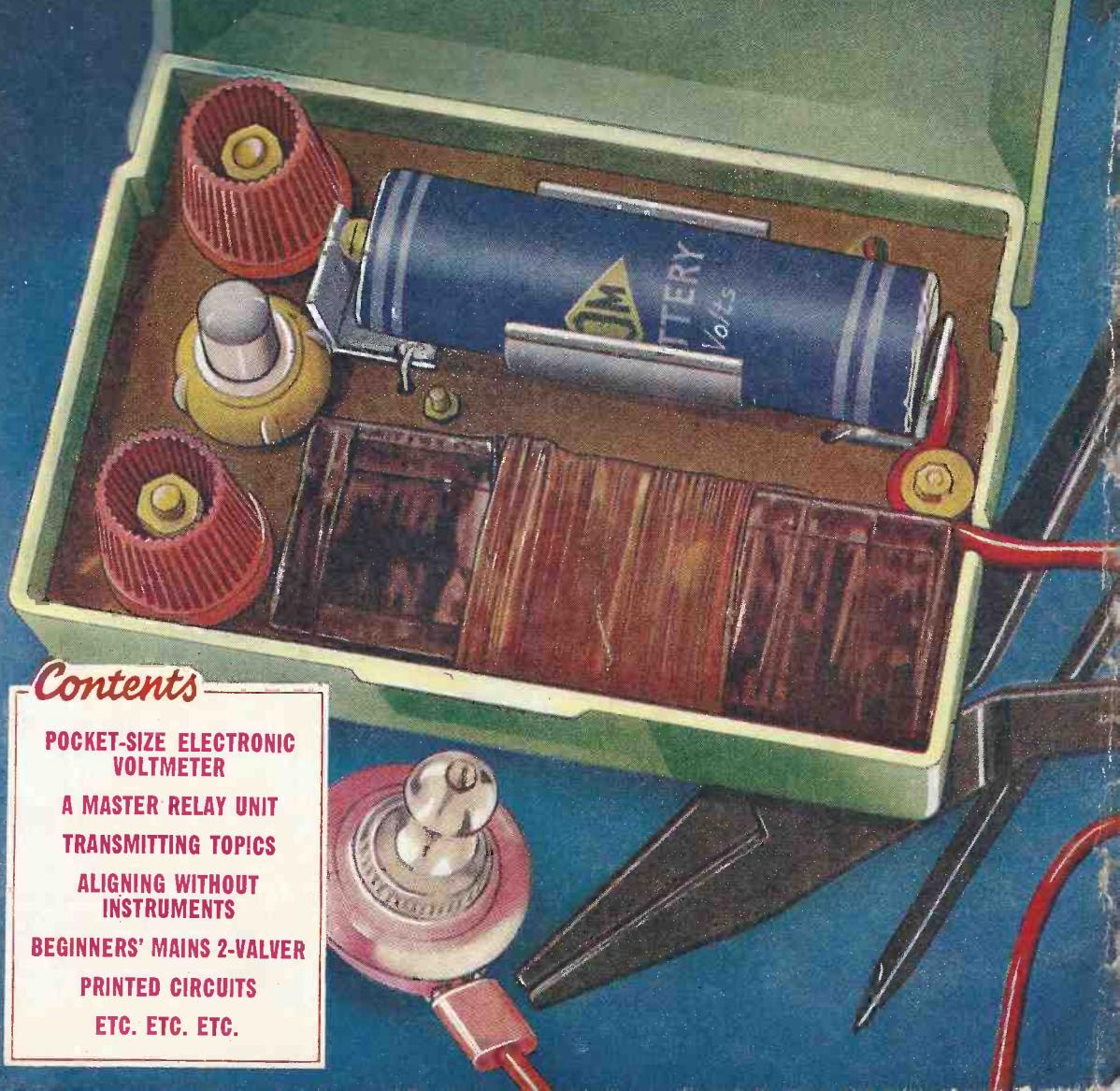


A D.-C. TRANSISTOR MIDGET
PRACTICAL 1/3
WIRELESS

MAY
1959



Contents

**POCKET-SIZE ELECTRONIC
VOLTMETER**

A MASTER RELAY UNIT

TRANSMITTING TOPICS

**ALIGNING WITHOUT
INSTRUMENTS**

BEGINNERS' MAINS 2-VALVER

PRINTED CIRCUITS

ETC. ETC. ETC.

WIRELESS STATION No. 19

● Undoubtedly the finest Transmitter/Receiver Installation available at such a low price. The installation comprises a complete Trans/Receiver operating from 12 or 24 volts, covering 2 to 8 Mc/s. (150 to 37.5 metres) in 2 bands, and using 15 valves. 12 and 24 volts/rotary power pack feeding L.T., H.T. and E.H.T. voltage requirements. Aerial variometer. Control boxes, Moving coil headphones and microphone. Morse key assembly, 12ft. whip aerial and base, connecting leads and mounting platform.

● THE TRANSMITTER incorporates: Receiver oscillator, heterodyne oscillator and mixer, buffer, power amplifier, modulator and A.F. oscillator, grid bias, automatic drive control.

● THE RECEIVER is a superheterodyne type incorporating: signal frequency, oscillator frequency changer, I.F. amplifier, detector AVC audio amplifier, heterodyne, oscillators (BFO).



● THE WIRELESS SET No. 19 incorporates a VHF Transmitter Receiver covering 230 to 240 Mc/s. and an intercom system. Tuning meter giving aerial and all voltage readings. Complete installation as illustrated. **all for ONLY £9.0.0** Carr. 20/-

HI-FI HEADPHONES

Uses high-quality permanent magnetic speakers with regular voice coil. The padded chamfered ear-muffs give correct spacing for optimum acoustic load, giving finest music and voice reproduction. Each unit has a built-in Hi-Fi 50Ω trans. total 100Ω. Only 25/- P. & P. 1/6.

AERIAL VARIOMETERS

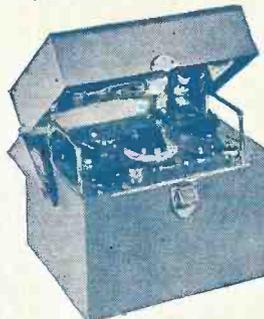
These magnificent instruments will enable you to receive maximum signal strength on all S.W. receivers. Precision calibrated control. Complete with connection details. 12/6. P. & P. 2/6.

VIBRATOR POWER PACK

Input 12 v., output 150 v. at 100 milliamperes. 2 bias packs 50 v. each. Complete with screen lead for battery. Completely smoothed. Brand new. Price 20/- P. & P. 3/6.

COMPLETE MORSE TAPPER ASSEMBLY

Enclosed. Simple 8 amp. key with lead and plug. As used with all Army Trans-receivers and Morse Training Equipment. Only 3/6. P. & P. 1/6.



POLICE-AIRCRAFT-HAM

U.S.A. RECEIVER BC624 This is a must for all intelligent radio enthusiasts. Complete receiver covering 100/156 Mc/s. has no less than 10 valves. Is a superhet with R.F., 3I F.S. second det., and O/P stages, perfect for 2 metres. Power requirements 300 volts 60 mA. and 12 v. at 1.7 amps. Supplied with full operating details and circuit, etc., all for only 30/- P.P. 5/- Mains power pack kit, 42/6. P. & P. 2/6.

TRANSMITTER BC625 used with above receiver, covers 100/156 Mc/s. will deliver 15 watts, consists of seven valves (2-832), 3 for modulation, 4 for R.F. Complete with operating details and circuits, only 45/- P.P. 5/- Complete Trans./Receiver Assembly, 70/- Carr. 10/-

"PYE" 10" HIGH QUALITY SPEAKER

Supplied in magnificent cabinet complete with 30ft. of lead and plug. Ideal for HI-FI and Stereo. Used by the Ministry with the finest communication receivers. Satisfaction guaranteed. Brand New in original packing. 45/- each carriage 5/-.

BARGAIN OFFER

Relay package containing: one 6, 12 and 24 volt stepping relay giving 4 break positions alternatively two miniature 12 and 24 volt coils with one make position, one 12 and 24 volt heavy duty relay with 2 make and break and 1 break positions, one miniature gate switch double pole press to make 1 amp. 250 volts. Made by leading American manufacturers, all for only 8/- P. & P. 2/-

SOLDERING IRON

Instrument type 230 to 250 volt A.C. 25 W. with neon indicator. Only 16/8. P. & P. 1/6.

RECTIFIER BARGAINS

Mains (doubler) 300 volts per section at 120 mA., 5/- each. P.P. 1/6. Two (full wave) for 8/- P.P. 2/-

VIBRATOR PACKS

12 volt input 300 volts output at 150 mA fully smoothed. ONLY 25/- carr. 7/6. Also 6 v. input 230 v. output at 100 mA. Fully smoothed. 25/- each. P. & P. 3/6.

12 VOLTS 10 WATT AMPLIFIER

Complete with internal dynamotor, 2-61/6s push-pull. 2-6N7. Incorporating mike and gram inputs, speaker outputs, tone and volume controls. Size 1 1/2" x 6 1/2" x 8 in. Sprung mounted. ONLY 12/10/- Carr. 10/-

AVO MULTI-MINOR

19 range pocket test meter covering A.C. and D.C. volts. D.C. current and resistance. Sensitivity 10,000 ohms per volt. Complete with test leads. 29/10/-

ILLUS. CATALOGUE 1/3

SPECIAL OFFER!

TEST SET 102

Consists of impregnated mains transformer 200-250 v. 50 cycles, 12 v. 2 amp, 6 v. 3 amp, output 230 v. at 80 mA. S.T.C. metal rectifier 80 mA. 1-DE119, 1-6J5, Bulgin plugs, sockets and pilot lights. Main leads. Circuit is a multi-vibrator locked mains type with cathode follower. Can be modified for:

- Audio Amplifier
- Audio Oscillator
- V.F.O.
- External Synchronizer
- Stabilized Power Unit
- Modulator, Etc.

Including circuit only 40/- carr. 5/-

WALKIE/TALKIE SET



ONLY 60/- EACH P. & P. 4/-

Consisting of transceiver covering 7.4-9 Mc/s. range up to 10 miles, complete with 5 valves, headphones, microphone, junction box & 6ft telescopic aerial. Only requires 120 v. & 3 v. dry battery. These magnificent Walkie/Talkie sets (as used by H.M. Forces) are ideal for any application and can be operated with ease by young and old alike.

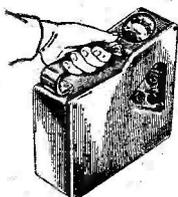
TWO FOR £6 POST FREE.

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GEIGER COUNTERS—BRAND NEW

LIGHT — ROBUST — RELIABLE



Ratemeter 1048A (currently in use at Harwell Nuclonics Div.) designed to detect and measure variations in gamma-ray intensity such as concentrations of radio-active minerals and estimates of uranium and thorium content of geological specimens. The radiation detector is a G.104 low voltage Geiger Müller tube, which has an effective cathode area of approx 90 sq. CMS and triggered at a rate of about 90 per minute by cosmic and gamma rays emitted by radioactive potassium and minute traces of uranium and thorium in ordinary soil and rock, the readings being measured on a 50 microamp meter. The electronic amplifying circuits employ cold cathode trigger valves. Working battery life is approx. 2,000 hours. Instrument is housed in a tough plastic case and hermetically sealed and all components, etc., have been I.S.C. Tech. Class. G. approved. Size 8 1/2 x 8 x 3 1/2 in. weight 6 1/2 lb., supplied with canvas carrying case. Fully guaranteed. **ONLY £7.10** P. & P. 7/6

PICTURE FRAME AERIAL

Incorporates MW and LW aerial with provision for tuning out unwanted signals, noise, etc. Size 8 1/2 x 11 x 1 1/2 in. Magnificent appearance. Brand new with full instructions. 12/6. P. & P. 2/6.

INDICATOR UNIT 277

Consisting of 1 in. C.R. Tube, type VCR522, 6 valves; 4 EF50, 2 V192. Incorporates Focus, Brightness and Gain Controls. Size, 7 x 10 x 5 in. Manufactured by Cossor. Only 45/- P. & P. 3/6.

P.A.C.K.A.R.D.—B.E.L.L. P.A.F.

AMPLIFIER. Complete with 1-2BD7, 1-6SL7GT, miniature relay, push pull input and output transformers, miniature 8-way plug and socket, switch and jack plug. Size 5 1/2 x 3 1/2 x 4 in. Complete with circuit. 17/6. P. & P. 2/6.

HOOVER'S ROTARY TRANSFORMERS

12 v. input, 500 v. output at 85 mA. or 8 v. input, 250 output at 75 mA. Now offered at only 10/6 each. P. & P. 2/-

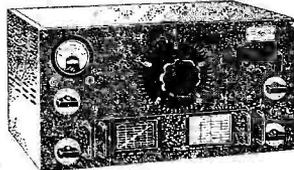
PORTABLE AMPLIFIER-PRINTED CIRCUIT

6 1/2 in. x 2 1/2 in. x 3 in. Will suit all crystal pick-ups. Output 3 watts. Uses UC182 output, UX85 rectifier. Volume and tone controls. With circuit diagram. **ONLY 45/-** P. & P. 2/6. 7 1/2 in. x 4 in. elliptical speaker for above. 14/6.

INFRA-RED VIEWING.

Yes, it's true! With this complete installation you can see undetected at night. Comprises adjustable long vision binoculars, 12 v. power pack, control unit, connecting cables and infra-red filters. Can be assembled within minutes. Govt. acquisition, £200. Brand new, boxed, laboratory tested. **£8.10.0** Carr. 10/-

H.R.O. SENIOR RECEIVERS



Total frequency coverage is 50 Kcs-30 Mc/s. obtained by inserting coil sets of which 4 sets are supplied with every receiver. Incorporates 9 valves, 2 R.F., 2 I.F. and 2 audio amplifiers. Crystal gate with crystal biasing control. Variable selectivity. Effective tuning scale of 12 feet. R.F. and L.F. gain controls. Signal strength meter. B.F.O. on/off and pitch control. H.T. and S.T. meter on/off switch. Phone jack and loudspeaker terminals. Black crackle cabinet. 17 1/2 in. x 9 in. x 12 in. deep. Fully tested and guaranteed. Complete with 110 volt or 6 volt (state which preferred) power pack.

ONLY £16.19.6. Carr. 20/6.

R.B.Z. PORTABLE RECEIVER

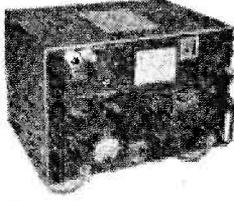
What a buy we made here! Do please excuse our enthusiasm but this is the smallest communication receiver ever produced for the American forces. Only 9 in. x 2 1/2 in. x 1 1/2 in.—and you should hear it! Covering 5 to 13 Mc/s. 6 valve permeability tuned superhet receiver. (1)—I.L.4. converter (oscillator mixer). (1)—I.S.5. diode detector. A.V.C. and first audio amplifier. (1)—I.L.4. 2nd. audio, power amplifier. Incorporates on/off gain and frequency controls. Supplied complete with headphones, aerial, matching battery container, canvas carrying case with strap, and 55-page instruction book. Operates from standard dry batteries. (H.T. consumption 5.5 mA.). Manufactured by Emerson Radio. Brand new in original cartons. Fully guaranteed and ready for immediate operation.



ONLY £5

P. & P. 5/-
Batteries 12/8.

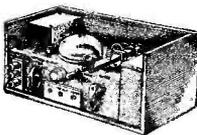
T.C.S. RECEIVER 1.5 to 12 Mc/s.



7 valve superhet, built like a dream. 12SK7-R.F., 12SA7 Mixer, 12A6 Oscillator, 12SQ7 Detector, AVC-BFO, 1st AF, 12SK7-I.F.s. The 12A6 final puts 1.4 watts into 500 ohms with an input modulated only 30%. Panel controls: R.F. Gain, A.F. Gain, C.W. pitch, bandswitch, mod-CW switch power switch, ground and aerial posts, MO or crystal frequency switch, speaker, 30 jack, card holder to log stations. **£8.10.0** Carr. 16/-

CANADIAN TELEPHONE SETS

Latest release! Brand new fully portable telephones with built-in hand generator, ringing device, hand telephone, Morse key, buzzer and indicator lamp to give speech or Morse reception over distances up to three miles by simply connecting twin wire and batteries to two sets. Housed in portable transit case 12 x 9 x 7 1/2 in. We offer two complete sets at the ridiculous price of only 60/-, plus carriage 10/-.



two complete sets at the ridiculous price of only 60/-, plus carriage 10/-.



TEST SET 16/APN

Used for alignment and calibration of Altimeters. Has internal vibrator supply, Audio Generator 80-1200 cycles, cavity tuned wavemeter, 400-460 Mc/s. Complete with 6 valves, 1 mA. Meter and all cables. In wooden case. A very fine instrument offered at only 40/- Carr. 10/-

WOT! You don't own a Relda catalogue! It's terrific and fully illustrated. **Only 1/2.**

DIPOLE AERIAL No. 4A. 52 feet hard drawn 7/22 copper wire with centre insulator, fitted with feeder sockets. Both ends have 3 link insulators and slotted wire adaptors. Brand new, price 9/- P. & P. 2/-.

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

POCKET VOLT TEST METER. Two D.C. ranges: 0-250 v. and 0-15 v. Complete with test prods. Brand New. Very limited quantity. **ONLY 10/6.** P. & P. 1/6.

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

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WESTINGHOUSE J.50 PEN-CIL RECTIFIERS. 500 v. 5 mA., 5/- P. & P. 1/-

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

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

U.S.A. WHIP AERIALS. 12ft., 12/6. Post Paid.

AMERICAN MIDGET ACCUMULATORS. 35 volts, lead acid type, 2/6 ea. P. & P. 1/-

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

WALKI-TALKI INTERCOM SET Boy! They're terrific!



Each set has two "space-styled" hand telephone units in beautifully finished coloured case which fits neatly into the palm of your hand. No batteries or soldering required; simply connect twin wire between the two sets and the Intercom is ready for use. Talk into microphone or listen on one or listen to speaker or talk on the other. Use them as an Intercom from room to room, house to house, tent to tent, etc. Can be used anywhere and even works up to 200 yds. Brand New with 25ft. of wire. **ONLY 6/6** per Set. P. & P. 1/-

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0B2	17/6	6C6	6/6	6X4	7/1	19H1	10/1	17475	7/6	DL33	9/1	EL32	5/6	KLZ63	10/6	PY82	9/1	UCC84	20/1	9/1	UCC85	10/6	10/6	
OZ4	6/1	6C8	12/6	6XS7	6/6	20D1	16/1	9002	5/6	DL66	15/1	EL33	20/2	L63	6/1	PY83	9/1	UCF80	23/1	20/1	UCF80	23/1	20/1	
IA3	3/1	6C9	12/6	6Z4/84	12/6	20F2	27/10	9006	6/1	DL92	7/6	EL34	17/6	LN152	14/1	PZ30	20/1	UCH21	24/4	24/4	UCH21	24/4	24/4	
IA5	6/1	6C10	12/6	630L2	10/6	20L1	27/10	AC/PEN	5/1	DL94	9/1	EL38	27/10	LZ319	9/1	QP21	7/1	UCH24	11/1	11/1	UCH24	11/1	11/1	
IAYGT	23/1	6CD36	31/4	7A7	12/6	20P1	27/10	or 7 pin	24/4	DL96	10/1	EL41	11/1	MH4	7/1	QP25	15/1	UCH28	11/1	11/1	UCH28	11/1	11/1	
IC5	12/6	6CH6	12/6	787	8/1	20P3	24/4	AC2PEN	10/6	DL10	10/6	EL42	11/1	MHL4	7/6	QV150/15	10/6	UCL82	15/6	15/6	UCL83	25/9	25/9	
ID5	17/5	6D3	20/11	7C5	8/1	20P4	27/10	24/4	DM70	8/1	EL81	15/1	MHL6	12/6	QV10/7	15/1	UF41	9/1	9/1	UF42	19/6	19/6		
ID6	10/6	6D6	6/6	7C6	8/1	20P5	24/4	AC2PEN	10/6	EA50	2/1	EL84	10/6	ML4	12/6	R12	10/6	UF42	19/6	19/6	UF42	19/6	19/6	
IHSGT	11/1	6E5	12/6	7D5	24/4	25A6G	20/2	DD	27/10	EA76	9/6	EL91	5/1	ML6	6/6	R2	10/6	UF42	19/6	19/6	UF42	19/6	19/6	
IL4	6/6	6F1	27/10	7H7	8/1	25L6GT	10/1	ACAPEN	10/6	EABC80	9/1	EL95	10/6	MPT4	5/1	R10	10/6	UF42	19/6	19/6	UF42	19/6	19/6	
ILD5	5/1	6F6G	7/1	7R7	12/6	25Y5	10/6	27/10	EAC91	7/6	EM34	10/1	EM71	24/4	MU11	24/4	R18	17/6	UF80	10/6	10/6	UF80	10/6	10/6
ILN5	5/1	6F6GTM	8/1	757	10/6	25Y5G	10/1	ACSPEN	10/6	EAF42	10/6	EM71	24/4	MU11	10/1	R19	20/11	UF85	10/6	10/6	UF85	10/6	10/6	
INSGT	11/1	6F8	12/6	7V7	8/1	25Z5	10/6	24/4	EB34	2/6	EM80	10/6	MX40	27/10	SD6	12/7	UF86	24/4	24/4	UF86	24/4	24/4		
IR5	8/1	6F11	18/1	7Y4	3/6	25Z4G	10/1	AC6PEN	7/6	EB41	8/1	EM81	10/6	N37	20/11	SPA(7)	15/1	UF89	10/6	10/6	UF89	10/6	10/6	
IS5	8/1	6F12	7/6	8D2	3/6	25Z6G	10/1	AC/HL	10/6	EB91	6/6	EN31	34/9	N78	20/11	SP41	3/6	UL41	10/6	10/6	UL41	10/6	10/6	
IT4	6/6	6F13	12/6	8D3	7/6	25Z6GT	17/5	DDD	15/1	EB93	7/6	EY51	10/6	N108	19/6	SP42	12/6	UL44	27/10	27/10	UL44	27/10	27/10	
IU5	10/1	6F14	27/10	9D2	4/1	27S5	20/11	AC/P4	8/1	EB41	10/1	EY83	17/5	N308	21/7	SP61	3/6	UL46	15/1	15/1	UL46	15/1	15/1	
1A7	10/6	6F15	16/1	10C1	15/1	28D7	7/1	AC/TP	34/9	EB81	14/8	EY86	14/6	N339	27/10	SP75	20/11	UL84	11/1	11/1	UL84	11/1	11/1	
2C26	4/1	6F16	9/6	10C2	27/10	30C1	9/1	AC/VP1	9/1	EBF80	10/1	EZ35	6/6	OA70	5/1	SU61	10/6	UM4	18/1	18/1	UM4	18/1	18/1	
2D13C	7/6	6F17	12/6	10F1	19/6	30F5	8/1	15/1	EBF89	9/6	EZ40	8/1	OA71	8/1	T41	24/4	URIC	17/5	17/5	URIC	17/5	17/5		
2P	27/10	6F32	10/6	10F9	11/6	30FL1	10/1	AC/VP2	10/6	EEL21	24/4	EZ41	10/1	OC72	30/1	TDD4	25/9	UU6	20/11	20/11	UU6	20/11	20/11	
2X2	4/1	6F33	7/6	10F18	12/6	30L1	9/1	27/10	EEL31	24/4	EZ80	9/6	P61	3/6	TH4B	27/10	UU8	27/10	27/10	UU8	27/10	27/10		
3A4	7/1	6C6	6/6	10LD3	10/1	30P12	12/6	ATP4	5/1	EC52	5/6	EZ81	9/1	PABC80	10/6	TH41	27/10	UYIN	17/5	17/5	UYIN	17/5	17/5	
3A5	12/6	6H6GTG	3/1	10LD11	16/9	30P16	10/1	IAZ1	17/5	EC54	6/1	FC2A	25/9	15/1	TH233	34/9	UY21	17/5	17/5	UY21	17/5	17/5		
3B7	12/6	6H6GTM	3/6	10P13	17/6	30PL1	14/1	IAZ31	10/1	EC70	12/6	FC4	27/10	PCC84	9/1	TH2321	20/1	UY41	8/6	8/6	UY41	8/6	8/6	
3D6	5/1	6J5G	5/1	10P14	2/2	31	7/6	IAZ41	14/8	ECC31	15/1	FC13	27/10	PCC85	12/6	TP22	15/1	UY85	10/6	10/6	UY85	10/6	10/6	
3Q4	7/6	6J5GTG	5/6	11D3	25/9	33A/158M	18/36	25/9	ECC32	10/6	FC13C	27/10	PCC89	31/4	TP25	19/6	VMP4G	15/1	15/1	VMP4G	15/1	15/1		
3Q5GT	9/6	6J5GTG	6/1	11E3	15/1	30	11/6	BL63	7/6	ECC33	8/6	FW4,500	10/6	PCF80	9/1	TP2620	34/9	VP2(7)	12/6	12/6	VP2(7)	12/6	12/6	
3S4	7/6	6J6	5/6	12A6	6/6	35/51	12/6	CI	12/6	ECC34	25/9	9/1	10/6	PCF82	12/6	TR86F	20/11	VP4(7)	15/1	15/1	VP4(7)	15/1	15/1	
3V4	9/1	6J7G	6/1	12AC6	16/1	35A5	20/2	CIC	12/6	ECC35	8/6	FW4,800	10/6	PCL82	12/6	UY12/14	12/11	VP4B	24/4	24/4	VP4B	24/4	24/4	
5R4GY	17/6	6J7GT	10/6	12AD6	18/1	35L6GT	9/6	CBLL1	27/10	ECC40	23/7	10/1	PCL83	14/1	UY16	12/1	VP13C	7/1	7/1	VP13C	7/1	7/1		
5U4G	8/6	6K7G	8/1	12AE6	14/8	35W4	9/6	CBLL31	24/4	ECC81	8/1	GZ30	10/6	PCL84	23/1	UY18/20	10/6	VP23	6/6	6/6	VP23	6/6	6/6	
5V4G	11/6	6K7G	5/1	12AH7	8/1	35Z3	10/6	CCH35	24/4	ECC82	7/6	GZ32	12/6	PEN4DD	U22	8/1	VP41	6/6	6/6	VP41	6/6	6/6		
5X4G	12/6	6K7GT	6/1	12AH8	10/6	35Z4	7/6	CK506	6/6	ECC83	10/1	GZ34	14/1	27/10	U24	31/4	VR105/30	9/1	9/1	VR105/30	9/1	9/1		
5Y3G	8/1	6K8G	8/1	12AT6	10/6	35Z5GT	9/1	CL33	20/2	ECC84	10/1	H30	5/1	PEN25	20/11	U25	24/4	9/1	9/1	9/1	9/1	9/1		
5Y3GT	8/1	6K8GT/G	12/6	12AT7	8/1	41MTL	8/1	CV63	10/6	ECC85	9/6	H63	12/6	PEN36C	U26	12/6	VR150/30	9/1	9/1	VR150/30	9/1	9/1		
5Y4	12/6	12/6	12/6	12AU6	24/4	42	24/4	GV85	12/6	ECC91	5/6	HABC80	24/4	U31	10/1	9/1	9/1	9/1	9/1	9/1	9/1	9/1	9/1	
5Z3	12/6	6K25	20/11	12AU7	7/6	32	24/4	CV271	10/6	ECCF80	13/6	13/6	PEN40DD	U33	27/10	VT61A	5/1	5/1	VT61A	5/1	5/1	5/1	5/1	
5Z4G	12/6	6L11	24/4	12AX7	10/1	50C5	12/6	CV428	30/1	ECCF82	13/6	HL133DD	25/1	U35	27/10	VT501	5/1	5/1	VT501	5/1	5/1	5/1	5/1	
5Z4GT	12/6	6L6G	9/6	12BA6	9/1	50CD6G	10/1	CVY1	17/5	ECH3	27/10	10/6	PEN44	U37	27/10	W61M	27/10	27/10	W61M	27/10	27/10	27/10	27/10	
6A7	27/10	6L7GT	12/6	12BE6	10/1	31/4	9/6	CVY31	17/5	ECH21	24/4	HL23	10/6	27/10	U43	10/6	W76	7/6	7/6	W76	7/6	7/6		
6A8	10/1	6L18	13/1	12BH7	22/3	50L6GT	9/6	DI1	3/1	ECH35	9/6	HL23DD	PEN45	19/6	U45	10/6	W81M	6/1	6/1	W81M	6/1	6/1		
6A87	8/1	6L19	24/4	12C8	15/1	53KU	20/11	DI5	10/6	ECH42	9/6	18/1	PEN45DD	U50	8/1	W107	12/6	12/6	W107	12/6	12/6	12/6	12/6	
6A88	14/1	6LD20	16/9	12E1	30/1	7/2	4/6	DI42	10/6	ECH81	9/1	HL41	12/6	27/10	U52	8/1	W729	19/6	19/6	W729	19/6	19/6		
6AC7	6/6	6N7	8/1	12J5GT	4/6	75	25/9	DE3	5/1	ECL80	14/1	HL41DD	PEN46	7/6	U76	7/6	X31	27/10	27/10	X31	27/10	27/10		
6AG5	6/6	6P1	20/2	12J7GT	10/6	77	8/1	DI77	6/6	ECL82	12/6	16/6	PEN383	24/4	U78	7/1	X41	27/10	27/10	X41	27/10	27/10		
6AK5	8/1	6P25	24/4	12K5	18/10	78	8/1	DAC32	11/1	ECL83	25/9	HL42DD	PEN453DD	U107	17/5	X42	27/10	27/10	X42	27/10	27/10	27/10		
6AL5	6/6	6P28	10/6	12K7GT	7/6	80	9/6	DAF91	8/1	EF9	24/4	20/2	34/9	U191	20/11	X61	12/6	12/6	X61	12/6	12/6	12/6		
6AM6	7/6	6Q7G	10/1	12K8GT	8/1	83	15/1	DAF96	10/1	EF22	14/1	HN309	25/9	PEN/DD	U251	15/1	X61M	27/10	27/10	X61M	27/10	27/10		
6AQ5	8/6	6Q7GT	11/1	14/1	83V	12/6	DD41	14/8	EF36	6/1	HVR2	20/2	4020	27/10	U281	20/11	X63	10/6	10/6	X63	10/6	10/6		
6AT6	8/6	6R7G	10/1	12Q7GT	7/6	85A2	15/1	DDT4	25/9	EF37A	8/1	HVR2A	6/1	PL33	20/2	U282	23/8	X65	12/6	12/6	X65	12/6	12/6	
6AU6	10/6	6SA7GT	8/6	12SA7	8/1	150B2	15/1	DF33	11/1	EF39	6/1	KF35	8/6	PL36	24/4	U301	24/4	X66	12/6	12/6	X66	12/6	12/6	
6B4G	6/6	6SC	10/6	12SC7	8/1	185B7	34/9	DF91	6/6	EF40	15/1	KL32	23/1	PL38	27/10	U329	15/1	X76M	14/1	14/1	X76M	14/1	14/1	
6B8G	10/6	6SG7GT	8/1	12SG7	8/6	185BTA	10/6	DF96	10/1	EF41	9/6	KL35	8/6	PL81	16/1	U339	20/11	X78	22/3	22/3	X78	22/3	22/3	
6B8G	4/6	6SH7	8/1	12SH7	8/6	34/9	DH63	10/1	EF42	12/6	KL32	25/9	PL82	10/1	U404	10/6	X79	22/3	22/3	X79	22/3	22/3		
6B8GTM	5/1	6SH7	8/1	12SH7	8/6	203THA	DH63(M)	17/6	EF50(A)	7/1	K72	5/1	PL83	11/6	U801	31/4	X109	18/1	18/1	X109	18/1	18/1		
6BA6	7/6	6SK7GT	8/1	12SK7	8/6	27/10	17/6	EF50(E)	5/1	KT33C	10/1	PM28	12/6	U402	17/5	XD(1.5)	6/6	6/6	XD(1.5)	6/6	6/6	6/6	6/6	
6BE6	7/6	6SL7GT	8/1	12SL7	12/6	22																		

The "NEW" 1959

Stern's "fidelity" TAPE RECORDER

for truly "Hi-Fi" Recordings

IT INCORPORATES

- The latest COLLARO TRANSCRIBTOR TAPE DECK.
- The model HF/TR3 "fidelity" AMPLIFIER. (Described below.)
- Matching elliptical 7in. x 4in. P.M. Speaker.
- 1,200 reel EMI tape.
- ACOS Crystal Microphone.

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 £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. 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—Lane—Brenell or Motek Decks. Please specify which.

Send S.A.E. for leaflet or 2/6 for the complete Assembly Manual.



PRICE
£49.10.0

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.

THE LEGS SHOWN IN THE ILLUSTRATION ARE READILY DETACHABLE AND ARE AN OPTIONAL EXTRA AT £12.6.

STERN'S—MULLARD TYPE "C" TAPE PRE-AMPLIFIER-ERASE UNIT

INCORPORATING THE NEW FERROXCUBE POT CORE PUSH-PULL OSCILLATOR and 3-SPEED TREBLE EQUALISATION by means of the latest FERROXCUBE POT CORE INDUCTOR.

PRICES . . . INCLUDING SEPARATE SMALL POWER SUPPLY

COMPLETE KIT **£14.0.0**

OF PARTS ASSEMBLED AND TESTED **£17.0.0**

Deposit **£3.3.0** and 12 months of **£1.4.11.**

ALSO AVAILABLE EXCLUDING POWER SUPPLY UNIT

FOR **£11.15.0** and **£14.10.0** respectively.

(Carriage and Insurance is 5/- extra.)

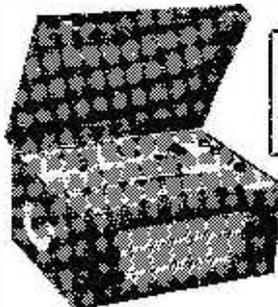
WHEN ORDERING PLEASE STATE MAKE OF TAPE DECK TO BE USED. We present this "Hi-Fi" Pre-amplifier strictly to Mullard's specification incorporating ONLY NEW HIGH-GRADE COMPONENTS and the SPECIFIED NEW MULLARD VALVES. It comprises a COMPLETELY SELF-CONTAINED UNIT, all components and valves being contained in a well-ventilated Box. Chassis neatly finished in Hammered Gold with a very attractively engraved PERSPEX FRONT PANEL.



HOME CONSTRUCTORS

YOU CAN BUILD THIS PORTABLE TAPE RECORDER from **£41.10.0**

TO ADD FULL TAPE RECORDING FACILITIES



WE OFFER YOU THIS SELECTION

- (a) Illustrated here **£5.0.0.**
- (b) 1,200ft. E.M.I. TAPE **(£1.15.0).**
- (c) ACOS CRYSTAL MIKE **(£1.15.0).**
- (d) ROLA 10in. x 6in. LOUD-SPEAKER **(£1.10.0).**
- ALL FOR . . . **£9.0.0**

AVAILABLE ON HIRE PURCHASE WITH (b) or (d) below.

(b) The COLLARO MK. IV TAPE DECK **(£25.0.0)** and the HF/TR3 AMPLIFIER Assembled and Tested. FOR . . . **£36.0.0**

H.P. Deposit **£7.4.0** and 12 months of **£2.12.6.**

(c) As in (b) above, but HF/TR3 supplied as **£32.10.0**

COMPLETE KIT OF PARTS.

(d) The TRUVOX MK. IV TAPE DECK incorporating Precision Rev. Counter **(£30.9.0)** and the HF/TR3 AMPLIFIER **£41.10.0**

Assembled and Tested

H.P. Deposit **£3.6.0** and 12 months of **£3.0.10.**

(e) As in (d) above, but the HF/TR3 supplied as **£38.0.0**

COMPLETE KIT OF PARTS

(Carriage and Insurance on above quotes 10/- extra.)

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

PLEASE SEND S.A.E. WITH ALL CORRESPONDENCE.

To any modern "Hi-Fi" AUDIO AMPLIFIER (such as our Mullard "5-10" and 2 Valve Pre-amplifier)

NEED IS . . . THE TYPE "C" PRE-AMPLIFIER and a TAPE DECK . . . WE OFFER—

(a) The COLLARO MK. IV TAPE DECK and the MULLARD TYPE "C" PRE-AMPLIFIER with Power Unit **£37.0.0**

Assembled and Tested

H.P. Deposit **£7.8.0** and 12 months of **£3.14.2.**

(b) As in (a) above but the Type "C" supplied as COMPLETE KIT OF PARTS. **£34.0.0**

(c) The TRUVOX MK. IV TAPE DECK incorporating Precision Rev. Counter, and the MULLARD TYPE "C" PRE-AMPLIFIER with Power Unit Assembled and Tested **£42.10.0**

H.P. Deposit **£3.10.0** and 12 months of **£3.4.2.**

(d) As in (c) above but the TYPE "C" supplied as COMPLETE KIT OF PARTS. **£39.10.0**

(Carriage and Insurance on above quotes 10/- extra.)

STERN RADIO LTD.

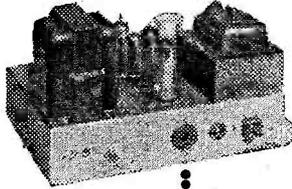
109 & 115 FLEET ST., LONDON, E.C.4

Telephone: FLEET STREET 5812,3/4

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

**MULLARD DESIGNS FOR
THE
HOME CONSTRUCTOR**

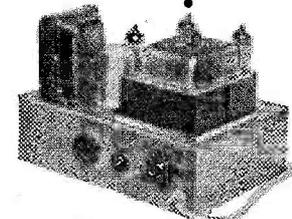
**THE VERY
POPULAR
MULLARD
"5-10" MAIN
AMPLIFIER**



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



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



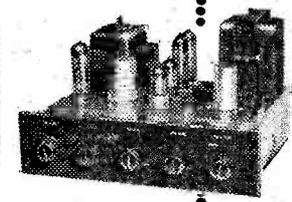
Please enclose S.A.E. if ILLUSTRATED and DESCRIPTIVE LEAFLETS are required; the ASSEMBLY MANUALS, containing Practical Drawings, etc., are available at 1/6 each.

SPECIAL PRICE REDUCTIONS . . .

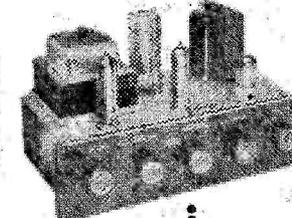
- (a) The COMPLETE KIT OF PARTS to build both the "3-3" MAIN AMPLIFIER and the 2-STAGE PRE-AMPLIFIER-CONTROL UNIT **£12.10**
 - (b) The COMPLETE KIT OF PARTS to build the "5-10" MAIN AMPLIFIER and the 2-STAGE PRE-AMPLIFIER-CONTROL UNIT **£15.15**
- PRICES FOR THE "5-10" ARE SUBJECT TO £1.60 EXTRA IF THE PARTRIDGE TRANSFORMER IS REQUIRED.

MODEL 510/RC

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



**THE NEW
COMPLETE
MULLARD 3-3**



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 **£10.00** Alternatively we supply ASSEMBLED & TESTED **£11.10** OF PARTS (Carriage & Insurance 5/- extra.)

THIS "5-10" with the latest PARTRIDGE **£1.60** EXTRA-ULTRA-LINEAR OUTPUT TRANSFORMER for

A completely new design employing two EF96 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.
 - Input for Crystal Pick-Ups.
 - Input for Tape replay.
 - (a) Direct from High Impedance Tape Head.
 - (b) From a Tape Amplifier or Pre-amplifier.
 - Sensitive Microphone Channel.
 - Wide range Bass and TREBLE Controls.
 - Attractive Perspex front control panel.
 - Our Kit is strictly to MULLARD'S SPECIFICATION.
- COMPLETE KIT OF PARTS **£6.60** Alternatively we supply ASSEMBLED & TESTED **£8.00** (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 PARTS **£7.00** Alternatively we supply ASSEMBLED & TESTED **£8.00** (Carriage & Insurance 5/- extra.)

- Only NEW HIGH GRADE Components
- MULLARD VALVES are supplied with these Kits.

- (a) The "3-3" and the 2-STAGE PRE-AMPLIFIER both ASSEMBLED and TESTED ... **£15.00**
H.P.: DEPOSIT £3.00 and 12 Monthly Payments of £1.20.
- (b) The "5-10" and the 2-STAGE PRE-AMPLIFIER both ASSEMBLED and TESTED ... **£18.18**
H.P.: DEPOSIT £3.18.00 and 12 Monthly Payments of £1.7.8. 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 incorporate 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 (£1.60 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** Alternatively we supply ASSEMBLED and TESTED **£13.10** (PARMEKO Transformer)

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

THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION

COMPLETE KIT OF PARTS **£7.10** Alternatively supplied ASSEMBLED and FULLY TESTED **£8.19.6** (plus 6/6 coverage and insurance)

H.P. Terms: Dep. £2.0.0 and 8 Months of £1.0.0. 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 RADIO LTD.

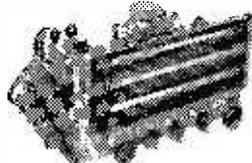
"MODERNISE YOUR OLD RADIOGRAM"

IT IS CHEAPER AND BETTER VALUE TO REPLACE YOUR OLD CHASSIS AND GRAM UNIT

!! RADIOGRAM CHASSIS !!

ARMSTRONG "STEREO TWELVE" £38.17.0

The most complete unit yet produced for Stereo, giving 6 watts high-fidelity push-pull output on each channel, 12 watts for monaural. Full VHF band, medium and long wavebands. Stereo and monaural inputs or records, tape and radio, and a tape output for stereo and monaural tape recording. Comprehensive matching for all types of crystal pick-ups. The perfect basis for a complete monaural reproducing system or for a complete stereophonic system now or later.



ARMSTRONG "JUBILEE" £30.9.0

An AM/FM chassis with nine valves and two diodes and with push-pull output stage providing 6 watts. Full VHF medium and long wavebands with automatic frequency control on FM and ferrite aerial on AM. Tape record and playback facilities. Can be adapted for stereo at any time by the addition of our compact, easy-to-fit converter amplifier.

ARMSTRONG "PB409" £29.8.0

A nine-valve AM/FM chassis giving 6 watts push-pull output and fitted with attractive piano key selectors. Covers full VHF band, medium, long and short wavebands and an output socket is provided for tape recording from radio and pick-up.

DULCI "H4PP" £29.3.10

An eight-valve AM/FM 4 waveband chassis giving 6 watts ultra linear output. Covers short, long, medium wavebands plus the VHF/FM band and has internal aerial on the medium and long wavebands. Tape outlet incorporated and suitable for 3 to 15 ohm loudspeakers.

DULCI "H3" £20.17.0

A 6-valve AM/FM chassis giving 4 watts output. Covers medium and long wavebands, on which an internal aerial operates, plus the VHF/FM band. Full AVC on all wavebands and Tape outlet incorporated.

AM/FM RADIO TUNING UNITS

Containing own Power Supply Units.

ARMSTRONG "S.T.3" £28.7.0

A self-powered high-fidelity tuner covering full VHF, medium, and long wavebands with automatic frequency control on VHF.

DULCI "H4/T" £24.19.0

A 4 waveband self-powered high-fidelity tuner covering the VHF/FM transmissions plus the long, medium and short wavebands.

NEW HIRE PURCHASE TERMS are available on all above. Illustrated leaflets available—send S.A.E.

STERN'S FOR STEREO OUR POPULAR MULLARD MAIN AMPLIFIERS ARE RECOMMENDED

FOR USE WITH THE DULCI STEREO PRE-AMPLIFIERS

WE OFFER PRE-AMPLIFIER AND AMPLIFIER AT

SPECIALLY REDUCED PRICES

Send S.A.E. for full details

OTHER STEREO EQUIPMENT AVAILABLE:

GRAM UNITS fitted with Stereo cartridge by . . . GARRARD-COLLARO

LENCO-B.S.R.

HIRE PURCHASE TERMS ARE AVAILABLE.

A SPECIAL CASH ONLY OFFER !!

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

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

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

The Portable Case will also accommodate almost any make of Autochanger and is attractively finished in Maroon and Grey Roxine. WE ALSO SUPPLY SEPARATELY—

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

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

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



!! CAR RADIO !!

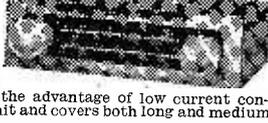
FOR THE HOME

CONSTRUCTOR

We have almost completed the design for a versatile 12 volt Car Radio. Incorporating a PRINTED CIRCUIT with TRANSISTOR output. This has the advantage of low current consumption, does not require a vibrator unit and covers both long and medium wavebands. Size is only 7 x 6 x 2 in.

THE COMPLETE KIT OF PARTS WILL BE AVAILABLE LATE APRIL, £13.10.0. (Carriage and Ins. 5/- extra.)

A general assembly Manual will also be available in April. Price 1/6.



THE LATEST MODELS ARE IN STOCK

MANY AT REDUCED PRICES!!!

SEND S.A.E. FOR ILLUSTRATED LEAFLET A FEW CASH BARGAINS

B.S.R. MONARCH
UA8 4-speed mixer
Autochanger with
Crystal Pick-up



£6.19.6

The COLLARO "CONQUEST" 4-speed Autochanger, Studio Pick-up **£7.19.6**

The latest COLLARO "CONTINENTAL" 4-speed MIXER Autochanger, Studio "O" Pick-up **£8.19.6**

The COLLARO 4-speed Single Record Player, Studio Pick-up..... **£6.19.6**

THE NEW B.S.R. Model UA12 is in Stock. A 4 "SPEED" MIXER AUTOCHANGER. **£8.19.6**

UA12 also available incorporating the B.S.R. STEREO Pick-up, plays L.F. and 78 Records **£11.17.6**

B.S.R. MODEL TU9 4-speed Single Record Player, complete with separate Crystal Pick-up..... **£4.10.0**

(This high output Pick-up is available separately for £1/18/6.) Carriage and Insurance on each above 5/- extra.

HIGH FIDELITY UNITS IN STOCK

The latest GARRARD TRANSCRIPTION MOTOR "301" with Stroboscopically marked turntable..... **£28.0.11**

The new GARRARD Model 4HF High-quality Single Record Player fitted with the latest T.P.A.12 Pick-up Arm and G.C.8. Crystal Cartridge **£19.7.10**

As above but fitted with the G.M.C.5 Moving Coil Pick-up and T.P.1 Transformer **£27.14.7**

GARRARD Model TAMK.II Single Record Player fitted with high output Crystal Pick-up detachable Head **£9.15.8**

The GARRARD T.P.A.12 TRANSCRIPTION PICK-UP ARM is available separately or with Crystal or Moving Coil Pick-up Heads.

GARRARD RC121/4-speed Autochanger fitted with latest crystal Pick-up..... **£10.10.0**

Send S.A.E. For Leaflet. NEW HIRE PURCHASE TERMS ARE AVAILABLE ON ALL EQUIPMENT VALUE £9.00 AND OVER.

STERN'S MK. II fidelity F.M. TUNING UNIT

PRICE **£15.0.0**

(Plus 5/- Carr. & Ins.)

HIRE PURCHASE: Deposit £3.0.0 and 12 Monthly Payments of £1.2.0

Incorporates the latest MULLARD PERMEABILITY TUNING HEART and the corresponding MULLARD VALVE LINE-UP comprising EC805, 2 type EF865 (or EF895) EM84 Tuning Indicator plus 2 type O.A.795 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 available to accommodate high-quality

Amplifiers, Pre-amplifiers, 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. WITH ALL CORRESPONDENCE.



109 & 115 FLEET ST., LONDON, E.C.4

Telephone: FLEET STREET 5812/3/4

Battery Charger

High output car battery charger, gives quick (car start) charge or trickle charge. Input standard A.C. mains, output 6 or 12 volt at 1.2 or 4 amps. With meter and variable charge selector. Complete in hammer finish louvered case. Only 75/-, plus 4/6 carriage, or 10/- deposit and 8 fortnightly payments of 9/-. New and unused, guaranteed for 2 years.



FREE GIFT.—All purchasing this month will receive as a free gift a pair of heavy duty charging clips.

Band III Converter

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

For Your Lab.

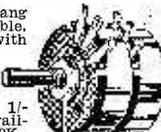
Resistance substitution boxes are great time savers and you really cannot have too many of them; here then, is an opportunity to acquire these at a very low rate. Our R.S. kit available for only 29/6, plus 1/6 postage, comprises 1 50 W. precision variable resistor 0-100 K., six 2-3 watt fixed resistors, one 6-position switch, one pointer knob and one ordinary knob and instructions. This unit when made up will give an infinite variability over the range 100 ohm to 2 meg.

RI155 for Spares

These are less valves but otherwise reasonably complete—ideal for spares—prices 22 to 24 depending on condition—carriage 7/6.

"Dim and Full" Switch

Particularly useful for controlling photoflood lamps which have only a short life at full brilliance. This toggle switch has three positions, the first position puts two lamps in series at half brilliance for setting up, the second position is off and the third position full brilliance for the operational shots. Also useful for controlling night lights, heaters, etc., etc. Price 2/6 each. Post 9d. Circuit diagram included.



Morganite Potentiometers

Single and 2-gang types available, standard size with good length spindle, complete in new and boxed. Single types 1/- each, valves available: 5K., 25K., 50K., 100K., 250K., 1 meg., 2 meg. Gang type, 3/- each—valves available: 5K., 5K., 100K., 100K., 1 meg., 2 meg., 2 meg. + 2 meg.

Cine Cameras



16 mm. motorised (24VAC) for 16 frames per second, contains fine F/5.5 triple anastigmatic lens and spool to carry 25ft. of film—probable cost around £150, brand new and in sealed carton, £6.10.0 or 20/- deposit and 13 fortnightly payments of 10/-, post and insurance 3/6.

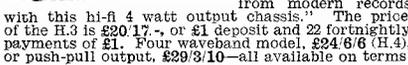
CABINET SNIP

Extremely well made portable amplifier case finished in two-tone and very modern in appearance. Large enough for stereo outfit with tape deck or auto-changer. Snip price 59/6, plus 3/6 carriage and insurance.



Dulci AM/FM Radiogram Chassis

Chassis Model H.3. This has three wavebands, F.M. 87-101 Mc/s., Medium Wave 187-540 metres and Long Wave 1,000-2,000 metres, uses 7 of the latest miniature valves and built-in ferrite aerial. "Why not modernise your Radiogram, get the best from modern records with this hi-fi 4 watt output chassis." The price of the H.3 is £20.17.-, or 41 deposit and 22 fortnightly payments of £1. Four waveband model, £24.6/6 (H.4), or push-pull output, £29.3/10—all available on terms.



Break-down Snip

American Radar Unit / ANAP1 this unit which cost a small fortune to make as illustrations show contains a wealth of components, including switches, transformers, pot meters, resistors, condensers, valves, holders, etc., etc. Offered while stocks last at the very low price of 8/6 plus 3/6 post and packing.



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 diaco 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 position. 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. A.H. at 10,000 ohms per volt.—Price £12.7/6 or £1 deposit and 24 fortnightly payments of 10/-, non callers add 5/- carr. & ins.



FREE GIFT.—All purchasers of the above item this month will receive Range Extender scale and data which add capacity 2p.-lim., in two ranges. Inductance 0-100 henrys, etc., etc.

Multi-Purpose Mains Transformer

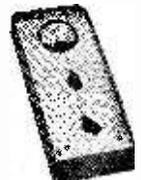
Heavy duty construction, must have cost at least £3 to make. Ordered at a sale price of 13/8.

Specification:—
Primary Standard 230 v.
Secondary 1. 660 v.-200 mA. centre tapped.
Secondary 2. 80 v.-100 mA.
Secondary 3. 23 v.-750 mA.
Secondary 4. 7 v.-5 amp. centre tapped.
Secondary 5. 5 v.-3 amp.

In addition there is a window space for extra L.T. windings, winding ratio is 2:1 turns per volt. Weight of transformer is 12 lb., size approximately 6in. x 4in. x 4in. Connections all brought out to terminals on bakelite panel. We have only 500 of these, so order at once to avoid disappointment. Non-callers add 3/6 postage please.

A.C./D.C. Multimeter Kit

Ranges: D.C. volts 0.5, 0.50, 0.500, 0-100, 0-1000. A.C. volts 0.5, 0.50, 0-100, 0-500, 0-1000. D.C. milliamms 0.5, 0-100, 0-500, 0-1000. 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.



Yaxley Switches

3 Pole 2 way	...	...	...	1/6
12 Pole 2 way	...	...	...	2/6
3 Pole 3 way	...	...	...	1/6
9 Pole 3 way	...	...	...	2/6
2 Pole 4 way	...	...	...	2/6
6 Pole 4 way	...	...	...	2/6
4 Pole 6 way	...	...	...	2/6
2 Pole 6 way	...	...	...	2/6
1 Pole 7 way	...	...	...	2/6
1 Pole 11 way	...	...	...	2/6
2 Pole 11 way	...	...	...	3/6
1 Pole 12 way	...	...	...	3/6
2 Pole 12 way	...	...	...	4/6
6 Position Shorting	...	...	...	2/6

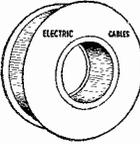
Unused and Boxed Valves

OZ4	9/-	6F5	9/6	7B5	12/6
1A4	9/-	6F6	7/6	7C7	12/6
1A6	9/-	6F7	12/6	7D5	9/6
1L7	12/6	6F8	10/6	7E8	8/6
1L8	8/6	6F32	10/6	7H7	8/6
1LA6	8/6	6C6	7/6	7K8	12/6
1N56	3/6	6H6	2/6	7R7	10/6
1LD5	3/6	6J5	5/6	7S7	10/6
1T4	7/6	6J7	6/-	12H6	8/6
1R5	7/6	6B6	7/6	12SH7	8/6
1S6	7/6	6K7	8/6	12S7	8/6
1T5	8/-	6K8	3/6	12SK7	8/6
2A5	12/6	6L5	9/-	25B5	12/6
2A6	12/6	6L6	9/-	26	10/6
2A7	12/6	6L7	10/-	27	10/6
2D3C	5/-	6N7	5/6	29D7	3/6
2X2	4/6	6O7	9/6	31	7/6
3A4	7/-	6R7	9/-	32E	7/6
3D6	5/-	6S7	9/-	34	12/6
3Q4	7/6	6SA7	8/-	39/44	10/6
4D1	2/6	6SG7	8/-	41E	9/6
5U4	8/-	6SH7	6/6	42	8/6
5Z3	12/-	6SJ7	8/6	43	10/-
5Z4	9/6	6SE7	6/-	47	10/-
6A6	12/6	6SL7	8/-	58	10/-
6AG5	6/6	6SN7	7/6	71	9/6
6AC7	6/6	6SQ7	9/-	75	12/6
6A8	10/-	6SR7	9/6	77	8/6
6B4	9/-	6T7	12/6	83	12/6
6B7	10/6	6U5	8/6	84	3/6
6B8	4/-	6V6	8/6	807	6/6
6BQ6	12/6	6X5	7/6	954	3/6
6C4	6/6	6T7	9/-	1625	10/6
6C8	6/6	6Z5	10/6	905	50/-
6C6	5/-	7A2	12/6	913	30/-
6D6	6/6	7A7	9/6		

Good range of British Valves kept at all addresses.

FOR ADDRESSES SEE OPPOSITE PAGE

Versatile Wire



Single-strand 18-gauge with P.V.C. covering which makes it rustproof. Extra strong, will stand tremendous strain. Ideal for gardening, clothes lines, indoor aerials, etc., etc. Also being steel alloy and having a resistance of approximately 1 ohm per yard this can be used for electrical work, soil heating, wrapping round water pipes, etc. New on drum containing 3,000ft. Price 8/6 plus 3/6 carr.

Also being steel alloy and having a resistance of approximately 1 ohm per yard this can be used for electrical work, soil heating, wrapping round water pipes, etc. New on drum containing 3,000ft. Price 8/6 plus 3/6 carr.

T.V. Service Sheets

200 sheets covering most popular post-war televisions by leading makers—Cossor, Ekco, Ferguson, Pye, etc. £2 post free. PREVIOUS PURCHASERS OF THESE SHEETS, PLEASE NOTE: WE CAN SUPPLY SHEETS Nos. 100-200, £1. or 150-200, 10/-.

**Hi-Fi Snip
Infinite Wall Baffle**

Nicely veneered and polished. Corner fitting (at latches 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.



Tube Tester and Re-Activator



We can supply all the main components for making this unit which will not only test Cathode Ray Tubes but also will re-activate them, supplied complete with full instructions. Price £3, plus 2/6 post and ins.

Adapt Your Gram for Stereo

Cartridges for adapting existing record players for stereo—available £2.15.0 each—please state make of player when ordering.

Chassis Assembly



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

Assure Your Future



The ownership of a good instrument has been the turning point in many a famous career. You can own the latest AVO Test instrument which has 10,000 O.P.V. sensitivity. It measures: Volts 0-1,000 (5 ranges A.C.) (7 ranges D.C.), Current 0-1 amp. (5 ranges), Resistance 0-2 megs. (2 ranges).

Free gift—all purchasers will receive our exclusive Range Extender Scale for measuring capacity 50 pF.—1 mfd., inductance, E.H.T., etc. Sent for 10/- deposit and 19 fortnightly payments of 10/- (plus Post and insurance 3/6). Cash price £9.10.0.

Avo Proclips



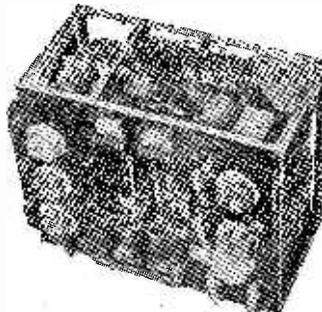
The advantage of these test prods is that by pressing the trigger at the side they become crocodile clips and can be left in circuit. This is a great time saver when servicing. Price, 15/- pair.

**THIS MONTH'S SNIP
Terrific Manufacturer's Surplus Offer**

Constructor's parcel: to build Pocket 6 Transistor Set as currently being sold at £17.17.0. Parcel comprises Motified two-tone cabinet as illustrated, tuning dial, two gang tuning condenser, combined bakelite chassis / printed circuit and easy to follow circuit. Costing value 57/6—offered while supplies last at only 29/6, plus 2/6 post. Suitable for your own circuit or to build original circuit. All parts available at highly competitive prices. Do not miss this tremendous bargain.



Famous Transmitter Virtually Given Away



The famous RI154—unused but slightly soiled and not tested. Covers 200-500 kc/s., 3-5.5 Mc/s and 5.5-10 Mc/s. Has unique "click stop" mechanism (7 stops) and permits selected frequency to be held, returned to, etc. Hartley oscillator, power amplifier, keying and speech. Wonderful breakdown value meters, relays, switches. Complete with valves—real bargain at 29/6, plus 10/- carriage.

Miniature Microphone. American made, Dynamic type, real bargain at 1/6. Plus 6d. postage.



Siemens High Speed Relays
1,750+1,750 Ohms..... 17/6
250+ 250 Ohms..... 8/6

Solenoid (plug type) 40 W. 100 V. powerful pull with mounting bracket. Price, 9/-, plus 2/-.

Flow Line Diverter (rotary actuator), high speed, angular movement 30° mean torque 6lb. inch. 40 W. at 100 V., 25/- each+2/6 post and insurance.

Long, Medium and Short Wave Coil Pack. An exceptionally well made coil pack which covers the standard long, medium and short wave bands for 455 Kc. I.F. complete with diagram of connections. 14/6 plus 1/6 postage and insurance—limited quantity only.

50 More T.V. Service Sheets. Readers already possessing our service sheets numbers 1-100 will be glad to know that 101-150 are now ready, price 10/- post free.

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

Synchronous Induction Motors. Standard type motors made by leading manufacturers they have been removed from equipment never put into service so they are virtually new and unused and are covered by 12 months' guarantee.

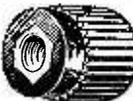
1 h.p. 1,450 r.p.m. £6.10.0
1/2 h.p. 1,500 r.p.m. £5. 0.0
1 h.p. 1,500 r.p.m. £5.10.0
1/2 h.p. 1,450 r.p.m. £4.10.0
1/16th h.p. £3.10.0

All plus 5/- carriage and insurance.

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

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

Neon Lamp, midget wire ended. Ideal for making mains tester or for any of the dozen-and-one applications to which a neon can be put. 2/-.



Insulated Terminal Heads. Always useful—special bargain price, 2/- dozen.

All items advertised can be obtained from the following Companies.

- If ordering by post, address your order to the Company nearest to you and please include postage.
- Instrument Co., 6, High Street, Thame, Oxon. Phone: THAME 182.
 - 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, Strand Green Rd., Finsbury Park, N.4. Phone: ARCHWAY 1049. Half day Thursday.

R.S.C. HI-FI TAPE RECORDER

REALISM AT INCREDIBLY LOW COST

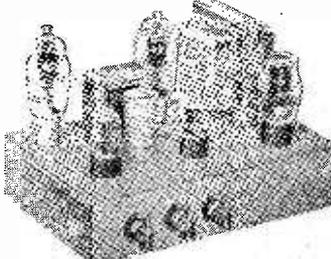
The Recorder incorporates the Latest Collaro Mark IV Tape Transcriber. The Linear LT-45 High Quality Tape Amplifier, High Flux P.M. Speaker, empty Tape Spool, and a Reel of Best Quality L.P. Tape (850ft.) are included. A Collaro Studio Microphone can be supplied with the recorder only at a special price of 37/6. Cabinet finish veneered walnut. Size 13in. x 17in. x 14in. high. SEND S.A.E. FOR LEAFLET.

39 1/2 GNS.
Carr. 15/-

H.P. TERMS. Deposit 3 Gns. and 12 monthly payments £3.10.6.

R.S.C. A8 HIGH FIDELITY 12 WATT AMPLIFIER

Ultra Linear 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 -5 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.



£7-15-0

For STANDING 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 FEDERATION UNIT. Size approx. 12-7in. For A.C. mains 200-250 v. 50 c/s. Outputs for 3 and 15 ohm speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Unapproachable value at £7.15. Factory built 45/- extra. Carriage 10/-.

If required louvred metal cover with 2

carrying handles can be supplied for 18/9. Additional input sockets, with associate 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 18/9 and 12 monthly payments, 18/9

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

HI-FI 8 WATT AMPLIFIER

Special Purchase price to Canceled Export Order. **£4-19-9** Carr. 7/6.

Limited number available of these 200-250 v. A.C. highly sensitive P.Pull units COMPLETE WITH LOUDSPEAKER. Brand name in working order. Separately controlled inputs for "mike" and gram, etc. LATEST B.V.A. VALVES. Excellent performance.

STAAR GALAXY 4-SPEED MIXER AUTO-CHANGERS

Brand new, cartoned. Turnover sapphire stylus. Many exclusive features. Unique design motor virtually free from wow. For 200-250 v. A.C. mains. Only £5.19.6, while stocks last or fitted Acos turnover head for 78 r.p.m., L.P. or Stereo records. £8.19.6. Carr. 3/9 extra.

PORTABLE CABINETS. High Quality Finish. Resiline covered. Attractive design. Inside measurements: 17in. x 12in. x 8in. High. Clearance above baseboard 5in. Below 2in. 69/9 each. Or size 14in. x 12in. x 6in., only 47/9.

SPECIAL OFFER. Above cabinet, LG3 Amplifier, Staar. Changer and 5in. P.M. Speaker. 11 Gns. Carr. 10/-.

THE SKYFOUR T.H.F. RECEIVER. A design of a 3-valve Long and Medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.F. stage and low distortion audio beam detector. Power pentode output. Valve line-up 6K7, SP61, 6V6G. Selectivity and quality are well up to standard, and simplicity of construction is a special feature. Point-to-point wiring diagrams, instructions and parts list. 49/- Maximum building costs. £4.19.6, inc. attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 6 x 5 1/2 in.

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

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

ACOS CRYSTAL MICROPHONES. Type 33-1, hand or desk. List price 50/-, Brand new, cartoned. 29/6.

EXTENSION SPEAKERS

Ready for use in walnut veneered cabinet. 6in. 2-3 ohms, 29/11. 8in. 2-3 ohms, 35/9. 10in. 2-3 ohms, 56/9. Very limited number



14 WATT AMPLIFIERS. Unused and in good order but store soiled. For 200-250 v. A.C. mains inputs. Outputs for 3 and 15 ohm speaker. Inputs for "mike" and Gram. Limited number, complete with valves. Only 6 Gns., carr. 5/-.



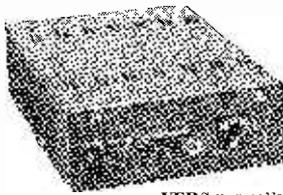
A SIX TRANSISTOR "POCKET" SUPERHET RADIO

All parts including Transistors Printed Circuit, Attractive Cream or Coloured Plastic case. Ferrite aerial, 2 1/2 in. P.M. Speaker, etc. etc. and full instruction booklet. Size 5 1/2 x 3 1/2 x 1 1/2 in. completed Long and Medium Wavebands 250 M.W. push-pull output. Demonstrated at our counter premises.

£9.19.6 Carr. 3/6 extra.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BMI. An all-dry battery eliminator. Size 5 1/2 x 4 1/2 x 2in. approx. 4. 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 120v. 90 v. and 60 v., 40 mA. and parts list. 49/- Maximum building costs. £4.19.6, inc. attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 6 x 5 1/2 in.

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 with diagrams and instructions. 49/9. or ready for use, 56/6.

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

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

250-0-250 v. 70 mA. 6.3 v. 2 a. 5 v. 2 a. ... 16/9
350-0-350 v. 80 mA. 6.3 v. 2 a. 5 v. 2 a. ... 18/9
250-0-250 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 23/9
300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 23/9
350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 23/9
350-0-350 v. 100 mA. 6.3 v. 4 a. 4 a. C.T. ... 23/9
0-4.5 v. 3 a. ... 23/9
350-0-350 v. 150 mA. 6.3 v. 4 a. 5 v. 3 a. ... 29/9

FULLY SHROUDED UPRIGHT

250-0-250 v. 60 mA. 6.3 v. 2 a. 5 v. 2 a. ... 17/6
Midget type 250 v. 103 mA. 6.3 v. 4 a. 5 v. 3 a. ... 26/9
300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 26/9
350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 26/9
300-0-300 v. 130 mA. 6.3 v. 4 a. 6.3 v. 1 a. ... 35/9
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. ... 49/9
6.3 v. 4 a. C.T., 5 v. 3 a. Suitable Williamson Amplifier, etc. ... 49/9

FILAMENT TRANSFORMERS

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

OUTPUT TRANSFORMERS

Midget Battery Pentode 66:1 for 354, etc. ... 3/9
Small Pentode, 5000 Ω to 3 Ω ... 3/9
Small Pentode 7/8,000 Ω to 3 Ω ... 3/9
Standard Pentode 5,000 Ω to 3 Ω ... 4/9
Standard Pentode, 7/8,000 Ω to 3 Ω ... 4/9
10,000 Ω to 3 Ω ... 4/9
Push-Pull 10-12 watts 6V6 to 3 Ω or 15 Ω ... 15/9
Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15 Ω ... 16/9
Push-Pull EL84 to 3 or 15 Ω ... 16/9
Push-Pull 15-18 watts, 6L6, KT68 ... 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.

120 v. 40 mA. 5-0-5 v. 3 a. ... 15/9
90 v. 15 mA. 4-0-4 v. 50 mA. ... 9/9

SMOOTHING CHOKES

150 mA. 7-10 H 250 ohms ... 11/9
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A complete set of parts to construct a Stereo amplifier with an undistorted output of up to 6 watts (3 watts each channel). For A.C. mains input of 200-250 v. Outputs for matched 2-3 ohm speakers. Sensitivity 130 m.v. Ganged Vol. and Tone Controls. Preset balance control. Full instructions and point to point wiring diagrams Carr. and pkg. 5/- supplied. Only good quality components and latest high grade valves used. Exceptionally realistic reproduction can be obtained at ample volume for the home, as can be demonstrated in typical surroundings at our County Arcade premises. A really sensational offer.

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12 GNS.

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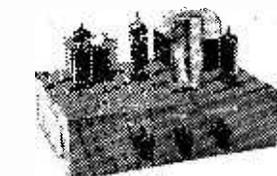
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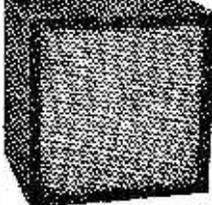
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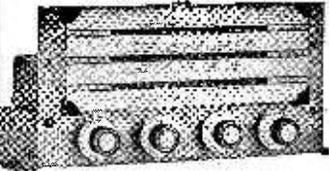


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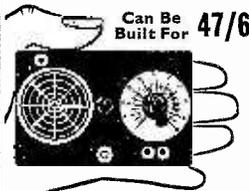
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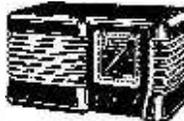


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Moving Coil P.M. Speakers, 2 1/2 in. 17/6; 3 1/2 in. 19/6; 5 in. 17/6; 8 in. 19/6.

ALL TYPES OF COMPONENTS STOCKED AT COMPETITION PRICES

PRINTED CIRCUIT POCKET SET

BUILD THIS 3 TRANSISTOR POCKET RADIO... PRINTED CIRCUIT VERSION! The "Companion" is comparable in sensitivity to a three-valve battery set, it is exceptionally small in size (4 1/2 in. x 3 in. x 1 1/2 in.) and is a self-contained pocket radio that does not need aerial or earth. It has built-in speaker and covers medium and long waves. This unique little set **CAN BE BUILT FOR ONLY 97/6**. **EVERYTHING INCLUDED!** (Plus post and packing 2/6.) All parts sold separately. Price list, etc., 6d. C.O.D. 2/- extra.

PRINTED CIRCUIT POCKET SUPERHET

BUILD THIS PROFESSIONAL-LOOKING, FIRST-CLASS 6 TRANSISTOR POCKET SUPERHET THE "TRANSIDYNE". Size only 6 1/2 in. x 4 1/2 in. x 1 1/2 in. Beautiful red and cream plastic case with engraved dial. Set weighs only 20oz. with batteries! Covers medium and long waves. Works off two No. 8 batteries. The second I.F. Stage is reflexed to give additional audio gain. In-built ferrite rod aerial and 2 1/2 in. P.M. speaker. This **TRANSIDYNE** is probably the best yet of its kind, it is simple to build and really sensitive. **ALL COMPONENTS INCLUDING CABINET, PRINTED CIRCUIT, TRANSISTORS—IN FACT EVERYTHING CAN BE SUPPLIED FOR £11/15/-**. (Plus post and packing 2/6.) (All parts sold separately. Price list, circuit, etc., 9d.) C.O.D. 2/- extra.

CAN BE BUILT FOR

47/6

Build this exceptionally sensitive high efficiency Pentode radio. Uses unique assembly system and can be built by anyone without any radio knowledge whatever in 45 minutes. Handsome black-crackle steel case with specially made black and gold dial with stations printed. Size of radio only 6 1/2 in. x 5 in. x 3 in. Covers all Medium and Long waves—uses only one all-dry battery. H.T. consumption only 1 to 1.5 mA. Uses personal phone. Ideal for Bedroom, Garden, Holiday, etc. **BUILD THE "SKYROMA" NOW!** Total building cost—everything down to last nut and bolt—**47/6** (Postage etc., 2/-)—with full set of clear, easy-to-follow plans. (Parts sold separately. Priced Parts Lists & Plans 1 9d.) C.O.D. 2/- extra.

READ WHAT OTHERS SAY!

"—I WAS SURPRISED AT THE NUMBER OF STATIONS—" L. D. G., of Worcester, writes, "—Just a few lines to let you know how pleased I am with the midget portable radio. I was surprised at the number of stations I could get with a clear performance. The price was a real bargain. Have you lists of other bargains? If so, please send them—"

"—I MUST SAY I AM VERY PLEASED—" J. W. S., of Scarborough, Yorks, writes, "—I feel I must say I am very pleased in the way you do business and if at any time I require anything, or can recommend you to anyone, I will not hesitate to help you—"

"—I'VE HEARD MUCH PRAISE OF THEM—" J. E., of Hilton, Nr. Derby, writes, "—I would like one of your portable radio kits as I've heard much praise of them—"

"—THIRTY-TWO STATIONS RECEIVED—" J. N., of Oxted, writes, "—Yesterday evening on the Medium Wave-band, between 10 p.m. and 10.30 p.m., I counted 32 distinguishable stations! I am very pleased with the set, which is well worth the money—"

"—MY DEEPEST ADMIRATION—" J. R., of North Shields, Northumberland, writes, "—The honest and direct dealing of your firm has earned from me my deepest admiration—"

"—ITS PERFORMANCE IS ALMOST UNBELIEVABLE—" E. F., of Ipswich, writes, "—For so small a set I think it is a wonderful station getter with ample volume on all. Its performance is almost unbelievable, and it's a very convenient little set giving me stations I've never been able to get on a larger set—"

THIS TRANSISTOR SET

CAN BE BUILT FOR ONLY

29/6

VERY SPECIAL OFFER WHILE STOCK OF PARTS LASTS!—The "Sky-Scout" Pocket two-stage transistor set, size only 7 in. x 4 1/2 in. x 4 1/2 in. Covers all medium waves and works entirely off tiny "penlight" battery which costs 6d. and fits inside case. All parts tested before despatch. Can be built for 29/6, plus 2/- post and packing, including Case, Transistor. **STEP-BY-STEP PLANS FOR ABSOLUTE BEGINNERS**, nuts, bolts, etc. (C.O.D. 2/- extra). Parts sold separately, priced parts list & Plans, 1/6. **VERY SIMPLE TO BUILD.**



CONCORD ELECTRONICS
69, PRESTON STREET BRIGHTON

Dept. PW7

Orders receive prompt attention. Cheques accepted. Cash on delivery 2/- extra. Please print name and address in block letters. Suppliers to Schools, Universities, Government and Research Establishments. Complete range of components and valves stocked. Retail no C.O.D. abroad. Money refunded if parts returned intact within 7 days.

DUKE & CO. FOR RECORD PLAYER CABINETS

SINGLE PLAYER CABINET 35/6



R.P.6 **49/6**

Elegant cabinet, cloth covered in grey or red with sunken control panel and speaker fret. Size 13 x 17 x 8in. deep. Takes a B.S.R. Monarch 4-Speed Autochanger; 7 x 4in. elliptical speaker, and most of the modern portable amplifiers. Carr. & Ins., 4/6.



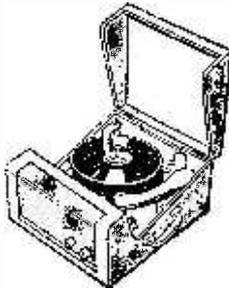
R.P.4 **79/6**

Stylish cabinet by famous manufacturer. Cloth covered in contrasting colours (red and grey). Grilled front controls panel. Size 15 x 19 x 8 1/2 in. deep. Beautifully made—a cabinet of which you can be really proud. Takes 4-speed B.S.R. Autochanger. 6in. round or elliptical speaker. Room for any amplifier of your own choice. Carr. & Ins., 4/6.



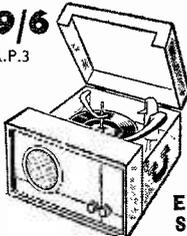
R.P.2 **69/6**

A beautifully styled cabinet. Made by a famous manufacturer. In polka dot cloth with clipped lid and carrying handle. Size 16 x 14 1/2 x 8 1/2 in. deep. Will take B.S.R. Monarch 4-speed Autochanger and 4 x 7in. elliptical speaker and most of the modern portable amplifiers. Carr. & Ins., 4/6.



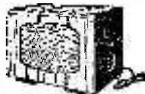
79/6

R.P.3



A delightful looking cabinet 14 1/2 x 17 1/2 x 8 1/2 in. in 2-tone leatherette. Will take a B.S.R. Monarch 4-speed autochanger and 6 1/2 in. round speaker. Carr. & Ins., 4/6.

EXTENSION SPEAKERS



19/9

Polished oak cabinet of attractive appearance. Fitted with 8in. P.M. speaker W.B. or Goodmans of the highest quality. Standard matching to any receiver (2-5 ohms). Switch and flex included. Ins. carr., 3/6.

IDEAL FOR STEREOPHONIC SOUND

8in. P.M. Speakers, 8/9. With O.P. transformer fitted, 10/-.
6 1/2 in. P.M. Speakers, 12/6. 4 x 7in. Elliptical Speakers, 19/6.
8 x 5in. Elliptical Speakers, 22/- Postage 2/9.

B.S.R. FUL-FI CRYSTAL TURNOVER CARTRIDGES 19/6.

Brand new. Including sapphire needles for L.P. and Standard, giving fullest range and finest tone obtainable for any player. Can be fitted to all standard pick-up arms. P. & P., 9d.

B.S.R. MONARCH 4-SPEED AUTOCHANGER £6.19.6

Incorporating auto and manual control complete with turnover crystal p.u. and sapphire stylus. P. & P. & Ins., 5/6.



COLLARO 4-SPEED AUTOCHANGER, £7.19.6

Incorporating auto and manual control complete with studio crystal p.u. and sapphire stylus. P. P. & Ins., 5/6.

TU9 B.S.R. 4-SPEED SINGLE PLAYER, £4.9.6. P. & P. 5/6.

COLLARO CONQUEST STEREO AUTOCHANGERS, 11 guineas. Carr. & Ins. 5/6.

UA12. Latest B.S.R. Monarch 4-speed mixer, £8.9.6. Carr. & Ins. 5/6.

B.S.R. MONARCH 4-SPEED STEREO AUTOCHANGERS, £9.19.6. Carr. & Ins., 5/6.

STEREOPHONIC AMPLIFIER, £7.19.6 12 Months Guarantee.

Beautifully made for portable stereophonic record players. Latest design with printed circuit. Dimensions 3 x 5 1/2 x 9 1/2 in. A.C. only. Mains isolated. Twin amplifiers each side giving 3-4 watts output. Incorporating ECL82 triode pentode valve. Full tone, volume and balance controls. Complete and ready to fit. Knobs, 3/6 per set extra. P & P. & Ins. 4/6.

★ A "must" for the build your own tape recorder enthusiast:

TAPE RECORDING CABINETS, 59/6

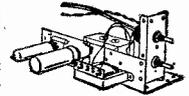
Suitable for the Truvox tape-recording deck. Less front cast speaker panel. Size 13 1/2 x 15 x 8 1/2 in. deep. Detachable lid with compartment for spare tape. Covered in green washable plastic material. P.P. & Ins. 4/6.

★ AMPLIFIERS ★

12 months guarantee

PORTABLE AMPLIFIER MARK D.1, 59/6

Brand new. Latest design with printed circuit. Dimensions 7 x 2 1/2 x 5in. A.C. only. Mains isolated. 2-3 watts output. Incorporating EL84 as high gain output valve. Volume and tone controls. Knobs 2/6 extra. P. & P. 3/6.



PORTABLE AMPLIFIER, Mark D.2, 79/6

Printed circuit. Latest design. Dimensions 7 x 2 1/2 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 controls. Knobs 2/6 extra. P. & P. 3/6.

PORTABLE AMPLIFIER Mark D.3, 89/6

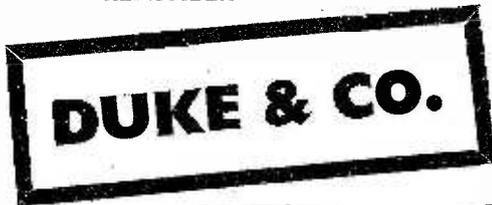
De luxe model. Printed circuit. Latest design. Dimensions 7 x 2 1/2 x 5in. A.C. only. Mains isolated. 3-4 watts output. Incorporating the latest ECL82 triode pentode output valve giving higher undistorted output. Volume, treble and bass control. Knobs, 3/6 extra. P. & P. 3/6.

PORTABLE AMPLIFIER Mark D.4, 69/6



Brand new. By famous manufacturer. Especially built for portable record players. Dimensions 4 1/2 x 3 1/2 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.

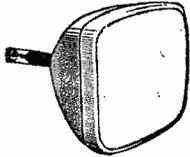
REMEMBER THE NAME!



MIDGET RADIO 5 VALVE SUPERHET, 49/6

Can be used on 110 volt-250 volt mains, A.C. or D.C. Compact little set using 12K8 ; 12K7 ; 12Q7 ; 35L6 and 35Z4 G.T. valves. 5in. speaker. Cabinet size 17 x 8 x 6in. Carr. & Ins., 3/6.

CONTEMPORARY EXTENSION SPEAKER, 32/6
18 x 7 x 15in. Dark veneered walnut cabinet. Attractive speaker fret. High quality 8in. P.M. speaker. On and off switch and volume control. P. & P., 3/6.



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 8 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., 10in., 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.

EXPRESS DISPATCH SERVICE

Please phone to confirm Tube in stock. Send Telegraph Money Order. Tube despatched Passenger Train same day. This service only available with remittance by a Telegraph Money Order.

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.

SOLDER REELS, 1/6

On plastic spools. 60/40 3-core Ersin. Will fit the Solo Tool. Post 4d.

POWER PACK & AMPLIFIER, 9/9

Output stage PEN45. O.P. trans. choke. Smoothed H.T. 325 volt 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.

O.P. Trans., 1/3

Standard size 2-5 ohms. Post 1/- 20 for £1. Post 5/6.

★ MAINS TRANSFORMERS ★

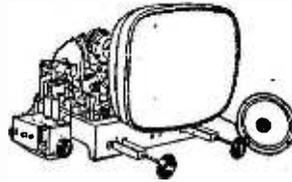
Drop Through Type, 12/9

350-0-350 volts at 250 mA., 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.

Upright Type, 3/9

350-0-350 volt at 80 mA., 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.

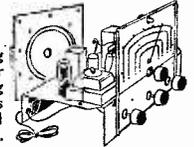
TV CHASSIS, TUBES & SPEAKERS



17" T/V CHASSIS, TUBE & SPEAKER 16 GNS.

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 of 50/- giving choice of any two channels (B.B.C. & I.T.A.). Extra channels can be supplied at 7/6 each. Chassis size 12 x 14½ x 11in., less valves. Similar chassis are used by well-known companies because of their stability and reliability. With tube and speaker (less valves), 16 guineas. Complete and working with valves and Turret Tuner, 24 guineas. 12 months' guarantee on the Tubes. 3 months' guarantee on the valves and chassis. Ins., carr. (incl. Tube), 25/-.

SUPER CHASSIS, 99/6



5 valve superhet chassis including 8in. 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.

14" T/V CHASSIS, TUBE AND SPEAKER 11 Gns.

As above, with 14in. Rectangular Tube. 12 months' guarantee on Tube, 3 months' guarantee on chassis and valves. Chassis with Tube and speaker (less valves), 11 guineas. Complete and working with valves and Turret Tuner, 19 guineas. Ins., carr. (incl. Tube), 25/-.

12" T/V CHASSIS 29/6

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 and tube. Speaker free. I.F.'s 16-19.5 Mc/s. vision. Channels 1-5 easily converted to I.T.A. by use of a Turret Tuner. Drawings available at 2/6 or free with order. Ins., carr., 10/6. 12in. Tube available at £6, plus Ins., Carr. 15/6

SOUND/VISION I.F. STRIP 5/9

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

TIME BASE, 4/9

Containing scanning coils, focus unit, line transformer, etc., less valves. Drawings free with order. P. & P., 2/6.

BAKELITE CABINETS, 5/9

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



INSULATING TAPE 1/6

Finest quality in sealed metal container. 75ft. by ½in. wide. Post 9d.

TELEVOX TELEPHONE AMPLIFIER 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. & Ins., 4/6.



DUKE & CO.

(Dept. D.5.), 621/3, ROMFORD ROAD, MANOR PARK, E.12.

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Send for FREE Catalogue. Tel. ILF. 6001/3.

EDISWAN
MAZDA

TRANSISTORS

Experimenters and home constructors! To meet the increasing demand for economically priced quality transistors Ediswan Mazda are now making the following range available through your radio or electronics dealer.

Transistor Type	List Price	
XA 104	18/-	General purpose R.F. transistor; frequency changer and/or oscillator for long and medium wave bands. Minimum common base cut-off frequency 4 Mc/s. Maximum mean or peak collector to emitter voltage—12v. Minimum small signal current gain—18.
XA 103	15/-	I.F. amplifier. Minimum common base cut-off frequency 2 Mc/s. Maximum mean or peak collector to emitter voltage—12v. Minimum small signal current gain—15.
XB 102*	10/-	General purpose audio transistor. Maximum peak or mean collector to emitter voltage—16v. Range of small signal current gain—18-47.
and XB 104†	10/-	

†Maximum collector dissipation at 25°C—150mW
" " " " 45°C— 90mW

*Maximum collector dissipation at 25°C—120mW
" " " " 45°C— 60mW

**CONTACT YOUR DEALER
OR HOME CONSTRUCTOR STORE
FOR SUPPLIES**

Full data from

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Technical Service Department 155 Charing Cross Road London WC2
Telephone GERrard 8660 Telegrams Sieswan Westcent London

PRACTICAL WIRELESS

27th YEAR
OF ISSUE

EVERY MONTH
VOL. XXXV, No. 629, MAY 1959
COMMENTS OF THE MONTH

BY THE EDITOR

THE V.H.F./F.M. RADIO SERVICE

MUCH has been written about the advantages of the BBC's "V.H.F./F.M." broadcasting service. While the advent of this system has improved the radio reception of many thousands, we contend that where the formerly existing medium- or long-wave transmissions were subject to negligible interference, V.H.F. transmissions offer little or no improvement. The full advantages of the new system have not yet been realised. The V.H.F. transmitters receive their signals *via* the same landlines as the medium- and long-wave transmitters. These landlines usually give an upper frequency limit of about 8.5 kc/s. However, the V.H.F. transmitters are capable of a response up to a considerably higher frequency with consequent increase in fidelity of reproduction at the receiver. True, the Wrotham transmitter is fed by a special low-loss coaxial cable which can go up to 12 kc/s or even higher, but only when programmes originate in the London area is this of any real value. If a Scottish programme is relayed, for instance, the upper frequency limit may be below 8.5 kc/s.

Surely, now that the V.H.F. service is more or less established, the landlines linking transmitters could be improved. We realise that the question of finance is involved, but if radio is to hold its own with television then some new fillip is needed.

It is with deepest regret that we have to inform readers of the sudden death of our Editor, Mr. F. J. Camm.

For many years, Mr. Camm's name has been synonymous with the "Practical" Group of journals, of which he was the originator, and the growth of which was largely due to his energetic and enthusiastic editorship.

He was one of the first to realise that there was a public demand for practical journals written in non-technical language, and he met this demand by producing the Practical Group of magazines that made his name a household word. Mr. Camm's extensive knowledge as a scientist and engineer enabled him to write many technical books in the engineering and radio field.

CLUB REPORTS

A REMINDER that Club Secretaries should send in their reports in the style in which we print them. It should also be noted that reports should reach us well in advance of the date of publication. This means that we should receive notices not later than the 10th of the month for publication in the following month's issue. Secretaries should also take care to ensure that any "future events" listed will not have taken place when the issue is on sale.

We have always fostered the growth of the Club movement, and the space devoted to reports is entirely free. In return, it is reasonable for Secretaries to co-operate with us.

Our next issue, dated June, will be published on May 7th

Editorial and Advertisement Offices:

PRACTICAL WIRELESS

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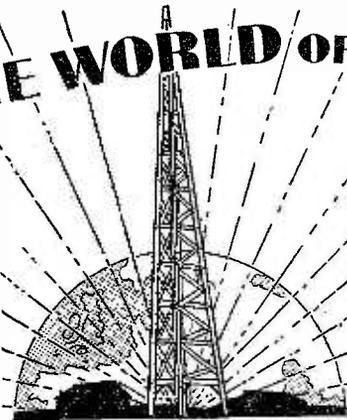
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The Editor will be pleased to consider articles of a practical nature. Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, 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



International Convention on Transistors and associated semiconductor devices which is to be held at Earl's Court during the period May 21-27, 1959.

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of January, 1959 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	930,564
Home Counties... ..	920,822
Midland	678,979
North Eastern	823,036
North Western	641,726
South Western	556,302
Wales and Border Counties	346,070
Total England and Wales ...	4,897,499
Scotland	603,735
Northern Ireland	166,299
Grand Total	5,667,533

By "QUESTOR"

prototype printed circuits of any size and complexity.

To ensure that users and prospective users of printed circuits are fully conversant with the advantages of printed circuits, a technical consultant service is now in operation and is freely available. Fully qualified technicians are visiting firms and advising manufacturers in the early stages on the best approach in the use of printed circuits and guiding them in the latest methods of assembly, flow soldering, etc.

Marconi Autoplex Equipment

MARCONI'S announce that they are in production with a new type of equipment which effects a significant improvement in long-range H.F. communications services. Fourteen of these Autoplex equipments (as they are known) have already been ordered by the British General Post Office, while a further fourteen are being manufactured for use by Cable and Wireless Ltd.

Autoplex is an automatic error-correcting device which makes for a much higher degree of accuracy in the transmission of radio-telegraphy than has hitherto been possible. Not only does it speed the service, thereby

Electronic Engineering Association

FOLLOWING the annual general meeting of the Electronic Engineering Association and the election of its new council in London recently, Mr. L. T. Hinton, B.Sc., M.I.E.E., (Standard Telephones & Cables Ltd.), was elected chairman in succession to Mr. F. S. Mockford (Marconi's Wireless Telegraph Co.). Mr. R. R. C. Rankin, O.B.E. (Mullard Ltd.), was elected vice-chairman.

The Council was enlarged from 12 to 14 members. All the 1958 members were re-elected with the exception of Kelvin & Hughes, who stood down, and newly-elected members were Automatic Telephone & Electric Co. Ltd., Siemens Edison Swan Ltd., and Ultra Electric Ltd.

"Multinex"

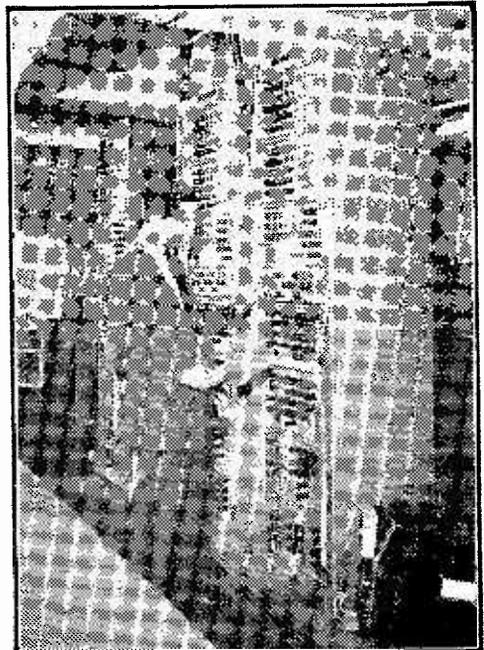
PRINTED CIRCUITS LTD.; of Boreham Wood, Herts, announce that the installation of the "Multinex" fully automatic electronically controlled camera now enables them to offer design engineers a 42-hour service for the production of

Change of Title

BY a decision of the Council the name of the Radio and Telecommunications Section of The Institution has been changed to: "Electronics and Communications Section."

International Convention on Transistors

THE Institution of Electrical Engineers announces that the Rt. Hon the Viscount Hailsham, Q.C., Lord President of the Council, has accepted an invitation to deliver the opening address at the



A Marconi engineer testing Autoplex equipments.

increasing the traffic-handling capacity of any given route, but it also enables H.F. radio-telegraph networks and ionospheric scatter circuits to be connected into the international Telex system.

"Skytowers"

THE illustration on this page shows two of the three "Skytowers" recently supplied by "Belling-Lee" and erected on the Time and Nautical Almanac Building at the Royal Greenwich Observatory, Herstmonceux. Each tower is 50ft. high in four sections, and is insulated at the base by means of specially designed insulators. The Time and Nautical Almanac Building was built for the Admiralty by Messrs. Charles R. Price. The consulting architect to the Admiralty was Mr. Brian O'Rorke, R.A.

Radio Industry Council Director

AIR MARSHAL SIR RAYMUND HART, K.B.E., C.B., M.C., A.R.C.S., M.I.E.E., has been appointed Director of the Radio Industry Council in succession to Vice-Admiral J. W. S. Dorling.

Sir Raymund was one of the pioneers of radar before the war. During the war he was responsible for the development of the operational use of radar on the ground and in the air and was Chief Air Signals Officer, Allied Expeditionary Air Force, during the planning and operational stages of the invasion of Europe in 1944.

The Radio Industry Council has been reconstituted to co-ordinate only the activities of the associations representing the manufacturers of radio and television receivers, components and valves, namely The British Radio Equipment Manufacturers' Association, the Radio and Electronic Component Manufacturers' Federation and the British Radio Valve Manufacturers' Association. The manufacturers of capital goods—transmitters, communications equipment, radar and radio navigational aids and industrial electronic equipment, including computers—have their own organisation, the Electronic Engineering Association, which

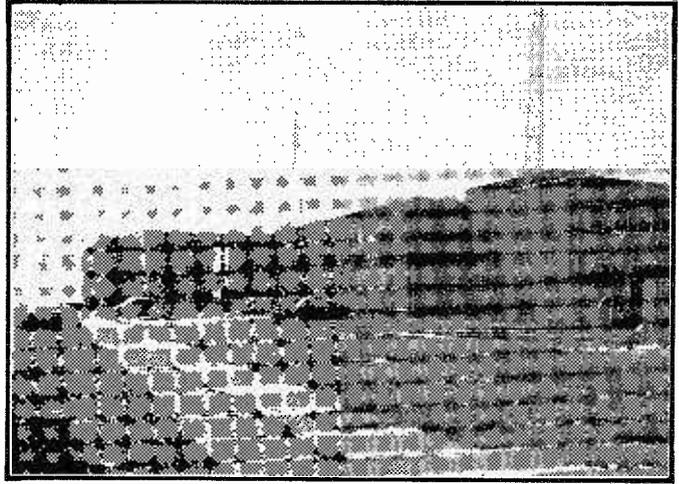
in future will be independent of the Radio Industry Council.

Maintenance Courses

THE Middlesex County Council, Wesley Evening Institute, Wesley Road, N.W.10, have just commenced a publicity drive

Dorset and Devon. The population of this area amounts to nearly three and a half million people.

The new transmitter for the Third Programme and Network Three will work on a frequency of 96.8 Mc/s, and the fre-



Showing two of the three "Skytowers."

for recruitment for fresh groups in the summer term which began on April 6.

They have a nightly students "library" at the institute. Recent numbers of periodicals and other literature are always welcome.

V.H.F. Transmitter at Wenvoe

THE BBC new high-power V.H.F. transmitter that has been installed at Wenvoe, South Wales, to broadcast the Third Programme and Network Three to listeners in South Wales and the West of England came into service on March 1.

The V.H.F. transmitter at Wenvoe for the Welsh Home Service has been working since December, 1955, and those for the West of England Home Service and the Light Programme since December, 1956. The new transmitter for the Third Programme and Network Three has the same power and range, and its service area will thus include the whole of the counties of Monmouth, Glamorgan and Somerset; most of Gloucestershire; and parts of the counties of Pembroke, Carmarthen, Brecknock, Hereford, Wiltshire,

frequencies used for the Light Programme (89.95 Mc/s), The Welsh Home Service (94.3 Mc/s) and the West of England Home Service (92.125) will remain unchanged.

A.A. Radio Link "Revolutionised Motoring"

DURING the ten years in which the Automobile Association has operated its radio road service—it opened in London in 1949 and now extends to 27 major cities and towns throughout Great Britain—free breakdown assistance has been given to A.A. members on over 1,800,000 occasions.

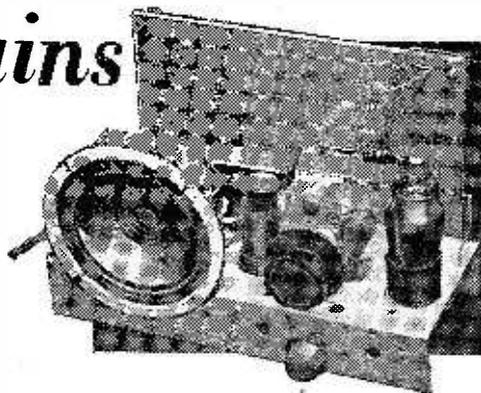
The Electronic Eye

THE human eye is an instrument of wonderful sensitivity, but its powers are not unlimited. Now, however, when the light falling on it is too weak to produce a satisfactory image the recently developed Electronic eye can be a great help. The image intensifier has many interesting applications, e.g., as an aid to radiologists, making X-ray examinations.

Beginners' Mains 2-Valver

AN INEXPENSIVE RECEIVER WHICH USES
A MINIMUM NUMBER OF COMPONENTS

By R. F. Graham



A MAINS circuit using two valves can easily provide enough volume for good loud-speaker results from a number of stations. Such circuits have the advantage of simplicity, so that the building cost is quite small, and there is little likelihood of wiring or other errors. A two-valver of this kind is thus particularly suitable for beginners who may not yet wish to attempt something more complicated. There are also no aligning or similar adjustments to be made.

The Circuit

The circuit, shown in Fig. 1, employs two valves which are capable of providing high sensitivity and ample speaker volume, and they may readily be obtained from many advertisers, in common with the other components. As experiments showed that satisfactory volume could be expected from local stations with a frame aerial winding, this is used instead of a tuning coil. If a short external aerial is added, volume and range are increased. It is thus possible to use the set

with its self-contained aerial, for local reception, or to add an aerial, as required.

Reaction is provided in the detector stage, the 100 k Ω potentiometer having an on/off switch, so that it functions similarly to the combined on/off and volume control frequently provided in more complex circuits. For tuning, a large knob with engraved line or pointer is fitted directly to the tuning condenser. A reduction drive could easily be provided instead, and would make accurate tuning easier. The 12.6 v. 0.5 amp. heater transformer can also run a 12.6 v., 0.15 amp. bulb, if necessary, and this could be fitted to illuminate the dial.

Aerial Winding

This is of simple construction, and is shown in Fig. 2. Dimensions are not critical, but any very great modification will change the number

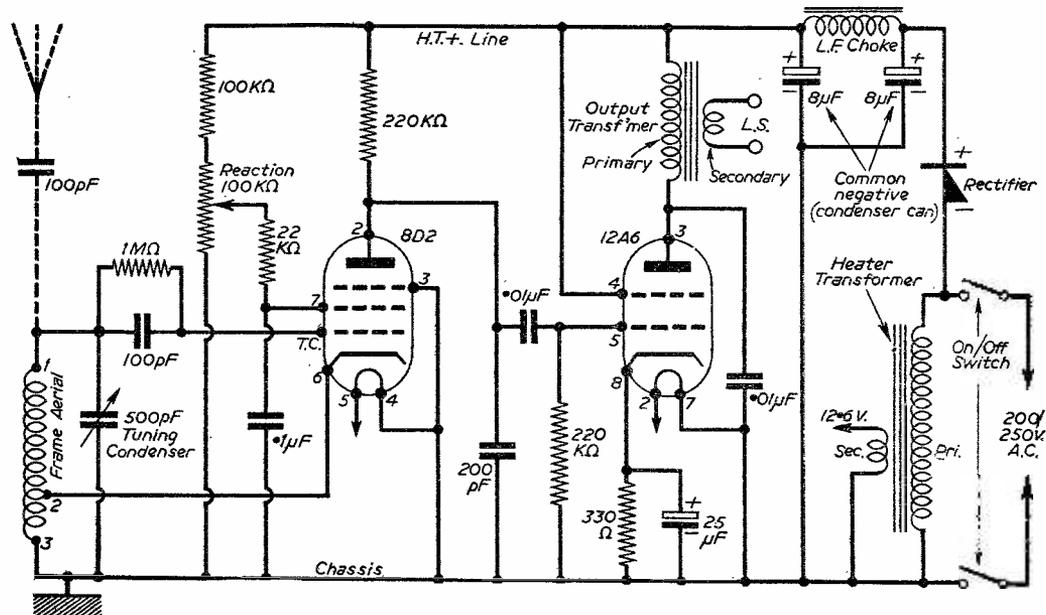
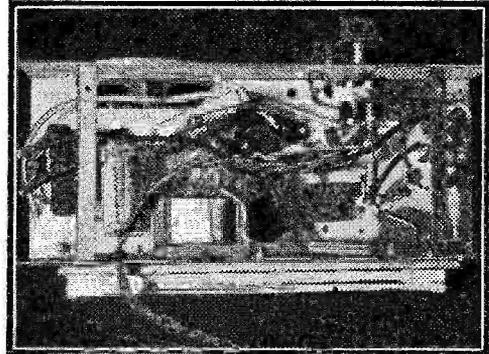


Fig. 1.—The circuit diagram.

of turns required to tune the medium waveband.

Four paxolin sleeves $\frac{1}{2}$ in. long are bolted securely near the corners of the three-ply washers under the bolt heads serving to keep the frame winding in place. Satisfactory results can be obtained by securing each bolt by means of lock nuts; one nut each side the three-ply, and winding two or three layers of insulating tape upon the bolts instead of using paxolin sleeves. The bottom bolts are a little longer than those at the top, and pass through two holes drilled in the rear runner of the chassis. The completed frame can then be secured in place by lock nuts. The winding is made by anchoring 28 s.w.g. double-cotton-covered wire near the top, to provide lead 1 in Fig. 2, and winding on 16 turns. Insulation is then scraped off, and a small loop twisted. A short length of flex is soldered to this loop, forming the tapping 2. One further turn is then wound, in the same direction, and the wire soldered to a tag clamped under the bolt "M.C." in Fig. 2, this being point 3, or the chassis con-



The underchassis view.

Valveholders can be bolted to the top or underside of the chassis, but sockets and valve pins must be well clear of the metal. It is wise to omit the speaker until other wiring is completed.

Very few connections appear above the chassis. Positive (red) on the metal rectifier is wired to the choke and smoothing condenser, negative going to mains (via switch). The secondary of the output transformer is connected to the speech coil tags of the speaker. If the transformer has no markings, it should be remembered that the secondary is the low-resistance winding, of fairly stout wire. The ends of this winding are often left issuing from the bobbin, to provide connections. The primary is wired to the H.T. line and output valve anode. Wrong transformer connections will prevent the set working.

As mentioned, 1 on the frame winding is taken to the fixed plates tag of the tuning condenser. The 100 pF condenser and 1 megohm resistor are also joined to this tag, as in Fig. 3. Short leads are required to the 8D2 valve cap clip, as a long connection here will cause some hum.

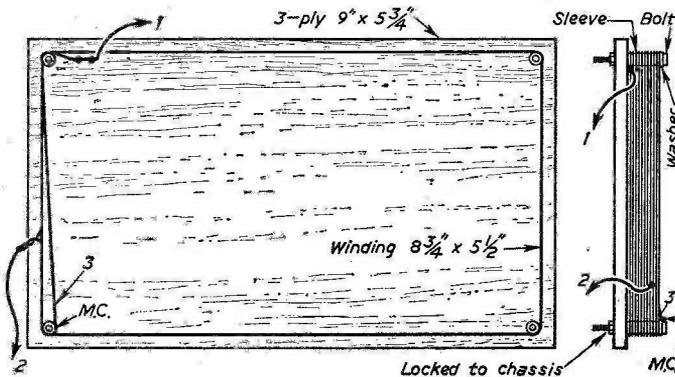


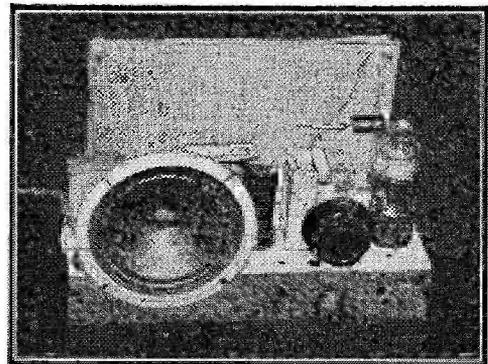
Fig. 2.—Details of the frame aerial.

nection. As indicated, point 1 is taken to the fixed plates of the tuning condenser, and point 2 to the detector cathode.

Experiments with a ferrite rod showed that this could be used instead of the frame aerial described. For medium waves, two turns require to be added between one end of the existing winding and chassis to provide a cathode tap. If no build-up of volume is obtained, the direction in which the two turns are wound should be reversed. The ferrite rod can be supported on brackets some 2½ in. to 3½ in. above the chassis. Volume with this type of aerial is rather less than with the frame in Fig. 2.

The Chassis Layout

Fig. 3 shows a suitable layout of components, but this can be modified somewhat to suit a chassis of different size, provided parts are not very near the frame winding. The position of the tuning condenser will depend upon whether a reduction drive is fitted. It is worth noting that a two-gang condenser is satisfactory (one section being left disconnected) as these are available at low cost from some advertisers of surplus components.



The receiver from the front.

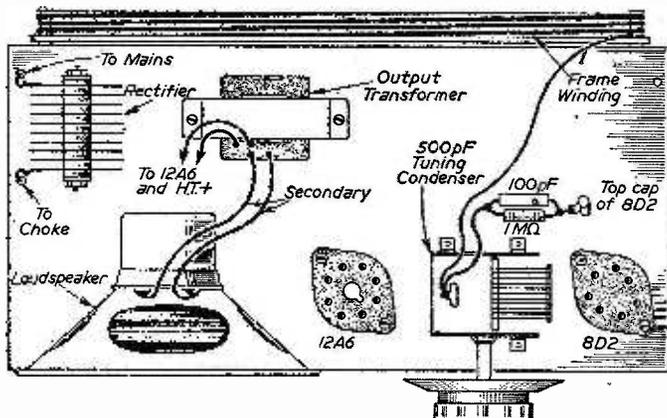


Fig. 3.—Above chassis view.

The Under-chassis Wiring

All other connections and parts are shown in Fig. 4, which will be given in the next article. Various points are marked "M.C." and these should be soldered to 6 B.A. tags which are tightly bolted to the chassis. A few feet of 22 s.w.g.

COMPONENTS LIST

$\frac{1}{2}$ amp 12.6 v. heater transformer for 200/250 v. Knob.
7,500 ohm optimum load output transformer and 5 in. P.M. speaker.
40 mA. 250 v. half-wave metal rectifier.
8D2 valve. British seven-pin holder.
12A6 valve. Octal holder.
Chassis approx. 5in. x 10in. x 2in. deep.

Capacitors :

Two 100 pF, 200 pF, two .01 μ F, .1 μ F, 8-plus-8 μ F 350 v.w. or similar, 25 μ F, 25 v.w., 500 pF air-spaced tuning condenser with large knob or drive.

Resistors :

330 ohm, 1 watt ; 22 k, $\frac{1}{2}$ watt ; 100 k, $\frac{1}{2}$ -watt ; two 220 k., $\frac{1}{2}$ watt ; 1 megohm, $\frac{1}{2}$ -watt ; 100 k. potentiometer with double-pole switch.

or similar tinned copper wire will be sufficient for connecting up, and insulating sleeving should be cut to length and slipped over all leads.

Referring to Fig. 4, point 2 is the frame tapping, already described. As mentioned, point 3 is returned to the receiver chassis.

The secondary of the heater transformer is wired to chassis and valve heaters. These are the 12.6 v. connections in Fig. 4. The one primary lead or tag is taken to chassis. The second primary connection is taken to the switch tag which is wired to rectifier negative.

Note that the 25 μ F condenser must have its negative end connected to the chassis. This also applies to the double smoothing condenser. Here, an 8-plus-16 μ F condenser, or double 16 μ F condenser, is equally satisfactory. Two separate condensers, with negative tags taken to chassis and positive tags to choke, are also suitable.

Mains Connection

Good quality twin flex should be used for the mains leads, these passing through a rubber grommet fitted in a hole in the rear runner of the chassis. It is recommended that flex with inner red and black conductors is used, black being wired to the switch tag which gives the chassis connection, when the switch is on. The red conductor will then go to transformer primary and rectifier negative, via the second pair of switch contacts.

Power is best drawn from a three-pin plug. Black is connected to the pin marked "N" or having a black dot. Red is taken to the pin marked "L" or coded with a red dot. If a fused, flat-pin 13-amp. plug is used, a low rating fuse may be inserted.

If a reversible two-pin plug is used, or a lamp adaptor, one method of connection will result in the chassis being alive at mains voltage. Quite apart from the danger of shocks, this may increase hum. Further safety can be assured by using an insulated cabinet, so that no parts are exposed. For maximum safety, care should be taken that control bushes or spindles and knob grub screws are not within reach. Insulating compound is sometimes inserted in grub screw holes for this reason.

Testing and Aerials

The set should reach operating temperature within about 30 seconds of switching on, and the local station should then be tuned in. For weak signals, slowly rotate the 100 k Ω potentiometer until the set is nearly oscillating. It will be found that this control gives a very great increase in sensitivity, and it needs to be adjusted fairly accurately, for distant stations.

(To be continued.)

PRACTICAL TELEVISION

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Shipping Band Four-Valver

THE ALIGNMENT OF THE RECEIVER AND THE CONSTRUCTION OF THE A.C. POWER PACK (Continued from page 140 of the April issue) By R. Morgan

SHOULD 24 v. accumulator running only be in view, as may be necessary in a boat, the heaters are all wired in series, a 42 ohm 1-watt resistor being connected in parallel with each of the holders except that taking the 6BW6 output valve.

If running from both, a 6.3 v. transformer and a 12 v. accumulator will be necessary; a 4.4 ohms resistor is included in circuit in the power pack. For both 6.3 v. transformer and 24 v. accumulator, this resistor is increased to 13.3 ohms. In each case a wire-wound type able to carry 1.35 A is necessary.

It will be appreciated that when the power pack is suitably arranged (with dropping resistor if necessary), no changes need be made to the receiver. There is, however, no point in wiring the heaters for 6.3 v. running if a 6.3 v. or 6 v. supply is unlikely to be used, because connecting the heaters in series for 12 v. or 24 v. will be more economical.

Details of the various power packs are to be given later, and reference need only be made to those which will actually be used.

Receiver Alignment

It is wise to leave the trimmers and coil-pack and I.F. transformer cores untouched until reason-

ably good reception is obtained. If local stations cannot be tuned in as soon as the receiver has warmed up, wiring errors should be sought at once.

When the receiver gives reasonable reception, careful adjustment of cores and trimmers will bring it up to peak performance. An insulated tool, such as a shaped ebonite rod (or a knitting needle) is most suitable for final adjustments, as the presence of a metal blade will slightly modify settings.

Satisfactory alignment is possible by ear, without instruments. Weak stations not subject to fading should be chosen, so that the A.V.C. action does not confuse adjustments.

Using a Meter

If a 10 mA or similar meter is to hand, it can be included between the second I.F. transformer H.T. tag and the H.T. line, with a .1 μ F condenser in parallel. Strong stations can then be used for alignment, adjustments being directed towards securing the lowest meter reading.

The I.F. transformers are dealt with first. A station should be tuned in accurately, and the four transformer cores adjusted for maximum volume. These cores are then left untouched.

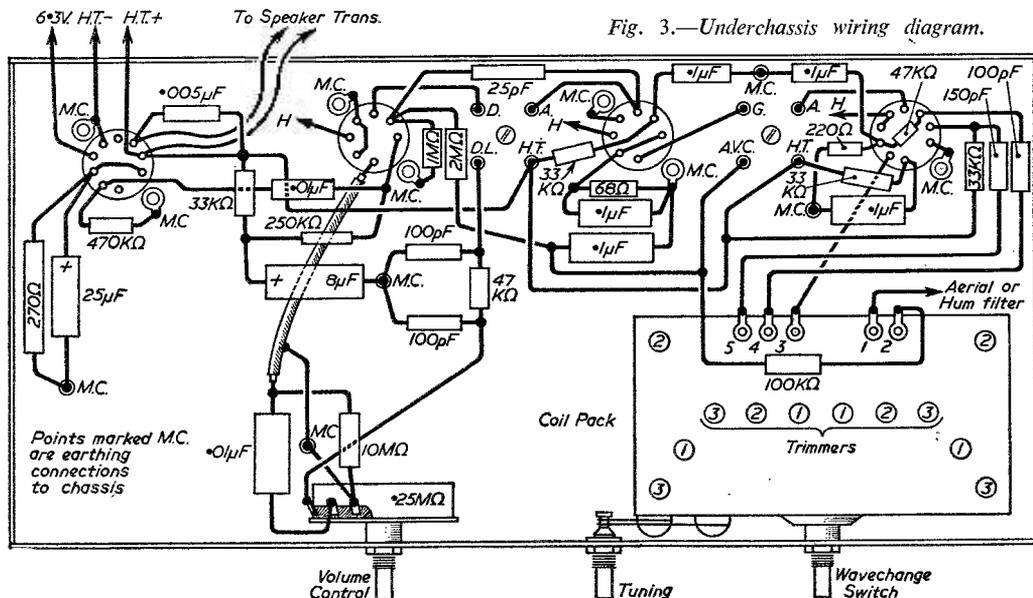


Fig. 3.—Underchassis wiring diagram.

Adjustment of the coilpack is greatly simplified if it is remembered that only two cores and two trimmers are effective upon any particular band. The M.W. band may be dealt with first. To do this, tune in a station of fairly high wavelength, and adjust the cores marked "2" in Fig. 3 for maximum volume (or minimum meter reading).

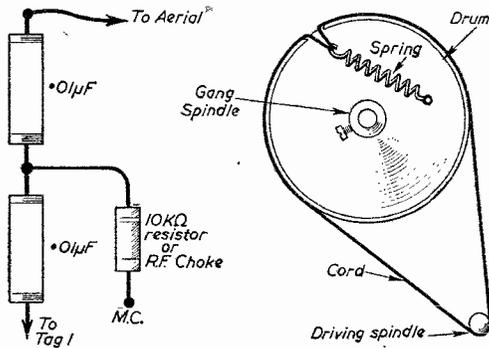


Fig. 4.—(Mentioned last month) The modulation hum aerial filter and the tuning cord drive.

Then tune to a station of low wavelength, and adjust the trimmers numbered "2," also for best volume. The procedure may be repeated two or three times for optimum settings. It is in order to adjust cores or trimmers at some wavelengths where the best possible reception is required—for example, trim on 208 metres.

The wavechange switch is then turned to one of the other positions, and the appropriate cores and trimmers numbered in Fig. 3 are dealt with. The procedure is quite easy if it is remembered that the trimmers are always adjusted at a low wavelength on the appropriate band, and the coil cores at a high wavelength.

It will be found that trimmer adjustment considerably influences dial readings at low wavelengths, while core adjustment modifies the high wavelength readings. This can be used to obtain accurate dial readings, known stations being selected for calibration. The pointer must be

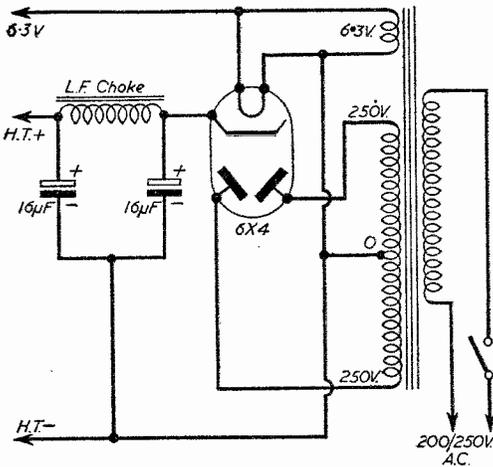


Fig. 5.—Circuit of the A.C. power pack.

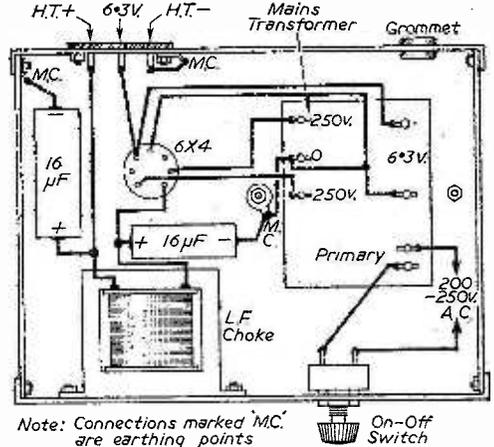
securely set on the condenser spindle, in its correct position.

A.C. Power Pack

This supplies 250 v. at 70 mA, and 1.35A at 6.3 v. A mains transformer with 2A secondary is required, to provide a further 6A for the rectifier. The circuit is shown in Fig. 5. Other rectifier valves, such as the 5Z4, are satisfactory, but a mains transformer with separate rectifier heater winding will then be necessary.

The inductance of the smoothing choke is not important, any small component for this type of circuit being suitable. Nor are the smoothing condenser values in any way critical. If to hand, 8 µF condensers may be used, or an 8-plus-16 µF block or tubular type.

A chassis about 7in. X 5in. X 2in. deep is required, and can be made by taking a piece of aluminium 11in. X 9in., and bending 2in. runners all round, after cutting to provide flanges to turn



Note: Connections marked 'M.C.' are earthing points

Fig. 6.—Wiring diagram of the A.C. power pack.

over and bolt in place, as in Fig. 6. An aperture for the mains transformer can be made by marking out and drilling several small holes, or using one of the well-known chassis cutters, so that a metal saw may be started.

Fig. 6 shows wiring, no connections being found on top of the chassis. The on/off switch can be a rotary or toggle type, for mains use. Mains leads, of good quality twin flex, pass out through a hole in the rear runner. a grommet being used to avoid possible shorts.

A 3-pin non-reversible plug and socket will be required for H.T. positive, heater, and common return connections. Suitable connectors will also be found in many ex-service units. A valveholder, to receive the base of a discarded valve, will also be satisfactory.

As with the receiver, connections marked "M.C." are securely bolted to the chassis. Clips held by the valveholder bolts will serve to keep the condensers in place. The tubular type of combined condenser can be fitted to the top of the chassis, with tags projecting through clearance holes.

(To be continued)

Aligning Without Instruments

METHODS OF ACHIEVING GOOD RESULTS

WHILE the experimenter may be in possession of a multi-range testmeter or some means of measuring voltage, current and resistance, he often finds himself faced with an alignment task which normally calls for a signal generator in addition to the basic instruments.

It is not suggested that a signal generator is not necessary to perform such an operation successfully and with the utmost speed, but where time is not an important factor and when simple current and voltage tests reveal conclusively that lack of signals is caused by misalignment of the receiver's tuned circuits, there is a method whereby the alignment can be restored to a reasonable standard of accuracy without the assistance of instruments of any kind. A basic understanding of the principles involved and a good deal of patience being the essential requirements.

Weak Signal

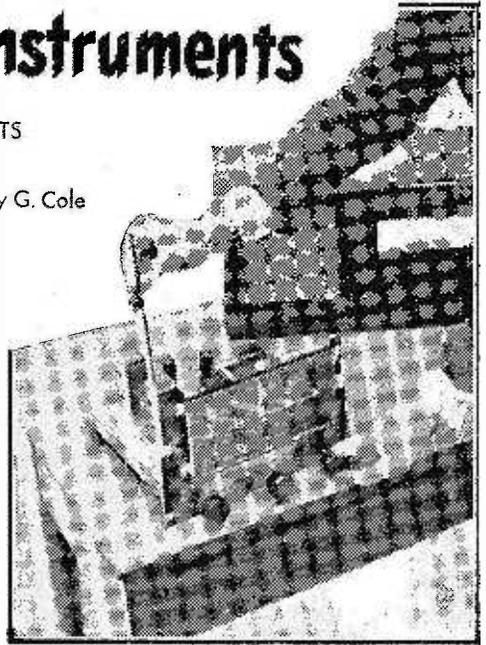
The skeleton circuit in Fig. 1 is representative of the frequency changer and I.F. stages of a typical three-band receiver. If such a set is completely out of alignment there is little hope of picking up a signal on any band over the full range of the tuning capacitor. However, by removing the aerial from the aerial socket and connecting it direct to the control grid (usually the top cap) of the frequency changer valve, it is often possible to receive a signal from the local transmitter (medium- or long-wave) somewhere within the range of the tuning capacitor. The signal will obviously be well removed from the correct tuning point.

Once a signal of sort can be received the battle is half won. If the set is working well within the service area of a powerful transmitter, it is likely that a weak signal will be obtained somewhere on the dial even with the aerial connected normally to the aerial socket, but this will also depend on the aerial and earth system, and in some cases it may save time to rig up a temporary aerial as a means of injecting into the misaligned receiver the strongest signal possible. A good earth also helps.

Let us suppose that weak reception of the L.W. Light Programme is possible at the end of the dial with the aerial connected to the control grid of V1 (see Fig. 1). The next move is to bring the I.F. transformers into some form of alignment. This is done by adjusting the cores in L13, L12, L6 and L5, in that order, for the loudest signal.

The signal should now be very much improved since the transformer windings are all tuned to the same frequency, even if this is removed from the correct intermediate-frequency. The design of I.F. transformers is usually such that the correct intermediate-frequency is obtained with the tuning cores fairly well balanced in the coil

By G. Cole



A non-metallic trimming tool is used for alignment

formers or with the trimmer capacitors adjusted between the very loose and very tight positions. It will probably be found that this is far from the case after the cores or trimmers have been adjusted on the weak signal.

The next move, then, is to establish an I.F. tuning point which is closer to the correct intermediate-frequency. The core in the secondary of the second I.F. transformer or the trimmer capacitor across this winding (L13 in Fig. 1) should be adjusted a turn or so towards the point of balance. This will weaken the received signal, but the strength should be restored by following up on the tuning of the set itself and coils L12, L6 and L5, in that order.

L13 should then be adjusted even more towards core or trimmer balance, as described above, and the remaining I.F. coils adjusted to suit, bearing in mind that as the intermediate-frequency is shifted so it will be necessary to re-tune the receiver to hold the signal originally selected. During this operation it will almost certainly be found that the receiver will tune the signal closer to the point that it should be received on the dial. The L.W. Light Programme is a good signal to work with since this is known to be at 200 kc/s, or 1,500 metres.

Long-wave Alignment

After the I.F. transformers have been finally adjusted for maximum signal at reasonable balance of the cores or trimmers, it can be assumed that the intermediate-frequency is pretty well within its correct tolerance. It is then necessary to concentrate on the oscillator and aerial tuned circuits.

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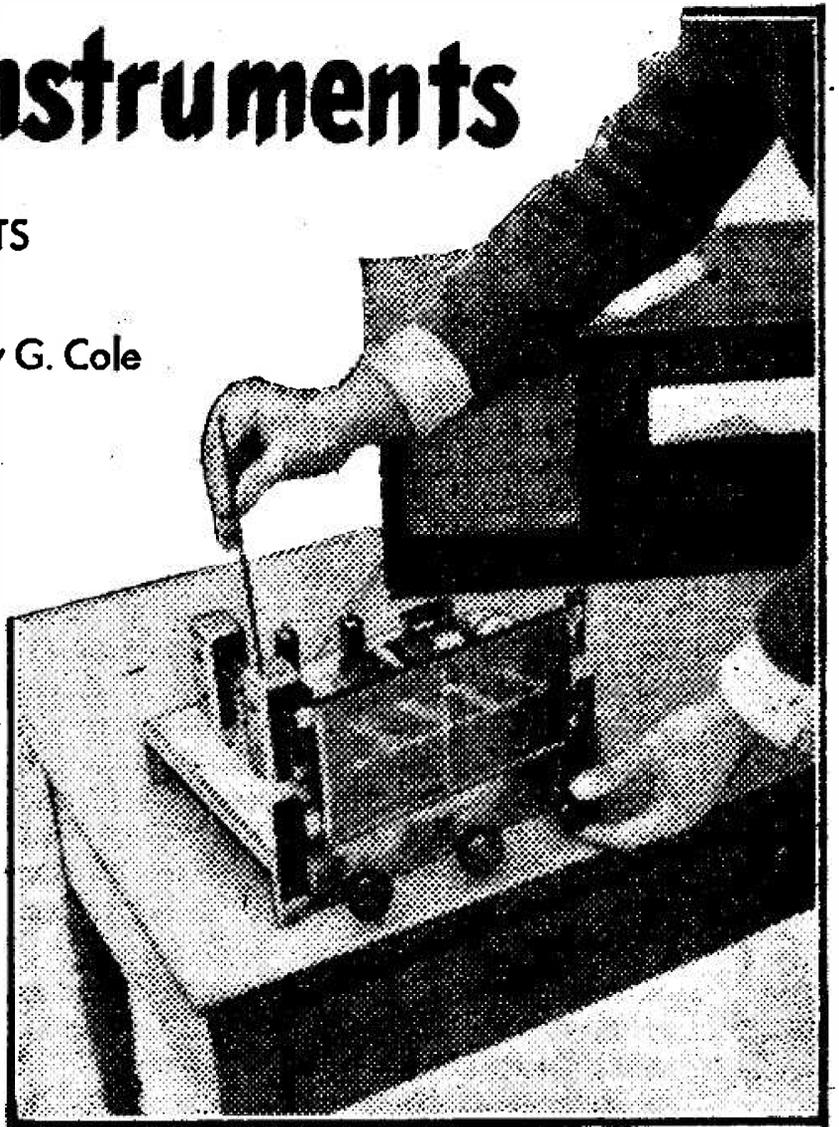
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When the I.F. transformers have been aligned

the signal will be much louder, and if the aerial has been connected to the control grid of the frequency changer valve it can be removed and connected to the aerial socket, resulting in a temporary loss of volume. This will be recovered as the aerial and oscillator circuits are brought into correct alignment. However, if the signal disappears on connecting it to the aerial socket, the aerial should be returned to the signal grid until the oscillator circuits have been aligned.

In some receivers a separate oscillator trimmer is available for each band and, in certain cases, a fixed padder is used and alignment at the low-frequency end of the band is achieved by the adjustment of dust-iron cores in the oscillator coils. With such receivers it is best first to adjust the L.W. trimmer in the direction which necessitates turning the tuning towards the correct point on the dial in order to hold the signal. In other words, the trimmer should be adjusted one turn, or less, and the signal re-tuned on the dial in the normal way. This should be continued until the signal is tuned at the correct point on the dial, that is, say, 1,500 metres for the Light Programme.

It may be found, however, that the correct tuning point cannot be established because the L.W. trimmer is at the end of its range. When this is the case, the trimmer should be adjusted to a "medium" setting, the signal re-tuned on the dial and adjustment made, in the same way as described for the trimmer, to the L.W. dust-iron core or padding capacitor. This will give the correct settings at, say, 1,500 metres, but is insufficient to ensure that the receiver tracks correctly over the band.

On L.W. this is unimportant owing to the small number of stations, but reasonable correction is possible by adjusting the L.W. oscillator dust-iron core or L.W. padder for maximum response of, say, Kalundborg with the receiver tuned to this station on the dial, and the L.W. oscillator trim-

mer for maximum response of Paris with the pointer correspondingly set. These two stations fall either side of the Light Programme, so when correct padder and trimmer adjustment has been attained on them the tuning will also be correct on the Light Programme.

Should it be found impossible to secure correct L.W. oscillator alignment as described, it may well be that the I.F. is too far removed from the correct frequency, in which case it will be necessary to readjust the I.F. transformers, in step, in the direction which swings the tuning of the selected station towards its name or wavelength as marked on the tuning scale.

Medium-wave Alignment

The same procedure is adopted for aligning the M.W. oscillator circuits. It is best first to establish the Home Programme on, say, 330 metres, and use this as a basis. Tracking of the M.W. band can be accomplished at the high-frequency end on Radio Luxembourg and at the low-frequency end on Athlone or any other stations in proximity which can be identified, bearing in mind that the padder or dust-iron core is adjusted at the low-frequency end of the band and the trimmer at the high-frequency end.

With certain receivers, such as that shown in Fig. 1, oscillator alignment is achieved on M.W. simply by adjusting trimmer C12, and on L.W. by adjusting padder C18. The signals to which these adjustments are made should fall approximately in the centre of the bands, the L.W. Light Programme and the M.W. Home Programme being suitable.

Short-wave Alignment

It is necessary to adjust the S.W. circuits to conclude the alignment exercise. This is usually a simple matter since fixed padding is invariably featured on "standard" receivers. The S.W. band is usually full of signals and as quite a large

frequency range is covered by the oscillator trimmer itself (C14 in Fig. 1) it may be necessary to listen to one or two signals over a period of time to establish their identity and frequency. However, when the frequency of any station has been discovered, usually by announcement, the S.W. oscillator trimmer should be carefully adjusted until the station is tuned at the correct point on the dial.

Aerial Circuit Alignment

So far we have been dealing with the I.F. and oscillator sections, and if these have been adjusted correctly the set should be fairly lively, even though the aerial circuits may be off-tune. In any case, the aerial may still be connected to the control grid of the frequency changer valve. This can now be connected to the aerial socket. There is little
(Continued on page 220)

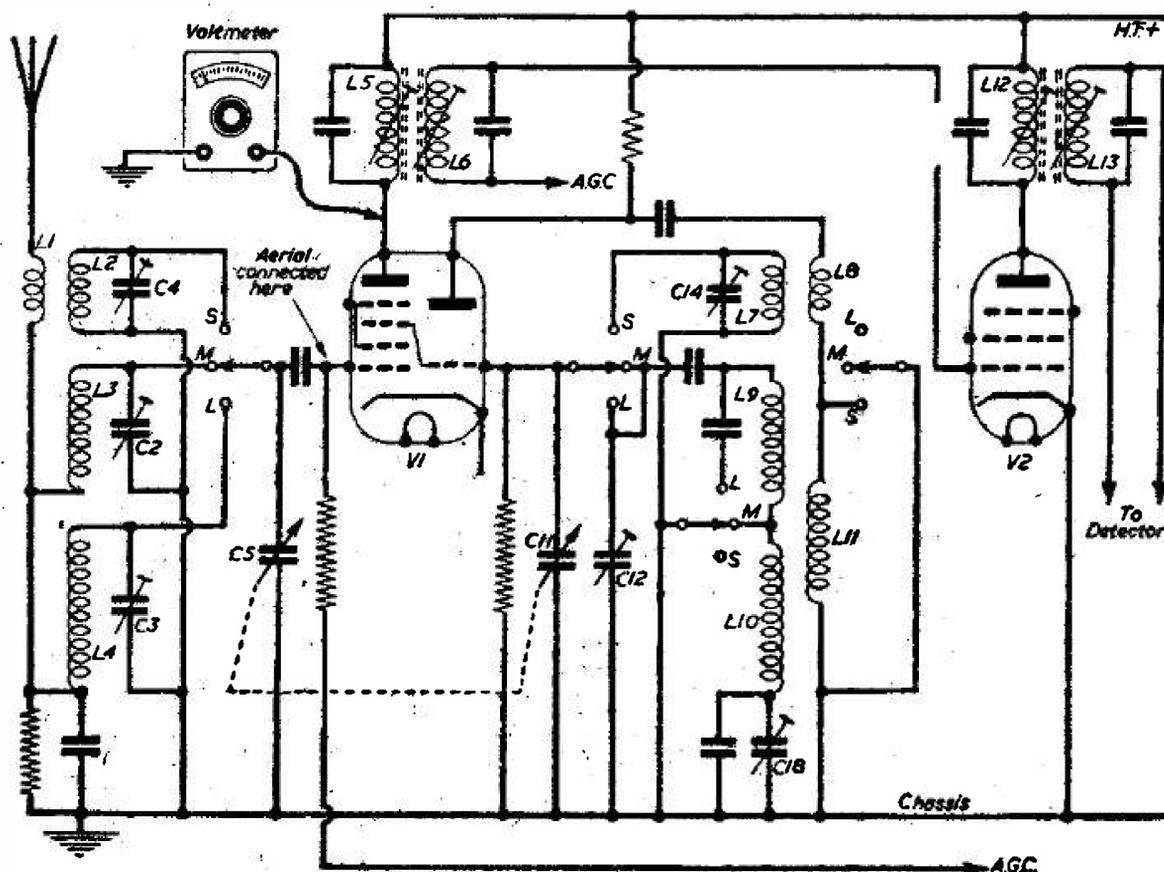


Fig. 1.—Skeleton circuit of the frequency-changer and L.F. stages of a typical three-band receiver.

ALIGNING WITHOUT INSTRUMENTS

(Continued from page 208)

doubt that signals will be heard this time and switching first to the L.W. band and tuning in the Light Programme, the L.W. aerial trimmer should be adjusted for maximum volume.

The receiver should then be tuned to the Home Programme and the M.W. aerial trimmer adjusted likewise. Finally, the S.W. aerial trimmer should be adjusted for maximum volume of a station towards the high-frequency end of the S.W. band, that is with the tuning gang towards minimum capacitance.

If the aerial coils feature adjustable dust-iron cores or if padding capacitors are included in the design, optimum tracking of the aerial circuits can be accomplished by adjusting the core or padder for maximum volume of a station at the low-frequency end of the band, and the trimmer for maximum volume of a station at the high-frequency end of the band. Exactly the same applies if the receiver incorporates a stage of R.F. amplification. Trimmers C3, C2 and C4 in

the circuit in Fig. 1 correspond to the L.W., M.W. and S.W. aerial circuits respectively.

No Signals

If, when the alignment procedure is begun, a signal cannot be obtained to align the I.F. transformers even when the aerial is connected direct to the control grid of the frequency changer, a suitable signal can be generated in the receiver itself simply by connecting a voltmeter between the receiver chassis and the anode of the mixer section of the frequency changer valve (see Fig. 1). The probe should not be firmly connected to the anode, however, but should be scraped against the anode tag on the valveholder. This action produces transient signals in the I.F. stages, and if the volume control is turned fully up and an ear is held close to the loudspeaker corresponding crackling noises will be heard.

The idea is to continue producing such noises while adjusting the I.F. trimmers, adjustment being made for the loudest crackling. At this point the I.F. circuits will be in reasonable alignment and so permit the passage of signals with the aerial connected to the frequency changer signal grid. From this stage the alignment process should be continued as outlined earlier.

the signal will be much louder, and if the aerial has been connected to the control grid of the frequency changer valve it can be removed and connected to the aerial socket, resulting in a temporary loss of volume. This will be recovered as the aerial and oscillator circuits are brought into correct alignment. However, if the signal disappears on connecting it to the aerial socket, the aerial should be returned to the signal grid until the oscillator circuits have been aligned.

In some receivers a separate oscillator trimmer is available for each band and, in certain cases, a fixed padder is used and alignment at the low-frequency end of the band is achieved by the adjustment of dust-iron cores in the oscillator coils. With such receivers it is best first to adjust the L.W. trimmer in the direction which necessitates turning the tuning towards the correct point on the dial in order to hold the signal. In other words, the trimmer should be adjusted one turn, or less, and the signal re-tuned on the dial in the normal way. This should be continued until the signal is tuned at the correct point on the dial, that is, say, 1,500 metres for the Light Programme.

It may be found, however, that the correct tuning point cannot be established because the L.W. trimmer is at the end of its range. When this is the case, the trimmer should be adjusted to a "medium" setting, the signal re-tuned on the dial and adjustment made, in the same way as described for the trimmer, to the L.W. dust-iron core or padding capacitor. This will give the correct settings at, say, 1,500 metres, but is insufficient to ensure that the receiver tracks correctly over the band.

On L.W. this is unimportant owing to the small number of stations, but reasonable correction is possible by adjusting the L.W. oscillator dust-iron core or L.W. padder for maximum response of, say, Kalundborg with the receiver tuned to this station on the dial, and the L.W. oscillator trim-

mer for maximum response of Paris with the pointer correspondingly set. These two stations fall either side of the Light Programme, so when correct padder and trimmer adjustment has been attained on them the tuning will also be correct on the Light Programme.

Should it be found impossible to secure correct L.W. oscillator alignment as described, it may well be that the I.F. is too far removed from the correct frequency, in which case it will be necessary to readjust the I.F. transformers, in step, in the direction which swings the tuning of the selected station towards its name or wavelength as marked on the tuning scale.

Medium-wave Alignment

The same procedure is adopted for aligning the M.W. oscillator circuits. It is best first to establish the Home Programme on, say, 330 metres, and use this as a basis. Tracking of the M.W. band can be accomplished at the high-frequency end on Radio Luxembourg and at the low-frequency end on Athlone or any other stations in proximity which can be identified, bearing in mind that the padder or dust-iron core is adjusted at the low-frequency end of the band and the trimmer at the high-frequency end.

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Short-wave Alignment

It is necessary to adjust the S.W. circuits to conclude the alignment exercise. This is usually a simple matter since fixed padding is invariably featured on "standard" receivers. The S.W. band is usually full of signals and as quite a large

frequency range is covered by the oscillator trimmer itself (C14 in Fig. 1) it may be necessary to listen to one or two signals over a period of time to establish their identity and frequency. However, when the frequency of any station has been discovered, usually by announcement, the S.W. oscillator trimmer should be carefully adjusted until the station is tuned at the correct point on the dial.

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So far we have been dealing with the I.F. and oscillator sections, and if these have been adjusted correctly the set should be fairly lively, even though the aerial circuits may be off-tune. In any case, the aerial may still be connected to the control grid of the frequency changer valve. This can now be connected to the aerial socket. There is little
(Continued on page 220)

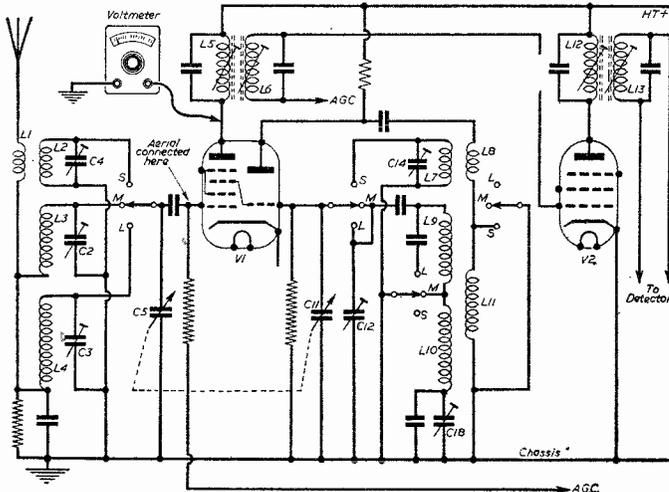


Fig. 1.—Skeleton circuit of the frequency-changer and L.F. stages of a typical three-band receiver.

Aligning Without Instruments

METHODS OF ACHIEVING GOOD RESULTS

WHILE the experimenter may be in possession of a multi-range testmeter or some means of measuring voltage, current and resistance, he often finds himself faced with an alignment task which normally calls for a signal generator in addition to the basic instruments.

It is not suggested that a signal generator is not necessary to perform such an operation successfully and with the utmost speed, but where time is not an important factor and when simple current and voltage tests reveal conclusively that lack of signals is caused by misalignment of the receiver's tuned circuits, there is a method whereby the alignment can be restored to a reasonable standard of accuracy without the assistance of instruments of any kind. A basic understanding of the principles involved and a good deal of patience being the essential requirements.

Weak Signal

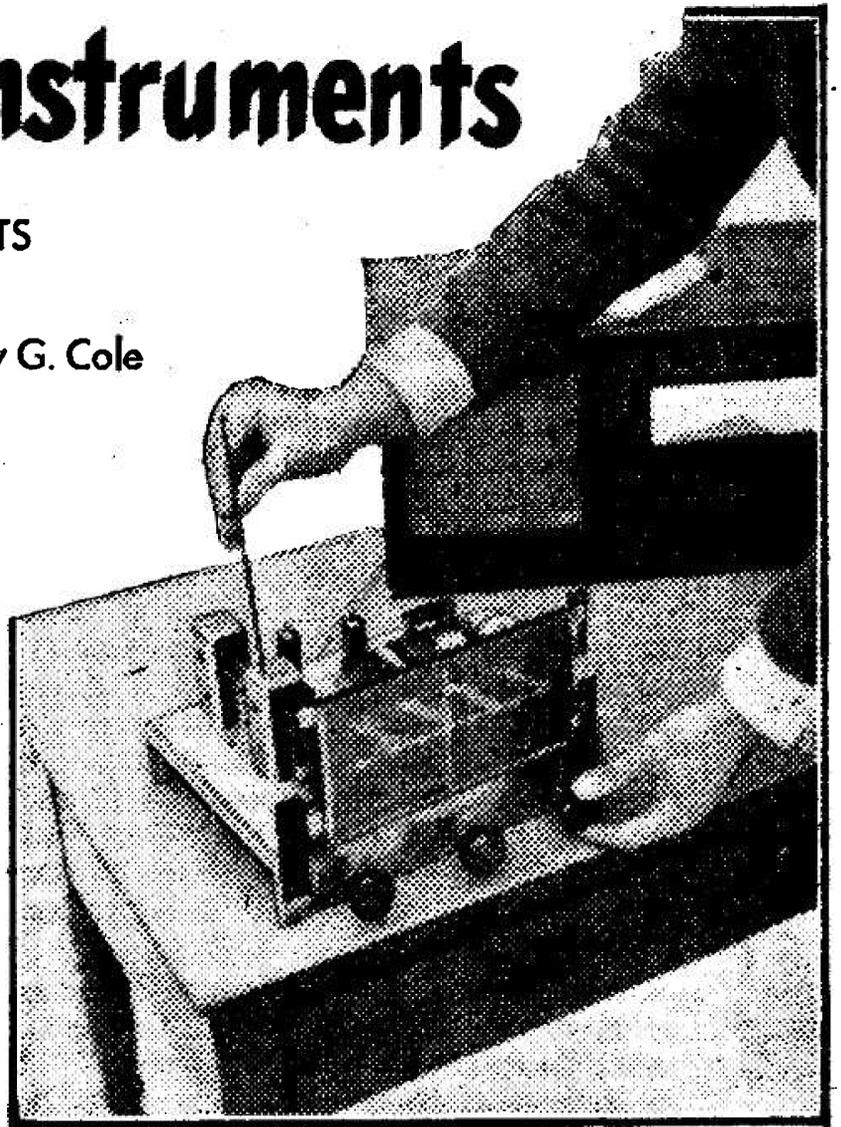
The skeleton circuit in Fig. 1 is representative of the frequency changer and I.F. stages of a typical three-band receiver. If such a set is completely out of alignment there is little hope of picking up a signal on any band over the full range of the tuning capacitor. However, by removing the aerial from the aerial socket and connecting it direct to the control grid (usually the top cap) of the frequency changer valve, it is often possible to receive a signal from the local transmitter (medium- or long-wave) somewhere within the range of the tuning capacitor. The signal will obviously be well removed from the correct tuning point.

Once a signal of sort can be received the battle is half won. If the set is working well within the service area of a powerful transmitter, it is likely that a weak signal will be obtained somewhere on the dial even with the aerial connected normally to the aerial socket, but this will also depend on the aerial and earth system, and in some cases it may save time to rig up a temporary aerial as a means of injecting into the misaligned receiver the strongest signal possible. A good earth also helps.

Let us suppose that weak reception of the L.W. Light Programme is possible at the end of the dial with the aerial connected to the control grid of V1 (see Fig. 1). The next move is to bring the I.F. transformers into some form of alignment. This is done by adjusting the cores in L13, L12, L6 and L5, in that order, for the loudest signal.

The signal should now be very much improved since the transformer windings are all tuned to the same frequency, even if this is removed from the correct intermediate-frequency. The design of I.F. transformers is usually such that the correct intermediate-frequency is obtained with the tuning cores fairly well balanced in the coil

By G. Cole



A non-metallic trimming tool is used for alignment

formers or with the trimmer capacitors adjusted between the very loose and very tight positions. It will probably be found that this is far from the case after the cores or trimmers have been adjusted on the weak signal.

The next move, then, is to establish an I.F. tuning point which is closer to the correct intermediate-frequency. The core in the secondary of the second I.F. transformer or the trimmer capacitor across this winding (L13 in Fig. 1) should be adjusted a turn or so towards the point of balance. This will weaken the received signal, but the strength should be restored by following up on the tuning of the set itself and coils L12, L6 and L5, in that order.

L13 should then be adjusted even more towards core or trimmer balance, as described above, and the remaining I.F. coils adjusted to suit, bearing in mind that as the intermediate-frequency is shifted so it will be necessary to re-tune the receiver to hold the signal originally selected. During this operation it will almost certainly be found that the receiver will tune the signal closer to the point that it should be received on the dial. The L.W. Light Programme is a good signal to work with since this is known to be at 200 kc/s, or 1,500 metres.

Long-wave Alignment

After the I.F. transformers have been finally adjusted for maximum signal at reasonable balance of the cores or trimmers, it can be assumed that the intermediate-frequency is pretty well within its correct tolerance. It is then necessary to concentrate on the oscillator and aerial tuned circuits.

When the I.F. transformers have been aligned

the signal will be much louder, and if the aerial has been connected to the control grid of the frequency changer valve it can be removed and connected to the aerial socket, resulting in a temporary loss of volume. This will be recovered as the aerial and oscillator circuits are brought into correct alignment. However, if the signal disappears on connecting it to the aerial socket, the aerial should be returned to the signal grid until the oscillator circuits have been aligned.

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So far we have been dealing with the I.F. and oscillator sections, and if these have been adjusted correctly the set should be fairly lively, even though the aerial circuits may be off-tune. In any case, the aerial may still be connected to the control grid of the frequency changer valve. This can now be connected to the aerial socket. There is little
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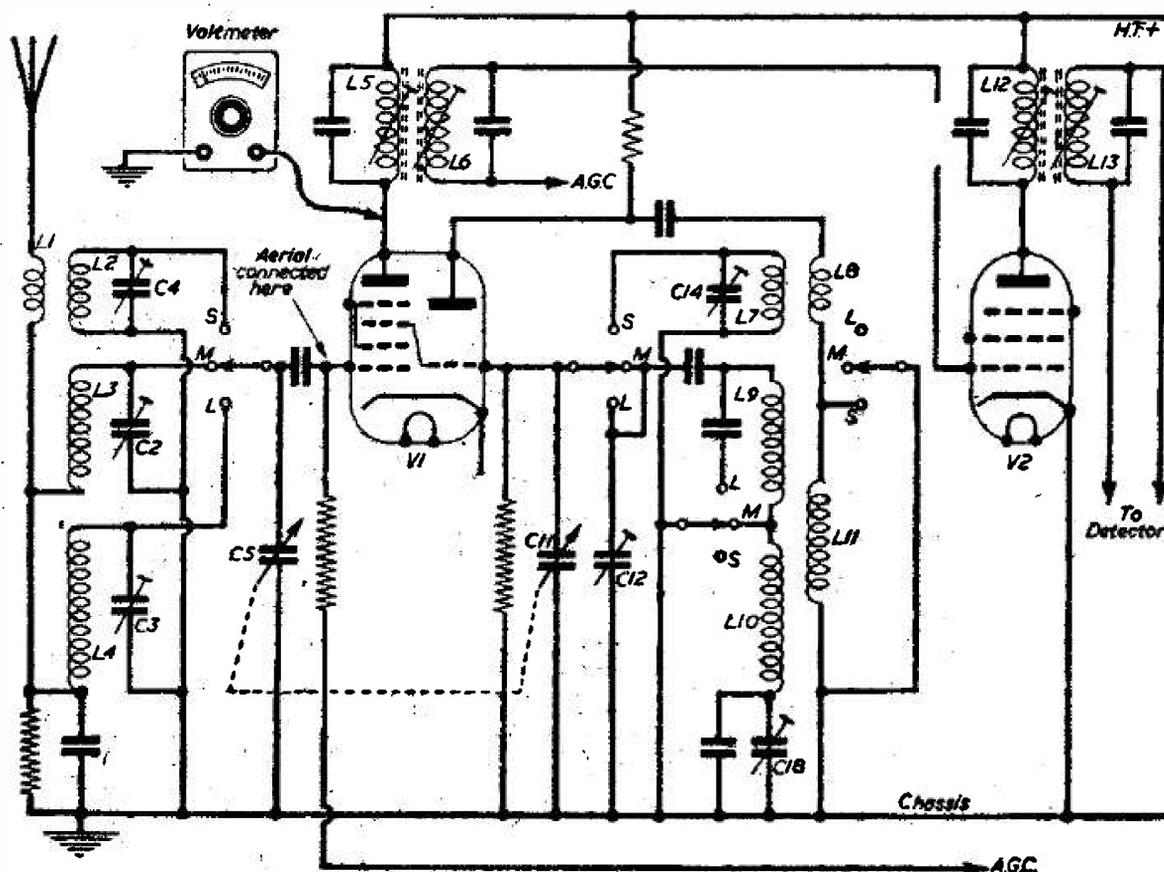


Fig. 1.—Skeleton circuit of the frequency-changer and L.F. stages of a typical three-band receiver.

ALIGNING WITHOUT INSTRUMENTS

(Continued from page 208)

doubt that signals will be heard this time and switching first to the L.W. band and tuning in the Light Programme, the L.W. aerial trimmer should be adjusted for maximum volume.

The receiver should then be tuned to the Home Programme and the M.W. aerial trimmer adjusted likewise. Finally, the S.W. aerial trimmer should be adjusted for maximum volume of a station towards the high-frequency end of the S.W. band, that is with the tuning gang towards minimum capacitance.

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the circuit in Fig. 1 correspond to the L.W., M.W. and S.W. aerial circuits respectively.

No Signals

If, when the alignment procedure is begun, a signal cannot be obtained to align the I.F. transformers even when the aerial is connected direct to the control grid of the frequency changer, a suitable signal can be generated in the receiver itself simply by connecting a voltmeter between the receiver chassis and the anode of the mixer section of the frequency changer valve (see Fig. 1). The probe should not be firmly connected to the anode, however, but should be scraped against the anode tag on the valveholder. This action produces transient signals in the I.F. stages, and if the volume control is turned fully up and an ear is held close to the loudspeaker corresponding crackling noises will be heard.

The idea is to continue producing such noises while adjusting the I.F. trimmers, adjustment being made for the loudest crackling. At this point the I.F. circuits will be in reasonable alignment and so permit the passage of signals with the aerial connected to the frequency changer signal grid. From this stage the alignment process should be continued as outlined earlier.

PRINTED CIRCUITS

No. 4.—PRACTICAL MANUFACTURE OF A CIRCUIT By W. G. F. Roberts

IN the previous article, we saw all the various methods used to make printed circuits. We are now going to take the transistor amplifier circuit, for which we made a master drawing in Part 2 (Fig. 11) and follow the process of the production of a sample by a manufacturer, for which he would charge about £3. A method will

master, and the fact that it is grainless enables fine detail to be obtained. The exposure has to be controlled to get a completely black and transparent negative. Too short an exposure leaves the clear part grey, and too long an exposure gives fuzzy edges. Both are undesirable. These plates are obtainable in all sizes, and the amateur with a plate camera could probably get one to fit it.



Fig. 16.—Photographing the master.

be described for an amateur or a group of amateurs, possessing a plate camera, an old gramophone motor, and an arc lamp for exposure. The process is the *Photo Resist* method as briefly described last month.

Making the Negative

The master drawing is first photographed on a process camera, where it is reduced to its final size. In Fig. 16 the author is supervising this operation. A process camera is a large plate camera, running on rails, with elaborate focusing arrangements so that an image of the drawing can be focused at the exact size required. The camera shown reduces up to six times, or enlarges up to $2\frac{1}{2}$ times. The plates used can be up to 20in. \times 16in., and the lens must give a clear focus over the area. Of course, it thus has no depth of focus, and the copy must be kept flat. Having focused the image so as to produce the required size, the dark slide is fitted and the plate exposed.

The plate is not of the usual type used in amateur photography, and is known as a lithographic plate. The emulsion is slow, orthochromatic and grainless. The orthochromatic feature enables the use of a blue guide graticule on the

Inspection

After developing, any pinholes, etc., are stopped out on a retouching table, and we finally have a negative. This is then inspected with a measuring microscope (Fig. 17). At this juncture, it is usual to make a copy positive, to be kept as a master, since, if the original negative is damaged, a fresh one can be made from the master positive, without re-photographing the drawing. If, however, a quantity of about a hundred is required, it is usual to print down a multiple sheet of printed circuits, as seen on the right of Fig. 17. This cheapens the process (for just the same reasons that it is more economical to print postage stamps in sheets). For this purpose, a multiple positive is prepared in a step-and-repeat machine, as shown in Fig. 18. The negative is mounted in a carrier on the machine, and successive prints made at repeated pre-selected ordinates. This positions each image accurately so that the sheet can be cut along straight lines.

Sensitising

Next, a piece of copper clad laminate of convenient size is taken. Usually a suitable scrap piece can be found in the factory, to save cutting a new sheet. If badly oxidised, it is dipped in a 3 per cent. nitric acid solution, and is, in any case, scrubbed thoroughly with pumice powder and washed. It is then mounted on a whirler, as shown in Part 3, Fig. 13. Whilst the plate is still wet, it is rotated at about 75 r.p.m. A small

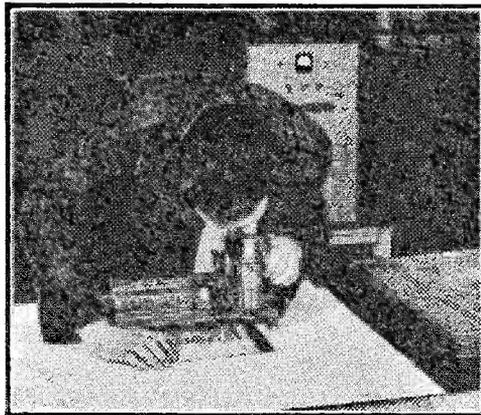


Fig. 17.—Inspecting the negative.

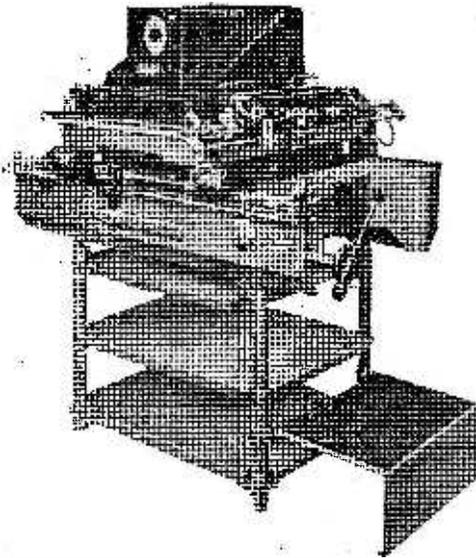


Fig. 18.—Step-and-repeat machine.

quantity of coating solution is poured on the centre, as shown in Fig. 13, and the whirling action spreads an even film over the copper. The lid, which contains a fan-heater, is closed and drying proceeds for about ten minutes. The amateur can easily reproduce the method with a gramophone turntable and a hair drier. The plate is then put, with the negative, into a printing frame, and exposed to a source of ultra-violet radiation such as an arc lamp, as in an old magic lantern or sun-ray lamp, or a mercury vapour printing lamp. The correct exposure has to be found for any lamp, this can be done by trial, without wasting the laminate, by washing off the developed resist and re-coating.

Development

The plate is then developed by swabbing with a piece of cotton wool, with the developer spread over the plate. Both the coating solution and developer are obtainable from printers' supply houses. After developing, the excess developer is removed with iso-propyl alcohol, and the circuit air-dried. It is not washed with water, as this would remove the resist. At this stage, the resist can easily be seen where the copper is to be left, and the rest of the plate should be clean. Any breaks in the circuit pattern are corrected with Stop-Out Solution, obtainable from the same source as the chemicals.

The circuit is now etched. The manufacturer uses an etching machine, in which the etchant is splashed over the circuit, and completes the process in about five minutes. The amateur can etch his circuit by swabbing with cotton wool, (wearing rubber gloves). One could also use a rocking dish, as in photography, but this is somewhat slower. The best etchant is ferric chloride, sometimes called iron perchloride, at a concentration of 43 deg. Beaumé. The amateur can dissolve his crystals in slight excess of boiling

water. Apart from its unpleasant and dangerous properties, nitric acid cannot be used with photo-resist. The ferric chloride solution must be handled with great care, and, if any should get into the eyes, they must be immediately and thoroughly irrigated with water and the person taken to hospital for examination. The solution also irritates the skin.

Cleaning the Circuit

Finally, the circuit is thoroughly washed in running water and scrubbed to remove any resist remaining, which would inhibit soldering. At this stage, our chosen circuit appears as shown in Fig. 19. Most people would agree that £3 is not

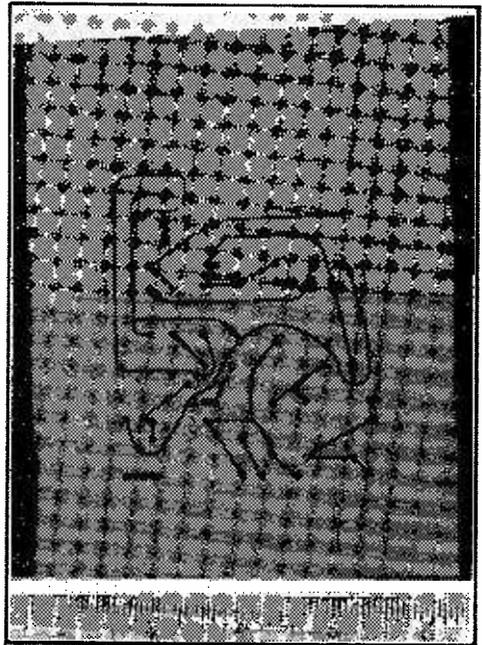


Fig.19.—Amplifier printed circuit, uncut.

an excessive charge for doing all this work, and providing material. In production, this circuit would be a prototype, and further quantities made by more economical methods.

However, the amateur is probably concerned with only one of a particular circuit. In this case, a simple do-it-yourself method is to obtain a piece of copper clad laminate. It is cleaned thoroughly with a detergent, and the required patterns printed with a cellulose lacquer. After drying, the usual etching is carried out and the lacquer removed.

In this article we have proceeded to the stage of the finished printed circuit, and, in the next, we shall see how the finished assembly is produced.

(To be continued)

SIX-VALVE CAR RADIO SERVICING RADIO RECEIVERS

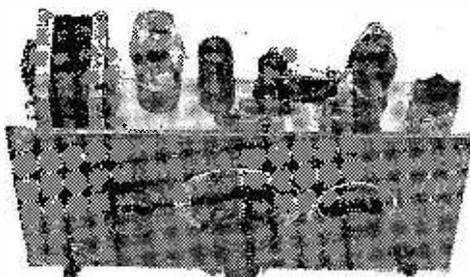
Owing to pressure on our space, these articles are held over until next month.

An All-band T.R.F. Receiver

WINDING THE COILS, WIRING AND
OPERATING THE SET

(Continued from page 128 of the April issue)

By F. G. Rayer



32 s.w.g. enamelled wire, side-by-side, with tap $1\frac{1}{2}$ turns up, will do for M.W., with 250 turns of 36 s.w.g. wire, in two piles, for L.W., the tapping being 3 turns from "C."

To use ready-made coils, wire grid end to "A" and earthy end to "B." Two turns are then added, with 32 s.w.g. or similar wire, between "B" and "C," close to the M.W. coil, and in the same direction. For the L.W. coil, 4 turns will be required. These extra turns may be regarded as a continuation of the existing windings, the junction providing the necessary tapping. The actual waveband tuned can be modified by moving the coil cores.

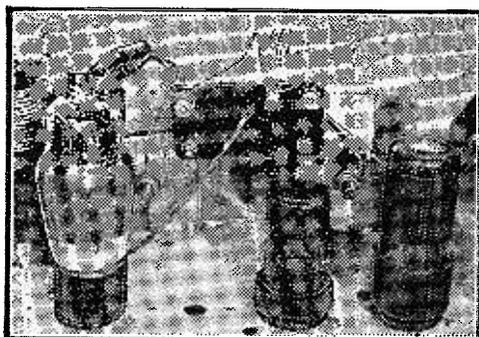
Very good M.W. reception will be obtained with a frame aerial. If the frame is 7in. X 7in. then 24 turns of 28 D.C.C. wire, turns spaced by the diameter of the wire, with "B" one-half turn from "C," will be satisfactory.

It is also feasible to wind a coil with 10 to 15 turns of 20 s.w.g. wire, on a $1\frac{1}{4}$ in. former, and mount this in the position shown in Fig. 2, for use on wavelengths over 19 metres. Clips can be fitted to the turns where required.

When experimenting with various coils, it will be remembered that the number of turns between "A" and "C" governs the wavelength, which increases as more turns are used. The position of "B" controls oscillation. This tapping should only be just far enough from "C" for sufficient reaction. Having the tapping too far up the coil will only cause violent oscillation, difficult to control.

Under the Chassis

All wiring will become clear from Fig. 5, points marked "M.C." being securely joined to the



Rear view, showing coil mounting arrangements.

WIRING grid leak and condenser in parallel, from "A" to 6J7 cap, completes this part of the receiver. These leads should be very short indeed, especially to the valve cap, or hum will be present.

Coil Winding

A great advantage of the circuit is the extreme ease with which any coil can be connected, but if dial readings are to be maintained then the

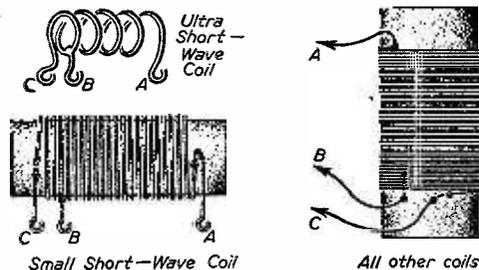


Fig. 4.—Coil winding details.

coils should be properly wound, with turns secure. Fig. 4 illustrates some of the coils which can be prepared.

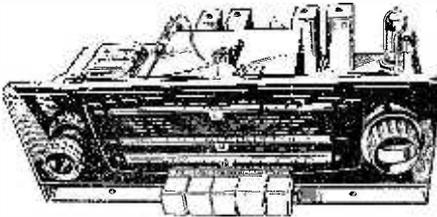
The smallest coil consists of five turns of 18 s.w.g. wire, self-supporting, $\frac{1}{2}$ in. in diameter and $\frac{3}{4}$ in. long, with the cathode tap $\frac{3}{4}$ turn from "C." This was found suitable for Sutton Coldfield and the 5 metre band. Stray capacities may vary, and it may be necessary to try modifying the coil, using a different number of turns, or compressing or extending the length of the winding.

For 10 metres upwards, seven turns of 20 s.w.g. on a $\frac{1}{2}$ in. diameter former spaced over $\frac{1}{4}$ in. is suitable, with cathode tap $\frac{3}{4}$ turn from "C." A somewhat similar coil, on a $1\frac{1}{4}$ in. former, will be obtained by using $3\frac{1}{2}$ turns of 20 s.w.g. wire, occupying $\frac{3}{4}$ in., with cathode tap $\frac{1}{2}$ turn from "C."

For 16 metres upwards, seven turns of 22 s.w.g., occupying $7/16$ in., with tap $\frac{1}{2}$ turn up, on a $1\frac{1}{4}$ in. former, will be suitable. For 33 metres upwards, 16 turns of 26 s.w.g. wire, also on a $1\frac{1}{4}$ in. former, with tap $\frac{1}{4}$ turn from "C," will be satisfactory.

Medium and long wave coils may be wound on $1\frac{1}{4}$ in. formers, or adapted from small dust-cored components. If wound, 90 turns of

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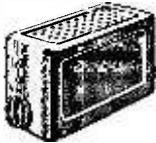
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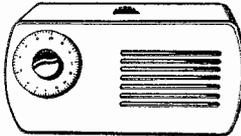
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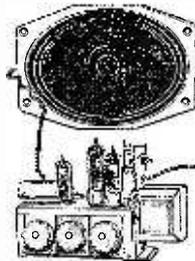
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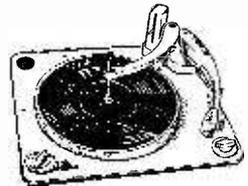
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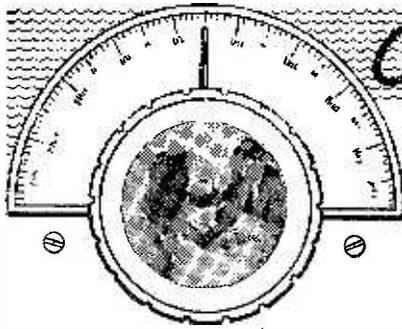
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On Your Wavelength

BY THERMION

"Thermion"

I HAVE once more been taken to task by a reader (who shall be nameless) who says I hide behind a *nom de plume*. Needless to say, this reader disagrees with all of my views and feels the Editor should dispense with my services. There is no question of "hiding"; the name "Thermion" is associated with an address, and if anyone wishes to write to me and express his views on any subject about which I have written, they are quite welcome to do so. The person who really hides behind a name is he who writes to me and signs himself "Disgusted," for example, or who writes an insulting letter omitting his name and address. These are the truly anonymous writers, and for them I have no time: their views are worthless and will be treated as such. My writings are sponsored by the Editor of this journal and readers should therefore take my integrity and standing for granted. As I mentioned earlier, I have been writing for many years now and my work has stood the test of time.

It is very amusing to read the letters sent anonymously or under a *nom de plume*. Without exception, all the writers disagree with me and often are quite abusive; they are obviously afraid to air their opinions under their own name and would be ashamed if it came to light that they had written such letters. I treat these letters with the contempt they deserve. (My waste-paper basket is large.)

Signature Tunes

WHY are there so many programmes on both radio and TV which begin and end with the same few bars of some hackneyed tune? The occasional use of signature tunes may be all right, but when almost every programme has one, it is nauseating. Surely factual programmes such as "Sports Report" would be all the better for spoken introductions and endings.

Pronunciation

I HAVE received much correspondence on this subject, most of it expressing agreement with my views. Announcers must not set themselves up as authorities on the pronunciation of the English tongue. They may say they do not, but if they alter the accepted pronunciation of words, apparently to suit themselves, then what else are they doing?

One of the commonest and most infuriating mispronunciations is "the sevening" for "this evening." Other, less common, instances readily

spring to mind: "trarl, perny, minny, barthday," meaning "trial, pony, many, birthday." So-called singers have a habit of making "you" rhyme with "dew" and then making "dew" rhyme with "blue." The only way to stop this misuse of our language is by ridicule in the press and I invite you to send me your examples and views.

Readers' Radio Dens

THE response to my request for photographs of readers' radio dens has been very good and many varied dens have been shown in these columns. It is heartening to see that many of my younger readers are as keen as I and my contemporaries were in our youth—(now some years distant!) I should be interested to receive photographs from those readers who possess equipment in their dens which was built twenty or more years ago, and which they still use regularly, possibly to revive old memories. Payment will, of course, be made for all of these.

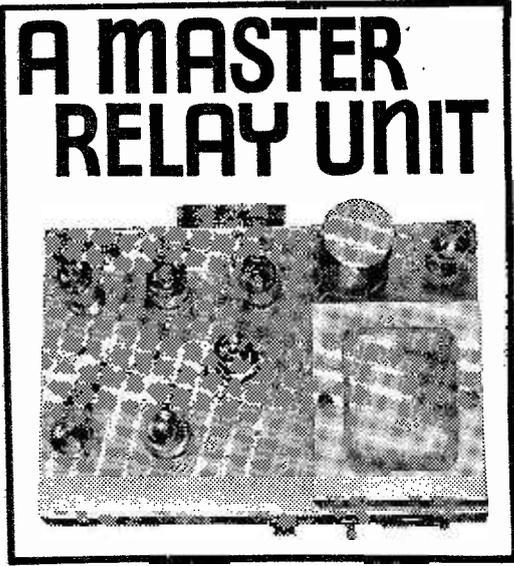
Mr. L. H. Brown, of Abingdon, has sent the photograph shown below which was taken about 1924. Mr. Brown says that he is a little puzzled about my remark in the March issue that an old reader first read my writings in this journal more than 33 years ago. He asks if I, in fact, meant 23 years and then he states *he* remembers my writing before 1930—the date he gives is 1926. If my arithmetic is correct, my original statement is also correct.

Referring to the use of valves in parallel push-pull. Mr. Brown once read that an American oscilloscope circuit used twenty-four 6CB6's in an output stage. I wonder whether anyone has heard of a larger number of valves being used; I certainly have not. I look forward to further letters on the subject.

Mr. L. H. Brown of Abingdon operating one of his first receivers.



A MASTER RELAY UNIT



THREE CHANNELS ARE PROVIDED: TWO FOR RADIO AND ONE FOR RECORDS

By Hugh Guy

THE unit described in this article was designed in the first instance for use in a ladies' hairdressing salon where customers under hair dryers could while away the drying session listening to one of three programmes. The latter were selected by means of a rotary switch, giving the customer the choice of either the Home or Light radio programmes or a third locally "transmitted" record programme.

Though this application of the apparatus is hardly likely to appeal to more than one or two readers the same master unit can be used as a general three-programme unit on the lines described above for room-to-room programme-relaying in a small hotel or boarding house, nursing home or private hospital or even, of course, in the home.

Loudspeaker outputs can also be obtained by modifying the output stages as described in the text.

The Circuit

The basic circuit, shown in Figs. 1(a) and (b) comprises two separate radio receivers and a further separate amplifier. Each radio receiver is pretuned; one to the medium-wave Light Programme, the other to the appropriate regional Home Service. Those areas in which the Light Programme is better received on 1,500 metres

require a receiver operating on the long waves.

A close examination of the circuit will show that the receiver circuits are almost identical and to simplify the explanation of their operation the circuit of one receiver is shown separately in Fig. 2. Here it will be seen that the first stage is an R.F. amplifier which feeds the second stage, one half of a double triode, acting as an infinite impedance detector. This type of detector is well known for its virtually distortion-free operation and gives the best quality obtainable from "straight" reception as opposed to superhet reception.

The output from the detector is taken from the cathode of V2a and fed to the triode amplifying stage V2b. The amplified audio frequency output is taken from the anode of this last mentioned stage and coupled to the output stage which is one half of a double triode. The other half acts as the output stage for the other receiver as reference to Fig. 1(b) shows. This output stage is a cathode follower.

Output Impedance

The cathode follower has a low output impedance—approximately 200 ohms—and enables a considerable length of twin lead to be connected to it without serious losses of output signal. Hence the output is coupled into the distribution line which in practice can be as long as 50 yards with no detrimental effect on the signal.

At the terminating end of the distribution line the signal power available is of course only sufficient to drive a pair of headphones. No attempt is made to match the headphones to the source impedance since the actual source impedance presented at any time will depend on the number of headphones connected to that particular output at that instant. The inefficiencies of the system when worked this way are compensated for by the economies effected in avoiding matching transformers and stepped attenuators for use as volume controls. These latter refinements, which form an essential part of more sophisticated audio frequency transmis-

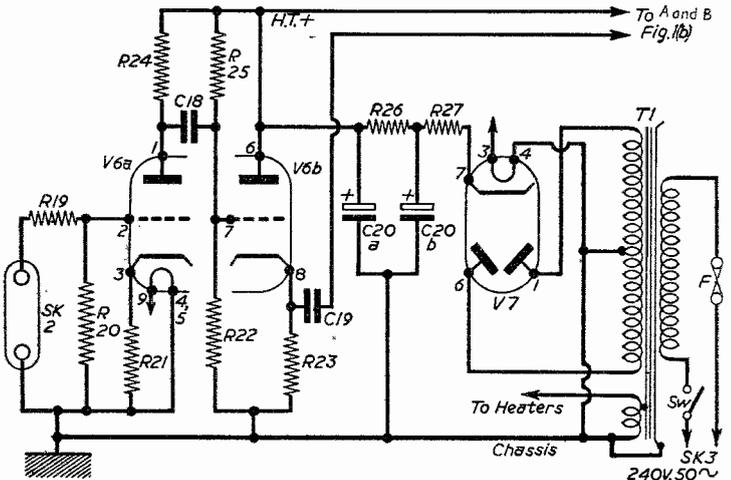


Fig. 1 (a)—Circuit of the power-pack and record/tape amplifier.

COMPONENT LIST

R1, R10	270Ω
R2, R11	1 K
R3, R12	47 K
R4, R14, R24	56 K (1 w)
R5, R14, R20	470 K
R6, R15, R21	330Ω
R7, R16, R25	680K
R8, R17, R22	330 K
R9, R18, R23	10 K ($\frac{1}{2}$ w)
R26	1 K (3 w) wire wound
R27	150Ω
R19	See text
C1	470 pF silver mica
C2, C4	120 pF, see text
C3, C11	0.1 μF 150 vw, paper
C5, C6, C13, C14	100 pF, silver mica
C7, C8, C15, C16, C18	0.01 μF 300 vw
C9, C17, C19	0.5 μF, 150 vw, paper
C10, C12	150 pF, see text
C20, a, b	32 + 32 μF 350 vw, electrolytic

Valves

V1, V4	W77 (M.O.V. Co.)
V2, V5	12AX7
V3, V6	12AT7
V7	6X4

Miscellaneous

T1	1A fuse in holder ("Bell-ing-Lee")
F	S.P.S.T. toggle switch
SW	Aerial socket (Cinch)
SK1	Pick-up socket (Cinch)
SK2	Bulgin shielded mains socket
SK3	6-way terminal block (Grelco)
TB	
250-0-250 v. 70 mA mains transformer (R.S. Co., Leeds)	

tion systems are, therefore, justifiably dispensed with here.

Referring to the circuit of Fig. 1(a) again, the double triode V6, a and b, comprises the simple
(Continued on page 242)

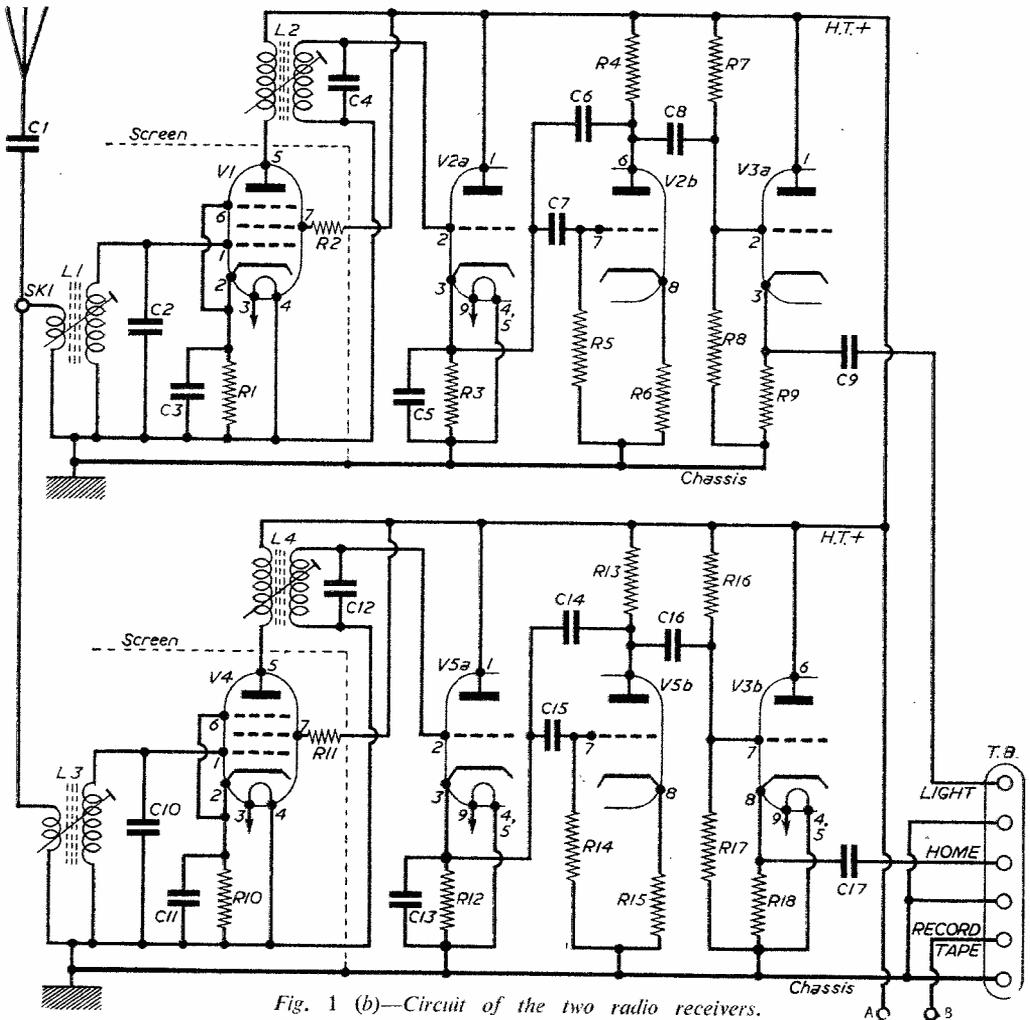


Fig. 1 (b)—Circuit of the two radio receivers.

POCKET SIZE ELECTRONIC VOLTMETER

A SENSITIVE, BATTERY-OPERATED INSTRUMENT

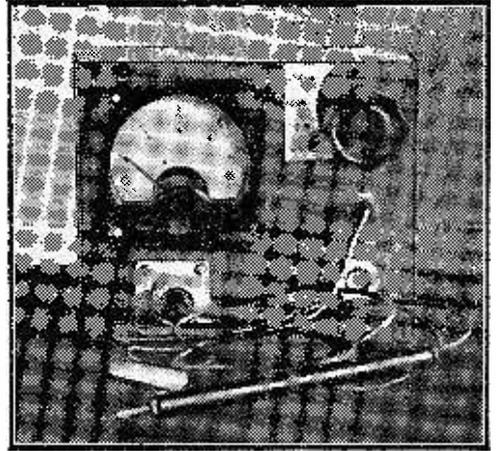
By L. Baker

ELECTRONIC voltmeters are usually very sensitive and accurate instruments. They draw negligible current from the circuit under test and so enable measurements to be made on very high resistance networks without the danger of partially shorting the resistor or circuit under test as may be the case with many other meters. Some of these draw so much current from the circuit (1 mA and sometimes more depending on the range to which the meter is switched) that the resulting reading obtained is so inaccurate as to be almost useless.

The electronic voltmeter has such a high input resistance that when connected across a high resistance circuit so little current is taken that very accurate readings can be made. Unfortunately, electronic voltmeters are usually run from the mains which makes them bench instruments. With this drawback in mind the instrument to be described was built. The power supply for the instrument consists of miniature batteries and the completed voltmeter is as small and portable as possible; pocket size in fact.

Three Ranges

It was decided at the outset, to make the instrument as simple as possible and it has only three ranges (10, 100 and 500 volts). These are sufficient for general use, and at the same time



enable fewer costly precision resistors and parts to be used.

The circuit (Fig. 1) was designed around a 1 mA FSD meter and a deaf-aid amplifier valve type C.K. 503. The meter was of surplus origin, 1½ in. in diameter, and had an internal resistance of 100 ohms. Meters of larger or smaller dimensions can be used in cabinets of suitable sizes but it is stressed that they *must* have a basic reading of 0 to 1 mA and an internal resistance of 100 ohms, otherwise false readings will be obtained. The only other components of critical value are R1, R2, R3 and R4. These should be precision resistors of 1 per cent. tolerance.

Wooden Case

The parts are housed inside a wooden case; in the original model this case measured 5 in. × 3 in. × 1½ in. (Fig. 2). Other cases, of metal or wood, may be used and there is no reason to adhere rigidly to the dimensions given. The batteries should be held in place inside the case with clips cut from brass sheet or tinplate. Holes should be cut or drilled to take the meter depending on the size used. The range switch is S1; J1 is the input jack (a miniature coaxial jack is ideal) and R6 is the zero set which is screwdriver adjusted. A small tagboard could be fitted for mounting the smaller wire-ended parts (see Fig. 5).

Circuit

The valve is held in place by a metal clip. It is best to slip a piece of soft rubber tubing over the valve before securing it with the clip and it must be stressed that no great force must be applied when screwing down the clip or the glass envelope of the valve will be

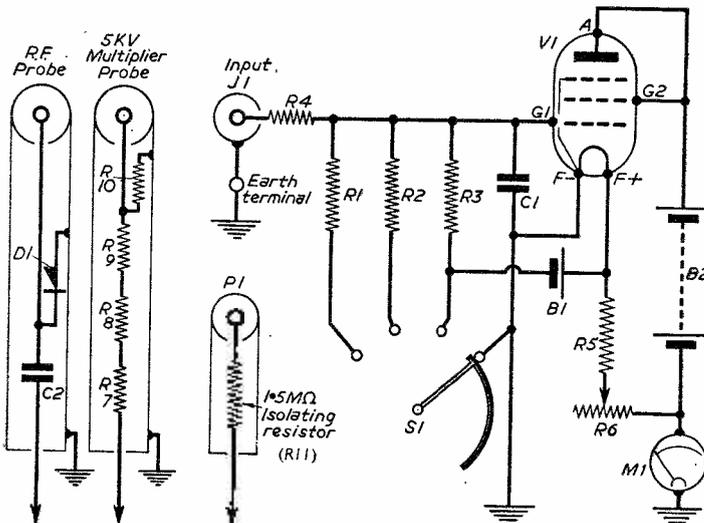


Fig. 1.—Circuit diagram of meter and probes.

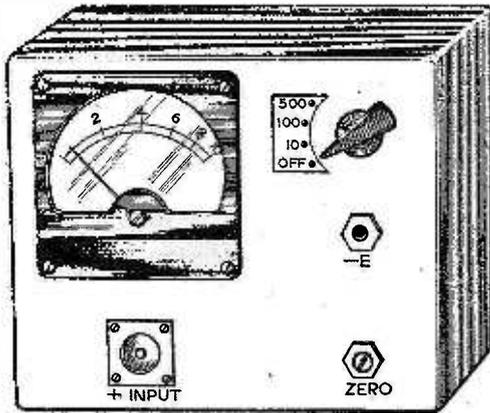


Fig. 2.—The meter in its case.

broken. A valveholder is not necessary. The valve has wire leads which can be taken directly to the points of termination for soldering. Small pieces of sleeving should be slipped over the leads before finally soldering them. Use a good clean soldering iron, resin cored solder, and avoid applying the hot iron to the valve leads for lengthy periods in order to avoid damage to the valve which is easily cracked by excessively heating the leads. For the ordinary voltage tests a probe containing the 1.5 MΩ isolating resistor is made from a discarded ballpoint pen (Fig. 1). The 1.5 megohm resistor is held in the hollow body of the pen, one end being taken to the brass tip, the other soldered to approximately 3ft. of lead which terminates in a plug to suit the input jack J1. For ordinary D.C. measurements this lead is used, the earth terminal of the instrument being connected to the chassis or negative side of the circuit under test. If desired the body of the ballpoint pen can be filled with pitch after wiring in the resistor. This will prevent breakage of the cable after extended use.

This completes the basic valve-voltmeter instrument. With the completed instrument the constructor will be able to take extremely accurate readings within the scope of the ranges of the instrument. If desired the range of the instrument can be increased further by the construction of the multiplier probe (which enables each range to be multiplied by 10) giving a total voltage range up to 5,000 volts. The effective input resistance is then increased up to 75 megohms

approximately. The R.F. probe can be constructed if desired to increase the scope of the instrument still further and will enable it to be used for simple R.F. and A.F. measurements.

Voltage Multiplier and R.F. Probes

To construct the remaining two probes very little extra material is needed (see Figs. 3 and 4). The basis of these probes is approximately 3in. of 1in. diameter plastic tubing of the type commonly used in plastic electrical conduit. Small circular discs should be made from thick plastic and filed or sanded to form a close fit in both ends of the conduit as shown in Fig. 3. The endpiece carrying the probe tip (which is copper rod threaded to suit the hole in the endpiece) should be a firm fit in the plastic conduit. This should not be cemented in place finally until the whole assembly is completed. A small thin bakelite "chassis" should be made to fit tightly inside the conduit as shown in Fig. 3. This piece of bakelite has the resistors R7, R8, R9 and R10 mounted along its length by drilling small holes in it and passing the wire ends of the resistors through the holes before soldering. The top piece of the probe should be drilled to take the cable which is screened. The cable, complete with insulation cover, should be a close fit in this hole.

Bakelite "Chassis"

The bakelite "chassis" should be attached to the top piece of the probe as shown with small brass brackets held in place by small nuts and bolts. The insulation should be stripped away from the cable exposing the braiding which should be unravelled sufficiently to make a connection to the solder lugs held on the bakelite strip with a small nut and bolt (Fig. 3). The centre conductor should be taken direct to the soldering point and a layer of insulating tape wound tightly around the cable to prevent it from slipping through the hole. The inside of the plastic conduit should be roughened with glass-paper as well as the side of the top disc. Both are then smeared with cellulose cement and the whole assembly pushed into the 3in. plastic tube, a short flexible lead having been soldered for connection to the tip of the probe at the other

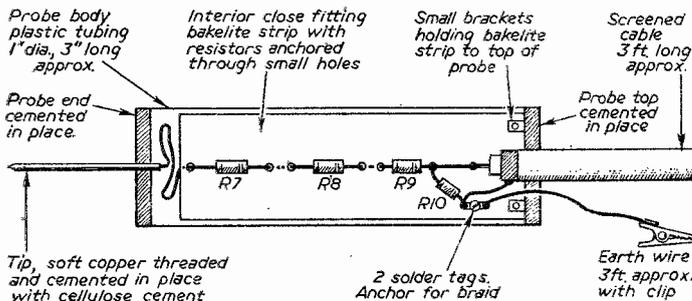


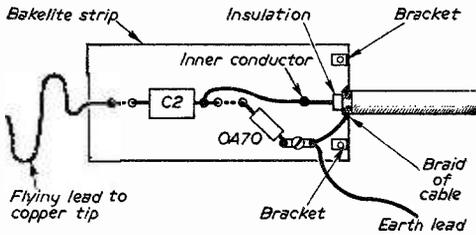
Fig. 3.—(Below) Details of the 5kV probe.

PARTS LIST FOR FIG. 1		
R1—100 kΩ	} Tolerance 1%	
R2—470 kΩ		
R3—5.6 MΩ		
R4—25 MΩ		
R5—620 Ω		
R6—1 kΩ pot.	} Radio Spares	
R7—22 MΩ		
R8—22 MΩ		
R9—22 MΩ		
R10—8.2 MΩ		
R11—1.5 MΩ		
C1—.006 μF		
C2—.001 μF		
T.C.C.		
D1—OA70 (Mullard)		
M1—1 mA (100Ω resistance)		
V1—CK503 or DL68 (Mullard)		
B1—1.5 v. Ever Ready D23		
B2—22.5 v. B122		
J1—Miniature Coaxial Socket		
P1—Miniature Coaxial Plug		
S1—4-position Shorting Switch		

end. The threaded end of the probe should be liberally smeared with cement and the inside of the tube and side of the other end disc roughened. It is then placed in position and left until thoroughly dry.

R.F. Probe

The R.F. probe can be made in a similar manner, but using the bakelite "chassis" containing the crystal diode and condenser as shown in Fig. 4. Both assemblies should have approximately 3ft. of braided lead passing through the cable end of the probes as shown. One end of this braided lead is soldered to the solder tags inside the probe on the bakelite strip and having passed through a small hole in the cable end should be terminated in crocodile clips. In use, it is not necessary to connect the earth terminal on the instrument proper to the equipment under



• Fig. 4.—Interior of the R.F. probe.

test. The crocodile clips should be used instead to provide an earth return. The cables of the multiplier and R.F. probes are terminated with small coaxial plugs and the braiding in each case is taken to the outer screwed part of the plug.

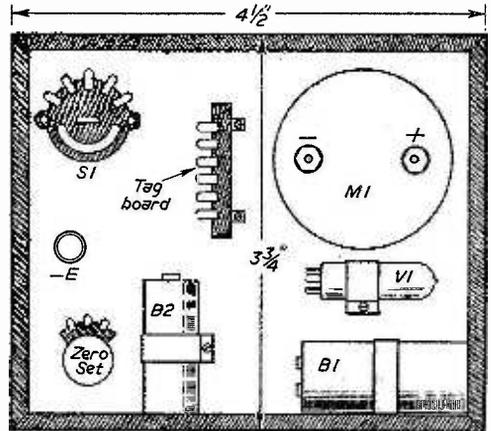


Fig. 5.—Layout of the parts in the case.

The R.F. probe cannot be used for exact A.C. measurements since the rectification efficiency of the diode is not constant for varying voltages and the D.C. output is not directly proportional to the A.C. input. Even so, it is extremely useful for making comparative gain measurements, etc. For best results voltages taken with this probe should not exceed 60 to 70 volts. In the instrument itself the effect of anode current from V1 is neutralised by applying some of the filament voltage across it via the 1 kilohm potentiometer. In use this potentiometer should be varied until the meter reading is zero with the instrument switched on. Calibration may be checked against an instrument of known accuracy. The scale for the instrument can read 0 to 10, suitable multiplication being applied to the other ranges.

ALIGNING WITHOUT INSTRUMENTS

(Continued from page 208)

doubt that signals will be heard this time and switching first to the L.W. band and tuning in the Light Programme, the L.W. aerial trimmer should be adjusted for maximum volume.

The receiver should then be tuned to the Home Programme and the M.W. aerial trimmer adjusted likewise. Finally, the S.W. aerial trimmer should be adjusted for maximum volume of a station towards the high-frequency end of the S.W. band, that is with the tuning gang towards minimum capacitance.

If the aerial coils feature adjustable dust-iron cores or if padding capacitors are included in the design, optimum tracking of the aerial circuits can be accomplished by adjusting the core or padder for maximum volume of a station at the low-frequency end of the band, and the trimmer for maximum volume of a station at the high-frequency end of the band. Exactly the same applies if the receiver incorporates a stage of R.F. amplification. Trimmers C3, C2 and C4 in

the circuit in Fig. 1 correspond to the L.W., M.W. and S.W. aerial circuits respectively.

No Signals

If, when the alignment procedure is begun, a signal cannot be obtained to align the I.F. transformers even when the aerial is connected direct to the control grid of the frequency changer, a suitable signal can be generated in the receiver itself simply by connecting a voltmeter between the receiver chassis and the anode of the mixer section of the frequency changer valve (see Fig. 1). The probe should not be firmly connected to the anode, however, but should be scraped against the anode tag on the valveholder. This action produces transient signals in the I.F. stages, and if the volume control is turned fully up and an ear is held close to the loudspeaker corresponding crackling noises will be heard.

The idea is to continue producing such noises while adjusting the I.F. trimmers, adjustment being made for the loudest crackling. At this point the I.F. circuits will be in reasonable alignment and so permit the passage of signals with the aerial connected to the frequency changer signal grid. From this stage the alignment process should be continued as outlined earlier.

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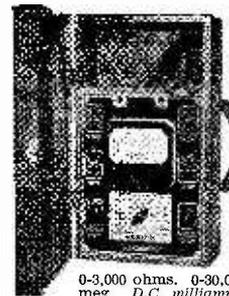
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THE STEREO SEVEN

CONSTRUCTIONAL AND WIRING DETAILS
ARE GIVEN THIS MONTH

By J. B. Willmott, A.I.P.R.E.

(Continued from page 116 of the April issue)

chassis. The four-way lead enters the amplifier chassis by a suitable grommeted hole in the rear runner.

Next proceed to wire the heaters of all four valves in parallel, using twisted flex. Keep this wiring pressed close down to the chassis. Note that on SP61 valves, pins 1 and 8 are the heaters, whilst on EL84 valves, pins 4 and 5 are used. Pin 6 of the SP61 valves should be connected to earth at the valveholder. This is the metallised coating of these valves. Incidentally, it is advisable to use screening cans for these valves.

Now proceed to take the H.T. positive supply from tag 1 of the input socket to the anodes and screens of each valve, dealing firstly with V3 and V4, then V5 and V6, thus incorporating the output transformer primary windings, the output valve screen decoupling and audio amplifier valve anode decoupling components. This should be followed by wiring in the connections to the cathodes of each valve. Earth connections should in every case be as short and direct as practicable.

Now proceed to wire in the course of the signal from source (radio and gram input), through the two-pole two-way switch (see Fig. 6), pre-set gain controls VR2 and VR3, to the top cap connections to V3 and V5 respectively. Single screened wire should be used here for all connections which exceed an inch or so in length, carefully earth-

MAINS supply to the gram motor is taken from across the primary leads of the mains transformer, and is thus also under the control of the on-off switch.

An MU14 type rectifier was used in the original as this was to hand, and the transformer had provision for 4 v. rectifier heater supply, but a 5Z4 could equally well be used with a 5 v. heater supply.

Whilst this receiver is perhaps not recommended for the "first timer," it is none the less extremely simple to construct, and anyone of only modest experience should be assured of first class results. Two 10in. diameter speakers in the medium price range were used in the original, and results have been very favourably commented on by all who have heard the receiver in operation.

Construction

It is recommended that construction be begun with the main amplifier chassis (12in. × 8in. × 2½in.). The layout of the main components is shown in Fig. 4. Note that the output transformers, the 8 + 8 μF electrolytics C14A/C15A and C14B/C15B, and the pre-set gain controls VR2 and VR3 are mounted beneath the chassis. The valveholders should be mounted with their locating spigots in the direction shown, to ensure short and direct wiring.

Wiring up should be carried out methodically, carefully marking off each connection on the theoretical diagram as it is completed. The recommended method is first to mark clearly the 4-pin power take-off socket as shown in Fig. 5, and then to prepare a suitable length of four-way flex for the lead from power supply chassis. This may conveniently comprise a red/black twisted flex, and a plain twisted flex. Use the red flex as H.T. + line, and connect to pin 1 of the four-pin socket. Black flex as H.T. negative goes to pin 2. The plain twisted flex is connected to pins 3 and 4, forming the heater supply. Pins 2 and 3 are then both earthed to

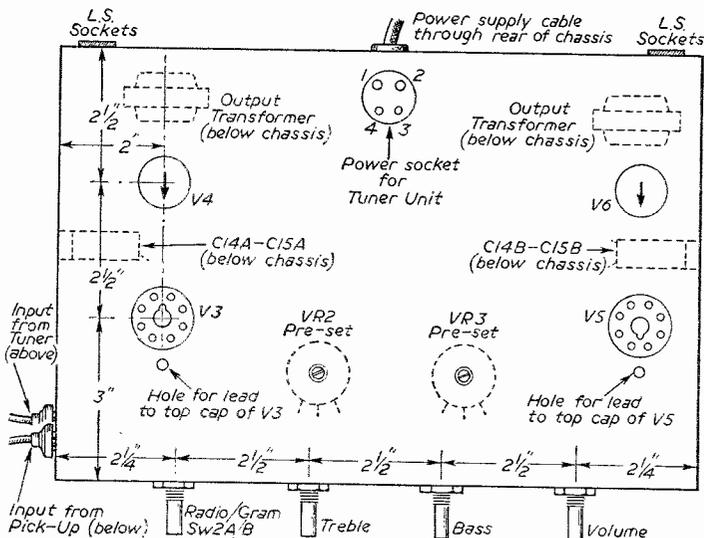
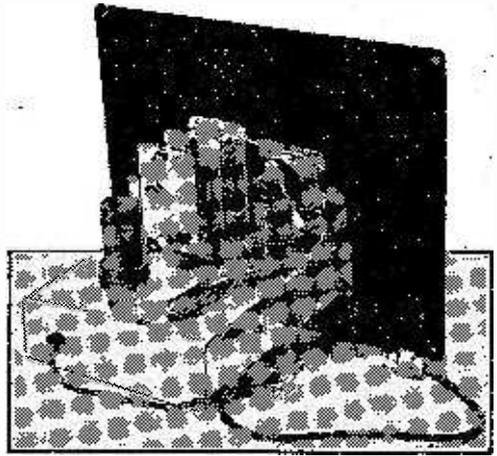
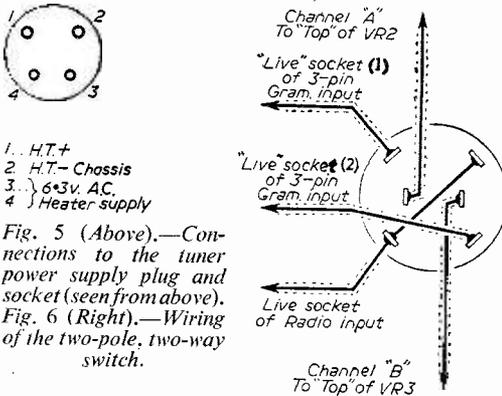


Fig. 4.—Layout of the chassis of the main amplifier.

ing the braiding at the nearest point. In the prototype, it was found convenient to mount the resistors and capacitors comprising the pick-up input filter (C10A, C10B, C11A, C11B, R7A, R7B, R8A and R8B), on three-way tag strips in the manner shown in Fig. 7.



Rear view of the radio tuner unit

Tone Controls

Now, dealing first with V3 and V4 ("Channel A") proceed to wire the signal circuit from the

MAIN AMPLIFIER : COMPONENTS

- 1 chassis 12in. x 8in. x 2½in.
- 2 2-socket strips, "L.S."
- 1 2-pin non-reversible socket.
- 1 3-pin socket and plug (input from pick-up).
- 1 4-pin socket.
- 2 3-way tagstrips, one earthed tag.
- 4 engraved control knobs (1 each Bass, Treble, Volume, Radio/Gram).
- 2 M.O. valveholders.
- 2 valve screening cans, Octal type.
- 2 B9A valveholders.
- 1 2-pole 2-way radio/gram changeover switch.
- 2 SP61 valves.
- 2 EL84 valves.
- 2 grid clips for SP61 valves.
- 1 yd. single screened wire.
- 1 grommet for ½in. hole.
- 2 small 1 meg. potentiometers (short spindle, pre-set type).
- 3 ½ meg. 2-gang potentiometers. (VR4, VR5, VR6).
- 4 1.5 meg. resistors (R7A, R7B, R8A, R8B).
- 4 10 k. resistors (R9A, R9B, R13A, R13B).
- 2 47 k. resistors (R10A, R10B).
- 2 470 ohm resistors (R11A, R11B).
- 2 220 k. resistors (R12A, R12B).
- 2 2.2 k. resistors (R14A, R14B) 1 watt.
- 2 150 ohm resistors (R15A, R15B) ½ watt.
- All resistors ½ watt unless otherwise specified.
- 2 .001 μF mica condensers (C10A, C10B).
- 2 .0001 μF mica condensers (C11A, C11B).
- 4 25 μF 25 v.w. electrolytics (C12A, C12B, C19A, C19B).
- 2 .1 μF tubular paper, 500 v.w. (C13A, C13B).
- 2 8 μF x 8 μF 350 v.w. midget electrolytics (C14A/C15A, C14B/C15B).
- 2 fixing clips for above.
- 2 .005 μF mica condensers (C16A, C16B).
- 2 .0005 μF mica condensers (C17A, C17B).
- 2 .002 μF mica condensers (C18A, C18B).
- All condensers 350 v.w. unless otherwise specified.
- 2 output transformers, 7,000 ohms to 3 ohms impedance.

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

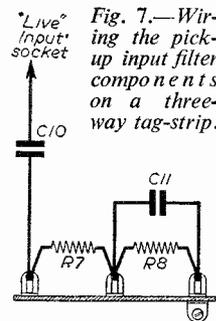
anode of V3 via the treble, bass and volume controls as shown in Fig. 8, using the front portion of these controls in each case, and so to the grid of V4 using screened wire for the longer leads. Similarly wire from the anode of V5 through to the grid of V6, ("Channel B"), using the rear section of the ganged controls.

Connect the secondary of the output transformers to the adjacent loudspeaker sockets. One side on each of these should be earthed to chassis.

Check over all wiring very carefully, and test

for possible errors such as short circuits from H.T. positive to chassis or heater line, and when fully satisfied that all is in order, proceed to construct the power supply unit. This is extremely straightforward, and Figs. 3 and 9 should contain all necessary guidance. Take great care in wiring the octal power take-off socket (Fig. 10) and its plug (a wrong connection here could have dire results). Adjust the dropper resistor R16 so that maximum resistance is in circuit, and having made doubly sure that no errors have been made, preliminary tests can be made.

Insert all valves, connect the amplifier to the power pack and wire mains on-off switch to tags 4 and 5 of power plug. Connect loudspeakers to both the output sockets on the amplifier. (Never operate without the speakers being connected.) Set pre-set gain controls and main volume control to minimum, and switch on. Watch carefully for any signs of trouble. After a few seconds, turn up the main volume control, a faint hum should be heard from each speaker as maximum is approached. Now take a voltage reading of the main H.T. supply at pin 1 of the tuner-unit power supply socket. Owing to the presence of the whole of R16 in circuit, this will probably be well below 250 volts. Now



switch off, reduce the amount of R16 in circuit and check again. Gradually reduce until the H.T. reads 250 v. or thereabouts.

Now gradually increase the setting of the pre-set gain controls VR2 and VR3; there should be only a slight increase in hum from the speakers as a result. Turn the switch to "radio," and gently touch the "live" radio input socket (smaller of two holes), a loud hum will be heard from both speakers if all is in order. Now turn the switch to "gram" when it will be found that by touching each of the "live" (outer) pick-up sockets in turn, the respective right- or left-hand speaker will "hum."

Constructing the Tuner Unit

If all is in order, construction may now proceed to the radio tuner unit, the essentials

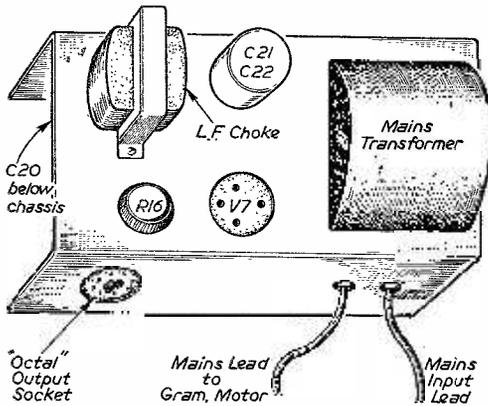


Fig. 9.—Layout of the chassis of the power supply.

of which are easily seen from Figs. 1, 11 and 12. The same sequence of wiring should be adopted. heater supplies first, then H.T. to anode of V2, and to anode and screen of V1, followed by the

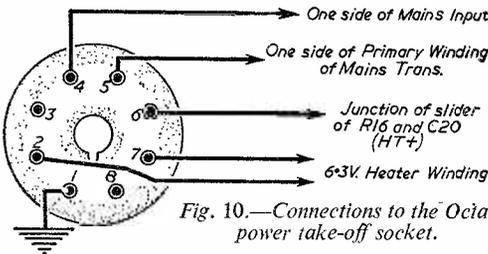


Fig. 10.—Connections to the Octal power take-off socket.

cathode circuits. The makers' instructions should, of course, be adhered to when wiring the tuning coils.

It will be found that the completed tuner unit can conveniently be fastened to the underside of the cabinet control panel by angle brackets,

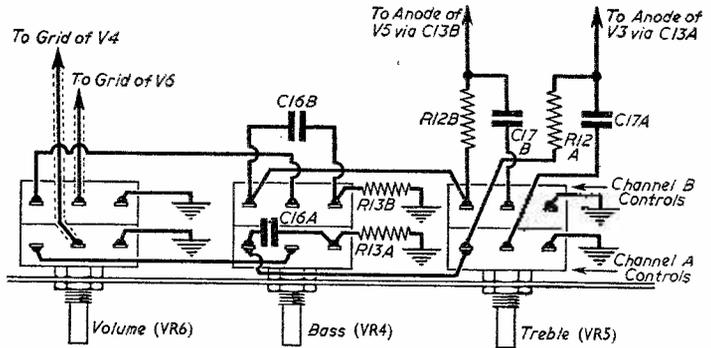


Fig. 8.—Wiring of the tone and volume controls.

and will fit nicely into the gap between V3 and V5 of the main amplifier. Leave sufficient gap between the tuner unit and the main amplifier for access to the pre-set gain controls on the latter when finally fixed into the cabinet.

When the tuner unit is complete, and wiring checked, further tests may be carried out. Plug the tuner power plug into its socket on the amplifier chassis, switch on, and ensure that valves light, and that there are no obvious faults. Re-adjust the dropper resistor (R16) on the main power pack, to compensate for the increased H.T. current load, remembering to switch off between each adjustment.

(To be continued)

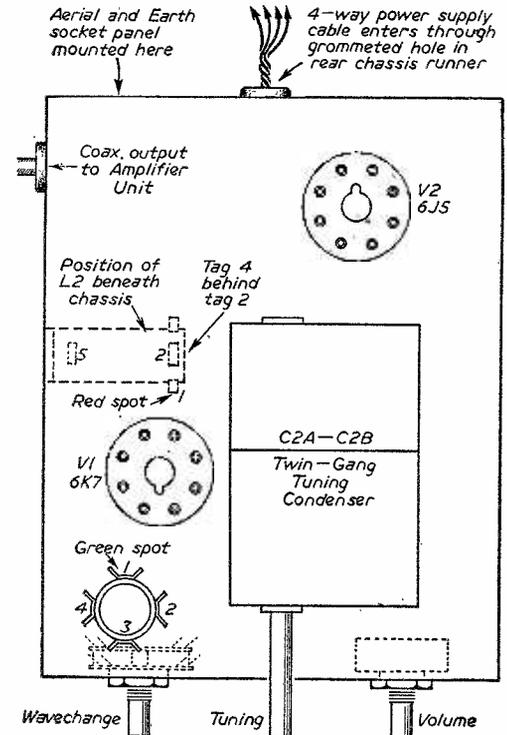
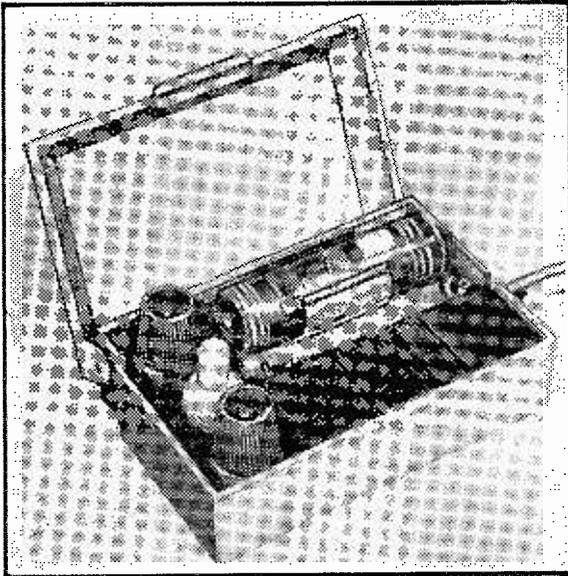


Fig. 11.—Layout of the chassis of the radio tuner unit.



The completed receiver.

THE aerial in this receiver is only 2½ in. long, but the permeability of the ferrite material gives the collecting power of an aerial of larger dimensions. The application of positive feedback or regeneration to the tuned circuit offsets the circuit losses so that a solid dielectric tuning condenser, not necessarily of the mica type, could be used. The selectivity curve is sharpened and tuning adjustments become rather critical.

Whistles

"Reaction" controls are not always satisfactory, because slight increases in the feedback fraction produce large increases of gain, and the receiver may easily become unstable at the brink of oscillation. Although strong heterodyne whistles can be produced in this receiver by screwing in the reaction core too far, these do not occur at normal settings, where the regeneration is quite manageable. There is no need to reject reaction on the grounds that ear-splitting whistles are inevitable.

Another difficulty is in obtaining uniform regeneration over the waveband. Usually it either increases or decreases as the frequency is raised. It will, of course, have to be increased for a weaker station. A 250 pF trimmer of the compression pattern is used as a reaction control. With a good R.F. transistor, it will normally be used at settings below 50 pF, but increases may be found necessary according to the temperature in which the receiver is working and the distance from the transmitter. Increases will also be necessary if any deterioration occurs in the R.F. transistor, e.g., owing to overheating during soldering.

A Direct- Transistor

THIS UNUSUAL CIRCUIT USES ONLY SEVEN RESISTORS AND OPERATES FROM

"Backlash"

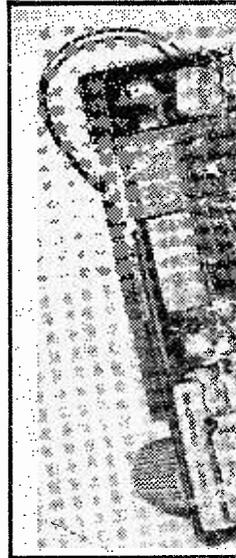
When the reaction is sufficient to cause oscillation, the oscillations will be rectified, producing a change in D.C. levels and in gain. The temporary change in circuit conditions tends to produce a "backlash" in the reaction adjustment adding to any mechanical "backlash" or looseness in the control. Rectification of the signal also enters into this effect.

The change in D.C. levels may be enough to interrupt the R.F. oscillation of the transistor at an audible frequency, producing a howl even when the set is not tuned to a station. In this receiver, the D.C. levels are stabilised throughout, but excessive regeneration can overcome the action of the stabilising circuit. A staccato motor-boating sound is then heard, corresponding to the large time-constant of the circuit.

Hand-capacity Effects

The use of regeneration makes the set susceptible to hand-capacity effects, which are not easy to avoid since a metal case cannot be used with a ferrite rod aerial. It might be possible to screen the set electrically and not magnetically, but this has not been attempted. The effect is not unduly troublesome if the receiver is laid on a table, or held at some point away from the aerial winding. It is always an advantage, when possible, to reduce reaction, as the tuning becomes easier, and distortion is less likely.

The reaction control serves as a volume control. Reduction of volume by turning the set to a less favourable angle for reception worsens the signal-to-noise ratio. After adjusting reaction, the tuning will require a slight readjustment since the controls are not independent.

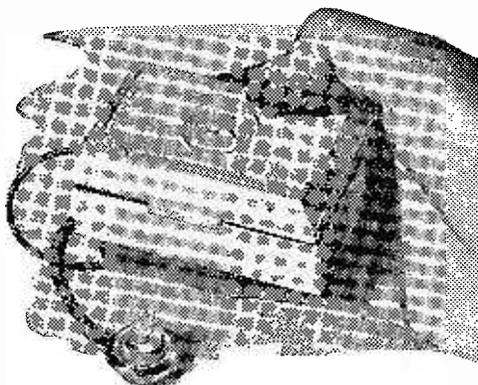


Rear view of

Coupled Star Receiver

FOUR TRANSISTORS, FOUR CAPACITORS AND
M A 1.5V BATTERY

By W. Cleland



Stabilising Circuit

It is unusual to attempt to stabilise the transistors in a receiver of this size, but the aim was to develop a fully stabilised circuit with only one electrolytic condenser instead of perhaps half a dozen. However, with the subminiature components now available, a miniature receiver with A.C. couplings presents few problems. A certain amount of simplification and economy can nevertheless be claimed for the type of circuit used in this receiver. Despite the stabilisation, it cannot be asserted that the receiver is completely insensitive to temperature changes. In cold weather it may be necessary to use a lower setting of the reaction control to avoid whistles.

The receiver is stabilised by feeding back to the input, in negative sense, a large part of the output D.C. level. The

accompanying A.C. feedback which would prevent any output from being obtained, is filtered out by means of an electrolytic condenser of 25 μ F. The effectiveness of the filtering decreases towards the lower audio frequencies and helps to offset the effect of the sharp selectivity curve upon the frequency response.

Quality

A more constant feedback with respect to frequency could be obtained by inserting a 10 Ω resistor in series with the 25 μ F condenser. This would improve the quality and reduce the effect of production spreads in the transistors, but a receiver using an earpiece works at a relatively low amplitude throughout, and negative feedback to reduce distortion should not be necessary.

Adding the 10 Ω series resistor would considerably decrease the volume above 500 c/s, making it necessary to increase reaction increasing the main sources of distortion (undue selectivity and detuning).

To obtain a large amount of stabilising feedback, the resistance of the 250 Ω earpiece was increased by adding a 450 Ω resistor in series, but with an earpiece of higher resistance, this resistor could be omitted, and a larger output obtained.

Tolerances

Stabilisation should assist in maintaining steady R.F. feedback conditions. It also implies that the resistors need not have exactly the values shown in the diagram, but with these values smoothly adjustable reaction is obtained. Reduction in the value of R2 would make the reaction unnecessarily strong. Reducing the value of C3 decreases the gain. The most influential values are those of R6 and R7, which determine the D.C. levels, and therefore the range of stabilisation, and these may have to be varied if changes elsewhere move conditions beyond the working range. With an unsuitable choice of values, the receiver may stop working in cold weather, the current drawn

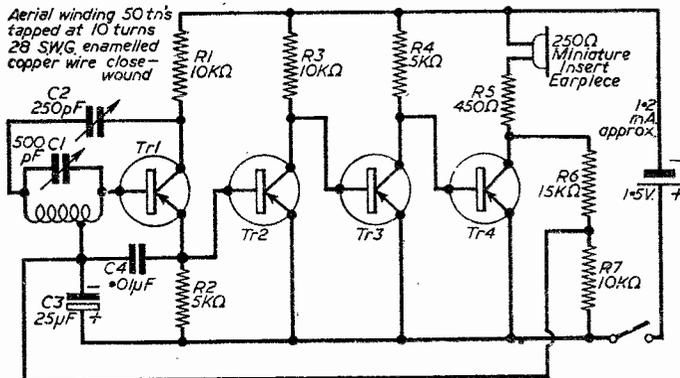


Fig. 1.—The complete circuit diagram.



the chassis.

TRANSMITTING TOPICS

THE MEANING OF THE TERM "STANDING WAVE RATIO (SWR)"

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



ONE of the current fashions is the reliance placed upon standing wave ratios. In fact the magic initials "SWR" are very frequently referred to these days, so much so that unless an aerial system is operating throughout with a "low SWR," the operator is firmly convinced that the inefficiency is appalling. It is possible in some quarters that undue reliance has been placed upon standing wave ratios, particularly as they are often not too fully understood.

Feeders

We can best see what all the fuss is about by remembering that the SWR refers to a feeder or transmission line as it is more grandly called. Now in the good old days of amateur radio, the only transmission line—or feeder—that was commonly used in amateur practice was one consisting of two parallel wires separated at intervals by spacers. The impedance of such a line is somewhere in the neighbourhood of five to six hundred ohms with usual construction.

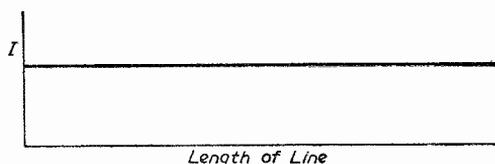


Fig. 1.—An ideal line of indefinitely great length has an SWR of unity. The current is uniform along its length.

In fact to get a "300 ohm line" one needs two wires rather closely spaced, and to get a line of much higher impedance than 600 ohms requires rather wide spacing. Thus the 500 and 600 ohm lines were taken as standards, and, in fact, many amateurs went to great pains to obtain the correct wire gauge and spacers of the correct width to make a line of 600 ohms characteristic impedance. As most of the aerial systems in use then were operated with "tuned feeders," i.e., with high standing wave ratios, the exact impedance of the feed line was not of great importance. In fact less fussy amateurs (including the writer) manufactured spacers from lengths of dowel rod boiled in paraffin wax to weatherproof it, screwing in eyelets at each end and threading lengths of the nearest handy gauge of wire lying around through the eyelets at either end of the dowels to produce a parallel wire transmission line. Many Zepp and similar aerials fed by such a line are in fact doing

Yeoman service at the writer's and many other amateur stations.

It should be noted by the purists, that on the usual amateur frequencies, open wire transmission line, even that manufactured by the dowel rod method, is quite a low loss affair. Coaxial cable has gradually obtained a reputation for being a highly efficient, modern and up-to-date type of transmission line. This reputation is not always justified. However, dipole and particularly beam aerials are very conveniently fed by coaxial cable, so that with the rise of such sophisticated types of transmission line, not to mention waveguides and similar devices, the "standing wave ratio" or "SWR" became a topic of importance.

Coaxial Cable

Ironically, one of the reasons, although not the only one, for SWR becoming of importance with the use of coaxial cable, is that losses are accentuated with a high SWR. With parallel wire open lines it is easy to make the losses so low that even a very high SWR may be tolerated without losses becoming unduly high. However with coaxial cable of the solid dielectric type or the semi-airspaced type used in amateur practice, the losses are appreciably higher, and a high SWR is definitely undesirable. Very low loss coaxial lines comparable in losses to open wire lines are, in fact, bulky and expensive affairs, sacrificing the convenience of the usual coaxial line in providing a flexible compact R.F. feeder that may be used to "pipe" radio frequency energy in a very convenient manner.

Coaxial feeder is here to stay, and accordingly it is necessary to pay attention to the SWR. Just

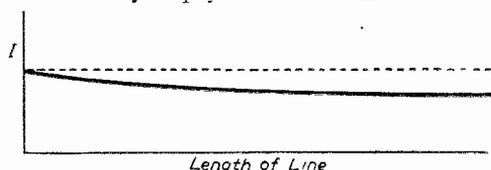


Fig. 2.—In a practical line, losses exist, so that the current gradually falls off with distance.

how much attention must be paid depends on circumstances. In order to see what is meant by SWR, and what importance it might have under various circumstances, let us consider the case of a perfectly matched line. Thus a 75 ohm coaxial line extending indefinitely (Fig. 1) is a "flat" line having an SWR figure of one. Thus if the current is measured anywhere along the line we find exactly the same value. This, of

course, is for an ideal line having no losses whatsoever. In practice, if we measure along a very long line, we find the current falls off owing to line losses absorbing R.F. energy (Fig. 2). Terminating a transmission line in a pure resistance exactly equal to its characteristic impedance does not alter the unity value for the SWR. That is because a resistance of 75 ohms simulates precisely the same load that a perfectly matched length of line presents. From the point of view of a transmitter supplying energy, a resistor of 75 ohms connected directly to its output, is exactly the same load as an infinite length of 75 ohm cable, or what is more akin to practice, a length of 75 ohm cable terminated in a 75 ohm resistor. If the cable has no losses and is perfectly matched, the load

the SWR. Conventionally, SWR's are all rated as greater than unity, so the ratio is taken to give a figure equal to or greater than one. Thus our 100 ohm cable terminated by 50 ohms will have an SWR equal to two, and again if we terminated this 100 ohm cable by 200 ohms we would still have an SWR of two. To see why we always take the SWR to be equal to or greater than one, consider the two cases in Fig. 5 in the next article. The current along the 100 ohm line varies from maximum to minimum at quarter wave intervals if we have an SWR greater than unity. In the two cases giving an SWR of two, that is with either a 50 ohm or a 200 ohm resistor terminating the line, the ratio of the minimum current position to the maximum current position is two. Thus the SWR measures the ratio of maximum and minimum current values in a line having standing waves. As can be seen from this, the SWR is a direct measure of the degree of mismatch; the larger the SWR, the further the load value is from the correct match.

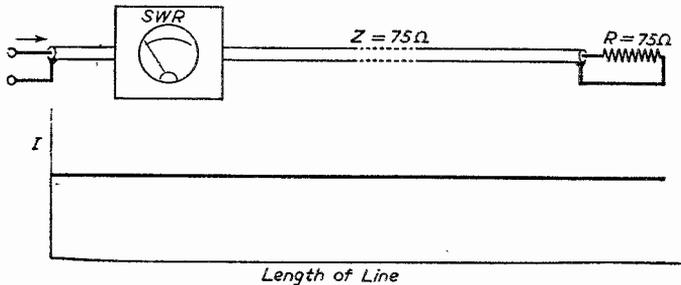


Fig. 3.—If a transmission line is terminated by a resistance equal to the impedance of the line, the SWR is still unity, and the current in the line is uniform.

resistor would receive the same amount of power whether it was connected directly to the transmitter, or connected through a long length of cable.

Unity SWR

This is generally appreciated. However some amateurs are under the impression that the transmitter loading affects the SWR of the cable. This is not so. Thus, provided the cable is operating with unity standing wave ratio, it does not matter whether it is heavily or lightly loaded into the transmitter. If power flows from the transmitter along the cable, and if the cable is correctly terminated for unity SWR, then no power will be reflected back along the cable. In fact unity SWR is the condition that all power travelling down the cable goes into the load connected at the far end, and none returns. A standing wave meter actually measures forward and reflected power. When no power is reflected the meter "reads" unity SWR. Therefore, of course, the "zero" of the meter is marked SWR 1.00, and there is no current actuating the meter at all (Fig. 3). Now if the line is not correctly terminated with a load equal to the impedance of the line, then power is reflected, and the current distribution along the line is not uniform (Fig. 4—given in the next article).

To make things easier, we will consider a cable with an impedance of 100 ohms. If we terminate this in an impedance of 50 ohms, we have an SWR of two. In fact the ratio of the impedance of the load to that of the cable gives

impedance of the line. In fact the load value changes with the length of line. That is fairly obvious from the fact that the current varies along a line having standing waves. Thus if the current at the transmitter end is less than the value it would have on the line when correctly terminated, the transmitter has to supply less current and more volts, which is equivalent to saying that the apparent impedance is higher. On the other hand if the line length is such as to bring the high current portion up to the transmitter, then the load presented to the transmitter is lower than the impedance of the line.

This variation of impedance presented to the transmitter when the transmission line is incorrectly terminated by a load differing from the impedance of the line may be quite a serious matter. Nowadays the Pi tank output circuit is a very popular transmitter circuit. The circuit constants are chosen to match into a specific line impedance such as 50 ohms or 75 ohms. Let us see what happens in the case of our 100 ohm line operated with an SWR of two. If we alter the length of the line, we will find that the impedance presented to the transmitter will vary from 50 ohms to 200 ohms. It does not matter whether we produce the SWR of two by terminating the line in 50 ohms or in 200 ohms, so long as the SWR is two. By altering the length of the line, we can produce any value of resistance between 50 ohms and 200 ohms at the transmitter end of the line.

(To be continued)

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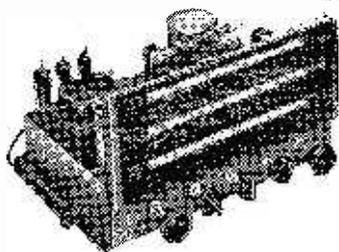
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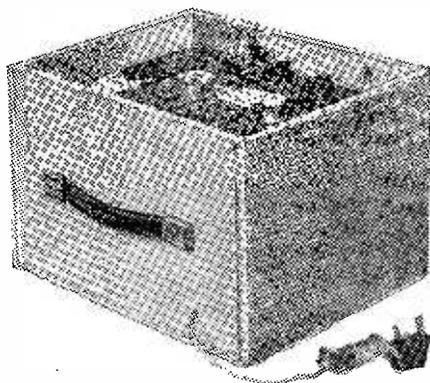
MAY/59

A Comprehensive Valve Tester

USING THE UNIT FOR VARIOUS TYPES OF VALVE

By F. Walker

(Continued from page 151 of the April issue)



THE 100 mA shunt was the first to be made. so that the meter read 50 mA F.S.D. Then the 10 mA shunt was made, making sure that the 100 mA shunt which had just been made was in series with it (see Fig. 8).

Next the 100 mA shunt was checked, and it was found that the meter read just over 100 mA F.S.D. A few turns were removed from the 100 mA shunt, so that the meter read just 100 mA F.S.D. When the meter is switched on the 100 mA range, the 10 mA shunt is in series with the movement. This is the reason why, when making the 100 mA shunt, it was adjusted to read 50 mA F.S.D. Enamelled copper wire, 36 s.w.g., was used for making the shunts.

Note: in all testing, if shorts are suspected, test with an ohm-meter first.

Rectifiers

Set the anode voltage selector to 25 v. (the lowest available), switch in the required heater voltage and insert the plugs according to the valve data book. Next, the valve is plugged in. Never try to test more than one section of a valve at a time. Thus, in a full-wave rectifier, each half is tested separately. The same applies to double triodes, triode-pentodes, etc.

Next the transformer and H.T. are switched on and the valve allowed to warm up. Some anode current should be registered. The anode voltage is now switched up until the full maximum current flows through the valve. This should be very low compared with the maximum R.M.S. anode voltage given in the data book. For instance, a U78 (approximate equivalent 6X4) had to have an anode-cathode P.D. of 25 v. to produce the maximum current of 70 mA, and the maximum R.M.S. anode voltage is stated as 350 v. The P.D. read on the tester represents the drop which occurs when the valve is passing the maximum anode current.

Triodes

The appropriate plugs are inserted, and the control grid, heater and anode voltages are set. The gas switch is opened, and the H.T. and transformer switched on. Observe the anode current. If the data book shows that the anode current is more than 10 mA, the tester is set to the 100. mA range. The "goodness" of a valve can be expressed as a percentage, i.e., "goodness" equals anode current on meter ÷ anode current from data book all multiplied by 100 per cent.

This is the emission test, and is usually a satisfactory test of

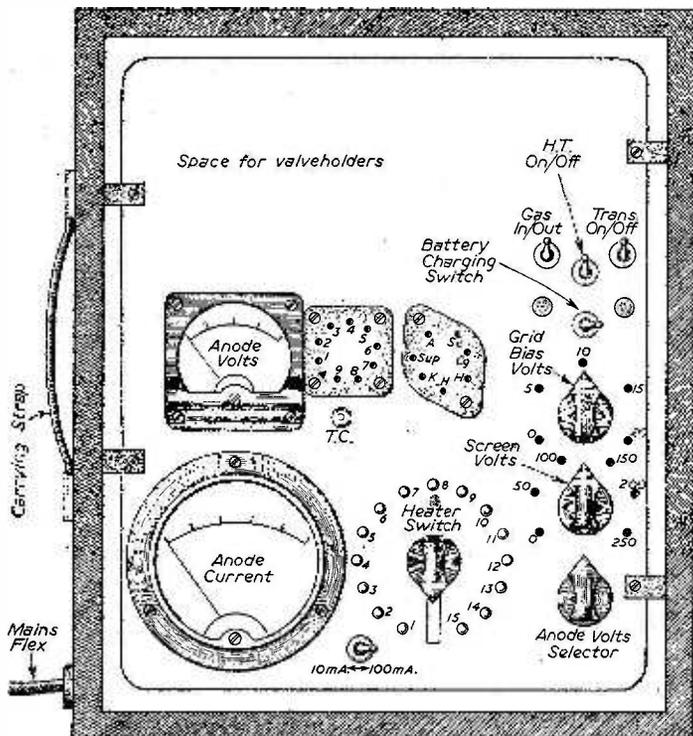


Fig. 5.—The control panel of the tester.

the valve. If gm is to be measured, do it as stated earlier.

Pentodes and Beam Tetrodes

This test is the same as for triodes, except that the screen grid is connected. The suppressor is connected to cathode.

Diodes

Apply the appropriate heater voltage and test with an ohm-meter between anode and cathode. The reading should be in the region of 1,000 ohms with a 1½ v. supply.

Testing Battery Valves.

Great care should be taken when testing to see that the electrode voltages are correct. The modern 25 mA valves are very easily damaged.

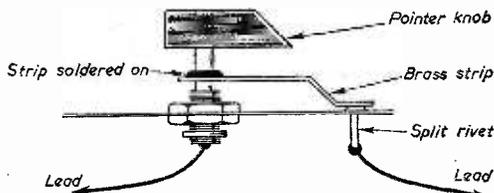


Fig. 6.—The construction of the heater switch.

Hints and Tips

When building the prototype, it was found that another chassis was needed below the front panel to mount the transformer, the two metal rectifiers, the chain of 470 ohm resistors (which were mounted on a tag board) and the electrolytic reservoir capacitor. The EA50 diode and the associated smoothing capacitors were mounted on some spare tags on the transformer tag board.

To calibrate, a multimeter is required. As can be seen from the diagram (Fig. 5), the screen potentiometer is marked every 50 volts, and the

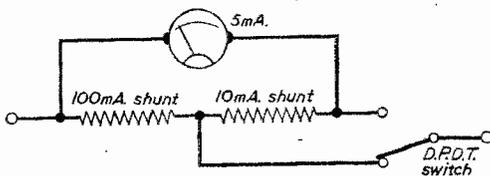


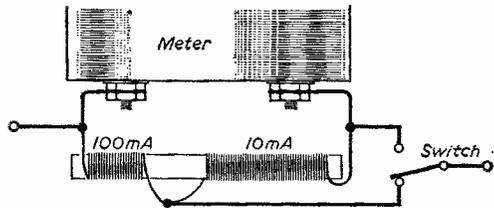
Fig. 7.—Circuit for shunting the meter.

bias potentiometer every 5 volts. Markings on the panel can be made very simply by drilling a shallow hole on the Perspex with a 1/16in. drill and filling it with white or any colour paint. Thus a coloured spot is produced. Alternatively, a circle can be scratched out around the potentiometer with a pair of dividers (this must be done before the hole for the mounting bush is drilled, of course), and scratches made on the circle. (See Fig. 9.)

The 150 kΩ potentiometer in series with the anode voltage meter was adjusted while the tester was working with the multimeter, set to 250 v. D.C., clipped across the meter and potentiometer. Care was taken to see that the resistance of the potentiometer was at maximum before adjusting.

Suppression of Parasitic Oscillations

When testing high-slope valves, e.g., EF50, there is a great tendency for parasitic oscillations to be set up owing to feedback from anode to grid of the valve under test. To stop the valve from doing this, suppression capacitors of .1 μF



Leads must be secured very tightly under the meter terminals

Fig. 8.—Wiring the shunts in position.

250 v.w. in value may be wired from grid to cathode of the valve, directly on to the valve socket, e.g., pins 5 and 8 of the octal types.

The number of valve bases the constructor puts on the panel is a matter for his own needs. There is enough space to mount all 14 of them, and this was done in the prototype.

The plastic type of holder is much better than the paxolin.

A cabinet was made out of mahogany plywood, and four rubber feet were screwed to the base. A mains lead, with a 3-pin plug on the end (arranged so that the neutral

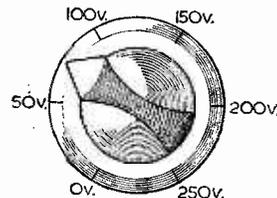


Fig. 9.—One way of marking the panel.

line was connected to the chassis), passed through a rubber grommetted hole in one of the chassis walls.

Referring to Fig. 1 on page 148 of last month's issue, it should be noted that the cathode pin should be connected to the neutral mains input line, and the cathode of the EA50 should be joined to point 8 on the mains transformer, not point 13.

The completed unit can be used not only for testing valves but also to plot the characteristics of an amplifying valve, and it can measure resistance if the unknown resistor is placed between anode and cathode sockets on the tester. The voltage across the resistor and the current through it are observed, and a simple application of Ohm's law will give the result in ohms. The tester will operate as a power pack.

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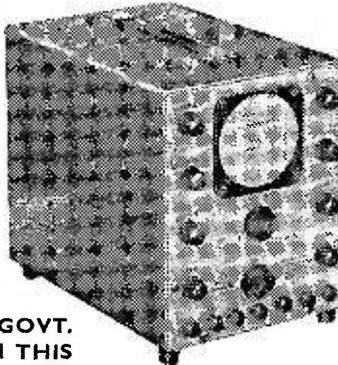
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Basic Theory for the Constructor

No. 4.—PRACTICAL PROBLEMS INVOLVING HEATER CHAINS

By G. Palmer

WE are now in a position to apply our knowledge gained from the previous articles to actual radio circuits. The simple series-connected heater circuit, such as that depicted in Fig. 1, often presents problems to the beginner. However, he should not now find himself unable to calculate the value required for the resistance R, given the types of the valves in the circuit and knowing the voltage of the mains supply. Incidentally, this resistor is usually referred to as the mains dropper or "ballast" resistor, its sole purpose being to develop across it that voltage which is the difference between the mains voltage and the sum total voltage of all the valve heaters connected in series.

If there were no resistor, then the full mains voltage would be applied across the series-

Any valve designed for series heater connection can be connected in series with any other such valve, irrespective of the heater voltages, provided the heater currents match. The valves mentioned above, even though they have a range of voltages, can be connected in the same series heater chain without any trouble at all.

Correct Voltage Automatically Secured

As soon as the heater chain current equals the common current value of the heaters, then automatically the voltage is correct across each individual heater. There is no worry at all about this provided the heaters are in good order and not partially short-circuiting.

Trouble starts if a valve whose heater does not match the common value is inserted in the circuit. Consider an 0.2 amp. heater chain into which has been inserted a valve with an 0.3 amp. heater. The current in the chain is controlled by the mains dropper valve and by the valve heaters themselves. Since only one valve with a differing heater voltage is introduced, the chain current will be maintained essentially at 0.2 amp. The 0.2 amp. valves will, therefore, light normally, but the 0.3 amp. valve, since it is passing only 0.2 amp., will be starved of current in the terms of 0.1 amp. It will light, but not very brightly, and, in fact, it may allow the set to operate after a fashion provided the type is correct; but since the heater is under-run the symptom of low emission will be exhibited in most cases.

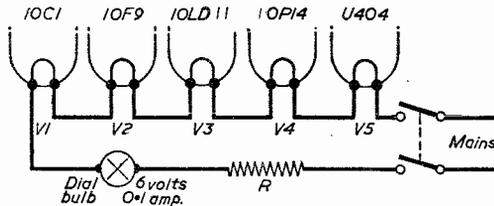


Fig. 1.—A simple series-connected heater circuit.

connected heaters and, unless the heater voltages equalled in total the mains voltage—which is unlikely—the heaters of the valves would be overloaded. The weakest of the chain would fuse, and since they are connected in series the remainder would also go out.

From our previous discussions of series-connected circuits, we discovered that the current in each element of the circuit is always the same, though the voltages developed across each element may well not be the same, being governed by the resistance of the element.

This reasoning applies also to series-connected valve heaters. Valves designed for series heater connection often have curious heater voltages, but this is of little consequence provided the heater current value is a reasonable figure which can easily be matched by the other valves in the receiver. Common current values are 0.1 amp., 0.15 amp., 0.2 amp. and 0.3 amp. Although a large number of the 0.3 amp. series have heaters rated at 6.3 volts, valves of other heater ratings have a diversity of heater voltages. For example, the Mazda 20D1 has a heater rated at 9.5 volts, the Mazda 20F2 at 11 volts, the Mazda 20P1 at 38 volts and so on, these all being of the 0.2 amp. series.

The Question of Resistance

Valve heaters have resistance. The resistance is not wholly constant since temperature increase causes it to rise. The heater is said to have a positive temperature co-efficient of resistance—it would be a negative temperature co-efficient if the resistance decreased with temperature increase.

Let us consider a 6.3 volt 0.3 amp. heater. Remember, when it is passing 0.3 amp., the voltage across it is 6.3. This, then, means that at its normal working temperature the heater resistance

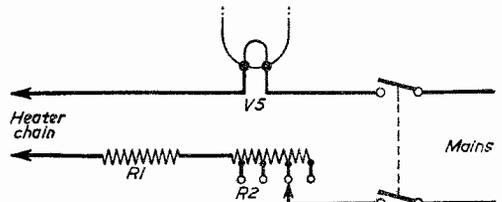


Fig. 2.—A method of voltage adjustment is usually provided with a tapped resistor such as R2.

is equal to $6.3/0.3$ ($R=E/I$), which is easily worked out to 21 ohms. If it is assumed that this value remains the same even when only 0.2 amp. is passing through the heater (it will in practice be less, as we have just observed), we can obtain some idea of what the voltage across the heater would be if it was introduced into an 0.2 amp. heater chain. The $E=I \times R$ formula is in this case called for; the calculation being 0.2×21 , which gives 4.2 volts. This reveals how an 0.3 amp. 6.3 volt valve would be under-run when introduced into an 0.2 amp. heater chain. In effect, the voltage would probably be less, since at the lower temperature the heater resistance would be less.

Calculating the Value of R

This calculation should now present no difficulty whatever, since it is just the application of Ohm's law. First, however, it is necessary to find out the heater voltages of the valves from a valve data book.

In Fig. 1, V1 is a 10C1 with a heater voltage of 28, V2 a 10F9, 13 volts; V3 a 10LD11, 15 volts; V4 a 10P14, 40 volts; and V5 a U404, also 40

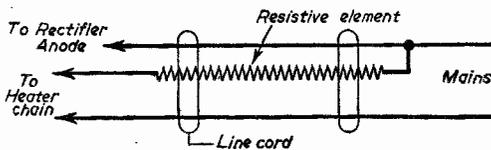


Fig. 3.—The mains dropping resistor in a line-cord is wound along the length of the cord on a flexible heat-resisting former. Also in the cord are two ordinary conductors.

volts. The data booklet shows that all these valves have 0.1 amp. heaters. If a dial bulb is used in the series circuit, then this also must be taken into consideration and its current should also match that of the valve heaters unless it is shunted with a resistor of some kind.

Including the 6 volts required by the dial bulb, the series heater chain voltage amounts to 142, by simple addition. Now, for the sake of simplicity of explanation, let us suppose that the mains supply is 242 volts. From this is subtracted the 142 volts of the heater chain, leaving exactly 100 volts to be eliminated by the mains dropper R. Thus, knowing the voltage to be dropped and the chain current, it is a simple exercise to find the value for R; $R=E/I$, which is $100/0.1$, or exactly 1,000 ohms. In practice, the arithmetic is rarely as simple as this, but the principle is identical.

With the circuit so balanced a few tests with a voltmeter would show that the voltage across the valve heaters and the dial bulb is exactly as it should be, as also the voltage dropped by R. However, when checking the heater chain for balance, it is desirable to make a test of the series current with a suitable meter, for if this is correct, then, as we have seen, the voltage across the heaters and bulb is bound to be correct. Adjustment to the value of R, if this is necessary, should thus be made to provide the current reading as demanded by the valves.

Even though this current is correct, it may in odd cases be discovered later that the voltage across a certain heater is incorrect. When this happens the trouble is due to the heater, which has either increased or decreased in resistance; in the latter case the voltage would be low and in the former case it would be high. The only real remedy lies in replacing the defective valve, which may well be exhibiting other fault symptoms.

A.C. or D.C.

Most sets with series heater chains are of the A.C./D.C. kind, and from the point of view of the calculations which we have been considering there is no difference in either case. With A.C., the calculation is based on the R.M.S. (root mean square) value of the mains voltage, for it is this value which has the same heating characteristic as a D.C. voltage of the same magnitude.

Voltage Adjustment

In addition to the mains dropper or ballast resistor, or being a part of it, is usually a resistor which is tapped along its length to provide slight alterations in resistance to suit a range of mains voltages. The idea is shown in Fig. 2, in which R1 is the ordinary dropper and R2 is the mains selector resistor. The resistance between the taps is usually of the order of 50-100 ohms to give steps of 10-20 volts over the range 200-250 volts. For example, 100 ohms in a 0.2 amp. heater chain would drop 20 volts.

This does not always apply to sets which use a line-cord resistance. In such receivers, the dropper is wound along the length of the mains lead, on a special heat-resisting cord. In the lead are also two ordinary conductors (one in some line-cords), one to supply the heater return circuit and the other to carry mains to the rectifier anode (see Fig. 3).

Line-cords are designed for a diversity of heater currents, 0.3 amp., 0.2 amp., 0.15 amp. and 0.1 amp. cords being readily available. There are also special types which may have taps to supply a dial bulb or the rectifier anode or both. They have a certain resistance per unit length: typical values being 180 ohms per yard with 0.3 amp. cord and 450 ohms per yard with 0.1 amp. cord, but this varies between different types.

The calculation of line-cord resistance should wherever possible be based on the voltage of the mains on which the receiver will normally be used.

Wattage Rating of R

Since the mains dropper is called upon to drop a relatively high voltage in most cases, and because there is quite a high current, the resistor is bound to operate at a high temperature. In the case of the first problem in Fig. 1, in which R would drop 100 volts at 0.1 amp., the resistor would have to be rated to dissipate at least 10 watts. We will recall that $W = I^2 \times R$ or $E \times I$, thus in Fig. 1, $W = 0.1^2 \times 1,000$, which is 10 watts.

(To be continued)

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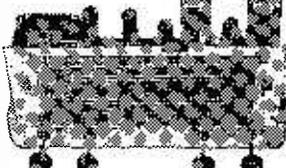
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6BW6	10/6	12BE6	10/6	EF80	10/6 SP61 5/6
9D6	7/6	12K7	8/6	EF91	8/6 UBC41 10/6
9F6G	7/6	12Q7	8/6	EF92	5/6 UCH42 10/6
916	3/6	313L8	9/6	EL22	5/6 U741 10/6
935	6/6	325A	4/6	EL84	10/6 U741 10/6
6J9	7/6	80	10/6	EM81	12/6 U741 10/6
6J7G	8/6	807	6/6	EZ40	5/6 UC22 10/6
6K6GT	8/6	85A1	1/6	EZ80	9/6 VBI05 8/6
6K7G	5/6	EA50	1/6	VR148	1/6 VR150 8/6

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£9.10.0 Carr. & Ins. 4/6.

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TRANSISTORS, GENUINE PVE GOLTOP, Audio, 10/-, R.F. (3 Mc/s) amplifier, 18/-, Handy, 20/-, Complete data sheets supplied.

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AUDIO PERFECTION

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Long spindles. Guaranteed 1 year. Midget 5 1/2 ohms to 2 meg. No Sw. D.P.-Sw. 3/- 4/9
Linear or Log Tracks. Air spaced.

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DOUBLE SOCKET ... 1/3

SCOCKETS ... 1/-

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WIRE-WOUND POTS, 8 WATT, Preset Min. T.V. Type. All values 25 ohms to 25 k. 3/- ea. 30 k, 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. 6/6; 30 k, 7/6

CONDENSERS, New Stock. .001 mfd. 7 kV, T.C.C., 5/6; Ditto, 20 kV., 9/6; 100 pF. to 500 pF. Micas, 6d.; Tubular 500 v., .001 to .01 mfd., 5d.; .05, 1, 1 1/2, 2, 10, 5/6; 2530 v., 1/9; 1,310 v., 1d.; .012, 0.000 v., 1/9; .1 mfd., 2,000 volts, 3/6

CERAMIC CONDS., 500 v., 3 pF. to .01 mfd., 9d.

SILVER MICA CONDENSERS, 10% to 5% to 100 pF., 1/-; 600 pF. to 3,000 pF., 1/3. Close tolerance (.±1 pF.) 1.5 pF. to 47 pF., 1/6. Ditto 10% 50 pF. to 815 pF., 1/9; 1,600 pF. to 5,000 pF., 2/-.

I.F. TRANSFORMERS 7/6 pair.

465 Kc/ Sec Tuning Miniature Can. 2 1/2in. x 1 1/2in. In. High Q and good lan. w. a. t. h. By Pye Radio. Data sheet supplied.

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8/500V. 2/9 4, 8, 450V. 4/6 2, 500, 8V. 4/-

16/450V. 3/6 8, 4, 500V. 5/- 6,000, 6V. 5/-

16,500V. 4/- 8, 16, 4,500V. 5/- 32 + 32, 350V. 4/6

32,450V. 5/6 8, 16, 5,000V. 5/6 50 + 50, 350V. 7/6

25,25V. 1/9 16 + 16, 450V. 5/6 64 + 120, 27V. 7/6

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SEMI-REEL RECTIFIERS. E.H.T. TYPE FLYBACK VOLTAGE. K3, 2 1/2 kv., 5/-; K3/40 3.2 kv., 7/-; K3/43, 3.6 kv., 7/6; K3/50 4 kv., 8/-; K3/100 8 kv., 14/6; 20 c.p.s. voltage, 30% of above.

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T.R.F. COILS A/H/F, 7/- pair. H.F. CHOKES, 2/6.

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Spare Power for Tuner, etc., 27/1.6.

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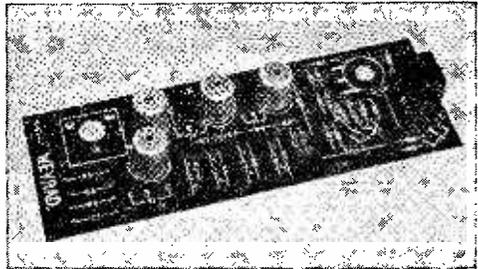
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EAF42 10/-	EY31 10/-	15/8	W142 9/-	6SL7GT
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ECC81 8/6	EZ80 8/-	PL21 17/3	Z152 8/6	8D3 8/6
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EF42 13/-	MSP4 15/-	UCH42	6F12 8/6	35Z4GT
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Quotations given for any types not listed. Obsolete and old types a speciality.



BLACKPOOL & FYLDE AMATEUR RADIO SOCIETY

Hon. Sec. : H. G. Newland, Penrose Avenue, Marton, Blackpool.

ABOUT 50 of the local "hams" are members of the above Club, which has recently opened permanent headquarters at Squires Gate Holiday Camp. About 25 members have transmitting licences. There is also a lady member, Miss Dora Legda, who joins enthusiastically in the club activities. At the new headquarters members meet every Tuesday night, and they plan to have more frequent meetings in the future and to build, install and operate a club transmitting station.

BRADFORD AMATEUR RADIO SOCIETY

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

DURING January we had a very interesting lecture on "Colour Television" by Dr. G. N. Patchett, Head of Department of Electrical Engineering at Bradford Institute of Technology. The meeting was enhanced by demonstrations, and the equipment was open for inspection after the meeting. We opened the meeting to local electrical, radio and television firms and societies and to Bradford schools, and an attendance of nearly 250 was reached.

Another interesting meeting was held in February when D. M. Pratt (G3KEP) lectured on transmitter design and construction.

In March we had a junk sale, and the Annual General Meeting was also held in March.

Future events are a lecture on "Stereophonic Sound" (April 7th), and a visit to Esholt Sewage Works (April 21st), while on May 5th we are discussing Field Day arrangements.

Meetings are held at 7.30 p.m. at "Cambridge House," 66, Little Horton Lane, Bradford, 5. Anyone interested in radio and/or television is very welcome to attend.

THE BRITISH INSTITUTION OF RADIO ENGINEERS

THE following Institution meetings will be held during April and May :

Tuesday, April 7th—6.30 p.m. (London Computer Group). Symposium on "Large Capacity Storage Systems," at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1.

Wednesday, April 8th—6 p.m. (North-Eastern Section). "Radio Exploration of the Galaxy," by J. Baldwin, Ph.D., at the Institution of Mining and Mechanical Engineers, Neville Hall, Westgate, Newcastle-upon-Tyne.

Thursday, April 16th—6.30 p.m. (London Radar Group). Inaugural Meeting, at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1.

Friday, April 17th—6.30 p.m. (Scottish Section). Annual General Meeting at the Department of Natural Philosophy, The University, Drummond Street, Edinburgh. 7.30 p.m. "Stereophonic Sound and Electrostatic Loudspeakers." A demonstration and informal lecture by D. T. N. Williamson, also at Edinburgh.

Wednesday, April 22nd—7 p.m. (Merseyside Section). Annual General Meeting of the Section, at the University Club, Liverpool.

Wednesday, April 22nd—6.30 p.m. (London Section). "The Application of Magnetic Resonance to Solid State Electronics," by D. J. E. Ingram, Ph.D., at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1.

Tuesday, April 28th—6.30 p.m. (London Section). "Two Papers on "Electron Microphony," by Prof. G. Causey and R. S. Page, at London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1.

Friday, May 1st—7 p.m. (South Midlands Section). "Transistor Amplifiers," by F. Butler, M.Sc. (Member), at North Gloucestershire Technical College, Cheltenham.

Tuesday, May 5th—6.30 p.m. (London Section). "An Experimental Diode Parametric Amplifier and Its Properties," by I. M. Ross, C. P. Lea-Wilson, A. J. Monk and A. F. H. Thomson, at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1.

Wednesday, May 13th—6.30 p.m. (London Section). "Improving Communication Techniques—What Have Engineers To Learn

From Information Theory?" by Prof. D. Gabor, F.R.S., at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY

(Affiliated to R.S.G.B.) Incorporating Derby Wireless Club (1911)
Hon. Sec. : F. C. Ward (G2CVV), 5, Uplands Avenue, Littleover, Derby.

OFFICERS elected at the Annual General Meeting held on Feb. 4th were : chairman, T. Darn (G3FGY) ; treasurer, H. Shaw ; secretary, F. C. Ward (G2CVV) ; committee, Messrs. C. M. Swift (G3IUK), F. Clay (G3IBL), B. J. C. Brown (G3JFD), A. Hitchcock (G3ESB), S. Swindle (G3NGV) and a junior member, Martin Shardlow. It was reported that the membership was the highest ever, there being 120 fully paid at the year end. The financial position was very sound, the majority of the assets being cash at the bank. The president, Mr. A. G. G. Melville, F.R.C.S.E., presented certificates to Martin Shardlow, being the winner of the G5YY trophy for the most meritorious entry in the local 40-metre contest held on Jan. 11th last, and to N. Birkett (G3EKX), winner of the president's trophy for the 1958 Direction Finding Contest. The trophies were presented at the annual dinner on March 6th. The society welcomes any enthusiasts and a programme will be forwarded to any reader on receipt of a request. Weekly meetings are held throughout the year, the first Wednesday in each month being devoted to a surplus sale, the second Wednesday a talk or lecture of topical interest, and the last Wednesday being devoted to an experiment for the benefit of beginners. Other evenings are set aside for visits and/or open nights with the club transmitter. The headquarters and club room are School of Arts and Crafts, Green Lane, Derby.

Some future events are listed below.

April 22nd.—Talk and Demonstration on Single Sideband, J. Curnow (G6CW).

April 29th.—Beginners' Demonstration.

May 3rd.—R.S.G.B. First 144 Mc/s Field Day C.W.

May 6th.—Surplus Sale.

May 13th.—Direction Finding Practice Run—7.30 p.m.—9.30 p.m.

May 20th.—Open night.

May 27th.—Beginners' Demonstration.

HALIFAX & DISTRICT AMATEUR RADIO SOCIETY

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

AT the monthly meeting of the above Society, held on February 3rd, at the "Sportsman Inn," Ogden, Mr. M. Whittaker (G31GW), gave a very interesting talk on DXpedition. The March meeting was in the form of a lecture by Mr. Falkys, of Fane Electronics Ltd., on "Hi-Fi." A quiz on licence conditions will take place in April.

Future meetings are as follow :

May.—Junk Sale.

June.—Recorded lecture on Aerials.

July.—Open Night.

August.—Annual Meeting.

FLINTSHIRE RADIO SOCIETY

Hon. Sec. : J. T. Lawrence, 9, East Avenue, Bryn Newydd, Prestatyn, Flintshire.

THE Annual General Meeting of the above was held on Monday, February 2nd, at the Railway Hotel, Prestatyn. Mr. F. G. Southworth, the retiring Chairman, in addressing the meeting, said that the past year had been a very successful one. In his résumé of the Society's activities he thanked the Officers and Committee Members for their regular attendance at all the committee meetings and for their efforts in arranging such a varied and interesting programme. "It was a pity," he said, "that a greater percentage of the total membership did not attend regularly at the normal monthly meetings."

Mr. J. Thornton Lawrence, the Hon. Sec., gave a detailed report of the many lectures, film meetings and outside visits to places of technical interest and was followed by Mr. Peter F. Jones, Hon. Treasurer, who gave his report and presented a balance sheet for the past year.

The election of officers then took place with results as follows : Chairman, D. C. Morris, GW2FVZ, Caerwys ; Hon. Sec., J. Thornton Lawrence, GW3JGA, Prestatyn ; and Hon. Treasurer, Peter F. Jones, GW3FPF, Rhyl. After taking two votes to eliminate a tie, the following committee members were elected : H. T. Jones, Rhyl ; W. Davies, Prestatyn ; and E. L. Jones, GW3JJI, Rhyl.

Following a suggestion by the Hon. Sec. it was agreed by all members that Mr. F. G. Southworth be invited to become the Society's first President. In replying, Mr. Southworth said that he would be pleased and honoured to accept. It was agreed that meetings continue to be held on the first Monday in each month and a new Programme of Forthcoming Events would be circulated to all members and their friends as soon as the new Committee had completed final arrangements. In closing the meeting, the Chairman welcomed new members and thanked existing members for their support.

THE LONDON SHORT WAVE CLUB

Hon. Sec. : K. R. Piper (G3LOO), 2, Catherina Terrace, Stockwell, S.W.8.

THE Club is organising a large scale rally on September 6th, at the Festival Gardens, Battersea Park. The full programme will be announced later, but we are planning this on the scale of a national rally, with quite a few added attractions which are normally outside the scope of the local rallies. Not the least of these is that we are able for the first time to cater for Maritime Mobile stations, and moorings are reserved for any /MM stations attending. Also the funfair will be in full swing, and this should provide an attraction for the wives and juniors.

We hope to have at least one /MM station of our own in operation in addition to three fixed stations in the grounds ; two of these will be control stations for talk-in purposes, and will operate on the 160 metre and 2 metre bands, the other will operate on the DX bands with a call sign in the GB2 series to be announced. There will be plenty of contests for the rallyists, and at least one for overseas contestants.

There will be a commemorative programme containing amongst other things details of contests, and entry form for same, a windscreen sticker, and a pass for concession tickets to the funfair, also there will be a map showing the major approaches. This will be available later about May ; price will probably be 6d. only.

RINGWOOD & DISTRICT RADIO CLUB

Hon. Sec. : R. S. Hodgson, 4, Westmoors Road, Three Cross, Wimborne, Dorset.

MEETINGS are held every Wednesday at 7.30 p.m., at 23, Merryweather Estate, Ringwood. A warm welcome is extended to anyone who has an interest in radio and/or electronics. The annual subscription is 10s., with a special reduction for those under 18 years.

LUTON & DISTRICT RADIO SOCIETY

Hon. Sec. : D. BaVister, 70, Crawley Green Road, Luton, Beds.

THE Club continues to meet every Monday night at 8, as it has done except for school holidays since it was formed in April, 1947. New members are welcome as well as older ones, whose reappearances are always equally welcome.

The club owns its own equipment, consisting of a large tent, four collapsible steel masts in bags, BC.348, TX, and P/E generator, etc., and assists the R.S.G.B. members on National Field Day and various two-metre contests in conjunction with local licensed amateurs. Occasionally a local "ham" operates a

/A call-sign from the club headquarters, but normally organised evenings end up in a talk.

Our biggest difficulty is to get lecturers on radio and electronic subjects, and any suggestions in this line would be appreciated.

SPEN VALLEY AMATEUR RADIO SOCIETY

Hon. Sec. : Norman Pride, 100, Raikes Lane, Birstall, nr. Leeds.

THE Club's headquarters are at the George Hotel, Cleckheaton, where we rent a room every other Wednesday. We thus meet fortnightly at 7.30 p.m. The annual subscription is 10s., with junior membership at 2s. 6d per annum and an associate membership at 2s. 6d.

The associate membership attracts members from roughly a 20-mile radius owing to our varied syllabus. People often like to come to one or two meetings in which they have particular interest, yet cannot attend regularly. To prevent them feeling "outsiders," we enrol them as associates. They are thus part-time members, but have no voting powers. They also have priority in works visits and trips, etc. Moreover, they receive all literature sent to the club for distribution and some 30 to 40 people like to be known as Spen Valley members, although they cannot attend regularly. In fact, some only come for the Annual Dinner. They consider that 2s. 6d. a year is worth it. Membership qualification is to be interested in radio or television.

Our accounts are duly audited each year and at the A.G.M. the Treasurer gives his report and certificate of audit.

We have been in continuous existence since 1946 with the original Treasurer still in office and have never had a balance sheet challenged.

We have a Social Secretary elected each year whose duty is to arrange the Annual Dinner. This was held in January at the Kingsway Cafe, Dewsbury ; 54 members and wives sat down to dinner. The guest speaker was Mr. I. C. I. Lamb, engineer-in-charge of the I.T.A. transmitter at Emley Moor and formerly G6LD. At the dinner the Swindon Cup was presented to Mr. H. Brooke (G3GJV/M) for his work on behalf of the Club at the 1958 Northern Mobile Rally at Harewood House.

For our annual trip we are literally treading fresh ground. On Sunday, June 6th, we embark on a motor-barge at Bingley and proceed up the River Aire to Skipton. Lunch and a look round Skipton Castle and return to Bingley. A mobile transmitter will be worked from the barge and we are hoping to have 60 to 80 on this novel trip. We work in close co-operation with the Leeds, Bradford, and Leeds University Union Radio Clubs.

We have been having demonstrations of colour TV for the last five years from Dr. G. N. Patchett, of Bradford Tech, who is one of our honorary members.

A MASTER RELAY UNIT

(Continued from page 217)

audio amplifier used in combination with the record player which in turn provides the third programme offered by this system. Should the output from a tape recorder rather than that from a record player be required here, then it is probable that some additional gain will be required together with some equalisation. The provision of such a stage is left to the discretion of the reader; an output of approximately 150 mV. is ample to drive the amplifier shown in the circuit. A full wave rectifier is used to supply H.T. to the system, the smoothing being effected by a resistance capacitance filter.

Power Output Stages

For the reader who requires loudspeaker outputs rather than using headphones then each output stage must be capable of delivering power. Consequently power tetodes capable of delivering suffi-

cient power for the number of speakers used must be substituted in the cathode follower stages.

The H.T. requirements for three such power stages make the power supply circuit included in Fig. 1(a) inadequate. Consequently a suitable power supply will be given later.

(To be continued)

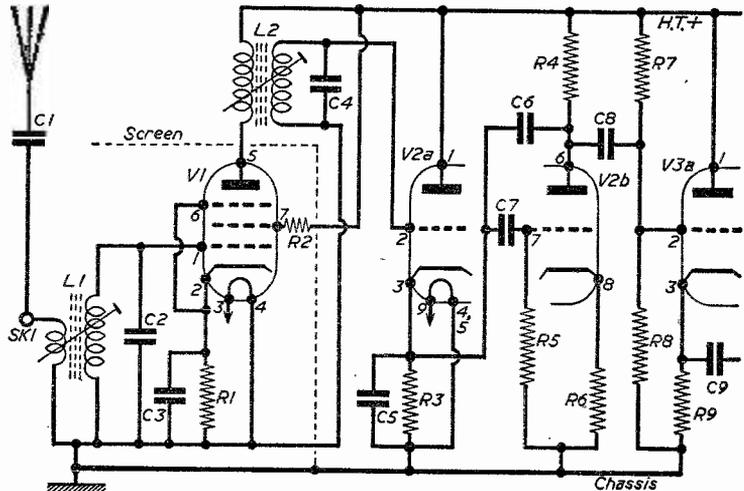


Fig. 2.—Circuit of one of the radio receivers shown in Fig. 1(b).

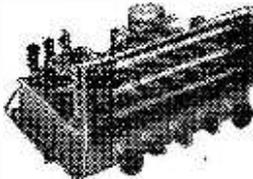
HOME RADIO OF MITCHAM

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We are stockists for:—EDDYSTONE, PANDA, ARMSTRONG, DULCI, DENCO, JACKSON BROS., WB STENTORIAN, REPANCO, TELETRON, GOODMANS, OSMOR, WHARFEDALE, GRAYSHAW, JASON, LINEAR, BULGIN, etc., etc.

ARMSTRONG



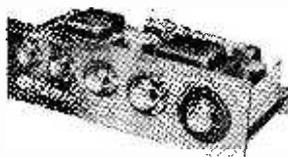
PB409.—9 valves. Long, medium, short, and F.M. bass and treble controls, push-pull output 28 gns.
Jubi ee.—9 valves. Long, medium, and F.M. with auto control. Treble and bass controls, push-pull output. 29 gns.
AF105.—10 valves. Long, medium, 2 shorts, and F.M. treble and bass controls. 10 watts push-pull output. 35 gns.
Stereo Twelve.—12 valves, push-pull. Long, medium, and F.M. 37 gns.

EMPRESS



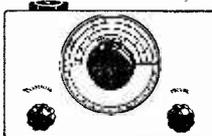
Model SS8.—Stereophonic radiogram chassis. 8 valves. Long, medium, and F.M. Bass and treble controls. A.C. mains. Size 15in. x 6½in. x 7½in. Price 27 gns.
Model SA4.—Amazing value for a full stereophonic amplifier. 3½ watts each channel. Tone, volume and balance controls. A.C. mains. Size 12in. x 3in. x 5½in. Price £8.
 Delivery from stock. 2/6 carriage. Leaflet on request.

PYE MOZART



Brilliant new 10-watt high-fidelity amplifier. Compact, easy to instal, the Pye Mozart has a commanding lead in technical quality. PRICE 22 gns.
Mozart F.M. Tuner.—Matching unit to the amplifier. FM,VHF with automatic frequency control. Smart streamlined appearance. PRICE 22 gns.
 Metal covers available for both units. Delivery from stock. 2/6 carriage. Call for demonstration or write for leaflets.

BATTERY SHORT-WAVE KITS



We now stock the R.C.S. short-wave and personal portable battery sets.
Model SW1.—1 valve short-wave set with coil for 20 to 40 metres. Can be increased to 2 or 3 valves and additional coils available. 1-valve kit, 35/-; 2-valve kit, 42/6.
Model PP2.—2-valve personal portable with rod aerial. Medium waves. All-dry battery operation. Kit 35/-.

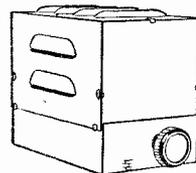
NEW EDDYSTONE DIAL



A new high-grade dial for short-wave receivers, converters, test equipment, etc. Gear driven and flywheel loaded smooth, positive movement with a reduction ratio of 110 to 1. Vernier scale gives 500 divisions for each traverse of pointer. The finest dial of its kind. Leaflet on request. Delivery from stock. PRICE 58/-.

DENCO 3-WATT AMPLIFIER KIT

Ideal amplifier for gramophone or FM tuner. 3 watts high quality output and power available for supplying tuner. Complete in an attractive bronze finished metal case with single control for switch and volume. Complete kit including output transformer for 3-ohm speaker, £5.5.0, plus 2/6 post. Building instructions in Denco DTB8. PRICE 1/9, post paid. Call for demonstration.



SPECIAL OFFER

16 mfd. 350 v. miniature tubular condensers by famous maker. Size 2 in. x 1in. ONLY 1/- EACH (Add 6d. postage on all orders).



G.P.O. pattern jack sockets. Brand new and well made in brass with extra contacts for switching. OUR PRICE 1/- EACH (Add 6d. postage to all orders).

BAKER'S HIGH-FIDELITY 12in. SPEAKERS



"The choice of the Connoisseur." Rigid die cast chassis and massive high flux magnets. First and foremost in the field of high quality moving coil loudspeakers. Every one fully rust and damp proofed and completely tropicalised.
 12in. Stalwart with foam suspension. £6/15/0, plus 3/6 post.
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 Send 6d. stamp for full specifications or call for demonstration.



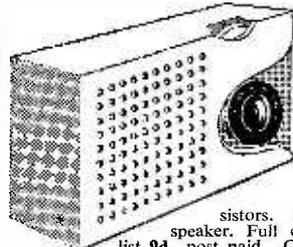
Bring out the realism with a WB tweeter. Frequency response up to 17,000 cycles. Impedance 5 or 15 ohms. MODEL T359. PRICE 35/-, 1/- post. Cross-over network 30/-, 9d. post.

TAYLOR MODEL 127A

20,000 ohms per volt. 20 megohms. 20 ranges. New high sensitivity pocket sized multi-meter. Large easy to read scale and robust centre pole movement. Ideal for all radio and television servicing work. Full specification sent on receipt of s.a.e. PRICE £10/0/0. Terms: Deposit £2/10/0 and six monthly payments of £1 7/6. Add 2/- post and packing.



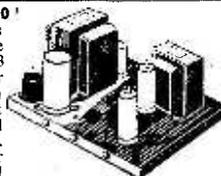
TRANSISTOR POCKET PORTABLES



The Repanco MINI-7. 7 transistor pocket portable with ferrite rod aerial. Gives amazing results. 2½in. speaker and plastic case. Illustrated. Constructional data and price list 1/9, post paid. Complete kit £9/19/6.
 The Teletron TRANSIDYNE. 6 transistor pocket portable using printed circuit and "gotop" transistors. Medium and long waves. 2½in. speaker. Full constructional data and price list 9d., post paid. Complete kit, £12/19/6.

MULLARD '3-3' and '510'

Printed circuit Amplifier kits We are now able to offer the famous Mullard 3 valve 3 watt amplifier and the larger "Five-Ten" amplifier in kit form using the latest printed circuits. Easy to build and perfect results every time. Can easily be adapted for stereo. Set of drawings and price lists 1/6 for each amplifier. Add 6d. post.



Write to us for a price list of the parts for a new battery short wave kit in next month's issue. Will be posted to you as soon as published.

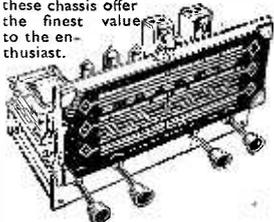
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ALL BRITISH RADIOGRAM CHASSIS. 3 WAVEBANDS 5 MULLARD VALVES EOH42, EF41, EBC41, EL41, EZ40.
Brand new and guar. A.C. 200/250 v. Short-Medium-Long-Gram. P.U. High Q dust core coils. Latest circuit technique. AVC and neg. feedback. 4 watts. Chassis size 13½ x 6 x 8in. high. Aligned and calibrated ready for use. **Quality at Low Cost.** Chassis isolated. H. P. Dep. £5 and five monthly of £1.

OUR PRICE £9-9-0

Matched Speakers, 5in., 6in. x 4in., 6½in., 8in. 17/6 ea. 10in. 25/-



BRAND NEW AND BOXED

OUR PRICE £6-19-6

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IDEAL FOR USE WITH OUR CHASSIS
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THE KINGSMERE POCKET MULTITESTER

Size 5½ x 3¾ x 1½in.

300 microamp F.S.D. 3in. Scale.
17 Ranges. 3,330 ohms per volt.

A.C. Volts. 0 to 1,200 v. in 5 ranges.

D.C. Volts. 0 to 1,200 v. in 5 ranges.

D.C. Current. 0 to 300 m.a. in 3 ranges.

Resistance. 0 to 20 K and 0 to 2 meg.

Decibels. -20 to +23 db. and +20 to +37 db.

Complete with leads and prods. Uses No. 8 battery.

Made in Belgium.

BARGAIN PRICE £6-19-6

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FINEST QUALITY WORLD FAMOUS "GEVAERT GEVASONOR"

LONG PLAY PLASTIC RECORDING TAPE

On universal fitting plastic spools, for all recorders single and double track. 50% extra at standard prices.
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5in. spool 850 ft. tape ... our price 21/- (List 28/-)

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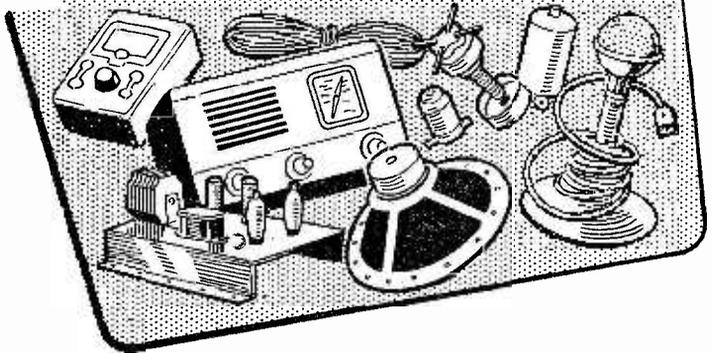
NEWS FROM THE TRADE

LATEST DEVELOPMENTS
IN RECEIVERS AND
COMPONENTS

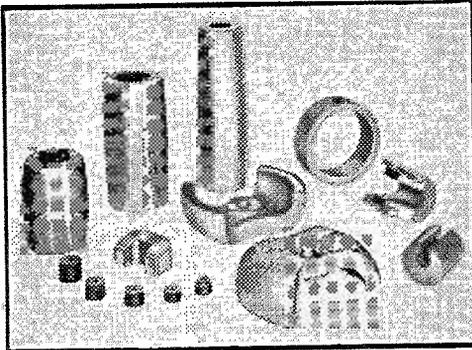
THE "MAGLOY" RANGE OF PERMA- NENT MAGNETS

A WIDE range of cast permanent "Magloy" magnets are now being produced at Swindon by Performations Limited, a company recently formed for this purpose by The Plessey Company Limited and the Arnold Engineering Company, of Illinois. These magnets, which are made from precipitation-hardened ferro-magnetic alloys, have many applications in the radar, television, electronics, communications and aircraft industries, including certain domestic uses.

The unique qualities of "Magloy" materials enable precision cast magnets, even of small sizes, to be produced to relatively close tolerances. These magnets possess excellent magnetic resistance to shock and vibration at any frequency; they are stable to within ± 0.02 per cent. per



GP73-1 pickup head. The valves are two ECL82's, plus a metal rectifier. The controls are: on/off; continuously variable tone with 4dB. fixed bass boost at 120 c/s; volume; and a balance control giving 7dB in either direction. The cabinet itself measures 9in. \times 15in. \times 17½in., but with the legs the overall height is 23½in. It is for A.C. only. It is made by Cossor Radio and Television Ltd., Cossor House, Highbury Grove, London, N.5, and Model 580 costs 41 guineas including purchase tax; matching legs (optional) 2 guineas extra.



The "Magloy" range of permanent magnets.

degree Centigrade temperature rise up to 500°C.: their resistance to external magnetic fields is such that their gap field strength will remain constant in use even after the influx of such external fields.

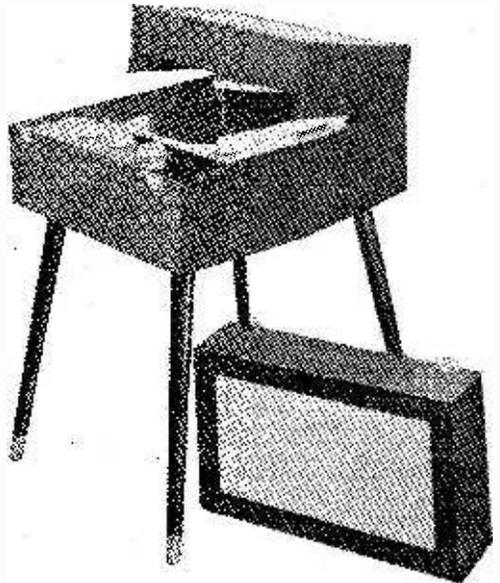
STEREO/MONO RECORD PLAYER

THE Cossor 580 is a compact stereo/mono record player in a wood cabinet, finished in selected veneers, to which four legs may be easily attached to make it into a console table in modern style.

Two matched speaker housings, with quick-release hinges, form the lid of the cabinet, and each contains a 6½in. 10,000 lines speaker unit delivering a total output of 3W. Player is a Collaro Conquest record changer with Acos

FERRANTI THREE DIGIT VOLTMETER

THE first digital voltmeter to be put into quantity production in the United Kingdom is announced by Ferranti Limited, Edinburgh. The voltmeter is the three digit model D101 which



The Cossor 580 Stereo/Mono record player.

covers the range of 0.01 v. to 999 v. D.C. with automatic ranging, polarity and decimal placement and with an accuracy of 0.1 per cent. on any of the three ranges which are 0.01 to 9.99, 10.0 to 99.9 and 100.0 to 999.0 volts D.C. The average reading time is 0.7 seconds.

The need for instruments capable of measuring voltages to a high degree of accuracy and with a fast reading time has long been apparent and the D101 has been specifically designed to meet these requirements. The basic principles employed in the voltmeter can be used for measuring ratios, currents and for analogue-to-digital conversion.

The instrument has been adapted so that a printing device can be coupled to it, and a printer is at present under development. It is also possible to have a remote read-out so that the indicator unit can be located in any suitable position, if necessary at a distance from the voltmeter or other digital instrument. An A.C. to D.C. converter is also under development by Ferranti Ltd., for use in conjunction with the three digit voltmeter.

The instrument is contained in a bench-style cabinet measuring 17in. X 13in. X 10½in. high. Weight is 50lb. approximately.

EVER READY—"SKY COUNTRESS"

RECENTLY released by the Ever Ready Co. (GB) Ltd., is their 4-valve battery operated radio receiver—the Sky Countess. This high quality radio provides splendid listening—



(Left) The Ever Ready "Sky Countess."

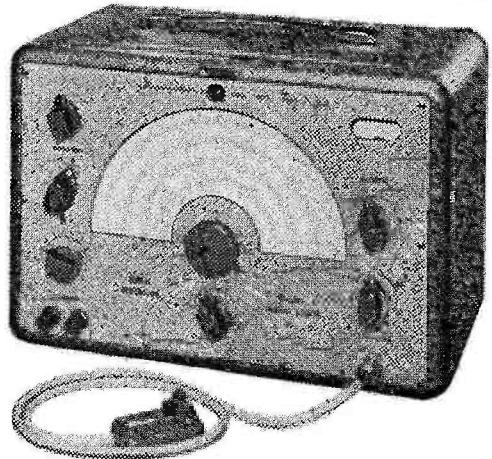
(Right) The Model 68A/M signal generator.

Every Ready batteries. The H.T. is the Ever Ready Batrymax B126, and the L.T. is the Ever Ready AD.35 which together give approximately 80 hours life, allowing the receiver to operate for less than 1½d. per hour. The circuit is a 4-valve superhet of printed circuit construction, utilising a ferrite rod aerial and low consumption Ever Ready valves. The set operates on medium and long waves and the 4in. moving coil loudspeaker is of high sensitivity, providing excellent quality reproduction. Complete with battery the weight is just over 6lb. and each receiver is individually packed with display plinth. Supplies are available at all Ever Ready dealers. It costs £13 2s. 6d.

NEW SIGNAL GENERATOR

A NEW A.M. signal generator known as Model 68AM, covering a frequency range of 100 kc/s to 240 Mc/s *all on fundamentals*, has just been released by Taylor Electrical Instruments, Ltd., Montrose Avenue, Slough. This exceptionally wide range on fundamentals is claimed to be unique on the market, particularly if one also considers the reasonable price, high accuracy, incorporated meter for monitoring R.F. output, and the separate dummy aerial. Particular attention has been paid to good attenuation and the leakage is indeed negligible. The frequencies of 100 kc/s to 240 Mc/s are spread over eight bands, and the total scale length is 58in.

A dummy aerial complete with a coaxial lead



and socket, is supplied with each instrument. Five alternative terminations covering a wide variety of applications are available, including a special lead for A.C./D.C. receivers. The list price is £32 10s.

NEW FACTORY

SOUND TAPE RECORDERS (ELECTRONICS) LTD., 784-788, High Road, Tottenham, N.17, announce that owing to the increased demand for "Sound" Tape Recorders they have now taken possession of a third factory, in the Wingate Trading Estate, Tottenham, N.17, which will be going into production very shortly and will enable not only a larger production of all models, but also a faster turn round of service and all other facilities.

combined with stylish appearance—at a very reasonable cost. The cabinet is covered in tan pigskin leathercloth which is enhanced by the high quality control knobs on a golden coloured engine-turned control panel. There is an easy grip carrying handle, and the finish is dirt resistant. The Sky Countess is powered by two popular



8-WATT PUSH-PULL AMPLIFIER

COMPLETE WITH CRYSTAL MIKE AND 8in. LOUDSPEAKER

A.C. mains 100/250 v. Size 10 1/2 in. x 6 1/2 in. x 2 1/2 in. Incorporating 6 valves, H.F. pen., 2 triodes, 2 output pens and rectifier. For use with all makes and types of pick-up and mike. Negative feed back. Two inputs, mike and gram., and controls for same. Separate controls for Bass and Treble lift. For use with Std. or L.P. records, musical instruments such as Guitars, etc.

£4.19.6 Plus P. & P. 7/6.

Or 35/- deposit Plus P. & P. 7/6, and 3 monthly payments of 25/-.

6-WATT PUSH-PULL AMPLIFIER

A.C. Mains 200/250 v.. Incorporating 4 valves and metal rectifier. 2 inputs, high and low, and controls for same. Separate controls for Bass and Treble lift. Size of chassis 11in. x 4 1/2 in. x 2 1/2 in.

59/6 Plus P. & P. 5/-.

PORTABLE AMPLIFIER

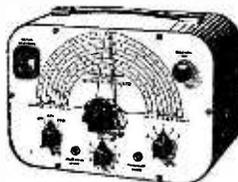
Size 6 1/2 in. long, 5in. high, 2 1/2 in. deep. Will suit any type of crystal pick-up. Output approx. 2 watts, incorporating ECC83 double triode. Cossor 142BT output pentode and contact-cooled rectifier. Fully isolated mains transformer for 200/250 A.C. mains. Base, treble and volume controls.

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

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



SIGNAL GENERATORS

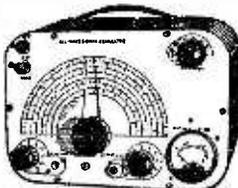


Cash **£6.19.6** or 25/- deposit and 6 monthly payments of 21/6. Post and Packing 5/- extra.

Coverage 120 Kc/s-84 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Metal case 10in. x 6 1/2 in. x 5 1/2 in. grey hammer finish. Incorporating three miniature valves and Metal Rectifier. A.C. Mains 200/250 v. Internal Modulation of 400 c.p.s. to a depth of 30%. Modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch, variable A.F. output. Incorporating magic eye as output indicator. Accuracy plus or minus 2%.

Cash **£4.19.6** or 25/- deposit and 4 monthly payments of 21/6. Plus Postage and Packing, 5/-.

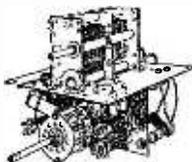
Coverage 120 Kc/s-84 Mc/s. Metal case 10in. x 6 1/2 in. x 4 1/2 in. Size of scale, 6 1/2 in. x 3 1/2 in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30%, modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch variable A.F. output and moving coil output meter. Grey hammer finished case and white panel. Accuracy plus or minus 2%.



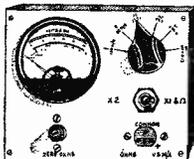
4-WAVE BAND COIL UNIT

Complete with tuning condenser. Separate sections for Short Wave. Coverage 10-21 m., 21-45 m., 44-100 m. and 190-545 m. I.F. 470 Kc. BRAND NEW, by famous manufacturer. Completely assembled on sub-chassis. With circuit diagram.

19/6 Plus P. & P. 3/6.



AC/DC POCKET MULTI-METER KIT



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

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

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

MAINS TRANSFORMERS

All with tapped primaries. 200-250 volts. 0-180, 180, 200 v., 60 ma., 6.3 v. 2 amps. 10/6. 320-0-320 v. 75 ma., 6.3 v., 2.5 amp., 5 v., 2 amp., 10/6. 350-0-350 v. 250 ma., 6.3 v. 7 amp., 5 v. 2 amp., 19/6. Postage and packing on the above 3/-.

COLLARO MIXER 4-SPEED AUTOMATIC CHANGER



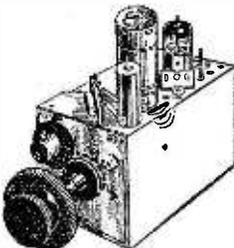
Model 457. Type "O" Pick-up, size 12in. x 13in. Minimum clearance above baseboard 5in., below 2 1/2 in., 10 records. A.C. mains 200-250 v. Turnover crystal head. BRAND NEW. Fully guaranteed. **£8.19.6**

Plus P. & P. 5/-.

13 CHANNEL TUNER

I.F. 34-38 Mc/s, complete with PCF80 and PCC84. These have been removed from chassis.

19/6 Plus P. & P. 2/6. Knobs 3/6 extra.



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

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

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

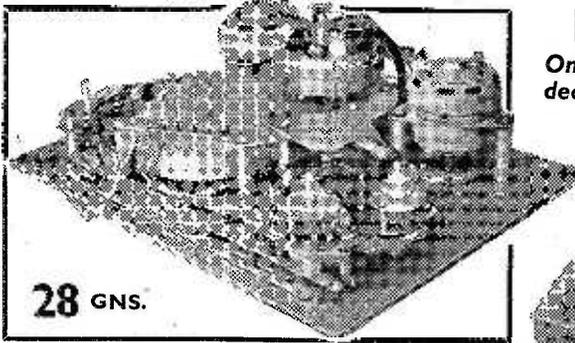
CONSTRUCTORS' PORTABLE PARCEL



Comprising case, chassis, top plate, scale, 5in. P.M. speaker with O.P. trans., twin gang, 2 470 Kc/s. I.F.s. trimmers, four valve holders, wave-change switch and volume control with switch.

39/6 Plus 3/6 Postage & Packing.

The **HEART** of a good tape recorder is its **DECK!**



28 GNS.

The outcome of almost 10 years' exhaustive research and manufacturing experience. Its remarkable features include:—

- ★ Four recording speeds, 1 $\frac{1}{2}$, 3 $\frac{1}{2}$, 7 $\frac{1}{2}$ and 15, giving an exceptionally wide frequency range.
- ★ Permits use of 8 $\frac{1}{2}$ in. reels. (2,400ft. of L.P. tape at 1 $\frac{1}{2}$ i.p.s., plays over 8 hours.)
- ★ Three independent motors (B.T.H.).
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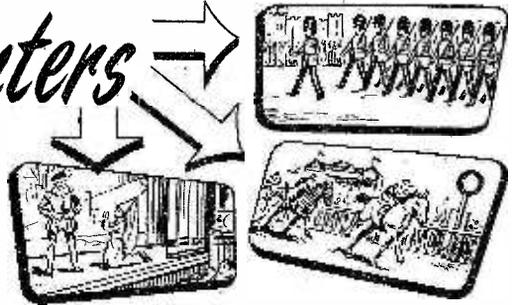
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Programme Pointers

OUR CRITIC, MAURICE REEVE, REVIEWS SOME RECENT PROGRAMMES



Light Opera

GILBERT and Sullivan is ideal material for broadcasting. Sullivan's music is, of course, heard frequently from various bandstands and light-music combinations, but Gilbert's lyrics are wrapped in darkness owing to copyright prohibition on the performance of single numbers: a ban which, happily, will soon be raised. At present the original combination of words and music is heard only when the complete opera is performed.

The transmission from the Princes Theatre of the D'Oyly Carte Company *Gondoliers* was very welcome and seemed as fresh as ever. In a world which is supposed to be changing daily under our very eyes, and which is, we are told, as different from Gilbert's and Sullivan's as Nye Bevan is from "Dizzy" Disraeli, it is pleasant to hear laughter and applause coming from the Princes in as great a volume as it came from the Savoy in its day.

The credit marks for this agreeable programme do not all go to the authors, for the whole company, and orchestra, performed most excellently.

Plays

Lorna Doone! I wonder what emotions she can arouse among the younger people of today. How many of them have read her or even heard of her. The time was, of course, when, together with *Waverley* and *Rob Roy*, *Jane Eyre* and *Tess*, she was a young woman to set the pulse quickening and the blood coursing along ever and ever faster.

The Sunday evening serial, with Pat Pleasance as Lorna, Tony Britton as that mammoth of herculean strength and a degree of chivalry only possible in those romantic, far-off days, to wit, John Ridd, was pleasant and nostalgic. All the Doones were there in their villainy and the Ridds in their virtue, food on the table piled ceiling high, snow up to the thatch in winter; everything, in fact, that always was but "never is no more." And glad of it we should be.

The Gettysburg Address

Another immortal memory, though a greater one, is known also by a few footprints such as the Gettysburg Address, John Brown's Body and, finally, the assassin's bullet. I refer, of course, to Lincoln, whose birth was the same distance away as Burns's death, and which was honoured by the relay from America of Robert E. Sherwood's magnificent play, *Abe Lincoln in Illinois*, with Rod Steiger in the title rôle. An old film

favourite. Chester Morris, was also in the cast. I revelled in it and thought it splendidly done.

Debate

The Oxford Union debate on "That Life Begins at Thirty-eight" was rollicking good stuff even if it didn't quite reach the heights attained in the rival university's motion "That the age of chivalry has passed." These sort of things make first-rate radio stuff, chiefly, I think, because they are spontaneous and have not suffered from more than a little bit of editing.

Documentaries

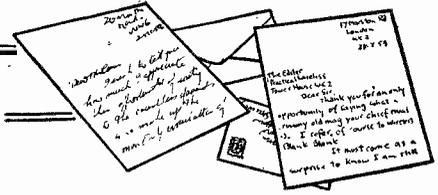
A powerful documentary was *The Bearded Warriors*, the story of the recent revolution in Cuba. Compiled by Christopher Serpell—Chief Correspondent of the BBC in Havana—and Alan Burgess, of the Features Department, it was made up of recordings of scenes of incredible violence, courage and tragedy, and interviews with persons on both sides and in all spheres. Nothing—no one—was spared; the price wasn't asked or counted. The title of the feature comes from the followers of Fidel Castro, the victorious leader, who vowed they would neither shave nor cut their hair until they had achieved their object. "Barbudos" was their native title.

"Poison for the King"

A good play based on life in the old kingdoms of France is a sure winner. Whether it goes right back into history, like *St. Joan* and *If I were King*, or is fairly modern, such as *The Only Way*, *The Scarlet Pimpernel* and *Monsieur Beaucaire*, they have a fascination and a romance all their own. *Poison for the King* was written by Sardou. A complicated though ingenious and well-balanced plot gave us all the ingredients of the popular recipe: Louis XIV, *le roi soleil*, de Montespan, the mistress, La Voisin, the clairvoyant and potion concoctor. Colbert the chief of police, Abbé Griffard, the priestly conspirator, as well as many another. Period 1660.

Howard Marion-Crawford, Margaret Whiting, Roger Delgado, Betty Baskcomb, Richard Williams and Elizabeth London played the principal parts with considerable panache. One point: de Montespan was a Marquise—feminine—*se*, but Betty Baskcomb, as La Voisin, regularly addressed her in the masculine gender with the silent s and no e.

Open to Discussion



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

Stereo Reproduction

SIR,—I feel I cannot let R. H. Cowtan's comments on Stereo Reproduction (PRACTICAL WIRELESS, March, 1959) go unchallenged.

I have a moderately good set-up, utilising a Garrard 4H.F. player, a pair of Mullard 5-10 amplifiers and two Wharfedale corner bass reflex cabinets on which I have experimented with stereophonic sound. I utilise both channels whether reproducing radio, monaural disc or stereo disc and after reading R. H. Cowtan's letter I decided to try a few tests. At the flick of a switch I am able to mix the two channels from the stereo cartridge and feed them into the two amplifiers, etc., thus producing the same results as one would get from a monaural disc played through the same set-up. Whilst demonstrating stereo to at least twelve of my friends (only one of whom is a hi-fi enthusiast) I craftily switched to "simulated stereo" and without exception, all heads turned to find out what had gone wrong.

This seems to blow your correspondent's theory to bits for I am sure at least one of my gathering must have been an "average listener." Incidentally, this test was in an ordinary room approximately 14ft. square.

One final comment. I agree entirely that a hi-fi monaural system is better than a low-fi stereo set-up, but for sheer excellence and the feeling of "being there" nothing can surpass the hi-fi stereo system.—G. SEWARD (Hasbury, Worcs).

Interference from TV Receivers

SIR,—Mr. Lord of Stamford (PRACTICAL WIRELESS, March) is sadly misinformed. The G.P.O. receive only a small part of a £3 licence to cover interference investigation and licencing records, the £1 tax goes in its entirety to the Exchequer.

Where a TV interferes with radio, or radio with a TV, it constitutes a contravention of the Wireless Telegraphy Act, as stated on the reverse of the licence. If no licence is held, the owner of the set is in worse trouble.

The G.P.O. Interference Service may require alterations in the positions of both receivers and/or aerials. If necessary, the offended owner may be advised to improve his aerial; the offending owner is required to permit filters to

be tried which, if successful, he is expected to purchase and fit. If he refuses to allow tests or refuses to take reasonable action to correct the trouble, the G.P.O. has the power to cancel his licence and legal proceedings, including possible confiscation of the receiver, would follow any further use of it.

The assertion that every TV causes interference is absurd, and a gross injustice to the manufacturers who conduct exhaustive tests before marketing their receivers.

The worst recorded case affecting TV over a wide area, some being completely blacked out, was caused by the out-

put pentode of a three-valve T.R.F. radio.—A. DEVERELL (Rickmansworth).

Radio Reception

SIR,—For those who require uninterrupted reception of speech and music today, there appear to be two alternatives:

To use V.H.F. frequency modulation equipment, or amplitude modulation equipment on the medium and long waves containing so many tuned circuits that troubles appear from either instability or side-band cutting. If one uses V.H.F. frequency modulated equipment one is confined to a very limited number of programmes, and even these are probably not capable of reception everywhere in the British Isles.

For those who want a variety of programmes with the minimum of interference between stations, probably the best, most economical and simplest method of achieving it, is to build a double superheterodyne receiver in which the intermediate frequency of the first frequency changer is not lower than 1.6 Mc/s per second. In doing this the amateur constructor is much restricted in his choice of coils. There are few such coils advertised. Is this not a challenge to manufacturers?—RICHARD PAGE (Singapore).

Automatic Time Switch

SIR,—I am surprised that nobody has remarked on the folly of using the Automatic Time Switch (September, 1958) with tape decks having mechanically operated pinch wheels. If the rubber pinch wheel is pressed against the capstan when it is not turning, a flat forms on the pinch

(Continued on page 253)

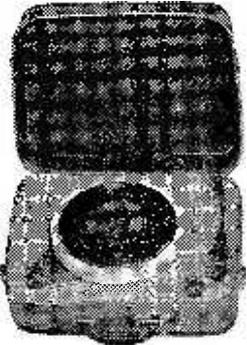
Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying commercial or surplus equipment. We cannot supply alternative details for receivers described in these pages. WE CANNOT UNDERTAKE TO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

...another TRS Winner



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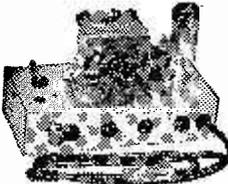
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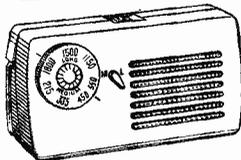
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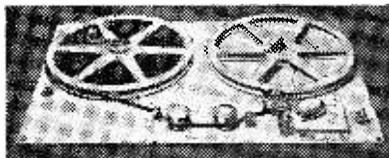
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wheel and causes a very unpleasant 'wow' on any subsequent recording.

This can happen on certain decks when the deck is operated (i.e., left in the record or play-back position) without the mains supply being connected.—S. BROWN (Edinburgh).

Novice Licences

SIR.—*Re* Novice "Tickets" I disagree with P. Bloor's opinion expressed in PRACTICAL WIRELESS (February issue). I foresee that the short wave bands, already overcrowded, will be cluttered up with a collection of irresponsible young people who do not know even the rudiments of radio. Today's youth is not stupid. If he can see that he can hold a novice ticket indefinitely he will.

No, let us perfect means of detecting "pirates" first. *then* think about Novice Licences.—A. N. HAMLYN (Felixstowe).

Correspondents Required

SIR.—I am 15 years of age and very interested in amateur radio. I hope to become an amateur transmitter in the near future, and would like to correspond with any S.W.L.'s.

I would also like to know if anybody has a circuit of the receiver type R.1466 or whether anyone can send me any details regarding this particular set.—S. LLOYD (15, Chadwell Avenue, Cheshunt, Herts).

Curious Phenomenon

SIR.—I am a newcomer to radio and have started to listen regularly on the short waves. At certain points on the dial, I can hear the BBC Light Programme, faint, but quite intelligible. Can any reader give an explanation of this?—W. B. (Coventry).

Transistor Receiver

SIR.—In response to many enquiries here are further details of my receiver (March, "Open to Discussion").

Tuning Condenser.—0.0005 μ F. Air-spaced, aluminium vaned. The better the quality the more selective will the set be.

Transistors.—Not critical. Brimar TS3 was the most selective of those tried. Any A.F. types will suit the amplifier.

Loudspeaker.—A 2½ in. P.M. type removed from a small portable was used in the original. More volume is obtained with a larger speaker.

Cabinet.—Plastic case (originally for sandwiches) measuring 6 in. \times 4½ in. \times 2½ in. which includes batteries and speaker. A fair amount of wasted space. The set was built before miniature components were available and consequently a considerable reduction in size may be achieved.

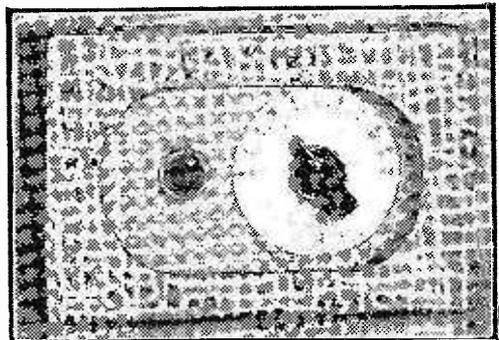
Current.—Only 2 to 2½ mA, so mercury cells may be used, four in series giving 5.2 volts which is quite adequate. To go above 6 v. collector currents should be measured carefully.

Performance.—Volume is very good; will give good phone volume with a ferrite rod glued inside the coil, but this increases volume and reduces selectivity with a large aerial.

Selectivity is good for a set of its type, as long as a good quality tuning condenser is used. I am unable to get L.W. stations here in Sussex so the coil is for M.W. only, receiving Home and Third with S.W. break-through on Luxembourg wavelength.—J. BOWYER-LOWE (Southwick).

Beginner's Constructional Course

SIR.—I recently constructed the transistor set described in your Beginner's Constructional Course. I found the crystal set worked very poorly here, but with the addition of one transistor volume was increased to a reasonable level. With two transistors volume was so loud that I decided that for my purposes one transistor would suffice. Using the original coil I found that I could not receive the Light Programme without the Home, loud in the background. After experimenting with many coils I found that a "Repanco DRR2" worked very well. A plywood box was then made and



Receiver built by Mr. M. J. Grimshaw from instructions given in the Beginner's Constructional Course.

covered with thin plastic material similar to that used on record players. The components were mounted on a plywood panel which was covered with speaker fabric and fixed into the front of the case. As can be seen from the photograph the final result looks quite professional.—M. J. GRIMSHAW (Uxbridge).

"Talk Back"

SIR.—I note the letter from T. Fuller of Beaminster which appeared in the April issue of PRACTICAL WIRELESS. His problem would seem to be that when his speaker is switched off the transformer, which couples the speaker to the output valve, is still in circuit. This phenomenon is often termed "talk back" and more usually occurs in the modulation transformer of a phone transmitter.

I should also like to reply to the recent outcry from certain readers with regard to novice licences. I agree entirely with the letters from G3HLW and I-S.W.L. G6667. As it is, it would seem that the standard set for the R.A.E. is by no means beyond the capabilities of someone who is really determined to come on the air. I think all readers will agree that we must deplore the

novice system which is in operation in the United States. There a novice has 75 watts of power available on certain bands after passing an extremely elementary exam. The result of this is obvious—overcrowding beyond all previous conception of the word.—VICTOR WYNNE STEWART (S.W.L.-A7394. Member R.S.G.B. Member R.A.E.N.).

SIR.—I was very interested in the letter from T. Fuller about the "talking" valve. The reason that the signal can be heard is due to the pressure of the electrons varying on the anode of the valve; part of the energy is turned directly into sound waves. I first noticed this effect with the "Old" PX4 output. There is also another cause of sound from components, and that is due to magnetostriction in transformers, i.e., the change of shape of the component owing to the current through it.—JAMES S. KENDALL (Birmingham).

Transistors v. Valves

SIR.—I recently heard two schoolboys talking outside a radio store, and my attention was drawn to them by the subject of their talk. After a time one of them said that valves were old-fashioned and out-of-date, and that before long all radio apparatus would use transistors. I am now told that this idea is growing among the younger generation, and it appears to me to be quite wrong. Surely you can perform a function by means of a valve not only cheaper, but much more efficiently than with a transistor. Take TV for instance: you must have high voltage for the tube, so that you must call on the mains supply. The voltage is available, and so why try to do away with the valve? Similarly in practically every home, mains power is available, and therefore a three- or four-valve set can be made up or bought for domestic entertainment, so why try to use transistors with a dry battery? Granted, in the field of the portable, or where there is no mains supply available, then the transistor comes into its own, but I fail to see how the valve can be called "old-fashioned."—G. PLACHEY (Chelmsford).

Valve Tester?

SIR.—A friend of mine and myself have thought of a quick, fairly inexpensive method of testing the emission of a valve. It involves only a heater supply and a fairly sensitive meter (0.1 mA will do). The heater supply is connected up and the cathode of the valve is connected to the positive of the meter and the first grid of the valve is connected to the negative of the meter. On switching on the heater the cathode heats up and there is slight emission which gives a reading of about 50 to 100 microamps.

An output transformer can often be used as a heater transformer, if the mains is fed into the high resistance winding and the output is taken from the low resistance winding. The output voltage should always be measured before connecting it to the valve, as it can vary between

three and 12 volts on various transformers.—DAVID SKYE (S.W.10).

Unusual Effect

SIR.—While testing some army throat microphones on a powerful amplifier, I heard music in the speaker. Accidentally I placed my thumb on the top, sensitive part of the microphone and I discovered the Home Service coming through clearly and with good strength. Has this happened to any other readers?—J. A. N. SEMPLE (Belfast).

TV on Radio

SIR.—In the February issue of PRACTICAL WIRELESS I read in "Open to Discussion" Mr. Diplock's letter on TV on his R.208. On my own 208 I get ITV on 38 Mc/s, BBC TV 45 Mc/s, but this biots out the picture on neighbouring sets. But the most unusual thing is, I receive New York Police H.Q. and the cars on 38.2 Mc/s. I've heard calls go out and come in around Beverley Hills, also stolen cars reported and even last week a motor coach was stolen. I also get different taxi services between 36-40 Mc/s. One in particular with the code name "Blue" asking to report to Philadelphia H.Q. At around 8 p.m. every day these stations usually fade off in volume but I pick them up regularly every day.—C. E. CRUNKHURN (Grimsby).

Meter Shunts

SIR.—I have read the article in the April issue on "Meter Shunts and Multipliers," and would like to pass on a formula which I believe is a simpler and easier way of calculating the value of shunts.

First use Ohm's law and find the voltage required to operate the meter at its f.s.d., i.e., $R_m \times I_{f.s.d.}$. Then find the resistance to give the required current flow at that voltage, i.e., $R_s = E \div I$, which is the resistance of the shunted meter. Then substitute in $R_u = \frac{R_m \times R_s}{R_m - R_s}$ where R_u is the resistance of the shunt, R_m is the meter resistance, and R_s is the resistance of the shunted meter.

Applying the method to the example in the article: R_m is 100 ohms and the f.s.d. of the meter is 1mA. Therefore the voltage required is 100×0.001 , or 0.1. Then the value of R_s to give 1 A f.s.d. is 0.1Ω. From the formula given,

$$R_u = \frac{100 \times 0.1}{100 - 0.1} = \frac{10}{99.9} = 0.1001.$$

R. A. BERRY (Southall, Middx.).

Radio Clubs

SIR.—Many members of radio clubs will have been pleased to note the increased space you are devoting to club activities. I think it very important that this branch of the hobby of radio should be publicised. Many clubs do not receive the support they deserve and new members may join them as a result of reading the notices in your columns.

I should also like to say that I find your series "Printed Circuits" one of the most interesting I have read.—J. P. THACKERAY (Nettleton).

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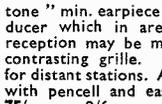
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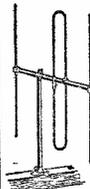
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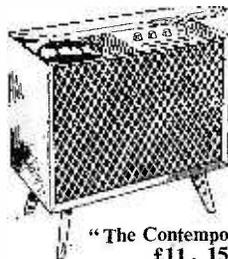
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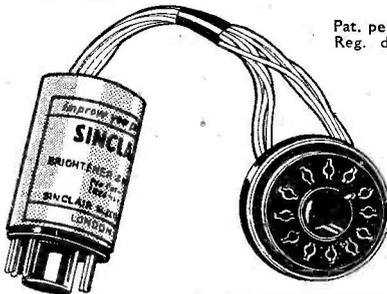
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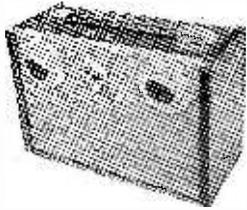
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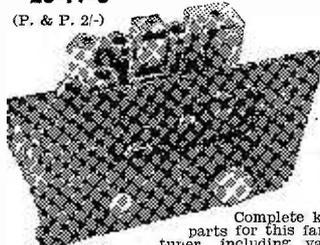


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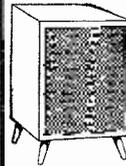
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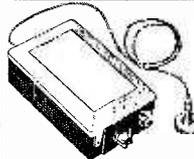
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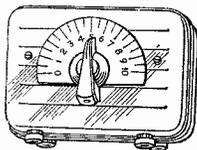
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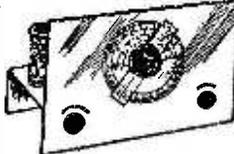
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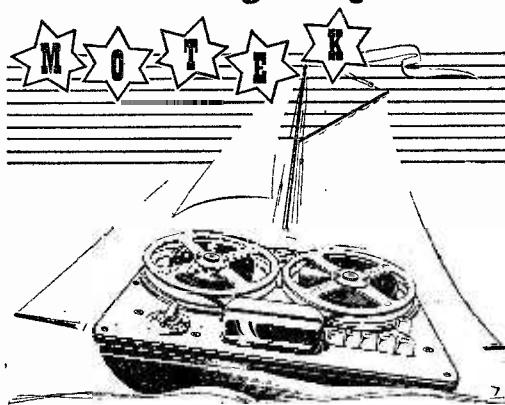
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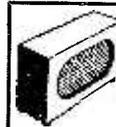
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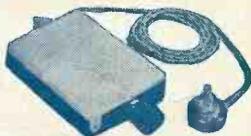
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