

AN ECONOMY MAINS TRANSPORTABLE

PRACTICAL 13

JANUARY
1959
EDITOR: F.J. CAMM

WIRELESS



CONTENTS..

RADIOGRAM CONTROL UNIT
LOUDSPEAKER MATCHING
SERVICING WITHOUT
INSTRUMENTS
A LOW-PRICE QUALITY
AMPLIFIER
THE USE OF TAG STRIPS
MAKING OHM-METERS
SERVICING RADIO
RECEIVERS, ETC. ETC.

Collins T.C.S. Transmitter & Receiver

PYE 10in. SPEAKER. 3Ω in magnificent case. Complete with lead and plug. Brand new. 45/- Carr. 5/-.

931A PHOTO MULTIPLIER CELL. Complete with associated video amplifier employing 3-6AC7, 1-6V6, complete strip only 60/- P. & P. 2/6.

AMERICAN ROTARY CONVERTER. With cooling Fan. Input 12 v. D.C. Output 250 v. at 90 mA. Completely suppressed. Ideal for running car radio, electric shaver, etc., from battery. Only 17/6. P. & P. 3/6.

WALKIE/TALKIE SET. Consisting of transreceiver covering 7.4-9 Mc/s, range up to 10 miles, complete with 5 valves, headphones, microphone, junction box, aerial and circuit. Only 60/- each. P. & P. 4/-. Two for £6. Post Free.

MALLERY 12 v. 4-pin VI BRATORS. Brand New. 2/6. P. & P. 1/-.

WESTINGHOUSE 150 PENICIL RECTIFIERS. 500 v. 5 mA. 5/- P. & P. 1/-.

R.F. UNITS. Type 25, 40/50 Mc/s with circuit, 8/6. Type 26, 50/65 Mc/s with circuit, 20/- P. & P. 3/6 on each.

MICROPHONES. BRAND NEW. Throat, magnetic, 4/6; No. 8 carbon with switch, 6/6; No. 7 moving coil, 8/6.

HEADPHONES, BRAND NEW, American chamois padded, moving-coil 100 ohms. 25/- U.S.A. lightweight, Type H.S.30. 15/- Low resistance 120 ohms, 6/6. High resistance, 12/6. P. & P. 1/6 on each.

TELEPHONE HANDSET. Brand new, 12/6. P. & P. 1/-.

SPECIAL VALVES. 813, 70/-; 829, 30/-; 832, 35/-; 866A, 13/6.

PLESSEY SPEAKERS. 7in. x 4in. elliptical 3 ohms, 5in. circular 3 ohms, 14/6 ea. P. & P. 1/6.

CRYSTAL MIC INSERTS. Postage stamp size, 3/6. 12 v. SUPPLY UNIT. Output 150 v. at 65 mA. and 40 v. at 35 mA. Brand new. Only 12/6. P. & P. 3/6.

SWITCHES. D.P.D.T. 2/6. P. & P. 6d.

U.S.A. WHIP AERIALS. 12ft. 12/6, post paid.

AMERICAN MIDGET ACCUMULATORS. 36 volts, lead acid type, 2/6 ea. P. & P. 1/-.

BUILD A POCKET RADIO with this latest dead aid complete with crystal

mike, on/off and volume controls, subminiature valves, etc., internal batteries, only 5x2½x3½in., beautifully styled, offered complete with pocket radio conversion details at the ridiculous price of 80/-.



EXCLUSIVE OFFER!



RECEIVER. A 7-valve superhet for phones or speaker covering 1.5-12 Mc/s incorporating R.F. gain, A.F. gain, C.W. pitch, and oscillator selector. Carr. 15/-.

£8.10.0

These units offer the perfect amateur station with perfect facilities for phone and C.W. on mains and mobile.

TRANSMITTER. Covering 1.5-12 Mc/s (160-80-40 metres) consists of V.F.O., Buffer, Doubler, P.A. with internal push-pull modulator, and provision for V.F.O. or crystal control on 4 channels. Output 40 watts phone, 100 watts C.W. Complete with aerial current and plate current meters. In excellent condition. Carr. 15/-.

£9.10.0

VIBRATOR PACKS. 12 v. input, 300 v. output at 150 mA., consist of 12 v. vibrator, 4 metal rectifiers, chokes and smoothing condensers. 25/- Carr. 7/6.

16 v. input, 230 v. output at 100 mA., complete with 4-pin vibrator, OZ4 rectifier. Fully smoothed. 25/- Carr. 3/6.

PORTABLE AMPLIFIER. PRINTED CIRCUIT. Size 6½in. wide, 2½in. deep, 3in. high. Will suit all crystal pick-ups. Output 3 watts. Uses UCL82 output, UY85 rectifier. Volume and tone controls. With circuit diagram. Only 45/- 7in. x 4in. elliptical speaker for above. 14/6.

AERIAL VARIOMETERS. These magnificent instruments will enable you to increase maximum signal strength on all Short Wave receivers. Precision calibrated control. Complete with connection details. 12/6 P. & P. 2/6.

COMMUNICATION RECEIVER RI155. This magnificent receiver covers 5 ranges: 75-200 kc/s, 200-500 kc/s, 600-1,500 kc/s, 3-7.5 Mc/s, 7.5-18.5 Mc/s. Fully tested before despatch. Complete with circuit and instruction booklet. £8.10.0, Carriage 10/-.

WHEATSTONE BRIDGE. Consisting of four stud switches: 0-210 ohms. Galvanometer centre zero F.S.D. 2.5 mA. Ranges easily extended. Housed in oak cabinet 16 x 7½ x 6in. Complete with instructions, 22/6. P. & P. 2/6.

12 V. 10-WATT AMPLIFIER. Complete with internal dynamotor, 2-6L6 push-pull, 2-6N7, mike and gram inputs, speaker output, tone and volume controls. Size 12½in. x 6½in. x 8in. Spring mounted. £12.10.0. Carr. 10/-.

METERS. 0-1 mA. 2in. square, 22/6. 500 micro-amp. 2in. circular, calibrated 0-15 and 0-600 volts, 17/6. 1 amp. H.F. 2in. circular, 5/6 P. & P. 1/6 on each.

ARMOUR RECORDING WIRE. U.S.A. top quality on original reels. Length 3,700 yds. 8/6. P. & P. 1/6.

INFRA RED MONOCULAR. Ideal for night viewing, etc. Complete with push-button zomboni pile power unit and focus lens. Brand new in beautiful leather carrying case. Originally cost Govt. £40. OUR PRICE 17/6. P. & P. 2/6.

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

3 for 15/- P. & P. 3/6. 6 for 27/6. P. & P. 5/-.



★ HAVE YOU SEEN OUR ★
★ CATALOGUE? IT'S TERRIFIC ★
★ ONLY 1/- SEND NOW ★



SEE IN TOTAL DARKNESS AND FOG!!

Yes, it's true! With this complete Inra-red night driving installation you can see undetected at night and in fog. Comprises adjustable long-vision binoculars, 12 v. power pack, control unit, connecting cables.

Can be assembled within minutes. **£6.10.0** Government acquisition £200. Brand new, boxed. Carr. 10/-.

BUILD AN F.M. TUNER

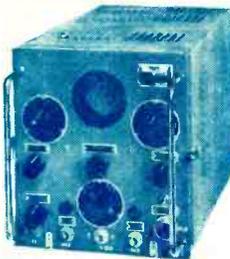
with this **MINIATURE 373 I.F. STRIP 9.72 MC/S.** Complete with 6 valves, 3 EF91, 2 EF92, 1 EB91, F.T.s, etc., supplied with circuit and complete conversion to F.M. Tuner details. The best buy of the year at 40/- with valves. 12/6 less valves. P. & P. 2/6.

OSCILLOSCOPE!!

MONITOR, TYPE 61. Employs 3½in. C.R.T. type YCR 138A. Panel controls: 3 speed time base, Focus, Brightness, Horizontal shift, R.F. tuning, Sync., Internal H.T. and E.H.T. mains power pack. Brand new with circuit. Size 10½in. x 12½in. x 19in. deep.

£8.10.0

Carr. 10/-.



32a, COPTIC STREET, LONDON, W.C.1.

and
87, TOTTENHAM CT. RD., LONDON, W.1.

Telephone: MUSeum 9607.
All post orders and correspondence to:
(Dept. 'P') 32a, Coptic Street, London, W.C.1.

Relda Radio Ltd.

BUILD YOUR OWN TAPE RECORDER

The TRUVOX way

Take 1 Truvox Mk. III or Mk. IV Tape Deck (available from 23 gns.), and 1 Truvox Type "K" Amplifier (available from 19 gns.), add 1 loudspeaker and cabinet and you not only have the thrill of owning a tape recorder that is well up to semi-professional standards, but the added satisfaction of having built it to suit, exactly, your own requirements.

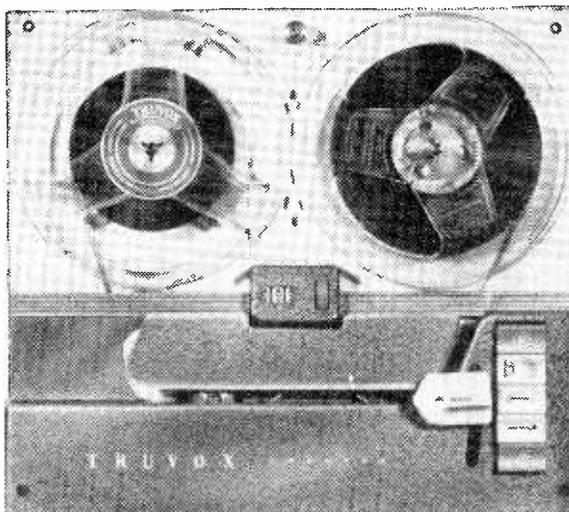
You can build your own amplifier from the circuitry supplied FREE with each Tape Deck.

GO STEREO WITH TRUVOX

Truvox Tape Decks can be supplied fitted with a stereophonic head at an extra charge. Add a second loudspeaker and amplifier and you'll have all the thrill of stereophony in your own home.

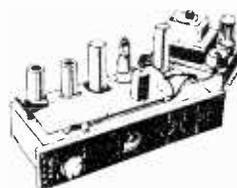
TRUVOX TAPE RECORDER COMPONENTS ARE AVAILABLE AT YOUR LOCAL STOCKISTS—SEND FOR FULL TECHNICAL DETAILS.

TRUVOX LIMITED
 NEASDEN LANE, LONDON, N.W.10. Telephone: Gladstone 6455.



TRUVOX Tape Deck Mk. IV.

TRUVOX TYPE "K" Amplifier accurately matched to Truvox Tape Decks.



TRUVOX Radio Jack for direct radio reception and programme recording.



TRUVOX Stereophonic Head for replay of pre-recorded stereophonic tapes.



BENTLEY ACOUSTIC CORPORATION LTD.

THE VALVE SPECIALISTS

38 CHALCOT ROAD, LONDON, N.W.1

Nearest Underground Station, Chalk Farm.

Primrose 9090.

EXPRESS SERVICE!!!

PHONE OR WIRE THAT URGENT ORDER FOR IMMEDIATE DESPATCH C.O.D. ALL POST ORDERS ARE CLEARED SAME DAY AS RECEIVED.

ANY PARCEL UP TO £10 INSURED AGAINST DAMAGE IN TRANSIT FOR ONLY 6d. EXTRA. ORDERS OVER £10 INSURED FREE.

024	6/-	6AQ5	8/6	6L7GT	12/6	12AH7	8/-	35A5	11/-	DAC32	11/-	ECC85	9/6	EZ81	9/-	PCL83	11/6	UBC41	10/6
1A3	3/-	6AT6	8/6	6L18	13/-	12AH8	10/6	35L6GT	9/6	DAF91	8/-	ECC91	5/6	FW4/800		PEN40DD		UBF80	9/6
1A5	6/-	6AU6	10/6	6N7	8/-	12AT6	10/6	35W4	8/6	DAF96	10/-	ECCF80	13/6		10/-	PEN46	7/6	UBF89	10/6
1CS	12/6	6B4G	4/6	6Q7G	10/-	12AT7	8/-	35Z3	10/6	DF33	11/-	ECCF82	13/6	GZ30	10/6	PEN45	19/6	UCC85	10/6
1D6	10/6	6B7	10/6	6Q7GT	11/-	12AU7	7/6	35Z4	7/6	DF91	6/6	ECH35	9/6	GZ32	12/6	PL81	16/-	UCH42	11/-
1H5GT	11/6	6BB8	4/6	6R7G	10/-	12AX7	10/-	35Z5GT	9/-	DF96	10/-	ECH42	9/6	GZ34	14/-	PL82	10/-	UCH81	11/6
1L4	6/6	6BB8GT	5/-	6SA7GT	8/6	12BA6	9/-	41MTL	8/-	DH63(C)		ECH81	9/-	H30	5/-	PL82	10/-	UCH82	15/6
1LD5	5/-	6BA6	7/6	6SC7GT	10/6	12BE6	10/-	50C5	12/6		10/-	ECL80	14/-	H63	12/6	PL83	11/6	UF41	9/-
1LN5	5/-	6BE6	7/6	6SG7GT	8/-	12C8	15/-	50L6GT	9/6	DH63(M)		ECL82	12/6	HABC80		PM2B	12/6	UF80	10/6
1NS	11/-	6B16	7/6	6SH7GT	8/-	12E1	30/-	61SPT	15/-		17/6	EF36	6/-		13/6	PM12	6/6	UF85	10/6
1RS	8/-	6BR7	11/6	6S17GT	8/-	12J5GT	4/6	72	4/6	DH76	7/6	EF37A	8/-	HK90	10/6	PM12M	6/6	UF89	10/6
1S5	8/-	6BW6	9/6	6SK7GT	8/-	12J7GT	10/6	77	8/6	DH77	8/6	EF39	6/-	HL23	10/6	PY80	8/-	UL41	10/6
1T4	6/6	6BW7	8/-	6SL7GT	8/-	12K7GT	7/6	78	8/6	DK91	8/-	EF40	15/-	HL41	12/6	PY81	9/-	UL46	15/6
1U5	10/-	6BC4	8/-	6SN7GT	7/6	12K8GT	14/-	80	9/6	DK92	10/6	EF41	9/6	HL133DD		PY82	9/-	UL84	11/6
2A7	10/6	6C4	7/-	6S7GT	9/-	12Q7GT	7/6	83V	12/6	DK96	10/-	EF42	12/6		12/6	PY83	9/6	UY41	8/6
2D13C	7/6	6C5	6/6	6S5GT	8/-	12SA7	8/6	85A2	15/-	DL2	15/-	EF50(A)	7/-	HVR2	20/-	QP21	7/-	UY85	10/6
2X2	4/6	6C6	6/6	6U4GT	12/6	12SC7	8/6	90AG	32/6	DL33	9/6	EF50(E)	5/-	HVR2A	6/-	QP25	15/-	V1507	5/-
3A4	7/-	6C8	12/6	6U5G	7/6	12SG7	8/6	150B2	10/6	DL66	15/-	EF54	5/-	KF35	8/6	QS150/15		VLS492A	£3
3A5	12/6	6C9	12/6	6U7G	8/6	12SH7	8/6	220P	15/6	DL92	7/6	EF73	10/6	KL35	8/6		10/6	VMP4G	£3
3B7	12/6	6C10	12/6	6V6G	7/-	12S17	8/6	807	7/6	DL94	9/-	EF80	8/-	KT2	5/-	QVO4/7	15/-	VP2(7)	12/6
3D6	5/-	6CH6	12/6	6V6GTG	8/-	12SK7	8/6	956	3/6	LD96	10/-	EF85	7/6	KT33C	10/6	R2	10/-	VP4(7)	15/6
3Q4	7/6	6D6	6/6	6X4	7/-	12S7	12/6	1203	7/6	DL510	10/6	EF86	14/-	KT44	15/-	R12	12/6	VP13C	7/6
3Q5GT-	9/6	6E5	12/6	6X5GT	6/6	12SR7	8/6	4033L	12/6	DM70	8/6	EF89	10/-	KT63	7/6	SD6	12/7	VP41	6/6
354	7/6	6F6G	7/-	6Z4/84	12/6	12Y4	10/6	5763	12/6	EB0F	20/-	EF91	7/6	KTW61	8/-	SP41	15/-	VR105/30	
3V4	9/-	6F6GTM	8/-	6Z5	12/6	14R7	10/6	7193	5/-	EA50	2/-	EF92	5/6	KTW62	8/-	SP41	3/6		9/-
4D1	7/6	6F8	12/6	6/30L2	10/6	19AQ5	11/-	7475	7/6	EA76	9/6	EL32	5/6	KTW63	8/-	SP42	12/6	VR150/30	
5R4GY	17/6	6F12	7/6	7A7	12/6	19H1	10/-	9002	5/6	EABC80	9/6	EL34	17/6	KTZ41	8/-	SP61	3/6		9/-
5U4G	8/6	6F13	12/6	7B7	8/6	20D1	16/-	9006	6/-	EAC91	7/6	EL41	11/-	KTZ63	10/6	SU61	10/6	VT61A	5/-
5V4G	11/6	6F17	12/6	7C5	8/-	25L6GT	10/-	AC6PEN	7/6	EAF42	10/6	EL42	11/6	L63	6/-	TP22	15/-	VT501	5/-
5X4G	12/6	6F32	10/6	7C6	8/-	25Y5	10/6	AC/HL/	15/-	EB34	2/6	ELB1	15/-	LZ139	9/-	TT15	20/-	W76	7/6
5Y3G	8/6	6F33	7/6	7H7	8/-	25Y5G	10/6	AC/VP1	15/-	EB41	8/6	ELB4	10/6	MH4	7/-	U16	12/-	W81M	6/6
5Y3GT	8/6	6G6	6/6	7R7	12/6	25Z5	10/6	AC/P4	8/-	EB91	6/6	EL91	5/-	MHL4	7/6	U18/20	10/-	X61	12/6
5Y4	12/6	6H6GTG	3/-	757	10/6	25Z4G	10/-	AC/VP1	15/-	EBC33	7/6	EL95	10/6	MHLD6	12/6	U22	8/-	X63	10/6
5Z3	12/6	6H6M	3/6	7V7	8/6	25Z6G	10/-	AL60	10/6	EBC41	10/-	EM34	10/-	ML4	12/6	U26	14/-	X65	12/6
5Z4G	10/6	6J5G	5/-	7Y4	8/-	28D7	7/-	AP4	7/6	EBF80	10/-	EM80	10/6	MPL6	6/6	U31	10/-	X66	12/6
5Z4GT	12/6	6J5GTG	5/6	8D2	3/6	30	7/6	ATP4	5/-	EBF89	9/6	EM81	10/6	MSP4(7)	15/-	U43	10/6	XD(1.5)	6/6
6A8B	10/-	6J5GTM	6/-	8D3	7/6	30C1	9/-	AZ31	10/6	EC52	5/6	EN31	34/9	MU14	10/6	U45	10/6	XFG1	18/-
6A87	8/-	6J6	5/6	9D2	4/-	30F5	8/-	BL63	7/6	EC54	6/-	EY51		OA70	5/-	U50	8/-	XRY12	6/6
6A88	14/-	6J7G	6/-	10C1	15/-	30FL1	10/-	CK506	6/6	EC70	12/6	(Small)	10/6	OA71	5/-	U52	8/6	XH(1.5)	6/6
6A87	6/6	6J7GT	10/6	10F1	19/6	30L1	9/-	CK523	6/6	ECC31	15/-	EY51		OC72	30/-	U76	7/6	XSG(1.5)	6/6
6A85	6/6	6K6GT	8/-	10F9	11/6	30P12	12/6	CV63	10/6	ECC32	10/6	(Large)	12/6	P61	3/6	U78	7/-		15/6
6A8	9/-	6K7G	5/-	10F18	12/6	30P16	10/6	CV85	12/6	ECC33	8/6	EY84	17/6	PA8C80	15/-	U251	15/-	Y63	7/6
6AK5	8/-	6K7GT	6/-	10LD3	10/6	30P11	12/6	CV21	10/6	ECC35	8/6	EY86	14/6	PCB84	9/-	U404	10/6	Z63	10/6
6AK8	9/-	6K8G	8/-	10LD11	16/9	31	7/6	CV428	30/-	ECCB1	8/-	EZ35	6/6	PCC85	12/6	UABC80		Z66	20/-
6A.L5	6/6	6K8GT/G		10P13	17/6	33A/158M		D1	3/-	ECC82	7/6	EZ40	8/-	PCF80	9/-		10/6	Z77	7/6
6AM5	5/-		11/-	11E3	15/-			D42	10/6	ECC83	10/-	EZ41	9/6	PCF82	12/6	UAF42	10/6	Z719	8/-
6AM6	7/6	6L6G	9/6	12A6	6/6	35/51	12/6	D77	6/6	ECC84	10/-	EZ80	10/6	PCL82	12/6	UB41	12/7	Z729	14/-

VOLUME CONTROLS

All with long spindle and double-pole switch.

10K.	25K.	50K.	100K.
1/2 meg.	1/2 meg.	1 meg.	2 meg.
4/6 each.			

Standard Can.	
32 x 32 mfd., 450 V.	5/9
64 x 120 mfd., 350 V.	8/3
60 x 250 mfd., 275 V.	9/6
100 x 400 mfd., 275 V.	12/6
100 mfd., 275 V.	2/6
200 mfd., 275 V.	3/6
100 x 200 mfd., 275 V.	6/6

ELECTROLYTIC CONDENSERS

Tag or Wire-ended Tubular	
8 mfd., 450 V.	1/9
16 mfd., 450 V.	2/9
32 mfd., 450 V.	3/9
8 x 8 mfd., 450 V.	3/-
16 x 16 mfd., 450 V.	3/9
32 x 32 mfd., 450 V.	4/-
8 x 16 mfd., 350 V.	4/-

NEW METAL RECTIFIERS, FULLY GUARANTEED

DRM1B	15/4	RM-2	7/6	WX6	3/6	14A97	25/-	14B261	11/6	16R2-1-8-1	8/6
DRM2B	16/2	RM-3	9/6	WX3	3/6	14A100	27/-	14RA 1-2-8-2	19/-	18RA 1-1-8-1	4/6
DRM3B	23/3	RM-4	18/-	WX4	3/6	14A124	28/-	14RA 1-2-8-3	23/6	18RA 1-1-16-1	6/6
RM-O	7/11	RM-5	24/-	WX6	3/6	14A163	38/-	16RC 1-1-16-1	8/6	18RA 1-2-8-1	11/-
RM-1	7/-	W4	3/6	14A86	18/-	14B130	35/-	16RD 2-2-8-1	12/-	18RD 2-2-8-1	15/-

Hivac miniature valve list or Metal rectifier technical leaflet free on receipt of S.A.E.

TERMS OF BUSINESS:—CASH WITH ORDER OR C.O.D. ONLY. POST/PACKING CHARGES 6d. PER ITEM. ORDERS VALUE £3 OR MORE POST FREE. C.O.D. 2/6 EXTRA. WE ARE OPEN FOR PERSONAL SHOPPERS MON.-FRI. 8.30-5.30. SATS. 8.30-1 P.M.

ALL VALVES NEW, BOXED AND SUBJECT TO MAKERS' FULL PERIOD GUARANTEE. FIRST GRADE GOODS ONLY, NO SECONDS OR REJECTS. LATEST CATALOGUE OF OVER 1,000 DIFFERENT VALVES, INCLUDING MANY SCARCE TYPES, WITH FULL TERMS OF BUSINESS, PRICE 6d.

PLEASE ENQUIRE FOR ANY VALVE NOT LISTED. 3d. STAMP, PLEASE.



The Popular

Stern's "fidelity" TAPE RECORDER

for truly "Hi-Fi" Recordings

THEY INCORPORATE

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

PRICE INCORPORATING

COLLARO DECK MK IV TERMS. Dep. £9.18.0 and 12 monthly payments of £3.12.7 or Dep. £16.10.0 and 12 monthly payments of £3.0.6. **£49.10.0**

PRICE WITH TRUVOX DECK INCORPORATING REV. COUNTER. **£52.10.0**

H.P. TERMS. Dep. £10.10.0 and 12 monthly payments of £3.17.0 or Dep. £17.10.0 and 12 monthly payments of £3.4.2.

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

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

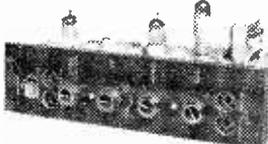
THE MODEL HF/TR3 TAPE AMPLIFIER

INCORPORATING

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

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

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



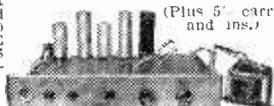
HIRE PURCHASE. Deposit £3.6.6 and 12 monthly payments of £1.4.2 or Deposit £5.10.0 and 12 monthly payments of £1.0.2. A very high quality Amplifier based on the very successful TYPE "A" design completed in the MULLARD LABORATORIES. ONLY NEW HIGH GRADE COMPONENTS are incorporated including MULLARD VALVES and a GILSON OUTPUT TRANSFORMER. . . . other features are—Magic Eye Recording hand indicator—Effective Tone Control—Monitoring and Extension Speaker Sockets—Has own Power Supply and can be used as independent Amplifier for direct reproduction of Gram Records or from Radio Tuner. Overall size 11in. x 6in. x 6in. Can be supplied for use with Truvox—Collaro—Lanc—Brenell or Motek Decks. Please specify which.

Send S.A.E. for leaflet or 26 for the complete Assembly Manual.

STERN'S TAPE PRE-AMPLIFIER & ERASE UNIT

STERN'S MODEL HF/TR1.P.—A completely assembled Pre-amplifier with own Power Supply. Can be supplied directly matched for use with Truvox or Collaro Decks and incorporates Recording Level Indicator and Monitoring facilities. Please send S.A.E. with any enquiry.

IF YOU HAVE A HIGH QUALITY AUDIO AMPLIFIER (such as our Mullard 5-10 and associate 2-valve Pre-amplifier) and wish to add full TAPE facilities—ALL YOU NEED IS —THE HF/TR1.P. UNIT together with a TAPE DECK. **PRICE £11.10.0** (Plus 5% carr. and ins.)



WE OFFER YOU . . .

(a) THE HF/TR1.P. PRE-AMPLIFIER together with the COLLARO MK. IV TAPE DECK (see note) . . . **PRICE . . . £32.10.0**
 . . . H.P. Deposit £6.10.0 and 12 monthly payments of £2.7.8 or deposit £10.15.8 and 12 monthly payments of £1.10.9.

(b) THE HF/TR1.P. together with the TRUVOX MK. IV DECK (Incorp. Precision Rev. Counter) . . . **PRICE £38.0.0**
 H.P. Deposit £7.12.0 and 12 monthly payments of £2.15.9 or deposit £12.13.4 and 12 monthly payments of £2.6.6.

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

A further development on the already successful and very popular "C" model. It incorporates THREE-SPEED TREBLE EQUALISATION by means of the FERROXCUBE POT CORE INDUCTOR together with an improved Oscillator Circuit. THE ASSEMBLED UNIT will be available approximately mid-December and the COMPLETE KIT OF PARTS approximately mid-January. **PRICES YET TO BE FIXED. PLEASE ENCLOSE S.A.E. WITH ANY ENQUIRY.**

THE NEW MULLARD TYPE "C" TAPE PREAMPLIFIER-ERASE UNIT

HOME CONSTRUCTORS

WE MAKE SPECIAL PRICES FOR COMBINED ORDERS

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

HIRE PURCHASE. Deposit £7.4.0 and 12 monthly payments of £2.12.6 or Deposit £12.0.0 and 12 months of £2.4.0.

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

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

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

HIRE PURCHASE. Deposit £8.6.0 and 12 months at £3.0.10 or Deposit £13.16.8 and 12 monthly payments of £2.10.9.

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

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

CARRIAGE and Insurance on any above is 10% extra. TERMS ARE NOT AVAILABLE WHEN KIT OF PARTS IS SUPPLIED.

TAPE EQUIPMENT IN STOCK

● COLLARO MK. IV TRANSCRIPTOR DECK. **£24.0.0**

HIRE PURCHASE. Deposit £4.16.0 and 12 monthly payments of £1.15.2 or deposit £8.0.0 and 12 monthly payments of £1.9.4.

● TRUVOX MK. IV DECK (incorporating Precision Rev. Counter). **HIRE PURCHASE.** Deposit £6.2.0 and 12 monthly payments of £2.4.8 or deposit £10.3.4 and 12 monthly payments of £1.17.3.

● PORTABLE CARRYING CASE (as illustrated), accommodates HF/TR3 Amplifier and available for Truvox or Collaro Decks. **£5.0.0**

● High Output ACOS CRYSTAL MICROPHONE **£1.15.0**

● 16in. x 6in. P.M. LOUDSPEAKER. **£1.10.0**

● 1,200 ft. reels E.M.I. or SCOTCHBOY TAPE. **£1.15.0**

● We have a Good quality Plastic Tape, 1,200 ft. reels at 2/-.

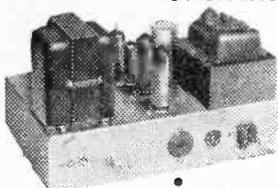
Please send S.A.E. with all correspondence.

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

**AMPLIFIERS
PRE-AMPLIFIERS
FOR THE "HI-FI" ENTHUSIAST**

**MULLARD DESIGNS FOR
THE
HOME CONSTRUCTOR**

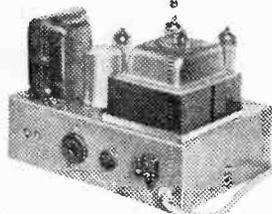
**THE VERY
POPULAR
MULLARD
"5-10" MAIN
AMPLIFIER**



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



**THE NEW
MULLARD 3-3
MAIN
AMPLIFIER**



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

SPECIAL PRICE REDUCTIONS . . .
(a) The COMPLETE KIT OF PARTS to build both the "3-3" MAIN AMPLIFIER and the 2-STAGE PRE-AMPLIFIER-CONTROL UNIT **£12.10.0**
(b) The COMPLETE KIT OF PARTS to build the "5-10" MAIN AMPLIFIER and the 2-STAGE PRE-AMPLIFIER-CONTROL UNIT **£15.15.0**
PRICES FOR THE "5-10" ARE SUBJECT TO £1.6.0 EXTRA IF THE PARTRIDGE TRANSFORMER IS REQUIRED.

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

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

THIS "5-10" with the latest PARTRIDGE **£1.6.0** EXTRA-ULINEAR OUTPUT TRANSFORMER for

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

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

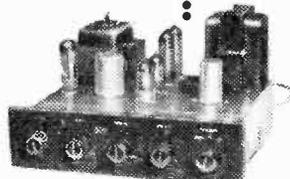
COMPLETE KIT OF **£6.6.0** Alternatively we supply **£8.0.0** PARTS ASSEMBLED & TESTED (Carriage & Insurance 5/- extra.)

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

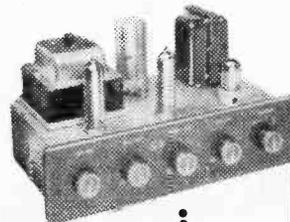
COMPLETE KIT OF **£7.0.0** Alternatively we supply **£8.0.0** PARTS ASSEMBLED & TESTED (Carriage & Insurance 5/- extra.)

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

**THE NEW
COMPLETE
MULLARD 5-10
AMPLIFIER**



**THE NEW
COMPLETE
MULLARD 3-3**



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

H.P. : DEPOSIT £3.0.0 and 12 Monthly Payments of £1.2.0 or DEPOSIT £5.0.0 and 12 Monthly Payments of 18/4.

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

H.P. : DEPOSIT £3.16.0 and 12 Monthly Payments of £1.7.8 or DEPOSIT £6.6.0 and 12 Monthly Payments of £1.3.1.

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

.....
Designed for a simple domestic installation with Genuine High Quality reproduction up to a maximum of 10 watts. Separate BASS and TREBLE Controls are incorporated with switched inputs for 78 and L.P. Records plus Radio Tuning Unit.

We incorporate SPECIFIED COMPONENTS and NEW MULLARD VALVES. We also give the purchaser the choice of two of the best ULTRA-LINEAR OUTPUT TRANSFORMERS made—first the latest by PARMEKO, LTD., and also the latest by PARTRIDGE (£1.6.0 extra). We also supply the PARMEKO MAINS TRANSFORMER, and this has extra power available to supply a Radio Tuning Unit. The Control Unit can easily be detached from the Amplifier Chassis for use in a remote position.

COMPLETE KIT OF PARTS **£11.10.0** Alternatively we supply **£13.10.0** (PARMEKO Transformer) ASSEMBLED and TESTED

H.P. Terms : Dep. £2.14.0 and 12 Monthly Payments of 19/10 or Dep. £4.10.0 and 12 Monthly Payments of 16/8. Send S.A.E. for ILLUSTRATED LEAFLET or 1/6 for the COMPLETE ASSEMBLY MANUAL.

.....
THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION

COMPLETE KIT **£7.10.0** Alternatively supplied ASSEMBLED OF PARTS and FULLY TESTED **£8.19.6** (plus 8/6 coverage and insurance)

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

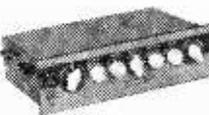
STERN RADIOS LTD.

STERN'S FOR STEREO

OUR POPULAR MULLARD MAIN AMPLIFIERS ARE RECOMMENDED FOR USE WITH THE

THE "STEREO EIGHT" PREAMPLIFIER
£23.20

(Carr. & Ins. 5 - extra.)



DULCI STEREO PREAMPLIFIERS
THE "STEREO TWO" PREAMPLIFIER
£9.90

(Carr. & Ins. 5 - extra.)

Both Preamplifiers can be supplied to correctly operate with our very popular MULLARD "3-3" and "5-10" MAIN AMPLIFIERS (described opposite). For Stereo reproduction TWO Main Amplifiers are necessary, but for normal "Hi-Fi" reproduction the "Stereo Eight" and the "Stereo Two" are perfectly suitable to operate with ONE Main Amplifier and the second Main Amplifier can then be added at any time, thus transforming a standard "Hi-Fi" installation over to Stereo.

FULLY DESCRIPTIVE LEAFLETS ARE AVAILABLE. ENCLOSE S.A.E. WE OFFER

- (a) The "Stereo Two" with one "3-3" MULLARD MAIN AMPLIFIER **£17.00**
- (b) The "Stereo Two" with two "3-3" MULLARD MAIN AMPLIFIERS **£24.10.0**
(This provides Stereo reproduction of max. 6 watts output and is an ideal Home Installation.)
- (c) The "Stereo Two" with one "5-10" MULLARD MAIN AMPLIFIER **£20.10.0**
- (d) The "Stereo Two" with two "5-10" MULLARD MAIN AMPLIFIERS **£31.10.0**
- (e) The "Stereo Eight" with two "5-10" MULLARD MAIN AMPLIFIERS **£44.10.0**
(This provides for up to 20 watts output.)
- (f) The above (e) with one MULLARD "5-10" **£34.00**

OTHER STEREO EQUIPMENT AVAILABLE:

GRAM UNITS fitted with Stereo Cartridge by . . . GARRARD-COLLARO Lenco-B.S.R.
These include Autochargers, Single Record Playing and Transcription Units.

STEREO CARTRIDGES and PICK UPS by . . . B.J.-GARRARD-COLLARO-1 ENCO-B.S.R.
(Please enclose S.A.E. with any inquiry.) **£12.12.0**

DULCI TWIN POWER AMPLIFIER S.P.44. **£12.12.0**
HIRE PURCHASE: REDUCED TERMS ARE AVAILABLE

RECORD PLAYERS THE VERY LATEST MODELS ARE IN STOCK

MANY AT REDUCED PRICES!!!

TRANSCRIPTION UNITS-AUTOCHARGERS, SINGLE RECORD PLAYERS.

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

A FEW CASH BARGAINS

- The U48 BSR MONARCH 4 SPEED "MINER" AUTOCHARGER. Enclosed with Crystal Pick Up **£6.19.6**
- The latest COLLARO 4 SPEED AUTOCHARGER-Complete with the Studio "O" Pick Up. (Also available with the low gain Studio "P" Pick Up for £8.15.6) **£7.19.6**
- The latest COLLARO 4 SPEED SINGLE RECORD PLAYER complete with Studio "O" Pick Up **£6.19.6**
- The BSR "TU9" 4 SPEED SINGLE RECORD PLAYER, complete with separate Crystal Pick Up (This high output Crystal Pick Up is available separately for £1.12.6.) **£4.10.0**
Carriage and Insurance on above Units 5 - ex.



A SPECIAL CASH ONLY OFFER!!

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

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

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

- (a) The 2-Stage (plus Rectifier) AMPLIFIER **£4.2.6**
- (b) THE PORTABLE CARRYING CASE **£3.17.6**



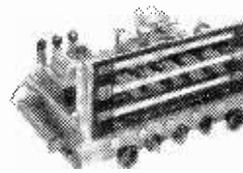
CAR BATTERY CHARGER **£2.19.6**

WE offer a COMPLETE KIT OF PARTS FOR ONLY **£2.19.6**
EASY-TO-FOLLOW ASSEMBLY INSTRUCTIONS ARE INCLUDED.
Will charge 6 or 12 volt Batteries at max. 21 amps. The design incorporates Ballast Resistor and Fuse, and we supply complete with Metal Box container.

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

TO MODERNISE YOUR OLD RADIOGRAM

THE NEW ARMSTRONG "JUBILEE"



A.M./F.M. RADIOGRAM CHASSIS

PRICE **£30.9.0**

(Plus 7/6 carr. and ins.)
HIRE PURCHASE: Deposit **£6.2.0** and 12 months at **£2.4.8** or Deposit **£10.3.4**, 12 Months at **£1.17.3**.

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

MAIN FEATURES

- 6 watts push-pull output with negative feedback.
- 9 valves and 2 diodes.
- Full P.M. band (87-108 mc/s) plus medium and long waves.
- Automatic frequency control on F.M.
- Adjustable Ferrite rod aerial on A.M. bands.
- Tape playback and record facilities.
- Two compensated pick-up inputs.
- Frequency response 30-22,000 cps. ± 2 db.
- Separate wide-range bass and treble controls.
- Output impedance for 3-, 7 $\frac{1}{2}$ - and 15-ohm SPEAKERS.
- Tuning indicator.
- Provision for booster unit for low output pick-ups.
- A satinised brass dial escutcheon and veneered lacia board is available.
- Size of chassis 12in. x 8in. x 7in. high.

DULCI MODEL H4

A.M./F.M. RADIOGRAM CHASSIS

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

PRICE **£24.6.6**

(Plus 7/6 carr. and ins.)
H.P. TERMS: Deposit **£4.17.6** and 12 monthly payments of **£1.15.8** or 12 Monthly Payments of **£1.9.9**.

Deposit **£8.2.2** and 12 Monthly Payments of **£1.9.9**.

BRIEF SPECIFICATION

- Covers Short, Med. um, Long and F.M. wavebands.
- Employs full A.V.C.
- The latest 7-valve line-up.
- For 3- or 15-ohm P.M. speakers.
- "Magic Eye" tuning indicator.
- Excellent tone range up to 4 watts output.
- Internal aerial for local stations.
- Overall size 12in. x 8in. x 7in. high.
- A Good Quality Chassis and well recommended.

STERN'S MK. II fidelity

F.M. TUNING UNIT

PRICE (Plus 5/- carr. and ins.) **£15.0.0**

HIRE PURCHASE: Deposit **£3.0.0** and 12 monthly payments of **£1.2.0** or Deposit **£5.0.0**, and 12 Monthly Payments of **18/4**.

Incorporates the latest MULLARD PERMEABILITY TUNING HEART and the corresponding MULLARD VALVE LINE-UP comprising ECC85, 2 type EP85s (or EP85s), EM84 Tuning Indicator, plus 2 type O.A./0s Germanium Diodes. A really first-class Tuner, very attractively presented and comparable to many offered at much higher prices. Power consumption is only 1.5 amps at 6.3 volts and 25 ma at 250 volts.

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



HOME CONSTRUCTORS

A RANGE OF "EASY TO ASSEMBLE" PREFABRICATED CABINETS

Designed by the W.B. "STENTORIAN" COMPANY for "Hi-Fi" Loudspeaker systems or to accommodate high-quality equipment. The acoustically designed Bass Reflex Cabinets containing the very successful "Stentorian" Speakers give really first-class reproduction and are well recommended. Models are also available to accommodate high-quality

Amplifiers, Preamplifiers, Tuning Units, Record Players, etc. All models are very easily assembled, in fact only a screwdriver is required. Fully illustrated leaflets are available, including complete specifications of the various STENTORIAN LOUDSPEAKERS. Please enclose S.A.E.

 <p>"Q Coils" All ranges adjustable iron dust cores 1/- With full circuit Amazing efficiency</p>	 <p>Potted 5/- Coils Ensure selectivity Superhet, T.R.F. For Sets or Tuners</p>	<p>Collaro TAPE COILS Officially recommended Bias Osc., QT9, 7/6 Push-pull circuit, 7/6 Bias Filter, QT6, 7/6 Treble Boost, QT7, 27/6</p>	<p>STATION SEPARATOR either Home or Light or Third or Lux. etc. 10/6 cleans up reception</p>	<p>STOP! T.V. Patterning easy to fit SIMPLE REMEDY 10/-</p>
<p>STEEP CUT Whistle Filter 7/6 (Circuit supplied) Scratch Filter Coil Cut-off 5-13 Kc/s. Essential for all older records. 10/6</p>	<p>DUAL RANGE COILS T.R.F., 5/8, 10/6 pr. T.R.F. with reaction, 7/6 Super-het., 12/6 pr. All high performance coils</p>	<p>Ideal for normal reception areas Mini-Magic F.M. Tuner Kit Coils only £2.12.6 Complete £4-10-0</p>	<p>"W. WORLD" 7 TRANSISTOR PORTABLE. Booklet, 2/9, including price list. Coils as specified, inclgd. F. rod, 42/6 set.</p>	<p>SUB-MINIATURE M.W. L.W. Trawler W High Q with ferrite core 5/- High performance guaranteed</p>
<p>FERRITE ROD AERIALS M.W. 8/9, Trawler, 8/9 M. & L.W., 12/9 M., L. & Tr., 15/6</p>	<p>I.T.A. Converter To fit inside T.V. FOR ALL SETS KIT Complete 65/- Very efficient £4</p>	<p>DIAL ASSEMBLY 24/6 complete Calibrated for Osmor coils</p> 	<p>THE WONDER 1v. SHORT WAVE World Wide Reception KIT 57/6 *Phones, 20/- extra</p>	<p>ITA/BBC EQUALIZER & TUNABLE REJECTOR Automatically Rejects Gets rid of Fuzz 10/6 with instructions</p>
<p>SUB-MINIATURE I.F. TRANS. for transistor circuits. Adjustable ferrite core. Highly efficient ferrite pot. Screened. Guaranteed High "Q." 9/6 Size 8 x 11/2 high, ea.</p>	<p>Coils for Car Radio Circuits including "Hybrid" (Valve-transistor)</p>	<p>COILS for A.M. & F.M. & Crystal Tuners for hi-fi amplifier circuits</p>	<p>Very "Hi Q" Standard Midget I.F. Trans. 14/6 With ferrite cores per pair. Pre-aligned</p>	<p>F.M. COILS FOR OSMOR "Wireless World" & many other circuits From Radio Press</p>

OSMOR COILS are regularly used and recommended by designers writing in "Practical Wireless," "Wireless World" and "Radio Constructor." Why not follow the experts?

Please State your current interests for special attention.

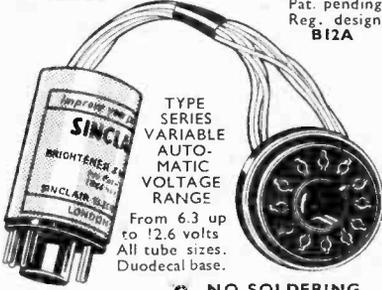
Send 1/- (stamps) for fully descriptive literature AND OSMOR DESIGNS—5-Valve S'Het, and Coilpack information and price lists and Miniature ditto, Battery and Battery/Mains information on circuits in "Wireless World," Receiver, Mains T.R.F. S'Het and T.R.F. "Practical Wireless," "Radio Constructor," Feeders, Band 3 Converters, F.M. Tuners, Full Circuits included.

418 BRIGHTON ROAD, SOUTH CROYDON, SURREY

FREE!



IS YOUR T.V. TUBE DIMMING ?
YOU CAN EXTEND THE LIFE OF THAT TUBE AND IMPROVE THE PICTURE



Pat. pending. Reg. design. B12A

TYPE SERIES VARIABLE AUTOMATIC VOLTAGE RANGE
From 6.3 up to 12.6 volts
All tube sizes. Duodecal base.

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- JUST PLUG IN
- IT'S AUTOMATIC
- IT'S GUARANTEED!

PRICE 30/-
Package & Postage 1/6.
(Postal Orders. C.W.O. C.O.D.)

Sinclair Electronics introduces the first series wired plug-in booster unit, for all universal TV sets operating off A.C. MAINS ONLY. TV tubes with Duodecal Bases B12A. When ordering please state make of set, model number, type of tube.
For Universal sets: Series Type.
For A.C. Sets: (Transformer Feed) Parallel Type.
If not satisfied money refunded within 7 days.

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247, BRICK LANE, LONDON, E2.

EXPRESS ELECTRONICS
ROSEDENE LABORATORIES
KINGSWOOD WAY, SELSDON, SURREY

VALVES NEW, TESTED AND GUARANTEED

IAC6	9/- 6BA6	7/- 12I7GT	10/- EABC80	8/6 N18	8/-
IC1	7/6 6BE6	7/- 12K7GT	6/9 EB91	5/6 N19	8/-
IC2	9/- 6BR7	10/6 12K8GT	12/6 EBC41	10/- PCC84	9/-
IC3	8/6 6BW6	7/6 12Q7GT	7/6 EBF80	9/6 PCF80	9/-
IF1	8/6 6BW7	7/- 16A5	9/- ECC81	7/6 PCF82	10/6
IF3	7/6 6C10	9/- 25A6G	10/6 ECC82	7/6 PL33	22/6
IFD1	8/6 6CH6	7/- 25L6GT	7/6 ECC83	7/6 PL82	9/-
IFD9	7/6 6D2	5/6 35L6GT	9/- ECC84	9/6 PY81	8/6
IL4	6/6 6F12	6/6 35W4	8/6 ECF80	10/6 PZ30	17/6
IP1	8/6 6J5G	5/6 35Z4GT	8/- ECF82	10/6 U52	6/6
IP10	7/6 6J7GT	8/6 5763	10/6 ECH42	9/- U76	7/6
IP11	8/- 6K7G	2/6 D77	6/9 ECH81	8/- U78	7/-
IR5	7/6 6K8G	7/6 DAF91	7/6 ECL80	13/6 UBC41	8/6
IS5	7/6 6L6G	10/6 DAF96	8/6 EF41	8/6 UCH42	9/-
IT4	7/6 6O7GT	8/6 DF91	7/6 EF80	8/6 UF41	8/6
IU5	6/- 6S17GT	7/6 DF96	8/6 EF91	6/6 UL41	10/-
3A5	10/6 6SN7GT	8/- DH76	7/6 EF92	5/6 UY41	7/6
3Q4	8/- 6V6G	7/6 DH77	5/6 EL38	22/6 W76	6/9
354	7/6 6X4	7/- DH142	8/6 EL41	10/- W142	8/6
3V4	8/- 6X5GT	6/- DH150	10/- EL84	8/6 X17	7/6
5U4G	6/6 8D3	6/6 DK91	7/6 EY51	10/6 X18	9/-
5Z4G	9/6 12A8H	10/6 DK92	9/- EZ40	7/6 X142	9/-
6AK6	6/6 12AT6	8/6 DK96	8/6 EZ80	8/- X150	9/-
6AL5	5/6 12AT7	7/6 DL92	7/6 EZ81	8/- X150	9/-
6AM6	6/6 12AU7	7/6 DL94	8/- KT33C	9/6 Z77	6/6
6AT6	7/- 12AX7	7/6 DL96	8/6 N17	7/6 ZD17	7/6

MATCHED PAIRS
EL84 21/-, 6V6G 17/-, KT66 27/6, 6BW6 18/- per pair.
Push Pull O.P. Transformers for above 3-15 ohm 14/6.

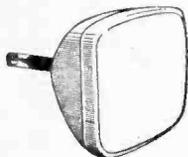
SETS OF VALVES

DK91, DF91, DAF91, DL92 or DL94	27/6
DK96, DF96, DAF96, DL96	35/-
IR5, IT4, IS5, 354 or 3V4	27/6
6K8, 6K7, 6O7, 6V6, 5Z4G or 6X5G	27/6
12K8, 12K7, 12Q7, 35L6, 35Z4	35/-

Postage and packing 6d. Over £1 post free. C.O.D. 2/6.

EXPRESS DESPATCH SERVICE

Please phone to confirm Tube in stock. Send Telegraph Money Order. Tube despatched Passenger Train same day.



REGETTERED IMPROVED VACUUM T.V. TUBES

17in. £7.10.0.
14in. £5.10.0.

12 MONTHS' GUARANTEE.

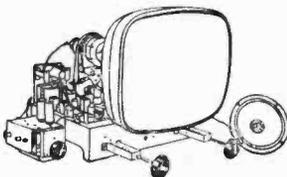
Our 12 months' guarantee (6 months' full replacement, 6 months' progressive) illustrates our wholehearted confidence in the Tubes we offer. We sell many hundreds a week throughout the country and have done so for the past 7 years. Many of them go to the Trade, i.e. to Insurance Companies, Renters and Retailers who are thoroughly satisfied with our supplies. Remember they also hold a 10 days' money back guarantee.

9in., 10 in., 14in., 15in. and 16in. Round Tubes. Our special offer of these sizes, £5. 12in. T.V. Tubes, £6. Three months' guarantee on Round Tubes. Ins., carr. 15/6.

17in. T.V. CHASSIS, TUBE & SPEAKER, £19.19.6

17in. Rectangular Tube on modified chassis.

Supplied as single channel chassis covering B.B.C. channels 1-5, or incorporating Turret Tuner which can be added as an extra, at our special price to chassis purchasers 50/-, giving choice of any two channels (B.B.C. and I.T.A.). Extra channels can be supplied at 7/6 each. Chassis size 12in. x 14½in. x 11in. less valves. Similar chassis are used by well known companies because of their stability and reliability. With Tube & Speaker, £19.19.6. With all valves, £25.19.6. Complete and working with Turret Tuner, £28.9.6. 12 months' guarantee on the Tube, 3 months' guarantee on the valves and chassis. Ins., carr. (incl. Tube), 25/-.



12in. T.V. Chassis, 49/6

Complete chassis by famous manufacturer. R.F. E.H.T. unit included. Easily fitted to table or console model, owing to this chassis being in three separate units (power, s/vision strip, t/base interconnected). This chassis is less valves & tube. Speaker free. I.F.'s 16-19.5 Mc/s. vision. Channels 1-5 easily converted to I.T.A. by use of Turret Tuner. Drawings available at 2/6 each or FREE with order. Ins., carr., 10/6. Tube available at £6.0.0. plus Ins., carr., 15/6.

Sound and Vision Strip, 25/6

Plessey. Tested. I.F.'s 10.5 Mc/s sound. 14 Mc/s vision. 8 valve holders less valves. (6-6F1's and 2-6D2's). Size 8½ x 5 x 4½in. Circuit incl. P. & P. 2/6. The Tuner unit plugs directly into this chassis.

SOUND & VISION STRIP, 10/6. Salvaged. Complete sound and vision strip. 8 valve holders. Less valves (6F15, etc.). I.F.'s 16-19.5 Mc/s. Size 8½ x 4½ x 4½in. Drawings free with order. P. & P. 2/6.

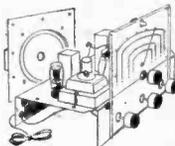
SOUND & VISION STRIP, 10/6. Salvaged. Superhet. 8 valve holders. Less valves. (6-EF91's, 6D2 and 6F14). I.F.'s 7.25 Mc/s sound. 10.75 Mc/s vision. Vision complete from input up to video output. Sound complete from input to A.F. Amplifier. P. & P. 2/6.

POWER PACK AND AMPLIFIER, 19/6. Output stage 6V6 with O.P. trans. Smoothed H.T. 350 v. 250 mA., 6.3 v. at 5 A., 22 v. at 3 A., 6.3 v. at 4 A. centre tapped. Less valves. Free drawings. Ins., carr., 5/6.

POWER PACK AND AMPLIFIER, 19/6. Output stage PEN 45 O.P. trans. choke. Smoothed H.T. 325 v. at 250 mA. 4 v. at 5 amp., 6.3 v. at 5 amp., 4 v. at 5 amp. centre tapped. Valve base for rectifier, octal or 4-pin. Output is taken from standard plugs. Less valves. Ins., carr., 5/6.

Super Chassis, 99/6

5 valve superhet chassis, including Bin. P.M. Speaker and valves. Four control knobs (tone, volume, tuning w/change switch). Four w/bands with position for gram. p.u. and extension speaker. A.C. Ins., carr., 5/6.



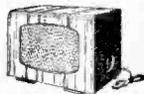
Solo Soldering Tool, 12/6



110 v. 6 v. or 12 v. (special adaptor for 200/240 v. 10/- extra). Automatic solder feed. Including a 20ft. reel of Ersin 60/40 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 for use. Post. 2/9.

Extension Speakers, 19/9

Polished wooden cabinet fitted with Bin. P.M. Speaker W.B. or Goodmans of the highest quality. Standard matching to any receiver (2-5 ohms). Switch and flex included. Ideal, too, for Stereophonic Sound. Ins. and carr. 3/6. Have you thought of fitting a speaker in the kitchen? And why not at our price? It's pleasant to listen to music whilst you're working.



Bin. P.M. Speakers, 8/9. With O.P. Transformer fitted, 10/-.
6½in. P.M. Speakers, 12/6. Postage 2/9.



Electric Convector Heater, 99/6

You may not have a stately home, but there is no reason why you shouldn't have a warm one at an economical price, too. A.C./D.C. Switched for 1 or 2 kW. Illuminated grille. Size 26in. x 18in. x 7½in. deep. Ins., carr., 10/6.

Mains Transformers

DROP THROUGH TYPE, 12/9. 350-0-350 volts at 250 m.a. 6.3 volt at 4 amp. 6.3 volt at 4 amp., 4 volt at 3 amp., 22 volt at .3 amp. 4 volt centre tapped at 1.5 amp. Primary 200-250 volt, 50 cycles. P. & P. 3/9.

HALF SHROUDED TYPE, 5/9. 280-0-280 volt at 80 m.a. 6.3 volt at 3 amp., 4 volt at 2 amp. 4 volt at 2 amp. Primary 200-240 volt. P. & P. 2/9.

UPRIGHT TYPE, 3/9. 350-0-350 volt at 80 m.a. 12 volt at 1.5 amp. 4 volt at 2 amp. Primary 100-120-200-250 volt. Fully shrouded. Ideal for mains auto transformers. P. & P. 2/9.

MAINS AUTO, 12/6. 0-205-225-245 volts at 300 m.a. Isolated windings of 6.3 volt at 2-6 amp., 6.3 volt at 3-6 amp., 2 volt at 1-4 amp. P. & P. 3/9.

O.P. TRANS., 1/3. Standard size 2-5 ohms. Post 1/-, 20 for £1. P. & P. 5/6.

Heater Transformer 12/9

12 v. at ½ amp. 0-200-250 volts primary. P. & P. 1/9.

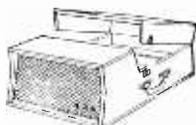


HEATER TRANSFORMER, 3/9. 2-1 ratio or 1-2 ratio auto transformer. 2 volt at 1.4 amp. primary 4 volt secondary. P. & P. 1/9.

TIME BASE, 4/9. Containing scanning coils, focus unit. line transformer, etc. Less valves. Drawings free with order. P. & P. 2/6.

ALL FROM

DUKE & CO.

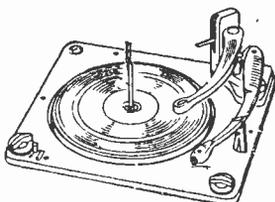


39/6

Latest contemporary style rexine covered cabinet in two-tone colour scheme. Hinged, clipped lid, carrying handle. Space available for all modern amplifiers and autochangers, etc. Many of the latest models now on show at similar prices. Size 19½ x 15½ x 9in. deep. Carr. & Ins. 4/6.

RECORD PLAYER CABINETS

39/6—69/6

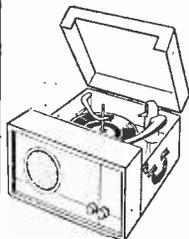


59/6

A well designed cabinet in brown leatherette, strong clip fasteners, easy carrying handle. Takes B.S.R. Monarch and has space for 4 x 6in. elliptical speaker. Can be made up into an ideal Record Player. Size 16 x 14½ x 8½in. deep. Carr. & Ins. 4/6.

Collaro 4-speed Autochanger

£7.19.6.



69/6

A delightful looking cabinet, 14½ x 17½ x 8½in. deep, in two-tone leatherette. Will take a B.S.R. Monarch 4-speed autochanger and 6½in. round speaker. Carr. & Ins. 4/6.

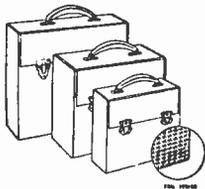
Incorporating auto and manual control complete with studio crystal p.u. and sapphire stylus. Also other makes at similar prices. A few only, Stereophonic 4-speed autochangers. P. P. & Ins. 5/6.

A beautifully styled cabinet. Made by a famous manufacturer. Size 16 x 14½ x 8½in. deep, covered in polka dot grey cloth with clipped lid and carrying handle. Will take B.S.R. Monarch 4-speed autochanger and 4 x 6in. elliptical speaker and most of the modern portable amplifiers. Carr. & Ins. 4/6.



69/6

Record Presentation Cases



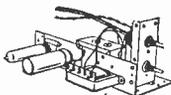
Beautifully made, Strong modern case covered in hard-wearing, washable rexine or leatherette. Choice of many colours, please state preference. Hinged top for easy access to records. Plated clip fasteners. Quick reference number index. Carry all your records, including long players, safely to parties and record sessions.

Record size	No. of records held	Price
12in.	40	46/-
12in.	25	32/6
7in.	40	32/6
7in.	25	31/-

P. P. & Ins. 2/6.

AMPLIFIERS

12 MONTHS GUARANTEE PORTABLE AMPLIFIER MARK D1 59/6



Brand new. Latest design with printed circuit. Dimensions 7 x 2½ x 5in. A.C. only. Mains isolated. 2-3 watts output. Incorporating EL84 as high gain output valves. Volume and tone controls. Knobs, 2/6 extra. P. & P. 3/6.

PORTABLE AMPLIFIER MARK D2 79/6

Printed circuit. Latest design. Dimensions 7 x 2½ x 5in. A.C. only. Mains isolated. 3-4 watts output. Incorporating the latest ECL82 triode pentode output valve giving higher undistorted output. Volume and tone control. Knobs, 2/6 extra. P. & P. 3/5.

PORTABLE AMPLIFIER MARK D3 89/6

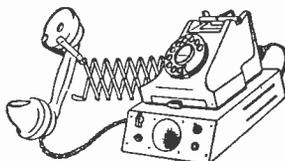
De Luxe model. Printed circuit. Latest design. Dimensions 7 x 2½ x 5in. A.C. only. Mains isolated. 3-4 watts output. Incorporating the latest ECL82 triode pentode output valve giving higher undistorted output. Volume, treble and bass control. Knobs, 3/6 extra. P. & P. 3/6.

PORTABLE AMPLIFIER MARK D4 69/6



Brand new. By famous manufacturer. Especially built for portable record players. Dimensions 4½ x 3½ x 4in. A.C. only. 2 valves EL84 as high gain output valve, EZ80 as rectifier. Volume and tone controls. Knobs, 2/6 extra. P. & P. 3/6.

Televox Telephone Amplifiers 89/6



Invaluable in a noisy office or workshop. 3 valves UY41; UF41; UL41. 3in. speaker and a suction type vibration microphone. A.C./D.C. Size of amplifier 7 x 11 x 3in. Fits any type of G.P.O. telephone. P. P. & Ins. 4/6.

STEREOPHONIC AMPLIFIER, £7.19.6

12 months guarantee. Beautifully made for portable stereophonic record players. Latest design with printed circuit. Dimensions 3 x 5½ x 9½in. A.C. only. Mains isolated. Twin amplifiers each side giving 3-4 watt output. Incorporating ECL82 triode pentode valves. Full tone, volume and balance controls. Complete and ready to fit. Knobs, 3/6 per set extra. P. P. & Ins. 4/6.

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British Institution of Radio Engrs., etc.

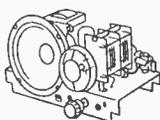
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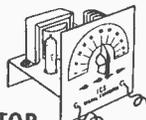
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REPANCO HIGH GAIN TRANSISTOR COMPONENTS

STANDARD RANGE

Ferrite Slab Aerials Type FS2. Designed for Long and Medium Wave reception with transistor portable superhet receivers. Slab size 5 1/2 in. x 3 in. x 5/32 in. Complete with fixing brackets, 13/6. **Combined Oscillator and 1st I.F. transformer Type OT1.** 13/16 in. sq. x 1 1/2 in. I.F. Frequency 315 Kc/s., 11/6. **2nd I.F. Transformer (315 Kc/s.) Type TT2, 5/-.** **3rd I.F. Transformer (315 Kc/s.) Type TT3, 5/-.** I.F. Transformers enclosed in iron dust pots with slug tuning. **Push Pull Interstage Transformer Type TT4.** Ratio 1 : 1 C.T. Stack size 1 3/4 in. x 1 1/16 in. x 7/16 in., 8/6. **Push Pull Output Transformer Type TT5.** Ratio 15 : 1 C.T. Size as TT4. Matched to 3 ohm speaker, 8/-.

MINIATURE RANGE.—For pocket receivers.

Ferrite Slab Aerial Type FS3. Medium Wave only. With fixing grommets. Size 3 in. x 3 in. x 5/32 in., 7/6. **Oscillator · Coil Type X08.** Medium Wave only. Overall size 3 in. dia. x 1 in. Enclosed in Ferrite pots, 5/-.

I.F. Transformer Type XT6. Suitable for 1st and 2nd I.F. 455 Kc/s. Size 3 in. sq. x 1 1/16 in., 10/-.

I.F. Transformer Type XT7. Designed for 3rd I.F.T. or detector I.F.T. 455 Kc/s. Size as XT6, 10/-.

Push Pull Interstage Transformer Type TT9. Ratio 1 : 1 C.T. Radiometal Core. Size 3 in. x 3 in. x 13/32 in., 12/6.

Push Pull Output Transformer Type TT10. Ratio 8 : 1 C.T. Matched to 3 ohm speaker. Size as TT9, 12/6.

Practical and Theoretical circuits enclosed with each Repanco Transistor Component.

JUST RELEASED. "THE MAJOR-7" a new portable transistor receiver. Size 9 in. x 7 in. x 4 in. Send 1/9 P.O. for instructions.

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SOUTHERN RADIO'S WIRELESS BARGAINS

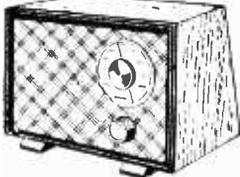
- **TRANSCEIVERS.** Type "38" (Walkie-Talkie) complete with 5 valves, etc. New condition, untested by us, but serviceable, no guarantee. 22/6 each.
- **ATTACHMENTS** for Type "38" Transceivers, ALL BRAND NEW. PHONES, 15/6; THROAT MICROPHONES, 4/6; JUNCTION BOXES, 2/6; AERIALS, No. 1, 2/6; No. 2, 5/-; WEBBING, 4/-; HAVERSACKS, 5/-; VALVES, A.R.P.12, 4/6; A.T.P.4, 3/6. Set of FIVE VALVES, 19/- the set.
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- **RESISTANCES.** 100 Assorted useful values. New wire end, 12/6
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- **LUFBA HOLE CUTTERS.** Adjustable 1" to 3 1/2". For Metal, Plastic, etc. 7/-
- **QUARTZ CRYSTALS.** Types F.T.241 and F.T.243, 2-pin, 1/2" Spacing. Frequencies between 5,675 Kc/s and 8,650 Kc/s. (F.T.243) 20 Mc/s. and 38.8 Mc/s. (F.T.241) 54th Harmonic, 4/- each. ALL BRAND NEW. TWELVE ASSORTED CRYSTALS, 45/-.
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- **TRANSPARENT MAP CASES,** Plastic, 14" x 10 1/2". Ideal for Maps, Display, etc..... 5/6
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- **POST OR CARRIAGE EXTRA. FULL LIST OF RADIO BOOKS, ETC.,** 3d.

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A.C./D.C. Multimeter Kit

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



The Skysearcher

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

All-Mains Amplifier



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

Simplex Transistor Kit



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

Don't Stumble in the Dark



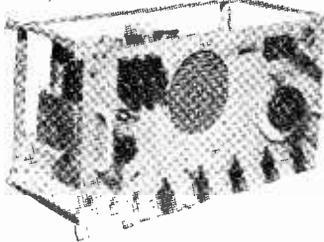
Install 2-way switches. Our outfit comprises: 30 yds. Multi-core cable, two 2-way switches, two wood blocks. Full instructions, 9/6 each, post and insurance 2/6.

Pullin Series 100 Test Set

Undoubtedly the most useful instrument by a firm long famous for fine instruments, entirely redesigned, it has a square movement with diacon plastic cover, this makes for a brighter, more readable scale, extra scale length and wider angle of vision. With the test set is included a pair of combined test prods and crocodile clips also a stand for inclining the meter at the best reading positions. Ranges: A.C. Volts: 0-10, 0-25, 0-100, 0-250, 0-500, 0-1,000 ditto D.C. A.C. Current 0-100 mA. D.C. Current 0-2.5, 0-10, 0-100, 0-500 mA. Resistance: 0-1M and 0-10K. All at 10,000 ohms per Ohm.—Price £12.7/6 or £1 deposit and 24 fortnightly payments of 10/-, non callers add 5/- carr. & ins.

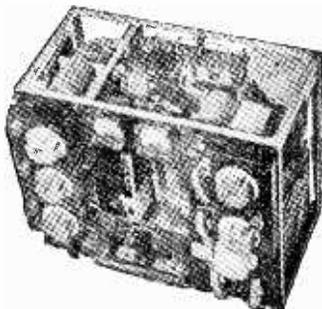


Short Wave Communications Receiver R208. 10/- Down.



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

Famous Transmitter Virtually Given Away



The famous R1154—unused but slightly soiled and not tested. Covers 200-500 kc/s., 3-5.5 Mc/s and 15-10 Mc/s. Has unique "click stop" mechanism (7 stops) and permits selected frequency to be held, returned to, etc. Handy oscillator, power amplifier, keying and speech. Wonderful breakdown value meters, relays, switches. Complete with valves—real bargain at 29/6, plus 10/- carriage.

**Electronic Precision Eqpt. Ltd.
FOR ADDRESSES SEE
PAGES 860 AND 861**

Beginner's Superhet



All the components including metal chassis, valves, metal rectifier, coils, tuning condenser, etc., etc., required to build the "Beginner's Superhet" as described in the January 1958 issue, are available as a parcel. Price £3, plus 3/- post and ins.

Variable Rheostat

Heavy duty slider resistor rated at 250 amps. Basic resistance is 4 ohms. Can be rewired to suit individual requirements. Ideal for dimmer circuit, etc. Price 9/3, post 3/6.

14in. T.V. Cabinet



14in. T.V. cabinet of the latest styling—beautifully veneered and polished—limited quantity—sale price, 15/- ea. Carr. and packing 3/6 extra. Mask 10/- extra.

Glass Panels

Size 10 1/2 x 9 1/2—parcel of five panels.

8/6

Post free.

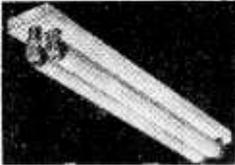


Unused and Boxed Valves

0Z4	9/-	6D6	6/6	735	12/6
1A4	9/-	6F5	9/6	7C7	12/6
1A6	9/-	6F6	7/6	7D5	9/6
1P7	12/6	6F7	12/6	7D3	9/6
1L18	3/6	6F8	9/6	7H7	8/6
1LA6	9/6	6F32	10/6	7K8	12/6
1N56	3/6	6G6	7/6	7R7	10/-
1LD5	3/6	6H6	2/6	7S7	10/-
1T4	7/6	6J5	5/6	12H6	8/6
1R5	7/6	6J7	6/-	12SH7	8/6
1S5	7/6	6K6	7/-	12SX7	8/6
1T5	8/-	6K7	5/-	12SK7	8/6
2A5	12/6	6L5	9/-	25B5	12/6
2A6	12/6	6L6	9/-	26	10/-
2A7	12/6	6L7	10/7	27	10/-
2D13C	5/-	6N7	8/6	28D7	3/6
2X2	4/6	6P7	7/6	31	7/6
3A4	7/6	6S7	9/-	32E	7/6
3D6	5/-	6SA7	8/-	34	12/6
3Q4	7/6	6SG7	8/-	39/44	10/-
4D1	2/-	6SH7	6/-	41E	9/6
5U4	8/-	6SJ7	8/6	43	8/6
5Z3	12/-	6SK7	6/-	43	10/-
5Z4	9/6	6SL7	8/-	57	10/-
6A6	12/6	6SN7	7/6	58	10/-
6AG5	6/6	6SQ7	9/-	71	9/6
6AC7	6/6	6SS7	9/-	75	12/6
6A8	10/-	6T7	12/6	77	8/6
6B4	5/-	6U5	8/6	82	12/6
6B7	10/6	6V6	8/6	84	8/6
6B8	4/-	6X5	7/6	807	3/6
6BQ6	12/6	6Y6	9/-	954	6/6
6C4	6/6	6Z5	15/-	1625	10/6
6C8	6/6	7A2	12/6	806	8/6
6C8	5/-	7A7	9/6	913	9/6

Good range of British Valves kept at all addresses.

Fluorescent Lighting



Complete lighting fittings. Built-in ballast and starters—stove enamelled white and ready to work. Ideal kitchen, workshop—anywhere. Twin 20 approximately 27in. long complete with two 20W tubes 39/6. Single 40 approximately 4ft. long complete with one 40W tube 39/6. Inductor 30 approximately 5ft. long complete with one 30W tube 59/6. Carriage & insurance up to 150 miles 5/6. up to 250 miles 7/6.

Band III Converter

Suitable Wales, London, Midlands, North, Scotland, etc. All the parts including 2 EF80 valves, fine tuner, contrast control, condensers and resistors. (Metal case available as an extra.) Price only 19/6, plus 2/6 post and insurance. Data free with parts or available separately 1/6. Please send two more kits, the one you want last week is performing magnificently.



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



TV Masks
Latest type grey crystallate
14in. 10/-; 17in. 12/-
Plus 1/- post.

Yours for 10/- down and 17 weekly payments of 10/- or cash price **£8.10.0**



The latest, most up-to-date Record Player made by the famous B.S.R. Company. Using Hi-Fi Crystal Pick Up and fitted with every modern device. Definitely a record changer which will give years of trouble-free music. Not surplus but the current model. Price 28/10/- or Terms.

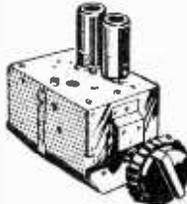
Latest AVO Testmeter



Can be yours for only 10/- deposit and 19 fortnightly payments of 10/-. Like all AVO meters it is a very fine instrument; it has a sensitivity of 10,000 ohms per volt and 19 most useful ranges as follows—

D.C. volts 0-1,000 (seven ranges)—A.C. volts 0-1,000 (five ranges) D.C. current 0-1 amp. (5 ranges), resistance 0-2 megohms. (2 ranges) (complete with test leads). Immediate delivery. Cash price 29/10/0.
FREE GIFT.—All purchasers will receive Range Extender scale and data which add: capacity 0-1 mfd., in two ranges. Inductance 0-100 henrys, etc., etc.

Latest Type Turret Tuner



Brand new stock, not surplus, with coils for Band I and III complete with valves. Model 1 L.F. output 33.33 Mc/s. Series heaters Model 2 L.F. output 16.19 Mc/s. Parallel heaters. With instructions and circuit diagram. 79/6. With knobs 3/6 extra, post and insurance 2/6.

A Mobile Receiver Transmitter Station

Compactly built to be carried by one man. This has a range of approximately 10 miles and being crystal controlled tuning is avoided and operation is as accurate as a telephone. Complete stations comprising: receiver transmitter, rod aerial, headphones and microphone in canvas carrying bag and additional canvas carrying bag for batteries. Items 1-8 in the illustration but less the plug in crystal/coil units (these are available for the specified frequencies as an extra). Price £4.10.0 per station. Frequency 3.5-9.1 Mc/s. Instruction book free with equipment or available separately. Price 2/6.



R1155 for Spares

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



Medresco Hearing Aid

As supplied by National Health, completely overhauled and in good working order with six months' guarantee. Only £2.15.0 plus 2/6 post and ins. Complete with earphone and new ear plug but not batteries, these can be supplied as an extra for 5/- per set. Instruction showing how to convert to pocket radio available free if requested.



Hi-Fi Snip Infinite Wall Baffle



Nicely veneered and polished. Corner fitting (attaches to picture rail). Takes up no floor space. Gives really fantastic results with only low-priced 8in speaker. Fitting for tweeter. Only 45/- each, carriage and insurance 3/6.

W.D. Circuit Details

Diagrams and other information extracted from official manuals. All 1/6 per copy, 12 for 15/-.

- A.1134
- BC.248
- BC.312
- R.103A
- BC.342
- RA-1B
- R-208
- R-1155
- R-1124A
- R-1132A R-1481
- R-1147
- R-1224A
- R-1032
- R-1353
- B.C.1206-A/B
- B-455-A (or -B)
- B-454-A (or -B)
- B-453-M-A (or -B)
- Transmitter T1151
- Fifty-eight valve R.F. unit 26
- R.F. unit 27
- Frequency meter
- B.C. 221
- R.109
- HRO Receiver
- R28/ARC5
- R1116/A
- RA-1B
- AR88D
- AN/AF-1
- 78
- 76
- R.T.18
- CAY-46-AAM-
- RADAR
- A.S.B.-3
- Indicator 62A
- Indicator A.S.B.-3
- Indicator 62
- Indicator 6K
- R.F. unit 24
- R.F. unit 25
- R.F. unit 26
- R.F. unit 27
- Wireless set No. 19
- Demobbed valves

Don't Be Caught Like This



Car Starter Charger Kit

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

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

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

Wire ended Neon Lamp. Midzet size as used in mains tester, dozens of applications, 2/- each. Install Those Extra Power Points. Big purchase of 7,023 3-core cable enables us to offer this at a real bargain price of 37/6 per 50 yd. coil. 100 yd. coil 75/-, carriage free.

ELECTRONIC PRECISION EQUIPMENT LTD.

66, GROVE ROAD, EASTBOURNE, SUSSEX

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

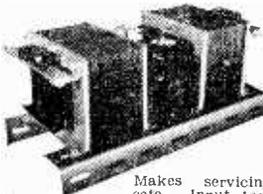
Suppressor Condenser



Stop your triflers or other

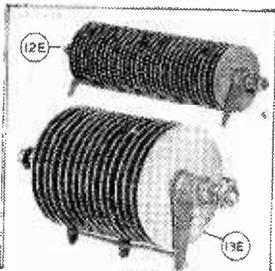
appliances interfering with your or your neighbours' radio or television. Simple instructions given 1/6 each. 12 - dozen.

Mains Isolation Transformer



Makes servicing safe. Input tapped 200-250 v., output tapped 200-250 v. Rated at 500 watts, intermittent rating 2,000 watts. Screens for suppressing mains interference. Size 14in. x 6in. x 6in., weight 40lbs. Price £5/12/6. Carriage 7/6 (up to 253 miles).

Rectifier Bargains



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

Chassis Assembly



Superhet Chassis, 3-waveband, coloured scale, scale pan, etc. Scale size 14 1/2 in. x 3 1/2 in. Chassis size 15 in. x 15 in. x 2 in. Price 9/6, plus 1/6 post.

Speaker Bargain



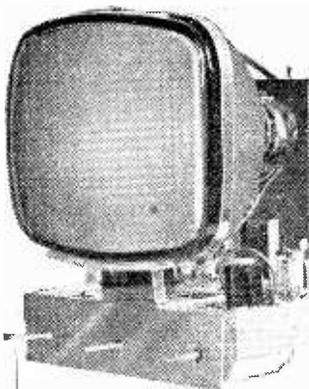
12in. Hi-fidelity loudspeaker. High flux. Permanent magnet type with standard 3 ohm speech coil. Will handle up to 12 watts. Brand new by famous maker. Price 32/6, plus 3/6 post and insurance.

BUILD THIS 17" TV FOR 22 GUINEAS

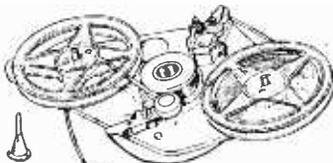
This is a very modern circuit and when you have completed it it will be equal to any factory made model. Note these special features:

- Miniature valves and metal rectifier.
- 12 channel turret tuner.
- Ferrox E.H.T. and scan coils.
- A.G.C. and A.V.C.

Supplied in component form with all metal work prepared and supplied with pictorial layout and theoretical wiring diagram (these are available separately, price 3/6). Total cost is only £23.2.0.



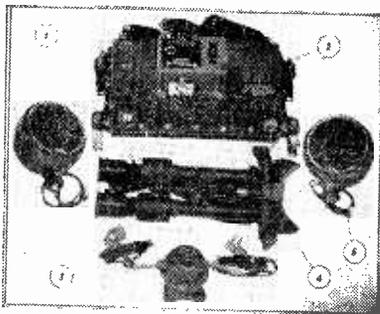
Gram into Tape Recorder



Convert your Record Player or Radiogram into a Tape Recorder. Can be fitted in a few seconds and then you have immediately all the facilities afforded by a normal Tape Recorder, i.e., record, playback, erase, rewind, etc. As illustrated. But less pre-amp, only £7 10/-, or 10/- down and 16 weekly payments of 10/-. Non-callers please add 5/- carriage and insurance. With pre-amp £13.2.6, or £1 down and 26 weekly payments of 10/-.

Avo Proclips

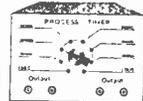
The advantage of these test prods is that by pressing the trigger at the side they become crocodile clips and can be left in circuit. This is a great time saver when servicing. Price, 15/- pair.



TABBY EQUIPMENT COMPLETE

Complete equipment for seeing in the dark, as fitted to Army vehicles for night driving, etc. Complete working equipment comprises: 2 Infra Red Radiators, adjustable binoculars, powerpack for 6 or 12 volts, control units and inter-connection cables. Original cost probably around £100. Unused and in perfect order—£6.19.6 or 10/- deposit and 15 fortnightly payments of 10/-.

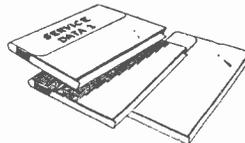
Process Timer for 15/-



Make a time delay switch to work off mains (A.C. or D.C.), all the parts (less case).

Price 15/-, post and ins. 2/6.

T.V. Service Sheets

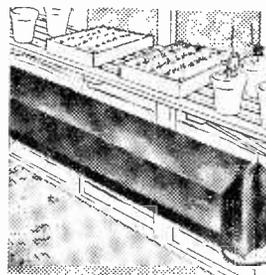


150 sheets covering the most popular post-war Televisors by leading makers—Cossor, Ekco, Ferguson, Pye, etc. £1.10.0 post free.

Radio Service Sheets

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

Instantus Heater



Convactor heater. Made from heavy gauge sheet steel (galvanised). For greenhouse, workshop, aviary, etc. 500 watt, £1 12/6; 1,000 watt, £2 10/-; 1,000 watt with wired but separate thermostat, £3 17/6; 2K watt free standing or wall mounting, £3 19/6; 2K watt with built-in thermostat, £4 19/6. Carriage and insurance 5/- per heater. ALL ARE GUARANTEED FOR 5 YEARS.

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

Electronics (Ruislip) Ltd.
42-46, Windmill Hill,
Ruislip, Middx.
Phone: RUISLIP 5780.
Half-day, Wednesday.

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

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



They ALL choose the **Brenell MARK 5**

With its outstanding features, its versatility in operation and application what more can be said—there's no finer value for the money!

- ★ Four recording speeds. 1½, 3½, 7½ and 15, giving an exceptionally wide frequency range.
- ★ Permits use of 8½ in. reels.
- ★ (2,400ft. of L.P. tape at 1½ i.p.s., plays over 8 hours.)
- ★ Three independent motors (B.T.H.).
- ★ Special foolproof interlocking controls. Instant stop without spillage. Pause control. Digital rev. counter. High quality amplifier. Recording level indicator. Monitoring facilities. Azimuth head adjustment. Provision for extra sound heads. Fast re-wind (1,200ft. in 45 secs.). Coloured signal lights.

Brenell PERFORMANCE
IS TRUE-TO-LIFE PERFORMANCE

Details from Sole Manufacturers.

BRENNELL ENGINEERING CO. LTD., 1a, Doughty Street, London, W.C.1. Tel.: CHA 5809 & HOL 7358 GD13.



64 GNS.

incl. 1,200ft. of tape

Because the Mark 5 is of unit construction the following can be supplied as separate items for incorporation in your own equipment.

Tape Deck with provision for extra heads	28 gns.
Tape Pre-amplifier Type T.P.2	17 gns.
Power Unit T.U.2	£4.18.0
Mixer Unit	£2.18.0

A SMALL DEPOSIT will bring you enough parts to make a complete **TRANSISTOR POCKET RADIO**

(Size 5¾ x 3¼ x 1¼) using a printed circuit

- ★ Send for **FREE PRICE LIST** (all parts sold separately) and/or 3/- for new simplified instruction booklet with suggested circuits and assembly details.

OUR CIRCUITS OFFER
HIGH SENSITIVITY
HIGH SELECTIVITY

using

R.F. Transistors **1 GN.** each
L.F. Transistors, **10/-** each
all specially selected to give
HIGH OVERALL GAIN with A.V.C.

FULL MEDIUM & LONG WAVE COVERAGE

for as little as **£9.19.6**

- Miniature loudspeakers, only **27/6**
1½ in. deep x 2½ in. diam.
- Miniature oscillator and i.f. coils, **8/-**
1½ in. high, ¾ in. diam.
- Jackson 00 twin gang tuning condenser with intersection screen **10/6**
- Attractive high impact polystyrene cabinet with fittings for tuner, trimmers, speaker and circuit board **12/6**

MANY OTHER SUB-MINIATURE COMPONENTS AVAILABLE

SPECIALISED ELECTRONIC COMPONENTS LTD 8 Eccleston Square · London · SW1
MAIL ORDERS ONLY

Brand new, individually checked and guaranteed

VALVES

A864 4/6	EAC91 4/6	KR6J1 3/6
AC/DD 2/6	EB34 1/9	KRN2A 15/6
AC/HL 2/6	EBC33 6/-	KRN3 15/6
AC/P 2/6	EC52 4/6	KT2 4/-
AC/PI 2/6	ECC34 3/6	KT30 7/-
AC6/PEN 2/6	ECC32 4/-	KTW62 4/-
	ECC91 5/-	KTW63 6/6
AL60 5/-	EF8 6/-	
AR6 4/6	EF22 7/3	LP2 3/-
ARP3 3/6	EF36 5/-	LS58 12/-
ARP12 3/6	EF39 5/6	LS78 12/-
ARP24 3/6	EF50 3/-	
ARP34 3/6	EF55 6/-	MH4 4/-
ATP4 3/6	EF91 7/-	MH41 6/6
ATP7 5/6	EF92 7/-	MHLD6 4/6
	EL32 4/6	ML4 4/6
B30 3/6	EL91 4/6	ML6 6/6
BL63 6/-	EY91 4/6	MS/PEN 6/-
		MS/PENB
D41 3/3	FA15 4/-	N34 6/-
D77 5/-	GDT-4B 4/-	NR15A 3/-
DD620 4/6		NR37 7/-
DET19 1/6	H30 5/-	
DET20 2/6	H63 3/6	(4033A) 14/-
DH76 4/9	HL2 2/6	NT62A 4/-
DL510 4/6	HL4 3/6	
	HL42/DD 6/-	OD3 6/-
	HP4101 6/-	OZ4 5/-
		OZ4A 5/-
E1148 2/-		
E1323 1/9	KBC32 5/-	
EA50 1/6	KF35 5/-	P61 2/6

PEN46 5/9	V2023 8/-	SU4G 7/-
PEN141 4/-	V2D33B 8/-	5Z3 8/6
PEN220A 3/-	VR99 8/-	
	VR150/30	6A6 5/-
PEN1340 6/-		6AB7 5/-
PM2BA 3/6	VS110 4/-	6AC7 5/-
PM2HL 3/6	VT25 8/6	6AG5 5/6
PM4DX 3/-	VU33 2/6	6AG7 8/6
PM202 7/6	VU111 3/-	6AK6 7/6
PT15 8/-	VU120A 3/-	6AL5 5/6
PT25H 7/6	W42 7/-	6AM5 8/6
		6AM6 7/-
QP21 6/-	Y66 8/-	6B4G 4/6
QP25 5/3		6BB 6/-
		6BBG 3/-
RGI-240A 17/6	IA3 3/6	6C4 5/6
	IA5GT 5/-	6C5 4/6
RG3-250 17/6	IB23 11/-	6C6 6/-
	IB24 11/-	6C8G 5/-
RG4-1250 17/6	IB26 11/-	6D6 5/-
	IB32 10/-	6F6 7/-
	ID8GT 6/-	6F6G 5/-
	IL4 4/-	6F8G 8/-
RK34 3/-	ILD5 3/6	6FI2 7/-
RKR72 5/6	ILN5 5/-	6G6G 3/-
RKR73 5/6		6H6 2/3
		6H6GT 1/9
SP2 4/6	2A3 8/-	6J5 5/-
SP4B 7/6	2A6 7/6	6J6 5/-
SP13C 4/6	2C34 2/6	6K7G 4/-
SP41 2/9	2D4A 4/-	6K7GT 6/-
SP61 2/9	2X2 4/-	6K8G 7/-
STV280/40 14/-	3A4 6/6	6K8GT 8/-
	3B24 3/-	6L5G 6/-
SU2150A 4/9	3E29 7/-	6L6 10/-
	(829B) 75/-	6L6G 8/6
TT11 3/-		6L6GA 8/6
U8 12/6	4A1 4/6	6L34 4/6
	4D1 2/6	(N7GT) 7/-
V885 5/-		6SA7 7/-
V1906 4/6	5T4 10/-	6SG7 7/-

6SH7 5/-	41FP 1/9	9004 4/-
6S7 7/6	45 7/-	9006 4/-
6SK7 5/6	53A 3/-	
6SL7GT 7/-	58 6/-	Cathode Ray Tubes:
6SN7 5/6	59 6/-	3BP1 25/-
6SN7GT 5/6	71A 4/6	5CPI 42/6
6SQ7 6/6	76 9/-	5FP7 45/-
6SS7 8/-	77 6/-	SMP1 17/6
6V6G 6/-	82 8/-	VCR97 10/-
6X5G 6/-	83 12/-	VCR517, 10/-
	83V 12/-	
	89 6/-	Special Valves:
8D2 2/6	21OLF 3/-	417A 15/-
	210VPT 3/-	723AB 52/6
9D2 3/-	217C 17/6	726A 27/6
	22CVSG 3/-	
11E2 5/-	446A 14/-	
11E3 5/-	446B 14/-	
	705A 17/6	
12A6 5/-	715B 97/6	
12AH7 7/-	717A 8/6	
12C8 7/6	801 6/-	
12E1 22/6	803 22/6	
12H6 2/6	805 30/-	
12J5GT 3/6	807AMER 6/6	
12SG7 6/6	12S17 6/-	
12SH7 4/9	12SK7 5/-	
12S17 6/-	12SL7 7/-	
12SK7 5/-	12WV7 6/-	
12SL7 7/-		
12WR7 6/-		
	15D2 6/-	
	15E 8/-	
	15R 7/6	
	843 7/6	
	872A 35/-	
	954 2/-	
	956 3/-	
	1625 6/-	
	1626 4/6	
	1629 4/6	
	1719 1/9	
	7575 5/-	
	8010AR 22/6	
	8020 6/-	
	9001 5/-	

Rotary Converter Unit. Input D.C. 12.5 v. D.C. Output 300 v. 200 m.A. 30% Postage and packing 15/-.

Tannoy Loudspeakers. New. 15/- P. & P. 3/-.

All Orders below 10/- P. & P. 1/-; over 10/- 1/6; Orders over £2 P. & P. free.

Brand new original spare parts for AR88 Receivers. Please see advert. Dec. issue.

Avominors in leather case, with leads, fully tested. £5.10.0. Packing and carriage 2/6.

SCR.522. Transmitters (BC625), including all valves, 45/- P & P. 5/-.

SCR.522. Receivers (BC624), including all valves, 25/- P. & P. 5/-.

HRO. Mains. 150/230 v. Power Supply Unit, complete with valve, checked, £3.9.6. P. & P. 5/-.

High Resistance Headphones. 4,000 ohms. Brand new, ex W.D. boxed. Type DHR. 10/6 per pair. P. & P. 1/-.

Low Resistance Headphones, brand new, type CLR, 5/-, DLR, 6/6 per pair. P. & P. 1/-.

Modulation Transformers (U.S.A. Collins), primary imp. 6,000 ohms. C.T., secondary 6,000 ohms, 20 W., 9/6 each. Post free.

Microphone Transformers. Balanced input 30 or 250 ohms. U.S.A. manufacture, 7/6. P. & P. 1/6.

813, Ceramic Valveholders, 3/- each. P. & P. 1/6.

Vibratory Supply Unit. Input 6 v., output H.T. 230 v., 100 m.A., L.T. 6 v., in metal case, 9in. x 5in. x 6in., complete with Vibrator, OZ4 valve. Checked working, £2. P. & P. 7/6.

Marconi Signal Generator. TF144G: 85 kc/s, 25 Mc/s. Made up to new standard. £70, delivered free.

Telephone Hand Set. Standard G.P.O. type. New, 10/- P. & P. 1/-.

AR88 and I.F. Receivers, completely overhauled and tuned, £60 and £57.10.0 respectively. Completely rebuilt with P.V.C. wiring, £85.

Hallcrafters' S27 Receivers, 27-143 Mc/s. Fully reconditioned, £30.10.0, delivered free.

P. C. RADIO LTD.
170 GOLDHAWK RD.,
W.12 SHEPHERDS BUSH 4946

PERSONAL CALLERS WELCOME

H.A.C. SHORT-WAVE EQUIPMENT

Noted for over 20 years for S.W. Receivers and Kits of Quality.

Improved designs with Denco coils. As supplied to Technical Colleges, etc.

One-valve kit, Model "C". Price 25/-

Two-valve kit, Model "E". Price 50/-

New Addition, Model "K". Price 50/-

Super sensitive "All Dry" Receiver. Special incl. price. Complete Kit, 77/-.

All kits complete with all components, accessories and full instructions. Before ordering call and inspect a demonstration receiver. We send stamped, addressed envelope for descriptive catalogue and order form.

"H.A.C." SHORT-WAVE PRODUCTS
Dept. TB, 11, Old Bond Street, London, W.1.

B.B.C.-I.T.V.-F.M. AERIALS

B.B.C. (Band 1).—Telescopic loft, 19/6. External S/D, 23/6. "X" Chimney unit, 75/-.

I.T.V. (Band 3).—3-element loft array, 24/-; 5-element, 32/6. Wall mounting, 3-element, 33/9; 5-element, 41/3.

Combined B.B.C. + I.T.V. Loft 1+3 element, 41/3; 1+5 element, 48/9. Wall mounting, 1+3 element, 50/3; 1+5 element, 63/9.

Belling "Golden V" room aerial, 42/-.

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C.W.O. or C.O.D. P/P 2/6. Coaxial cable, 8d. yd. Coaxial plugs, 13. Send 6d. stamps for illustrated Lists.

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SPARKS' DATA SHEETS present THE AMAZING "COX'N" A.C./D.C. 3

A truly "Hot" design which will give unlimited New Thrills and Interest on 10 TO 220 METRES

Amateurs, S.W. Broadcasts, Ships, Aeroplanes, Trawlers and Liners, etc. Unique Cathode Regen. circuit ensures Highest Efficiency with Simplicity. Full-size Data Sheet plus Instructions. 2/3 Post Free. All Components, Chassis and Coil available.

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High efficiency with perfect stability and simplicity of control. 10 to 220 metres. Switched Coils. Separate Power Pack. Data Sheet 22in. x 27in. with full instructions. Etc., Etc. 3/6 Post Free.

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R.S.C. BATTERY CHARGING EQUIPMENT

ASSEMBLED CHARGERS
 6 v. 1 amp 19/9
 6 v. or 12 v. 1 amp 27/9
 6 v. 2 amps 29/9
 6 v. or 12 v. 2 amps 38/9
 6 v. or 12 v. 4 amps 56/9
 Above ready for use. With mains and output leads. Carr. 3/6.

SELENIUM RECTIFIERS
F.W. BRIDGE TYPES
 6/12 v. 1 a. 3 1/2 I.T. Types J.W. 1/11
 6/12 v. 2 a. 8/9 2-6 v. 1 a. H.W. 2/9
 6/12 v. 3 a. 10/9 6/12 v. 1 a. H.W. 2/9
 6/12 v. 4 a. 14/9 I.T. Types H.W.
 6/12 v. 6 a. 19/9 150 v. 40 mA. 3/9
 6/12 v. 10 a. 25/9 250 v. 50 mA. 5/9
 6/12 v. 15 a. 35/9 250 v. 80 mA. 7/9
 24 v. 2 a. 14/9 250 v. 80 mA. 7/9
 24 v. 6 a. 26/9 250 v. 250 mA. 11/9

BATTERY CHARGER KITS
 Consisting of Mains Transformer, F.W. Bridge, Metal Rectifier, well ventilated steel case. Fuses. Fuse-holders. Grommets, panels and circuit. Carr. 2/9 extra.
 6 v. or 12 v. 1 amp 22/9
 As above, with Ammeter 32/9
 6 v. or 12 v. 2 amps 31/6
 6 v. or 12 v. 2 amps. Inclusive of Ammeter 41/6
 6 v. or 12 v. 4 amps 53/9
BATTERY CHARGER KIT
 6/12 v. 6 amp. consisting of F.W. Bridge Rectifier, Mains Trans. and Ammeter. 49/9.
 Post and packing 4/6.

ASSEMBLED CHARGER
 6 v. or 12 v. 2 amps.
 Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case. finished attractive hammer blue. Ready for use. With mains and output leads. Double Fused.
 Only Carr. 3/9 **49/9**

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



Assembled 6 v. or 12 v. 4 amps.
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Inter-leaved and Impregnated. Primary 200-230-250 v. 50 c/s. Screened.
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 250-0-250 v. 70 mA. 8.3 v. 2 a. 5 v. 2 a. 18/9
 350-0-350 v. 80 mA. 6.3 v. 2 a. 5 v. 2 a. 16/9
 250-0-250 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. 23/9
 300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. 23/9
 350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. 23/9
 350-0-350 v. 100 mA. 6.3 v. 4 a. 4 a. C.T. 0-4-5 v. 3 a. 23/9
 350-0-350 v. 150 mA. 6.3 v. 4 a. 5 v. 3 a. 23/9
FULLY SHROUDED UPRIGHT
 250-0-250 v. 60 mA. 6.3 v. 2 a. 5 v. 2 a. Midget Type 21-3-3 in. 17/6
 250-0-250 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. 26/9
 For R1355 conversion 31/2
 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
 300-0-300 v. 130 mA. 6.3 v. 4 a. 6.3 v. 1 a. for Mullard 510 Amplifier 35/9
 350-0-350 v. 150 mA. 6.3 v. 4 a. 5 v. 3 a. 33/9
 350-0-350 v. 150 mA. 6.3 v. 2 a. 6.3 v. 2 a. 5 v. 3 a. 35/9
 425-0-425 v. 200 mA. 6.3 v. 4 a. C.T. 6.3 v. 4 a. C.T. 5 v. 3 a. Suitable Williamson Amplifier. etc. 49/9

CHARGER TRANSFORMERS
 All with 200-230-250 v. 50 c/s. Primary: 0-9-15 v. 1 a. 11/9; 0-9-15 v. 3 a. 16/9; 0-9-15 v. 5 a. 19/9; 0-9-15 v. 6 a. 23/9.

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 150 mA. 7-10 H 250 ohms. 11/9
 100 mA. 10 H 200 ohms. 6/9
 80 mA. 10 H 350 ohms 5/9
 60 mA. 10 H 400 ohms 4/11

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 Midget Battery Pentode 66:1 for 354. etc. 3/9
 Small Pentode. 5,000 Ω to 3 Ω 3/9
 Small Pentode 78,000 Ω to 3 Ω 3/9
 Standard Pentode 5,000 Ω to 3 Ω 4/9
 Standard Pentode. 7900/00 Ω to 3 Ω 4/9
 10,000 Ω to 3 Ω 4/9
 Push-Pull 10-12 watts 6V6 to 3 Ω or 15 Ω 15/9
 Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15 Ω 16/9
 Push-Pull EL84 to 3 or 15 Ω 16/9
 Push-Pull 15-18 watts. 6L6. KT66 22/9
 Push-Pull for Mullard 510 Ultra Linear 29/9
 Push-Pull 20 watts. sectionally wound 6L6, KT66, etc., to 3 to 15 Ω 47/9

ELIMINATOR TRANSFORMERS
 Primaries 200-250 v. 50 c/s.
 12 v. 40 mA. 5-0-5 v. 1 a. 15/9
 90 v. 15 mA. 4-0-4 v. 500 mA. 9/9

FILAMENT TRANSFORMERS
 All with 200-250 v. 50 c/s. primaries 6.3 v. 1.5 a. 5/9; 6.3 v. 2 a. 7/6; 0-4-6.3 v. 2 a. 7/9; 12 v. 1 a. 7/11; 6.3 v. 3 a. 8/11; 6.3 v. 6 a. 17/6; 12 v. 3 a. or 21 v. 1.5 a. 17/6.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

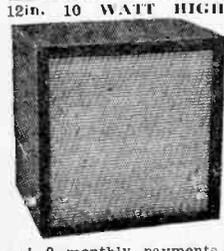
Type BM1. An all-dry battery eliminator. Size 6 1/2 x 4 1/2 x 2 1/2 in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s is available. Suitable for all battery portable receivers requiring 1.4 v. and 90 v. This includes latest low consumption types.
 Complete kit with diagrams. 39/9. or ready to use. 46/9.



Type BM2. Size 8 x 5 1/2 x 2 1/2 in. Supplies 120 v. 90 v. and 60 v. 40 mA. and 2 v. 0.4 a. 40 mA. fully smoothed. Thereby completely replacing both I.T. batteries and L.T. 2 v. accumulators. When connected to A.C. mains supply 200-250 v. 50 c/s. **SUITABLE FOR ALL BATTERY RECEIVERS** normally using 2 v. accumulator. Complete kit of parts with diagrams and instructions. 49/9. or ready to use. 56/6.

STEREOPHONIC EQUIPMENT AT SPECIAL PRICES

(a) Linear L33 Stereo Amplifier, 7 GNS.; (b) Staar Galaxy Auto-Changer fitted Turn-over head for Stereo, Long Playing and Standard Records, £8.19.6, carr. 4/6; (c) Matched 12in. P.M. Speakers in polished Walnut finished wood cabinets, £8.15.0 per pair; (d) Cabinet Speakers, illustrated below, £9.19.0 pair; (e) Matched High Flux 8in. P.M. Speakers in polished Walnut veneered Cabinets, £3.19.9 pair; (f) Matched 6in. R.A. P.M. Speakers in polished veneered Walnut cabinet, £3.10.0 pair; or (a), (b) and (c) 19 gns., carr. 15/-. (a), (b) and (d) 22 gns., carr. 15/-. (a), (b) and (e) 18 gns., carr. 15/-. (a), (b) and (f) 17 gns., carr. 15/-.
 12in. 10 WATT HIGH QUALITY LOUD-SPEAKERS IN POLISHED WALNUT FINISHED CABINET
 Gauss 12,000 lines, speech coil 3 ohms or 15 ohms
 Only £4.19.6
 Carr. 5/-.
 Terms: Deposit 11/- and 9 monthly payments of 11/-



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

ACOS CRYSTAL 'MIKE' INSERTS. Approx. 1in. square. Fly lead connections. Only 5/11 each. Brand New. Round type approx. 1 1/2in. diam. Equipment tested, 4/11 each.

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

PORTABLE CABINETS. High Quality Finish. Rexine covered. Attractive design. Inside measurements: 17in. x 12 1/2in. x 8 1/2in. High. Clearance above base-board 5 1/2in. Below 2 1/2in. 69/9 each.

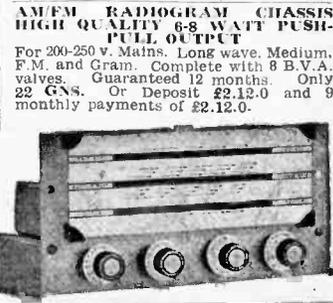
SPECIAL OFFER. Above cabinet, LG3 Amplifier, Staar Changer and 6in. P.M. Speaker. 11 GNS. Carr. 7/6.

THE SKYFOR T.R.F. RECEIVER. A design of 9-valve Long and Medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.P. stage and low distortion anode bend detector. Power pentode output. Valve line-up 6KT, SP61, 6V6G. Selectivity and quality are well up to standard, and simplicity of construction is a special feature. Point-to-Point wiring diagrams, instructions and parts lists, 1/9. Maximum building costs £4.19.6, inc. attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 8 1/2 x 5 1/2 in.



AM FM RADIOGRAM
 By leading manufacturer. Brand New. Cartoned with guarantee 4 wavebands including V.H.F. Auto-changes at 3 speeds. Hi-20-point pick-up. sapphire stylus pick-up. For 200-250 v. A.C. mains. 29/9 Gns. Limited stocks at a fraction of normal price. Credit Terms. Deposit £6.19.6 and 9 monthly payments of 3 gns. Carr. 10/-.
COMPLETE AUTO-CHANGER RECORD PLAYERS. 4-SPEED. By well-known manufacturer. Hi-fi crystal pick-up. Matched amplifier and speaker. Attractive, well-finished rexine covered cabinet. For 200-250 v. A.C. mains. Brand New. Cartoned. Limited number. List price well over **15 Gns.** Carr. 10/-. £20.

AM/FM RADIOGRAM CHASSIS HIGH QUALITY 6-8 WATT PUSH-PULL OUTPUT
 For 200-250 v. Mains. Long wave, Medium, F.M. and Gram. Complete with 8 B.V.A. valves. Guaranteed 12 months. Only 22 GNS. Or Deposit £2.12.0 and 9 monthly payments of £2.12.0.



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

High-Fidelity Push-Pull Amplifier with "Built-in" Tone Control. Pre-amp stages, high sensitivity, includes 5 valves (807 outputs). High Quality sectionally wound output transformer, specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut." Frequency response -3 db. 30-30,000 c/s. Six negative feedback loops. Hum level 71 db. down. ONLY 70 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and practically all microphones. Comparable with the very best designs.

For STANDARD or LONG - PLAYING RECORDS. For MUSICAL INSTRUMENTS, such as STRING BASS, GUITARS, etc. OUTPUT SOCKET with plug provides 300 v. 20 mA. and 6.3 v. 1.5a. For supply of a RADIO FEEDER UNIT. Size approx. 12.9-7in. For A.C. mains 200-250 v. 50 c/s. Outputs for 3 and 15 ohm speakers. Kit completely to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Unapproachable value, at £7/15 - or factory built 45/- extra. Carriage 10/-.

£7-15-0

If required louvred metal cover with 2 COLLARO RC54 3-SPEED AUTO-CHANGERS with Studio pick-up. Brand new. For 110 v. 50 c.p.s. A.C. mains. Price with 110 v. to 220-250 v. Auto Trans. only £5 19/6. Carr. 5/6.

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

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

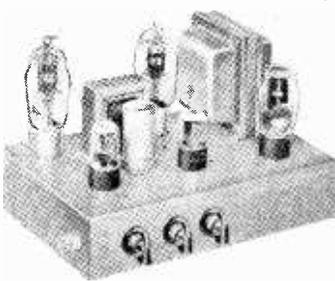
PICK-UP ARMS complete with HI-FI turnover crystal head. Acos GP54. Limited number brand new. perfect, at approx. half price. Only 29/9.

LG3 MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with above or any other single or auto-change units. Output for 2-3 ohm speaker. For 200-250 v. 50 c.p.s. A.C. mains. Overall size 6 1/2 x 4 1/2 in. Controls: Vol. and Tone with switch. Guaranteed 12 months. Only 55/9.

SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner Unit (specially suitable for use with any of our Amplifiers). Delayed A.V.C. employed. The W.Ch. Sw. incorporates Gram Position. Controls are Tuning, W.C. and Vol. Only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size of unit approx. 9.8-7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustration. 2/6. Total building cost £4/15/-. For descriptive leaflet send S.A.E.

LINEAR L45 MINIATURE 4.5 WATT QUALITY AMPLIFIER. Suitable for use with Collaro, B.S.R. or any other record playing unit, and most microphones. Negative 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 6.5-5.5in. high. Output for 2-3 ohm speaker. Guaranteed for 12 months. Only £5 19/6. Send S.A.E. for illustrated leaflet. Credit Terms. Deposit 22/6 and 5 monthly payments of 22/6.

LINEAR DIATONIC 10-14 WATT HIGH FIDELITY PUSH-PULL ULTRA LINEAR AMPLIFIER. For 200-250 v. A.C. mains. Valves ECC83, ECC83, EL84, EL84, E281 miniature Mullard. Self-contained Pre-amp. Tone Control stage, and separate Bass and Treble Controls. "Lift" and "Mike" and Gram input sockets are provided. Output Matchings for 3 and 15 ohm speakers. Only 12 GNS. - or Deposit 26/9 plus 10/- carr. and 9 monthly payments of 26/9. Send S.A.E. for leaflet.



carrying handles can be supplied for 18/9. Additional input sockets, with associated Vol. control so that two different inputs such as Gram and "Mike" or Tape and Radio can be mixed, can be provided for 13/- extra. Guaranteed 12 months.

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

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

R.S.C. 4.5 WATT A5 HIGH-GAIN AMPLIFIER

A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output



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

LINEAR STEREOPHONIC L33 3+3 WATT QUALITY AMPLIFIER



Output 6 watts when not used with stereo head. For 200-250 v. 50 c.p.s. A.C. mains. Ganged controls. Volume and Tone. Outputs matched by preset balance control. For use with 2 matched 3 ohm speakers. Only requires connecting to Pick-up speakers and mains point. Sensitivity 150 m.v. Supplied with guarantee and instructions. Send S.A.E. for leaflet.

7 GNS.

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

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, EF86, EF86, ECC83, 807, 807, G233. 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. If required cover as for A8 can be supplied for 18/9. The amplifier can be supplied, factory built with 12 months' guarantee, for £13-19-6. TERMS: DEPOSIT 36/9 and 9 monthly payments of 31/9.

11 GNS.

Carr. 10/-

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

LINEAR L745 HIGH QUALITY TAPE DECK AMPLIFIER. With "built in" power pack and output Ready for Stereo. For Tape Decks Use ONLY with High or Low Impedance. Playback and Erase Heads, such as Lane, Truvox, Collaro, Brennel. Carr. 7/6 etc. For A.C. Mains 200-250 v. 50 c/s. Linear frequency response of + 3 db. 50-11,000 c/s. Negative feedback equalisation. Illustrated leaflet 6d.

12 GNS.

R.C.A. 20 WATT RE-ENTRANT SPEAKERS, 15 ohms matching. For Outdoor work. Only 8 Gns. P.M. SPEAKERS. All 2-3 ohms, suitable for use with LG3, L45, A5 or A7 amplifiers. 5in. Goodmans, 17/9. 7 x 4in. Elliptical Elac., 19/9. 6in. Goodmans, 17/9. 8in. Rola, 19/9. 10in. R.A., 27/9. 10 x 6in. Elliptical Goodmans, 29/9. 12in. Plessey, 29 1/2. 10in. W.B. Stentorian "3 or 15 ohms type HF1012 10 watts, hi-fidelity type. Recommended for use with our A8 Amplifier, £4/10/9. 12in. Plessey 3ohms 10 watts (12,000 lines), 59/6.

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

ACOS HGP59 HI-FI Crystal Cartridges. (Turnover type with sapphire stylus.) Standard replacement for Garrard and B.S.R. Only 19/9.

R.S.C. 3.4 WATT A7 HIGH-GAIN AMPLIFIER

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

Terms: C.W.O. or C.O.D. No C.O.D. under £1. Post 10/- extra under £2; 9/- extra under £5.

RADIOSUPPLY CO. (LEEDS) Mail Orders to 29/31 Moorfield Rd., Leeds 12. Callers to 5 and 7 County (Mecca) Arcade, Briggate, Leeds 1. LTD.

C.R.T. ISOLATION TRANSFORMER

Type A. Low leakage windings. Optional 50% and 50% boost on secondary. 2 v. or 4 v. or 6.3 v. or 10.8 v. or 13.3 v. with mains primaries ... 12.6. Type B. Mains input. Multi Output 2, 4, 6.3, 7.5, 10 and 13 volts. Boost 25% and 50% Low capacity ... 21.7. Type C. Low capacity transformer for 2 volt Tubes with falling emission. Mains Primary. Output 2-21-21-3 volts at 2 amps, 176.

TRIMMERS. Ceramic. 30, 50, 70 pf. 9d.; 100 pf. 130 pf. 1/3. 250 pf. 1/6; 500 pf. 750 pf. 1/9. RESISTORS. Preferred values. 10 ohms to 10 meg. 1/4 w. 4d.; 1/2 w. 4d.; 1 w. 6d.; 1 1/2 w. 8d.; 2 w. 1.1. HIGH STABILITY. 1% w. 2 - Preferred values. 100 oh to 10 meg. 10 to 500, 100 pf to 5 meg. 1/3. 5 watt. WIRE-WOUND RESISTORS. 1/3 10 watt 25 ohms-10,000 ohms 1/6 13 watt 25 ohms-10,000 ohms 2.3 15,000 ohms-50,000 ohms. 5 w. 1.9; 10 w. 2.

12/6 PURETONE RECORDING TAPE

1,250 ft. on standard 7" Metal reels. Spare Reels 7" plastic, 4"; 7" metal, 2.3. SUPERIOR 1,260 ft. Plastic Tape on 7" Plastic Reels. Quality Guaranteed, 21. "Instant" Bulk Tape Eraser. 200 250 v. A.C. for any make or size of tape, 27.6.

O.P. TRANSFORMERS. Heavy Duty 50 mA. 4.6. Multiratio, push-pull, 7.6. Miniature. 38.4, etc. 4.6. L.P. CHOKES 15/10 H. 60/65 mA. 5.; 10 H. 85 mA., 10.8; 10 H. 130 mA., 14.4.

MAINS TRANSFORMERS 200 250 v. A.C. STANDARD. 250-0-250, 80 mA. 6.3 v. 4.5 a. tapped 1/2 v. 4 a. Rectifier 6.3 v. 1 a. 3 v. 2 a. or 4 v. 2 a. ditto. 350-0-350 ... 22.6 MINIATURE. 200 v. 20 mA. 6.3 v. 1 A. 10.6 MIDGET. 220 v. 45 mA., 6.3 v. 2 a. ... 15/6 SMALL. 220-0-220, 30 mA., 6.3 v. 3 a. ... 17.6 STANDARD. 250-0-250, 65 mA., 6.3 v. 3.5 a. ... 17/6 HEATER TRANS. 6.3 v. 11 amp. ... 7/6 Ditto, tapped sec. 2, 4, 6.3 v. 14 amp. 8/6 Ditto, sec. 6.3 v. 3 amp. ... 10/6

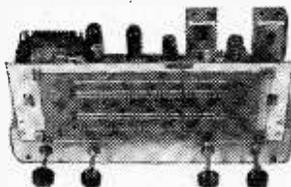
ALADDIN FORMERS and core, 1in., 8d.; 1in., 10d. 9.3in. FORMER 5807/8 and Cam TVI 2. 1in. sq. x 2 1/2in. and 1in. sq. x 1 1/2in. 2/- each, with cores. TYANA. -Midget Soldering Iron. 200/220 v. or 220 250 v. 16.8. Solon Instrument Iron, 24.-

MAINS DROPPERS. 3in. x 1 1/2in. All. Meters. 0.3 amp. 750 ohms. 4.3. 0.2 amp. 1,000 ohms. 4.3. LINE COED. 3 amp. 60 ohms per foot, 2 amp. 100 ohms per foot, 2-way, 6d. per foot, 3-way, 7d. per ft. LOUDSPEAKER P.M. 3 OHM. 2 1/2in. x 5 1/2in., 17.6. 5in. Plessey, 19/6. 7in. x 4in. Goodmans, 21.- 6 1/2in. Goodman, 18/6. 10in. K. A., 30.- TBL. Tweeter, 1.8/17. 8in. Plessey, 16.- STENTORIAN HF1012 10in. 3 to 15 ohm 10 v. 99/6-12in. Baker 15 watt 3 ohms, or 15 ohms, 105/- CRYSTAL DIODE G.E.C., 2/-. GEX34, 4.- HIGH RESISTANCE PHONES. 4,000 ohms, 4/6 per. MIKE TRANS. 50, 1.3/9 ea.; 100, 1.1. Portol 10.8 SWITCH CLEANER Fluid spirit, 4/6 4in. TWIN GANG TUNING CONDENSERS. 365 pf. miniature 1in. x 1 1/2in., 10/-, .0005 Standard with trimmers, 9/-, less trimmers, 8/-; midket, 7/6. SINGLE. 50 pf., 2/6; 100 pf., 7/-; 150 pf., 8/6. Solid dielectric 100, 300 pf., 3/6. SPEAKER FEET. Expanded Metal Silver, 1 1/2in. x 9 1/2in., 2/- each. GOLD CLOTH. 17in. x 25in., 5/-; 25in. x 35in., 10/- Tygan 4ft. 6in. wide, 10/-; 2ft. 3in. wide, 5/- ft.

All Boxed VALVES 90-day Guarantee.

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1959 RADIOGRAM CHASSIS THREE WAVEBANDS FIVE VALVES S.W. 16 m.-50 m. LATEST MULLARD M.W. 200 m.-550 m. ECH42, EF41, EB11, L.W. 800 m.-2,000 m. EL41, EZ40, 12-month guarantee. A.C. 200/250 v. 4-way switch; Short-Medium-Long-Gran. A.V.C. and Negative feedback 4.2 watts. Chassis 13 1/2 x 2 1/2in. Glass dial 12 1/2in. x 5 1/2in. horizontal or vertical 10in. x 4 1/2in. 2 Pilot Lamps. Four Knobs Walnut or Ivory. Aligned and calibrated. Isolated Chassis.

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UAS World's Finest 4-Speed Autochanger

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COLLARO Mixer Model RC456 HIGH-FIDELITY AUTOCHANGER 4-SPEEDS-10 RECORDS With Studio "O" pick-up BRAND NEW IN MAKER'S BOXES

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BUILD THIS REPRODUCER BARGAIN SINGLE PLAYER KIT Ready for immediate assembly.

4-speed Collaro "Junior" Unit, 44 12 6 Handson case, 17 1/2 x 13 1/2 x 7 1/2 in., with room to play 12 in. records ... 22 5 0 Ready-built 3-watt amplifier with two valves and loudspeaker, 23 12 6 or £9.15.0 complete kit post free. £8.5.0 extra with Garrard 4 Sp.

ALUMINIUM CHASSIS. 18 s.w.g. undrilled. With 4 sides, riveted corners and lattice fixing holes, 2 1/2in. sides, 7 x 4in., 4/6; 9 x 7in., 6/-; 11 x 7in., 6/8; 13 x 9in., 8/6; 14 x 11in., 10/6; 15 x 14in., 12/6; 18 x 16 x 3in., 16/6.

TRANSISTORS, GENUINE PYE GOLTOP. Audio, 15/-; R.F. (3 Mc/s average), 24/-. Complete data sheets supplied.

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CRYSTAL MIKE INSERT by Acos, precision engineered. Size only 1in. x 3 1/2in., 6/6.

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TELETRON "TRANSIDYNE" MIDGET SUPERHEAT PORTABLE 6" x 4" x 1 1/2" 6 transistors, printed circuit, Ferrite aerial. All parts and cabinet. £12.19.6. We include 8 Pye Goltop Transistors for maximum performance. Plans 9d.

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AUDIO PERFECTION

Designed to play 16, 33, 45, 78 r.p.m. Records 7in., 10in., 12in. Lightweight Xtl. pick-up. GC2 turnover head, two separate sapphire stylis.

OUR PRICE £8.0.0 each. Post Free. De luxe cabinet with amplifier and 6 1/2 in. speaker. £6.15.0 or complete kit, £14.10.0.

Volume Controls 80 ohm COAX

Long spindles. Guaranteed 1 year. Midget 3K, ohms to 2 M. Ohm No. D.P.S. 3/- Linear or Log Tracks. COAX PLUGS. 1 - DOUBLE SOCKET ... 1.3 SOCKETS ... 1 - OUTLET BOXES ... 4.6 BALANCED TWIN FEEDER yd. 6d. 80 x 200 ohms. DITTO SCREWED per yd. 1.1. 80 ohms only. WE-WOUND POTS. WATT. Pre-set Min. T.V. Type. All values 25 ohms to 50 K. x ea. 50 K. 4/-. (Carbon 50 K. to 2 m., 3/-) WIRE-WOUND 4 WATT. Pots 2 1/2in. Spindle Values, 100 ohms to 50 K. 5/6; 100 K. 6/6. CONDENSERS. New Stock. 100 mfd. 5 1/6. T.C.C. 5/6; Ditto, 50 K., 9/6; 100 pf. to 500 pf. Micas, 6d.; Tubular 500 v. .001 to .01 mfd., 9d.; .05, 1/1; .25, 1/8; .5/350 v. 1.9; 1,250 v. 8d.; .01 2,000 v. 1.9; 1 mfd., 2,000 volts, 3/6. CERAMIC COMES 50 K., 3 pf. to .01 mfd., 10d. SILVER MICA CONDENSERS. 10%, 5 pf. to 500 pf., 1/-; 600 pf. to 3,000 pf., 1/3. (Close tolerance ± 1 p.f.) 1.5 pf. to 4 pf., 1/8. Ditto 1%, 50 pf. to 815 pf., 1/8; 1,000 pf. to 3,000 pf., 2/-.

I.F. TRANSFORMERS 7/6 pair. 465 Kcs Sluk Tuning Miniature Can. 2 1/2in. x 1 1/2in. High Q and good bandwidth. By Pye Radio. Data sheet supplied.

Wearite M800 I.F. 465 Kcs. 12.6 per pair. Wearite 550 I.F. 465 Kcs. 12.6 per pair.

NEW ELECTROLYTICS. FAMOUS MAKES

Table with 3 columns: Tubular, Tubular, Can Types. Includes values like 1.350, 2.450, 4.150, 6.450, 8.300, 10.450, 16.300, 32.450, 50.225, 50.500, 50.500, 50.500.

SENTENCE RECTIFIERS. E.H.T. TYPE FLY-BACK VOLTAGE.

K/25 2 kv., 5/-; K/40 3.2 kv., 7/-; K/45 3.6 kv., 7/6; K/30 4 kv., 8/-; K/10 8 kv., 14/6. 50 v. caps. voltage 20% of above. MAINS TYPE ALUMINIUM 300 v. 65 mA. 7/6. CONTACT COELED 250 v. 50 mA., 7/6; 60 mA., 8/6; 85 mA., 9/6. 14RA1-2-3, 27/6. COILS Wearite "P" type, 3/- each. Osmor Midget "O" type add. 2/- each from 4/- All ranges. TETTRON. L. and M. R.F. with reaction, 3/6. FERRITE ROD AERIALS. M.W., 8/9; M.L., 12/6. T.R.F. COILS A HF, 7/- pair. H.F. PHONES, 2/6. FERRITE ROD tin x 3/8in. dia., 2/6.

JASON F.M. TUNER COIL SET, 26.-. H.F. coil, aerial coil, Oscillator coil, two I.F. trans.

10.7 Mc/s. Ratio Detector and heater choke. Circuit book using four 6X6, 2/6. COMPLETE JASON F.M. KIT WITH VALVES. £8.15.0. Fringe area kit, 22/6 extra. MULLARD 3-3 AMPLIFIER READY BUILT. Spare Power for Tuner, etc., £7.17.6.

FULL WAVE BRIDGE SELENIUM RECTIFIERS.

2, 6 or 12 v. 1 1/2 amp., 8/9; 2 a., 11/3; 4 a., 17/6. CHARGER TRANSFORMERS. Tapped input 200/250 v. for charging at 2, 6 or 12 v. 1 1/2 amps., 15/6. 2 amp., 17/6; 4 amps., 22/6. Circuit included. VALVE and T.V. TUBE equivalent. D.P. 5.0. TOGGLE SWITCHES. S.P. 2/-; D.P. 3/6. I.O.T. 4/-; WAVECHANGING SWITCHES 3 p. 4-way 2 wfer long spindle ... 6/6 2 p. 2-way, or 3 p. 2-way short spindle ... 2/6 3 p. 4-way, 4 p. 2-way, 4 p. 3-way long spindle ... 3/6 3 p. 4-way, or 1 p. 12-way long spindle ... 3/6

VALVEHOLDERS. Pax. Int. Oct., Ad. E150, EA50, 6d. B12A, CRT, 1/3. Eng and Amer. 4, 5, 6, 7 and 9 pin, 1/-.

MOLDED MAZZA and Int. Oct. 6d. BGT, 8SA, 8Bt, 9A, 9d., B7G with can., 1/8. 9A with can., 2/6. CERAMIC EF50, B7C, 8A, Int. Oct., 1/-; B7G with can., 1/9.

A MERRY CHRISTMAS TO ALL READERS OF "PRACTICAL WIRELESS" OUR WRITTEN GUARANTEE WITH EVERY PURCHASE. Please post Christmas Orders by 18th Dec.

RADIO COMPONENT SPECIALISTS 337 WHITEHORSE RD., WEST CROYDON OPEN ALL DAY - (Wed. 1 p.m.) Catalogue 6d.

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PRACTICAL WIRELESS

EVERY MONTH
VOL. XXXIV, No. 625, JANUARY 1959
COMMENTS OF THE MONTH

EDITOR : F. J. CAMM

26th YEAR
OF ISSUE

BY THE EDITOR

Hire Purchase and Rental Changes

THE Government's decision to withdraw all regulations governing the amount of deposit or rental in advance has caused a rush to buy new receivers. It has been agreed that there should be a minimum of 10 per cent. deposit on hire purchase and credit sale arrangements and the maximum period of not more than two years for completion of payment. It has also been decided that there should be at least eight weeks' rental in advance. Unemployment in the radio and TV industry is bound to be considerably reduced as a result of the abolition of H.P. and rental regulations. The new demand will encourage manufacturers to tool up for new designs in time for this year's radio show.

KIT SETS

THE moment seems opportune for the reintroduction of the kit sets which were so popular before the war. We are referring to such kit sets as the "Melodymaker", and the "Music Magnet", sponsored by two large companies. They sold in their thousands and we believe that they would still sell in considerable quantities. We believe that a kit V.H.F. set would find a ready market.

THE "P.W." AND "P.T." FILM SHOW

IF you have not already done so, there is still time for you to apply for a free ticket for our film show which takes place at the Caxton Hall, at 7.30 p.m. on January 22nd. Three films will be shown dealing with the transistor, the manufacture of junction transistors, and a colour film entitled "The Conquest of the Atom." There will be an interval for refreshments which will also be provided free. The meeting will be under my chairmanship. Mark applications for tickets, "Caxton Hall" in the top left-hand corner. The meeting is being arranged in conjunction with Messrs. Mullard Ltd. You are entitled to bring your friends but you must, of course, apply for a sufficient number of tickets.

INDEXES

A REMINDER that indexes to each volume of this journal are published annually at 1s. 3d., by post. Send orders to The Publisher, George Newnes, Ltd., address as on this page.

CONTRIBUTIONS

WE welcome contributions from our readers on any practical aspect of radio, such as set or instrument construction, coil making, and so on. Articles should be about 1,500 words in length and be accompanied by photographs, rough sketches, list of components, sources of supply, and theoretical and wiring diagrams. Where possible, we should like to have the apparatus for test and photographs. Such contributions are paid for immediately on acceptance. The price paid depends of course on the work involved, but is at a high rate. Please write or type on one side of the paper only.—F. J. C.

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

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

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ROUND THE WORLD OF WIRELESS

Broadcast Receiving Licences

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

Region	Total
London Postal	1,016,632
Home Counties	1,018,227
Midland... ..	750,274
North Eastern	927,905
North Western	714,031
South Western	623,549
Wales and Border Counties ...	388,752
Total England and Wales ...	5,439,370
Scotland	661,729
Northern Ireland	175,885
Grand total	6,276,984

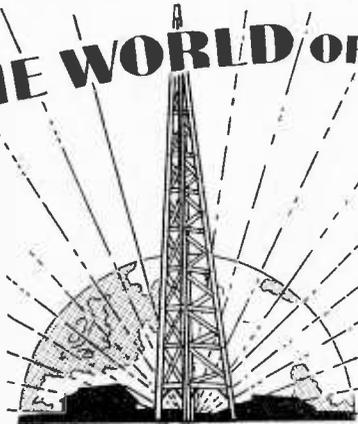
R.C.A. Monopoly

IN a recent action in the U.S. an anti-trust suit brought against the Radio Corporation of America has been settled by negotiation. The R.C.A. were accused of creating a monopoly by the use of patents and they are now to grant licences under its patents on a non-discriminatory basis. It is reported that the Government estimate that about 12,000 patents are affected, about 100 of them dealing with colour television.

E.M.I.'s Computer Training Course

SO great has been the interest shown in Emidec 1100, the new digital computer, that E.M.I. Electronics Ltd. has organised a series of training courses at Hayes for programmers from customers' staffs and for other interested executives. This is an intensive, practical course which, after introductory lectures on such matters as machine characteristics and flow charting, quickly gets down to cases. Each computer function is studied in detail and typical applications are mentioned throughout the course.

A special feature is the large proportion of exercise periods



By "QUESTOR"

(over one-third), during which at least four tutors are present, and the class is limited to about 15 students, so individual attention is assured during these important periods. The course includes tours of several E.M.I. factories including, amongst others, those where computers and magnetic tapes are manufactured.

Emidec training courses last for three weeks. Several places have already been reserved for the next course, which starts on 12th January, 1959, and this aspect of E.M.I. Electronics' activities is likely to increase during the coming months.

New Marconi Directors

MR. F. N. SUTHERLAND, C.B.E., M.A., M.I.E.E., for eleven years General Manager of Marconi's Wireless Telegraph Company Limited, has been

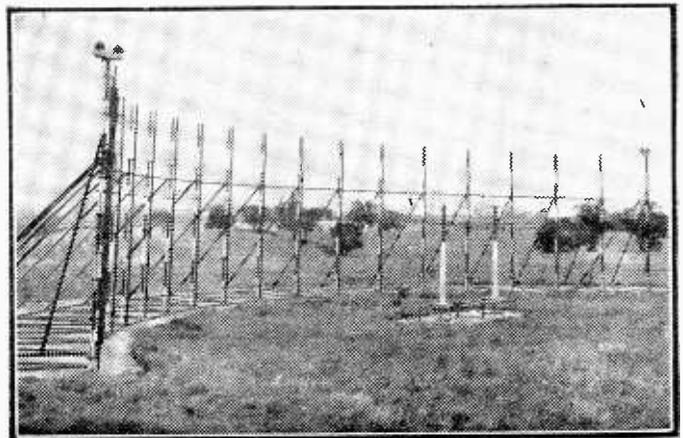
elected to the Board of Directors of the Company and appointed Managing Director with effect from November 5th. He has also been elected a Director of Marconi Instruments Limited.

Mr. Paul de Laszlo, O.B.E., who has been associated with the Marconi Group of Companies for a number of years has also been elected to the Boards of Directors of Marconi's Wireless Telegraph Company Limited and Marconi Instruments Limited with effect from November 5th.

Tax Relief on Subscriptions to Brit.I.R.E.

THE Council of the British Institution of Radio Engineers has advised members that under Section 16 of the Finance Act, 1958, the whole of the annual subscription paid by a member who qualifies for relief under that section will be allowable as a deduction from his emoluments assessable to income tax under Schedule E.

Particular attention is drawn to the fact that applications will only be accepted provided that the subscription is defrayed out of the emoluments of the office or employment. It is a further condition that membership



The interesting aerial used for blind landing. (See next page)

should be relevant to the office or employment of the claimant, that is to say, the performance of the duties of the office or employment is directly affected by the knowledge concerned or involves the exercise of the profession of radio engineering.

Moon Bounce Signals

THESE signals have been received by at least 30 people, and possibly 60 or more, according to the U.S. Army Signal Engineering Laboratory at Fort Monmouth, N.J., which is aiming radar signals at the moon with 1.2 megawatts of radiated power.

Responses to its Diana project have come from the U.S., Europe and Latin America, a laboratory spokesman said. The moon radar has been operating on frequencies of 108 and 151.11 Mc/s and the laboratory has been sending QSL cards to amateurs who report the conditions under which they have received the signal.

During December, the moon radar pulses will be on 413.25 Mc/s. Readers who pick up the signals may send a listeners card to Diana, c/o Radio-Electronics, 154 W. 14 Street, New York 11, N.Y. The information will be forwarded to the Signal Corps and will be acknowledged with a moon radar QSL card.

Next B.I.R.E. President

THE Council of the British Institution of Radio Engineers takes pleasure in announcing that the President-elect for 1958-59 is Professor E. E. Zepler, who occupies the Chair of Electronics at the University of Southampton. His election will be confirmed by members at the Institution's Annual General Meeting on November 26th, when he will give his presidential address.

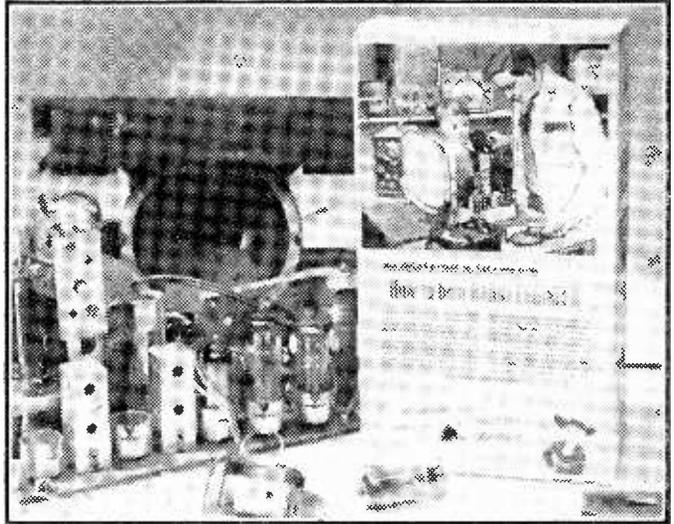
How to be a Radio Engineer

HOW to be a Radio Engineer is the title on the back of a packet of One-Minute Quaker Oats. It is one of a series of twelve careers featured for this winter. The article gives a few basic facts about radio engineering, indicates openings for a qualified radio engineer and explains about the length of training.

It is often difficult for parents

to find out about careers other than those they have met with themselves, and it is therefore a valuable service that Quaker Oats Limited are supplying. On the back of every pack there is

for the completion of the landing. The work of the Blind Landing Experimental Unit is mainly concerned towards eliminating the final phase of the landing.



Careers have proved so popular as pack backs that Quaker have decided to continue this for a further year.

the address of an authoritative body on that particular career from whom more information can be obtained.

The careers series was first introduced by Quaker Oats Limited in 1956. It has proved so popular, both with schools and the appropriate organisations, as well as with parents and children, that they have decided to continue this service for a third year.

Aids to Landing

RECENTLY representatives of industry and of the Services attended demonstrations of automatic landing equipment and visual aids to approach and landing developed by the Blind Landing Experimental Unit of the Royal Aircraft Establishment, Bedford.

The modern civil airliner carries equipment which, used in conjunction with ground based radio beam systems, enables approaches to be made down to a height of about 150 feet above ground level, the automatic pilot being used to fly the aircraft. From this height, the pilot must depend upon visual approach and landing aids

New radio guidance systems have been developed which provide the necessary accuracy to enable aircraft to be landed under completely automatic control.

E.M.I. Three-day Conferences

A RECORD Production Managers' Conference and a Recording Engineers' Conference were held simultaneously at E.M.I., Hayes, Middlesex, recently. The object of both conferences was to maintain close liaison between the E.M.I. group of companies.

Visitors from overseas were amongst the representatives of E.M.I.'s world-wide organisation—the largest of its kind in existence—who met to discuss both trade and technical developments in the recording field.

Mr. J. B. Stevenson, director, engineering and personnel, E.M.I. was in the chair at the Production Managers' Conference.

Mr. F. J. Camm

MR. F. J. CAMM has been elected Vice-President of the Institute of Practical Radio Engineers.

Servicing Without Instruments

FAULT FINDING AND REPAIRS FOR THE BEGINNER

By Gordon Cole

ALTHOUGH accurate test instruments are absolutely essential in the service department where a large number of sets having a diversity of faults are dealt with each week, it is truly surprising just how much can be done without them, aided only by one or two odd items which are nearly always present in the experimenter's den. This is not to suggest that one could start a full-time repair business along these lines, but if the faulty set is the property of the enthusiast it is his own personal responsibility if he decides to try to repair it.

There are those so-called "sticky" faults which require a battery of instruments to locate. The experimenter may eventually find that such a fault is present on his receiver, and for this reason it is as well not to interfere unnecessarily with the wiring and trimmers. If a connection is broken for the purpose of a simple test, it should be made good immediately following the test. Also, if it is decided to alter a trimmer, its original setting should be marked in some way so that it can be restored if the alteration does not give the

stops working, then there is little doubt that the trouble can be found without instruments and without replacing all the components one by one until the culprit is discovered. This article deals essentially with this kind of fault, and it is assumed that the experimenter is a regular reader of "Practical Wireless" and has a fair understanding of circuits. If the circuit diagram of the defective receiver is available so much the better, but this is not essential. It will assist if the experimenter has available a valve data book or leaflet giving the pin connections of the valves used in the set.

Heater and Mains Circuit

In the event of complete failure, the first thing to do is to check whether or not the valves are alight when the receiver is switched on and connected to the mains supply. If they are not alight, the trouble lies somewhere in the mains supply or heater circuit.

Start with the mains socket and check for mains current with an ordinary household lamp. Follow the test right up to the input of the receiver; check at the mains side and the receiver side of the on/off switch (see Fig. 1). If power is present at the set side of the switch further investigation inside the receiver is required; if it is present at the mains side but not at the set side the switch is faulty and its replacement will effect a cure; if it is not present in the receiver at all, a check should be made of the mains lead and all plugs and sockets. There may be fuses in the circuit at the set or plug—sometimes one

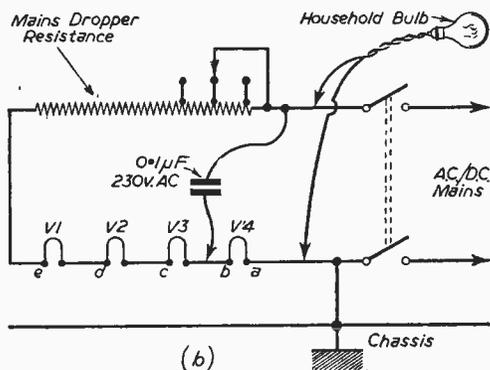


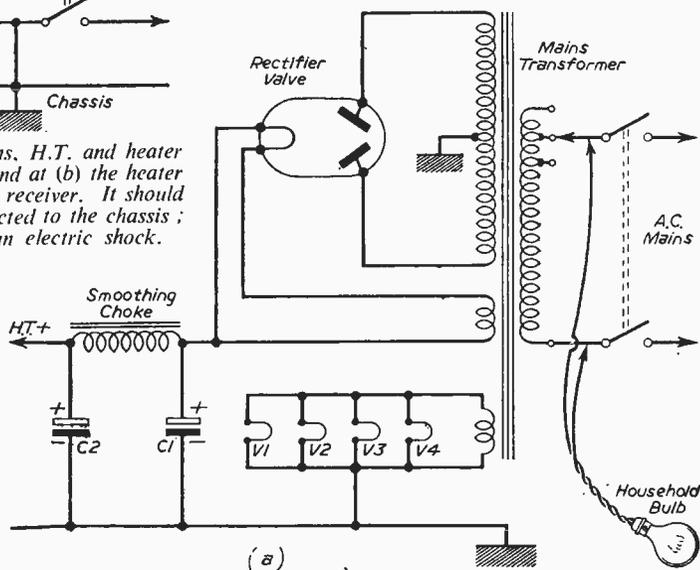
Fig. 1.—At (a) is shown the mains, H.T., and heater circuits of an A.C. only receiver and at (b) the heater and mains circuit of an A.C./D.C. receiver. It should be noticed that the mains is connected to the chassis; care must be taken to avoid an electric shock.

required effect.

Complete Failure

Dealers and their engineers are not very happy to accept sets for servicing which have been severely altered. There is also the question of cost; it is obvious that to put right faults other than that which caused the receiver to fail in the first place will increase the overall cost of the repair.

If the receiver suddenly



in each lead—and these should be checked with a battery and bulb or by substitution. If replacements blow when the set is switched on, then a short almost certainly exists in the mains or H.T. circuit of the receiver.

If the receiver has a mains transformer, as do most of the A.C.-only type, and the heaters of all but one valve are alight, the inactive valve may well have an open-circuit heater. This can be checked by applying the appropriate voltage (or less) across the heater pins. A check for heater power at the heater tags on the valve holder is possible by momentarily shorting the tags with a fairly thick piece of wire; a spark will be observed if power is available, but if the short is prolonged the heater wiring will burn out.

If all the valves are not lit in an A.C.-only set, a check for heater power should be made across the two wires from the heater winding of the mains transformer, Fig. 1(a). A high resistance soldered connection often accounts for lack of heater power, and it should be remembered that one side of the heater circuit is usually connected to the chassis.

In most receivers, the rectifier valve heater is energised from a separate winding on the mains transformer, so there is a possibility that this valve may be alight while the remainder are inactive. If all the valves but the rectifier are alight, then the rectifier valve heater and the power supply can be tested as detailed above.

A.C./D.C. Receivers

All the heaters are connected in series in receivers of the A.C./D.C. variety, and failure of one will mean that none light, Fig. 1(b). Open-circuiting of the mains dropper resistor will also give the same symptom, so some means of simple testing is called for. A method which has been practised by the author requires a capacitor of 0.1 μ F 250 volts A.C. working. If such a capacitor is connected across the mains supply there is always a small spark when the connection is made, which is a good indication of mains voltage and can be used on the heater test.

If one side of the capacitor is connected to the heater circuit as shown in Fig. 1(b) and on the other side is connected an insulated flylead, the flylead can be connected in turn to points a, b, c, d and e along the heater line. Power is present at point a because the mains current was checked at the receiver side of the on/off switch with a bulb, but if we check here again with the capacitor we shall have some idea of the size of the spark to expect. If a spark occurs at a, but not at b, then it is fairly clear that V4 heater is open. Similarly, if a spark occurs at a and b but not at c, then V3 heater is open; a spark at c but not at d would indicate open-circuiting of V2 heater, while a spark at d but not at e would indicate open-circuiting of V1 heater. If a spark also occurs at e, then the mains dropper resistor is open.

Owing to the relatively high reactance possessed by the 0.1 μ F capacitor at 50 c/s, there is no danger of damaging the heaters of the good valves by this test, but it is not a good idea to use a capacitor above this value as the surge current may rise to a high level. This test takes a few

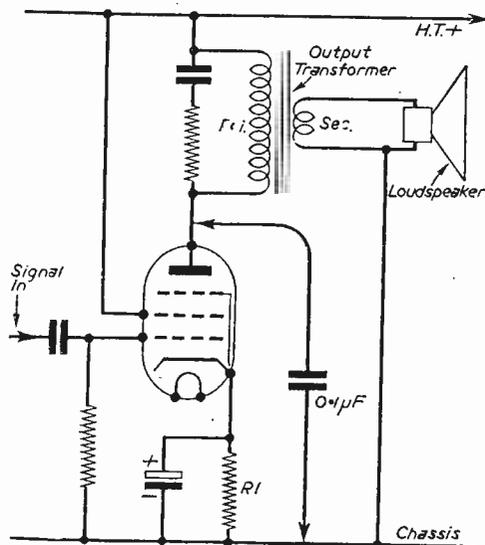


Fig. 2.—A typical output stage.

words to describe, but is fairly rapid in practice once the heater circuit has been established in the receiver under test. Of course, the valve heaters can be checked with a battery, but many different voltages are usually needed with A.C./D.C. valves.

More Simple Tests

Suppose the valve heaters are alight and the receiver is dead. The first thing to do is to observe carefully the inside of the receiver for any signs of overheating. If a resistor quickly rises to a high temperature and the surface starts frying, there is a short in that circuit somewhere which is causing a high current to flow into the resistor. For the time being, suppose that there is no undue disturbance inside the receiver.

The next thing to do is to put an ear close against the loudspeaker grille and listen for mains hum. If it can be established that there is no sound at all from the loudspeaker, the trouble almost certainly exists in the loudspeaker itself, or in the H.T. supply circuit or in the output stage.

Testing the temperature of the rectifier valve (assuming that a valve is used) and of the output valve with the fingers gives quite a lot of information. If the rectifier valve is very hot and the anodes are glowing a dull red, there is a short-circuit probably at the cathode or heater of the valve. Under this condition, the output valve would be relatively cool since it would be starved of H.T. owing to the short.

The most likely cause would be a short in the electrolytic reservoir capacitor, which is the one connected directly to the cathode or heater of the rectifier (C1 in Fig. 1(a)). The best way of checking is to disconnect the capacitor completely and then switch the set on again. If the rectifier operates at normal temperature and the receiver works with a loud hum, replacing the capacitor will cure the trouble; if it is a dual unit, it is best

to replace the whole as the other section will fail eventually.

On an A.C./D.C. receiver, such a short would be likely to cause visible sparking around the cathode. There is also the possibility that a short in the rectifier is responsible; in this case the trouble would exist with the suspect capacitor disconnected.

If a short exists in the smoothing capacitor, C2, Fig. 1(a), the rectifier would overheat as in the previous case, but to a smaller degree, since the current is limited by the resistance of the smoothing choke or filter resistor. The choke or resistor would also tend to overheat; in fact, the resistor may well start smoking owing to the excessive current, but the lower resistance of the choke would load the H.T. circuit and possibly reduce the voltage sufficiently to avoid overheating of the component, though the rectifier would suffer.

If both the rectifier and the output valve are of reasonably normal temperature (they normally operate fairly hot) the H.T. voltage is probably normal, and its presence can be checked either at the cathode of the rectifier or on the H.T. line by connecting an 8 μ F electrolytic capacitor between the H.T. point and chassis, observing the correct polarity of the capacitor (negative to chassis). On connection a spark will be seen (and heard). The capacitor will then be charged and should be discharged across the chassis, when again there will be a spark.

The Output Stage

Having established the presence of H.T. look at the output valve when the receiver is switched on. If the screen grid is glowing red, this is indicative of lack of H.T. on the anode, and one of the main causes of this is an open-circuit of the primary winding of the output transformer (see Fig. 2). In some sets, however, there may be a capacitor connected between the anode and chassis, and a short in this would have the same effect, whilst at the same time loading the H.T. supply and causing an excessive current to flow in the transformer primary, but this would give rise to a hum from the loudspeaker.

If the valve looks normal, the loudspeaker circuit can be checked by connecting an 0.1 μ F capacitor between chassis and the valve anode, Fig. 2. On connection of the capacitor a surge of current will occur in the transformer primary and this, under normal conditions, will cause a click in the loudspeaker. The capacitor will charge, and will have to be discharged before the test can be made again. If this action does not

cause the expected effect, then the loudspeaker should be checked with a battery. The loudspeaker should be disconnected from the secondary of the transformer and across its terminals should be connected a 3-volt torch battery. A crackle will be heard if the loudspeaker is in good order. The soldered connections on the units should be examined, as also should the loudspeaker muting switch, if fitted, and the connections on the transformer.

The faults detailed above cover those which would prevent a slight mains hum from the loudspeaker, though there is one more possibility and that is a short in a capacitor which may be connected across the output transformer primary. Usually, as in Fig. 2, a resistor is connected in series, so that a capacitor short would not remove the hum completely.

The next move is on to the control grid of the output valve. Touching this with a screwdriver should incite a click from the loudspeaker. A better test can be made by arranging a buzzer hook-up as shown in Fig. 3. If the test leads are connected between chassis and the control grid, a loud buzz should be heard from the loudspeaker if the output stage is working. This will almost certainly happen if the valve is operating at normal temperature and the previous tests prove positive.

Failure to inject a signal into the set at this point can be caused only, in addition to the faults given above, by (a) a break in the screen grid connecting lead; (b) emission failure of valve (in this case it would not be hot) and (c) open circuiting of the cathode resistor R1.

The consideration so far dealt with was a receiver which suddenly failed to perform. Simple methods for testing the mains and heater circuits and the output stage without instruments have been fully described. Attention will now be focused on the audio-frequency and detector stages, and the sections prior to the detector, including the mixer and oscillator of superhet receivers.

A Word of Warning

Before continuing, however, we would emphasise that all sets of the A.C./D.C. variety and certain A.C.-only models feature a connection direct from one side of the mains supply to the chassis. There is, therefore, a fifty-fifty chance of the chassis being "live" to earth—that is if it happens to be connected to the "live" side of the supply. Under this condition a severe electric shock may be had by touching the chassis, especially if the operator happens to be standing on a slightly damp stone or concrete floor and wearing shoes which are not adequately insulated, or if an "earthed" object, such as touched with the other hand or other part of the an electric fire, soldering iron or bench lamp, is body at the same time as the chassis.

It is always best to be on the safe side and either isolate the receiver completely from the supply by means of a 1:1 ratio transformer or ensure that the chassis is in connection with mains neutral.

(To be continued)

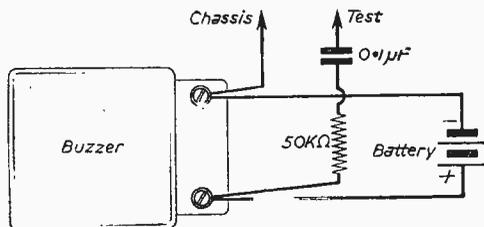


Fig. 3.—A buzzer set-up for test purposes.

A Low Price Quality Amplifier

VARIABLE FEEDBACK IS USED TO CHANGE THE INPUT SENSITIVITY

By T. W. Dresser

MOST articles on audio amplifiers start with the assumption that those who will read it wish to fill a large hall with sound. Experts will tell you that the mean level of electrical input to a normal type speaker in a moderately sized hall of, say, 4,000 cubic feet in volume will be around 50 milliwatts, and as peak amplitudes are 20 to 25 db above the mean level it follows that the available power output from the amplifier must be about 15 watts. This statement is accurate, no doubt, but few of us want to fill a hall with sound; all we require is a high enough level to be pleasant in our living room and following as faithfully as possible the original performance.

Sensitivity

The amplifier to be described will deliver approximately 5 watts of output for an input of 0.05, 0.1, 0.25 or 0.5 of a volt according to the position of the bypass capacitor in the cathode circuit of the first stage. In other words, variable current feedback on this valve makes the gain of the stage adjustable in four steps. With the capacitor switched to position 1 (across the whole of the cathode resistor chain) there is no feedback and the stage operates with full gain. In this position 0.05 v. will load the amplifier fully. Connecting the capacitor to the second position reduces the stage gain by 7 db and 0.1 v. will be required to fully load the amplifier. With the capacitor switched to the third position the gain is reduced by 14 db and an input of 0.25 v. is now needed for full output. Finally, in the fourth position the capacitor is entirely out of circuit and full feedback is provided. The gain is now cut down by 20 db and the input required to give the full output is now 0.5 v. This flexible arrangement is of decided advantage when, for

instance, it is necessary to test a number of different pickups, or where different inputs such as from a pickup or radio are required.

After the variable gain first stage which uses a 6J7 or a 6SJ7 valve the remainder of the circuit is quite conventional. The signal is fed through a volume control to the grid of a 6J5, to which negative feedback from the secondary winding of the output transformer is applied, and is then passed on to the output stage, a single 6V6, through a regular resistance-capacity coupling arrangement. No tone control circuits are included as such circuits usually reduce the overall gain and, in any case, the application of negative feedback will almost certainly straighten out any variations in response it was intended to introduce by means of the tone control circuits.

Chassis and Components

The amplifier is built on an aluminium chassis 9in. X 5½in. X 2½in. of 14 or 16 gauge half hard metal bent into a standard box shape, and the parts are placed as shown in Fig. 1. The theoretical diagram is given in Fig. 2. All the components are readily obtainable and many of them may be bought from ex-service dealers. Probably the only exception is the output transformer, which must be of rather better construction than is usual in small amplifiers, as it has to handle a much greater range of frequencies. Provided it is a good make and not the cheap, small type, the frequency response will be no more than about 1 db down from the 1 kc/s level at 50 cycles and at 12 kc/s.

Negative Feedback

On completion the amplifier should be thoroughly tested. Firstly, the feedback loop should be disconnected from the output transformer secondary. The reproduction should then tend to be shrill, particularly if a small speaker is being used, but the amplifier, nevertheless, should be perfectly stable. With the loop reconnected, next check that the amplifier is not in self oscillation. This can happen if the loop is connected to the wrong side of the secondary winding of the O.P. transformer, as the feedback will then be positive and not negative. In fact, oscillation is then almost inevitable. Reversing the loop and earth connections to the transformer secondary winding will remedy this fault. The resultant slight drop in volume and the improvement in fidelity clearly indicates the correct way of connecting the loop.

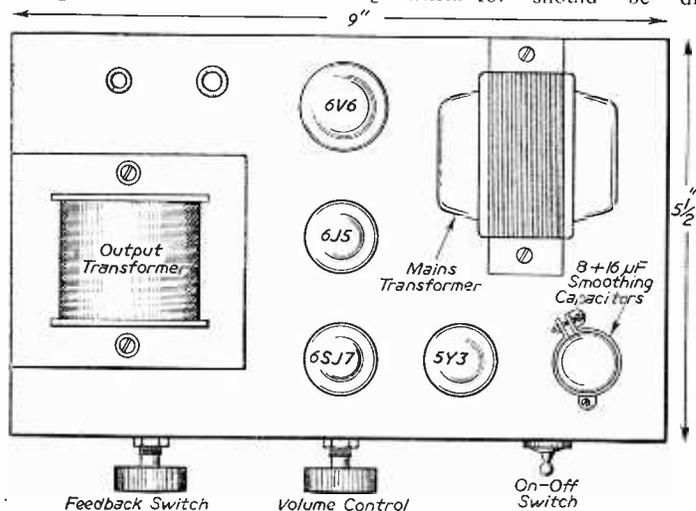


Fig. 1.—Showing how the parts are placed on the aluminium chassis.

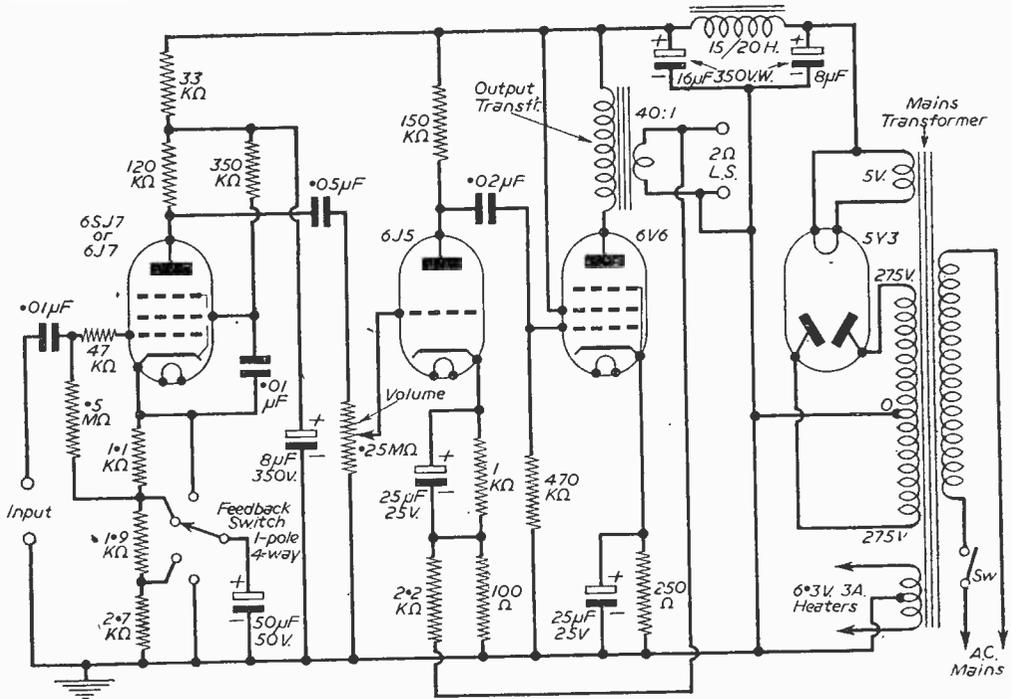


Fig. 2.—The theoretical diagram.

Another source of trouble, which may occur in this and in other audio amplifiers where feedback is employed, is a form of supersonic oscillation, usually noticed as a persistent hiss. That this type of oscillation is present can be determined by inserting a milliammeter in the H.T. positive line, noting the reading, and then shorting the transformer secondary leads together. If the reading then changes, this form of oscillation is present and should be dealt with by connecting a 100 to 250 pF condenser from the anode of the 6J5 to chassis. This particular trouble is much more likely to occur with pentode valves than with triodes, however, and there was no trace of it in the original amplifier.

It is possible that some readers may wish to increase the feedback, either to reduce the overall gain, or for other reasons of their own. This is easily done by reducing the value of the existing feedback resistor. However, if a very great change is made, the output impedance will also be altered and it may be necessary to readjust the output ratio to match the speaker voice coil. That is the only reason for the use of a multi-ratio output transformer. If there is no intention of experimenting with the feedback or of using a speaker with a different voice coil impedance from the usual 3Ω, a standard pentode output transformer will serve just as well and prove considerably cheaper, although, as has already been stated, it should be of the type designed specifically for high fidelity purposes.

In conclusion, the cost of the amplifier will be found to be very reasonable and the results more than satisfactory, having regard to the outlay.

Books Received

HIGH FIDELITY: A BIBLIOGRAPHY OF SOUND REPRODUCTION. First edition compiled by K. J. Spencer, A.L.A. Published at 30s. by Iota Services Ltd., 38, Farringdon Street, London, E.C.4.

This work of reference will be of value to those who wish to be able to consult quickly and easily most of the material which has been published on various aspects of high fidelity—from definitions to installation and maintenance. It is intended to publish supplements from time to time.

THE PRACTICAL ELECTRICIAN'S POCKET BOOK 1958 EDITION. Edited by Roy C. Norris. Price 6s. postage free. Published by Odhams Press Ltd.

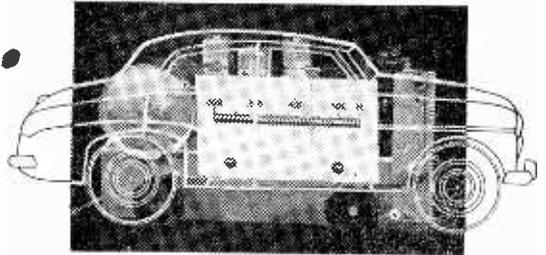
Two features of this edition of the "Little Red Book" illustrate how it covers both the everyday problem and the wider interests of those in the electrical contracting industry. One is a new section—more concise, more practical—on motors, the other is an explanation of the electronic computer.

RADIO VALVE DATA: Characteristics of 3,000 valves, transistors, rectifiers and C.R. tubes. Sixth edition. Price 5s. net (postage 9d.). Published by Hiffe & Sons Ltd. Size 11in. × 8½in. 136 pages.

A feature of this edition is that the valve base connection codes have been included in the index, as well as being retained in the main tables.

A 12v. Valve-Transistor Car Radio...

IN THIS SECOND ARTICLE DETAILS OF THE TRANSISTOR OUTPUT STAGE ARE GIVEN
By R. Morgan



AS the 12K5 and 12 v. H.T. supply does not provide sufficient power for usual loud-speaker volume a transistor output stage is employed, and this also runs from the vehicle accumulator without any need for higher voltages. An output of over 2 watts may be achieved, which is sufficient for normal speaker reception.

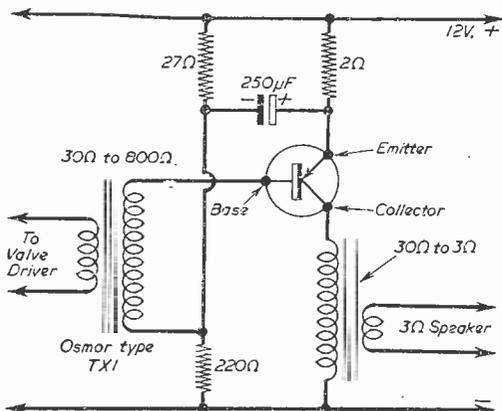


Fig. 1.—Circuit for output stage using Pye V30/20P.

Fig. 1 shows a circuit for the Pye V30/20P transistor, with base input and speaker coupled to the collector in the usual way. The transformer windings must be able to carry the required current, and the driver may employ 40 s.w.g. for primary, with 30 s.w.g. for secondary. Using a M. & E.A. (Magnetic & Electrical Alloys Ltd.) No. 21 square stack, in accordance with the data provided for "Brimar" valves by Standard Telephones & Cables Ltd., this would require 1,200 turns for primary, with 158 turns for secondary, the laminations being fitted with no air gap, but not interleaved.

The output transformer can be auto-wound, with 400 turns, tapped at 126 turns for a 3 ohms speaker, 24 s.w.g. wire being used on a M. & E.A. No. 74 square stack, with a 5 mil. air gap.

Fig. 2 shows a circuit for the Mullard OC15 transistor. With a 14 V. supply, the collector current is given as 475 mA and base current as

6 to 30 mA, with 1.14 to 1.37 base voltage. The 1.8 ohms resistor should preferably be wire-wound in the interests of stability. Mullard suggest R1 be a pre-set wire-wound resistor. R2 consisting of the valve heaters, as the relatively large current in the two sections of the potential divider R1 and R2 helps stability. Two separate resistors may be used, as in Fig. 1. A 6 ohms pre-set for R1, with 40 ohms value for R2, may be used. Higher resistance values will reduce current consumption in the divider, but maintain a less stable base voltage.

When installing the receiver, a 3 or 5 amp. fuse should be included in circuit to protect the accumulator, etc. It may be necessary to reverse connections to the secondary of the driver transformer to secure the best phase working between transistor and output stage.

The Heat-sink

Several watts are dissipated at the collector, and an excessive rise in temperature will cause damage. A heat sink, or heat-conductive mounting is used to combat this, and serves to keep the transistor cool. Fig. 3 shows how the OC16 is mounted on the heat sink, mica insulating washers being necessary to avoid electrical shorts. The heat sink can be of 2 mm. or more thickness, with an area of some 50 sq. in. (say, 5in. × 10in.).

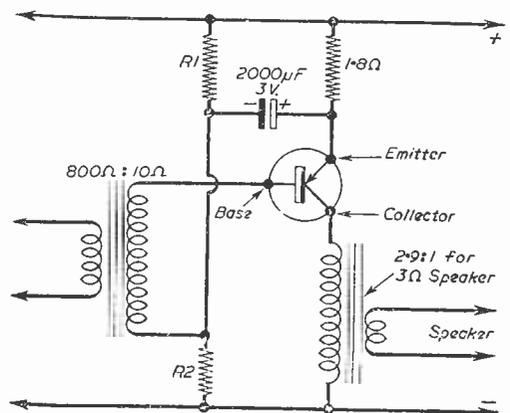
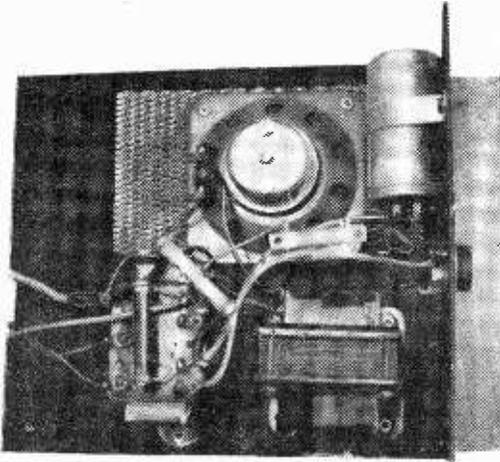


Fig. 2.—Circuit using Mullard OC15.

Blackened aluminium is recommended, and the metal may be bent to form back and sides of a speaker enclosure. It should not adjoin valves or other items generating heat, and air circulation is necessary to keep down temperature during prolonged running.

The transistor temperature depends considerably upon the air temperature, and it is thus wise to be fairly generous in the size of the heat sink.



Layout of the parts for the output stage.

For the OC16, a power dissipation of 6.9 W. is listed for an ambient temperature of 25 deg. C., with 2.9 W. for 55 deg. C., with a 4in. X 7in. metal plate sink. It will thus be seen that the limits of safe running very much depend on temperature. In less favourable conditions, such as proximity of warmed metal, lack of air circulation, etc., an increase in the size of the plate would be necessary.

The Loudspeaker

The loudspeaker can be of the usual permanent magnet type. The very small speakers intended

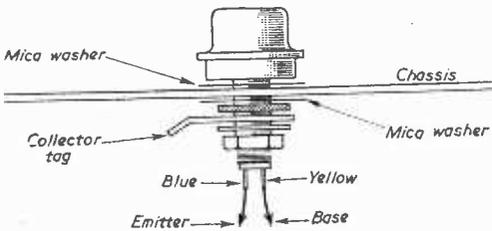


Fig. 3.—Mounting of the OC16.

for battery portables are usually not able to handle sufficient power and are not satisfactory, but any 3½in. to 5in. model able to handle some 2 to 3 watts, and of the correct impedance for the transformer, will suit. A small cabinet or baffle board is necessary for the speaker for best results.

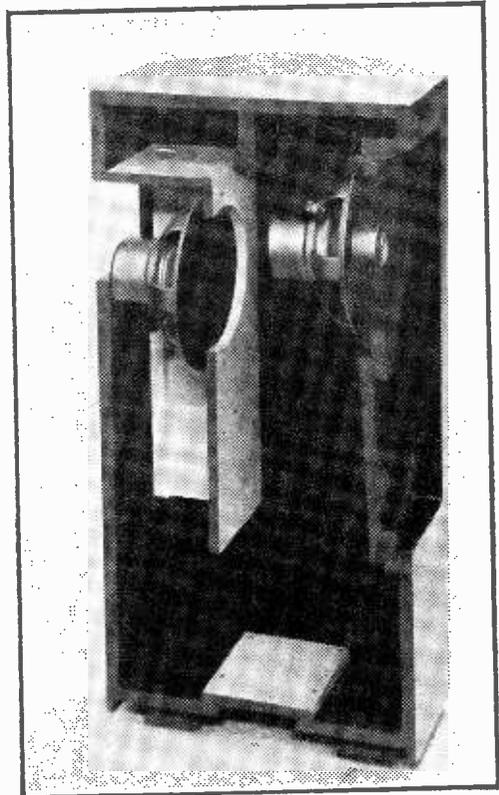
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New G.E.C. Speaker

At the 1958 Autumn Audio Fair, The General Electric Co. Ltd. gave a demonstration of stereophonic sound using a new loudspeaker system, the "Periphonic Octagonal." Developed by Hugh Brittain at the Company's Wembley Research Laboratories, the cabinet is based on the original G.E.C. octagonal enclosure but has an entirely new port-loading system which incorporates the periphonic principle. Particularly suitable for stereophonic operation and identical in appearance with the existing octagonal design, the enclosure can also be used in a simple form with one metal cone loudspeaker only.

Fully Periphonic

The enclosure has a volume of 3.6 cu. ft. and is loaded by means of an inside-mounted rectangular pipe. A rectangular port opening at the rear of the cabinet is placed at approximately the same height as the front speaker, and loading by the port extends the bass response to below 30 c/s. A second metal cone loudspeaker is mounted inside the pipe to operate in push-pull with the first, thus forming a periphonic system. By this means the second harmonic distortion at 30 c/s. is reduced from 3 per cent. (with one speaker) to 1½ per cent. (two speakers).



A sectional view of the new G.E.C. speaker.

MAKING OHM-METERS

THIS ARTICLE DEALS WITH THE THEORETICAL AND PRACTICAL ASPECTS OF DESIGN

By J. S. Kendall

IN radio, television and electronic work there are three basic measurements, those of voltage (more accurately, potential difference), current and resistance. Whilst most multi-range measuring instruments measure voltage and current, a resistance range, if included, usually only covers the range of 1,000 ohms to 500,000 ohms. Often, it is wished to measure lower values of resistance, such as those of inductances, and this may not be possible even with a comprehensive multi-range ohm-meter.

stocked them and then normally only in the range of 10 ohms to 10 megohms. One firm of wholesalers—Kendall & Mousley Ltd.—does stock 1 per cent. high stability resistors from 1 ohm to 10M ohms, and your local dealer should be able to obtain your requirements within a matter of days. This firm also stocks 1 per cent. wire-wound resistors of higher wattage rating than the carbon type. It is a great advantage if the lower value resistors have a high wattage rating; for example, with the 1 ohm 1W resistor the maximum voltage drop permissible is only 1 volt, and if a 0 to 5 voltmeter is used the deflection is only 20 per cent. of full-scale, which may be detrimental to accuracy. If a 5W type is used, double the deflection can safely be obtained with the meter, and with a larger safety factor. When the resistor under test is thought to be larger than it really is, it is possible to attempt to pass a far heavier current through the standard that it is intended to take. Frequent or prolonged overloading of standard resistors will seriously impair their accuracy.

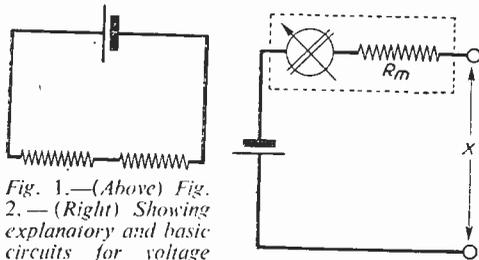


Fig. 1.—(Above) Fig. 2.—(Right) Showing explanatory and basic circuits for voltage comparisons.

Voltage Comparison

For the measurement of very low resistance a voltage comparison is useful. The unknown is measured against a known standard by the comparison of the voltages developed across each when they pass the same, steady, current. In Fig. 1 there is a battery in series with two resistors, and therefore the same current flows in each. If one resistance is a 1 per cent. standard, then it is possible to measure the resistance of the other by the ratio of the voltages across the resistors. (It will be remembered that the voltage developed is found by multiplying the resistance in ohms by the current in amperes—Ohm's Law.)

In a usable version of this meter, three, four or five standards can be used, and the most useful are 1, 3, 10, 30 and 100 ohms. The voltmeter used for the measurement of the voltage ratio draws current itself, and so introduces a small error. If the meter has a full-scale deflection (F.S.D.) of 1 mA, on, say, the 5 volt range with a 1 ohm standard, then with 1 volt developed across the standard there will be a maximum error of one part in 5,000. This may be ignored. But, with a 100 ohm resistor with 5 volts across it a maximum error of 2 per cent. will result. This error is a maximum because the reading in each case will be lower than the true value and the two errors will tend to cancel each other.

Wattage Rating

In designing these meters the chief consideration is to ensure that the wattage rating of the resistors used as standards is not exceeded. Until recently, 1 per cent. resistors were only available at a reasonable price in carbon; very few firms

The Circuit

The practical circuit is shown in Fig. 3. It consists of a battery—say, of 3 volts; a "bank" of suitable standard resistors—three only are shown; two pairs of terminals; a set/read switch and a range selector switch. The set/read switch can be obtained from Bulgin and the selector switch from K. & M. The voltmeter is connected to the two terminals marked "M." The polarity must be correct. In one position of the switch the voltage across the standard is measured and

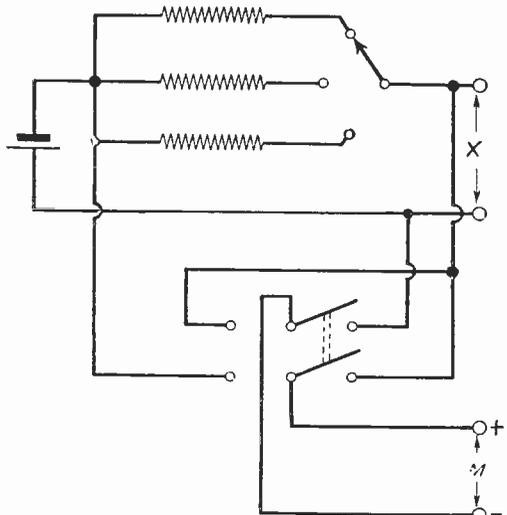


Fig. 3.—Circuit for an uncompensated ohm-meter.

in the other the voltage across the unknown. The mounting of the meter and the components can best be left to the constructor.

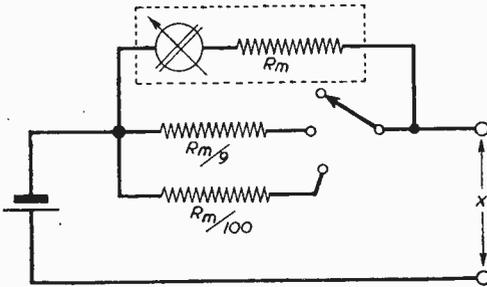


Fig. 4.—(Above) Circuit with several ranges.

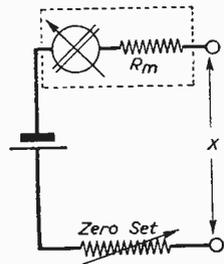


Fig. 5.—(Left) Incorrect circuit for a compensated ohm-meter.

The calculation for the resistance is as follows:—

Let V_1 be the voltage across the unknown and R_x be the ohmic resistance of the unknown and R_1 that of the standard. Then $R_x = \frac{R_1 V_1}{V_2}$.

The device is simple to make, and once made proves a valuable piece of equipment.

An Uncompensated Ohm-meter

In these days of government surplus one can buy a small voltmeter quite cheaply. These meters often have a high full-scale current. It may, for example, be a 0-10 voltmeter and draw 10 mA full scale, and thus be of little use for most radio purposes. It can, however, be used, with a suitable battery, for the measurement of resistance. The voltmeter can also be made from a surplus milliammeter. (Previous articles in PRACTICAL WIRELESS have dealt with such conversions.) For the calibration of the unit, charts are made and stuck into the lid of the meter case. Since these charts have to be calculated, convenient values of meter resistance are of great assistance. For example, a meter of 10 mA full-scale current and 10 volts full-scale deflection will have a resistance of some 1,000 ohms. A 9-volt meter of the same F.S.D. would have a resistance of 900 ohms and most people would prefer to multiply by 1,000 than by 900. Difficulty occurs where the movement to be used has some odd resistance such as $333\frac{1}{3}$ ohms. Better by far here not to use the $333\frac{1}{3}$ ohms, but a convenient fraction: $\frac{1,000}{3}$ ohms. A simple ohm-

meter is shown in Fig. 4. It consists of a voltmeter (shown as equivalent to a movement having no resistance, in series with a resistor, R_m , which has a value equal to that of the movement's actual resistance) and a battery. The voltage of the

battery should be slightly lower than that giving the F.S.D. of the meter. Several charts for differing battery voltages will have to be calculated as the voltage of the battery will not remain constant during its life. For example, a 9-volt battery has six cells. The voltage of each of these when new is 1.55 volts. Thus, a new 9-volt battery will probably give a reading of 9.3 volts.

A voltmeter really measures the current flowing through a resistance. If, in the circuit of Fig. 3, a resistance is joined across the two terminals marked "X," the total current through the meter will be less than if the terminals "X" were short-circuited. Thus, the reading, in volts, on the meter will be the actual voltage drop across the meter. The difference between this reading and the one taken across the battery (by short-circuiting terminals "X") is the voltage across the unknown resistor. If, then, V_1 is the reading with the terminals short-circuited and V_2 the reading with the unknown in the circuit the voltage across the unknown will be $(V_1 - V_2)$. The current through the meter, I , will be given by dividing the voltage (V_2) by the resistance of the meter (R_m). Thus $I = \frac{V_2}{R_m}$ and $R_x = \frac{(V_1 - V_2)}{I}$;

$$\text{therefore } R_x = \frac{V_1 - V_2}{\frac{V_2}{R_m}} \text{ or } R_x = \frac{R_m (V_1 - V_2)}{V_2} \text{ ohms.}$$

$$\text{or } R_x = \frac{R_m (V_1)}{V_2} - 1 \text{ ohms.}$$

A typical calculation follows: a meter of 1,000 ohms resistance is used with a battery of 9.1 volts (i.e., $V_1 = 9.1$); V_2 is found to be 6.7 volts. Therefore, the value of the unknown is $\frac{1,000 (9.1 - 6.7)}{6.7}$.

This gives 358 ohms, a figure which has the unfounded ring of high precision. The standards used were perhaps accurate within 1 per cent., the meter within 2 per cent. Thus, the reading can only be accurate at best to, say, plus or minus 5 per cent. and the actual resistance will be between about 340 and 376 ohms. The figure can be rounded off and the result given as 360 ohms. This, while reasonably accurate, does not give the false impression of high accuracy.

The meter can be made to read several ranges

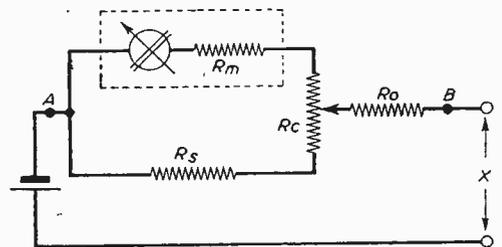
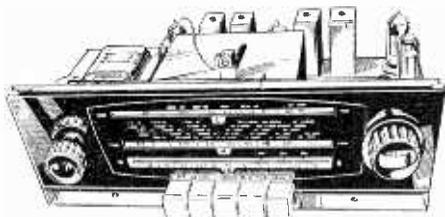


Fig. 6.—Correct circuit for a compensated ohm-meter.

of resistance by the use of shunts across the meter. The low resistance limit is set by the smallest deflection that the meter can record, and by its internal resistance.

(To be continued)

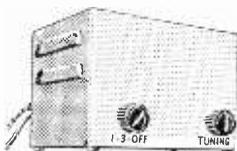
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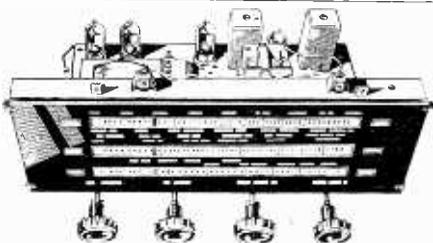
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Xenon Power Supplies

CONSIDERATIONS IN THEIR DESIGN AND OPERATION

By E. G. Bulley

XENON rectifiers are today becoming popular and will no doubt find their way into the gear of the radio transmitting amateur. Unlike their mercury vapour counterparts, they can be operated in almost any position, this being an advantage for many applications. These valves are constructed from high quality materials and great care is taken in their manufacture to avoid contamination by dust and grease, etc.

Physically, many xenon valves are comparable in size to mercury vapour rectifiers and are based with standard caps, so if the need arises, plug-in replacements for mercury vapour valves will be available as time goes on.

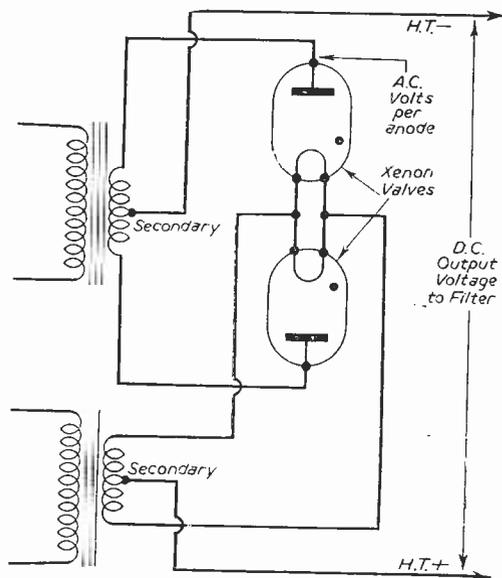


Fig. 1.—Basic xenon rectifier circuit. Note.—Secondaries of heater transformer must have adequate insulation for voltages greater than the maximum peak inverse voltages.

Operating Conditions

The operating conditions of xenon rectifiers must be such that their maximum ratings are never exceeded. The filaments or heaters must not be operated in excess of their rated voltage, otherwise the emissive properties of the oxide coating on the cathode or heater will be destroyed. Note that too low a heater or filament voltage will result in low emission and often produce cathodic sputtering.

Xenon rectifiers have a much shorter heating time compared with mercury vapour rectifiers, the reason being that the xenon gas pressure within the valve remains more or less constant

over the ranges of temperature encountered. The temperature limits of many xenon rectifiers are usually between -55 and $+75$ degrees C. Adequate ventilation must, therefore, be provided.

Ratings

The maximum peak inverse voltage specified for xenon rectifiers must never be exceeded otherwise the destruction of the valve will result. The maximum peak inverse voltage is the highest peak voltage that the rectifier can safely withstand in the direction opposite to that in which it is designed to pass current.

The relationships between the peak inverse voltage, D.C. output voltage and the applied A.C. voltage ratings for xenon rectifiers when used in full-wave single-phase circuits, are given in the following paragraph. A basic xenon rectifier circuit is shown in Fig. 1.

The transformer secondary voltage, that is the A.C. voltage to each valve anode, is equal to 0.353 multiplied by the peak inverse voltage (P.I.V.) of the rectifier, and the D.C. output voltage to the filter is equal to 0.9 multiplied by the A.C. voltage at each rectifier anode, or 0.318 multiplied by the rated peak inverse voltage. The peak inverse voltage of each valve is equal to 2.83 multiplied by the A.C. anode voltage. The maximum average load current is equal to twice the maximum average anode current rating per valve, remembering that there are two rectifiers in the circuit.

These relationships do not take into account the voltage drop in the transformer and filter choke windings when under load conditions, nor the voltage drop across the valves which in the case of xenons is approximately 12 volts.

The constructor should now have a basis on which to design a power supply as and when xenon rectifiers become readily available to him.

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LOUDSPEAKER MATCHING

AN EXPLANATION OF AN IMPORTANT ASPECT OF AMPLIFIER DESIGN

By K. Royal

MUCH is said about the power output of amplifiers. Let us see what is really meant by this term. Electrical power is measured in watts (W) and is dependent on the current (I) and the voltage (E) (more accurately, potential difference) in the circuit in which the power is developed.

Take a 1,000 Ω resistor and connect it across a 100-volt battery, as in Fig. 1. If the current is measured it will be found to be 0.1 amp., which is what would be expected according to Ohm's Law, which states that $I = E/R$. Excluding the resistance of the wires and the battery, we have 0.1 amp. in the 1,000 Ω resistor and 100 volts across it. The resistor will get hot because the power in it is being dissipated in the form of heat. The power can be computed by multiplying the potential difference across the resistor, in volts, by the current, in amps. Thus, $W = E \times I$ and from Ohm's Law, the power in watts is also equal to E^2/R and $I^2 \times R$. In the simple example in Fig. 1, therefore, the power in the resistor is 10 watts, and this will be found to work out by using any of the three equations.

Audio Power

Now let us consider a 15-watt audio amplifier. Let us suppose that this has a 15-ohm output resistance (impedance to be theoretically correct) and that the loudspeaker is removed and in its place is connected a 15-ohm resistor. If a signal of constant tone is applied to the amplifier and the controls are adjusted to give the full 15

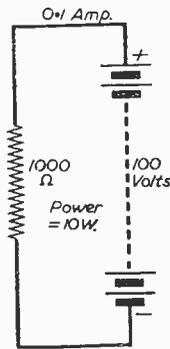


Fig. 1.—A simple resistive circuit in which 0.1 amp. flows through the resistor when a potential difference of 100 volts is across it. Under these conditions, the resistor dissipates a power of 10 watts.

watts output, an A.C. voltmeter connected across the resistor will read 15 volts, while a series-connected ammeter will register 1 amp. These values conform to the above equations in relation to 15 watts. Indeed, this represents a good way of assessing the power output of an amplifier, that is, by removing the loudspeaker, employing a resistor of suitable value in its place and then computing the output from the E^2/R formula.

It should be ensured that the resistor is adequately rated to withstand the full power of the amplifier, otherwise there is a likelihood of its going open-circuit and causing the amplifier to operate without a load. This is a dangerous condition and may well result in failure of the

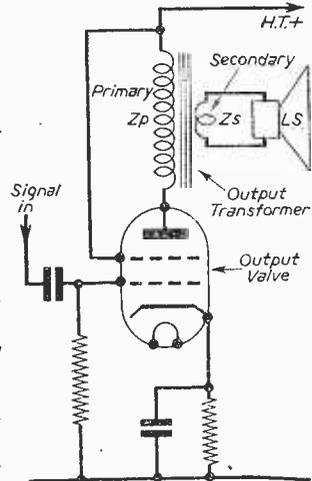
output transformer owing to an uncontrolled rise in audio voltage across its primary winding.

Output Valve/Loudspeaker Coupling

Any thermionic valve is a high resistance device. This means (a) that it has to be loaded with a high resistance circuit, and (b) that the signal current in its anode circuit is limited to fractions of an amp.: to milliamps. The signal voltage in the anode circuit, however, is fairly high.

The formulæ relating power to voltage and current show that for a constant power the volt-

Fig. 2.—A simple output stage in which the coupling from the valve's anode circuit is by way of the output transformer. The turns ratio of the transformer to provide maximum power to the loudspeaker with least distortion is equal to $\sqrt{Z_p/Z_s}$, where Z_p is the optimum anode load value of the valve and Z_s is the impedance of the loudspeaker.



age can be increased and the current decreased or that the voltage can be decreased and the current increased. Fortunately, this change-about can be achieved by means of a transformer, and from the aspect of the output stage means that the high voltage and low current of the signal in the valve anode circuit can be transformed to low voltage and high current in the loudspeaker circuit. Moreover, the transformer serves to reflect the correct impedance to the anode circuit from the low impedance of the loudspeaker. The transformer thus acts as an impedance matching device and the current and voltage change-about is complementary to this function.

Let us investigate the simple output stage in Fig. 2. Here, as is normal, an output transformer couples the anode of the valve to the loudspeaker. The primary of the transformer has a large number of turns of fine wire since it is called upon to handle only a small current. The secondary winding, on the other hand, has fewer turns of heavy gauge wire to handle a larger current.

In a transformer without losses, the step-down in voltage and step-up in current from the

primary to the secondary is equal to the turns ratio. This means that if the signal across the primary winding of a transformer with a 10:1 turns ratio is 100 volts, only 10 volts will appear across the secondary winding. Similarly, if the primary current is, say, 0.01 amp., the secondary current will be 0.1 amp. The current rises in the same ratio as the voltage falls.

Impedance Transformation

In the output stage the primary winding is connected in the anode circuit of the output valve, and the impedance reflected across this winding is that of the loudspeaker modified by the transformer turns ratio.

The turns ratio can be expressed as the number of turns on the primary divided by the number of turns on the secondary, or N_p/N_s . If Z_s is used to represent the load impedance across the secondary, then the impedance reflected across the primary (Z_p) is equal to $(N_p/N_s)^2 \times Z_s$. This means that if the load impedance is 15 ohms and the turns ratio is 10:1, the impedance across the primary will be 1,500 ohms.

Now, in order to secure maximum audio power from the output valve, the impedance reflected across the primary winding should equal the optimum anode load value of the valve. Such values are given in valve data books and leaflets.

The 6V6G, for example, has an optimum load of 5,000 ohms, and if a 5-ohm loudspeaker is used with such a valve the transformer turns ratio has to be arranged so that the 5-ohm loudspeaker reflects 5,000 ohms across the primary.

Turns Ratio

The turns ratio required can easily be discovered by altering the expression given above to produce: $N_p/N_s = \sqrt{Z_p/Z_s}$. In the case given, Z_p is 5,000 ohms and Z_s is 5 ohms, so the turns ratio (N_p/N_s) is equal to $\sqrt{5,000/5}$, which works out to about 32:1. This formula can be used to calculate the turns ratio required for any impedance matching application.

In practice the nearest ratio to that calculated is suitable, for there is a certain degree of tolerance in view of the fact that pure resistance is

not really representative of the loads. They are, in fact, reactive since they comprise inductance and capacitance as well as resistance. Nevertheless, at one particular frequency they are virtually resistive, and it is at that frequency that the turns ratio as calculated matches. The frequency is usually 400 or 1,000 c/s.

There are available so-called "universal" output transformers which have tappings to allow the turns ratio to be adjusted to suit the particular valve. There are also transformers which can be used to match a loudspeaker of almost any impedance to the output impedance of an amplifier. In this latter case, the turns ratio is considerably less than that of transformers actually

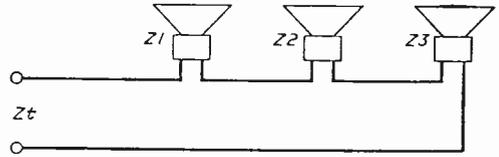


Fig. 4 (Above).—The total impedance (Z_t) of series-connected loudspeakers is equal to $Z_1 + Z_2 + Z_3 + \dots$

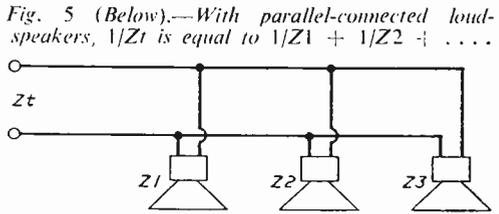


Fig. 5 (Below).—With parallel-connected loudspeakers, $1/Z_t$ is equal to $1/Z_1 + 1/Z_2 + \dots$

connected in the anode circuit of the output valve, for such a transformer is already included and the matching transformer has to transform a small impedance ratio, possibly from 600 ohms to 15 ohms or 15 ohms to 3.5 ohms.

Experimenters may have available an output transformer of unknown turns ratio and wish to utilise it in a radio or amplifier circuit. The turns ratio can be discovered quite simply by applying a known A.C. voltage across the primary winding and then measuring the voltage across the secondary. The idea is shown in Fig. 3 where a mains transformer is used to reduce the voltage applied to the transformer under test. No more than about 50 volts A.C. should be applied otherwise the transformer may overheat and burn out. The transformer ratio is equal to the voltage across the primary divided by the voltage induced across the secondary. For example, if 1 volt is measured across the secondary as the result of 50 volts across the primary, then the transformer has a turns ratio in the region of 50:1.

Multiple Loudspeakers

As with resistors, the resultant impedance when a number of loudspeakers are connected in series is equal to the sum of the impedances. This is shown in Fig. 4, where $Z_t = Z_1 + Z_2 + Z_3$, etc. With loudspeakers connected in parallel, as in Fig. 5, $1/Z_t = 1/Z_1 + 1/Z_2 + 1/Z_3$, etc. (cf. parallel-connected resistors). (Cont. on p. 915)

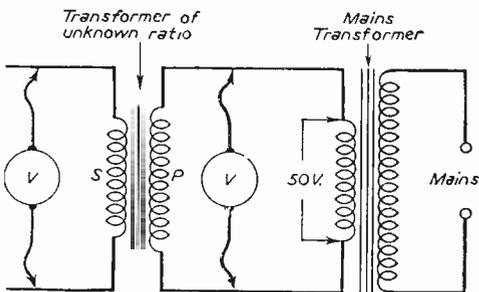
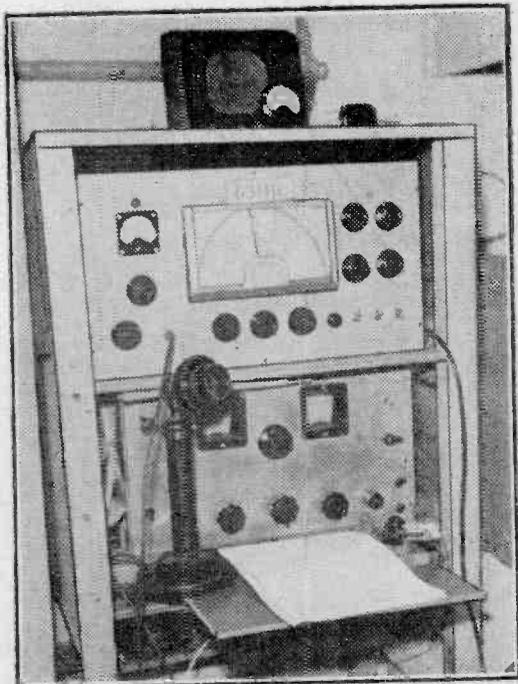


Fig. 3.—The turns ratio of a transformer can be discovered by applying a known A.C. voltage across the primary and measuring the voltage across the secondary. The turns ratio is equal to the primary voltage divided by the secondary voltage.

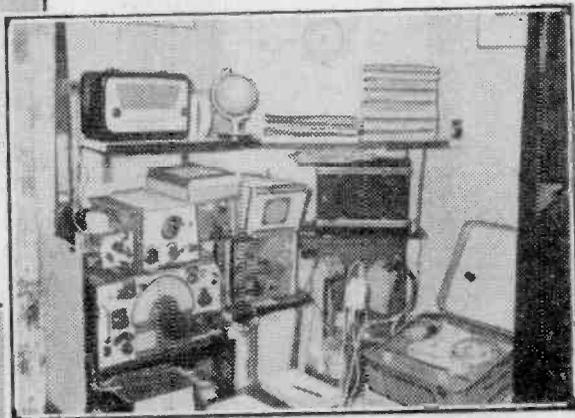
Readers' Radio Demos



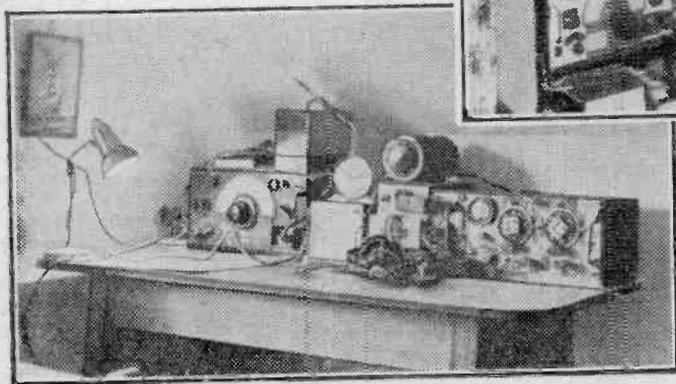
(Above).—Amateur station G8UA, owned by Mr. H. Tee, Burnley, Lancs. It has been designed to take up as little space as possible.



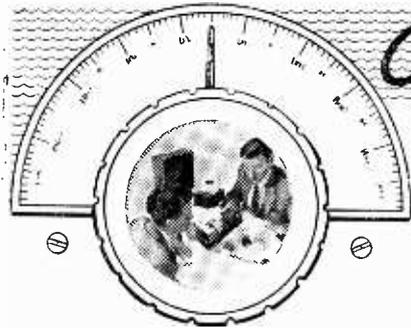
(Above).—The radio shack which is run by Warrant Officer Langfield (G3VHC), of the R.A.F., Finningley. The transmitter is a 50 W. "Vanguard," and the receiver is a rebuilt Hammerlund.



(Above).—The variety of gear which is owned by Mr. D. O. G. Sutherland, of Edinburgh. He has QSL cards confirmed in 42 countries.



(Left).—This shows the den of Mr. Derek Gibson, of Lyme Regis, Dorset, which is situated in the corner of his room.



On Your Wavelength

BY THERMION

What is a Farntin?

I SEE that the *Sunday Times* is augmenting my attack on the sloppy pronunciation used by some of the announcers on the BBC. In a recent issue it said: "More and more announcers seem to be developing the Portland Place twang. What is a sperksman? Who is Minny People? Where is Ulgeria? And do they have Farntins? Who are the proprarters? What is a trarl? I append my glossary: spokesman; many people; Algeria; fountains; proprietors; trial. The nastiest moment of all is when they tell you that Miss Pat Smythe has just come into the ring on a perny." Collecting these weird, and in some cases ignorant, pronunciations has become almost a national hobby since I started my attacks over 20 years ago. The utterers of these mispronunciations give me the impression that they are trying to give the listening audience an impression of their erudition. In other words, they are hiding their ignorance. Even Alvar Liddell during the war years could not pronounce his name correctly. When he was reading the news, he shot it into the ether as Al Varleydell. Try making a collection for yourself and let me have them. It is only by publishing them that we may rag the announcers into reforming their ways. Send lists in an envelope marked BBC and include where possible the name of the announcer or artist concerned. The I.T.A. announcers are just as bad.

Readers' Radio Dens

I HAVE received a large number of photographs of readers' dens in response to my request. I ought perhaps to add a note regarding the photograph of Mr. L. J. Short's receiver published on page 792 of the December issue. His photograph shows an interesting collection of early gear. The receiver was one of the Peto Scott unit receivers, very popular in the early twenties. There was a home-made solenoid tuner unit and next to it a honeycomb coil holder with swinging coupling adjustment. I am indebted to Mr. A. G. Chapman, of London, S.E.12, for pointing this out.

Preferred Values

ONE of our advertisers points out that when they quote readers for lists of parts they refer to our circuits and are "amazed" that we permit the use of spot-on values for resistors. They say that many of the values prescribed are

not available. Some readers do not understand preferred values and thus friction is caused when they are only able to supply a preferred value and the readers insist upon our specified value. It must be remembered that the criticism refers to designs submitted by readers and not those produced in our own workshops. The readers concerned have probably obtained the components from ex-W.D. equipment, and give the exact value. I cannot too strongly stress, however, that very few radio resistances and condensers are of critical value, and preferred values, that is to say, nearest values to those specified, are quite adequate and should be accepted.

Stop Those Serials

IT is time that serial programmes such as *Educating Archie*, the *Archers of Ambridge* and *The Barlows of Beddington* were taken off the air. There is something unnatural about them. As an attempt to picture family life they are unreal and gutless. They do not reflect in their dialogue the sort of conversations and interests which take place in family life. *Mrs. Dale's Diary* is a particularly bad example, and *The Archers of Ambridge* merely indicate what a boring and witless lot they are. I cannot see why it is necessary to use a ventriloquist in *Educating Archie*, as in a sound broadcast the dialogue could be spoken by two real people. Yet year in and year out, these programmes are continued as serials without end. Amen! I am certain that listeners are bored to death with them.

You remember the story of the nagging housewife who had laid sausages on the table for her husband's dinner on Thursday night. He expressed disapproval of them and the wife commented: "I gave you sausages on Monday, and you liked them, you had sausages on Tuesday, and you liked them, you also had sausages on Wednesday, and you did not complain. How come that on Thursday night you do not like sausages?"

And as a hint to the script writers, break away from the stupid alliterative titles and if you do write any fresh dialogues, write them more naturally and let your characters be natural.

L.P. Sales

THE production of 45 r.p.m. continues to show improvement at the expense of 78 r.p.m. One million, seven hundred thousand were sold in June. This was rather more than in June, 1957. No less than 10.5 million were produced in the January-June, 1958, period, which is 89 per cent. higher than the previous year. Comparable figures for 33½ r.p.m. were 7.7 million, 78 r.p.m., 17.5 million, which is 30 per cent. lower. On this basis, it is seen that 78 r.p.m. will die out in about 10 years' time.

The Use of Tag Strips

AND GROUP ASSEMBLY BOARDS

By J. Hallett

THE radio experimenter may on occasion wish to change an amplifier from the rough prototype form, with its soldered joints in the air to a neat efficient layout. Most of us have found time and time again that whilst the original worked well, the neat version did not. Perhaps the circuit seemed all right until the volume was turned up—then the loud notes just “barked.” Perhaps the output valve just ran red

The group board has the disadvantage that longer leads have to be used. In the days of octal valves, the tags on the valve holders were quite capable of supporting the components. For example, it was common for the bias electrolytic capacitor to be soldered between an earth tag and the valve-holder tag, and the resistor soldered across the capacitor. Now the more modern valve holders, in many cases, will not take the weight of the components. However, if one uses one of the better class of holders, one still has a tag that will take quite an amount of weight. Since the average circuit using one valve only uses two resistors and two capacitors there is no real need to use the group board, it is with the multiple valves—such as a double triode—that group boards are required.

Basic Double Triode Circuit

The circuit shown in Fig. 1 is just a simple double triode circuit and looks like an amplifier. It can, by the incorrect use of the group board, be turned into an oscillator. We have assumed that the cathode circuits are taken to suitable earthing points, and that a six-way group board is available. Normally the two parts of a double triode are on opposite sides of the valve base. Thus in Fig. 2, due to bad positioning on the group board, leads cross the base of the holder and then run parallel. There will be capacity between the leads, and if that capacity is from the anode of one valve to the grid of the same valve it applies negative feedback, which stabilises the circuit and reduces the stage gain. On the other hand, if it is from the anode of one valve to the grid of the preceding valve then it is positive feedback. This, if sufficient, will cause the circuit to oscillate.

In Fig. 2, R1 is followed by R4, the leads are long and run across each other, and in other cases run parallel. Thus it will be realised that there is a small amount of capacity between R1 and R4, so that in effect the circuit is converted to the

(Continued on page 889)

Fig. 1.—A double triode circuit.

hot—until its cathode resistor burnt out. Resistors that had been cool ran hot. Voltages and currents changed. Everything was different.

The Group Board

The trouble is not in the group board but with the manner in which it has been used. Output valves are very fussy, and if their anode, screen and grid leads are left long parasitic oscillation will occur. This type of trouble can often be cured by the use of “stopper” resistors. These are just resistors which are soldered as close to the valve pin as is possible, by that it is meant that the wire on the resistor is cut down to about $\frac{1}{2}$ in. long, and that the short end of the wire is soldered direct to the valve holder. All leads must be taken to the end distant from the valve holder. The values used must be as high as possible without upsetting the circuit. A resistor in the screen lead can cause an amount of negative feedback, whilst one in the output circuit can cause a reduction in output. The values normally used for the output pentode is 10K to 100K in the grid circuit, 100 to 470 ohms in the screen circuit and in the anode circuit usually 10 to 47 ohms. The figures 470 and 47 ohms are used as they are the nearest preferred value to 500 and 50.

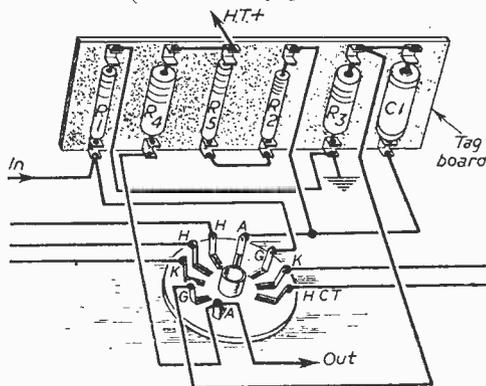
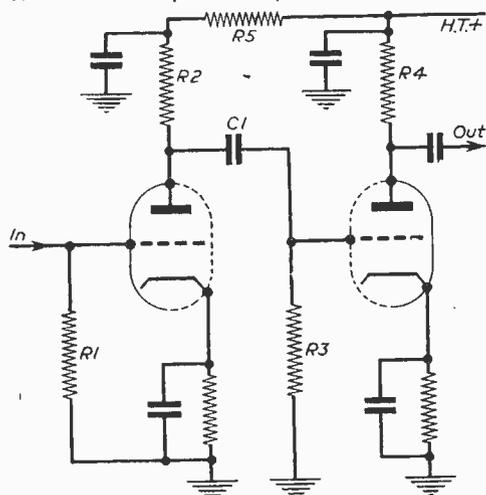


Fig. 2.—The group board.



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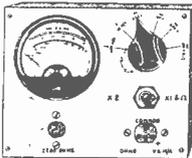
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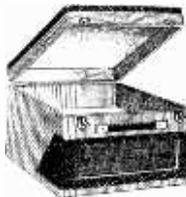


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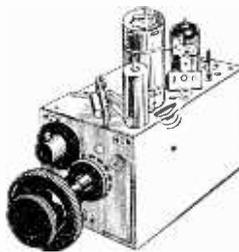
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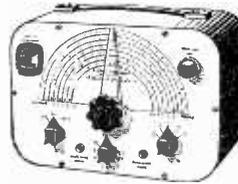


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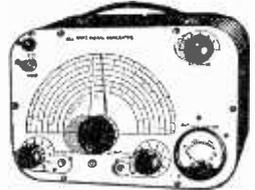


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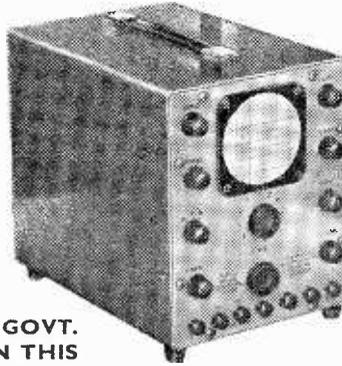


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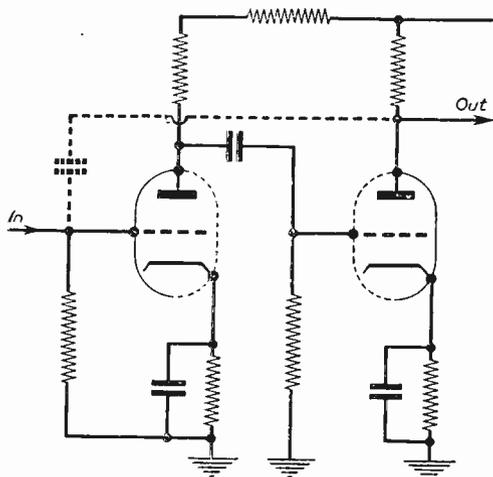


Fig. 3.—Multi-vibrator circuit.

multi-vibrator circuit shown in Fig. 3. Reversing the connections to R1 would, of course, help a little, but when one considers that the average double triode with both sections used as triode amplifiers gives an overall gain of over 3,000, one soon realises just how small an amount has to be fed back. Of the output fed back 1/3,000 will cause the circuit to oscillate.

The Layout

First, position the valve holder so that there is no need to cross the wires at all to get to the

group board. Look at the direction in which the signal is to travel. Then, if from left to right of the group board, have the space between the valve pins on the holder pointing to the centre of the group board. If in the reverse direction point the two heater pins at the board. Angles are not critical and a few degrees are not important. A suitable order along the group board would be, taking Fig. 1, R1, R2, R5, R4, C1, R3, thus all six components are mounted in line. Now the capacity between components is inversely proportional to the distance, thus R1 and R4 will now have three times the spacing, and R2 will apply negative feedback to R1, R4 will be screened from R1 by R2 and R5, thus with the increased distance the feedback will be almost nil. The distance of R4 is three times that of R2 from R1: R2 would be in a position to feed back negatively nine times as much as R4 if their capacities were identical, but they are not, as R4 is screened from R1.

Method of Screening

A very effective method of screening on group boards can be done with the aid of bias electrolytics and decoupling capacitors, provided that these latter are joined with outer foil to chassis. These components can be mounted between sections of valves, or between amplifier stages, so that the radiation from anode resistors is taken to earth either by the metal screen or outer foil.

Large and complex tone control and compensating circuits often make the use of a group board essential, but it is the layout on that group board that can make or mar the performance of the finished piece of equipment.

Crystal Filters

CATHODEON CRYSTALS LTD., Linton, Cambridge, have developed miniature I.F. band pass crystal filters, suitable for all A.M./F.M. receivers operating H.F., V.H.F. and U.H.F. bands. These filters give a minimum of 80 db of attenuation outside the pass band.

All filter units are interchangeable with no trimming or padding required; thus, if a set designer requires to change from one channel spacing to another, it is only necessary to insert the filter with the corresponding band-width. The rugged sub-miniature crystal units, together with all other components, are mounted on printed circuit boards and housed in hermetically sealed brass containers.

The miniature units require only 2in. x 1 5/16in. of chassis space and give substantially flat pass-band characteristics with almost vertical cut-offs. Several band-widths are available. The relatively low insertion loss values render them most suitable for use between the frequency changer and the I.F. amplifier, and the characteristics entirely eliminate the need for I.F. transformers and permit broad-band amplifier design techniques with only a single frequency conversion.

The centre frequency stability of the response

curve over a wide temperature range is better than 12 parts per million. The ratio of the band-width at -60 db compared with the band-width at -6 db is less than two to one. Peak R.F. input voltage is 12 volts and the phase linearity over most of the pass band guarantees faithful reproduction for F.M., or pulsed systems. Although the filters are normally terminated for use with vacuum tube impedances of approximately 1,600 ohms, impedances giving maximum power transfer in transistorised systems are available.



Band pass crystal filter.

A summary of the specification follows:

- Centre Frequency: 10.7 Mc/s.
- Band-width (-6 db): 25 kc/s, 12.5 kc/s and 7.5 kc/s.
- Band-width (-6 db): <50 kc/s, <25 kc/s and <15 kc/s.

- Minimum attenuation: 80 db.
- Pass-band ripple: 2 db.
- Power insertion loss: 6 to 8 db.
- Operating temperature range: -40 to +90 deg. C.
- Centre frequency stability: 0.0012 per cent.
- Dimensions: 2in. x 1 5/16in. x 2in. high.
- Weight: 5 1/2 oz.
- Terminating impedance: 1,600 ohms, approximately.

The circuit is reasonably conventional, the L.W., M.W. or S.W. aerial coil being selected by S1R and S2R (Figs. 1 and 3). An I.F. trap, comprising L1 and C1, is included in the aerial circuit to block the passage of spurious signals falling in the I.F. range which may be picked up on the aerial. VC4 is the aerial tuning section of the gang.

The L.W., M.W. and S.W. oscillator coils are L7, L8 and L9 respectively and are selected by S2R and S1R. Feedback is provided by C9 and these coils, as with the aerial coils, feature dust-iron cores and parallel-connected trimmers for alignment purposes. The oscillator circuit is tuned by VC5 section of the tuning gang, and on all bands the oscillator frequency is above the signal frequency.

The incoming R.F. and oscillator signals are mixed in V1 and the intermediate-frequency, which is at 470 kc/s, is first developed across the I.F. transformer T1. The I.F. signal is then passed on to the control grid of V2 and appears in amplified form across the second I.F. transformer T2 (Fig. 2). From here the signal is applied to the signal diode (pin 6) of V3, and the detector load consists essentially of R10. The A.F. content of the signal at this point is applied to the volume control (R8) through the coupling

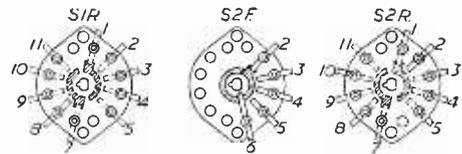
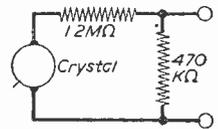


Fig. 3.—Switch wafers as viewed under chassis from knob.



Pick-Up Shunt for B.S.R. Monarch UA6.

capacitor C21. Resistor R9 and capacitor C20 from the I.F. filter.

On all but the "gram" position of the band-selector switch, the demodulated signal is applied to the grid of V3 triode. On the "gram" position the pick-up signal is applied to the volume control and this follows the normal passage of the A.F. signal through the following stages.

The required level of amplified A.F. signal, as selected by the volume control, appears across the triode anode load resistor, R11, and from here is fed to the control grid of V4 through the coupling capacitor C23 and the A.F. stopper R20. The signal is thus developed across the

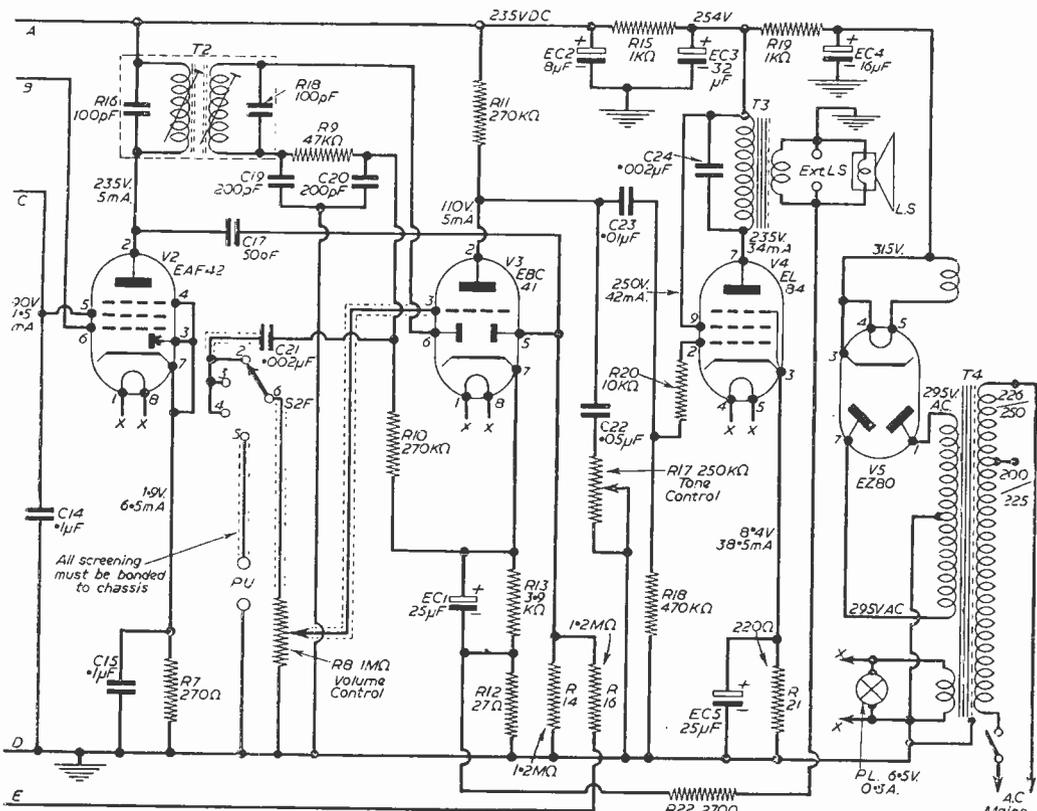


Fig. 2.—Circuit diagram of the I.F., detector, and output stages.

primary of the output transformer T3, and in low-impedance form is developed across the secondary winding to drive the loudspeaker.

The H.T. is given by the full-wave rectifier, V5, and a centre-tapped H.T. secondary winding on the mains transformer. The mains primary is completely isolated, which is considered in certain quarters as a very desirable feature. Low voltage secondary windings for energising the heaters of the rectifier and valves are also included on the transformer. The pilot lamp (6.5 volt 0.3 amp.) is connected across the valve heaters. One side of the heater supply is connected to chassis.

A smoothing choke is not used in this model, but excellent attenuation of hum is accomplished by the two-stage resistor-capacitor filter comprising EC2, EC3 and EC4 and resistors R15 and R19.

Negative feedback is taken from the secondary

stages when the signal is high and increasing the gain when the signal is low. A delay is given by the voltage across R12 and R13 in V3 cathode circuit, and no A.G.C. bias is produced until the signal level overcomes the delay voltage. Thus, on weak signals the sensitivity is at maximum.

Standing bias is also given to the first two valves by the cathode resistors, R4 and R7. Bias for the output valve is obtained in the same way by the cathode resistor R21. This resistor is decoupled by the electrolytic capacitor EC5 to avoid current feedback, which would not only reduce the A.F. sensitivity but also increase the source impedance of the output stage and thus destroy the high damping factor obtained by the use of voltage feedback.

Circuit Alignment

The I.F. stages are first aligned by applying a 470 kc/s modulated signal, via a $0.1 \mu\text{F}$ capacitor, to the "live" side of VC4, with the "earthy" side of the generator cable connected to chassis. The set should be switched to M.W. and the cores in T2 and T1, in that order, adjusted for maximum output, indicated either by the loudest sound from the loudspeaker or the maximum indication on an output meter or A.C. voltmeter connected across the loudspeaker at the extension loudspeaker sockets.

The I.F. signal should next be applied across the aerial and earth terminals and the generator signal should be turned to maximum. The core in the I.F. trap coil, L1, should then be adjusted for *minimum* output. In both cases enhanced I.F. response can be achieved by having the tuning gang fully open.

R.F. Alignment

First establish that with the gang fully closed the tuning pointer coincides with the 100 deg. position marked on the scale; adjust if necessary. In all cases, the generator signal should be applied across the aerial and earth terminals through a dummy aerial or generator loading pad and as the circuits are brought into alignment the generator output signal should be reduced accordingly. To avoid alignment errors as the result of A.G.C. action, the smallest generator signal possible, consistent with workable output indication, should at all times be used.

L.W.

Tune the receiver to the 160 kc/s calibration mark and apply a signal at the same frequency. Adjust L7 core and then L2 core for maximum output. Retune to 300 kc/s and set the receiver to that calibration mark. Adjust VC6 and then VC1 for maximum output. Repeat over these two frequencies for minimum tracking error.

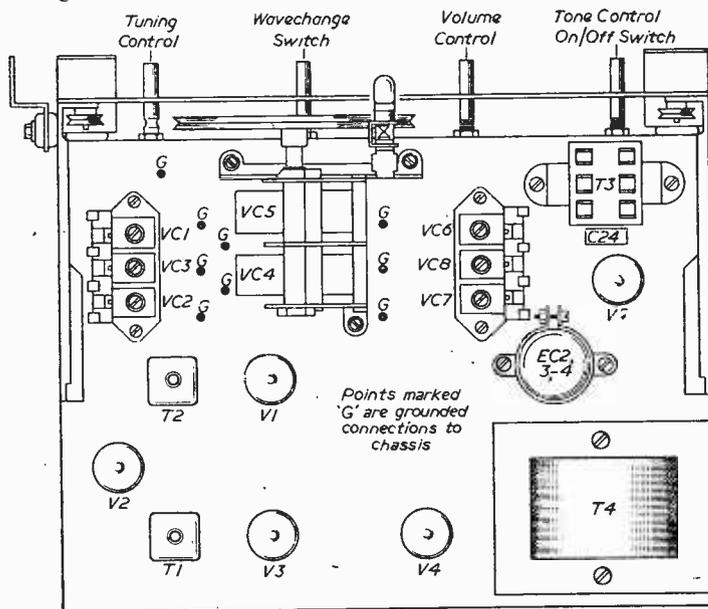


Fig. 4.—Top chassis layout.

of the output transformer, one side of which is connected to chassis and the other side is connected to the cathode circuit of V3 through R22 R22 and R27 (in V3 cathode circuit) form a potential divider and are arranged in value to provide optimum feedback voltage. This feedback also reduces the hum level.

A variable tone control system is incorporated which uses the tone control, R17, and the series-connected capacitor C22. Fixed tone compensation is also provided by C24 across the output transformer primary.

The I.F. signal at the anode of V2 is fed through C17 to the A.G.C. diode (pin 5) of V3. This produces a D.C. voltage across the load resistor R14 whose value depends upon the signal level and is negative with respect to the chassis. This is applied through the filter resistor R16 to the control grids of V1 and V2 and serves as A.G.C. bias—reducing the gain of the

M.W.

Set the receiver to the 575 kc/s calibration mark. switch to M.W. and apply a corresponding generator signal. Adjust L8 core and then L3 core for maximum output. Retune to 1,500 kc/s and set the receiver to that calibration mark. Adjust VC7 and then VC2 for maximum output. Repeat over these two frequencies for minimum tracking error.

S.W.

Set the receiver to the 7.5 Mc/s calibration mark. switch to S.W. and apply a corresponding generator signal. Adjust L9 core and then L4 core for maximum output. Retune to 15 Mc/s and set the receiver to that calibration mark. Adjust VC8 and then VC3 for maximum output. Repeat over these two frequencies for minimum tracking error.

It will be found necessary to adjust the tuning capacitor about the 15 Mc/s mark when adjusting the aerial trimmer (VC3) so as to counter the effects of oscillator "pulling."

Servicing Notes

The position of the coils and trimmers are given in the chassis layout diagrams in Figs. 4 and 5. If the alignment is extensively disturbed when adjusting the dust-iron cores, the correct alignment position is on the second tunable signal when the cores are screwed into the coils from the top of the formers. The first response should be ignored and alignment should be made on the second response. *This does not apply to the S.W. oscillator core, which should be adjusted on the first response.*

Complete Failure

If the receiver appears to be "live" and clicks are obtained on adjusting the wavechange switch, the trouble almost certainly lies in the local oscillator section. Low emission of the triode section of V1 is usually responsible, but open-circuit of C6 or C9 produces the same symptom. If only one band is affected, the alignment of that band should be checked as detailed above, but if a signal cannot be passed through the receiver, the associated oscillator coil and trimmer should be examined and checked for continuity and dielectric insulation.

If the receiver is absolutely dead and there is no trace of residual hum from the loudspeaker, the EZ80 may well be finished and a check should be made of voltage at the cathode (pin 3) of the valve. Before replacing in the event of lack of voltage, EC4 should be checked for insulation, for this may have short-circuited and blown the rectifier. If voltage is present at the cathode, it should be checked through R19 and

R15 so as to establish continuity of these components. Overheating of one or other of the resistors should lead immediately to a check of the insulation of EC2 or EC3.

If the H.T. line voltage seems fairly normal, the cathode voltage of V4 should be checked. Should this be very low or missing altogether, the trouble is caused by one of the following: (a) low emission or open-circuit of V4; (b) open-circuit T3 primary and (c) a short across EC5. In case (c), however, the bias of V4 will be removed, but while this will result in severe distortion it may not cut off the signals completely unless, of course, the valve fails through lack of bias.

There is also the possibility that the loudspeaker has become disconnected from the output

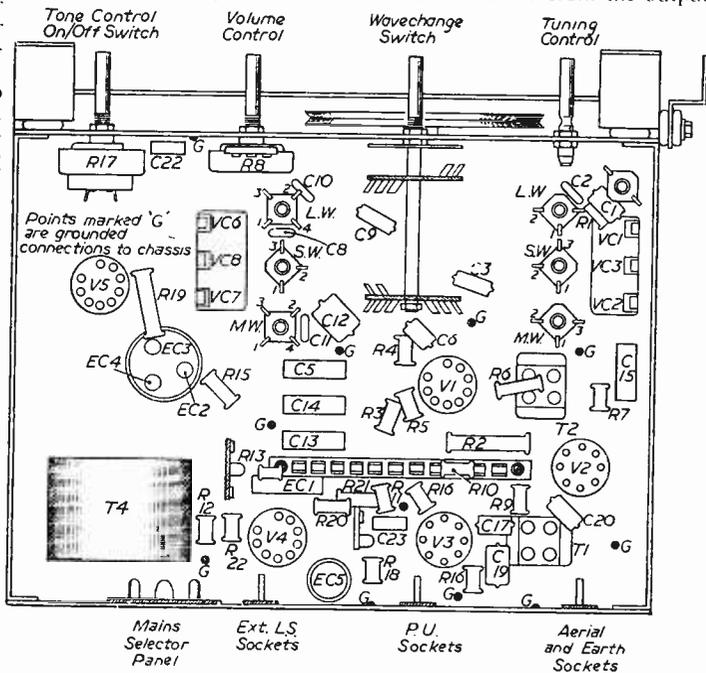


Fig. 5.—Under chassis layout.

transformer or that its speech coil has broken, but a quick test with an extension loudspeaker will soon prove this.

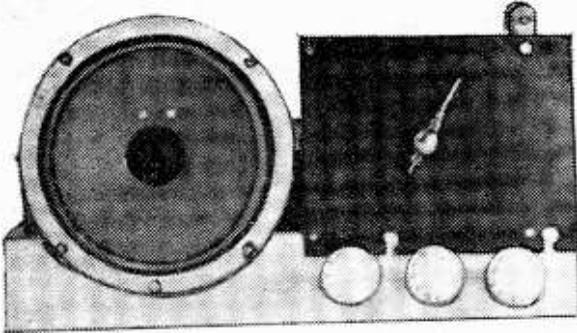
If the gram side is working, then the trouble lies somewhere in stages V1 and V2, but if both gram and radio are out, attention should be directed towards stages V3, V4 and V5.

Distortion

Distortion on radio only may be caused by overloading owing to an A.G.C. fault. A leaky C17, the signal feed to the A.G.C. diode, will cause the trouble by reflecting a positive potential to the control grids of V1 and V2.

Distortion on both radio and gram is invariably caused by a leak across the A.F. coupling capacitor, C23, and a substitution test will quickly prove this possibility. Low emission of V4 and

(Continued on page 908)



An Eco Mains Tra

This superhet includes pre-s
programme and features :

By R.

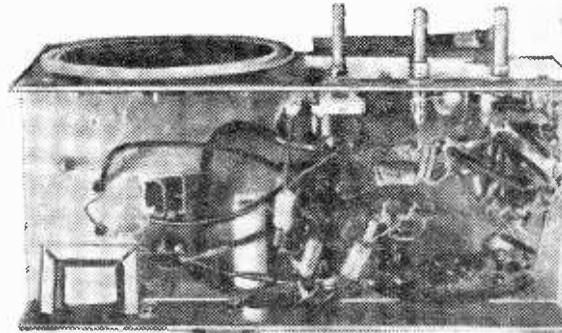
TELEVISION, V.H.F. and high fidelity gramophones have all had their effect on the pattern of home entertainment and the increasing difficulty in receiving stations on the medium and long wavelengths without interference has also served to divert attention to other branches of the radio field. Nevertheless, the construction of receivers for these wavelengths is still the easiest and most popular side of the hobby. The present design is not a midget portable, but a small transportable that can be used anywhere where there is a power point—no other connection is needed.

Economy was sought for, and as economy usually means simplicity it seemed reasonable to consider the design from the point of view of easy construction, so that those with little experience could expect to make it without difficulty and with every expectation of success.

Design Considerations

It is usual when thinking of the beginner and those less experienced in construction to suggest straight receivers with tuned R.F. circuitry but undoubtedly it is easier to build a superhet than a straight set of sufficient selectivity for use as a household receiver. This is because the

manually tuned circuits operate at different frequencies in a superhet and therefore instability is not a problem. Also the circuits contributing the bulk of the amplification and selectivity in this type of receiver, which, of course, have to be tuned to a common frequency, are in the intermediate frequency stages where they can



Above—View of the underside of the chassis. Right—View from the rear with the receiver in its case.

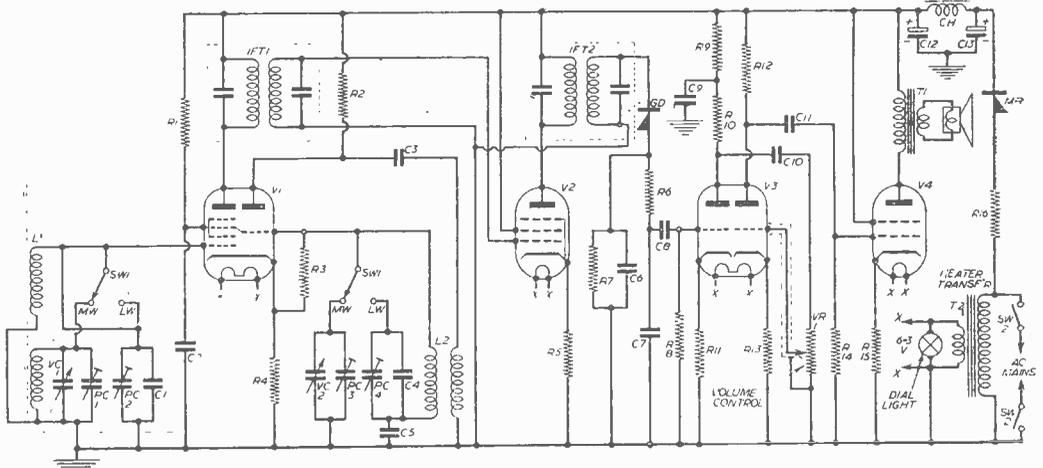
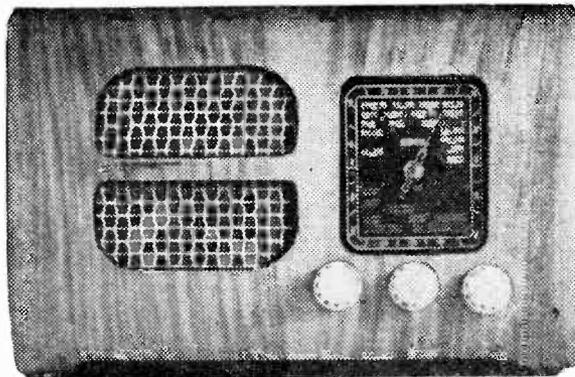


Fig. 1.—Circuit diagram of the receiver.

conomy nsportable

tuning for the L.W. Light
double triode A.F. stage

indle



be pre-tuned once and for all and consequently they can be well screened.

For a simple receiver of this kind a single, efficient output valve is an obvious choice and a 6BW6 is used. This can give up to 4 watts of audio power with an anode supply of 250 volts, though a receiver of this type is not likely to need such an output. Consequently a somewhat lower order of H.T. will be acceptable and it will be economical to take it from the mains using A.C./D.C. receiver technique. This now raises the matter of heater supply. Series-connected heaters would completely avoid the need for a mains transformer but there would be the

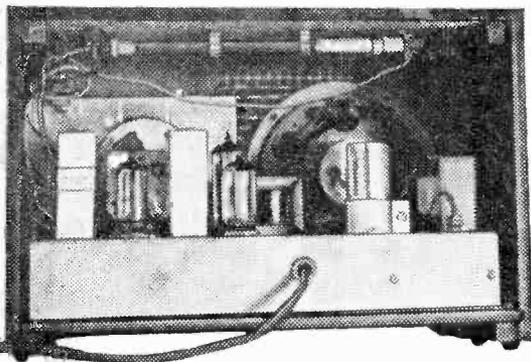
problem of dropping the surplus voltage. If a resistor is used, the heat generated has to be dissipated; the alternative of a reactive dropper such as a fixed capacitor is not practicable because usually the size of capacitance needed is not a standard value and a resistor has to be used along with the nearest value of capacitance available. By far the most convenient way, assuming, of course, that the receiver will not have to be used on D.C. mains, is to use a mains transformer to supply the heaters only. Suitable transformers are quite cheap and of reasonable size and weight. Of course, if D.C. mains are to be used there is no choice but to use a dropper resistor. The decision has to be taken at this point because it has a bearing on the types of valves used. If the dropper resistor

Tuning Requirements

The next step is to decide the tuning requirements. Still aiming at simplicity, no short waves are provided. Very few people have a need for the short waveband and without it the receiver is easier and cheaper to make. Coverage of the medium waveband will satisfy most requirements but the Light programme cannot always be received with satisfaction on the medium waves and so provision for its reception on long waves is included. There is little else of value on long waves and so this range is not tuneable. At the long-wave range position of the switch the Light programme is pretuned. Thus, whatever the position of the tuning condenser, a flick of the switch gives the Light programme. If the medium range is normally left tuned to the regional programme it gives in effect switched station selection. A separate aerial coil is used for the long-wave Light programme, but the oscillator tuning for this programme makes use of the medium wave oscillator coil padded up to the long wavelength by means of additional capacitance.

Circuit

The complete circuit diagram is given in Fig. 1 and from this will be seen how the tuning arrangements are provided. In order to avoid the need for an aerial external to the receiver the input coils are in the form of a ferrite rod aerial. This provides separate medium and long-wave coils; VC1 is half of the twin-gang tuning capacitor and tunes the medium-wave aerial coil and PC2 is a trimmer that with the fixed capacitor C1 tunes the long-wave coil to 200 kc/s. L2 is the oscillator medium-wave coil tuned by the other half of the two-gang capacitor VC2 at the M.W. position of the switch; with the switch at the L.W. position, C4 and the preset trimmer PC4 tune the same coil to 665 kc/s to produce the right frequency to convert the 200 kc/s signal to



problem of dropping the surplus voltage. If a resistor is used, the heat generated has to be dissipated; the alternative of a reactive dropper such as a fixed capacitor is not practicable because usually the size of capacitance needed is not a standard value and a resistor has to be used along with the nearest value of capacitance available. By far the most convenient way, assuming, of course, that the receiver will not have to be used on D.C. mains, is to use a mains transformer to supply the heaters only. Suitable transformers are quite cheap and of reasonable size and weight. Of course, if D.C. mains are to be used there is no choice but to use a dropper resistor. The decision has to be taken at this point because it has a bearing on the types of valves used. If the dropper resistor

the I.F. of 465 kc/s. Note that PC4 and C4 do not go to earth and this is for a very good reason. The tuned circuit on medium waves consists of VC2 and C5 in series across the primary of L2, C5 being the padder to reduce the effective capacitance of the variable capacitor (two capacitors in series have always a resultant capacitance less than either), because the range of frequencies to be swept by the oscillator is less than the range of frequencies needed from the aerial tuner. This may seem odd to some readers so perhaps the old hand will excuse the following explanation.

The M.W. range is very roughly 1,500 kc/s to 500 kc/s. The oscillator range is higher by the intermediate frequency (465 kc/s), or again in very round figures 2,000 kc/s to 1,000 kc/s. It is the same number of kc/s in both cases, of course, but the capacitance swing to tune does not depend on the number of kc/s to be swept: the significant factor is the ratio between the lowest and the highest frequency needed in the range. The oscillator swing being from 1,000 kc/s to 2,000 kc/s more or less, the ratio is 2 : 1. The aerial swing, 500 kc/s to 1,500 kc/s, has a ratio of 3 : 1. As both halves of the standard tuning capacitor have identical capacitance ranges C5 is introduced to reduce the effective range and give the appropriate ratio of highest to lowest capacitance for the oscillator section.

Tuning

It is convenient and usual to connect the tuning capacitor moving plates to earth because they are in electrical contact with the frame of the component which is earthed to the chassis by the mounting bolts. If now the long-wave tuning capacitor C4 is connected to earth, C5 will still be in circuit and this will limit the effective tuning capacitance to something less than its own capacitance. The size of C5 is determined by medium-wave tuning requirements. The range of tuning capacitance wanted is equal to the square of the frequency range so that the aerial tuning capacitance range is 9 : 1 whereas the oscillator range is 4 : 1.

The stray capacitances are likely to be of the same order in each case and these determine the minimum capacitance, so the maximum needed at the oscillator stage can be expected to be about half that of the aerial circuit, calling for a C5 of about the same order as the two gang used. This theory and rather crude calculation is borne out in practice and, in fact, C5 is 500 pF. This in itself is inadequate to tune the medium-wave oscillator coil up to the long-wave range and so one would have the disconcerting result that no matter how large a capacitance were to be put between the L.W. switch position and earth the circuit could not reach the long-wave range. By connecting C4 directly across the coil as shown in Fig. 1, however, it is made fully effective and independent of C5. PC4 could go to earth, but C5 would somewhat limit its range of adjustment for the same reason and so, provided the trimmer has not the same baseplate as the other trimmers used, or provided the trimmer is not in electrical connection with the common baseplate it is better connected as shown in the circuit diagram.

COMPONENTS LIST

- R 1, 13.—33 K Ω .
- R2.—27 K Ω .
- R3, 7.—47 K Ω .
- R4.—220 Ω .
- R5.—100 Ω , $\frac{1}{4}$ watt Dubilier type BT.
- R6, 9.—10 K Ω .
- R8, 14.—470 K Ω .
- R10, 12.—100 K Ω .
- R11.—3.3 K Ω .
- R15.—250 Ω , 1 watt wirewound Dubilier type BWF.
- R16.—22 Ω .
- VR1 and Sw. 1.—Volume control 0.25 M Ω , with 2-pole switch Dubilier type C.
- C1, 3.—100 pF.
- C4.—220 pF and 330 pF in parallel, Dubilier type 400.
- C6, 7.—220 pF.
- C5.—500 pF, Dubilier type 635.
- C2.—.05 μ F 250 volt, Dubilier type 410.
- C8, 10.—.1 μ F 250 volt.
- C9.—.8 μ F 350 volt, Dubilier type BR.
- C12, 13.—16 and 16 μ F 350 V.W. Dubilier type CT with mounting clip.
- V1—12AH8.
- V3.—12AT7, V2.—6AM6 Brimar.
- V4.—6BW6.
- MR.—Selenium rectifier SenterCel C2D, STC.
- GD.—GD5, Brimar.
- L1.—Ferrite Rod Aerial M.W. and L.W.
- L2.—QO8.
- IFT1, 2.—Miniature I.G. transformers 465 Kc.
- T1.—Miniature output transformer, Osmor.
- T2.—Filament transformer 6.3 volt.
- Ch.—Smoothing Choke Miniature.
- Sw. 1.—2-pole 2 way (switch used was 4-pole, two not used), wafer type.
- Speaker.—5in., Elac.
- VC1, 2.—Miniature two-gang 500 pF max. Osmor.
- PC1, 2, 3, 4.—4 x 50 pF trimmers, Osmor.

Sometimes, however, a strip of presets has a common earth. If this is so in the case of the strip to be used by the constructor, he should not attempt to connect it also to the upper end of C5: if he does C5 will be short circuited and the medium waves will not track.

The actual capacitances used to tune L2 to 1,500 metres (200 kc/s) depends on the exact position of the core of L2 when the setting up of the circuit on medium waves has been completed: consequently the long-wave circuit must not be adjusted until the medium range is satisfactory. The approximate capacitance can be calculated as a guide and having then an idea of the value, the exact size of component can be determined quickly by experiment. The oscillator coil is an Osmor QO8 which can be adjusted by its core over the range of 65 μ H to 120 μ H. The medium wave setting will be well within this range, say 100 μ H for ease of calculation.

(To be continued)

RADIO CONTROLLED MODELS

By F. J. CAMM

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GEORGE NEWNES, LTD.,

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*The President : Derek M. Hall, B.A., M.I.P.R.E.
The heading photograph shows the packed attendance
at an I.P.R.E. meeting.*

A SHORT HISTORY OF THE INSTITUTE OF PRACTICAL RADIO ENGINEERS

tuition as could be given him by those who might already have a little experience in the work.

This situation was realised by a number of people, amongst whom must be numbered Mr. W. Edwardes, a telephone and communications engineer, who was engaged in the training of service engineers. Radio dealers at that time were reluctant to provide facilities for their engineers to attend instructional classes during business hours and so it came about that Mr. Edwardes undertook tuition in the dealers' own workshops.

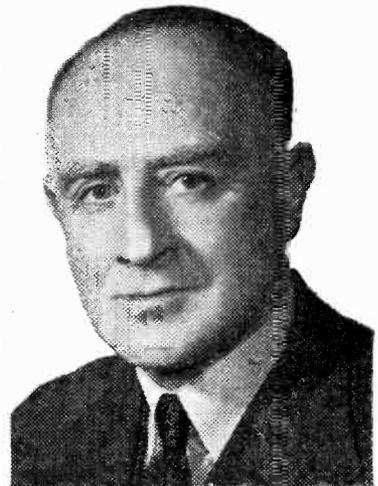
Coming into contact in this way with a considerable number of radio technicians, their

shortcomings in basic knowledge became immediately apparent, with the result that, in addition to tuition in practical work, Mr. Edwardes evolved a number of technical courses of instruction specially drafted to provide that basic knowledge which was so essential to enable the then radio

The Institute of Practical Radio Engineers provides the pool of technicians from which the industry draws its technical personnel. It ensures a high standard of practical and theoretical knowledge and that those qualified to use the letters M.I.P.R.E. after their names are men of first-class knowledge and experience. It is not a learned society concerned only with pure theory. Its motto is practice combined with theory, and its remarkable growth in the space of 22 years is due to the success which has attended its efforts to raise the standard of radio and television technicians.

The industry owes it a debt of gratitude for the work it has done. It was founded in 1936 as an independent professional body with membership limited to those actively engaged in any branch of radio, television, electronics and telecommunications.

Today, when many hundreds of technical colleges and other educational establishments provide special facilities for the training of technicians in the electronic industry, it is very difficult to visualise the yesterday of some 25 years ago. At that time electronic technicians were largely engaged in the repair and maintenance of broadcast receivers and communications equipment. There were virtually no facilities for proper instruction in such maintenance work and the technician was largely dependent on such



Mr. C. H. Gardner, past president I.P.R.E., who has been a driving force in building up this important National Institute, the I.P.R.E.

engineer to employ systematic diagnosis and effective set servicing. Constantly revised in step with development, these courses are still available.

The keenness of the radio technician and engineer to acquire such knowledge and his desire to broaden his technical and practical outlook and to discuss problems with his fellow technicians became obvious. The need for an institute to cater especially for the practical technician was apparent.

The matter came under discussion by a number of interested people with the result that it was decided to form an institute to cover the particular requirements of the the practical radio engineer, and in 1936, some 22 years ago, the Institute of Practical Radio Engineers was founded as an independent professional body with membership limited to those actively engaged in any branch



The indefatigable technical and general secretary of the I.P.R.E.—Mr. W. Edwards. He founded the Institute and has been secretary from the start.

of radio, television, electronics or telecommunications.

The registered objects of the institute were stated to be:

(a) To promote, encourage, foster and improve the science and practice of practical radio engineering; and for that purpose to do any of the following things:

(i) To hold meetings of the Association for reading and discussing communications bearing upon the said science and practice, or the application thereof, or upon subjects relating thereto.

(ii) To enable radio engineers to correspond and to facilitate the interchange of ideas respecting improvements in the various branches of the practice of practical radio engineering, and to publish journals and magazines or otherwise disseminate information on such subjects to members of the Association and others.

(iii) To establish scholarships, organise lectures, hold examinations, grant premiums and prizes for papers and essays, and by any other similar means to enlarge the knowledge and improve the practice of practical radio engineering.

(iv) To establish, undertake, superintend, administer and contribute to any charitable or benevolent fund from which may be made donations or advances to persons at any time employed by the Association, or who are or may have been engaged in practical radio engineering work and are not members of the Association.

(v) To establish, form and maintain a library and collection of models, designs, drawings, instruments and other articles of interest in connection with the development and improvement of practical radio engineering.

(vi) To establish and maintain, in such places as shall from time to time be determined, schools and institutions for instructing and training persons engaged in or desirous of becoming engaged in the science or practice of practical radio engineering.

These objects have changed in no way during the life of the institute which became incorporated in the year 1951. The association now has 11 sections covering England, Scotland and Wales, and has local secretaries in Northern Ireland, Eire, New Zealand, Kenya, Rhodesia, Nigeria, Australia, Burma, the West Indies and British Guiana. Members are located in many other countries as well.

Local sections appoint their own committees and officials and regularly hold meetings which are addressed by leading lecturers in the industry on subjects and matters of interest to the members.

For certain such meetings non-members are admitted by invitation and on many recent occasions attendances have exceeded the 400 mark. Membership of the institute in one or other of the authorised grades is available to all technicians in the electronic industry, the fees being moderate, though the Admission Committee exercises very careful supervision of the grade applicable to any particular prospective member. Students, for instance, must be undergoing a course of training approved by the council, and all higher grades require that the applicant will have spent a certain minimum time in the industry and attained a defined technical standard. Entrance into the corporate grades, graduates, associate members and members is through examination invigilated by independent authorities; also certain certificates, diplomas and degrees may be considered as qualifications partly or entirely on a subject-for-subject basis. A syllabus of examinations and conditions of membership, with application forms, is available on request from: The General Secretary, I.P.R.E., Fairfield House, 20, Fairfield Road, London, N.8. The I.P.R.E. publish their proceedings quarterly, members of all grades receiving free copies. The institute is a non-profit making one. Readers of PRACTICAL WIRELESS and *Practical Television* who are studying these subjects with any of the well-known schools and colleges are eligible for the grade of Student-Member, or if engaged entirely in radio, television or electronic activities for the Associate and corporate grades.

A Radiogram Control Unit

A SINGLE-VALVE TWO-STAGE TONE CONTROL FOR THE RECORD PLAYER

WHAT form should the modern domestic reproducing equipment take? Changes have taken place in broadcasting and in family tastes over the past few years. Television for some time has been tempting the household away from pure sound reproduction, and has been helped by the state of the medium waveband, so that for a time the enthusiastic constructor has had it all his own way. He has worked on his sound equipment without hindrance since the less technical members of his household have had their attention directed elsewhere. That was too good to last and the state of affairs has changed with the advent of hi-fi and developments in gramophone recording and reproduction, whilst later the introduction of F.M. has restored sound broadcasting to favour in a large number of households. The ordinary amplitude modulated broadcast still fills a gap when the record session

palls and when the V.H.F. programmes offer nothing of interest. At those times a lower degree of fidelity and a modicum of interference will be tolerated in view of an acceptable programme from overseas. The home constructor is more fortunately placed than his brethren because he can follow the latest trends whilst still indulging his interests. Indeed, if he has not yet turned his attention to what is now being offered to him in the way of sound reproduction he should realise what he is missing and should take an interest in the subject.

COMPONENTS LIST FOR FIG. 1

- | | | |
|---------------|-----------------------------|---|
| R1—820Ω | } ½ w. | C5—1 μF 250 v. (Dubilier 410) |
| R2—68 KΩ | | C6—100 pF (do. 5635) |
| R3—10 kΩ 1 w. | | C7—1200 pF |
| R4—820Ω | } ½ w. | C8—500 pF |
| R5—1 KΩ | | C9—6,000 pF (5,000 pF and 1,000 pF in parallel) |
| R6—470 KΩ | | VR1 |
| R7—680 KΩ | | VR2 } 1 MΩ miniature Dubilier YN |
| R8—68 KΩ | | VR3 } |
| R9—680 KΩ | | V 12AT7 Brimar. |
| R10 470 KΩ | Sw. 4 pole, 4 way, 2 wafer. | |
- All above are Dubilier type BT.
 C1—50 μF 12 v. (Dubilier BR)
 C2—1 μF 250 v. (do. 410)
 C3—50 μF 12 v. (do. BR)
 C4—16 μF 350 v. (do. BR)
- 3—Coaxial sockets—stand-off type (Aerialite).
 1—Two-socket strip.
 1—Tagboard (5 tags and 2 earth).
 1—Tagboard (1 tag and earth).
 1—Valveholder (B9A).

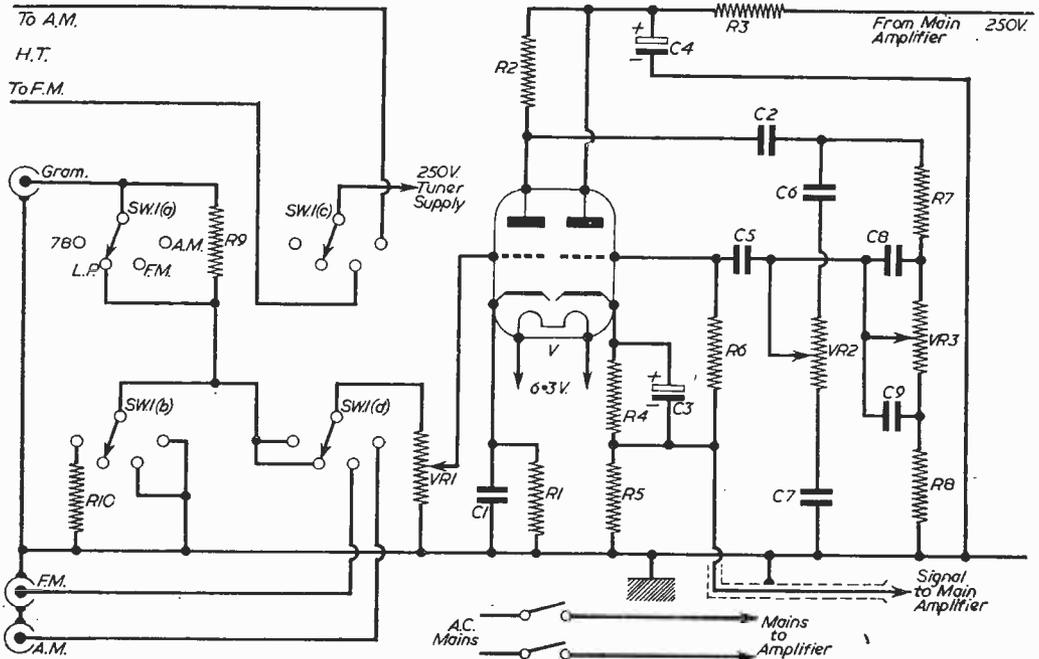


Fig. 1.—Circuit diagram of the unit.

It is clear from the above that the equipment needed must cover a range of sound sources. There must be a V.H.F. tuner, an A.M. tuner that provides the medium and usual short-wave ranges (but probably no long-wave range in view of the provision of V.H.F.), and a record-playing unit. All these must play through a common amplifier and speaker system which should be of as high a fidelity as the user can afford.

Hi-fi has been called a cult and some of its adherents treasure their equipment above all other worldly goods. Now, the desire for the reproduction of music in the home is usually found in all members of the family, though their tastes may vary widely, and it is the duty of the constructor to provide a versatile player for the use of all of them.

Gramophone Player

The crystal pick-up is not generally considered the best, but the types now available can give remarkably good results that can most certainly be classed in the hi-fi range, if properly used, and they have the very special attraction of giving a good level of output that eliminates many equipment problems. Similarly, the best in motors are very highly priced so that one would expect quite a marked inferiority from the cheaper units. This is no attempt to decry the best, but the truth is that the modern cheap motor is extraordinarily effective and those who can afford nothing better need have no fear that they will, therefore, be unable to enjoy results of high fidelity. Indeed it would be foolish to spend too great a proportion of the available funds on a superlative motor if there were then insufficient to enable this quality to be matched in the amplifier and speaker.

At this point the controversy of auto-changer versus single player will be met. Much has been said against autochangers from the hi-fi point of view and, in fact, much of the justification for such units is lost in these days of long-playing records. But the author would much rather trust the action of the present-day auto-changer than

the heavier fisted members of his family in handling records and pick-up.

The type of pick-up has to be allowed for and the present unit has a flexible design and can easily be set up for different types of pick-up. Basically, however, it is planned for the type of crystal cartridge that is so popular these days.

Main Amplifier

The main amplifier is the largest and heaviest piece of equipment and usually it provides the power to drive other chassis. Probably few amplifiers will supply the amount of power likely to be needed for the whole of the proposed equipment. Of course, if the constructor realises the full demands likely to be made he can allow for them in his amplifier design. There are advantages in making separate panels self-powered, or in some cases perhaps in providing a heater transformer whilst taking H.T. from the main amplifier, leaving the surplus power from the main amplifier for the smaller units. The control unit is certainly in the latter category, so it is intended to power it from the amplifier.

Because of its bulk, the main amplifier can be very difficult to house unless the wise course of avoiding all controls on this chassis is taken. It should have no tone controls, volume control nor even an on-off switch. Then it can be tucked away on the floor of the cabinet out of the way.

Control Unit

The control unit provides a means for connecting any of the available sources of signals, radio or gramophone, to the amplifier and it houses the gain and tone controls.

The convenient place to mount a unit such as this is alongside the turntable, but usually there is very little space. Consequently the design takes the form of long narrow chassis. The on-off switch is included in the circuit, but the author has an aversion to switches incorporated in volume controls in this type of equipment. Thus an extra control position is needed. The

(Continued on page 903)

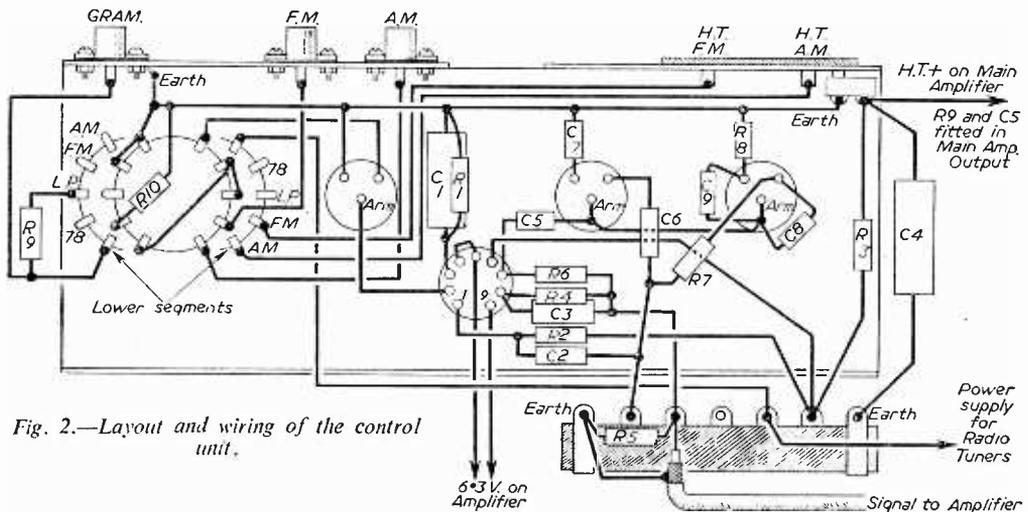


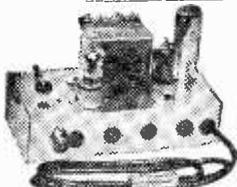
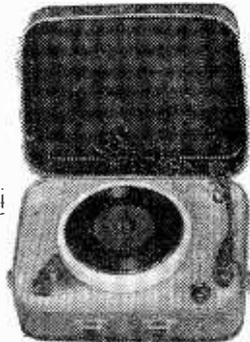
Fig. 2.—Layout and wiring of the control unit.

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8 450 v. B.E.C.	4	32 16 + 16 450 v. T.C.C.
8 450 v. T.C.C.	5	32 350 v. B.E.C.
16 450 v. B.E.C.	3	32 + 32 275 v. Hums.
16 500 v. Dub.	4	32 + 32 450 v. T.C.C.
32 250 v. T.C.C.	5	50 350 v. B.E.C.
32 250 v. B.E.C.	4	50 350 v. T.C.C.
32 500 v. Dub.	5	50 350 v. B.E.C.
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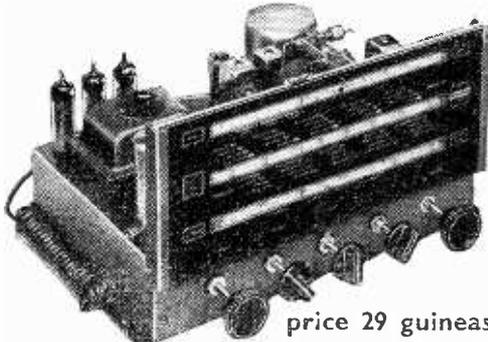
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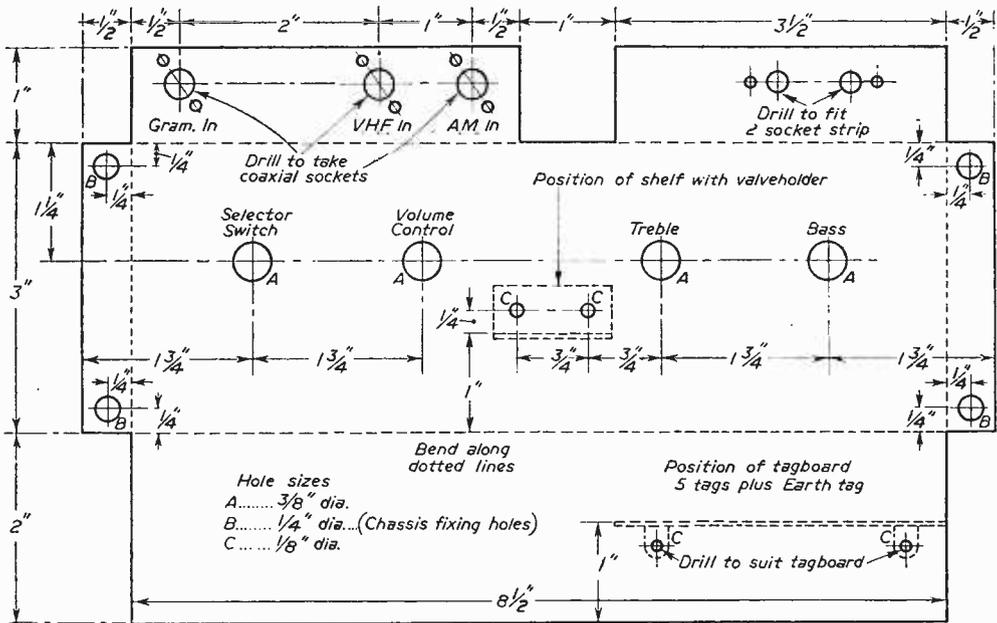


Fig. 3.—Chassis drilling plan.

controls that must be included in the design are four, apart from the on-off switch, namely: 1, selector switch; 2, volume control; 3, treble tone control; 4, bass tone control.

If the on-off switch is added as a fifth control the extended length of chassis needed to house it may be just too much for the available space. The switch is not wired into the circuit of the control panel anyway, and so there is little point in incorporating it in the construction. The proposition is that by leaving it free, it can be mounted at any convenient point in the cabinet, but if the most convenient point is, in fact, in line with the controls of the control chassis it can be mounted directly on the instrument board of the cabinet or the constructor could, if he wished, make the chassis longer for this purpose.

The next point to decide is the degree of amplification to be provided in the chassis. It is desirable that all three input signals should be of about the same amplitude so that, when switching the selector switch, there are no disturbing bursts of volume. The input signal should be equal to that needed to load the main amplifier. Then the control amplifier need only provide sufficient gain to counteract the losses in the correction circuits. The crystal pickup already referred to more than loads the main amplifier used with the prototype, so this was taken as the standard input amplitude. There is no difficulty in obtaining a similar signal from the two tuning units proposed. If in the final count the three inputs are somewhat out of balance, the matter can be put right by inserting resistors in series with the larger inputs.

The Circuit

Fig. 1 gives the basic circuit diagram and Fig. 2 the layout. It will be seen that there are no elaborate correction circuits. Unless the

amplifier and speaker assembly to be used are exceptional in quality this arrangement is likely to be quite satisfying. It will be seen that a single valve, a double triode, is used in which the first half acts as a voltage amplifier. The second half is shown as a cathode follower and this arrangement is very desirable because the length of lead between the main amplifier and the control amplifier can then be made any reasonable length without trouble and there is the greatest of freedom in laying out the various chassis in the cabinets. For those whose main amplifier gives somewhat less gain the second half can easily be converted into a low-gain amplifier stage and this will be dealt with later, but if possible the cathode follower version should be used.

Before the first half are the selector switch and the volume control. The selector switch has four positions, the first two each select the pickup input but allow for different correction circuits, the third gives F.M. and the fourth provides A.M. signals. This switch has actually four banks of contacts and it is bank (d) that provides the actual signal selection. Bank (b) permits the inclusion of parallel correction circuits and also shorts out the gramophone circuitry when one of the radio inputs is in use. Bank (a) also serves a dual purpose. It can provide an additional position for correction circuits but also it can switch in equalisation components to correct for differences in signal levels.

(To be continued.)

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TRANSMITTING TOPICS

MORE ON AERIALS

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



AS the most important single item in the amateur communication chain, the aerial is also the one item that repays attention. There are many aspects of aerial operation which are not often fully appreciated. Moreover, amateurs who consult authoritative textbooks often fail to realise that many "idealised" treatments must be modified extensively when applied to real life cases.

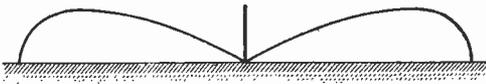


Fig. 1.—The ideal textbook vertical radiation pattern of a vertical aerial mounted directly on a perfectly conducting earth.

It is an unreasonable amateur who demands a "simple" book enabling the effects of any old location and site to be allowed for so that he can calculate just what his aerial will do, and who complains that "textbooks" do not help.

Vertical Aerials

A typical situation where textbook illustrations are taken as gospel is the vertical aerial. Fired

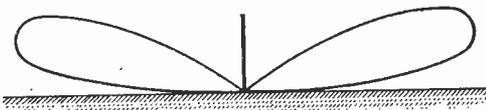


Fig. 2.—Actual radiation pattern of a grounded quarterwave, vertical over a soil of appreciable resistance. Note that the extremely low angle radiation is very greatly reduced compared with the ideal case.

by the usual diagram (see Fig. 1), showing excellent low angle radiation from a quarter wave vertical, many amateurs try such antennas and give them up as useless. Yet many DX chasers swear by vertical antennas.

Of course, Fig. 1 applies over a perfectly conducting earth, and in fact it is possible to compute the effects of aerials operating over normal, imperfectly conducting, soil. With due allowance for soil conductivity, Fig. 2 represents the vertical radiation pattern of a vertical quarterwave aerial. Note that the very low angle radiation falls to zero, and that the maximum radiation angle instead of being a zero angle is now at an angle of several degrees to the horizontal. This is a very different picture from the ideal case of a vertical antenna located on a perfectly conducting soil.

As the DX performance of a vertical depends

upon good low angle radiation, it thus emerges that the efficiency or otherwise of such an antenna depends greatly upon the efficiency of the earthing system. The "ground plane" is commonly supposed to avoid earth conductivity troubles by virtue of the four radials acting as an earth plane. However, this is *only partly true*, and in fact a ground plane antenna is still greatly affected by the conductivity of the surrounding soil. An elaborate radial earthing system as shown in Fig. 3 will improve matters, and a really low loss earth system, such as operation over salt water, salt, marshy land, or on a large extended metal roof will effect a startling improvement in cases where soil resistance is high. The radials may be terminated in earthing rods rather than being unconnected as in the conventional ground plane. Burying a large metal object a few feet underneath the vertical antenna will help.

Aerial Height

Another point in connection with the vertical is the height at which it is mounted. In fact the "ideal" low angle textbook diagram refers to a vertical mounted directly on the earth. Despite

(Continued on page 907)

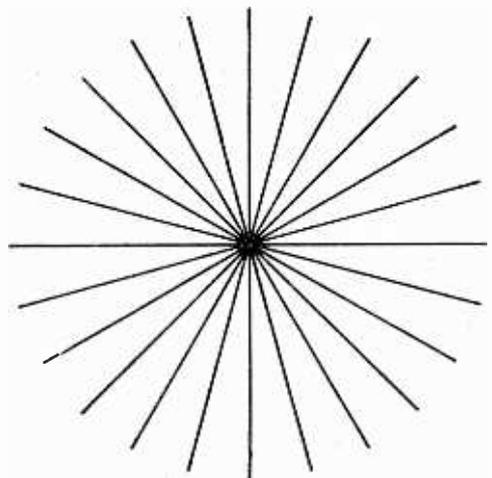


Fig. 3.—An elaborate system of radials may be used to improve low angle performance of a vertical and to reduce losses. On long wave commercial installations over a hundred radials extending for long distances may be employed. Short-wave amateur installations need not be so elaborate, but top-band verticals may require a quite extensive earth system for good results.

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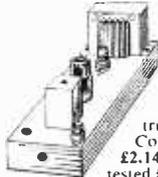
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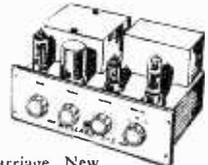
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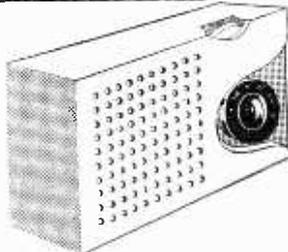
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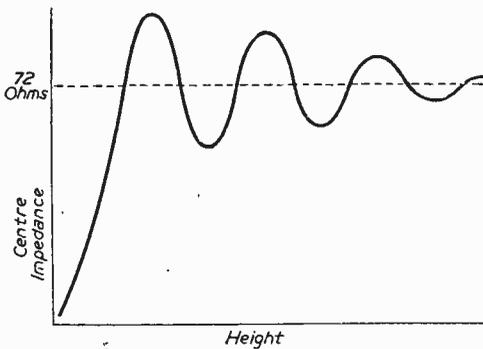


Fig. 4.—The centre impedance of a horizontal dipole varies considerably with height.

this many amateurs are obsessed by "height" and try to mount their verticals as high as possible. This is not necessarily desirable, and may even result in little or no low angle radiation. In fact under some conditions a good soil may actually ensure that there is little or no low angle radiation. If a good radial earthing system is provided, the vertical mounted just above the earth is in as good a position as any. Those who live in metal framed buildings will generally find that good operation may be obtained by roof top mounting provided that water tanks or similar metallic objects are utilised as extended earth planes. A large corrugated iron roof may in fact approach perfection as a mounting for a vertical.

Dipoles

So much for verticals, we can now consider the dipole. Here there is often a conflict between those employing coaxial cable and those employing tuned feeders. Many take SWR considerations very seriously indeed and insist on 72 ohm cable for "a perfect match." Fig. 4 shows the impedance of a horizontal dipole at various heights above the earth. This is understood to be above a "perfect" earth of course, but in practice similar variations occur. It is quite clear that it is highly unlikely that any given amateur dipole taken at random will have a centre impedance of 72 ohms. Thus on 80 metres, with a dipole, say, 30 feet high, i.e., about one-tenth of a wavelength, the centre impedance will be very much lower—possibly 20 ohms. However, a 10 metre dipole mounted at about 30 feet may have an impedance at the centre of perhaps 100 ohms. Thus those owning a SWR meter may like to raise and lower their centre-fed dipole, and observe the changes in SWR indication as the earth reflections alter its centre impedance. Only in free space would an ideal dipole have 72 ohms impedance. This value in any case is subject to many factors, and the preferred "ideal" value is 73 ohms. However, owners of, say, 50 ohm coax. will not be committing any great crime if they use this cable to feed a centre-fed dipole. The effect of height upon the centre impedance of a horizontal dipole has actually been used to effect a good match by adjusting the dipole height until a SWR meter gave the lowest possible indication. Anyone who places a great

deal of faith in having a low SWR may do the same.

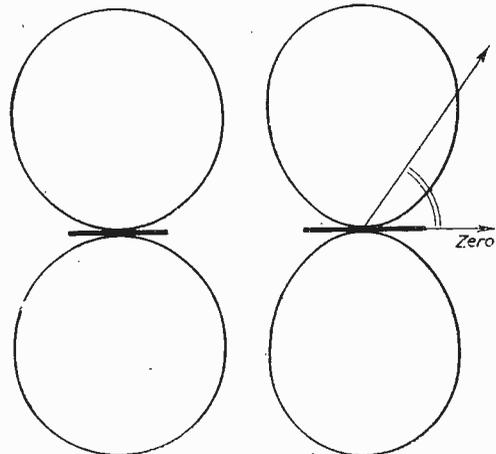
Feeder Cables

Incidentally, the use of an unbalanced feeder such as conventional coaxial cable to feed the essentially balanced centre of a dipole, is a matter for consideration. Previously, various methods of providing an "unbalanced-to-balanced" transformation have been discussed. This is of some importance for example, in beam aerials, where such unbalance may interfere with their correct operation. However, a full discussion on this subject is outside the scope of this article.

Dipole Radiation Patterns

The radiation pattern of a dipole is often shown as in Fig. 5. It is therefore assumed by many that there is no radiation in the direction of the ends of the dipole. It is considered to be quite an achievement to work a DX such as I or GM "off the ends of the dipole where there is no radiation." Fig. 5 shows the radiation pattern in a horizontal plane and Fig. 6 the radiation pattern in a vertical plane. From Fig. 6 it may be seen that while there is zero radiation in a direction along the axis of the dipole, there is radiation in any direction which makes an angle other than zero to the horizontal (as indicated by the arrow in Fig. 6). Therefore, even if the line of the dipole points exactly at a station, there will be radiation in that direction at all angles to the horizontal except zero. This argument neglects the effects of earth reflections, which may actually assist radiation in the direction of a station lying along the line of the dipole.

It should be noted that at angles to the vertical of 30 deg. or so, the radiation "off the end" of the dipole will be about as strong as the general forward radiation. Hence for contacts within a range of about 1,000 miles it will not much matter in what direction the dipole is placed, and signals will be about as strong in



Figs. 5 and 6.—(Left) The oft-quoted "free space" polar diagram of a dipole. (Right) At all vertical angles other than zero, a dipole has appreciable radiation "off the ends."

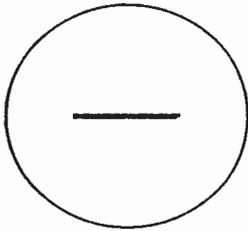


Fig. 7.—For vertical angles of thirty deg. or so, the dipole radiates almost uniformly to all points of the compass.

any direction for medium-range contacts. To make this clear, Fig. 7 shows the actual polar diagram of a half-wave dipole for radiation at angles of about 30 deg. and greater. While such diagrams are readily available for inspection in amateur handbooks, they do not seem to be appreciated, and the conventional "free space" diagram of Fig. 4 is taken as the

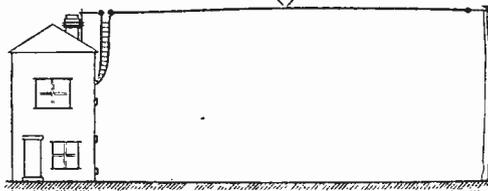
last word on dipole radiation.

In regard to angles of propagation, it is seldom realised that most of the contacts around Europe on the usual bands are by radiation at angles of 20 to 30 deg. Thus for a start the performance of an aerial system intended to be used for DX operation can hardly be judged from its behaviour on contacts within 1,000 miles radius. An inefficient aerial radiating at high angles may give very good results on such semi-DX contacts, but an efficient ground plane with excellent low angle performance may show up very badly on QSO's around Europe. On long DX hauls the ground plane may be some three S points up on a horizontal dipole. Moreover the attenuation of European signals by a ground plane is very valuable in minimising QRM. However, those who tried a ground plane and got very poor results in QSO's under 1,000 miles range might get a pleasant surprise if they tried them on DX contacts. As an example, G3MFQ recently was S9 in Barbados with 10 watts when using a vertical antenna, while another local station using 30 watts and a dipole was only S7 to S8.

Reflected Signals

On topband and 80 metres, unless aerials are extremely high, practically all the radiation from horizontal aerials is skywards as shown in Fig. 8.

Fig. 8.—Even local contacts on 160 and 80 metres are carried on largely by sky-waves: horizontal aerials, unless extremely elevated, have mainly upward radiation.



Thus, except for the most local contacts, QSO's over a few miles separation on the ground may involve over 100 miles of airline. This is because only reflected waves are involved, and signals are merely directed skywards to meet the ionosphere, some 60 miles up, to be reflected to a receiving aerial, which may be located only a few miles away from the transmitter. Reflection conditions are usually very stable for these sky-wave transmissions, but under very disturbed conditions even local signals will have heavy fading and sound like DX signals. Thus, a station within the same city has been observed to fade like DX under such conditions.

When using vertical aerials (unless an excellent earth system is used) local and semi-local results may seem poor. If some attention is given to making vertical aerials operate with reasonable low angle radiation, excellent local performance may be achieved. An efficient vertical on the L.F. bands will give indifferent results out to 1,000 miles or so, and then start to give good DX performance.

While the practical performance of real aerials on real soil is not the same as that of "ideal" aerials on the textbook's "ideal soil," the practical performances may be calculated from the ideal conditions by appropriate methods. With correct interpretation there is no conflict between theory and practice.

SERVICING RADIO RECEIVERS

(Continued from page 893)

increase in value of R11 are other possibilities which may need investigation.

Dial Drive

Details of the cord drive system for the tuning

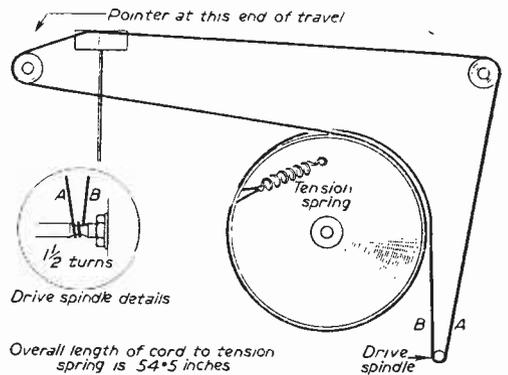


Fig. 6.—Details of the cord drive system.

gang and pointer are given in Fig. 6. This diagram is self explanatory.

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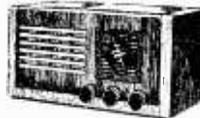


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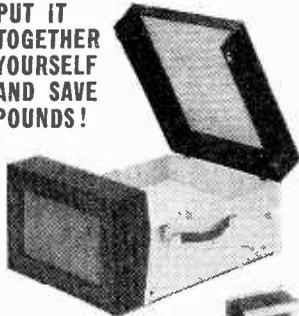
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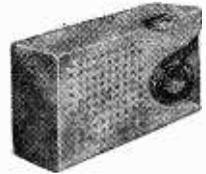
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A.C. PRE-TUNED SUPERHET

IN THIS CONCLUDING ARTICLE WE GIVE THE UNDERCHASSIS WIRING PLAN AND ALIGNMENT DETAILS
By F. G. Rayer

WITH a few yards of wire for aerial, a local station should be audible on switching on and adjusting one pair of pre-sets. The switch may be in the first position, and the condensers marked M.W.1 in Fig. 4 turned with a screwdriver, volume control being at maximum. If no signal is heard, temporarily take the aerial to the top cap of the 6K8 valve.

When a signal is heard, the cores of the I.F. transformers should be carefully peaked for maximum volume. A fully insulated tool must be used—a length of ebonite rod, filed to screwdriver shape, may be used. A metal blade screwdriver is only suitable for rough initial adjustments, as its presence in the windings alters their inductance. To keep volume down it will be necessary, as the I.F.T. cores are adjusted, to transfer the aerial to its proper input point. No core should come at the limit of its travel. If it does, adjust the other cores so that this is no longer necessary. Once all the cores have been peaked for maximum volume, they require no further adjustment.

The two screws of the pre-set should then be adjusted carefully for maximum volume. Tuning of the oscillator section will be sharp. With a little care the trimmers can be tuned together through the waveband covered, two screwdrivers being employed. When the settings are satisfactory, the switch is turned to the

second position, and the second double trimmer adjusted for another station. This is repeated until all five pairs of pre-sets are adjusted. In all probability the coil cores will not require moving for pre-set tuning. If necessary, they may be adjusted to modify the maximum wavelengths tunable with the pre-sets.

Manual Tuning

If manual tuning is required, one switch position should be used to bring in a two-gang .0005 μ F condenser, the condenser frame being wired to chassis. Dial and condenser may be fitted to the right of the chassis. The coil selection wafers, 1, 2 and 5, may be wired so that the M.W. coils are in circuit when the gang condenser is brought in. This will provide medium-wave manual tuning. If long-wave manual tuning is also wanted, the next switch position may be wired to switch in gang condenser and L.W. coils. With a six-way switch, this would leave four pre-selected stations.

With a gang condenser, aerial and oscillator coils must be aligned. To do this, peak the I.F. transformers as explained. Then tune in a station of fairly high wavelength in the M.W. band and adjust the M.W. coil cores (with a fully insulated tool) for best results (or for correct dial readings, if a dial is used). A

(Continued on page 920)

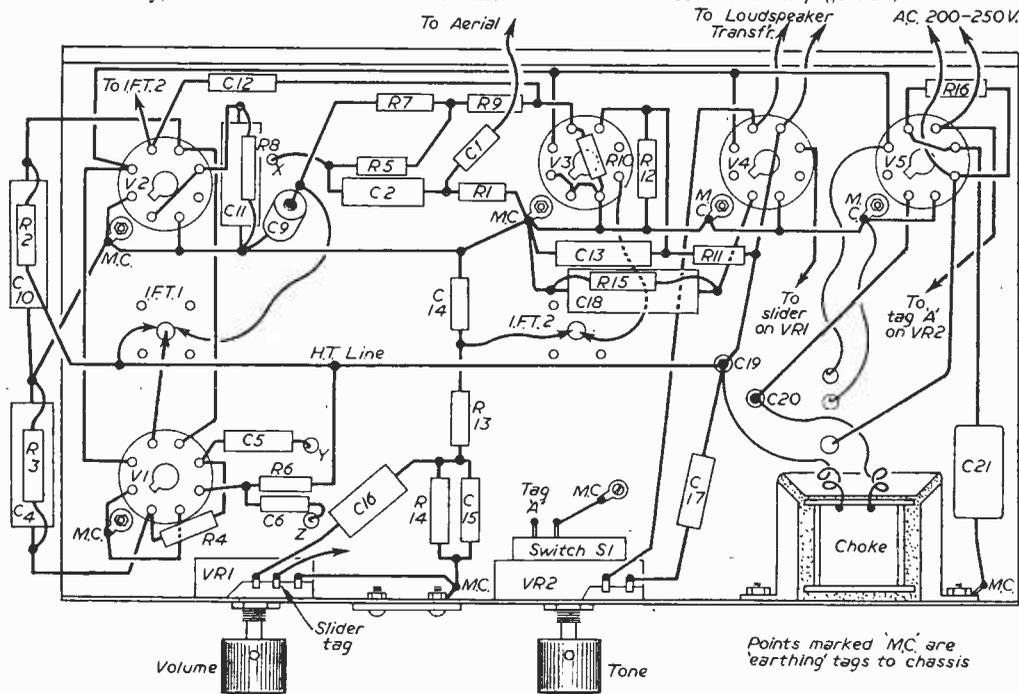


Fig. 5.—The underchassis wiring plan.

An Auto-changer Cut-out

AN AUTOMATIC DEVICE FOR THE "STAAR" RECORD PLAYER

By R. Shatwell

THE recent sale of the "Staar" 4-speed auto-changer will have resulted in the modernisation of many readers' equipment. The author was rather disconcerted to find that the motor did not cut out when the speed lever returned to "0," but idled indefinitely. As the motor is extremely quiet, it was felt that it was highly probable that it might be left running by the younger members of the family, and an automatic cut-out seemed desirable.

An examination of the mechanism under the plastic cover, which is secured by a single screw near the speed lever, made it obvious that the only position to which operation could be tied was the speed change lever, and that operation should be effective in the move from "0" to "78" and no alteration be made by further movement of the lever. In fact, two tapped holes in the base plate seem to indicate that a switch may be fitted in some models.

Materials

Use was made of readily available materials, consisting of 1/16in. paxolin, 1/4in. paxolin or other insulating material, and a pair of standard size relay leaf springs with the associated insulating clamp. 8 B.A. bolts were used throughout. Fig. 1 shows the position of the switch on the metal base plate of the player, with the related speed change mechanism also visible. The position shown is the "78" speed (i.e., motor "on"). Further speed change does not affect the switch, which is in the "relaxed" position when on, the leaf springs being under tension in the "off" position. As the speed switch moves

to "0" the arm 5 is pushed back by 8 and the contacts forced apart by 3 being turned between the contact leaf springs.

Relay Clamp Assembly

The relay clamp assembly will normally have three screws securing the insulation and contact springs and is cut off above the last of these to the required length of .6in. and then pulled apart to enable the leaf springs to be cut back a further 1/32in. as a precaution against electrical shorts at the end. Only one bolt is replaced as shown at 7, and this secures the angle piece 6 to the assembly. Check here that a good clearance exists between this and the contact springs, as, in operation, the mains voltage may be applied between them.

Switch Parts

A study of Fig. 2 and the details of the switch parts (Fig. 1) will no doubt suffice for most constructors, but the following notes will clarify any doubtful points. 1, 2, 3 and 5 are of 1/16in. paxolin; 4 is 1/4in. paxolin or other insulator; 6 is 20 s.w.g. aluminium. The holes in 2 and 4 are best drilled with the base, 1, as template. Some adjustment of the contact leaf springs may be necessary to ensure a good solid contact when 3 is in place between them, as the spring of these is used to operate the movement. The screw holding 6 to the base 1 passes through an 8 B.A. clearance hole in the metal player table, as does one of the screws securing 2 and 4 to 1. (It was not possible to use the existing tapped holes.) The other bolt in 2 and 4 is best screwed into the

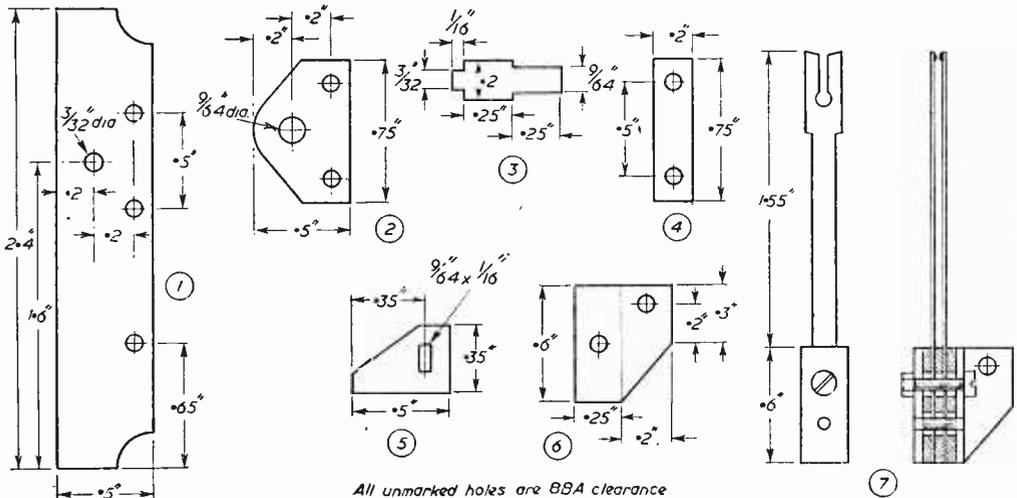


Fig. 1.—The parts required for the switch.

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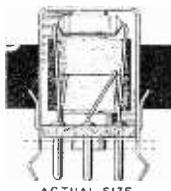
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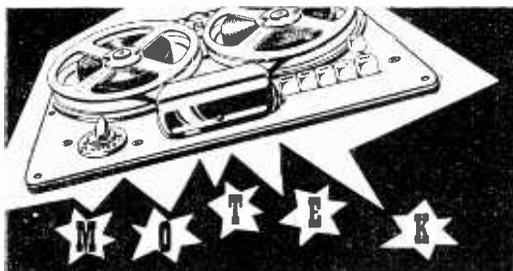
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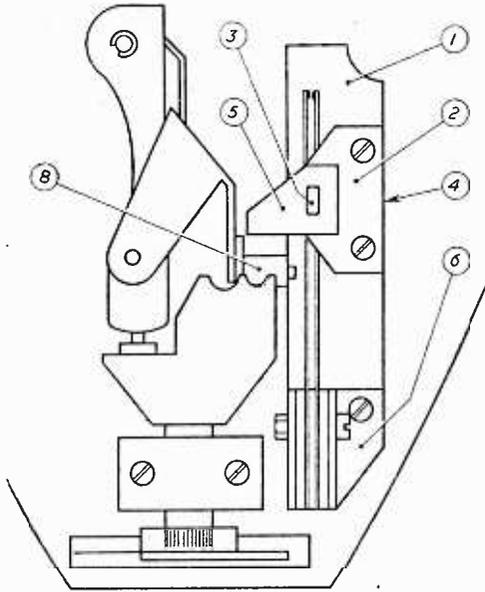
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paxolin base and filed flush beneath. To enable the switch to be fitted partially assembled, 5 is a tight push fit on 3 which pivots in the 3/32in. dia. hole in the base and the 9/64in. dia. hole in 2. A slight movement opens the contacts at once and the spring of the contacts should return it to the "on" position equally quickly. If necessary a 1/16in. split pin can keep 5 in place, but a good fitting and a spot of shellac on the joint has proved quite effective.

Position of Switch

The position of the switch is best set by moving the speed lever to "78" and fitting by the bolt through 6, so that about 1/32in. clearance exists between 5 and the roller 8. Some final adjustment is then possible by side movement, before drilling and bolting the final fixing point. Wiring to the switch is made by direct soldering to the leaf springs 1/4in. from the clamp and if the turntable is removed by opening the spring circlip at the centre, the wiring can run in the existing plastic sleeve in the tag strip where it is arranged that the switch is in series with one of the leads to the motor.

Fig. 2 (Left).—The assembly of the parts shown in Fig. 1

LOUDSPEAKER MATCHING

(Continued from page 883)

Loudspeakers may be connected in series-parallel if required, and this may be necessary if the total impedance of a number of loudspeakers has to be arranged to suit the output impedance of an amplifier.

With hi-fi equipment, however, series-connected loudspeakers are not favoured because the higher total loudspeaker impedance tends to result in a reduction of the damping factor. The damping factor is reduced by the additional impedance introduced into the loudspeaker circuit. The application of negative voltage feedback reduces the amplifier source impedance at the output terminals, and thus improves the loudspeaker damping, the damping factor being increased.

Most public-address amplifiers feature output terminals denoted "100-volt line" instead of the usual 3-, 7.5- and 15-ohm terminals which are found on most hi-fi or lower power amplifiers. With the 100-volt line system, 100 volts of audio signal is present across the terminals when the amplifier is giving full output. Now, as would be expected, the power drawn from the line by the loudspeakers cannot exceed the total power of the amplifier. Thus, if the amplifier is rated at, say, 10 watts, three loudspeakers could be connected as shown in Fig. 6, that is, one

drawing 5 watts and two drawing 2.5 watts each.

The loudspeakers cannot be directly connected across the line, of course, and transformers, one for each loudspeaker, must be used to select the required power. The turns ratio of the transformers depends upon the power it is required to give the loudspeakers and the impedance of their speech coils. In each case, the turns ratio is equal to $100/\sqrt{Z_c \times W}$, where Z_c is the speech coil impedance and W is the power in watts it is required to feed to the loudspeaker.

Referring again to Fig. 6, therefore, one can see that to provide 5 watts to the 5-ohm speech coil of LS1, T1 will require a turns ratio of 20:1, while T2 and T3 will need a turns ratio of 40:1 to produce 2.5 watts in the speech coils of LS2 and LS3.

Any type of loudspeaker (for any degree of power, provided this does not exceed the amplifier rating) can be connected to the 100-volt line by the use of suitable transformers.

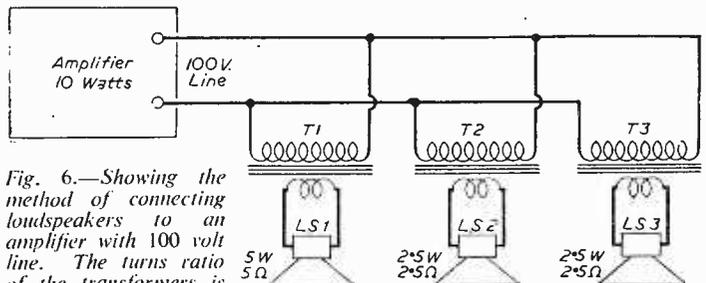


Fig. 6.—Showing the method of connecting loudspeakers to an amplifier with 100 volt line. The turns ratio of the transformers is equal to $100/\sqrt{Z_c \times W}$, where Z_c is the speech coil impedance and W is the power in watts it is required to feed to the loudspeaker.

News from the Trade

NEW GRUNDIG TAPE RECORDER

THE latest addition to the Grundig range of tape recorders is the TK.25. A special feature of this machine is the single input fading control allowing a smooth and easy changeover from microphone to diode, or microphone to



The new Grundig TK.25 tape-recorder with condenser microphone.

radio. The TK.25 operates at tape speeds of $3\frac{1}{2}$ i.p.s. and $1\frac{1}{4}$ i.p.s. This machine has a frequency response of 60-15,000 c/s at $3\frac{1}{2}$ i.p.s. and 60-8,000 at $1\frac{1}{4}$ i.p.s. It is contained in a distinctive blue-grey case, and weighing only 25lb. is easily portable. The price is 62 guineas, excluding microphone. It is obtainable from your local electrical store.

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Ultra linear output stages provide an output of 10 watts into 3.75 or 15 ohms on each stage for a total distortion not

greater than 0.1 per cent. at 400 c/s. The frequency response is flat to within 0.5 db from 20 c/s to 15 kc/s; noise level is at least 70 db below 10 watts. Separate inputs are provided not only for pickups and tape decks but also for radio. The amplifier can, therefore, be used on BBC experimental stereophonic transmissions and is ready for future developments in this field.

Volume on both stages is controlled by a single ganged control and the relative gain on each stage can be adjusted over a range of ± 2 db by a preset differential control. The price of the amplifier is £37 10s. (Airmec Limited, High Wycombe, Bucks.)

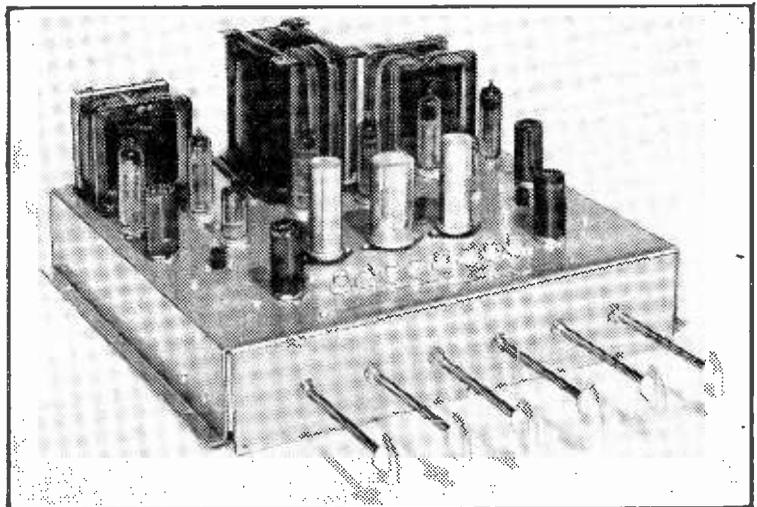
ELECTRIC SOLDERING GUN

CREATORS LTD., of Sheerwater, Woking, Surrey, have announced a new trigger operated soldering gun. It weighs only 1½lb. and is supplied with two yards of flex. Built into the handle are a transformer to reduce the voltage



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THE AMATEUR RADIO CLUB OF NOTTINGHAM (G3EKW)
Hon. Sec.: F. V. Farnsworth, 32, Harrow Road, West Bridgford, Nottingham.

THE Nottingham Amateur Radio Club continues to meet on Tuesdays and Thursdays at 7.30 p.m., when the station transmitter G3EKW is on "Top Band" most club nights.

A H.F. transmitter covering 80, 40 and 20 metres is almost on the air, but unfortunately is suffering from teething troubles. Talks on "Transistors" and "Two Metres" are planned for December, but the dates have not yet been finalised at the time of going to press.

Facilities for construction are available, together with morse practice and new members are cordially invited to visit us at the Sherwood Community Association, Mansfield Road, Nottingham.

BRADFORD AMATEUR RADIO SOCIETY

Hon. Sec.: David M. Pratt (G3KEP), "Glenluce," Lyndale Road, Eldwick, Bingley, Yorkshire.

FEB 10th (Tuesday).—Colour Television. Dr. G. N. Patchett at Technical College, Bradford.

Feb. 28th.—To be arranged.

Mar. 4th.—Receivers for 420 megas. G. D. Enoch (G3KLZ).

Mar. 18th.—Recorded Lectures.

April 1st.—The Electron Microscope. G. W. Reply (G3AHV), at Leeds University.

April 15th.—The Auto Telephone. G.P.O.

April 29th.—Metal Refidification. Standard Telephones and Cables, Ltd.

May 13th.—Visit to Holme Moss TV and V.H.F. Station.

May 27th.—Radio Control of Model Boats. V. W. Whitehead.

June 10th.—Demonstration of Radio Controlled Boat. Batley Park.

June 24th.—Visit. Birstall Carpet Co.

July 12th.—Annual General Meeting. Commencement of new session. Meeting 7.30 p.m., followed by discussion.

BRIGHTON & DISTRICT RADIO CLUB

Hon. Sec.: E. Roberts, 9, Clifton Hill, Brighton, 1, Sussex.

AT the recent A.G.M. the following new committee was elected: Hon. Sec., Mr. E. Roberts, 9, Clifton Hill, Brighton, 1, Sussex; Chairman, Mr. R. T. Henley; Treasurer, Mr. L. Langridge; also Vice-Chairman and fifth member.

The Club will continue to meet at the "Eagle Inn," Gloucester Road, Brighton, 1, on Tuesdays at 8 p.m., when all visitors and prospective members will be most welcome.

THE BRITISH INSTITUTION OF RADIO ENGINEERS

9, Bedford Square, London, W.C.1.

THE following Institution meetings will be held during December:

Friday, Dec. 12th, 6.30 p.m. (London). Technical Films on subjects of interest to radio and electronics engineers, at London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1.

Wednesday, Dec. 17th, 6.30 p.m. (London). "A Vidicon Camera for Industrial Colour Television," by I. J. P. James, B.Sc., at London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1.

Friday, Dec. 19th, 7 p.m. (Edinburgh—Scottish Section). "Design and Construction of Precision Toroidal Potentiometers for Data Transmission," by H. J. Arnott, at the Department of Natural Philosophy, The University, Drummond Street, Edinburgh.

Thursday, Dec. 18th, 7 p.m. (Glasgow—Scottish Section). "Design and Construction of Precision Toroidal Potentiometers for Data Transmission," by H. J. Arnott, at the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow.

Wednesday, Dec. 10th, 6.30 p.m. (Llandaff, South Wales Section). Annual General Meeting followed by a Discussion Meeting on "The Training of Electronics and Radio Engineers," at Llandaff Technical College.

Wednesday, Dec. 10th, 6 p.m. (Newcastle—North Eastern Section). "High Resolution Airfield Control and Ground

Surveillance Radar," by P. H. Walker, at the Institution of Mining and Mechanical Engineers, Neville Hall, Westgate Road, Newcastle-upon-Tyne.

Wednesday, Dec. 10th, 7.15 p.m. (Wolverhampton—West Midlands Section). "Electronic Instruments in Motor Vehicle Research," by J. C. Dixon, B.Sc., at the Wolverhampton and Staffordshire College of Technology, Wulfruna Street, Wolverhampton.

BRITISH SOUND RECORDING ASSOCIATION

ALL meetings are held at the Royal Society of Arts, John A. Adam Street, Adelphi, London, W.C.2, and commence at 7.15 p.m. Doors open at 6.30 p.m. and light refreshments are available.

Friday, December 19th, 1958.—"Microphone Balance Techniques." J. Borwick, B.Sc.

Friday, January 16th, 1959.—"Some Further Developments in Loudspeakers." A. R. Neve.

Friday, February 20th, 1959.—"The Design of an Electronic Organ for the Home." G. W. Barnes, B.Sc., A.M.I.E.E.

Friday, March 20th, 1959.—"F.M. Feeder Units." R. S. Roberts, M.Brit.I.R.E., Sen.M.I.R.E.

Friday, April 17th, 1959.—"The Quest for Quality." Peter Ford, L.I.B., F.R.S.A.

Friday, May 15th, 1959.—The Annual General Meeting.

CHILTERN AMATEUR RADIO CLUB

Hon. Sec.: R. Barton, 11, Glade Road, Marlow, Bucks.

THE above Club are now meeting at the British Legion Hall, St. Mary Street, High Wycombe, on the last Thursday in the month. Will anyone wishing to attend these meetings kindly get in touch with the Secretary, address as above?

CIVIL SERVICE RADIO SOCIETY

THE Science Museum Radio Society has changed its name to the above Society, and the venue is the Science Museum, South Kensington, S.W.7.

1958

Monday, December 8th.—Film Show (in the Lecture Hall, Ground Floor). (1) Design and manufacture of long distance transmission lines and repeater stations (the latest transatlantic submarine cable). Courtesy of Standard Telephones & Cables. (2) "Radar Helps Shipping"—The Golden Arrow service Dover-Calais in Fog. Courtesy of British Transport Commission. (3) "Made for Life"—The design and complete manufacture of Television Picture Tubes. Courtesy of Mullard Ltd. (4) "Signal Success"—Communications and signals equipment installed at Waterloo Station signal box by former Southern Railway Ltd. (5) Four Back Rooms—Story of Electrical research and techniques in British Transport commission laboratories, 1959

Monday, January 5th.—"Capacitor Techniques and Peculiarities," by Mr. J. Lank (Chief Development Officer T.C.C. Ltd.), with colour films. In the Lecture Hall.

Monday, February 9th.—"High Fidelity and Stereoscopic Sound Techniques" (tentative arrangements have been made with Messrs. Tannoy Limited)—with demonstrations.

Tuesday, March 10th.—Lecture and films on communications work. (Tentatively arranged with Messrs. Cossor Ltd.) in the Lecture Hall.

Tuesday, April 14th.—Annual General Meeting (in the Dem. Room).

All meetings are timed to commence at 6 p.m., but wherever possible light refreshments will be available and a general Pow-wow held prior to commencement.

HALIFAX & DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: A. Robinson (G3DW), Candy Cabin, Ogdan, Halifax.

AT the monthly meeting held on November 4th, 1958, at the Sportman Inn, Ogdan, Halifax, of the above Society, a very interesting lecture was given to the members by Mr. H. Swift (G3ADG), of Halifax, whose lecture was on transmitters.

A vote of thanks was proposed by Mr. H. Makin (G3FDC), and it was also decided that the meeting should be held twice monthly instead of the present monthly meetings, so in future they will be held on the first and the third Tuesday of each month, the first Tuesday will be a lecture and the third Tuesday an open meeting. There was a very good attendance.

LIVERPOOL & DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: W. D. Wardle (G3EWZ), 16, Mendip Road, Childwall, Liverpool.

MEETINGS every Tuesday, 8 p.m., at Gladstone Mission Hall, Queen's Drive, Childwall, Liverpool.

At the recent A.G.M. the following were elected for the 1959 term:

Hon. Sec.: W. D. Wardle (G3EWZ).

Chairman: A. D. H. Looney (G3L1U).

Treasurer: R. Kenyon.

Contests Manager: R. Halhead (G3KOR).

The year has started well with the winning, for the second year

running, of both the Region 1RSGB Trophy and the R.R. Trophy for the highest Regional score in National Field Day. Activity is at a high level generally, and the present programme culminates in the Liverpool Hamfest, provisionally to be held on February 1st, 1959.

The programme is as follows:
 Jan. 6th.—Technical Quiz.
 Jan. 13th.—Open Evening.
 Jan. 20th.—Talk: "Westmorland DX-pedition."
 Jan. 27th.—Films.
 Feb. 3rd.—Sale of surplus gear.
 Feb. 10th.—Open Evening.

PRESTON AMATEUR RADIO SOCIETY

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

THE recent Hobbies Exhibition was very successful. Great interest was shown in the Club's stand and 16 new members were enrolled with many more "possibles." Operation of the station G3PRS was very difficult due to bad receiving conditions, noise in the hall and QRN, but many contacts were made, mostly on 160 metres. All contacts will be acknowledged by special QSL cards, which have been kindly donated by Messrs. Mullards Ltd.

Dec. 10th.—Film Strip Lecture.
 All meetings commence 7.30 p.m., at Fruiterers' Club, High Street, Preston. Morse practice, 7.30 to 8 p.m. New members are cordially invited. Write to the Secretary for details or just drop in at the meetings.

RAVENSBORNE AMATEUR RADIO CLUB

Hon. Sec.: J. Wilshaw (G3MPX), 4, Station Road, Bromley, Kent.

THE Club meetings are now being held on Wednesday evenings, 8 p.m., at the Malory Secondary School, Launcelet Road, Downham, Bromley, Kent, where the club transmitter G3HEV will be on the air each week. The Club chairman, G2DHV, hon. sec., G3MPX and G5MOW will be in attendance.

A radio and TV instruction class is also held at the same time, also a Morse class if required.

CLIFTON AMATEUR RADIO SOCIETY

Hon. Sec.: C. H. Bullivant, G3DIC, 25, St. Fillans Road, Catford, S.E.6.

THE main event during October was the Anniversary Social held on Friday 17th. Some 50 people attended this function comprising members of the Society, their Ladies and Guests. During the evening Mrs. W. Martin, wife of the Chairman (G3FVG) of the Society presented the winners of the Championship Cup, D. F. Shield and Transmitting Field Day Cup with their trophies.

On Friday 31st October members were invited to take part in a competition to construct an O-V-O receiver in one hour. This competition originally held many years ago again provided much interest and amusement. The winner of the competition was SWL D. Vincent who received a pair of side cutters as a prize. Mr. Vincent's time was 44 minutes.

TEES SIDE AMATEUR RADIO CLUB

Hon. Sec.: A. L. Taylor, G3JMO, 12, Endsleigh Drive, Acklam.

IN spite of difficulties the above club have been able to put on their Xmas Dinner by using an outside catering firm and this will now take place as detailed.

Tees Side Amateur Radio Club Christmas Dinner, Settlement House, Newport Road, Middlesbrough, Saturday, December 13th, at 7.30 p.m. A full dinner with wine for 10s. 6d.

G3LXG/A on 1.98 Mc/s from 6.30 p.m. onwards will "talk-in" mobile transmitting visitors in their cars; aperitifs served at 7.30 p.m. Dinner 8 p.m. Settlement House closes 11 p.m. Raffles and prizes provided. Guests are invited to bring gear to place on the "swap" table along with their QSL card. Other guests may then privately contact them during the evening and in this way some good gear may change hands. The Club will not take any part in these arrangements for this is not an auction of "junk."

Manufacturers and dealers are invited to send lists and leaflets, catalogues, etc. for distribution. About 40 guests are expected. All reservations must be made in advance as outside catering makes it difficult to provide for latecomers. Remittances will be acknowledged. Applications to the Hon. Sec. before December 10th.

WELLINGBOROUGH & DISTRICT RADIO & TELEVISION SOCIETY

Hon. Sec.: P. E. B. Butler, 88, Wellingborough Road, Rushden, Northants.

THE Society continues to meet every Thursday at 7.30 p.m. at the club room above the W.I.C.S. fruit shop in Silver Street.

The winter programme is as follows:
 Dec. 11th, 1958.—G. Abrams, M.I.P.R.E., A.M.T.S., will give a talk on his wartime experiences with radio countermeasures.
 Dec. 18th, 1958.—The Annual Christmas Party will be held in the party room of the Peacock Inn.

Jan. 8th, 1959.—The A.G.M. will take place.

Constructional evenings will be held between 7 p.m. and 8 p.m. when there are no set lectures. Visitors and new members always welcome.

Catalogues Received

Testing Instruments

AVO LTD., Avocet House, 92-96, Vauxhall Bridge Road, London, S.W.1, have recently produced a new instrument catalogue. It deals with the Universal AvoMeter Models 7, 8 and 40, and the Avo Electronic Testmeter and Multimeter. The new Avo Signal Generator Type 378, which has been designed to provide R.F. signals between 1 μ V. and 25 mV. into a 75-ohm load at any frequency between 2 Mc/s and 225 Mc/s is fully described, as well as the Avo Prodclips, which cost 15s. per pair.

Home Radio of Mitcham

A NEW catalogue dealing with radio and television components has just been published by Home Radio (Mitcham) Ltd., 187, London Road, Mitcham, Surrey. There are 92 pages, and it costs 1s. 6d., plus 6d. postage. It gives a comprehensive list of parts, together with prices, as well as photographs and illustrations. It contains a very useful index. In addition to the page number there is also a number showing the line where a particular item is.

Stereophonic Equipment

THE DULCI CO., LTD., Villiers Road, Willesden, N.W.2, have sent us a leaflet and price list of their latest range of stereophonic equipment for three dimensional sound. The notes given are intended to assist the prospective stereo enthusiast in his choice of the various items which go to make up a stereophonic system. The leaflet deals with the complete installation, loudspeakers, power amplifiers, pre-amplifiers, programme source, converting monaural to stereo, and loudspeaker location.

A.C. PRE-TUNED SUPERHET

(Continued from page 911)

station low in the band is then tuned in, and the trimmers on the gang condenser are adjusted for best results. The procedure is then repeated, cores being adjusted at a high wavelength, and gang condenser trimmers at a low wavelength, until no further improvement is possible. The L.W. band, if provided, can then be treated in the same way. Afterwards, the pre-sets are adjusted for the desired stations, as explained.

When no further adjustment of any trimmer or core improves volume, alignment is complete.

The valves required are the 6K8, 6K7, 6H6, 6V6 and 6X5. Valves in which the type number is followed by the letters "G" or "GT" are also suitable; for example, 6K7G, 6K7GT, 6H6G, 6H6GT, etc. "G" denotes the ordinary type of glass bulb. "GT" denotes the smaller tubular bulb. Any of these may be accommodated and have the same electrical characteristics. In the illustration the actual valves are the 6K8, 6K7G, 6H6GT, 6V6G and 6X5GT.



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CB131 24/4	KL32 8/6	UCF80 23/-	6A7 12/6	7H7 9/-
CCH35 24/4	KT24 5/-	UCH42 10/6	6A8G 10/-	7Q7 9/-
CL33 13/-	KT33C 10/-	UCH81 11/6	6AC7 6/6	757 9/6
CT31 12/-	KT36 27/10	UCL82 23/-	6AG5 5/6	7Y4 8/6
DAF96 10/6	KT55 12/6	UCL83 17/6	6AK5 6/6	8D2 2/9
DF96 10/6	KT66 15/-	UCF11 10/6	6AL5 6/6	9D2 3/6
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DK96 10/6	KTW63 7/6	UF89 10/6	6AQ5 7/6	
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ECC86 13/6	PL85 12/6	12/14) 8/9	6F6M 7/6	
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ECC88 13/6	PL85 12/6	12/14) 8/9	6G6 4/6	
ECC89 13/6	PL85 12/6	VU139 (MU	6G6 4/6	
ECC90 13/6	PL85 12/6	12/14) 8/9	6H6GT 2/6	
ECC91 13/6	PL85 12/6	VU139 (MU	6J5M 6/6	
ECC92 13/6	PL85 12/6	12/14) 8/9	6J6 6/6	
ECC93 13/6	PL85 12/6	VU139 (MU	6J7G 6/6	
ECC94 13/6	PL85 12/6	12/14) 8/9	6J7M 9/-	
ECC95 13/6	PL85 12/6	VU139 (MU	6K6GT 7/-	
ECC96 13/6	PL85 12/6	12/14) 8/9	6K7G 5/-	
ECC97 13/6	PL85 12/6	VU139 (MU	6K7M 6/9	
ECC98 13/6	PL85 12/6	12/14) 8/9	6K8G 8/6	
ECC99 13/6	PL85 12/6	VU139 (MU	6K8GT 10/-	
ECC100 13/6	PL85 12/6	12/14) 8/9	6L6G 9/-	
EF36 6/-	PZ30 20/11	X78 15/-	6L8 15/-	
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EF41 9/9	PEN25 5/-	Z359 9/6	6Q7GT 9/-	
EF42 11/-	PEN44 27/10	Z359 9/6	6R25 20/11	
EF50 4/-	PEN45 27/10	IA3 3/6	6L6G 9/-	
EF54 6/-	PEN46 7/-	IA5GT 6/-	6L8 15/-	
EF80 8/6	PEN220A	IA7 12/6	6N7 7/6	
EF85 9/-	PEN220A	IC2 11/6	6P28 27/10	
EF86 14/6	PEN220A	IC5GT 12/6	6Q7G 9/-	
EF89 10/-	PEN220A	ID5 12/6	6Q7GT 9/-	
EK32 8/6	QP21 7/6	ID6 12/6	6SA7GT 8/-	
EL32 5/6	SP41 3/6	IH5GT 10/6	6S7 7/6	
EL33 15/-	SP61 3/-	IL4 6/6	6S7 7/6	
EL38 27/10	T41 24/4	IN5 10/6	6SH7 6/6	
EL41 11/-	TP22 8/-	IR5 8/-	6SK7 5/-	
EL42 12/-	TP23 8/-	IS4 7/-	6SL7GT 8/6	
EL84 10/6	TP25 27/10	IS5 7/6	6SN7GT 7/6	
EM34 9/-	U10 10/6	IT4 7/-	6S7 7/6	
EM80 10/6	U22 8/-	IU5 7/6	6U4GT 12/6	
EM81 11/6	U26 12/6	2C26 1/6	6U5/6G5	
EY51 13/6	U37 27/10	2X2 4/6	6U5GT 8/6	
EY86 13/6	U45 15/-	3A4 7/-	6U7G 8/6	
EZ40 9/-	U50 8/-	3A8GT 6/-	6V6G 7/6	
EZ80 8/9	U403 17/5	3D6 5/-	6V6GT 7/6	
EZ81 11/10	U404 11/10	3Q4 9/6	6V6M 9/6	
EZ90 8/-	U801 31/4	3Q5GT 9/6	6X4 7/6	
EI48 2/-	UABC80	3S4 8/-	6X5G 7/6	
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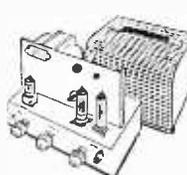
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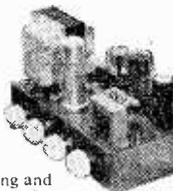
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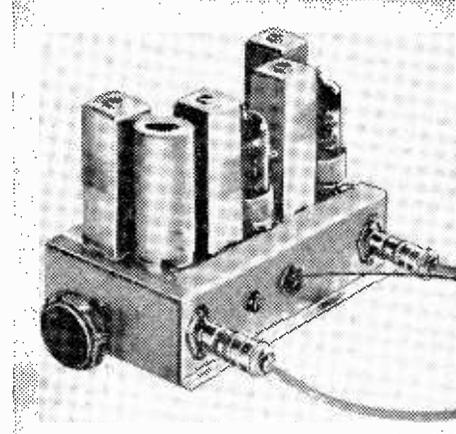
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Programme Pointers

OUR CRITIC, MAURICE REEVE, REVIEWS SOME RECENT PROGRAMMES

GRAND HOTEL has long been one of radio's most popular Sunday features, and Albert Sandler was one of its favourite personalities. It has passed through one or two crises recently, most notable—and most to be regretted—being the early termination, through disability in his arm, of Jean Pougnet's career as a violinist. But good musician that he is, Mr. Pougnet has formed his own "Palm Court" orchestra and thus maintains his connection with it. On their first appearance they played with considerable pep and dash, so that this favourite Sunday forty-five minutes should continue with unabated popularity.

Tribute to "Monty"

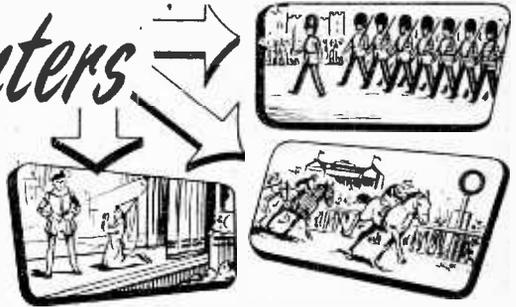
Montgomery of Alamein. The sixty minute tribute to the Field-Marshal on his retirement was very quiet and unexciting. I expected the guns of his victorious armies to be unloosed but was very glad they weren't. As with all these programmes, only praise was heard: it was entirely non-controversial. General Sir Brian Horrocks narrated a script edited by Graham Jackson and David Woodward, and the programme was produced by Laurence Gilliam. Many famous colleagues and contemporaries paid their tributes; a pity the most illustrious of all was missing.

Noël Coward

A Noël Coward Festival was bound to follow those which have honoured other playwrights. And whose plays have given more pleasure than his? One or two, such as *Private Lives* and *Blithe Spirit*, are high in the estimation of both the critics and the public, and should retain their popularity for many years to come. And who can gainsay that they are not entitled to their high place in modern comedy? Not only does their wit sparkle and cascade from curtain rise to fall, but, whatever their particular milieu may be, they make us feel participants in what is going on and they draw us into their ambit, which is what all good plays do. Also, Mr. Coward's horizons range far and wide: the social strata of *Private Lives* is poles away from *This Happy Breed*.

Plays

I listened to *The Queen Was In the Parlour*, *Private Lives* and *Brief Encounter*. I enjoyed every minute of them. One's memories of the stars we saw in the original stage productions—the author himself, for example, with the late Gertrude Lawrence in *Private Lives*—are bound to intrude, especially when we are only able to hear voices and have no figures to



exercise our powers of sight. Annabel Maule and Simon Lack in *Brief Encounter*. Maxine Audley, Robert Eddison, Malcolm Keen and Heron Carvic in *The Queen Was In the Parlour* and Denise Bryer, William Fox, Mary Wimbush and Simon Lack in *Private Lives*, were the chief contributors to the three plays I heard. All were admirable together with their colleagues in the casts.

Trials

The series of reconstructions of famous trials, with summaries by Lord Birkett, are extremely interesting and exciting, and very well produced. *The Verdict of the Court* is their generic title. The unbelievable Tichbourne impersonation case formed the best possible opening.

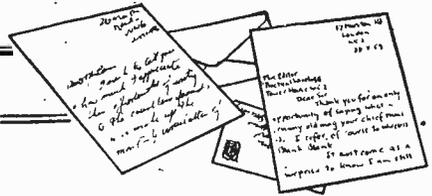
"Story of Nelson"

A Life of Nelson, to mark the bi-centenary of his birth, was good of its kind. One wondered how Lady Hamilton would be handled. She was not exactly omitted, but dealt with on a very soft pedal. Strange, and fascinating, how his countrymen have forgiven him an affair which it would not have, and has not, tolerated in many other public men's lives. In his service Nelson was, like Monty in our own day, the strictest of disciplinarians. Yet with both men some of their most important achievements arose through an act of the grossest personal indiscipline. A wonderful story.

"Any Questions"

The tenth anniversary of *Any Questions* demands a comment or two on its progress towards its present position in radio commentary programmes. That it is one of the most looked-forward-to of items few will dispute. It has an ideal chairman in Freddy Grisewood. And it has a sufficient number of vital personalities among its panels to insure stimulating discussions and humorous interludes. Also, I suggest its public audiences must be a great help in not only keeping it up to scratch, but in giving it reality and vitality. Some of the studio items, with their invited or "application" audiences, suffer greatly in consequence, more especially the variety shows. Some of the questions put forward sink below the nadir of ineptitude and foolishness. But the majority are interesting, stimulating and provocative, and the programme fully deserves the high place it holds in intellectual radio entertainment.

Open to Discussion



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

"Cliché English"

SIR.—Thermion's strictures on "cliché English" in the November issue in "On Your Wave-length" have my wholehearted approval. I suppose none of us is completely free from the use of the cliché, but some writers and speakers don't seem to be able to avoid the constant use of trite platitudes. You know the types who keep reiterating "couldn't agree more," "let's face it," "grand job of work," and excuse everything from a broken appointment to attempted murder with "it was just one of those things."

It is most encouraging to find a prominent journalist so outspoken against the gross misuse of our very expressive language. We may expect a vocabulary to develop and change in step with the times, but empty vulgarisation is to be deprecated.—J. S. BAUCHOP (Glasgow).

A Reader's Results

SIR.—I have made the two-transistor/crystal receiver, as described in the January, 1958, issue of PRACTICAL WIRELESS.

I have had very good reception on a fairly short aerial, and normal earth: Light programme quite good. Home and Network Three/Third, deafening on H.R. earphones. I found that on the long-wave coil described, I could not get the Light programme, so I used a miniature, dual-wave crystal coil, with success.

A short while ago, the 25 μ F/25 v. electrolytic capacitor went O/C, and it was then that the set really "went."

The "Light" could be heard in every room of the house, and the "Home" could be heard quite clearly on a 2 $\frac{1}{2}$ in. P.M. loudspeaker, without any output trans. whatsoever!

I am 15 years old, and have made several 2- and 3-valve sets to date, but this transistor set literally leaves them way behind.

I am using Green/Yellow spot transistors, instead of red spo's.

Thank you very much for a really "A1" circuit.—C. V. PLAICE (Mumbles).

G.B.Z.

SIR.—With reference to a letter in "Open to Discussion," I would like to explain the strange G.B.Z. signal picked up by Mr. Chesters of Tamworth. This signal is given by a beacon

placed in the local R.A.F. airfield here in Gibraltar. The letters mean, Gibraltar British Zone. The beacon gives a bright red light apart from the signal. This helps to guide aircraft down to the airfield. The signal is kept up all night by this special light and radio beacon.—JOSEPH SCHEMLIN (Gibraltar).

Long-wave Reception

SIR.—Your correspondent, M. A. Bushell, asks why manufacturers continue to include a long waveband in receivers.

The very simple answer is, of course, that for quite a large number of listeners the Light Programme can only be received satisfactorily from Droitwich.

In the area of my home, some 65 miles from London, the Medium-wave Light Programme transmissions are quite impos-

sible after dark, even when using a good aerial and sets employing an R.F. stage. On the other hand, the Droitwich transmission provides the strongest signal from any station received.—F. H. COWLES (Winchester).

[Dozens of letters have been received pointing out that the Long Waves are the only satisfactory signal.—ED.]

"Micro-Midget"

SIR.—With reference to the "Micro-Midget," am I right in pointing out, as no doubt many others have already done, that in Fig. 5 showing the wiring of the transistors, the spots of TR2 and TR3 are shown on the wrong side? I discovered this when the set I made did not work.—W. D. DEVINE (Seven Kings, Essex).

[You are quite correct.—ED.]

Correspondent Wanted

SIR.—I am 16 years old and very interested in amateur radio, and would like to correspond with radio enthusiasts of my own age.—SEAMUS RYAN, Upper Mary Street, New Ross, Co. Wexford, Ireland.

No Long Waves?

SIR.—Referring to the letter from M. A. Bushell (November issue), I must entirely disagree with him that "there is no programme value on,

(Continued on page 927)

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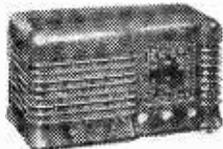
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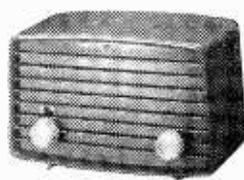
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the long waves." I travel on business all over the country with a caravan and there are many places where the Light Programme cannot be received on medium band, in fact, I should say half of the British Isles depend on L.W. for the Light.

No programme value? I listened to the whole of Tosca (perfect reception) with Renate Gebaldi and Stefano relayed from the Brussels Exhibition by Radio Paris. That station is as powerful as the Light and can always be depended on, for programme value. Radio Luxembourg and Europe Number One, also are very good signals day and night both giving continuous light music from 6.30 a.m. to midnight daily. There is no fading on the long waves—try to get 208 Luxembourg in three-quarters of the country or its short-wave counterpart. Both at times completely disappear.

I also deplore the way set designers are making for single station L.W. band. I had to adapt my transistor superhets to tune on L.W.—very successfully, owing to transistors' high L.W. efficiency.—F. NEVILLE HART (W.2).

Reproduction

SIR.—Of course R. G. Hann (November issue) obtains better reproduction on his record-player than on his radio receiver! It has nothing to do with his loudspeakers either, as a 7in. X 4in. elliptical should give approximately the same response as a 5in. round. If Mr. Hann cares to make a small experiment of switching his two speakers, he will find that Radio Luxembourg still sounds poor compared with his record-player. It is because Medium waveband stations are restricted to a bandwidth of 9 kc/s. and consequently, even under perfect conditions, can only give an audio response up to 4.5 kc/s. No amount of treble boost will help either, because there "just ain't no treble to boost."—P. R. WILLIAMS (E. Molesey).

The C.R.L. Bridge

SIR.—The parts list in the January issue was incorrect. The correct values are as follows:

R1—4.7 k.	R11—Not used.	C1—8 μ F.
R2—47k.	R12—10 ohm	C2—.001.
R3—1 k.	precision.	C3—.001.
R4—100 k.	R13—100 ohm.	C4—.1.
R5—10 ohm.	R14—10 k.	C5—.1.
R6—10 k.	R15—1 meg.	C6—8 μ F.
R7—2 meg.	R16—10 meg.	C7—100 pF.
R8—1 meg.	VR1—10 k. pot	C8—.001.
R9—1 meg.	w/w.	C9—.01.
R10—7.5 k. 10	VR2—2 meg.	C10—.1.
watt.	pot.	C11—1 μ F.
—J. HILLMAN (Co. Antrim).	VR3—3 k. pot.	

Unusual Phenomenon

SIR.—With reference to Mr. J. Chesters' letter in the November issue of PRACTICAL WIRELESS. G.B.Z. is the call sign of the General Post Office long distance radio station Criggion. The station transmits on a frequency of 19.6 kilocycles and in the intervals between traffic

broadcasts sends the signal G.B.Z. continuously.—J. S. JOHNSON (Radio Officer) S.S. Winneba.

Two-valve Hi-Fi Amplifier

SIR.—Re Mr. T. W. Dresser's article "Two-valve Hi-Fi Amplifier." in the November issue. The B7G valveholders listed by Mr. Dresser for the 6AQ5 and 6X4 are correct but the EF86 used needs a B9A valveholder which is much larger than a B7G if drilling his chassis to take a B7G valveholder type. This could be misleading to constructor not noticing the mistake.—R. HALEY (S.E.27).

A Full-compass Electric Organ

SIR.—As a result of enquiries referring to a 7 K resistor, further perusal of the circuit as published in the August issue shows this to be a type error. The value should be 47 K.—R. WOODCOCK (Sale).

"An Automatic Time Switch"

SIR.—I cross swords with Mr. Romley, (September issue), in that in his anxiety to avoid using a second relay (they are cheap enough) he has brought in many unnecessary complications. In the first instance I would replace the three (or four) setting switches with one single jumper board with two circles of nuts, connected as he had suggested to the relative studs on the dial—inner circle for hour positions and the outer for five minute intervals. Beneath this jumper board would emerge from the panel four flying leads each armed with a crocodile clip. Two to set the "on" and two the "off." Setting would simply consist of clipping the first two leads to the "on" time, and the other two to the "off."

The hour clips and leads would pass direct to earth. Power would be fed to one operating terminal of both relays and the operation would be by earthing. The "on" minute lead would (when the fingers were in the appropriate position) earth one side of relay "A" via the fingers and bring on the mains, and at the same time a second contact on relay "A" would do the same thing thus locking it on, even when the fingers had cut the original operating circuit. There would be no question of "chatter" as the second contacts would be well and truly closed long before the fingers had "cut." So far so good, but now to the switching "off." Relay "B" would only have one pair of contacts and at rest they would be closed and would be wired in series with the locking contacts of relay "A." While the switching "on" operation for the mains was taking place they would be closed but when the time came for "off" they would open and as the fingers would have already cut, and "A" was being held closed by the locking contacts, relay "A" would open and the mains cut off. Relay "B" would remain on until the minute finger had passed its stud, when it would revert to normal and the whole circuit would also become "at rest."

In this method like that of Mr. Romley's, in my view there is a bad feature in that all the

while the mains are "on" current is being taken from the battery.

A much better idea is to mount both relays sideways on as indicated in the sketch, and to add to relay "A" a small retaining clip to hold the armature down. There need only be one contact set on relay "A" and if heavy duty contacts are not available several pairs can be wired in parallel. If the contacts are arranged for an early make there will be an appreciable amount of travel of the armature after closure, making it easy for the clip to slip into position, and ensuring that when the power is cut by the movement of the hands, the small amount of take up will not open the contacts. All relay "B" does is to pull the retaining clip back, allowing relay "A" to return to normal. In this system the battery is only being used while the minute hand is passing the studs—say at the outside five minutes in all.—E. NORMAN EVANS (G3FRT) (Hoylake).

Ex-Service Equipment

SIR.—Now that the market is well flooded with various items of ex-government apparatus I think it is about time that some source of information could be found where all the data could be collated. For instance, I know that receivers and transmitters are in a category all of their own, but what about such things as resistors, condensers, etc. These carry, in many cases, an R.A.F. Vocabulary number (10/C something or other), whilst certain Army items have AR numbers. Could not the standard commercial equivalents of these be collected by someone in the Service, and submitted for publication? There can be no security on this type of information, and I am sure that dozens of readers would welcome this data if one of your service readers would supply it.—H. T. R. (Sidcup).

"A High Quality Record Player"

SIR.—I have just completed construction of the above and find results most disappointing. I have made certain modifications to resistor values, with some improvement and should be glad to know whether the quality should be good from this unit as described.—J H. Y. (Liverpool).

[Unfortunately the values of R9, R15 and R18 were wrongly quoted in the list of parts. R9 should be 100 ohms, R15 should be 250 ohms and R18 should be 100 ohms. The original unit gives bass response which is more than adequate and for the benefit of those who may wish to duplicate the designer's results, it may be pointed out that the mains transformer and the output transformer are both "Elstone" components, and that the amplifier was used in conjunction with a Garrard type G.C.2 crystal pick-up.—ED.]

SIR.—In the above described in the October and November issues of PRACTICAL WIRELESS, two 6J5s were used. On examining my Valve Data Book I found that the only differences between a 6J5 and a section of a 6SN7 were the inter electrode capacities. As these make little difference to the operation of an A.F. amplifier, a 6SN7 could be used.

One 6SN7 would replace two 6J5s and, if new (i.e., not surplus) valves were used, the cost would be reduced to approximately 5/7th of the original price of two 6J5s. Using the cheapest surplus valves only 4d. difference was found.—E. THORNILEY (Stockport).

Stereo Reproduction

SIR.—I have read that one firm has an invention which enables stereo results to be obtained with a single pick-up, and I wonder if any readers have experimented with stereo using a single amplifier. It appears to me that it should be possible to adopt some scheme similar to that which at one time was used to provide high quality reproduction in which a valve acted as a "channel splitter," feeding all notes below a certain value to one section of an amplifier, and those above to another section. Each of these sections fed speakers so that high quality was obtained. Could not such an arrangement be used to split the two channels in some manner, and then we would only need a two-stage amplifier at the most to feed our two speakers, and this would be very much cheaper than elaborate twin amplifiers of high power. Where are the experimenters, or what are the snags?—G. R. (S.W.3).

The Great Transistor Chaos

SIR.—I couldn't agree more with Mr. R. H. Stewart (December issue).

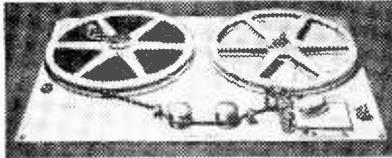
I built a well-known pocket 7 transistor receiver and though at first I was immensely impressed by the performance of so tiny a radio, I soon became disgruntled with the lack of quality.

After scouting around I purchased a Stentorian H.F. 610 speaker and mounted this at the end of a 6in. square box (stoutly made), 12in. long. I then connected up a Mullard 6 volt 250 MW amplifier for which a printed circuit is available and fed this from a band pass crystal feeder (necessary to separate Light and Home in the London area). The results are by no means hi-fi, but they are quite impressive all the same, especially when the back end of the box (opposite end to the speaker) is left open—this idea came from a book on speaker enclosures.

I am now thinking of incorporating a superhet front end to make the set truly portable and sensitive, though I realise I must sacrifice quality and I am looking for a suitable circuit.

Let me add that I have only been at the radio game for six months and am very green, but apropos the letter from Mr. P. R. Williams, I don't think I ever would have become interested if it had not been for transistors. They are indeed the greatest electronic invention since the valve and some articles in the "Engineer" recently, describing their progress in the U.S. over the last 10 years since they were invented makes breathtaking and exciting reading even though most of it was above my head. It was there predicted, if I remember correctly, that in 15 years' time, 95 per cent. of present valve applications would be carried out by transistors and apparently an experimental all transistor TV set has even been constructed.—H. CURTIS (Chingford).

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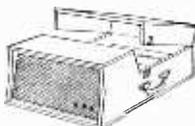
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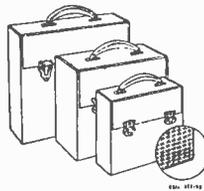
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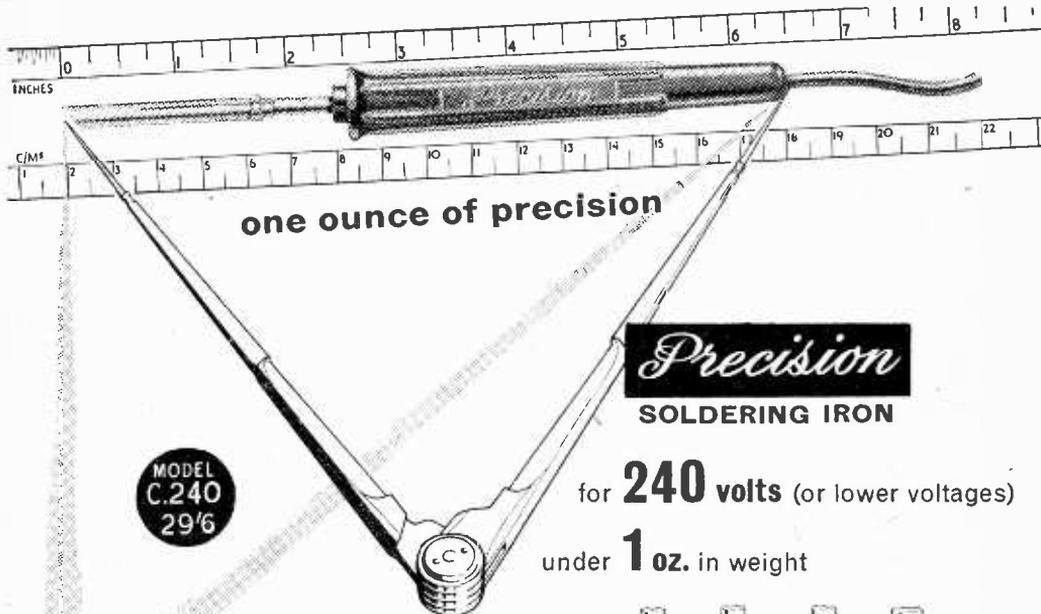
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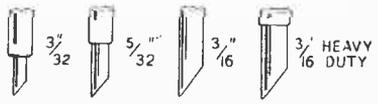


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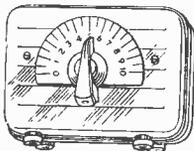
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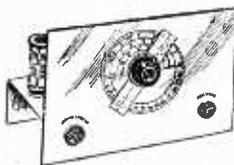
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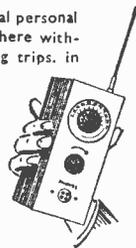


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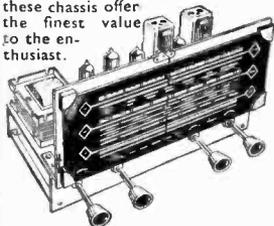
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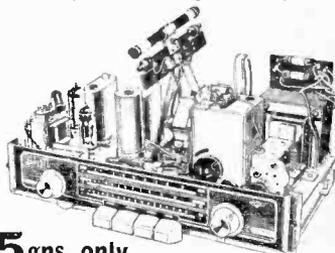
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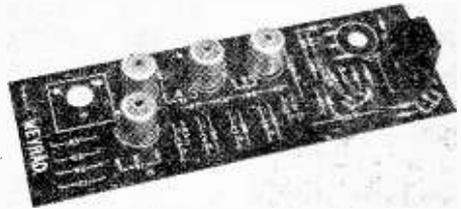
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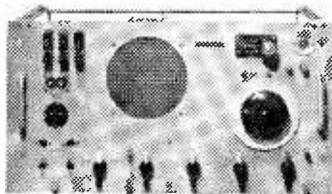


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Complete in screened case with 6SL7GT; 28D7; leads; jack plug, etc. Handbook. Sealed in carton. **ONLY 12/6** P.P. 2/-.

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gram Two (D, Pow) ... PW19*

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AMATEUR WIRELESS AND WIRELESS MAGAZINE

STRAIGHT SETS

Battery Operated

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

Mains Operated

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

SPECIAL NOTE

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

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

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

No. of
Blueprint

SHORT-WAVE SETS

Battery Operated

- One-valve : 2/6 each
S.W. One-valver for
American ... AW429*

- Two-valve : 2/6 each
Ultra-short Battery Two
(SG, det Pen) ... WM402*

- Four-valve : 3/6 each
A.W. Short Wave World-
beater (HF, Pen, D, RC,
Trans) ... AW436*

- Standard Four-valver
Short-waver (SG, D,
LF, P) ... WM383*

Mains Operated

- Four-valve : 3/6
Standard Four-valve A.C.
Short-waver (SG, D,
RC, Trans) ... WM391*

MISCELLANEOUS

- Enthusiast's Power Am-
plifier (10 Watts) (3/6) WM387*

- Listener's 5-watt A.C.
Amplifier (3/6) ... WM392*

- De Luxe Concert A.C.
Electrogram (2/6) ... WM403*

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- ★ Variable tuning over medium waves.
- ★ 3-stage reflex circuit.
- ★ Highly sensitive.
- ★ Internal ferrite aerial.
- ★ Drilled chassis.
- ★ Long-life battery.
- ★ Complete constructional details.
- ★ Weight less than 2 ozs.
- ★ Size only 3 x 2 x 1/2 in.

Total cost, including transistor, personal miniature 'phone case, battery and complete circuit and layout diagrams, 52/6 post free. All components sold separately. Circuit and shopping list FREE. Call and Hear Demonstration Model.

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- ★ 4-stage reflex circuit.
- ★ Variable tuning over medium waves.
- ★ Highly sensitive.
- ★ No aerial or earth.
- ★ Home, Light and Third. Economical.
- ★ Drilled and mounted chassis.
- ★ Size 4 1/2 x 3 x 1 1/2 in.
- ★ Internal ferrite aerial.
- ★ Weight less than 4 ozs.
- ★ Complete layout diagram.
- ★ May be built in 1 hour.

All items can be supplied, including EDISWAN transistors, battery, case and personal 'phone, etc., for 72/6, post free. All components sold separately. Circuit and shopping list FREE. Call and Hear Demonstration Model.

As described in Oct. issue of "Radio Constructor."

"THE TRANSISTOR-8"

Push-Pull Portable Superhet.

This Portable 8 Transistor Superhet is tunable for both Medium and Long Waves and is comparable in performance to any equivalent Commercial Transistor Set. Call and Hear Demonstration Model.

STAR FEATURES

- ★ 8 EDISWAN Transistors.
- ★ 250 Milliwatts Output Push-Pull.
- ★ Medium and Long Waves.
- ★ Internal Ferrite Rod Aerial.
- ★ Elliptical Speaker.
- ★ Drilled chassis 8 1/2 x 2 1/2 in.
- ★ Point-to-Point Wiring and Practical Layout.
- ★ Economical. Powered by 7 1/2 v. battery.
- ★ Highly sensitive.
- ★ Attractive lightweight contemporary case. In various colours.

COMBINED PORTABLE/CAR RADIO

Two sets for the price of one.

We can supply all these items including Cabinet for £11.10.0 P.P. 2/6. All parts sold separately. Circuit diagrams and shopping list free.

Car Radio Conversion Components, 8/- extra. A.V.C. 5/9 extra. 325 mW. version, 40/- extra.



Size: 8 x 7 x 3 1/2 in. Weight: 4 lbs.

TELETRON "TRANSIDYNE" RECEIVER
Six Transistor Pocket Superhet.



- ★ TCC Printed Circuit.
- ★ Medium and long waves.
- ★ Powered by two No. 8 batteries.
- ★ Push-Pull Output.
- ★ Moulded Plastic case.
- ★ Rola 2 1/2 in. P.M. speaker.
- ★ Internal ferrite aerial.
- ★ Weight 20 ozs.
- ★ Complete layout instructions.
- ★ Easy to assemble.
- ★ (All components identified.)
- ★ THE BEST YET!

Size: 6 1/2 x 3 3/4 x 1 1/2 in.

All components, including NEW EDISWAN-MAZDA TRANSISTORS, cabinet, batteries, etc., can be supplied for £11.19.6, p.p. 2/6.

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ALL FOR 52/6 P.P. ONLY 2/6

Complete Selection of Miniature Transistors and Components in stock: Free List on request.

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1/2 in. Square ...	3/6	1 1/2 in. Round (Acos) ...	7/6
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Moulded plastic hand mic. case suitable for any of above, only 2/6

SEE OTHER ADVT. INSIDE

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Complete Kit with 2 Transistors, Components, Phones and Circuit and plastic case.

37/6

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2.5 Kc/s. Complete Kit with 2 Transistors, Components. Circuit and plastic case.

20/-

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" XB105 Audio pre-amplifier ...	12/6
" XB104 Audio output ...	10/-

(A pair in push-pull will give up to 250 mW. audio output.)

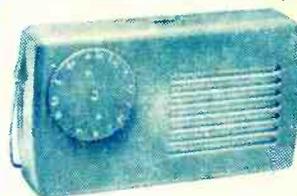
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SPECIAL OFFER!

Unrepeatable bargain offer of the well known Perdio Pocket Radio (Model P1)



- ★ 5 Transistor Superhet.
- ★ Full Medium Wave coverage.
- ★ Full volume speaker output.
- ★ Lightweight pocket size cabinet.
- ★ Long life battery.

We are able to offer this complete receiver in original boxes, including battery, for only £8.10.0. Fully Guaranteed! First switch on! LIMITED QUANTITY ONLY

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