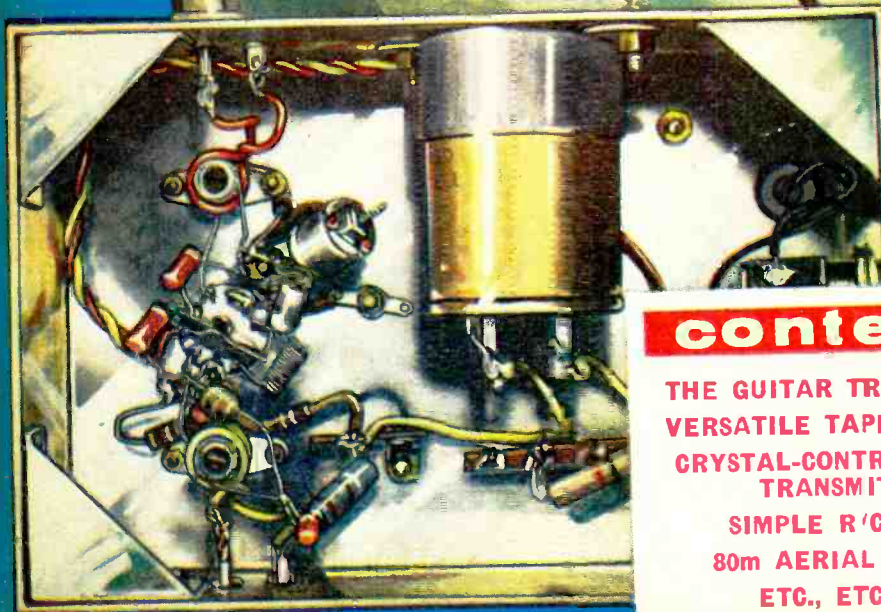
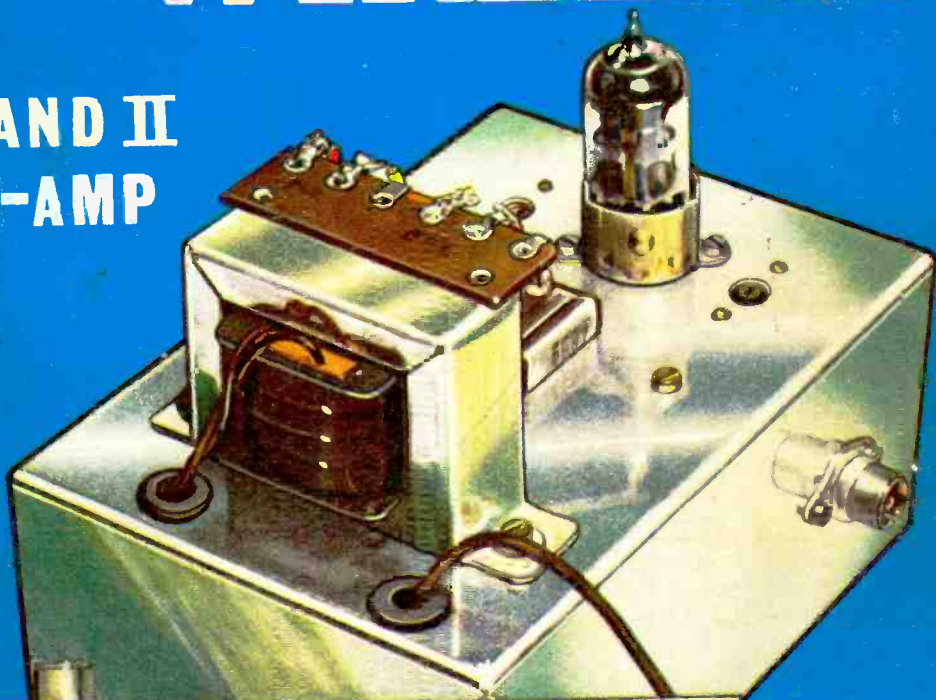


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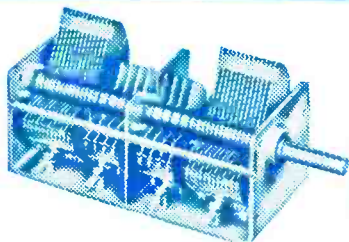
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6A7	18/6	6M2	10/6	12SQ7	11/6	328	7/6	DL96	9/6	EL81	14/9	KTW62	7/6	SD6	8/6	UL84	9/6
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6BE6	7/6	6X4	5/-	20P3	23/-	ACVPI	17/6	ECC33	5/-	FC2	21/-	N19	8/-	U25	14/-	X61M	21/6
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6C4	6/6	7H7	8/-	30	13/6	B36	21/-	ECCB5	9/6	GZ34	13/6	N309	11/6	O50	8/6	Z63	7/6
6C5GT	8/-	7K7	10/6	30C1	12/6	B65	8/6	ECC91	5/6	H30	5/6	N329	10/-	U52	7/6	Z66	19/6
6C6	6/6	7Q7	11/6	30F5	11/6	B152	8/6	ECF80	12/6	H63	9/6	N727	7/6	U76	7/6	Z77	4/9
6C9	12/6	7R7	12/-	30FL1	10/6	B309	9/6	ECF82	12/6	HBC90	9/6	N729	8/-	U78	7/6	Z152	8/6
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6D1	8/-	8D3	4/-	30P12	11/6	B719	9/6	ECH81	9/-		10/-	PCC89	10/-	U147	7/-		
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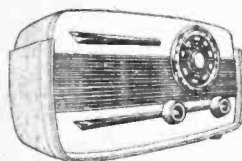
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A few only—Transistor record player cases in light grey cloth—complete with motor board. Size: 12 x 8 x 6 in. 18/6 each. P. & P. 1/9.

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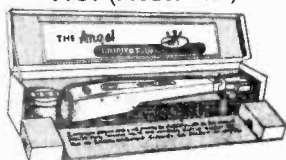
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HARVERSONS SUPER STEREO KIT

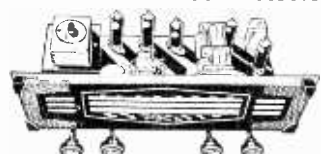
The product of a renowned maker, this stereo amplifier is composed of "ready-built" units, only requiring interconnection. This system has the advantage of being adaptable to fit any cabinet. Each unit is made from first-grade components, and valves used (ECL82, EZ80 range) are genuine Mullard. The comprehensive 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 3-7 Ω speakers, and have remote bass, treble and volume controls. Size 5" x 2½" x 3" high (each amplifier).

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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, EBC81, 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 3½" high.)

ISOLATED MAINS TRANSFORMER of robust construction may be mounted independently.

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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.

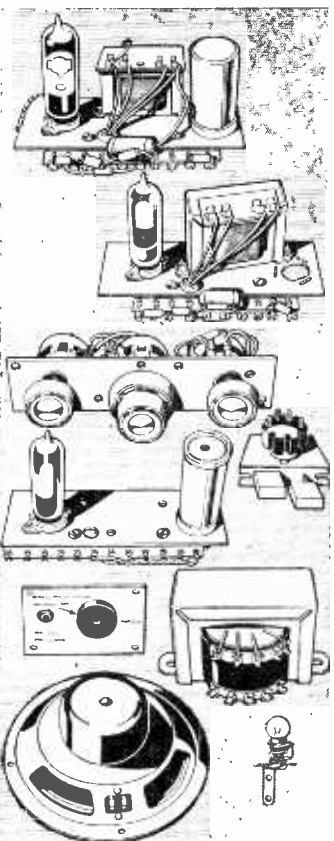
59/6

PLUS 6/6 POST & PACKING

B.S.R. UA12

STEREO CHANGER

The ideal changer to suit this amplifier
few only £9, carr. 5/-



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

ACHLDD	EB131	22/-	EL81	15/6	KTW61	6/-	PEN46	6/6	UCB41	8/6	W21	11/9	5H4GY	9/-	6F13	13/-	6U5GG5	12/6	8/8	30L14	18/6
AC/P	7/3	ECU31	7/-	EL84	8/6	KTW63	7/-	PEN38322	10/6	W76	11/9	31 4G	8/6	6F15	13/-	6U5GG5	12/6	8/8	30L14	18/6	
AC/P4	7/-	ECU82	7/-	EM84	8/6	KTZ41	3/6	PEN220A	10/6	W77	11/9	31 4G	8/6	6F17	11/9	6U5GG5	12/6	8/8	30L14	18/6	
AC/PEN	6/-	ECU85	8/6	EM81	8/6	ML4	8/6	PEN45D1	10/6	W79	11/9	31 4G	8/6	6F17	11/9	6U5GG5	12/6	8/8	30L14	18/6	
DD	25/9	ECU84	9/6	EY51	9/6	MM4B	16/-	25/-	10/6	W22	11/9	31 4G	8/6	6F17	11/9	6U5GG5	12/6	8/8	30L14	18/6	
AC/PEN	6/-	ECU85	8/6	EY56	9/6	MM4B	16/-	25/-	10/6	W22	11/9	31 4G	8/6	6F17	11/9	6U5GG5	12/6	8/8	30L14	18/6	
AC/P1/39/3	ECU80	11/3	EZ40	6/6	MM4P45	7/-	PM21	7/6	UCL82	15/6	Y63	8/6	647	10/6	647G	4/6	647	10/6	647G	4/6	
ATP4	3/3	ECU82	12/3	EZ41	7/-	MV8/PEN	UP21	4/6	UCL83	11/6	Y21	8/6	647	10/6	647G	4/6	647	10/6	647G	4/6	
AZ1	9/3	ECU81	22/-	EZ80	6/6	MX40	9/3	R16	25/-	UP41	8/6	U239	7/-	647G	4/6	647	10/6	647G	4/6		
AZ11	11/2	ECU82	22/-	EZ81	6/6	N37	18/6	AP41	2/9	UP59	8/6	U33	7/-	647G	4/6	647	10/6	647G	4/6		
B36	14/-	ECU81	8/6	EZ80	6/6	N37	18/6	AP41	2/9	UP59	8/6	U33	7/-	647G	4/6	647	10/6	647G	4/6		
CB131	22/9	ECU80	11/3	EZ40	6/6	N37	18/6	AP41	2/9	UP59	8/6	U33	7/-	647G	4/6	647	10/6	647G	4/6		
CUH35	22/9	ECU82	12/3	EZ41	7/-	N37	18/6	AP41	2/9	UP59	8/6	U33	7/-	647G	4/6	647	10/6	647G	4/6		
CU4	11/9	ECU82	12/3	EZ41	7/-	N37	18/6	AP41	2/9	UP59	8/6	U33	7/-	647G	4/6	647	10/6	647G	4/6		
CU4	11/9	ECU82	12/3	EZ41	7/-	N37	18/6	AP41	2/9	UP59	8/6	U33	7/-	647G	4/6	647	10/6	647G	4/6		
CU4	11/9	ECU82	12/3	EZ41	7/-	N37	18/6	AP41	2/9	UP59	8/6	U33	7/-	647G	4/6	647	10/6	647G	4/6		
CU4	11/9	ECU82	12/3	EZ41	7/-	N37	18/6	AP41	2/9	UP59	8/6	U33	7/-	647G	4/6	647	10/6	647G	4/6		
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CU4	11/9	ECU82	12/3	EZ41</																	

Brand new, individually checked and guaranteed VALVES

AC/DD 2/6	DL71 8/-	EL41 8/3	PCC84 7/-	U27 8/-	4D1 2/6	6R7G 6/-	21B6 9/-	1619 5/-
AC/P 4/6	DL72 7/6	EL42 9/-	PCC85 8/-	U52 5/-	5U4G 5/-	6R7GT 8/-	30 5/-	1625 6/-
AC/PI 2/6	DL92 6/-	EL84 7/6	PCF80 7/-	UL41 7/-	5Y3GT 6/-	6S47 6/-	35T 30/-	1626 4/6
ACSPEND/DL 9/6	DL96 6/-	EL85 10/-	PCF82 8/-	UL84 7/6	5Z3 8/6	6S47G 5/6	35Z4 5/-	1629 4/6
AC6/PEN5/-	DX25 9/-	EL91 7/6	PC182 8/6	UL85 7/6	5Z4G 8/-	6S67GT 6/-	35Z4GT 7/-	412J 4/-
AC/PEN5/-	DX25 9/-	ESU208 8/-	PEN45 4/6	UL85 7/6	5Z4G 8/-	6S67GT 6/-	35Z4GT 7/-	7193 1/19
AC/SP3 4/6	E1232 5/6	EY51 8/-	PEN46 5/-	V226 5/-	6A6 5/-	6S67GT 6/-	35Z4GT 7/-	6475 5/-
AL60 6/-	E1323 25/-	EY86 8/-	PEN65 6/6	V248A 8/-	6A87 4/-	6S67GT 6/-	35Z4GT 7/-	8010AR 22/6
AP4 4/-	E1524 6/6	EY91 3/6	PEN220A 3/-	V2D33B 8/-	6A87 4/-	6S67GT 6/-	35Z4GT 7/-	8013A 10/-
AR8 5/-	EA50 1/6	EZ40 7/-	PENDD/ 7/6	VMP4G 6/-	6A87 4/-	6S67GT 6/-	35Z4GT 7/-	8020 6/-
ARDD5 2/-	EAC91 4/6	EZ80 6/6	PL81 7/6	VP23 3/6	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	9001 4/6
AR3 3/-	EB34 1/6	FW4/500 6/6	PL82 8/-	VR78 4/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	9003 5/6
AR4 3/6	EB91 3/9	GZ32 9/-	PL83 7/9	VR99 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	9004 4/-
AR12 2/6	ECB33 5/-	H30 5/-	PM24A 4/-	VR105/30 7/6	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
AR24 3/6	ECB91 4/6	H63 3/6	PT25H 7/6	VR150/30 7/3	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
AR21 5/6	EC52 3/-	HL2K 3/6	PM4DX 3/-	VS110 4/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
AR34 4/6	EC32 4/-	HL23 6/-	PX4 19/-	VT25 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
ARTH2 7/1	EC881 5/6	KBC32 5/-	PY81 7/-	VU39 6/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
ATP4 2/9	EC882 6/6	KF35 5/-	PY82 8/-	VU111 3/3	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
ATP7 5/6	EC883 7/1	KT2 4/-	Q21 6/-	VU120 3/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
AU1 5/-	EC884 7/1	KT31 8/-	Q25 5/3	VU133A 3/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
AU4 5/-	EC885 7/9	KT32 8/-	Q25 5/3	W21 4 pin 7/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
AW3 4/-	EC886 7/1	KT33 8/-	Q25 5/3	W31 7/1	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
AZ 8/-	EC887 8/-	KT44 6/3	Q25 5/3	Y63 7/1	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
BL63 6/-	EF22 7/3	KT63 6/-	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
BT45 40/-	EF32 5/-	KT66 11/-	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
BT9B 40/-	EF36 3/6	KT241 1/-	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
CY31 11/6	EF37A 8/-	KTW62 7/6	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
D41 3/3	EF39 4/3	KTW63 6/6	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
D42 4/-	EF50 2/6	L30 4/6	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
D77 4/3	EF52 5/-	LP2 3/6	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
DA30 12/6	EF54 3/3	MH4 3/6	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
DAF86 8/-	EF55 6/-	MHL4 3/9	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
DAF91 6/-	EF70 4/-	ML4 4/-	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
DET5 15/-	EF80 5/6	ML6 6/-	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
DET19 2/6	EF85 6/10	MPT42 5/3	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
DET20 2/6	EF86 9/-	MS/PEN 6/-	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
DF70 9/-	EF89 7/9	N34 8/-	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
DF72 7/6	EF91 3/6	NR15A 3/-	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
DF91 3/3	EF92 4/6	NT37 8/-	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
DF96 8/-	EF95 7/6	(4033A) 10/-	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
DH76 4/9	EL32 3/9	OD3 5/-	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
DK96 8/-	EL33 8/-	PS 4/-	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	
DL36 10/6	EL35 8/3	PG1 2/3	Q25 5/3	Y66 8/-	6A17 4/3	6S67GT 6/-	35Z4GT 7/-	

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 to 30 Mc/s. in very good condition. £25. Carriage 30/-.

Cossor Double Beam Oscilloscope 339A. Fully tested and working £15. Carr. 10/-.

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.

Lw 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 Henries 0.600A D.C. 25 ohms D.C. resistance 18,000 v. R.M.S. 60 cycle test, £1.12.6. P. & P. 6/-.

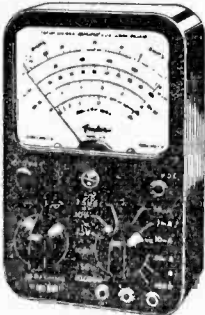
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Carbon Inset Microphone, G.P.O. Type 2/6. P. & P. 1/-.

NEW PRODUCT OF TAYLOR

Model 127A
Pocket size meter. Sensitivity 2.0, 0.0 0.0 o.p.v. D.C. 1,000 o.p.v. A.C. 2.0 ranges. D.C. current 50A to 1 amp. D.C. volts 0.3 v. — 1,000 v. (25 kv by probe). A.C. volts 1.0 v. — 1,000 v. 3 resistance ranges from 0.20 megohms (self contained). Meter 40x1A 3 1/2 in. arc. Accuracy D.C. 3% A.C. 4%, ohms 5%. Dimensions 5 1/2 in. x 3 1/2 in. x 1 1/2 in. weight 14 ozs. Price £10 complete with instruction manual, test plots and clips. Leather case £11.2.0 extra.



Variometers for W/S No. 19. Fully tested and working 12/6. P. & P. 2/6.

Filament Transformers. Primary 0-190-210-230-250 v. 50 C. Sec. 1.25 v. C.T. at 10 amps. 2.25 v. C.T. at 10 amps; 3.10 v. C.T. at 11 amps., 4,000 v. insulation. Price £2.19.0. P. & P. 5/-.

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

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 £11.6.0. P. & P. 5/-.

Primary 230 v. 50/60 c. 67 v. amp. Sec. 1.63 v. 1-6 amps.; 2.63 v. C.T. 3 amps.; 3.63 v. C.T. 3 amps.; 4.63 v. C.T. 3 amps. £11.2.0. P. & P. 5/-.

Ferranti Transformer. Oil cooled, 20/19.5 K.V.A., 3 phase, 50 cycles. Primary 360/380/400/420/440 v. Secondary 2,700/2,900/3,100/3,300/3,500 v., 2.1 amp. Voltage regulation by simple switches on primary and secondary. Weight 1.150 lbs. Price £125.0.0. Carriage at cost.

Driver Transformers. Primary 500 ohms imp. Sec. to match two 805 in push-pull. £17.6.0. P. & P. 5/-.

Insulation Test Meter. Testing voltage adjustable up to 6,000 v. D.C. Mains supply 180/250 v. in wooden case £25. Carriage 10/-.

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/-.

Moving Coil Round Hand Microphone No. 13. 2 1/2 in. dia. with press switch, 12/6. P. & P. 1/-.

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.

Output Transformer in screening can give 9 different ratios 10:1 up to 120:1 for battery receivers or any high resistance pentodes used as output valves, 6/6. P. & P. 1/6.

Cathode Ray Tubes

3BP1 25/-

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217C 17/6

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872A 35/-

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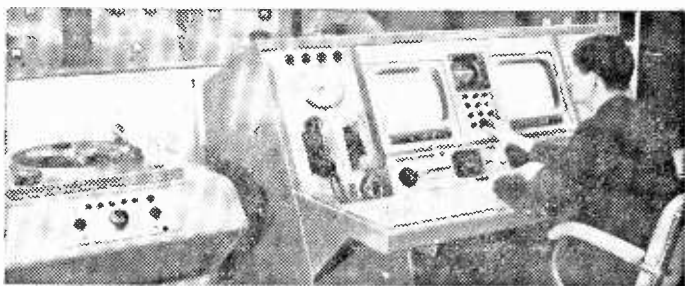
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R.S.C. HI-FI TAPE RECORDER KIT

REALISM AT INCREDIBLY LOW COST. CAN BE ASSEMBLED IN HALF AN HOUR
The Recorder incorporates the Latest Collaro Audio Tape Transcriber. The Linear LT45X High Quality Tape Amplifier listed £12.12.0 High Flux P.M. Speaker listed 30/-, empty Tape Spool, a Reel of Best Quality Tape listed 22/6, and a Handsome Portable carrying Cabinet with latest attractive two-tone polychrome finish, size 18 x 13 x 9 in. high, listed £4.10.0 and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£90 class. S.A.E. for leaflet.

HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

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

Two input sockets with associated controls allow mixing of "mike" and gram, as in A10. High sensitivity includes 6 valves ECC83, ECC83 EL84, EL84, 5Y3. High quality sectionally wound output transformer specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. **INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut"**. Frequency response ± 3 D.B. 30-30,000 c/s. Six negative feedback loops. Hum level 60 D.B. down. **ONLY 23 millivolts INPUT required for FULL OUTPUT**. Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs. For **STANDARD** or **LONG PLAYING RECORDS**. For **MUSICAL INSTRUMENTS** such as **STRING BASS, GUITARS, etc.** **OUTPUT SOCKET** with plug provides 300 v. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT**. Size approx. 12-9-7 in. For A.C. mains 200-250 v. 50 c.p.s. Output for 3 and 15 ohms speakers. Kit is complete to last nut. Chassis if fully punched. Full instructions and point-to-point wiring diagrams supplied. **Only 8 Gns.** Carr. 10/-

If required louvered metal cover with 3 carrying handles can be supplied, or 18/8. **TERMS ON ASSEMBLED UNITS. DEPOSIT 24/6**, and 9 monthly payments of 24/3. Send S.A.E. for detailed leaflet detailing Ready-to-assemble Cabinets, Speakers, Microphones, etc., with cash and credit terms.

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

A complete set of parts for the construction of a stereophonic amplifier giving 5 watts high quality output on each channel (total 10 watts). Sensitivity is 50 millivolts, suitable for all crystal stereo heads. Ganged Bass and Treble Controls give equal variation of "left" and "right". Provision is made for use as straight (monaural) 10 watt amplifier. Valve line-up ECC83, ECC83, EL84, EL84, E281. Outputs for 2-3 ohm speakers. Point-to-point wiring diagrams and instructions supplied. Send S.A.E. for leaflet. Full constructional details and price list 2/6. **DEAF AID EARPIECES**, High Impedance complete with lead, 15/6. **MICROPHONE INSERTS**, Crystal type, 6/9.

8 Gns.

Carr. 10/-

R.S.C. BATTERY CHARGING EQUIPMENT

ASSEMBLED CHARGERS

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

HEAVY DUTY CHARGER KIT

6 1/2 v. 6 amps variable output. Consisting of Mains Transformer 0-200-230-250 v., F.W. (Bridge) Selenium Rectifier, Ammeter, Multi-Position Switch with Knob, Panels, Plugs, Fuses, Fuseholder and circuit. 59/9, Carr. 4/6.



Assembled 6 v. or 12 v. 4 amps.

Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvered steel case with anodized blue main finished. Fused, and ready for use with Carr. 5/- mains and output leads. Terms Deposit 18/3 and 5 monthly payments 13/3.

ASSEMBLED CHARGER

6 v. or 12 v. 2 amps.

Fitted Ammeter and selector plug for 6 v. or 12 v. Louvered metal case finished attractive hammer blue. Ready for use with mains and output leads. Double Fused. **Only 49/9** Carr. 3/6.

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

BATTERY CHARGER KITS

Consisting of Mains Transformer, F.W. Bridge, Metal Rectifier, well ventilated steel case, Fuses, Fuse-holders, Gronometers, panels and circuit. Carr. 3/6 extra.

6 v. or 12 v. 1 amp.	24/9
As above with Ammeter.	32/9
6 v. 2 amps.	25/9
6 v. or 12 v. 2 amps.	31/6
6 v. or 12 v. 2 amps. inclusive of Ammeter.	42/9
6 v. or 12 v. 4 amp.	53/9
6 v. or 12 v. 4 amps. with Ammeter and variable charge rate selector.	59/9

CHARGER AMMETERS.
0-1.5 a. 0-3 a. 0-4 a. 0-7 a. 0-25 a. 0-80 a. 8/9.

R.S.C. MAINS TRANSFORMERS

Interleaved and Impregnated. Primaries 200-230-250 v. 50 c/s. Screened **TOP SHROUDED DROP THROUGH**

250-0-250 v. 70 mA. 6.3 v. 2 a. 5 v. 2 a.	17/9
350-0-350 v. 60 mA. 6.3 v. 2 a. 5 v. 2 a.	17/9
250-0-250 v. 100 mA. 6.3 v. 2 a. 5 v. 2 a.	19/6
250-0-250 v. 100 mA. 6.3 v. 3.5 a. C.T.	19/9
250-0-250 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.	25/9
300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.	25/9
350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.	25/9
350-0-350 v. 100 mA. 6.3 v. 4 v. 4 a. C.T.	25/9
0-4-5 v. 3 a.	25/9
350-0-350 v. 150 mA. 6.3 v. 4 a. 5 v. 3 a.	29/9

FULLY SHROUDED UPRIGHT

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Midrect type 21-31 in.	17/11
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300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.	26/9
350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.	26/9
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For Mullard 5U4 Amplifier	35/9
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6.3 v. 4 a. C.T. 5 v. 3 a.	49/9

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

OUTPUT TRANSFORMERS

Midrect Battery Pentode 6B1 for 354, etc. 3/9

Small Pentode 5000 Ω to 30 Ω	3/9
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Push-Pull for Mullard 5U4 Ultra Linear	29/9
Push-Pull 20 watts sectionally wound 6L6, KT96 etc. to 3 to 15 Ω	47/9

We can quote for special types singly or in any quantity.

FILAMENT TRANSFORMERS

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

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Push-Pull 10-12 watts 6V6 to 30 Ω or 15 Ω	18/9
Push-Pull 10-12 watts to match 6V6 to 3.5- Ω or 15 Ω	19/9
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Primaries 200-250 v. 50 c/s.

120 v. 40 mA. 5-0-5 v. 1 a.	15/9
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150 mA. 7-10 Ω 250 ohms	11/9
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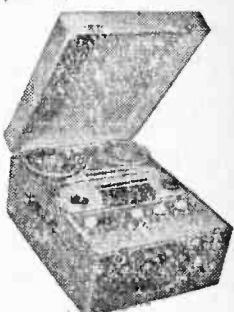
All with 200-230-250 v. 50 c/s Primaries; 0-9-15 v. 1 a. 11/-; 0-9-15 v. 2 a. 14/9; 0-9-15 v. 3 a. 16/9; 0-9-15 v. 5 a. 19/6; 0-9-15 v. 6 a. 23/9; 0-9-15 v. 8 a. 25/9.

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0-10-12-20-250 v. 50-80 watts 13/9; 0-110-120-200-230/250 v. 150 watts 27/9.

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



25 1/2 GNS.

Carr. 17/6

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

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

RECURRENT SPEAKERS. Tannoy 3 watt. 7.5 ohms. Only 22/6 each. Parmeko Horn Type. 10 watt. 15 and 200 ohm matching. 50/6. R.C.A. 20 watt. 15 ohms or 200 ohms. 8 c/s.

COLLARO RC 457 4 SPEED MINER AUTO-CHANGERS. Turnover Stud 9. Pick-up head, for 200-250 v. A.C. £7.19.6. Carr. 4/6.

THE SKYFOUR T.R.F. RECEIVER. A design of a 3-valve Long and Medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.F. stage and low distortion detector. Power pentode output. Valve line-up 6KT, SP61, 6V6G. Selectivity and quality excellent. Simple to construct. Point-to-Point wiring diagrams. Instructions and parts list. 1/9. maximum building costs £4.19.6. inc. attractive Walnut veneered wood cabinet 12 x 6 1/2 x 5 1/2 in.

D.C. SUPPLY KIT. 12 v. 1 a. consisting of a partially drilled metal case, mains trans. P.W. Bridge Rectifier, 2 fuseholders and fuses. Change Direction switch, variable Speed regulator and circuit. For 200-250 v. A.C. mains. Suitable for Electric Trains. Limited number available at 33/9.

R.S.C. A12 STEREOGRAPHIC AMPLIFIER KIT

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

STEREO EQUIPMENT OFFER.
Comprising A12 Kit, 2 matched 8in. L/ Speakers, and Acos TJO Stereo head with sapphire stylus suitable most pick-ups. **£6.19.6** Carr. 7/7

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

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 807 output valves. All components are chosen for reliability. Six valves are used EF96, EF86, ECC83, 807, 807, GZ33. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 millivolts so that ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE. The unit is designed for CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS, etc. For use with Electronic ORGAN, GUITAR, STRING BASS, etc. For standard or long-playing records. OUTPUT SOCKET PROVIDES L.T. and H.T. for a RADIO FEEDER UNIT. An extra input with associated vol. control is provided so that two separate inputs such as Gram, and 'Mike' can be mixed. Amplifier operates on 200-250 v. 50 c/s. 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. It 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.

11 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 11 1/2 x 2 1/2 in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s is available. Suitable for all battery portable receivers requiring 1.4 v. and 90 v. This includes latest low consumption types.

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

**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 A3 amplifier. Complete Kit with diagrams. £23.15.0. Carr. 3/6.

R.S.C. BRADFORD, MANCHESTER and LEEDS

4 Gns.

LINEAR L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER. Suitable for use with any record playing unit, and most microphones. Negative feedback 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 3/4 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.



Mains input of 200-230-250 v. 50 c/s.

Alto, Kit is complete in every detail and includes fully punched chassis (with baseplate) with Blue hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £24.15.0, 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 8in. Loudspeaker 'built-in'. Handsome, strongly made Cabinet (size approx. 14 x 14 x 7 in.) finished in satin walnut, and fitted carrying handle. H.P. Terms. Deposit £1 and 9 monthly payments of £1.

£8.19.6

Carr. 7/6

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 m. elliptical for Treble. Cabinet is well made and finished satin walnut. Size approx. 18 x 18 x 18 in. H.P. Terms. Deposit 34/9 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. 31or 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 8 monthly payments of 11/3.

12in. 20 WATT HIGH QUALITY LOUD-SPEAKERS IN CABINETS. Size 18 x 18 x 18 in. Finish as above. Terms: Deposit 17/9 and 9 monthly payments of 17/9. Only £27.19.6. Carr. 8/6.

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

A highly sensitive 4-valve quality amplifier for the home, small club use. Only 30 millivolts input is required for full output so that it is suitable for use with the latest high fidelity pick-up heads, in addition to all other types of pick-ups and practically all 'mikes'. Separate Bass and Treble Controls are provided. These give full long-playing record quality. Hum level is negligible being 70db. down. 15db. of Negative feedback is used. H.T. or 300 v. 23 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 is not painted. Fully punched chassis (with baseplate) with Blue hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £24.15.0, 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. JUNIOR BASS REFLEX CABINETS. Specially designed for W.B. HF1012 Speaker, but suitable for any good quality 10in. speaker. Acoustically lined and ported. Polished walnut veneer finish. Size 18 x 12 x 10 in. Handsome appearance. Ensure superb reproduction for only £23.19.6.

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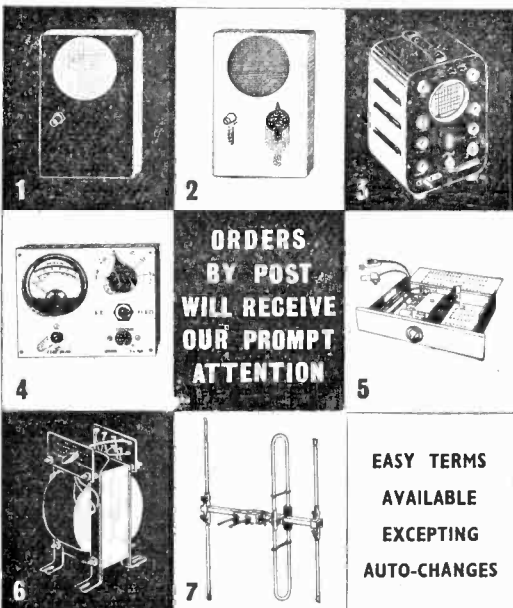
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6BW6	8/6	7A7	12/6	25L6GT	10/6	CY31	18/7	ECC82	10/6	GZ32	10/6	U75	6/-	W729	19/11	TP2	10/6		
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6BX6	6/-	7B7	8/6	25Z4G	9/6	D5	15/3	ECC84	23/3	GZ34	14/-	PEN383	23/3	U107	16/7	X41	15/-	TS1	10/-
6C4	5/-	7C5	8/-	25Z5	9/6	D63	5/-	ECC35	6/6	H63	12/6	PEN45DD	U191	16/7	X61(C)	12/6	TS2	12/3	
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6C6	6/6	7D6	10/6	27SU	19/11	DAC32	10/6	ECC81	8/6	HL2	13/6	PEN/DO	U251	14/6	X63	9/6	TS4	24/6	
6C9	13/6	7H7	8/-	28D2	7/-	DAF91	15/3	ECC83	13/11	HL2	7/6	4020	33/2	U281	19/11	X65	12/6	XA101	23/-
6C10	9/6	7H7	12/6	30C1	8/-	DAF96	8/6	ECC80	9/-	HL3DD	7/6	PL33	19/3	U232	22/7	X66	12/6	XA102	26/-
6CD6G	36/6	7H7	9/6	30F5	6/-	DD41	13/11	ECC82	10/6	HL4DD	7/6	PL35	12/-	U301	23/3	X76M	14/-	XA103	15/-
6CH6	9/-	7V7	9/6	30FL1	10/-	DET25	7/6	ECC83	19/3	HL4DD	7/6	PL38	26/6	U329	14/6	X73	23/3	XA104	18/-
6D3	19/11	7Y4	7/6	30L1	8/-	DF33	10/6	EF3	23/3	HL42DD	7/6	PL81	10/6	U339	16/7	X79	23/3	XB102	10/-
6D6	6/6	8D2	3/6	30L15	11/6	DF66	15/-	EF22	14/-	19/3	PL82	7/6	U403	16/7	X101	33/2	XB103	14/-	
6E5	12/6	8D3	4/6	30P4	12/6	DF70	15/-	EF36	4/-	HN309	24/7	PL33	9/-	U404	8/6	X109	17/3	XB104	10/-
6F1	26/6	9B/W6	15/3	30P12	7/6	DF91	3/6	EF37A	9/-	HVR2	20/-	PL84	12/6	U801	29/10	XDI(1.5)	6/6	XC101	16/-

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4. A.C. D.C. POCKET MULTI-METER KIT. 2m. moving coil meter, scale calibrated in A.C./D.C. volts, ohms and milliamperes. Voltage range A.C./D.C. 0-50, 0-100, 0-250, 0-500. Milliamperes 0-10, 0-100. Ohms range 0-10,000. Front panel, range switch, wirewound pot (for ohms zero setting), toggle switch, resistor and rectifier. 19/8. P. & P. 1/6. Wiring diagram 1/-, free with kit.
5. CHANNEL TUNER. Will tune to all Band I and Band III stations. Complete with P.C.C. 84 and P.C.P. 80 valves (in series) I.F. 16-19 or 33-38. Can be modified as an aerial converter (instructions supplied). 32/6. plus 3/6 P. & P. HEATER TRANSFORMER to suit above, 200-250 v., 8/-, plus 1/6 P. & P.
6. MAINS TRANSFORMERS. All with tapped primaries, 200-250 volts, 0-100, 150, 200 v., 50 mA, 6.3 v. 2 amp, 10/6. 250-0-250 x 0 mA, 6.3 v. 2 amp, 6.3 v. 1 amp, 10/6. 350-0-350 v., 70 mA, 6.3 v. 1 amp, 6.3 v. 2 amp, 10/6. 250-250 v. 70 mA, 6.3 v. 2 amp, 10/6. P. & P. 3/-.
7. WOLSEY 3-ELEMENT FOLDED DIPOLE. 1.T.V. Aerial less mounting bracket for external use, complete with 12 yds. of coaxial cable, 15/-, P. & P. 3/6.
8. CYLON TURRET TELETUNERS I F 34/38 Mc/s. Brand new complete with biscuit for channels 2, 4, 8 and 9. Less valves, 10/-, P. & P. 2/6. Pair of knobs to suit, 3/6. Valves required P.C.C. 84 & P.C.P. 80.
9. SIGNAL GENERATORS. Cash £8.19.6 or 25/- deposit and 8 monthly payments of 21/8. P. & P. 5/- Coverage 100 kc/s to 100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Case 10 x 8½ x 5½in.

- Three miniature valves and Metal Rectifier. A.C. mains 200/250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent. Modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch, variable A.F. output. Magic eye as output indicator. Accuracy ± 2 per cent.
10. SIGNAL GENERATORS. Cash £4.19.6 or 25/- deposit and 4 monthly payments of 21/8. P. & P. 5/- Coverage 120 kc/s to 84 Mc/s. Case 10 x 6½ x 4½in. Size of scale 6½ x 3½in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent. Modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch variable A.F. output and moving coil output meter. Accuracy ± 2 per cent.
 11. BATTERY RECORD PLAYER AND AMPLIFIER. 45 r.p.m. "Star" motor. Acos crystal pick-up, 3 transistor push-pull amplifier complete with transistors. Output 500 milliwatts, 49/6. P. & P. 3/6.
 12. 8-WATT PUSH-PULL AMPLIFIER COMPLETE WITH CRYSTAL MIKE AND 8in. LOUDSPEAKER. A.C. mains 200-250 v. Size 10½ x 6½ x 2½in. 6 valves. H.F. pen, 2 diodes, 2 output pens and rectifier. For use with all makes and type of pick-up and mike. Negative feed back. Two inputs, mike and gram, and controls for same. Separate controls for Bass and Treble lift. Response flat from 40 cycles to 15 kc/s, ± 2 db. 4 db down to 20 kc/s. Output 8 watts at 5 per cent total distortion. Noise level 40 db down all hum. Output transformer tapped for 3 and 15 ohms speech coils. For use with Std. or L.P. records, musical instruments such as guitars, etc. £4.19.6. P. & P. 7/6 or 20/- deposit plus P. & P. 7/6 and 4 monthly payments of 23/-.
 13. B.S.R. MONARCH UAS WITH FUL-FI HEAD. 4-speed, plays 10 records, 12in., 10in., or 7in. at 16, 33, 45 or 78 r.p.m. Internixes 7in., 10in. and 12in. records of the same speed. Has manual play position: colour, brown. Dimensions: 12½ x 10½in. Space required above baseboard 4½in. below baseboard 2½in. Fitted with Ful-Fi turnover crystal head. £6.19.6. P. & P. 5/- With Stereo Head £7.19.6. P. & P. 5/-.
 14. TRANSISTOR TESTER. For both P.N.P. and N.P.N. transistors incorporating moving coil meter. In metal case size 4½ x 3½ x 1½in. Scale marked in gain and leakage. 19/6. P. & P. 2/6.
 15. PUSH-PULL OUTPUT STAGE inclusive of transistors with input and output transformers to match 3 ohms speech coil, suitable for use with the POCKET RADIO. Kit of parts, including transistors. 19/6 P. & P. 1/6. Wiring diagram 1/6, free with kit.
 16. PORTABLE AMPLIFIER. On printed circuit for A.C. Mains 200/250 v. Size 4 x 3in. with tone and volume control. Valves: ECL82 and E780. 39/6. P. & P. 2/6.



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MINIATURE ROTARY TRANSFORMER. H.T. 11 volt. 11 volts input. 310 volts 30 m.a. Output. Will give approx. 120 volts at 20 m.a. from a 6 v. input. 4 in. dia. 3 in. dia. Weight 1 lb. Current consumption underload approx. 2 amps. 17/6 each.



ROTARY TRANSFORMERS
TYPE HT. 31
 Input: 11.5 volt.
 Output: 250 volt
 at 120 m.a. **TYPE**
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 11.5 volt. Output:
 100 volt at 65 m.a.
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MINIATURE AMERICAN LEAD ACID ACCUMULATORS. 36 volts 20 m.a. 4 x 1 1/2 x 3 1/2 in. 3/6 each.

PANEL FUSEHOLDER ASSEMBLY

2A/US 1054 American pattern. Will take standard cartridge fuses. New 2/6 each or 8/- pckt. of 3



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MINIATURE DYNAMIC SPEAKERS

A must for all Build-it-yourself-Hams. As supplies with all current transistor kits. Can also be adapted for home phones or intercom. 2 in. diameter. Resistance 70 ohms. ONLY 5/- each.

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Types available. Plugs: CZ 64662/64669/64648. Sockets: UZ 64647/64669/64661. New and unused. For Radar Stations, TV Link-up and Atomic research application.



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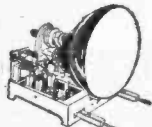
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 Fractional Horse Power. 24 volts. Beautifully constructed throughout and fully governed. Ratio 2 1/2 in. to 1 in. Size: 3 x 1 1/2 x 1 1/2 in. Brand New and in New original sealed cartons. ONLY 12/6 each.

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TV CHASSIS 5/6



56 resistances incl. 7 variable controls, 54 condensers incl. electrolytics. Coils, 7 I.F. and R.F. Trans. Mains output, line and frame. Metal rectifier 300 v. at 250 m.a. Fuse panel, focus magnet, plugs, sockets, switch, chassis screws, tag strips, etc. I.F. strip can be separated. Power pack can be used without dismantling. These chassis have been used, but were working when stored. Six-page circuit available with order. Carr. 7/6.

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SOUND/VISION STRIP, 1/-. Not tested. Complete sound and vision strip. 8 valve holders (6B13's etc. incl.) 1 F's 16-19.5 Mc/s. size 8 1/2 x 4 1/2 in. Drawings FREE with order. Postage 2/6.

HEATER TRANSFORMERS, 7/9. 12 volt at 4 amp. 0-200-250v primary. Post and packing 1/9.

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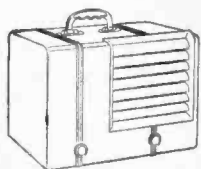


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8 in. P.M. SPEAKER, BARGAIN 5/9. Limited quantity of these modern-type speakers. They are tested and have "Money Back Guarantee". They have slight cone fault, that is repaired, not affecting the quality. Post and packing one, 2/6; post on two, 3/6.

NEW LOOK AMPLIFIER 59/6

Ideal for Stereo attachment. Brown/Ivory. Contains 9 in. high dux speaker. 3 valves - 10F1, 10P14 and U934. Maximum O.P. 4.5 watts. Size 14 x 11 x 6 1/2 in. Wonderful for Home, Hall or Amuseur. Theatrical. S.A.T.A.G.E. Guarantee. DEPOSIT 30/-. Ins. Carr and ten Weekly Payments of 8/-.



NEW LOOK JUNIOR AMPLIFIER, 49/6. As above but without Cabinet Salvage guarantee. P. & P. 3/6.

PORTABLE AMPLIFIER Mk.D1, 59/6. Brand new. Latest design Famous manufacturer. Size 7 x 5 1/2 x 8 in. A.C. only. Mains isolated 4 watts output incorporating ECL82 high gain valve. Volume and tone controls. Knobs 2/6 extra. Post, packing and ins., 2/6.

PORTABLE AMPLIFIER Mk.D5, 39/6. Similar to the above circuit employing ECL80 triode pentode output valve, giving 3 watts output. A.C. only. Mains isolated. Single control for Volume and On/Off switch with knob. Post, packing and insurance 3/6.

TAPE RECORDER AMPLIFIER, 47.29/6. Compact, well-designed five valve amp. Output 3.5 watts. Valves: 6X4, ECL82, EL84, EM84, E280. Input for Mike, Radio and Gram. Controls - Record Playback, volume, playback tone and On/Off. Size 8 1/2 x 4 1/2 in. Ins. and carr. 4/6. Deposit 30/- plus ins. and carr. and 20 weekly payments of 7/6.

COLLARO CONQUEST, 47.19/6. 4 speed auto. Incorporating auto and manual controls. Combines with dual turn-over type audio crystal P.U. and sapphire stylus. A.C. mains. 200-250 volt. Post, packing and ins. 5/6.

MICROPHONES, 11.7/6 each. P. & P. 1/8.

SCANNING COILS - ALL 2/9 each. Wide angle 90deg, 38 mm. Low imp. Postage 1/3. Also Brand New 70° 38 mm. Low imp. Postage 1/3. And Low imp. 70° 35 mm. P. & P. 1/8.

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VOLUME/TONE CONTROLS, 2/6 per doz. Aset red, and tone controls, stripped from working chassis. P. & P. 2/1.

CO-AX CABLE, 6d. per yd. Cut to any length. Good quality at a very low price. Allow 1/6 postage on 20 yards. 45/- per 100 lbs. Post and packing 3/6.

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JASON F.M. TUNER KITS

We are the Authorised Jason Dealer and the whole kit is as supplied by them. You can therefore safely return to Jason for alignment without them rejecting it for non-standard components.

We can also align for the standard charge, to our kits only.

FMT1 is the standard variable tuner for cabinet mounting, unpowered. Supplied complete with four EF91 valves ... £7.10. 0
Hire purchase Deposit £1.10.0 and 6 monthly £1. 3. 4
Instruction book, 2/6 extra.

FMT1 Power pack kit with ready drilled chassis ... £2.14. 0

FMT2 is a new tuner in a modern case, green, which can be used for shelf or cabinet mounting, and has space for power supplies if required. Supplied complete with four EF80 valves ... £8.12. 6
Hire purchase Deposit £1.14.6 and 6 monthly £1. 6. 4

FMT2 With power. Complete kit ... £10.14. 0
Hire purchase Deposit £2.4.0 and 8 monthly £1. 3. 9
Instruction book 2/6 extra.

FMT3 is the fringe version and should be used when farther than 70 miles from the transmitter. Supplied complete with 6 valves ... £10.12. 6
Hire purchase Deposit £2.2.6 and 8 monthly £1. 3. 9

FMT3 With power. Complete kit ... £12.13. 0
Hire purchase Deposit £2.13.0 and 8 monthly £1. 7. 7
Instruction book 2/6 extra.

NEW JASON SWITCHED TUNERS

The **JTV/2** and **Mercury 2** are both of the pre-set station type with the addition of BBC and ITA sound. They use the latest "Fireball" turret and the A.F.C. ensures freedom from drift. The **Mercury 2** is for cabinet mounting with external power supplies. The **JTV/2** has the same tuning heart, with power supplies mounted in a case. This again can be used for shelf or cabinet mounting. The **JTV/2** cannot be supplied less power.

JTV/2 Complete with valves and book ... £16.14. 9
Hire purchase Deposit £3.14.9 and 12 monthly £1. 3.10
Mercury 2 Complete with valves and book ... £12. 0. 0
Hire purchase Deposit £2.8.0 and 8 monthly £1. 6. 6
Power pack Kit for Mercury 2 with drilled chassis £2. 14.0
Instruction book for all switched tuners, 3/6.

REQUIRED CHANNELS MUST BE SPECIFIED FOR SWITCHED TUNERS

All Jason kits can be supplied less valves. To find the cash price deduct 7/6 for each valve.

A more detailed list can be sent upon request.

ALL JASON TUNERS ARE ON DEMONSTRATION

GRAMOPHONE EQUIPMENT

All these units are brand new and boxed

	Cash	Deposit	Mthly.	pmts.
B.S.R. Monarch TC8H , cartridge, UA14 ...	£7.15.0	£1.11.0	6	£1.4.0
COLLARO Conquest O cartridge ...	£7.15.0	£1.11.0	6	£1.4.0
GARRARD TA/Mk.2 , GC8, cartridge ...	£8.10.0	£1.14.0	6	£1.6.0
GARRARD 4HF, GC8 , cartridge ...	£18. 9.9	£3.19.9	12	£1.6.7
PHILIPS AG2009, AG3016 cartridge ...	£10.10.0	£2. 2.0	8	£1.3.6

For further information please write for manufacturers' list.

★ POST FREE ★

COLLARO STUDIO DECK. 3 speed, 3 motors, 7in. spools. Pause control, space for third hand, piano keys, counter. OUR PRICE £13.10. 0
List price £17.10.0
Hire purchase Deposit £3.0.0 and 12 monthly 19. 3

TAPE AMPLIFIER for Studio deck, with two printed circuit boards, control and input panels, mains and output transformers, complete with knobs and plans, EF86, ECC83, EM84, EZ80, OA81 and two EL84. 4 watts output. Magic eye, Radio and Mic inputs, Mixing and Superimposing facilities, EX L.S. socket, low level output, tone control. Can be used as amplifier. CASH PRICE £11.12. 6
Hire purchase Deposit £2.6.6 and 8 monthly £1. 5. 9

TAPE RECORDER CASE to house the above deck and amplifier. Two-tone Grey ... £5. 5. 0

E.M.I. Speaker to fit case 10 x 5in. ... £1. 7. 6

1200ft Brand Five tape 25/-; Crystal Mic Stan Kelly Screened Jack Plugs, 4/6 each. Spare 7in. tape spool 4. 6

The above recorder complete to PERSONAL SHOPPERS ONLY for ... £35. 0. 0
Hire purchase Deposit £7.0.0 and 12 monthly £2. 11. 4

This machine is a first-class job and normally sells for £41. 0. 0

SEND FOR MAKER'S ILLUSTRATED LEAFLET

Collaro Tape Heads Record/Playback and Erase. Lower track only ... 37/6 pair

B.S.R. Monardeck T.D.2, 3 3/8 i/s, 5 1/2in. spool. List price £12. 12. 0 OUR PRICE £7. 9. 6

FERRODYNAMICS "BRAND FIVE"

Magnetic Recording Tape. Made in U.S.A. Fully guaranteed. High Grade Acetate base and boxed.

600ft 5in. Standard	16/-	1200ft 7in. Standard	25/-
900ft 5in. L. play	18/6	1800ft 7in. L. play	35/-
1200ft 5 1/2in. L. play	23/6		

SEND FOR MANUFACTURERS' LEAFLET

Also stocked **SCOTCH BOY, EMITAPE** and **BASF**. LIST ON REQUEST.

TRANSISTORS

OC44 Mixer ...	12/-	OC78 Audio ...	15/-
OC45 I.F. ...	12/-	OC78D Driver ...	17/-
OC70 Audio ...	14/-	OC71 Photo ...	25/-
OC71 Audio ...	8/6	OC81 Audio ...	18/-
OC72 Audio ...	8/6	Red spot Audio ...	5/-
OC75 Audio ...	15/-	White spot R.F. ...	6/-

The above transistors, except the Red and White spot, are all BRAND NEW MULLARD, and are NOT sub-standard. Matched pairs of OC71 and OC72 can be supplied at no extra cost.

"PRACTICAL WIRELESS" POCKET SUPERHERO

OSMOR PRINTED CIRCUIT VERSION

Osmor Rod aerial, 10/-; IFTs and Osc. coils, 22/6; Osmor Driver, 11/6; Osmor Output, 10/6; Set MULLARD transistors, 61/6; JB Gang, 11/-; Trimmer, 1/4; Set Condensers, 15/-; Resistors 6/6; Ardente Volume Control, 10/6; Ardente V/C, 3/6; Speaker, 19/10; OA81 diode, 4/-; Hardware, 4/6; Printed circuit, 9/-; Case and knob, 7/6; PP4 battery, 2/-; Press studs, 1/-; Leaflet, illustrated, giving full instructions and constructional details. 1/9.

ALL THE ABOVE COMPONENTS IF PURCHASED AT ONE TIME—£10.0.0.

The above components are all new and miniature, by reputable manufacturers, and are fully guaranteed.

WE PAY ALL POSTAGE AND INSURANCE
ALL ORDERS DESPATCHED SAME DAY
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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 12/6, Magnetic 10/6. Post and Insurance 1/-.

SUB MINIATURE COMPONENTS FOR TRANSISTOR SETS

- Push-pull o.p.t. and driver 17/- pair.
- 1/2 Transformers and oscillator and circuit 23/6.
- Ferrite aerial with coils for medium and long wave and circuit.
- Smallest possible electrolytics 1/8 each. 1 mid. 2 ml. 4 mid. 8 ml. 10 mid. 20 mid. 30 mid. 50 mid. 100 mid.
- Smallest 1 watt resistors 5d. each all popular values.
- Miniature 0.1 mid. 1/-, 0.05 2.04 9d., valves up to 0.025 6d. each.
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- 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 OC72. £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/-.
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- White Spots 3/6.
- Surface barriers 25 mc/s 9/6, 50 mc/s 12/6.
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- 3in. Speakers 3 ohm 18/6.
- 3in. Speakers 8 ohm 18/6 and 19/6.
- 2in. Speakers 3 ohm 19/6.

1 Watt Transistor H.F. Amplifier

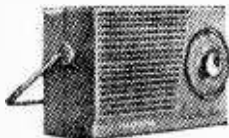
Four transistors on printed circuit all wired up ready for immediate use—excellent performance on pushkeys or microphone on r.f. input £4.12.6. post and insurance 1/6.

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



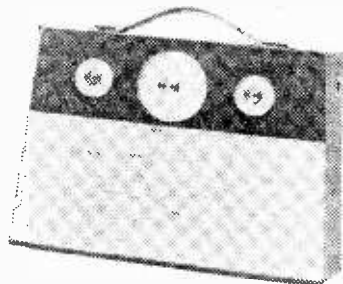
Very modern cream cabinet, size 5 1/2 x 3 x 1 1/2 in. with chrome handle, tuning knob and scale. Price 7/6. plus 1/6 postage and packing.

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"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.
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- ★ 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.

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Money returned in full if parcel not up to expectation and returned unassembled.
Price complete, less battery, £8.19.6. Battery 3/6, plus carriage and insurance 7/6.

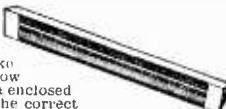
PHILIPS TRANSCRIPTION UNIT

Philips AG 3009 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 (2.12gms.). Supplied with Philips Hi-Fi crystal type AG3019 for micro-groove 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 monoaural pick-up £10.10.0, or 2 kus. deposit and 20 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/- 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

Read these testimonials

Mr. J. Brown, Glamorgan, S. Wales.

"My Pocket 3 arrived safely. I must say I am very pleased with it indeed. It is absolutely wonderful. Thank you very much. I now enclose 16/6 for your conversion parcel to Pocket 4".

Mr. A. Bell, Wokingham.

"I am writing to express my satisfaction at the standard of your kit for your Pocket 4 Transistor set and also to state that it has come up to my expectations in regard to performance".

Mr. K. Edwards, Boreham Wood, Herts.
"I have completed the assembly of your Pocket 3 and am very pleased with the results".

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".

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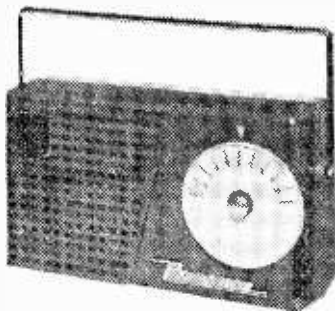
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"I have made up one of your 55/- transistorised radios and I am very pleased with the results".

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Mr. E. Batcombe, Manchester.

"I have constructed your Pocket 4 Loudspeaker radio and am delighted with its performance and appearance, for the cost I consider it excellent".

Mr. R. Bell, Newcastle-on-Tyne.

"I have built your Pocket 5 Transistor set I am very pleased with it".

Mr. R. Morse, Bournemouth-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".

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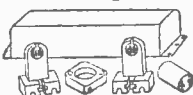


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There are no better value-for-money Tape Recorders on the market—if you can't call and hear them, send S.A.E. for fully descriptive leaflets.

MODEL CR3/6 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 1CR3/T Incorporates the very popular 3-speed COLLARO Mk. IV "TRANSCRIPTOR", Deck **£47.10.0** which has both upper and lower tape tracks. H.P. Terms: Deposit £8.10.0 and 12 months of £3.9.8.

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.

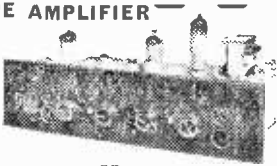
TAPE AMPLIFIERS and PRE-AMPLIFIERS PRESENTED FROM MULLARD DESIGNS

MODEL HF/TR3 TAPE AMPLIFIER

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

KIT OF PARTS **£12.15.0** OR ASSEMBLED **£16.10.0**

H.P. Deposit £3.6.6 and 12 months at £1.4.2.



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

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

KIT OF PARTS **£14.0.0** H.P. £3.8.0 Deposit and 12 months **£1.4.11.** OR ASSEMBLED **£17.0.0**



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 **£7.12.0** and 12 months **£2.11.0**
- (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 BRENNELL 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.)

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

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)

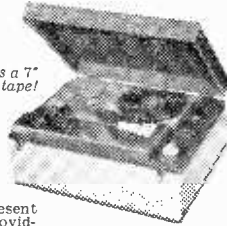
FOR ONLY 22 gns.

H.P. Dep. £4.14.0, 12 months £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 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.

The "MODEL TR3/Mk.IV" 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 £23.13. (Carr. & Ins. 10/- extra). Incorporates the Truvox Mk.IV Tape Deck, Rola/Celestion 9 x 5 in. Loudspeaker and the Truvox Type "K" Amplifier specifically developed by Truvox Ltd to correctly operate their Mk.IV 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". A Twin Track Two speed model operating at 3 1/2 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.) **£10.00**

Alternatively we supply ASSEMBLED and TESTED **£11.10.0**

ABOVE INCORPORATING PARTRIDGE OUTPUT TRANSFORMER. **£16.0 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 KIT 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 18/10. ABOVE INCORPORATING PARTRIDGE OUTPUT TRANS. **£16.0 extra**

COMPLETE MULLARD "3-3"

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

COMPLETE KIT OF PARTS **£7.10.0** OR ASSEMBLED AND TESTED **£8.19.6** (plus 6/6 carriage and insurance). H.P. Terms: Deposit **£2.0.0** and 8 months at **£1.0.0**. Complete to MULLARD'S SPECIFICATION including Mullard valves and a PARMEKO OUTPUT TRANSFORMER.

STEREO "3-3" MAIN AMPLIFIER

Comprises two MULLARD 3-3 Main Amplifiers on one chassis. Operates with MULLARD STEREO PRE-AMPLIFIER. Output power 6 watts. Inputs for Crystal Pick-up and Radio Tuner.

KIT OF PARTS **£10.0.0** OR ASSEMBLED **£11.15.0**

COMPLETE STEREO AMPLIFIER

Meets the many requests for a low priced but good quality Stereophonic Amplifier. Output power is 4 watts and suitable for Crystal Pick-ups.

KIT OF PARTS **£8.10.0** OR ASSEMBLED **£10.10.0**

RECORD PLAYERS

THE LATEST MODELS ARE IN STOCK. MANY AT REDUCED PRICES

SEND S.A.E. FOR ILLUSTRATED LEAFLET
B.S.R. MONARCH UAs 4-speed mixer Autochanger with Crystal Pick-up. **£6.19.6**

The NEW COLLARO MODEL RP594 4-speed Single Record Player. Studio Cartridge. **£9.18.9**

The COLLARO "CONQUEST" 4-speed Autochanger Studio Pick-up. **£7.10.0**

The COLLARO 4-speed Single Record Player. Studio Pick-up. **£6.9.6**

THE NEW B.S.R. Model UA12 in Stock. A4 "SPEED" MIXER AUTOCHANGER. **£8.7.6**

U.A.12 also available incorporating the B.S.R. STEREO Pick-up, plays L.P. and 78 Records. **£10.10.0**

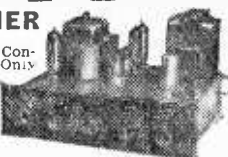
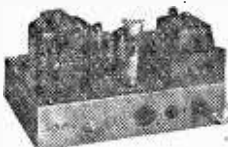
GARRARD MODEL T.A.MK11 4-speed Player fitted high output Crystal Pick-up. **£8.10.0**

GARRARD MODEL R.C.2110. Autochanger 4 speeds. High output. Crystal Pick-up. **£10.10.0**

Carriage and Insurance on each above, 5/- extra.

H.P. TERMS AVAILABLE ON EQUIPMENT OVER £9.

DESCRIPTIVE LEAFLETS AVAILABLE FOR ALL EQUIPMENT. PLEASE SEND S.A.E.



PRICE REDUCTIONS

(a) The KIT OF PARTS to build both the "5-10" Main Amplifier and the 2-valve PRE-AMP CON- **£15.15.0**

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

(c) The KIT OF PARTS to build the DUAL-CHANNEL "3-3" AMPLIFIER and the DUAL-CHANNEL PRE-AMPLIFIER CON- **£21.10.0**

(d) The DUAL-CHANNEL "3-3" AMPLIFIER and the DUAL-CHANNEL PRE-AMPLIFIER CONTROL UNIT BOTH ASSEMBLED and **£25.0.0**

TESTED H.P. Terms: Deposit **£5** and 12 months of **£1.16.8**

(e) THE KIT OF PARTS to build one "3-10" MAIN CHANNEL and the DUAL-CHANNEL PRE-AMP CONTROL UNIT **£21.10.0**

(f) ONE "5-10" AMPLIFIER and the DUAL-CHANNEL PRE-AMPLIFIER both ASSEMBLED and **£25.0.0**

TESTED H.P. Terms: Deposit **£5**, 12 months of **£1.16.8**

(g) KIT OF PARTS to build Two "5-10" MAIN AMPLIFIERS incorporating Parmeko Output Transformers and the DUAL-CHANNEL PRE-AMPLIFIER CONTROL **£31.0.0**

(h) TWO "5-10" AMPLIFIERS and the DUAL-CHANNEL PRE-AMPLIFIER CONTROL UNIT BOTH ASSEMBLED & TESTED **£36.0.0**

H.P. Terms: Deposit **£7.4.0**, 12 months **£2.12.0**

Carriage and Insurance 7/6 extra.

Prices quoted are subject to **£1.6.0** extra for Partridge Transformer.

STEREO PRE-AMPLIFIER

This model incorporates two Mullard 2-valve Pre-Amplifiers combined into a single unit enabling it to be used for both STEREO PHONIC or MONAURAL operation. It is designed primarily to operate with our MULLARD MAIN AMPLIFIERS but will also operate with a range of MULLARD MAIN AMPLIFIERS requiring an input of 250 mV/valts.

COMPLETE KIT OF PARTS **£21.10.0** ASSEMBLED AND TESTED **£15.0.0**

H.P. £3 Dep. and 12 mths. at **£1.2.0**

MODEL L.L. one microphone input matched for moving coil or Ribbon Mike. **£1.17.0 extra**

MULLARD FOUR CHANNEL MIXER UNIT

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

Complete Kit of Parts **£8.8.0**

Assembled and Tested **£10.0.0**

H.P. Terms: Deposit **£2** and 12 months at 15/-

MK.11 "Fidelity" FM TUNING UNIT

An attractively presented Unit incorporating MULLARD PERMEABILITY TUNING HEART and corresponding Mullard valve line up. FOR THE CONSTRUCTOR **£10.10.0** ASSEMBLED **£14.5.0**

A SPECIAL CASH OFFER !!

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

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

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

The Portable Case will also accommodate almost any make of Autochanger

WE ALSO SUPPLY SEPARATELY—

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

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

(c) 6in. P.M. SPEAKER 18/9 Carriage and Insurance 4/- extra.



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

Telephone: FLEET STREET 5812/3/4

DE LUXE TAPE RECORDER

~~29 gns.~~ **OUR PRICE 18 gns.**

Beautifully styled rexine covered cabinet in Red/Beige, with carrying handle. Size: 14½ x 13 x 9½ in. Storage space in lid for tapes and mike. Speed 3½ in. per second. Compact set using latest 5-valve amplifier. B.S.R. Tape Deck. 5½ in. standard tape. Fully guaranteed. Ins. and Carr. 12/6. Terms available.

The "STUDIO TWIN"

~~40 GNS.~~ **29 GNS.**

Quality Tape Recorder at amazing low price. 7 in. Standard reels. Latest Studio 3-speed Deck, 1½, 3½, 7½ i.p.s. Includes Twin Track reverse counter. Pause control and magic eye recording indicator. Volume and tone control, superimpose switch, 3 watts output. Attractive cabinet in Beige. Size: 19 x 13 x 8 in. Fully guaranteed. Terms available. Ins. and Carr. 12/6. Mike 27/6 extra. Tapes 25/-.

**DE LUXE TAPE RECORDER CABINET**

ONLY 29/9



Beautifully made Tape Recorder Cabinet. Size: 13 x 10½ x 7 in. Covered in two-tone coloured rexine cloth. Stylish design. Carrying handle and detachable lid. Easily adapted to Record Player Cabinet. P. & P. 4/6.

B.S.R. "MONARDECK" £9.9.6
Single speed, 3½ i.p.s. Uses 5½ in. spools. Size 13 x 8½ x 2½ in. P. & P. 4/6.

COLLARO "STUDIO" TAPE DECK £12.19.6
3 motors, 3 speeds. Takes 7 in. spools. Press-button controls. P. & P. 5/6.

REPLACEMENT, REBUILT TV TUBES!

12 MONTHS' GUARANTEE

Terms available over 10 weeks
Carr. and Ins. 15/-

21" TUBE £8.10.0 **£2 ALLOWED ON OLD TUBE**
17" TUBE £7.10.0

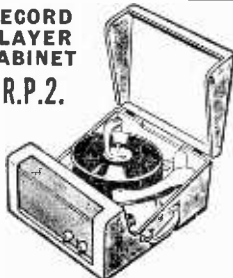
12" } £5.10.0 **£1 ALLOWED ON OLD TUBE**
14" }
15" }

SOLO SOLDERING TOOL

ONLY 12/6



110v., 6v., 12v. (special adaptor for 200/250v., 10/- extra). Automatic solder feed including a 20ft. reel of solder and spare parts. It is a tool for electronic soldering or car wiring. Revolutionary in design. Instantly ready for use and cannot burn. In light metal case with full instructions. Pos. 3/6.

RECORD PLAYER CABINET R.P.2.

RECORD PLAYER CABINET 19/6 R.P.9. A lightweight portable cabinet by famous manufacturer. Size 14½ x 11½ x 6 in. in Cream. Complete with moulded deck board of attractive design. Takes B.S.R. TU9 single player; 2 control amplifier; 5 in. round speaker. P. & P. 4/6.

RECORD PLAYER CABINET 29/6 R.P.1. 2 control, portable cabinet. Imprecable finish in smart two-tone colour scheme. Size 14½ x 6½ x 14½ in. P. & P. 4/6.

RECORD PLAYER CABINET WITH EXTENSION SPEAKER CABINET

99/6



1960 Show Model Portable in two-tone colours. Suitable for stereo with extension speaker cabinet secured in lid. Size 18 x 14 x 8½ in. Ins. and Carr. 5/6.
SHOW MODEL CABINET 79/6 as above but less Extension Speaker. P. & P. 5/6.

COLLARO CONQUEST 4-speed autochanger £7.19.6

B.S.R. MONARCH 4-speed autochanger £6.19.6
ns. & Carr. 5/6

10,000 VALVES TO CLEAR 9d. EACH

DUKE & CO. (LONDON) LTD

621/ Romford Rd., Manor Park, E.12
LF 6001/3. Send for FREE LIST
Liverpool St. Stn. to Manor Park Stn. only 10 mins.

SPEAKERS SALE EXTENSION SPEAKERS

Bin. P.M. Speaker fitted into polished cabinet. Complete. Switch and flex included. P. & P. 3/9.

**CONTEMPORARY EXTENSION SPEAKERS 19/9**

Covered in smart two-tone leatherette colour scheme. Beautifully made. Including Bin. P.M. speaker. P. & P. 3/9.

BARGAIN SPEAKER 5/9
Bin. P.M. Repaired cone defect not affecting reproduction quality.

Bin. P.M. SPEAKER 6/9
As above but with output transformer.

Bin. P.M. SPEAKER 9/9
Highest quality. Fitted o/p transformer. **ELLIPTICAL SPEAKERS 15/9**
8 x 3 in. and 7 x 4 in. Brand new. Post and packing on each, 2/9.

AMPLIFIERS

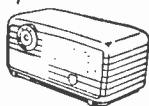
ALL PORTABLE — 12 months' Guarantee
TAPE RECORDER AMP. £7.19.6

Compact, well designed 5-valve amplifier. Output 3.5 watts. Valves: ECC83, ECL82 EL84, EM84. Record level indicator. EZ80. Input for mike, radio and gram. Controls: Record Playback volume and On/Off Playback tone. Dia.: 8½ x 3 x 4½ in. Ins. and carr. 4/6. Terms available. Knobs, 2/6 per set. Beautiful perspex dial plate, 3/6. Complete with sockets for Mike. Radio and superimpose switch. **MK. D.I. 59/6.** Brand new. Latest design. Dimensions 7 x 2½ x 5 in. Mains isolated 3 watts output. Incorporating ECL82 as high-gain output valve. Volume and tone controls. Knobs 2/6 extra. P. & P. 3/6.

MK. D.J. 87/6. As above but with 3 controls, incorporating a special tone correction circuit for extra base and top boost, giving tone of reproduction seldom heard on a very expensive amplifier. Must be heard to be appreciated. Knobs 3/6 extra P. & P. 3/6.
MK. D.S. 35/6. Simple circuit employing ECL80 triode pentode output valve giving 3 watts output. A.C. only. Mains isolated. Single control for volume and on/off switch with knob. P. & P. 3/6.

BAKELITE CABINET only 2/9

Brand new. Colour brown. Attractive design. Size 12 x 7 x 5½ in. Ideal for small receivers, converters, etc. P. & P. 3/9.



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. Simply place telephone on the pick-up platform and connect lead to the input of any medium gain tape, disc, or wire recorder. Brand amplifier or direct to any 1/6 p. & p. complete with 5ft. shielded cable. FC-8 only. 16/- plus 1/6 p. & p.

MODEL RC-6. Designed to feed into the microphone input of either a tape recorder or any high gain amplifier. Easily attached to telephone by rubber suction attachment. The coil is electrostatically shielded to minimise hum pick-up.

When positioned on telephone this model is more than adequate for a fully modulated tape recording. Brand new complete with 5ft. shielded cable. RC-6 only 14/- plus 1/- p. & p.



HI-FI HEADPHONES

These miniature Hi-Fi phones use high quality permanent magnetic speakers with re-usable voice coil. The soft rubber



ear moulds give correct spacing for optimum acoustic load. Each unit has a built-in miniature Hi-Fi transformer to ensure the finest music and voice reproduction. Supplied free is a small transformer unit which steps impedance up to 4000 ohms. Only 15/- P. & P. 12/6.

VHF RECEIVER 1392

15 valve superhet covering 95-150 Mc/s which includes police, aircraft and amateur bands. Complete with slow motion tuning, tuning meter, circuit diagram, etc. Here is your opportunity to sensitive receiver offered at a reduction of original cost. ONLY £6.5.0 Carr. 15/-.



CRYSTAL MIKE

1in. dia. 70-8000 c/s response. Brand new. ONLY 6/6. P. & P. 6d. 2 for 12/-.

PORTABLE TRANS/RECEIVER No. 18.

A self-contained Trans/Receiver for approx. 10 miles. C.W. Range (50-33.3 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 17in. Only 60/- Carr. 10/-.

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.

MICROPHONES. BRAND NEW.

Throat magnetic 4/6; Throat carbon 3/6; No. 8 carbon with switch 6/6; No. 7 moving coil 7/6. Tannoy power mikes only 5/-. Crystal mike 22/6.

Relda's Pick-up Coils require no Electric connections—offer virtually unlimited use.



COMMAND TRANSMITTERS

Complete with all valves, crystal, etc. 3-4 Mc/s, 45/-; 4-5.3 Mc/s, 45/-; 5-3.7 Mc/s, 45/-.

COMMAND RECEIVERS

3-9.1 Mc/s., 60/-.

P. & P. 3/6 ea



ONLY 60/- Per Set P. & P. 4/- Batteries 20/- per Set

PORTABLE TRANS/RECEIVER TWO FOR

£6 Post Free.

Consisting of trans-receiver covering 7.4-9 Mc/s. range up to 10 miles, complete with 5 valves, headphones, microphone, junction box and 8ft. telescopic aerial. Only 120 v. and 3 v. dry battery.



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 over 130-253 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

MINIATURE EARPHONE

A really sensitive dynamic earphone of exceptionally fine quality. Provides clear reproduction of music as well as speech. Fully Guaranteed and complete with transparent ear insert, 3 feet cord, sub-miniature plug and socket.

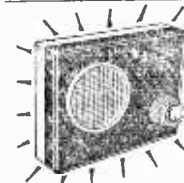
CR-3 High Imp. 12/6 Post
MR-4 Low Imp. 10/6 1/- each



NEW! TRANSISTOR RADIO

With Miniature Speaker. Simple instructions enable anyone to build this miniature radio. Gives reception over the entire broadcast band. Each kit is supplied with all latest miniature parts including:

★ two transistors ★ ferrite rod ★ speaker ★ coloured plastic case ★ step by step illustrated instructions. Size 4 x 3 x 1in. ONLY 27 6 Battery 1/- ex.



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 on only 5/-.

each. Post 1/- 2 for 10/-, post free.

R.F. UNITS. R.F.24. 20-30 Mc/s.

switched tuning, 22/6. R.F. 23. 40-50 Mc/s. switched tuning, 5/6. R.F. 27. 65-85 Mc/s. variable tuning, 29/6. Circuits supplied. P. & P. 3/6 on each.

POCKET VOLT TEST METER

Two D.C. ranges: 0-250 v. and 0-25 v. Complete with test prods. and leather case. Very limited quantity. Only 12/6. P. & P. 1/6.



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 5in. Complete with test leads and instruction manual. ONLY £14.19.6. Carriage 5/6. Fully Guaranteed.

ACCUMULATORS

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



WIRELESS SET No. 19 MK. II

incorporates TX/RX covering 2-8 Mc/s (37.5-150 metres), and intercom. amplifier. Complete with test valves, 500 microamp check and tuning meter, circuit and instruction book. ONLY 65/- Carr. 10/-.

R.C.A. COMMUNICATION RECEIVER AR-88

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.

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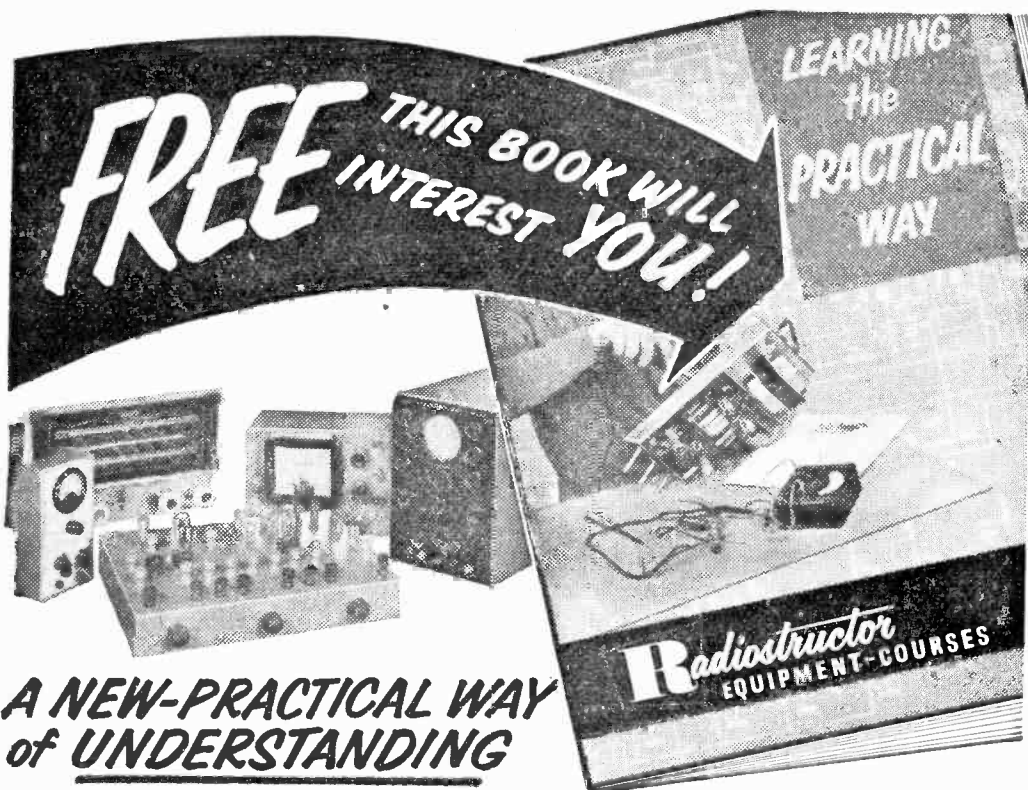
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Practical Wireless

VOL. XXXVI, No. 648, FEBRUARY, 1961

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COMMERCIAL BROADCASTING

EVER since commercial radio transmissions were first directed at this country from stations on the Continent, there have been periodic comments in the press and elsewhere on the possibility of introducing sponsored radio broadcasting in the United Kingdom. In our editorial in the October issue, we mentioned an announcement by the Government of the setting up of an inquiry into the future of sound and television broadcasting in this country; this announcement has renewed speculation as to whether commercial radio will soon make its appearance. Those who favour its introduction seem, for the most part, to visualise the eventual establishment of one station for every 50,000 people, perhaps with the use of medium waves by day, and Band II by night. The stations would derive their revenue from advertisements, in much the same way as commercial television.

Upon consideration, this clamour for commercial radio seems to be based on a desire for novelty alone. It appears to us that there is insufficient material and talent for the success of local broadcasting to be ensured. In other countries, even where there is no national network, small local stations have generally had to reduce their standards until programmes have eventually degenerated into an output of almost continuous music, with breaks only for advertisements and news summaries.

It may be argued that because the major commercial transmitter on the Continent with programmes directed at the British Isles is a highly successful concern, then similar sources of entertainment operating in this country would also be a success. This is not necessarily a valid argument: if the number of commercial stations is increased, the popularity of the broadcasts may well deteriorate.

The introduction of sponsored local broadcasts could have serious effects on other advertising media—the press for example. Many small firms would be forced to purchase time on the radio programmes and would have no spare funds to continue their advertising in the local evening newspaper.

We are of the opinion that commercial radio would not improve, but detract, from present programme standards. It is generally admitted that to attract and retain a large listening audience, programme quality must be degraded—commercial television is often cited as evidence of this. The BBC at present provides a balanced service which caters for most tastes—even for minorities. By the nature of its source of revenue, a sponsored network cannot transmit programmes which attract small audiences. Only if the revenue of the stations were derived from the small audience concerned could suitable programmes be transmitted and the method for deriving such an income might well cause difficulties.

If there is an increasing demand for some form of local transmission system, and such a system is ruled to be impracticable, the way out of the *impasse* would seem to be to increase the regional activities of the BBC. Naturally, some modification of the present regional divisions would be necessary, but some form of local broadcasting could be achieved without the attendant disadvantages and possible dangers of a sponsored system.

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

Round the World of Wireless

POTENTIAL AND CURRENT NEWS

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of October, 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	745,124
Home Counties	700,802
Midland	513,769
North Eastern	566,763
North Western	483,573
South Western	419,036
Wales and Border Counties	251,622
Total England and Wales	3,680,689
Scotland	419,363
Northern Ireland	126,042
Grand Total	4,226,094

Manuals for Technical Colleges

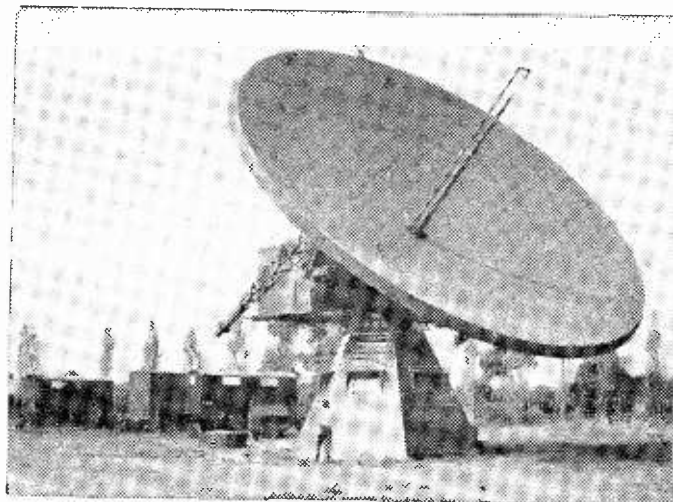
AN issue of service manuals covering Philips' current radio and television range is to be made to all of the main technical colleges throughout Britain.

Until now, while manuals and other technical information have normally been supplied to technical colleges on request, there has been no "matter of course" issue.

Philips' offer was made direct to the Ministry of Education, and colleges receiving the manuals are being asked to treat the information being made available as confidential and to use it only for academic purposes.

Conference on Microwave Measurement Techniques

THE Electronics and Communications section of the Institution of Electrical Engineers is organizing a conference to discuss recent advances in microwave measurement techniques to be held in the Institution building, Savoy Place, London W.C.2., from the 6th to the 8th September, 1961. The topics to be discussed will include: The measurement of microwave power, frequency, Q factor, impedance, admittance, reflection coefficient and noise.



The 45ft radio telescope which was used during investigations by the Royal Radar Establishment at Malvern into the roughness of the Moon's surface. Future investigations may possibly include Venus, Mars and Jupiter. An English Electric Valve Co. Ltd. M543 2½MW Magnetron is used in this equipment.

The organizing committee will welcome the submission of papers for consideration for inclusion in the proceedings of the conference, and invite intending authors to submit, as soon as possible, and preferably not later than 15th February, 1961, abstracts of not more than 250 words for preliminary consideration.

It is proposed to associate with the conference an exhibition of microwave measurement techniques.

Traffic Radars

THE portable electronic device which measures the speed of passing vehicles made by Marconi's has been ordered for the police forces of fifteen counties in Great Britain. The equipment is now being evaluated by police authorities abroad and Australia, Canada, South Africa and Singapore, are amongst the first countries to try this new apparatus.

In the past two years Marconi's have demonstrated the portable electronic traffic analyser to police authorities and local government departments in Portugal, Italy, France, Austria,

Belgium, Holland and Switzerland.

The first company in Britain to develop a traffic radar device, Marconi's have received in the last twelve months orders for the apparatus totalling about £14,500.

Appointment

THE BBC announces the appointment of Mr. J. D. MacEwan, B.Sc., A.M.I.E.E., A.M.Brit.I.R.E., as Engineer-in-Charge, Television, Birmingham, in succession to Mr H. G. Whiting, A.M.I.E.E., who recently became Regional Engineer, Midland Region.

Mr. MacEwan joined the Operations and Maintenance Department of the BBC in 1947 and after service in Glasgow and Edinburgh he became a member in 1953 of the staff of the BBC's Television Outside Broadcast unit covering Scotland and north-east England. During the following year he was transferred to the television staff in Glasgow.

In 1956 Mr. MacEwan was appointed Senior Lecturer (Technical Operations) at the Corporation's Engineering Training Department, Wood Norton, Worcestershire, which post he

has held until taking up his new duties in Birmingham on 14th November, 1960.

New Zealand's First Broadband Microwave Telephone System

NEW ZEALAND'S capital, Wellington, and the country's largest city, Auckland, are now linked by a 262-mile microwave multi-circuit telephone system supplied by Standard Telephones and Cables Limited, London.

The system may be used, with certain additions, to carry television programmes at a later date, using the existing buildings and equipment.

At present the link has one two-way radio channel capable of carrying 600 simultaneous telephone calls. There is also an identical "standby" radio channel to which the telephone traffic is switched automatically in the event of severe fading or excessive noise on the "working" channel.

The radio terminals for the new 4,000Mc/s radio link are at Hamilton and Palmerston North: these are linked by cables to Auckland and Wellington respectively. There is also a spur connection between Urenui, on the main link, and New Plymouth, on the west coast.

Between Hamilton and Palmerston North eight repeater stations amplify the broadband block of 600 telephone channels. The incidence of earthquake shocks and high winds called for special care in the construction of the masts at these stations. This type of communication system uses a transmitter power of only 5W, concentrated into a very narrow beam. Consequently, the alignment of the aerials must remain correct in all circumstances to maintain the quality of the link.

The automatic supervisory equipment for the microwave link uses a VHF radio system also supplied by STC. This supervisory channel enables faults at repeaters to be reported and identified at the terminal control stations; it also allows the control stations to interrogate each repeater for checking its operational condition.

Sound Reinforcement System

THE contract for an installation at the Aldwych Theatre, London, and covering the provision of a comprehensive sound

reinforcement system, a dressing call system, programme monitoring system, bar interval signals and staff location has been given to RCA Great Britain Ltd.

The object of the sound reinforcement system is to produce sound effects and some incidental music, and not to amplify actors' voices from the stage. The system provides for inputs from remotely controlled tape decks, one disc player and three microphone channels. These six inputs are fed into a patch panel which incorporates input volume controls and switching to enable the six inputs to be pre-selected into four outgoing channels in any combination.

The main/call programme system has some 30 points, and each is so arranged that the programme volume can be altered to zero, but no control over paging calls is possible. The programme is picked up by a single microphone on the circle front, and paging is done from the prompt corner, and the circuit, being normally "dead", is actuated by a push-button on the microphone. Since programme monitoring is continuous, the action of paging automatically reduces the programme level to a pre-set point.

The bar interval signals also use the paging circuit, and by depressing an additional button the backstage paging is cut off and 10 front-of-house speakers

are introduced, conditions reverting to normal when the button is released. The staff location system also uses the paging circuit, and is done from the stage door, but the prompt corner microphone has, of course, overriding facilities.

VHF Sound Broadcasting Station

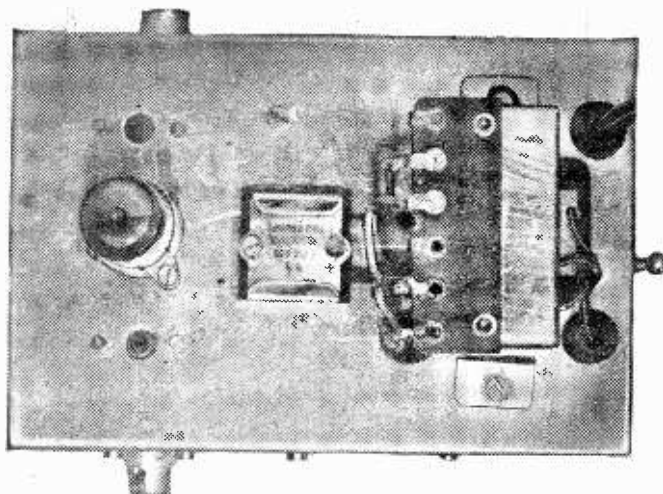
THE BBC has placed contracts with British Insulated Callender's Construction Co. Ltd. for the supply and erection of the 500ft mast to carry the aerials, and with F. R. Hipperson and Son Ltd., for the construction of the building for the new Oxford television and VHF sound broadcasting station to be built near Beckley, some four miles north-east of the city.

This is one of several low-power stations which the BBC is building to extend and improve the coverage of its television and VHF sound services.

The Oxford station will improve television reception for about a quarter of a million people in the area including Bicester, Thame, Abingdon and Witney. It will also extend the VHF sound service to more than a quarter of a million people, including those in Swindon, and will give improved reception for a further quarter of a million people. It is expected that the station will be completed in about 15 months' time.



An operator actuating the controls of the reading console of the Solartron ERA (Electronic Reading Automaton). The tally roll on the right-hand side has been read by the machine.



a BAND II Pre-Amp

THE coverage of the BBC's F.M. may now be said to range from "satisfactory" to "excellent" in most parts of the country. However, in certain areas, perhaps because of local conditions, reception is difficult or almost impossible using conventional techniques.

Initially, if signals are weak, it would seem only necessary to use a sufficient degree of amplification. However, upon further consideration, it is realised that the limit to amplification is set by the signal-to-noise ratio; "noise" in this context refers to any unwanted signals which are picked up with the radio signals and amplified with them. These noise signals may proceed through the ether or be caused by the random movement of electrons in the first valve of the receiver. The current flow from the cathode of this valve to the anode and any other electrodes is not steady because it is composed of negative charges (electrons) and the quantity of electrons is not constant. The effect is a change in anode current and this gives rise to spurious signals in the output. The noise voltages are only of appreciable magnitude in the first stage where they can become comparable with the signal voltages. It can therefore be seen that one of the limiting factors in the amplification is the choice of a low-noise valve for the first stage in the receiver.

Cascode Circuit

The standard input circuit which is employed is the "cascode" and this consists of two triode valves in series. The first triode operates as a neutralised, grounded cathode amplifier and the second as a grounded grid amplifier. Triodes are used to reduce the number of active electrodes and thereby reduce noise and, as the same H.T. current flows through both of them, noise is still further reduced. In this pre-amplifier the cascode valve used is the PCC89, a comparatively recent introduction.

Of course, the use of high gain, low noise valves must be accompanied by the use of the optimum aerials for the particular site: a signal must be present at the input of the receiver before it can be amplified. The best aerial for a particular location is not always the most complicated array; much depends on local conditions, particularly upon the incidence of reflections which give rise to in-phase and out-of-phase effects. Thus, in fringe areas, it is extremely important to test out various aerial arrays, or at least, move the available one around until a comparatively strong signal is found. The use of a low loss downlead is also a necessity which is seldom appreciated; the normal

A USEFUL ADDITION TO RECEIVERS FAR FROM THE TRANSMITTER

downlead can give rise to sufficient losses to reduce the signal reaching the set to negligible proportions. A low loss downlead, while more expensive, is essential.

General Design

When designing this pre-amplifier various circuits and valve types were reviewed but as previously stated a cascode circuit was chosen with a frame grid valve for low noise and high gain.

One of the problems which arose in the design of this pre-amplifier is worthy of note; whilst it is possible to design a circuit and unit which will give some improvement in most locations it is virtually impossible to make a design to give optimum results with every receiver and aerial system. Naturally, the input circuit of the pre-amp tends to be the most critical as regards losses and care should be taken to avoid unnecessary losses.

Circuit Analysis

The circuit employed is conventional. The input is designed for 75Ω coaxial cable but cables of other impedance or balanced cables could, no doubt, be employed with suitable alterations to the input circuit.

Coils L2 and L4 are the input and output tuned coils and L1 and L3 are their associated aerial and output coupling coils respectively. Bias for the first triode is provided by R2 in the cathode circuit and this triode is neutralised by the two capacitors C1 and C2. These two capacitors form two arms of a bridge circuit, the other two arms being the inter-electrode capacitances of V1. Capacitor C2 is made variable so that the bridge circuit can be balanced to give lowest noise. From the anode of V1 the signal passes to the cathode of V2 via

the inductance L_5 which is adjusted for best results. As previously mentioned the grid of V_2 is earthed but only so far as R.F. is concerned and this decoupling is achieved by capacitor C_6 . Resistors R_5 and R_3 form a potential divider across the H.T. supply to the valve for biasing purposes. It must be emphasised here that the capacitor C_6 must be wired with short leads, otherwise the combination of capacity and inductance may give a resonance resulting in ineffective decoupling.

H.T. Voltage

The H.T. used is not critical and can have a voltage of about 140-180; for highest gain the voltage should be in the region of 180. As might be expected, the decoupling capacitors used in the circuit and their wiring have a large bearing upon the results obtained. The associated leads *must* be made

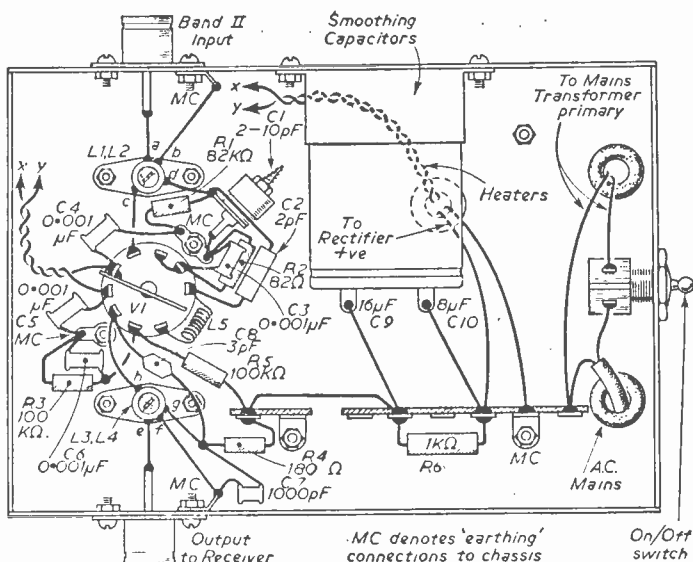
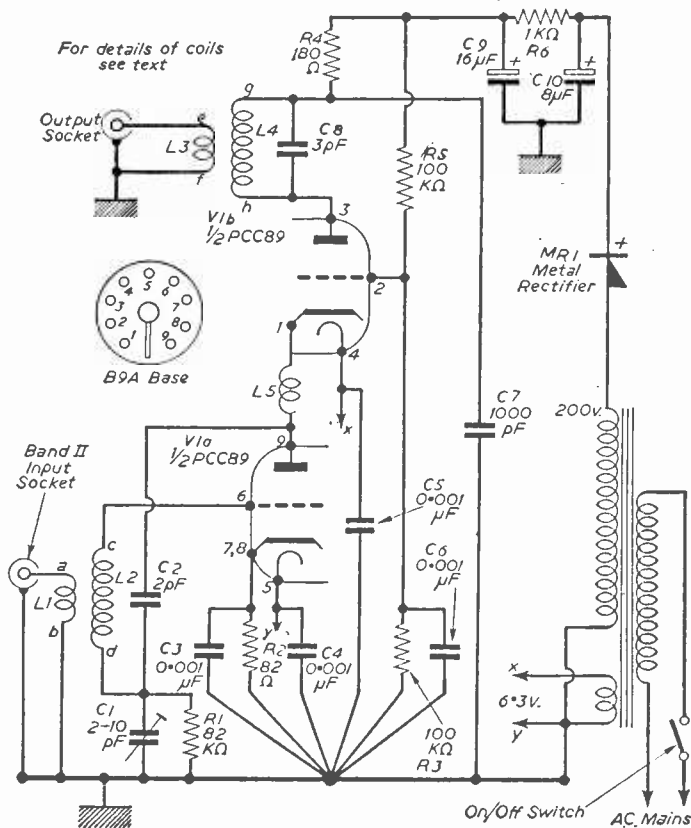


Fig. 1.—Underchassis component layout.



as short as possible and it is best if the "earthy" leads of these capacitors are taken to a common point as indicated on the circuit diagram. This common point can be the metal spigot of the valveholder. The spigot is then wired to chassis by the shortest route, probably to a soldering tag underneath a bolt used to secure the valveholder.

Constructional Details

The construction of this pre-amplifier is not unduly critical but the layout given in the diagrams has been proved to give good results and should be used. The chassis is a box type about 10in. x 6in. x 2in. but these dimensions are not critical and will depend to some extent on the parts employed and on the chassis available.

Coils

The coils are wound on small polystyrene formers with purple coded dust cores. No spacing is employed between turns and the ends of the winding are fixed to the formers with cellulose cement. The coupling windings are wound on a suitable former slightly larger in diameter than the tuned windings so that they

Fig. 2 (left). — The simple circuit employed in this pre-amplifier.

may be slipped over them before the tuned windings are soldered into circuit.

When final adjustments are made, and the optimum positions of the coupling coils have been found, they may be cemented lightly in position. Coils L2 and L4 may be wound with 18-22s.w.g. bare copper or tinned copper wire. Alternatively, the wire used may be 22-26s.w.g. copper, enamelled or DCC.

Inductance L5 is wound with 22-26s.w.g. copper wire, enamelled or DCC, and on a $\frac{1}{4}$ in. diameter former. It is wired between pins 9 and 1 on the valveholder.

obtain a transformer with a suitable heater winding rating it should be remembered that many converter transformers rated at 6.3V at 1 or 2A give about 7V when the total load is only 0.3A—the winding resistance is comparatively high. The H.T. smoothing is by R6, C8 and C9. The value of R6 is not critical and may be adjusted when tests are made to give the optimum H.T. voltage. The values of C8 and C9 are also not critical but should be at least $8\mu\text{F}$. As the H.T. consumption is low, a small metal rectifier can conveniently be used and a contact-cooled type is ideal. The rectifier should be rated at about 30mA.

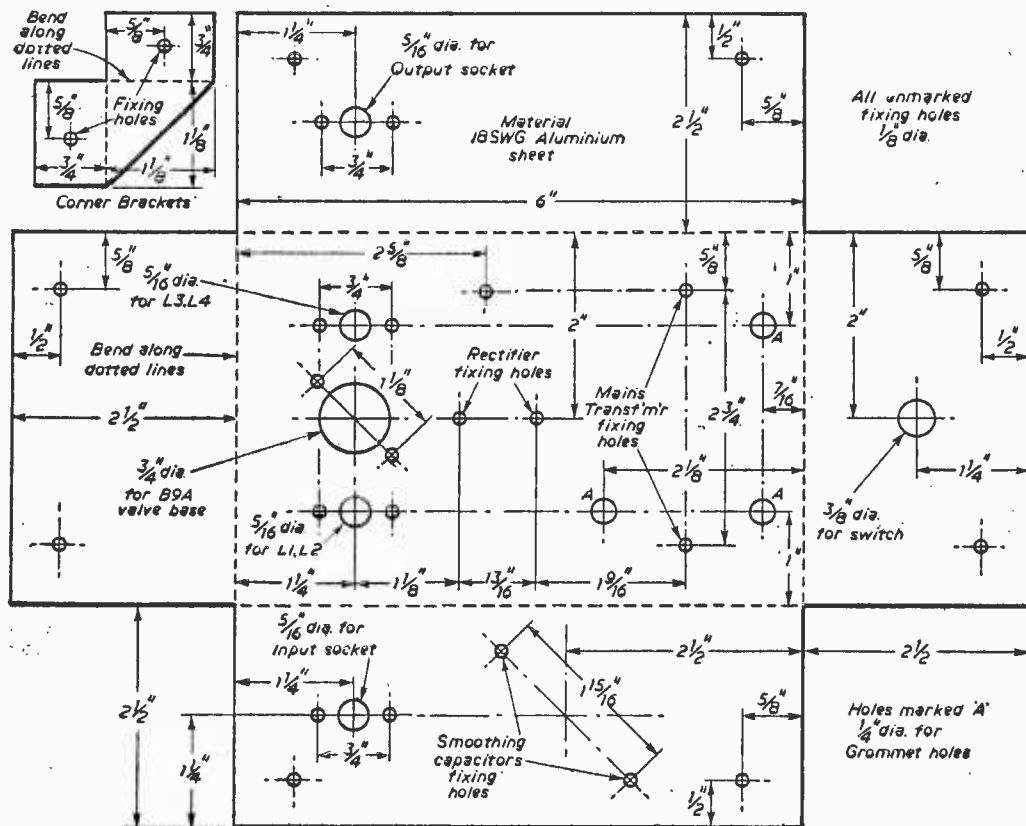


Fig. 3.—The drilling dimensions for the aluminium chassis (the details of the corner brackets are shown in the top left of the diagram).

Power Supply

The H.T. circuits of the power supply employ half-wave rectification for convenience. The transformer used is of the type commonly sold for use in the construction of television converters. A tapped primary is not essential provided the correct rating is obtained for the local mains voltage. The H.T. secondary winding should be rated at about 150-200V r.m.s. at 30mA. The heater winding should give 7.2V at 0.3A if the valve heater is to be run correctly. However if it is difficult to

Valve Connections

The input triode of the PCC89 has two cathode leads. Pin 7 should be wired, at the valveholder, to pin 8. This reduces the effect of the inductance of the cathode lead of the input triode and results in improved performance. It should be noted that the triode connected to pins 9, 6, 8 and 7 should be used for the input and the one connected to pins 3, 2 and 1 for the output as the valve was designed for this arrangement.

(To be continued)

Crystal Controlled C.W. TRANSMITTERS

By G3OGR

JHOUGH a variable frequency oscillator is often used to control the operating frequency of a transmitter, crystal control has the advantage of simplicity. The main disadvantage of crystal control lies in the fact that the transmitter is confined to one or more fixed frequencies, according to the type of circuit, and number of crystals. To some extent this limitation can be overcome by calling for contacts, instead of replying to calls from other transmitters. When answering a call from another station, it is usual to net the V.F.O. on that station's carrier, and reply on his frequency. With crystal control it is unlikely that a crystal will fall on the correct frequency. Therefore a call can be made, and an answering station can net on the crystal frequency. With this method of working, many satisfactory contacts can readily be made.

One-Valve Transmitter

A circuit suitable for a one-valve transmitter is shown in Fig. 1. This will operate successfully with almost any valve. For a fairly good output, a power valve such as a 6V6, 6L6, 6F6, 6BW6 or any similar type will be satisfactory. A 6L6 may easily be run at up to 15W input, which is a very useful level. If more output is required, a single 6146 can be run with an input of 50W or more. With a given valve, the maximum input will depend largely on the power supply. It is, of course, necessary to avoid over-running the valve, but on the other hand good outputs can be obtained with an H.T. voltage much lower than the maximum for the valve.

Such a transmitter is extremely easy to start working, and can be run from even a receiver type power pack, if necessary. It is thus excellent as a standby, or as a simple unit with which to begin working while a more elaborate transmitter is being constructed. It is unlikely that more than 50W input will be required, even for long distance working, and the 6146 R.F. power valve mentioned can then be run from an H.T. line of about 400V, with 10k for R1, and 47k for R2. With other valves, R1 and R2 may be modified to obtain a suitable screen grid voltage. Or

a 50k or similar resistor, with a movable clip, can be used. The screen grid is then fed from the clip, which is adjusted to obtain a suitable voltage. When using a relatively low H.T. voltage the screen grid can be run directly from the H.T. line.

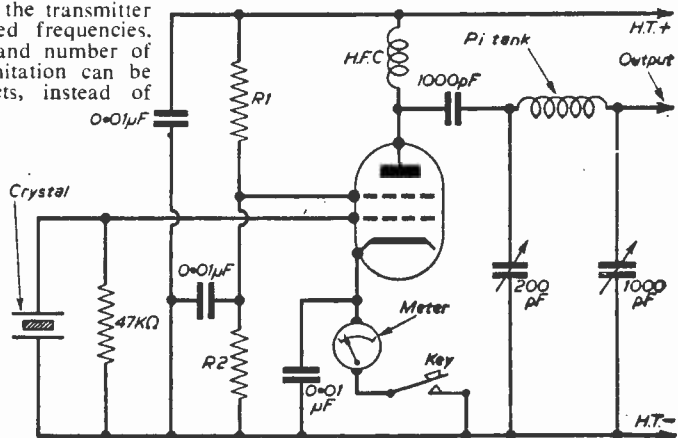


Fig. 1.—Crystal controlled one-valve transmitter.

For the 3.5Mc/s band, the π -tank can have about 36 turns of 18s.w.g. or similar wire, on a ribbed former about 1½ in. in diameter. For the 7Mc/s band, 16 turns will suffice. For other than small power, the 200pF condenser should be a transmitting type. The 1000pF condenser does not need to have widely spaced plates, and may conveniently be obtained by wiring the two sections of a 500pF

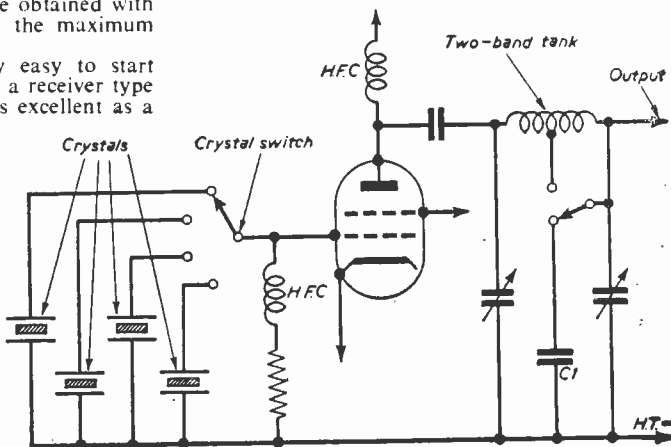


Fig. 2 (right).—Crystal and output tank switching.

or similar 2-gang receiver tuning condenser in parallel.

For working on one band, a fixed coil can be used. For two or more bands, plug-in coils may be provided, and changed while changing crystals. For working the various crystals in one band, the same tank coil is retained. The 200pF condenser is adjusted to obtain a current dip on the meter. If this dip indicates less input than required, the 1000pF condenser is adjusted to a lower value to increase loading, and the 200pF setting modified as necessary to restore the current dip, which will then be higher.

Crystal and Tank Switching

Though crystals can quite easily be changed in a holder, it is an added convenience to fit a switch, as shown in Fig. 2. Immediate operation upon any of the crystal frequencies is then possible, with only slight re-adjustment of the tank tuning condenser. A H.F. choke may also be included, as indicated, and can give a slight increase in efficiency.

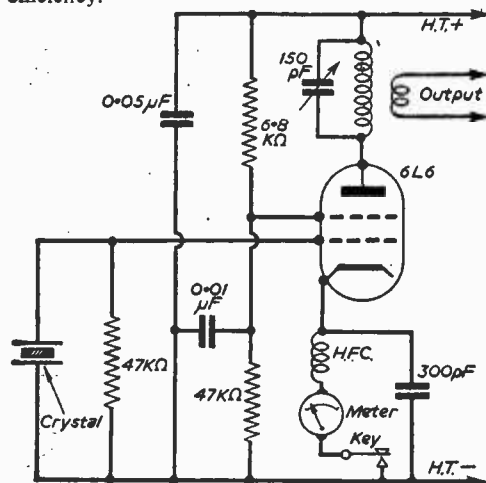


Fig. 3.—A regenerative oscillator.

For two-band working, a tapped coil may be fitted. This can have 36 turns as described, tapped at 16 turns. The whole coil will then provide 3.5Mc/s band working, with 7Mc/s band working when the switch is closed to short out the unrequired turns.

If a 2-way switch is used, as in Fig. 2, this can bring a fixed condenser C1 into circuit, for 3.5Mc/s band working. This is an advantage when the aerial loading condenser (1000pF in Fig. 1) is of insufficient capacity for the aerial. In these circumstances, C1 can be a high grade mica condenser of 100pF to 500pF, as required. The crystals may, of course, be for two bands, according to what is available.

Regenerative Oscillator

The radio frequency output from the stage may be increased by providing some regeneration. One method of doing this is shown in Fig. 3. The 300pF condenser may be modified in value, if necessary, to obtain a suitable effect. Actual results depend

to some extent on crystal activity. Fig. 3 also shows values for a 6L6, which may be run to 12 to 15W input, if desired.

Another method of obtaining regeneration is to increase the 300pF condenser to about 500pF, and connect a 20pF or similar trimmer from grid to cathode. Regeneration can then be adjusted by means of the trimmer.

A π -tank, as in Fig. 1, may be used in Fig. 3. With the tank in Fig. 3, loading is adjusted by modifying the loop coupling. To feed a single wire aerial, the loop can be taken to an aerial tuner. For band changing, 4-pin plug-in coils may be used, each with its own loop. Windings may be as described, with two turns for the 7Mc/s loop, and 4 turns for the 3.5Mc/s loop, tightly coupled to the H.T. end of the coils.

Regeneration is also useful when the stage will be used to drive a doubler, to give 2-band working from one crystal. With any of the one-valve transmitter circuits, doubling is possible. However, R.F. output will fall off, and an aerial tuner should be added to reduce possible radiation of the fundamental. Regeneration is also desirable, with an active crystal, and adequate H.T. voltage.

A Push-pull Circuit

Similar valves may be employed in push-pull, to obtain increased output, and one circuit for this is shown in Fig. 4. This can give a powerful output, the actual maximum depending on the valves and H.T. voltage. The valves should be similar, but it is not necessary that 6L6's be used.

The screen grid supply may be obtained from a resistor with clip, as described, if preferred. For 250V receiver type power supply, the resistors may be omitted, as mentioned.

When adjusting any of the circuits, a 200/250V household lamp may be used as an R.F. indicator, for the smaller powers, a 25W lamp is suitable. If a 6146 is employed, a 60W lamp will be satisfactory. With π -tanks, connect the lamp from the output socket to chassis. With tank circuits like those in Figs 3 and 4, best loading will be obtained by connecting the lamp across some turns of the aerial tuner.

An "Automatic" Two-Band Circuit

In Fig. 5, the oscillator drives two output valves. The grids of these are operated in push-pull, but the anodes are in parallel. This provides a good output at twice the crystal frequency. When working in this way no neutralisation is needed, because of the frequency multiplication, and the high band coil L1 is in use.

For operation on the crystal frequency, the anode circuit is switched to L2. At the same time one output valve heater is switched off. The remaining valve then operates as a straight through amplifier, while the inter-electrode capacity of the unused valve provides neutralisation, due to the centre-tapped grid coil.

This circuit is particularly useful for the 1.8Mc/s and 3.5Mc/s bands. Here, regulations limit the input to 10W on the 1.8Mc/s band, so that the H.T. voltage or aerial loading can be adjusted until this figure is approached. When doubling into the 3.5Mc/s band the input will then be about 20W, as both valves will be in use. This provides extra useful power, as the 10W limit does not apply to this band.

For operation in this way, the oscillator coil can have about 70 turns of 24s.w.g. or similar wire, on a $1\frac{1}{2}$ in. or near diameter former. The coil is centre tapped. To maintain circuit balance, a split stator or butterfly type condenser is preferable for tuning this coil, but is not essential.

The screen grid resistors are selected as already explained. Three 6L6 valves will be satisfactory, but other valves are equally suitable. The screen grid resistors may be omitted for moderate voltages.

then be ensured that the normal grid drive is present, before switching in the output stage. With this method of operation, there will be no need to provide a separate bias supply for the output stage. It is in order to obtain safety bias for the output stage by using a cathode resistor. With a 6146, 2mA to 2.5mA grid current with a 27k grid resistor will be satisfactory. The output stage may otherwise be as shown for Fig. 1.

(To be continued)

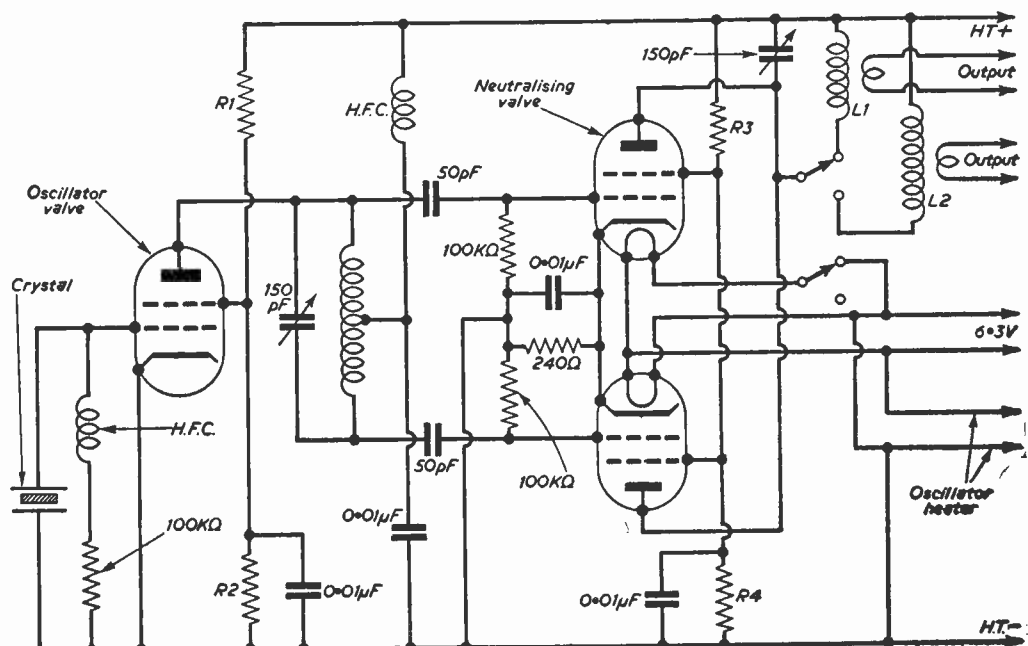


Fig. 5.—A circuit for two-band operation with one crystal.

Multiplier Stages

A simple method of obtaining frequency multiplication by the use of an extra stage. The anode circuit of the first stage is tunable to the crystal frequency, and the second stage is tuned to twice this frequency. The output then drives the grid of the valve or valves forming the output stage.

Normal screen grid voltages are provided. Bias for the second stage is obtained by grid rectification, so the circuit should not be left switched on without the first tuned circuit correctly adjusted. If preferred, a cathode resistor may be added to provide safety bias for the doubler. For efficient doubling, fairly high bias is required. Even with cathode bias, additional bias will be developed across the 100k grid resistor.

The output stage should have a grid current meter, so that grid current may be read before applying the anode and screen grid voltage. It should

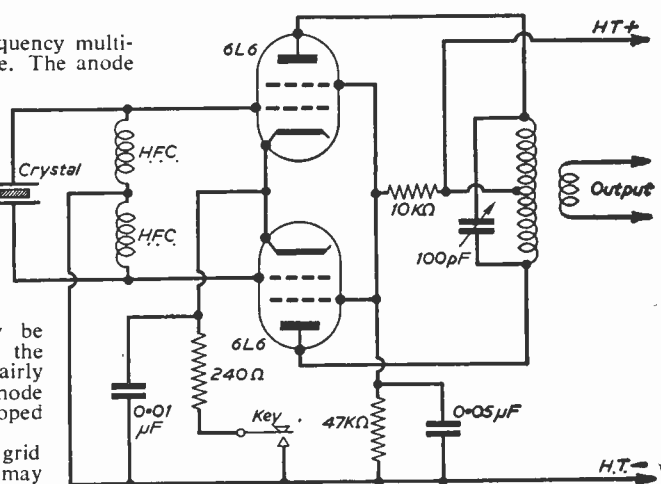


Fig. 4.—A push-pull 20W transmitter.

COMBINED RADIO AND TABLE LAMP

USING A 40W LIGHT BULB INSTEAD OF A MAINS DROPPER

By M. J. Dunn

(Continued from page 805 of the January issue)

ALTHOUGH general wiring details were given last month, it must be borne in mind that the final form of the set may be altered to suit individual requirements. Most of the connections between and around the valve sockets and tag-strips can be made by soldering the components straight in from point to point. All grid and anode leads in the R.F. and detector stages should be kept very short and the coils mounted so as to achieve this. A few points will be mentioned later on with regard to the possibility of encountering R.F. instability, but at this stage careful attention to the "hot" leads and stray capacities in the circuits associated with the two coils will pay dividends later. Nearly all the information required can be derived from the circuit diagram of Fig. 4, but Fig. 1 showed a suggested form of layout which is in fact that adopted with success in the author's model. Figs. 2 and 3 gave all the switch connections.

two sections of which ("A" and "B") act as a normal wave change switch for the coils in positions 2 (L.W.) and 3 (M.W.). In position 1, Section C short circuits the heater chain so that the lamp is connected directly across the mains and section D disconnects the mains from the rectifier, so that in this position the apparatus works solely as a source of illumination. R2 (470k) is included connected across the H.T. supply to act as a bleeder and it discharges the smoothing capacitors when the set is switched off, or switched to "lamp only" position. The mains are switched on and off by SW1 ganged to the volume control and it is a wise policy to leave SW2 in position 1 when the set is not in use so that the lamp takes the initial surge when switching on. However, no ill effects have been noticed from switching on and off with the heaters in circuit and in practice the surge is so instantaneous that the brunt is almost entirely borne by the lamp which reaches incandescence so rapidly compared with the many seconds required for the heaters to warm up. The author strongly recommends the use of a three-pin mains plug—not necessarily for earthing the set, but to ensure that the polarity is such that the neutral lead goes to chassis. If the set is earthed through a three-pin plug, the inclusion of the two capacitors C11 and C12 is good for avoiding mains-borne

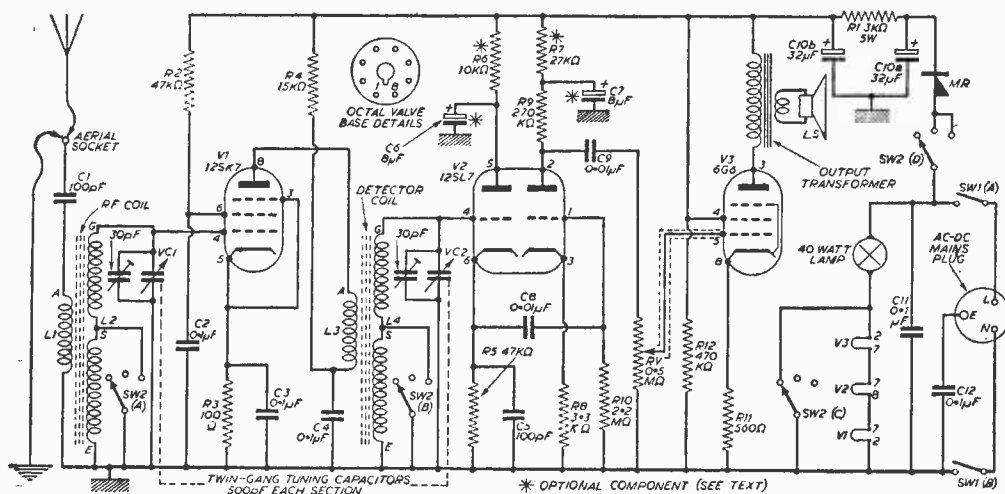


Fig. 4.—The circuit diagram.

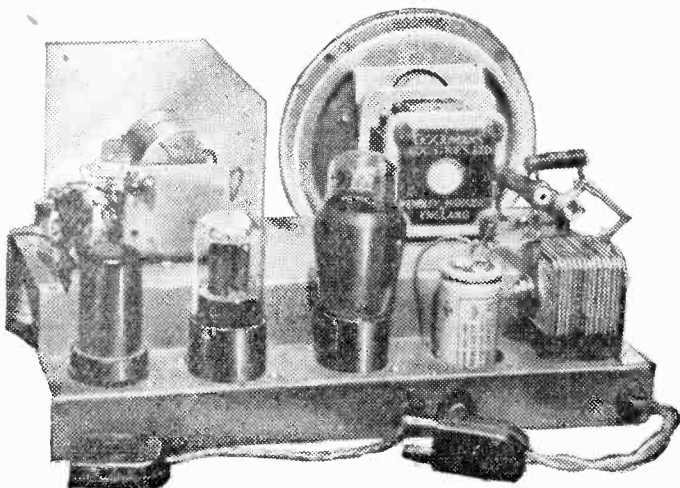
The Power-Pack

After passing through the double-pole on/off switch, one limb of the mains goes direct to the chassis and the other to one of the lamp connections, the second of which returns to chassis via the valve heater chain. The "hot" mains lead also goes to the negative end of the H.T. rectifier via section "D" of SW2, the function of which can now be explained. This is a four-pole, three-way selector switch,

interference and modulation hum; however, the earth often gives excellent results as an aerial, in which case the arrangement in Fig. 6 can be adopted and the earth lead can terminate in a standard wander-plug to be placed in the aerial socket. All the usual precautions should be taken, of course, to see that in the finished article no part of the chassis, or anything connected with it, can be touched by the operator.

Final Setting-up, Aligning and Testing

After wiring up, the circuit should be thoroughly checked over and this is best done stage by stage. Particular attention should be paid to the mains, heater and power supplies. It is a wise procedure first to switch on with the H.T. disconnected and to check the voltages across the heaters, both individually and as a whole, unless this has been done as a separate operation during construction. Using a high resistance voltmeter, V1 and V2 should read 12.6V across each of their heaters and V3 should read $6.3V \pm 7\%$ per cent allowed. If the heaters are found to be working within their tolerance limits the H.T. can be reconnected and the set lined up. To do this the standard procedure for lining up T.R.F. receivers is adopted. Insert the aerial and tune the dial to within a few degrees of the lower end to receive any readily available station. Adjust the trimmers for maximum reception. Then swing the tuning capacitors to the top end of the dial and on hearing a station, adjust the cores for maximum reception. Repeat this process at the lower and upper ends of the dial until a good compromise is obtained. Due to the excellent selectivity of this set, the trimmer of the first stage will probably require adjustment for different lengths of aerial so that initial setting should be done on the actual aerial to be used or one of similar characteristics. The above procedure applies, of



The completed receiver prior to fixing in its cabinet.

course to the medium waveband (SW2, position 3). After this, switch to the L.W. position. If the Light Programme on 1500m needs any adjustment, this is best effected by a separate trimmer on one or other of the L.W. coils; this will, of course, be shorted out together with the coil, in the M.W. position of the switch. The important thing is to get the M.W. correct and probably no trouble will be experienced with the L.W. However, trouble may occur due to capacity effects of the wavechange wiring and switch.

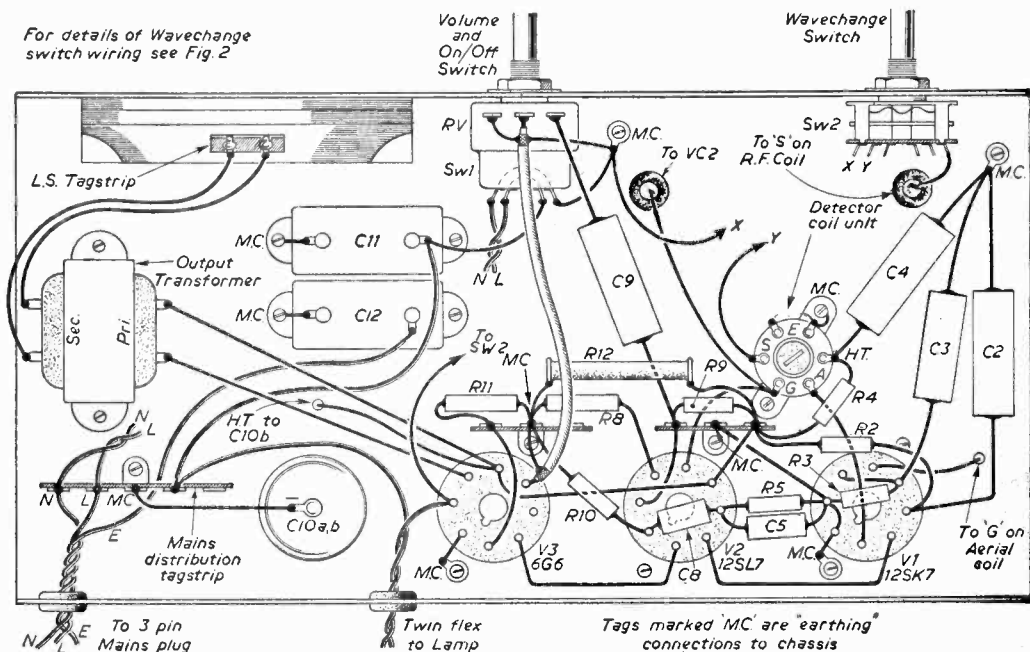


Fig. 5.—The underchassis component layout and wiring diagram.

Instability

The cathode follower detector imposes no load on its associated tuned circuit (L4) with the result that with a good coil a very high Q is obtainable with excellent selectivity and gain. Because of this,

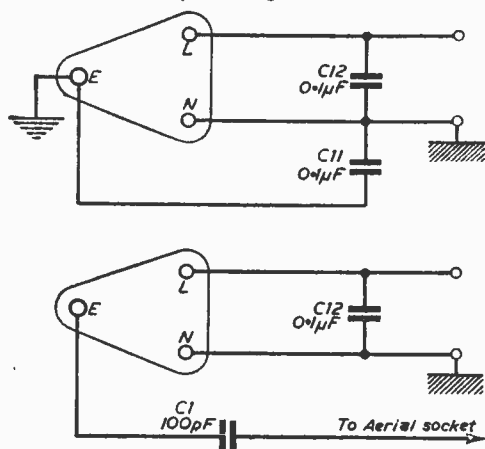


Fig 6.—This shows the mains connections for a 3-pin plug; in the lower diagram the earth pin is connected to the aerial socket.

COMPONENTS LIST

R1	3k, 5W
	all other resistors are $\frac{1}{2}$ W.
R2	47k
R3	100Ω, see text
R4	15k
R5	47k
R6	10k
R7	27k
R8	3.3k
R9	270k
R10	2.2M
R11	560Ω (6G6).
	390Ω (12A6).
	1k (12J5).
RV	0.5M with D.P. switch.
C1	100pF (500V).
C2, 3, 4	0.1μF.
C5	100pF.
C6, 7	8μF, see text.
C8, 9	0.01μF.
C10 a-b	32–32μF.
C11,12	0.1μF (500V).
Twin-gang tuning capacitors: 500pF.	
with trimmers: 30pF.	
Slow motion drive, pointer and dial.	
V1	12SK7 (or 12K7, 12SJ7, 12J7).
V2	12SL7.
V3	6G6 (or 12A6, 12J5).
3 International Octal valve sockets.	
Pair of matched T.R.F. dual range coils (Repanco).	
Miniature O.P. Transformer. Loudspeaker.	
Metal Rectifier: 250V, 50mA.	
SW2 4-pole, 3-way rotary switch.	
Electric light bulb—40W, 240V rating (see text).	
(Holder, lampshade and support).	

however, the circuit is rather prone to R.F. instability and this will arise if the anode to grid capacity of V1 is above a certain safety margin. There is, of course, an inherent capacity between these two electrodes in the valve itself, but apart from this extra will arise from the external wiring and possible coupling between the grid and anode coils. Although the latter are separated by being above and below chassis, one critical item is the leads from the coils to the wave-change switch, which although at chassis potential on M.W. are part of the tuned circuit on L.W. and unavoidably near each other. They should, therefore, be kept as far apart as possible throughout their course, and should be kept short and non-parallel. If the set howls on L.W. but not on M.W. this wiring should be suspect. Oscillation may occur over certain parts of the tuning range if the set is not properly lined up, so this matter should be attended to before condemning and making radical alterations to the wiring. If intractable oscillation is found to be present, apply the minimum necessary of "negative reaction". The specified pair of coils has an otherwise unused reaction winding on L3—4. One end should be connected to chassis and the other to the grid of V1 via the smallest possible capacity, making sure that the feedback is out-of-phase. Over-doing this will impair the high Q otherwise obtainable in the circuit and the procedure should be avoided if possible.

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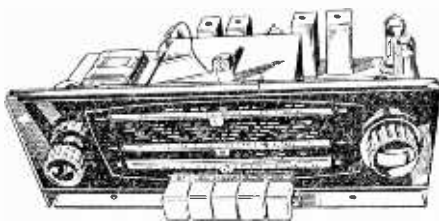
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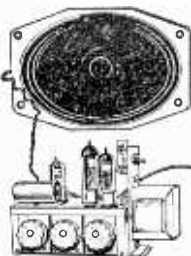
A-10 £4.17.6

B-20 £6.10.0



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: 5½ x 3½ x 1½in. Weight 17 ozs.

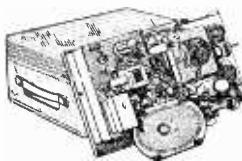
B-20—10K ohms/v. on 0.5 v. and 2.5 v.; 4K ohms/v. on 10, 50, 250, 500 and 1000 v., A.C. and D.C. Resistance, 2K, 200 K., 2M and 20M-ohms; D.C. current, 100 microA, 2.5 mA, 25 mA, 250 mA. Size: 5½ x 3½ x 2½in. Weight, 24 ozs.



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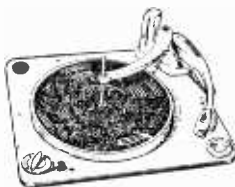
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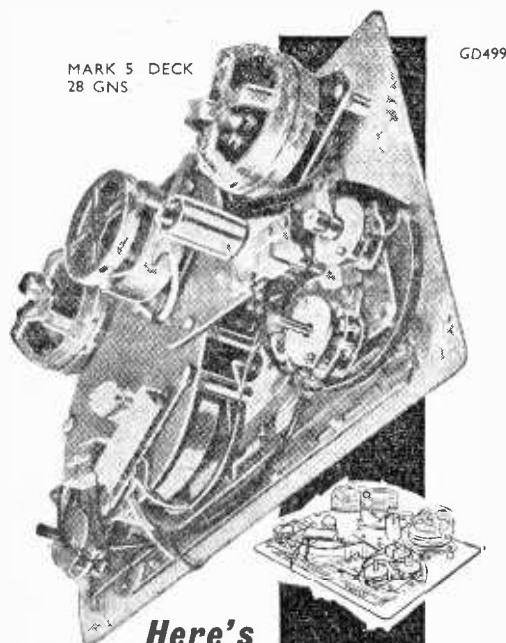


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A reflex cabinet consists of an enclosure of between 1—27cu.ft. the larger the better. There is a small vent hole in the cabinet that makes it resonate at a low note. The smaller the hole the lower the note. A speaker is mounted in one wall or on the top of the cabinet, facing outwards. While the speaker projects the higher notes into the room, the cabinet builds up the bass notes which come out of the vent hole. The principles involved are that as the note from the speaker descends towards the resonant note of the cabinet the cabinet resonates louder, but at the same time the enclosed air reacts against the cone of the speaker, damping down the cone movement. These two factors give an even bass response.

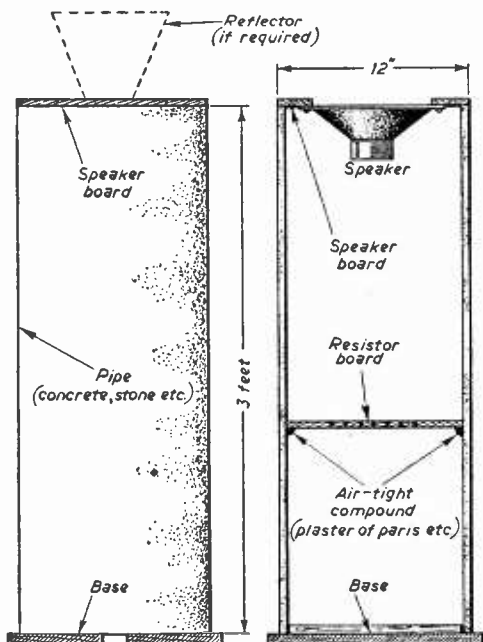


Fig. 1.—Plan and sectional views of the enclosure.

Making these cabinets out of wood and packing them with sand is a skilled job, for not only must they be solid and heavy, but no part of them must vibrate. Any vibration of a speaker cabinet

INEXPENSIVE, HIGH QUALITY ENCLOSURES

By F. B. Burge

destroys the purity of the tone and absorbs the energy of the speaker.

Expensive reflex cabinets 1ft square and 3ft high, fitted with full range 8in. speakers are becoming very popular as they are neat and well fitted to stereophonic reproduction.

The ideal cabinet would be one made of concrete, but these, of course, are not produced.

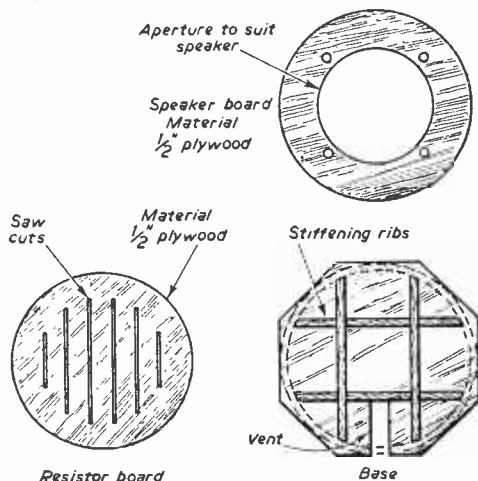


Fig. 2.—Plan views of the loudspeaker board, the acoustic resistor board and the base of the enclosure.

Fortunately the same effect can be obtained by using standard cheap objects made for other purposes.

Suitable Materials

Concrete sewer pipes, flue linings, chimney pots and drain pipes may be used and are cheap and can be made very presentable when painted. Speakers mounted in these give astonishing results even from ordinary wireless sets, tape recorders and record players. Chimney-pots tend to give slightly better results than the others as their tapered shape improves the tone.

The choice of design of the cabinet is entirely the constructor's as large ornamental chimney-pots give as good results as plain sewer pipes, etc. The recommended dimensions of the cabinet are 3ft (tall) x 12in. (diameter). For this size a speaker of not more than 8in. is suitable.

An Acoustic Resistance

An acoustic resistance must now be fitted one-third of the way up the pipe. The resistor consists of a piece of $\frac{1}{4}$ in. plywood cut to fit into the pipe. This board has parallel saw cuts in it, $1\frac{1}{2}$ in. apart starting and finishing 2in. from the edge so that

(Continued on page 886)

80-Metre Aerial Coupler

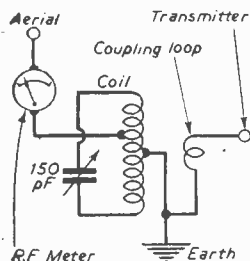
A COMPREHENSIVE MATCHING CIRCUIT

By G3OGR

ALTHOUGH coil details for the aerial coupler described here are for the 3.5Mc/s to 3.8Mc/s band, the coupler can be used on other bands merely by changing the number of turns on the coil. The coupler is intended as a matching device between transmitter and aerial, or as a coupler allowing a dipole to be fed from a π output network. It also provides a means of feeding a single wire aerial from a coupling link, and allows loading up of the transmitter with end-fed aerials which would not load sufficiently with a π output.

Former Winding

The circuit is shown in Fig. 1. For the 80m band a standard ribbed former approximately 2½ in. in diameter and 5 in. long will be satisfactory.



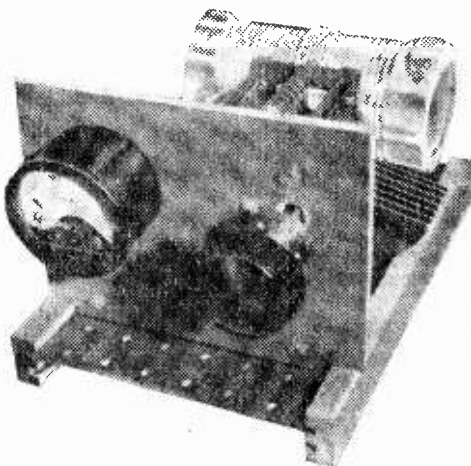
The winding can consist of 26 turns of 18 or 20s.w.g. wire, occupying about 3½ in. winding length. With formers of other diameters, it is only necessary to change the number of turns until resonance can be obtained.

Fig. 1 (left). — The circuit for the coupler.

For coupling, three turns of adequately insulated wire, placed centrally round the coil as shown in Fig. 2, will usually be sufficient. This loop may be modified as described later, if necessary.

A radio-frequency type meter is included as shown in Fig. 1, so that aerial current may be read. This is a useful addition, as it immediately shows if the transmitter is providing its accustomed output. It also indicates how aerial current is modified by tuning, coupling adjustment, etc. Provided the aerial itself is not changed, the meter will give an increased reading, as the transmitter and coupling are adjusted for optimum performance.

For most moderately powered transmitters, an 0.350mA or 0.500mA R.F. meter will be satisfactory, when the aerial is end-fed. For powers in excess of 40W or so, a meter with a higher full



scale reading can be employed, or the meter may be shunted with a piece of connecting wire.

When feeding a dipole, the meter is in one feeder only. As feeder currents will roughly balance, two meters are not essential. Since a dipole will normally be fed at a low impedance point, the current will be larger. However, the meter can easily be shunted, as mentioned, if necessary.

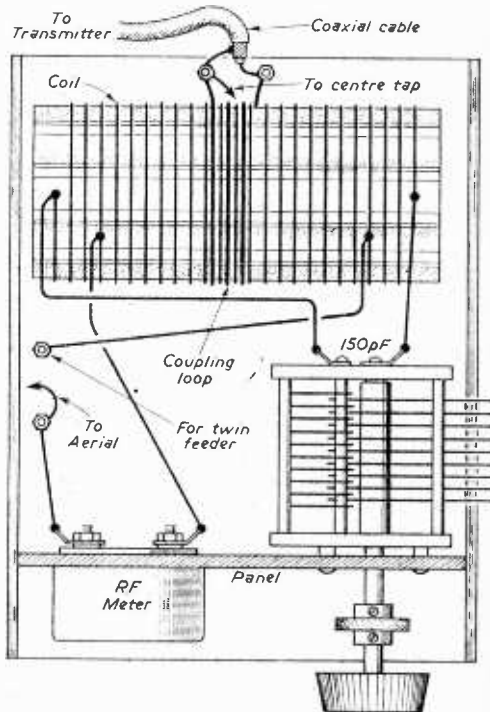


Fig. 2.—The wiring diagram of the unit.

Coupler Construction

Fig. 2 shows a suitable layout. An insulated baseboard about 9in. x 6in. with a panel about 6in. x 5in. will be convenient. Strips 9in. long raise the base, to give clearance for the terminals.

The meter may be a flush or projecting type, either being equally satisfactory. The tuning condenser may be about 100pF to 200pF. For low powers, a receiver type condenser will do. But for larger power, wider spacing will be necessary. New and surplus condensers are available from many suppliers.

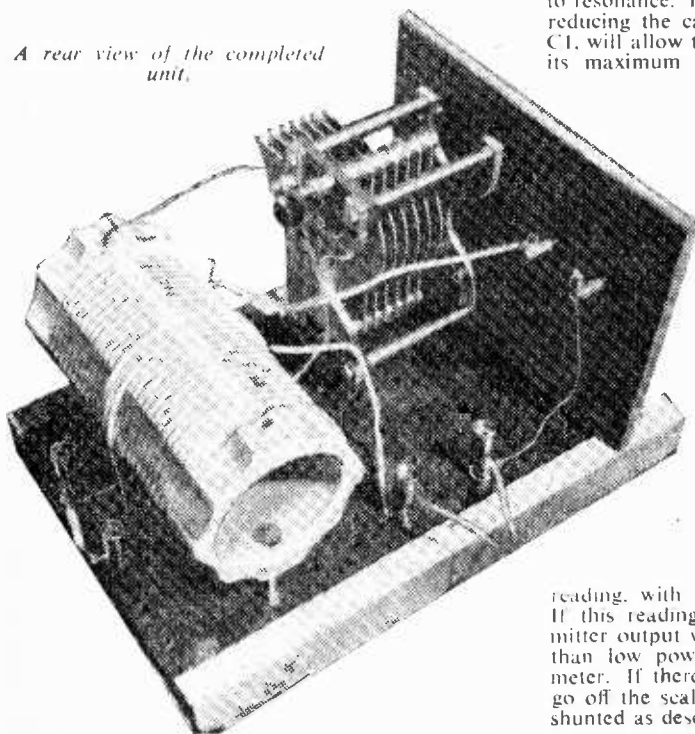
If the coil is wound as directed, leads from it may be permanently connected to the condenser. But if the coil is of different size, a check should first be made that resonance can be obtained throughout the band.

A short, insulated spindle is best used with the control knob, as the condenser spindle will be alive with R.F. when a centre tap is employed on the coil winding.

Feeding from π Output

A co-axial socket is usually provided with π output circuits, and a short piece of co-axial cable is then convenient between the transmitter and tuner.

A rear view of the completed unit.



This method of connecting the unit is shown in Fig. 3. The cable can be of such a length that the tuner may be placed at a handy position, and near the aerial feeder.

When used with a π tank, the coupler allows high-impedance aerials to be matched to the transmitter. If the π tank is used alone with an end-fed

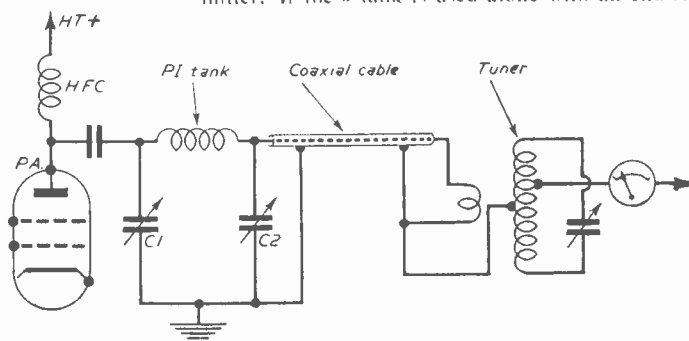


Fig. 3. This shows the method of coupling to a π output.

aerial, it may be found that no adjustment of the π tuning controls will allow satisfactory loading. With an end-fed aerial, an excessively high impedance is likely.

When the tuner is connected, close C2 in the π tank in the usual way when commencing to load an aerial. Adjust C1 for the customary P.A. anode current dip. The aerial unit should then be tuned to resonance. It should then be found that slightly reducing the capacity of C2, and readjustment of C1, will allow the transmitter to be loaded to draw its maximum anode current. If not, the meter aerial tapping on the coil should be moved a turn or so towards the end of the coil.

A dipole cannot normally be fed from a π tank, except with a coupler, and the unit will allow this to be done. In this case, adjustments are as described for the end-fed aerial, except that the two feeders of the dipole are connected to the coil at equal distances from the centre tap. The meter will be in one feeder only, as mentioned. An additional terminal is provided for the second feeder, as shown in Fig. 2.

The impedance of a dipole fed in this way can be very low, so theappings will usually need to be much nearer the centre of the coil. The aerial current will also be greater, due to the reduced impedance, so the meter should be shunted with a piece of connecting wire until it gives a convenient reading, with the transmitter operating normally. If this reading is noted, any reduction in transmitter output will be at once obvious. With other than low power, take care not to burn out the meter. If there is any tendency for the pointer to go off the scale, as loading is begun, it should be shunted as described.

Link Coupling

When link coupling is used, a loop is connected as shown in Fig. 4. This loop should be similar to

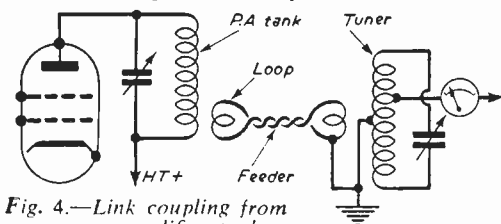


Fig. 4.—Link coupling from a power-amplifier tank.

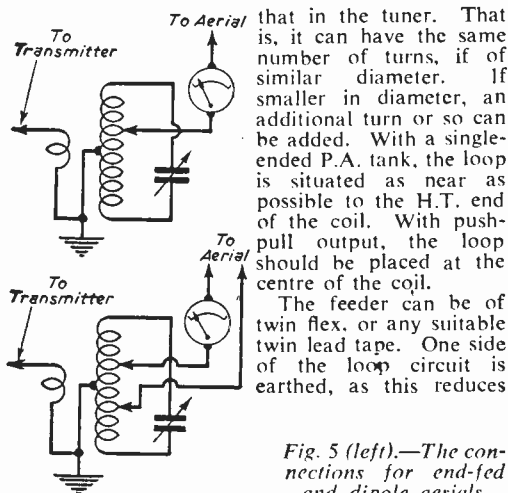


Fig. 5 (left).—The connections for end-fed and dipole aerials.

harmonic radiation, in addition to the normal harmonic suppression furnished by the aerial tuner.

With link coupling, tune the aerial circuit to resonance, and adjust the loop until the P.A. draws its normal loaded anode current. Moving the aerial tapping on the tuner coil will also modify loading,

so a suitable degree of coupling can be found without much difficulty.

End-fed and Dipole Aerials

When using an end-fed aerial better results are normally achieved if the centre of the coil is earthed, as in Fig. 5. With a co-axial input, this circuit may be completed through the sheath to the transmitter (Fig. 3.)

End-fed aerials will usually present an impedance of several hundred or thousand ohms, when approaching a half-wave in length. For this method of operation, the aerial current will not be very large for a given wattage. Reasonable results are obtainable with no earth, in these circumstances, and this is sometimes a convenient system.

When the end-fed aerial is near a quarter wave, it will be current-fed, as its impedance is lower. For a given wattage, the aerial current will then be very much larger. A really good earth is desirable, for maximum efficiency in these circumstances.

The usual dipole will be current-fed at the centre for the band for which it is cut when used with an untuned feeder. The feeder may be any twin conductor. Good results are obtainable without an earth, in these circumstances.

With a harmonically operated aerial, or aerial with a tuned feeder, current and voltage will be present at the tuner, in varying proportions, according to the aerial and feeder length.

In all cases, any of these aerials may be matched by tuning to resonance, then adjusting π or link coupling until the P.A. draws its maximum anode current on resonance.

If it should be found that the transmitter cannot be loaded with the tuner loop described, more turns should be added to the loop. When first adjusting the tuner, the aerial feed points should be modified a turn at a time. When suitable positions are found, connections should be soldered. After adjusting the tuner at the centre of the band (e.g. 3650kc/s. for the 80m band) no other modifications will be necessary.

CERAMIC SPEAKER CABINETS

(Continued from page 883)

the board is not made too weak. This limits the amount of air that can move in the pipe. When fixing the board it is easier to manage if a screw is inserted as a handle. It can then be wedged into position with another screw placed between the board and the pipe. The edges then can be made air-tight with plaster of Paris or similar compound.

The speaker (which must match the amplifiers) should have its face protected from dust by a covering of thin material, and then be bolted firmly on to a board. This board ($\frac{1}{2}$ in. plywood) should have been shaped to fit on to the top of the pipe and can be firmly fixed with more plaster of Paris, etc. The speaker is now in the pipe facing upwards.

A base is now made for the pipe to stand on with a slit about 4in. x 1½in. (for a 3ft by 12in. pipe) left open for the vent. If the bars that hold the base together fit the pipe exactly they will

keep it centrally positioned on its base. A larger cabinet would have a proportionately larger vent hole.

(A reflector may be placed above the speaker to throw the higher notes into the room and gives improved results.)

When all is assembled it can be finished as the reader chooses.

Large ornamental chimney-pots look the best. 3ft tall 12in. flue linings are the neatest. But sewer pipes and drain pipes can be made to look quite neat. I recommend a 12in. pipe with a speaker not larger than 8in. Chimney-pots have the additional advantage of being tapered, which seems to improve their tone. The general rule is the bigger the better. A 9in. pipe seems to be the minimum size for good results. Large speakers find difficulty in moving fast enough for the high notes.

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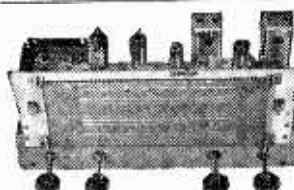
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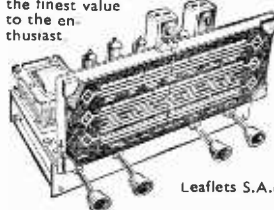
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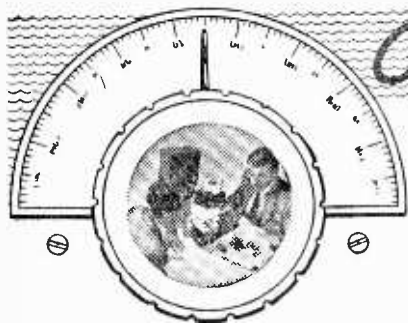
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On Your Wavelength

BY THERMION

Pocket Sets

I was recently loaned a pocket set of doubtful make and asked what I thought of it. I had not previously troubled about this type of apparatus, but was agreeably surprised by the quality and tone of reproduction in London. I had to make a journey and thought it would be a good idea to take the set with me. I am glad I did so, as I found that the performance of the set varied considerably from area to area. In fact at one place I could hear nothing at all on it, and it must be remembered that the small aerial which is fitted is very dependent upon signal strength in the area. I am sure that much of the disappointment which is expressed by readers in this type of apparatus is due to its use in unsuitable areas, or perhaps by the use of an unsuitable set in a bad area. If you happen to be one of those who perhaps have been disappointed, try a better type of set. Perhaps you tried a two transistor loudspeaker set and did not get much joy out of it, whereas a four transistor set might completely change your mind on this type of receiver.

S.W. Receivers

I RECENTLY wrote about short-wave reception and in the course of my notes I mentioned that many years ago a set which I was using had proved better than a commercial (American) S.W. set, and that details of this set had been published in these pages. I have received dozens of letters since those notes appeared, asking if a copy of the issue or issues describing the set could be obtained, and in many of these letters readers suggested, if the information was no longer obtainable, that I might be in a position to recommend a modern set which would be ideal for short-wave listening. The details of the set in question are completely out of print (it was in a pre-war issue), and in any case it could not now be built as it incorporated certain components and parts which are no longer on the market. The circuit incorporated the superhet principle, with an "S" meter, and the main novelty was in the tuning circuits, where band-spreading was employed, but the band-setter consisted of the ganged main tuning condensers, and the small band-spreaders were ganged and taken to the main slow-motion tuning control fitted with a 300deg tuning dial which formed the main control. Therefore, if you are seeking a new set, look for some similar type of tuning system if this arrangement interests you and above all try and select one with an "S" meter. Although this means little from a point of view of reporting signal strengths (there is no basic measurement, remember, and it is purely an arbitrary reference) it does give the user of the receiver a direct reading which may be used for comparisons.

The "Best" Set

As for my recommending a set, this is a little difficult as personal preferences play such a large part in the choice of a set, not only from the point of view of operation, but also from the appearance. Some amateurs like to see a set full of dials and controls, even if half of them are more ornamental than useful, whilst others prefer an open bread-board type of construction which gives results—never mind the looks. I have tried many ex-government pieces of apparatus, but remember that these have in the main been designed to do a specific job, and as such price has not been spared. But whether they will fulfil a general purpose situation such as is needed in the amateur's den is another matter. The receiver which I kept longest in my active transmitting days was an AR88, and I had no fault to find with it. It had an "S" meter and stood up well to the work it had to do at an active amateur station, but I know it does not suit everybody.

Annoyance

Whilst on the subject of these little sets I would like to mention that a note appeared in a local paper recently deploring the introduction of them, as they annoy other people. The writer said he had visited a beach on the south coast and could not enjoy his stay as several portables were "blaring out" in the neighbourhood. After all, many people do go out into the country or to the seaside to get away from the noises of civilisation, and it can be very annoying to hear the radio following you—especially as in many cases the users of these sets seem to prefer modern jazz. I venture to think that if these little sets do become very popular and this type of outdoor use grows, the Noise Abatement Society will try and do something about it. I believe that in the London parks the L.C.C. have a by-law preventing the use of radios at a volume which can cause annoyance to members of the public.

Radio Speeds X-ray Servicing

All X-ray service engineers of Philips Electrical Ltd. working in the Home Counties now have their cars fitted with two-way radio. And after only two months working the scheme has already shown reductions in engineers' time and costs and an all-round increase of efficiency.

The control room is at the company's X-ray service H.Q., Balham. Signals are put out on 70Mc/s, the transmitting mast being situated at nearby Crystal Palace.

The longest distance over which a conversation has so far been held was between London and Winchester.

Engineers on the system call Balham whenever they have completed a job. They can then be sent to other calls which have since come in, or they can be recalled to base.

Amplified D.C. Transistor Receiver

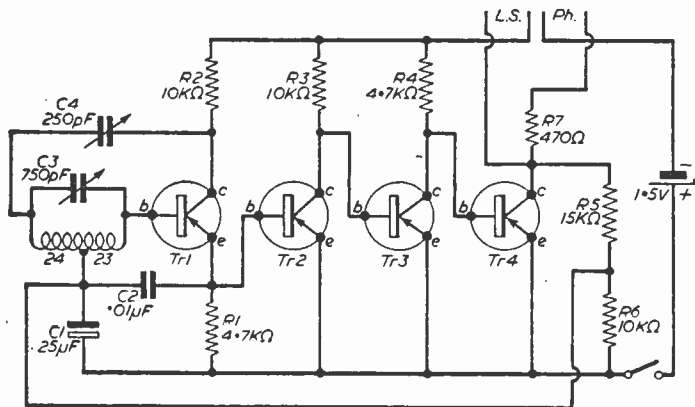
THIS RECEIVER MAY BE USED WITH EITHER AN AMPLIFIER OR AN EARPIECE

By E. J. Wotton

HAVING spent considerable time trying to produce a small radio receiver which could compete with the commercial sets now on the market, the following effort justifies the time and small outlay entailed. The complete arrangement consists of:—1 A receiver. 2 An earpiece. 3 An amplifier. The approximate cost is £6 10s. 0d., although most amateurs will find many of the components in their spares box. The receiver can be used with the deaf-aid earpiece as a pocket personal receiver using a small ferrite rod aerial. If on the other hand one wishes to share the radio with others, the earpiece is simply unplugged, complete with flex, and the amplifier plugged in and switched on. The mere act of removing the small home-made plug from the receiver switches it off. The amplifier can also be used as an intercom. using the earpiece as a microphone, and also as a gram amplifier. When used this way it would be necessary for a volume control to be introduced.

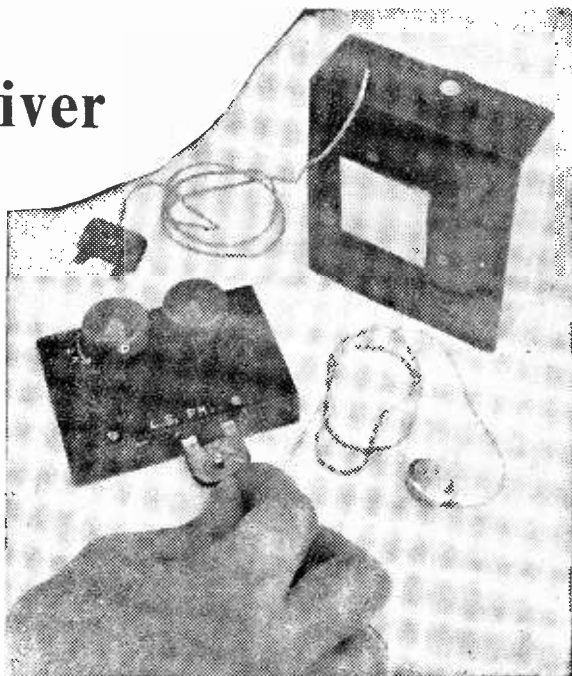
Receiver

It will be noticed that the circuit is the now well-



The receiver circuit (the tapped coil is wound on a ferrite rod and constitutes the aerial).

known 4-transistor type, first published in the May issue of PRACTICAL WIRELESS. The only modification which seemed necessary was the aerial winding, this being some 2in. of $\frac{1}{16}$ in. ferrite rod with 47 turns of 33 s.w.g. enamelled copper wire wound on



The completed receiver and its amplifier.

a Sellotape covering tapped at 23 turns. Transistor holders are used throughout. A U12 battery is also accommodated in the case, and, as only 2mA are consumed, it will be found to last many weeks.

Method of Assembly

The first procedure is to cut a stiff piece of cardboard about 2½in. x 3½in. Then cover the ferrite rod with one or two layers of Sellotape and, starting about ½in. from one end, wind on 23 turns of approx. 33s.w.g. enamelled copper wire and twist a 3in. long loop, then continue with another 24 turns leaving a 3in. Cover with a layer of Sellotape. Clean and tin the ends and tap ready to solder in position. Carefully lay out the components on the cardboard making sure that there is enough room for the socket contacts (see Fig. 1), and battery. Mark the position of the transistor holders, battery, and sockets and pierce the cardboard each side of the transistor holders and secure them with thread. Make battery contacts from springy brass (see Fig. 2), and clip into the cardboard allowing the battery to be a spring fit. The compression condensers can be temporarily secured by their nuts. The socket

contacts are also made with springy brass and secured at a later stage. Proceed with the wiring.

Socket Contacts

The centre contact also acts as the switch, so be careful that the two pieces of brass do not come into contact with each other. This method of fixing the contacts to the card chassis is very satisfactory, it was found better if the brass was laid flat on to the card and ears marked before bending

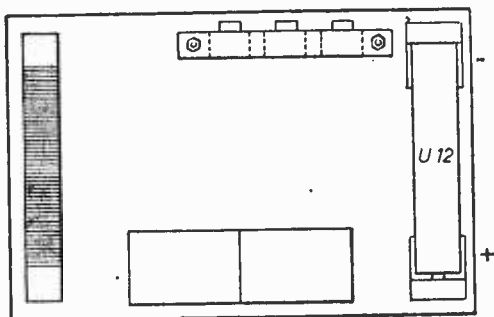


Fig. 1.—General layout of receiver.

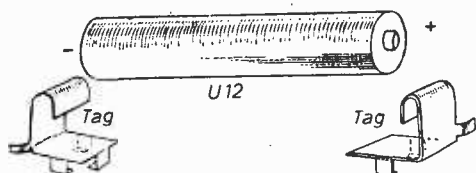


Fig. 2.—Receiver battery clips.

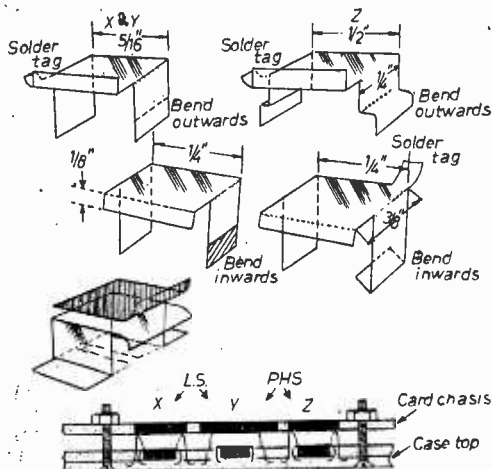


Fig. 3a.—Details of the construction of the socket contacts.

at right angles. The small slots were formed by using a small screwdriver. The indents in the one side of the plugs were cut out with a $\frac{1}{16}$ in. chisel, being careful not to cut right through the plastic.

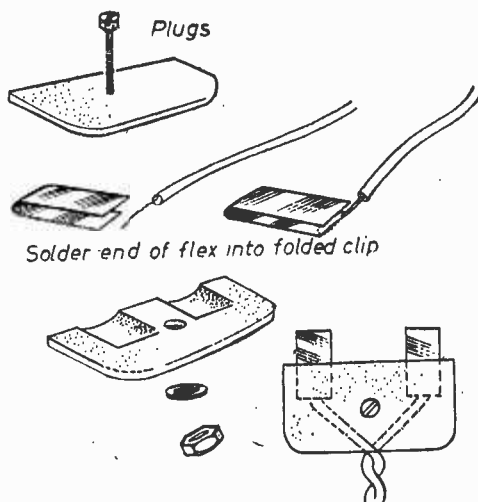


Fig. 3b.—Method of mounting the brass clips on the plastic.

It can be seen that it is not important to prevent the two halves of X and Z from touching. A small strip of plastic was bolted over the set of three contacts (Fig. 3). At this stage it is best to mount the whole assembly on the top of the case. Cut a piece of plastic, size $3\frac{1}{2}$ in. x $2\frac{1}{2}$ in.

Carefully mark the position of the compression condensers making sure the chassis is $\frac{1}{16}$ in. smaller

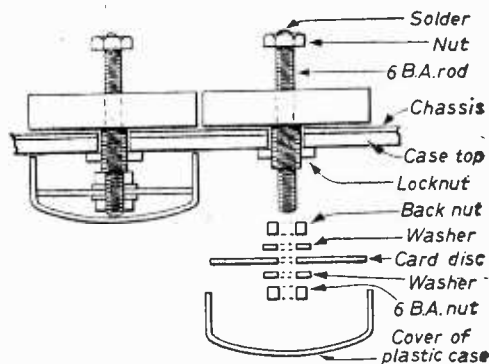


Fig. 4.—Removing the back nuts.

on all sides, drill two $\frac{1}{16}$ in. holes for this, remove back nuts and bolt the chassis to the top with them (see Fig. 4). Now the plastic strip can be bolted right through the chassis and the top with two 8 B.A. countersunk bolts (Fig. 3).

The Cabinet

The tuning knobs are quite easy to make and fix. Cut two pieces of 6 B.A. threaded brass rod $1\frac{1}{2}$ in. long and solder a nut on one end. Remove the adjusting screw supplied with the condensers and screw in the prepared spindles which should stand out about $\frac{1}{16}$ in. when screwed in tight. Obtain two plastic container covers about $1\frac{1}{2}$ in. in diameter.

COMPONENTS LIST

Receiver

R1—4.7k, R2—10k, R3—10k, R4—4.7k,
R5—15k, R6—10k, R7—470 Ω ,
C1—25 μ F Sub min Elec. 6VW.

C2—0.01 Ceramic.

C3—750pF Comp Trimmer.

C4—250pF Comp. Trimmer.

T1—Coupling transformer; about 8 $\frac{1}{2}$:1.

T2—Driver transformer; red spot; two
XB104.

T3—Output transformer to match two
XB104s to loudspeaker.

Ferrite Rod 2in. by $\frac{3}{16}$ in.

About 3yd of 30 to 35s.w.g. covered copper wire.

Amplifier

R8—10k, R9—56k, R10—3.3k, R11—1.2k,
R12—10k, R13—22k, R14—470 Ω , R15—1.0k,
R16—7.5k, R17—180 Ω , R18—56k.

C5 6 μ F

C6 100 μ F

C7 12 μ F

C8 100 μ F

C9 100 μ F

C10 100 μ F

C11 0.1 μ F

Miniature Electrolytic 6V W

Transistors

No. 1 White Spot R.F.

No. 2, 3, 4, 5, 6 Red Spot A.F.

No. 7, 8 XB104. Red Spot. Perdio 3in.
loudspeaker. Offcut Waverite about 14in.
by 6in. Medium Resistance Earpiece. 2yd
small flex. Small switch. About 6sqin.
springy brass.

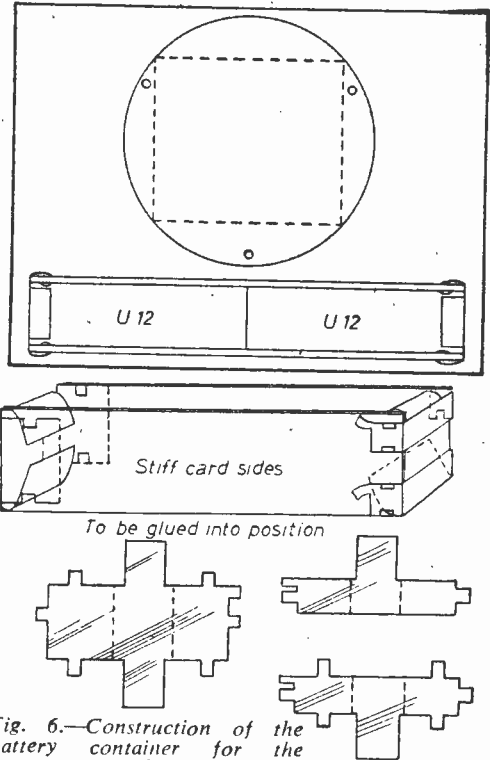


Fig. 6.—Construction of the battery container for the amplifier.

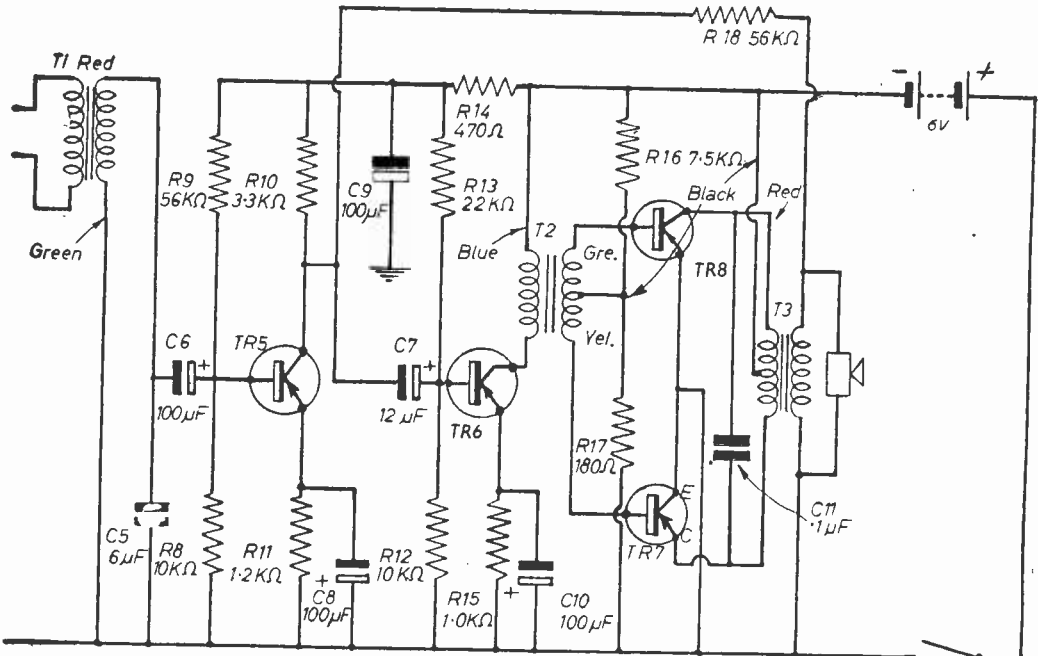
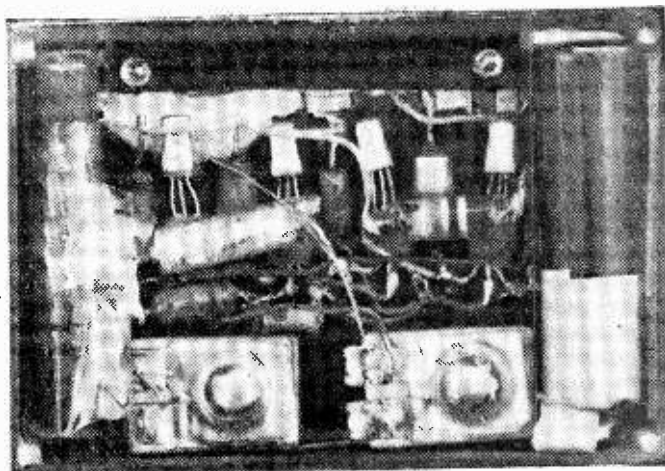


Fig. 7.—The amplifier circuit.

Mark two circles on stiff cardboard to fit tightly into the knobs and drill a hole in the centre to pass over the 6B.A. spindle. Secure in position with a nut and washer each side. Press the knobs over and secure with some adhesive. Turn the knobs clockwise until the trimmers are fully open, and leave to set (see Fig. 4). The case is then made by cutting the four sides from plastic or any material preferred by the reader. Three notches are cut in one side to correspond with the sockets, and four sides are glued to the top. When quite dry, a cover is cut to fit securely with four pieces of Sellotape, and carefully the corners are filed smooth. Remove the back and fit the battery and transistors and check that the polarity is correct. Replace the back and plug in the earpiece lead. It



The lay-out of components in the completed receiver.

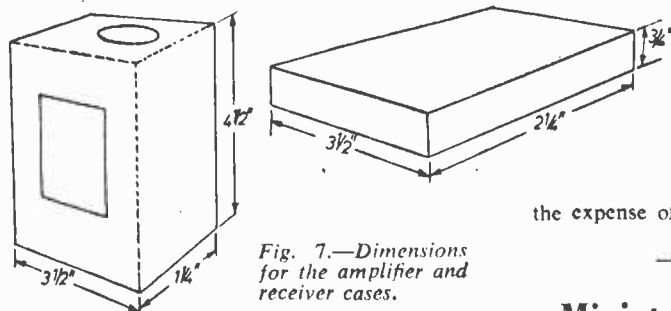


Fig. 7.—Dimensions for the amplifier and receiver cases.

should be quite easy to obtain a strong signal when C4 is at the point of oscillation.

Amplifier

Cut a piece of plastic size $3\frac{1}{2}$ in. x $4\frac{1}{2}$ in. Position the components on the back of this and mark the fixing holes. Drill these to take about size 6B.A. bolts. Cut a hole either square or round to correspond with the loudspeaker position (Fig. 5), it was found that a rectangular hole was quite adequate.

Before fixing the loudspeaker in position a piece of fine linen was glued over the aperture. Now that the loudspeaker and transformers are in position, carefully lay out the other components. Next proceed with the wiring from the loudspeaker end, working back to the input transformer, leaving enough space to slip the transistors into their holders. The batteries should be allowed plenty of space. When the wiring is complete, the sides can be fitted together. With the small switch it is as well to solder the connections to this before gluing into position on the sides. The best way to accommodate the batteries is to make a small cardboard frame with the contacts fixed in the usual manner (Fig. 6). In all cases when making the small brass contacts it is wise to leave a large nib which can be soldered to the wiring. The

input flex is soldered into position, knotted and passed out through a small hole in the side, after which the home-made plug can be attached. (See Fig. 4).

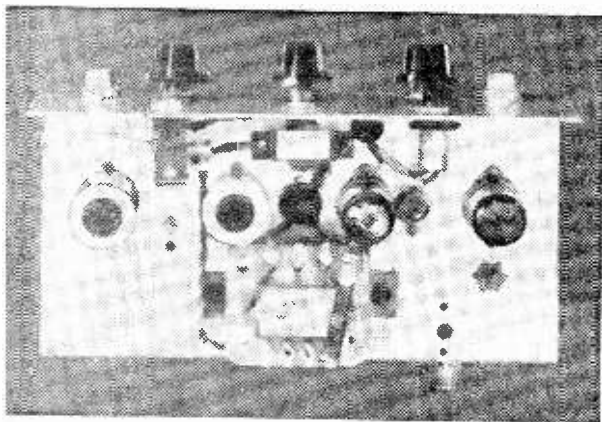
With the coil wound as before it is not possible to receive the Third Programme. If a 100pF is wired in parallel with C3 this station can be tuned in, but at the expense of losing Radio Luxembourg.

Miniature I.F. Transformers

A new range of miniature pass-band intermediate frequency transformers has been introduced by the Wireless Telephone Co. Ltd., one of the Plessey Group of companies. These are intended for portable transistorised receivers with intermediate frequencies within the range of 450-480kc/s. The chief feature of the new transformers is the parallel mounting of the coils which gives stable coupling and compact assembly. The ferrite cup cores are potted in an epoxy resin to give good mechanical rigidity with resistance to vibration. The can size has been reduced to $1\frac{1}{2}$ in. x $\frac{1}{2}$ in. x $\frac{1}{2}$ in.

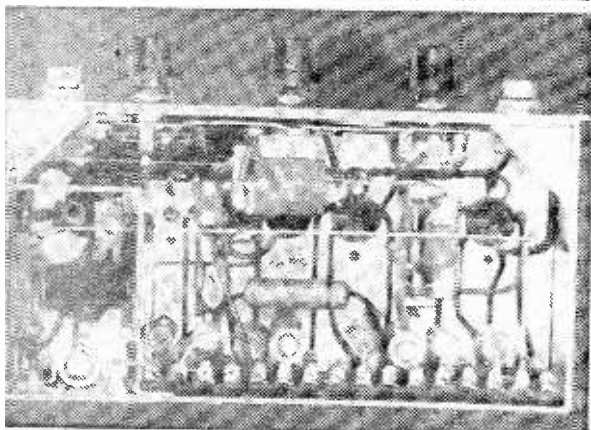
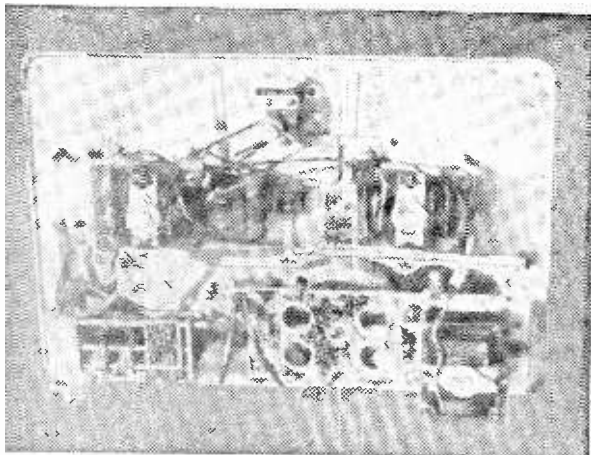
Double tuned transformers are used in the first two stages, and a single tuned unit in the third stage, and I.F. alignment is carried out by adjustable dust cores. These are mounted in a novel way: in place of the normal threaded core a plain core is bonded to a polystyrene screw working in a threaded hole in the coil former. This provides a robust adjusting screw for operation by conventional metal-bladed screwdrivers, and this design allows the cores to be wax sealed after final trimming.

The transformer for the third stage has the diode R.F. by-pass capacitor mounted inside the shielding can. *Wireless Telephone Co. Ltd., Hallamgate Works, Crookes Road, Sheffield 10.*



Above.—An above-chassis view of the amplifier.

Below.—The lower side of the tape-deck.



The underchassis view of the amplifier and its panel.

A Versatile TAPE RECORDER

THIS tape-recorder uses a Motek K.9 tape-deck in conjunction with a home-built amplifier and cabinet. For convenience, the recorder can be divided into two sections. The tape transport mechanism and associated motors, together with the record/playback and erase heads, form one section; whilst the amplifier, power-supply, cabinet and loud-speaker form the other.

The Tape-Deck

From the start, it was decided to use a commercially built tape-deck, as previous efforts to build a satisfactory deck had not been successful. One of the main difficulties in constructing a tape-deck is to achieve a very steady tape transport mechanism together with a fast and efficient rewind. Although reasonably fair results were obtained, these were not of a high standard. The tape-deck finally chosen is easily built into a home-made cabinet, small in size although taking 7in. reels, and has simple, push-button controls. The layout of the mechanical parts of the deck is such that there is ample room for placing an amplifier, power-supply and loud-speaker underneath it, without any need to miniaturise or place components in positions likely to get overheated.

Positioning the Power Supply

Preliminary measurements on the deck gave an idea as to what room was available for the various pieces of equipment and also the best layout. One of the difficulties in magnetic recording is the susceptibility of the various parts of the apparatus to interact with each other and produce undesirable hum and noise. The power-supply is the chief offender, especially if placed close to the record/playback head. The best place for the power pack is as far away as possible from the head, yet in a space that will allow an uncramped layout and a small amount of movement, for even altering the position of the mains-transformer by $\frac{1}{4}$ in. can greatly reduce hum.

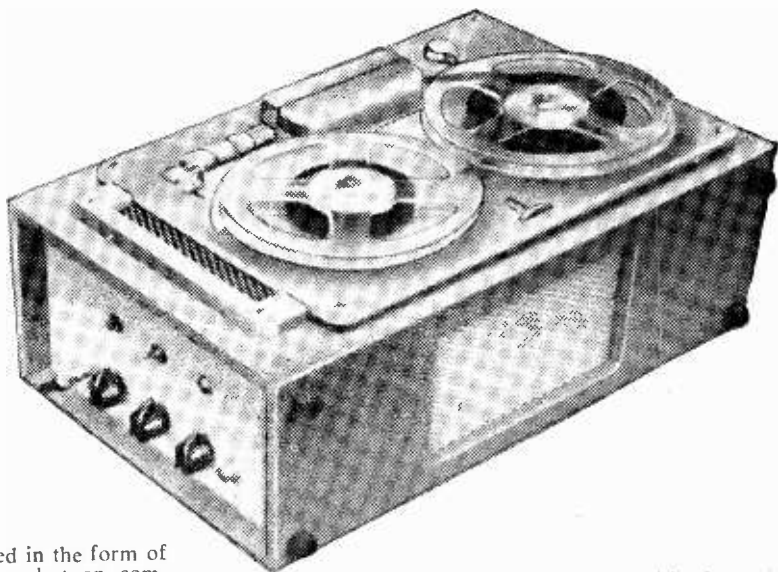
Choice of the Loudspeaker

In order to obtain good results from the loudspeaker, it should be as large as possible and well mounted in the cabinet. The maximum size of loudspeaker that could be used without making the cabinet too bulky was found to be 8 $\frac{1}{2}$ in. x 5 $\frac{1}{2}$ in. An

ORDER

A HOME-MADE AMPLIFIER AND CABINET WITH A COMMERCIAL TAPE-DECK

By D. L. Woolley



alternative was considered in the form of two smaller loudspeakers, but on comparing the results obtained from the two arrangements, the larger loudspeaker sounded more realistic, especially for music. Finally, a high-flux permanent-magnet loudspeaker was chosen.

The Amplifier

With a general idea as to the room available, the amplifier was considered next. It had already been decided as to what was expected of the amplifier and it was necessary to design one which would fit into the allotted space and yet would function as required.

For a recorder of this type, the amplifier has to serve both as a record and play-back amplifier; each function being determined by suitable switch-

ing signal to energise the recording head in the record position, and a similar amount of gain to drive the loudspeaker from the small playback signal. As the average output from a combined record/playback head is only about 3mV, the gain has to be very high. In carrying out these functions, the hum and noise level should be kept as low as possible, or the signal to noise ratio will be greatly reduced. Another difficulty to be faced is that of providing the correct compensations for the non-linear record/playback process.

The graph (Fig. 1) shows the probable constant-current recording frequency response and the required playback compensation. At low frequencies—between 50c/s and 1,500c/s a compensation network, giving 6dB per octave boost, is required, but above about 1,500c/s another network is needed giving more than 6dB.

A number of ways of doing this are described later, including the one chosen for this recorder.

In order to provide a high frequency signal for both erasing and biasing, an oscillator is needed, working at a frequency of about 60kc/s, but it is only required during the record process.

With these thoughts in mind, the circuit diagram (Figs. 2 and 3) was the one finally chosen. In all, only five valves are used, one being a full-wave rectifier, and of the other four, only three are used during playback.

Record/Playback Switch

With amplifiers of this type, great care is needed when designing the switch that will convert the amplifier from the record to the playback position. In this case, the number of switched circuits has been kept down to a minimum without sacrificing

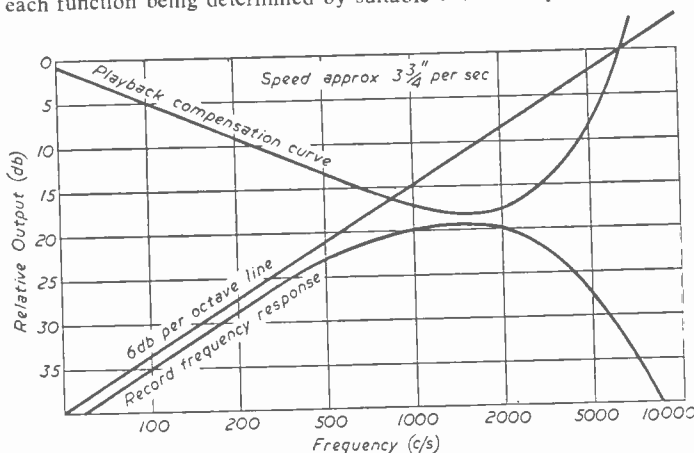


Fig. 1.—The graph of the relative output (dB) to frequency.

ing. In addition, there are several aspects of such an amplifier which are very important. It must have sufficient gain to amplify signals from the microphone, or other source, to provide an adequate

any efficiency. There are only four sections of the switch, each being three-way. The second, or central, position of the switch is used to convert the amplifier into a general purpose one, so that it can be used without the tape-deck. Another important feature of the switch mechanism is that

via C14 and R19 to SB1 where they are switched on to the high-impedance record head. The oscillator valve V4, is also switched on by SD1 and bias signals are applied via C17 and SC1 to the record head, whilst an erase signal is fed via C18 to the high-impedance erase head.

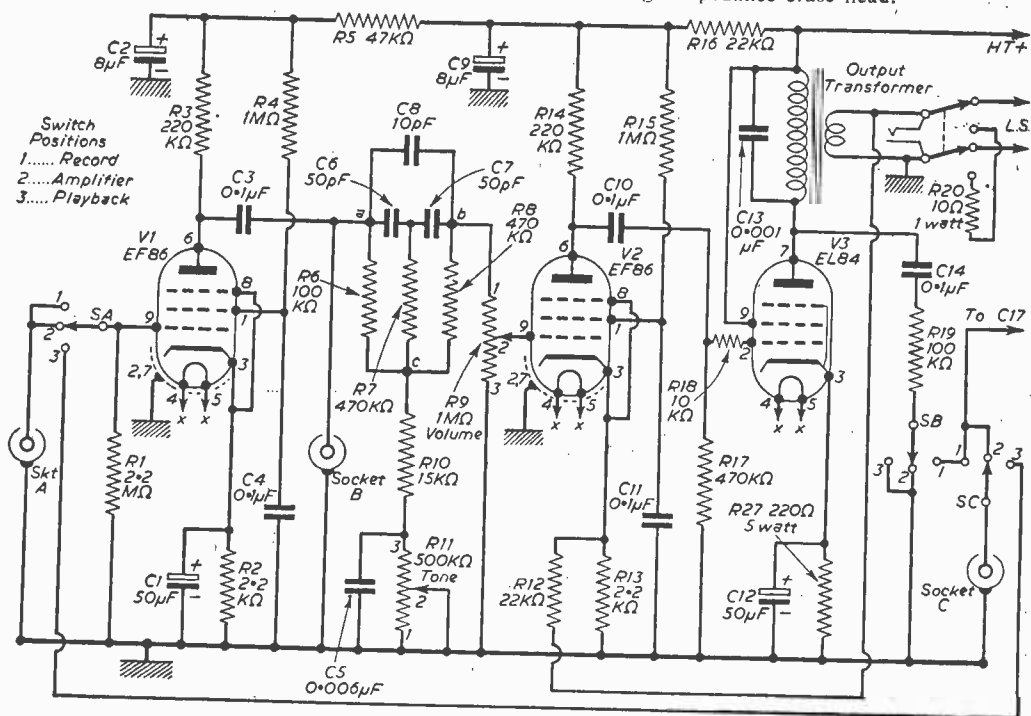


Fig. 2.—The circuit of the amplifier, excluding the bias oscillator and power supply.

on switching from record to amplifier, the bias voltage on the record head is made to die away slowly as C19 discharges. This prevents the record head from becoming magnetised by abruptly switching off the bias. A magnetised head will introduce a great deal of additional noise on playback.

Amplifier Theory

For recording, the grid of V1 is connected via SA1 to the high-gain input socket A. V1 acts as a high-gain voltage amplifier with screen grid and bias voltages supplied by R4 and R2 (decoupled by C1) respectively. After amplification the signals are passed via C3 to a frequency-compensating network; which will be described in detail later, and on to the volume control R9. From here the signals are further amplified by V2 (acting in exactly the same way as V1) and passed on to the output valve via C10 and R18. After further amplification in V3 the signals can be heard via the output transformer and loudspeaker (or through headphones if it is desired to mute the loudspeaker when recording "live" from a microphone).

From the anode of V3 the signals are also passed

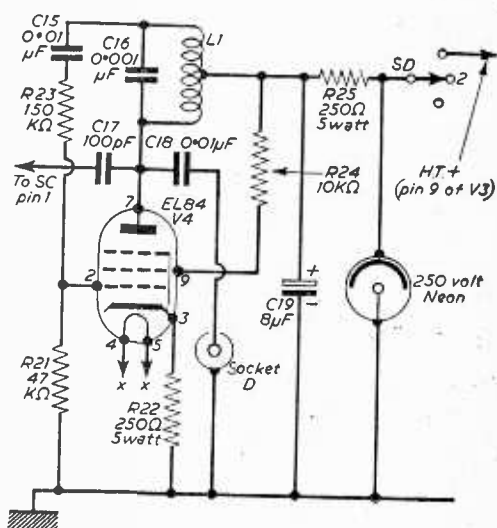


Fig. 3a.—The bias oscillator circuit.

If a high input source is available (e.g. a radio-tuner or gramophone), this can be connected to the low-gain socket (B) and socket A shorted out with a shorting plug, or fed from a microphone with a built-in volume control. In this way, two signals can be mixed together at the volume control and then recorded.

Record-Level Indicator

One feature during recording is the record-level indicator. This is built as a separate unit in a small box and not into the recorder as is the general practice. If the source of sound is varying in intensity considerably, constant watch on the record-level indicator is required.

The recorder was used mainly with a small mixer unit, which controlled the signal being fed into the input socket (B), the volume control R9 being at maximum. With the indicator close at hand (being fed from the output transformer with the loudspeaker switched off), the recorder could be placed over 20ft or more away. The indicator can easily be built into the recorder if so required.

In the amplifier position, both input sockets A and B are used as before, but R19 is now earthed via SB2 and the bias oscillator switched off. The amplifier can now be used on its own for a good quality reproducer of radio or gramophone signals, at a maximum output of 5W. In all three positions of the switch, negative feedback is applied from the secondary of the output transformer to the cathode of V2. This greatly improves the quality of reproduction of the amplifier.

In the playback position, the grid of V1 is connected via SA3 and SC3 to the record/playback head; R19 remains earthed via SB3. Socket B can now be used to supply a larger amplifier with signals from the tape in order to obtain the very best reproduction, although the playback amplifier will be ample for normal purposes, especially if an extension loudspeaker in a large cabinet is used. If required, socket B can be used to mix another signal with that from the tape (e.g. background music for a play can be tried out this way without spoiling the tape).

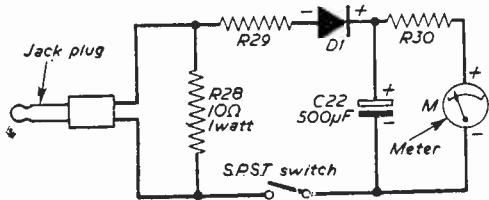


Fig. 3b.—The circuit of the record level indicator.

The Amplifier and Power Supply

The amplifier itself is built on to an aluminium chassis measuring 8in. x 4in. x 2½in. deep. Except for the bias oscillator and equaliser circuits, all small components are built onto one 16-way tag board. The equaliser circuit is itself built on to a smaller 5-way tag board which is mounted in such a way that it can be removed easily and an alternative equaliser circuit tried. A smaller aluminium chassis, 7in. x 3½in. x 1in. deep holds all the power

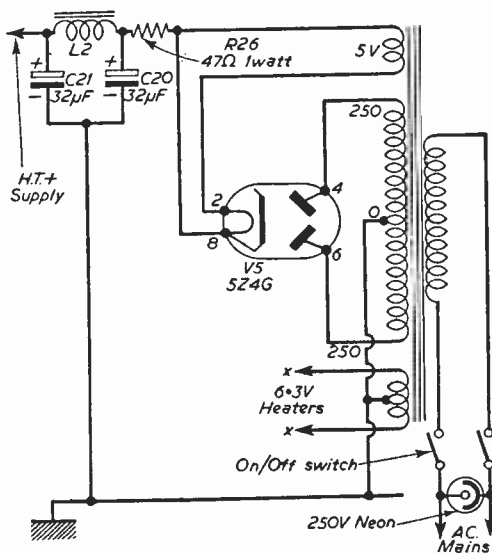


Fig. 3c.—The power supply circuit.

supply components and has ½in. external flanges on the 3½in. sides in order to mount the power-pack on to the wall of the cabinet.

The Front Panel

An aluminium front panel is used with the amplifier chassis, the size of the panel can be altered slightly to suit requirements. It must, however, be 5½in. high, although the length can be from 9in. to over 11in. depending on the width of the recorder cabinet used.

First of all, the amplifier chassis is required. This can be home-made to the dimensions given in Fig. 4a, or a commercial chassis may be used. The four valve-holder holes should be cut first. A valve holder (B9A) should be placed in each hole in turn and two marks made indicating positions for holes to be drilled for fixing bolts. These holes should be ¼in. in diameter. The other holes can now be drilled, care being taken to make sure that the socket, grommet or other component fits the hole made for it. Do not mount any components yet. A piece of 16s.w.g. aluminium is cut to size and drilled to form the screen that isolates the oscillator section. The three bends should be made carefully—a good idea is to score the metal heavily with a sharp tool on the inside of the bend. A sharp bend will then result. The screen can now be fitted into the chassis temporarily and tested for size and shape, its fixing holes being made to align with others drilled in the chassis. Now, remove the screen and put it carefully to one side.

It should have already been decided as to the make of tape-deck and size of cabinet to be used. In most cases, an external width of about 12in. is needed. (The length does not affect the size of the front panel used.)

(To be continued)

A Tremolo Unit for an Electric Guitar

THIS PIECE OF EQUIPMENT MAY BE USED SEPARATELY OR IN AN AMPLIFIER

THE well-known Tremolo effect, which constitutes variations of either amplitude or frequency, has recently become popular with guitarists using the modern electric instrument and its associated amplifier.

Amplitude Variation

One of the problems with the amplitude variation method is that of preventing the harmonics of the low-frequency tremolo oscillation from being amplified, thus producing an objectionable thumping sound, especially when the amplifier chain is

By F. C. Judd, A.Inst.E.

amplifier unit using the circuit of Fig. 1.

The pre-amplifier V1 has almost zero gain because of the negative feedback between the anode and grid. The valve is used primarily to obtain the necessary amplitude variation and is controlled by the low-frequency phase shift oscillator V2. The circuit also makes provision for a power supply, although there is no reason why the power should not be obtained from the main amplifier (250/350V D.C. and 6.3V A.C. are required).

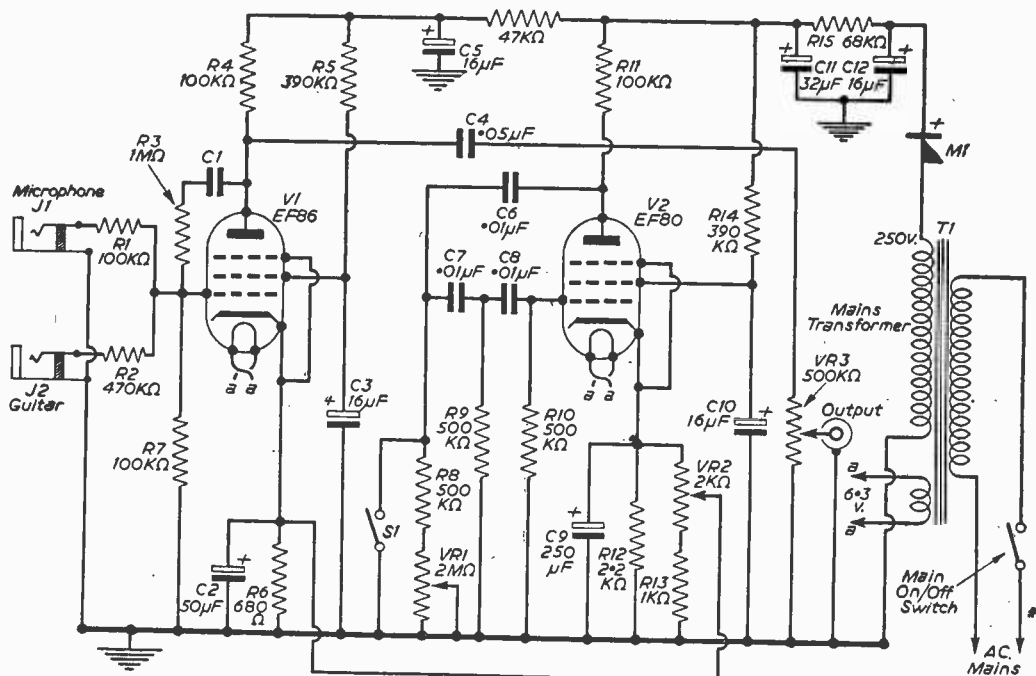


Fig. 1.—The circuit of the tremolo and pre-amp unit.

operated at full gain. The problem may be partly solved by injecting the tremolo oscillation at the final stages of the amplifier; for example, into the amplifier valve directly preceding the actual output stage. This is quite practicable if the main amplifier can be specially constructed with an incorporated slow-rate oscillator. However, for those who have an existing amplifier and do not wish to modify it, the only solution is to build an entirely separate but combined tremolo and pre-

The output from the tremolo unit is taken from a 500k potentiometer, VR3, which provides full control over the output voltage so as not to overload the main amplifier first stage. The original design was contained in a case 11in. x 5in. x 4½in., which included the power supply transformer and components. Layout of the unit is not critical, and providing the usual rules for audio equipment are observed no trouble with hum or instability should be experienced.

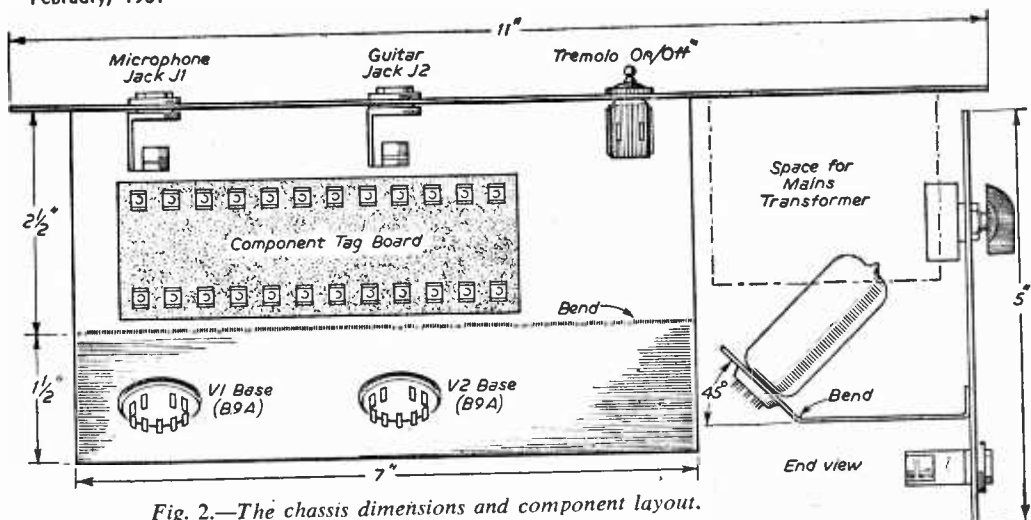


Fig. 2.—The chassis dimensions and component layout.

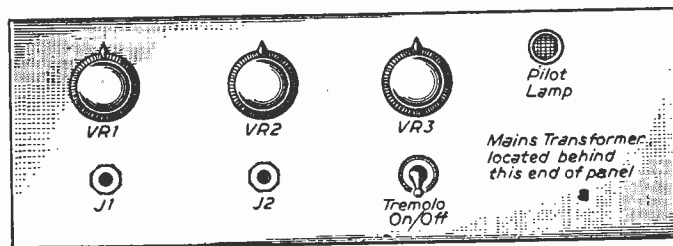


Fig. 3.—The control panel

Circuit Description

Two inputs are provided which may be used for guitar or microphone. The one marked "Microphone" requires only a low voltage input and may be found useful for guitars with low sensitivity pick-ups. The input marked "Guitar" is adjusted to comply with pick-ups of average sensitivity. Negative feedback prevents full gain from V1 whose cathode is taken via a potentiometer VR2 (tremolo amplitude) to the cathode of the phase shift oscillator V2. Note the very high capacity decoupling capacitors on V2 cathode. The use of a smaller value will result in harmonic thump from the main amplifier. Variation of the tremolo rate between 4.5 and 10c/s is provided by VR1 and the tremolo may be switched off by S1.

Adjustment of Tremolo Rate

The output from the tremolo unit is taken to the guitar input of the main amplifier which may be operated with nearly maximum gain, thus allowing the gain control on the tremolo unit to be used for normal gain control purposes. In this way overloading of the main amplifier input may be prevented, unless the guitarist wants a square-wave output—which incidentally is an effect sometimes deliberately introduced for single string solos.

To produce the best and most pleasing tremolo, adjust the amplitude control until a slight waver

on a struck note is just noticeable, the most effective rate being about 6c/s. Too much amplitude and too fast a rate of oscillation will spoil the effect and is likely to introduce a certain amount of harmonic thump.

Constructional Details

The original design was produced for commercial application and a prototype was constructed in a mild steel (18s.w.g.) case, 11in. x 5in. x 4 1/2in. Fig. 2 gives chassis and panel dimensions and shows the layout adopted with regard to the positions of the valves and the tagboard on which all

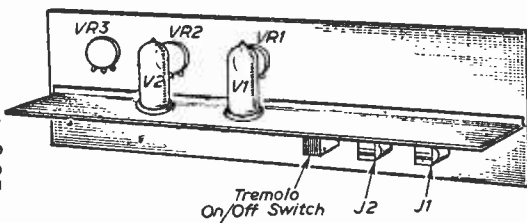


Fig. 4(a).—This unit can be mounted on an existing guitar amplifier.

the small components were mounted. The chassis is folded at an angle of 45deg to accommodate the valves within the case. There is ample space for the small mains transformer on the back of the panel within the area marked. Controls may be arranged side by side on the front panel above the chassis, and if small single-hole fixing microphone jacks are used they may be accommodated on the section of panel below the chassis (see Fig. 3). The tagboards (miniature 12 way) are mounted on the under side of the chassis, thus permitting short

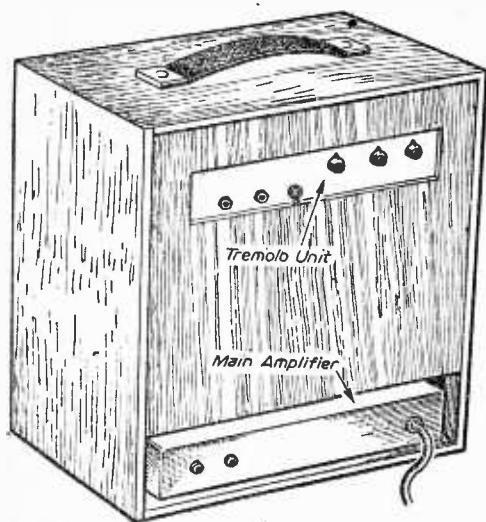


Fig. 4(b).—An amplifier with a tremolo unit fitted in the back.

leads to the valveholders. The order of components on the tagboard is not critical as there is no likelihood of instability or cross-talk; simply plan the layout for convenience of wiring and if an all-metal box is in use no leads need be screened. The output co-axial socket may be mounted at the rear

of the case or on the front panel; whichever is more convenient.

Alternative Arrangement

Some may find it more practical to mount the unit in the guitar amplifier case. An alternative version was in fact assembled on a fairly long but narrow panel that could be mounted on the back cover at the top. Fig. 4 shows how this may be done and if this arrangement is used the chassis need be only 2in. or so wide but long enough to comfortably accommodate the two valves and the tagboard. Power may, of course, be obtained from the main amplifier H.T. and heater supplies as the unit consumes only a few milli-amps of H.T. current and 0.6A for the heaters.

COMPONENTS LIST.

- | | |
|---|--|
| V1 EF86. | C2, C3, C5, C9, C10, |
| V2 EF80. | C11, C12 Electrolytic Capacitors. |
| Microphone Jacks. | Resistors all ½W. Remaining of capacitors are tubular. |
| S1 On/Off type toggle switch. | |
| M1 Metal Rectifier — Westinghouse type 16.R.C.-1-16-1. | |
| T1 Mains transformer 220-250V pri. 250V single sec: H.T. 6.3V 1A. | |
| VR3 and VR1 Standard size potentiometers. | |
| VR2 Wire wound. | |
| Standard type co-axial Output socket. | |
| Valve Holders B9A Noval. | |

A Stereo Amplifier

(Continued from page 888)

The previous stage must provide a signal V_a equal to V_{in} plus the signal voltage across R_2 .

V_a must therefore be $\frac{4}{3}$ of V_{in} , which is the same as saying that the stage gain is reduced to $\frac{3}{4}$ of what it was without feedback. The stage gain thus becomes 9, and for the two stages the overall gain is $9 \times 9 = 81$ times. An input of 150mV, will produce 12V of audio for the output valve which will thus be fully loaded. It follows from the above argument that the higher the anode load the less the loss through feedback, but the higher the cathode resistor the greater the feedback; unfortunately the higher the anode load the higher the cathode resistor has to be for a given bias voltage, and consequently the benefits of a larger anode load can be taken only in stages working at a low signal level in which a low bias voltage can be accepted.

In the present design the cathode bypass capacitor has been omitted in the output stage also. The effect on gain is noticeable but not serious whereas the feedback does clean up reproduction to any degree. If the constructor found the need for just a little extra gain he could try the effect of fitting a 25μF electrolytic across R_8 and R_{16} .

(To be continued)

COMPONENTS LIST

Resistors:

- | | | |
|---------------|---------------------|------|
| R1, 9 | 1M | } ½W |
| R2, 6, 10, 14 | 3.3k | |
| R4, 12 | 10k | |
| R7, 15 | 220k | |
| R3, 5, 11, 13 | 100k high stability | ½W |
| R8, 16 | 240Ω wire wound | 5W |

Condensers:

- | | |
|-------|---------------------------|
| C1, 4 | 32+32μF 350V electrolytic |
| C7, 8 | 16+16μF 350V electrolytic |
| C2, 5 | 0.01μF 400V |
| C3, 6 | 0.1μF 350V |

VR1, 2 1M

Valves:

- | | |
|-------|-------|
| V1, 3 | 12AU7 |
| V2, 4 | 6BW6 |
| V5 | EZ81 |

Other Parts:

- | | |
|---------|---|
| S1, 2 | Single pole toggle switch. |
| L1, 2 | Indicator lamps in holder. |
| TFR1, 2 | Output transformer (Parmeko P2641). |
| TFR3 | Mains transformer 300-0-300V 120mA (Parmeko P2644). |
| | 2 x 6.3V CT, 6.3V |
| | Choke 10H 120mA (Parmeko 549). |
| | Output sockets. |
| | Input socket—4 pin miniature. |
| | Valve holders—5 off type B9A. |

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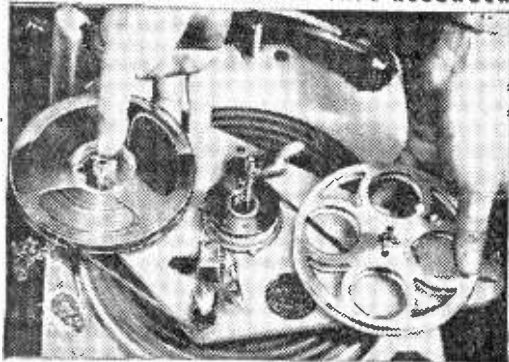
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1A5GT	11/8	6A17	7/8	6K7	5/8	7B5	12/6	12Q7GT	5/5	50K10	10/8	DH76	5/8	EC8F2	9/9	EM51	10/6	PC89	13/8	U33	13/8	UF98	14/6
1U6	9/8	6B8G	3/6	6K7GT	5/-	7B7	7/3	12K17	5/8	54K10	9/8	DH77	7/-	EC8H21	14/6	EY86	8/6	PC89	13/8	U37	20/6	UF98	14/6
1U6	9/8	6B8A	6/-	6K8	10/-	7C5	7/8	12K17	5/8	618PT	11/-	DK32	11/8	EC8H35	9/6	EZ35	6/8	PC142	8/6	U38	7/8	UF98	14/6
1U6GT	9/8	6B8E	6/-	6K8G	10/6	7C8	7/3	12K17GT	8/6	75	8/-	DK61	6/-	EC8H42	8/6	EZ40	6/8	PC143	11/8	U50	9/8	UF98	14/6
1U6	3/6	6B8G	12/6	6K8GT	10/-	7E2	9/8	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1U6	3/6	6B8H	6/-	6L1	12/6	7H7	7/6	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1N5	4/6	6B36	6/-	6L6	9/8	7J2	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B37	6/-	6L7	9/8	7J3	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B38	6/-	6L8	9/8	7J4	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B39	6/-	6L9	9/8	7J5	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B40	6/-	6L10	9/8	7J6	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
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1R5	4/6	6B42	6/-	6L12	9/8	7J8	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B43	6/-	6L13	9/8	7J9	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B44	6/-	6L14	9/8	7J10	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B45	6/-	6L15	9/8	7J11	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B46	6/-	6L16	9/8	7J12	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
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1R5	4/6	6B55	6/-	6L25	9/8	7J21	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B56	6/-	6L26	9/8	7J22	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
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1R5	4/6	6B58	6/-	6L28	9/8	7J24	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
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1R5	4/6	6B60	6/-	6L30	9/8	7J26	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B61	6/-	6L31	9/8	7J27	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B62	6/-	6L32	9/8	7J28	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B63	6/-	6L33	9/8	7J29	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
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1R5	4/6	6B66	6/-	6L36	9/8	7J32	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B67	6/-	6L37	9/8	7J33	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B68	6/-	6L38	9/8	7J34	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B69	6/-	6L39	9/8	7J35	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B70	6/-	6L40	9/8	7J36	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B71	6/-	6L41	9/8	7J37	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B72	6/-	6L42	9/8	7J38	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B73	6/-	6L43	9/8	7J39	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B74	6/-	6L44	9/8	7J40	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B75	6/-	6L45	9/8	7J41	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B76	6/-	6L46	9/8	7J42	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B77	6/-	6L47	9/8	7J43	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B78	6/-	6L48	9/8	7J44	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B79	6/-	6L49	9/8	7J45	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B80	6/-	6L50	9/8	7J46	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B81	6/-	6L51	9/8	7J47	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B82	6/-	6L52	9/8	7J48	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B83	6/-	6L53	9/8	7J49	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B84	6/-	6L54	9/8	7J50	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B85	6/-	6L55	9/8	7J51	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B86	6/-	6L56	9/8	7J52	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B87	6/-	6L57	9/8	7J53	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8	U52	5/8	UF98	14/6
1R5	4/6	6B88	6/-	6L58	9/8	7J54	7/3	12K17	5/8	77	7/6	DK92	8/6	EC8H41	8/6	EZ41	7/3	PC144	9/8				

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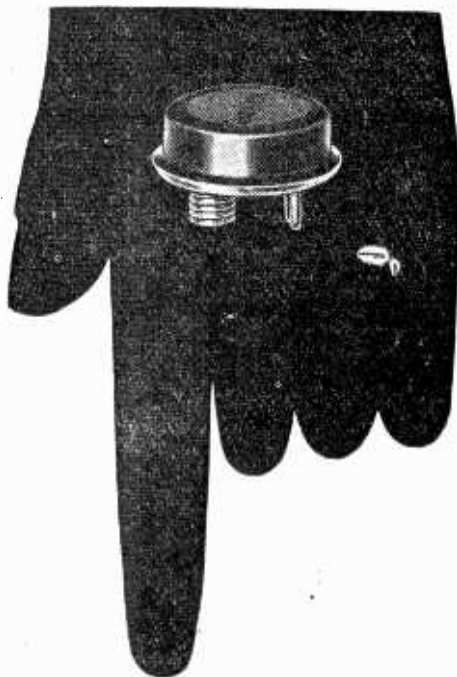


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An Efficient Mains Filter

ELIMINATING MAINS-BORNE INTERFERENCE

By M. D. Roberts

THIS filter was designed for use with mains radio receivers in areas where mains interference is troublesome. It consists simply of two chokes and four condensers, but the very nature of the construction makes it into an efficient filter network.

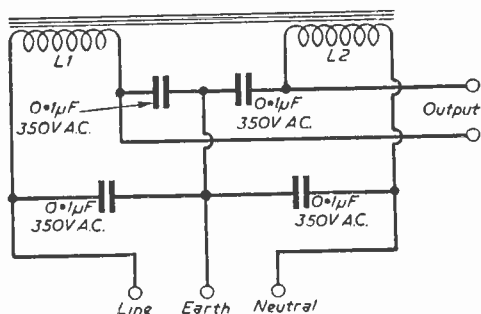
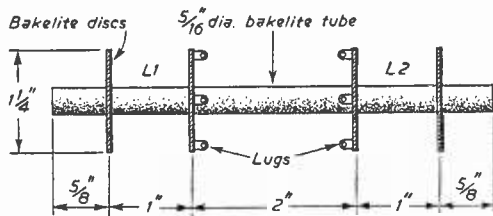


Fig. 1 (above).—The simple circuit.

Fig. 2 (below).—Details of the coil cheeks fitted on the bakelite tube.



Mains Input

The mains to the receiver is fed through L1 and L2, these two coils being wound on the same core to help limitation of interference in the filter. The addition of the four condensers make up a very efficient filter.

Construction

The first stage is to obtain a piece of 1/4 in. diameter Bakelite tube, 5 1/2 in. long, and four Bakelite discs 1 1/4 in. in diameter with a hole in the centre of each so that they just fit on to the tube. Fig. 2 shows these in position, but before they are glued down two of the discs must be modified

slightly. From Fig. 2 it will be seen that there are some connecting lugs on two of the Bakelite discs. These lugs are at 90° to each other (Fig. 3). They consist of 8B.A. nuts and bolts with 8B.A. solder tags, and they must be as close to the edge as possible, as otherwise they get in the way of the coils when they are wound.

When two of the discs have been modified, assemble them as shown in Fig. 2 and cement them into place with some hard-setting glue.

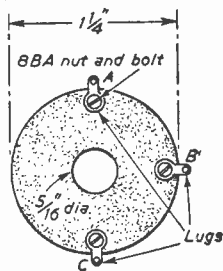


Fig. 3 (right).—The bakelite formers and the lugs set at 90° to one another.

Material... 1/16" thick bakelite 4 required

Coil Winding

When the glue has set, pile-wind 140 turns of 18s.w.g., tinned copper wire for L1 and L2. Wind both coils in a clockwise direction, and about four layers of winding will be needed for each coil. Connect the ends of each coil to tags A and C on its respective disc. Next join the B lug on both discs together with a short piece of lead. Wire the earth of the mains input lead on to one of the B tags, and the live and neutral mains lead on one end of each choke. Take the mains output from the other end of each choke via a piece of mains lead.

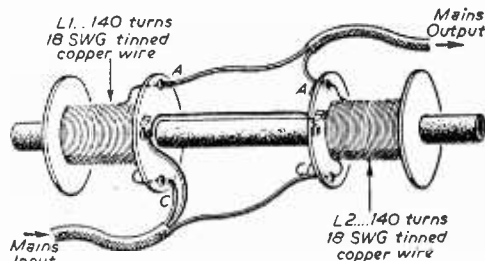
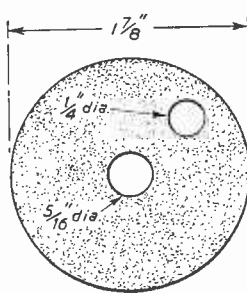


Fig. 4.—The unit complete without its case.



The unit should appear as it does in Fig. 4 at this stage, being completely wired except for the condensers. Take two condensers each to B1. Wire one side of the remaining two condensers to lug B. One of the condensers that has been wired to B must be wired on to A, and the other on B1 must be wired to C.

Fig. 5 (left).—Drilling details of the case ends.

(Continued on page 910)

High Impedance Voltage Indicator

A USEFUL AID FOR ALIGNING VHF/F.M. RECEIVERS

By J. Willmott

THE constructor of VHF receivers is faced with one seemingly difficult problem, that of alignment of the completed unit. Here, there is a major difference between, say, the normal A.M. superhet receiver and a VHF/F.M. unit, the former can be aligned to a reasonable degree of accuracy without the use of instruments, provided that care and patience are taken over the procedure. When it comes to the alignment of F.M. tuner, a much higher degree of accuracy is required if satisfactory results are to be obtained, and the use of instruments is essential. Many of the firms retailing kits offer an alignment service for a very modest fee, and doubtless to many constructors this represents the easiest and most satisfactory solution, but for the radio enthusiast who neither wants to resort to these means nor to buy equipment such as wobblers and oscilloscopes, necessary for any such operation, all is not lost, provided he is in possession of an ordinary A.M. signal generator, capable of covering the 10.7Mc/s I.F. of standard F.M. receivers, and a sensitive output indicator of some sort, either a voltmeter set to the 10V range and having a sensitivity of not less than 10,000 Ω /V, or a valve voltmeter. Moving-coil meters of this sensitivity are expensive and somewhat delicate, and most constructors have to make do with a less sensitive, multi-range meter for general testing needs, and so the "Valve" voltmeter comes to mind, which is an ideal instrument for the purpose in hand, as it draws virtually no current from the circuit to which it is connected.

Valve Voltmeters

There have been a number of designs for valve voltmeters featured in PRACTICAL WIRELESS from time to time, but these were of fairly elaborate design, having provision for measuring a large range of voltages with great accuracy. All that is required in the present instance is some indication of the presence and amplitude of voltages in the 0 to 10V range, the exact voltage represented by any particular meter deflection is of no importance. In other words all that is needed is an indication of rise or fall in voltage present at the selected high impedance test point. With these factors in mind, a simple indicator to which the normal multimeter can be connected to provide the comparative readings was designed, and has proved highly satisfactory. The indicator can be used with any meter possessing a basic movement of 2.5mA, or better still, 1mA. The cost of construction is extremely low, even if every component had to be

purchased, but the majority of parts will be found in most "spares boxes". The prototype was constructed to operate from the standby bench power supply of 6.3V (heaters) and 250V (H.T.), but as it is obviously preferable to have a more self-contained instrument, a further design was developed, incorporating a fully isolated half-wave power supply unit, using a small mains transformer of the type designed for TV pre-amplifiers, etc. The impedance of the completed instrument is in the region of 10M Ω , and will be found to give a useful deflection of the meter movement when connected to the AVC line of an F.M. tuner (or ordinary A.M. superhet receiver), or across the ratio detector network.

It is well known that the current passed in the anode circuit of a triode valve is dependent upon the applied H.T. voltage at the anode, and the negative "bias" voltage applied to the control grid, and that if the anode volts remain constant whilst the grid bias voltage is varied, the anode current will vary, a reduction in bias causing an increase in anode current. If it is arranged to monitor the anode current passed

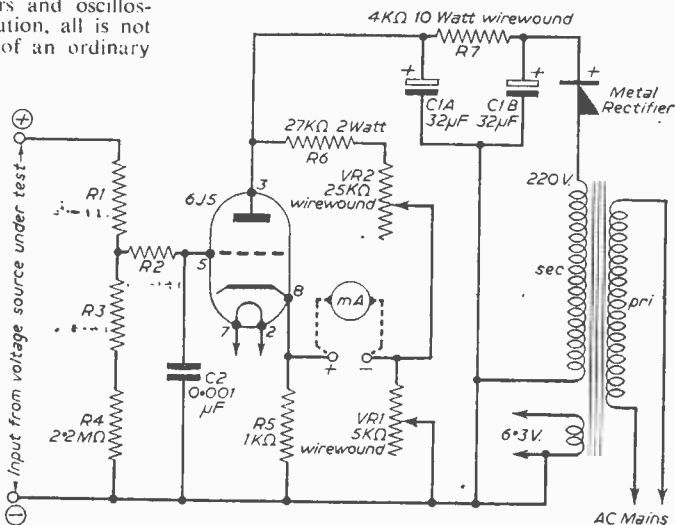


Fig. 1.—The theoretical circuit of the voltage indicator.

(R1, R2 and R3 are 3.9M Ω .)

by the valve with a meter in the anode circuit, any change in voltage existing at the control grid will be reflected in the meter reading. The impedance of the grid circuit can be made so high (10M Ω in the present case) that practically no disturbance is made to the voltage distribution of any circuit to which the test probes are connected. It is usual to arrange that under static conditions, i.e. when no external voltage is present at the test probes, the valve is so biased that anode current is exactly cut off, and the meter reads "zero". As soon as a positive voltage is applied, this will oppose (and therefore decrease) the standing negative bias, allow current to flow, and the meter to be deflected accordingly.

In practice, it is found desirable to have both the anode voltage and grid bias voltage variable within

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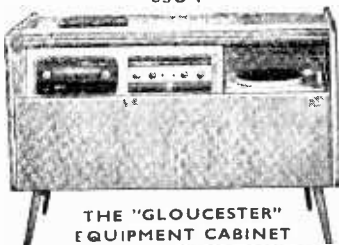
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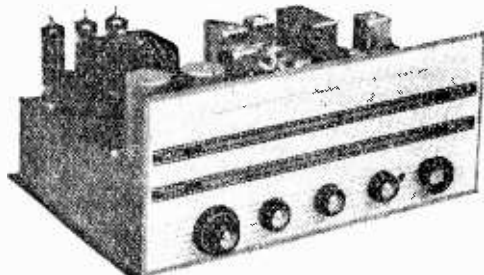
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Wire ended, 16 mid./450 v., 2/4; 16-16/450 v., 4/-; 8-8/450 v., 2/9;

4-16/450 v., 2/9; 50 mid./50 v., 1/9; 25 mid./25 v., 1/9; 100 mid./6 v.,

2/3. Miniature, 25 mid., 2/6; 50 mid., 2/8; 8 mid., 2/8; 2 mid., 1/9.

SUB MINIATURE: 32 mid., 25 mid., 16 mid., 8 mid., 2 mid.,

100 mid., 2/8.

TUNING CONDENSERS: Solid, dielectric, 500 pF (0.0005 mfd.)

4/-; 300 pF, 3/9; 100 pF, 3/-; Miniature, 500 pF, 5d.

RESISTORS: All values 10%, 1 w., 8d.; 1 watt, 8d.

BEGINNERS' VALVE: Circuit and plans, 11d. Kit, 25/-.

COILS: Reparo DR2, 4/-; DRX1, 2/6; Teletron BAX, 3/-;

HMX, 3/-; LFB, 3/6. All complete with circuits.

H.R. HEADPHONES (for Crystal Transistor or Valve Sets):

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CONNECTING WIRE: Six assorted colours, 1 yard of each

colour, 1/9; 2 yds. of each colour, 2/9; 10 yds. of each colour, 10/6

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limits, so that the exact point of "cut off" can be readily set up. Referring to Fig. 1, the theoretical diagram, it will be seen that the pre-set potentiometers VR1 and VR2 provide the necessary adjustments. It is convenient to fit a control knob to VR1, as this will require "resetting" to zero the meter accurately from time to time, as a simple instrument of this type invariably shows signs of thermal drift when in use.

Construction Details

Construction of the instrument is extremely simple, and apart from the need to keep the connections between the junction of R1, R2 and R3, and the valve control grid, as short as possible, the layout is in no way critical. A chassis of standard size, 7in. x 4in. x 2½in. is used, and drilling dimensions are given in detail in Fig. 2. Fig. 4 should make the layout of components perfectly clear. The mains supply leads enter through the ½in. grommetted hole in the rear chassis runner, and are anchored to the two insulated tags of a 3-way tagstrip mounted nearby. No on/off switch was provided in the original, although there is no reason why one should not be provided, and mounted at any convenient point on the rear or side chassis runners. The test leads,

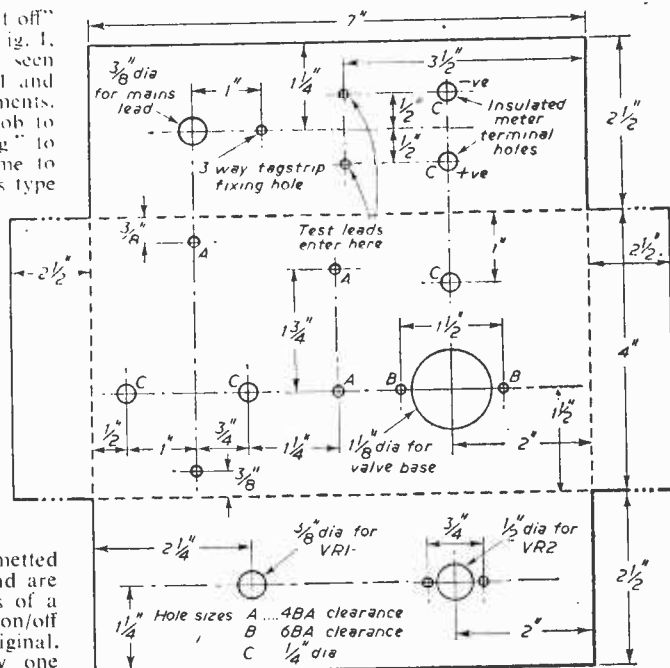


Fig. 2.—Drilling plan of the chassis.

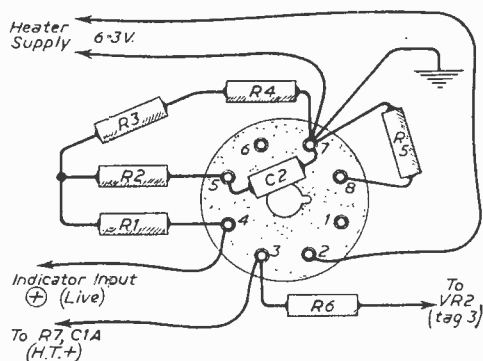


Fig. 3a.—Connections to the Octal valve-holder.

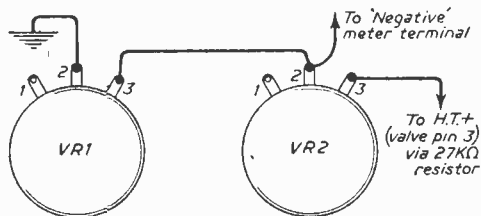


Fig. 3b.—The wiring of the balance potentiometers.

comprising red and black plastic-covered flexible wires (not twisted together, as this would introduce

COMPONENTS LIST

- Resistors:**
 R1—3.9M ½W.
 R2—3.9M ½W.
 R3—3.9M ½W.
 R4—2.2M ½W.
 R5—1k ½W.
 R6—27k 2W.
 R7—4 to 5k 5 or 10W W.W.
 C2—0.001μF.

Chassis 7in. x 4in. x 2½in.
 A small mains transformer, 6-3V and 220V 40mA.

A metal rectifier, 250V, 10mA or more.
 32μF + 32μF, 275V.W. electrolytic (C1A and C1B).

Fixing clip for above.

One I.O. Valveholder.

6J5 Valve.

Two insulated terminals.

One small knob (for VR1).

Mains lead and plug.

Red and black flexible test leads.

Two crocodile clips.

Four rubber grommets.

Nuts, bolts, solder tags, connecting wire, sleeving, etc.

"Multimeter" with basic movement 2.5mA or better.

VR1—5k W.W. potentiometer.

VR2—25k W.W. potentiometer.

unwanted capacity), enter through the holes "B" in the rear runner, the black lead going to any convenient earth point and the red lead to pin 4 of the octal valveholder, which in the case of the 6J5 valve

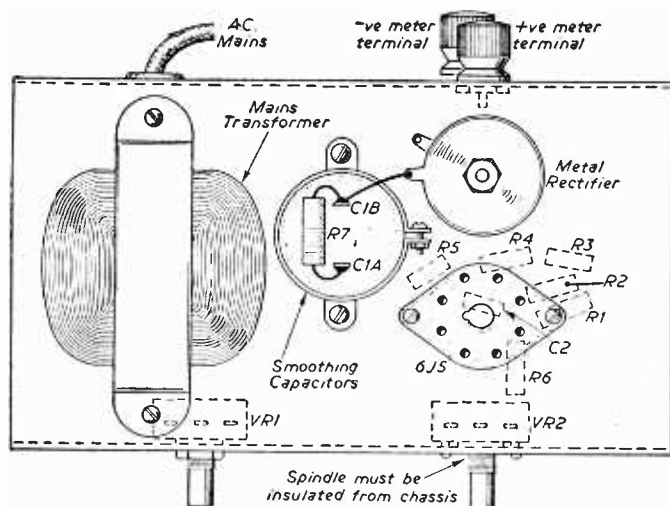


Fig. 4.—Plan view of the chassis.

is a "spare" pin used for anchoring purposes. Two well-insulated terminals are mounted in the holes, $\frac{1}{2}$ in. diameter, on the rear runner, and it is to these that the external meter is connected. The power supply requirements are 6.3V at 0.3A, and about 200V at about 5 to 10mA, so that any type of metal rectifier capable of withstanding an input voltage of 250V will be suitable.

Wiring the Instrument

Wiring is perfectly straightforward, and if the theoretical diagram is used in conjunction with Figs. 3 and 4 no difficulty should be experienced. It is recommended that the power supply components be wired into position first, followed by the heater and H.T. supply to the valveholder. The two potentiometers must be of the wirewound type, as they have to carry D.C.

The two test leads are terminated in crocodile clips, to facilitate easy connection to the external circuit under test. When connecting the "live" lead to a tuned circuit, such as the windings of an I.F. transformer, it is advisable to incorporate a 100k resistor at the point of connection to minimise the disturbance to the tuned circuit. It should also be remembered that when measuring the AVC voltage present at the limiter valve of an F.M. receiver, or on the AVC diode of an A.M. superhet, it is a negative voltage that is being measured, and in order to prevent the indicator meter movement from trying to record a reverse voltage, care should be taken to reverse the polarity of the meter connections to the terminals at the rear of the instrument.

Testing the Completed Unit

To test the completed instrument, when wiring has been finished and checked for any possible errors, connect a multimeter across the terminals, set to a fairly high current range (say 100mA), in order to avoid any danger of the pointer swinging hard over and causing damage. After two or three minutes warming-up period, the meter may be gradually switched (or plugged) down to the lowest current

range available, and the potentiometers VR1 and VR2 adjusted to bring the pointer to rest exactly at zero. VR1 should first be set with maximum resistance in circuit, and VR2 adjusted to obtain as near zero reading as possible, VR1 then being used as the "fine" control. Now connect a low voltage D.C. source to the test prods, e.g. a single or double cell torch battery, when the meter should immediately show a considerable deflection.

Alignment procedure

It is not proposed to relate in detail the procedure to be adopted in the alignment of F.M. receivers; if a proprietary kit has been purchased, full instructions will be given with the kit.

AN EFFICIENT MAINS FILTER

(Continued from page 905)

Also one condenser wired on to B must go to A1, and the other to C1. This completes the wiring of the filter, and its wiring should be carefully checked against the circuit diagram (Fig. 1).

To complete the unit all that is needed is a case.

The Case

Obtain two Bakelite discs $\frac{1}{2}$ in. x $1\frac{1}{2}$ in. diameter and drill a $\frac{3}{8}$ in. diameter hole in the centre of each. Also drill a $\frac{1}{4}$ in. diameter hole in both discs and fix one on each end of the mains filter. Feed the mains leads through the $\frac{1}{4}$ in. holes. A piece of Bakelite tube with a $1\frac{1}{2}$ in. internal diameter, $5\frac{1}{2}$ in. long is fixed over the whole filter assembly and glued into place. The $\frac{3}{8}$ in. diameter tube should be packed with 5in. length of iron wire to form a core before the unit is finally glued.

Installation

This completes the unit and makes it ready for installation in the mains circuit of a radio receiver. This is simply a matter of fixing a plug on the input end of the filter to fit the mains socket, and feeding the other end into the receiver.

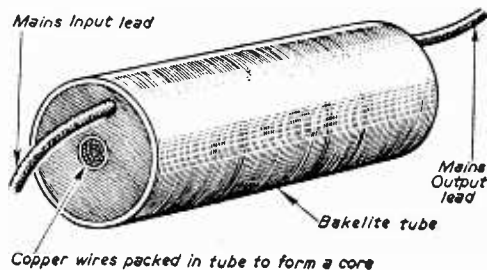
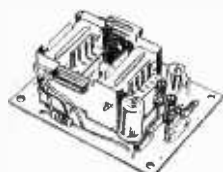


Fig. 6.—The case of the filter unit.

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A beautifully engineered miniature I.F. amplifying strip measuring only 3½ x 1½ x 1 in. completely assembled on printed circuit. Fully aligned and tested. Two OC169 transistors in new circuit using five tuned circuits with A.V.C. Send s.a.e. for leaflet. PRICE £4.12.6, post paid.

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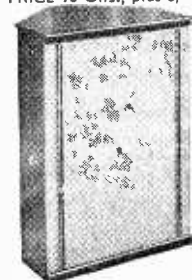
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A handsome cabinet designed to take any size of tape deck or record player, as well as amplifier, pre-amp, and radio tuner. Storage space in lower section for 150 records. Doors fitted with patent magnetic catches. Size 36 x 24 x 18 in. Polished walnut. PRICE 16 Gns., plus 5/- part carriage.



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All these cabinets are beautifully made and finished, and are supplied packed flat. They can be completely assembled in a few minutes, using only a screwdriver. Full range of WB Stentorian Hi-Fi Speakers and Tweeters in stock. Send 3d. stamp for illustrated leaflet. Specially recommended to give real "Zing" to your reproduction.

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Celestion P44 high-flux 12 in. unit, 3 or 15 ohms impedance, £3.15.0.

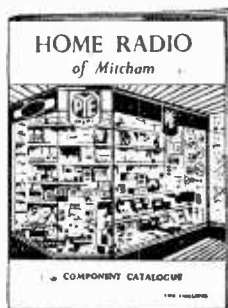
Goodmans Axiom 110, 10 in. unit, 15 ohms only, £5. Wharfedale 10 in. Golden FSB (as used by B.B.C.) 3 or 15 ohms. £8.6.7. Please add 1/6 postage.

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PRINTED CIRCUIT—PCA1

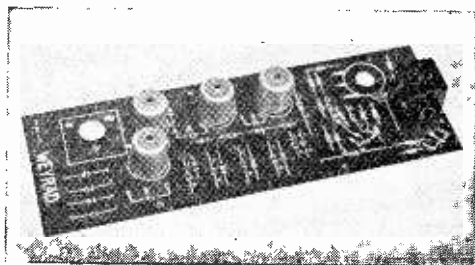
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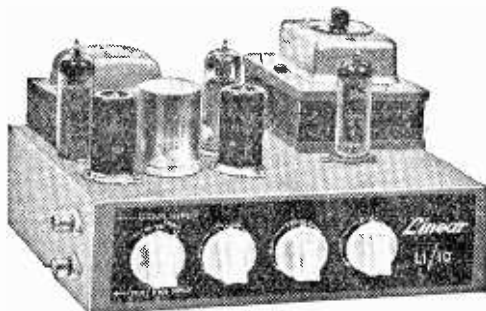
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THE LT45 TAPE DECK AMPLIFIER. A complete unit (power pack and oscillator incorporated) ready for connection to A.C. mains. 3 ohm loudspeaker and practically any make of deck.

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Radio Construction for the Beginner

No. 5—COMPLETING THE REGENERATIVE RECEIVER

By D. B. Kidd

THE two small tool-clips used to secure the small piece of ferrite rod in the last receiver described may be used to hold the long rod in this receiver. Both clips are placed on the rod on the side farthest from L2. One clip is slid towards the middle until it almost touches the fixed coil L1, the other remains near the end of the rod. The two clips are thus much less than half the rod-length apart.

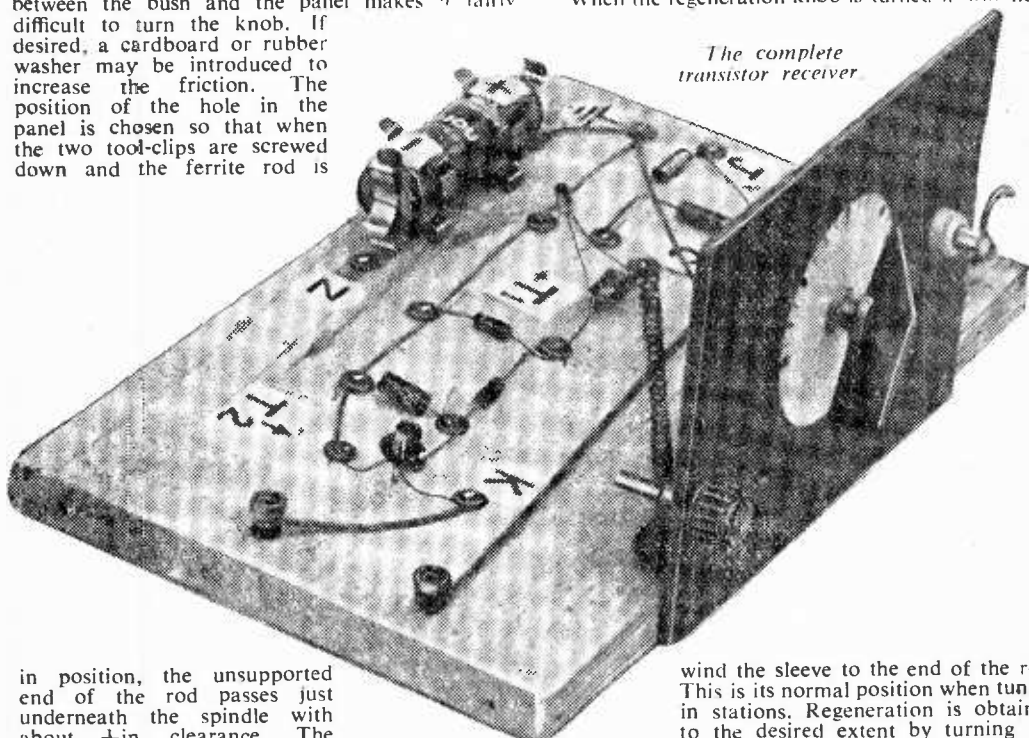
Now the three "extra" parts mentioned can be fitted. The $\frac{1}{4}$ in. brass spindle is fitted into the small knob and secured, the spindle passed through a $\frac{1}{4}$ in. hole in the panel (near the bottom on the right) and the bush tightened on to the spindle so that the friction between the bush and the panel makes it fairly difficult to turn the knob. If desired, a cardboard or rubber washer may be introduced to increase the friction. The position of the hole in the panel is chosen so that when the two tool-clips are screwed down and the ferrite rod is

through the hole in the spindle and secured by knotting. The movable coil is slid along the rod until it touches L1 then the thread is laid over it and bound on to L2 with Sellotape or other means. The thread is extended just beyond L1 then cut and tied to the end of a piece of rubber band. The far end of the rubber band is anchored to a nail, woodscrew, lug-hook, or any other convenient pillar on the extreme left of the board and exactly in line with the centre line of the rod.

The elastic cord need not be very strong; it is only required to overcome the friction between the sleeve and the ferrite rod. A single strand will probably be enough.

When the regeneration knob is turned it will now

The complete transistor receiver



in position, the unsupported end of the rod passes just underneath the spindle with about $\frac{1}{16}$ in. clearance. The ferrite rod assembly is as close as possible to the panel without quite touching the bush.

A mark must now be made on the spindle just over the centre line of the rod and a very small diameter hole drilled through the spindle at this point. This will mean removing the bush and reassembling the arrangement when completed. The constructor will need to file a slight "flat" at the point marked before drilling, otherwise the drill point will slip. The spindle should be held in a vice while drilling.

The Regeneration Control

The end of a length of strong thread is passed

wind the sleeve to the end of the rod. This is its normal position when tuning in stations. Regeneration is obtained to the desired extent by turning the

knob in the *opposite* direction when the elastic cord will cause L2 to approach L1. Although the arrangement is simple, and indeed almost crude, better and finer regeneration control is obtained by it than by more orthodox methods on expensive receivers. Figs. 3 and 4 gave the details. Note that the knob should be turned on so that the thread winds *under* the spindle.

The two leads of L2 should lastly be made spiral in form by releasing them from points "N" and "C" wrapping them tightly round a knitting needle then replacing. This keeps them tidy in spite of the movements of L2.

Two experiments may be tried with the completed receiver. Firstly, the aerial and earth may be disconnected and reception attempted with the ferrite rod alone. This will require the regeneration control to be advanced much more, but under good conditions and especially after dark it is worth trying. The receiver will now be found to be very "directional", the whole apparatus needing to be turned for the best results from a given station.

Adding a Loudspeaker

If reception is very loud with an aerial and earth, the constructor may care to try connecting the two leads of a loudspeaker across the output terminals in place of the headphones. If faint reception is heard, then it is worth risking the expense of an output transformer which will greatly increase the volume of sound obtainable.

This should be bought as "suitable for transistor circuits" (valve-type transformers are almost useless for this job), and it should have a ratio of between 15 : 1 and 30 : 1. The two primary leads of the transformer go to the headphone terminals; its two secondary leads go to the loudspeaker terminals. The reader need not worry if the primary and secondary leads are not marked. Connecting the transformer each way in turn will soon settle the question, one way increasing the volume, the other greatly

diminishing it. The largest diameter loudspeaker obtainable should be used; it will give the greatest volume and the best tone.

The receiver just described should give pleasing results if built and handled correctly. Regenerative receivers require a little skill to operate but this soon comes with practice, both controls being used in conjunction. When the station required is correctly tuned, it is usual to advance regeneration until oscillation just commences, then to reduce it slightly until normal undistorted reception is obtained with a slight final adjustment of the tuning.

The queer noises which the receiver produces whilst being tuned are quite normal to this type of set. They can, however, cause annoyance to other listeners if too long an aerial is employed. A modest aerial of a few yards only is therefore suggested for this receiver where other receivers are known to be fairly close.

This marks the end of the series to introduce beginners to the art and science of radio construction, completely without the use of solder.

There is, however, no substitute in the long run for the technique of soldering, and it is to be hoped that having gained some experience and confidence while constructing the three receivers in this series, the constructor will make an effort to learn the technique, and so move on to more ambitious projects.

Short-wave Listeners' Log—4

MANY USA transmitters beam English transmissions towards Europe, and these programmes can generally be received well in this country. Numerous frequencies are employed, so if propagation conditions make one band unsatisfactory, other bands will often give good reception. As many of the frequencies fall within the coverage of ordinary all-wave receivers, a special short wave set is not necessary.

Some of the "Voice of America" transmissions which may be tuned in, with times, frequencies, and wavelengths, are listed below. These are generally half-hour programmes, consisting of news followed by announced features. (Greenwich Mean Time is used throughout.)

16:00 (GMT): 21.5Mc/s., 13.95m., 15.27Mc/s., 19.65m., 15.205Mc/s., 19.73m., 11.76Mc/s., 25.51m.

17:00 (GMT): 21.505Mc/s., 13.95m., 15.205Mc/s., 19.73m., 11.76Mc/s., 25.51m., 9.635Mc/s., 31.14m., 9.620Mc/s., 31.19m., 9.520Mc/s., 31.51m., 6.185Mc/s., 48.5m.

18:00 (GMT): Generally similar to 17:00 (GMT).

Later in the day the lower frequencies, such as those in the 31 and 49m bands, will often be well received, while the higher frequencies, in the 13, 19 and 25m bands will generally give better reception earlier. News in "Special English" may be heard at 19:00 and 20:00 (GMT). This employs a limited vocabulary. "Radio Amateur's Notebook" may be heard at about 21:15 (GMT).

The 19, 25, and 31m bands, at least, will generally be within the tuning coverage of any all-wave receiver. Very good results can often be obtained on these bands.

Listeners who are just becoming interested in Amateur band reception may wish to know where the

stations they tune in are situated. Many amateurs all over the world use English, and they have to announce their call signs frequently, when carrying out a contact. As a result, it is usually easy to log quite a number of countries in a short time. Lists of calls may be obtained, but some of the most generally heard calls, with the countries they indicate, are as follows:

DJ, DL and DM, Germany; EI, Ireland; F, France; G, England; GI, Northern Ireland; GM, Scotland; GW, Wales; II, IT1, Italy; OZ, Denmark; VE, VO, Canada; K, W, USA.

Others, less frequently heard, include: CN8, CN9, Morocco; DU, Philippines; GC, Channel Islands; HB, Switzerland; HP, Panama; LA, Norway; OH, Finland; VK, Australia; ZS1 to ZS9, Africa.

When logging such stations, individual call numbers and letters follow the prefix showing the country. For example, G2XYZ, G3ABC, and G3XYZ, etc., would all be in England. Very many stations also give their locality during the course of the transmission and this is a further aid to logging new countries.

As most S.W. listeners will know, reception conditions on the various frequencies vary in approximately a 24-hour cycle, according to whether the transmission path between station and receiver is in daylight or darkness. For this reason it is wise to check over two or three bands when beginning a period of DX listening. Some frequencies which may have been giving good reception from one part of the world will cease to be usable for that direction, as darkness falls. But at the same time other frequencies will come into use, giving reception from other stations. When conditions are suitable for the band employed, transmissions may be heard over exceedingly great distances, even with the simplest type of receiver.

Wharfedale TRANSFORMERS

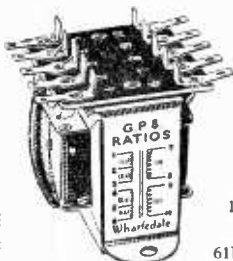
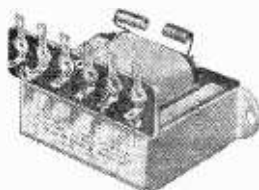


OP3 (3 ratios)

Small output transformer for battery and portable sets or mains sets up to 3 watts output. Ratios 30, 60 and 90 to 1. Max. D.C. 30mA. Inductance at 4v 50c/s. 26H with zero D.C. 3.8H with 30mA D.C. Width 2½in. by height 1½in. Weight 6 oz. Max. watts 3. Price 7/6

TYPE P (4 ratios)

The ideal replacement transformer for sets up to 5 watts output. Ratios 30, 45, 60 and 90 to 1 (90:1 centre tapped). Max. D.C. 50mA. Inductance at 4v 50c/s. 28H with zero D.C. 6.5H with 30mA D.C. 4.0H with 50mA D.C. Width 2½in. Height 2in. Weight 12½ oz. Max. watts 5. Price 9/.



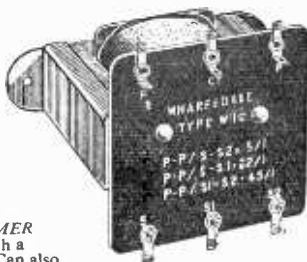
GP8 (8 ratios) General purpose output transformer with two centre-tapped primary windings and two secondaries. Matches practically all output conditions to speakers of 1 to 15 ohms impedance. Suitable for use up to 5 watts output. Ratios 12, 18, 24, 30, 36, 48, 60 and 72 to 1 (ratios 36, 48 and 72 to 1 are centre-tapped). Max. D.C. 50mA. Inductance at 10v 50c/s (each primary winding 22.5H with zero D.C. 5.0H with 30mA D.C. Width 2½in. Height 2½in. Weight 12½ oz. Max. watts 5. Price 12/6

W12 (3 ratios—all centre tapped)

A high quality transformer for undistorted output up to 10 watts with speakers up to 15 ohms impedance. Ratios: 15:1, 22:1, 45:1.

D.C. resistance of primary 460 ohms. Max. D.C. 80mA. Inductance at 4v 50c/s. 61H with zero D.C. Leakage inductance 200mH. Width 4½in. Height 3in. Weight 2 lb. Max. watts 10. Price 26/.

Special ratios to order 30/.



SMI STEREO MIXER TRANSFORMER

Enables stereo systems to be operated with a single bass unit and two treble speakers. Can also be used to add a centre speaker to "fill in the middle" where existing speakers are too widely spaced. Existing full range speakers can also be converted to stereo using the SMI and an additional treble unit. Size 4 x 2 ½ in. Weight 2 lb. Input 15 watts Max. Price 30/.

WMT1 MATCHING TRANSFORMER

Auto transformer for matching with 10-16 ohm or 7-9 ohm speakers to sets with 2-5 ohms output or vice versa. Frequency response within 1dB from 20c/s to 15kc/s. Power handling capacity 15 watts. Can be used to match loudspeakers of different impedances to cross over unit in high-quality two or three speaker systems. Width 2½in. Height 2½in. Weight 12½ oz. Max. watts 15. Price 13/6



AIR CORED INDUCTORS

High grade air cored inductors wound with 17 s.w.g. aluminium wire can be supplied to order within the range 0.1 to 8.0mH. Suitable for use in cross over networks and filter circuits. Prices on application.

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UNIVERSAL VOLT-OHM- MILLIAMETER

At last a first grade multi-tester within the reach of everyone's pocket, and a necessity to all interested in Radio and TV. Reads A.C. and D.C. Volts up to 1,000 in 5 ranges, at 1,000 ohms per volt, D.C. current (3 ranges) to 500 mA. Resistance readings to 200 K ohms in 2 ranges. Basic movement 300µA sensitivity. Easily read open scale, beautifully made and fully guaranteed. Limited number available under import quota. Complete with leads, prods, and internal battery.



ONLY 59/6

COMMUNICATIONS RECEIVER R1155. The famous Bomber Command receiver known the world over to be supreme in its class. Covers 5 wave ranges 18.0 to 7.5 Mc/s, 7.5 to 3 Mc/s, 1.500 to 600 kc/s, 500 to 200 kc/s, and 200 to 75 kc/s, and is easily and simply adapted for normal mains use. Full details being supplied. All sets thoroughly tested and in perfect working order before dispatch, and on demonstration to callers. Fitted latest type super slow-motion tuning assembly. Have had some use but are in excellent condition. ONLY 29/9.8. A.C. MAINS **POWER PACK OUTPUT STAGE**, for the above in black crackle case to match receiver, enabling it to be operated immediately, but just plugging in, without any modification. With built-in 6in. speaker, 29/10.0. DEDUCT 10/- IF PURCHASING RECEIVER AND POWER PACK TOGETHER. Send S.A.E. for illustrated leaflet, or 1/3 for 10-page booklet which gives technical information, circuits, etc., and is supplied free with each receiver. Add carriage 10/6 for Receiver, 5/- for Power Unit.

B.C. 342 RECEIVERS. A few only of these famous American sets covering 1.5-12.0 Mc/s in six bands. Internal 115 v. A.C. mains pack. Super receiver in first class condition, and perfect working order. ONLY 28/5, (carr. 15/-).

H.R.O. MAINS POWER UNITS A.C. Input 115/230 v. output D.C. (fully smoothed) 230 v. 75 mA. and 6.3 v. 3.5A. Complete in black crackle case. ONLY 59/6.

12 WAY SCREENED CABLE. In 10 foot lengths, fitted with plugs, originally made for No. 19 Wireless Set. UNUSED ONLY 15/- per lead.

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

CANADIAN MOVING COIL PHONES. Low resistance, fitted noise excluding chamois ear muffs, and leather covered head band. Lead terminates to jack plug. Supremely comfortable. BRAND NEW. ONLY 19/6 (post 1/6).

INTERCOM TELEPHONE SET. Two pairs of Brand New Headphones connected to Breast Microphones, with leads, etc. in fitted carrying cases. Supplied with 44 volt battery, 10 yards twin wire, and full instructions for connecting to make super intercom. ONLY 27/6 (post 3/6). Extra Wire 3d. per yard.

RCA 8in. P.M. SPEAKER, in heavy black crackle metal case. Can be used as normal 3 ohms extension. Size 11 1/2 in. x 6 in. NEW IN MAKER'S CARTONS. ONLY 45/- (post 3/6).

AMERICAN HALLICRAFTERS 6 VOLT VIBRATOR-PACK. Output 300 volts D.C. at 170 mA. Designed to run Communications Receivers from 6 volt car battery. In grey metal case, size 6 1/2 in. H. x 6 1/2 in. W. x 7 1/2 in. D. Complete with 2 valves, 6X5, and instructions, in maker's cartons. BRAND NEW and UNUSED. ONLY 29/6 (carr. 3/6).

POWER UNIT TYPE 3. Primary 200/250 volts A.C. 50 cycles. Outputs of 250 volts 100 mA. and 6.3 volts 4 amps. Fitted double smoothing, and 2 metres to read H.T. Current and Voltage. For normal rack mounting (or bench use) having grey front panel, size 19 in. x 7 1/2 in. BRAND NEW. ONLY 79/6 (carriage 7/6).

10/- CONSTRUCTION PARCEL. 10 yards each of 6 colours wiring wire, solder, 24 each assorted Resistors and Condensers. **RESISTORS.** 100 assorted values. NEW 10/-.

CONDENSERS. 100 assorted mica and silvermica. NEW 12/6. **SPRAGUE CONDENSERS.** Metal cased, wire ends. New 0.01 mid. 1,000 volt, and 0.1 mid. 500 volt, 7/6 per dozen. Special quotes for quantities.

MINIATURE MOTORS. Ideal for models. Will operate on 3-6 v. D.C. Size 1 1/2 x 1 x 1 1/2 in. plus 1/4 in. spindle. BRAND NEW only 7/6.

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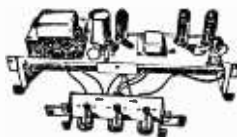
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Gladstone Radio

PUSH-PULL AMPLIFIER £4.15.0 (3/- P. & P.)

Brand new 200-240 A.C. mains. Bass, treble and col. controls on flying panel. Valves EZ80, ECC83 and 2-EL84 giving full 8 w. Chassis 12 x 3 1/2 x 3 1/2 in. With o.p. trans. for 2-3 ohm speaker. Suitable for Crystal Mike Input.



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COMPLETE TAPE REORDER for only £19.10.



B.S.R. deck. Two-tone leatherette case. Acos crystal mike, 850ft. tape, extra spool. On/Off Tone and Vol. 7 x 4 in. Speaker. 1 1/2 hours playing time. Single speed 3 1/2 in./sec. fast forward and reverse, mike and radio inputs, ext. speaker socket; cannot be accidentally erased, 13 1/2 x 12 x 8 in. Weight 20 lbs. 12 months' guarantee. Carr. 7/6 extra. Terms: £6 down and 6 monthly payments of 50/-.

B.S.R. "MONARDECK" for TAPE SINGLE SPEED. Our price only £8.10.0 including 850 ft. 1st grade tape, carr. paid.

COLLARO STUDIO TAPE TRANSCRIPTION. 3 MOTORS. 3 SPEED. Push Button Controls. £12.10.0 (10/- carr.)

AMPLIFIER FOR STEREO WORK



Beautifully finished wood cabinet with "gold" and brown dividing strip and "gold" finished fabric front. Size 13 x 7 1/2 in. front to back 4 1/2 in. Sin. P.M. speaker. ECL82 valve with metal rectifier. Vol. tone, on-off. 82/6 (3/- p. & p.).

AMAZING OFFER!! BRAND NEW 6-12 VOLT D.C. REVERSIBLE MINIATURE MOTORS at a FRACTION OF MAKER'S PRICE.

Weight 2.1 ozs. Motor dimensions 1 1/2 in. long, 1 1/2 in. dia. Spindle 0.4 in. long, 0.077 in. dia. Consumption 0.72 watts off load. 7.68 watts on load. Speed 7,000 r.p.m. Switch. Centre off reverse by switching either side. General specification. These motors have a tremendous power-weight ratio, are extremely efficient. Can be used on 6 volts without great loss in power. Precision built in polythene housing. Self lubricating. With sintered bronze bearings. Easily mounted. Supplied Brand New and Guaranteed. 15/6, p.p. 1/6. Special price for quantities over 50.

FOR ADDRESSES SEE THE OTHER ADVERTISEMENT FOR GLADSTONE RADIO ON PAGE 881.

A Simple R-C Bridge

THIS INSTRUMENT MEASURES COMPONENTS FROM 10Ω TO $10M$, AND FROM $10pF$ TO $10\mu F$.

By A. Guy

THIS unit is simple both in construction and operation, self-contained battery operated, uses only two resistance and two capacitance ranges giving wide coverage, reasonably accurate in use, and can readily be made portable if desired. No special components are required and, with the exception of the bridge standards, the instrument is constructed from parts found in most spares boxes, a choice of valve or transistor oscillator being described.

The Valve Oscillator

The oscillator shown in Fig. 1 follows conventional circuitry and utilizes a 3S4 valve only because this was to hand; a 1S4 or 1T4 would use less current and result in longer battery life. Providing that the oscillator is switched off when not in use (a warning light being included for this purpose), the battery will give nearly a year of satisfactory service with normal usage. A $67\frac{1}{2}V$ battery is required to operate the unit.

The Transistor Oscillator

If a portable bridge is desired, a transistor oscillator provides the answer, and Fig. 2 shows that very

few components are required. The transistor can be either one of the surplus "red spot" variety, or a OC71 or similar. The transformer is not critical and almost any interstage transformer will suffice, that used by the writer being a 3 : 1 type salvaged from an old battery amplifier. If midget construction is required a suitable transistor transformer should be obtained.

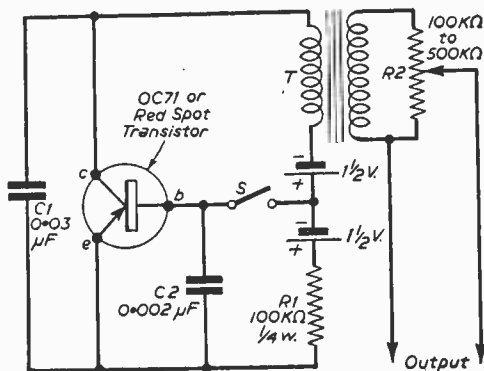
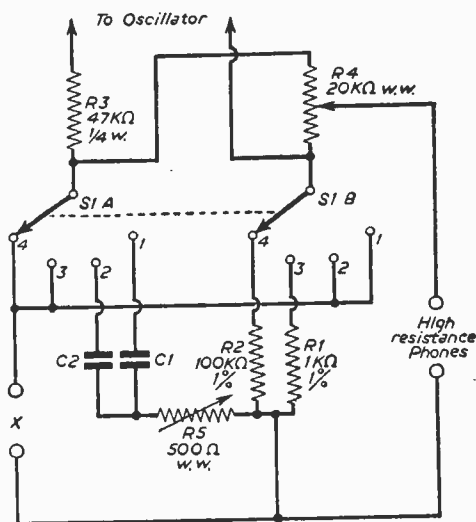


Fig. 2 (Above).—A transistor oscillator for portable use "T" is a 3:1 interstage transformer.

Fig. 3 (Below).—The two test terminals are marked "X" in this circuit diagram of the bridge. (C1 is $0.1\mu F$ and C20- $001\mu F$.)



The Bridge

Fig. 3 shows the extreme simplicity of the network, the only critical components being R1, R2, C1, and C2. The resistors are 1 per cent tolerance and the capacitors good quality paper types, all checked for accuracy against a bridge by an obliging dealer. The bridge balance potentiometer should not exceed about 50k, and in the prototype a 20k was used. It must however be of the linear wire-wound pattern as large as possible. The power factor potentiometer

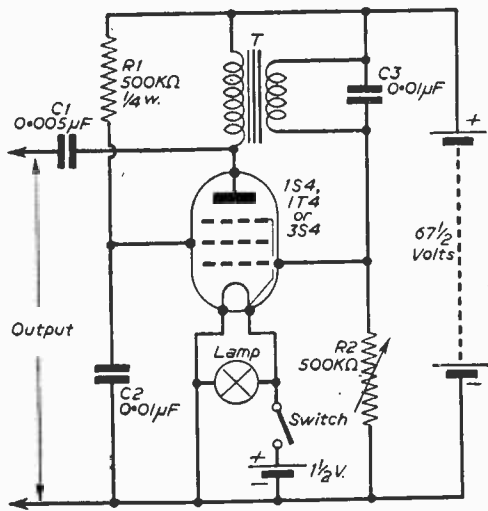


Fig. 1.—This shows a valve oscillator circuit. The valveholder used is a B7G type and "T" is a 3:1 interstage transformer.

is also a linear wire-wound type of 500Ω . A $47k$ resistor feeds the bridge and is inserted to limit the load on the oscillator and prevent variations in frequency and amplitude.

The "null point" is detected on the original by a single earpiece which, when not in use, is hung on the side of the case by a small hook. This has one disadvantage in that it must be held when using the bridge, but normal headphones may be used if desired, this being entirely a matter of preference by the constructor. High resistance phones must however be used, and if not available, a suitable matching transformer will be necessary to feed low resistance types; a small loud speaker transformer will serve the purpose adequately.

The switch numbering shown in Fig. 3 indicates the bridge ranges as follows:

Range 1— 10Ω to $100k$.

Range 2—1, to $10M$.

Range 3— $10pF$ to $0.1\mu F$.

Range 4— $1000pF$ to $10\mu F$.

If desired, and to avoid marking-out two separate scales, a chart to convert pF to μF can be affixed to the side of the case. A number of additional ranges could easily be added if required, but this was considered unnecessary, the ranges obtained having proved satisfactory for general checking purposes.

Switching is very simple and the changeover from resistance to capacitance ranges is effected in one movement.

Construction

The instrument can be constructed in any convenient form and the original was housed in a discarded multi-range meter case measuring $8\text{in.} \times 4\frac{1}{2}\text{in.} \times 2\text{in.}$ All components were mounted on the back of the panel and the battery fixed inside of the case. A circular piece of white card was used for the scale which, when calibrated was covered with thin perspex. The pointer was made from a small piece of thicker perspex having a narrow line scribed down its centre by a razor blade, and "blackened in" with pencil. This was screwed to the back of a large tuning knob. Panel lettering was done with a small artist's brush, but the finish of the instrument is left to the constructor.

Calibration

Calibration is simply a matter of balancing the bridge against a number of resistors and capacitors of known value, using series and parallel arrangements, a little thought showing that about ten components only are needed. If desired the scale can be marked in preferred values, with red or other coloured bands to indicate the limits for each value. The power factor control is calibrated quite simply as shown in Fig. 4, 0— 250Ω indicating a high power factor, and 250 — 500Ω a low power factor.

Use

To check the value of any resistor or capacitor, connect the component under test to the terminals marked "X", switch to the appropriate range and turn the dial to the null point, when the value can be directly read. If difficulty is experienced in finding the null point, the power factor control should be rotated clockwise, a reading over the half-way mark indicating a low power factor. When testing resistors and capacitors it is important that they be disconnected at one end from their associated wiring,

otherwise incorrect readings will be obtained. When a component measures out in the overlapping areas of any scale, it is worth taking a reading on both ranges, as the centre portions of each range are more accurate than the extremities.

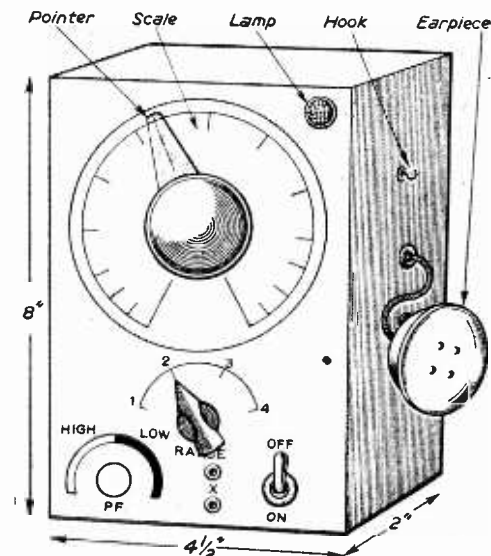


Fig. 4.—The completed bridge.

No originality is claimed for the design which follows standard circuitry, and providing leads are kept as short as possible, the layout is not in the least critical, any convenient cabinet being suitable. The original instrument using the valve oscillator has been in use for a period of approximately four years and has been invaluable in the workshop.

British Standard for Fixed Wire-wound Resistors (B.S.2111: Part 1: 1960.)

The latest in a series dealing with components intended primarily for use in telecommunication and allied electronic equipment, this British Standard is divided into two parts, the first (now available) specifying requirements and tests, and the second (to be published later) comprising a list of standard sizes and ratings, for fixed wirewound resistors.

The specification applies to insulated and non-insulated fixed resistors consisting of a winding of resistance wire on a heat-resisting former, and having a dissipation of 70degC not exceeding $200W$ and a rated resistance value not greater than $200k$. Precision wire-wound resistors are excluded from the standard.

Part 1 of the standard requires reference to B.S.2111, "Basic climatic and durability tests for components for radio and allied electronic equipment." The object of the tests is to establish, as far as is possible, in laboratory conditions, the components' suitability for use over stated ranges of temperature and humidity, their ability to withstand specified conditions of mechanical shock, expected in transit or under operational conditions, and their ability to withstand normal assembly processes, such as soldering.

TRS

BARGAIN OFFERS for the Constructor!

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Manufacturers' brand new, current production offer. Latest 5-valve circuit based on Mullard's famous design. Magic eye level indicator. Volume and tone controls. T.C.C. printed circuit already wired. Only power pack and controls to assemble and wire. Valves EF86, ECC88, EL84, EM84 and E280. A sensitive quality recorder at special Unit Prices.

Wired printed circuit, power pack components, controls and knobs, etc. .. £5.10.0 p. & p. 2/6
Set of 5 valves, as above .. £2.5.0 p. & p. 1/-
B.S.R. Monarch Tape Unit .. £3.19.6 p. & p. 4/6
Bargain reduction for complete kit .. £16.10.0 carr. 5/-

Attractive two-tone Cabinet and 9 x 5 1/2 in. speaker at special discount price .. £3.5.0 p. & p. 4/6
Illustrated Handbook with full details, 2/6 post free.

Colaro Studio Tape Deck can be supplied with modified circuit as alternative for approx £5.10 extra



TRANSISTOR PORTABLE

Famous manufacturer's 6 x 1 design based on Mullard and G.E.C. developments. Printed circuit, 6BVA 1st grade transistors, XA102, XA101 (2), OA70, XE103, XC101 (2) or equivalent. Quality components only supplied to ensure best results at attractive price.

Set of 6 BVA Transistor and Diode 70/- p. & p. 6d.
Printed Circuit, IF's (8), osc. coil, Driver Trans. Ferrite rod aerial .. £1.18 p. & p. 1/6
Resistors, Condensers, Twin Gang and Volume Control .. £7/8 p. & p. 1/6
7 x 4 in. Quality 35 ohm matching Speaker .. £5/- p. & p. 1/6

Complete Kit at special offer ONLY £8.19.6 post free Handbook and Circuit details .. 2/- post free.



RE-GUNNED TV TUBES

New Reduced Prices
New Heater, Cathode and Gun Assembly fitted to all tubes. Reconditioned virtually as new. Now 12 months' guarantee to highest standards—as used by our own Service Dept.

12in. £5. 14in. £5.10.0. 17in. £6. etc.
Mullard and Mazda types ex-stock Carr. and Ins. 10/- 10/- Part Exchange allowance on your old tube.

JASON FM TUNER KITS

STANDARD MODEL (FMT1) as previously extensively advertised. Complete Kit 5 gns. Set of 4 spec. valves now only 20/-.

MODEL (FMT2). Attractively presented shell mounting unit in enclosed Metal Cabinet with Built-in Power Supply. Complete Kit £7. Set of 5 spec. valves, 37/8. P. & P. 2/6.

LATEST MODEL—JTV2. Switched Band 1-2-3 AM/FM Unit with AFC. Kit £12.19.6. P. & P. 2/6.

NEW JASON COMPREHENSIVE FM HANDBOOK 2/6. 48 hr. Alignment Service. 7/6; P. & P. 2/6.

REDUCED PRICES		VALVES		ALL GUARANTEED	
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DP96	9/-	EF91	5/-	PCL33	12/6
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Mazda	14/6	OC70	9/8	GET114	9/8
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XA102	15/-	OC72	15/6		
XA103	18/-	OC44	28/6	Newmarket	
XA104	18/-	OC45	21/-	"Goldtop"	
XB102	10/-			V15/10P	15/-
XC101	10/6				

Germanium Diodes, OA70 2/6, GEX34 4/-, OA81 3/6.

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All brand new latest 4-speed Models.

SINGLE PLAYERS—B.S.R. (TU9) 90/-; Colaro Junior, 90/-; Garrard TA Mk.2 with GCS Head, 90/-; Garrard 4HP Transcription Unit, £18. Carr. 3/6.

AUTO CHANGERS—B.S.R. (UA8), £8.19.6; UA8 Stereo, £7.19.6; UA14, £7.19.6; Colaro Conquest, £7.19.6.

GARRARD RC210 4-speed Autochanger Model with latest features and GCS Plug-in Head only 10 gns. carr. 4/6.

Latest Garrard Transcription Autochanger Model "A" £18.19.6 with balanced P.U. Arm. Carr. 3/6.

E.M.I.—4-speed Single Player with Auto Stop-Start Dual Turnover Cartridge for Stereo and Monaural L.P. and 75—Bargain Buy at £6.19.6.

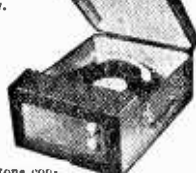
AUTO CHANGER RECORD PLAYER KIT

A.C. Supply 200-250 v.

Attractive 2-tone cabinet — famous B.S.R. Monarch 4-speed, full tuner, 10-record gram unit. Full-hi dual pick-up with dual stylus for std. L.P. recordings. 2-valve amplifier with quality neg. feedback circuit, volume and tone controls. Fully fitted from mains by double-wound transformer. NOT the five chassis type as often offered in cheap commercial models.

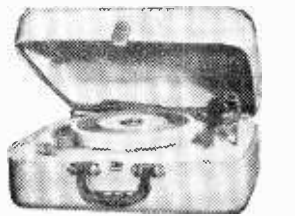
A recommended buy while stocks last!

Ready-wired 2-valve Amplifier, complete with 6.3v. high flux speaker .. £3.19.6 p. & p. 2/6
Two-tone cabinet 18 x 13 x 5 1/2 in. £3.3.0 p. & p. 3/6
B.S.R. Monarch UA8 160v. .. £5.19.6 p. & p. 4/6
Complete 3 unit kit, special Bargain price .. £12.19.6 carr. 7/6
Simple assembly a screwdriver only required.



SPECIAL OFFER!

Superior type Art Leather covered Portable Case—well-known Manufacturer's Surplus—in attractive Tan and Fawn with non-scratch gilt fitted with latest Colaro Junior 4-speed Record Player Unit with Turnover Xtal Cartridge and dual sapphire stylus for 78 and LP records. Ready mounted and wired complete with Mains Lead and detachable screened P.U. lead. A.C. Mains 200/250v. Size 15 x 11 1/2 x 5 1/2 in. An ideal unit for Tape or Amplifier use.

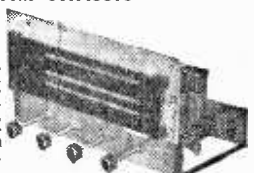


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Valve Line-up: ECC85 ECH81 F89 EABCS80
EL84 EM81 EZ80.

Three Waveband and Switched Gram position. Med 200-500 in. Long 1,000-2,000 in. VHF/FM 88-95 Mc/s. Philips Continental Tuning insert with permeability tuning on FM and combined AM/FM IF transformers. 480 Kc/s and 10.7 Mc/s. Dual core tuning coil. Latest circuitry including AVC and Neg. Feedback. Three watt output. Sensitivity and reproduction are of a very high standard. Chassis size 15 1/2 x 5 1/2 in. Height 7 1/2 in. Edge illuminated glass dial 1 1/2 x 3 1/2 in. Vertical pointer. Horizontal station names. Gold on brown background. A.C. 200/250 v. operation.



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Three ohm P.M. speaker only required. Recommended quality speakers 10in. Rom (Heavy Duty) £1/8. Post & Pkg. 1/6.

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EMI 1st grade. Brand new sealed boxes.

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9in., 175ft. ..	7/-	250ft. ..	8/-
9in., 600ft. ..	19/-	550ft. ..	25/-
9in., 850ft. ..	25/-	1,200ft. ..	31/8
7in., 1,200ft. ..	31/8	1,800ft. ..	45/-

SPARE REELS: Emiltape, new, boxed: 3in. 3/-, 5in. 3/8, 5 1/2 in. 4/-, 7in. 4/6.

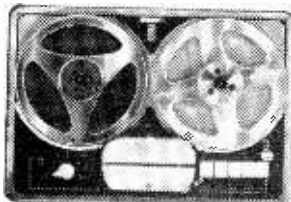
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Plastic Tape Reels, special offer. Manufacturers surplus. 3in. 2/8, 5in. 3/-, 7in. 5 1/2 in. 3/6.



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Brand new and unused in maker's cartons. Limited number only. The well-known MOTEK K10 Deck with push-button controls, 3 motors, 3-speed (11, 31, 71 l.p.s.), rev. counter. Free response better than 40-12,000 c/s at 74 l.p.s. 2-tone grey finish. Listed at £22. LASKY'S PRICE **£9.19.6** Carr. & Ins., 7/6.

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LASKY'S PRICE for the Kit **56/-** Post 5/-
with 3 new Mullard valves.

Full data, circuit diagram, assembly instructions and suggested layout supplied.

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Suitable Cabinets available at bargain prices!
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Carr. free

6 v. operation. For all L.P. and standard records. All components available separately.

AMPLIFIER. 300 milliwatts push-pull output, using two OC71 and two OC72 transistors. Fully assembled. 79/6. Knobs, 3/6 extra.

LOUDSPEAKER. 30 ohms, 7 x 4in. elliptical, matched to Amplifier. 25/-.

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CAN BE BUILT FOR 39/6

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Uses 3 transistors plus germanium diode on printed circuit, size 31 x 4 x 1in., and incorporates ferrite rod aerial, tunable over medium and long waves. Extremely simple to build. Circuit diagram and full instructions, 1/6 (free with parcel).



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Expanding Meter Ranges

USING
ZENER DIODES WITH VOLTMETERS

By J. B. Dance

It is often necessary to measure a voltage fairly accurately over a limited range of values. Suppose, for example, that it is required to measure a voltage which varies between 100 and 120. The normal method would be to use a voltmeter with a full scale deflection of 120V or more but the part of the meter scale from 0 to 100V would then be wasted. In order to obtain the greatest possible accuracy, a meter which reads from 100 to 120V is required such that this range of voltage occupies the whole of the meter scale.

Alternative Methods

It would be possible to use a 100V battery in opposition to the voltage being measured so that the remaining voltage could be measured on a 0 to 20V meter. Such a method employing a large battery is not convenient and variations in battery voltage would render it very inaccurate. Special meters have been designed for limited ranges, but these would normally have to be specially ordered and would consequently be very expensive.

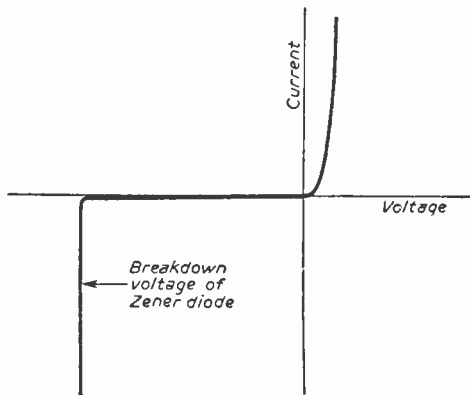


Fig. 1.—The current-voltage curve of a zener diode.

The zener diode provides an excellent means of removing the unwanted 100V so that a 0 to 20 voltmeter can be used to give a zero reading at 100V and a full scale deflection at 120V. The voltage-current curve of the zener diode is shown in Fig. 1, but when such a diode is employed for expanding meter ranges its properties that produce the reverse of the curve are used.

As the reverse voltage across a zener diode increases, the current remains at zero until quite suddenly, at the breakdown voltage, the current rises and the voltage remains constant.

Range of Diodes

The circuit used is as shown in Fig. 2. The meter and the resistor form a normal voltmeter, but the zener diode has a constant voltage across it irrespective of the current passing through it providing that the voltage is above the breakdown value. Zener diodes with a wide range of breakdown voltages are available and can therefore be used in circuits for the measurement of a few to many hundreds of volts. Several zener diodes can be connected in series, if desired, so as to obtain a higher breakdown voltage. On many types of diodes this is not usually quoted to an accuracy greater than about ± 5 per cent, therefore it is necessary to calibrate the circuit shown in Fig. 2 against a standard voltmeter. Nevertheless it is not necessary to do this if only the changes in voltage, and not the actual voltage must be known accurately.

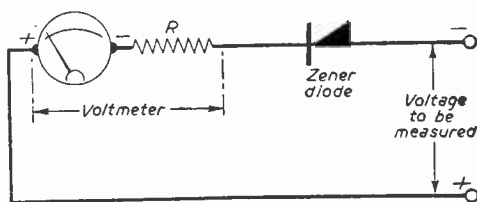


Fig. 2.—The simple circuit employing a zener diode.

Zener diodes have a maximum current rating which if exceeded causes a large amount of power to be dissipated in the diode which may subsequently be destroyed. This fact must be taken into account when the circuit values are being chosen. The meter used normally has a full scale deflection of between about $100\mu\text{A}$ and a few milliamps, but the optimum value depends on the voltage to be measured and the type of zener diode used. If several diodes are used in series, the maximum power dissipation becomes greater, but the largest permissible current is the same as that for a single diode.

The small size and long life of a zener diode make it a very convenient device for fitting inside the case of a meter.

FRIDAY, JANUARY 13th, 1961

A FILM SHOW

(in collaboration with Mullard Ltd.)

CAXTON HALL, WESTMINSTER

at 7-30 p.m.

A few tickets still remain and may be obtained from our offices. Mark your envelope "Caxton Hall" in the top left-hand corner and enclose a stamped addressed envelope (at least $3\frac{1}{2}$ in. x 6 in.) for the tickets.

The films to be shown are "Conquest of the Atom", "The Invisible Force" and "Particles Count".

Club News

REPORTS OF CURRENT ACTIVITIES

CHESTER AND DISTRICT RADIO SOCIETY

Hon. Sec.: A. Bagley, G3JJS, Oak Lea, Long Lane, Saughall, near Chester.

Future Events:

January 10th—Annual General Meeting.
January 17th—GW3HEU will give an account of his tour of Germany illustrated by transparencies.
January 24th—"My Tx" by G3OPT and G3MGK.
January 31st—"The Oscilloscope" by GW3HEU.
February 14th—Mr. C. Riche will give a talk on electric motors.
February 21st—Discussion on National Field Day.
February 28th—G3FWV will explain and exhibit a K.W. Vanguard.

All meetings will be held at the Y.M.C.A., The Old Bishop's Palace, Chester, at 8 p.m.

CHILTERN AMATEUR RADIO CLUB

Hon. Sec.: C. Simpson, 2 Mead Street, High Wycombe, Bucks.

The November meeting was a talk given by G2INZ and the December meeting, which was held on the 29th, was entitled "This or That". All interested in any aspect of radio are invited to join.

CLIFTON AMATEUR RADIO SOCIETY

Hon. Sec.: C. H. Bullivant, G3DIC, 25 St. Fillas Road, London, S.E.6.

Meetings are held on Fridays and Wednesdays at 8 p.m. and on Sundays at 11.30 a.m. Morse Practice is held on Wednesdays.

On November 11th G3AW introduced a quiz on various radio subjects. On December 2nd the club chairman, G3FVG, conducted a Junk Sale and on December 16th the annual constructional contest was held.

HALIFAX AND DISTRICT AMATEUR RADIO SOCIETY

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

Future Events:

January 17th—Pea and Pie Supper at the Sportsman Inn, Ogden, at 7.30 p.m.
February 7th—Lecture on Transistors by Mr. E. C. Bell, lecturer at the Bradford Technical College.
February 21st—Ragchew Night.
March 7th—National Field Day arrangements.
Meetings are held on the first and third Tuesday of each month at the Sportsman Inn, Ogden.

LIVERPOOL AND DISTRICT AMATEUR RADIO SOCIETY

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

The December meetings included a Film Show on the 6th, a talk by G3FBH on "Quartz Crystals" on the 13th, and a B.Y.O.B. (Bring Your Own Beer) night on the 20th.

MEDWAY AMATEUR RADIO SOCIETY

Hon. Sec.: S. W. Nutton, 42 Richmond Road, Gillingham, Kent.

The new headquarters is at Riverside Buildings, Gun Wharf, Chatham, Kent, and meetings are held on alternate Mondays at 7.30 p.m. The club will soon be back on the air with their old call G2FJA. Equipment installations are nearly ready at the club's new headquarters and a grand opening night in the near future is arousing great interest. The new headquarters provide plenty of room for aerial construction.

NORTHAMPTON SHORT WAVE RADIO CLUB

Hon. Sec.: S. F. Berridge, G3ITW, 20 Ethel Street, Northampton.

Meetings are held at Allen's Pram Works, 8 Duke Street, Northampton. On December 1st twenty members and guests visited the BBC transmitting station at Daventry and following a most interesting tour of inspection under the guidance of Mr. D. Pasfield, G5NH, the party was entertained by the BBC (Daventry) Amateur Radio Club, G5XX. Visits to other places of interest are being planned. Working demonstrations of equipment have included V.H.F./U.H.F. receivers, a receiver and its associated panoramic adaptor, teleprinter equipment and frequency meter. These demonstrations have been given by Mike Perry, G2ANS. The Club is operational under its call-sign G3GWB on two metres and "Top Band", and work is on hand to fill in the gaps between those two extremes. All senior officers are now licensed amateurs, the former "odd man out", treasurer Stan Haddon, having just received his licence, G3OOJ.

PLYMOUTH RADIO CLUB

Hon. Sec.: R. Hooper, 2 Chestnut Road, Peverell, Plymouth.

Meetings are held at 7.30 p.m. on Tuesdays at Virginia House Settlement, St. Andrew's Cross. The club may be heard on 80m and 160m under the call-sign G3JYB/A.

READING AMATEUR RADIO CLUB

Hon. Sec.: P. Nash, G3EJA, "Peacehaven", 9 Holybrook Road, Reading.

Recent meetings have been fairly well attended despite other attractions, and have included "Mobile Operations on Two Metres" by G2AHL and a taped lecture "Two Metres" by G2JU. The December meeting was held at Palmers Hall, West Street, Reading, on December 31st, at 7.30 p.m. and was devoted to the Short Wave Listeners and their queries.

All subscriptions are now due, and the treasurer will be glad to receive them.

Future Event:

January 28th—Election of officers for the coming year followed by a talk on "Low Power Equipment for 2m" by G3ASH and G2BRO.

ROYAL NAVAL AMATEUR RADIO SOCIETY

Hon. Sec.: H. Matthews, G3JFF, H.M.S. Mercury, Leydene, Petersfield, Hants.

After just over three months since the Inaugural Meeting of the Society the membership totals 66 corporate members, 6 associate members and 3 junior members.

Membership of the society is open to all serving, or past members of the Royal Navy, Royal Marines, Women's Royal Naval Service, Reserves or Commonwealth Navies. Associate membership is open to civilians who are, or have been, connected with the above services in any way.

The Headquarters Amateur Radio Stations, G3BZU, is regularly on the air on 40m and the DX bands, and will welcome calls from "Naval Types". The Society has applied for affiliation to the Radio Society of Great Britain.

WEST KENT AMATEUR RADIO SOCIETY

Hon. Sec.: M. R. Richards.

Meetings are held at the Kent Education Committee's Adult Centre, Culverden House in Culverden Park Road, Tunbridge Wells. Meetings commence at 7.45 p.m.

Recent events have included "Getting Going on 2m", Part III; "Transmitters", by G2UJ; "Single Side Band", a talk and demonstration by B. Williams. An audio night was held on December 9th and the Christmas party on December 21st.

A morse tape is run from 7.15 to 7.45 p.m. before each meeting for the benefit of members learning the code.

COURSES OF INSTRUCTION

RISLEY EVENING INSTITUTE

Roland Hill School, Lordship Lane, Tottenham, N.17. Head of Institute: R. Finch, A.F.T. com. Tottenham 2419.

A course entitled "Amateur Radio" is being held at the above institute on Monday evenings from 7.30 p.m. to 9.30 p.m. The Spring term commences on January 9th, 1961. The course is mainly intended to serve as an introduction to Amateur Radio and is not a course for the Radio Amateurs' Examination, although if enough interest is shown this later course will be started.

The main emphasis will be on the practical side and it is hoped to have an amateur radio station operating by the end of the spring term. The course is mainly intended for 14-17 age group, but naturally all will be welcomed. Inquiries should be made to J. D. Harris, G3LWM, 2 Lambton Avenue, Waltham Cross, Herts.

STREATHAM AND TOOTING EVENING INSTITUTE

H. N. Caley, 6 Farnan Road, Streatham, S.W.16.

Streatham and Tooting Evening Institute announce that Radio and TV classes for beginners will recommence on January 9th, 1961. There is room for a few more enrolments at each of the classes which take place on Mondays, Wednesdays and Fridays at Dunraven, Penwortham and Hillcroft schools respectively. The terms are the same as for other L.C.C. evening classes.

The Entirely New 5th Edition of the Famous Standard Work

BEGINNER'S GUIDE TO RADIO

By F. J. CAMM

Considerably enlarged and amplified with a new chapter on transistors.

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TAPE RECORDER CONSTRUCTORS FOR THE CONNOISSEUR
LATEST COLLARO STUDIO TAPE TRANSCRIPTOR. 3 motors, 3 speeds, 11, 31, 71 l.p.s. takes 7in. spools. Push-button controls. £12.19.6 plus 5/- P. & P. Usual H.P. facilities.

TAPE RECORDER AMPLIFIER. Suitable for use with either of the above Tape Decks, and most other types. For A.C. mains, 4 watts output. 40-12,000 CPS at 71 l.p.s. ± 3 db. Facilities for superimpose. Valves: 6E96, ECL82, 12AX7, EM84, and contact cooled metal rectifier. Radiogram input, microphone input, monitor facilities. (can be used as straight through amplifier), volume control and separate treble and bass controls. Chassis measurement 11 1/2 x 3 1/2 in. Supplied complete with attractive grey/blue escutcheon plate finished in black and gold. Circuit diagram & connecting instructions included Price £11.5-0 only, plus 3/6 P. & P. If purchased with the above deck, both items post free!

ATTRACTIVE TWO-TONE PORTABLE CARRYING CASE. Suitable for above amplifier and Collaro. Studio deck. Limited quantity only at 72/6 plus 3/6 P. & P.
MIC 45-1 Acos latest flat pistol-grip crystal microphone. Attractive black and gold finish. OUR PRICE 29/6 plus 1/- P. & P.
ACOS MIC 39-1. Crystal stick microphone. list price 3/6s. Our price 39/6 plus 1/6 P. & P.
MIC 40. General purpose crystal microphone with desk stand. Our price 25/- only plus 1/6 P. & P.

M.C. 24. Imported. crystal, attractive streamlined polished metal case. incorporates muting switch. List price 64/-. OUR PRICE 42/- only, 1/- P. & P.

ANOTHER HAND MIKE BARGAIN! Lightweight crystal with built-in desk stand at only 19/6, P. & P. 1/-.

LIMITED IMPORT QUOTA ONLY! OUTSTANDING BUY!



MODEL U.I. MULTI-RANGE TESTMETER

Ideal for amateurs and service engineers. Incorporates 3in. rectangular meter. Ranges: A.C. & D.C. voltage, 0-10-50-250-500-1000 v. D.C. current 0-100-500 mA. 0-1 mA (used at 0-10v. range). Resistance 1-2000 ohms (centre 24 ohms), 100-200,000 ohms (centre 2.4 k.). Sensitivity: 1000 ohms per volt A.C. & D.C. Size 5 x 3 x 2 1/2 in. Wt. 22 ozs. only.

Fully guaranteed. Supplied complete and ready to use with test leads, at the very low price of ONLY 79/6, P. & P. 3/6. (Rona fide trade enquiries invited).

"FAMILY FOUR"

Our supersensitive T.R.F. Receiver for home construction. Covers Long and Medium wavebands. Is housed in very smart plastic table cabinet in Brown or Black. For A.C. mains 200/250 v. Comprehensive assembly instructions provided, including practical and theoretical diagrams, which are easy to follow and will enable you to complete this receiver which will be the envy of your friends. ALL NECESSARY COMPONENTS ARE BEING OFFERED FOR LIMITED PERIOD ONLY at the REMARKABLE PRICE of ONLY 79/6, plus 2/6 P. & P. Instruction book available separately if you wish to study before purchase at 1/6 post free.



NEW! the "PAGEBOY" 2-TRANSISTOR POCKET PORTABLE

Completely portable—No external Aerial or Earth Req'd.

An amazing little receiver with built in aerial and small enough to be held in the palm of the hand. Medium wave reception at wonderful volume. No fiddly tuning! condenser tuned!



Supplied with drilled chassis and colour coded components. Easily assembled with the aid of the easy-to-follow assembly instructions provided. Total cost of all necessary components, including transistors, wiring wire and even solder only 32/6, plus 1/6 P. & P. Battery 3/- extra. Ardente type dead airdie complete with cord and plugs 12/6 extra. Parts price list and Easy Lay-out Plans 1/- post free. Write us to hear this set demonstrated at any of our branches. Our reputation is your guarantee.

RADIO JACK

Covers local medium wave stations variably tuned. Compact self contained unit requiring only connection to aerial (no power supplies req'd.) for list class reception when used in conjunction with your tape recorder or high gain amplifier. All necessary parts available at a special inclusive price of ONLY 19/6, P. & P. 1/6.

LATEST GARRARD MODEL 210.

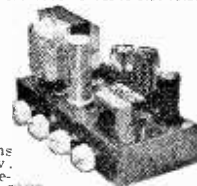
Four-speed manual or automatic. 10in. and 12in. records of same speed can be mixed in any order, wired for stereo. Attractive white colour scheme. Price 10/6s., plus 3/6 P. & P.

B.S.R. UAN STEREO/MONAUROAL Few only at 27.19.6, plus 3/6 P. & P. Brand new. Guaranteed.

LATEST B.S.R. UA14. 4-speed. Attractive appearance. Wired for stereo. Fully guaranteed. 27.19.6, plus 3/6 P. & P.

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Compare the advantages. Treble bass and middle controls. For crystal or magnetic pick-up. A.C. Mains 200/250 v. Valve line-up: 6V6GT, 6X5GT.



Negative feedback. Built on stove enamelled steel chassis, measuring only 8 x 4 x 1 1/2 in. Four engraved cream knobs are included in the price of the complete kit with all necessary practical and theoretical diagrams at £4.5.0 only, plus 2/6 P. & P. or Instruction Book fully illustrated for 1/- post free. This amplifier can be supplied, tested, and ready for use at £5.5.0 plus P. & P.

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All required Components for the Complete Osamor Version described in Practical Wireless, now available at special inclusive price of £9.19.6, complete including Printed Circuit and Osamor booklet. All items available separately, send stamp for list.

Have you tried the famous American Ferrodynamics "BRAND FIVE" Recording Tape. An enthusiast's must!



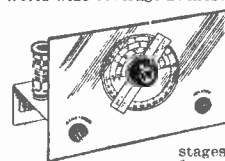
High Quality Acetate Base:

5" 600ft., 18/-; 7" 900ft., 18/6; 5 1/2" 1,200ft., 23/8; 7 1/2" 1,200ft., 25/-; 7 1/2" 1,800ft., 35/-; Extra Quality Mylar Dupont: 3" 300ft., 13/-; 5 1/2" 1,200ft., 37/6; 7 1/2" 1,800ft., 44/-; 7 1/2" 2,400ft., 60/-; Each on plastic spool. All post free.

BRAND NEW—NOT SUB-STANDARD

I VALVE SHORT-WAVE RADIO

World-wide coverage at most reasonable cost.



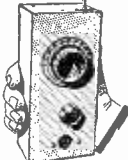
Covers 40-100 metres with the coil supplied. Can be extended to cover 10-100 metres. Provision is also made for the addition of two extra valve stages. Employs the famous Acorn-type 954

valve. All necessary components can be supplied complete with full assembly instructions at ONLY 35/- plus 2/- P. & P. Send 2/- for point-to-point wiring diagram and price list.

SUPER PERSONAL PORTABLE

A wonderful little set that you can take anywhere. Ideal for camping, picnics, etc. Detachable aerial rod supplied. Covers Medium waveband 200-500 metres. Can be built in approx. 1 hour. All necessary components available at the following SPECIAL

INCLUSIVE PRICES: 1-valve version ONLY 35/- plus 2/- P. & P. Super 2-valve version ONLY 41/- Plus 2/- P. & P. Send for point-to-point wiring diagram and parts price list 2/- post free. Extra for use with the above DLR5 balanced armature headphones. 7/6 pair.



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"THE MID-FI" A NEW DESIGN 4½ WATT AMPLIFIER KIT



MAY BE BUILT FOR 95/- plus 3/- p. & p.
A new circuit for the home constructor requiring a good quality medium powered Amplifier for reproduction of Records of F.M. Broadcasts. For use with Loudspeakers of 3 or 15 ohms impedance. Technical Specifications: separate bass and treble controls. Valve line-up EF86, EL84, EZ80. Voltage adjustment for A.C. mains from 200-250 volt. Negative feedback. Size 7 x 5 x 2in., overall height 5in. Silver hammered finish Chassis. Instruction Book 1/-.

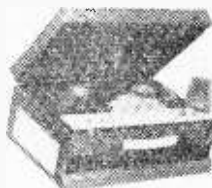


The "Petite" PORTABLE

MAY BE BUILT FOR

£7.7.0 Plus p. & p. 3/-

BATTERIES EXTRA.
H.T. 10/- (Type B126) or equivalent L.T. 1/6 (Type AD35) or equivalent.
★ Size only 8in. x 8in. x 4½in.
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Once again Premier is first with another magnificent offer. Introducing the "TR/2" the latest and cheapest addition to our range of popular Recorders.

Star features:

- ★ Latest BSR Tape Deck, with interlocking device to prevent accidental erasure.
- ★ Single speed 3½in. per sec.
- ★ Playing time 5½in. std. tape, 1½ hrs; L.P. tape, 2 hrs 8 mins.
- ★ Volume on/off and tone control.
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PRICE including Microphone, tape and spare spool

19 Gns. Plus 15/- P. & P.

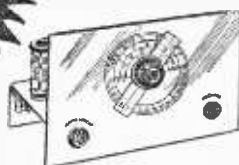
★ Extension speaker socket. Size: 13½ x 9½ x 6in., weight 17 lb.

SPECIAL BARGAIN OFFER THE PERFECT STEREO SYSTEM:

Two DL7-35 power amplifiers; Original cost £91.0.0
One SP21 Stereo Control Unit-
Brief Specifications: **Our Price £47 Gns.**
SP21 Power requirements 6.3V at 1.3A A.C., 250V at 5mA D.C. Dimensions 14½ x 9 x 4in. ORIGINAL PRICE £28.10.0
DL735 Power output each amplifier, 54 watts peak. Valve line-up: GZ34, 2-EL34, ECC83, EF86. L.S. impedance 4, 8 or 16 ohms, switch selected. ORIGINAL PRICE 30 GNS.

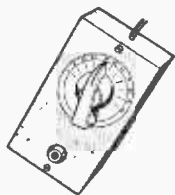
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Explore the world on short-wave radio (10-100m)

FOR ONLY **35/-**



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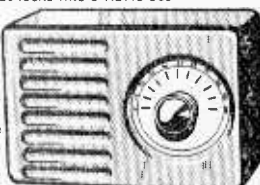
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Trade News

NEW PRODUCTS AND DEVELOPMENTS

GENERAL COVERAGE RECEIVER

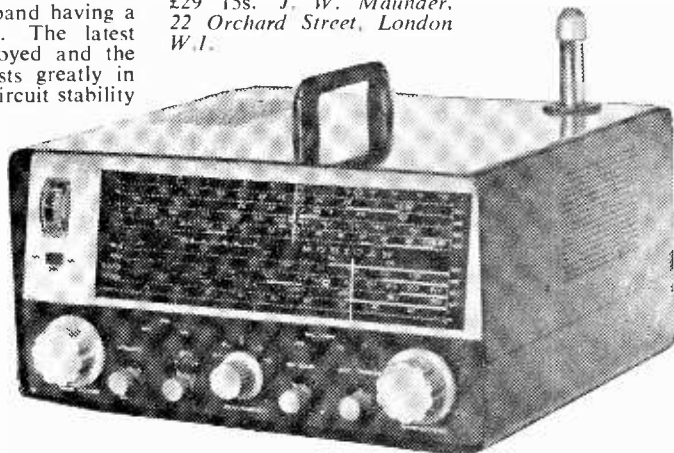
THE GC-1U is a portable or fixed station receiver for both the ham and the short-wave listener. It has been designed for good performance and some of its features are a ten transistor circuit, printed circuit board, internal dry battery power supply, telescopic whip antenna, tuning meter and a large slide-rule dial giving a total scale length of approximately 70in.

To overcome the problems of alignment etc., the R.F. "front-end" of the receiver is supplied as a pre-assembled, wired and aligned unit.

Continuous frequency coverage is provided from 550kc/s to 30Mc/s in five bands thus enabling world-wide reception. Electrical bandspread on five additional bands covers the amateur frequencies from 80 to 20m each, the band having a scale length of approximately 8in. The latest printed circuit techniques are employed and the use of a printed circuit board assists greatly in successful kit assembly and ensures circuit stability and consistent performance.

A 7in. x 4in. loudspeaker is mounted on a side panel within the cabinet and is automatically disconnected when the phone plug is inserted in the socket.

The GC-1U is housed within a strong steel cabinet finished in stove-enamelled green and it is powered by a 12V dry battery mounted internally. For static and mobile use a socket is provided for the connection of external power supplies. It is available from *Daystrom (Heathkit) Ltd., Gloucester, England.*



The Heathkit "Mohican" general coverage receiver.

STYLUS PRESSURE GAUGE

A STYLUS pressure gauge is being produced by Garrard Co. Ltd.

The gauge ensures optimum reproduction of all types of gramophone records by providing an accurate means of correcting the pressure of the stylus on the record. It accommodates all current pick-up arms and heads, and a swivelling balance lever ensures sensitivity. The gauge is freely adjustable and easy to operate. *The Garrard Engineering and Manufacturing Co. Ltd., Swindon, Wilts.*

MOVING COIL MICROPHONE

J. W. MAUNDER, U.K. agent for Shure Brothers Incorporated, announces the release of Model 545 "Unidyne III", a small cardioid dynamic microphone.

A slender moving-coil microphone only 1½in. diameter x 6in. long, the "Unidyne III" provides wide-range reproduction of music and speech whilst the uni-directional characteristic largely overcomes problems of feedback and unwanted

noise and ensures highly satisfactory performance under adverse acoustic conditions.

For a given feedback level the microphone can be placed at 75per cent greater distance from the performer than is possible with conventional models.

Of dual-impedance, the "Unidyne III" can be connected direct to a 50-250Ω line or high impedance input. It is supplied complete with 18ft of high quality shielded cable and plug and with an adjustable swivel adaptor which permits instant withdrawal for hand use.

Also available is the Model 544 Series, comprising the "Unidyne III" mounted on a flexible support for fitting to control desks and consoles.

The Model 545 "Unidyne III" Microphone, cost £29 15s. *J. W. Maunder, 22 Orchard Street, London W.1.*

HIGH TORQUE BATTERY MOTOR

DESIGNED primarily for professional tape recorders, this new EMI battery motor (part no. 98170D) is also suitable for television camera remote control, and for medical and other scientific uses. This high-grade precision motor is built for long life and exceptional speed regulation over a wide range of load and voltage. A multi-pole armature gives low electrical interference, long brush life and high efficiency and a ball race bearing is incorporated for handling heavy duty side loads. *The Gramophone Co. Ltd. (Components Division), Hayes, Middlesex.*

MONAURAL RECORD PLAYER

THIS new monaural record player is made by Magnavox and is selling at 19½ gns. (including purchase tax). The M.602 "Manhattan" record player incorporates features normally found in instruments selling in a higher price range.

Owing to advanced amplification technique, the "Manhattan" gives freedom from distortion at high volume. This is due to the first-class per-

formance of the 7in. x 4in. elliptical wide range unit. The Magnavox standard auto-changer operates at 16 $\frac{1}{2}$, 33 $\frac{1}{2}$, 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's. The cabinet features clean-cut contemporary styling. *Magnavox, 129 Mount Street, London W.1.*

A.M./VHF TRANSISTOR TABLE RADIO

A NEW 8-transistor A.M./VHF table radio, by Ekco (model BT359), makes everyday family listening independent of the mains supply without involving any undue extra running cost.

It is a full-size table model measuring 11 $\frac{1}{2}$ in. high by 17 $\frac{1}{2}$ in. wide by 6 $\frac{1}{2}$ in. deep and a Class B push-pull output stage delivers up to 1W into a high-flux (10,000 line) 8in. by 5in. elliptical speaker. In addition to the usual ferrite rod aerial for medium waves, a double folding-rod dipole is provided for VHF reception.

This receiver can provide a standard of performance at least comparable with that of a typical better-class mains receiver while the absence of all external connections means that the receiver can be used wherever it is most convenient — without reference to the availability of a mains socket.

An attractive feature of this receiver is the clearly marked tuning scale which also carries the two concentric pairs of control knobs and extends to the full width of the cabinet. Controls include tuning, wavechange, volume on/off and tone. Wave-ranges are 185 to 570m and 85 to 100Mc/s.

In appearance, the receiver is of modern design, the cabinet is veneered in sapele mahogany and trimmed with silver-colour metal styling bars and a woven plastic speaker grille.

The price of the receiver is 27 gns. (£21 9s. 3d. plus tax £6 17s. 9d.) and the recommended battery costs 11/-.

Technically, the receiver makes few concessions to tradition. There are four printed wiring panels, one for the R.F. tuner, one containing the audio frequency circuits, another containing the F.M. intermediate frequency and demodulator circuits and the fourth containing the A.M. frequency-changer, intermediate frequency and demodulator circuits. Between the two latter panels, a slide switch carries three transistors which are switched from one panel to the other by the wavechange switch. All three transistors serve as I.F. amplifiers when switched into the F.M. panel, only two of them serving as amplifiers when switched to the A.M. panel, the third then forming

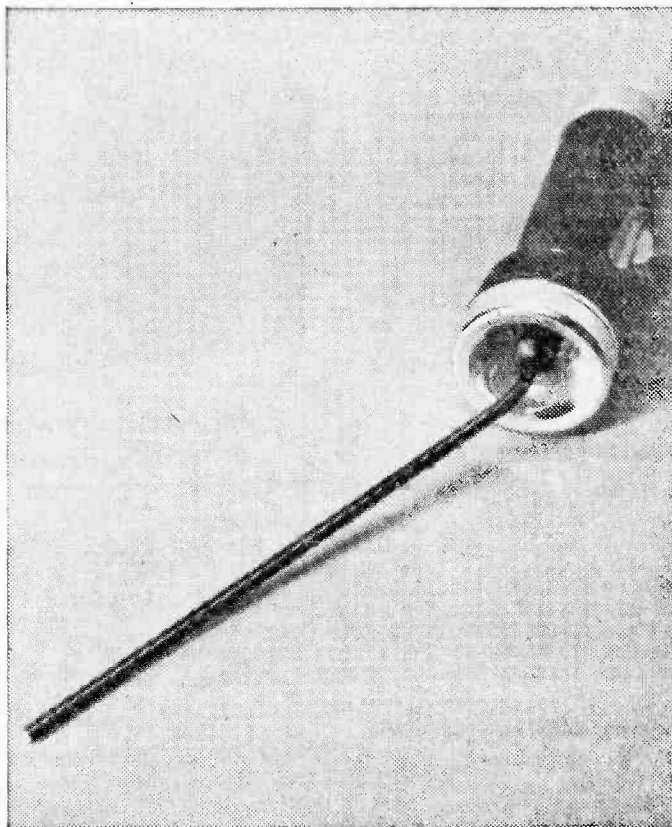
an oscillator/mixer. With ample space inside the cabinet, all the printed panels are easily accessible for servicing if required. *E. K. Cole Ltd., Southend-on-Sea, Essex.*

TORCH ATTACHMENT

THE "Clinton Prodlite" can be fitted to any two-cell electric torch in place of the standard miniature screw bulb.

The diameter of the stalk is only $\frac{1}{8}$ in., or with an insulating sleeve, $\frac{1}{4}$ in., and it contains a specially made ultra-miniature bulb incorporating a lens which directs an intense beam of light wherever required. As the bulb is sheathed within the hollow stalk, it is protected from damage and has a long working life.

For such purposes as inspecting the interior of radio apparatus, the practical value of this device is obvious. It can be obtained with a longer, or a specially shaped stalk, or with a flexible lead and switch. Incidentally, a 12V model for motorists and garage service will also be available. The price is 15/6. The Prodlite has been introduced by the *Clinton Laboratory, 43 Broomhall Place, Sheffield 10.*



The "Clinton Prodlite" torch accessory enables areas normally inaccessible to light to be illuminated.

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 P. & P. 2/-

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This set can be built for £7.19.6. Size 6 x 3½ x 1½ in. 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 2½ in. moving coil speaker. Instruction book with point to point wiring diagram, 2/6 each. Batteries, PP4 (Ever Ready) 2/- each.

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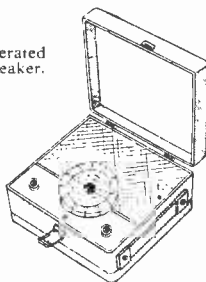
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P. & P. 2/6

COSSOR BATTERY PORTABLE
£7.7.0 P. & P.
 3/6

This extremely sensitive battery operated set has a printed circuit and 5in. speaker. A frame aerial fitted in the lid gives high quality listening on L and M Bands.

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P. & P. 3/6

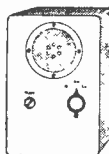
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3½ in. SPEAKER .. 17/6
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"SUPER- THREE"

Transistor Pocket Radio



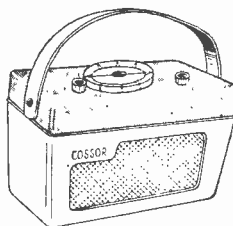
Printed circuit technique using 2 Surface Barrier type transistors, one A.F. Trans and one Diode. Ferrite aerial, fully tunable on LW and MW. Uses 2 U16 1½ volt batteries. And easily assembled by the beginner.

Kit of Parts
Complete**39/6**

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COSSOR BATTERY PORTABLE SPECIAL**£6.19.6**

P. & P. 3/6



LIST PRICE 12½ gns.

A printed circuit, 5in. speakers are features of this battery portable. An internal ferrite rod aerial for L and M Bands. A polythene wrapper provided to protect receiver. Width 10in., height 6½ in., depth 5½ in.

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A first class tape recorder at a reasonable price. Separate Treble and Bass controls for replay, facilities for monitoring and mixing. 3-speed Collaro Studio deck, and many other refinements. Output 4 watts.

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Complete with crystal microphone with lead and jack plug. 5½ in. reel of tape and spare reel and spare lead for recording from radio.

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Another fine recorder fantastically cheap. It also uses the famous Collaro Studio 3-speed tape deck. Separate inputs for microphone and gram. recording tone control for replay. Output 3 watts.

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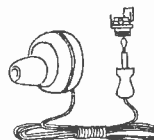
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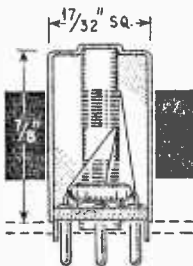
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A 10.7 Mc/s double-tuned transformer with tapped secondary and primary windings. Wound on polystyrene former complete with iron dust tuning cores and sub-miniature polystyrene foil capacitors. Completely enclosed in an aluminium screening can measuring 7/8in. high by 17/32in. square with two fixing clips. Termination is made to base mounted silver plated pins which are ideal for either printed circuit board or normal metal chassis mounting.

Bandwidth of single transformer at — 6 db is approx. 250 kc/s. Unloaded 'Q' of winding 70. Price 10/6



ACTUAL SIZE

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A sub-miniature 10.7 Mc/s transformer for use in ratio discriminator type circuits. Secondary winding is of bifilar construction. Dimensions as IFT.15. Peak Separation approximately 220 kc/s.

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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.

LOUDSPEAKER DESIGN

SIR.—Recent letters have given details of loudspeaker design and problems, but I have not so far seen any mention of some experiments which were carried out some time ago and according to the reports which I read, foretold great steps in development in the reproduction of sound. I believe that a flame was modulated in some way and that this gave reproduced sound of a very high quality. I have heard nothing further of this. Similarly, the flat plate type of reproducer was hailed as a wonderful new departure in loudspeakers, but also has faded away without any models incorporating it coming on the market. Can anyone tell me if there has been anything new in loudspeaker design in the period since the war? Apart from the fabric cone of certain models it seems to me that the modern loudspeaker is no different from those in use before the war.—**F. R. ENDELL** (Bristol).

WIDE-BAND S.W. TWO

SIR.—I recently finished the set described in the June issue but was very disappointed as it would not work. After some trouble I discovered a fault in the wiring in your Fig. 4 and when this was remedied the set responded well. I have had immense pleasure from this little set, and although it was built primarily to give to a young friend, I am keeping this for my own use and building another. I was terribly thrilled on the first night's listening by the large number of entertaining stations which could be picked up, and I think that I shall now have to build myself a really good aerial as the scope of this set seems endless—**R. T. BURTON** (Wembley).

[In Fig. 4 on page 128 of the June 1960 issue, the 270k screen resistor of V1 should be connected to H.T.+, as in the circuit diagram.—Ed.]

TRANSISTOR HOLDERS

SIR.—I have followed your articles and my main interest nowadays is in the transistor. I find, however, that after I have used a transistor three or four times it seems to have worn out. This prompted me to make some enquiries and I finally found that I had in fact more or less ruined the transistors by soldering them into the sets. I would have thought that after the time which these com-

ponents have been on the market, some attempt would have been made to produce a transistor to plug in, just the same as the valve, and it looks to me as though the transistor manufacturer is cashing in on the fact that you have to solder them and therefore you will ruin them and have to buy another. Could not you publish an article on how to fit pins to the base (with a minimum risk of damage) and how to make sockets to take them. I am sure this would be welcomed by all, and could be done without making them any larger.—**E. M. KRFL** (Reading).

PLAYING A RECORD BACKWARDS

SIR.—During Christmas I saw a stunt carried out by a radio enthusiast which has me guessing. First of all he showed us how to play a gramophone record backwards, by putting it on a pencil and letting its edge rest against the edge of the turntable. Whilst we appreciated the "stunt" (it was quite good as a sort of party game to try and guess the artiste, and was really funny to listen to) he then astounded us by playing a tape recording backwards. I know a little about tape recording, but cannot see how he managed this, as it would not be sufficient just to turn the tape over. What has to be done so far as I can see it is to turn the tape "inside out backwards."—just turning it over will not give the same effect. Perhaps some ingenious reader has ideas on this and could let us have the "know-how".—**F. KEATING** (S.W.5).

TAG BOARDS

SIR.—The modern set is a masterpiece of "juggling", the many components having to be placed in awkward positions, and, the wiring made intricate, unless some special procedure is adopted. I some time ago took to using tag boards to simplify construction, making a drawing and mounting all the components required on the tag boards, which result in only the connecting wires from the edges of the boards to the valveholders having to be made to complete the set. I believe it is now possible to obtain valveholders in which a step further in this direction has been made in the U.S.A. and an extension of the valveholder base is made so that all the items associated with the valve may be mounted actually on the holder. Thus all the wiring to the valveholder may be made before it is mounted on the chassis, and this would surely greatly simplify construction, as well as making it much easier to ensure that there were no bad connections to a component which is very inaccessible when the same is completed. Does anyone know of this type of valveholder and whether it is available in this country? — **H. NEVILLE** (Bournemouth).

MODULATION

SIR.—With reference to Mr. J. R. Miller's letter printed in the January issue, concerning modulation at low power in the VFO, modulation in the oscillator stages is certainly practicable and was popular with amateurs in the early days of high-cost power valves when any economy not incurring too many disadvantages was given serious consideration.

The main fault with this method is that in modulating the oscillator on grid, screen or anode, a current change must occur and a corresponding voltage variation. Thus in turn reduces stability, frequency modulation occurring with consequent reduction of quality.

Now that cheap valves for power amplifier and modulator output stages are available e.g., the ubiquitous 807 type mentioned, it is surely worth the extra outlay to obtain the stability necessary for modern amateur operation on crowded bands such as 40m.

In reply to Mr. Miller's other query, it is possible to run 120W unmodulated R.F. from two 807's in parallel.

In the same issue Mr. E. Haines refers to Radio Luxembourg as having "hardly enough power to bridge the ether"! It would seem to me that the 350kW output radiates efficiently enough for I have heard the station with consistency whilst residing in Orkney. This was at a distance of roughly 800 miles and still S9+.—R. A. WHITE (Sevenoaks, Kent).

PUSH-PULL AMPLIFIER

SIR.—In reply to Mr. Haskell's request (January issue) for the value of separate cathode resistors for two EL84's in push-pull, I can inform him that the value will depend upon the loading of the output stages.

For normal loading, the value will be 270Ω for each resistor, and for low loading it will be 437Ω (i.e., 390Ω + 47Ω). The latter mode of operation will give a reduced distortion level, approximating the conditions of fixed bias, although the former arrangement also works admirably.—R. J. BURG (East Ham, E.16).

SHORT WAVE LISTENING

SIR.—With reference to Mr. F. N. H.'s letter that appeared in your December 1960 issue, I would also like to remark on such interesting reception. For, on the afternoon and early evening of November 27th I received on the 10 and 15m amateur bands large numbers of U.S. and Canadian amateurs as well as stations in Central America, Hawaii and Alaska. The receiver used was a 7 valve superhet and an R.F.24 pre-selector.—I. K. GURNEY (Chalfont St. Peter, Bucks.).

INTERFERENCE

SIR.—Reading the December 1960 issue of PRACTICAL WIRELESS, section "Letters to the Editor", I came across a sub-heading "Interference".

The explanation for this type of interference is commonly known as the Luxembourg effect. This phenomenon has been the object of much investigation, and an explanation of it was first given by

two Australian physicists, Bailey and Martyn. They showed how a powerful low frequency station could affect the ionosphere in such a way that any other waves deflected from the affected region would acquire a modulation from the unwanted power station.

The only cure for this unfortunate mixing of transmissions would appear to be a reduction of a proportion of the skyline.

Under the action of a powerful electric field, such as a powerful transmitting station, the motion of the electrons does not follow a linear law. It is possible to make use of this non-linear characteristic, in the way which one does when employing grid modulation, by a process resembling the latter. The waves of the distant station passing through the area of the powerful electric field have a modulation from the latter impressed on them.—E. S. JACOBSON ZS6ATQ (Brakpan, South Africa).

CRYSTALS

SIR.—What has happened to the old-fashioned crystals which we used in earlier days as a detector? The various circuits which I have tried lately have not proved very thrilling, in spite of the exchange of silicon diodes and transistors, and I wanted to try a diode arrangement with a piece of the old Galena or Hertzite, but when I asked at the shop the dealer said he had never heard of them. Why not? I feel convinced that they are more sensitive than the modern components when once a suitable sensitive point has been found, and perhaps one of your readers knows a source of supply.—T. L. MENCE (N.W.).

A.C./D.C. EQUIPMENT

SIR.—I know there has been a long controversy about the merits and demerits of apparatus wired to what has become known as the A.C./D.C. technique, but there is one point which I do not think I have seen touched upon. What about hum? In a properly wired A.C. set, the heater wiring will be continuous on both pins, with the wires twisted tightly and run close to the chassis, thus ensuring that any A.C. field surrounding those wires will be so small as to be negligible, thereby avoiding the ejection of A.C. (hum) into other wires. In a set where the heaters are all wired in series, there is usually one single wire running all round the chassis, radiating, in my opinion, quite a considerable A.C. field which is bound to make its presence felt at one point or another. The purists may argue that the transformer gives a larger field, but it is possible to obtain totally shrouded transformers, and I am convinced many of the troubles of the set wired "A.C./D.C." are due to the A.C. bearing wires. — H. FRANKS (Belmont).

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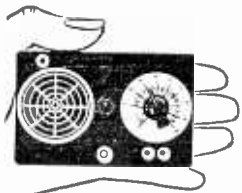


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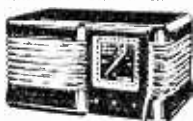


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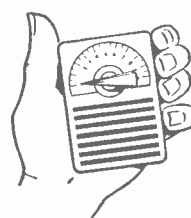
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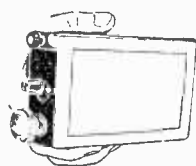
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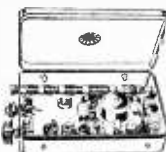
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IC51	7/8	8X35	7/8	DL123	8/6	EC181	10/-	C26	7/8
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IC57	7/8	8X41	7/8	DL129	8/6	EC181	10/-	C26	7/8
IC58	7/8	8X42	7/8	DL130	8/6	EC181	10/-	C26	7/8
IC59	7/8	8X43	7/8	DL131	8/6	EC181	10/-	C26	7/8
IC60	7/8	8X44	7/8	DL132	8/6	EC181	10/-	C26	7/8
IC61	7/8	8X45	7/8	DL133	8/6	EC181	10/-	C26	7/8
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IC88	7/8	8X72	7/8	DL160	8/6	EC181	10/-	C26	7/8
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IC91	7/8	8X75	7/8	DL163	8/6	EC181	10/-	C26	7/8
IC92	7/8	8X76	7/8	DL164	8/6	EC181	10/-	C26	7/8
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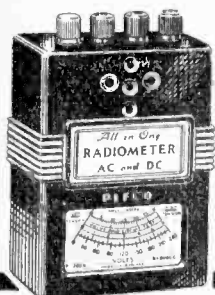
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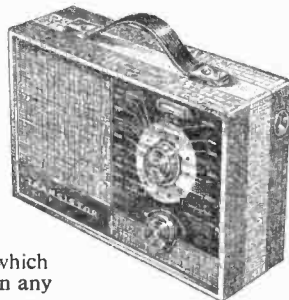
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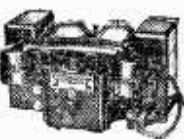
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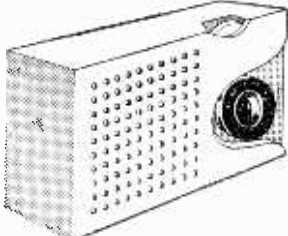
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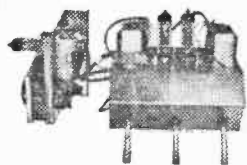
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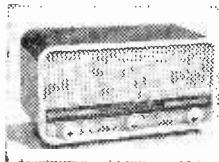


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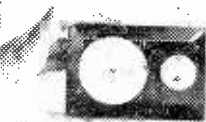
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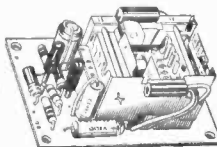
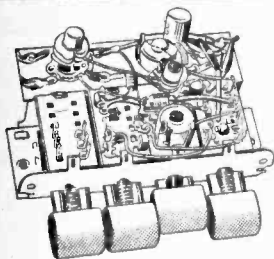
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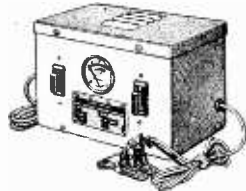
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Crystal controlled heterodyne with individual numbered calibration book with check points.
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12in. TV Chassis for Spares. Four for 10/-, cart. 5/-
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New Tube Units complete with VCR87 and EF80 valves etc. 15/-, cart. 7/6.

154 T.V. Complete. 16/-, cart. 12/-.

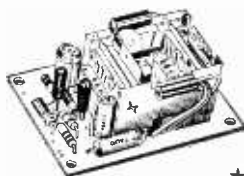
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EF80	2/6	6H8	1/-	6P28	5/-
6SN7	2/9	KT83	5/-	6AL5	5/-
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All types for 12in. G.E.C. TV Sets in Stock.



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★ PRE-BUILT UNITS ★

— THE NEW EASY WAY TO BUILD A RADIO —

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Press Button Osc/Mixer stage, OC170 Transistor. S.W. 5.9 to 13Mc/s; MW 510 to 1620 kc/s; L W150-to 275 kc/s. Printed Circuit, size 3.4 x 2.1 x 1.8in. PRE-ALIGNED AND TESTED

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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.

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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.

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8 x ½in. M.L.S. Ferrite Aerial and Coils. 12/6. 176pF ± 176pF Tuner, 9/6. 2-15pF Trimmers, 1/- each. 7x4in. 3 ohm Speaker, 20/- OR 9 x 6in. Cels., 25/-.

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TRANSISTORS From 3/6 each

SEND FOR NEW FREE LIST WITH
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We can supply a Transistor for every need!

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Latest ACOS 43-1, 2½in.	12/6	P.P. 6d.
½in. square (ex-units)	3/6 ea.	P.P. 6d.
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IDEAL FOR PORTABLE RECORD
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- ★ FULL TONE and VOLUME CONTROL
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- ★ ECL82 VALVE and MAINS

OPERATED
BUILT AND READY TO USE
59/6 P.P. 2/-

9 x 6in. Celestion Speaker for use with
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Telescopic Chrome Aerials

7-Sections, 3ft. 6in. open; 6in. closed.
Ideal for Portable Receivers. Walkie-
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With Clips 12/6. P.P. 1/-
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New high-gain circuit with full tone,
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- ★ 2 WATTS PEAK PER CHANNEL
- ★ ECC83; 2-ECL82 VALVES
- ★ MAINS 110/250V A.C.

£5.7.6

Complete with speaker
sockets, calibrated dials, etc. P.P. 2/-
BUILT AND TESTED

- ★★ COLLARO 4SPEED STEREO
AUTO-CHANGER, ideal for use
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for use with STEREO 3-D, 37/- pair.
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ACOS 39-1 Stick Microphone with
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2—OC45
1—OC71
2—OC72
and
2—OA81

ONLY
60/-
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ALL TRANSISTOR BABY ALARM

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PERSONAL POCKET RADIO

- ★ Medium Wave Tuning
- ★ Three Transistors and Diode.
- ★ 9 Months' Battery Life for 4½d.

- ★ Simple to Build
- ★ After Sales Service
- ★ Ideal for Beginners

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AERIAL

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Personal Earphone Out-
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Total cost of all necessary
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Free List by Return.
Valves, Quartz, Crystals,
Transistors and
Components.

Practical Wireless

BLUEPRINT

SERVICE

ALL OF these blueprints are drawn full-size and although the issues containing descriptions of these sets are now out of print, 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.

Title Number Price

CRYSTAL SETS

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

STRAIGHT SETS

Battery Operated

Modern One-valver	...	PW96*	2/6
All-dry Three	...	PW97*	3/6
Modern Two-valver	...	PW98*	3/6

SUPERHETS

Mains Operated

A.C. Band-pass Three	...	PW99*	4/-
A.C. Coronet-4	...	PW100*	4/-
A.C./D.C. Coronet	...	PW101*	4/-

MISCELLANEOUS

The PW 3-speed Autogram	...	—*	8/-
The PW Monophonic Electronic Organ	...	...	8/-

TELEVISION

The PT band III converter	...	—*	1/6
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A.C. Fury Four	...	PW20*	2/6
Experimenter's Short Wave	...	PW30a*	2/6
Midget Short Wave Two	...	PW38a*	2/6
Band-Spread Three (Battery)	...	PW68*	2/6
Crystal Receiver	...	PW71*	2/-
Signet Two (Battery)	...	PW76*	2/6
Simple S.W. One-valver	...	PW88*	2/6
Pyramid One-valver	...	PW93*	2/6

BBC Special One-valver	...	AW387*	2/6
Short-Wave Two	...	AW429*	2/6
Short-Wave World Beater	...	AW436*	3/6

Standard Four Valve S.W.	...	WM383*	3/6
Enthusiast's Power Amplifier	...	WM387*	3/6
Standard Four Valve	...	WM391*	3/6
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PRACTICAL WIRELESS, FEBRUARY, 1961.

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6 TRANSISTOR MEDIUM AND
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SPECIFICATION

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- 6 "Top-Grade" Ediswan Transistors
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● Size 10 x 7½ x 3½ in. Weight 4½ lb.



RANGER-3

PERSONAL POCKET RADIO

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

● LUXEMBOURG GUARANTEED (where normally receivable)

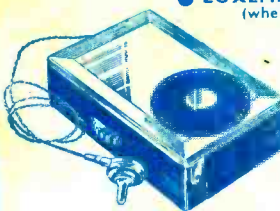
- ★ Full Station Separation
- ★ Calibrated Dial
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RANGER-2

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- ★ Two High Gain Transistors
- ★ 9 Months' Battery Life
- ★ Calibrated Dial
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- ★ 120 metres to 500 meters coverage
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Total cost of all items with battery, transistors and personal earphone, etc.

65/-

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Building Instructions and Prices **FREE** On Request



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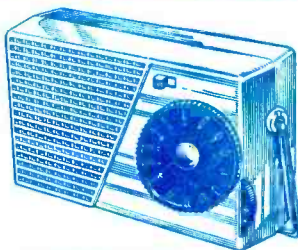
- After Sales Service
- Simple to Build

"PW" 6 Transistor Medium & Long Wave Pocket Superhet

- 6 MATCHED MULLARD TRANSISTORS AND DIODE
- 150mW Push-Pull Output
- Easy to Follow Printed Circuit with all Components Marked
- Full Medium and Long Wave Tuning
- High "Q" Internal Ferrite Aerial
- Quality 2½ in. Speaker

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- ★ All Parts Sold Separately
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