR the third year in succession the Premier Award in the Physical Society Competition—the Silvanus P. Thompson Prize—has been won by a Marconi apprentice. This year's winner is 21 years old John Palmer. His exhibit, together with those of other Marconi apprentices who won awards in the competition, were on display when the 1961 Physical Society Exhibition opened at the Royal Horticultural Society Hall on Monday, January 16th.

Of the five Marconi entrants to this year's competition all received awards in the various classes.

John Palmer, a technician apprentice, won the Premier Award (for draughtsmanship) for his exhibit of a reset motor assembly. He also won first prize in the Senior Grade of the Scientific Instruments and Components section.

The others were: Tony Raven (21) Certificate of Merit, Senior Grade, Scientific Instruments and Components. D. R. Porter (17) Certificate of Merit, Junior Grade, Scientific Instruments and Components. J. L. De'ath (20) 1st prize, Senior Grade, Electronic Circuitry, and John Cross (18) 2nd prize, Junior Grade, Electronic Circuitry.

Their exhibits were, respectively: an oscillator, a torque connector assembly, a translator unit and a blanking and sync mixer.

The prize winners received their awards at a ceremony in the Royal Horticultural Society's New Hall on Thursday, January 19th. After the Physical Society Exhibition closed on January 20th their exhibits were on show in the Science Museum for about three weeks.

International Congress on Cybernetics

THE third International Congress on Cybernetics, organized by the International Association for Cybernetics, will be held at Namur, Belgium, from 11th until 15th of September, 1961.

The programme for this inter-

national, scientific event will include, principles and methods of cybernetics; semantic machines; automation (technical aspects); automation (economical and social aspects); and cybernetics and life.

The Congress will be opened on September 11th, at 3p.m. General Conferences with discussions will be held in the morning on September 12-14th. The general closing meeting will be held on September 15th in the afternoon.

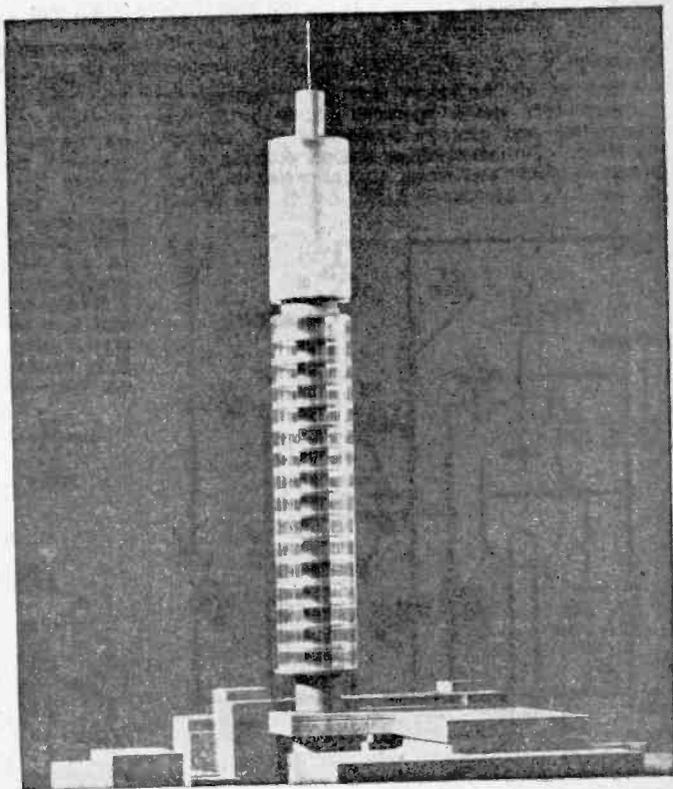
The scientists, the philosophers, and the specialists who want to present a paper to the Congress are now invited to inform the secretary of the Association of their intention. Simultaneously they will give the title of their papers.

507ft Tower for London

FOR some time now the Post Office has been faced with the risk of obstruction to tele-

vision links and public telephone services from the high buildings already built in London.

These services are going to depend more and more on microwave radio links, which require a clear line of sight from point to point, and high buildings on this line can break the link. To overcome the problem the Post Office plans to build a 507ft tower at the Museum exchange in Howland Street, London, W.1, to replace the radio mast on the existing building. At Museum exchange is located the switching centre for the interconnection of outlets from London to the existing national radio and television network in the London area and the BBC and ITA transmitters and from numerous television studios in the London area. It is also the London focal point for microwave radio links over which more and more trunk telephone traffic is being carried instead of by underground cables.



The 507ft mast for Television and radio Telephony which the G.P.O. propose building in Howland Street, London.

A Beginners' Battery Operated TX

MANY newcomers join the ranks of amateur radio enthusiasts each year and it is an unfortunate fact that many do so believing that communication is impossible with anything less than, say, 50W power in the output stage of the transmitter. Other "necessities" include a Variable Frequency Oscillator (VFO), a complicated aerial array and a good communications receiver. It must, of course, be admitted that possession of such equipment does much to increase the number of contacts one can make on the various amateur bands but it is not necessary and one can have much fun, instruction and sense of achievement with more simple equipment costing, literally, a few shillings.

The equipment to be described here was built to prove to two comparative beginners that amateur radio as a hobby was perfectly feasible with very simple gear.

Circuitry

Since many beginners are not particularly familiar with mains operated power units, the transmitter and associated receiver are battery-operated. The transmitter section consists of a power amplifier and Pierce crystal oscillator, input to the P.A. stage being 1.5W, but if two power

amplifier valves are connected in parallel, power can be raised to 2.5W. That this power is sufficient can be shown by the fact that within half an hour of going on the air for the first time with the set, contacts had been made from the east coast with North Wales, South Wales and France, all on 7Mc/s.

The circuit diagram of the transmitter is shown in Fig. 2 and this should require little comment. The output from the power amplifier (P.A.) section is coupled by means of RFC2 and C4 into the π -aerial coupling: C5, L1, C6. This type of aerial coupling has the advantage that an aerial wire of practically any length can be attached to the aerial terminal of the transmitter, thus making the set very versatile so far as the aerial arrangements are concerned. Of course, the best possible aerial should be used since power loss owing to an inefficient aerial cannot be tolerated with such a low input power.

Harmonics

With a suitable crystal plugged-in across anode and grid of the oscillator valve, V1, the output π -circuit (C5, L1, C6) can then be tuned to give an output on the crystal frequency, but, if required, the output circuit may be tuned to the second harmonic of the crystal frequency—the power amplifier stage now operating as a frequency doubler. This is possible since C2/R2 will provide sufficient bias—owing to the drive—to put the amplifier valve(s) into a Class "C" operating condition. This means that with, say, a 3.5Mc/s crystal, output may be obtained on 3.5 and also on 7.0Mc/s. Similarly, with a 7.0Mc/s crystal output is available on 7.0 and 14Mc/s. If it is intended that the transmitter shall be used on two—or more—bands then two or more

different values of inductance will be required in the L1 position. These various values may be obtained by having sufficient inductance for the lowest frequency upon which the transmitter will be used and then when operating on the higher frequency bands, short out—by means of a switch, or flexible link—unwanted portions of the inductance. Handy though either method

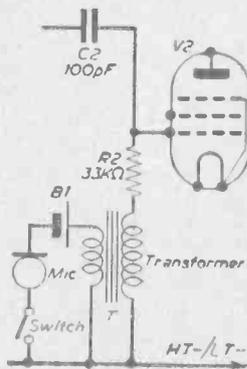
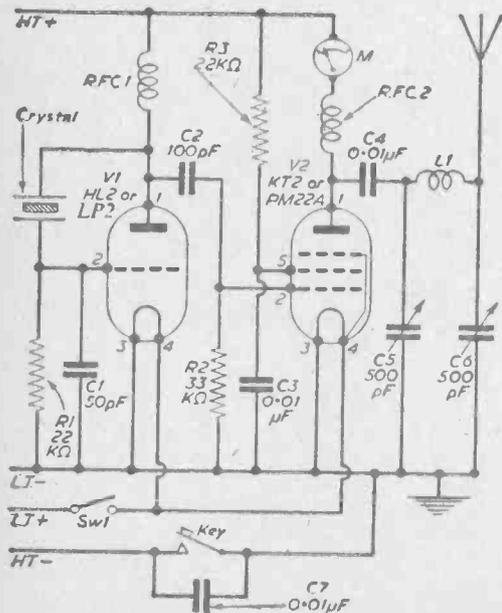


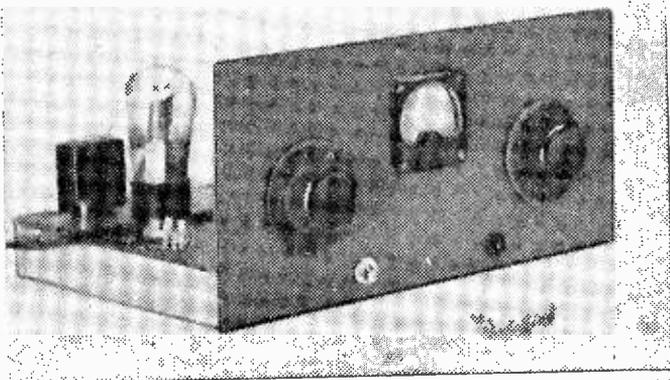
Fig. 1 (above).—The circuit of the modulated output stage.
Fig. 2 (left).—The circuit diagram of the transmitter.

A UNIT DESIGNED TO COVER THE BASIC NEEDS OF THE NEWCOMER TO RADIO CONSTRUCTION

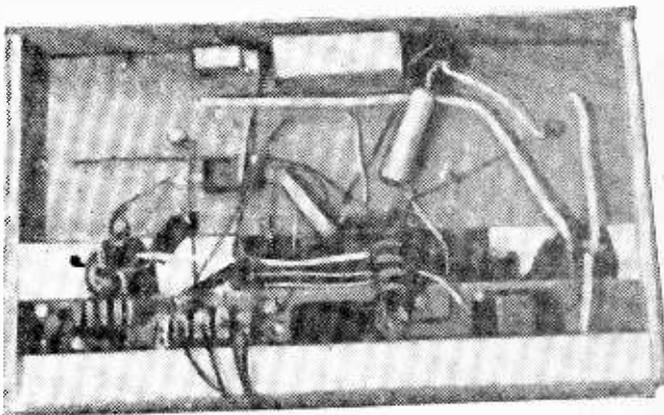
By R. Wright

12in. fastened at each end to $\frac{1}{4}$ in. thick wood cross-strips. A small block of wood screwed to the front chassis supports the chassis in the centre. The two strips are fastened 1-2in. apart and the valve bases located between the strips. This distance apart must, of course, depend upon the type of valve base employed. The method of construction can be seen from the accompanying illustrations. The front panel measures 12in. x 6in. and carries the on-off switch (SW1 in Fig. 2), a jack socket for the key connections, the tuning and coupling capacitor dials (C5 and C6) and the meter.

Almost any 2V filament triode valve, such as type HL2 or LP2, will operate successfully as the Pierce Oscillator, and the Power Amplifier valve should be a 2V filament pentode, KT2 or PM22A, for example. These valves, or their equivalents, can be obtained from many of our advertisers. L.T. can be obtained from a 2V accumulator and H.T. from a 120V H.T. dry battery (or two 60V batteries connected in series). If an "All-dry" transmitter is required the oscillator should be a DL96 type valve, triode connected (screen grid and anode connected together at the valve-holder pins). The power amplifier



This shows the front panel of the transmitter and below is an under-chassis view.



may be, losses will occur and so it is suggested that plug-in coils be used in this position. Here the constructor has the alternative of buying the coils already wound, or winding them himself. If the constructor wishes to construct the coils for himself then six-pin plug-in coil formers Eddystone type 538 are suggested. The six-pin base (type 964) will also be required. Suitable winding details are given below:

- 1.8Mc/s. 46 turns, 20s.w.g., DSC or DCC, close wound;
- 3.5Mc/s. 32 turns, 20s.w.g., DSC or DCC, close wound;
- 7.0Mc/s. 20 turns, 20s.w.g., DSC or DCC, spread over 1 $\frac{1}{2}$ in.;
- 14.0Mc/s. 10 turns, 18 enam., spread over 1in.

Ideally, the transmitter would be constructed on a metal chassis and have a metal front panel and also be housed in an earthed metal cabinet. However, the original was built up on a hardboard chassis with a front panel of the same material. It proved very satisfactory and the absence of a metal cabinet did not cause any interference to the domestic television receiver. For the beginner, such material has the advantage that it is easily worked, compared with aluminium.

Chassis Details

The chassis of the prototype consists of two strips of hardboard, one 4in. x 12in., and the other 2in. x

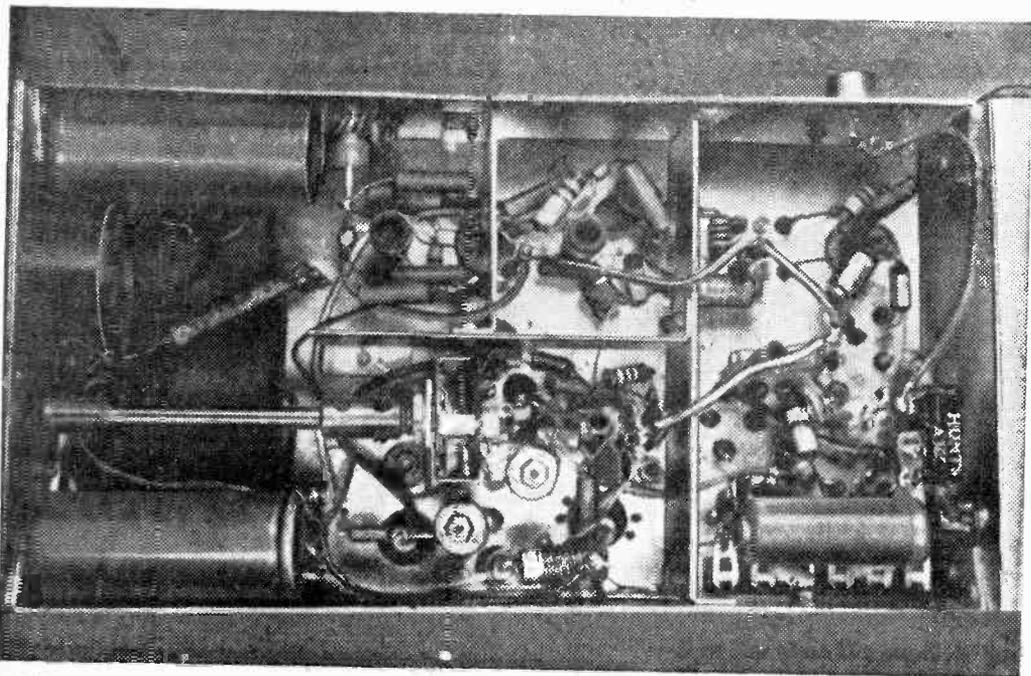
valve(s) should also be of this type, normally connected. L.T. will now be 1.5V and H.T. 90V while the distance between the two hardboard strips forming the chassis will have to be decreased in order to accommodate the B7G valveholders. These valves have been tried and found quite satisfactory though the output power of the transmitter is slightly less than with the 2V types.

For tuning purposes, a meter (M in Fig. 2) should be connected in series with the H.T. supply to the R.F. choke (RFC2). This meter should have a full scale deflection of about 25mA.

(Continued on page 1102)

A VHF TUNER

By
E. H. Berney



An underchassis view.

THIS tuner is suitable for use anywhere in the primary or secondary service areas of the BBC VHF transmissions and with a suitable aerial will also give good results in fringe areas or difficult reception conditions. The oscillator frequency is accurately controlled so that the valves can be operated under high gain conditions at maximum H.T. voltages and the power pack can be accommodated on the same chassis without fear of the consequences of temperature rise. Special attention has been paid to the elimination of interference. Switch tuning is employed so that no dial, drive or tuning indicator is necessary.

The Circuit

The circuit is given in Fig. 1. The valve, V1 is a 6AM6 employed in a conventional R.F. stage and the signal from the aerial is applied to its grid via the coil L1 which is slug tuned to the centre of Band II. The amplified signal appears at the anode and is transferred to the mixer valve, V3, with the aid of C6 and L2. Variable tuning for L2 is no great advantage and as its omission simplifies the switching, the coil is tuned by means of its dust core to the centre of the three transmissions to be received. Note that the anode of V1 is decoupled to its own cathode and also to the cathode of V3.

The Oscillator

The local oscillator, V2A, is one half of a double triode valve, 12AT7. L3 is the oscillator coil and

when the tuning switch is set to receive the highest frequency transmission, the tuning capacitance, apart from the frequency control network, consists of C15 in series with the parallel combination C19, C20. C19 has a negative temperature coefficient (N750K). Additional capacity in the form of the air spaced trimmers C9 and C11 is switched into circuit to receive other transmissions. The oscillator frequency is conveyed to the grid of the mixer valve, V3, by the capacitor C12, which must be a high stability ceramic. The oscillator anode supply voltage requires particular attention as even a slight ripple is liable to be reproduced as modulation hum. Separate additional smoothing is therefore provided by R8 and C8. These components may not always be necessary and they can be omitted in the construction and fitted later if found necessary.

Oscillator Drift

For an hour or more after a VHF receiver is switched on, from cold, the effect of rising temperature in the chassis produces an apparent increase in the capacity of the components in the oscillator circuit. The oscillator frequency therefore falls and if this is not corrected, the I.F. signal will move away from mid-resonance in the I.F. amplifier with consequent non-linearity distortion in the detector stage. In this tuner, the drift is reduced by under-chassis ventilation and roughly balanced by C19. Automatic tuning correction is then applied.

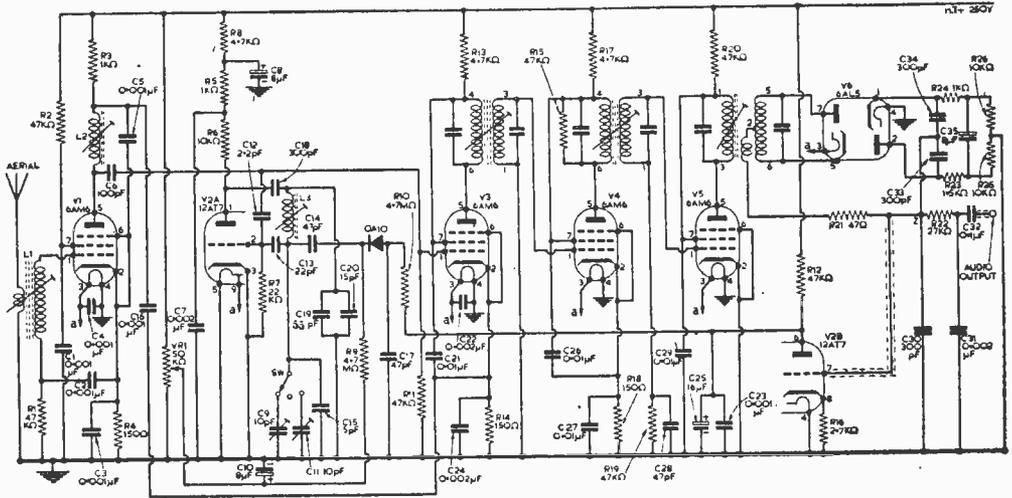


Fig. 1.—The circuit diagram.

Tuning Correction

It will be seen from Fig. 1 that in addition to the tuning capacitances already mentioned, there is connected across L3 a junction diode, OA10. This diode is biased into the non-conducting region and in this condition exhibits a change in the capacitance between its elements as the applied bias is varied. The bias is derived on the one side from a potential divider (VR1) across the H.T. supply and on the other from the anode of V2B. The capacitors, C14 and C17 block off the bias voltages from the oscillator circuit and the resistors R9 and R10 hold the oscillator away from the low impedance of the bias source. As might be expected, this network imposes some resistive damping and tends to reduce the amplitude of oscillation, but so long as a favourable L/C ratio is maintained the effect is negligible with this particular circuit.

Control Voltage

The bias applied to the diode is made to vary according to the state of the tuning by a control voltage derived from the detector stage at point Z in Fig. 1. The voltage here is zero when the receiver is in tune but it swings either side of zero according to the degree and direction of any mistuning which may be present. This voltage is fed to the grid of the D.C. amplifier V2B and, reappearing at the anode in amplified form, varies the bias applied to the diode. Matters are so arranged that if, say, the oscillator frequency rises, the control voltage causes an increase in the capacity of the diode thus reducing the error. It will be understood that as the control voltage is itself a product of tuning error, the tuning can never, in theory, be exact, but in practice the oscillator frequency is controlled very closely indeed and the error is always less than would be likely to be present with manual tuning, aided by a "magic eye" indicator. The anode of V2B is decoupled by the 16µF capacitor, C25 to remove modulation frequencies and by the 1000pF ceramic C23 to eliminate any voltage at oscillator frequency which may be present through the inter-electrode capacitance of the valve. It will be seen that the control line from point Z to the grid

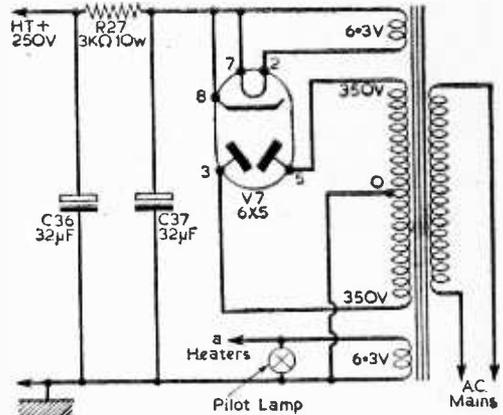


Fig. 2.—Circuit diagram of the power supply.

of V2B carries audio frequencies and it is therefore screened to avoid any possibility of hum pick-up.

Radiation

The second harmonic of the oscillator frequency falls in television Band III. The presence of the R.F. stage before the mixer however, reduces radiation to insignificance and no trouble is likely to be experienced. Some care is necessary though when the tuner is on the bench for preliminary adjustment and it is better to do this out of television viewing hours if possible.

The Mixer

Multiplicative mixers are not very reliable at VHF so a second R.F. pentode, 6AM6, is employed in an additive circuit. Both signal and oscillator frequencies are fed to grid No. 1 and are combined within the valve to produce in the anode circuit the required intermediate frequency of 10.7Mc/s. The conversion conductance of this arrangement is high.

COMPONENTS LIST

Resistors (all $\frac{1}{4}$ W unless otherwise stated)

- | | |
|-------------------------|----------------------------|
| R1 47k | R15 47k |
| R2 47k | R16 2.7k |
| R3 1k | R17 4.7k |
| R4 150Ω | R18 150Ω |
| R5 1k | R19 47k |
| R6 10k | R20 47k ($\frac{1}{2}$ W) |
| R7 22k | R21 47Ω |
| R8 4.7k | R22 27k |
| R9 4.7M | R23 1.5k |
| R10 4.7M | R24 1k |
| R11 47k | R25 10k |
| R12 47k | R26 10k |
| R13 4.7k | R27 3k (10W) |
| R14 150Ω | |
| VR 50k (wire wound, 3W) | |

Capacitors (ceramic unless otherwise stated).

- | | |
|-----------------------------|------------------------|
| C1 0.001μF | C12 2.2pF |
| C2 0.001μF | C13 22pF |
| C3 0.001μF | C14 47pF mica |
| C4 0.001μF | C15 5pF mica |
| C5 0.001μF | C16 0.001μF |
| C6 100pF | C17 47pF mica |
| C7 0.002μF | C18 300pF |
| C8 8μF electro-lytic | C19 5pF N75OK |
| C9 10pF air spaced trimmer | C20 15pF mica |
| C10 8μF electro-lytic | C21 0.01μF |
| C11 10pF air spaced trimmer | C22 0.002μF |
| | C23 0.001μF |
| | C24 0.002μF |
| | C25 16μF electro-lytic |

COMPONENTS LIST (cont.)

- | | |
|-------------|----------------------------------|
| C26 0.01μF | C34 300pF |
| C27 0.01μF | C35 8μF electro-lytic wire ended |
| C28 47pF | C36 32μF electro-lytic |
| C29 0.01μF | C37 32μF electro-lytic |
| C30 300pF | |
| C31 0.002μF | |
| C32 0.1μF | |
| C33 300pF | |

Valves

- V1, V3, V4, V5—6AM6, B7G base and screen.
 V2—12AT7, B9A base and screen.
 V6—6AL5, B7G base.
 V7—6X5, octal base.
 OA 10 Junction diode.

Transformers

I.F. and detector transformers—10.7Mc/s.
 Mains—350-0-350V, 50mA, 6.3V, 2A, 6.3V, 1A.

Coils

See text for winding instructions.

Tuning switch

Any 3-way component of suitable size
 Length of $\frac{1}{2}$ in. brass rod for extension spindle.

The I.F. Amplifier

The I.F. amplifier has two stages, employing two more 6AM6 valves. The first is quite conventional and requires no comment except to say that the capacitor C27 in the cathode circuit must be completely non-inductive. Most ceramics are suitable

(Continued on page 1122)

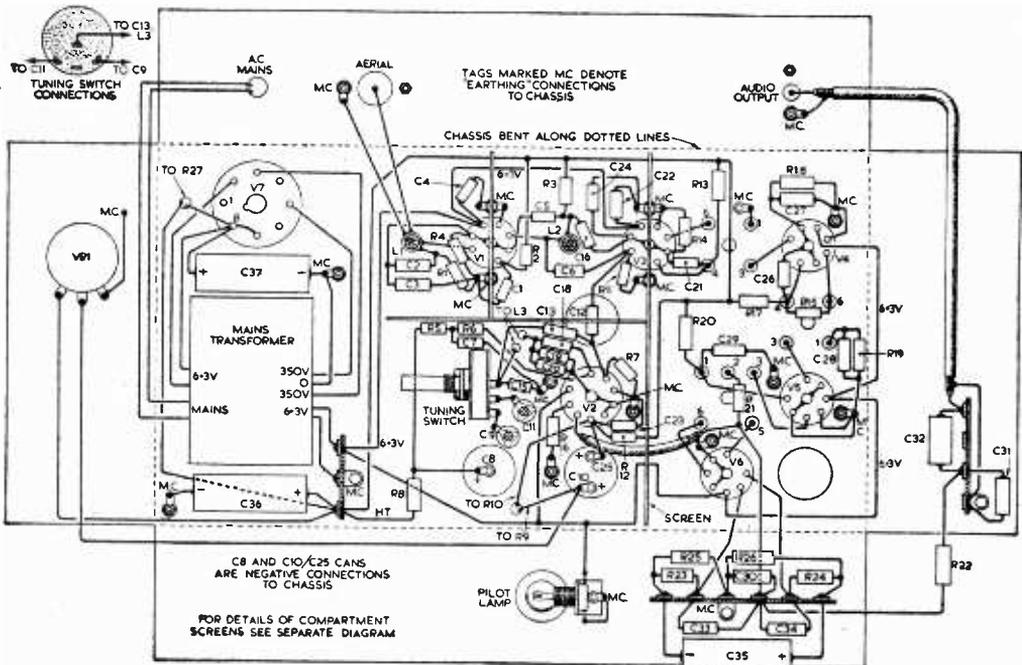
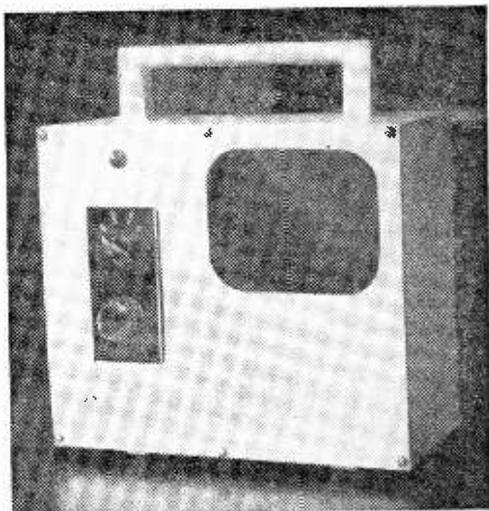


Fig. 3.—Underchassis component layout and wiring diagram.

A SWITCH TUNED TRF RECEIVER

A PORTABLE UNIT DESIGNED PRIMARILY FOR USE IN THE HOME

By J. Harrison



JHIS receiver was designed to meet a need for a portable receiver which could be used in any part of the house. In view of its limited application, the cost of constructing it had to be comparable with that of wiring every room of the house with an outlet for an extension speaker powered by the main receiver. However, it was considered that no major loss of quality could be tolerated; and, more important, that safety in use must meet modern standards.

The Circuit

The receiver was to be used in an area of high

field strength for both the medium-wave Home and Light programmes of the BBC and so, with the economic considerations in mind, a TRF circuit with switched tuning was chosen.

The switching was designed to provide reception of three medium-wave transmissions with a fourth position providing "Mains off". This arrangement was adopted instead of the more usual one

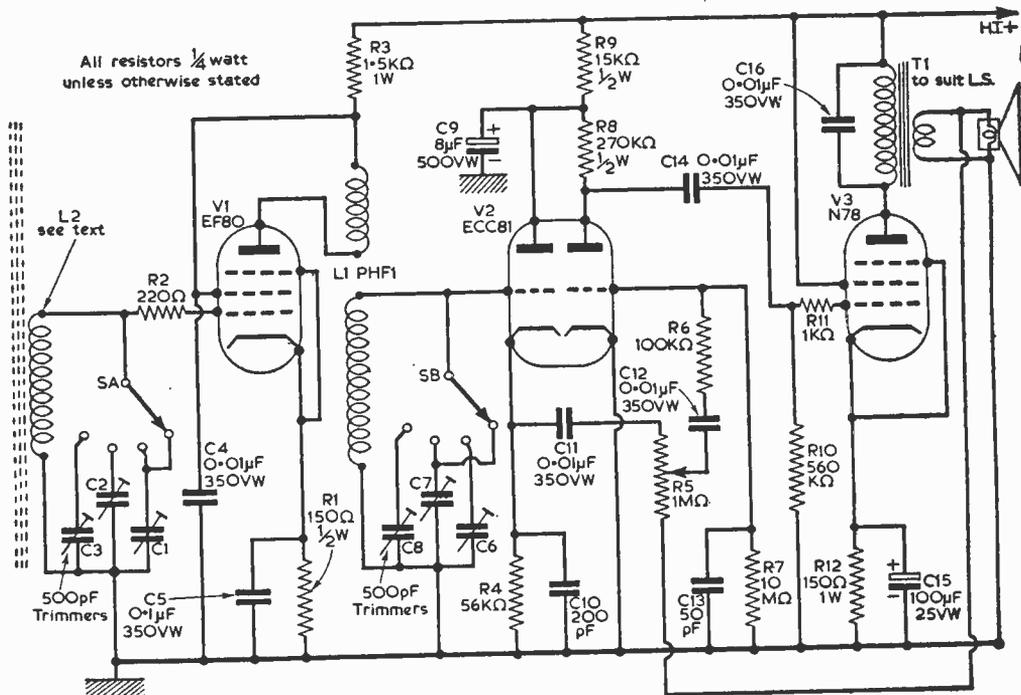


Fig. 1.—The circuit of the receiver: all the switches are shown in their "off" positions.

of incorporating the mains switch in the gain control in order to reduce wear on this component.

The receiver has four stages, an EF80 as an R.F. amplifier, an ECC81 double triode as an infinite impedance detector and A.F. amplifier and an N78 in the output stage.

The R.F. amplifier is quite conventional, the function of R2 being to prevent oscillation caused by capacitive feedback.

The detector, V2a, has its anode voltage held substantially constant by the electrolytic capacitor C9. The charge on C10, and thereby the cathode potential, rises on each positive half-cycle of the grid R.F. potential until the peak grid potential and the cathode potential are almost equal. Thus, the cathode potential follows the peak value of the grid potential with a high degree of fidelity and thereby reproduces the audio-frequency modulation. The advantage of this type of detector is that it draws very little current from the resonant circuit and thus imposes little damping upon it. This results in the selectivity of the circuit remaining high; much higher, in fact, than can be achieved with leaky-grid detectors.

The A.F. amplifier, V2b, is unconventional in that its grid bias is provided by grid current flowing in the 10M grid resistor R7. This eliminates the need for the usual bulky and unreliable cathode bias circuit.

The components C10 and C13 serve to reduce the high frequency response slightly to suppress interference in the form of a whistle of 9kc/s frequency, caused by adjacent stations. Capacitors C11 and C12 reduce the bass response of the amplifier to prevent distortion in the small loud-speaker.

The power amplifier has no special features; however, to improve the fidelity of its output, negative feedback is applied over the whole A.F. amplifier by applying the whole of the output voltage to the earthy end of the gain control. The use of this method results in the amount of feedback being affected by the setting of the control; low settings produce the maximum amount of feedback.

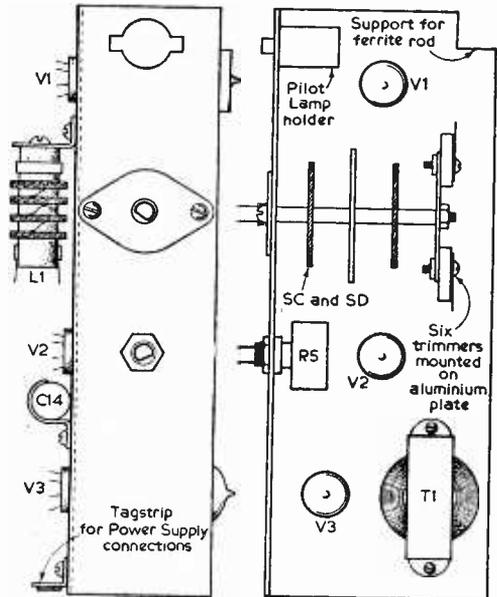
In order to keep the weight and cost of the receiver down, a transformerless H.T. supply was chosen, using a small metal rectifier. This leads to the special hazards associated with the live chassis in this arrangement and double pole mains switching was adopted. A small transformer giving a 6V supply for the valve heaters and pilot lamp is used since this dissipates much less heat than a high-wattage resistor and can now be purchased almost as cheaply.

Construction

Several versions of this receiver were constructed, some of them incorporating second-hand components from discarded apparatus. For this reason, no attempt has been made to formulate a set of instructions in the following account. The matter of detailed arrangement is left to the judgement of any reader who wishes to construct a similar receiver.

At the risk of somewhat wearisome repetition, however, it must be pointed out that the safety precautions described are the minimum required to comply with modern standards.

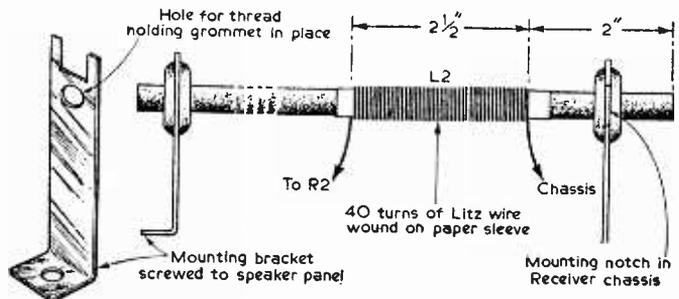
The receiver and power supplies were constructed on separate chassis in order to make the best use of the space in the case. The receiver chassis is a piece of 18s.w.g. aluminium sheet, bent



Major components only are shown

Fig. 2.—(above) A suggested layout of the major component of the receiver.

Fig. 3 (below)—The aerial winding and mounting details.



through 90deg. The major components are arranged as shown in Fig. 2 and the illustrations. Since a receiver of this type is liable to some rough usage, it was necessary to support all except the smallest components by the use of clips. Similarly, in order to reduce tuning drift, owing to variation in stray capacities, wiring was carried out with well-insulated wire of fairly heavy gauge. For this purpose, all conductors associated with

resonant circuits were of 18s.w.g. tinned copper and all others of 22s.w.g.

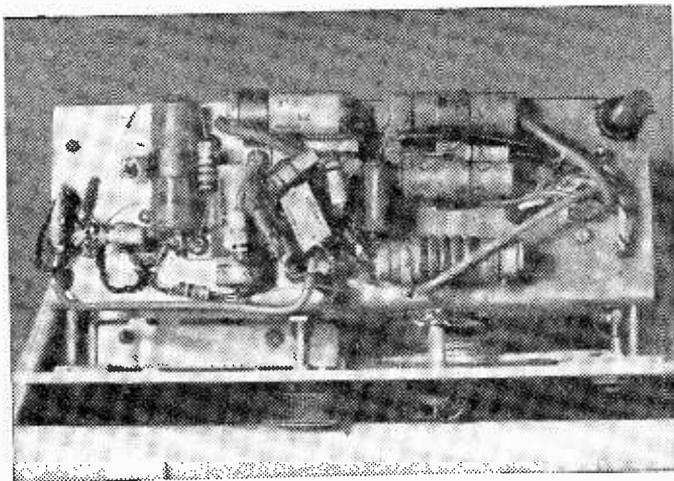
The switch used in the receiver constructed was made up from two 2-pole, 4-way wafers mounted on a standard 4-way mechanism. A heavy aluminium plate was placed between the wafers to act as a screen and a second behind SA and SB to carry the tuning trimmers.

No special precautions were needed in the wiring of the receiver except for the provision of tag-strips to carry otherwise unsupported junctions such as that between C12 and R6. Connections were kept as short as possible for the reasons mentioned earlier.

The receiver was mounted with the controls one

primary of T1, since the feedback was in the wrong sense and caused oscillation.

The power-supply chassis consists of an inverted aluminium tray with the components mounted beneath it. This arrangement was adopted in order to prevent the stream of warm air from T2 and the rectifier from impinging directly on the speaker above. This would cause the precipitation of dust on the cone which can cause trouble after long periods of operation. The layout of the components in the power supply is not critical, the only point needing consideration being that smoothing capacitors have their longest life when mounted in a vertical position with the connecting tags at the bottom.



A view of the tuning panel and its associated components.

above the other, the output valve, which dissipates the most heat, then being at the bottom.

The ten-inch ferrite rod aerial is mounted in two rubber grommets, supported at one end by an aluminium bracket attached to the speaker cut-out; and at the other in a notch cut in the receiver chassis. The grommets were secured by a binding of thread. This method of mounting must be used with this circuit, since if the ferrite rod were allowed to protrude through holes in the aluminium, the metal around the holes would act as shorted turns, coupled to the resonant circuit, and drastically reduce the selectivity of the aerial.

The aerial coil, L2, consists, as shown, of 40 turns of fine Litz wire wound on a paper sleeve over a length of 2½ in. The winding was started 2 in. from one end of the rod and covered with a binding of P.V.C. tape after completion. The small quantity of Litz wire required for this purpose was obtained from a pre-war I.F. transformer, although 36s.w.g. enamelled copper could have been used with a slight loss of sensitivity. The wire used for the winding was not used for the connecting leads, since its flexibility might have resulted in tuning variations. Instead, it was soldered to stiff copper conductors and the joints bound under the P.V.C. tape.

After assembly and testing the receiver it was found necessary to reverse the connections to the

The Front Panel

Since the chassis of the receiver is liable, at times, to rise to mains potential, special attention was given to its insulation. The two chassis and the speaker are mounted on a paxolin panel ¼ in. thick. The use of plywood for the panel was considered unsuitable because its insulating properties are rather unreliable in damp surroundings.

The method of mounting is shown in Fig. 4, this being designed to eliminate the need for filler which might fall out of screw holes. Thus the strips of paxolin carrying the screws are given the comparatively large surface area of 5 sq. in. total for the receiver chassis and 10 sq. in. total for the more compact power supply.

The speaker is mounted on a piece of plywood, ¼ in. thick,

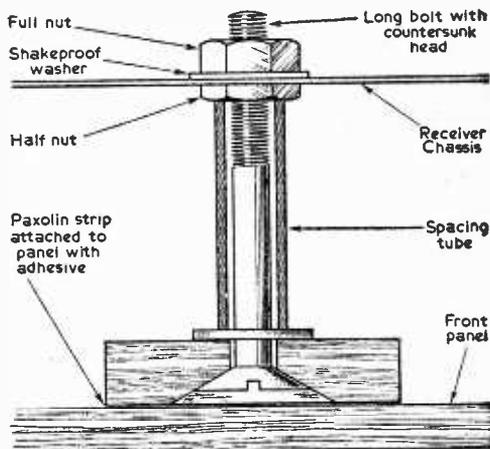


Fig. 4.—The method of mounting the chassis to the panel.

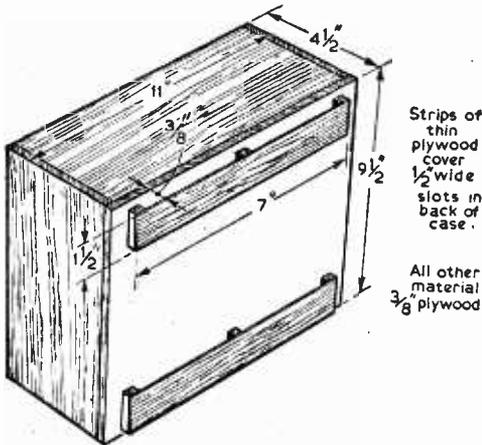
with a large circular hole cut through it with a fretsaw. The entire front surface of this plywood is covered with black cloth to show in the speaker opening in the front panel. Those parts of the cloth which are obscured by the panel

are well impregnated with adhesive, great care being taken to ensure that it will bond equally well to the plywood and the front panel. The plywood cut-out is then pressed into position and clamped there while the adhesive hardens. Before the two chassis and speaker are mounted, the panel is finished with gloss enamel. Finally, the speaker is screwed to its plywood mount with 1/4 in. brass woodscrews.

The Case

The case was designed to fulfil three functions: to provide adequate ventilation, complete mechanical and electrical protection and some loading for the 5in. speaker to improve its bass response. Of these the provision of protection against shock is considered of paramount importance. For this reason, a perforated back was considered unacceptable.

The design finally chosen is shown in Fig. 5. Plywood, 3/8 in. thick, is used to provide the necessary mechanical strength. Slots, 1/2 in. wide and



Strips of thin plywood cover 1/2 wide slots in back of case.
All other material 3/8 plywood

Fig. 5.—A rear view of the case.

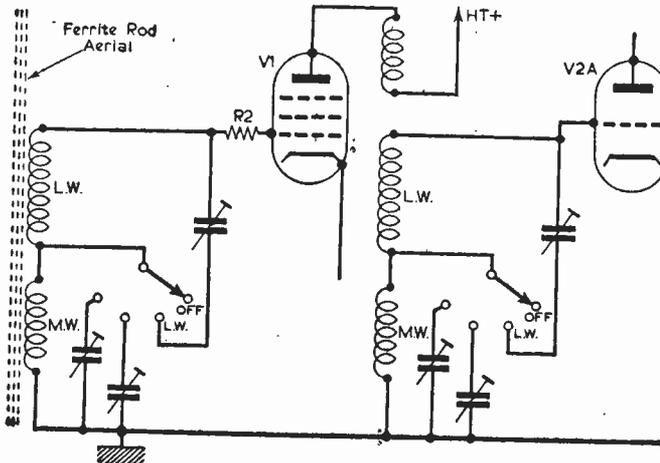


Fig. 6.—A possible modification for receiving one L.W. station.

COMPONENTS LIST

Resistors

- R1—150Ω 1/2W
- R2—220Ω
- R3—1.5k 1W
- R4—56k
- R5—1M linear pot
- R6—100k
- R7—10M
- R8—270k 1/2W
- R9—15k 1/2W
- R10—560k
- R11—1k
- R12—150Ω 1W

Resistors are rated at 1/2 Watt unless otherwise stated

Capacitors

- C1, 2, 3, 6, 7, 8 are 500pF compression trimmers
- C4—0.01μF 350VW
- C5—0.1μF 350VW
- C9—8μF 500VW
- C10—200pF
- C11—0.01μF 350VW
- C12—0.01μF 350VW
- C13—50pF
- C14—0.01μF 350VW
- C15—100μF 25VW
- C16—0.01μF 350VW

- V1—EF80 on B9A base with screening can
- V2—ECC81 on B9A base with retaining clip
- V3—N78 on B7G base with retaining clip

- L1—Wearite PHF1, or similar
- L2—See text

Power Unit

- C17 } 32 x 32μF
- C18 } 350VW

- L3—Small, iron-cored smoothing choke, 60mA
- T1—Small pentode output transformer, to match speaker
- T2—Small 6V heater transformer, rated at 2A
- Half-wave metal rectifier rated at 60mA
- Pilot bulb, 6V, 0.04A in Bulgin holder, type MES 103
- Speaker—5in. moving coil unit

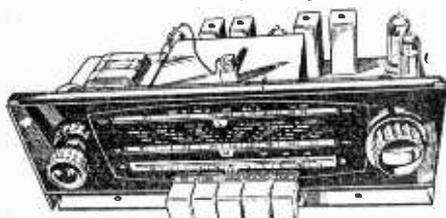
about 7in. long, are cut near the top and bottom of the back panel. These are covered by strips of thinner ply mounted on spacers in such a way that nothing could be pushed into the interior of the case. This arrangement was found to be fairly satisfactory from an acoustic standpoint because whilst the slots provided the necessary pressure outlet for the speaker back, the outer strips provide some of the damping necessary to prevent bass resonance.

The entire assembly is joined with panel pins and an adhesive and then dried thoroughly in the oven to assist the curing of the adhesive and to reduce the water content of the plywood. It is then fitted with a handle and feet to ensure that it will stand firmly. Finally, it is primed inside and out with a solution of shellac in methylated spirit to render it waterproof and finished with high-gloss enamel.

The front panel is secured in the case by six chromium-plated woodscrews, 1in. long, which are inserted in holes drilled in the edge of the plywood. This procedure, whilst not in the best traditions of wood-working, eliminates the need for the blocks in the corners of the case, which would otherwise have to be used, and which would waste a considerable amount of space.

(To be continued)

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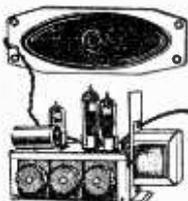
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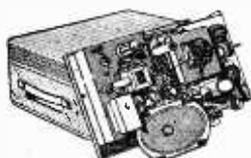
B-20—10K ohms/v. on 0.5 v. and 2.5 v.; 4K ohms/v. on 10, 50, 250, 500 and 1000 v. A.C. and D.C. Resistance. 2K, 200K., 2 M and 20M ohms.; D.C. current, 100 microA, 2.5 mA, 25 mA, 250 mA. Size: 5 1/2 x 3 1/2 x 2 1/2 in. Weight, 24 oz.



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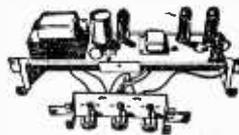
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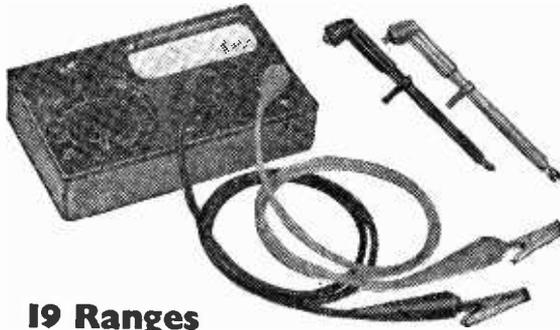
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| 0—1000 V. | |
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- | | | | |
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A Versatile TAPE RECORDER

BUILDING THE POWER PACK, AND COMMENCING TESTING

By D. L. Woolley

(Continued from page 1021 of the March issue)

FINALLY, the earth bus-bar, made of thick (16s.w.g. or thicker) tinned-copper wire is connected as shown in Fig. 15. It should touch the chassis at one point only, i.e. a solder-tag fixed to the mounting bolt of socket B. All under-chassis wiring has now been completed and is checked, before turning the chassis over and mounting the output transformer and panel components. The neon lamp may now be mounted if it does not have its own leads for reasons given previously. The output-transformer wiring is shown in Fig. 14: R12 can be mounted across two spare tags on the output-transformer.

If the record level indicator is added to the panel, a single-pole single-throw switch is put in one lead to switch the meter off when it is not required. The leads to the meter are connected to the output transformer secondary; all small meter components are mounted on a tag-board, which is fixed to the top of the chassis.

The component values for different full-scale deflections are approximately—

- 500 μ A—R29=R30=4.7k.
- 1mA—R29=R30=2.2k.
- 2mA—R29=R30=1k.
- 5mA—R29=R30=470 Ω .

Trial and error will show the correct meter deflection for a satisfactory recording: If too low

a deflection results, reduce R30 in value until the meter reads about half f.s.d. at the correct level.

The Power Pack

The power pack still remains to be built. This is constructed on an aluminium chassis to the dimensions given in Fig. 16. It is easily built; direct connections being made. The leads from the mains transformer are connected to two 5-way tag-strips, mounted on the chassis using the transformer fixing bolts. The mains input panel is shown in Fig. 18 The panel is cut from 16s.w.g.

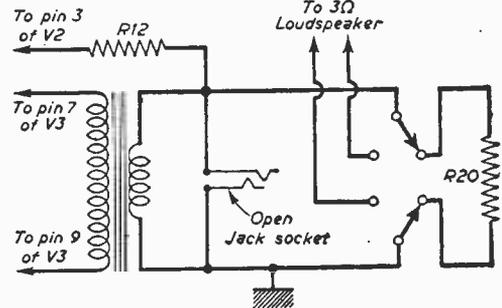


Fig. 14.—The circuitry of the output transformer and its associated components.

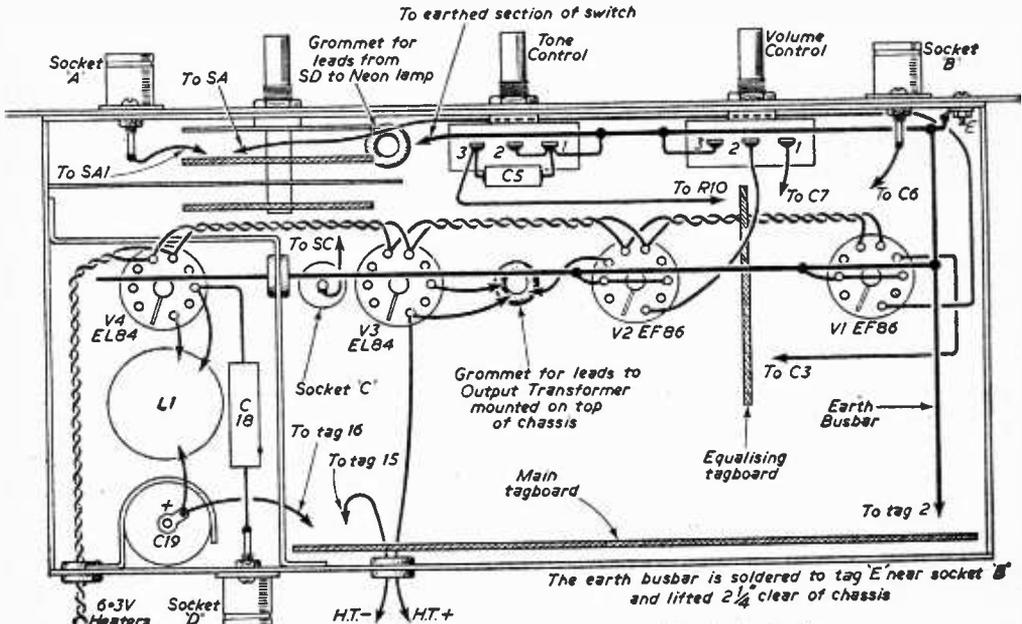
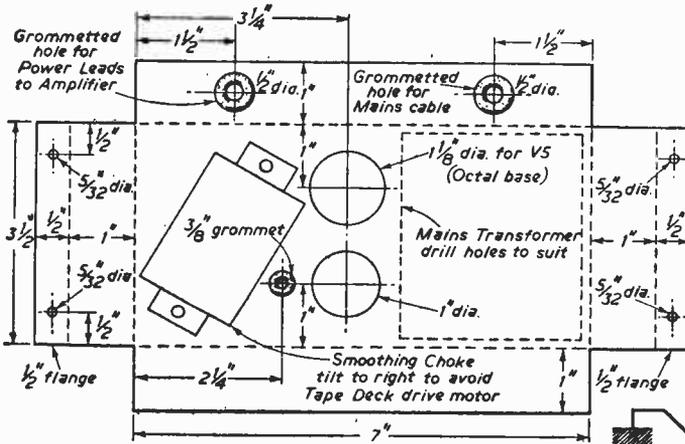


Fig. 15.—The wiring diagram of the underside of the main chassis.



aluminium. It is wired so that as long as the mains supply is connected, the neon lamp is illuminated. this was found to be the best position as the recorder was often used in buildings which had switched sockets and the neon thus showed whether they were switched on or not, even before the recorder was itself switched on.

Testing the Recorder

The recorder although not complete may be tested at this point. After checking once more for faults, connect the power-supply to the amplifier temporarily, insert the valves, connect a 3Ω loud-speaker and switch on. If, after warming up, there

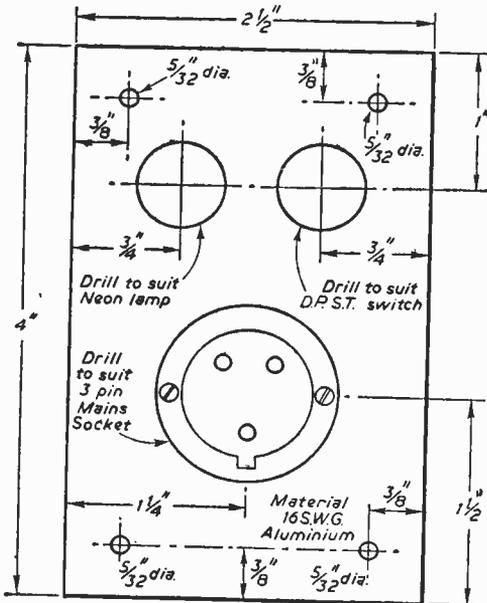
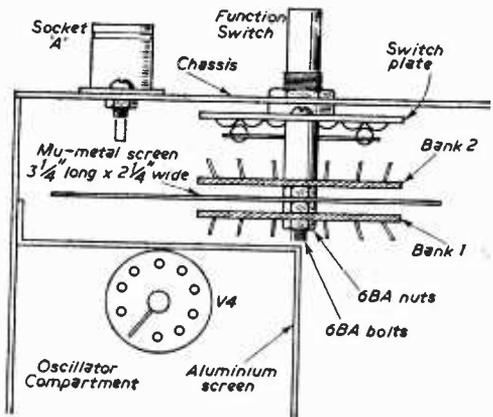
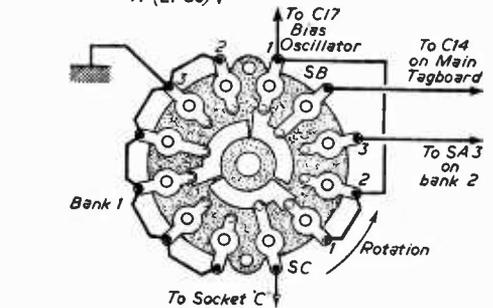
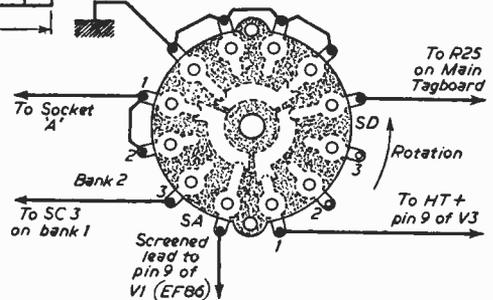


Fig. 18 (Above).—The drilling dimensions for the mains input panel.

Fig. 19 (Right).—Details for mounting and positioning the function switch.



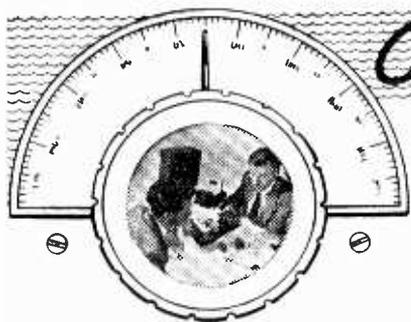
is a violent howling noise, switch off immediately and reverse the connections to either the output transformer primary, or secondary, but not both.

If the low-gain socket B is touched there should be a loud hum from the speaker. A microphone (crystal or similar high impedance type) plugged in socket A should be tried.

(continued on page 1126)

Fig. 16 (Left).—Constructional details of the power pack chassis.

Fig. 17 (Below).—Some more details of the function switch referred to on page 988 of last month's issue.



On Your Wavelength

BY THERMION

Solder Problems

An acquaintance of mine, who spends his entire working time servicing radio and television receivers, visited me the other day and complained bitterly about the increasing use of transistors. He saw one or two miniature pocket transistor sets which I was playing about with and remarked that the man who invented the transistor was Public Enemy No. 1. He appeared to feel so bitter about this that I went further into the question.

It appears he finds that servicing and fault-finding in the modern transistor set built on a printed circuit board is at least ten times more difficult than with the older type of set. I told him that this was not my experience and I know from letters which the Editor has received that a very large proportion of our readers also prefer the new techniques. It does, however, raise an interesting problem and I should like to hear from any other reader who agrees with my friend. It could, of course, be that his experience was exceptional, or that the particular receivers which he had dealt with were of special design. I have constructed several transistor sets over the past few months, some of them amateur designs, some from details published in these pages, and three or four commercial kit sets. In many cases these have been very easy to build, one especially having special resistors provided with flat strip ends which fitted into the holes in the printed circuit board and the edges of the strip cut into the sides of the holes so that the resistor remained in place without soldering. It was thus possible to insert all the resistors from one side, then turn the board over and solder all points at one fell swoop. Another point about this particular home-constructor kit was that the stepped ends of the strips on the resistors held them slightly above the board so that when the set was finished it was still possible to see the R number. In some of the circuits which I have seen, even commercial models, the R and C numbers have been obscured by the component, and probably this is one of the main difficulties which beset the serviceman. Where the apparatus is very compact, using a small board crowded with parts, I can well understand the difficulty of access, as well as reading a value if the wire ends have been bent so that the colour coding spots are underneath the body of the resistor. It is as well, if you are making up a set to bear this point in mind, and when you bend the wire ends of either resistors or condensers, bend them away from the markings or values so that when soldered into place you can still read the value.

While on the subject of connecting these parts into a set I should like to mention that a reader recently wrote to say that when he built a set on a printed circuit panel he had gone to the trouble, before starting construction, of soldering the entire surface round every hole which was marked. I do not recommend this procedure. Firstly, it is not necessary, as, provided the surface is clean, the solder will run better and will run round the wire and the edges of the hole if the iron is applied at the right temperature and if the right cored solder is used. Secondly, the double application of a soldering iron may result in the metal coating lifting from the board and this can be a real trouble as it may fracture and lead to a fault which is very hard to find. I know that some printed circuit boards are supplied with a surface flux already painted on and no previous treatment is necessary. Others are best prepared by lightly cleaning the surface by wiping with a rag dipped in warm water and a small quantity of detergent and then drying thoroughly. This should only be done immediately prior to actually working on the board, as when thoroughly cleaned in this manner the surface takes the dirt from the atmosphere very much more quickly, and your cleaning process may have removed any protective coating which had been provided. Use a very thin cored solder and remember to apply the iron and the solder together to the wire and use a bit with the tip cleaned all round and of a shape which will enable you to touch both the wire and the printed circuit. The moment you see the solder run, remove the iron and the solder and nothing but a neat round blob of solder should remain.

Working to a "Thou"

Most of my readers are aware that engineers and mechanics now work to a thousandth of an inch almost every day of their life and that this measurement which was at one time regarded as very fine engineering is now more or less a common factor. I recently went over a factory to see some of the modern developments in electronics which are taking place and was most impressed with some of the tolerances which were being used. The "thou" seems to have taken a back seat in this factory, but the surprise came later when I was seeing some apparatus used in a modern satellite installation. I was shaken by the remark that the work was being tested to one thousand-millionth of a second! I must confess that this left me rather cold and I tried to form a mental picture of such a time interval. It is bad enough trying to picture "endless space", but I feel that one thousand-millionth of a second is the end. But no doubt as time marches on even this figure will begin to take a back seat, just as the measurement above has done, and perhaps a time will come when negative measurements of time will be used!

A Portable Transceiver for 70Mc/s

A SIMPLE-TO-CONSTRUCT 3-VALVE INSTRUMENT

By O. Diplock

EXPERIMENTS that have been carried out involving small portable rigs working at VHF, make the author feel confident that the apparatus to be described, gives a good introduction to the VHF portable aspect of amateur radio. Compared with the size of the "38", "18", "68" and B.C.611 sets, the 70Mc/s transceiver is smaller, and performs equally well, if not better. No difficulty should be experienced in construction provided the instructions are followed carefully.

Circuit Details

As can be seen from the circuit diagram the basis of this rig is the well known super-regenerative detector, and by the throw of a single switch (SW1), it is converted into a self-excited oscillator. The 3V4 valve was chosen to fill this position, although almost any small battery output pentode or tetrode could be used. The first A.F. stage is a high gain amplifier which permits a crystal microphone to be used. Also, this stage provides considerable gain from the detector to be further amplified to good earphone level. The 1S5 is suited to this stage in which low microphony is a very desirable asset. Even whilst walking, the small amount of mechanical vibration could cause strange effects, if an unsuitable valve were used. The 3V4 again, was employed in the output/

modulator stage. The output of the modulator should be half of the transmitter input for 100per cent modulation, and in this circuit very near 100per cent modulation was obtained, with good quality.

The Controls

Tuning the receiver/transmitter frequency is extremely simple, and is accomplished by means of only one control.

The only essential controls which are on/off and send/receive have been situated for ease of operation, on the side of the case. The tuning ensures that, as may be noted from the circuit, the Tx is

The completed Transceiver.

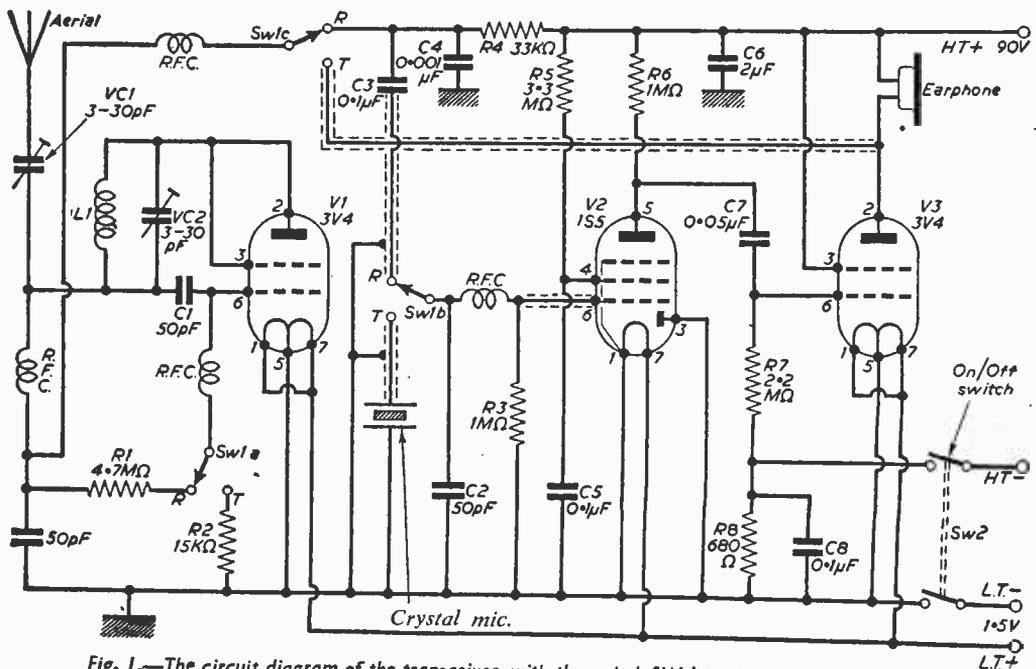
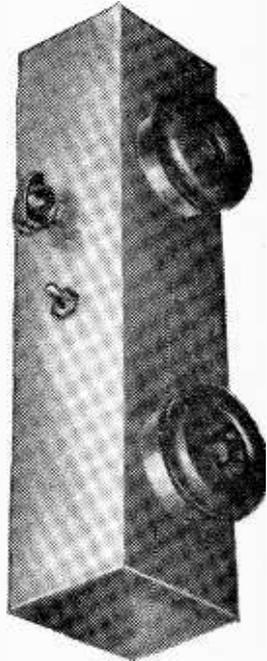


Fig. 1.—The circuit diagram of the transceiver, with the switch SW.1 in the "receive" position.

always operating on the same frequency as the Rx, and once set, needs no adjustment. On "receive" the detector functions in the "Positive Drive" arrangement, and with the switch in the send position, the grid leak resistor is switched from a 4.7M to a 15k component. In this state the oscillator supplies power to the car-radio type telescopic aerial. The A.F. amplifier is connected to the Tx/Rx switch SW1 which brings in or out the crystal microphone, or the detector depending on the position of the switch. Modulation using the Heising choke method was decided upon, the earphone taking the place of the conventional L.F. choke. In this way the speech is automatically monitored on transmit.

A 90V battery supplied the H.T., whilst a 1.5V battery supplied the L.T.. The total L.T. current is 250mA, using the valves specified, and the H.T. current drawn on receive was about 14mA and on send, about 20mA.

Mechanical Construction

The main case dimensions are 12in. x 3in. x 2 1/4in. deep. The dimensions allow plenty of room for battery changing and valve replacement. The valve deck was wired and tested before fitting in the case. In this way cramped working was avoided.

No special notes are required regarding chassis construction, but a glance at the drilling details will clarify assembly.

Wiring and Assembly

The points to bear in mind when wiring are:-

1. Keep all H.F. leads short and direct.
2. Use rigid connecting wire.
3. A.F. leads should be of the screened type.

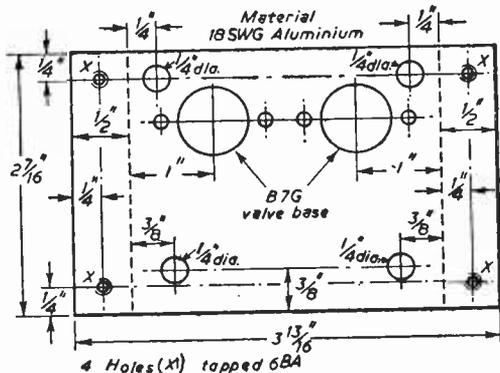


Fig. 4.—The A.F. chassis.

The coil L1 and condenser VC2 should be securely soldered to the through-terminals positioned adjacent to V1. One end of the coil is connected to the strapped anode and screen. The other end in series with a 50pF ceramic capacitor

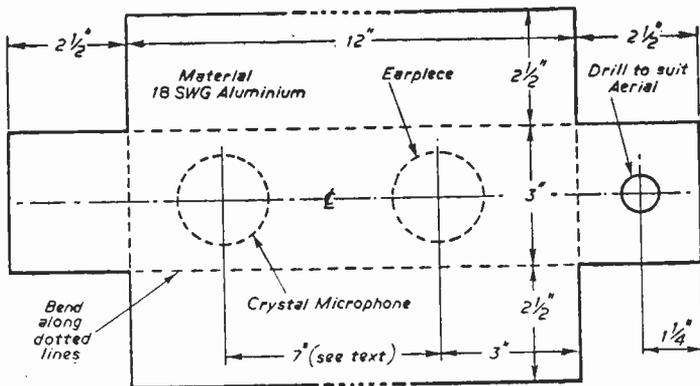
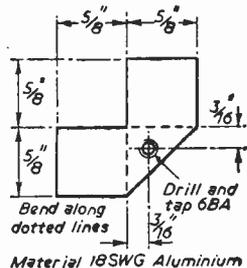


Fig. 2.—Constructional details of the main case.

Fig. 3.—A corner bracket.



to the control grid of V1. These leads comprise the main tuned circuit and should be kept as short and direct as possible. The radio frequency chokes (RFC) may be made by winding a single layer of 36s.w.g. enameled copper wire on a high value resistance, of about 500k. The original wires of the resistance being used to anchor the choke winding.

A pair of high resistance headphones were used with the prototype, one of which was stripped, leaving only the case. This was used for housing the microphone. A distance of approximately 7in. should separate the centres of the earpiece and the

COMPONENTS LIST

- All resistors 1/4W 20per cent tolerance
- | | |
|---------|---------------------|
| R1—4.7M | C1—50pF silver mica |
| R2—15k | C2—50pF silver mica |
| R3—1M | C3—0.1µF 150VW |
| R4—33k | C4—0.001µF 150VW |
| R5—3.3M | C5—0.1µF 150VW |
| R6—1M | C6—2µF 150VW |
| R7—2.2M | C7—0.05µF 150VW |
| R8—680Ω | C8—0.1µF 150VW |
- VC1—3—30pF Concentric trimmer
 VC2—3—30pF Concentric trimmer
 RFC—(see text), four required
 V1, V3—3V4
 V2—1S5
 Three B7G valve bases
 One double pole on/off switch
 One 3-pole change over Yaxley switch
 AE—3 to 4ft telescopic whip
 H.T. battery—90V (B126)
 L.T. battery—1.5V (U2)
 Chassis—See Figs. 4, 5 and 6
 Earphone—2,000Ω Impedance
 Crystal microphone insert

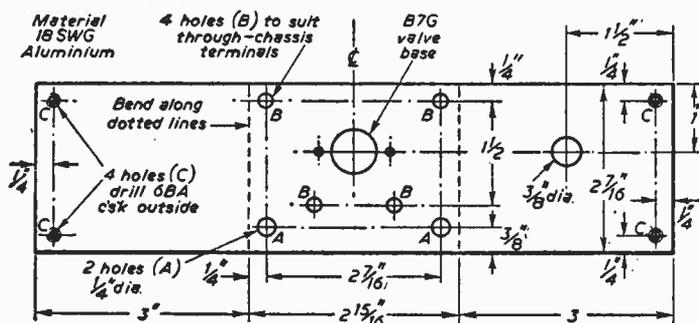


Fig. 5.—Drilling details of the oscillator chassis.

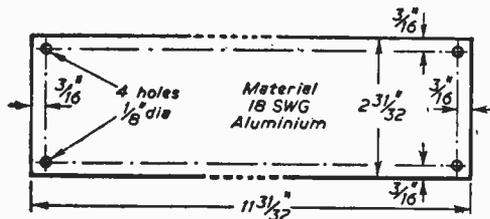


Fig. 6.—Constructional details of the cover plate (see text).

microphone, but this dimension would depend on the individual constructor's requirements.

Screened leads should be used in connecting the microphone to the send/receive switch and to the grid of the 1S5 valve. Careful screening of the anode wiring of the 3V4 to the send/receive switch is necessary to eliminate any possible audio feedback.

Coll Details

L1 for 70Mc/s.—6 turns of 16s.w.g. enamel copper wire $\frac{1}{2}$ in. in diameter

L1 for 28Mc/s.—10 turns of 16s.w.g. enamel copper wire $\frac{1}{2}$ in. in diameter

Experimental 2m coll.— $1\frac{1}{2}$ turns of 14s.w.g. silver plated copper wire $\frac{1}{2}$ in. in diameter

Wiring of the A.F. stage and the modulator should be in common with conventional audio equipment. No particular details are required save those which have already been mentioned.

Aligning

With the valves plugged in their respective sockets and assuming H.T. and L.T. connections are correctly made, a pronounced hiss should be heard in the earpiece.

If there is no noise at all check that the send/receive switch is in the receive position and adjust the aerial capacitor VC1 to minimum capacity with the aerial at its maximum length. The quench hiss will then be heard. With the aid of an absorption wave-meter or crystal oscillator tuned to 70.3Mc/s adjust VC2 until the quench hiss drops in volume. Remove the absorption wave meter or crystal oscillator and the quench hiss will be heard again. Increase the capacity of VC1 until the point is reached where the hiss just starts to fall off, and re-tune VC2 as before. The transceiver is then ready for operation.

The transceiver was primarily intended for use on the 70Mc/s (4m) band, but has been tested on 28-30Mc/s (10m) and found to perform equally well. The author sees no reason why the specified oscillator valve should not function satisfactorily on 144Mc/s.

Results

Good signal strengths have been obtained whilst testing the receiver portion from BBC TV sound at R5 S9+; Wrotham F.M. transmissions at the same strength. Though the power input to the oscillator is quite low, about 0.5W, ranges of two miles (across town) or so have been obtained, and reports of R5 S7—8 both ways been exchanged using two such rigs.

It must be emphasised that a Post Office amateur transmitting licence is necessary before the transmitter be put into use.

New Headquarters in Glasgow

IN two week-end operations, Philips Electrical in January moved their Scottish organisation into the company's new regional headquarters, Highland House—situated in the heart of Glasgow.

The moves were made during the week-ends of January 21-22nd and January 28-29th, and Mr. Norman Houston, Philips Electrical Scottish Regional Manager, expected that his whole organisation would be completely established and in full working condition in High-

land House by February 1st.

The first move to Highland House, which stands at the corner of Waterloo Street and West Campbell Street, was that of the company's Scottish stores, service department and lighting division, which were a quarter of a mile from the regional offices, which are at Bothwell Street.

During the January 28-29th week-end, all the offices and showrooms were moved to Highland House, the position of which is only two minutes' walk from the Central Station.

SEARCH AND RESCUE AND HOMING EQUIPMENT FOR THE ARGENTINE

ULTRA ELECTRONICS LIMITED have negotiated a contract with the Argentine Aeronautical Mission for the supply of SARAH, search and rescue and homing equipment.

Three airborne transmitter/receivers with search aeriels will be supplied, for installation in Beaver aircraft, and a quantity of personal beacons.

This contract extends SARAH coverage to the south-west Atlantic, bringing the number of countries supplied up to twenty-five.

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Up to 100 Mc/s fundamental and 200 Mc/s. on harmonics and up to 100mV. output on all bands. £11.11.0

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100 c/s to 100 kc/s. switch selected. Distortion less than 0.1% 10 v. sine wave output metered in volts and dB's. £19.3.0

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5 in. **OSCILLOSCOPE Model O-12U**
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Measures capacity 10pF to 1,000µF resistance 100Ω to 5 MΩ and power factor 5-450 v. test voltages. With safety switch. £7.19.6

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10-12 watt Hi-Fi amplifier. Extremely low distortion and wide frequency range. £9.19.6

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46 1/2 x 30 x 21 in. deep Mk. I houses Record Player Stereo Amplifier, F.M. Tuner, records, etc. Mk. II will house a Tape Deck in addition. Left in the white for finish to personal taste.
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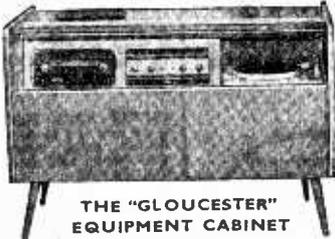
UXR-1



OS-1



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SHORT-WAVE TRANSISTOR PORTABLE Model RSW-1
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Pre-aligned I.F. transformers, printed circuit, 7 x 4 in. high-flux speaker. Real hide case. £14.18.6

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This sensitive headphone set is a fine introduction to electronics for any youngster. £2.16.6

HI-FI F.M. TUNER
Tuning range 88-108 Mc/s. For your convenience this is available in two units sold separately as follows: Tuner-Unit (FMT-4U) with 10.7 Mc/s. I.F. output (£3.2.0 inc. P.T.). I.F. Amplifier (FMA-4U) complete with cabinet and valves (£10.10.6). £13.12.6

HI-FI 16W STEREO AMPLIFIER Model S-88
10mV. basic sensitivity (2 mV. available, £1 extra). Ganged controls. Stereo-Monaural gram. radio and tape recorder input. Push-button selection. Two-tone grey metal cabinet. £25.5.6

6W STEREO AMPLIFIER Model S-33
3 watts per channel, 0.3% distortion at 2.5 w/chm 20dB N.F.B. Inputs for Radio (or Tape) and Gram. Stereo or Monaural, ganged controls. £11.8.0 Sensitivity 100 mV.

TRANSCRIPTION RECORD PLAYER RP-1U
4-speed A.C. motor Ronette Stereo/ Mono pick-up. Complete with plinth. £12.10.0

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Ducted-port bass reflex cabinet "in the white" Twin speakers. With legs £11.12.6. £10.5.6

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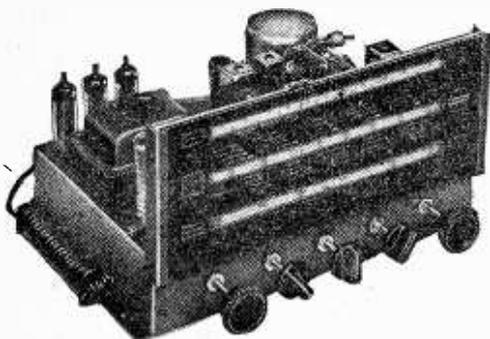
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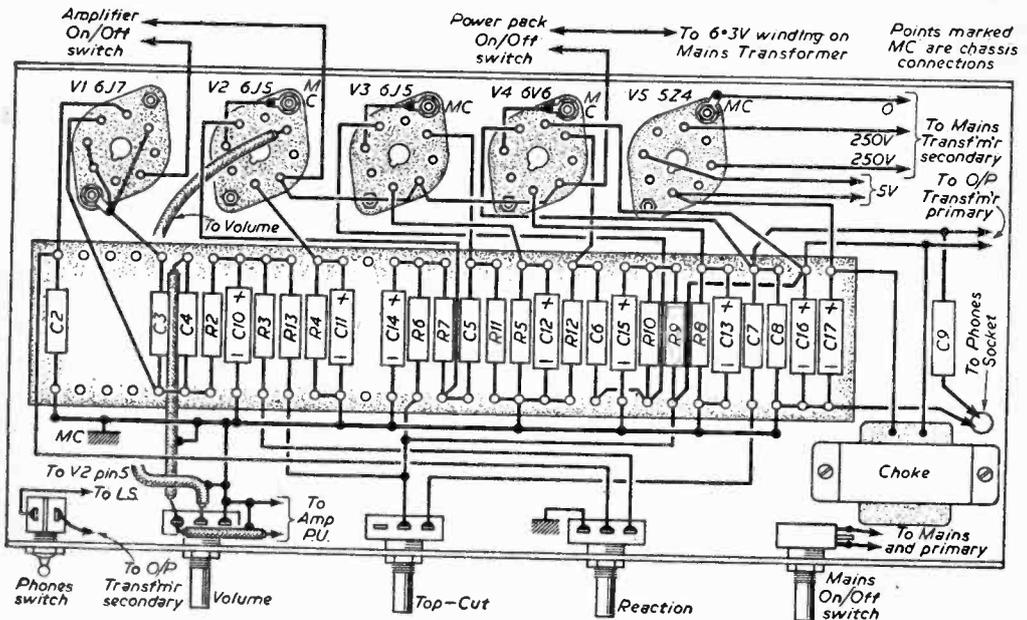
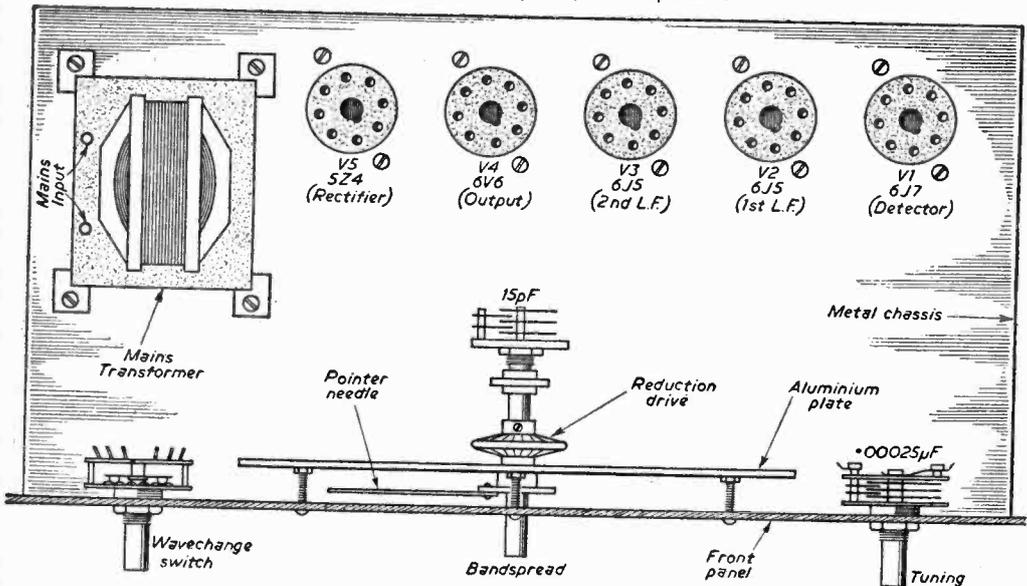


Fig. 3 (above).—The underchassis wiring diagram; details of the heater chain will be given in a separate diagram.

Fig. 4 (below).—The layout of the components.



the bottom row has the power pack, the reaction, the top-cut, the volume control, the amplifier switch and the switch disconnecting the speaker when the earphones are in use. The power pack switch, the amplifier and phones switch are all toggle switches. The other four are the small black pointer knobs.

Screened lead is used for the connection from the 6J5 grid to the volume control and between the volume control and the input of the amplifier.

All the resistors used may be of the 1/4W type, 10 per cent rating. The only resistor needing to be 1W is the 270Ω.

(Continued on page 1087)

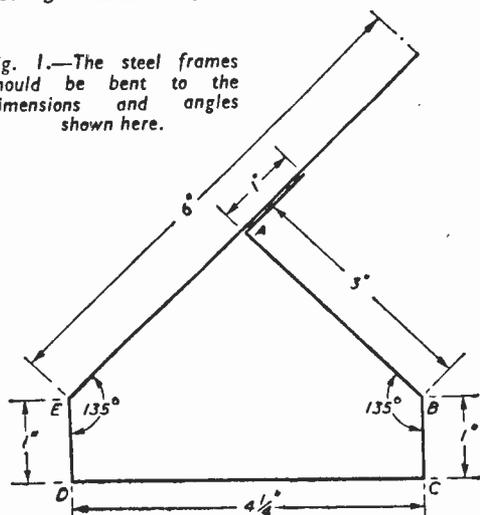
A Transistor Tester

AN EFFICIENT INSTRUMENT OF SIMPLE DESIGN

By J. S. Kendall.

THE coming of the transistor has brought with it testing problems. This tester is simple and uses an ammeter which can be obtained from any Government Surplus Store. The other components should be easy to obtain, as they are all manufactured by a reputable firm, and a local supplier should be able to obtain them in a matter of days. The tester gives two readings, one an emitter current with the base current controlled by a fixed series resistor and the other under no base current conditions. This type of test is very much like testing a three electrode valve with bias and without bias with the meter in the cathode circuit. The basic circuit is exceptionally simple, and contains just two resistors. It is impossible to damage the unit or the average transistor by wrong connections provided that the battery used is not higher than the specified 1.5V.

Fig. 1.—The steel frames should be bent to the dimensions and angles shown here.



The Meter Case

The meter should be a 0-20mA full scale deflection, moving-coil type: the larger the better (the one used in the prototype was about 3in. in diameter). The mounting panel for the meter and the terminals is a 6in. square of aluminium and it is recommended that this should be not less than .064in. (16 gauge). If a special meter is ordered for the tester, then the manufacturers should be given full information of the thickness and the material for the panel if a ferrous material is used in place of aluminium. Steel can be used as it is firmer, cheaper and can be given a very attractive finish, but it should be remembered that it is much

harder to work with. If aluminium alloys are used, they should for preference be painted or enamelled.

The frames used for the support of the unit are very simple and firm. The material for the frames is mild steel of $\frac{1}{8}$ in. thickness and $\frac{1}{2}$ in. wide. All markings should be done before bending the steel. The first bends that should be made are those at point E in Fig. 1 (135°). Next proceed to bend the metal at A, C and D (all right angles). It is recommended that they be done in that order. As it is not important when the marking and drilling of the holes for the fixing screws are done, these operations may be carried out when the constructor chooses. 4B.A. screws were used in the original. Three of the holes were tapped and the other was a clearance. The clearance hole is drilled in the first section $\frac{1}{2}$ in. from the end (half-way between the end and the bend at A Fig. 1). The three tapping holes are 1in., 2 $\frac{1}{2}$ in. and 5in. from the other end. In all cases measured from the end thus the spacing is end to 1st hole, 1in. 1st to 2nd hole, 1 $\frac{1}{2}$ in. 2nd to 3rd hole 2 $\frac{1}{2}$ in. 3rd hole to bend E 1in. All holes are, of course, drilled in the centre of the strip. It may be preferred to clamp the 1in. to bend "A" against the 6in. piece and drill both together with the aid of a tapping size drill. Spring the two parts clear and then ream the hole in the 1in. length with a clearance drill. If the bending is done correctly the holes will register perfectly. Two of these ends have to be made but whilst the constructor is at the job there is no reason why several sets cannot be made up, as they form a basis of a useful and matching set of mounts for various pieces of equipment. The writer has a number of different items mounted on such stands.

The Panel

The panel, as mentioned earlier, should be of 6in. square. First, mark $\frac{1}{8}$ in. off down each side. Mark 1in. across the top and the bottom, after also marking $\frac{1}{8}$ in. off across the top. Drill the intersections of the 1in. and $\frac{1}{8}$ in. lines (four) with 4B.A. clearance. These are the mounting holes for the panels and they should register with the holes in the end frames. A number of such panels for other equipment can be made at the same time, and the suggested lengths are 9in. and 12in. To mark the centre of the large hole for the meter, it is suggested that a line is drawn from each corner of the panel to the one diagonally opposite. Where the two lines join is the centre of the panel. Mark out a circle slightly larger than the diameter of the meter and then remove with the aid of a tank cutter. When this has been done clean up the hole if required and drop the meter through, and then mark the fixing holes using the meter as a template. Drill the fixing holes for the meter. This can best be done by drilling oversize clearance holes, and then fixing with the aid of nuts and bolts these latter are usually 6B.A. and round heads are advised. We now have the panel with the fixing holes taken out for the fixing of the meter and the fixing of the mounts. Another six holes have now to be

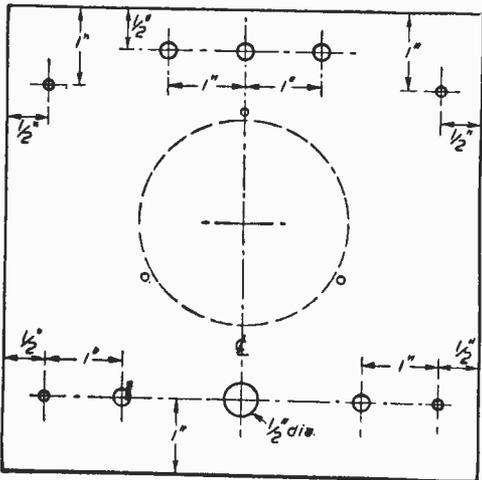


Fig. 2.—The drilling details of the panel.

holes will vary with alternative makes of terminals and the maker's instructions as to mounting should be studied before the holes are drilled.

Finishing the Panel

At the top three fixing holes for three Bulgin T103s have to be made. Three sets of holes are made, one on the centre of the line scribed $\frac{1}{4}$ in from the top edge, and two $\frac{1}{4}$ in. either side of it. The fixing for the T103 is one $\frac{1}{4}$ in. diameter hole and a smaller, say $\frac{1}{8}$ in. diameter, near it for the spigot. We now have the panel complete except for finish. All marks should be on one side of the panel, and as the panel is perfectly symmetrical, this can now be called the back. The finish can be completed with a simple coat of paint or enamel. It can also be given an attractive finish as follows:—

Take a piece of very fine emery cloth, and rub in one direction only, until you have a very fine, mat surface, and dip the panel into a solution of caustic soda or potash. This will etch the panel—the weaker the solution, the slower will be the etch and the more control can be exercised on it. When suitably etched remove and wash thoroughly. The panel must be absolutely free from grease and must not be touched with the fingers during the process or finger prints will be etched on the surface of the panel! When the panel is finally dried, it can be given a coat of a suitable varnish. This very attractive finish applies to pure aluminium only, and it is advisable to check with a test piece of metal first. Any trace of blackness developing on the test piece will show that the metal cannot be used for the process.

Assembly

Next assemble all components leaving off the final nuts and washers. Looking at the front of the panel the top row should be:—

Three Bulgin T103 terminals. One each from left to right, Black, Yellow and Red (the yellow can be a black with top painted yellow—as the yellow terminals cost a little more than the black and red).

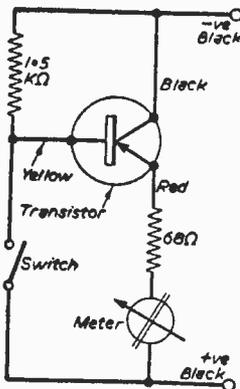


Fig. 3 (Left).—The circuit of the tester.

drilled and there is a line $\frac{1}{4}$ in. from the top of the panel and $\frac{1}{4}$ in. from the bottom. Take the bottom line and drill a $\frac{1}{4}$ in. diameter hole at its centre to take the Bulgin switch. This is a spring-loaded type and has been specially selected for the job: no substitute is recommended. Bulgin terminals have also been selected for the unit, as they are readily

available. Other types and makes can be used provided that they are insulated from the panel. Care should be taken if ordering alternative makes not in stock at your suppliers to see that supplies can be obtained easily and quickly. Some of the first will now only supply minimum quantities from wholesale houses; thus either the terminals cannot be supplied because the order is not large enough, or the supply only effected after a long delay, due to the wholesaler having to build the total order to a sufficient size. If, on the other hand, your supplier has suitable terminals in stock, then provided that they are the insulated types, take them. If no Yellow is available as specified for the "base" then the top of the terminal can easily be painted with the aid of yellow paint. For the two bottom terminals, two Bulgin type T102s are used. These are 2B.A. thread, and require a mounting hole of $\frac{1}{4}$ in. and a $\frac{1}{8}$ in. pilot hole for fixing a small spigot. This latter should be drilled as it is essential for stopping the terminal becoming loose with usage. The common practice of cutting off the spigot is not recommended. The centre of the $\frac{1}{4}$ in. diameter hole for the two T102 terminals should be $\frac{1}{2}$ in from the edges of the panel. The fixing

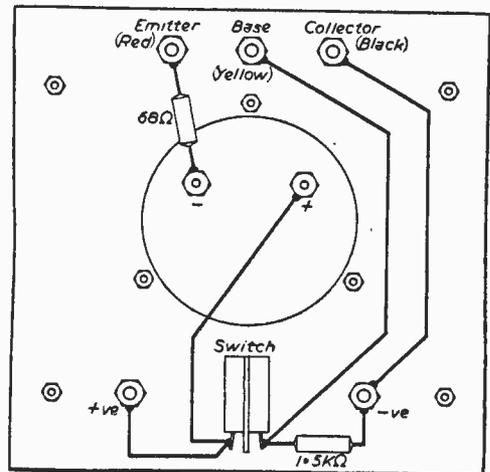


Fig. 4.—The wiring details.

In the centre is the meter.

Bottom row, Black Bulgin T102, centre Bulgin S271 spring loaded toggle switch, then at the other end a red T102. The arrangement of terminals, etc., are taken as from left to right. This is important as the wiring is done from the back. The drilling is shown in Fig. 2.

The Circuit

The basic circuit of the transistor tester is shown in Fig. 3. 1.5 volts only are used, and the unit is designed so that a separate single cell is used. The voltage is sufficiently low to prevent damage to the transistor in event of a mis-connection, and high enough to give a good indication with the transistors. The circuit tests the transistor under two fixed sets of conditions and is equally suitable for both the power and the small R.F. types. Basically a current is fed to the base of the transistor via a 1.5k resistor, a ½W was used in the original, and almost any size can be used within reason—even under short-circuit conditions the load is so small that it can be ignored. The tolerance should be 10per cent. The other resistor, the 68Ω was also a ½W, and again 10per cent. The use of this is mainly to protect the meter under short circuit conditions, with 1.5V it only allows enough current to take the pointer off the end of the scale and not enough to bend it around the stop! The meter resistance for the normal 0.2mA meter is only very small,

and the slight variation from manufacturer to manufacturer will not greatly upset the readings. It is, in fact, no greater than the variation from transistor to transistor. The total transistor current cannot exceed 20mA and so even the smallest type cannot possibly overheat—it is not possible to get a dissipation of higher than 0.1W.

The circuit tends to give a logarithmic sensitivity deflection, so that whilst a very large power transistor will go well over the scale, perhaps 18 or 19mA, the small types will give a good usable reading. Since the current through a transistor from a base to emitter is amplified in terms of the collector current, a small base current via the 1.5k resistor will give a good reading at the emitter. On the other hand if the base is taken to positive, then there should be only a small leakage current in the collector circuit. This latter is not readable with a good "small" transistor but will, with the large power-types, be as high as 0.5mA.

It is a small simple instrument and actually does not require any soldering at all. Everything can be joined with the aid of terminals. No great detail for construction should be required and the circuit diagram in Fig. 4 should give all the practical information that is required.

The small transistors are simple enough to test, the positive emitter type can be joined:— emitter to red, base to yellow, and collector to black. Where the transistor has a negative emitter, the emitter is joined to black, base to yellow and collector to red.

IMPROVING THE ALL BAND TRF

(Continued from page 1084)

Heaters

The heater circuit is first to be wired as the wires can be pressed up against the chassis. A switch is placed in the circuit between the 6V6 and the rectifier, so enabling the rest of the set to be cut out when the power-pack is needed for use on some other equipment. A similar switch is placed between the 6J7 and the 6J5, so cutting out the detector stage when it is desired to use the set as an amplifier. The 5Z4 has a 5V heater taking 2A but if the transformer has no 5V tapping a 6.3V rectifier such as the 6 x 5 may be used which takes 0.6A.

Operation

To gain maximum sensitivity, the reaction control should be advanced until the set is on a point of oscillation. Reduction of regeneration is only used to reduce the volume of local stations when selectivity falls.

Each waveband is split up by the 250pF (1000 25µF) condenser into several smaller bands. If a dial is used, stations can be returned to without any trouble. If a reduction drive is not used on the 15pF condensers, a large knob will be needed and even so tuning below 10-15m will become critical.

If one has the facilities for a long vertical outside aerial, a 2-pole 2-way switch is used to earth the aerial and disconnect the aerial and earth from the set (Fig. 6).

The aerial trimmer setting will depend, of course, on the type of aerial and where it is situated.

COMPONENTS LIST

C1	50pF	C4, C5, C6	0.01µF
C2, C9	0.1µF	C7	0.05µF
C3	0.0005µF	C8	2000pF

Electrolytics

C10	16µF
C11, C12, C13	25µF
C14, C15, C16, C17	8µF

Variables

C18	0.00025µF Band-set
C19	15pF Bandsread

Trimmers

C20	3-30pF
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Resistors

R1	2.2M	R9	27k
R2, R3	100k	R10, R13	47k
R4, R5	3.3k	R11, R12	270k
R6	33k	VR1	50k Reaction
R7	47k	VR2	0.5M Volume
R8	270Ω (1W)	VR3	25k Top-cut

Valves

5Z4	(Rectifier)
6V6	
(2)	6J5
	6J7

6 International Octal Valve Holders

Mains Transformer

250/0/250V, 60mA
6.3V, 2A
5V, 2A

Output Transformer, Smoothing Choke, High Resistance Earphones, Mains On/Off Switch, Three Toggle Switches, Two Jack Plug Sockets, Indicator Light, Wire Screened Lead

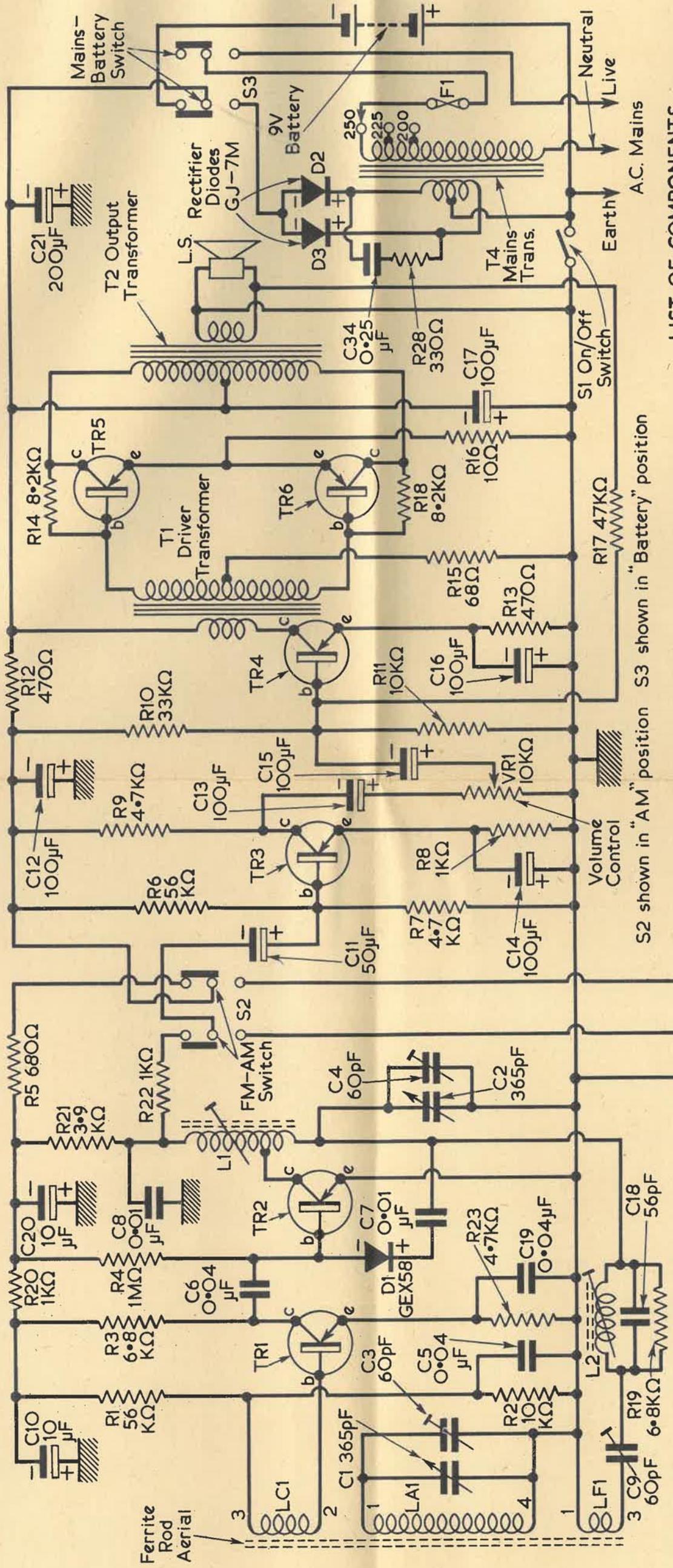
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S2 shown in "AM" position S3 shown in "Battery" position

A.C. Mains

LIST OF COMPONENTS

The P.W. "Roadfarer"

OUR FREE BLUEPRINT RECEIVER

THE A.F. amplifier section incorporates three specific feed-back networks and provision is made for plugging in the output from a record player. The A.M. section is unconventional in design and is basically a TRF reflex circuit with reaction using a ferrite rod aerial for signal pick-up. The F.M. section uses only one VHF transistor in a super-regenerative circuit coupled to an electrically loaded telescopic rod aerial for signal pick-up. Power for the receiver is derived from a nine-volt battery for portable use and this may be switched out in favour of the internal mains operated power unit when used at home.

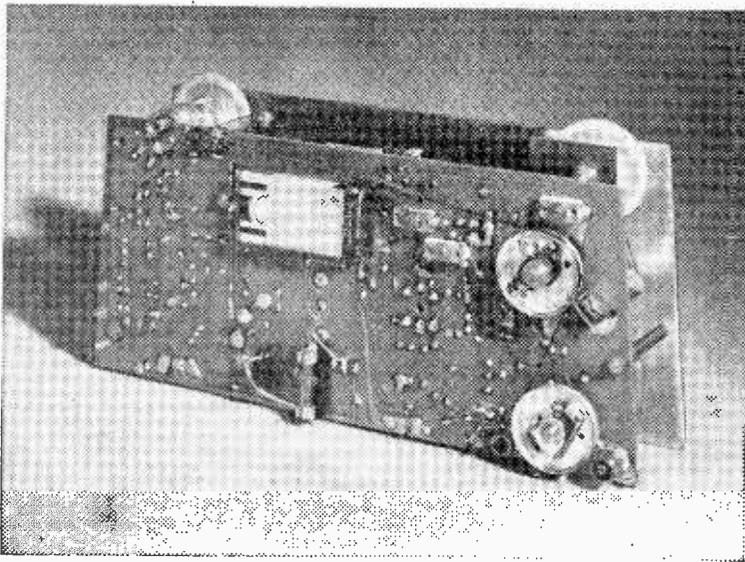
The complete circuit is shown in the blueprint and construction has been divided into two parts—the construction of the A.F. amplifier and the A.M. tuner; and the F.M. tuner and the complete assembly of the receiver.

Circuit Description

Four transistors are used in the A.F. amplifier. TR3 is a voltage amplifier operating in the common emitter mode, the signal being fed to the base via C11. The amplified signal appears across the collector load R9 and is fed to the volume control VR1 and from here to the base of TR4, the driver transistor. The driver transformer T1 matches the collector impedance of the driver transistor to the base input impedance of the output transistors, which then feed the signal to the speaker via T2, the output transformer. Negative feed-back is applied to the base of the driver transistor from the secondary of the output transformer via R17, and to improve quality further

additional negative feedback is applied in the output stage in rather an interesting way. Instead of the usual potentiometer chain feeding the centre tap of the driver transformer and thus applying a small forward bias to the output transistor, this bias is derived via a potentiometer chain consisting of a resistor from collector to base of each of the output transistors, and a resistor from the centre tap of the driver transformer to earth. This gives the required forward bias to the output transistors and also applies a negative feedback from collector to base of each output transistor and tends to make the distortion factor independent of the matching of the output transistors although a matched pair should be used. Improved D.C. stabilisation combined with further negative feedback is obtained from the common emitter resistor R16 which also tends to cancel out inequalities in the output transistors. The A.M. tuner uses two transistors and consists of an R.F. amplifier, TR1, followed by a further R.F. amplifier TR2 which also acts as an A.F. amplifier in a reflex circuit. Signals are picked up in the tuned winding of the ferrite rod aerial and passed to the base of TR1, via the coupling wind LC1. The amplified R.F. signals are developed across the collector load R3 and passed via C6 to the base of TR2. The signals are now further amplified by TR2 and developed across the tuned collector load L1. To give improved selectivity and sensitivity, comparable with that of a superhet receiver, reaction is required in the form of positive R.F. feedback to the input winding of the ferrite rod aerial. There are, however, several problems which tend to

make such a circuit rather difficult. Firstly, the impedance of the tuned aerial winding varies with frequency, and whilst satisfactory results can be obtained at one end of the band, instability can occur at the other end. The problem is further complicated by the characteristics of the transistors themselves, since they not only fall off in gain as frequency rises but also tend to introduce a phase change, thus the feedback is not necessarily always positive. In this particular circuit very careful attention has been given to the design of the feedback winding and a special network introduced into the feedback line consisting of L2, R19 and C18 which combine to give constant sensitivity over the entire medium



A rear view of the set, showing the printed circuit, and the two large pulleys for the dial drive.

wave band. Thus R.F. signals of the required amplitude and phase are fed back via LF1 to the tuned circuit of the ferrite rod aerial and the desired R.F. gain is achieved. The R.F. signals appearing across L1 are now fed via C7 and the diode D1 back to the base of TR2. Signal detection takes place by the action of the diode D1 which is in series effectively with the base-emitter diode of TR2 thus audio signals appear at the base of this transistor. The audio signals are amplified by TR2 and appear across the resistor R21. The R.F. signals do not appear across this resistor owing to the by-pass action of the capacitor C8. The audio signals are then fed via the resistor R22 to the A.F. amplifier.

Amplifier Construction

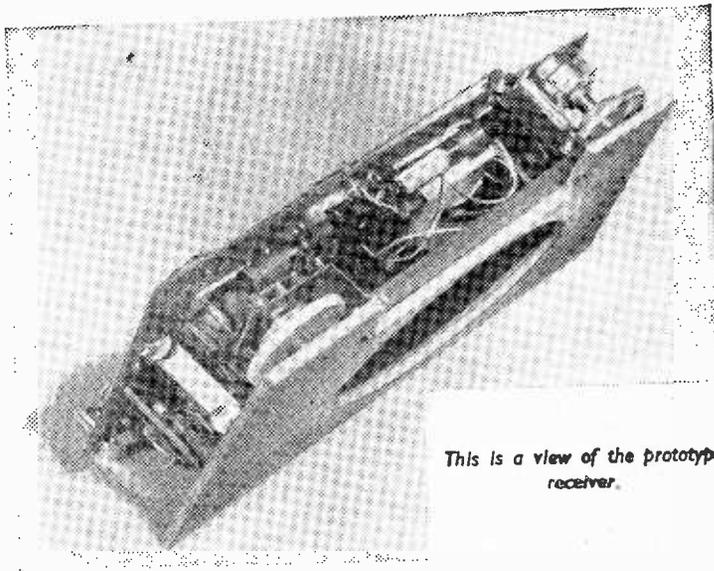
The printed circuit board of the set is clearly marked with the component positions, and providing assembly is carried out in the correct order no difficulties will arise. Whilst the use of printed circuit boards offer greater advantages, there are several precautions which must be observed to ensure reasonable results. A good cored solder must always be used, never use paste or liquid flux as these will damage the copper foil and paxolin panel or corrode it, or both. A small 45/50W soldering iron with a bit not larger than $\frac{1}{16}$ in. in diameter must be used and when making a joint both the solder and the iron must be applied together and the joint made as rapidly as possible.

Constructing the Amplifier

The first step in the construction of the amplifier is to mount the two resistors R14 and R18 and solder them into position. Next, mount and solder in the output and driver transformer. The clips for the output transistors should be screwed to the heat sinks and then these components should be inserted into their clips. Now mount the heat sinks on to the printed circuit board passing the transistor wires through the appropriate holes in the board. Next, mount the driver transistor and the input transistor and the volume control and switch. The rest of the components may be assembled on to the board in any order and it is advisable to first mount all these remaining components without soldering, check their disposition on the board and their values and see that they are correct and then solder to the circuit.

A.M. Tuner Assembly

The medium wave tuner is assembled on the printed circuit board. The first step is to mount the dual-gang capacitor C1/C2 and the coil L1. To ensure that L1 is mounted the correct way round a colour-spot identifies one side of the can. This should be matched with the dot shown



This is a view of the prototype receiver.

on the printed board. The trimmers C3, C4 and C9 should next be mounted on to the board. It should be noted that C9 is mounted on the reverse side of the board from the rest of the components, and this has been done to enable the reaction to be adjusted when the receiver has been completely assembled into its cabinet. The rest of the components may now be placed on to the board and should be checked before soldering into the circuit. The transistor TR2 should be inserted after the resistors and capacitors otherwise some difficulty may be experienced in inserting R4. The last step is to assemble the aerial rod and slip on the two coils as shown in the illustration. The coil terminations are clearly shown on the blueprint and the corresponding terminations are marked on the board. The wires connecting the larger of the two aerial coils to the board should not be longer than 1 in., and the wires connecting the feed-back coil to the board should not be longer than $1\frac{1}{2}$ in. Care should be taken in mounting L2 to ensure that this is the correct way round. A flat on one side of the former is identified on the board, and these should be matched up when inserting this component. Once again the polarity of the electrolytic capacitors and also the polarity of the diode D1 should be carefully noted.

It now only remains for the drum which takes the cord-drive to be fitted to the spindle of the gang condenser and the medium wave tuning unit is complete. When mounting the ferrite rod aerial the following procedure, if adopted, ensures a good tight fit into the rod cradle. Slip the plastic strapping into the rod cradle and insert the small plastic stud to give a loop rather smaller than that required to take the ferrite rod. Remove the two windings from the ferrite rod and now insert the rod into the cradle by squeezing it between the strapping and the cradle. Now slide the windings back on to the rod and connect them to the board.

(To be continued)

Club News

REPORTS OF CURRENT ACTIVITIES

BARNET AND DISTRICT RADIO CLUB

Hon. Sec: E. W. Brett, 28 Edward House, Edward Grove, New Barnet, Hertfordshire.

All meetings are held at the Red Lion Hotel, High Barnet commencing at 8 p.m. on the last Thursday of every month.

Future Events:

March 28th—"Aerials (Verticals in Particular)" by R. C. Hills, G3HRH.
 April 28th—"D.F. Gear" by H. W. Pope, G3HT.
 May 30th—"Mobile Equipment" by V. A. Frisbee, G3KVF.
 June 27th—"VHF Equipment" by T.H.A. Withers, G3HGE.
 July 25th—"Single Sideband" by R. F. Stevens, G2BVN.

BRADFORD AMATEUR RADIO SOCIETY

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

On February 14th A. R. Bailey, M.Sc. gave a lecture on "Tran-sistor Pirates and D.F."

Future Events:

March 14th—Display of members' gear.
 March 28th—Annual General Meeting.
 April 11th—First meeting of the new session. Arrangements to be made for Field Day.

HALIFAX AND DISTRICT AMATEUR RADIO SOCIETY

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

On January 3rd the members heard a talk illustrated with slides, on the Secretary's recent Interlaken holiday. Recent call signs issued to members are G30KS, G30NQ and G30MM.

Future Events:

March 7th—Field Day Arrangements.
 March 21st—Ragchew Night.

LIVERPOOL AND DISTRICT AMATEUR RADIO SOCIETY

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

A film show was held on February 7th and the meeting on February 14th was held for Open Discussion. On February 21st a Junk Sale was held and on the 28th G3JPJ and G3IQO gave a talk on "D.F. Equipment."

MITCHAM AND DISTRICT RADIO SOCIETY

Hon. Sec: M. Pharoah, G3LCH, 1 Madeira Road, Mitcham.

The annual general meeting was held on February 24th at 8 p.m. The affiliated societies contest was held on 4/5th February. The meeting on February 10th was a National Field Day meeting. National Field Day will be held on 3rd/4th June.

The Mitcham club network takes place on or around 1980 kc/s on Tuesday evenings between 8 p.m. and 10 p.m.

NEW CLUB

A meeting was held of local amateurs and listeners at the Cross Keys Hotel on Tuesday, February 21st with the object of forming a radio club. Anyone interested in this idea should contact Mr. N. B. Lomas, 26 Tweedale Avenue, Higher Blackley, Manchester 9.

PADDINGTON AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec: N. Lambert, G3LVK, 22 Sunderland Terrace, Bayswater, W.2.

The first meeting of the club took place on January 4th and meets every Wednesday evening at 7.30 p.m. It is the only radio club in the area and caters for those of all ages, whether they are complete beginners or "old hands". Any enquires should be addressed to the Hon. Sec. at the above address.

G3PAD should be operational on Wednesday evenings in the very near future, the call sign having been made available by the G.P.O.

REIGATE AMATEUR TRANSMITTING SOCIETY

Hon. Sec: F. D. Thom, G3NKT, 12 Willow Road, Redhill, Surrey. At the Annual General Meeting on January 21st the retiring officials were all re-elected as follows:

Chairman P. D. Lucas, G3JDN, Hon. Sec. F. D. Thom, G3NKT, Hon. Treasurer G. E. MacKrell, G3KAX, Contests Secretary K. J. Wheatley, G3BBR. New committee members are J. Duckworth, G3FM, C. Cowan and P. Mellett. In addition to the regular monthly meetings on the 3rd Saturday in each month, informal meetings will now be held on the 1st Thursday of each month and the juniors will be welcomed at the homes of the transmitting members on the 1st Saturday in each month, the first evening to be Saturday March 4th at 14 Rushetts Road, Woodhatch.

Future Event:

March 18th—G4ZU will be speaking at the Tower, High Street, Redhill.

SOUTH YORKSHIRE AMATEUR RADIO SOCIETY

Hon. Sec: E. Brailsford, 15 Ayrsoke Walk, Cantley 4, Doncaster. The first meeting at the new club room at Palace Buffet, Silver Street was held on January 12th and the following officers were elected. Chairman J. Clennell G3HNI, Secretary E. Brailsford, Treasurer L. Bennet, G2BOJ. Messrs. E. Judkins, G30MJ, C. Stagg, G3KPW and M. Harris were elected committee members.

C. Stagg, who is the lecture organiser, gave the first lecture of the year on January 25th entitled "Building a Top Band Transmitter". A film show given by Mullards was held at the Earl of Doncaster Arms on January 31st.

A club transmitting station is to be set up shortly and a receiver has been offered by Gerry G3OFP. The club is also opening a library service for the benefit of members, especially those studying for the R.A.E.

STOKE-ON-TRENT AMATEUR RADIO SOCIETY

Hon. Sec: V. Reynolds, G3COY, 90 Princes Road, Hartshill, Stoke-on-Trent.

During the City's Jubilee Celebration the club took part for several months in a round of rallies, demonstrations and exhibitions. Plans are now in hand for a similar spell this season commencing with the Midlands Mobile Rally, which is run at Trentham Gardens in co-operation with the Midlands Amateur Radio Society of Birmingham, to be held on April 30th. The talk in facilities for the rally will be the responsibility of the club. Members recently tried out the coverage offered by the talk in stations and altered the direction of the fixed stations' dipoles so as to prevent overlap of signals. The Rally will be opened by the Lord Mayor and Lady Mayoress of Stoke-on-Trent.

Future Events:

March 23rd—Spares Sale.
 April 6th—April annual general meeting.
 April 30th—Mobile Rally at Trentham Gardens.

WANSTEAD AND WOODFORD RADIO SOCIETY

Hon. Sec: K. Smith, G3JIX, 82 Granville Road, Walthamstow, E.17.

The junior section of the club is now a very successful group, running its own affairs. They would be interested to hear from other juniors who would like to correspond with members of the club. The club is also interested to hear of any other radio society who could form, or would be interested in forming separate Junior Sections and of any youngsters who would like to join such a group. In the junior section of this club there are boys from 12-16 years of age.

WIRRAL AMATEUR RADIO SOCIETY

On January 6th the Junior section held a meeting, at 6.30 p.m. and at 7.45 a talk was given by G3GG on "Teleprinter 3A". The annual dinner was held at "The Coach and Horses", Moreton on February 24th. Owing to the fact that the club is looking for new premises many meetings have not yet been planned. Two internal competitions are both to be held this year. The first is the "Newsletter Prize" for the best article written by any member and the second for the best entry in the Construction Contest. This will be presented in September.

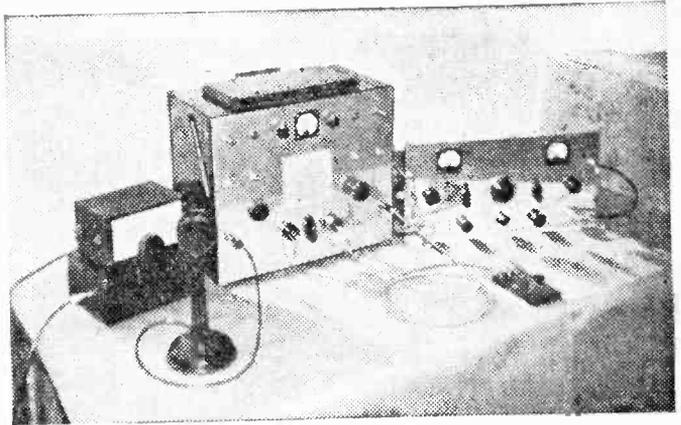
Future Event:

April 7th—DXpedition to Carmarthen.

CATALOGUE RECEIVED

The 1961 edition of the Home Radio Catalogue is now available. At two shillings this will be found of the greatest interest and value to the keen experimenter, as it lists components by practically every well-known manufacturer and carries illustrations of hundreds of individual items. Well printed on art paper, this 128 page book (quarto size) has a complete index occupying three pages, a book-mark carrying a full list of the abbreviations used in the catalogue two part 15 page supplement. On the inside of the back cover will be found some useful formulae, and this is a publication which should be in every experimenter's workshop. Home Radio, 187 London Road, Mitcham, Surrey.

AN ALL BAND 75 W TRANSMITTER



A COMPREHENSIVE INSTRUMENT OF MODERATE COST

By G. Favour

SOME important requirements had to be met in the design of this transmitter, these being: (i) excellent stability, tone, and lack of spurious radiations.

- (ii) cheap construction.
- (iii) reasonable input power with high efficiency.
- (iv) low impedance (80Ω) output without the need for an aerial tuning unit.

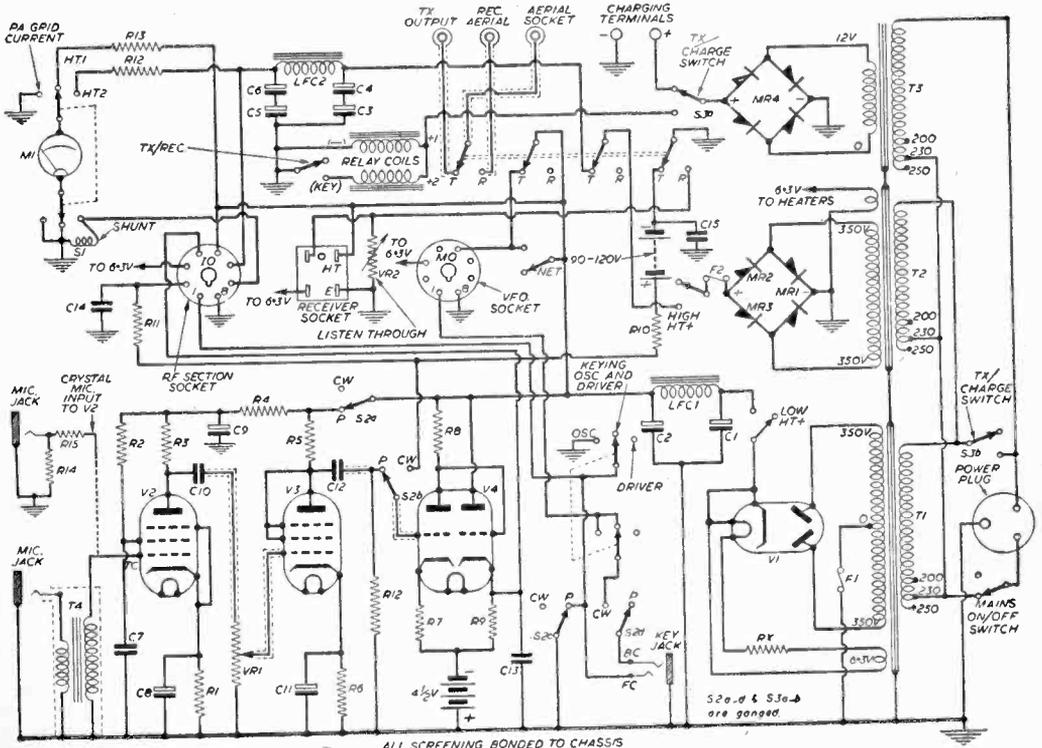


Fig. 1.—The circuit of the modulator and power unit.

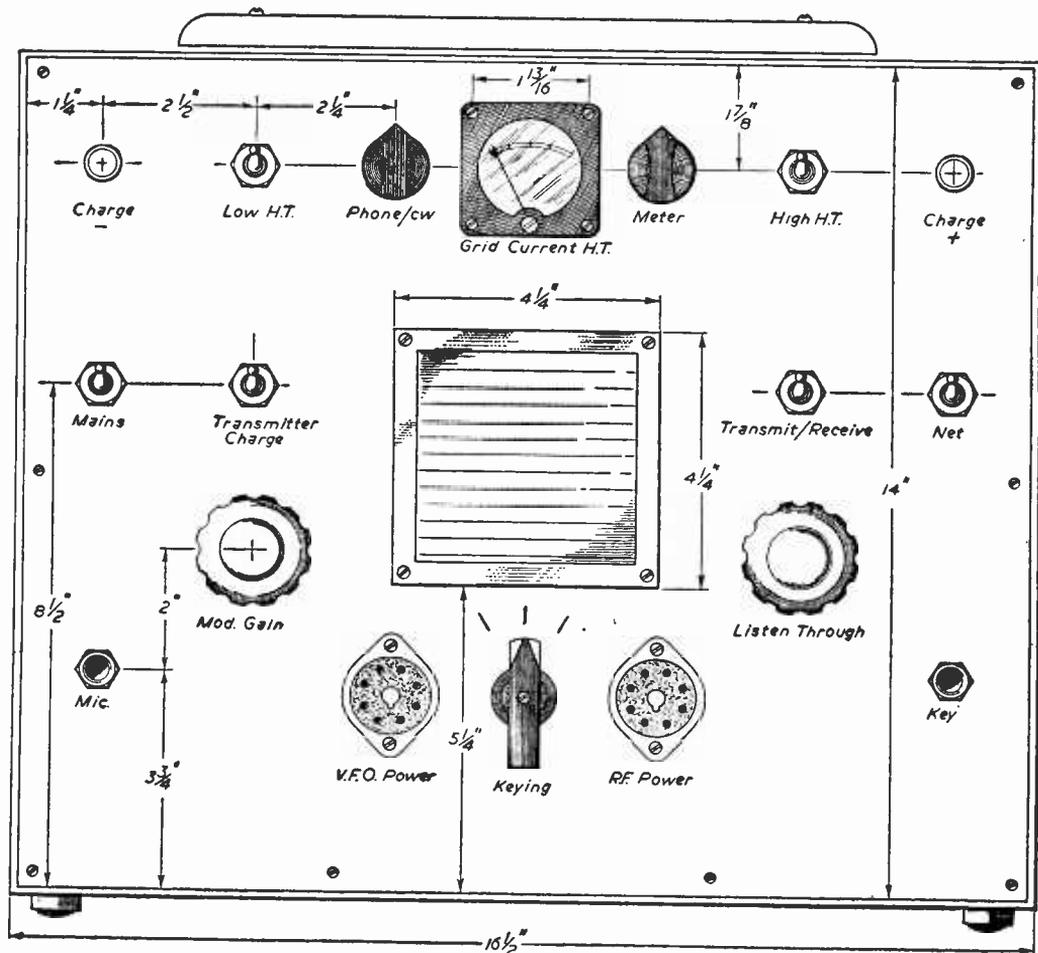


Fig. 2.—The layout for the panel of the modulator and power unit.

- (v) good quality, one hundred per cent modulation.
- (vi) freedom from broadcast and television interference.
- (vii) pleasing professional appearance.
- (viii) easy quick bandchange.

These requirements have been fully satisfied in the present design. The drive unit is the stable 80m V.F.O. which I described recently in PRACTICAL WIRELESS. This gives excellent frequency stability and lack of "pulling" by alteration of the tuning in the following stages. The output is entirely free of hum and frequency modulation under all conditions. Tone is excellent, being reported as T9X.

Construction is cheap, since most components are currently available on the surplus market. Over 75W input to the P.A. is possible on all bands, giving the transmitter a world wide range when an efficient aerial is used.

The output from the π -coupled tank circuit is suitable for directly feeding 80 Ω coaxially fed

dipoles and beams, and, with the use of link-coupled or Z-match aerial tuning units, into 300 or 600 Ω feeder, or voltage, end-fed, half-wave aeriels.

Modulation

The modulation system used is a variation of the rediscovered series-screen modulation. Carrier control is not used, and full power 100per cent modulation of the carrier is possible. Extra audio gain is available under all conditions. Splatter-proof, speech-clipping may be applied by increasing the modulator gain control.

Although the R.F. section is built on an open chassis, no broadcast interference has ever been noted, and a receiver may be operated when the transmitter is on, without interaction. No interference to ITV is caused on any band, and none to BBC TV on 80 or 40m, when a low-pass filter is used in the aerial feed. Operation on the three high frequency bands is impossible during TV hours at this location, since the television trans-

mitter is over 100 miles distant with 20 miles of sea and two mountain ranges between. Two well known types of commercially built transmitter which are advertised as being completely TVI proof behave in the same way, so completely inter-

non-technical observers. Both front panels are of highly polished aluminium with symmetrical layout. The three units can be connected together in about one minute, plugs and sockets with multiway cable being used throughout.

Bandchange

Total bandchange time takes about $\frac{1}{4}$ minute, since only one switch need be moved, one plug-in coil replaced, and tuning of the doubler stages peaked up for the required grid drive. The P.A. grid current is variable from 0 to 20mA on most bands, although 4mA is quite satisfactory for normal operation.

Additional useful features included in the design are: full metering of all essential supplies — both H.T. voltages, double anode currents, and P.A. grid and anode currents, single transmit/receive switch for the entire station, single switch 'phone/CW switching, netting facility, and choice of stage being keyed. The keying positions are—oscillator, oscillator + driver, or driver alone. For the centre position, sequence keying is adopted by the use of a back contact key, which switches on the oscillator a fraction of a second before the driver, thus preventing the radiation of any chirps or clicks when the oscillator commences operation. The keying note emitted is absolutely perfect.

Power is also available for the operation of the station receiver, this being 6.3V at 5A and 300V at 100mA, with a listen-through control to allow outgoing signals to be monitored, and keying side-tone obtained. Complete coaxial aerial changeover switching is also provided.

By turning off one switch, 12V battery changing facilities are available, with the remainder of the transmitter off. This supply is normally used to operate the transmit/receive switching relay.

V.F.O.

• Since this has been described in detail previously, the only part to be mentioned here is one small addition, which consists in taking lead from the screen (pin 4 of the oscillator valve (SP611) to pin 1 on the power socket. This is the oscillator keying connection, and is one of the simplest and most effective keying methods. When the screen is earthed oscillation ceases immediately.

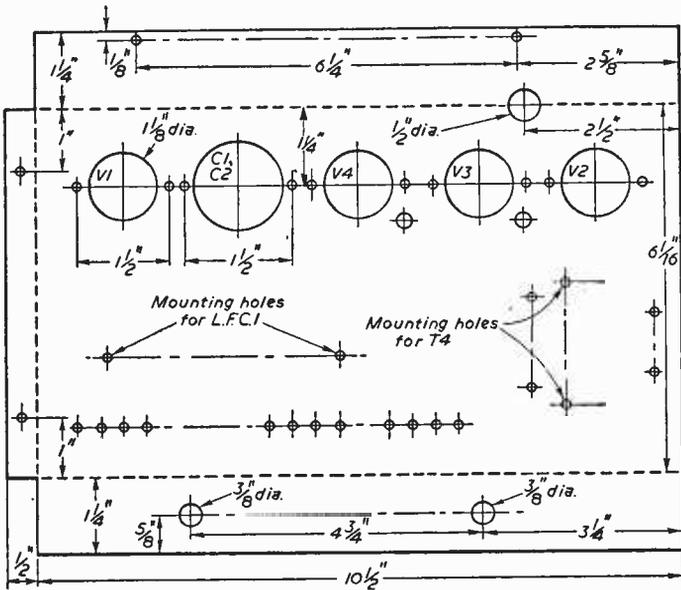
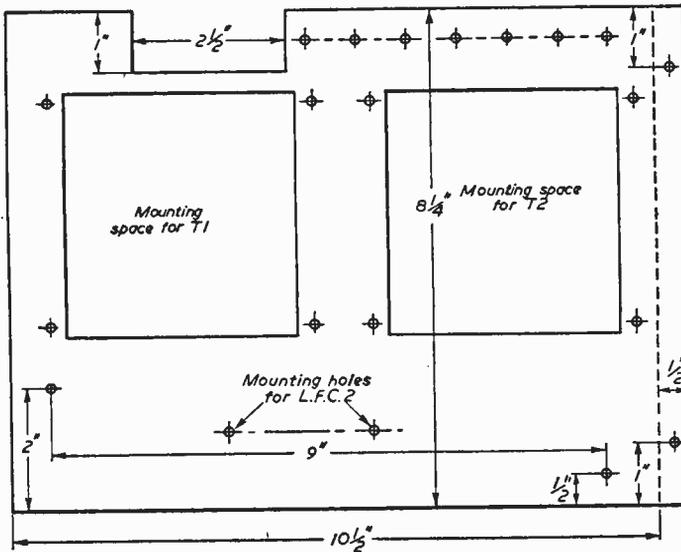


Fig. 3 (Above).—The constructional details of the modulator sub-chassis.

Fig. 4 (Below).—The drilling dimensions for the transformer support.



ference-free operation should be possible in higher signal strength areas.

The appearance is quite pleasing, being very favourably commented on by both technical and

Modulator and Power Unit

The basis for this was the case and frame of an old T1154N, obtained very cheaply, without valves. Although, as they are purchased, these are only pieces of junk, on dismantling, very many useful components are obtained. Many of these will be useful in the construction of the transmitter. Everything in the 1154 is removed, with the exception of the main frame, 4-pin Jones plug mounted on the side, large relay, sub-chassis supporting large resistor board, and Yaxley switch with long spindle, supported on it. The case may be painted with either black crackle or ordinary black enamel paint. As may be seen from the illustration, this gives a very good appearance. A front panel is made from 20s.w.g. aluminium drilled to the dimensions of Fig. 2. The switch spindle is moved slightly to the side so as to pass through the hole provided. The distances apart of the holes needed

ium to come directly behind the large hole in the case. The outer portions of these sockets are all connected together. The large transformers may be mounted by removing the nuts on the top, passing through the sub chassis, and screwing up again. The metal rectifiers are mounted on brackets on the upper sub-chassis, as shown in the photograph. Ventilation holes must be drilled in the chassis under these (see Fig. 5). The paxolin board supporting the large resistors is not needed with this circuit, and may be removed, since no heavy duty resistors are required. The 12V transformer and rectifier are mounted beside the rectifiers. The two fuses are mounted at the back of the chassis. The modulator sub-chassis runs down the left-hand side of the unit, and is fixed to the front panel by the mains switch and key jack. The microphone transformer (ex 1154) should have an aluminium screen around it, and all leads from it should be

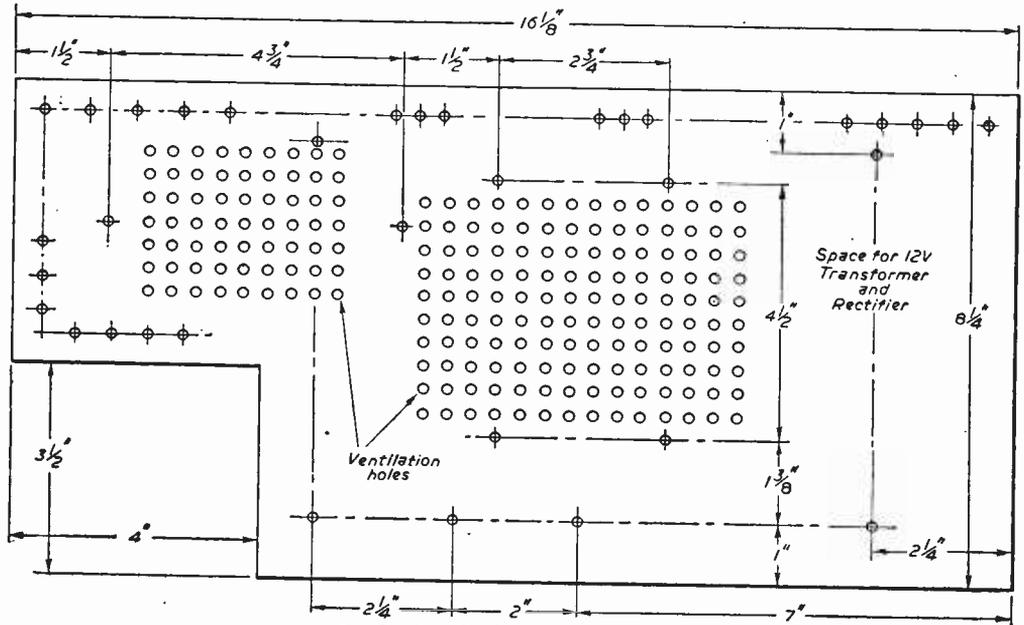


Fig. 5.—Details of the rectifier support.

to fix the front panel to the frame have not been given on Fig. 2, since the easiest way to obtain these is by marking through from the back with a pencil. The chart frame mounting holes have not been marked, as a different type may have to be used. The frame is fitted with a piece of glass, and any required information on the operation of the rig.

Sub-Chassis

The three sub-chassis (Figs. 3, 4 and 5), constructed with 16s.w.g. aluminium, are fitted into the case after fitting the switches, potentiometers and sockets on the front panel. The meter should be left until later. The V.F.O. power socket is a Mazda octal, and the R.F. section socket an International octal valveholder. Two coaxial sockets are mounted on the relay in place of the old aerial sockets, and a third on a small piece of alumin-

ium. Valve V2 should have a screened top cap, and the metallising (Pin 6) should be earthed at both V2 and V3. A screening can should be fixed around V4, since it is in close proximity to the rectifier valve V1 and choke L.F.C.1.

Circuit

The circuit will now be described, and reference should be made to Fig. 1. The mains voltage is fed to the primary windings of T1, T2 and T3 through the on/off switch. The Tx/charge switch removes the input from T1 and T2. The secondary winding of T1 is connected to the anodes of V1, the centre tap being earthed through F1. The correct filament voltage (5V) for the valve is obtained from the paralleled 6.3 windings by the use of Rx (0.8Ω) made from a short piece of Nichrome wire.

(To be continued)

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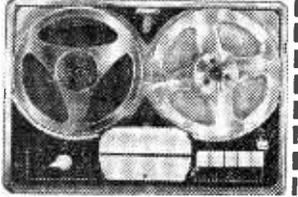
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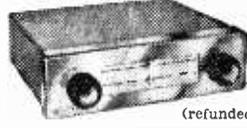
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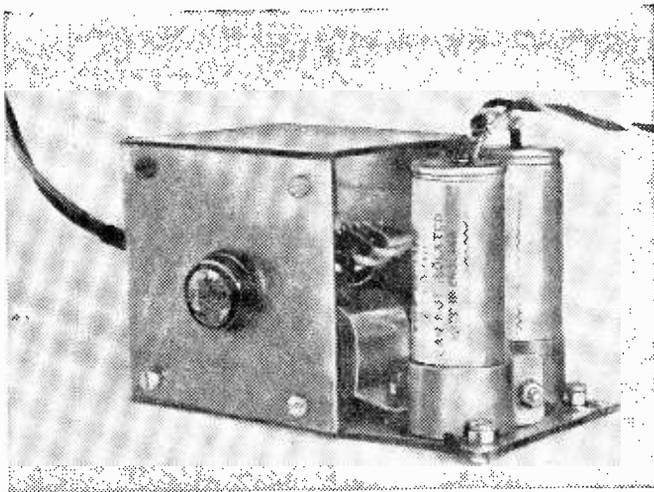
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(Left) The assembled unit

input 12·6V, 1·25-1·5A D.C.; output 200/230V, 40-60mA D.C.

General Description

The circuit consists of a pair of power transistors connected in push-pull to a transformer; feedback windings on the transformer provide the necessary drive to the transistors to maintain oscillation and a further winding on the transformer feeds a voltage doubling rectifier circuit, from which the output of the inverter is derived. The arrangement is shown in Fig. 1.

Method of Operation

The two transistors are caused to function alternatively as switches, connecting the power supply to one or the other end of a centre tapped primary winding on a step-up transformer. The resulting square wave voltage waveform, as seen by the primary inductance of the transformer, produces a trapezium shaped current waveform (Fig. 2). This waveform can be considered to consist of two components. The first is that caused by the reflected resistive secondary load, and resistive transformer losses (this is represented by

the parallelograms formed under the dotted lines in Fig. 2). Being caused by resistance, the current waveform follows in shape the square-wave applied voltage. The second is triangular waveform as seen above the dotted lines in Fig. 2 produced when a constant voltage is applied to the inductance of the transformer, this current increases at a steady rate $di/dt = \text{Primary Volts} / \text{Primary Inductance}$. In practical circuits this component of current waveform is modified by a spike added to the trailing edge of the waveform associated with the change-over to the following half cycle (not shown in Fig. 2). The resistive component of the current has been labelled IR and is supplied directly from the power source. The peak current caused by the primary inductance has been labelled IM, denoting magnetizing current, and in practical circuits may be supplied by the collapsing field of the magnetizing current in the previous half cycle.

The change-over point between successive half cycles is determined by the transformer characteristics. The primary winding is so arranged that at the peak current, passed by the transistor, the transformer core is driven well into saturation. This produces a rapid increase in primary current for little change in feedback voltage to the transistors, but on reaching the peak an abrupt loss of feedback occurs, resulting in a reduction of transistor

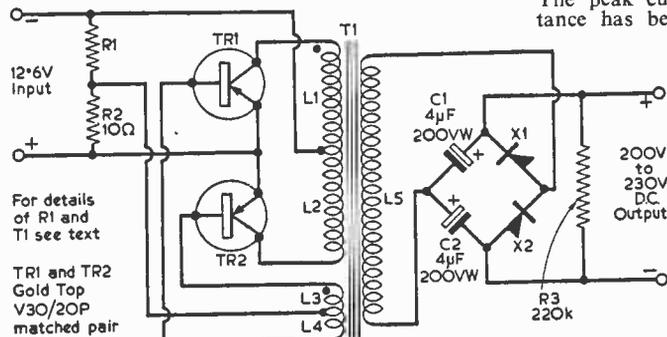
A TRANSISTORISED D.C. INVERTER

A SIMPLE UNIT TO GIVE 200/230V, 40-60mA D.C.

By A. J. Short

A RECENT addition to the many types of electronic equipment available to the amateur radio enthusiast is the transistor D.C. inverter. This device shows several advantages over other methods of changing a D.C. potential, higher power efficiency, lighter, less noise, no moving parts, and long life.

A description is given of a transistor D.C. inverter suitable for supplying power to a car or mobile radio receiver or small transmitter, drawing very little power from a 12V source and capable of being constructed at home in two or three evenings for a modest cost. The specifications are:



For details of R1 and T1 see text

TR1 and TR2 Gold Top V30/20P matched pair

Fig. 1.—The circuit of the inverter.

collector current and initiating a reversal of transformer voltages and a change-over to the other transistor. For high efficiency this change-over should occur as rapidly as possible as it is the only time during operation that a transistor is both passing appreciable current and having a substantial voltage applied to it. Power dissipation at this stage is kept down by careful transformer design. The feedback voltage is selected to provide adequate base current when applied to the appropriate transistor, it may be adjusted by variation of the series base resistor, R2. The purpose of the resistor R1 is to provide a small forward base bias to bring the transistors into the conducting region when starting.

With the type of transistor inverter shown it is important to make use of both half cycles by using bi-phase, bridge or voltage doubling circuits on the secondary winding. This is to dispose of the energy stored in the transformer core, which would otherwise be applied dangerously to the transistors in the unused half cycle. In the same way it is

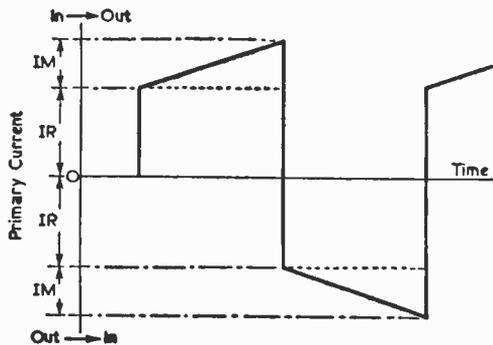
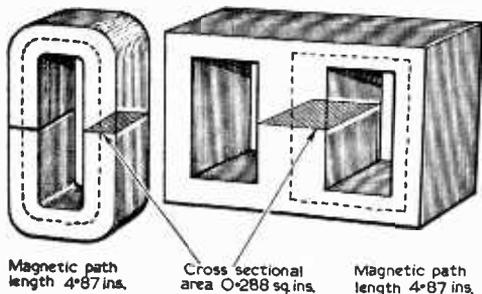


Fig. 2 (above).—The trapezium shaped current waveform.

Fig. 3 (below).—Recommended coil dimensions.

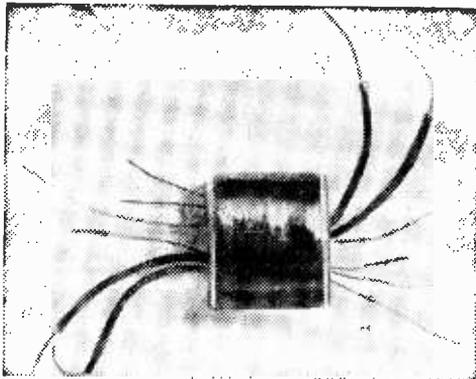


unwise to operate the converter under no-load conditions, as the peak voltages built up in the output circuit and consequently applied to the transistors via the primary windings, are a source of risk to the parts concerned. If the load applied to the inverter is increased above the figure about which it was designed, an increased load is thrown primarily upon the transistors up to the point when oscillation ceases. In this design wide margins of safety have been allowed to permit the

unit to be as adaptable as possible to a wide range of working conditions. Due regard should, however, be given to the intended output.

Materials

The majority of the parts used in the construction of the unit are generally available from advertisers in this magazine or from local suppliers; the exception to this, however, is the transformer. A suitable transformer can be constructed at home in an evening from the necessary parts, which are, 2oz of 32s.w.g., 2oz of 21s.w.g., and 1oz 28s.w.g., all enamelled copper wire. The



The ends of the winding are positioned as follows: from top to bottom.

- | | |
|--------|---------|
| L1 in | L4 out |
| L2 in | L3 out |
| L5a in | L5b out |
| L5b in | L2 out |
| L3 in | L1 out |
| L4 in | L5a out |

core is an English Electric grain-oriented silicon-steel "C" core, type HWR 10/16/5 or equivalent, and such a core may be readily recovered from an ex-Government potted high-cycle transformer, available at small cost from surplus dealers. To aid recognition of a suitable core the recommended dimensions are given in Fig. 3. The following corrections allow for minor deviations from the given dimensions.

1—A difference in length of the magnetic path—multiply number of turns in all the windings by the fractional change in magnetic path length, anticipate proportional change in operating frequency.

2—A difference in cross-sectional area—when it is a small difference it will only influence the operating frequency, this might possibly be utilised to compensate for a change in magnetic path length, i.e. a decrease in cross-sectional area will make up for an increase in magnetic path length. However large, changes in core dimensions are not recommended without a complete re-design of the inverter.

Construction of the Transformer

A cardboard rectangular tube is first constructed on which the windings will be made, for the "C"

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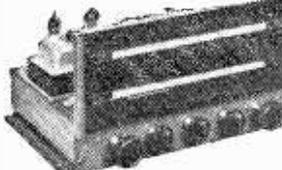


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2/330v.	2/3	100/25v.	2/-	32/350v.	4/-	4/450v.	2/3	250/25v.	2/6	100/270v.	5/6	8/450v.	2/3	500/12v.	3/8	2,500/3v.	4/-	8/500v.	2/3	8+8/450v.	3/6	32+32/350v.	5/-	16/450v.	3/-	8+16/500v.	5/6	32+32/450v.	6/-	16/500v.	4/-	8+16/450v.	5/6	50+50/350v.	7/-	32/450v.	8/6	16+16/450v.	6/6	84+120/350v.	11/6	25/25v.	1/6	16+16/500v.	6/6	100+200/270v.	12/6	50/50v.	2/-	32+32/350v.	4/8	100+200/270v.	12/6

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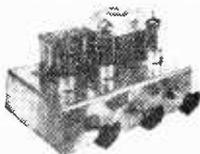
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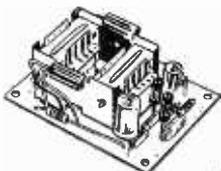
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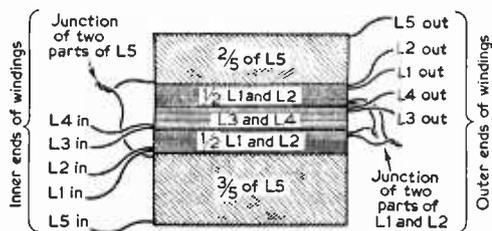
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L5.....500 turns total

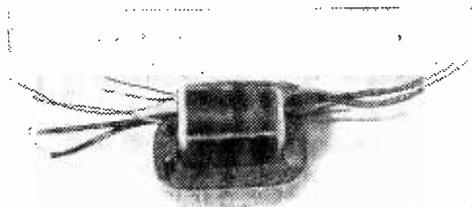
Fig. 4.—A section through the transformer windings.

cores specified it will be $1\frac{1}{16}$ in. x $\frac{3}{8}$ in. tube, $1\frac{1}{8}$ in. long, well varnished for rigidity and to repel damp. The tube is first covered with Sellotape, and after securing a flexible lead to the end with a well-taped joint, a layer of 100 turns of 32s.w.g. is wound on to the former. The layer is taped over with a single layer of Sellotape and two more similar layers of wire and Sellotape are added, making 300 turns in all. This winding is then terminated with a flexible lead. When starting and finishing a layer it may be found advantageous to secure the first and last few turns by catching a short strip of Sellotape under these turns, folding it up over them, when it will be held temporarily by its adhesion and later by the next layer of tape and wire. The second winding consists of a single layer of two strands of 21s.w.g. wire wound together in bifilar manner to enhance the mutual coupling between them, and thus reduce high transient voltages on the transistors, caused by

COMPONENTS LIST

- R1 See Text
- R2 $10\ \Omega\ \frac{1}{2}W$
- R3 $220k\ \frac{1}{2}W$
- C1, 2 $4\ \mu F, 200VW$
- X1, 2 Silicon rectifiers
150V
60mA Wkg eg
0A210 etc
- TR1, 2 Gold top V30/20P—
matched pair (for class B etc)

leakage inductance. When the one layer of 21s.w.g. has been wound, the ends are left hanging temporarily while the feedback windings of eight turns of two strands, bifilar, of 28s.w.g. wire are terminated and wound on. These windings are also taped with a single layer of Sellotape, and when secure are overwound with further layers of the bifilar 21s.w.g. wire until this winding consists of 45 bifilar turns in all. The heavy windings are then well covered with a few layers of Sellotape, tightly wound. The final winding consists of a further 200 turns of 32s.w.g. wire in two layers. The outer end of the first winding (300 turns) is connected to the inside end of the last winding (200 turns), all turns on the transformer having been wound in the same direction. The windings now consist of the bifilar feedback winding (8 turns double) sandwiched between the two halves of the bifilar primary winding (45 turns double), which is in turn sandwiched between the two halves of the secondary. This arrangement pro-



The transformer ready for mounting.

duces a transformer of optimum efficiency.

When the windings have been checked, the two halves of the core are inserted and a securing clamp made from a length of 1in. aluminium strip, 20-22gauge, which is passed through the length of the cardboard former and the ends bent down to the level of the opposite side of the core, and then outwards and drilled to provide a means of clamping the transformer down and holding the two halves of the core together. The leads from the windings may then be brought upward and secured to a small tag-board taped to the top of the transformer.

The Inverter

The chassis of the converter consists of two pieces of $1/12$ in. thermoplastic material. The baseplate is $2\frac{1}{2}$ in. x 5 in. with two $\frac{1}{2}$ in. side pieces turned up at 90° to secure the transistor fins. The top plate measures $2\frac{1}{2}$ in. x 3 in. plus two $\frac{1}{2}$ in. side pieces turned down. Bending of the material can be easily accomplished by gripping the material along the line of bend in a vice and then cautiously applying a small gas jet along this line on either side until the material is felt to become pliable when slight pressure is applied to the protruding sheet. The bend is then made, and the line of bend subjected to firm pressure from a smooth, flat object until the material has cooled and set.

The transistors are mounted on 3in. x 3in., 16gauge aluminium cooling fins to promote cooling. Care must be taken to ensure that the cooling fins do not come into electrical contact with any other part of the circuit. The transistors should be purchased as a matched pair. The remainder of the circuit is wired as in the theoretical diagram. The resistor R1 will vary slightly with the particular transistors employed. It should be the largest value which gives reliable starting under the most adverse conditions in which the inverter will be used, and which does not cause the current drawn to exceed 1.5A. A suggested starting point is $1000\ \Omega$.

Care must be taken not to overheat the transistors when soldering and to avoid accidental reversal of the polarity of the supply potential.

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REACTIVATING DRY BATTERIES

INCREASING THE LIFE OF THE CELLS

By R. H. Wright

REACTIVATION of dry batteries consists of passing a low reversed current through the cells from some external source, but owing to the lack of chemical knowledge on the part of the writer, no attempt can be made to explain the process which occurs during the reactivation. Whatever the reason, the over-all effect of reactivation is to increase the effective life of the cell, thus enabling it to supply further current.

Experiments

Reactivation experiments have been carried out on two U2-type cells, two No. 8 cells and two twin-cell cycle batteries, also on L.T. and H.T. batteries taken from the writer's portable receiver. In the case of the U2, No. 8 and cycle-lamp batteries, one of each was allowed to exhaust itself fully before reactivation was attempted while the second of each type was "cycled"—discharged a little and then reactivated again immediately. The L.T. and H.T. batteries were subjected to reactivation every third day.

The cells that were first completely exhausted did not respond to reactivation sufficiently well to warrant further experiment, but the "cycled" cells responded very well, particularly in the case of the cycle-lamp battery, while the portable receiver batteries were kept in service between 50 and 75 per cent longer than usual though the L.T. battery showed a much better response than the H.T. battery. In this latter case, reactivation raised the voltage always to 90, off load, but it soon dropped to its former voltage when put on load.

As a result of the experiments, the following facts have emerged:

- (1) A completely discharged cell cannot be successfully reactivated.

- (2) Reactivation is more successful if the cell is subjected to a heavy load for a short period rather than to a light load for a long period.
- (3) Reactivation should commence as soon as possible after discharge has ceased.
- (4) The zinc case must be unpunctured and the cell should not be corroded.

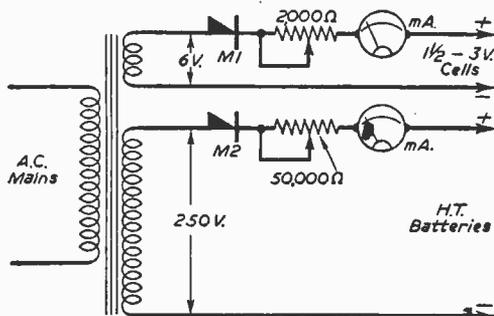


Fig. 1.—The system used by the author in his experiments.

- (5) High currents during reactivation must be avoided if bursting of the cell (which is probably due to excessive gas formation) is to be avoided.

Fig. 1 shows the equipment used during the course of these experiments, and the table shows the currents used on the various types of cell.

Current Rates for Reactivation

No. 8 type cell	...	...	3 to 5mA.
U2 type cell	...	...	6mA.
Cycle-lamp battery	...	...	10mA.
Receiver 1.5V L.T. battery	...	...	10mA.
Receiver 90V H.T. battery	...	...	3mA.

A BEGINNERS' BATTERY OPERATED TX

(Continued from page 1065)

Tuning Procedure

With an appropriate crystal and inductance (L1) plugged in adjust C6 to full capacitance and rotate C5—with the key pressed—watching the meter for a dip in the reading. Adjust C5 to the "bottom of the dip". Now decrease the capacitance of C6 a little and readjust C5 to the dip again and continue this procedure of reducing C6 in small steps and retuning C5 for the dip until the dip is only just obvious. The transmitter is then tuned. Aerial and earth connections should, of course, be made before attempting to tune the transmitter.

For the R/T man, the output stage can be simply modulated. The circuit is shown in Fig. 1. A carbon microphone is connected in series with a switch, 3V battery and the primary of a microphone transformer. The audio voltages induced in the secondary side of the transformer are connected in the grid circuit of the power amplifier valves and provide quite reasonable modulation of the output.

COMPONENTS LIST

C1	50pF
C2	100pF (mica dielectric)
C3/4/7	0.01 μF (mica dielectric)
C5/6	500pF variable capacitors
R1	22k ½W
R2	33k ½W
R3	22k 1W
RFC1 and 2 Denco RF chokes, type RFC/5	
SW1 on-off toggle switch	
0.25mA moving coil meter	
Jack plug and socket (for key connection)	
V1, V2 and holders—see text	
L1 see text	

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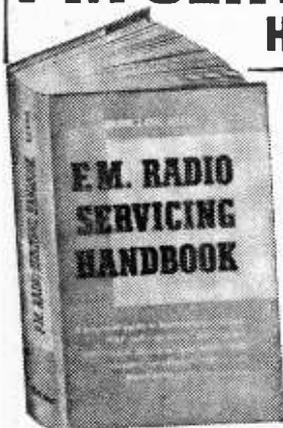
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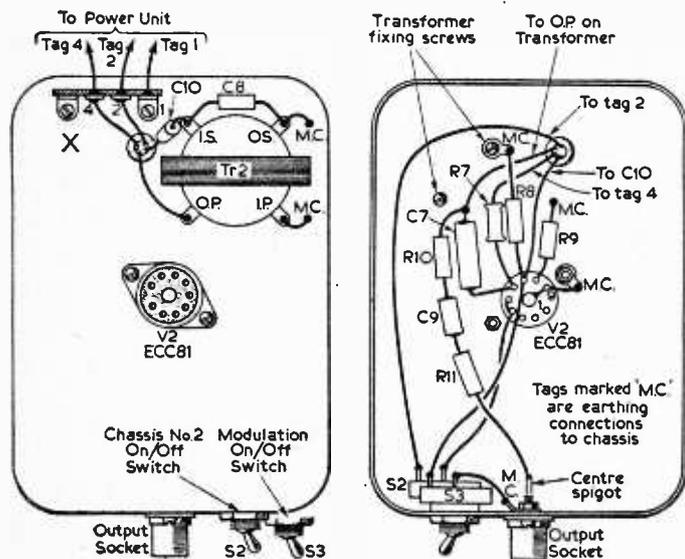
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Figs. 5 and 6 (left and right).—Above— and below—chassis wiring of the A.F. modulator. Another valveholder—for V5—should be mounted on the chassis at point X with the same orientation as the holder for V2.

Mounting the switches

These are mounted with as much of the screwed portion as possible projecting as shown in Figs. 5 and 6.

A small 5-tag strip is mounted on the rear as in Fig. 5. Verify that three of the tags are not shorting to the chassis. (Note: tag 3 is not shown in Fig. 5.)

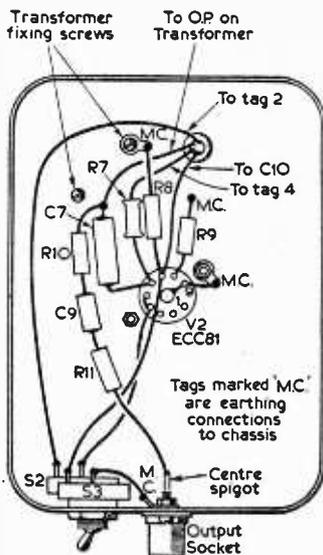
Wiring and progressive testing

Tag 2 (Fig. 5), is wired with insulated wire through the grommet to one tag of S2 (if a double pole switch is used ignore the extra pair of contacts). Join the other tag of S2 (this is the switch nearest the chassis top sheet) to pin 4 of V2 and continue the lead to pin 5. Earth to chassis pin 9 and continue the lead to the centre spigot of the valveholder (this acts as a screen). Connect the unit to Chassis No. 1 (power unit), tags 1 to 1 and 2 to 2 (Fig. 5) and switch on at the mains. Put S2 (Fig. 5) on and the valve heater should light up, verify that S2 works.

Next connect pin 5 of V2 to pin 4 of V3 and continue the wire to pin 5. Earth pin 9 of V5 and continue the wire to the centre spigot. Plug in V5 and verify that the heater lights up. If this valve heater is not wired at this stage it will be very difficult to do so later. The valve is not used yet.

The valve wiring

Solder R7, using only $\frac{1}{16}$ in. of lead to pin 6 on V2. Solder a wire to the other end of R7 and take it through the grommet to tag 4 (for H.T. + from the power unit). Connect R9 directly between pin 8 and the chassis, and R8 between pin 8 and the chassis.



Test 1

Connect a milliammeter in the lead to tag 4 of the power unit. Switch on the unit and there should be a drain of about 0.5mA. Touch pin 7 with a screwdriver with the metal part held in the hand (be careful not to touch pin (6) and the current drawn will show a small change (about 0.1mA more or less than above reading).

Test 2

Connect a pair of headphones to the chassis and then via a good 0.01 μ F condenser to pin 6. Switch on and touch pin 7 as before. A buzzing or humming noise should be heard in the phones.

Do not proceed with more wiring until one or both tests give correct results. If necessary check all resistances for value, the wiring of the valveholder and that the power unit is correct.

Wiring the output socket

This actual wiring is only temporary, but all the parts are required later. Connect pin 6 of V2 (this already has R7 on it) to terminal O.P. of the transformer via a good 0.01 μ F condenser (C7). Join R10 to C9 and R11 to the other side of C9 and connect them in line between terminal O.P. of the transformer and the coaxial socket.

Carry out Test 2 above, but put phones directly between socket inner pin and outer casing. The hum will not be so loud but should be audible.

Wiring the oscillator circuit

Connect terminals O.S. and I.P. to the chassis. Plug in the phones to the output socket and switch on. A note, higher than 400c/s should be heard. If not, check all the wiring, and finally, but only if necessary, try reducing R9 to 1k. If this does not produce a note the valve or wiring is definitely faulty. Do not leave the 1k in circuit in that case, but make it as large as possible. Generally, except with secondhand valves, R9 will be as stated. If the value is too low the waveform will not be a good sine curve.

Tuning the oscillator (to 400c/s)

This is mainly done by putting a condenser across from terminal I.S. to earth (C8). With new components as stated the value given will give approximately the correct note. Try it on the phones and, if you wish, experiment with other values. 400c/s is the accepted modulation note for service work and corresponds to about "G" (above middle "C") on the piano, but this note is by no means absolutely necessary.

Completing the unit

S3 is now wired in. Take one tag to earth and the other is carefully (there is not much room)

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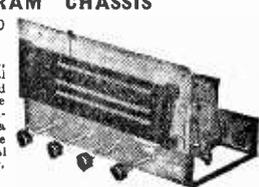
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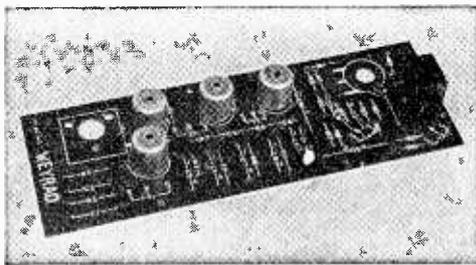
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wired to tag 7 of V2, verify that there are then three wires on this tag.

Test again with the phones. The note should now disappear when S3 is put over to the "Modulation Off" position of Fig. 5.

Use of the unit

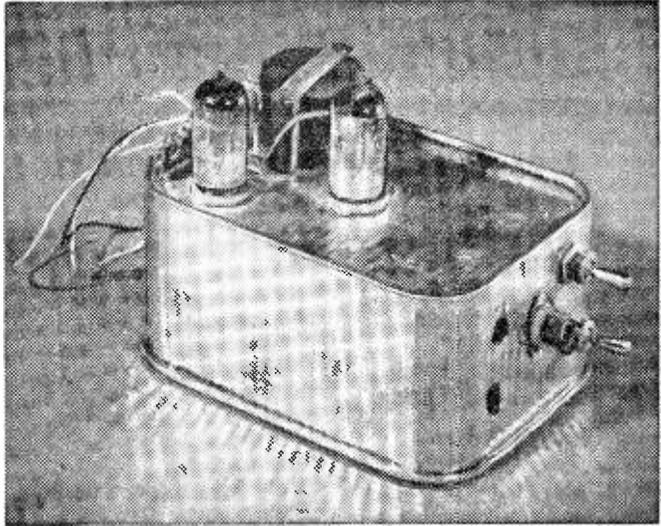
The unit will not have an output for external use when completed, as a separate completely tunable oscillator is to be built for audio testing. For the time being the output can be used for testing amplifiers and amplifier circuits. Try injecting the output directly into the pick-up sockets of a radio or amplifier. When testing an amplifier, earth the amplifier chassis to chassis No. 2 and touch each grid in turn with the centre lead from the coaxial socket working backward from the output valve. The fault will then be located at one valve, or alternatively an idea of stage gain can be obtained as one works backward towards the pre-amplifier.

Using other transformers

The heart of this audio oscillator is the transformer. Most audio types, as were formerly used for interstage use on battery sets will do, but

readers must then be prepared to experiment as mentioned in the parts list. If the details given are adhered to the waveform will be an almost pure sine wave.

(To be continued)



The audio modulator section (showing V5 in position, also)

Short-wave Listeners' Log—6

QUITE a number of amateur transmitters are now using single-sideband, or suppressed or reduced carrier modes of transmission. With ordinary transmission, a large part of the signal radiated is at carrier frequency, and is therefore wasted. With suppressed carrier methods, available power is directed towards the production of modulated sidebands. With single-sideband, one sideband is also almost eliminated, and most of the radiated power is usefully employed in modulation (that is, getting out the voice frequencies). As a result, SSB transmissions have the effect of being very much more powerful, for a given transmitter power.

Expensive receivers have circuits designed to receive SSB transmissions. However, it is not always realised that SSB can be rendered intelligible with almost any communications type receiver by using the beat frequency oscillator to replace the missing carrier. Some amateurs frequently employ ordinary communications receivers for SSB reception in this way.

For normal reception of telephony (voice) signals it is usual to leave the R.F. gain of the receiver fairly high (for good AVC efficiency) and to control

volume with the A.F. volume control. Receivers with no R.F. volume control will always be working in this way. If an SSB signal is tuned in, it will be recognised as a voice, but will be unintelligible.

To render such a signal intelligible with an ordinary communications receiver, the BFO should be switched on (as for C.W. Morse). The A.F. volume control should then be turned up to maximum, or near this point. The R.F. gain control is then turned down, in order that the SSB signal at the second detector shall not be more powerful than the BFO signal. The receiver is then tuned carefully, and the BFO tuning control is adjusted, until the BFO signal occupies the position of the suppressed carrier. At this spot the signal becomes intelligible. If careful adjustment does not give an intelligible signal, and speech sounds inverted, this shows that the BFO signal is at the wrong side of the SSB signal. This will be corrected by simply tuning the BFO to the other side of the SSB signal, in the same way as may be employed for C.W.

After a few trials, the procedure can usually be carried out quickly. With some receivers it is helpful to switch to manual control of R.F. gain (AVC off), so that the SSB signal can be reduced to a low enough value.

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Acre, London, W.C.2.

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SET-MAKING COMPETITION

AS announced in the Editorial on page 1061, a prize of £100 will be awarded for the “Roadfarer” receiver which, in the opinion of a committee, is judged to be the most efficiently constructed and presents the neatest appearance. Consolation prizes will be awarded to runners-up.

The committee will consist of the Editor and representatives of the following firms:—

Richard Allan Radio Ltd.

Jackson Bros. (London) Ltd.

Newmarket Transistors Ltd.

Osmor Radio Products Ltd.

Swindon Condenser Co. Ltd.

Readers who intend to participate in this competition should complete the coupon below and send it to:—The Editor, PRACTICAL WIRELESS, Tower House, Southampton Street, London W.C.2.

Mark your envelopes “Competition” in the top left-hand corner.

DO NOT SEND IN YOUR ENTRY YET. A further announcement will appear next month.

I intend to enter my receiver in your competition, and agree to abide by the decisions of the Committee.

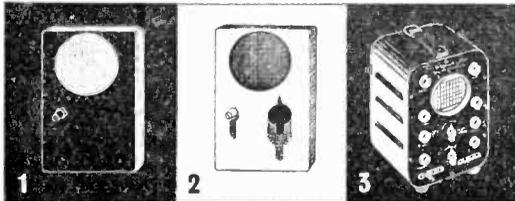
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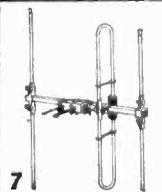
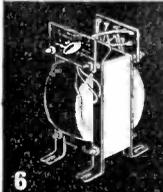
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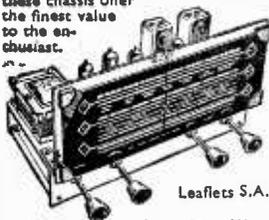
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A TWO-BAND TRF TUNER

A SINGLE VALVE MAINS DRIVEN UNIT

By A. Sydenham

ALTHOUGH it is recognised that really good quality radio reception is best achieved by means of VHF equipment, a well-constructed A.M. tuner may well perform better than a contemporary F.M. unit that is indifferently aligned. The simple, single-valve tuner arrangement presented here, even though it contains no I.F. amplifiers, discriminators and so forth, is also capable of tuning in BBC transmissions free from interference caused by other transmitters.

Detector

The particular type of detector used does not damp the tuned circuit to which it is connected to any appreciable extent, and so the selectivity obtainable is of a very high order indeed and the audio signal, which is undistorted, is suitable for feeding into a good quality amplifier.

The Circuit

This is given in Fig. 1 and shows a two-waveband arrangement powered by a simple section comprising an isolating transformer and half-wave rectifier. If the voltage and current demands can

be provided by the main amplifier the power supply section depicted can sometimes be omitted.

Both the medium and long wavebands are covered using the coils specified, but where the latter band is not required, L2 and L4 can either be omitted or exchanged for another range. A smaller type of coil could have been used but would have made the trimmer mounting less easy; as it is the necessary trimmers (C1 on the diagram) are easily soldered directly across each coil.

The valve used is the B9A based ECF80, which comprises a pentode and a triode enclosed in a single glass envelope, the pentode section being used as an R.F. amplifier with the triode arranged to function as a detector of the infinite impedance type. Both the primary and secondary windings are used on the aerial coils L1 and L2, but for the inter-stage connection choke/capacity coupling makes the use of the primary windings on L3 and L4 unnecessary, and simplifies the switching considerably. Note that the waveband selector switches, S1, S2, S3, are arranged to silence the unit when in one of the three positions by short circuiting the aerial to chassis.

The variable control, R1, is included more as a sensitivity adjuster than as a volume controller, as in most cases the latter would be contained within the amplifier following. It may be omitted if desired together with R7 provided that a fixed resistor of approximately 100k is connected from

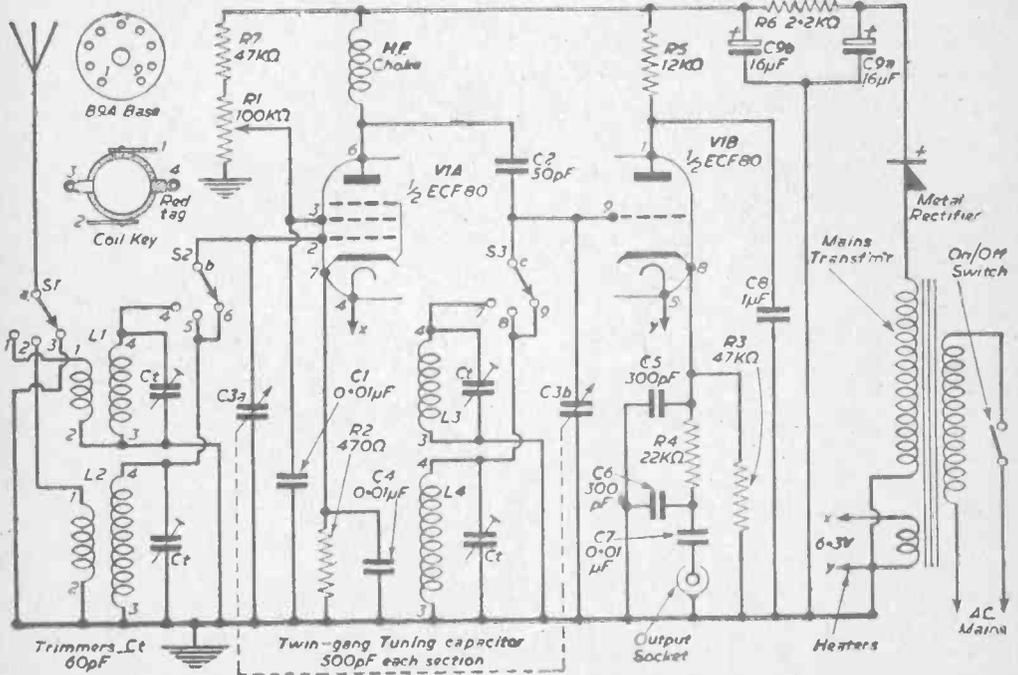


Fig. 1.—The circuit of the Tuner.

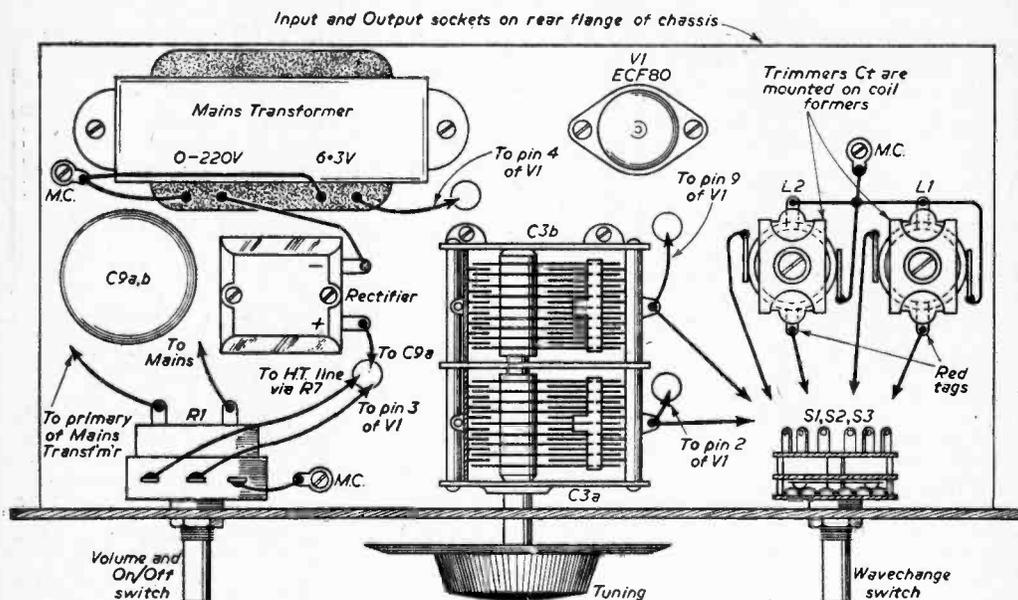


Fig. 2.—The above-chassis layout and wiring details.

pin 3 of the valve base to the H.T. rail, ensuring that C1 remains in circuit for decoupling purposes. If this is done the front panel can be kept symmetrical in appearance by fitting a rotary on/off switch in the hole vacated by R1.

Detection occurs by placing the load in the cathode circuit of V1B—the advantage being that

due to negative feedback, little damping, if any, of the tuned circuit connected to the grid takes place: such damping would broaden the tuning considerably and spoil selectivity. The demodulated signal appears at the cathode and after being filtered by R4, C5 and C6, is passed to the output socket, DC being blocked by C7.

COMPONENTS LIST

Resistors:

- R1—100k Potentiometer and switch (see text)
 R2—470Ω
 R3—47k
 R4—22k
 R5—12k
 R6—2.2k
 R7—47k (see text)

Capacitors:

- C1—0.01μF
 C2—50pF
 C3a and b—500pF variable
 C4—0.01μF
 C5—300pF
 C6—300pF
 C7—0.01μF
 C8—1μF
 C9—16 x 16μF Electrolytic, 275 V/W
 Contact cooled metal rectifier, 250V, 50mA

Mains Transformer—A.C. Mains input; Secondary, 0-220V, 25mA, 6.3V, 1A

- L1—PA2
 L2—PA1
 L3—PHF2
 L4—PHF1

One ECF80

R.F. Choke—All-wave type

Wavechange switch—3-pole, 3-way rotary type

Trimmers—Postage stamp type, 60pF. Chassis—8in. x 4in. x 2in. B9A Valve base, coaxial socket, panel material, control knobs, etc.

The Power Supply

This is very simple in design because of the modest demands made by the ECF80 and comprises a small double-wound mains transformer (which, incidentally, helps a lot in keeping out mains-borne interference) feeding into a miniature contact-cooled metal rectifier that makes use of the chassis as a heat sink. The current flow is not large enough to warrant the inclusion of an A.F. choke and R6 and C9 adequately smooth the D.C. provided by the rectifier before feeding it to the H.T. rail proper. If sufficient H.T. is available from the main amplifier, care should be taken to ensure that an isolating transformer is part thereof or a dangerous amount of current will be present. If sufficient L.T. is not available in such a situation, then the tuner can be fitted with a small heater transformer solely for the purpose of supplying the ECF80 which requires 300mA at 6.3V.

Construction

The amount of chassis drilling needed is small and Figs. 2 and 3 show all the wiring. Whilst the use of sub-miniature components is not necessary, capacitors, etc., reasonably small in size will make assembly easy. Care should be taken over coil and valve base positioning, and those shown in the diagrams ensure short and convenient wiring.

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1A07T	5/-	6A05	6/-	6J7GT	7/6	6X6G	5/8	12J5GT	3/8	43	7/6	DF33	8/9	ECC81	5/9	EL81	4/9	N108	15/-	TH30C	12/8	UCH83	13/6
1C5GT	9/9	6AT6	7/9	6K6GT	6/9	6X8GT	10/6	12K1GT	5/8	50C5	9/6	DF94	4/-	ECC82	9/6	EM80	8/8	N153	10/8	TR100	12/8	UCH84	8/6
1D3	9/6	6B7	9/6	6K7G	2/3	7B5	12/6	12Q7GT	5/8	53K10	10/6	DH83	6/9	ECC84	8/9	EM81	9/3	P61	2/3	U18	8/6	UF42	6/9
1D6	8/9	6B8G	3/6	6K7GT	5/-	7B6	9/6	12S6T	6/8	54K10	10/6	DH70	5/6	ECC85	8/3	EM84	9/9	PABCO011	1/22	6/9	UF89	9/6	
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1L4	3/6	6BE6	6/-	6K8GT	10/0	7C5	7/6	12S27	6/8	75	7/5	DK32	11/9	ECC83	9/9	EN31	16/-	PC85	9/3	U25	13/6	UF86	14/6
1L4D5	3/6	6B6AG	12/6	6L1	12/8	7C8	7/3	12SN7GT	5/8	77	8/6	DK91	6/-	ECH12	14/-	EY51	16/-	PC88	19/-	U26	11/6	UF99	7/6
1L5	4/6	6BH6	6/-	6L4	9/9	7E7	9/6	12Y4	9/8	79	7/6	DK92	8/6	ECH35	9/9	EMALL8	8/9	PC89	13/9	U31	7/3	UL41	7/6
1N5GT	8/9	6B36	6/-	6L6G	7/8	7H7	7/6	12Z4	14/8	14/0	8/9	DK96	7/8	ECH42	8/6	EY86	8/6	PCF90	7/9	U32	13/6	UL44	12/6
1R5	8/-	6BR7	8/9	6L7	9/-	7K7	8/-	19A05	7/5	83	9/6	DL33	8/6	ECH81	8/3	EZ35	6/-	PCF92	7/6	U35	8/8	UL46	8/8
185	8/6	6BV8	7/9	6L7G	7/8	7R7	10/6	19B36G13	00A7	4/6	DL33	9/9	EL80	7/6	EZ40	6/9	PC82	8/6	U37	26/8	UL84	7/6	
1S5	5/9	6RV7	6/8	6L18	9/-	7R7	9/6	20D1	9/6	117/27	10/8	DL82	9/8	ECL59	10/-	EZ41	7/3	PCL83	11/8	U43	8/9	UM80	9/6
1T4	4/-	6X8	3/6	6L19	12/6	7V7	7/9	20F2	9/6	155B7	16/-	DL91	8/9	ECL83	14/6	EZ80	6/3	PC84	9/9	U50	5/6	U9	12/6
2D21	4/6	6C4	3/6	6LD3	8/8	7Y4	7/-	20L1	13/8	723A	29/-	DL92	6/6	EP22	12/-	EZ81	7/-	PC85	4/6	U52	8/6	U97	9/6
3A4	5/8	6C5	4/8	6LD12	7/8	7Z4	7/6	20P1	11/8	807A	5/-	D184	7/-	EP34	3/3	CTIC	7/-	PC86	5/3	U76	6/6	U98	8/6
3A5	9/8	6C8	4/8	6LD20	8/8	8D3	3/6	20P2	12/6	807B	3/9	D196	7/9	EP39	4/9	EZ82	8/9	PC86A	5/3	U78	5/6	UY11	11/6
3C4	7/8	6C9	9/8	6L7	6/6	9C1	11/-	20P4	17/-	808	15/-	E450	9d.	EP40	13/6	EZ84	12/6	PL33	9/-	U91	9/6	UY21	11/6
3Q5GT	8/9	6CD6G	18/6	6P1	14/-	10C2	13/6	20P5	16/-	955	3/9	E4C80	7/6	EP41	8/6	EZ37	10/6	PL36	11/-	U92	8/6	UY41	6/6
384	6/-	6CH6	9/3	8P25	9/-	10C14	9/-	25A8G	8/-	956	3/9	E4C91	4/9	EP42	7/6	HABC80	9/6	PL38	18/-	U93	15/6	UY5	6/6
3V4	7/-	6D1	9d.	8P28	12/6	10P1	6/9	25L6G	6/9	2060	7/6	E4F42	8/6	EP43	8/6	EZ83	7/6	PC87	8/9	U94	10/6	VR150/30	9/6
584G	9/8	6D2	3/9	8G7G	6/8	10P9	10/3	25L8G	9/-	5783	10/-	E4F43	8/6	EP44	8/6	EZ84	7/6	PC88	8/9	U95	10/6	W61M	11/6
5U4G	8/-	6D3	12/8	8G7GT	12/6	10L14	8/-	25Y5G	8/-	9001	4/-	E4B1	7/-	EP45	2/6	KT32	6/9	PL84	11/-	U99	12/6	W61M	5/6
5V4G	9/8	6D6	4/9	8R7U	7/8	10LD3	8/3	25Z4G	7/3	9003	4/-	E4B1	3/9	EP54	3/3	KT33C	6/8	PM84	10/6	U99	11/6	W76	5/6
6A7	5/6	11L	5/9	8F12	5/9	10LD12	8/3	ATP4	8/9	9004	8/9	E4B3	9/9	EP90	5/3	KT38	9/-	PK35	10/6	U403	8/6	W77	4/9
5Y3G	6/-	8F9G	7/-	8G7G	4/9	10P13	9/8	25Z6	8/-	AZ31	9/-	E4C33	8/9	EP85	7/6	KT44	9/3	PK31	8/3	U404	6/6	W81	6/9
5Y3GT	6/6	8F9M	7/-	8SH7	4/8	10P18	9/8	30C1	7/6	B85	4/9	E4C81	8/6	EP86	10/3	KT45	8/6	PK32	10/6	U601	18/-	X61M	12/6
5Z43	8/6	8F12	3/6	8SH7	4/8	10P18	9/8	30C1	7/6	B85	4/9	E4C81	8/6	EP89	8/-	KT61	9/3	PK37	7/-	U408	8/6	X63	9/6
5Z4GT	11/-	8F13	3/9	8R7J	5/-	12A6	5/3	30P5	7/-	CBL21	21/-	EP80	8/6	EP91	3/6	KT63	6/6	PK38	6/6	U4F42	9/-	X65	11/-
6A7	10/-	8F14	9/6	8R7K	5/3	12A87	6/9	30FL1	9/8	OCR35	15/-	EP89	8/6	EP92	4/9	KT68	12/6	PK39	6/6	U481	8/-	X66	11/-
6A9G	9/6	8F15	9/6	8R7LT	6/-	12A8H	6/9	30L1	7/9	CL33	13/-	E4B121	14/-	EP95	6/6	KT81	14/-	PK40	8/6	U481	8/-	X67M	9/6
6A9GT	13/6	8F16	8/9	8R7GT	4/9	12A76	7/9	30L4	12/6	CY31	9/9	E4B131	21/-	PK33	7/9	KT81	5/6	PK41	12/6	U481	10/-	X78	14/6
6AB8	8/3	8F38	6/9	8R7Q	6/3	12A77	5/9	30P12	8/-	D63	1/6	EP62	3/9	EP32	3/6	KTW63	5/8	R18	12/6	U489	8/6	X79	16/6
6AC7	4/3	8H2	2/-	8E57	5/-	12A7U	6/8	30P16	7/9	D77	3/6	EC90	3/6	EP33	9/6	KT263	5/8	R19	12/6	U481	14/6	X80	6/3
6AG5	4/3	8L5	4/3	6U4GT	10/8	12A7X	7/-	30PL1	10/8	D162	6/6	EC91	4/9	EP36	11/6	L63	2/6	SP4	3/9	U481	14/6	X80	6/3
6AG7	5/-	8J56	2/9	6U5G	6/8	12A86	7/9	30L8GT	9/8	DA30	12/6	EC91	9/8	EP37	11/6	LN52	7/6	SP4	3/9	U481	14/6	X80	6/3
6AK5	6/9	8J8GT	3/9	6V6G	5/8	12BE6	8/9	35W4	9/9	DA90	2/6	EC92	4/9	EP38	12/6	LZ319	7/6	SP4	3/9	U481	14/6	X80	6/3
6AL5	3/9	8J8	4/-	8V6GT	6/8	12BH7	10/6	38Z4GT	5/8	DAC92	8/9	EC93	4/9	EP41	8/6	ML14	8/6	SP1	2/6	U481	14/6	X80	6/3
6AL5G	4/6	8J7	7/9	8X2	8/8	12C84	8/6	35Z5GT	8/6	DAF91	5/3	EC93A	9/-	EP42	9/6	N37	11/-	AT925	15/-	U481	14/6	X80	6/3

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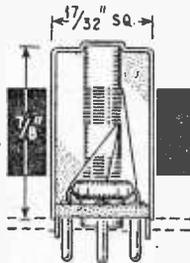
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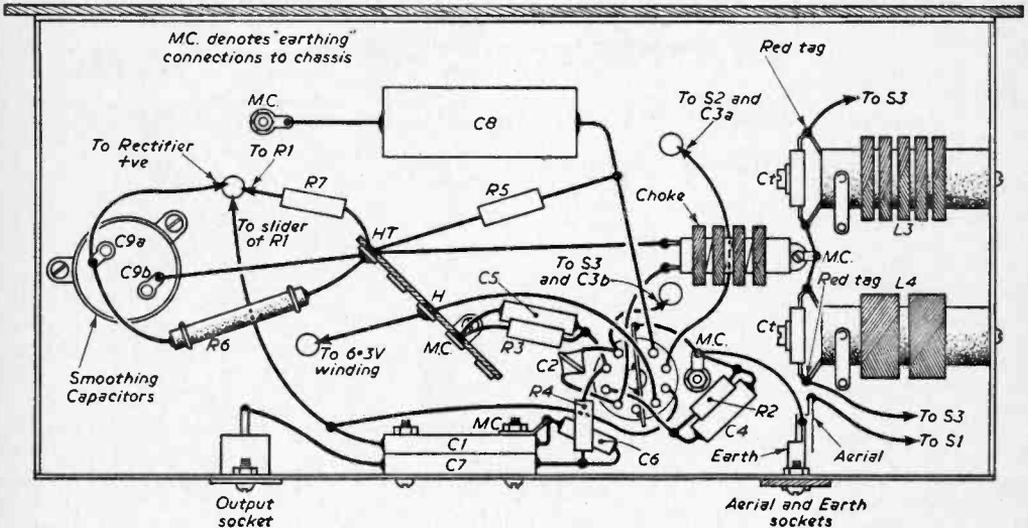


Fig. 3.—The under-chassis wiring diagram.

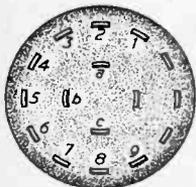


Fig. 4.—The wavechange switch wiring details.

- 7.....To Aerial socket
- 1.....To tag 1 of L1
- S1 { 2.....To tag 1 of L2
- 3.....To Chassis
- 6.....To pin 2 of V1 and C3
- S2 { 4.....To tag 4 of L1
- 5.....To tag 4 of L2
- C.....To pin 9 of V1 also C2 and C3
- S3 { 7.....To tag 4 of L3
- 8,9.....To tag 4 of L4

Setting Up

On completion of the wiring, etc., a thorough check should be made to see that everything is in order and to make certain that no short circuits exist, either from the H.T. rail to the chassis or from either side of the mains plug. If all is in order the valve may be inserted into its holder and an aerial and earth connected. A length of coaxial cable fitted with necessary plugs at either end should now be connected from the tuner to the amplifier with which it is to be used and the two pieces of equipment switched on. Once a transmission is located it may be roughly peaked by means of the appropriate trimmers, when it will undoubtedly be discovered that the control R1, or alternatively, the volume control in the amplifier, has to be backed off.

The main tuning capacitor, C3, should now be turned in an anti-clockwise direction and a trans-

mission sought at the end of the dial travel, where the moving vanes of C3 are most fully disengaged and for this the West Home Service radiating on approximately 1500kcs will be found useful. The appropriate trimmers should now be adjusted very carefully for maximum output, commencing with the interstage trimmer. Should it not be possible to obtain an optimum peaking point, adjust C3 to slightly fuller capacity and try again. Should the tuner burst into oscillation, adjust R1 until it ceases, then check the wiring carefully to make sure that positive feedback is not occurring owing to wiring associated with the anode of V1A being in too close proximity to that of V1B grid. An offending lead can often be located by prodding the wiring gently with a plastic knitting needle and one at fault will cause the oscillation to change in pitch. Slight rearrangement will usually effect a cure although in stubborn cases screening might become necessary.

During the whole alignment procedure—which is identical in form on both bands—it will be discovered that the inter-valve circuit trimmers peak very sharply and this is a desirable feature.

An Alternative Arrangement

Whilst the selectivity of the tuner just described is of a very high order, the sensitivity is not great because the triode contributes nothing to the gain, so that it is upon the pentode entirely that the gain depends and in some cases this may not be considered sufficient. Provided that slightly impaired quality is not objected to and a lower value of selectivity is acceptable, improvements in gain and overall sensitivity can be made by employing the circuitry shown in Fig. 5.

Here R.F. is conveyed, as in the previous arrangement shown in Fig. 1, to the second tuned circuit and so to the grid of the triode by capacitor C2. But instead of allowing this R.F. to pass direct to the triode grid, it is made to negotiate a small-value fixed capacitor. The grid

is also connected to the cathode—which is now at chassis potential—via a high value resistor. The grid and cathode form in fact a diode that demodulates the signal, whilst these two electrodes in conjunction with the anode also operate as a triode audio amplifier.

Although greater output apparently results from the use of this circuit, one grave disadvantage soon becomes evident, and that is, that as the inter-valve tuned circuit is heavily damped by the diode action, transmissions close in frequency to the one desired, also find their way into the output and this is most unsatisfactory.

The arrangement can be made workable, however, by using primary windings of the inter-valve coils for reaction purposes, as feeding back energy from the anode circuit to the grid offsets the damping effect previously referred to, to some extent.

But, if too much energy is fed back, oscillation commences and reception becomes impossible so another variable control is necessitated, this being shown in Fig. 5 as a 300pF variable capacitor. Optimum results are best obtained by adjusting this "reaction capacitor" in conjunction with the main tuning control in such a way as to keep the triode close to the oscillation point, and this should also be done when aligning the unit. The procedure for this is identical with that required for the unit previously described. It will, however, be found that the inter-valve trimmers peak very flatly in this case.

A Cabinet

A simple case or cabinet for housing the unit can easily be constructed, but since it will vary in different instances, there seems little point in giving a detailed design.

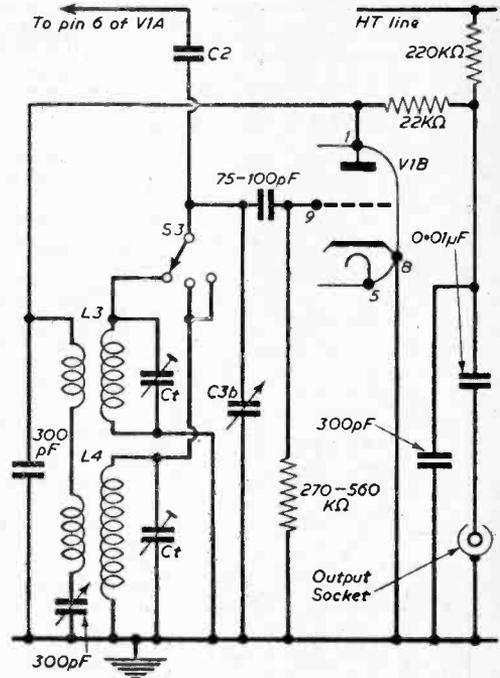


Fig. 5.—Alternative circuitry to give improved gain and overall sensitivity.

A COMPREHENSIVE GUITAR AMPLIFIER

IN our October and November 1960 issues we published constructional details on an amplifier under the above title. A number of readers have asked us to publish a list of the essential components for this, and in response to this request we give such a list below. In addition to these items there are, of course, a number of incidentals such as chassis etc., and the constructor is reminded that there is a choice of valves in certain cases—the double-triode may be either a 6SN7 or an ECC83.

(All $\frac{1}{2}$ W unless otherwise stated)

- R1, 3, 4—1M
- R2, 8, 9, 19, 20, 22, 26, 34, 35—470k
- R5, 25—2.2k
- R7, 30—4.7k
- R6—47k
- R10, 12, 13, 14, 15, 16, 17, 24, 27—100k
- R11—25k
- R23—15k 1W
- R18, 21—1k
- R28—1k 2W
- R29, 31—100k Matched pair
- R32—Not required
- R36—270Ω 3W
- R33—Not required
- C1—0.05μF 250 or 350 VV
- C2, 3, 4, 6, 8, 14, 16, 19, 20, 21—0.01μF 250 or 350 VV
- C5—100μF electrolytic 25 VV
- C7, 13—25μF electrolytic 25 VV
- C9, 10, 11, 18—0.005μF, 250 VV

C12, 17—8μF electrolytic 350 VV

C15—0.02μF 350 VV

C22, 23—16-8μF electrolytic 350 VV

VR1—Depth control 50k—Linear

VR2—Speed control 1M—Linear

VR3—Volume "A" 500k—Linear

VR4—Volume "B" 500k—Log

VR5—Volume "C" 500k—Log

VR6—Tone 100k—Linear

VR7—Feedback control 25k w.w.—Linear

V1—ECC83

V2—EF86

V3—ECC83

V4—ECC83 (B9A base) or 6SN7 (Int. Octal base)

V5—6V6

V6—6V6

V7—5Z4

3 way terminal block

4 input jacks

Input sockets

Mains transformer:

Primary: 0-200/220/240V input (or to suit mains)

Secondary: 270-0-275V 100mA or more

Coax sockets

2 switches

8-12in. speaker—3 or 15Ω

It should be noted that in the circuit diagram (Fig. 1, page 509 of the October issue), the heater pins of V4 were given as 4 and 5. For an ECC83 these should be 4/5 and 9, and for a 6SN7 they should be 2 and 7. These corrections also apply to the theoretical circuit Fig. 4.

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2.—35 to 85 metres	... XSA34	... XSF35	... XOS36
3.—16 to 43 metres	... XSA37	... XSF38	... XOS36

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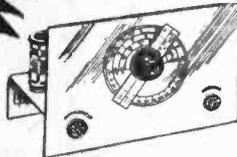
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Construction price includes valve and one coil covering 40-100 m
 ● Can be converted to 2v. or 3v.
 ● Receives speech and music clearly from all over the world.
 Send 2/- for diagram and price list.



Explore the world on short-wave radio (10-100m)
FOR ONLY 35/-

YOU CAN NOW BUILD THE R.C.S. TAPE TUNER

Will operate on all types of Recorder. Size 3 1/2 x 1 1/2 x 1 in. High impedance output, variable med. wave tuning. Triple wound Super-Hi-Q coil. Easily constructed from full instruction data and Layout Diagrams. Chassis and components colour coded.



All parts to Build. Post 1/6.

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Covers M/W Band

All components including case **12/6** for
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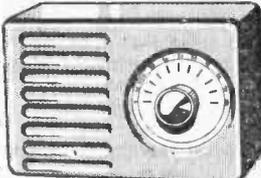
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 The set that looks like a Radio Set

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You can't go wrong. We guarantee good results.

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Components Price List. Layout Plans 1/6 free with order.

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 Bronze-finished case. Ideal for the beach, the bedroom, the office—in fact anywhere.
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B.B.C. (BAND 1). Telescopic loft. 18/6. External. 5/3, 26/3.

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Post 6d. per valve extra.
 Any Parcel insured Against Damage in Transit 9d. extra.
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Trade News

NEW PRODUCTS AND DEVELOPMENTS

RECHARGEABLE BATTERY

THE Chilton Permabeam is a small cartridge-type battery which is capable of being re-charged repeatedly.

A single, compact unit about 4½ in. long and 1½ in. in diameter, it is the same size as two standard U2 batteries. Basically it is a blue-coloured durable plastic case which contains a series of rechargeable nickel cadmium button-type cells, being equipped with normal battery contacts and a two-pin plug for recharging.

Primary advantage of the Permabeam is its ability to be recharged time and time again. It is simply plugged into an A.C. mains socket (110-240V) and left to recharge overnight or during some convenient off-duty period. It has a guaranteed long life. It will not deteriorate or corrode; stores indefinitely; and is completely shockproof.

Permabeam rechargeable batteries will be available in four voltage ratings with no variation in size. The standard model is 2.5V priced at 29s. 6d. Other models are rated at 3.5, 5 and 6V. The Permabeam is made by *Chilton Electric Products Ltd., Hungerford, Berkshire.*

MONAURAL RECORD PLAYER

THE "Manhattan", a new monaural record player by Magnavox, costs 19½ gns. (including purchase tax). The Magnavox M.602 measures 19 in. x 15 in. x 8½ in. and is finished in blue and tan. This record player uses a 7 in. x 4 in. elliptical wide range speaker and the Magnavox Standard auto-changer operates at 16½, 33½, 45 and 78 r.p.m. There is a crystal turnover cartridge with a 1mil sapphire stylus for L.P. discs and a 3mil sapphire stylus for 78 r.p.m. *Magnavox, 129 Mount Street, London, W.1.*

TRANSCRIPTION PICK-UP ARM

THE M236 transcription pick-up arm just released in this country by Shure Brothers Incorporated is recommended for studio and professional use and plays records up to 16 in. in diameter.

The M232 pick-up is intended for applications where space is more limited and for records up to 12 in. in diameter.

Both models accept practically any cartridge, stereo or monophonic, and are designed to exploit to the full the performance potentialities of modern cartridges and in particular the lower tracking pressures at which these cartridges will operate.

Setting of the arm is extremely simple but highly accurate. Precision balance is first obtained and the tracking pressure then adjusted to the required degree (0.8 grams) as indicated on the scale.

Features include precision ball-bearings at all pivot points, plug-in head with positive alignment lock, variable height adjustment, instant adjustment of overhang to ensure optimum tracking and cable with plugs at both ends to simplify installation. The U.K. agent for Shure Brothers Incorporated is *J. W. Maunder, 22 Orchard Street, London, W.1.*

SOUND SPECTROMETER

THE Sound Spectrometer SPM.1 by Advance Components Limited incorporates many new features for the measurement and analysis of noise, and conforms fully to the latest international requirements of the Rapallo Convention. This instrument is compact and of comparatively light weight and, with battery power supply and sensitive microphone incorporated, the unit is self-contained and truly portable.



The "Manhattan" monaural record player produced by Magnavox.

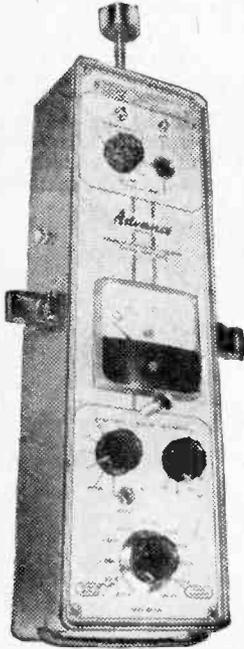
well adapted to a wide variety of applications. In particular, the possibility of new legislation covering noise nuisance indicates a great demand for this instrument outside its current purpose as a diagnostic tool in the engineering industry in general, and as an acoustic analyser in particular. In conjunction with an oscilloscope, reverberation times may be measured with this instrument.

Noise measurements can be made in phons or decibels with an accuracy to ASA and DIN standards. The overall frequency coverage is from 20c/s to 12kc/s, and sounds within this range can be analysed in separate frequency bands by suit-

able selection from one of eight filters.

Provision is made for the connection of a transducer or accelerometer for vibration analysis, and measurements, including internal battery checks, are made on a built-in moving coil meter. A jack socket permits the use of an external monitoring device, such as headphones, etc.

Including the meter scale, the total measuring range of the instrument is from 20dB to 150dB, the sound pressure reference being 2×10^{-4} dyne/cm². The spectrometer is produced in this country by *Advance Components Ltd., Roebuck Road, Hainault, Ilford, Essex.*



CIRCUIT BREAKERS

FROM France comes news of introduction of neoprene synthetic rubber as an insulant and protective covering. The new breaker, called the "Minirupteur",

A Sound Spectrometer by Advance Components Ltd.

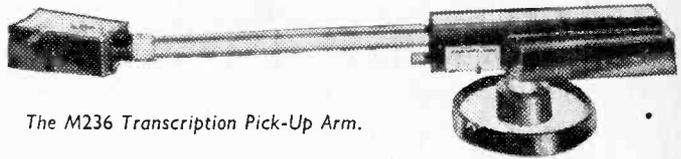
has the advantage of being completely insulated where previously it had been difficult to provide sufficient protection for the delicate mechanisms of these high precision electrical contacts.

The system of make-and-break is based on a thin S-shaped metal plate. The metal case of the breaker is protected by a neoprene cover which enables it to function in dust-laden atmospheres, in oils, water and chemicals.

They are subjected to a variety of conditions and must withstand many different atmospheres, weather, water vapour and ageing. Previously, moulded plastic materials had been used. Neoprene has now replaced them because of its superior physical properties and also because it is considered a much safer material from the point of view of its electrical insulation properties. The circuit breakers now have longer lives and require less frequent replacements as a result of the new design and the choice of neoprene for the cover material. "Minirupteur" circuit breakers are manufactured by *Société Sermec, 18 Rue Jean-Jacques Rousseau, Valence, France.*

NEW RADIO

A NEW table radio, designed for easy movement from place to place, and with a cabinet that



The M236 Transcription Pick-Up Arm.

really does blend with every room in the contemporary home, is announced by *Cossor.*

Named the *Crusader*, this new model, the CR.1201.U, provides a wide choice of tuning and high quality reception on both the long and medium bands.

Use of modern materials for the least possible weight (less than 5lb.) and the built-in ferrite rod aerial mean that it can be moved around for music in all the rooms of the home. All that is needed is for it to be plugged into the mains supply—200-250V, A.C./D.C.

The plastic cabinet is subtly toned in fallow brown, magnolia grille and red scale.

The *Crusader* retail price 12½ gns. (tax paid), is available to the public from February, 1, 1961, and is produced by *Cossor Radio and Television Ltd.*

A VHF TUNER

(Continued from page 1068)

but if instability is experienced, it will almost certainly be due to the use of an unsuitable component in this position. It will be noticed that the I.F. transformer in the anode circuit of V4 has a 47k resistor across its primary. This damps the transformer and so ensures the wide acceptance bandwidth which is necessary for high quality reception.

The second I.F. stage is arranged as a limiter. The anode and screen voltages are low so that the valve is in a saturated condition and amplitude changes at the grid are reproduced in the anode circuit only to a very limited extent. The gain of the tuner up to the grid of V5 is high and so considerable negative bias is generated across the network C28, R19 in the grid circuit; the cathode current is reduced to a very low value, thus assisting the limiting function. This stage, in conjunction with the limiting properties of the following ratio detector, provides virtually 100 per cent interference rejection.

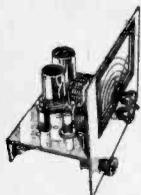
Demodulation and De-emphasis

The frequency variations of the transmission are converted to amplitude variations for subsequent reproduction as sound by the ratio detector transformer in the anode circuit of V5 and the double diode valve, V6 with its associated resistance-capacitance network. This is a conventional ratio detector circuit with the addition of the two balancing resistors R23 and R24. These should be 10 per cent or better as also should be R25 and R26, the load resistors. The audio signal is extracted from the junction of C33 and C34 and passed through the filter R22, C31 to remove the pre-emphasis of the higher frequencies which is a feature of the BBC VHF transmissions.

(To be continued)

CODAR "CLIPPER"

All Band Receiver, 10-2000 metres!



Anyone can build this amazing radio in one evening. Listen to:
 ★Amateurs, shipping, aircraft, short, medium and long wave stations throughout the world!
 ★Precision 7 x 4in. dial with two pointers, dual slow motion 8-1 and 48-1 ratios, complete with escutcheon!
 ★Bandspread on ALL bands!
 ★Air-spaced tuning and regeneration condensers!
 ★Polystyrene iron-cored plug-in Coils!

Tremendous performance with latest circuitry using Hi-gain regenerative valve detector PLUS Transistor Booster Stages! Transistor stages are completely assembled tested, in sealed cans, only 3 wires to connect! Chassis 8 x 5 1/2 in. all holes punched, ready for simple assembly with step-by-step instructions.

Uses small standard dry batteries which will last many months.

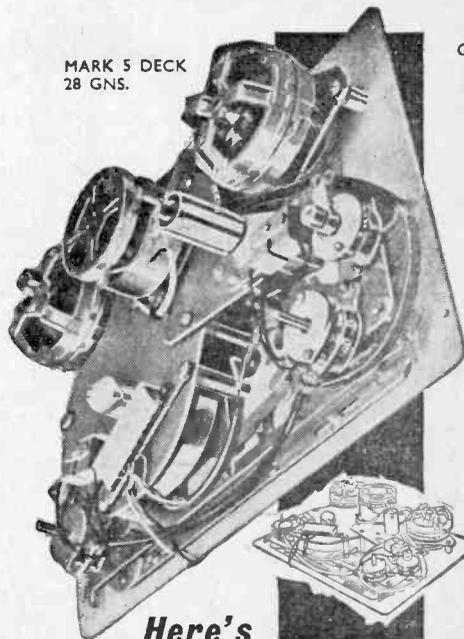
"CLIPPER" Kit, complete with all components, valve, one transistor stage, nuts, bolts, wire, 2 coils 20-60 and 55-180 metres..... 79/6, P. & P. 2/6.

Extra transistor stage can be added at any time.

"SUPER CLIPPER" Kit, complete, two transistor stages..... 88/6, P. & P. 2/-
 Optional Front Panel, 10 x 7 1/2 in., beautiful stoved Silver Hammer finish, dial aperture and holes punched, dial glass..... 6/9, P. & P. 1/6.

Send 3d. stamp for Leaflet. Further models in the "CLIPPER" All-Band Series are under development and advance details now available.

CODAR RADIO COMPANY
 Colebrook Road, SOUTHWICK, Sussex



MARK 5 DECK
 28 GNS.

GD499

Here's where you get performance!

A tape recorder is only as good as its deck. This is where precision in manufacture and assembly are vital for professional standards of recording and reproduction. In the Brenell Mark 5 deck there's a rare combination of advanced technology and an almost-forgotten kind of craftsmanship.

The Mark 5 deck has a remarkable, new main motor of a type widely regarded as the most efficient to be used in tape recording. The HYSTERESIS SYNCHRONOUS MOTOR, with a balanced outer rotor and a heavy, statically and dynamically balanced flywheel. It brings 'wow and flutter' down to below 0.1% at 7 1/2 i.p.s./ This and the other components providing the specification shown below, are assembled with fanatical care. Brenell Mark 5 production is an individual task which is repeatedly checked and tested. Nothing less than mechanical and electrical perfection will do.

At 28 gns. you'd be missing a great deal to pay less and there's no need to pay more.

ABRIDGED SPECIFICATION: 3 INDEPENDENT MOTORS - 4 RECORDING SPEEDS - FAST REWIND in either direction. 1,200ft. reel rewound in 45 seconds.

WOW AND FLUTTER	FREQUENCY RANGE
Below 0.05% at 15 i.p.s.	15 i.p.s. 50/16,000 c/s ± 3db
Below 0.1% at 7 1/2 i.p.s.	7 1/2 i.p.s. 60/12,000 c/s ± 3db
Below 0.15% at 3 3/4 i.p.s.	3 3/4 i.p.s. 60/7,000 c/s ± 3db
Below 0.25% at 1 1/4 i.p.s.	1 1/4 i.p.s. 60/4,000 c/s ± 3db

SELECTIVE FREQUENCY CORRECTION at 15, 7 1/2 and 3 3/4 i.p.s. ACCEPTS 8 1/2 in. REELS - PAUSE CONTROL DIGITAL REV. COUNTER. PROVISION FOR EXTRA HEADS

TAPE RECORDERS:

3 STAR	58 GNS.
MK.5	64 GNS.
3 STAR R/P Stereo	89 GNS.
MK.5 R/P Stereo	£98.12.0



★ 1 track available with 3 Star models
 Sole manufacturers: **BRENELL ENGINEERING CO. LTD.**
 1a DOUGHTY STREET, LONDON, W.C1. Chancery 5809 and Holborn 7356

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NEW TESTED AND GUARANTEED FOR THREE MONTHS

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1F1	8/-	6BR7	8/8	12A77	5/-	DB150	10/-	EF91	4/-	PY81	8/6
1F3	7/6	6BS7	10/6	12AX7	7/6	DK91	7/6	EF92	5/6	PY82	7/6
1FD1	8/-	6BW7	7/6	12BE7	10/6	DK92	7/6	EL41	9/6	PY83	7/6
1FD9	7/6	6BW7	7/6	12K8T11	10/6	DK98	8/-	EL84	7/-	R19	11/6
1L4	6/9	6C10	9/-	12Q7GT	7/6	DL92	7/6	EM34	7/-	TH41	15/6
1P1	8/-	8D2	4/-	16A5	9/-	DL94	7/6	EY51	7/6	U26	9/6
1P10	7/6	8P12	4/-	25A6G	8/6	DL96	8/-	EY81	10/-	U52	7/6
1P11	7/6	8EGT	2/-	25L6GT	8/6	EB91	4/-	EZ40	7/6	U76	7/6
1R5	6/-	8AT7	5/6	35Z4G	9/-	EBC41	10/-	EZ80	5/6	U78	7/-
1R5	6/-	6K7G	5/6	30C1	6/9	EBF90	8/6	EZ81	8/-	UBC41	8/6
1T4	7/6	6K8G	6/-	30L1	7/-	ECC81	9/-	K139C	11/6	UF42	9/6
1U5	6/-	9U7GT	8/6	35L6GT	9/-	ECC82	8/-	K166	11/6	UF41	8/6
324	8/-	9SL7GT	6/-	35W4	8/6	ECC83	7/6	N17	7/6	UL41	8/6
384	7/6	9SN7GT	6/-	39Z4G	8/6	ECC84	7/6	N18	8/-	UY41	8/6
3V4	7/6	6V6G	7/6	8763	7/6	ECCF80	8/6	N19	7/6	W76	9/9
5U4G	7/6	6X4	7/-	8763	7/6	ECCF82	8/6	N37	10/6	W142	8/6
5Y3GT	4/6	8X5G	5/-	80	4/-	ECCF83	8/6	PC84	6/9	X12	7/6
5Z4G	9/6	6X3GT	6/-	DAP91	7/6	ECH42	9/-	PC84	6/9	X12	7/6
6AK5	6/6	7B7	7/6	DAP96	8/-	ECH51	10/-	PCF80	6/9	X142	9/-
6AL5	4/-	7C5	7/6	DF91	7/6	ECL80	8/6	PCF82	7/-	X150	9/-
6AM6	4/-	7S7	9/6	DF96	8/-	ECL82	8/6	PCL82	7/-	Z77	4/-
6AT6	7/6	8D3	4/-	DH76	7/6	EP41	8/-	PCL84	7/-	ZD17	7/6

VOLUME CONTROLS MIDGET SIZE LONG SPINDLES, D.P. switch 4/-, Less switch, 2/6. Values 10K to 2M. B9A, B7G v. Holders 9d., Screens 9d., Contact Cooled Rectifiers 50mA, 50mA, 8/6, 80mA, 8/6.

MATCHED PAIRS

EL84 17/-, 6V6G 17/-, 6BW6 18/- per pair. Pub Pull O.P. Transformers for above 3-15Ω 14/6. P. & P. 1/6. 12in. P.M. Speakers 3Ω 24/6, Baker's "Selhurst" 12in. 13Ω 10/-, 90/-, P. & P. 2/6. 12in. Stereo Model 27.7.0

SETS OF VALVES

DK91, DF91, DAP91, DL92 or DL94..... 19/8 ECH42, EF41, EBC41, DK96, DF96, DAP96, DL96..... 27/6 EI41, EZ40..... 37/6 1C3, 1F1, 1FD1, 1P6..... 27/6 UCR42, UF41, UBC41, 1R5, 1T4, 1R5, 3S4, or 3V4..... 18/6 UL41, UY41..... 35/- Postage and packing 6d. Over £1 post free. C.O.D. 2/6.

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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.

A.C./D.C. EQUIPMENT

SIR.—With reference to Mr. H. Frank's letter in the February issue. He mentions the twisting of the heater wiring in an A.C. receiver to eliminate magnetic A.C. fields set up by the flow of the heater current. In the case of an A.C./D.C. receiver, the field is more of an electrostatic nature, owing to the smaller current but higher voltage present in the wiring. If the grid circuits, etc. of the set are properly screened, this electrostatic radiation should prove much less troublesome than the magnetic fields associated with A.C.-only sets.—**H. E. OWENS** (London N8).

TRANSISTOR USE

SIR.—We are often told that reversing the bias voltages to a transistor invariably results in its destruction. Could any reader explain why this is so? It implies a difference between the emitter/base and collector/base junctions.

There does not appear to be such a difference, and the transistor seems to be a symmetrical device in which operation depends upon the direction of the biasing voltages, e.g. the emitter/base junction is biased in the forward direction, thus the input circuit appears to have a low resistance, while the base/collector junction is biased in the reverse direction, the output appearing as a high resistance. (This is the grounded emitter circuit.)

Why could not the junction transistor work in the opposite direction merely by reversing the connections to collector and emitter; the collector thus becoming the emitter and vice versa?—**G. MAY** (Manchester).

VHF POPULARITY

SIR.—With reference to your Editorial (January 1961), may I submit that one of the reasons why VHF is not very popular with the general public is simply because there are very few reputed firms who make a complete (VHF only) quality A.C. receiver.

VHF units are available, but without an amplifier becomes just another accessory to be wired into an existing A.M. receiver, with consequent waste of power and life of the A.M. valves not used.

I suggest that a standard VHF/FM receiver should be designed by BBC engineers, specifications of which to be available to all manufacturers.

The description of the receiver might well be "The BBC, FM Quality, Silent background, A.C.

Receiver", then, I think, popularity in the use of VHF would soon increase. — **E. E. GOLDSMITH** (Strood).

LUXEMBOURG RECEPTION IN HALIFAX

SIR.—I am positively infuriated by some of your writers who live in London and the southern regions of England. Many of them never seem to think of anywhere else in the whole of the British Isles. I have noticed in past issues of **PRACTICAL WIRELESS** many writers who assure us that their receiver, using only one-and-a-half transistors will pick-up Radio Luxembourg loud and clear provided you follow their instructions on how to build it. Let me tell you of my experiences with Luxembourg in Halifax, Yorkshire.

Having just completed building a tape recorder I decided to try my hand at making a radio tuner to get Luxembourg on to tape. Since I have yet to hear a mains superhet that gives good quality reproduction I decided to build a battery set. After many experiments I finally finished up with a set employing one R.F. stage, a double triode frequency changer, two I.F. valves, a diode detector and one stage of A.F. amplification. I found this set would "drag" Luxembourg in under any conditions.

Unfortunately I also found that when Luxembourg faded out completely on a normal mains receiver (as it often does), my battery set still received it, but horribly distorted.

In my locality it would seem impossible to receive Luxembourg loud, clear and free from distortion and fading.

Perhaps it would be a good idea if radio designers would try their sets in different localities and under different conditions. If they then published a test report along with their designs, we constructors would know whether a particular circuit was worth trying. — **A. S. FIELDING** (Halifax).

COPIES OF "P.W." WANTED

SIR.—I would be obliged to any reader who could lend or sell to me the copies of **PRACTICAL WIRELESS** containing details of the "3½in. Oscilloscope", published in 1956. The complete series, all but the first, is required.—**J. WILLIAM** (Wigan, Lancashire).

STEREOPHONIC BROADCASTING

SIR.—I do not claim to understand all the problems concerning stereophonic broadcasting, but it seems to me that the main problem is that of providing a compatible system. I know that such systems have been suggested, but it has occurred to me that if stereophonic broadcasting were only done on VHF and that all modulation

above the carrier frequency were to correspond to, say, the left-hand channel, and all modulation below the carrier frequency were to correspond to the other channel, a perfectly compatible system would result. I would like to hear from readers concerning this point. All letters and tapes (recorded at 7½ in.) will be answered.—R. PATON (183 Bampton Road, Carlisle, Cumberland).

MODULATION

SIR,—With reference to J. R. Miller's letter (PRACTICAL WIRELESS, January 1961), modulating in the low power stages is all very well, provided linear amplification is used after the modulated stage (i.e. not Class "C" as is normally found in higher power transmitters). There is however, a serious disadvantage in using this type of modulation in a normal A.M. transmitter—more stages of amplification are required for a given output. The "snag" that Mr. Miller has been unable to see is that we can afford quite considerable distortion of the R.F. carrier, since the fly-wheel effect of the tuned circuit restores the waveform's shape, therefore Class "C" can be used and greater efficiency results. But a modulated carrier (A.M.) cannot be amplified by a Class "C"

amplifier without serious distortion resulting.—Cpl. NORRIE (Malaya).

CONVERTING TO MAINS

SIR.—Some time ago I purchased a R.109 short-wave receiver and for a few weeks I used it on a 6V battery supply, but this meant having to charge the battery every so often.

So I had the idea of running the receiver from the mains, and how I did this I think would be of some use to readers who have purchased one of these sets.

First I shorted all the filament resistors, and as the valves have two volt filaments this meant that the set now required a two volt low tension supply, instead of the original 6V.

Secondly I removed the vibrator power-pack and in its place I substituted another power-pack which supplied 120V H.T. and 2V L.T. This unit can be obtained from one of the advertisers in this magazine.

Connections for this unit to the receiver are as follows: H.T.+tag 1 or 4, H.T.—tag 5, L.T.+tag 6, and L.T.—to chassis.

The set should now function without the use of batteries.—F. SKINNER (Bromley).

A VERSATILE TAPE RECORDER

(Continued from page 1076)

Below is given the components list for this tape-recorder; more constructional information will be given next month.

COMPONENTS LIST

Resistors:

All resistors $\frac{1}{2}$ W unless stated otherwise. All $\frac{1}{2}$ W resistors are high stability.

R1—2.2M.	R13—2.2k.
R2—2.2k.	R14—220k.
R3—220k.	R15—1M.
R4—1M.	R16—22k.
R5—47k.	R17—470k.
R6—100k.	R18—10k.
R7—470k.	R19—100k.
R8—470k.	R20—10Ω 1W.
R9—1M Log-Law Pot.	R21—47k.
R10—15k.	R22—250Ω 5W w.w.
R11—500k Log-Law Pot.	R23—150k.
R12—22k.	R24—10k.
	R25—250Ω 5W w.w.
	R26—47Ω 1W.
	R27—220Ω 5W w.w.
	R28—10Ω 1W.
	R29—
	R30—} See Text.

Capacitors:

All capacitors above 0.1μF are electrolytic. All 0.1μF capacitors are of high quality, paper tubular. All silver mica are 10 per cent tolerance.

C1—50μF 25VW wire ends.
C2—8μF 350VW wire ends.
C3—0.1μF 350VW paper.
C4—0.1μF 350VW paper.
C5—0.006μF silver mica.
C6—50pF silver mica.
C7—50pF silver mica.
C8—10pF silver mica.
C9—8μF 350VW wire ends.
C10—0.1μF 350VW paper.
C11—0.1μF 350VW paper.

C12—50μF 25VW wire ends.
C13—0.001μF silver mica.
C14—0.1μF 350VW paper.
C15—0.01μF silver mica.
C16—0.001μF silver mica.
C17—100pF silver mica.
C18—0.01μF silver mica.
C19—8μF 350VW wire ends.
C20—
C21—} 32+23μF (500VW) can type.
C22—500μF 6VW wire ends.

Mains Transformer:
Primary 0, 110, 220, 250. Secondaries 250-0-250 V at 100mA, 6.3V at 5A, 5V at 3A.
Choke L2, 10H at 100mA.
Loudspeaker: High Flux, permanent magnet 8in. x 5in.
Oscillator Coil L1. Denco T.D.O.I.
Aluminium Chassis 8in. x 4in. x 2½in. and 7in. x 3½in. x 1in.
Four B9A valve holders, two with screens.
3-pole 3-way switch, two banks.
Two potentiometers. Log-Law M and 500k.
Two panel mounting Neon lamps.
Double-pole double-throw toggle switch.
Double-pole single-throw toggle switch.
Single-pole single-throw toggle switch.
Meter, moving coil (see text).
Open Jack socket (Bulgin).
Mains socket 3-pin (Bulgin).
Four Coaxial sockets, with plugs.
Output Transformer. Elstone MR/JT.
Valves: V1—EF86 V3—EL84, V4—5Z4G.
Grommets, nuts, bolts, solder tags, wire, etc.
Tape Deck. Motek K10 (or K9).

(To be continued)

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Frost Warning Thermostats. Low volts, 9d., post 6d.

VW Resistors. 75K, 50W, 6d., post 9d. 3K, 50W, 6d., post 9d. 21 ohm, 3d., post 9d.

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Meter Rectifiers. 1 ma, 5/-, post 6d.

IFT 40 mc. Lechers 450 mc, 2 x 0.8 mfd., 400 v., 1 mfd., 600 v., all at 3d. ea. post extra.

Block Condensers. 10 mfd., 250 v., 1/6, post 1/6.

Midget Soldering Irons. 8 v. require 1 1/2 amps (from mains transformer—not supplied). New. 11/9, post free.

Resistors. 50 ohm, 1W, 1K 1W, 2.2M, 1/8 doz.

Ceramic Condensers. 3.4 pF, 18, 33, 62, 180 pF. New. 1/8 doz, post extra.

TA.12.G. Transmitters. 25 ea., carr. 10/-.

BC 624 Recv. or BC 625. Trans. 32/6, carr 5/-.

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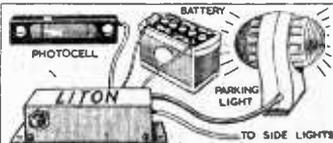
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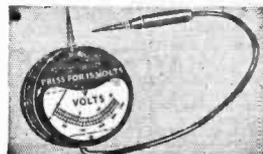
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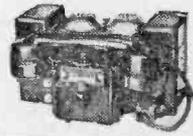
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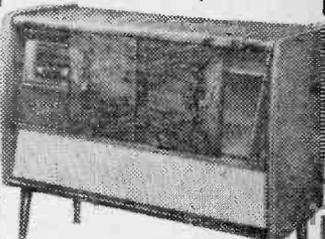
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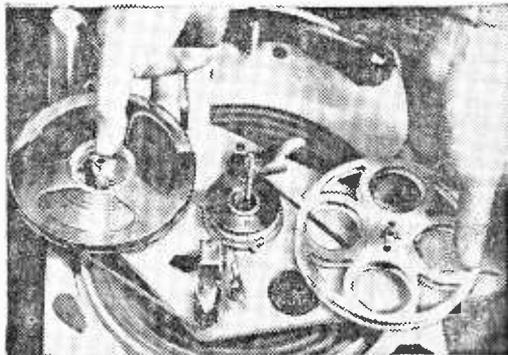
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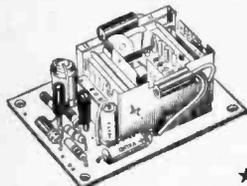
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460 kc/s I.F. Amplifier, 2-OC169 Transistors. Double tuned I.F.T.'s. Diode Detector, A.V.C., etc. Printed Circuit, size 3½ x 1½ x 1in. PRE-ALIGNED AND TESTED. 92/6. P. & P. 1/-.

UNIT 3 (ILLUSTRATED).

4 Transistors, 1 watt Audio Amplifier, 60-1600 c/s ± 3dB. 5mV input for 1 watt. 2-OC71, 2-OC74 Transistors. Printed Circuit size 3 x 2.2 x 1.2in. 92/6. P. & P. 1/-.

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8 x ½in. M.L.S. Ferrite Aerial and Coils. 12/6.
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RANGER-2

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(where normally receivable)

- ★ Full Station Separation
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Practical Wireless

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SERVICE

ALL OF these blueprints are drawn full-size and although the issues containing descriptions of these sets are now out of print, an asterisk in the list below denotes that constructional details are available free with the blueprint.

The index letters which precede the Blueprint Number indicate the periodical in which the description 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.

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Junior Crystal Set	PW94*	2/-
Dual-wave Crystal Diode	PW95*	2/6

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MISCELLANEOUS		
The PW 3-speed Autogram	—*	8/-
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The PT band III converter	—*	1/6

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6 TRANSISTOR MEDIUM AND
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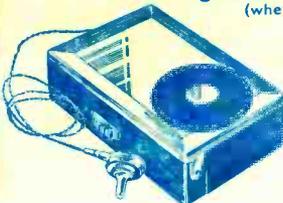
● Size 10 x 7½ x 3½ in. Weight 4½ lb.



RANGER-3

FULL TUNING OF MEDIUM WAVEBAND AND AMATEUR TOP BAND (120 metres to 500 metres)

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(Over 1 watt peak output)

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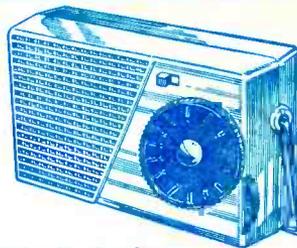
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