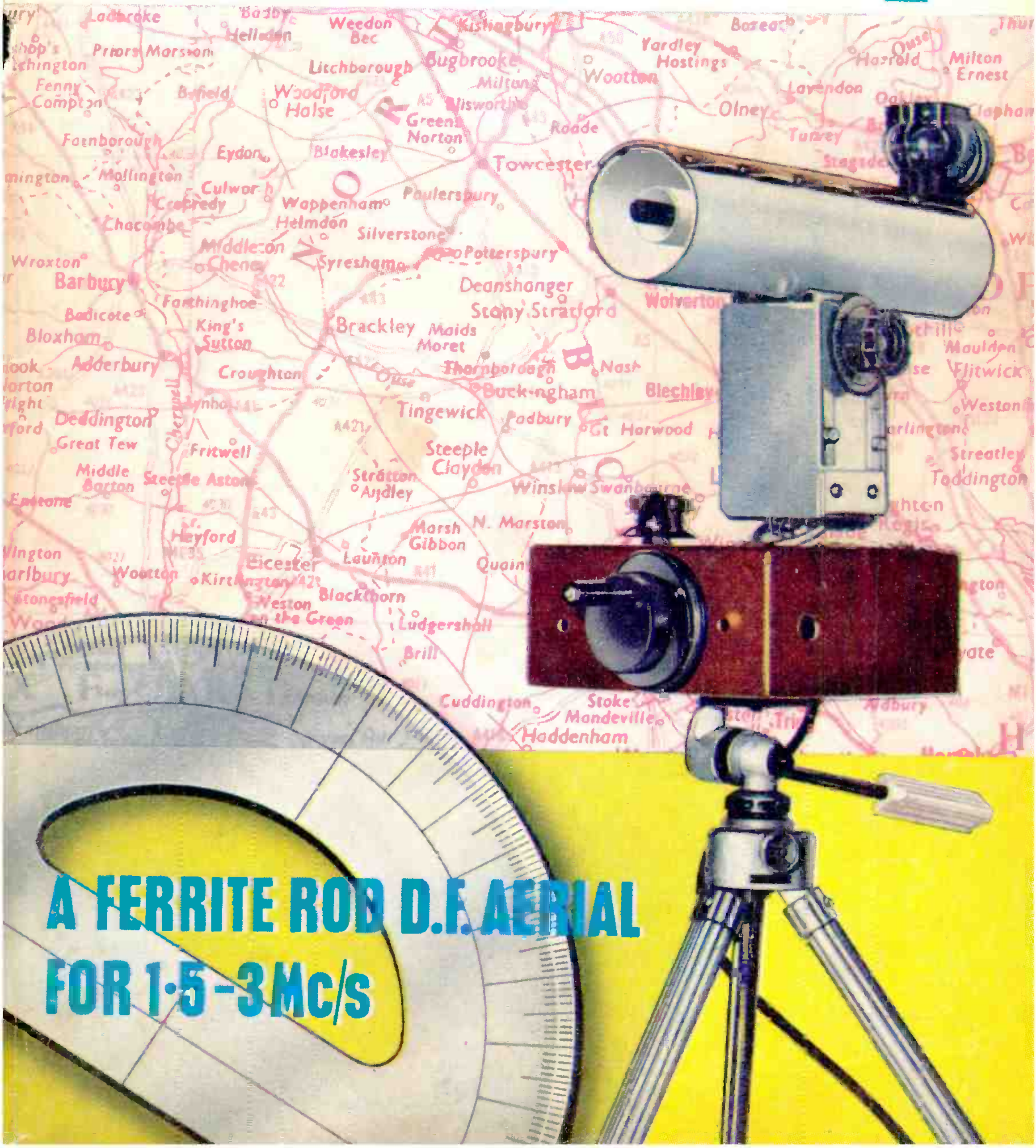
PRACTICAL WIRELESS

JANUARY 1965

2/-



A FERRITE ROD D.F. AERIAL FOR 1·5–3Mc/s

GUARANTEED ★ VALVES ★

by return of post

THE MOST ATTRACTIVE COMPETITIVE VALVE LIST IN THE COUNTRY

All valves are new and unused unless otherwise advised

POST 1 Valve 6d., 2-11 1/-. FREE for 12 or more valves.

3 MONTHS GUARANTEE in writing with every valve.

FREE TRANSIT INSURANCE. Satisfaction or Money back Guarantee on Goods if returned within 14 days.

0Z4	4/6	6J7GT	7/6	20L1	16/-	DL82	9/-	EZ80	5/9	U22	6/9
1A7GT	8/3	6K8GT	6/-	20P1	9/6	DL92	5/-	EZ81	6/-	U24	12/6
1C5GT	7/-	6K7	5/9	20P3	12/6	DL94	6/6	FC4	8/-	U25	10/6
1D5	7/-	6K79	2/-	20P4	17/-	DL96	7/3	FW4/500	7/-	U26	8/6
1D6	9/9	6K7GT	4/9	20P5	15/-	EA50	1/3	GT1C	12/6	U31	7/-
1H5GT	8/-	6K8G	5/-	25A6G	8/-	EABC80	6/9	GZ32	7/6	U33	14/-
1L4	3/-	6K8GT	11/-	25L6GT	7/9	EAC91	4/-	GZ34	11/6	U35	12/6
1LD5	4/3	6K25	8/6	25Y5G	8/-	EAF42	8/3	HK90	9/6	U37	26/-
1LN5	4/6	6L1	9/6	25Z4G	7/-	EB34	1/3	HL41DD	8/6	U50	4/9
1N5GT	8/9	6L6G	7/6	25Z5	8/-	EB41	5/-	HN309	19/-	U52	4/9
1R5	5/6	6L18	7/9	25Z6G	8/-	EB91	3/-	HVR2	9/-	U76	5/6
1U5	5/3	6L19	11/6	27SU	17/6	EBC33	4/9	KT32	6/9	U78	4/6
1S4	7/6	6LD20	7/9	30C1	6/9	EBC41	7/9	KT33C	4/-	U107	12/6
1S5	4/6	6N7	7/6	30C15	11/6	EBC81	7/9	KT36	14/-	U191	11/6
1T4	3/-	6P1	9/6	30F5	7/6	EBF80	7/6	KT44	6/-	U281	9/6
2D21	5/6	6P25	8/6	30FL1	9/6	EBF83	9/6	KT55	17/6	U282	12/-
3A4	4/-	6P28	9/9	30L1	6/6	EBF89	7/9	KT61	11/-	U301	12/-
3A5	8/9	6Q6G	6/6	30L15	9/9	EBL21	10/9	KT63	4/6	U309	6/6
3D6	4/9	6Q7GT	8/9	30P4	9/6	EC52	4/9	KT66	13/6	U329	9/6
3Q4	7/-	6R7G	9/-	30P12	7/6	EC91	4/6	KT76	8/6	U339	11/6
3S4	5/-	6SA7	5/9	30P19	13/6	EC92	8/6	KT88	19/-	U403	10/6
3V4	6/6	6SC7	4/9	30PL1	9/3	ECC81	7/6	KTW61	5/9	U404	6/-
5R4GY	9/6	6SG7	4/9	30PL13	9/6	ECC82	4/-	KTW62	6/6	U801	17/6
5T4	8/-	6SH7	3/-	35C5	8/6	ECC33	4/9	KTW63	5/9	UABC80	7/-
5U4G	5/6	6SJ7	5/6	35L6GT	8/-	ECC34	9/-	KTZ6	11/-	UAF42	7/9
5V4G	7/6	6SK7	5/-	35W4	6/-	ECC35	5/9	L67	3/-	UB41	7/-
5Y3G	4/9	6SL7GT	5/9	35Z4GT	5/6	ECC40	9/6	LN152	6/6	UBC41	7/6
5Y3GT	5/6	6SN7GT	4/9	35Z5GT	7/-	ECC81	5/6	MU14	7/-	UBC81	7/9
5Y4G	9/6	6SQ7	5/9	41	6/6	ECC82	6/-	N37	10/6	UBF80	7/9
5Z4	9/-	6SS7	3/6	42	6/6	ECC83	6/6	N78	17/-	UBF89	7/6
5Z4G	7/6	6U4GT	9/6	50B5	7/9	ECC84	7/6	N108	17/-	UBL21	12/-
5Z4GT	9/6	6V6G	4/6	50C5	8/6	ECC85	7/6	N152	8/7	UC92	7/9
6/30L2	9/-	6V6GT	6/9	50L6GT	7/6	ECC88	9/6	P41	7/6	UCC84	9/9
6A6	3/9	6X4	4/9	53KU	9/6	ECF80	8/9	P61	2/9	UCC85	7/3
6A7	9/-	6X5G	5/-	61BT	17/6	ECF82	8/3	PABC80	8/-	UCF80	10/6
6A8G	7/9	6X5GT	6/-	61SPT	11/-	ECH21	10/9	PC86	11/6	UCH21	9/6
6A8GT	12/6	7B6	10/9	62BT	13/6	ECH35	11/6	PC97	9/6	UCH42	7/3
6AC7	3/-	7B7	7/9	75	5/6	ECH42	8/6	PCC84	6/6	UCH81	7/9
6AG5	2/9	7C5	7/9	78	5/-	ECH81	7/-	PCC85	7/9	UCL82	9/-
6AG7	6/9	7C6	7/6	80	5/6	ECH83	8/6	PCC88	11/9	UCL83	12/-
6AK5	5/-	7H7	7/3	83	9/6	ECL80	6/6	PCC89	9/6	UF41	8/-
6AL5	3/3	7Y4	6/-	185BT	19/6	ECL82	8/-	PCC189	12/-	UF42	5/6
6AM6	3/-	7Z4	6/-	185BTA	19/6	ECL83	10/6	PCF80	6/9	UF80	3/-
6AQ5	6/-	8D	3/-	807	7/6	ECL84	12/-	PCF82	7/-	UF85	7/6
6AT6	5/-	10C1	11/6	813	49/-	ECL86	10/3	PCF84	12/-	UF89	3/-
6AU6	7/-	10C2	14/6	832	14/-	EF22	7/-	PCF86	11/-	UL41	8/-
6AV6	5/9	10F1	4/9	866A	12/6	EF36	3/3	PCL82	7/3	UL44	14/-
6B7	8/6	10F9	10/6	954	3/9	EF37A	8/-	PCL83	9/-	UL46	9/9
6B8G	3/-	10F18	10/-	955	2/3	EF39	7/6	PCL84	7/3	UL84	3/-
6BA6	5/6	10LD11	14/6	956	2/-	EF40	11/-	PCL85	10/6	UM80	3/9
6BE6	5/6	10P13	8/6	1625	5/6	EF41	8/-	PCL86	10/6	UR1C	7/6
6BG6G	15/-	10P14	9/6	6060	7/6	EF42	6/9	PEN25	3/9	UU6	11/6
6BH6	6/6	10P18	7/-	6057	9/6	EF50-BR	1/6	PEN45	8/6	UU7	9/6
6BJ6	5/9	12A6	2/3	6067	9/6	EF50(A)	2/6	PEN46	4/6	UU8	13/6
6BQ7A	6/6	12AH8	11/-	5763	7/6	EF54	3/-	PL33	9/6	UY1N	11/-
6BR7	8/6	12AT6	6/6	9001	3/6	EF80	4/6	PL36	9/6	UY21	9/6
6BR8	9/6	12AT7	5/6	9002	4/9	EF85	6/-	PL38	15/-	UY41	6/-
6BW6	7/9	12AU6	9/-	9003	5/9	EF86	7/6	PL81	8/3	UY85	6/-
6BW7	5/-	12AU7	6/-	ATP4	2/6	EF89	6/9	PL82	6/6	VP4B	9/-
6C4	2/3	12AV6	6/9	AZ31	7/6	EF91	3/-	PL83	6/6	VP23	2/9
6C5	5/6	12AX7	6/6	AZ41	7/-	EF92	3/-	PL84	7/-	VP41	5/6
6C6	3/6	12BA6	7/-	B36	6/9	EF183	9/9	PL820	8/3	VR105	5/6
6C9	11/-	12BE6	6/6	C1C	8/-	EF184	9/6	PM34	8/-	VR150	5/-
6CD6G	19/6	12BH7	8/9	CBL31	13/6	EK32	7/6	PX4	12/6	W76	4/9
6CH6	6/3	12C8	5/6	CCH35	13/6	EL32	3/9	PX25	9/-	W81	7/3
6D2	3/3	12E1	17/6	CY31	7/6	EL33	11/-	PY31	8/-	X61M	11/-
6D3	9/6	12H6	1/9	D77	3/3	EL34	11/6	PY32	10/-	X63	8/6
6D6	3/-	12J5GT	3/3	DA30	11/6	EL35	6/-	PY33	10/6	X65	11/-
6F1	4/9	12J7GT	8/-	DAC32	8/-	EL38	12/6	PY80	6/6	X66	7/9
6F6	7/6	12K7GT	4/9	DAF91	4/6	EL41	8/-	PY81	6/3	X76M	11/-
6F6G	4/6	12K8	9/9	DAF96	7/3	EL42	9/6	PY82	5/9	X78	21/-
6F13	4/9	12K8GT	11/6	DF33	8/9	EL81	8/9	PY83	6/9	X79	21/-
6F14	9/6	12Q7GT	4/9	DF91	3/-	EL84	6/6	PY38	8/9	X81M	9/-
6F15	9/6	12SA7	7/-	DF96	7/3	EL85	9/9	PY800	7/9	Y63	6/-
6F19	6/-	12SG7	4/6	DF97	7/6	EL91	3/9	PY801	7/9	Z63	4/9
6F32	4/9	12SH7	3/6	DH63	5/6	EL95	6/-	PZ30	9/6	Z66	8/6
6F33	4/-	12SJ7	5/6	DH76	4/6	EM34	8/9	R19	9/6		
6H6	1/6	12SK7	4/6	DK32	9/6	EM80	7/6	RL18	11/-		
6J5	4/3	12SN7GT	6/9	DK91	5/6	EM81	8/9	SP41	2/3		
6J5G	3/-	12SQ7	8/6	DK92	7/-	EM85	9/6	SP61	2/-		
6J5GT	4/3	13D3	6/6	DK96	7/9	EN31	16/-	SU25	16/-		
6J6	3/6	19AQ5	7/9	DL33	7/6	EY51	7/6	SU2150	4/6		
6J7	8/6	19BG6	14/-	DL35	7/6	EY86	7/3	T41	6/9		
6J7G	4/9	20D1	8/9	DL63	9/-	EY88	9/6	TDD4	8/6		
		20F2	9/6	DL75	6/-	EZ40	7/-	U14	7/6		
						EZ41	7/-	U18	7/6		

100's TYPES NOT LISTED S.A.E. ENQS.

Tubes

HIGHEST QUALITY— COMPARE OUR PRICES

GUARANTEED

MOST MULLARD, MAZDA, COSSOR, EMITRON, EMISCOPE, BRIMAR, FERRANTI TYPES, PROCESSED IN OUR OWN FACTORY (Carr. & Ins. 12/6)	6 Months	12 Months	NEW TYPES
12in.	£2. 0.0	£3. 0.0	MW 31/74 £3.15.0
14in.	£2.10.0	£3.10.0	MW 36/24 £4.15.0
15–17in.	£3. 5.0	£4. 5.0	CRM 172 MW 43/64 £6.0.0
21in.	£3.15.0	£5.15.0	

SATISFACTION GUARANTEED

EKCO L.O.P.T. Unused replacements for Perspex cased 1954/7 models, complete with E.H.T. rect. unrepeatable. **39/-**

CO-AX, low loss, **6d.** yd., 25 yards, 11/6, 50 yds., **22/-**, 100 yds., 42/6 Co-ax Plugs, **1/3.** Wall outlet boxes **3/6**

SPECIAL C.R.T. OFFER
Due to huge Bulk Special Purchase we are offering MW 31/74 Tubes at the unrepeatable price of **29/-.** MW 36/24 ditto, **39/-.** P.P. 12/6. The above are guaranteed for 6 months.

LOUDSPEAKERS 6½in. 8in. **7/6** 3 Ω Top Makes 5in. 7 x 4in. **8/6**

CONNECTING WIRE

P.V.C. Bright Colours. Five 25ft. coils only. **4/-**

3 VALVE AMPLIFIERS

Kit of new parts, consisting chassis mains and output transformers, valves (P61, 6G6G, 6X5G) and all components. With full instructions for making high gain amplifier with separate bass and treble controls, negative feed-back, etc. Truly unusual value at **29/-**

MAINS TRANSFORMERS

Excellent Quality Guaranteed. Upright mounting 250-0-250 V 60 mA. 6.3 V 3 A (80mA 12/6) **9/6** Ditto semi-shrouded 9/6.

13 CHANNEL T.V.s

Table Models. Famous Makes. Absolutely Complete. These sets are unequalled in value due to huge purchase direct from source. They are untested and not guaranteed to be in working order. Carr. etc., 15/–.
14in. **£2.19.0** 17in. **£4.19.6**

★ BULK BARGAINS ★

12 POTS. Popular values. 5K to 2 Meg. Unused, mixed, pre-set, long sp., switch, etc. **4/6**

CONDENSERS. 25 Mixed Electrolytic. Many popular sizes. List Value £5. Our price **10/-**

TURRET TUNERS

Most makes, your choice if available, with valve 16/-, less valves 10/- S.A.E. enquiries.

100 RESISTORS 6/6

Excellent. Sizes ¼–3 watt.

100 CONDENSERS 9/6

Miniature Ceramic and Silver Mica Condensers, 3 pF to 5,000 pF, LIST VALUE OVER £5.

25 TAG STRIPS 4/-

2, 4, 6, 8 way etc. Unused.

100 HI STABS 9/6

1% to 5% 100 Ω to 5 M Ω.

TRANSISTORS

GUARANTEED TOP QUALITY

Huge reduction. **Red Spot** standard L.F. type now only **1/6**
White Spot R.F............ **2/-**
Mullard Matched Output Kits OC81D and 2-OC81. **12/6**
R.F. Kits OC44, OC45 (2). 3 transistors. **12/6**

AF114	8/-	OC44	5/6
AF115	7/6	OC45	5/6
AF116	7/6	OC72	5/6
AF117	7/-	OC81	5/6
AF127	9/6	OC81D	5/6
OC26	12/6	OC82	6/-
OC36	14/-	OC170	8/6
OC171	8/6		

GERMANIUM DIODES

General Purpose miniature detector, A.V.C. etc. **8d.** or 6/6 doz.
Gold Bonded highest quality. Individually tested. **1/-** 9/6 doz.

SILICON RECTIFIERS

Guaranteed performance. Top Makes Tested 250V working.
100mA (3 for 9/6) **3/9** 250mA (3 for 19/6) **7/6**

VALVE HOLDERS. B7G, **6d.** ea., with Screen **8d.** ea., B9A **6d.** ea., with Screen **8d.** ea. Int. Octal **6d.**, Mazda Octal **4d.** B8A **6d.** (less 15% in dozens).

LINE TRANS

Huge quantity, most makes at only **29/-** S.A.E. enquiries.

ELECTRIC MOTORS. AC/DC 3-8 volts. Totally enclosed standard mounting, powerful V pulley, spare brushes, 2in. x 2in. **7/6**

ELECTROSTATIC SPEAKERS

Type LSH75. Originally 25/–. As fitted to German Hi-Fi Radios. Bargain **5/-** ea. **9/6** pair.

ACCUMULATORS

Small 2 volt 3 amp/hour, **3/6** each.

H.T. TRANSFORMERS

200/250V a.c. 350-0-350V 150 m.a. 6.3V 5 amp, 5V 3 amp. Gift **27/6.**

TUNING CONDENSERS

F.M. 2 gang 15+15 pf. standard with slow motion, **3/9.** AM/FM 500 pf. and 15 pf. 2 gang with slow motion, **4/9.** Standard .0005 2 gang, **4/6.** Small .0005 2 gang, **4/6.**

A.C. MOTORS

For 230V a.c. Powerful, self-starting, weight 1½ lb., **12/6.**

SYNCHRONOUS MOTORS

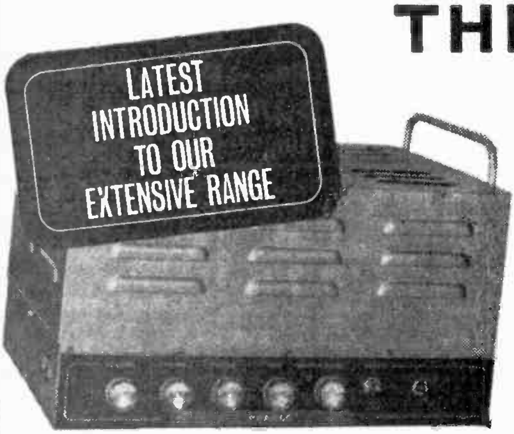
200/250V A.C. 50 Ω top quality 1 rev. per hour. Ideal clocks, timers, etc. **12/6.**

ENQUIRIES WELCOMED
Quantity Prices or Quotes for Items not listed, particularly rare values.
TELEPHONE C.O.D. ORDERS DISPATCHED THE SAME DAY

Post: 2 lbs. 2/-, 4 lbs. 2/6, 7 lbs. 3/6, 15 lbs. 4/-, etc. (C.O.D. extra). ALL VALVES LESS 5% AND POST FREE IN DOZENS.

TECHNICAL TRADING CO.

350 352 Fratton Road, Portsmouth Tel: 22034
72 East Street, Southampton Tel: 25851
ALL MAIL ORDER, RETAIL SHOP AND HI-FI ROOM
DEVONIAN COURT PARK CRESCENT PLACE, BRIGHTON. Tel. 680722



THE PEAK 60

60 WATT AMPLIFIER

A multi-purpose high output power amplifier for MICROPHONE and INSTRUMENTAL applications or for providing high quality sound for Auditoriums, Halls, Dance Bands and outside Public Address functions.

As the amplifier is capable of delivering 60 watts over a wide frequency range it is equally suitable for Bass Guitar, Lead Guitar, or Voice Reproduction. In addition it will meet the most discriminating requirements in domestic sound installations where peak power is not of prime importance.

The use of the two inputs with their associated volume controls, together with the Master volume control gives an effective mixing facility. Silver hammer finish. Black perspex front panel. Overall size 14 x 9 x 7¾in. high including cover (plus 1½in high handles).

- BASS AND TREBLE CONTROLS
- MASTER VOLUME CONTROL
- MIXING FACILITIES
- BUILT IN PRE-AMPLIFIER AND CONTROL UNIT
- 60 WATT UNDISTORTED OUTPUT
- SWITCHED OUTPUT for 3 or 15 ohms loudspeakers
- TWO INPUTS high gain and low gain with individual volume controls.

FULL DETAILS ON REQUEST

COMPLETE KIT OF PARTS £18.18.0
ASSEMBLED AND TESTED £25.4.0
(Ventilated Cover with chrome plated handles as illustrated 35/- extra).

STERN-

GREAT BRITAIN'S GREATEST

STERN CLYNE

SOUND REPRODUCING AND HI-FI EQUIPMENT

READY BUILT AND TESTED OR KITS OF PARTS FOR HOMECONSTRUCTION

MAKE YOUR CHOICE FROM THE FOLLOWING

	Complete Kit of parts	Ready built and tested	Carr. and Ins.	Instruction book available separately
Stern Mono-Gram Amplifier 3 watts	£4 10 0	£6 0 0	3/6	2/6
Mullard 2 valve Audio Pre-amplifier	£6 6 0	£9 10 0	5/-	2/-
Mullard 3 valve Audio Pre-amplifier	£10 0 0	£13 13 0	5/-	3/6
Mullard "3-3" Amplifier with Passive Control Unit Model 33/RC 3 watts	£8 8 0	£11 10 0	6/6	2/-
Mullard "5-10" Main Amplifier Model 510/M. 10 watts	£10 0 0	£13 10 0	6/6	2/-
Mullard "5-10" Amplifier with Passive Control Unit. 10 watts	£12 0 0	£16 0 0	7/6	2/-
Stern JL10 Double Feature Pre-amplifier for Audio and Tape	£13 13 0	£19 19 0	5/-	5/-
Stern JL10 Main Amplifier Mono. 10 watts	£10 0 0	£13 13 0	8/6	3/-
(The above two items purchased together)	£23 13 0	£32 10 0	10/-	—
Stern Twin Three Stereo Amplifier. 3 watts per Channel	—	£9 0 0	5/-	—
Stern Twin Three Stereo Amplifier in Portable Case with Two Speakers and Leads	—	£16 10 0	10/-	—
Mullard "10+10" Stereo Amplifier. 10 watts per Channel	£16 0 0	£20 0 0	8/6	3/-
Mullard "10+10" Stereo Amplifier with Passive Control Unit. 10 watts per Channel	£20 0 0	£24 0 0	10/-	3/-
Mullard 4-channel Electronic Mixer Unit Model 2H for 2 Mics. Radio and Gram.	£8 8 0	—	5/-	2/6
Mullard 4-channel Electronic Mixer Unit Model IL	£10 5 0	—	5/-	2/6
HF/TR3 Tape Amplifier with Power Unit	£13 13 0	£19 0 0	7/6	3/-
Type "C" Tape Pre-amplifier with Power Unit	£14 0 0	£19 10 0	7/6	3/6
STP-1 Tape Pre-amplifier with Power Unit. Mono and Stereo	£22 0 0	£28 0 0	8/6	5/-
CR3/8 Tape Recorder with Studio Deck	£33 8 0	—	15/-	3/-

INDIVIDUAL DESCRIPTIVE LEAFLETS GIVING TECHNICAL SPECIFICATIONS- DIMENSIONS, PRICES, TERMS, ETC., FREE ON REQUEST

SURBITON PARK RADIO LTD.

ALL ORDERS DESPATCHED SAME DAY ● WE PAY POSTAGE AND INSURANCE
MONEY REFUND GUARANTEE

LEADING STOCKISTS OF MARTIN RECORDAKITS AND AUDIOKITS

MARTIN RECORDAKITS

	Price	Dep.	&	Mthly. pmts. of
HALF TRACK				
TAPE AMPLIFIER FOR STUDIO DECK with ready wired printed circuit, control and input panels, mains and output transformers, knobs, plans, screws, etc. EF86, ECC83, EZ80, EM85 and 2 EL84. 3 watts output. Magic eye, Radio and Mic. inputs. Ex. speaker socket. Tone and Monitor controls. Can be used as an amplifier	£11.11.0	47/-	8	25/6
COLLARO STUDIO DECK. Very latest model, 3 speeds, 3 motors and 7-in. spools	£10.19.6	44/-	8	24/6
CASE for above with 8 x 5in. speaker, two-tone grey	£5. 5.0			
COMPLETE KIT with tape and microphone	£29.19.6	120/-	12	44/-
QUARTER TRACK				
TAPE AMPLIFIER FOR STUDIO DECK as above	£12.12.0	52/-	8	27/6
CASE as above with speaker, two-tone grey	£5. 5.0			
COLLARO STUDIO DECK fitted Marriott "X" series heads	£13.19.6	56/-	12	20/6
COMPLETE KIT with tape and microphone	£33.19.6	136/-	12	49/10
TAPE PRE-AMPLIFIERS				
HALF TRACK for **STUDIO** deck. 400 mV out	£8. 8.0	34/-	6	25/8
QUARTER TRACK as above	£9. 9.0	39/-	6	28/4
TAPE HEADS				
BRADMATIC Half track Record/Playback and Erase on plate	£1.19.6			

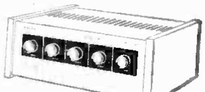
MARTIN AUDIOKITS

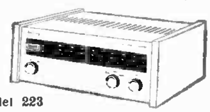
The new **MARTIN** all-transistor **TEN WATT AMPLIFIER** kits represent excellent value for money. Each unit is complete, requiring only to be connected to the next. We show only the popular units here. Others are available. Leaflet upon request.

	Price	Dep.	&	Mthly. pmts. of
UNIT 1. FIVE INPUT SELECTOR. Size 3¼ x 3in. Mag. P.U., Crystal P.U., Radio, Mic. Tape head. 9-15 Volts. Must be used with Unit 4	£2. 7.6			
UNIT 4. PRE AMPLIFIER AND CONTROL. Size 6¾ x 2½in. Volume on/off, Bass and Treble control. 9-15 Volts. Must be used with Unit 1	£3. 2.6			
UNIT 7. MAIN AMPLIFIER. 10 watts. 6-transistor Transformerless Push-pull output. Mounted on Heat sink. 15 ohms output. 40 Volts supply	£6.12.6			
UNIT 8. POWER SUPPLY. Gives 9 and 40 Volts. Heavy duty transformer, rectifier and smoothing	£2.15.0			
CONTROL PANEL for Units 1 and 4	10.6			
ALL FOUR ABOVE UNITS WITH PANEL. 15 ohms	£15. 8.0	62/-	12	22/6
UNIT 5. MAIN AMPLIFIER. As Unit 7 but 3 ohms output. 24 Volts	£5.12.6			
UNIT 6. POWER SUPPLY. As Unit 8, use with Unit 5	£2.12.6			
ALL FOUR UNITS 1, 4, 5 & 6 WITH PANEL. 3 ohms	£14. 5.0	57/-	12	20/10

STEREO VERSIONS NOW AVAILABLE, LEAFLET UPON REQUEST.

NEW ARMSTRONG TUNERS AND AMPLIFIERS


Model 222


Model 223

	Price	Dep.	&	Mthly. pmts. of
● **TUNERS, SELF-POWERED**				
224 F.M.	£22.10.0	90/-	12	33/-
223 A.M./F.M.	£28.15.0	115/-	12	42/2
● **TUNER/AMPLIFIERS, MONO**				
127 A.M./F.M. with 5 watt amp	£26.10.0	106/-	12	38/10
227 A.M./F.M. with 10 watt amp	£36.15.0	147/-	12	53/-
● **TUNER/AMPLIFIERS, STEREO**				
127 A.M./F.M. with 5+5 watt amp	£37.10.0	150/:	12	55/-
227 A.M./F.M. with 10+10 watt amp	£52.15.0	211/-	12	77/4
226 As 227 plus Mag. P.U.	£56. 0.0	214/-	12	82/1
● **STEREO AMP 222** 10+10 watt	£27.10.0	110/-	12	40/4

SHELF MOUNTING TEAK CASE **£3.10.0** EXTRA ALL MODELS.
SEND FOR NEW LEAFLET GIVING FULL TECHNICAL DETAILS.

MONO AMPLIFIERS

	Price	Dep.	&	Mthly. pmts. of
LINEAR L45/A 3 valve, 3 watt	£6. 6.0			
DULCI GA5 Integrated, 5 watts, ECL86 valve	£13. 2.6	52/6	12	19/3
TRIPLETONE HI-FI MAJOR 10 watts output, 2 EL84	£15.18.9	64/9	12	23/3
LEAK TL12 10 watt MAIN AMPLIFIER	£20. 0.0	80/-	12	29/4
LEAK VARISLOPE Mono Pre-amplifier	£15.15.0	63/-	12	23/1
DULCI DPA15 15 watt with 2 valve Pre-amp.	£26.5.0	105/-	12	38/6

STEREO AMPLIFIERS

	Price	Dep.	&	Mthly. pmts. of
ROGERS CADET Mk. II with P.A.	£26.15.0	107/-	12	39/2
LEAK TRANSISTOR STEREO 30 P.A.	£49.10.0	198/-	12	72/7
LEAK STEREO 20 P.A. and main amplifier	£55. 9.0	229/-	12	80/3

HI FI LOUDSPEAKERS

	Price	Dep.	&	Mthly. pmts. of
GOODMANS AXIETTE 8-inch	£5. 5.7			
GOODMANS AXIOM 10 inch	£6.5.11			
GOODMANS 5K/20/XL Tweeter and crossover	£7. 7.0			
GOODMANS X05000, £2.0.11. X0950, £5.10.11				
GOODMANS 210 12in. unit, Full range, 15 watt	£10.17.6	43/6	8	24/3
GOODMANS 301 12in. unit, Full range, 20 watt	£15. 4.6	61/-	12	22/4
GOODMANS "MAXIM"	£17.10.0	70/-	12	25/8
W.B.HF1012 10in. unit, 3.75, 7.5 & 15 ohms	£4.12.0			
WHARFEDALE SUPER 3 Tweeter	£5.16.8			
WHARFEDALE SUPER 5 Tweeter	£5.19.7			
WHARFEDALE SUPER 8 RS/DD	£6.14.2			
WHARFEDALE SUPER 10 RS/DD. Full range	£10.18.0	44/-	8	24/3
WHARFEDALE RS/12/DD 12in. unit, Full range	£11.10.0	46/-	8	25/6
WHARFEDALE SUPER 12 RS/DD	£17.10.0	70/-	12	25/8

LEAFLETS BY WHARFEDALE AND GOODMANS ON REQUEST.

F.M. TUNERS

	Price	Dep.	&	Mthly. pmts. of
TRIPLETONE F.M. TUNER, Less power	£13.19.6	46/-	12	20/6
TRIPLETONE F.M. TUNER, With power	£15.14.6	63/-	12	23/1
JASON JTV/2 F.M. and T.V. sound. Switched, self-powered	£22. 5.0	89/-	12	32/7

GRAMOPHONE UNITS

	Price	Dep.	&	Mthly. pmts. of
NEW BSR UA25 with Mono Cart	£6. 6.0	—	—	—
GARRARD SRP10. Single player, Mono cart.	£5.10.0			
GARRARD AUTOSLIM, 4 speed changer, Mono	£6.12.6			
GARRARD AT6 AUTOSLIM DE LUXE, Mono	£10.10.0	42/-	8	23/6
GARRARD AT/5/P Imprvd Autoslim (Stereo)	£9. 0.0	36/-	6	27/4
GARRARD AT5/3000 LM as AT/6 with slim arm (Stereo)	£11.12.0	46/6	8	25/9
GARRARD "DECCADEK" Single Player with Decca Deram Cartridge	£15.15.0	63/-	12	23/1
GARRARD 4HF Transcription Unit, Mono	£17. 0.0	68/-	12	24/11
GARRARD LAB. "A" Transcription changer	£19.14.9	79/-	12	28/11
GARRARD 301 STROBE Transcription unit	£22. 0.0	88/-	12	32/3
PHILIPS AG1016, Stereo cartridge, will change 7in. records with adaptor, 10/- extra	£12.12.0	50/6	12	18/6
GOLDRING GL58 with arm but less cartridge	£17. 1.0	69/-	12	24/11
GOLDRING GL70 with arm but less cartridge	£27. 9.4	111/4	12	40/1
GOLDRING "88" Transcription, less arm	£18.18.5	76/5	12	27/8

GUITAR SPEAKERS

	Price	Dep.	&	Mthly. pmts. of
FANE L 12in. Heavy duty unit, 20 watt	£5. 5.0			
WHARFEDALE W12/EG 12in. 15 watt LEAD	£10.10.0	42/-	8	23/6
WHARFEDALE W15/EG 15in. 15 watt BASS	£17.10.0	70/-	12	25/8
GOODMANS AUDIOM 51 12in. 15 watt BASS	£9. 2.8	36/8	6	27/8
GOODMANS AUDIOM 61 12in. 20 watt LEAD or BASS	£14. 7.8	57/8	12	21/1
GOODMANS GUITAR Speaker Audiom 81-15"	£25. 0.0	100/-	12	36/8
GOODMANS AUDIOM 91 18in. 50 watt BASS	£27.10.0	110/-	12	40/4

WRITE FOR GOODMANS LEAFLET "LOUDSPEAKERS FOR ELECTRIC GUITARS."

GUITAR AMPLIFIERS

	Price	Dep.	&	Mthly. pmts. of
LINEAR DIATONIC 12 watt, 2 inputs	£13. 2.6	52/6	12	19/3
LINEAR CONCHORD 30 watt with **COVER**	£19. 4.6	77/-	12	28/2
LEAK TL25 with Pre-amp., 25 watt	£42. 5.0	169/-	12	61/11
LEAK TL50 with Pre-amp., 50 watt	£51. 5.0	205/-	12	75/2

MICROPHONES AND FLOOR STANDS

	Price	Dep.	&	Mthly. pmts. of
RESLO RBH/T Ribbon	£11. 2.6	44/6	8	24/9
RESLO RBH/TS Ribbon with on/off switch	£13.10.0	54/-	12	19/9
RESLO Heavy Duty Floor Stand	£7. 0.0.			
TEISCO DM304 Dual impedance with switch	£4.10.0			
PIEZO BM3 Crystal with switch	£2.10.0			
JAP: FLOOR STAND	£3. 3.0			

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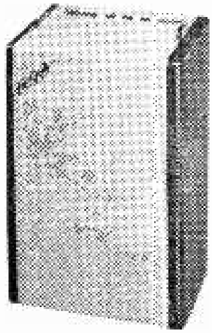


BASS-MAJOR 30 WATT GUITAR AMPLIFIER

A MULTI-PURPOSE HIGH FIDELITY, HIGH OUTPUT UNIT FOR VOCAL AND INSTRUMENTALIST GROUPS

Eminently suitable for bass, lead or rhythm guitar and all other musical instruments

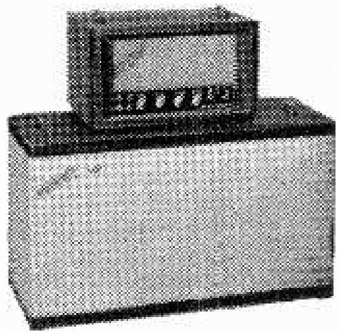
★ Incorporating two 12in. heavy duty 25-watt high flux (17,000 lines) loudspeakers with 2in. diameter speech coils. Designed for efficient handling full output of amplifier at frequencies down to 25 c.p.s.
★ Dual Cone in second speaker reproduces frequencies up to 17,000 c.p.s.
★ Heavily made cabinet of convenient size 28 x 15 x 13in. has an exceptionally attractive covering in two contrasting tones of Vynair.
★ For 200-250 v. to 50 c.p.s. A.C. mains operation.
★ Four jack socket inputs and two independent vol. controls for simultaneous connection of up to four instrument pick-ups or microphones.
★ Separate bass and treble controls providing more than adequate "Boost" or "Cut".
★ LEVEL frequency response throughout the audible range.
★ SUPERIOR TO UNITS AT TWICE THE COST.

39½ Gns. Send S.A.E. for leaflet OR DEPOSIT of £4.3.0 and 12 monthly payments of £3.9.11. Carr. 17/6.

BASS-REGENT
50 WATT GUITAR AMPLIFIER

AN EXCEPTIONALLY POWERFUL HIGH QUALITY ALL-PURPOSE UNIT

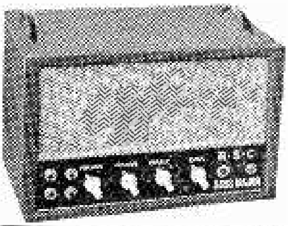
For bass, lead or rhythm guitar and all other musical instruments
For vocalist, gram, radio, tape and general P.A.



★ UNUSUALLY POWERFUL LOUDSPEAKER COMBINATION consisting of a FANE HIGH FLUX 15 in. 30 watt unit and a FANE 12 in. 20 watt unit with extended frequency response.
★ 4 Jack Socket inputs and two independent volume controls for simultaneous use of up to four instruments, pickups, or mikes.
★ Separate Cabinets fully covered with Rexine and Vynair in contrasting tones for Amplifier and Speakers.
★ Separate Bass and Treble controls for "Boost" and "Cut".

Send S.A.E. for leaflet. Or call at one of our many branches and compare the Bass-Regent with units at more than 3 times the cost.

44 Cash Price GNS. Carr. 19/6 Or Deposit £4.10.8 and 12 monthly payments of £3.16.8



30W. HIGH QUALITY AMPLIFIER

A Four Input, two volume control, Hi-Fi unit with separate Bass and Treble "Cut" and "Boost" controls. Designed for vocal or instrumental groups. For Bass, Lead or Rhythm Guitar. Six Mullard or Brimar latest type valves. Housed in strong Rexine covered cabinet with twin chrome carrying handles. Attractive black and gold perspex fascia plate. For 200-250 v. A.C. mains. Output for 3 or 15 ohm speakers. Send S.A.E. for leaflet.

16½ GNS. Carr. 10/- or Deposit £2.1.6 and 12 monthly payments of £1.8.4

R.S.C. G15 15 WATT LEAD OR RHYTHM GUITAR AMPLIFIER

High-fidelity push-pull output. Separate bass and treble "cut" and "boost" controls. Twin separately controlled inputs so that two instruments or "mike" and pick-ups can be used at the same time. Loudspeaker is a heavy duty high flux 12in. 20 watt model with cast chassis. Cabinet is well made and finished as G5 Model. Size approx. 18 x 18 x 8in. Only **19 Gns.** Carr. 10/-

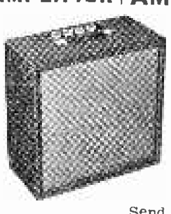
Send S.A.E. for leaflet. Or DEPOSIT 39/11 and twelve monthly payments of 33/4.

R.S.C. G5 GUITAR AMPLIFIER

5-watt high quality output. Incorporating high flux 12in. 12.000 line loudspeaker. Sensitivity 50 m.v. High impedance jack input. Handsome strongly made cabinet (size 14 x 14 x 7in. approx.) finished in complimentary shades of Rexine/Tygan. 200-250 A.C. mains. Suitable for Lead or Rhythm Guitar in the home or small club, etc.

£9.19.6 Or DEPOSIT 22/3 and 9 monthly payments of 22/3. Carr. 7/6.

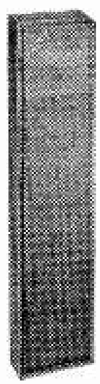
R.S.C. B20 BASS GUITAR AMPLIFIER



A highly efficient unit incorporating a massive 15in. high flux loudspeaker specially constructed to withstand heaviest load conditions. Rating 25 watts. Individual bass and treble controls give ample "boost" and "cut". Two high impedance jack socket inputs are separately controlled. All controls are conveniently positioned in a recess on top of the cabinet. Cabinet is of substantial construction and attractively finished in two contrasting tones of Rexine and Vynair. Size approx. 24 x 21 x 13in. Operation from 200-250 v. 50 c.p.s. A.C. mains. Send S.A.E. for leaflet **29½ Gns.** Or deposit £3.2.0 and 12 monthly payments of 51/8. Carr. 17/6.

LINEAR TREMOLO/PREAMP. UNIT

Designed for introducing the Tremolo effect to any amplifier which is fitted with a reserve power supply point for smoothed H.T. and 6.3 v. A.C. L.T. The unit plugs into power supply point and any input socket or amplifier. Controls are Speed (frequency of interruptions). Depth (for heavy or light effect). Volume and Switch. Three sockets are for two inputs and Foot Switch. ONLY **4Gns.**



R.S.C. COLUMN SPEAKERS

Finished in polished veneered walnut. Ideal for vocalists and Public Address. Normally supplied for 15 ohm matching but can be supplied for 100 v. line for 35/- extra.

Type C57, 10-15 watts. Fitted five 6 x 4 elliptical speakers. Overall size approx. 26 x 9 x 4ins. **9 Gns.** Carr. 7/6

Type C58, 15-20 watts. Fitted five 8in. high flux speakers. Overall size approx. 42 x 10 x 5ins. **12 Gns.** Carr. 10/-

Or Deposit 27/6 and 12 monthly payments 20/10.

HEAVY DUTY LOUDSPEAKERS in SUBSTANTIAL REXINE COVERED CABINETS. Type BG1. Suitable for Bass Guitar. Speaker Unit 15in., High Flux, 15 ohms, 30 watts. Cabinet size approx. 24 x 21 x 13in. Only 19½ gns. Or Deposit 43/- and 12 monthly payments of 34/-. Type BG3/2. Suitable Bass and Lead Guitar. Two 12in. high flux 15 ohm 25 watt speakers, one with aluminium speech coil and dual cone to provide smooth frequency response from 25 to 17,000 c.p.s. Cabinet size approx. 30 x 21 x 14in. Covered in two contrasting tones of grey Vynair and Rexine. Rating 50 watts. Only 29 gns. Or Deposit £3.7.6 and 12 monthly payments of 50/-.

R.S.C. (Manchester) Ltd.

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S.A.E. with all enquiries, please. Personal shoppers welcomed at any of the branches below. Open all day Saturday.

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Opening 14th Jan. 1965, spacious new premises at 10 North Parade.
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Larger premises now open.

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LEICESTER 32 High Street (Half-day Thursday)

LEEDS 5-7 County (Mecca) Arcade (No half-day closing)

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New large store.

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EX. GOV. 2 V. ACCUMULATORS. 16 A.H. Size 7 x 4 x 2in. Brand new, 4/9 each. Three for 12/6, carr. 5/-.

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

LINEAR L45 MINIATURE 4-5 WATT QUALITY AMPLIFIER. Suitable for any record playing unit and most microphones. Negative feed-back 12dB. Separate Bass and Treble Controls. For mains 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Mullard valves EZ80, ECC83, EL84. Size only 7 x 5 x 5½in. high. Guaranteed 12 months. Only 6 gns. Send S.A.E. for leaflet. Terms: Deposit 24/9 and 5 monthly payments of 24/9.

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

A highly sensitive Push-Pull high output unit with self-contained Pre-amp. Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 dB down. Frequency response ±3 dB 30-20,000 c/s. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used EF86, EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 millivolts so that **ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE.** The unit is designed for **CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS,** etc. For use with Electronic **ORGAN, GUITAR, STRING BASS,** etc. For standard or long-playing records. **OUTPUT SOCKET PROVIDES** L.T. and H.T. for **RADIO FEEDER UNIT.** An extra input with associated vol. control is provided so that two separate inputs such as Gram and "Mike" can be mixed. Amplifier operates on 200-250 v. 50 c/s. A.C. Mains and has output for 3 and 15 ohm speakers. Complete Kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required perforated cover with carrying handles can be supplied for 19/9. The amplifier can be supplied, factory built with EL34 output valves and 12 months' guarantee, for 14 gns. Send S.A.E. for leaflet.

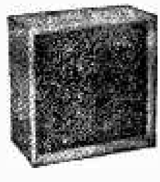
11 Gns. Carr. 10/-.

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

FANE HEAVY DUTY HI-FI SPEAKERS

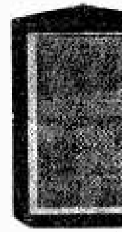
12in. 15 ohms. Cast chassis. Exceptionally robust 2in. diam. Voice Coil Assemblies.
122/10 20watt, 5 gns. 122/10A 20watt, 6 gns.
122/12 20watt, 7 gns. 122/12A 20watt, 8 gns.
122/14 22watt, 9 gns. 122/14A 22watt, 10 gns.
122/17 25watt, £11.17.6 122/17A 25watt, £12.17.6
15in. 15 ohms. Cast chassis. Exceptionally robust 2in. diam. Voice Coil Assemblies.
152/12 20watt, 12 gns. 152/12A 20watt, 13 gns.
152/14 27watt, 14 gns. 152/14A 27watt, 15 gns.
152/17 35watt, 16 gns. 152/17A 35watt, 17 gns.
"A" indicates dual cone type. 30-17,000 c.p.s. Send S.A.E. for leaflets. Terms available.

12in. 10 WATT HIGH QUALITY LOUDSPEAKER.



In walnut veneered cabinet. Gauss 12,000 lines. Speech coil 3 ohms or 15 ohms. Only **£4.19.6.** Carr. 5/-. Terms: Deposit **11/3** and 9 monthly payments of **11/3.** **12in. 20 WATT HI-FI LOUDSPEAKERS IN CABINETS.** Size 18 x 18 x 10in. Finish as above. Terms: Deposit **17/9** and 9 monthly payments of **17/9.** Only **£7.19.6.** Carr. 8/6. **For larger types see page 815.**

R.S.C. CORNER CONSOLE CABINETS



Polished walnut veneer finish. Pleasing design.
JUNIOR MODEL. Size 20 x 11 x 8in. for 8 x 5in. or 10 x 6in. speakers. **£2.9.9.**
STANDARD MODEL Size 27 x 18 x 12in. for 8 or 10in. speakers. **£4.11.9.**
SENIOR MODEL. Size 30 x 20 x 15in. for 12in. Speaker. Suitable Speaker systems below. Only **7 gns.**

AUDIOTRINE HI-FI SPEAKER SYSTEMS. Consisting of matched 12in. 12,000 line. 15 ohm high quality speaker; cross-over unit (consisting of choke, condenser, etc.) and Tweeter. The smooth response and extended frequency range ensure surprisingly realistic reproduction. Standard 10 watt rating **£4.19.9.** Carr. 5/-. Or Senior 15 watt. **£6.19.6.** Carr. 7/6.

R.S.C. BASS REFLEX CABINETS, JUNIOR MODEL. Specially designed for W.B. HF1012 Speaker, but suitable for any good quality 10in. speaker. Acoustically lined and ported. Polished walnut veneer finish. Size 18 x 12 x 10in. Handsome appearance. Ensure superb reproduction for only **£3.19.6.**

STANDARD MODEL. As above but for 12in. speakers. Size 20 x 15 x 13in. For vertical or horizontal use. **£5.19.6.** Set of legs with brass ferrules. **19/6.**

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

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

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

TWEETERS. R.A. 3 ohm 25/9; 15 ohm 25/9.

R.A. 12in. DUAL CONE 3 ohm 8 watt Speakers. Ideal for Stereo. Only 39/9 ea.

P.M. SPEAKERS. 10in. W.B. "Stentorian" 3 or 15 ohms type HF1012 10 watts, hi-fidelity type. Recommended for use with our A11 Amplifier, £4.12.6. 12in. R.A. 3 ohms 10 watts (12,000 lines). 59/9.

ARMSTRONG, DULCI, LINEAR, ROGERS, LEAK and JASON EQUIPMENT, GOODMANS, W.B. AND FANE SPEAKERS. GARRARD AND GOLDRING T/TABLES CASH or H.P.

SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner (specially suitable for use with our Amplifiers). Delayed A.V./C. Controls are Tuning, W/Ch. and Vol. Only 250 v. 15 mA H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size approx. 9 x 6 x 7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustrations, 2/6. Total building cost £5.5.0. S.A.E. for leaflet.

MULTI-METER, CABY M1. Sensitivity 2,000 ohms per volt. A.C. and D.C., 54/-. **A.10.** Basic Meter sensitivity 155 micro-amps A.C. and D.C. ranges £4.11.6. **B.40.** Sensitivity up to 10,000 ohms per volt A.C. and D.C., £8.2.6. 30,000 ohms per volt, with overload buzzer. £8.19.6.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

R.S.C. BATTERY TO MAINS Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s is available. **Suitable for all battery portable receivers requiring 1.4 and 90 v.** This includes low consumption types. Complete kit with diagrams, **39/9,** or **ready to use, 46/6.**

Type BM2. Size 8 x 5½ x 2½in. Supplies 120 v. 90 v. and 60 v. 40 mA and 2 v. 0.4 a. to 1 amp. fully smoothed. **Thereby completely replacing both H.T. batteries and L.T. 2 v. accumulators when connected to A.C. mains supply 200/250 v. 250 c/s. SUITABLE FOR ALL BATTERY RECEIVERS** normally using 2 v. accumulators. Complete kit of parts with diagrams and instructions, **49/9, or ready for use, 59/6.**

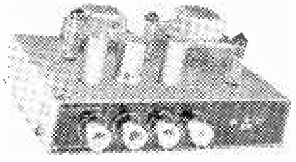
AUDIOTRINE HI-FI TAPE RECORDER KIT 25½ GNS. Carr. 17/6.

REALISM AT INCREDIBLY LOW COST. CAN BE ASSEMBLED IN AN HOUR
Incorporating the latest Collaro Studio Tape Transcriptor. The Audiotrine High Quality Tape Amplifier with negative feedback equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Reel of Best Quality Tape and a Handsome Portable Carrying Cabinet tastefully covered in two contrasting shades of Rexine and Vynair, size 14¼ x 15 x 8¼in. high and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£80 class. S.A.E. for leaflets. **TERMS. Deposit £2.13.9** and 12 monthly payments of **44/-**. Cash price if settled in 3 months.

ONLY 3 PAIRS OF SOLDERED JOINTS PLUS MAINS

HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

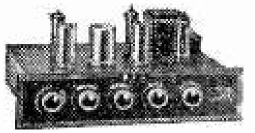
PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP STAGES



Two input sockets with associated controls allow mixing of "mike" and gram., as in A10 High sensitivity. Includes 5 valves. ECC83, ECC83, EL84, EL84, EZ81. High Quality sectionally wound output transformer specially designed for Ultra Linear operation. Reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut". Frequency response ±3 dB 30-20,000 c/s. Six negative feedback loops. Hum level 60 dB down. ONLY 23 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs for **STANDARD or LONG PLAYING RECORDS.** For **MUSICAL INSTRUMENTS** such as **STRING BASS, LEAD OR RHYTHM GUITARS**, etc. **OUTPUT SOCKET** with plug provides 300 v. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12 x 9 x 7in. For A.C. mains 200-250v. 50 c.p.s. Output for 3 and 15 ohms speaker. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Only **8 Gns.** Carr. 10/-. (Or factory built **51/-** extra.)
If required louvred metal cover with 2 carrying handles can be supplied for **18/9. TERMS ON ASSEMBLED UNITS. DEPOSIT 24/9** and 9 monthly payments of **24/9.** Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Microphones, etc., with cash and credit terms.

LINEAR TAPE PRE-AMPLIFIER. Type LP/1. Switched Negative feedback Equalisation. Positions for Record 1⅞in., 3¾in., 7½in. and Playback. EM84 Recording Level Indicator. Designed primarily as the link between a Collaro Tape Transcriptor and a high fidelity amplifier, but suitable for almost any Tape Deck. Only 9½ gns. S.A.E. for leaflet.

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



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

R.S.C. GRAM. AMPLIFIER KIT. 3 watts output. Negative feedback. Controls Vol., Tone and Switch. Mains operation 200-250 v. A.C. Fully isolated chassis. Circuit, etc., supplied. Only **39/9.** Carr. 3/9.

HI-FI CRYSTAL PICK-UP HEADS. (Cartridges.) Acos Standard replacement for Garrard, B.S.R. and Collaro, **16/9.** Acos Stereo-Monaural, **29/9.** Ronette Stereo-Monaural **39/9.** B.S.R. Stereo **39/9.**

BRADMATIC RECORDING HEADS. High Impedance Record/Playback **22/-.** Low Impedance Erase, **12/6.**

MARRIOTT RECORDING HEADS. High Impedance, Record/Playback. Low Impedance, Erase. **25/-** pair

PICK-UP ARMS. Complete and with latest Acos/hi-fi Turnover Cartridge **29/11**

CRYSTAL MICROPHONES. Hand type NP110 **12/9.** R.T.C. **19/9.** Acos Mic 40 **25/9.** Acos Mic 45 **29/9.** Stick type Acos 39-1 **39/9.** BM3 with neck band and heavy table stand **49/9.** Lapel type **29/9.**

COLLARO JUNIOR. 4-speed Single Player Unit and Crystal Pick-up with hi-fi Turnover head. Only **59/6**

B.S.R. UA14 4-sp'd AUTO-CHANGERS with hi-fi turnover head. **£5.19.6.** Carr. 4/6.

GARRARD AUTO-SLIM 4-SPEED AUTO-CHANGER with high fidelity pick-up. Latest model. For 200-250 v. A.C. mains, **£7.17.6.** Carr. 4/6.

GARRARD AT6 AUTO-SLIM DE-LUXE 4-SPEED AUTOCHANGERS. Turnover GC8 head, for 200-250 v. A.C. mains, **£11.9.0.**

GL3A MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with any single or auto-change unit. Output for 2/3 ohm speaker. For 200-250 v. A.C. mains. Size 11½ x 2¼ x 2¼in. Controls: Vol. and Tone with Switch. Only **59/6.**

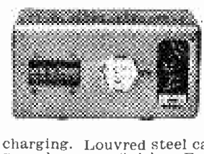
SENSATIONAL STEREO OFFER

A complete set of parts to construct a good quality Stereo amplifier with an undistorted output total 6 watts. **4 Gns.** For A.C. mains input of 200-250 v. Sensitivity 130 m.v. Ganged Vol. and Tone Controls. Preset balance control. Full instructions and wiring diagrams supplied. Stereo Pick-up Head **19/9** extra with above only.

HEAVY DUTY CHARGER KIT 6/12 v. 6 amps., variable output. Consisting of Mains Transformer 0-200-230-250 v.; F.W. (Bridge) Selenium Rectifier; Ammeter, Variable Charge Rate Selector Panels, Plugs, Fuses, Fuseholder and circuit. **59/9.** Carr. 4/6.

R.S.C. BATTERY CHARGING EQUIPMENT Guaranteed 12 months

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



ASSEMBLED 4 amps 6/12 v. Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved grey hammer finish. Fused and ready for use with mains and output leads and battery clips. Carr. 4/6. **59/9**
Terms: Deposit **12/-** and 5 monthly payments of **12/-.**

ASSEMBLED 6/12 v. 2 amps. Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case finished attractive hammer blue. Fused. ready for use with mains and output leads. **39/9** Carr. 3/9.
6/12v. 1 amp. 27/9 Less meter.

BATTERY CHARGER KITS Consisting of Mains Transformer, F.W. Bridge, Metal Rectifier, well ventilated steel case. Fuses. Fuse-holders. Grommets, panels. Heavy Duty Clips, circuit. Carr. 3/6 extra.

6v. or 12v. 1 amp......	22/9
As above with Ammeter..	28/9
6 v. or 12 v. 2 amps........	25/9
6 v. or 12 v. 2 amps, inclusive of Ammeter........	35/9
6 v. or 12 v. 4 amps, with Ammeter and variable charge rate selector......	52/9

CHARGER AMMETERS 0-1.5 a., 0-4 a., 0-7 a., **8/9** each.

CHARGER KIT, 12v. 10 Amp. with variable charge rate adjustment and ammeter. **£4.19.6.** Carr. 10/-.

SPECIAL OFFER

12v. 2 amp. F.W. Bridge Metal Rectifiers, 3 for **7/9.**

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

Interleaved and Impregnated. Primaries 200-230-250 v. 50 c/s. Screened

TOP SHROUDED DROP THROUGH

250-0-250v. 70mA. 6.3v. 2a. 0-5-6.3v. 2a	17/9
350-0-350v. 80mA. 6.3v. 2a. 0-5-6.3v. 2a	19/9
250-0-250v. 100mA. 6.3v. 2a. 6.3v. 1a ..	21/9
250-0-250v. 100mA. 6.3v. 3.5a. C.T. ..	19/9
250-0-250v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a	27/9
300-0-300v. 130mA. 6.3v. 4a. 6.3v. 1a. for Mullard 510 Amplifier	33/9
300-0-300v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a	27/9
350-0-350v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a	27/9
350-0-350v. 150mA. 6.3v. 4a. 0-5-6.3v. 3a	35/9

FULLY SHROUDED UPRIGHT

250-0-250v. 60mA. 6.3v. 2a. 0-5-6.3v. 2a Midget type 2½ x 3 x 3in.	17/11
250-0-250v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a	28/9
300-0-300v. 100mA. 6.3v. 4a. 5v. 3a ..	28/9
300-0-300v. 130mA. 6.3v. 4a. C.T. 6.3v. 1a. for Mullard Amplifier	35/9
350-0-350v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a	28/9
350-0-350v. 150mA. 6.3v. 4a. 0-5-6.3v. 3a	37/9

FULLY SHROUDED (continued)—

425-0-425v. 200mA. 6.3v. 4a. C.T. 5v. 3a	57/9
425-0-425v. 200mA. 6.3v. 4a. C.T.. 6.3v. 4a. C.T.. 5v. 3a	59/9
450-0-450v. 250mA. 6.3v. 4a. C.T. 5v. 3a	69/9

OUTPUT TRANSFORMERS

Midget Battery Pentode 66:1 for 3S4, etc.	4/6
Small Pentode. 5.000Ω to 3Ω	4/6
Small Pentode. 7/8.000Ω to 3Ω	4/6
Standard Pentode 5.000Ω to 3Ω ..	5/9
Standard Pentode 7,000Ω to 3Ω ..	5/9
10,000Ω to 3Ω	5/9
Push-Pull 8 watts. EL84, or 6V6 to 3Ω or matched to 15Ω	9/9
Push-Pull 10-12 watts to match 6V6 or EL84 to 3-5-8 to 15Ω	19/9
Following types for 3 and 15Ω speakers	
Push-Pull 10-12 watts 6V6 or EL84 ..	18/9
Push-Pull 15-18 watts. 6L6, KT66 ..	22/9
Push-Pull Mullard 510 Ultra Linear ..	29/9
Push-Pull 20 watts. sectionally wound 6L6, KT66, EL34, etc.	49/9

MIDGET MAINS Primaries 200-250 v 50 c/s.

250v. 60mA. 6.3v. 2a.	11/9
250-0-250v. 60mA. 6.3v. 2a.	12/11

Both above size 2⅝ x 2⅝ x 2¼in.

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

SMOOTHING CHOKES

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

CHARGER TRANSFORMERS
All with 200-230-250v. 50 c/s Primaries; 0-9-15v. 1½a, **12/9**; 0-9-15v. 2a, **14/9**; 0-9-15v. 3a, **16/9**; 0-9-15v. 5a, **19/9**; 0-9-15v. 6a, **23/9**; 0-9-15v. 8a, **28/9.**

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

MICROPHONE TRANSFORMERS
120:1 high grade, clamped, **8/9.**

TRANSMITTER RECEIVER NO. 46

Compactly built to be carried by one man. This has a range of approx. 10 miles, and being crystal controlled, tuning is avoided, and operation is as accurate as a telephone. Frequency 3.6—9.1 Mc/s. Complete stations comprising receiver transmitter, rod aerial. One set of headphones and mike, in canvas carrying bag. The crystal coil units can be supplied for only 35/- per set, post free. Brand new in maker's sealed cartons. Price per station **£4.10.0** P. & P. 10/- each. Two stations for **£9.10.0** Post free.

HANDY POWER PACK

Housed in compact metal case. 200/250 v. A.C. mains. Output 250v. 50mA D.C. fully smoothed. 6.3 at 2 amps. Can be used for powering almost any pre-amp. or radio tuner. Price 39/6. P. & P. 2/6.

No. 19 SET INSTRUCTION HANDBOOK 3/6 each P. & P. 6d.

1155 INSTRUCTION HANDBOOK 3/6 each P. & P. 6d.

H.R.O. INSTRUCTION HANDBOOK 3/6 each P. & P. 6d.

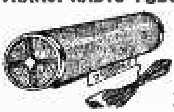
TRANSMITTER RECEIVER NO. 46 HANDBOOK 3/6 each P. & P. 6d.

FREQUENCY METER BCC221 HANDBOOK 3/6 each P. & P. 6d.

RESISTOR COLOUR CODE INDICATOR

Enables you to determine value of resistor at a glance. A must for the constructor. Price 1/6. P. & P. 3d.

TRANS. RADIO TUBULAR SPEAKER



Booster Speaker. Plugs into earpiece socket of most radios and tape recorders. Gives double the volume and a hi-fi stereo effect that will amaze you. Size approx. 9 x 2¼in. Price 25/-. P. & P. 1/9.

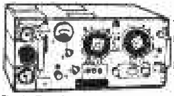
2-WAY SOUND POWERED TELEPHONE

As used by the armed forces. These sound powered earpieces will work up to a distance of one mile without the use of batteries. Beautifully made, ideal for use in the house, office or garden. Complete with connecting cable, 17/6. P. & P. 2/6.

HIGH IMPEDANCE PERSONAL LISTENING EARPIECES

Suitable for all types of crystal sets and transistor sets. Complete with plug. Price **4/11** P. & P. 6d.

TYPE 19 SHORT WAVE RECEIVING SET

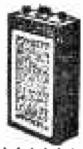


Works straight off the mains. An excellent short wave receiver, requires only phones for immediate operation. Price £5.19.6. P. & P. 10/-.

Suitable phones 15/- per pair. P. & P. 2/6.

During an evening testing on this excellent receiver, we obtained clear reception from scores of stations, many of them thousands of miles distant, including ship stations, Government transmission, maritime broadcasts and also the short wave radio Luxembourg broadcasts.

LEAD ACID ACCUMULATORS (Unspillable)



2 volts at 16 A.H. Brand new. Size 4 x 7 x 2½in. 4/11 each. 3 for 12/6. P. & P. 3/- per cell.

4 CHANNEL TRANSISTORISED SOUND MIXER

Add musical highlights plus additional sound effects to your tape-recorder. This instrument permits mixing of 4 signals such as microphone, record player, radio tuner etc., into single output. Fully transistorised and self contained in handsome cabinet. Price 49/6. P. & P. 2/6. Standard jack plugs to fit same, 2/6 each. P. & P. 6d. 2 for 4/6. P. & P. 9d. Chrome shielded 3/6 each. P. & P. 9d. 2 for 6/6. Post free.

TRANSMITTER RECEIVER NO. 46 and NO. 38 SET H.T. POWER PACKS

Power your 46 trans./rec. or 38 trans./rec. set straight from the mains. This valuable unit provides a stabilised D.C. H.T. for these sets. Robustly and compactly made. Only 39/6. P. & P. 5/-.

LIGHTWEIGHT GRAMOPHONE PICK-UP ARM

Complete with Acos hi-fi turnover cartridge. Price 25/-. P. & P. 1/-.

TRANSFORMERS

TYPE 1. Filament Transformer. 200/250 primary 50 c/s. Secondary 6.3 volts at 2 amps. Price 5/11. P. & P. 2/3.

TYPE 2. Mains Transformer. 200/250 primary 50 c/s. Secondary 250, 0.250 volts at 80 m.a. 6.3 v. at 4 amps. 5 v. at 2 amps. Price 19/9. P. & P. 3/6.

TYPE 3. Primary 200/250 50 c/s. Secondary tapped as follows: 5 v., 11 v. and 17 v. all at 4 amps. Price 29/6. P. & P. 3/6.

TYPE 4. Primary 200/250 50 c/s. Secondary tapped as follows: 3 v., 4 v., 5 v., 6 v., 8 v., 9 v., 10 v., 12 v., 15 v., 18 v., 20 v., 24 v. and 30 v. all at 2 amps. Price 39/6. P. & P. 3/6.

TYPE 5. Primary 200/250 v. 50 c/s. Secondary 350-0-350 v. at 80 m.a., 6.3 v. at 4 amps, 5 v. at 2 amps. Price 25/-. P. & P. 3/6.

TYPE 6. A really excellent well-made robust transformer. Fully shrouded and upright. Primary 200/250 50 c/s. Secondary 450-0-450 v. 250 m.a., 6.3 v. at 4 amps, 5 v. at 3 amps. Price 65/. P. & P. 5/-.

SPECIAL XMAS OFFER

'Six-transistor' radios at 59/6 each. Fully guaranteed. Will receive Home, Light, Luxembourg etc. Hi-Fi toned speaker. Few only. P. & P. 3/6. Battery 2/6 extra. Earpiece 3/6 extra. Hurry while they last.

MICRO ALLOY TRANSISTORS

Mat 100 .... 7/9
Mat 120 .... 7/9
Mat 121 .... 8/6
VHF Transistor ADT140 .... 15/-
Above MAT's postage paid.
Ferrite Slab Aerials suitable for transistor sets 3/-. P. & P. 6d.

TANK AERIALS

Fully interlocking copper rods. One foot sections. Ideal for car or scooter aerials. Will make excellent dipoles. Six sections complete with canvas carrying case. 3/6, P. & P. 1/6. Additional sections 6d. each. Please send sufficient postage.

PAXOLIN SHEETS

Strong, high quality paxolin sheets. Size 10½ x 8½ x 1/10in., 3 for 5/-. P. & P. 1/-.

MORSE KEYS

Morse key assembly Key with base, cover and terminals. Complete with lead. 6/11. P. & P. 2/-. 2 Morse Keys for 12/6 post free.

HIGH IMPEDANCE HEADPHONES

Lightweight. Suitable for all applications. 11/- per pair. P. & P. 1/6. 2 pairs for 22/6. Post free.

R.A.F. SHORT WAVE RECEIVER

35 to 40 Mc/s. Power supplies 12 volts and 250 volts D.C., in excellent condition with exceptionally fine slow-motion tuning and clean component layout. Price £2.19.6. P. & P. 6/-.

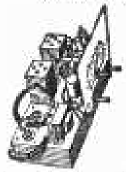
SONA STREAMLINE/BM3 MICROPHONE CRYSTAL INSERTS

Price 7/6. P. & P. 9d.

BATTERY CHARGE ADJUSTERS

●Charge Rate Adjuster. ●Government manufacture. ● Easily fitted to charging circuit. 3/6 each; 2 for 6/6. P. & P. 2/6.

SUPERHET RADIO CHASSIS



These well-made radio receivers were made for the Government for Forces entertainment. Valve line-up: 6K8, 6K7, 6Q7 and 6V6. Choke smoothing, slow-motion tuning, printed scale 200—550 metres, complete with all valves and 6 v. power pack. Provided with a robust cabinet and an 8in. speaker to fit. Only £3.19.6. P. & P. 10/-. Few only left.

TX RX NO. 19 POWER UNITS

12 v. D.C. input. Output 275 volts at 110 mA and 500 volts at 50 mA. The equipment is of American or Canadian manufacture. Price £1. Carriage 10/-.

DOUBLE THROAT MIKES

Double throat mikes. Can be adapted for use with musical instruments. 5/11. P. & P. 9d

TRANSISTOR BATTERIES

Save pounds this winter. PP3 type replacement. 6 for 10/-. P. & P. 1/9. 12 for 18/6. P. & P. 2/6. Limited stocks.

NEW WALK ROUND STORE OPEN IN LAMBERT'S ARCADE, LOWER BRIGGATE, LEEDS 1. NEXT TO HALFORDS CYCLE SHOP. OPEN ALL DAY SATURDAY. 48 HOUR DESPATCH SERVICE. ALL MAIL ORDERS TO OUR BRIGGATE HOUSE ADDRESS

Postage rates apply to U.K. only.

TERMS:
CASH WITH ORDER
5/- EXTRA ON C.O.D. ORDERS
No C.O.D. under 30/-

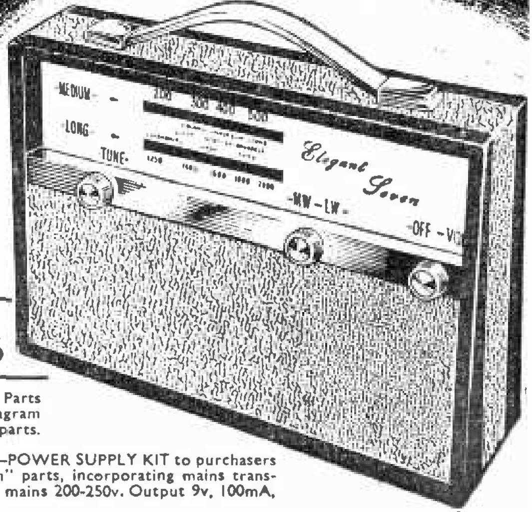
SONA

TRADE SUPPLIED
ORDERS FROM ABROAD WELCOMED
Telephone: 34768

SONA ELECTRONIC CO. (Dept. PW13) BRIGGATE HSE, 13 ALBION PL, LEEDS

SPECIAL OFFER! FROM R. & T.V. LTD.

Elegant Seven



COMBINED PORTABLE & CAR RADIO

The Radio with the STAR features

4in. SPEAKER

★ 7-transistor superhet. Output 350mW.
★ Two-tone grey wooden cabinet, fitted handle with silver coloured fittings. Size $12\frac{1}{4} \times 8\frac{1}{2} \times 3\frac{1}{2}$in.
★ Horizontal tuning scale, size $11\frac{1}{4} \times 2\frac{5}{8}$in. in silver with black lettering.
★ All stations clearly marked.
★ Ferrite-rod internal aerial.
★ I.F. 470 K/cs.
★ Operated from PP9 battery.
★ Full comprehensive instructions and point-to-point wiring diagrams.
★ Printed circuit board, back printed with all component values.
★ Fully tunable over medium and long waveband.
★ Car aerial socket.
★ Full after-sale service.

ONLY £4.19.6

Plus 5/6 P. & P. Parts list & circuit diagram 2/6. FREE with parts.

SPECIAL OFFER—POWER SUPPLY KIT to purchasers of "Elegant Seven" parts, incorporating mains transformer etc. A.C. mains 200-250v. Output 9v, 100mA, 7/6.

Goods not despatched outside U.K. All enquiries S.A.E. Terms C.W.O.

RADIO & TV COMPONENTS (ACTON) LTD 21C High St., Acton, London W3

Open 9 a.m.—6 p.m. including Sats. Early closing Wed.

COSSOR DOUBLE BEAM OSCILLOSCOPE. TYPE 339A
This extremely useful instrument operates from A.C. mains. Screen dia. 4in. Time base range 6 c/s. to 250 Kc/s. Two amplifiers with max. sensitivity 1.3 mV/mm. Max. bandwidth 2 Mc/s. Size 13 x 8½ x 19in. Controls: Brilliance, Focus, "X" shift, "Y1" shift, "Y2" shift, TB coarse, TB fine, Amplitude, Trigger, "A1" gain, "A2" gain and Synch. In very good condition and working order. Demonstrated to callers. A real bargain at £9.19.6. Carr. 10/-.

SILICON RECTIFIERS. Type BY100 (⅜in. x ⅜in.) will handle 250 volts at up to 500 mA. Replaces any TV metal rectifier. BRAND NEW—not seconds, 7/-.

VHF COMMUNICATIONS RECEIVER R-1949. This is the Air Force version of the well-known Hallicrafters S-27 or S-36. Covers 27 to 145 Mc/s. in three wavebands. It is complete with all valves, stabiliser, "S" meter etc., but requires an external power supply to give 250 volts HT and LT. Picks up police, amateurs etc. and could easily be used for mobile operation. Tested and in good condition. £17.10.0. Carr. 10/-.

AR 88 VIBRATOR PACKS. For 6V. operation. Complete with vibrator and OZ4 rectifier. NEW in original cartons, 15/-. P. & P. 5/-

AR 88 SPARE VALVES. Complete Set of BRAND NEW individually boxed original valves (1-4), 50/-. Plus 2/6 P. & P.

MOVING COIL PHONES. Finest quality Canadian with Chamois ear muffs and leather covered headband. With lead and jack plug. Noise excluding, supremely comfortable BRAND NEW .... 22/6, post 1/6

MAGNETIC COUNTERS (ex G.P.O.). 4 figures to 9,999. Coils 500Ω for 24V. operation. Tested. (No reset), 5/- each. P. & P. 1/6. SPECIAL OFFER! 10 for 30/-. P. & P. 6/-.

MICRO AMMETER. 0-500μA. Made by R.C.A., Weston Westinghouse and other famous American manufacturers. Circular 2½in. flush panel mounting. Dials are engraved 0-15 0-600 volts. As used in the American version of the "19 SET". TESTED AND GUARANTEED 15/-.

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GARRARD A.T.6 Hi-Fi Autochanger GC8 mono cartridge—£9.19.6, post free.
GARRARD AUTOSLIM 4 speed changer—£6.10.0, post free.
12in. ALTHAM SPEAKER with built in tweeter 3 ohm or 15 ohm 7,000 Gauss Magnet. Only 29/6, postage 3/6.
HAYDON CABINET (17 x 15 x 8in.) designed to take a 12in. Heavy Duty Speaker. 50/-, postage 7/6.
The Famous **B.M.3 XTAL MICROPHONE** with neck lanyard 30/- table stand for above 9/6 extra. Xtal insert 7/3.
GUITAR PICK-UP complete with clip and screened lead—12/6.
3-WAY PUSH BUTTON UNITS Each button operates a 4-pole 2-way switch—4/6.
BARGAINS IN TRANSISTORS Mullard RF Packs OC44 two OC45. 12/6; AF Packs OC81D two OC81, 8/6; OC44, 3/6; OC45, 3/-; OC71, 2/6; OC72, 3/-; OA81 diode 2/3; OC170, 6/6; AF 117, 6/6; ORP12, light cell, 7/6; OC29, 12/6; OC35, 12/6.
TRANSISTOR ELECTROLYTICS 1, 2, 4, 5, 8, 10, 16, 32, 50, 100 Mfd. all at 15 volts—1/3 each.
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CARTRIDGES Acos 67-1G Low Output, 67-2G Medium Output, GP59-5 High Output, Garrard GC2 or GC8 all with mounting bracket 15/-.
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EARPIECES with cord and 3.5mm plug. 8 ohm magnetic 3/-; 250 ohm, 4/-; 180 ohm magnetic with clip 6/6; Xtal. 4/-; 3.5mm plugs with nice long shank complete with jack, 3/-.
3.5mm plugs with nice long shank complete with jack **SCREENED**, 4/-.
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SPARES

APQ-43 30 Mc s I.F. Strips
This is a 6 stage I.F. strip with 10 Mc/s bandwidth. Uses valves 6AK5w x 7, 6AG7, 6AL5, 12AT7. Supplied brand new in makers boxes. PRICE 42/6 plus 3/6 P.P.

12 Volt Amplifiers
Made by MULLARD LTD: push pull EL91s. 12v Pos or Neg earth. Brand new and boxed. See September P.W. for further details. PRICE 35/- plus 5/- post.

P.C.R. Communications R.X.
Covers long and medium waves, S.W. 6 to 18 Mc/s. Made by PYE & PHILLIPS. 6 valves with built in speaker. there i. ample room to build an Internal Power Pack. Supplied with 50ft. of aerial wire and insulators. R.E.M.E. reconditioned and tested. PRICE £6.10.0. plus 10/- carriage.

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6 valve receiver tunes 33 to 40 Mc/s. requires 250v and 12v L.T., I.F. 7 Mc/s. No circuit but connections supplied. In new condition. PRICE 32/6 plus 7/6 carriage.

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Primary 180/250v 50 c/s Secondary 300-0-300 150MA 6.3v 6a. 5v 3a. Made by L.T.P. Ltd., and supplied brand new in makers boxes. PRICE 25/- plus 4/- post.

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These are a light weight head set of 600 ohms Impedance and are fitted with soft rubber ear pads. Supplied in good condition but less cord and plug. PRICE 22/6 plus 1/6 post.

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Moving coil, headphones fitted with ear mufls suitable 19 set etc: Brand new and boxed. PRICE 11/6 plus 1/6 post. Two pair post paid.

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Primary 230v Secondary 64v 360 MA. Made by Gardeners Radio. Brand new and boxed, ideal for rewinds. PRICE 5/6 plus 1/6 post.

Drive Assemblies
Scaled 0 to 999. Ideal for use with helical pots: or variable inductors. O/p shaft does 10 turns. American manufacture, brand new and boxed. PRICE 5/- plus 1/6 post.

SCR 522 Control Boxes
Fair condition 5/- plus 2/6 post.

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Contains 6 24v relays, condenser. hash chokes etc: Ext. soiled clean inside. PRICE 10/- plus 2/6 post.

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Skirted type, Brand new, American manufacture. 6 for 3/- plus 1/- post.

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Each core colour coded. Ideal for connecting wire. PRICE 3/- per yard plus 1/- post.

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Guaranteed Set Tested
24-HOUR SERVICE

1R5, 1S5, 1T4, 3S4, 3V4, DAF91, DF91, DK91, DL92, DL94, SET OF 4, 14/-.
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OA2	3/9	DL35	6/6	PCL83	7/9
1D5	4/9	DL92	4/3	PCL84	7/-
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1T4	2/3	EABC80	5/9	PL82	5/-
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6X5GT	6/3	ECF82	5/9	PY800	5/11
12K7GT	3/3	ECH42	7/3	U25	8/-
12K8GT	8/6	ECH81	5/3	U26	7/9
12Q7GT	3/3	ECL80	5/9	U191	8/3
20P4	13/3	ECL82	6/3	U801	15/-
25L6G	4/9	EF41	5/9	UABC80	5/-
30PL1	7/9	EF80	3/9	UAF42	6/9
35L6GT	6/-	EF85	4/6	UBC41	6/-
35Z4GT	4/6	EF86	5/9	UBF80	5/6
85A2	5/9	EF89	4/3	UCC84	7/11
CL33	8/6	EL41	7/-	UCC85	6/-
DAC32	7/9	EL84	4/6	UCF80	8/3
DAF91	3/3	EY51	5/6	UCH42	6/9
DAF96	5/6	EY86	5/6	UCH81	5/9
DF33	7/6	EZ40	5/-	UCL82	7/3
DF91	2/3	EZ80	3/9	UCL83	7/9
DF96	5/6	EZ81	3/9	UF41	6/3
DH77	3/6	PCC84	5/3	UF89	5/9
DK32	7/6	PCC89	8/6	UL41	6/6
DK91	4/3	PCF80	6/9	UL84	5/9
DK92	6/9	PCF82	6/-	UR1C	5/-
DK96	6/-	PCF805	9/-	UY41	3/11
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Postage 6d. per valve extra. Any Parcel Insured against Damage in Transit 6d. extra. Any C.O.D. Parcel 4/3 extra. Office address, no callers.

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Valves UY85 Rectifier and UCL82 Triode/Pentode giving 3½ watts output. Overall chassis size (inc. valves) 5 in. high × 5½ in. wide × 2 in. deep. Each amplifier new and tested and supplied complete with valves, 3 ohm output transformer and knobs fo tone and volume/on off controls.

ONLY **37/6** P. & P. 3/6.

Can be used with 80v. motor tap or 1.5k mains dropper 2/6 extra if required. *Owing to the limited number available and the extremely high value we regret we cannot enter into any correspondence.*

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HIGH GRADE 2 STAGE GRAM AMPLIFIERS
Made by very well known manufacturer

Using a double-wound mains transformer (fully isolated chassis) with tapped primary, full wave contact cooled rectifier, and Mullard ECL82 triode-pentode valve. 3 watt output. Separate tone and volume controls. Overall size 6½in. wide x 3in. deep x 4½in. high. Each amplifier Brand New and tested and supplied complete with valve, 3 ohm output transformer and knobs.

PRICE **49/6** P. & P. 4/-.

BRAND NEW 3 OHM LOUDSPEAKERS

2½in., 12/6; 5in., 12/6, 6½in. 15/-; 8in., 21/-; 10in., 25/-; 12in., 27/6; (12in. 15 ohm, 30/-).
10in. x 6in. 26/-
Latest type E.M.I. 13½ x 8in. with high flux ceramic magnet, 11,000 gauss. Aluminium centre cone. 10 watts. 30 c/s to 10 Kc/s., 42/-.
P. & P. up to 6in. 1/6; over 6in. 2/6 per speaker.

SPECIAL OFFER ! !

BRAND NEW HEAVY DUTY 12in. SPEAKERS
Response 45 c/s-13 Kc/s. 1½in. voice coil. Available in 3 or 15 ohm. Guaranteed full 15 watts British rating. Heavy cast aluminium frame. These are current production by world famous maker and as they are offered well below list price we are not permitted to disclose the name. LIMITED NUMBER ONLY. UNREPEATABLE AT 89/6, P. & P. 5/-. Also 25 watt Guitar Model available at £5.5.0.

SPEAKER AND CABINET FABRIC

Oatmeal for speaker and cabinet covering. 52in. wide and usually sold at 35/- yard.

OUR PRICE **13/6** per yard length.

Plus P. & P. 1/9 (minimum order 1 yard), Other fabrics available for cabinet covering, send S.A.E. for samples.

BARGAIN OFFER CORNER

ROLA CELESTION, Approx. 9in. x 6in. 3 ohm Middle register speaker, 10/6. P. & P. 2/6.

MAINS TRANSFORMER
Drop thru' type. Tapped primary 110v., 200v., 220v., 240v., 320-0-320v. at 80mA and 6.3v. at 3 amps. Generous core, stack size 3¾ x 2¾ x 1¾in. Weight 4 lbs. ONLY 15/-. P. & P. 3/6.

ACOS CRYSTAL MIKES. High imp. For desk or hand use. High sensitivity, 18/6. P. & P. 1/6.

TSL CRYSTAL STICK MIKE. Listed at 45/-. Our price 18/6. P. & P. 1/6.

T.C.C. SUPPRESSOR CONDENSERS. 250v. A.C. .005 + .005 x .1. In tubular can 1¾in. long x ¾in. dia. 2 for 3/-. Post free.

TRANSISTOR DRIVER and O/P TRANSFORMERS. (Tapped 3 ohms and 15 ohms output). plus 4 suitable Transistors giving approx. 1 watt output. 25/-. P. & P. 2/6.

CONDENSERS. 5,000 mFd. 12v. wkg. Size 3 x 1in. dia. 2/- each. P. & P. 6d. each.

T.V. or AMPLIFIER, EDGE CONTROL PANELS. Two 500k Lin. pots; one 500k Log; one D/P mains switch. Brand new 3/6 panel. P. & P. 1/-.

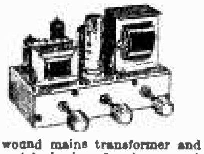
CONTACT COOLED BRIDGE RECTIFIERS. 250v. at 125 mA. Size 1¾ x 1⅜ x ⅜in., 7/6, P. & P. 1/-.

MATCHED PAIR OF 2½ WATT TRANSISTOR DRIVER AND OUTPUT TRANSFORMERS. Stock size 1½x1⅜x⅜in. Output trans. tapped for 3 ohm and 15 ohm output. 10/- pair, plus 2/- P. & P. Worth double.

TWIN TELESCOPIC AERIAL. Comprising two 3-section heavily chromed rods. Closed 12in. each extending to 32in. each. Completely adjustable from vertical to horizontal. Supplied complete with universal mounting bracket, approx. 36in. of coax. and standard coax. plug. Suitable for F.M. or T.V. 12/6 plus 2/- P. & P.

Harverson Surplus Co. Ltd.

3-VALVE AUDIO AMPLIFIER MODEL HA34



Designed for Hi-Fi reproduction of records A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7¾in. w x 4in. d x 4½in. h. Incorporates ECC83., EL84, EZ80 valves, heavy duty double-wound mains transformer and output transformer matched for 3 ohm speaker, separate Bass Treble and volume controls. Negative feedback line. Output 4½ watts. Front panel can be detached and leads extended for remote mounting of controls.

The HA34 has been specially designed for us and our quantity order enables us to offer them complete with knobs, valves, etc., wired and tested for only **£4.5.0** P. & P. 5/-

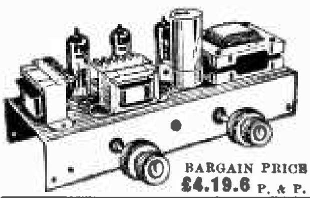
TAPE DECKS

COLLARO STUDIO DECK. 3 motors, 3 speeds, push button control. Up to 7in. spools. **£10.10.0.** P. & P. 5/6.

B.S.R. MONARDECK. Single speed, 3¾in. per sec., simple control uses 5¾in. spools, **£6.15.0** plus 5/6 carr. and ins. (Tapes extra on both.)

STEREO AMPLIFIERS

Incorporating 2 ECL82s and 1 EZ80 heavy duty double-wound mains transformer. Output 4 watts per channel. Full tone and volume controls. Absolutely complete.



BARGAIN PRICE **£4.19.6** P. & P. 5/-

6 TRANSISTOR AND DIODE SUPERHET

A first-class 2 wavebands transistor superhet ● Printed circuit panel (size 8½ x 2¾in.). ● 3 pre-aligned I.F. transformers. ● High-gain Ferrite rod aerial. ● All First-grade transistors. ● Car aerial winding. ● push-pull output. ● All parts supplied with simple instructions.

All parts sold separately. Set of parts if purchased at one time.

ONLY £4.5.0 P. & P. 2/6.

Circuit diagram 1/6 (free with set of parts).

35 OHM SPEAKERS

Suitable for use with above. 2in. Goodmans. Ideal replacement for most pocket portables. **8/6**, 3½in., **12/6**; 5in., **17/6**; 7 x 4in., **21/-**. P. & P. 1/6 per speaker.

Portable CABINET

Size approx. 9¼ x 6¼ x 3¼in. Suitable for above using 3¼in. speaker, **25/-**. P. & P. 2/-.

COIL AND TRANSFORMER SET FOR TRANSISTOR SUPERHET

3 I.F. transformers. one oscillator coil, one driver transformer and wound Ferrite aerial (med., long and car aerial coupling). **33/6** complete, post 1/-. 6 transistor printed circuit board to match, **8/6** Post 9d. Circuit diagram 1/6 extra.

SPECIAL TRANSISTOR BARGAINS

ALL BRAND NEW

GET 15 (Matched Pair) **15/-**; V15/10p. **10/-**; OC71 **5/-**; OC76 **6/-**; AF117 **7/6**; ORP12 **10/6** Set of Mullard 6 transistors, OC44, 2—OC45, OC81D matched pair, OC81, **35/-**

EDISWAN MAZDA

PXA101 **6/6**; XA103 **6/6**.

R.F.1 Pack: 1—PXA102 Mixer: 2—PXA101 I.F. Amp.; (Equiv. OC44 and OC45) **10/6**

R.F. 2 Pack: 2—PXA101 I.F.;—PXA102 Osc.; 1—PXA102 Mixer **12/6**

L.F.6 Pack: Consisting of PXB113 Driver. Matched pair PXC171, mounted complete with heat sinks (Equiv. OC81D and OC81) **12/6**

ALL TRANSISTORS POST FREE

QUALITY RECORD PLAYER AMPLIFIER

A top-quality record player amplifier. Size 7in. w. x 2¾in. d. x 5¾in. h. This amplifier (which is used in a 29 gn. record player) employs heavy duty double wound mains transformer, ECC83, EL84, EZ80 valves. Separate bass, treble and volume controls. Complete with output transformer matched for 3 ohm speaker. Ready built and tested

PRICE 69/6 P. & P. 3/6

ALSO AVAILABLE. Mounted on board with output transformer and 6in. speaker, ready to fit into cabinet below. PRICE **89/6**. P. & P. 4/6.

QUALITY PORTABLE R/PLAYER CABINET

Uncut motor board. Will take above amplifier and B.S.R. or GARRARD Autochanger or single Record Player Unit. Size 18 x 14 x 8¼in.

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EMBASSY PORTABLE RECORD PLAYER CABINET. Will accommodate amplifier, up to 7 x 4in. speaker and B.S.R. or GARRARD autochanger or single player unit. Attractive rexine covered finish. Overall size 17 x 15 x 8¼in. Supplied with uncut motor board. PRICE **69/6.** Carr. 5/-.

4-SPEED PLAYER UNIT BARGAINS

All Brand New in Makers' Original Packing

SINGLE PLAYERS

B.S.R. TU/12........... **£3.10.0** Carr. 3/6

B.S.R. GU7 with unit mounted pick-up arm **£4.18.6.** Carr. 4/-

AUTO CHANGERS

B.S.R. UA14, **£5.19.6**; B.S.R. UA16, **£6.19.6**

Latest B.S.R. UA25 Super Slim **£6.2.6**

Standard Garrard Autoslim.......... **£6.10.0**

Garrard AT6 Mono................. **£10.10.0**

Carr. 5/- on each

NEW CARTRIDGE BARGAINS!

B.S.R. TC8S. High output compatible Stereo Cartridge. Brand new. Complete with Stereo/LP/78 sapphire styli and universal mounting bracket. Original price 44/11. OUR PRICE **22/6.** P. & P. 1/-.

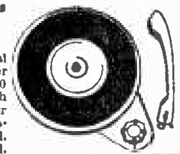
RONETTE STEREO 105 CARTRIDGE. Stereo/LP/78. Complete with two sapphires. Original list price **67/9.** **OUR PRICE 24/-.** P. & P. 1/-.

COLLARO HI-FI STEREO T/O CARTRIDGE, Type "C". Complete with universal bracket and styli for Stereo, L.P. and 78. Original list price **59/8.** **OUR PRICE 25/-.** P. & P. 1/-.

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

FURTHER HUGE PURCHASE enables us to offer these at

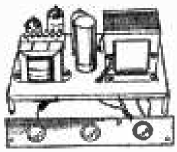
67/6 P. & P. 4/6.



Heavy 8¼in. metal turntable. Low flutter performance 200/250 v. shaded motor with tap at 45v. for amplifier valve filament if required. Turnover LP/78 head.

THE NEW HARVERSON KIT FOR THE HOME CONSTRUCTOR

A really excellent all purpose A.C. mains 200/240v.



AMPLIFIER KIT TYPE HSL 'FOUR' 3 VALVE. 4 WATT USING ECC83, EL84, EZ80 VALVES

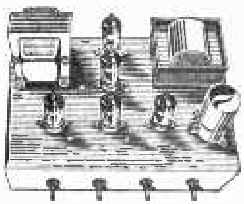
Special features include:

Heavy duty double-wound mains transformer with electrostatic screen. ● Separate Bass, Treble and Volume controls, giving fully variable boost and cut with minimum insertion loss. ● Heavy negative feedback loop over 2 stages ensures high output at excellent quality with very low distortion factor. ● Suitable for use with guitar, microphone or record player. ● Provision for remote mounting of controls or direct on chassis. ● All this builds onto a chassis size only 7¼in. wide x 4in. deep. Overall height 4¾in. ● All components and valves are brand new. ● Very clear and concise instructions enable even the inexperienced amateur to construct with 100% success. ● Supplied complete with valves, output transformer (3 ohms only), screened lead, wire, nuts, bolts, solder etc (No extras to buy)

PRICE **79/6** P. & P. 5/-

Comprehensive circuit diagram, practical layout and parts list 2/6. (Free with Kit.)

10/14 WATT HI-FI AMPLIFIER KIT

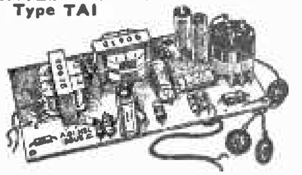


A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull Super reproduction of both music and speech with negligible hum. Separate inputs for mike and gram. allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15Ω speaker and independent volume controls and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 1/6. (Free with parts.)

All parts sold separately. ONLY £6.19.6 P. & P. 6/6

Also available ready built and tested complete with standard input jack sockets. **£8.15.0.** P. & P. 6/6. Carrying Case for above 28/6 P. & P. 4/-

HIGH GAIN 4-TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT Type TAI



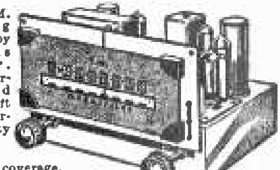
● Peak output in excess of 1½ watts. ● All standard British components. ● Built on printed circuit panel size 6 x 3in. ● Generous size Driver and Output Transformers. ● Output transformer tapped for 3 ohm and 15 ohm speakers. ● Transistors (GET 114) or 81 Mullard OC81D and matched pair of OC81 o/p). ● 9 volt operation. ● Everything supplied, wire battery clips, solder, etc. ● Comprehensive, easy to follow instructions and circuit diagram 1/6 (Free with Kit). All parts sold separately.

SPECIAL PRICE 45/- P. & P. 2/6

Also ready built and tested, **52/6.** P. & P. **2/6.**

A pair of TA1's are ideal for stereo.

HARVERSON'S F.M. TUNER Mk. I



● F.M. tuning head by famous maker. ● Guaranteed non-drift ● Permeability tuning. ● Frequency coverage. 88—100 Mc/s. ● Balanced diode output. ● Two I.F. stages and discriminator. ● Attractive maroon and gold dial (7 x 3in. glass). ● Self powered, using a good quality mains transformer and valve rectifier. ● Valves used ECC85, two EF80's and EZ80 (rectifier). ● Fully drilled chassis. ● Size of completed tuner 8 x 6 x 5¼in. ● All parts sold separately. Set of parts if purchased at one time **£5.19.6,** plus 8/6 P. P. and ins. Circuit diagram and instructions 1/6 post free. **Mark II Version as above** but complete with magic eye, front panel and brackets, **£6.12.6.** P. & P. 8/6.

Mark III Version as Mark I but with output stage (ECL82) and tone control. **£7.7.0.** P. & P. 8/6.

Handsome Metal Cabinets. Choice of Grey, Black or Green. To fit Mark I, **25/-.** P. & P. 2/6. To fit Mark II, **17/6.** P. & P. 2/6.

SPECIAL PURCHASE TURRET TUNERS

By famous maker. Brand new and unused. Complete with PCC84 and PCF80 valves, 34-38 Mc/s I.F. Biscuits for Channels 1 to 5 and 8 and 9. Circuit diagram supplied. ONLY **25/-** each. P. P. 2/6.

BRAND NEW CYLDON F.M. TUNER HEAD

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7in. Long play, 1,800ft., Acetate base....	15	0
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3in. Message tape, 225ft................	4	11
3in. Message tape, 300ft................	7	6
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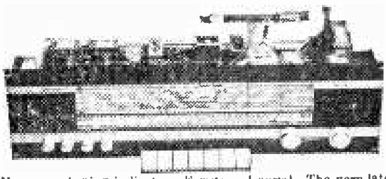

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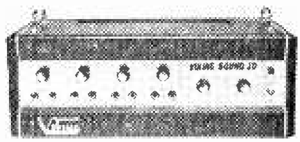

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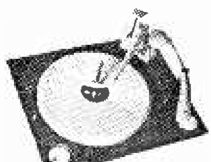

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Practical Wireless

Vol. XL No. 695 JANUARY, 1965

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Contents

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, London, W.C.2. Owing to the rapid progress in the designs of wireless apparatus and to our efforts to keep readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Is C.B. the answer?

FOR some years, a Citizens' Band has been authorised in the U.S.A. An operator does not have to pass technical or morse tests, but simply obtains a special licence from the F.C.C. This permits operation of low power equipment on 27Mc/s.

The introduction of a similar licence in this country has been sometimes mooted as a possible means to siphon off many would-be and actual pirates into more legitimate channels.

Superficially, it would seem that a good case can be made out for such a Citizens' Band, on its own merit, disregarding the question of piracy. Those in favour often quote the C.B. radio of the U.S.A. But what, in actual fact, *is* the situation in America? A recent report from the American Correspondent in a national newspaper is revealing:

> *Young radio hams are ruining television reception for thousands of viewers in New York, says the Federal Communications Commission. Their chatter causes jiggling lines on the picture tube. Their bad language is coming over loud and clear on the sound tubes. "We're getting 900 complaints a month—the situation is serious and is getting worse" said a spokesman.*

Allowing for the rather quaint phraseology, this report lays bare the way C.B. radio has gone. It shows that even with power limitations, inexperienced and/or irresponsible operators can play havoc with their fellow citizens' pleasures.

In setting up C.B. radio, the F.C.C. have created a kind of electronic Frankenstein. And in view of the widespread abuses have now found it necessary to tighten up considerably on the issue of licences and to insist on restrictions in operating conditions.

Perhaps one mistake was to allow the Citizens' Band to degenerate into a sort of third rate amateur band. This was *not* the original intention. And, far from easing any problems caused by illicit transmitting, the so-called Citizens' Band has only served to aggravate the problem. It is clear then that C.B. is no magic formula, no panacea.

Going back to that report, note that the opening words are "Young radio hams". Now, *we* all know that C.B. operators are *not* radio hams, but nothing will convince the general public (and newspaper writers) that they are not. Thus the good name of amateur radio gets linked with the bad boys of C.B.

We feel therefore, that although the basic idea of a British C.B. may seem attractive, it could well rebound on us and worsen existing problems. But if we ever do get a C.B., the authorities must learn from the lesson of the U.S.A. and clamp down from the start on those who only want the facility as an easy way to play at being radio amateurs.

Christmas 1964

The Editor, staff and contributors join in wishing all readers a Happy Xmas and a successful New Year

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

ROUND THE WORLD of WIRELESS

NEWS AT HOME AND ABROAD

FAR EAST TELEPHONE CABLE COMPLETE

BRITAIN'S newest cableship, the C.S. Cable Enterprise, arrived at Singapore during October at the end of her maiden voyage from Britain. She was joined there a day later by the cablelayer C.S. Mercury, and from here the two ships left a few days after to make the final lay of the South East Asia section of the Commonwealth telephone cable (SEACOM).

Both these ships belong to Cable and Wireless Limited, whose task it has been to lay the 2,000 nautical miles which form SEACOM. During final operations, C.S. Cable Enterprise provided navigational cover and marked the route with buoys which C.S. Mercury followed to lay the last 700 miles of cable.

Terminal points on the cable are at Singapore, Jesselton and Hong Kong and because of the monsoons of the South China Sea, operations had to be completed before November.

With the completion of SEACOM and its inauguration at the beginning of February, communication facilities will be greatly improved throughout the area and with the eventual extension of the link to Australia and thence via COMPAC and CANTAT to international telephone circuits, the region will be further opened up to the world.

R.S.G.B. COMPETITION AWARDS

AS usual at this year's International Radio Communications Exhibition, a number of trophies for equipment construction ability were awarded to winners of the various competitions.

The "Home Constructors' Plaque" this year was awarded to H. Rogers, G3NHR, for his 1·8 and 144Mc/s transmitter. The "Manufacturers' Plaque" went to T. Withers (Electronics) Ltd., for their T.W. Communicator and Sven Weber won the "Horace Freeman Trophy" with his audio frequency peak level meter and 435Mc/s tunnel diode amplifier. The "Amateur" Amateur Award—open to contestants having no professional connections with the electronics industry—was presented to L. J. Hodgkinson, G3LLJ.

Other awards (for members of the RSGB outside Region 7) went to M. D. Mason, G6VX and Basil O'Brien, G2AMV whose entries were a linear amplifier and an electronics keying unit respectively.

Apart from the constructional contests, a Hammerlund HQ 170A receiver was awarded to the holder of a lucky entry card, who this year was Mr. Horace Freeman, late RSGB Advertisement Manager.

The winner of the RACAL RA.71 receiver competition, the proceeds of which were donated to the Imperial Cancer Research Fund, was Mr. Buckby of 62 Wheater Avenue, Corby, Huntingdonshire. His guess of 1911 as the number of solder joints in the receiver was the nearest made to the actual number of 1910.

"Practical Wireless" Film Show

IN order to give readers every opportunity of obtaining entry to the annual PRACTICAL WIRELESS Film Show, those interested in attending this year are invited to send for their free tickets *now*.

As in previous years, the Film Show will be held in collaboration with Mullard Limited at the Caxton Hall, Westminster. It will be held on February 5th.

Although the programme has been arranged to interest the amateur radio enthusiast, the selection will make it an entertaining as well as informative evening, with refreshments provided.

Films to be shown include "Electromagnetic Waves" and "The New Panorama Tubes".

Last year the P.W. Film Show attracted more readers than ever, attendance being well over the 400 mark. This year as many if not more are expected to attend and so only immediate application to the PRACTICAL WIRELESS offices, enclosing a stamped addressed envelope can guarantee a seat.

New R.S.G.B. President

THE Council of the Radio Society of Great Britain has appointed Mr. E. W. Yeomanson to the office of President of the Society for 1965.

Mr. Yeomanson has been a member of the Council since 1958 and until this appointment was Executive Vice-President.

Mr. Yeomanson, who holds an amateur transmitting licence with the callsign G3IIR, has been in the telecommunications industry for 30 years.

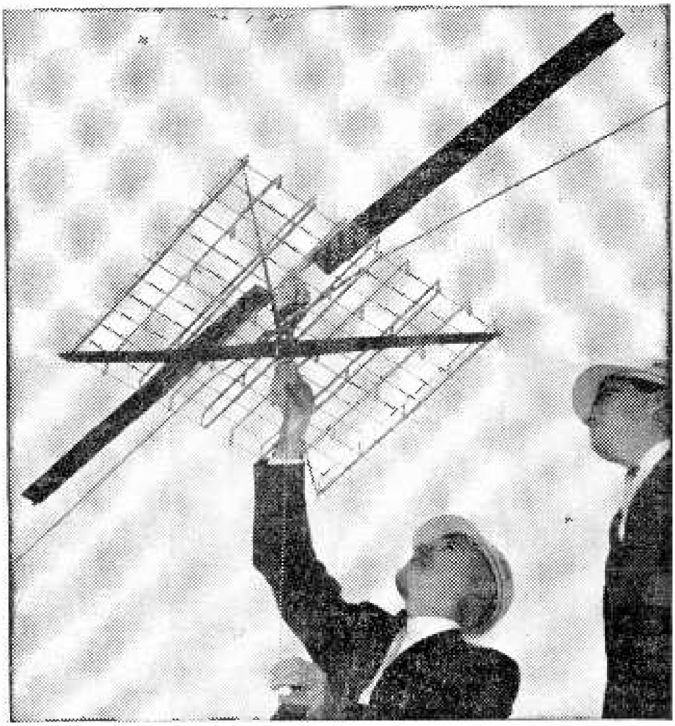
DEMONSTRATION OF MICROWAVE POWER TRANSMISSION

AN impressive demonstration of microwave power transmission was recently staged by the Raytheon Company at their laboratory in Burlington, Massachusetts.

During a demonstration for visiting officials of the U.S. Air Force's Rome Air Development Centre (RADC), the 6ft. rotor-span "helicopter" shown under inspection in the accompanying photograph, climbed 50ft. into the air under the power of invisible energy provided by a microwave generator on the ground. (The vertical wires in the photograph are merely guide lines.)

The microwave energy was beamed towards the helicopter by a saucer-shaped transmitting aerial situated directly beneath it. The helicopter's square platform, mounted under the rotor, is in fact the "receiving" aerial, made up of thousands of tiny diodes, each less than half-an-inch long. This array collects the transmitted beam and the diodes rectify the microwave energy into an immediate source of direct current electricity. This electricity is then used to power the small motor which turns the rotor blades of the helicopter.

This demonstration served to provide an intermediate indication of Raytheon's progress with an RADC commission to develop a helicopter device using power transmitted continuously from the ground without the use of wires. Apart from the academic interest in wireless power transmission raised by the demonstration, it seems as though practical applications for "flying platforms" on the lines of the experimental helicopter, could be developed and used for television transmissions, missile detection, aviation beacons, navigational and weather aids, and surveillance. Continued development will, of course, be necessary to make it possible for a flight vehicle to keep itself continuously in the path of the microwave power without the use of guy lines.


Raytheon's "helicopter" used in a recent demonstration of microwave power transmission.

I.E.E. Christmas Holiday Lecture

THE annual Christmas Holiday Lecture for older school children arranged by the Institution of Electrical Engineers will be delivered this year by Dr. D. H. Parkinson, D.Phil., of the Royal Radar Establishment. The lecture, which is intended for boys and girls of the fifth and sixth forms, will be given in the lecture theatre at Savoy Place on Wednesday, December 30th, at 2.30 p.m., and will be repeated the following day at the same time.

Dr. Parkinson will talk on "Superconductivity" (an electrical condition appearing in certain elements, compounds and alloys when cooled to temperatures nearing absolute zero) and will illustrate his lecture with slides, films and demonstrations.

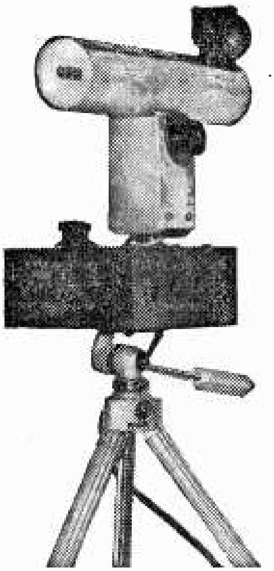
Admission to the lecture is free, and application for tickets stating for which afternoon they are required should be made to the Secretary, the Institution of Electrical Engineers, Savoy Place, London, W.C.2.

AIRLINES ORDER MORE EQUIPMENT

TWO recent orders for Marconi radio equipment have come from two of the world's leading airlines, Qantas of Australia and British United Airways.

The equipment to be supplied to Qantas is the latest Marconi doppler navigator. This equipment will be installed in their fleet of Boeing 707 aircraft, operating their new trans-Pacific route. The doppler equipment is transistorised and forms part of the widely-used Marconi Company's Sixty Series of aircraft radio equipment.

The other contract also involved Sixty Series equipment, and Vickers VC-10 aircraft, currently operating B.U.A.'s flights to South America, are provided with navigation and communication facilities by this Marconi equipment for the 7,900 mile flight.



A FERRITE ROD D.F. AERIAL for 1·5 - 3 Mc/s

BY F. C. JUDD

THE basic principle of finding the direction and ultimately the location of a radio station was discovered early in the history of radio and has since remained almost unchanged.

The different applications are far too numerous to mention here, but in addition to straightforward location of radio stations the "loop" system of direction finding is now widely used by yachting and motor cruising enthusiasts on open sea and to this end there are several types of ferrite loop d.f. sets available for operation in conjunction with the longwave coastal beacon stations. These beacons are extensively used for position location and homing.

The loop aerial can also be used very effectively for reducing interference from unwanted radio signals or electrical noise and is equally effective in locating electrical noise sources.

The interest in radio direction finding is also quite prominent with members of various radio societies and R.S.G.B. groups who annually sponsor direction finding contests. These are usually for the 160m amateur band, for which the d.f. aerial described in this article was designed.

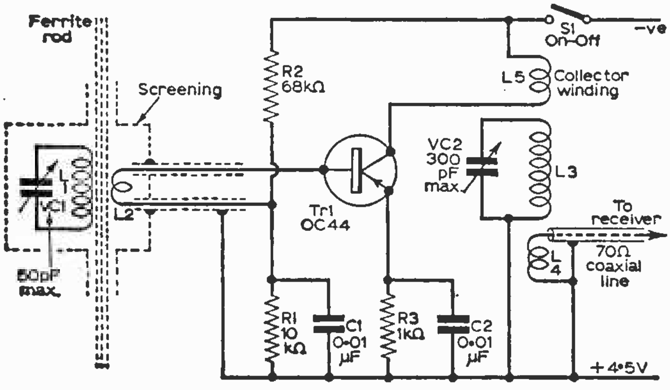
Earlier types of d.f. loop usually consisted of several turns of wire on a square frame, the number of turns depending on the frequency of operation. The loop was therefore tuned to resonance at the required frequency.

An unscreened loop of this kind was quite favourable for general reception, but not very accurate for d.f. For this purpose it was better to "screen" the loop so as to neutralise the self capacity of the winding. This type of loop is, however, large and not greatly sensitive.

Nowadays the ferrite rod aerial is used almost universally for domestic receivers because of its much greater sensitivity. This type of aerial also has highly directional properties and can be made to operate in exactly the same way as a wire loop type aerial. Even an unscreened ferrite rod aerial will provide a reasonably accurate bearing so long as it is not influenced by other conductors or by poor balancing within its own circuit.

Any loop aerial behaves somewhat like a half wave dipole aerial, i.e., it has a polar response like a figure of eight. In the case of the ferrite aerial maximum pick up is *broadside to the rod* with minimum pick up at each end. These are referred to as the maxima and minima (null) respectively and will be explained in more detail later.

Ferrite rod d.f. aerials are very easy to make and consist of the rod, a tuned winding and a coupling winding. The ferrite rod should be as long as possible, 8 to 10 inches, and of a grade suitable for the highest frequency of operation. The diameter is not greatly critical but should be ¼in. to ½in. for best results.



COMPONENTS LIST

Resistors:
R1 10kΩ R3 1kΩ
R2 68kΩ
All 10% ½W carbon.

Capacitors:
C1 0·01μF C2 0·01μF
VC1 50pF variable
VC2 300pF maximum variable

Miscellaneous:
L1, 2 Aerial coil, see text. L3, 4, 5, Transistor tuning coil (Denco range 3, yellow). Tr1 OC44. S1 Single-pole on/off switch. Ferrite rod. 70Ω coaxial cable.

Fig. 1: The circuit of the transistor r.f. amplifier with the ferrite rod aerial arrangement on the left.

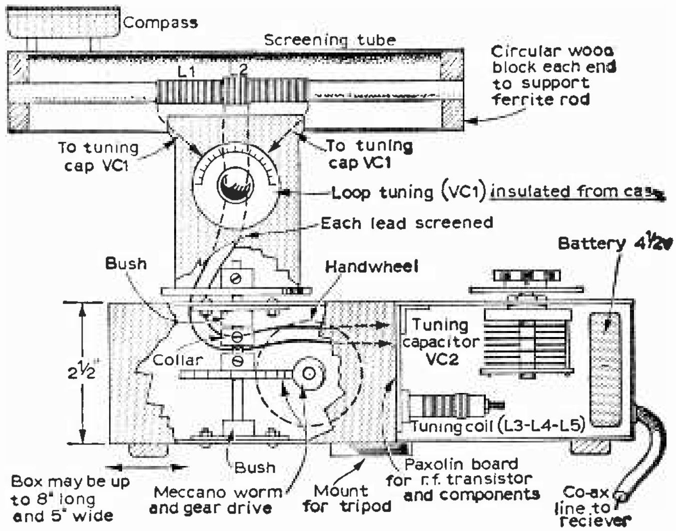


Fig. 2: Here the mechanical construction of the d.f. loop is illustrated. Few dimensions have been given as neither these nor the general layout are critical.

Mullard *Ferroxcube* grade B2 is suitable for medium and long-wave with B3 for below 200 metres or, of course, for either of the three bands. Direction finding below about 3Mc/s is not very practicable with loop or ferrite rod aerials.

The ferrite direction finding aerial shown in the photograph on the cover was designed for operation from 1·5 to 3Mc/s in order to cover the 160 metre amateur band of 1·8 to 2Mc/s. It is intended for use with any receiver covering the same frequency range.

The aerial, its attendant r.f. amplifier and turning box, etc., are mounted on a collapsible tripod as shown in the photograph. The circuit of the ferrite d.f. aerial and its r.f. amplifier is shown in Fig. 1. Although the loop alone would operate directly with a sensitive communication receiver, the transistor r.f. amplifier does provide a very useful gain.

General constructional details are shown in Fig. 2 but aside from continuity of the screening, etc., the actual electrical layout is not critical. It is important, however, to wind the aerial coils as shown in Fig. 3 and to screen the tuning capacitor VC1.

It is equally important to completely screen the r.f. stage because any direct signal pick up here would result in inaccurate bearings. *On no account use steel or tinplate in the construction of the screening tube or the r.f. amplifier box.* Only aluminium dural, brass or copper can be used. Details of the slotted ferrite aerial screen are given separately in Fig. 4.

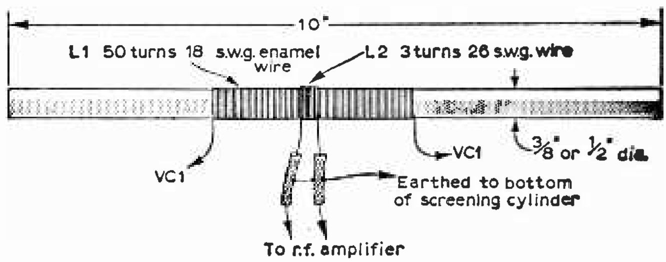


Fig. 3: Winding details of the ferrite rod aerial.

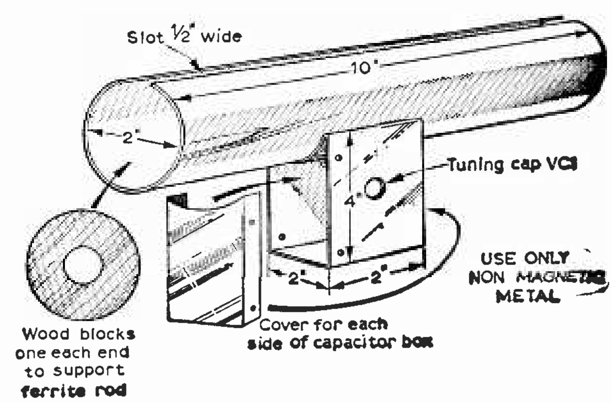


Fig. 4: A detailed construction diagram for the slotted ferrite aerial screen and its support.

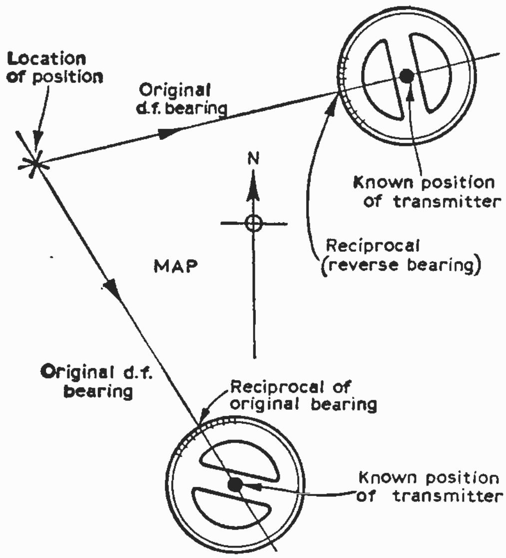


Fig. 5: Fixing a map position from two stations of known locations.

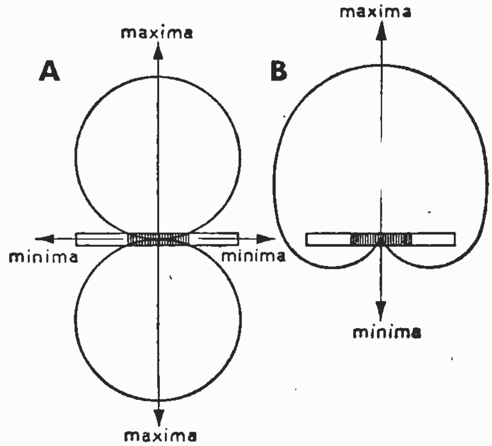


Fig. 6 (a): The co sine pattern of the normal ferrite aerial; (b): the cardioid pattern obtained when a sensing aerial is coupled to the d.f. aerial.

The tuning gear consists of various Meccano parts as shown in Fig. 2 although, if desired, the worm and gear etc., could be dispensed with and the aerial turned by hand.

The aerial coil L1 should be tightly wound and the winding secured with cellotape or a cellulose fixative. The link coupling coil L2 is wound over the exact centre of the main winding. Each leg of the link winding is screened as shown and the screening braid bonded to earth at either end.

The tuning capacitor VC1 is isolated from earth and must therefore be mounted on an insulating bush or small panel let into the side of the screening box.

The compass used for the prototype was a small aircraft type although any small hand compass or car compass could be used. The compass will not be affected by the ferrite rod providing it is mounted as shown in Fig. 2.

The aerial and the r.f. stage tuning capacitors are separate and are therefore tuned separately. Initial tests should be carried out on strong signals from local stations because the tuning of both . e aerial and r.f. stage is very sharp. It will be found advantageous to use a changeover switch so that the receiver can be switched to the normal receiving aerial or the d.f. aerial.

It is easier to find and tune a station on an open aerial first, but remember that when taking a bearing all other aerials must be disconnected and not connected to earth or any other equipment.

Checking the Accuracy of the Loop

There are numerous causes of inaccuracies and of these other aerials, in fact any conductors that can re-radiate are most likely to produce them.

Don't forget that the compass can also be affected by nearby magnetic metals such as drainpipes and even more so by loudspeaker magnets etc. For this reason the co-axial line between the d.f. aerial and the main receiver should be about six feet long so as to keep the compass clear of magnetic fields etc.

One important check is to make sure that the receiver and co-axial line etc., are not picking up signals when the r.f. amplifier of the d.f. aerial is switched off. Any pick up except from the d.f. aerial itself will result in inaccurate bearings.

Make initial tests by taking "fixes" on stations whose locations are accurately known. *A d.f. is taken on the null or minimum signal.* Check these with a map and protractor and see that the reciprocal of the bearing obtained comes back to your own position.

Don't forget to add approximately 10° to the compass reading to allow for the difference between magnetic North and true North. The diagram of Fig. 5 shows how a fix on your own position is taken.

For finding the true position of a station whose location is unknown it is necessary to take a fix at each of two different places. The distance between these two places will depend on the distance of the station and its general direction.

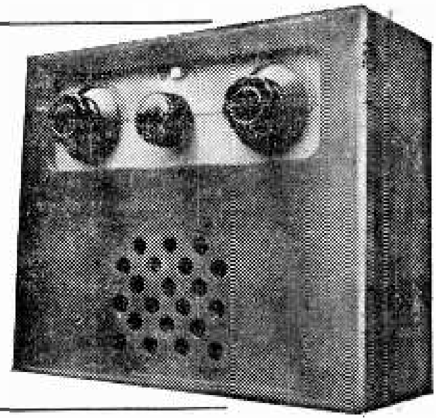
This is where a sensing aerial can be useful although it is not absolutely necessary. A sensing aerial is coupled to the d.f. aerial so as to alter the pick up pattern from co-sine (figure of eight) to cardioid as shown in Fig. 6.

Signals from the sense aerial are added in phase to those from the d.f. aerial so that when this is tuned only one maxima and one null is obtained. Either can be used to determine the general direction of the station.

The sense aerial is then disconnected and a minima obtained on the station. This will not show

—continued on page 865

Separate oscillator and aerial tuning makes alignment of this circuit easy.



BEGINNER'S SUPERHET SIX

THIS receiver is designed to avoid the difficulties which often arise in aligning aerial and oscillator stages. It is usual to employ a ganged capacitor for aerial and oscillator tuning and efficiency falls off badly if tracking of these circuits is not correct.

This difficulty, which can be particularly troublesome for an inexperienced constructor, is overcome by using separate oscillator and aerial tuning capacitors. This arrangement gives maximum efficiency and the trimming and padding capacitors otherwise required are eliminated.

in the long wave position C1 and C4 are added and this allows tuning to 1,500m for the Light Programme. This system avoids the need for separate aerial windings, etc., and gives very good signal strength.

The remainder of the circuit is of straightforward type and neutralising is not used in the intermediate frequency stages. This further

by R. F. Graham

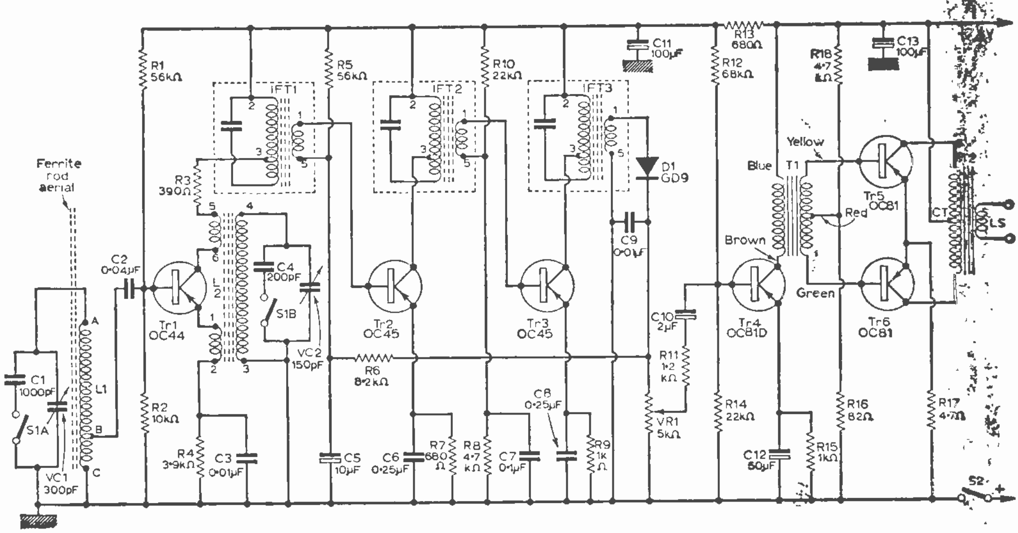


Fig. 1: The complete superhet circuit.

The circuit is shown in Fig. 1, VC1 being the aerial tuner and VC2 the oscillator tuner. The aerial is wound so that the whole medium wave band is covered. When the wavechange switch is

reduces the number of components. Automatic volume control is applied to Tr2 through R6 in the normal way. Tr4 is an OC81D, followed by a matched pair OC81s for Tr5 and Tr6.

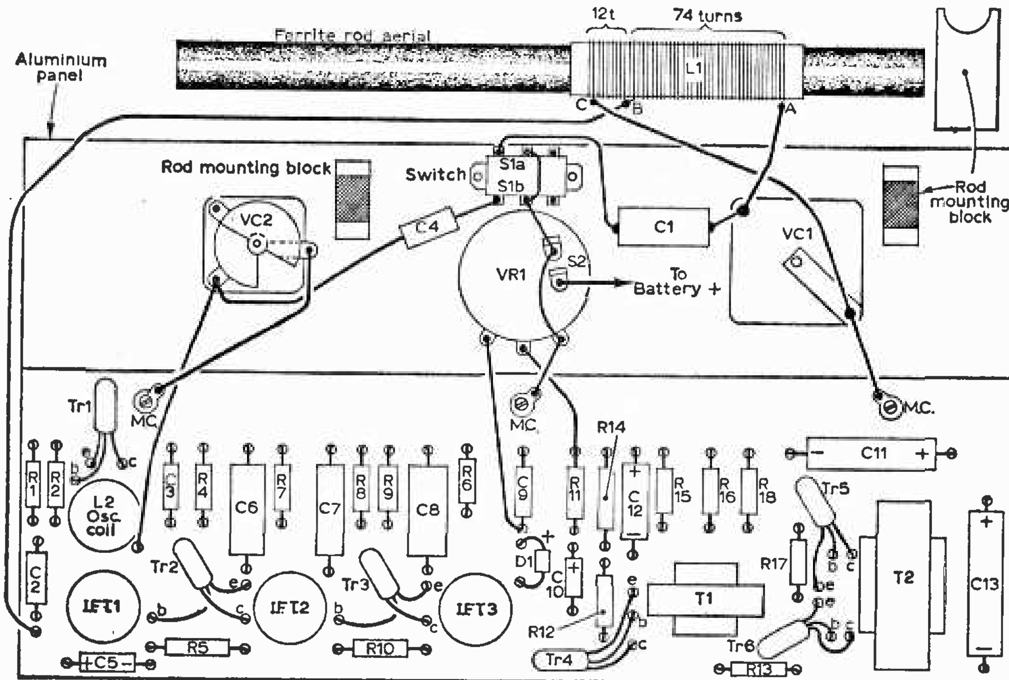


Fig. 2: Connections between the front panel (controls and aerial) and the chassis, and the layout of components.

Ferrite Aerial

This is shown in Fig. 2. Paper is wound round the rod and the 26s.w.g. enamelled wire is fixed 1in. from the rod end at point "A". This can be done with adhesive tape. Seventy-four turns are then wound on side by side and the small loop "B" is made. Another 12 turns are wound on in the same direction and the wire is secured at "C" with tape.

End "A" goes to the stator (fixed plates) tag of VC1. Tapping "B" is extended by a lead soldered to C2. End "C" is taken to the rotor (moving plates) tag of VC1 and to metal panel earth line.

The rod is mounted on two pieces of wood about 1½in. x ½in. x ½in. These are cut to fit the rod (Fig. 2) and are held by countersunk wood screws through the metal panel. String or thread through small holes binds the rod to the mounts.

Construction

The receiver is wired on a paxolin board 8in. x 2½in. and $\frac{1}{16}$in. thick. Aluminium 8in. x 3½in. has a flange about ⅜in. wide bent along one edge. The flange is bolted to the paxolin board. The variable capacitors, volume control and switch fit to the aluminium panel and the finished receiver is fitted in its cabinet by two screws through the panel into the cabinet front.

Space under the paxolin accommodates the speaker and battery. A 3½in. unit (overall) can be fitted or an oval unit. A very small speaker is not recommended.

If a suitable cabinet is to hand the positions of VC1, VC2, volume control and wavechange switch may be adjusted to suit. No changes to wiring on the paxolin panel will be needed.

Circuit Board

The positions of holes can be found by placing the paxolin under Fig. 3 and marking with a sharp-pointed tool. All the small holes are then made with a $\frac{1}{16}$in. drill. A ⅛in. drill can be used for the three 6B.A. bolts and to clear the oscillator coil and i.f. transformer pins. Each of these components has two can tags which pass through holes.

T1 is held by its wire ends. T2 is secured by lugs which pass through slots and are bent over. These slots can be made by drilling $\frac{1}{16}$in. holes side by side.

It is best to drill all holes before mounting any parts and to clear away dust and fragments. When all holes have been made from Fig. 3, components can easily be inserted.

The volume control, switch and variable capacitors are mounted on the panel as in Fig. 2. The slide switch needs a slot, made by drilling holes and cleaning up with a small file.

The flange on the panel is drilled to match the paxolin board and three 6B.A. bolts hold these items together. A tag is placed under each bolt head and under the nuts. Construction is easier if the ferrite rod VR1 and the variable capacitors are left off until last.

Top of Circuit Board

This is shown in Fig. 2. All the resistors except R3 may be added first. The colour coding is given in the components list to avoid any errors here. The wire ends are bent to pass through the circuit board holes. The bend should not be immediately against the resistor body. R16 and R18 *must* be 5% tolerance.

Capacitors C5, C10, C11, C12 and C13 are electrolytic and their positive and negative ends are placed as in Fig. 2. All the other capacitors can be inserted either way round.

The oscillator coil has a coloured spot between pins 1 and 6 and this must face transistor Tr1, Fig. 2. The transistors are left off until other wiring is completed.

Under the Circuit Board

A 22s.w.g. (or similar) bare tinned copper wire is soldered along the three tags and provides an earth return for numerous leads. For connections elsewhere 26s.w.g. tinned copper wire with 1mm sleeving is most convenient. Connections are shown in Fig. 3.

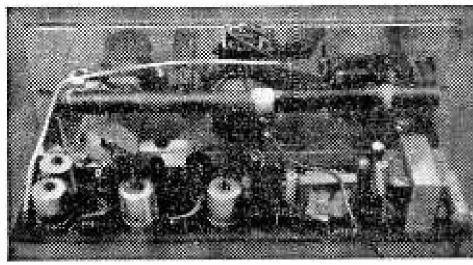
The oscillator coil and i.f.t. can tags should first be earthed. The resistor and capacitor ends can then be bent over, cut and soldered. Insulated sleeving is only required where wires cross. R3 is soldered from pin 5 of the oscillator coil to pin 3 of IFT1.

As leads are placed and soldered they can be marked with coloured pencil. If this is done systematically there is no danger of overlooking any connection.

Transistors and Diode

With the transistors specified a red spot shows the collector lead. The base lead is centrally placed and the remaining lead is emitter. In Figs. 2 and 3 C, B and E show collector, base and emitter connections.

All transistors may be mounted with their leads quite long and this reduces chances of damage due to heat while soldering. Tr1 has a $\frac{3}{4}$in. piece of sleeving on its base lead. The wires are then



The chassis and panel completed, ready for mounting in the cabinet.

pushed through the holes shown, bent over and soldered. Excess is snipped off. Radio-type cored solder is used and a small electric iron is best. It should not be necessary to hold the iron in contact with the joint for more than about a second or so.

Transistors Tr2 and Tr3 each have a $\frac{3}{4}$in. piece of sleeving on the base lead. With Tr4, Tr5 and

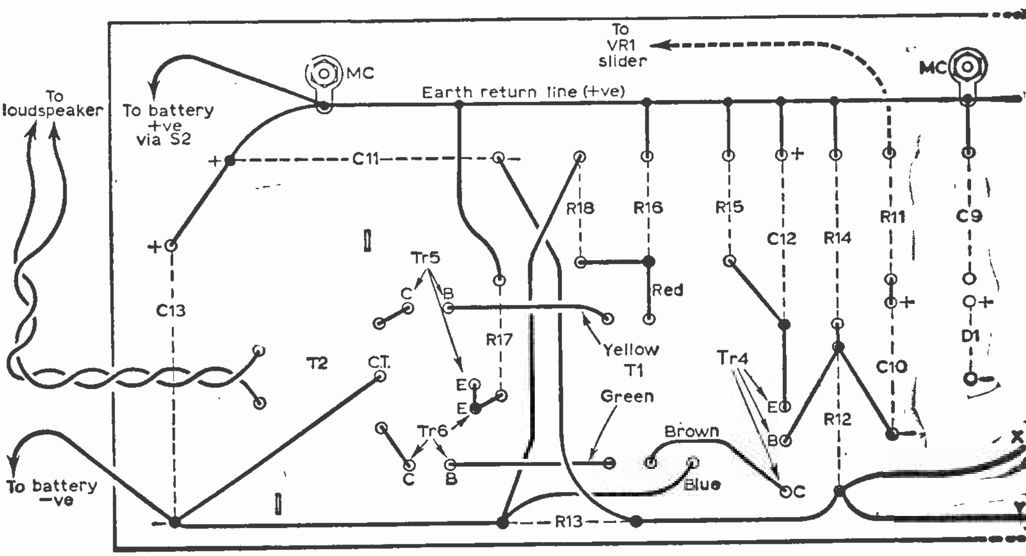


Fig. 3a: The underside wiring: driver and output stages.

Tr6 the leads can be left full length if wished. Sleeving is needed on each base lead to prevent shorts to emitter or collector leads.

The negative end lead of diode D1 is about ¼in. long and is soldered to pin 1 of IFT3. The positive end goes to C9.

Panel Wiring

This is shown in Fig. 2. A lead passes from pin 4 of the oscillator coil, through hole "X" in Fig. 3, to the fixed plates tag of VC2. C4 is also soldered on here. VC1 fixed plates go to "A" on the aerial and C1.

The slider (centre tag) of VR1 is wired to R11. One outer tag goes to the on/off switch, wave-change switch and chassis, Fig. 2. The other outer tag is connected to the junction of diode D1 and C9.

Thin red flex provides the positive battery connection from the on/off switch. Black flex from the negative end of C13 is for battery negative. These leads are about 9in. long and are taken into the pins of a non-reversible 7½V battery twin plug and are soldered. Correct polarity is absolutely essential.

A length of thin twin flex is soldered to the secondary tags of T2 and to the speech coil tags of the speaker. Best reproduction is not to be expected until the speaker is fitted in a cabinet.

Controls

A piece of thin card about 3in. x 8in. is secured to the aluminium panel by means of the nuts holding the capacitors and volume control. Viewing the set from the front, medium waves are tuned with the slide switch knob to the left (switch open). The other position brings in C1 and C4 for 1,500m.

Both variable capacitors are set fully open and the knobs are secured with their pointers to the left. When tuning, both knobs are moved approximately in step. However, VC2 is the more critical, so it is easier to tune with this, then adjust VC1 for best volume. When tuning positions for a few stations have been marked it will be clear how tuning operates and adjustment will be found very simple. No aerial and oscillator circuit alignment has to be undertaken as with ganged tuning.

When a station has been tuned in, the cores of IFT1, IFT2 and IFT3 are adjusted for best volume. This is best done with a weak station. The i.f.t.s are intended for 470kc/s but results will be similar if they are by chance adjusted to some other frequency.

No neutralising is used in the i.f. amplifier. As a result oscillation may arise when the i.f.t.s are exactly in tune. If so, slightly "stagger" them until this is cured. That is, screw one core in slightly and another out slightly.

It may be preferred to add neutralising later. If so, connect a 1·2kΩ resistor to pin 1 of IFT1. Take a 56pF (2%) capacitor from the free end of the resistor to pin 1 of IFT2. Also solder a 3·9kΩ resistor to pin 1 of IFT2. Solder a 18pF (2%) capacitor to the free end of the 3·9kΩ resistor and to pin 1 of IFT3. These components are best under the circuit board. The i.f.t.s can

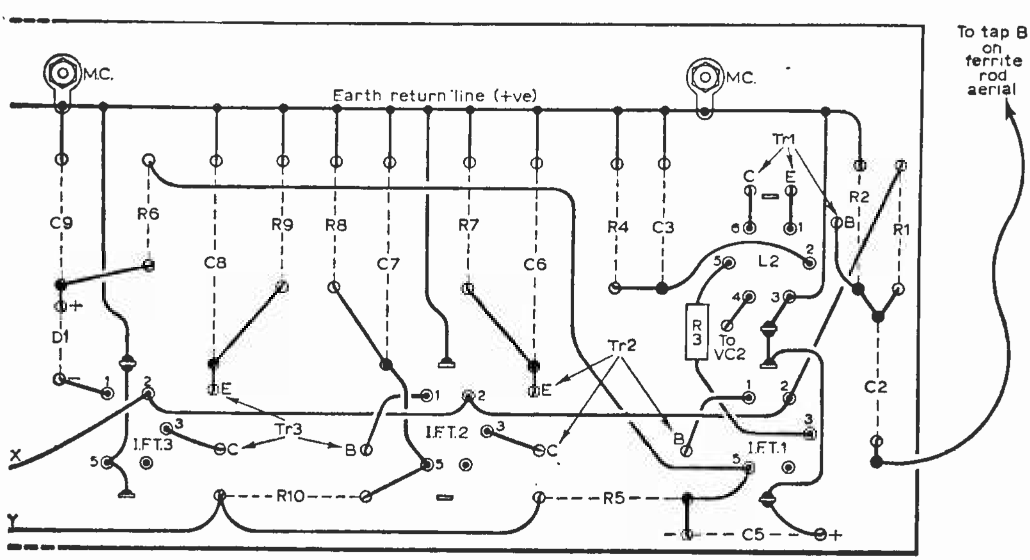


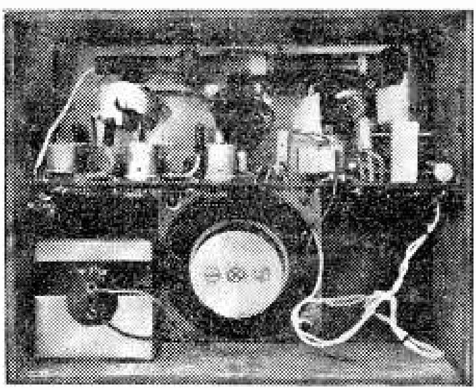
Fig. 3b: The wiring; mixer, i.f. and detector.

COMPONENTS LIST

Resistors:

R1 56kΩ green-blue-orange-silver
R2 10kΩ brown-black-orange-silver
R3 390Ω orange-white-brown-silver
R4 3·9kΩ orange-white-red-silver
R5 56kΩ green-blue-orange-silver
R6 8·2kΩ grey-red-red-silver
R7 680Ω blue-grey-brown-silver
R8 4·7kΩ yellow-violet-red-silver
R9 1kΩ brown-black-red-silver
R10 22kΩ red-red-orange-silver
R11 1·2kΩ brown-red-red-silver
R12 68kΩ blue-grey-orange-silver
R13 680Ω blue-grey-brown-silver
R14 22kΩ red-red-orange-silver
R15 1kΩ brown-black-red-silver
R16 82Ω grey-red-black-gold
R17 4·7Ω yellow-violet-gold-silver
R18 4·7kΩ yellow-violet-red-gold

All 10% (last band silver) $\frac{1}{2}$W carbon, except R16 and R18 which are 5% (gold band)



A rear view inside the cabinet of the finished receiver.

Capacitors:

C1 1,000pF silver mica 1%
C2 0·04μF 150V
C3 0·01μF 150V
C4 200pF silver mica 5%
C5 10μF electrolytic 6V
C6 0·25μF 150V
C7 0·1μF 150V
C8 0·25μF 150V
C9 0·01μF 150V
C10 2μF electrolytic 6V
C11 100μF electrolytic 12V
C12 50μF electrolytic 6V
C13 100μF electrolytic 12V
VC1 300pF variable (Jackson 2094)
VC2 150pF variable (Jackson C804)

Potentiometer:

VR1 5kΩ with single-pole switch (S2)

Semiconductors:

Tr1 OC44 Tr3 OC45
Tr2 OC45 Tr4 OC81D
Tr5 OC81 } Matched
Tr6 OC81 } pair
D1 GD9 or equivalent

Inductors:

IFT1, 2 I.F. transformers (Osmor PW/2)
IFT3 I.F. transformer (Osmor PW/3)
L1 Aerial coil—see text
L2 Oscillator coil (Osmor PW/1)
T1, T2 Driver and output transformers suitable for OC81's and a 3Ω loudspeaker (Osmor QXD1 and QXO2 respectively)

Miscellaneous:

S1 2-pole slide switch or any other small change-over type
S2 Single-pole on/off switch, on VR1

26 s.w.g. enamelled copper wire for L1. Ferrite rod 6in. x $\frac{3}{8}$in. diameter. 3Ω loudspeaker, $3\frac{1}{2}$in. in diameter. Piece of aluminium $3\frac{1}{2}$in. x 8in. Piece of paxolin $2\frac{1}{2}$in. x 8in. Two knobs $1\frac{1}{4}$in. in diameter, one 1in. in diameter.

then be readjusted for best results.

If the receiver is wanted for medium waves only omit the wavechange switch, C1 and C4. If a vehicle aerial or other outside aerial is ever used a 25-turn coupling winding can be placed on the ferrite rod about $\frac{1}{2}$in. from "C". One end of the winding is taken to the external aerial and the other to the nearest earth return tag.

A capacitor of 0·1μF or 0·2μF may be wired from Tr4 collector to earth return to reduce the hiss and heterodynes sometimes heard with some medium wave transmissions after dark.

VC1 and VC2

These may be air spaced or solid dielectric. The former is better for VC2 because it is likely to be smoother in action. A 150pF short wave miniature variable capacitor is ideal. A 100pF capacitor will cover to about 500m if the oscillator coil core is well in. If to hand a 300pF capacitor may be used with a 300pF fixed capacitor in series.

If VC1 is 300pF this covers medium waves with a little to spare. If to hand a miniature ganged capacitor could be used for either VC1 or VC2.

Cabinet

This is made from $\frac{3}{16}$in. or $\frac{1}{4}$in. wood. Internal dimensions are $8\frac{1}{8}$in. wide, $6\frac{3}{4}$in. high and $2\frac{3}{4}$in. deep. An opening $6\frac{3}{4}$in. wide and $2\frac{1}{4}$in. high is cut in the front to clear switch and knobs.

The speaker opening may be circular, covered with speaker gauze. Or several rows of $\frac{1}{4}$in. or similar holes may be drilled. The battery is a H1187 or equivalent.

Joining edges of wood are smeared with adhesive and the pieces are fixed together with panel pins. When the adhesive is hard the cabinet can be cleaned up with glasspaper and it may then be varnished, painted or covered with one of the popular fabric materials. A small carrying handle can be screwed to the top. The receiver is fixed by screws through the aluminium panel into the front. Tuning positions can be marked on the card.

Current drain is about 7mA to 10mA with very low volume, rising to 15mA to 25mA or so with good volume. If a heavy current flows when first connecting the battery, switch off and look for a short-circuit or other defect. ■

PHOTOCONDUCTORS

BY B. R. GAINES

Audio Volume Control with the K42

PART 2

ALTHOUGH a photoconductor is essentially a non-linear device in that its resistance even at constant illumination decreases slightly with increasing applied voltage, at low voltages the departures from non-linearity are so slight that the cell can be used to control small-signal audio-frequencies without introducing distortion.

The basic circuit of a light-operated volume control is shown in Fig. 10. The photoconductor forms the lower leg of a potential divider across the signal voltage. When illuminated it has a resistance of about 100Ω and there is an attenuation of 1,000 times of 60db—when in darkness it has a resistance greater than 10mΩ and the attenuation is negligible. If this arrangement is to be used as a volume control it is required that the photoconductor should change logarithmically when a control is advanced linearly (as in the usual 'log pot'), because the ear responds to stimuli in this way.

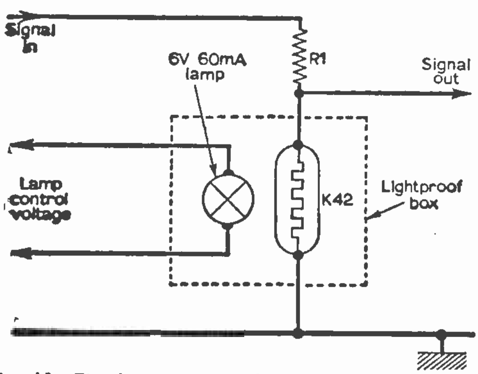


Fig. 10: The basic circuit of a light-operated volume control.

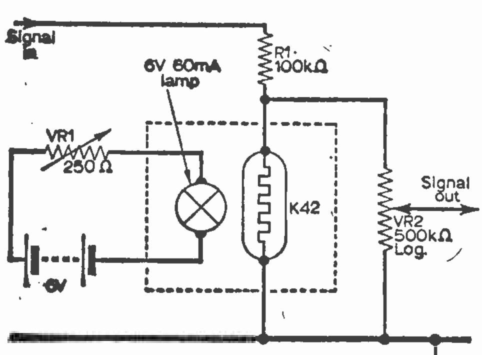


Fig. 11: A practical remote volume control circuit.

A plot of the resistance of a K42 illuminated by a 6·3V 60mA lamp bulb close to its glass window in a light-proof box is shown in Fig. 12, the resistance-scale being of the logarithmic or decibel form. The voltage across the lamp was varied by a resistor VR1 in series with the 6V supply. Curve J shows the variation of photoconductor resistance with lamp voltage, and curve K shows the variation with the lamp series resistance. To get a "log pot" law a control would have to give a straight line on this diagram, and it will be seen that the lamp-voltage curve departs greatly from linearity. The lamp series-resistance curve K however, is much straighter because of the "constant current" characteristic of incandescent lamps, hence a linear series resistor provides the required control.

Remote Volume Control

A practical circuit for a remote volume control is shown in Fig. 11. VR2 is the normal volume control in the amplifier and is set so that with the lamp off the signal is at the maximum required level. VR1 is the remote control: decreasing the resistance of this allows more current to flow

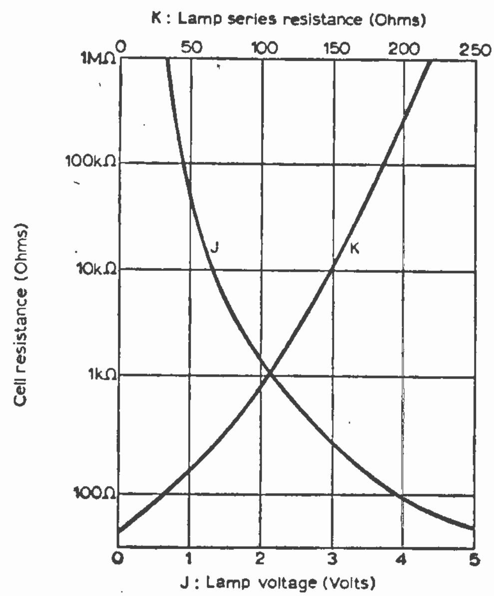


Fig. 12: Resistance graph of the K42 illuminated by an incandescent lamp.

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1S5	3/9	12AT6	4/3	DH81	12/6	EF86	6/3	PCF86	9/6	U78	3/9
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3A5	6/9	12AX7	4/9	DK92	6/9	EF92	2/6	PCL82	6/6	U291	9/-
3Q4	4/10	12K7GT	4/3	DK96	6/6	EF183	7/6	PCL83	9/-	U301	12/-
3S4	4/9	12K8GT	8/9	DL33	7/3	EL38	11/9	PCL84	7/6	U801	15/9
3V4	5/6	12Q7GT	4/3	DL35	6/9	EL41	7/3	PCL85	8/6	U4020	5/9
5U4G	4/6	19BG6G	6/9	DL92	4/9	EL84	4/9	PENA4	6/6	UABC80	5/9
5Y3GT	5/-	20L1	12/6	DL94	5/6	EL95	5/6	PENB4	17/6	UAF42	8/-
5Z4G	7/-	20P4	13/6	DL96	6/-	EM34	7/11	PEN383	9/6	UBC41	6/6
6AL5	2/-	20P5	11/9	EABC80	6/-	EM80	6/9	PEN3520		UBC81	7/3
6AQ5	6/-	25L6GT	4/9	EAF42	8/-	EM81	7/9		15/-	UBF80	6/-
6AT6	3/6	30C18	9/6	EB91	2/-	EM84	6/3	PEN4VA		UBF89	6/9
6BA6	6/-	30FL1	9/6	EBC33	5/-	EM87	7/-		12/6	UCC84	8/-
6BE6	5/3	30L15	9/6	EBC41	7/3	EY51	6/-	PEN36C		UCC85	6/9
6BG6G	12/6	30P4	13/6	EBF80	6/-	EY86	5/6		15/-	UCF80	8/6
6BH6	5/-	30P19	13/6	EBF83	7/6	EZ40	5/6	PL36	8/9	UCH42	7/6
6BJ6	5/6	30PL1	8/-	EBF89	6/-	EZ41	7/6	PL81	7/-	UCH81	6/6
6F13	3/6	30PL13	9/-	EBL21	10/6	EZ80	4/-	PL82	5/6	UCL82	7/6
6F14	9/-	30PL14	12/3	ECC40	6/9	EZ81	4/6	PL83	5/-	UCL83	8/3
6J7G	4/6	35A5	14/-	ECC81	3/9	FW4/500	6/3	PL84	5/9	UF41	7/3
6K7G	1/6	35L6GT	6/3	ECC82	4/9	GZ33	14/6	PX25	7/9	UF42	4/9
6K7GT	4/-	35Z4GT	4/11	ECC83	7/-	GZ37	8/9	PY32	9/-	UF89	6/3
6K8G	4/3	53KU	8/6	ECC84	6/3	KT32	5/-	PY33	9/-	UL41	7/-
6K8GT	7/9	AC/VP2		ECC85	6/3	KT76	8/-	PY80	5/3	UL44	15/-
6P28	9/6		12/6	ECF80	6/3	ME1400	15/-	PY81	5/9	UL84	6/3
6Q7G	4/9	AZ31	6/6	ECF82	6/3	MU14	5/-	PY82	5/-	UU7	6/6
6Q7GT	7/9	B36	4/6	ECF86	10/9	MVS/PEN B		PY83	5/9	UY21	7/-
6SL7GT	5/-	CL33	9/6	ECH35	6/-		12/6	PY88	7/3	UY41	4/9
6SN7GT	3/9	CY1	12/6	ECH42	8/3	N18	4/10	TDD4	7/9	UY85	5/-
6V6G	3/9	DAC32	8/3	ECH81	6/-	N108	16/6	TH21C	9/6	VP4B	12/6
6V6GT	6/6	DAF91	3/9	ECL80	6/3	OD3	4/6	U22	4/9	W76	3/6
6X4	3/9	DAF96	6/-	ECL82	7/-	PC95	6/9	U25	8/6	W77	2/6
6X5GT	6/6	DCC90	6/9	ECL86	9/-	PC97	7/-	U26	8/6	W729	16/6

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through the lamp making it brighter, thus decreasing the resistance of the photoconductor and hence the signal voltage to the amplifier. If VR2 is not to be used it should be replaced by a 500kΩ fixed resistor to limit the output resistance of the divider when feeding directly into a valve grid. This circuit has the advantage that switching off the lamp leaves the amplifier in its normal operating state, so that power is taken from the battery only when the volume is turned down by remote control.

Even though the cells have a fairly slow response time they are still sufficiently sensitive to 50c/s to pick up the slight ripple on mains-driven bulbs and a d.c. supply to the bulb must be used. The photoconductor must also be protected from ambient lighting so that it responds only to the light of the lamp. They may be mounted close together in a light-proof box or the lamp may be taped to the glass window of the K42 with black p.v.c. tape and the whole unit cocooned in this tape. If ambient light leaks into the photocell its resistance will fall and full volume will not be obtained.

Obviously this circuit has a disadvantage over the usual volume control in that it requires a lamp dissipating some 200mW to control audio-voltages of negligible power. This is inefficient but has the great advantage for purposes of remote control that the controlling leads carry no signal voltage and may be as long as required since hum pick-up and brief switching transients on these leads do not get into the audio side. Also the slow response of light bulb and cell provides freedom from potentiometer noise.

Volume Compressor

It is often required to produce a constant output signal from a source which is fluctuating greatly in intensity, e.g. to reduce output variations in a public address system due to differences in the placing or vocal intensity of speakers. There are valve volume compression circuits which achieve this, but they are generally very complicated and difficult to set up. By driving the volume control lamp from the output of the power amplifier it is controlling (Fig. 13) a volume compressor *par excellence* can be constructed such that a thousand to one change of input voltage causes only a three to one change in output voltage, at any power from 60mW upwards.

The reason for this great compression of dynamic range may be seen by reference to curve J of Fig. 12 which shows the variation of photoconductor resistance with lamp voltage. Suppose R1 is 1MΩ and the input signal to the amplifier via the volume control is such that there is 2V output across the lamp, then the photoconductor resistance is 1kΩ and the volume control is attenuating by 1,000.

Now suppose the input signal falls so that the output across the lamp is 1V, then the photoconductor resistance is 100kΩ and the volume control is attenuating by only 10. Thus an input voltage swing of 200 has produced an output voltage swing of only 2!

The circuit of Fig 13 stabilises the output at about 1V which represents 60mW into a 15Ω load or 300mW into a 3Ω load. To make the circuit capable of stabilising any level of output above this figure a variable resistor (VR1) is placed in series with the lamp bulb (Fig. 14). The greater this resistor the greater the output from the amplifier necessary to maintain 1V across the bulb. Thus this control acts as the volume control determining the stabilized output; the normal volume control on the amplifier performs a different function which will be explained in the next paragraph.

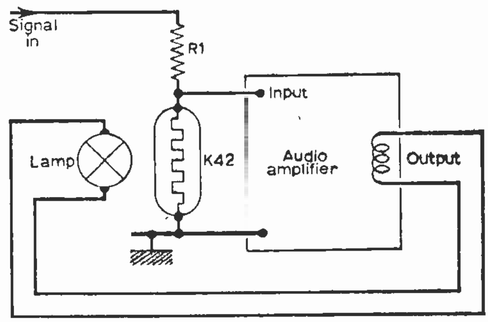


Fig. 13: A volume compressor circuit.

The table below gives the approximate values of VR1 for various maximum output powers into 3Ω and 15Ω loads.

Power	Load 3Ω	Load 15Ω
60mW	—	0
300mW	0	60Ω
1W	40Ω	150Ω
3W	100Ω	300Ω
10W	250Ω	600Ω

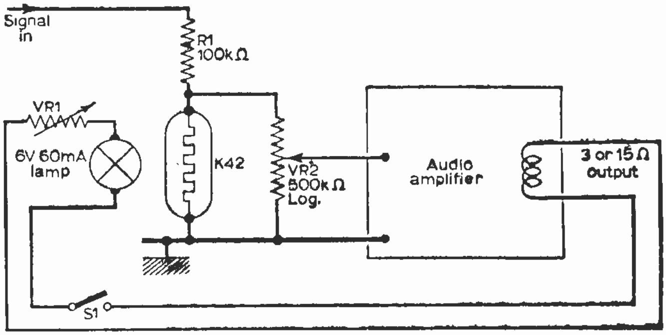


Fig. 14: A volume compressor for variable output levels.

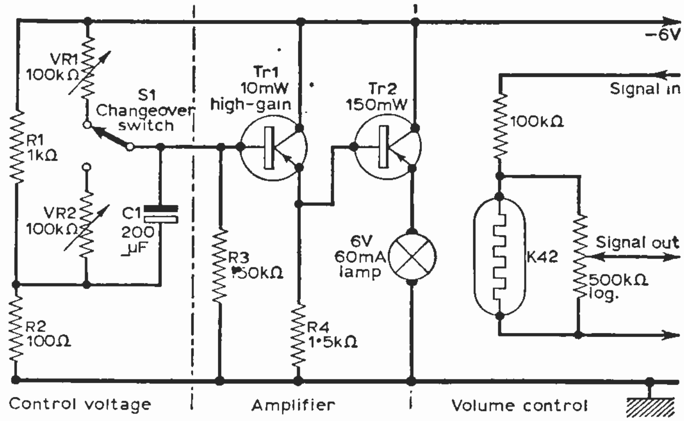


Fig. 15: A circuit for automatic attack/decay control.

In setting up the final circuit (Fig. 14) the constructor must decide what is the lowest signal which must give full output from the amplifier. The latter must then itself have the sensitivity to give the required output on this signal before all the control circuits are added, since these circuits only attenuate large signals and do not amplify smaller ones. The control VR2 is used to adjust the amplifier sensitivity so that it just gives the required output power on this minimum signal; it controls the range of compression not the output volume.

To set up the circuit the lamp is switched off, the minimum signal fed in and VR2 adjusted to give the required output into the loudspeaker. Then the lamp is switched on, a signal near maximum fed in and VR1 adjusted to give about the same output. Any signal below the minimum will not be compressed and will be amplified normally at maximum sensitivity. Any signal above minimum will come out at the pre-set volume. Since the gain of the system is greatest on low inputs the signal to noise ratio will be increased on these by the volume compression achieved. This trading of noise for compression limits the range of compression which is realisable in practice.

Automatic Attack/Decay Control

Automatic volume controls which when switched on "swell up" the sound at a pre-determined rate, and when switched off allow the sound to decay at some pre-determined rate, are used in electronic musical instruments to control the "attack/decay" envelope of the notes: variations of this on a sound of given pitch make all the difference between gentle bowing of a violin and the percussive "ting" of a bell. Also in sound studios similar automatic controls are used to fade sound effects in and out gradually rather than suddenly switching them on.

This type of control is of great help to the amateur tape-recordist trying to mix several inputs with only one pair of hands—instead of having to turn a volume control by hand when he wants to bring in a sound effect, he can just flip a switch and the automatic control will do the rest. As with the volume compressor there are valve circuits to perform this task, but they are complex and generally introduce distortion—here again the K42 circuit scores in simplicity and versatility.

The volume control of Fig. 10 is used again but with the lamp driven by an automatically controlled voltage from a d.c. power amplifier. The output from this amplifier is an almost exponentially rising or decaying voltage which compensates for the non-linearity in the lamp/photoconductor system and produces a constant rate of change of sound in decibels per second — this giving the required audio effect. The rates of rise and fall of this voltage may be pre-set and determine the time taken for the sound to attack and decay.

The circuit of the automatic attack/decay control may be considered in three stages (Fig. 15):

(1) The lamp-driven volume control which is the same as that of Fig. 10 and needs no further explanation.
(2) The two transistor d.c. power amplifier which consists of two emitter followers in cascade. This configuration gives no voltage gain, but matches the very low resistance of the lamp to the high output impedance of the control circuitry.
(3) The control voltage circuit which provides a varying voltage whose rates of rise and fall can be pre-set as required.

The d.c. amplifier circuit is very simple and should present no difficulty in construction provided the correct types of transistors are used. Tr2 provides the power for the lamp and must be capable of dissipating 150mW, any audio transistor with this power rating and medium to high gain is suitable, e.g. NKT223, NKT224, OC81, etc. Tr2 should be in good condition and high-gain, NKT223, NKT224, OC71, etc. — a poor transistor will work but the longest attack/decay times will be unobtainable. When the input to the amplifier is disconnected the output voltage should be less than 0·3V and the lamp should not glow. When the input is connected to the 6V negative rail the lamp should glow brightly.

The control voltage is provided by alternately charging a large capacitor C1 through resistors VR1 and VR2 by means of the changeover switch S1. The resistors are made variable so that the time taken for the sound to swell up or die away may be pre-set. From Fig. 12, curve J, it may be seen that the photoconductor attains its maximum resistance with a lamp voltage of 0·7V and is not affected by voltages below this. Therefore the control voltage must vary above 0·6V and to ensure this C1 is returned not to earth but to a potential divider consisting of R1 and R2 whose junction is about 0·6V negative to earth.

Consider the switch S1 switched to VR2 and C1 completely discharged: the input voltage is then

—*continued on page 890*

SIMPLE TIMING DEVICE

By S. W. Andrew

A TIMING device was required which would be able to operate a relay carrying mains supply to a photographic enlarger. Many methods were considered but as the range of the unit was quite small, 1 to 30 sec., a resistance-capacitance charging circuit was used. The design, being very basic, can be adapted to suit individual requirements. It uses familiar components all of which are likely to be found in the spares box. The following description of the circuit is given for the benefit of readers with only a limited knowledge of electronics.

The basis of the unit is the charging of capacitor C1 via resistance Rx. Charging voltage is derived from a converter-type mains transformer used to isolate the unit from the mains. The secondary voltage, about 200V, is half-wave rectified by diode D1 and applied via rotary switch S1 to C1 and Rx. Thus C1 begins to charge towards 200V. When it reaches a certain potential, measured to be 79V, neon tube V1 conducts for a very short period. This pulse partly charges C2, which then discharges via R2 and the coil of relay RL1, causing the relay contacts S3 to close for a short period. When S3 closes, a second path is completed via D2, R3 and RL1 which keeps the relay energised. When RL1 is de-energised a voltage appears at socket SK1 which is used to drive a relay switching off and on the photographic enlarger R5 and a small neon pilot lamp V2 give visual indication of the unit's functioning. The off/on switch S2 is a two-pole two-way, the second half placing R6 across C1 when the unit is off in order to discharge C1 ready for the next cycle of operation.

The duration of the output is selected by a 12-way switch S1. Indicated in the table below are the approximate value of Rx for various timing durations:

sec.	1	2	3	4	6	8	10	12	15	20	25	30
Rx (kΩ)	16	30	50	61	82	100	115	127	150	175	200	230

Longer durations are not practical as the charging current is quite small, i.e. not much greater than the leakage current in C1. Since the leakage current is dependent on temperature and past history of the capacitor it can vary quite a lot, causing great inaccuracies in the duration.

The unit was constructed in a die-cast instrument box but any suitable chassis can be used. The layout is not critical but if a metal chassis is used it should be earthed. The components list is given only as a guide. The values of R2, R3 and R4 may have to be changed to suit individual relay requirements. S1 can be replaced with a 0·25MΩ potentiometer and a calibrated scale. ■

COMPONENTS LIST

Resistors:

R1	220Ω	R4	220kΩ
R2	3·3kΩ	R5	6·8kΩ 1W
R3	5kΩ 5W	Rx	See text

All 10% ½W unless otherwise stated.

Capacitors:

C1 50μF electrolytic 100V
C2 64μF electrolytic 100V

Valves:

V1 OA3 V2 Small pilot neon

Switches:

S1 Single-pole, 12-way rotary
S2 2-pole, 2-way toggle

Miscellaneous:

T1 Mains transformer, converter type. Primaries, 240V. Secondaries, 200V 20mA
RL1 Single-pole change-over relay. 1kΩ coil resistance
D1, 2 Silicone power diodes, 200V 100mA
SK1 Output socket
0·5A fuse and holder. Pilot lamp holder. International Octal valve-holder. Chassis, wire, etc.

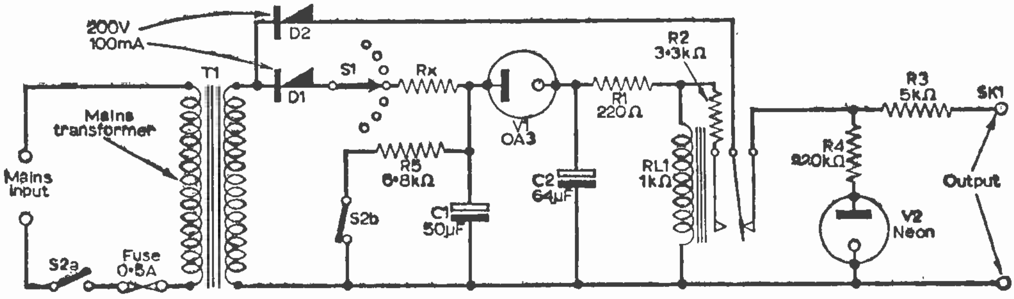


Fig. 1: In this circuit of the timer unit, all switches are shown in the "unit off" position.

on the Short Waves

MONTHLY NEWS FOR DX LISTENERS

All times are in G.M.T. All frequencies are in kc/s.

The Broadcast Bands—by John Guttridge

SOME technical information has recently come to hand on the transmitting facilities of the Canadian Broadcasting Corporation at Sackville on the Canadian Atlantic coast.

Here there are three 50kW transmitters which can operate on any of the short wave bands from 6,000 to 21,000. Special variable frequency oscillators maintain the operating frequency within 25c/s. The transmitters are capable of full modulation by any audio frequency in the 30 to 10,000c/s range.

Each transmitter can be tuned to any one of 13 aerial systems. The directional properties of these antennae can be reversed to cover different areas. For example, the European beam is reversible to cover New Zealand, Central America and Mexico.

Some of the antennae are of a dual-frequency type which enable two transmitters operating simultaneously in adjacent short wave bands to be connected to the same antenna through a common transmission line.

The whole antenna system is designed to withstand pressures corresponding to an indicated wind velocity of 120 m.p.h. and an ice coating ½in. thick on all members.

Three stations from which I have recently received verifications are *Radio Nacional de Espana* (General Yague 1, Madrid, Spain), *Radio Vatican* (Vatican City, Vatican State) and *Radio Tirana* (Rue Conference de Peza 3, Tirana, Albania).

That from the Vatican was best, giving date, time and meter band. The Spanish card gave the frequency and date only. Radio Tirana simply sent a carbon copy letter saying the report was correct. English transmissions from this station are from 2000—2030 and 2130—2200 on 9,390/ 7,090 and 1,088 medium wave.

A check on stations operating in the 31m band brought the following results. On 9,450 the home service of *Radio Moscow* was heard with station identification at 1615. The Moscow home service was also heard at 2100 on 9,615. Between 1700—1730 there was an unidentified language transmission on 9,480 from Moscow and between 1730—1800 Arabic was being transmitted on 9,500.

At 1615 *Cairo Radio* (Maspero, Cairo) uses 9,475 for its transmission to the Sudan. Reception was slightly better on this frequency than the 25m band alternative of 11,915. Cairo was also heard in Arabic on 9,495 around 1730. The programme appeared to be the *Voice of the Arabs* service and, although the signal was strong, suffered from c.w. interference.

Radio South Africa can be heard throughout the evening until close down at 2115 on 9,525. Reception is variable, mainly because *Radio Moscow* also has a transmitter on this frequency.

Well known as the home of the European service of the Swiss Broadcasting Service, Berne, Switzerland, is 9,535. From 2100 this channel begins to fade out, although the alternative outlet of 6,165 gives a first-class signal. News in French can be heard at 2130.

Several transmitters make use of 9,540. After 1900 the *Voice of America* puts in a very good signal in its Russian service. Around 2200 *Radio Free Europe* is the dominant station, although there is strong interference from another station, as yet unidentified.

During the evening *Radio Sofia*, Bulgaria, uses 9,560 for several of its European transmissions, including the half-hour English transmissions at 1930 and 2130. During the 1930 transmission a 54,444 SINPO rating is not unusual. Most of the Sofia transmissions on 9,670 are also carried on 6,070.

Five kilocycles further on—9.565—the *Voice of America* Tangier transmitter comes through well, although Sofia occasionally splashes over to spoil the signal. During the evening the *Voice of America* transmitter carries the English programme with Music, U.S.A., at 1915 and news at 2000.

At 2000 two stations clash on 9.575. These are R.A.I., Via del Babuino 9, Rome, Italy, and *Radio Mayrink Veiga* (Rua Mayrink Veiga 15, Rio de Janeiro, Brazil). By 2100 the Italian station has closed down, with the result that the Brazilian may be clearly heard. Radio Mayrink Veiga, by the way, asks those wanting a QSL verification of their report to enclose the return postage.

The European service of the BBC uses 9.580 at 2100 for a news broadcast and commentary in English.

On weekdays and Saturdays 9.590 is used by the English service of *Radio Nederland* (P.O.B 222, Hilversum). Reception is variable and the alternative frequency of 11.730 is more reliable.

Up to 2115 the General Overseas Service of the BBC can be heard on 9,625. A good frequency to try after 2115 is 9.410.

From 2000—2145 the Canadian Broadcasting Corporation transmits in English and French to Europe on 9.630. This is the best of the three frequencies used. Of the others 11.720 is quite good but 15,320 is often inaudible, especially after 2100.

Radio Nacional de Espana has a Spanish language broadcast from 1620—2120 on 9,695. Reception is good, spoilt only by a weak jamming transmitter. Fair reception is given also on the alternative frequencies of 6,140/7,105.

Finally a note about *Radio Australia* (P.O. Box 428G, G.P.O., Melbourne). This station now comes crashing in during the afternoon on 9,570. Signal strength on the SINPO rating is usually 4.

This month I have mentioned a few of the stations coming through well in the 31m band. Don't be surprised if you get different results—that is the nature of short wave. I shall be interested to hear of any changes you find.

The Amateur Bands—by David Gibson G3JDG

A SOMEWHAT disappointing month on the l.f. bands, which should have yielded better things considering the activity which was about in the form of contests. There was the VK/ZL c.w. contest, VU2/4S7 contest phone and c.w., the RSGB 7Mc/s DX phone contest, CQ world wide DX contest on phone, and the YL/RL party on c.w. Yet, in spite of all this activity things didn't come through at all as planned, at least not at this QTH.

On Top band 1800—2000kc/s many G stations were monitored on both phone and c.w., some quite a distance i.e. Somerset, but the furthest one to arrive was GW3HUM 579. Another very loud signal signed itself G3LYW and was using SSB. It is surprising really that more stations don't use this mode of transmission on Top band, especially in view of the power limit of 10W. A point of interest is that RTTY is not permitted. Eighty metres seems to be getting more like Forty as regards noise. One or two excursions into this band proved very frustrating and the only stations who managed to filter through at this QTH were SM5BX, DJ9TN, OK2PS and G3BZU. DJ9PB/P (the P signifying portable) put in a very creditable signal, and was going great guns. After this, Eighty was given a rest, but a chance listening early one morning at 0500—0630 hours G.M.T., was rewarded by some real DX from ZL4BX and ZL4LM, both SSB about 5 and 6. Needless to say, the big rig was hurriedly switched on, but alas no success in raising either of these stations.

With so much more activity on Twenty the usual procedure at G3JDG is to listen for about half an hour on Forty and then either switch off in disgust or switch to Twenty. However, this month it was decided to stick at it and see if there really was anything about. The result was a battle royal to nurse through a VK call sign, which after much effort turned out to be VK4SS. Having now got the hang of it, other signals were sorted out from the QRM (commercial type prominent) which included VQ2SD, OK1AFM, YU3ABZ, OK1OO, SM5BOU, SP6OQ and IT1AGA on Sicily. A new one for the book OX3LP (Greenland).

The H.F. Bands

Twenty metres, always good for DX somewhere didn't quite live up to it this time, although much activity is nearly always in evidence. At the time of writing, the band starts to open up at about 0400 hours GMT and returns to graveyard like conditions at around 2000 hours GMT. W's were plentiful and many were received, far too many to mention. Those who were 5 and 8/9 were K3VAB, W4HZI, W2WY, W4AF, WB2CPW and WA8FQU.

The VK/ZL contest was very disappointing as regards logging anything, the only VK other than VK4SS heard at all at any time was VK2ADE. Much of Europe came in and another Greenland station on phone was OX3HM. Looks like the polar regions are hotting up—as far as Ham radio is concerned of course.

My remarks in this column about the Fifteen metre band have not gone unnoticed, and even if I can't hear anything it doesn't mean to say that everyone else if afflicted with 21Mc/s deafness. A "G3" colleague in Watford writes to say that on Sunday, 18th October, from 1625 to 1707 hours GMT, the following stations were in evidence: WA2KRM, W1CHG, W4SJT, PY5RB, WA4UEJ/MM, CN8AK, VQ2JM and CR4AB.

Ten Metres

A terrible confession this month! The cubical quad, which gave such sterling service during the summer months was brutally dismantled and a two element wire beam (rotatable) was put up in its place at the same height (12ft). This gives less gain but nevertheless seems to work quite well. G stations worked with it were G2CZM, G3FIB, G3GXJ (SSB), G3MXQ, G3RRK, G3JDB, G3SFZ, G3AYC, G3EUJ, G3PAO, G3AEQ. G6FS was heard many times and called without success. DX-wise on this band it's been a poor month with only four stations to report. ZE1AN, ZE1JD, ZE1EV and ZC4AK, all on the same Sunday morning. ZE1AN in Bulawayo was a very FB signal and Tom made it a three-way with himself, G3JDG and G3TMI in Canterbury. The interesting thing is that although G3TMI was completely inaudible ZE1AN literally hundreds of miles away was a good 5 and 6/7.

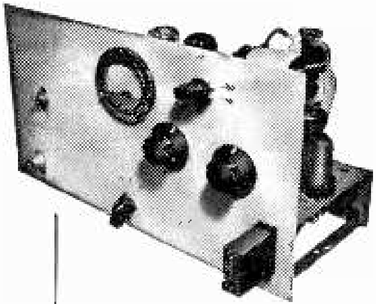
Perhaps an explanation about the ZC4 station is necessary since last month I reported that all ZB4 (Cyprus) callsigns had been withdrawn. This is perfectly true, but this does not affect the sovereign base areas, they merely change their callsigns from ZB4 to ZC4.

Here and There

Many stations classified as rare DX, often are small portable rigs operated on some remote island so small that they may not even be shown on some maps. A round-up to check which islands are inhabited by a box emitting r.f. and which are not, revealed the following. On Jan Mayen Island, LA2QJ/P and LA9PI/P are fairly active. The South Shetland Islands are put on the radio map

—continued on page 894

a simple Two-band 'Phone Transmitter



BY G3OGR

THIS transmitter has been found very satisfactory, and can be built almost entirely from receiver type components. Change-over switching is included, so that it is only necessary to add an aerial, receiver, and microphone. Many transmitters in the power range up to 10W cover the 160m band only, but in the present circuit 80m is also included. As end-fed aerials are often used on 160m, the same aerial will be even more effective on 80m, while with the latter band greater ranges can usually be covered.

Fig. 1 is the circuit, and the method of working is straightforward.

Switching

The control switch has three positions, for transmit, receive and net. Section S1a applies h.t. to the oscillator in both transmit and net positions. With the switch at net, only the oscillator is working, so that the signal can be tuned in on the receiver, to find if the channel is clear. (This position is also used for tuning-up if a variable frequency oscillator or VFO is employed with the transmitter as described later.)

With the switch in the central position, the aerial is connected to the receiver by section S1b, so that the same wire may be used for both reception and transmission. R14 is a bleeder, to discharge C10 and C11 when the equipment is switched off.

With the switch in the last position, S1a applies h.t. to the oscillator. S1b takes the aerial to the power amplifier tank coil L1, while S1c shorts the receiver aerial circuit to earth. Section S1d applies h.t. to the modulator and p.a. stage V2.

The single pole on/off switch connected to L1 is for 160/80m, half the coil being shorted out for 80m working.

Metering

This is reduced to the simplest possible method, by including a 100mA or similar meter in the cathode circuit of V2. With the transmitter switched to net, grid current through R3 from the cathode is indicated, and should be between 1mA and 2mA. The reading at this current is small, but the 807 operates well over a wide range of grid currents.

When the 3-way switch (S1) is on transmit, grid, screen grid, and anode currents all pass through the meter, thus showing the total d.c. input.

Oscillator

V1 is employed as a Pierce oscillator, and thus needs no coils or tuning. The crystal holder is to the right of the panel, so that crystals can be plugged in easily. C1 isolates h.t. from the crystal, while the trimmer TC1 allows oscillation, and thus the drive to V2, to be adjusted.

V1 may be used as a buffer when operating the transmitter with a VFO.

Modulator

This consists of the high gain twin triode V3, followed by a single 6V6. No audio gain is included, because modulation was found satisfactory with a crystal microphone at a normal distance. The modulating power can be adjusted by moving the microphone nearer or farther away.

The 6V6 has an audio output of about 4·5W and good modulation is obtained. The audio choke L2 is actually the primary of a speaker matching transformer, the secondary being ignored. This transformer should be rated at 80-100mA, and is of the type intended for use with mains output pentodes.

With modulation of this kind, the anode of V4 cannot swing negative, so that over-modulation (and consequent splatter) is avoided. If excessive modulation is attempted, audio distortion will become severe, and this is a sign that the audio input should be reduced.

RFC2 and L1

RFC2 is an anti-parasitic choke, made by winding six turns of 20s.w.g. enamelled wire on 100Ω ½W carbon resistor, the winding being stretched out to about ⅝in. long. This is then soldered by short leads to the cap clip of V2.

L1 is 60 turns of 26s.w.g. double cotton covered wire, on a 1½in. diameter former. This is close wound, and the ends pass through small holes. The centre turn is prised up, a piece of card is slipped under it, and it is scraped so that a lead can be soldered on. The coil is supported by a bracket screwed to the frame of the twin-gang capacitor VC2.

Power Supply

The 5U4G rectifier valve requires a 5V 3A secondary, but a 5V4G may be used and run from a 5V 2A secondary. If a 100-125mA smoothing choke of low d.c. resistance is to hand, this can replace R15.

With a 250/0/250V transformer, the h.t. line voltage dropped to 210-220V, at 100mA, so a 275V transformer is preferable, though the 250V type is satisfactory. The h.t. drain is around 90mA with a crystal, or about 110mA with the VFO. As resting intervals follow periods of transmitting, a 100mA secondary can be used, though a 125-150mA secondary would be better if available.

The 6·3V winding should be able to deliver 2A, for crystal operation, or 3A if the VFO is to be added.

Above Chassis

A chassis approximately 13½in. x 5½in. is suitable, with an aluminium, hardboard, or ply-

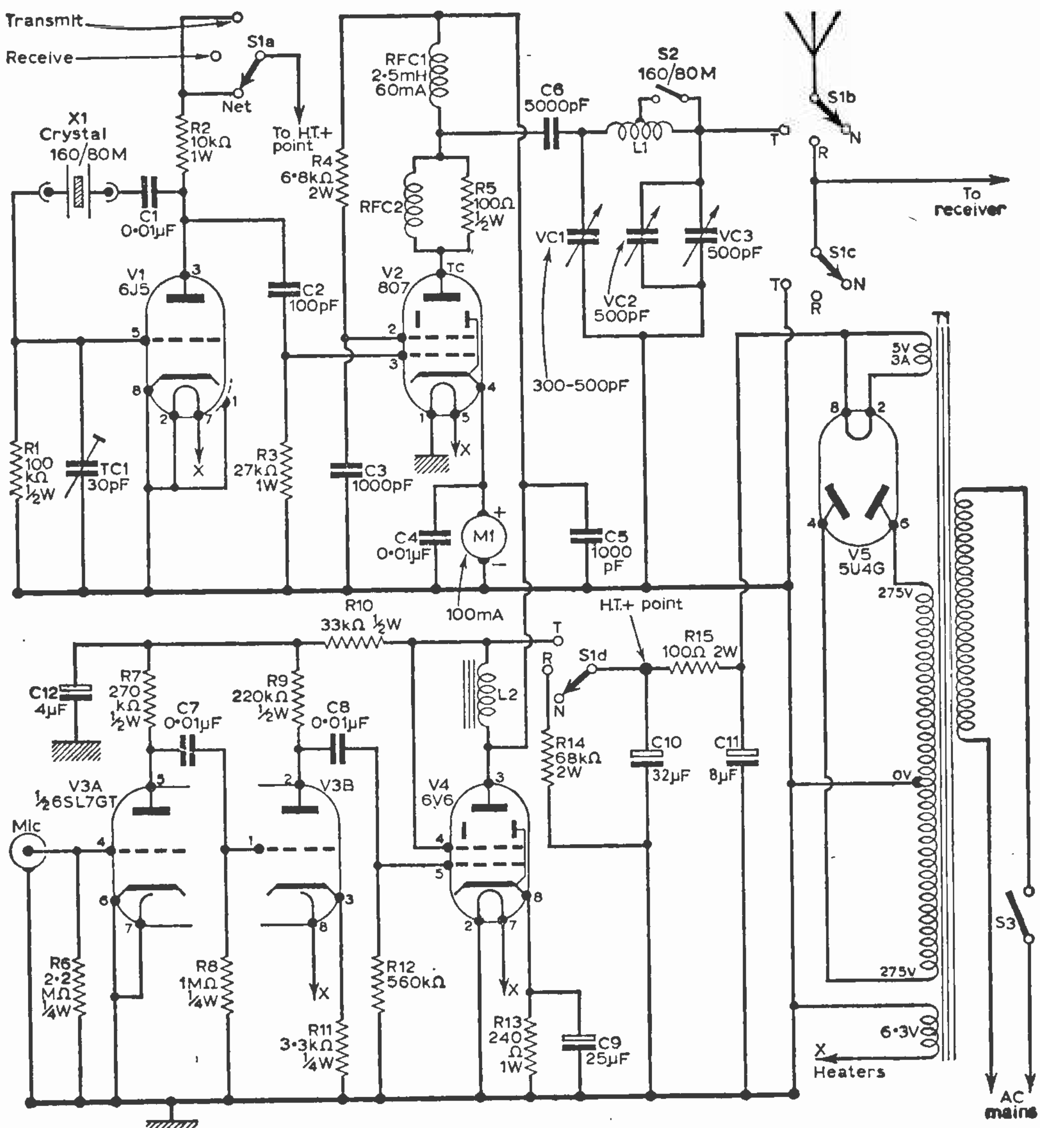


Fig. 1: The complete circuit of the transmitter.

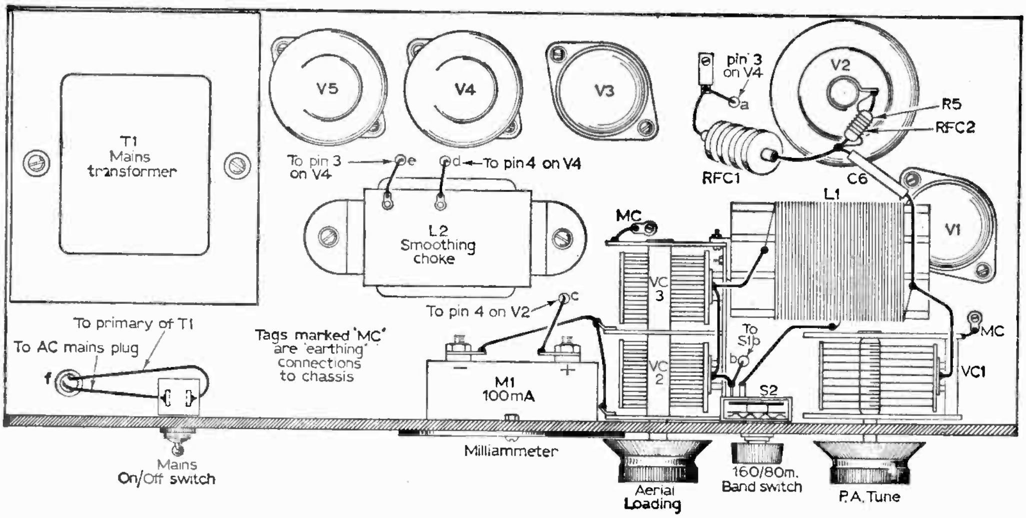


Fig. 2: The above-chassis layout of components.

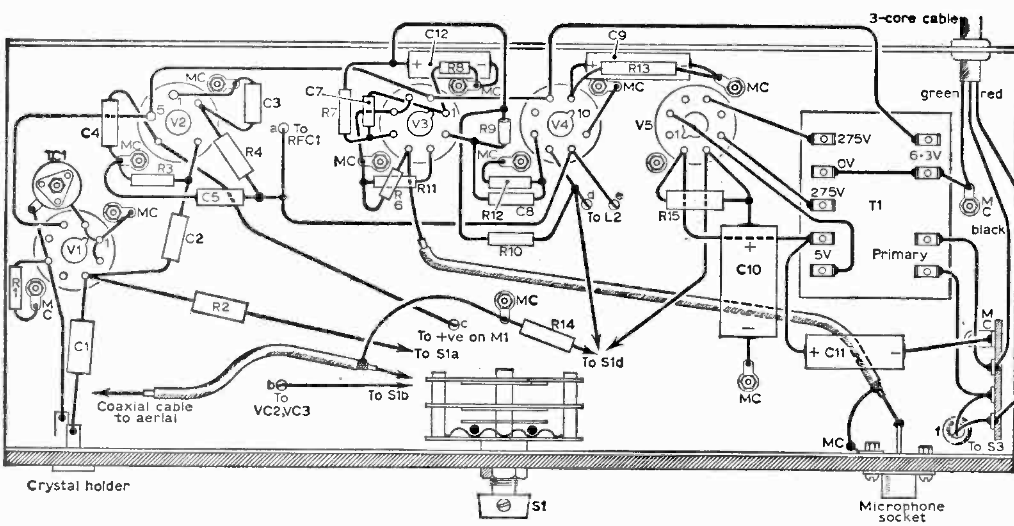


Fig. 3: The underchassis wiring of the transmitter.

wood panel about 13½in. x 8in. bolted to the front runner. The layout of components is shown in Fig. 2, and is not critical.

The variable capacitors may be attached to the panel, or fixed to the chassis with brackets. Both are electrically connected to the chassis. The two sections of the gang capacitor are wired in parallel. A lead is soldered to one bottom tag, and passes through a hole to S1b.

A pillar or strip with an insulated tag supports the RFC1 choke. C6, RFC2 and R5 are held by the wiring. RFC2 and R5 should not be omitted.

The meter is bolted in a hole cut in the panel. An adjustable washer cutter is useful for this. Though a 100mA instrument is convenient, other meters can be perfectly satisfactory. If V2 anode receives 250V, an anode current of 40mA indicates 10W input, which is the maximum permitted on 16m. (Input=E x I, or 250 x 0·04A.) A 0-50mA meter is thus suitable, if included in the anode circuit. To do this, wire pin 4 of V2 to chassis, and connect the meter in the lead passing from RFC1 to R4. Connect C4 or a similar value capacitor across the meter.

A 1mA or other sensitive meter can be shunted to read 0—50mA, or 0—100mA. It is thus often possible to use an instrument to hand.

A mains voltage switch S3 is used in the mains circuit. The 160/80m switch is a single pole two-way rotary type.

Under the Chassis

Wiring etc., can be seen from Fig. 3. The heater circuit is completed first, with the connections run near the chassis. Both sockets of the crystal holder need clearance holes. Crystals may have ½in. or ¾in. pin spacing, with a holder to suit, or a 3-socket holder which will take either type may be used.

The centre pin of the trimmer TC1 is soldered to an earthed tag of the valveholder. A screened lead is required from the microphone socket. Points marked MC go to tags bolted to the chassis.

For mains supply, a 3-core flexible cord is used. Equip the cord with a 13A type plug fitted with a 3A or similar fuse. Green is for earth, and goes from the large pin to chassis. Red is the live conductor, from plug fuse to transmitter mains switch. Black is the neutral circuit, from plug neutral to transformer primary. A tag strip anchors the leads, if necessary, and also provides a chassis connecting point for C11.

All leads should be short and direct, and approximately in the positions shown. Tag 7 of the rectifier valveholder is merely used as an anchor point for R15 and C10.

Function Switch

This is 4-pole, 3-way and may have two wafers, or be a double sided single wafer. Fig. 4 shows connections to a two-wafer switch, viewing both wafers from behind. S1a applies h.t. to R2 in positions 1 and 3. S1b takes the aerial to the transmitter in position 1, and to the receiver in position 2. S1c earths the receiver aerial lead in position 1. S1d applies h.t. to the transmitter in position 1, and to the bleeder R14 in position 2. Positions are:—1 Transmit. 2 Receive. 3 Net.

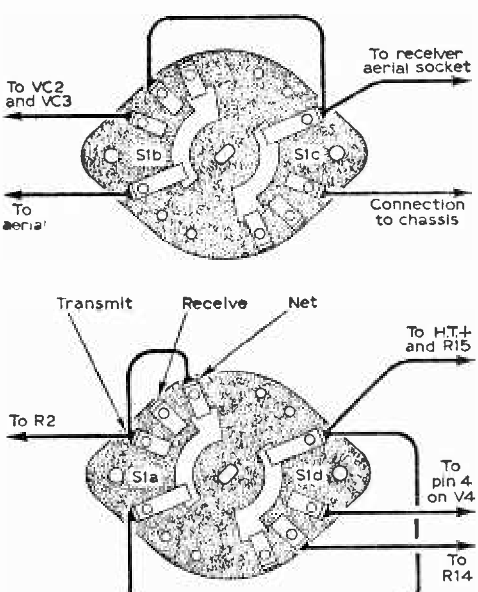
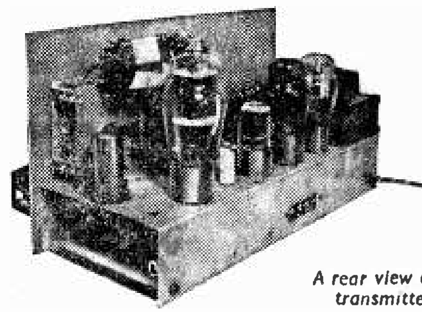


Fig. 4: Connections to the switch, S1.

If a 4-pole 2-way switch is to hand, this can be used for transmit/receive. An on/off toggle switch is then fitted to the panel and connected to apply h.t. to R2 only, for net operations. This switch is returned to its off position, for transmitting and receiving.

If a double sided wafer is used, check that this is wired correctly, because tags will appear reversed when viewing part of the circuit from the front of the wafer.



A rear view of the transmitter.

Oscillator Adjustment

With a crystal inserted, and the transmitter switched on, turn the function switch to net. Commencing from the open position, screw down TC1 until the meter shows between 1mA and 2mA grid current. If preferred, a test-meter may be temporarily inserted between R3 and chassis, for this test. If so, meter positive goes to chassis. A check should be made with any crystals to be used, so that TC1 can be adjusted to suit all crystals.

P.A. Loading

A first test is best made by connecting a 15W 200/250V household lamp from aerial lead to transmitter chassis. Close the gang capacitor fully. Check with the net position that grid drive is obtained, then turn the switch to transmit. The off-tune current may be very heavy, and VC1 is quickly rotated until current dips to a low value—probably 10—15mA or so. The gang capacitor is then opened, to increase loading, VC1 being re-adjusted as necessary for minimum current, as shown by the meter. As this progresses, the input will rise, and the lamp light with increased brilliance.

With the valve employed, the screen grid current was about 5mA so that the screen and grid currents together total about 6—7mA. In these circumstances, loading is increased until the meter shows roughly 6mA more current, than the required anode input. An anode input of about 8—9W is most suitable.

If prepared, the meter can be included in the h.t. circuit from L2 to RFC1 as mentioned. It then indicates anode current only.

For 160m band working, crystals in the 160m band are necessary, and the 160/80m switch (S2) is open. For 80m, close this switch, and use 80m crystals. Those 160m crystals whose 2nd harmonics fall in the 80m band may be used for 80m and 160m operation.

Testing Modulation

If wished, the modulator section can be tested by temporarily connecting a loudspeaker to the unwanted secondary of L2. Keep microphone and speaker separated, to avoid howling.

Modulation may be checked by connecting phones to a loop consisting of a few turns of insulated wire, with a crystal diode in one lead. With the transmitter loaded into the lamp, bring this loop near to L1. Speech should sound clear and distinct.

The station receiver may also be used. To avoid overloading, the r.f. gain should be turned back, and it may be necessary to short circuit the aerial socket to chassis. Tune in the signal on the receiver, again keeping the microphone clear of the loudspeaker.

Interconnections

The function switch provides single control send/receive working. Receiver and aerial connecting sockets can be fitted to the panel. Or a length of co-axial cable can be connected to the switch, and taken to the receiver aerial socket.

Transmitter and receiver are best side by side, and the aerial lead should run clear of other equipment.

Before transmitting, the function switch is turned to net, and the oscillator signal is tuned in on the receiver. This shows the position which the radiated signal will occupy. The switch is then turned to transmit, a call made, and the switch returned to receive for replies.

Aerial

An end-fed wire, with a total length of about 45ft. upwards, is often employed for 160m. The transmitter is loaded into the wire in the way described for the lamp test. The transmitter pi output tank coil can work effectively into a wide range of impedances.

Loading conditions can only be anticipated with any accuracy with ¼-wave and ½-wave aerials. On 80m, a ¼-wave is roughly 64ft. This will have low impedance, so that the gang capacitor is well closed. On this band, a ½-wave is about 128ft, which has a high end impedance, so that the gang capacitor (VC2, VC3) will have to be set at a lower capacity. The 128-132ft. or so would be about a ¼-wave on 160m, and thus low impedance on this band, while high impedance on 80m.

With intermediate lengths, perfectly satisfactory working is generally possible, the gang capacitor being adjusted to suit. If a particular aerial length will not load the transmitter, the solution is to use an aerial tuner, or change the aerial length.

A dipole is very satisfactory, for one band only. For 80m, it can be about 128ft. with a centre 75Ω co-axial or twin feeder. The feeder brading, or one lead of the twin, is taken to the chassis of the transmitter. The remaining conductor is the aerial connection.

Satisfactory results have been obtained with short indoor wires, spirals suspended vertically, and other aerials which can be erected in a limited space. Aerial tuners have appeared in past issues.

The following measurements were taken with the transmitter and VFO. Some variation from the figures given is not important. A 2kΩ/V meter was used on its 300V range.

Mains transformer output 250/250V on net and receive.

Mains transformer output 240/240V on transmit.

Current consumption on receive: 6mA.

Current consumption on net (crystal) 5mA.

Current consumption on net (VFO) 25mA.

6J5 anode, 200V.

6AG7 anode, 150V. S.G. 110V. (VFO).

807 grid current 1½mA.

Loaded to 45mA (cathode) input, 807 anode (at RFC) 200V.

Loaded to 45mA (cathode) input, 807 screen 165V. 5mA.

6V6 anode current 38mA. 6V6 cathode 10V.

807 total input, 9W.

807 anode input, nearly 8W.

H.T. drain on transmit (crystal) 88mA.

H.T. drain on transmit (VFO) 108mA. ■

COMPONENTS LIST

Resistors:

R1	100kΩ	R9	220kΩ
R2	10kΩ 1W	R10	33kΩ
R3	27kΩ 1W	R11	3·3kΩ
R4	6·8kΩ 2W	R12	560kΩ
R5	100Ω	R13	240Ω 1W
R6	2·2MΩ	R14	68kΩ 2W or similar
R7	270kΩ	R15	100Ω 2W
R8	1MΩ		

All 10% ½W carbon, unless otherwise stated

Capacitors:

C1 0·01µF mica or ceramic
C2 100pF mica or ceramic
C3 1,000pF mica or ceramic
C4 0·01µF mica or ceramic
C5 1,000pF mica or ceramic
C6 5,000pF mica or ceramic
C7 0·01µF mica or ceramic
C8 0·01µF mica or ceramic
C9 25µF electrolytic 25V
C10 32µF electrolytic 350V
C11 8µF electrolytic 350V
C12 4µF electrolytic 250V
VC1 300pF or 500pF air-spaced variable, *not* miniature
VC2, 3 500pF twin-gang variable
TC1 30pF air-spaced trimmer

Valves:

V1	6J5 (metal)	V4	6V6
V2	807	V5	5U4G
V3	6SL7GT		

Switches:

S1A, B, C, D 4-pole, 3-way rotary
S2 Single-pole, 2-way rotary (band-change)
S3 On/off mains switch

Miscellaneous:

RFC1 2·5mH 100mA all-band r.f. choke
RFC2 See text
L1, 2 See text
Crystal and crystal holder. Meter. Mains transformer (see text). Four octal valveholders and one UX5 valveholder. 5½in. x 13½in. chassis, 8in. x 13½in. panel. Microphone socket, knobs, nuts, etc.

ADDING A "MAGIC EYE" TUNING INDICATOR

By W. J. Holdsworth

A TUNING indicator of the magic eye type is a refinement easily added to a receiver by the home constructor, and the type used, a Y63, is readily obtainable from advertisers in this magazine.

The indicator consists of a triode amplifier valve with an extended cathode which allows electrons to strike a visible target electrode causing it to glow green. A V-shaped black shadow decreases as the signal is tuned in. The shadow is the result of a deflection of the electron flow by a field around the cathode ray electrode, introduced between the cathode and the target anode and joined to the triode anode.

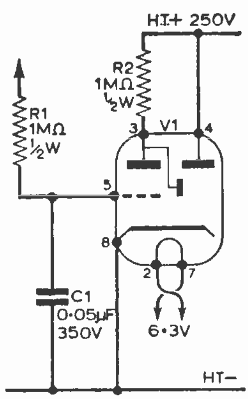


Fig. 1: The circuit arrangement necessary for the inclusion of the magic eye tuning indicator in a receiver circuit.

The grid is connected to the a.v.c. line in an a.m. receiver; or to the negative end of the discriminator stabilising capacitor in an f.m. receiver.

The anode current will be high in the no signal condition, and a large voltage drop will be produced across the anode load resistor. The triode anode and c.r. electrode will be at a much lower potential than the target anode.

There is a considerable effect on the electron flow and there will be a wide shadow.

As a station is tuned in the a.v.c. voltage rises and anode current decreases, causing an increase in the anode and c.r. electrode potential.

The shadow decreases in area and minimum shadow indicates correct tuning. Components may be mounted close to the valveholder. The indicator can be fitted to the front and panel by means of a capacitor clip or in any way which appeals to the constructor.

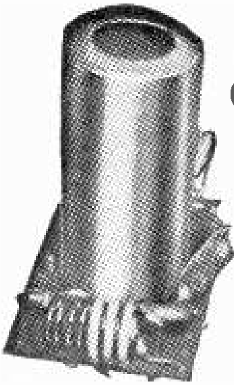
A hole $1\frac{1}{32}$in. will have to be cut for the Y63. A piece of sponge rubber may be placed around the valve under the clip.

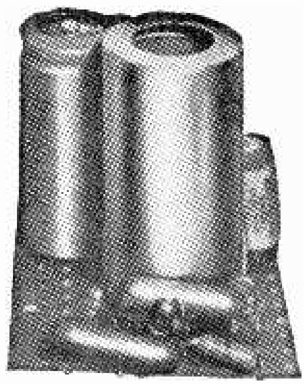
An escutcheon, Bulgin type E8, may be utilised on the front to complete the finish. ■

COMPONENTS LIST

R1 1MΩ ½W R2 1MΩ ½W
C1 0·05µF 350V
Y63 valve. One international octal valveholder. 1½in. capacitor clip. Piece of sponge rubber. Nuts, bolts, etc.

a pair of printed circuit





Although initially designed for u as boosters in a v.h.f./f.m. tur these two units can readily adapted for many other purpos

PHYSICAL size is of some importance to constructors when items are built for "add on" application, i.e. are to be inserted or attached to equipment already operative. The pair of pre-amplifiers presented here are each quite small physically as may be seen from the illustrations and either, or both, may be added to a v.h.f./f.m. tuner to increase its output. Both units make use of a simple "printed circuit" construction easily duplicated.

A Base for the "Printed Circuitry"

One of the aids available to constructors nowadays is a specially prepared "printed circuit type" board. This comprises thin plain paxolin with parallel copper strips each 0·1in. wide spaced apart by a similar distance on one side.

A matrix of small holes spaced evenly over the surface at 0·2in. to coincide with the copper strips enables conventional wiring to be largely dispensed with and a circuit may be interlinked via the strips and the resistors and capacitors, etc., of which it is made. The board may go under various names but that used for the prototype is named "Veroboard" and is easily obtained.

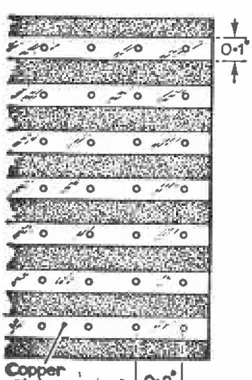


Fig. 1: The type of commercially available "printed board" used for the units.

A representative section of "Veroboard" (conductor side) is shown in Fig. 1, and as will be appreciated the material enables small items to be neatly constructed in a surprisingly short time. It is not thought likely that the board could withstand the application of high potentials but here no danger results since the h.t. voltages chosen are hardly lethal.

Why Boosting is Required

Not all users of v.h.f./f.m. tuners are fortunate enough to reside close to a transmitter and results sometimes prove disappointing due to a poor location—which might also be one where traffic interference constitutes a further hazard.

Considerable distortion can be present in the output of v.h.f./f.m. equipment operated with insufficient aerial input because the limiter and discriminator stages are unsaturated. Furthermore, even if a tuner confers a reasonably high output this might not be comparable to that afforded by ancillary aparatus such as a crystal pick-up, a tape recorder outlet, etc.

One can, admittedly, attenuate these other sources to obtain a levelling overall but this might not always be desirable and in these cases it is better to increase the output of the tuner instead.

There are various ways in which the tuner output can be raised. (1) By improving the aerial system. (2) By amplifying the v.h.f. signal before it reaches the tuner. (3) By amplifying the *output* afforded by the tuner (audio amplification). (4) By using all the systems simultaneously.

preamplifiers

A. S. CARPENTER
G8ABG

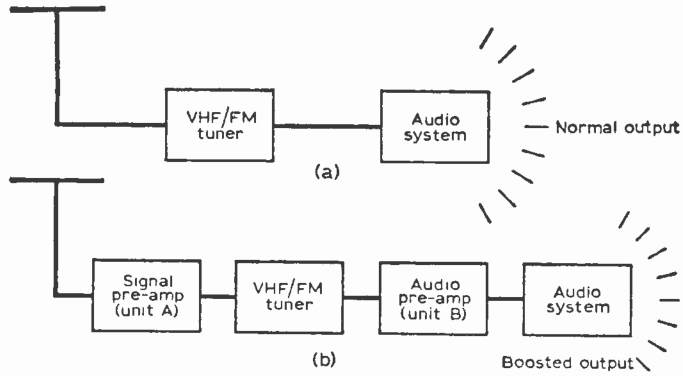


Fig. 2: (a) A simple v.h.f./f.m. system and (b) with the addition of "booster" units.

It should be noted, however, that on no account should the cores of the i.f. transformers in a v.h.f./f.m. tuner be "peaked" to obtain greater output.

A typical set-up is illustrated in Fig. 2 (a) where a conventional tuner feeds an audio amplifier. In many cases the first valve in such a tuner will be a ECC85 or similar type. Fig 2(b) shows a rearrangement to accommodate the proposed pair of preamplifiers and, of course, the resulting output will be much greater.

In the test assembly both units were easily accommodated within the tuner itself but other arrangements are possible. Both units need not necessarily be used, however, but if one is omitted it should, if possible, be Unit "B"—in a weak signal area at any rate.

Unfortunately, although Unit "A" is likely to be most suitable under such conditions it is less easily set up than Unit "B" since it contains tuned circuits. Current demands must also be considered and Unit "A" requires 8mA at 150V d.c. plus 0·33A at 6·3V a.c., whilst Unit "B" although more economical consumes some 2mA at 150V d.c. and 0·3A at 6·3V a.c.

This means that when both units are incorporated at least 10mA and 0·63A *must* be available from the existing d.c. and a.c. feed lines respectively.

Construction is equally simple for either unit.

The Signal Preamplifier (Unit "A")

The circuit of Unit "A" is shown in Fig. 3, a cascade configuration being adopted. V.H.F./F.M. signals from the aerial are fed to T1 and appear amplified at T2 where they may be injected into the original aerial circuit of the tuner. The first triode (V1A) functions in grounded cathode mode but V1B operates as a grounded grid stage, the overall result being comparable to a pentode but without its noise.

Anyone wondering how V1A anode derives a potential for its anode should note that the two triodes are connected in series across the d.c. supply lines, each anode receiving one half of the available voltage, due to current flow.

The valve chosen is specially designed for the work and the potentials are adequate; the 180V

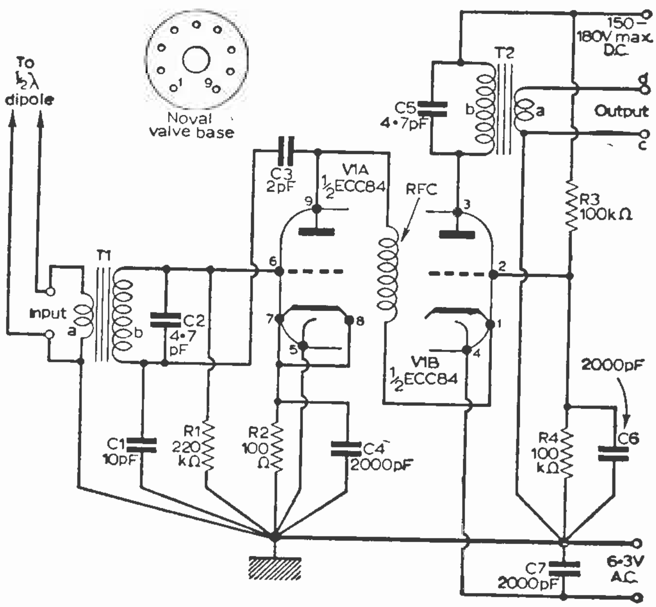


Fig. 3: The circuit of Unit "A", the signal preamplifier.

limit should not be exceeded, however. Resistors R3 and R4 merely split the supply potential to bring the grid of V1B to a suitable voltage with respect to its cathode.

The input and output transformers are hand-made, both being air-cored. No variable tuning is fitted, the transformers being adjusted to give maximum output at the middle frequency, viz., the Third Programme. The overall bandwidth is restricted slightly by fixed capacitors C2 and C5. Details of transformer construction will be given later.

C1 and C3 are neutralising capacitors and were not found to be unduly critical, although if a very low noise level is desired C1 may be replaced by a 15pF (max) concentric trimmer. The r.f. choke is also hand-made and can materially affect the gain of the unit; in practice it is adjusted experimentally. With careful adjustment an overall gain of 18dB can be secured.

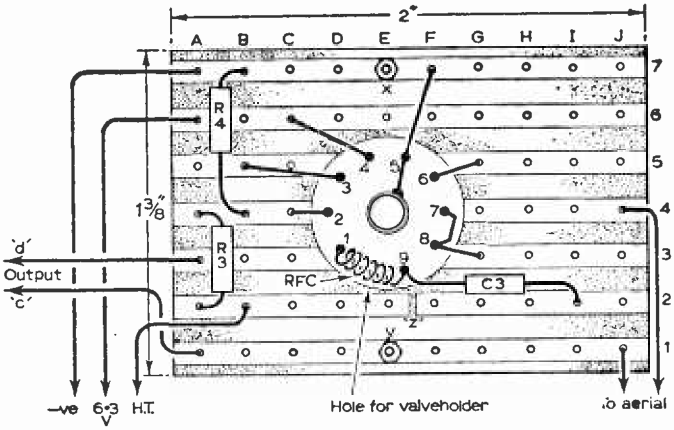


Fig. 4: Wiring of Unit "A" shown from the conductor side.

Constructing Unit "A"

The first step is to take a piece of "Veroboard" and with a hacksaw or fretsaw cut out a piece to the size shown in Fig. 4 so that it has seven conductor strips—which may be imagined to have numeral designations as shown. The ten rows of "holes" are given imaginary letter designations.

Next a cut-out should be made exactly as shown (in Fig. 4) just large enough to accommodate a ceramic noval valveholder. The two holes at "x" and "y" are then enlarged to 6BA clearance and a slot cut in the appropriate copper strip at "z" with a file.

In this state the board is rather fragile but rigidity is regained immediately the skirted valveholder is bolted down. For the valveholder tag orientation it must be emphasised that a ceramic valveholder with tags placed in a like position with respect to the locking holes as that shown *must* be selected.

Fig. 4 also shows the wiring of the conductor size although with regard to the valveholder this mostly consists of bending over the contacts and soldering them where marked.

Resistors R3 and R4 are deliberately placed on the conductor side to simplify transformer adjustments later on the plain side.

At this stage four stout copper wires each about 1in. long of, say, 22s.w.g. are located and soldered in holes B2, B5, I2 and I5 to stand upright on the plain side of the board. These are later shortened to form "pillars" to accept the T1 and T2 main winding endings. The choke can be left until later.

Various differently coloured flying leads for supplies, etc., are also required and may be soldered where shown. Depending on the final usage the negative line—and also perhaps lead "C"—will not be needed, as for instance if either strips "1" or "7" are in some way finally connected to the actual tuner chassis.

Work on the plain side of the board is illustrated in Fig. 5 and is quite straightforward. Remember, however, that when the valve can is placed over the valve it could short-circuit nearby component wires if care is not taken.

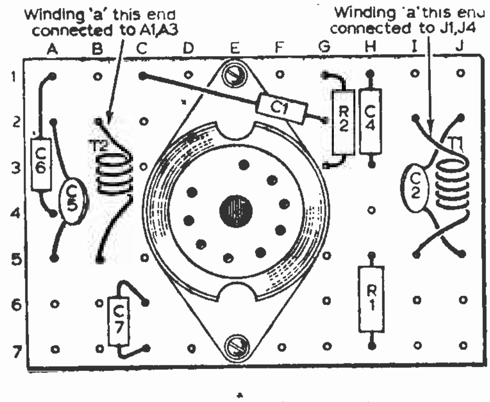


Fig. 5: Wiring of Unit "A" on the plain side.

Making the Transformers

The aim is to obtain an inside winding diameter of ⅜in. and reasonably thick wire—say 22s.w.g.—should be used for the main windings.

Experimentally select a suitable capacitor, fountain pen or other "dummy former" that will permit the required final diameter and taking a length of wire together with another length of thin single strand PVC wire wind on seven full turns of *both wires together*, remembering that it is easier to remove a turn later than to add one.

Next unwind the PVC length until only two turns remain and cut off unwanted lengths as necessary. With the dummy former still in position solder the transformer under construction as shown in Fig. 5, the main winding endings being soldered to the shortened wire lugs already fitted.

When the ends of the PVC insulated winding have been soldered as shown, carefully slide out the dummy former, when a self-supporting and neat transformer should be seen with the main winding turns spaced at about wire thickness from each other.

The other transformer is similarly constructed. To make the self supporting choke wind six turns of fine enamelled copper wire on to a ¼W resistor then slide off.

The valve is next inserted into its holder and the screening can fitted. Check to see that no component lead-out is fouled. Check the unit with an ohmmeter to ensure no h.t. short circuit exists.

Locating and Testing

The actual location of the unit in a given set-up will depend on the type of apparatus in use. If the preamp can be fitted in the tuner itself so much the better and one simple way of fixing it is to locate 1in. long threaded spacers at each valveholder bolt so that the board is held stilt fashion.

With h.t. and l.t. fed lines connected it is merely necessary to remove the aerial leads to the tuner and re-connect to winding (a) on T1. A short length of screened cable is then connected between the tuner input and points (c) and (d) on T2.

At switch-on the h.t. voltage should immediately be checked and if in excess of 180V d.c. the apparatus should be switched off and a 1W dropper resistor inserted in the lead to the preamplifier h.t. To determine the approximate value needed use the simple formula:

$$R=\frac{E \times 1{,}000}{8}$$

where R=the value of resistor required in ohms, and E=voltage to be dropped.

Therefore, if the measured h.t. line voltage is 244V this is in excess of 180 by 64, and so

$$R=\frac{64 \times 1{,}000}{8}=8{,}000\Omega.$$

A 1W resistor of 8·2kΩ would be suitable in this case. If such a resistor is used, however, connect the red end of a 4—8μF, 250V electrolytic capacitor to hole C2 and its negative end to hole C7 using a wire ended item.

Setting Up

Tune in the Third Programme then adjust T1 and T2 for maximum output aurally, or visually by employing a suitable indicator and a signal generator. If it is found that when holding the dust iron cored end of a tuning wand inside either transformer the output increases, then the inductance value is too low and the turns should be squeezed together.

If on the other hand, as is more likely, introduction of the brass end of the wand causes output to increase then the inductance value is too large and if slightly increasing the turns spacing does not allow "peakiness" then a turn must be removed and the spacing readjusted.

COMPONENT LIST

For Unit 'A'

R1	220kΩ	C1	10pF
R2	100Ω	C2	4·7pF
R3	100kΩ	C3	2pF
R4	100kΩ	C4	2000pF
All ¼W 10%		C5	4·7pF
		C6	2000pF
V1—ECC84		C7	2000pF
T1, T2, RFC (see text)		All ceramic	

Miscellaneous—Noval valveholder (ceramic and skirted) with can, aerial lead, small piece 'Veroboard', wire, nuts and bolts, etc.

For Unit 'B'

R1	470kΩ	C1	32μF electrolytic 250V
R2	100kΩ	C2	25μF electrolytic 6V
R3	1·8kΩ	C3	10,000pF ceramic
R4	1MΩ	C4	10,000pF ceramic
R5	1·2kΩ		
R6	22kΩ		
R7	10kΩ	V1—ECC81	
All ¼W 10%			

Miscellaneous—Noval valveholder (skirted) with can, small piece 'Veroboard', wire, nuts and bolts, etc.

Fortunately this is fairly easy to accomplish, due to the layout, without completely removing the transformer. Supplies should be switched off whilst such adjustments are made.

When the transformers have been attended to the choke can be experimented with and slightly spacing the turns, using an insulated tool will indicate what is needed. If gain falls off the inductance of the choke is insufficient and vice versa.

On completion the transformers and the choke should be "doped" to keep the turns correctly positioned. The only other items capable of affecting gain are R3 and R4 and although some small amount of experimenting can be done here the values should not be made widely dissimilar.

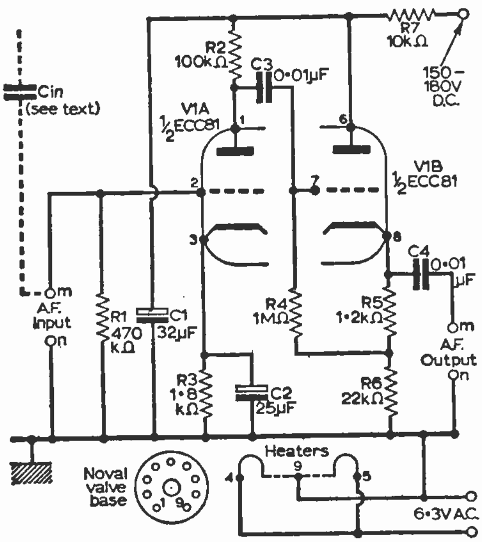
Other uses for Unit "A"

By modifying the transformers and the choke the preamplifier could be made to act similarly at different frequencies—for the 144Mc/s amateur band or for Band III TV perhaps. The number of turns required must be found experimentally but for 144Mc/s tuned windings of 4 turns are suggested with 2—3 turns for Band III TV. The input and output windings should also be reduced to about 1½ and 1 turn respectively.

THE AUDIO PREAMPLIFIER (UNIT "B")

This unit is so simple as to need little description. The circuit is shown in Fig. 6 where V1A functions as a conventional audio amplifier feeding V1B operative as a cathode follower.

Leads associated with the input need to be kept short and might need screening but the output leads may be quite long if necessary since these



points are at low impedance. In this section the load resistor is R6 in the cathode circuit, R5 merely being a bias fixing item.

Low note response might possibly be improved by increasing the value of C4—and perhaps C3—although sub-miniature specimens might not be available at values ten times greater than the specified value.

The anode of V1B is made "earthy" due to C1 which further confers decoupling for the whole unit in conjunction with R7. The h.t. current demand (less than 2mA) is light indeed.

Constructing Unit "B"

Here again a small piece of "Veroboard" is cut and prepared to agree with Fig. 7, and although its length is identical with that used for Unit "A", it is wider by one conductor strip. "Wiring up" is very simple as may be seen from Figs. 7 and 8. Note, however, that some items are mounted vertically—as shown inset.

Again is it ncessary to select a valveholder with tags orientated as shown; it is also necessary to

Fig. 6: The circuit of Unit "B", the audio preamplifier

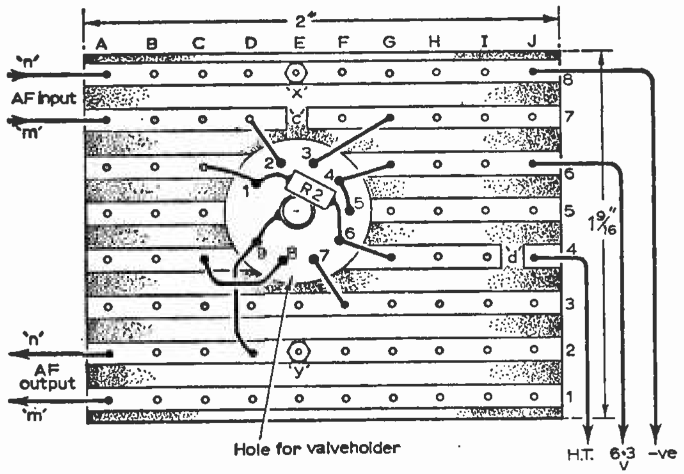


Fig. 7: Wiring of Unit "B" shown from the conductor side.

select physically small components.

Normally C_{in} (Fig. 6) will be integral with the apparatus with which the unit is to be used and a volume control might also exist at this point. Should it do so, pin 2 of V1A could be connected to the slider and R1 omitted. The output at C4 (point m) would then be joined to the wire originally in connection with the volume control slider but if this is done a 470kΩ to 1MΩ resistor should be wired between holes B1 and B2 or the valve following may receive no bias.

A simpler method is to allow the top end of the volume control to be fed from C4 whereupon C_{in} which originally connected there, is wired directly to hole A7 as shown in Fig. 7 and R1 retained.

Supplies are picked up similarly as for Unit "A" but in this case the h.t. voltage is not too critical; the board is not overstressed due to the preparation. A check for h.t. short circuits should be made on completion and before switch-on.

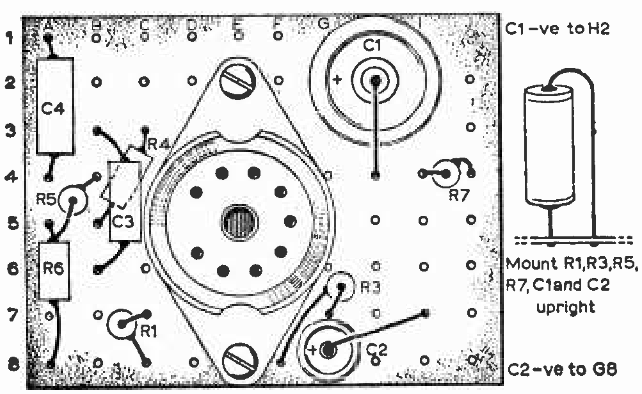


Fig. 8: Wiring of Unit "B"—plain side.

Other Uses for Unit "B"

These are fairly obvious and if required an ancient receiver can be "pepped up" by the addition of a low power audio amplifier made to give really "meaty" output. Care should be taken to see that no overloading can occur though.

Conclusion

Earlier it was stated that one way of improving reception of weak v.h.f./f.m. signals was to improve the aerial system. Actually this should be dealt with first of all, for a good aerial is greatly to be preferred to any preamplifier. It is easy to make a suitable aerial which should be mounted as high as is possible. If an outdoor location is not possible try using the loft, or a safe place under the eaves. If results are then inadequate the preamplifier(s) can be tried.

The dimensions and essential details of a suitable aerial can be seen in Fig. 9; the material being $\frac{1}{4}$-$\frac{3}{8}$in. dural or copper tube and connected to coaxial cable as illustrated. If possible the aerial should be wholly in the horizontal plane but in difficult situations length "A" may be bent downwards.

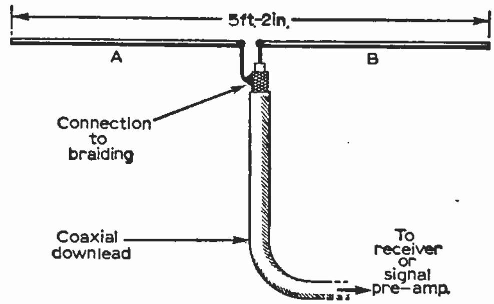


Fig. 9: The dimensions and connections of a v.h.f./f.m. dipole.

Although such an aerial is not very directive it should be orientated for maximum pick-up of the area transmission. Directors or a reflector would increase the gain but are not usually desirable as excessive "beaminess" is introduced which limits the choice of stations considerably. If trouble is likely from passing traffic keep the aerial as far away from the roadway as is practicable. ■

A FERRITE ROD D.F. AERIAL

—continued from page 838

the true position, however, so a second fix will still have to be taken from another point.

For example we have taken a fix from point A as in Fig. 7. The actual direction could be to X or Y as outlined above, a sensing aerial would determine the direction but since another fix must be taken from another point (B) to find the true position, the direction would become known anyway.

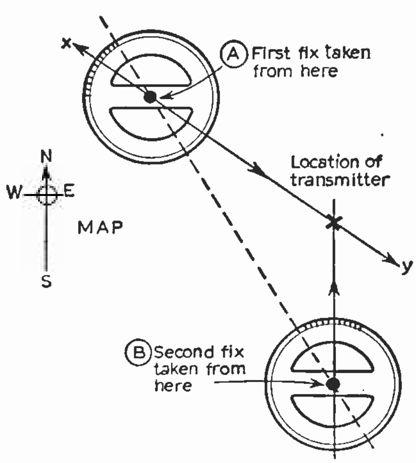


Fig. 7: Plotting the true position of the unknown location of a transmitter.

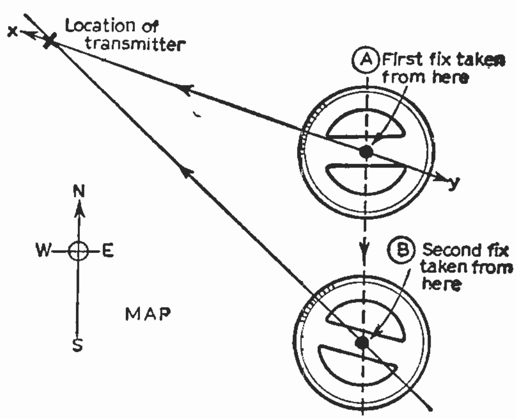


Fig. 8: Another typical direction finding arrangement.

Supposing the location of the transmitter were as shown in Fig. 8, i.e., in the direction of X (we will assume the d.f. receiver is already at point A as before). The second fix, taken at point B would now show the transmitter's true position somewhere along the line in the direction of X.

One must obviously avoid taking fixes along the same line of direction. Always take the second fix at as wide an angle as possible from the first. ■

some experiments with A.M. INTERFERENCE SUPPRESSION

BY G. R. WILDING

PURPOSEFUL experiment must surely be one of the most engrossing aspects of amateur radio and one of the avenues in which the writer has carried out exploration is a.m. interference suppression.

In this article some original and interesting circuits are given for individual experiment and development, but first a recap on the only system used in pre-war receivers, apart from special aerials, when some attempt was made to remove this background noise.

The detector diode was negatively biased so that unless any signal first overcame this bias it could not be rectified, therefore this meant that inter-station noise and weak station signals failed to break through and left the entire waveband silent except for the really strong signal.

This method not only removed entirely weak signals but distorted any on the edge of the cut-off voltage as well as failing to remove heavy interference present with the strong signals and was by no means a good approach to the problem and, therefore, such systems are not now used.

The basic idea in the author's system is graphically shown in Fig. 1, where it will be seen that a high-mounted aerial in a static free zone has a dummy downlead running parallel to its own and being terminated at opposite ends of a standard medium wave coil whose centre tap feeds the receiver's aerial socket.

Equal value signal and noise microvolts are picked up by the real and dummy downlead, cancelled out by the coils' magnetic field, leaving only the signal picked up by the actual aerial for amplification.

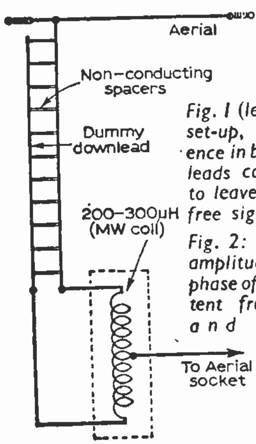


Fig. 1 (left): In this set-up, interference in both downleads cancels out to leave a static-free signal.

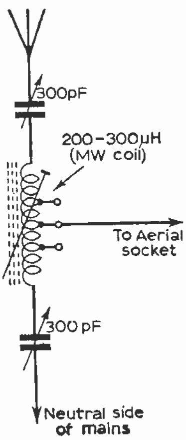


Fig. 2: Equalising amplitude and phase of noise content from aerial and mains "aerial".

This is a sound and simple scheme which works well in practice, but while it ensures that the downlead does not contribute to the general noise level, fails to remove what interference may be picked up directly by the aerial.

Then again, many listeners will be unable to have good outdoor aerials of any type in a static-free zone.

The next step is to accept that an inferior indoor or outdoor aerial may have to be used and feed in anti-phase at the other end of the coil, a signal composed of equal noise level but much lower still signal level.

In other words, as poor an aerial as possible.

The most obvious solution is a connection via a blocking capacitor to the neutral side of the mains, using the mains as an aerial, or the use of a three-core mains lead whose third wire will then comprise the " poor " aerial.

But here we strike snags. To get the two inputs to cancel out their noise content when fed to the inductance and leave only the strong station signal minus some quite unavoidable weak station signal from the mains aerial requires that both inputs must be of equal phase and voltage.

Variations in voltage amplitude can be levelled in various ways, perhaps the simplest being a sliding ferrite core to the coil which can vary the relative inductance of each half so that the magnetic fields can cancel out.

To get the phasing similar is much more difficult as the phase of each input is dependent on the LC values of the source.

Probably the best way, although here there is much opportunity for experiment, is to tune both aerial and mains aerial to the same frequency, when, of course, on resonance both circuits must be in phase.

Such an arrangement is shown in Fig. 2 and when correctly set up background noise will be found to diminish as adjustment of the core and capacitors produces almost a 100% noise cancellation.

Unfortunately the background noise pattern on both medium wave and long wave varies in character and intensity over the tuning range of the set so that the capacitor settings must be varied as one tunes up or down the dial.

This, of course, is a disadvantage and again calls

—continued on page 873

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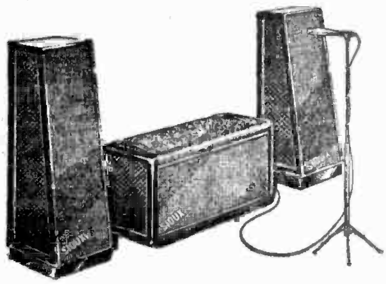

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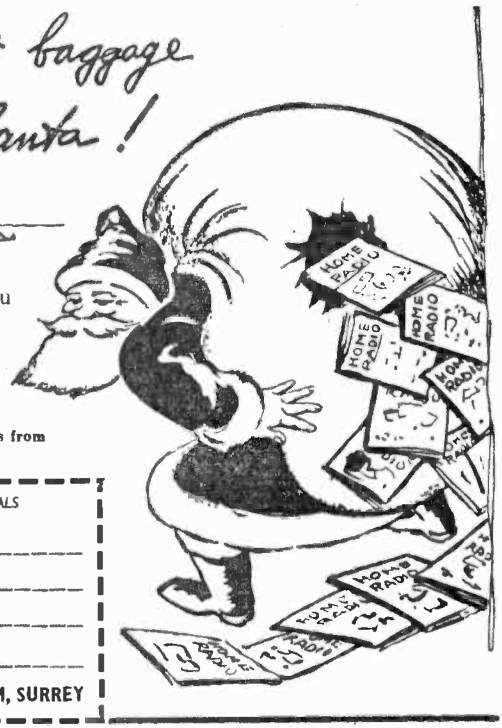

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3: CAPACITANCES CONTINUED AND BASIC A.C. THEORY

3.1 Capacitances Connected in Parallel

WHEN capacitances are connected in parallel, the total capacitance of the group is given by adding together the capacitances of the individual components. For example—in Fig. 23a,

$$C = C_1 + C_2$$
$$= 1 + 5 = 6\mu F$$

and in Fig. 23b,

$$C = C_1 + C_2 + C_3$$
$$= 1 + 2 + 3 = 6\mu F$$

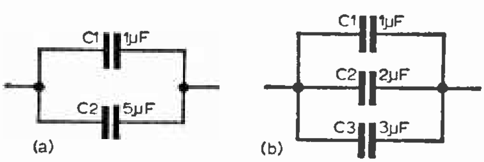

Fig. 23: Capacitances arranged in parallel.

When capacitances are connected in parallel, the highest voltage which can be applied to the combination is equal to that which can be applied to the capacitance with the lowest working voltage.

3.2 Capacitances in Series Connections

If two capacitances are connected in series, as shown in Fig. 24a, the total capacitance will be given by—

$$C = \frac{C_1 \times C_2}{C_1 + C_2}$$
$$= \frac{3 \times 6}{3 + 6} = \frac{18}{9} = 2\mu F$$

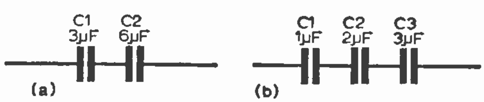

Fig. 24: Capacitances in series.

In Fig. 24b the total capacitance will be given by—

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$
$$= \frac{1}{1} + \frac{1}{2} + \frac{1}{3}$$
$$= \frac{6}{6} + \frac{3}{6} + \frac{2}{6}$$
$$\frac{1}{C} = \frac{11}{6}$$

cross multiply—

$$11C = 6$$
$$C = \frac{6}{11}$$
$$C = 0{\cdot}545\mu F$$

It must be remembered that the *same units* must be used throughout in any calculation of this type.

The total capacitance when two or more capacitances are connected in series is always less than the value of the lowest capacitance used.

The voltage appearing across a capacitance in a series connected arrangement can be found in the following way:

1,000V, E, is applied to three capacitances connected in series and having values of 1, 2 and 3μF. C is the total capacitance and from Fig. 24b it can be seen that $C = 0{\cdot}545\mu F$. Let the voltage across C_1 be E_1, that across C_2 be E_2 and that across C_3 be E_3—

$$\text{then } E_1 = \frac{C}{C_1} \times E = \frac{0{\cdot}545}{1} \times 1{,}000 = 545V$$
$$E_2 = \frac{C}{C_2} \times E = \frac{0{\cdot}545}{2} \times 1{,}000 = 273V$$
$$E_3 = \frac{C}{C_3} \times E = \frac{0{\cdot}545}{3} \times 1{,}000 = 182V$$

—the sum of E_1, E_2 and E_3 being equal to E. Therefore in series connected arrangements care must be taken to ensure that the voltage appearing across a capacitance does not exceed its Working Voltage.

3.3 Alternating Current

An alternating current is one which commences at zero, rises to a maximum positive value, falls to zero, reaches a maximum negative value and finally rises to zero once more. This whole process represents one complete *cycle* in an alternating current flow. This is shown graphically in Fig. 25, and it can be seen that the time taken for one complete cycle is called the *period* of the alternating current.

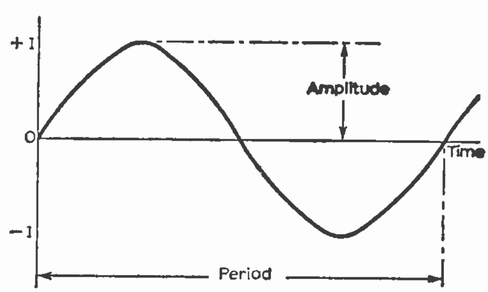

Fig. 25: An a.c. waveform.

The *amplitude* of an alternating current is the maximum value of current reached—whether positive or negative. The *frequency* of an alternating current is the total number of complete *cycles* which take place in one second or $f = \frac{1}{T}$ where t is in seconds and f is in *cycles per second*. Two examples of the frequencies of alternating currents are (1) The mains supply—50c/s. (2) The Light Programme—200,000c/s.

3.4 Phase Differences in Alternating Currents

A complete alternating current (a.c.) cycle is divided into 360 degrees, as shown in Fig. 26.

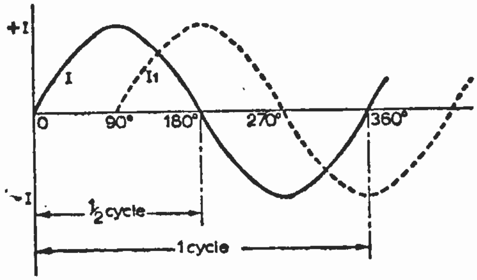

Fig. 26: Phase differences in alternating currents.

The a.c. cycle drawn as a dotted line has the same frequency and amplitude as I, but it LAGS 90° behind I—or it has a phase lag of 90° compared with I.

Although the above work is concerned with alternating currents, exactly the same conclusions are reached when dealing with alternating voltages or a combination of the two.

3.5 Alternating Currents Applied to Resistances

When a.c. is applied to a (pure) resistance, the current flowing in the resistance varies completely in step with the voltage appearing across the resistance. This means that there is *no phase difference* between current and voltage. Because there is no phase difference, Ohm's Law can be applied directly when a.c. is applied to a resistive circuit.

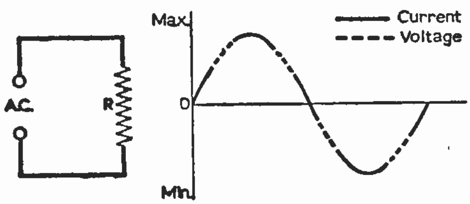

Fig. 27: A.C. applied to a resistance.

3.6 R.M.S. Values for Alternating Currents

If a voltage of 250 d.c. was applied to a resistive circuit and the amount of heat which was dissipated was noted and then 250 volts a.c. was applied for the same length of time, it would be found that the heating effect of the a.c. would be more than that of the d.c. The value of the a.c. voltage which would give the same heating effect as 250 volts d.c. is

$$250 \times 0{\cdot}7 = 175\text{V}$$

This voltage is called the Root Mean Square (r.m.s.) value of the a.c. voltage and it is equal to $\frac{1}{\sqrt{2}}$ of the

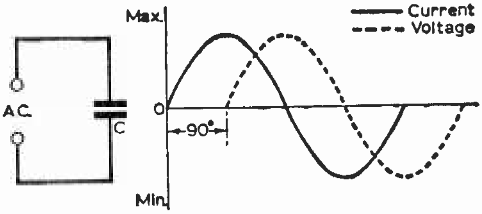

Fig. 28: A.C. applied to a capacitance.

peak voltage.

$$\text{Vpeak} = \sqrt{2} \times \text{Vr.m.s.}$$

or $$\text{Vpeak} = 1{\cdot}4 \times \text{Vr.m.s.}$$

also $$\text{Vr.m.s.} = \frac{1}{\sqrt{2}} \times \text{Vpeak}$$

or $$\text{Vr.m.s.} = 0{\cdot}7 \times \text{Vpeak}$$

3.7 Alternating Current Applied to a Capacitance

When an alternating current is applied to a capacitance the voltage which is being used to push the current through the capacitance *lags* 90° *behind the current* or the *current leads voltage by* 90°. This is shown graphically in Fig. 28.

3.8 Capacitive Reactance

When a.c. is applied to a capacitance the current flowing depends on the frequency of the a.c., the value of the capacitance and the applied voltage. The frequency of the a.c. and the value of the capacitance affect the current flow in much the same way as resistance affects the current flow in a d.c. circuit. The name of the component, derived from the frequency and the capacitance, is the *capacitive reactance* and it is measured in ohms and is represented by X_c.

$$X_c = \frac{1}{2\pi fC}$$

where X_c is in Ohms, f is in cycles per second, C is in farads and the constant $\pi = 3{\cdot}14$. It is however much easier to use microfarads for C and megacycles for f, in which case the capacitive reactance will still be in ohms.

e.g. Find the reactance of a capacitance of $0{\cdot}005\mu$F at $0{\cdot}5$ megacycles (Mc/s).

$$X_c = \frac{1}{2\pi fC}$$

$$= \frac{1}{2 \times 3{\cdot}14 \times 0{\cdot}5 \times 0{\cdot}005}$$

$$= 63{\cdot}7\Omega$$

For a circuit containing only capacitive reactance,

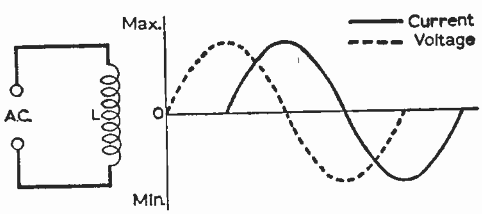

Fig. 29: A.C. applied to an inductance.

the current flowing in the circuit, I, can be found by using the expression:

$$I=\frac{E}{X_c}$$

which is purely a modification of Ohm's Law.

3.9 Alternating Current Applied to an Inductance

If an alternating current is applied to an inductance, the voltage in this case *leads the current by* 90°. This is the opposite to the case when a.c. was applied to a capacitance. The flow of current through an inductance, compared with voltage, is shown graphically in Fig. 29.

3.10 Inductive Reactance

When a.c. is applied to an inductance the current flowing through the inductance depends on the applied voltage, the frequency of the a.c. and the value of the inductance in henrys. The current flow does in fact vary *directly* as the frequency and *inversely* as the inductance. Once again, the frequency and the inductance affect the current flow in the same way as does resistance in a d.c. circuit. The component, which is derived from the frequency and the inductance, is called the *inductive reactance* and it is measured in ohms and represented by X_L.

$$X_L=2\pi fL$$

where X_L is in ohms, f is in cycles per second and L is in henrys.

In radio frequency circuits however, the inductance can be expressed in millihenrys (mH) and the frequency in kilocycles (kc/s).

e.g. What is the reactance of an inductance of 0·2 henrys at 500c/s.?

$$X_L=2\pi fL$$
$$=2\times3{\cdot}14\times500\times0{\cdot}2$$
$$=628\,\Omega$$

For a circuit containing only inductive reactance, the current flowing in the circuit, I, can be found by using the expression:

$$I=\frac{E}{X_L}$$

which is once more purely a modification of Ohm's Law.

Question

What is the reactance of a capacitance of 2μF at 50c/s and what current would flow through it if 250V a.c. were applied to it? What value of inductance would have the same reactance as the above capacitance, when the frequency remains at 50c/s?

Answers to Last Month's Problem

1. To convert to a Voltmeter reading to 250V.

$$R=\left[\frac{E}{I}\times1{,}000\right]-Rm$$
$$=\left[\frac{250}{10}\times1{,}000\right]-50$$
$$=25{,}000-50$$
$$=24{,}950\,\Omega$$

or Voltage across meter

$$=E=IR$$
$$=0{\cdot}01\times50$$
$$=0{\cdot}5V$$

∴Voltage across shunt

$$=250-0{\cdot}5=249{\cdot}5V$$

Current through shunt

$$=\frac{E}{I}$$
$$=\frac{249{\cdot}5}{0{\cdot}01}$$
$$=24{,}950\,\Omega$$

2. To convert to an ammeter reading to 2 amps.

$$R=\frac{Rm}{n-1}$$
$$=\frac{50}{200-1}$$
$$=\frac{50}{199}$$
$$=0{\cdot}252\,\Omega$$

or Voltage across meter=0·5V (see above)
∴Voltage across shunt=0·5V
Current through meter=0·01A
∴Current through shunt=1·99A

$$\therefore R=\frac{E}{I}$$
$$=\frac{0{\cdot}5}{1{\cdot}99}$$
$$=0{\cdot}252\,\Omega$$

Part 4 Next Month

A.M. INTERFERENCE SUPPRESSION

—continued from page 866

for experimental work to eliminate.

However, to remove the noise from one particular station, or over an 80 to 120m waveband sector, the unit described will be found most effective, although for best results it should all be enclosed in an earthed metal case.

The same principle of feeding two noise-bearing signals in anti-phase so that the unwanted interference cancels out, leaving only the pure signal, can be employed with two ferrite rod aerials.

One is positioned in the usual manner for maximum signal strength while the other is placed for maximum *interference* pick-up consistent with minimum signal pick-up.

The two aerial windings are connected in series anti-phase and as both will be of identical construction no centre-tapped coil will be needed, for cancellation will not be achieved magnetically but by the subtraction of the two opposing e.m.f.s in exactly the same manner as the equal but opposite voltages in a frame aerial cancel out when placed facing the station.

Unfortunately as the two aerial windings are in series it will be essential to halve the number of turns on each rod to maintain the correct inductance and this will halve the induced e.m.f.

However, in strong cases of local interference it may be found that sufficient noise voltage can be picked up by a one-third winding on the static rod, leaving two-thirds for the signal rod, thus keeping station strength to a maximum. ■

BOOKS REVIEWED

PHILIPS PAPERBACKS

An innovation from the publishing side of the Philips organisation is a series of technical paperbacks. These are prepared by Centrex Ltd. of Eindhoven, a subsidiary of N. V. Philips. Eighteen titles are planned for publication during the next three years. They are printed in Holland and the English editions are being distributed by Iliffe Books Ltd.

The first three of these paperbacks are reviewed below. All have the same page size (8½in. x 5½ in.) and are square back bound with glossy stiff card covers.

P1: AUDIO QUALITY, by G. Slot
156 pp. Price 13s. 6d.

THIS is not a book for those requiring circuit diagrams or other specific information of that kind. It is, however, a storehouse of facts, figures and design ideas. Some measure of this can be illustrated by the fact that it contains 26 tables within the twelve chapters.

This does not mean that the book is academically "dry"; on the contrary the author tackles his subject matter in a readable (dare we say "chatty"?) spirit. Experiments made by the author are used to illustrate points, and throughout the book, one has the feeling that one is in the hands of the authoritative, yet "human" writer.

The opening chapter is full of interest and sets the pace and style for the rest of the book. In dealing with the question "what *is* hi-fi?", the author approaches the subject with wisdom and common sense and should be required reading by anyone interested in this subject. As a brief example, he states that "Technically perfect reproduction leads to uncertainty about the musical quality. Musically perfect reproduction leads to uncertainty about the technical specification."

The main chapters are Power Requirements, Non-linear Distortion, Frequency Response, Pitch Deviations, Background Noises, Stereophony, Other chapters include one entitled Experimental Evidence and the opening sentence "When theory and experiment agree, one is naturally suspicious" gives a lead to the entertaining approach of the whole book. Not to be missed by audiophiles.—*W.N.S.*

P2: THE TAPE RECORDER, by C. G. Nijsen
142 pp. Price 13s. 6d.

WE have two quarrels with this one. Firstly the sub-title is "A complete handbook on magnetic recording". This is not quite true since it is written mainly for the *user* of tape recorders and does not delve into details of the mechanics (or the electronics). Secondly, and this must be correlated to the first comment, the section on faults only occupies 4½ of the 142 pages of the book; even then the information given is extremely basic and has appeared elsewhere many times.

Having said this, one cannot carp any more. And, in any case, the criticisms given are really relative to the aims of the author. We will even forgive him such extravaganza as ". . . this most ingenious product of Man's imagination set out on what was to prove the triumphant globe-encompassing path" in the Introduction!

In all fairness, this is good value. Chapters include introductory ones on the nature of sound and a potted history of sound recording. A third of the book covers The Tape Recorder (Principles, Speeds, Sound Tracks, Electromagnetic Process, Recording and Reproducing Processes, Sound Quality, The mechanism, Microphones, Loudspeakers)—42 pages.

The next largest section (29 pages) is Advice on Making Recordings, and this is, perhaps, the one which will appeal most to the type of reader at which the book is aimed. Other sections are quite brief, but deal with a wide range of subject—Stereophony, Acoustics, Choosing a Recorder, Connections and Accessories, to name the most important.

This book is not for the technical genius or advanced tape enthusiast, but at the price it can hardly be bettered as an introduction to the subject for newcomers requiring an essentially non-technical treatment of how to get the best from a tape recorder.—*W.N.S.*

P3: AERIALS, by D. Sjobbema
110 pp. Price 10s. 6d.

THIS is a practical book, with little mathematics, and is particularly designed for those who have to tackle the problems of siting and erecting aerials. It is not a treatise on all manner of aerials, but confines itself to considering TV and f.m. aerials only and although this may at first seem to detract from the value of the book, on reflection it seems a good idea. For here we have the information in a concise form with no extraneous information to detract.

The book takes a more or less predictable form —a first chapter dealing with the theoretical aspects of energy transfer from transmitter to receiver, followed by descriptions of dipole aerials (the book confines itself, of course, to dipoles and elaborations thereof, such as the Yagi) and then chapters on the choice and installation of aerials, connections to the receiver, attenuators and multiple installations. The book rounds off with an appendix of useful data, including a host of British, CCIR and RTMA channel numbers and frequencies.

One criticism is that nothing is said at all about preamplifiers, except for a valve unit for use in collective aerial systems. It is a pity that some mention could not have been given of transistor aerial preamplifiers. Nevertheless, the book has much useful information and merits a place on the bookshelf.—*W.N.S*

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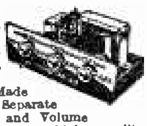

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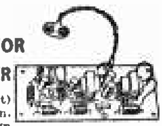

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Bread-board Wiring

By W. Groome

FOR CONSTRUCTION APPROACHING PRINTED CIRCUIT STANDARDS OF COMPACTNESS AND NEATNESS

THE object of bread-board wiring is not to imitate printed circuitry but to achieve similar compactness by methods familiar to the home-constructor and more suitable for single hand-made products. As in printed circuitry the usual metal chassis is replaced by a thin plastic panel—today's descendant of the plywood bread-board of early radio days. Bare tinned copper wires are firmly attached by simple methods and with more freedom in arrangement than is possible with printed stripes.

Some Advantages

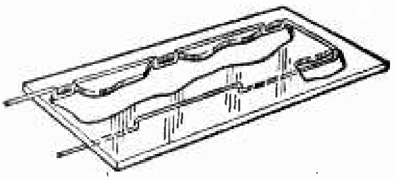
With no earthed metal to worry about live components can be fixed anywhere on the panel, conserving space by using head-room necessary in any case to clear valves, coil-cans and other fixed items, and allowing short connections above or below. This arrangement, with the wires secured neatly along the panel surface, is comparable with printed circuitry and is particularly suitable for small transistor equipment. However, we can improve the scope of the system in a way that is denied to the printed circuit designer by allowing a small clearance beneath the board in which small components and short wires can be suspended. This amounts to a two-layer wiring capable of conserving considerable panel area, which is a worth while exchange for a small depth of ½in. that is often needed in any case for panel stiffeners or mounting arrangements.

A four-valve experimental push-pull amplifier shown in the photograph on the following page, is housed comfortably on a 9in. x 6in. panel of which almost one-third was necessary for the large output transformer. Although the underside wiring looks slight compared with the conventional style of wiring the amplifier is of full specification and is used later in this article as an example of practical work. The abolition of group-boards and the arrangement of the components in logical positions has led, as we shall see later, to a lay-out having a distinct resemblance to the theoretical circuit.

Plain plastic laminate (not metallised) is available in several grades from radio quality "Paxolin" to the cheap "backing veneer" seen in the photographs. Use $\frac{1}{16}$in. thick material for valve circuits and about half this thickness for little transistor sets.

Interconnections

Ignoring components for the moment Fig. 1 shows how wire can be safely attached to the panel by "stiches" passed through small holes. A change of direction is initiated by a single hole or a two-hole stitch. Note particularly the way the wires can be shifted from one side of the panel to the other. This is of the utmost value in allowing wires to dodge each other at crossings, for the "leap" that clears them without danger of electrical contact also anchors them to the panel. This is the feature that makes it possible to complete a complex circuit mainly with bare wire—entirely



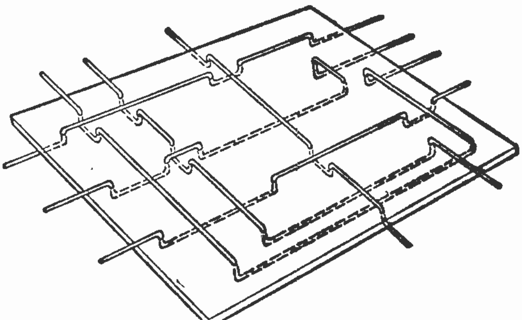
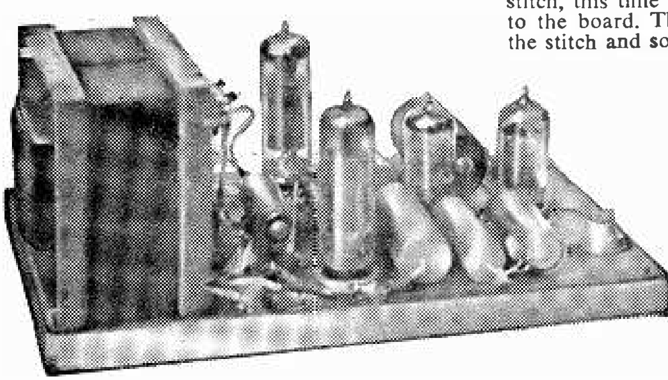


Fig. 1: The method of "stitching" connecting wires between holes made in a paxolin chassis.

with bare wire if one is determined to push the system to the extreme.

Fig. 1 gives several variations of the method and it will be obvious that wires can be made to emerge through the board at any point convenient for the connection of components on either side. This surface wiring is an important part of the system but there is no need to make a fetish of it simply to achieve some resemblance to printed circuitry, for it is possible to make the work even easier by using here and there a few of the more useful tricks of chassis wiring. For short point-to-point connections 20 to 22 s.w.g. wire is stiff enough to be reliably self-supporting and there is no reason why this well-known idea should not be used with a bread-board, with the wire either pressed close to the surface or suspended clear of it (and other items) by the tags to which it is soldered. This is one advantage of the underside clearance already suggested. Stiff air-spaced wires form another safe way of crossing without contact.



An amplifier constructed by the author which shows the clean layout obtainable using bread-board wiring.

Very often, in this underside space, small capacitors and resistors can be point-to-point connected, as in chassis wiring. Using conventional valveholders (which are as well suited to the system as the printed circuit surface type) and again drawing from chassis experience, common-earth connections with small components soldered across the tags demand no extra panel area and provide the technically correct short, direct leads.

Anchoring Components

Instead of the group-boards necessary with a metal deck the non-conductive bread-board permits wire-ended components to be fixed direct to its surface. Solder tags (Fig. 2) are a handy method of anchorage. Ordinary BA screws can be used, of course, but I find it quick and convenient to fit No. 4 type "Z" self tapping screws. These can be driven like wood-screws into holes made with a No. 39 drill and no nuts are required. I usually put a dab of "Araldite" adhesive under each tag, and when this has hardened and the wiring is completed the screws can be removed for re-use. Self-threading screws can be obtained from engineer's stockists; the No. 39 drill is a suitable size for making stitch holes.

Fig. 2 also shows another way of anchoring components. Here the panel wiring ends at a couple of stitch holes and is threaded through them twice before being snipped off. The "groove" between the two turns accommodates the component wire snugly and provides an anchorage area for solder, which converts the anchorage into a tiny composite metallic block virtually incapable of movement or fracture in any normal conditions. The last method in Fig. 2 again uses a two-turn stitch, this time to bind the component wire down to the board. The end is then doubled back over the stitch and soldered.

The absence of a metal chassis is no problem even at v.h.f. Indeed, it is an advantage because wiring capacitance is virtually eliminated. As a screen the chassis was never wholly effective, while its ability to circulate hum and interference currents had long ago led to a preference for busbar earthing. This, or a near equivalent, is the earthing method used in bread-board wiring. If conventional metal-collared valveholders are used (they are quite suitable, and easier to obtain than the printed-circuit type) put tags under the fixing screws so that a continuity wire can be run along the panel from holder to holder. With two tags per valveholder it is possible to branch the earth lead for convenient connection of components anywhere on the board, or to duplicate it

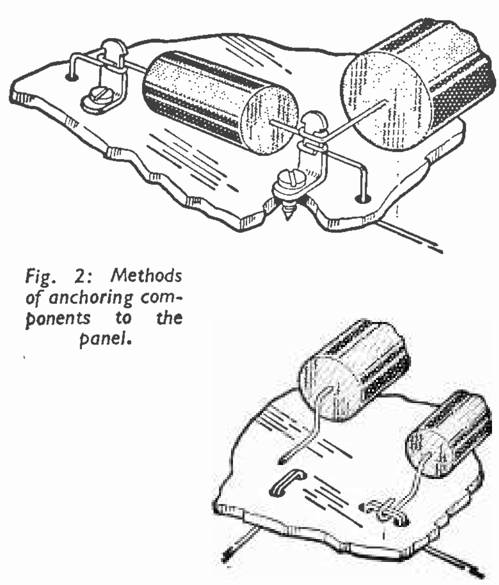


Fig. 2: Methods of anchoring components to the panel.

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12AV6	6/6
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12AY7	9/9
12BA6	5/9
12BE6	4/9
12BH7	6/-
12E1	16/9
12H6GT	1/6
12J5GT	2/6
12J7GT	7/3
12K5	10/-
12K7GT	3/6
12K8GT	9/-
12Q7GT	3/6
12SA7	6/9
12SC7	4/-
12SG7	3/-
12SH7	3/-
12SJ7	5/-
12SK7	3/-
12SQ7	8/-
12SR7	5/-
12U5G	7/-
13D1	5/-
13D3	5/6
14B6	20/9
14H7	9/6
15D2	6/-
18	12/6
19	10/6
19AQ5	7/3
19BG6G	20/5
19H1	6/-
20D1	10/-
20D2	21/-
20F2	11/6
20L1	12/6
20P1	12/6
20P3	12/-
20P4	13/6
20P5	12/3
25A6G	7/6
25L6	4/9
25U4GT	16/2
25Y5	7/9
25Y5G	7/9
25Z4G	6/6
25Z5	7/3
25Z6GT	8/-
27SU	23/3
28D7	6/9
30C1	6/-
30C15	9/-
30C18	10/6
30F5	5/9
30FL1	9/3
30L1	5/6
30L15	9/3
30P4	12/3
30P12	7/6
30P16	5/3
30P19	12/3
30PL1	8/6
30PL13	9/6
30PL14	12/6
33	12/6
35/51	12/6
35A5	14/6
35L6GT	6/9
35W4	4/9
35Z3	14/6
35Z4GT	4/6
35Z5GT	5/9
36	12/6
39	2/6
40SUA	6/6
41MTL	8/-
41STH	15/-
42	5/-
43	10/-
45	17/6
45Z6	15/-
50A5	21/10
50B5	6/6
50C5	6/6
50CD6G	40/9
50L6GT	6/3
52KU	14/6
53KU	14/6
72	6/6
77	5/-
78	4/9
80	5/3
83	22/6
83V	8/-
85A2	6/6
90AG	67/6
90AV	67/6
90CG	42/-
90CV	42/-
90C1	16/-
150B2	11/9
150C2	4/6
161	18/-
185BT	34/11
215SG	6/6
220B	10/6
301	20/-
302	10/6
303	15/-
304	15/-
305	18/-
306	13/-
866A	12/6
956	2/-
1203A	7/-
1622	13/6
2101	12/6
4033	15/-
4687	71/-
5763	7/6
6067	10/-
7193	1/6
7475	2/9
9002	4/6
9006	2/6
A1834	20/-
ACO42	23/3
ACO44	9/-
AC2HL	10/6
AC2pen	11/6
AC2PEN/DD	12/6
AC5PEN/DD	23/3
AC6PEN	4/9
AC/PEN (5)	17/6
AC/PEN (7)	17/-
AC/SG	22/6
AC/SG/VM	12/-
ACTH1	15/-
AC/TP	18/-
AC/VP1	12/-
ACVP2	20/5
ATP4	2/3
AZ1	5/9
AZ31	6/6
AZ41	6/6
B36	4/9
B319	5/6
BL63	10/6
C1	12/6
CCH35	12/6
CK506	6/6
CL4	19/6
CL33	11/6
CV6	2/6
CV63	10/6
CV85	14/6
CV271	12/6
CV428	19/-
CY1	16/4
CY1C	6/6
CY31	5/9
D1	1/3
D15	13/6
D42	10/6
D63	5/-
D77	2/3
DAC32	7/9
DAF91	3/6
DAF96	5/9
DCC90	6/9
DD4	12/6
DD41	10/6
DDT4	7/6
DET25	7/6
DF33	8/6
DF66	15/-
DF72	30/-
DF91	2/3
DF96	5/9
DF97	10/-
DH30	15/6
DH63	4/-
DH76	3/6
DH77	3/9
DH81	23/3
DH101	25/-
DH107	16/11
DK32	7/9
DK40	15/6
DK91	4/-
DK92	8/-
DK96	6/3
DL33	7/-
DL35	5/-
DL63	5/3
DL68	15/-
DL72	15/-
DL75	30/-
DL92	4/6
DL94	5/3
DL96	5/9
DL810	10/6
DM70	5/-
DM71	9/9
DW4/350	8/6
DW4/500	8/6
DY86	6/9
DY87	8/-
E80F	24/-
E83F	24/-
E88CC	10/-
E180F	19/6
E1148	1/9
EA50	1/6
EA76	6/9
EABC80	5/6
EAC91	3/3
EAF42	7/6
EB34	1/-
EB41	4/9
EB91	2/3
EBC3	20/6
EBC33	6/-
EBC41	6/6
EBC81	5/9
EBC90	3/9
EBC91	5/6
EBF80	5/6
EBF83	7/3
EBF89	6/3
EBL21	10/6
EC52	4/3
EC53	12/6
EC54	6/-
EC70	4/9
EC90	2/3
EC91	3/-
EC92	6/6
ECC31	7/3
ECC32	4/-
ECC33	29/1
ECC34	21/7
ECC35	5/-
ECC40	7/-
ECC81	3/6
ECC82	4/6
ECC83	4/6
ECC84	5/6
ECC85	5/9
ECC88	8/9
ECC189	11/6
ECC807	15/-
ECF80	6/-
ECF82	6/3
ECF86	11/6
ECF804	24/-
ECH3	23/3
ECH21	9/-
ECH33	22/8
ECH35	6/3
ECH42	7/6
ECH81	5/9
ECH83	6/6
ECH84	9/6
ECL80	6/-
ECL82	6/3
ECL83	9/6
ECL86	8/9
ECLL800	26/2
EF6	20/6
EF9	20/6
EF22	6/6
EF36	3/3
EF37A	6/-
EF39	3/9
EF40	8/9
EF41	6/9
EF42	3/9
EF50	2/6
EF54	3/-
EF73	5/-
EF80	3/9
EF83	9/9
EF85	4/6
EF86	6/-
EF89	4/-
EF91	3/-
EF92	2/6
EF97	10/-
EF98	10/-
EF183	7/-
EF184	7/-
EH90	7/-
EK2	25/11
EK32	5/9
EL2	19/6
EL32	3/6
EL33	6/9
EL34	8/6
EL35	10/-
EL36	8/9
EL37	12/3
EL41	7/-
EL42	7/6
EL81	8/3
EL83	6/9
EL84	4/6
EL85	7/6
EL86	7/3
EL91	2/6
EL95	5/6
EL360	27/-
EL820	16/4
EL822	18/6
ELL80	20/5
EM4	17/9
EM34	11/6
EM35	12/-
EM71	13/6
EM80	6/3
EM81	7/-
EM84	6/9
EM85	8/9
EM87	7/6
EN31	10/-
EN91	5/6
EY51	5/6
EY81	7/3
EY83	9/3
EY84	9/6
EY86	5/6
EY88	8/9
EY91	3/-
EZ35	4/6
EZ40	5/3
EZ41	6/-
EZ80	3/9
EZ81	4/-
EZ90	3/9
FC2	14/6
FC4	8/9
FC13	14/6
FC13C	17/-
FW4/500	6/6
FW4/800	8/6
GT1C	9/9
GU50	55/-
GZ30	7/-
GZ32	7/6
GZ33	17/6
GZ34	10/-
GZ37	14/6
H30	5/-
HABC80	9/3
HL2	7/6
HL13C	4/-
HL23DD	5/-
HL41	3/9
HL41DD	8/6
HL42DD	8/6
HL133DD	9/6
HN309	25/-
HVR2	8/3
HVR2A	8/9
IW3	5/6
IW4/350	5/6
IW4/500	6/-
KBC32	20/5
KF35	12/6
KL35	11/6
KLL32	21/7
KT2	5/-
KT8	15/-
KT32	4/9
KT33C	4/-
KT36	29/1
KT41	7/6
KT44	5/-
KT61	6/9
KT63	3/9
KT66	12/3
KT74	12/6
KT88	28/-
KTW61	4/9
KTW62	5/6
KTW63	5/6
KTZ41	5/6
L63	3/-
LN152	6/-
LN309	7/9
LN319	8/6
LP2	9/6
LZ319	6/-
LZ329	6/-
ME41	13/-
ME91	12/6
MH4	3/6
MHD4	7/6
MHLD6	12/6
ML6	5/9
MS4B	20/5
MSP4	12/-
MU12/14	4/6
MX40	8/9
N37	23/3
N78	26/-
N108	26/2
N339	15/-
P41	3/6
P61	2/6
PABC80	6/9
PC86	10/3
PC88	9/6
PC95	11/8
PC97	7/3
PCC84	5/6
PCC85	6/9
PCC88	10/6
PCC89	7/9
PCC189	10/6
PCF80	6/-
PCF82	6/3
PCF84	8/6
PCF86	7/9
PCF801	10/-
PCF802	10/-
PCF805	10/6
PCL82	6/3
PCL83	7/9
PCL84	7/-
PCL85	7/6
PCL86	8/9
PCL88	12/6
PEN4DD	25/-
PEN40DD	34/-
PEN45	7/-
PEN45DD	12/-
PEN46	4/-
PEN383	10/3
PEN453DD	10/-
PENA4	7/-
PEN/DD 4020	17/6
PL33	9/-
PL36	8/-
PL38	16/-
PL81	6/9
PL82	5/8
PL83	5/3
PL84	5/-
PL500	15/9
PM84	9/3
PT15	10/-
PX4	9/-
PX25	8/6
PY31	6/-
PY32	8/6
PY33	8/9
PY80	5/-
PY81	4/9
PY82	4/9
PY83	5/9
PY88	7/9
PY800	6/-
PY801	6/3
QP21	5/-
QP22B	12/6
QP25	5/-
QS7520	10/6
QS150/15	9/6
R10	15/-
R12	5/6
R16	29/-
R17	17/6
R18	9/6
R19	6/6
R52	9/-
RG1/240A	54/-
RK34	7/6
S130	22/6
SP4B	19/6
SP13C	12/6
SP41	2/-
SP42	12/6
SP61	2/-
SU25	27/2
T41	9/-
TDD2	12/6
TDD4	7/6
TH4B	15/-
TH21C	10/6
TH30C	14/6
TH233	6/9
TP22	5/-
TP25	5/-
TP2620	17/6
TY86F	11/-
UABC80	5/-
UAF42	7/-
UB41	10/6
UBC41	6/3
UBC81	6/3
UBF80	5/9
UBF89	6/9
UBL21	10/9
UC92	6/3
UCC84	8/9
UCC85	6/-
UCF80	8/9
UCH21	8/-
UCH42	7/-
UCH81	6/6
UCL82	7/9
UCL83	8/6
UF41	6/9
UF42	4/9
UF80	6/3
UF85	6/9
UF86	9/-
UF89	6/-
UL41	6/9
UL44	23/3
UL46	8/6
UL84	6/-
UM4	15/2
UM34	16/10
UM80	8/3
UR1C	6/6
UU5	7/-
UU6	9/-
UU7	7/6
UU8	11/6
UU9	5/3
UU12	4/-
UY1N	10/3
UY21	7/3
UY41	4/6
UY85	5/-
U10	9/-
U12/14	7/6
U16	15/-
U17	5/-
U18/20	6/6
U19	48/6
U22	5/9
U24	12/6
U25	8/6
U26	7/6
U31	6/9
U33	13/6
U35	16/6
U37	29/-
U45	15/6
U47	8/6
U50	4/9
U52	4/6
U76	4/6
U78	3/9
U84	10/6
U101	19/6
U107	17/6
U191	9/6
U251	9/-
U281	8/9
U282	12/3
U301	11/3
U329	9/-
U339	9/6
U403	9/9
U404	6/-
U801	16/3
U4020	6/6
VMP4G	11/9
VMS4B	12/-
VP2	3/6
VP2B	9/6
VP4	14/6
VP4A	14/6
VP4B	20/5
VP13C	7/-
VP23	2/6
VP41	5/-
VP133	9/9
VR75	21/-
VR105	5/6
VR150	4/9
VT61A	7/-
VT501	3/-
VU111	5/-
VU120	10/-
VU120A	10/-
VU133	7/-
W21	5/-
W42	20/5
W61M	24/6
W63	10/6
W76	3/6
W77	2/6
W81M	5/9
W101	26/2
W107	10/6
W729	17/6
X14	7/9
X18	8/-
X24	16/6
X41	15/-
X61	6/3
X63	5/9
X64	4/6
X65	5/6
X66	7/3
X76M	9/-
X78	20/6
X79	27/-
X81M	29/1
X101	23/6
X109	26/-
X118	8/9
X119	6/6
X142	7/-
Y63	5/-
Y65	5/-
Z63	4/6
Z66	7/3
Z77	3/-
Z729	6/-
Z749	6/3
Z759	36/-
Transistors and diodes	
AA129	4/6
AC107	14/6
AC127	9/6
AD140	25/-
AF102	27/6
AF114	11/-
AF115	10/6
AF116	10/-
AF117	5/6
AF118	20/-
AF124	11/-
AF125	10/6
AF126	10/-
AF127	9/6
BYZ13	11/6
GD3	5/6
GD6	5/6
GD14	10/-
GET103	7/-
GET104	10/-
GET106	17/6
GET111	12/-
GET113	6/9
GET114	6/6
GET872	10/-
GET873	9/3
GET874	9/6
GEX35	3/-
GEX36	10/-
GEX45	6/6
GEX64	11/6
GEX66	15/-
MAT100	7/9
MAT101	8/6
MAT120	7/9
MAT121	8/6
OA5	6/-
OA10	6/6
OA70	3/-
OA73	3/-
OA79	3/-
OA81	3/-
OA85	3/-
OA86	4/-
OA90	3/-
OA91	3/-
OA95	3/6
OA210	9/6
OA211	13/6
OC16W	35/-
OC19	25/-
OC22	23/-
OC23	57/-
OC25	12/-
OC26	25/-
OC28	23/-
OC29	16/6
OC35	9/6
OC36	21/6
OC41	8/-
OC42	5/-
OC43	12/6
OC44	8/3
OC44PM	11/-
OC45	8/-
OC45M	8/-
OC65	22/6
OC66	25/-
OC70	6/6
OC71	3/6
OC72	8/-
OC73	16/-
OC74	8/-
OC75	8/-
OC76	8/6
OC77	12/-
OC78	8/-
OC81	4/-
OC81D	4/-
OC81M	8/-
OC82	10/-
OC83	6/-
OC84	8/-
OC139	12/-
OC140	19/-
OC170	8/6
OC171	9/-
OC200	10/6
OC201	29/-
OC203	14/-
OCP71	17/6
ORP12	12/6
SX641	10/-
T82	12/6
T83	15/-
V10/15A	12/-
XA103	15/-

WE REQUIRE FOR PROMPT CASH SETTLEMENT ALL TYPES OF VALVES, LOOSE OR BOXED, BUT MUST BE NEW

METAL RECTIFIERS. DRM1B 13/-. DRM2B and DRM3B 15/6. LW7 21/- LW15 26/-. RMO 7/11. RM1 5/3. RM2 6/3. RM3 7/9. RM4 12/9. RM5 17/6. 14A86 17/6. 14A97 19/6. 14A100 23/-. 14A124 36/6. 14A163 35/6. 14B130 31/-. 14B261 11/6. FC101 16/9. 16RC.1.16.1 8/-. FC31 21/-. 16RD.2.2.8.1 11/-. 16RE.2.1.8.1 8/6. 18RA.1.1.8.1 4/-. 18RA.1.2.8.1 11/-. FC116 6/-. FC124 12/6. SB3 10/6. C2D 9/-. C2H 5/9. C2V 9/-. C3D 11/-. C3B 14/8. C3V 11/-. R3/2D 4/3. Q3/4 3/7.

ELECTROLYTICS. Can types: 32 x 32/450v. 5/9. 50 x 50/350v. 7/-. 64 x 120/350v. 8/3. 60 x 250/275v. 9/6. 100 x 400/275v. 12/6. 100/275v. 3/-. 200/275v. 4/-. 100 x 200/275v. 9/6. Tubular types: 8/450v. 1/9. 16/450v. 2/9. 32/450v. 3/9. 8 x 8/450v. 3/-. 16 x 16/450v. 4/-. 32 x 32/350v. 4/-. 8 x 16/450v. 3/9. 32/350v. 3/-.

MULLARD Midget silicon rectifiers. Types BY100. Output 250 volts ½ amp. No larger than a shirt button. 7/- each. Series limiting resistance 1/6.

EXPRESS POSTAL SERVICE! ALL ORDERS DESPATCHED SAME DAY AS RECEIVED

Terms of business:—Cash with order or C.O.D. only. Post/Packing 6d. per item. Orders over £3 post free. C.O.D. 3/6 extra. All orders cleared day of receipt. Any parcel insured against damage in transit for 6d. extra. We are open for personal shoppers 8.30—5.30 p.m. Sats. 8.30—1 p.m. Complete list of modern and obsolete valves, resistors, condensers, transformers, potentiometers, microphones, etc. with terms of business, 6d. Please enquire for any item not listed with S.A.E.

IMPROVED STANDARDS OF ACCURACY AND RELIABILITY

Modern styling in light grey with legible black engraving.

Constructed to withstand adverse climatic conditions.

Ever ready case, including leads, prods and clips.

Improved internal assemblies.

Re-styled scale plate for easy rapid reading. 2 basic scales, each 2.5 inches in length.

New standards of accuracy, using an individual calibrated scale plate d.c. ranges 2.25% f.s.d. a.c. ranges 2.75% f.s.d.

Available accessories include a 2500V d.c. multiplier and 5, 10 and 25A shunts for d.c. current measurement.

The Mk. 4 MULTIMINOR is an entirely new version of this famous Avo instrument and supersedes all previous models. It is styled on modern lines, with new high standards of accuracy, improved internal assemblies, and incorporating panclimatic properties.

The instrument is supplied in an attractive black carrying case, which also houses a pair of leads with interchangeable prods and clips, and an instruction booklet. It is packed in an attractive display carton. Robust real leather cases are available, if required, in two sizes, one to take the instrument with leads, clips and prods, and the other to house these and also a high voltage multiplier and a d.c. shunt.

AVO Mk 4

MULTIMINOR

D.C. Current: 100μA f.s.d. —A f.s.d. in 5 ranges
A.C. Voltage: 10V f.s.d. —1,000 f.s.d. in 5 ranges
D.C. Voltage: 2.5V f.s.d. —1,000 f.s.d. in 6 ranges
D.C. Millivolt range: 0 —100mV f.s.d.

Resistance: 0-2 MΩ in 2 ranges using 1.5V cell.
Sensitivity: 10,000Ω/V on d.c. Voltage ranges. 1,000Ω/V on a.c. Voltage ranges.

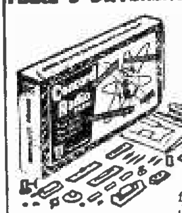
● *For full details of this great new pocket-size instrument, write for descriptive leaflet.*

AVO LTD AVOCET HOUSE • 92-96 VAUXHALL BRIDGE ROAD • LONDON, S.W.1 • VICtoria 3404 (12 lines) M GROUP

MM17

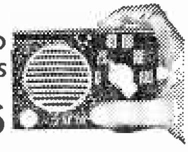
★ ★ TIME TESTED — LOW PRICED KITS ★ ★

MAKE 5 DIFFERENT TRANSISTOR RADIOS FOR 35/-



NO EXPERIENCE NECESSARY. No Soldering. Only 8 connections for first radio to work. Just look, you get Radio Book, A.B.C. Plans, Cabinet, Carrying Case, Loudspeaker (alone 17/6) Earphone, 4 Semi-conductors, Coils, Condensers, Resistors, Tuner, Switch, Screws, etc. YES—EVERYTHING! Loud clear English and Foreign reception. As supplied to Educational Authorities, H.M. Forces, etc. TESTIMONIALS GALORE. Mr. R. O'D. of Londonderry, writes:— "*. . . I received your components and I must say that I am very satisfied with them. I have it already set up! . . .*" COMPLETE HOME RADIO COURSE, Originally £6 SEND ONLY 35/- plus 2/6 post etc. (C.O.D. 3/- extra).

NEW RADIO ANYONE CAN BUILD IN 2-3 HOURS 19/6



EVEN THE OLDER CHILDREN BUILD THEM! . . . no soldering—only 16 connections! then hear it reach out bringing in station after station, loud and clear. Palm-of-hand size 4¾ x 2¾ x 1½in. Many Testimonials: M.H. of Bradford, writes: "*. . . I have just completed one of your sets successfully, it is the first time I have ever tackled anything like a radio, and I must state here and now, I am amazed how easy it is to a layman like me. Your instructions and plan have obviously been very carefully thought out so that even the most dim can follow them . . .*" Direct from Manufacturers to You. SEND 19/6 plus 1/6 post etc. (C.O.D. 2/6 ex.).

PARTS AVAILABLE SEPARATELY

AMAZING CIGARETTE RADIO! ONLY 18/6

Yes, a perfectly ordinary packet of cigarettes!—but watch your friends' astonishment on hearing it fetch in station after station, loud and clear! Still holds 10 Cigarettes—yet cleverly conceals highly sensitive, fully transistorised circuit (including tiny battery). Even a young boy can assembly it in under 2 hours. No soldering. No experience necessary. Only 16 connections to make. Ideal for taking to work with you. From our bulging testimonial file. Mr. D.B. of Huddersfield writes:—"*. . . I have fitted the parts in and it is working wonderfully . . .*" ALL PARTS including Semi-Conductors, A.B.C. Plans, etc. ONLY 18/6 plus 1/6 post, etc. (C.O.D. 2/6 ex.). (Parts available separately).

READ WHAT SATISFIED CUSTOMERS SAY

R.C. of HARRINGAY writes *Received with thanks Skyroma . . Very pleased. Working well.*

B.M. of HARROGATE writes *. . . I would like to thank you . . . it is a real bargain.*

L.S. of LONDON W.8 writes *. . . given it a good try out and I am very pleased with the results.*

S.B. of SOMERSET writes *. . . delighted with this radio . . . glad if you could send one more.*

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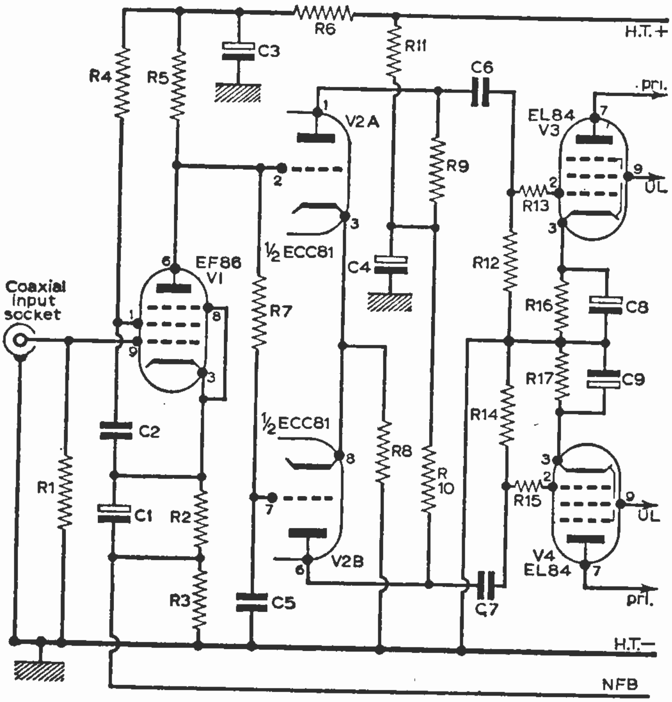

Fig. 3: The push-pull amplifier circuit used in the practical example.

when it is desirable to halve its r.f. inductance. Near to the tags small holes enable short wire connections to be dropped through to the valveholder tags. Other underside leads and components can be earthed at the valveholder common point or fed through the panel to any point on the bus-bars.

Heater, h.t., a.v.c. negative feedback and other long lines should be stitched to prevent them from drooping and touching other parts. Although all wiring can be bare it would be ridiculous to spurn an insulated lead if this could help to achieve the speed and simplicity that is the aim of the system. Centre-tapped heater wiring is an example. The twisted pair for this must obviously be of insulated wire. The single lead for an unbalanced heater supply, however, is often more conveniently arranged with bare stitched wire.

With a thin bread-board and fairly fine wire transistor circuits present no problems. Wire-holes can be pierced with an awl. Screwed tags will generally seem too large for this miniature work, therefore the alternative anchorage illustrated in Fig. 2 should be scaled down for this purpose. All components can go on top and the wire can run on either side; the underside clearance can be reduced to as little as ⅛in. Remember that plastic materials are poor conductors of heat and that power transistors must be mounted on the area of metal recommended by the makers to avoid thermal run-away.

A Practical Example

The amplifier shown in the photograph is used for a description of practical work because most of its circuit (Fig. 3) is familiar. It was built to test a number of unconventional output transformers that will not be described here, and as the photograph shows signs of the rough experimental treatment a little "tidying up" has gone into the wiring diagram, Fig. 4. To achieve the utmost clarity the drawing is purposely out of scale and the components have been spaced much more widely than in

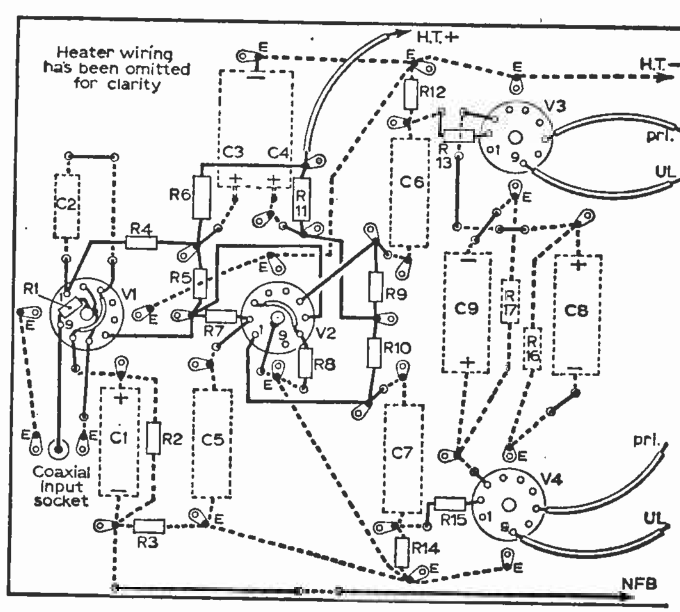

Fig. 4: The bread-board wiring diagram of the amplifier circuit of Fig. 3.

the photographs, although their relative positions are unchanged. This is for the purpose of illustration and the practical version would be compressed to the scale of the photograph.

Fig. 4 is an underside view and everything visible on that side is depicted in bold line (double to indicate air-spaced wires), while top-side wires and components are "ghosted" in broken line. I suggest the following procedure which will be suitable for wiring the majority of circuits. Beginning at a tag screwed to the flange of the input socket run an earth line on to the top side to all valveholders and to the negative terminal of the power supply. Drop wires through to connect earth to the appropriate tags on the valveholders. Connect the insulated and twisted heater wiring, pressing it close to the surface of the panel. Alternatively, this pair can be laid on top and fed through where needed for connection. The heater wiring is not shown in Fig. 4, which does, however, indicate tags in places where none are to be seen in the photograph in order to make clear indication of certain connections. The constructor will quickly learn where tags are essential and where they can safely be omitted.

Begin the signal circuit with an air-spaced connection from the input socket to V1 grid and solder R1 at the valveholder. Strap cathode and suppressor across the valveholder with a short insulated wire and from here take a bare wire through to the top where C1, R2 and R3 are supported on tags in positions very similar to those in the theoretical circuit. These three components have a common point to which the feedback lead is connected. C2, quite small, is supported on top of the panel by stitches with its wire ends fed through to the screen-grid and common cathode-suppressor tags. R4 makes a point-to-point connection to the decoupling network.

This first valve stage illustrates very distinctly the way that wires in crossing directions can be kept safely apart by separating them to opposite sides of the panel, and even with the deliberate "expansion" of the drawing the shortness and directness of the wiring is noticeable. Wire the anode to a tag supporting the load resistor R5 and the grid components of V2. Although an insulated wire was used for the direct grid connection during the experiments this can be left bare in a normal job not subject to frequent alteration. R7 makes a point-to-point connection to the other grid of V2, from which a wire feeds through to C5 on top of the panel. Strap the cathodes with insulated wire across the valveholder and connect R8 to earth. Connect the anodes to R9, R10 supported on three tags.

The decoupling components for these two stages have resistors on the underside and the double electrolytic capacitor above; the correct wiring for this network is as indicated in Fig. 4 and not as used for a special purpose in the prototype.

Again following circuit sequence and avoiding the unrelated positioning often needed with group-boards, connect the coupling capacitors C6, C7 convenient to the anode resistors and to the grid components of the output stage. Fit the four bias components on the top with the resistors R16 R17 raised well clear so that their heat may be dissipated in air. With many output transformers it may be best to use flexible insulated connections from the anodes and screen-grids, as shown in the diagram.

This is not intended as a final amplifier design, for readers of this journal are already well served in that respect, but it is familiar enough to enable the bread-board version to be studied without difficulty. The layout shown could be used for any similar circuit provided the design differences (in feedback arrangements, for instance, or added phase-correction networks) are incorporated. The amplifier was particularly well behaved in the high frequency end of the audio range, and this was undoubtedly due to the absence of stray capacitance which, with a metal chassis, can be high enough to influence feedback stability.

Layout Planning

Perhaps the most welcome virtue of the bread-board is the elimination of metalwork, for the construction and assembly work is delightfully easy with laminated plastic. As always, the best results will be the outcome of a little advance planning. Shuffle your components on the bench until you arrive at a layout that is compact and suitable for the circuit and physical connections, deciding which shall go on top and which below. For a start in planning you could begin with positions similar to those of the circuit diagram, but be practical about this when some variation is obviously preferable. Measure the area required, sketch your final plan, and then go to work on the panel.

You will not find edge stiffeners necessary with small panels and light components, but the addition of the ½in. square hardwood strips does aid cabinet installation and heavy parts like transformers do need this extra support. I have compared this panel system with the old bread-board, but, curiously enough, the edge stiffeners actually convert it into a shallow box not unlike the (genuine) cigar boxes used for crystal sets in even earlier radio times! ■

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A COMMENTARY BY HENRY

PRACTICALLY WIRELESS

No. 5 Bring in the New

THE turn of the year is the time for three things: resolutions, diaries, and wild, wicked speculations about the year to come.

Take a look at any daily paper; any weekly periodical; any monthly magazine. You will find the sages and the pundits solemnly pontificating on the prospect that lies before us. Never a word, you'll note, about the equally emphatic predictions of yesteryear. Unless, by some twist of chance, the random shaft of prophecy hit the mark and became fact.

This column has learned its lesson about resolutions. Wilde observed accurately that the fatality of good resolutions is that they are always too late. He might have added that the fatuity of the bad ones is that they are always too easy to keep. Like the resolve made to wrap each joint firmly before applying the solder: later regretted when one discovers the component was fastened to the wrong tag. Or the determination to build and test all those coveted pieces of equipment: usually resulting in a heap of half-completed junk in the corner of the outhouse.

No, the only resolutions your scribe will impose are the few he expects others to adhere to: Writing legible letters, enclosing stamped, addressed envelopes, keeping strictly to the point . . . especially when writing to the Editor.

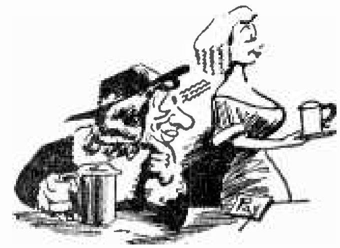
A heap of half-completed junk.

He could add also some optimistic hopes: that manufacturers of radio equipment would resolve (a) to be a little less enthusiastic when applying the power screwdrivers to those dinky-headed self-tapping screws; (b) to eschew the plastic knob that disintegrates when threatened with removal, and (c) to provide some sort of service data on the tangled mystery their clever advertising has sold us.

Or, to be even more optimistic, to hope that the radio trade would regard the questing amateur as a friend and not a potential rival. Would supply, not necessarily at less than full profit-making prices, the asked-for spares across the counter. But that would imply a revolution rather than a resolution.

Diaries: what of them? There is no lack of exemplary material. But the famous diarists of the past do not seem to have included a radio pioneer among their ranks. Pepys was, it is true, well versed in the art of communication: but mainly on the wavelength of serving-maids. Dampier had something of the right idea, stuffing his rolled manuscripts up his hollow, bamboo rods for posterity to find. And as for John Evelyn, though he was a Fellow of the Royal Society, it is hardly likely he could whip up much information on electronics at the end of the seventeenth century.

Nowadays, we are all too busy to bother with more than the cryptic ideograms that may once have been meant as reminders about those standard faults and useful formulae. Pages are covered with strange snippets of circuits and figures that bear no relation to anything, least of all



Pepys was well versed in the art of communication.

the date at the head of the page. Interspersed with odd shopping lists, telephone numbers now ex-directory, and addresses of bankrupt firms that were once the source of our bargain lines in spares. I can trace the progress from a Short-wave Two to a Communications Double-Super that never did reach completion.

Leafing through old diaries, which one dare not throw away in case the information comes in handy, is a pleasure akin to browsing through the musty back numbers of P.W. But some of the entries seem completely foreign. Wilde was right to observe that everyone should keep someone else's diary. It certainly looks as if someone else was keeping Henry's during the stereo upsurge of '58. How else to account for those enthusiastic entries:

"Double amp — try feedback over balance . . ." or

"Speakers — $Z^2 + Z_0 = ???$. Match Trans. 8mf series . . . ".

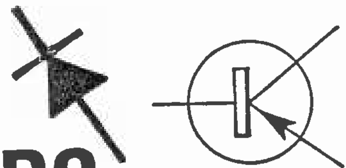
"Back-to-back cardioid—sound cancellation? What price Blumlein?"

Perhaps the most interesting part of the modern diary is the "specialist" section. We find ranks of these handy pocket compendiums in the bookshops. Whether you are a Boy Scout, an engine-driver, a rose-grower, a radio fanatic or a plain and

—continued on page 898

PART 4—FEEDBACK IN TRANSISTOR CIRCUITS

Understanding SEMICONDUCTORS



BY LESLIE MOORE

CONTINUED FROM PAGE 774 OF THE DECEMBER ISSUE

TRANSISTOR amplifier gain also depends on the interstage coupling. This consists of the emitter - collector capacitance, impedance matching between stages and the working frequency.

The gain of an amplifier may be altered by taking some of the amplifier output and feeding it back to the input. This method is known as applying feedback.

Feedback may be split generally into two main categories: Positive feedback, negative feedback.

When positive feedback is applied to the input terminals of an amplifier it is additive to the input signal and therefore it can be said that the amplitude of the input signal is effectively increased. The gain of the amplifier stage itself is constant; the amplitude of the input has increased, hence the output amplitude will also increase. The apparent gain of the amplifier has then become greater with the application of positive feedback.

Fig. 25 shows the input signal, the signal fed back and the effective value of input due to feedback. The input and feedback signals are in phase.

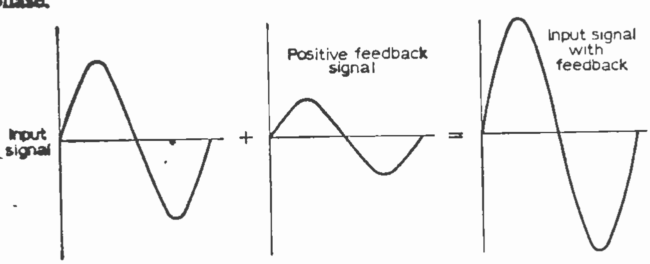


Fig. 25: The effect of positive feedback on the input signal.

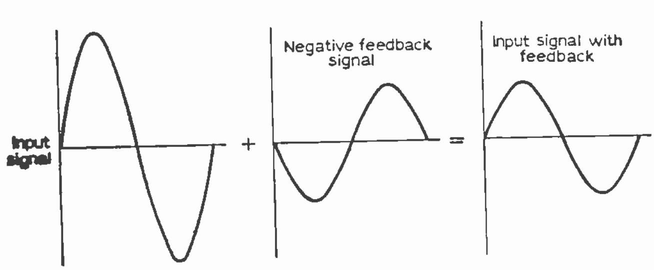


Fig. 26: The input signal with negative feedback applied.

Negative feedback is that feedback which, when applied to an amplifier, makes the effective input signal smaller; the output signal is then also made smaller. Stage gain will then appear to decrease by applying negative feedback.

Fig. 26 shows diagramatically the effective value of input signal due to negative feedback.

Input and feedback signals are in opposite phase or 180° out of phase.

The application of feedback to a circuit may have several other effects on the functioning of that circuit, otherwise there would be little need to ever apply negative feedback.

A most important effect is on the working frequency range or "bandwidth".

Although positive feedback increases amplifier gain the bandwidth is made smaller. If an amplifier is required for small frequency ranges only, or even for a fixed frequency, positive feedback would be ideal.

Negative feedback increases amplifier bandwidth. This would be used in a circuit which required a stable gain of a wide frequency range such as an audio amplifier used for both speech and music.

Unintentional feedback in the circuitry may take place due to component positions. Two resistors connected in the circuit, side by side, will act as a small value capacitor. Component positions are of more importance in valve circuitry than in transistor circuitry due to the larger component sizes but are still of some importance.

Too much positive feedback could drive a transistor into cut-off or saturation, whereas negative feedback may dampen the input to such a degree that no output is obtainable.

Feedback is also used extensively in a series of electronic circuits known as oscillators.

A pendulum is an analogy to the oscillator.

The mechanical movement of the pendulum is such that if some force is not present to sustain the swinging action the sweep angle decays due to friction losses at the fulcrum and a minute amount of windage.

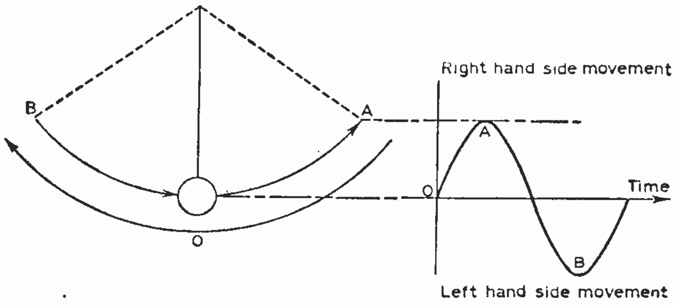
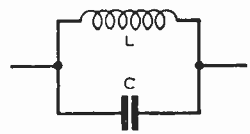


Fig. 27 (left): Plotting the movement of a pendulum against time produces a sinusoidal graph.

Fig. 28 (below): The parallel LC arrangement for oscillator circuits.



Suppose a pendulum were to be set in motion but, instead of leaving the movement to die away, a small force is used at the end of each swing to make up for the friction and windage losses, it would be seen that the pendulum would swing indefinitely.

If the length of the pendulum were shortened the pendulum would swing to and fro more quickly. Conversely if the pendulum were to be made longer the number of swings per second or swing frequency would decrease.

Considering one swing of the pendulum, starting from the centre and plotting the vertical movement of the weight against time, a sinusoidal wave is produced as shown in Fig. 27.

Several types of oscillators exist using either inductors and capacitors (LC) or resistors and capacitors (RC) to produce oscillation.

If a capacitor and inductor were connected together in parallel as in Fig. 28 and a battery applied across them for a moment, allowing the capacitor to charge up to the voltage of the battery and then (the battery) withdrawn, the capacitor would discharge into the inductor, producing a magnetic field around the inductor. This would then be converted into energy to recharge the capacitor.

It is impossible to obtain an inductance with zero resistance, therefore a certain amount of energy would be lost on each oscillation.

This parallel circuit would act similarly to the pendulum in that the oscillations would fall away, also the oscillations would be of a sinusoidal form.

It was explained that, by applying a battery across a capacitor and inductor in parallel and then withdrawing it current in the parallel circuit moved to and fro sinusoidally with an amplitude decreasing in size with time due to resistive losses in the inductor. To enable the parallel circuit to produce an oscillation of constant amplitude, feedback must be applied. The type of feedback must be additive to the oscillation, therefore positive feedback must be used.

A transformer or two inductors in magnetic coupling has an inductance due to factors contained by both coils. A transformer may also produce a 180° phase shift in currents flowing through the coils.

A grounded emitter amplifier produces a 180° phase shift between base current and collector current; 360° phase shift may be taken as no phase shift as one cycle of oscillation spans 360°. One winding of the transformer in the collector circuit of the transistor would produce a 180° phase shift between the collector current and that flowing in the second transformer coil. The base current would then be in phase with the current in the second transformer coil. If the second coil were to take the place of the inductor in the LC parallel circuit the induced current in the second coil would be of such a nature so as to aid the natural oscillations. Providing this feedback is of sufficient magnitude to overcome losses the circuit would oscillate at a constant amplitude.

The basic idea of this system is shown in Fig. 30.

Fig 31 shows a circuit diagram of such an oscillator. R_1, R_2, R_3 and C3 provide biasing between base and emitter. The value of inductance

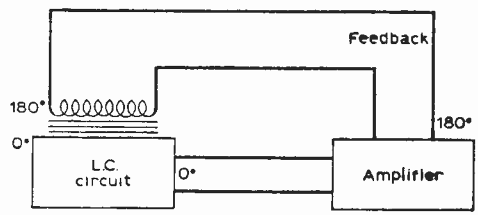


Fig. 29: Explanatory diagram of the LC oscillator.

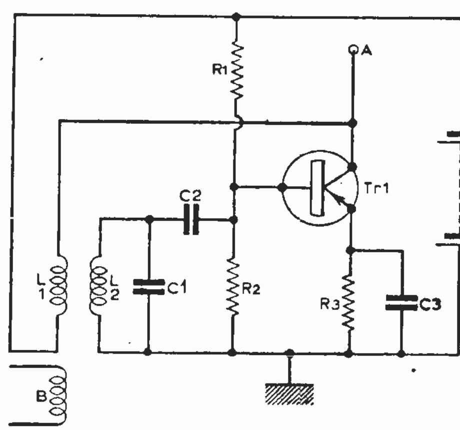


Fig. 30: Circuit of an LC oscillator. C1 prevents the base from shorting to earth.

is a combination of factors in L1 and L2. Frequency of oscillation depends on this combined value. known as mutual inductance, and the value of capacitor C1.

On application of the voltage source a voltage is seen across C1 and L2 in parallel. C1 will charge and begin to discharge through L2. This will change the voltage difference across C1, thus changing the potential at the base. A change 180° out of phase with this will be seen in coil L1 due to amplifier action and hence fed back into the coil L2 with a further 180° phase displacement. Energy would normally be lost in the coil L2 but due to the feedback via Tr1 and L1, oscillation is able to continue at a fairly constant amplitude.

There are two main methods of obtaining an output from this type of oscillator; normal amplifier output may be taken from the collector (point A in Fig. 30) but very small values of current only may be drawn. otherwise oscillation will cease due to lack of feedback. A more common method is to use a third winding on the transformer (B in Fig. 30) from which slightly larger values of current may be drawn but whose presence changes the mutual inductance value of the transformer and hence the frequency output.

There are other types of LC oscillators using feedback in a similar manner to the one in Fig. 30 but there is not space to deal with them here.

RC oscillators are also of several types and again only one shall be dealt with here—the "phase-shift" oscillator.

The phase-shift oscillator is allowed to oscillate at one frequency only, which is determined by the values of capacitance and resistance used in the "phase-shift network".

Similar to the LC oscillator, a grounded emitter amplifier is used to amplify the oscillations but an RC network is used to provide feedback in place of the inductive method.

The circuit shown in Fig. 31 provides a current phase shift of 60° between input and output, therefore three of them connected in series would give a 180° phase shift.

Fig. 31 (right): A CR circuit giving 60° phase shift.

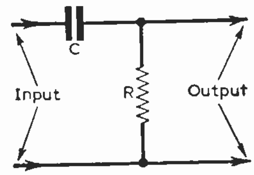


Fig. 32 (below): Phase shift oscillator circuit.

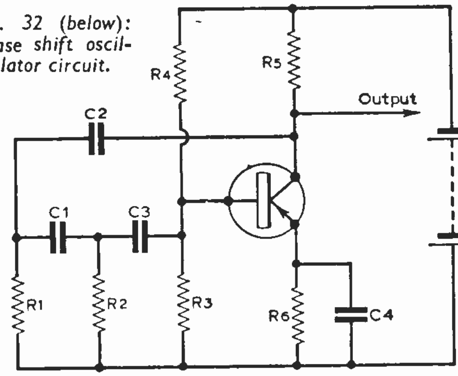


Fig. 32 shows the diagram of a phase-shift oscillator.

R_3, R_4, R_6 and C4 provide the base-emitter biasing. R_3 is also a part of the phase-shift network. Obviously there are several losses in the CR network and to overcome these the amplifier stage should have a gain of at least 29 times.

The output is taken from the collector of the transistor.

Part 5 follows next month

PHOTOCONDUCTORS

—continued from page 848

0·6V and the lamp is off so that the volume control is up at maximum output. Now S1 is switched to VR1 the "decay" control: C1 slowly charges up through VR1. the voltage across the lamp rises and the resistance of the photoconductor falls so that the volume control output decreases, reaching its minimum when C1 is fully charged; the volume control is now off.

Now S1 is switched back to VR2: C1 slowly discharges through VR2, the lamp voltage falls etc.—the whole cycle being repeated in reverse until the initial state with C1 completely discharged and the volume control at maximum is reached.

With the values of C1, VR1 and VR2 given, the attack and decay times can be varied from several seconds down to practically instantaneous. If longer times are required C1 may be increased to 1,000μF or more.

In this article the writer has described only a few of the possible applications of photoconductive cells. They are a comparatively recent device and many manufacturers in Great Britain and the U.S.A. are working on improved forms and new applications. Their use to replace relays in switching circuits has perhaps the greatest potential at present: a neon lamp or electroluminescent panel can control several photoductors, switching them from virtually open-circuit to virtually short-circuit by means of its light output. The most important improvement to be made in these devices is a great decrease in their response time, at present over one tenth of a second. Cadmium Selenide cells can bring this down to one hundredth of a second and other compounds may bring it much lower. Other photosensitive devices of entirely different principles are also becoming available and the ultimate value of the photoconductor cannot yet be judged, but it is safe to say that it will be with us for many years, assuming greater importance as improved forms become available.

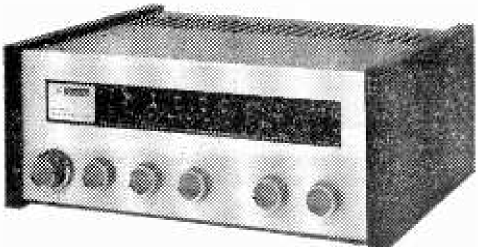
Acknowledgement is made to Ericcson Telephones Ltd. for permission to use their published data on the K42.

The K42 is available from Service Trading Co. at 8s. 6d. It is *not* available direct from the **manufacturers in quantities less than 500.**

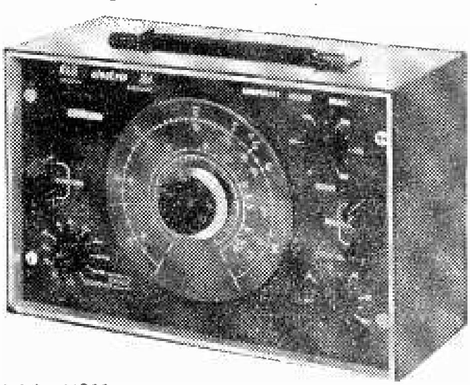
TRADE NEWS • TRADE NEWS • TRADE NEWS TRADE NEWS • TRADE NEWS • TRADE NEWS

Tuner/Amplifiers

ANNOUNCED by Armstrong Audio Ltd., are two new models to join their range of amplifiers and tuners. They are the 127 Stereo Tuner/Amplifier and the 127M Mono Tuner/Amplifier. In the amplifier sections power output is 5W, hum and noise 55dB below rated output. The FM tuner sections cover 88—108Mc/s and have a sensitivity of $1{\cdot}5\mu V$ for 20dB quieting at 75kc/s deviation. The a.m. tuner sections cover medium and long waves and have a sensitivity of $5\mu V$ for 20dB quieting at 30% modulation. Model 127 weighs 15lbs., and the 127M weighs 17lbs. The dimensions of both units are 13in. wide x 5⅜in. high x 11¼in. deep. The price of the 127M is £26 10s., and the 127, £37 10s. *Armstrong Audio Ltd., Warlters Road, London, N.7.*



The 127 stereo tuner/amplifier from Armstrong Audio Ltd.



K.L.B.'s M300 component bridge.

Component Bridge

RELEASED by K.L.B. is the M300 Component Bridge. This instrument has four capacity ranges from 10pF to $1{,}000\mu F$, and four resistance ranges from $0{\cdot}05\Omega$ to $100M\Omega$. There are also facilities for capacitor leakage tests, with an adjustable test voltage up to 500V d.c. Ratio tests in the ranges of 0·05—1 and 20—1 can be carried out between any two capacitors, inductors or resistors. The M.300 is priced at £22 5s. *K.L.B. Electric Ltd., 335 Whitehorse Road, Croydon, Surrey.*

Recorded Guitar Tuition

THE surprising thing about such records as these is that they were not thought of sooner. As a commercial proposition they have not been going for more than six to nine months—at the most. The guitar, on the other hand, has been the foremost instrument in the popular music field for a good ten years.

However, such a record as this certainly fills a need. For no matter how many books, booklets and advice may be read on the subject, there is nothing like coming to grips with something in practice for rapid learning.

Side 1 is split into two parts. The first half describes the techniques of tuning the guitar—i.e., pitch-pipes, tuning fork, etc., and gives full details on how once one string is correctly tuned, the rest can be adjusted in unison. This section is perhaps the most important on the whole record. For as is rightly stated, the hallmark of the good guitarist is an accurately tuned instrument, which applies even more so to the beginner, because at the outset the ear too easily accepts *any* sounds—whether the right or wrong ones.

The second half of track 1 deals with basic chords and their formation, the common key of C being chosen. Simple accompaniment is also touched upon.

Side 2 is the more difficult to master and one gets the impression that things are pushed along a little too quickly. But the truth is that the newcomer has only to lift the pick-up from the record and start again, so that he learns at his own rate in any case. The key of Am is dealt with and an explanation of picking out on the bass strings in conjunction with chord work is given.

Part B of side 2 concentrates on the right hand and the use of the plectrum, with a little more on the use of bass notes. Lastly, part C is concerned with rhythm and in addition to the electric guitar a bass guitar is brought in to illustrate the effects of various beats and times.

While it would be naive for any would-be guitarist to expect to be able to play like Segovia simply by hearing this record, it is a great help for a beginner to be able to make direct comparisons of his own playing with that on the record, which of course he can do. In short, a record such as this justifies its expense to the learner by its help in the all-imporant initial, formative, stage of playing, and even on that score alone would stand recommended.

"Learn To Play The Guitar" by Johnny Bennett, retails at 25/-, and comes complete with a sheet of simplified chord forms. *Recorded Tuition Ltd., 174/176 Maybank Road, South Woodford, London, E.18.*

SINCLAIR X-10—TRADE NEWS, DECEMBER P.W. (P.786)

WE have been asked to make clear that T.S.L. are the sole distributors for this amplifier so far as the wholesale and retail trades are concerned. This company does not supply the public direct.

CLUB NEWS

ACTON, BRENTFORD AND CHISWICK RADIO CLUB
Hon. Sec.: W. G. Dyer, G3GEH, 188 Gunnersbury Avenue, London, W.3.

At the meeting on 8th December at Club H.Q. at 66 High Road, Chiswick, there will be a demonstration arranged by Ad. Auriema Ltd., of transceivers, including the National NCX5. The meeting commences at 8 p.m.

BASILDON AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: C. Robertson, Milestone Cottage, London Road, Wickford, Essex.

Peter Blair, G3LTF, who is well known for his activities on 2m., 70cms. and 23cms. will be giving a talk on v.h.f./u.h.f. at the Ballroom of the Bullseye, Southernhay, Town Centre, Basildon. The meeting will be held on Wednesday, 9th December at 8 p.m. Admittance is free and there are ample car-parking facilities.

CHESTER AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: P. J. Holland, Field House, 19 Kingsley Road, Great Boughton, Chester.

On 3rd November there was a net night on 160m. and 2m. The following week there was a film show when several technical films were shown. On 17th November, Mr. J. Butler, G3FNV, gave a report on the International Radio Communications Exhibition held at the Seymour Hall, London, and on 24th November there was a sale of members' surplus equipment. All meetings are held at 8 p.m. in the Y.M.C.A., Chester.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: F. C. Ward, G2CVV, 5 Uplands Avenue, Littleover, Derbyshire.

On 4th November members held a surplus sale and a week later saw a demonstration of communications receivers. 14th November brought the Short Wave Magazine contest and on the 18th there was a technical film show. On 25th November there was an open evening with a juniors' meeting, and the following week, the second R.S.G.B. Top-Band contest.

GUILDFORD AND DISTRICT RADIO SOCIETY
Hon. Sec.: D. H. Mead, G3OXI, 41 Egley Road, Woking.

The lecturer on 13th November was A. Birt, G3NR, who gave a talk on the Racal R.A.17 Receiver. On the 27th P. H. Jones, Esq., gave a talk on the Decca Navigation System.

MELTON MOWBRAY AMATEUR RADIO SOCIETY
Hon. Sec.: D. W. Lilley, G3FDF, 23 Melton Road, Asfordby Hill, Melton Mowbray, Leicestershire.

At the meeting on 26th November held in the St. John Ambulance Hall, Asfordby Hill, members brought and discussed items of gear recently built, or that were in the course of construction.

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY
Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax, Yorkshire.

On 10th November members saw a Mullard Film Show, at the King's Hall, Bradford, and on the 11th three young SWLs gave a talk on their hobby. This was followed on the 25th by Mr. L. M. Dougherty, B.Sc., F.R.A.S., who gave a talk and demonstrations on transmitter alignment.

READING AMATEUR RADIO CLUB
Hon. Sec.: R. G. Nash, G3EJA, "Peacehaven", 9 Holybrook Road, Reading, Berkshire.

The meeting held on 28th November was concerned with the conversion and use of government surplus gear. All entries had to be in by this meeting for the Trophy Competitions held by the Club, which will be judged at the meeting to be held on 19th December.

SLADE RADIO SOCIETY
Hon. Sec.: D. T. Wilson, 177 Dower Road, Four Oaks, Sutton Coldfield, Warwickshire.

On 13th November, Mr. R. Palmer (G5PP), well known for his potent signals on top band and two meters, gave a talk on "Mobile Operation". The Society's A.G.M. was held on 27th November.

SPEN VALLEY AMATEUR RADIO SOCIETY
Hon. Sec.: N. Pride, 100 Raikes Lane, Birstall, Nr. Leeds.

Members visited the Home Office Wireless Depot on 12th November, and on 26th November, A. W. Walmsley, G3ADQ, gave a lecture on SSB.

WELLINGBOROUGH RADIO CLUB
Hon. Sec.: J. Baker, 34 Essex Road, Rushden, Northamptonshire.

On 12th November, Mr. D. Slater gave a lecture on "Electrochemistry". The following week, members saw a film entitled, "Super Grid Construction", and on 26th November, D. Britton spoke on "Model Aircraft and Radio Control".

WEST KENT AMATEUR RADIO SOCIETY
Hon. Sec.: H. F. Richards, 17 Reynolds Lane, Tunbridge Wells, Kent.

At the meeting on 13th November, members heard an illustrated talk entitled "Components", given by a representative of Messrs. Erie Resistors Ltd. A week later, H. Turner spoke on "Dual Standards TV Circuitry".

There will be an Exchange and Mart on 11th December, where members may offer their surplus gear for sale or exchange.

ON THE SHORT WAVES

—continued from page 851

by LU1ZC and LU8ZI around 1400kc/s. ZL1ABZ on Kermadec Island is now QRT having gone home to New Zealand so at the moment no r.f. emanating from Kermadec. This also applies to Campbell Island. The Andaman Islands are on the map with the callsign VU2NRA. Norfolk Island VK9RB and VK9DR. Christmas Island is still with us, and KG6IF on Marcus Island. Deception Island has three or four operators, and the callsign to listen for here is LU4ZI. Heard Island is out of the running at present, but plans are reported to be afoot to remedy this, the callsign will probably be VK0PK. Finally Aaland Island boasts the call OH0—and is a fairly easy one to hear. (This one is big enough to be shown on the map.)

In case you can't believe your ears then be assured that a W callsign is emanating from Russia. If you log W8NRB/UA then it really is W8NRB who has special permission to work /UA from Russia until about the second week in January.

My thanks to those who pointed out that GB3LER the beacon is on 29·005Mc/s and not 29·000Mc/s as I claimed last month. There must be some real accurate frequency metres about amongst our readers!

National Field Day

Congratulations to the winners of NFD. The two-station winners made 2,185 points and the single station winners 1,067. One thing emerges from NFD which is both surprising and interesting. These are the high scores made amongst the bedlam on 7Mc/s Considering the low power limit for NFD and the conditions usually prevailing on Forty this is really quite some achievement. The two station and single station scores respectively for 7Mc/s—610 points and 422 points.

MEDIUM WAVE DX

Now that the MW/DX season is in full swing, "Medium Wave News" is again being published. For details drop a line, enclosing S.A.E., to K. Brownless, 7 The Avenue, Clifton, York.

LETTERS TO THE EDITOR

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 the cover.

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

USEFUL H.T. BATTERIES

SIR,—I have a number of h.t. batteries which I would be willing to give free of charge to readers of PRACTICAL WIRELESS.

Voltage is 138V with taps at 67·5V and 73·5V. The size is 10in. x 6$\frac{3}{4}$in. x 2$\frac{1}{2}$in. and the weight is 8lb. They were made in 1962 for U.S. Forces and have now been rejected for time limit on expected life. In fact they will give hours of running time.

As I have over 100 I will genuinely be glad to let people have them. If sent by post I should need 4s. per battery.—H. HUMPHRIES (The Old Vicarage, Gazeley, Newmarket, Suffolk).

NATIONAL RADIO CLUB FOR BOYS

SIR,—I was rather disappointed to find that there is no national radio club for boys and I feel that many of the young readers of PRACTICAL WIRELESS may like to start such a club.

I fully realise the many difficulties that are involved but I would like readers under the age of 16 who are interested in starting such a club to write to me expressing their views on the matter. —M. OVERBURY (9 Jerome Drive, St Albans, Hertfordshire).

IMPROVED RECEPTION

SIR,—Recently I was experimenting with a piece of ferrite rod to improve the reception on a domestic portable receiver. I first obtained a rod of ferrite about 3$\frac{1}{2}$in. long and wound as many turns of plastic-covered copper wire on it as possible, keeping the turns in place with adhesive tape. Fixing one end to a good aerial and the other to a good earth. it was only necessary to place the wire-covered rod on or near the radio receiver to effect an amazing increase in volume. —R. A. CRANE (Great Yarmouth, Norfolk).

A READER'S THANKS

SIR,—As a result of a request through your columns a reader has sent me the circuit diagram of the Ekco car radio CR/61A.

This gentleman did not send his address—the postmark on the envelope was Sidcup—and as I am unable to reimburse him for his trouble may I thank him through your columns?

I had quite given up hope of ever getting the circuit of the set and would like to say how grateful I am to him.—P. HEARNE (Gossops Green, Crawley).

CAROLINE AGAIN

SIR,—I would like to make the following points concerning "Radio Caroline" and her sister ships. Firstly, in some newspapers there can be found a Caroline "Radio Times"; secondly, a certain watch firm has agreed to supply watches as prizes in one of their competitions and thirdly, there are several land addresses which are read out over the air to which correspondence may be sent.

Surely the people arranging such facilities are all assisting the ships and are therefore breaking the law. Since the Postmaster has done nothing about it does this mean that he is going to compete with them as Mr. D. Barrington suggests?—M. BALLANCE (Oxford).

BROKEN COIL CORES

SIR.—Recently I was faced with the problem of removing a cracked iron dust core from a coil former, and I successfully adopted the following procedure.

Firstly, a small hole was drilled as deep as possible in the core. A thin metal rod was then obtained and its end smeared with metal adhesive (Loy is a commercially available example). This rod was then inserted in the hole in the core and left there until the adhesive hardened. The broken core was then removed by rotation of the rod.—A. J. MULLEY (Preston, Lancashire).

HIGH SENSITIVITY BRIDGE

SIR.—My congratulations to Mr. M. A. Harris, contributor to your PRACTICAL WIRELESS periodical dated December, 1961, and January, 1962, for his clear and straightforward circuit. I have constructed the unit and found it most accurate.

Additional accuracy of reading, however, not envisaged by Mr. Harris, may be obtained by the adoption of a slow-motion cursor traversing a circular protractor. The latter was fixed behind the calculated scale and orientated to correspond to the maximum swing "θ" of the potentiometer.

Accurate interpretation may be then undertaken using the formulae:

$$R = \frac{S\phi}{\theta - \phi} \quad \text{and} \quad C = \frac{S(\theta - \phi)}{\phi}$$

when R=test resistance, S=standard R or C, C=capacitance, θ=total swing of potentiometer and ϕ=swing, degrees.

As Mr. Harris implies, the basic accuracy is limited by the standards obtainable, but these may be replaced with those of greater accuracy as they appear on the market.

Precision 1μF capacitors 0·1%—0·3% accuracy at 20°C are now available at G. W. Smith, Lisle Street, London, W.1.—G. W. NIXON (Epsom, Surrey).

ELECTRONIC WALLPAPER

SIR,—I am looking for a wallpaper pattern with an electronic theme for my "shack/bedroom". Please can any of your readers help me.—C. P. FINN ("South Dene", South Kirkley, Pontefract, Yorkshire).

REQUESTS FOR INFORMATION ARE INSERTED IN THIS COLUMN ON THE UNDERSTANDING THAT READERS USING THE SERVICE UNDERTAKE TO REPLY TO ALL OFFERS RECEIVED AND TO RETURN ALL DATA NOT REQUIRED. BECAUSE OF THE LARGE NUMBER OF REQUESTS RECEIVED, ILLEGIBLE WRITING WILL AUTOMATICALLY DISQUALIFY LETTERS FROM PUBLICATION. FOR THE SAME REASON, WE CANNOT GIVE SPACE FOR REQUESTS FOR PAST ISSUES OF "PRACTICAL WIRELESS."

Sir—I would be grateful if any reader could sell or loan me . . .

. . . circuit diagram and information on a.m. receiver unit 71 v.h.f. It has a three push-button system, with several EF50 and EF39 valves.—P. LAPWOOD, 16 Cheviot Drive, Melbourne Farm Estate, Chelmsford, Essex.

. . . a copy of QST for August 1940.—G. T. DOWSON, 39 Victoria Street, Scarborough.

. . . service data or manual for Stella tape recorder, Model ST450.—J. J. HUDSON, 1 Park Terrace, Barnard Castle, Co. Durham.

. . . the service sheets, manual or any useful data on the C.R.100.—W. EDMONDSON, 13 Lindfield Gardens, Hampstead, London, N.W.3.

. . . service sheet, circuit diagram or any other information on the Perth "Clarissa" Mk. I Tape Recorder.—T. G. WIGMORE, 73 Robertson Way, Malpas, Newport, Monmouthshire.

. . . an instruction manual for the R107 and any details on this receiver.—N. SUDRON, 1 Aiskew Grove, Fairfield, Stockton-on-Tees, Co. Durham.

. . . the operating manual, circuit diagram or any useful data on the Marconi Trans-Receiver, Type CNY2.—DONALD MACAULAY, Police Station, Cardross, Dumbartonshire, Scotland.

. . . any information on the No. 19 Set, Mk. 3 version.—K. R. PEGLEY, 68 Rails Lane, Hayling Island, Hampshire.

. . . any information, circuit diagram, instruction manual, setting-up instructions on a Hallicrafters Marine Radiophone Type HT11B.—EA1 F. MATTHEWS, C.P.O.'s Mess, H.M.S. *Osprey*, Portland, Dorset.

. . . information on converting the 38 Set, Mk. 2, to top band operation.—S. ALDERTON, 2a Goldings Road, Loughton, Essex.

. . . servicing data on "Claviolines"—all models. Would purchase or part exchange Univox servicing data.—D. CASSERLEY, c/o Mrs. E. Dudley, 27 George Street, Chesterton, Stoke-on-Trent, Staffordshire.

. . . any information on working the R109A from a.c. mains.—A. CORKER, 5 West Crescent, Sunnyside, Nr. Rotherham Yorkshire.

. . . circuit and any other data on the AP61357 Admiralty Type 62H Receiver.—H. A. FORRESTER, 58 Bede Avenue, Sherburn Road Estate, Durham.

. . . the manual or circuit for the Air Ministry Receiver 1116A. All expenses gladly refunded.—J. HIGGINS 47 Crawford Street, Greenock, Renfrewshire, Scotland.

. . . the circuit and details of Wavemeter Type W1191A.—L. HALL, 13 Werter Road, London, S.W.15.

. . . instruction book or a circuit on the Type 3, Mk. 2 Transceiver (i.e. circuit for transmitter, receiver and power supply).—L. O. TULLY, 120 Victoria Street, Fairfield 53, Brisbane, Queensland, Australia.

. . . the handbook, instruction manual, etc., for the R107 Receiver.—G. B. WESTWOOD, 114 Pettits Lane, Romford, Essex.

. . . the manual and any information on the Ex-Army Radio Set No. 18, Mk. 3T.—G. P. MYATT, 25 Lowshill Lane, Rednal, Birmingham.

. . . the circuit diagram of the Marconi Radiogram, Model No. 563.—W. G. GOMERSALL, 16 Radcliffe Drive, Ipswich, Norfolk.

. . . circuit or details of the Williamson High Power Amplifier.—"Monkroyd", Portsmouth, Todmorden, Yorkshire.

. . . the circuit diagram of the Canadian 52 Receiver.—M. J. COOPER, "The Lawns", Usk, Monmouthshire, Wales.

. . . the circuit and any information about the R.A.P. radiogram chassis.—D. SHILLAM, 49 Kingsbridge Road, Southall, Middlesex.

. . . information, instructions and circuits for Microtimer (Number 130) built by R. K. Dundas Ltd., Portsmouth.—R. SHARLAND, 70 Hillcroft Crescent, Oxhey, Watford, Hertfordshire.

THE "TEN-FIVE"

In the circuit diagram, Fig. 2(a) on page 518 of the October issue, pin 1 of T2 should be taken direct to +ve line and not to the junction of C5/R3 as shown. Also in Fig. 2(c) the pole of S2B should be taken to the −ve line.

TRANSISTOR PRE-AMP

When power is drawn from a conventional valve amplifier h.t. supply for the pre-amp, the coaxial output socket (Fig. 1) should not be connected to the +ve line, otherwise an h.t. short will occur.

PRACTICALLY WIRELESS—*continued from page 885*

—continued from page 885

ordinary phillumenist, there is a diary aimed especially at you, with a wealth of listed information that often crowds the entry pages into a slim centre section. My last diary tells me how to calculate series and parallel combinations, what frequencies the radio stations of the world employ, the size of wire I must use to construct my own coils, the equivalents of long-forgotten valves, and the addresses of all the technical institutes and societies I could have joined if I had been able to learn the above information by heart. Somewhere among the small print I should undoubtedly find a Greek alphabet, a decibel conversion table and a flurry of Abacs.

Also among my souvenirs is a so-called Radio Diary that some misguided relative gave me, knowing my hobby. Unfortunately, the compilers had concentrated on output rather than input, and I now have a fund of gen on the lives of the pop stars, and instead of valve curves there are photographs less useful, if more revealing. Cleavage in place of characteristics: fancy instead of fact.

Which brings us back to some of those wild speculations we began this column with — but more about them anon.

Don't Miss These Bargains

Transistor ferrite rod aerial with medium and long wave coils with circuit **7/6.**
Oscillator Coil and set of 3 I.F. transformers for transistor set with circuit. **12/6.**
Tuning Condenser to suit. air-spaced with trimmers. **9/-.**
Ditto but sub. min. 7mm. **10/-** the set; two gang condensers to suit. **8/6.** (Request sub. min. circuit.)
Midget 3in. P.M. Loudspeaker 3 ohm **12/6,** 80 ohm. **13/6.**
Midget 208 pF +176 pF two-gang Tuning Condenser with trimmers for transistor set Price **9/-.**
Push-Pull Transformer. Sub-miniature **8/6.**
0005 mfd. Single Tuning Condenser. Solid dielextric ¼in. spindle for transistor of Crystal set, with spindle tapped 6 BA. **2/6.**
46 Sets (Receiver/Transmitter pack set). Unused sets complete except for crystals. Packed with parts and easily rebuildable into other gear. **19/6** each. Post 3/-.
Battery Charger Kit. Comprises 5 amp. transformer, 5 amp. rectifier, metal case and meter to charge 6 or 12 volt batteries up to 5 amps. With variable charge rate **39/6** each. Post and insurance. 3/6.
Mains Transformer. 250-0-250 at 80 mA. 6.3 volts, 5a (normal mains input). **12/6** each carriage **2/6.**
Output Transformer. Standard pentode matching type. **4/6** each. **48/-** per doz.
Slide Switch. Sub-miniature but dpdt. **2/-** each, **18/-** per doz.

T.C.C. or Dubilier Tubular Condensers.

.5 mf 500 v.	**10/-** doz.
.25 mf 500 v.	**7/6** doz.
.25 mf 350 v.	**6/-** doz.
.05 mf 500 v.	**5/-** doz.
.0001 mf 1,000 v.	**5/-** doz.
.001 mf 1,000 v.	**6/-** doz.
.002 mf 1,000 v.	**7/6** doz.
.005 mf 1,000 v.	**9/-** doz.
.02 mf 750 v.	**8/6** doz.
.01 mf 1,000 v.	**10/-** doz.

Battery Charger Rectifier—selenium 12-15 v. 5 amp. **9/6.**
Metal Chassis—punched for Mullard 510 Amplifier, complete with inner screening sections and stove enamelled. **12/6** set.
Filament Transformer. 6.3 v. 1½ amps.. **6/6.**
Neon Lamp—midget wire ended. Ideal mains tester. etc. **2/-.** Ex. Govt., **1/6.**
Phillips Trimmers—0.30pF **1/-** ea., **9/-** doz.
Tag Panels. Ideal for constructors, experimental circuits, etc. 3 of each of 12 different types, **5/-.**
Slydlok Panel Mounting Fuses with carrier, 5 amp. **2/-** each. 15 amp. **2/6** each.
Metal Rectifier. 250 v. 60-80 milliamps ideal for mains set or instrument or to replace that expensive valve, **4/6.**
Piano Key Type Switches. 3 key type **3/-,** 4 key type **3/9,** 5 key type **4/6,** post and packing 1/- regardless of number ordered.
500 MW Amplifier. Uses 3 transistors. 2 of which are in Glass B push-pull for battery economy. Ideal little unit for baby alarm, record player, intercom.. etc.. etc. **19/6.** Speaker **12/6** extra.
Electrolytic Condenser—Bargain Sub-miniature type 50 m.f.d. 6v. made by T.C.C. **7/6** per dozen (minimum quantity supplied).
Transistor Set Cases. Finished in two-tone with handle and back. Size 10½ x 7¼ x 3in. **15/-** each plus 2/6 Carriage and Insurance.

THERMOSTATS

Type 'A' 15 amp. for controlling room heaters, greenhouse, airing cupboard. Has spindle for pointer knob, quickly adjustable from 30-80°F. **9/6** plus 1/- post. Suitable box for wall mounting. **5/-.** P. and P. 1/-.

Type 'B' 15 amp. This is a 17in. long rod type made by the famous Sunvic Co. Spindle adjusts this from 50-550°F. Internal screw alters the setting so this could be adjustable over 30° to 1,000°F. Suitable for controlling furnace, oven, kiln, immersion heater or to make flame-stat or fire alarm. **8/6** plus 2/6 post and insurance.

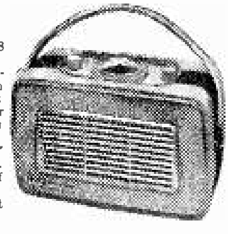
Type 'C' is a small porcelain thermostat as fitted to electric blankets etc. 1½ amp. setting adjustable by screw through side. **3/6,** P. and P. 6d.

Type 'D'. We call this the Ice-stat as it cuts in and out at around freezing point. 2-3 amps. Has many uses. one of which would be to keep the loft pipes from freezing, if a length of our blanket wire (16 yds. **10/-**) is wound around the pipes **7/6,** P. and P. 1/-.

Type 'E'. This is a standard refrigerator thermostat. Spindle adjustments over normal refrigerator temperatures, **7/6** plus 1/- post.

Where postage is not definitely stated add 2/- all orders under £3.

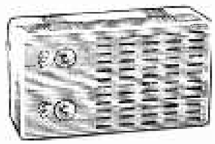
Good Companion Mark IIB



The 6 transistor set with the 8 transistor performance. Incorporating all the latest requirements. Anyone who can solder can make it. Many thousands already in use all over the country. Full coverage of Long and Medium wavebands. Fine looking cabinet, size 11" x 8" x 3". Q.P.P. Output approx. 750 mW. Excellent reception of difficult stations like 208. Variable feed back gives excellent tone. ONLY **£5.19.6**

Plus 4/- post and insurance.

OUR BARGAIN OF THE YEAR



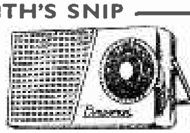
A complete kit of parts to build a 6 transistor 2 wave superhet receiver at only 39/6. Post & Ins. 3/6

"CORONET" Mk. IV

It fully covers the medium waveband and that part of the long waveband to bring in B.B.C. Light. The circuit includes a highly efficient slab aerial and 2½" P.M. speaker. Overall size approximately 4½ x 2¼ x 1½in. Supplied complete with carrying case.

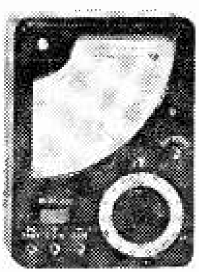
THIS MONTH'S SNIP

£5.10.0 Radio for only 37/6



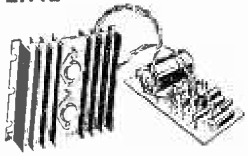
Originally sold at £5.10.0. we now offer the "Pimpernel" 5 Transistor Pocket Radio at only **37/6.** The sets are complete but are "line rejects" so there will be some small faults to find. Components are all new and unused, and their retail value, even at today's lowered price, is over £4. Parts you will get include:—
Jackson "OO" Tuning Condenser, **9/-.** Plessey Driver Transformer, **8/6.** Goodman's or Plessey 3" speaker, **12/6.** Morganite Volume Control with switch, **4/6.** Philco RF Transistor, **12/6.** S.T.C. matched output transistors and driver, **15/-.** Plastic case with carrying handle, **7/6.** 5 Electrolitic Condensers, **7/6.** 10 Resistors, **3/6.** Ferrite Aerial, **5/-** and printed circuit board. trimmers, battery connectors, r.f. choke. etc., etc.
All this fine equipment offered this month at only **37/6** plus 2/6, postage and insurance.

MULTI-METER BARGAIN



Model number EP10K. Extra wide scale fitted corner-wise for compactness, extra accurate as it uses 1% components. Sensitivity 10,000 ohms per volt A.C. and D.C. ranges D.C. voltage up to 1.2kV in 5 ranges. A.C. voltage up to 1.2kV 5 ranges. D.C. current up to 300mA 3 ranges. Resistance up to 2 meg. Capacities .005 to .15 mfd and decibels. Complete with full instructions and test prods and battery for ohms range. A real bargain not repeatable once stocks cleared. Price **69/6.** Carriage and insurance 5/-.

THE STRAIGHT LINE AMPLIFIER



We call this the straight line amplifier because it is virtually distortionless, even at 10 watts. This is achieved by the careful use of feed back, choice of components and transformerless design. Sensitivity is 100 mV from 10K source. Push-pull output. For battery or mains operation.
Model 815, 15 ohm output, **£5.19.6** plus 2/6 post and insurance.
Model 83, 3 ohm output, **£5.10.0** plus 2/6.
Mains unit, **59/6.**
Pre-Amplifier, mono, **65/-;** stereo, **£10.19.6**
F.M. Tuner for above, **£7.19.6.**
Note (except for F.M. Tuner) all above are made up ready for use. fully guaranteed for 12 months.

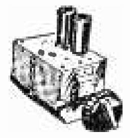
MAINS POWER PACK

Designed to operate transistor sets and amplifiers. Adjustable output 6v—9 to 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1-PP3-PP4-P6-PP7-PP9 and others. Kit comprises: mains transformer-rectifier, smoothing and load resistor 5000 and 500 mfd condensers, zener diode and instructions. Real snip at only **14/6** plus 2/6 post.

Infra Red Heaters

Make up one of these latest type heaters. Ideal for bathroom, etc. They are simple to make from our easy-to-follow instructions—uses silica enclosed elements designed for the correct infra-red wavelength (3 microns). Price for 750 watt element and metal casing as illustrated, **19/6,** plus 2/6 post and insurance.

Brayhead Turret Tuner



Complete with Band 1 and Band 3 coils. New but removed from unused equipment. Less valves **15/-** each or with valves **25/-** each. Post 2/6. Knobs 3/6 extra.

Waterproof Heater Wire

16 yds length. 70 watts, self regulating temperature control. **10/-,** post free.

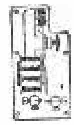
Fluorescent Lights Kits

For pelmet lighting, etc. Kit consists of: Super silent choke: 2 chrome clips to hold tube: 2 bi-pin holders for tube and starter with a starter holder. Kit A for 80 watt tube at **27/6.** Kit B for 40 watt tube at **19/6** Kit C for 2 x 2ft. 20 w lamp **25/-.** Kit D for 1 x 2ft. 20 w lamp **18/6.**
Post and Insurance 2/6 per kit.

Cabinet Snip

This fine cabinet as illustrated but less control knobs is available this month at a special snip price of **12/6,** plus 3/6 post and insurance. Size is 13¾in. x 9in. x 4in. and it is nicely covered in two tone I.C.I. fabric.

Siemens High Speed Relay

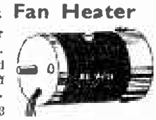


Twin 250 ohm coils adjustable tension change over contact—plat points **7/6.** Post 1/-.

Five Core Cable

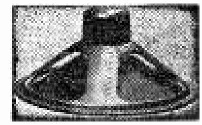
Ideal for switching circuits, intercoms., P.A. runs etc. each core flex copper with rubber insulation, cores covered overall in tough rubber or P.V.C. **9d.** per yd. or 30 yds. length **15/-** plus 5/- post.

Making a Fan Heater



Miniature motor 2¼in. long x 1¾in. diameter, laminated poles, Operates off 20-30v. D.C. Original cost at least £3 each, **8/6** plus 1/6 postage and insurance. Mains model **9/6,** plus 2/6 postage and insurance.

Speaker Bargain



12in. High-fidelity loudspeaker High flux permanent magnet type with standard 3 or 15 ohm speech coil. Will handle up to 10 watts. Brand new, by famous maker. Price **27/6** plus 3/6 post and insurance.

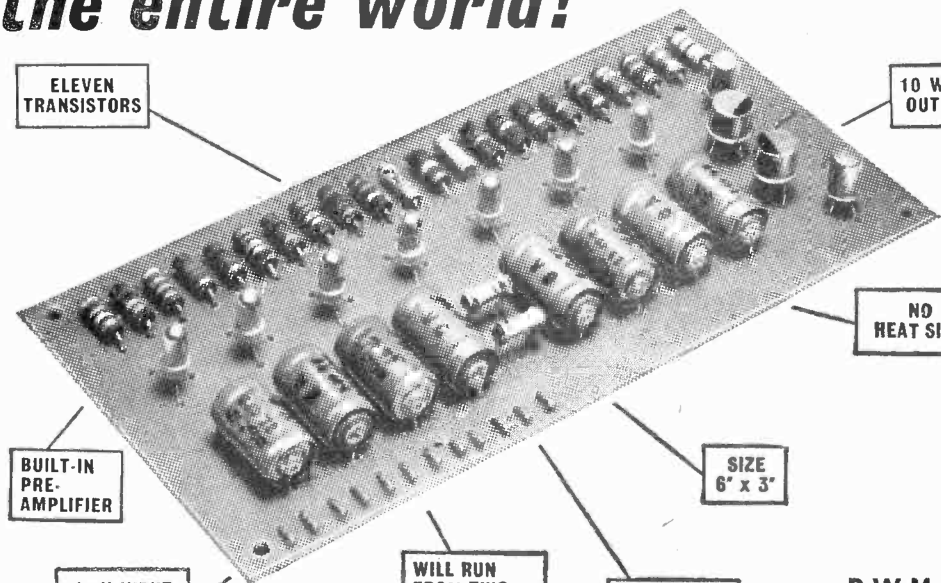
ELECTRONICS (CROYDON) LTD

266 LONDON ROAD WEST CROYDON SURREY

Post orders to: 43 Silverdale Road, Eastbourne, Sussex

10 WATT INTEGRATED AMPLIFIER USING PULSE WIDTH MODULATION

the entire world!



P.W.M. THE ANSWER!

- ★ **Number of transistors**—11
- ★ **Overall size**—6 x 3 x ¾in.
- ★ **Input sensitivity**—1mV into 1K. ohm.
- ★ **Total harmonic distortion**—less than 0.1%
- ★ **Output power**—10 watts
- ★ **Frequency response**—5–20,000 c/s ± 0.5dB
- ★ **Speaker impedance**—15 ohms
- ★ **Damping factor**—greater than 100
- ★ **Quiescent consumption**—75mA
- ★ **Supply voltage**—12 volts D.C.
- ★ ***Completely British Design***

ONLY THE X-10 USES P.W.M. (PULSE-WIDTH MODULATION)

With P.W.M. the audio signal modulates a high frequency square wave "carrier" by varying the mark-space ratio. These variations are converted to energy in the output stage. Being independent of the transfer characteristics of the output transistors, the output is an exact replica of the input signal. The improvement in the quality of reproduction from the loudspeaker is instantly apparent. Transient response is greatly improved, there is no falling off in the higher audio frequencies, no intermodulation distortion and the response curve is so flat that you could draw it with a ruler! A new type of output stage and P.W.M. plus many other refinements result in an amplifier which is compact, rugged stable, requires no heat sink—and costs so little. *The X-10 may be used with low-output pick-ups such as Decca Deram, Ortofon, etc., as well as with tape play-back heads. Used in pairs the X-10 brings new depth to stereo listening.*

SINCLAIR X-10 MANUAL

Explains how the amplifier functions, how to add volume and tone controls to suit your precise requirements, and how to use the X-10 for stereo. A variety of systems is shown, none of which will add more than a few shillings to the original cost of your X-10. The Manual which is included with every X-10 is available separately for 1/-.

ORDER FORM AND MORE SINCLAIR DESIGNS ON PAGES FOLLOWING

RADIONICS LTD

Telephone: COMBERTON 682

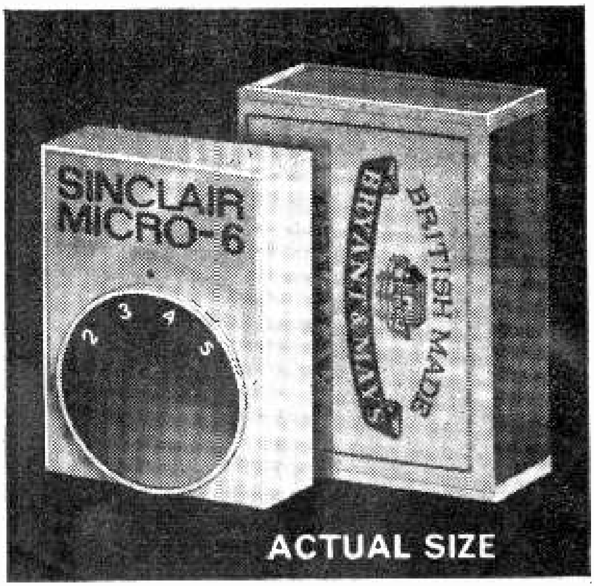
THE SMALLEST AND MOST

The British designed

SINCLAIR

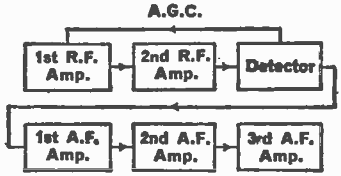
MICRO-6

SIX STAGE RECEIVER



NOW MORE THAN EVER IS THE TIME TO BUILD YOUR MICRO-6. With the days so short, the performance from this amazing 6-stage radio is proving sensational. Stations simply pour in from the Continent with outstanding quality and again and again the Micro-6 is reported to be giving excellent results where other sets cannot be used at all. As the illustration shows, the set is smaller than a matchbox, yet everything including batteries and ferrite rod aerial is contained in the tiny white, black and gold case. The Micro-6 has vernier-type tuning and is switched on by inserting the Micro-plug of the earpiece into the socket at the side. This remarkable British receiver cannot be too highly recommended both as an intriguing design to build and a most practical radio to use. It's a set you will be delighted to build and use. IT PLAYS ANYWHERE.

- ★ **SIZE—$1^4/_5$ x $1^3/_{10}$ x $^1/_2$ in.**
- ★ **WEIGHT—Less than 1 oz.**
- ★ **TUNES OVER M.W. BAND**
- ★ **BANDSPREAD FOR EASY LUXEMBOURG RECEPTION**
- ★ **AMAZING POWER AND RANGE**



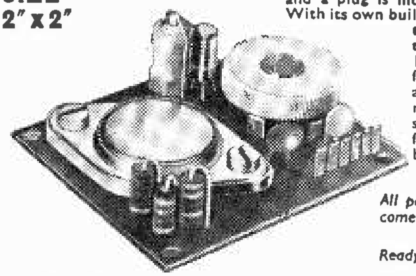
BLOCK DIAGRAM OF MICRO-6

The Micro-6 uses three special Micro Alloy transistors in a new and original circuit. Two stages of R.F. amplification are followed by an efficient double diode detector which drives a high-gain 3-stage A.F. amplifier. Powerful A.G.C. applied to the first R.F. stage ensures fade-free reception from the most distant stations tuned in.

SINCLAIR TR750 AMPLIFIER

Designed specially for Micro-6 and Slimline Users

SIZE 2" x 2"



This amplifier makes a powerful car, portable or domestic radio used with the Micro-6 or Slimline receivers and a plug is included for connecting to these sets. With its own built in volume control and on-off switch, the TR 750 has a full 750 milliwatt transformerless output for 10mV into 10K ohms and a frequency response from 30 to 20,000 c/s ± 1dB. It will also make an efficient hi-fi record reproducer used singly or paired for stereo and there are many other uses for the TR 750 which is available for building or ready built.

All parts with instructions come to **39/6**

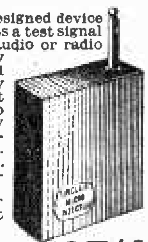
Ready built and tested **45/-**

Trace that fault with a Sinclair

MICRO-INJECTOR

This ingeniously designed device generates and injects a test signal into any part of audio or radio equipment at any frequency from 1 kc/s to 30 Mc/s by means of which, it becomes easy to locate faults rapidly and accurately. Measures $1^4/_5$ x $1^3/_{10}$ x ½in. excluding probe. With full instructions.

No constructor should be without a Micro-Injector.



Parts and instructions come to **27/6**

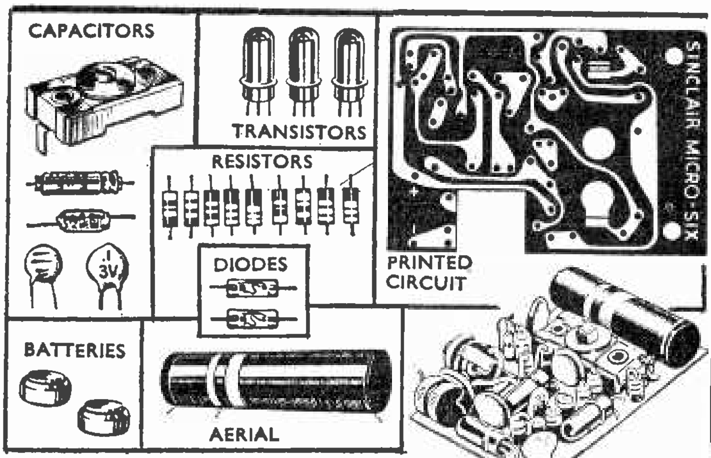
Ready built and tested **32/6**

sinclair

SINCLAIR RADIONICS LTD

COMBERTON, CAMBRIDGE *Telephone* COMBERTON 682

EXCITING SET ON EARTH



THE MICRO-6 INCLUDES THE SMALLEST COMPONENTS EVER!

We show here some of the components (apart from case, dial and earpiece) required for building the Micro-6, drawn to actual size. They include the smallest components ever to be made available to domestic set constructors. Being of the kind used in space and computer electronics, they have to be reliable. The tuning system has ingenious vernier control for easy station separation. The batteries (obtainable anywhere) are each smaller than an aspirin tablet and give upwards of 70 hours working life! The 8-page fully illustrated instruction manual shows very clearly how to assemble the Micro-6 step by step making it easy for anyone to build.

All parts required to build the Micro-6 including lightweight earpiece, case and instructions come to

59/6

"Transrista" nylon strap for wearing the Micro-6 like a wrist watch. **7/6**

Mallory Mercury Cell Type ZM 312 (2 required) each 1/11. Pack of 6, 10/6

Build it in a single evening

WHAT THE UNIQUE SINCLAIR GUARANTEE MEANS TO YOU

Every purchase you make from Sinclair Radionics Ltd., is covered by the following guarantee:

If you are not completely satisfied with your purchase (we are confident you will be delighted) the amount you have paid will be refunded in full instantly and without question.

FULL SERVICE FACILITIES ALWAYS AVAILABLE TO ALL SINCLAIR CUSTOMERS

SINCLAIR SLIMLINE

The ideal Sinclair design for beginners

4-STAGE POCKET RECEIVER

Here's a fine performing set which is ideal for newcomers to transistor building. It has a self-contained aerial and takes a standard PP5 battery. Measures only 2 11/16 x 1 11/16 x 3/4 in. Tunes over medium waveband by means of vernier type control.

The Slimline has great power and quality and will bring in B.B.C. and European programmes with great ease.

All parts including royal blue and gold case, earpiece and easy to follow instructions come to **49/6**

SINCLAIR X-10

UNIQUE 10 WATT AMPLIFIER

See preceding Sinclair pages

SINCLAIR MICRO-AMPLIFIER

- Makes an F.M. Transmitter
- Makes an Audio or Broad Band R.F. Amplifier

Smaller than a 3d. piece! Frequency response 30 to 50,000 c/s ± 1dB. Power gain 60dB (1,000,000 times). Instructions show you how to make a broadband R.F. amplifier, F.M. transmitter or a sub-miniature hi-fi amplifier with an output suitable for any earpiece or even loudspeaker. A fascinating design for experimenters, modellers etc. Parts and instructions come to **28/6**

TO SINCLAIR RADIONICS LTD., COMBERTON, CAMBRIDGE *Phone:* COMBERTON 682

Please send items detailed below £ s. d.

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TOTAL £

For which I enclose cash/cheque/money order

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ADDRESS ....

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BLOCK LETTERS P.W.165

BOOKS & PUBLICATIONS

AUDIO, America's foremost journal. Year's subscription 43/-, specimen copy 4/-. All American radio journals supplied—list free. WILLEN (Dept. 46), 61a Broadway, London, E15.

SOUND RECORDINGS

A UNIQUE BUY! Recording tape top brand, 7in. 2,400ft. D.P. 25/-; 5¾in. 1,200 ft. **19/6d.** P. & P. 1/6d. per spool. Bargains in all sizes. S.A.E. for list. We repair, buy and sell recorders. E. C. Kingsley & Co. Ltd., 132 Tottenham Court Road, London.

RECEIVERS & COMPONENTS

TRANSISTORS now half price, unmarked but tested packets of 16; unmarked, untested packets of 40; duds suitable as diodes, packets of 80. All packets **10/-** each, postage 1/-. Four packets post free C.W.O. K. R. WHISTON (Dept. PWT), New Mills, Stockport.

R & R RADIO & T V SERVICE

Dept. P.W.
MARKET STREET, BACUP, LANCS.
Telephone 465

SALVAGE VALVES Tested before dispatch

6F13	4/6	10P14	5/-	PL82	3/6	20P4	6/6
6L18	4/6	20P5	6/6	U801	7/6	30P16	5/-
EF80	1/6	30P4	7/-	10F1	1/6	PCC84	4/-
ECC82	3/-	6F15	5/-	20F2	5/6	PCL83	5/-
ECL80	3/6	EB91	1/-	30FL1	5/-	PY81	3/6
30F5	5/-	EF85	5/-	PY32	6/-	U301	6/-
PL38	6/-	6/30L2	4/-	6U4GT	5/-	10P13	5/6
PCF80	4/-	20P3	6/-	6F1	2/6	20D1	2/-
PL81	5/-	30PL1	4/-	ECC81	3/-	30P12	5/-
PZ30	5/-	PL36	6/-	EY86	4/-	PY82	5/-
U329	5/-	PCL82	5/-				

Speakers, Ex-TV. 5in. round, 6 x 4in. 3/6; 8in. round, 6/-; post 2/-.

Line Output Transformers available. State set model No.

Turret Tuners, 8/-, post 2/-.

Scan Coils, etc. Quote set model No. with all enquiries and S.A.E. for prompt reply. All goods subject to satisfaction or money refunded.

TRANSISTORISED SIGNAL INJECTOR. Complete kit of components and circuit of injector for testing and amplifier or radio. **7/6d.** only. Post free. G. F. MILWARD, 17 Peel Close, Drayton Bassett, Staffs.

AERIAL MATCHING TUNING UNITS

LATEST AMERICAN RELEASE BULK PURCHASE OF 3,000

These well made tuning units made for the American 19 T.X.-R.X. are housed in a metal case, size 4 x 4 x 10in., using a large precision calibrated scale, are an essential piece of equipment for the serious T.X. or R.X. operator. This unit will match an untuned wire or whip aerial to almost any short wave receiver or transmitter, exceptionally good for mobile top band use. This American version being well noted as far superior to any other. GUARANTEED BRAND NEW only **20/-**, post 7/6. Instructions supplied.

PYE OR INVICTA LOUDSPEAKER UNITS

Enclosed in a brown wooden cabinet and carrying handle, using a silver speaker mesh. Complete with 40ft. of lead and Jack Plug. A 10in. heavy duty 3 ohm speaker is used, being very useful for Groups, Halls, P.A. work etc. (made for Army entertainment use). BRAND NEW and BOXED Only **£2.15.0**, carr. 5/-, a fraction of cost.

88 T.X.-R.X. POWER UNIT

12V input to 90V, 7.5V, 1.4V stabilised output. Also contains L.F. amplifier. These are sold BRAND NEW with 4 B.7.G. valves, only **50/-**. P.P. 5/-.

J. T. SUPPLY (Dept. D)
38 MEADOW LANE, LEEDS 11

RATES: 7/3 per line or part thereof average five words to line, minimum 2 lines. Box No. 1/- extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Wireless," Tower House, Southampton St., London W.C.2.

RECEIVERS & COMPONENTS
(continued)

"HEATHKITS" can now be seen in London and purchased on easy terms. Free brochure. DIRECT TV REPLACEMENTS LTD., Dept. PW7/9, 126 Hamilton Road, West Norwood, S.E.27. GIPsy Hill 6166.

TUBES—FAMOUS MAKES!

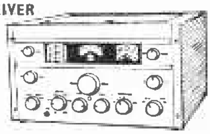
MW43/69, AW43/80, MW36/24, AW43/88 etc. Fully screened, aluminised, 100% new (except glass). Mostly **£4.15s.** (12/6 cge.). **LISTS. One Year's Guarantee Card. STOP PRESS!—BY100/PY800 57/- doz.** U.26 (equivalent) **8/6** each.

P. BEARMAN, 43 Leicester Road
New Barnet, Herts. Tel.: BAR 1934

FM OUTSIDE DIPOLE (or loft) cranked arm with bracket, **12/6** plus 2/6 p. & p. (list 35/-). F. WRIGHT, 19 St. James Road, Salford 7, Lancs.

TRANSISTORS! Give away price. NKT124/5 Power Type, 6 for **10/-**. 2SO17 4W, up to 60Mc/s, **5/-** each. Post free. G. F. MILWARD, 17 Peel Close, Drayton Bassett, Staffs.

RCA AR88D RECEIVER



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2½	7000	80	8/-	4	6000	35	10/6	5	8500	3	9/6
3	8500	3	10/-	4	7000	35	11/-	5	9500	3	10/6
3	6000	5	8/6	4	9500	35	11/6	5	9500	5	10/6
3	7000	5	9/-	4 Twtr.	10000	3	11/6	5	9500	15	12/6
3	7000	35	9/-	4	9500	15	12/-	5	8500	25	10/6
3½	9500	3	10/6	5	6000	3	8/-	5	9500	35	11/6
3½	9500	8	10/6	5	6000	5	8/-	6½	6000	3	11/-

Elliptical Size	Gauss in lines	Imped. in ohms	Price	Elliptical Size	Gauss in lines	Imped. in ohms	Price	Elliptical Size	Gauss in lines	Imped. in ohms	Price
5 × 3	6000	3	7/6	6 × 4	9500	35	12/-	8 × 2½	7000	5	9/-
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5 × 3	9500	35	11/-	7 × 4	9500	3	11/-	8 × 2½	9500	4	10/-
5 × 3	9500	3	9/-	7 × 4	10000	3	12/6	8 × 2½	9500	5	10/-
6 × 4	6000	3	8/6	7 × 4	10000	15	13/6	8 × 5	8500	3	11/-
6 × 4	7000	3	9/-	7 × 4	9500	30	12/6	8 × 5	10000	3	13/-
6 × 4	8500	3	9/6	7 × 4	9500	35	12/6				
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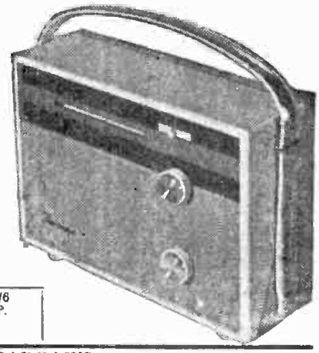

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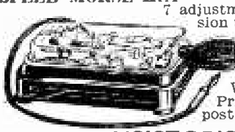

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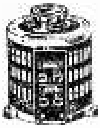

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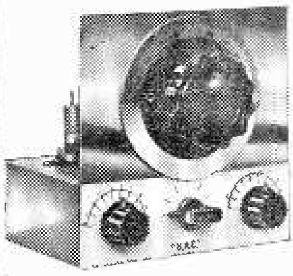

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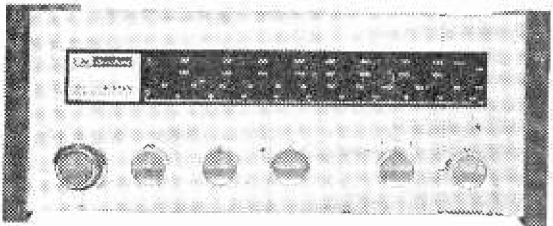

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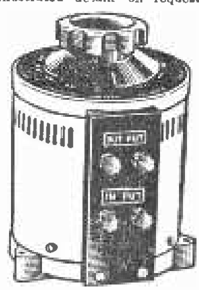

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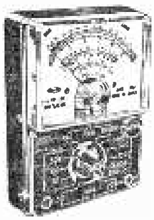

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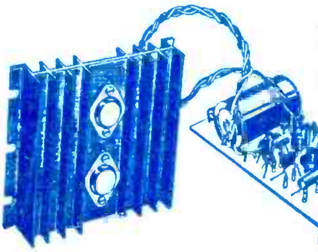

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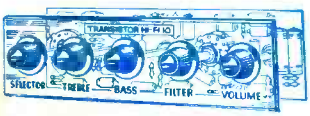

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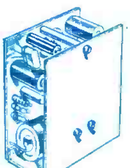

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