31. LEOP

PRACTICAL WIRELESS

NOVEMBER 1965

2/-

FREE INSIDE

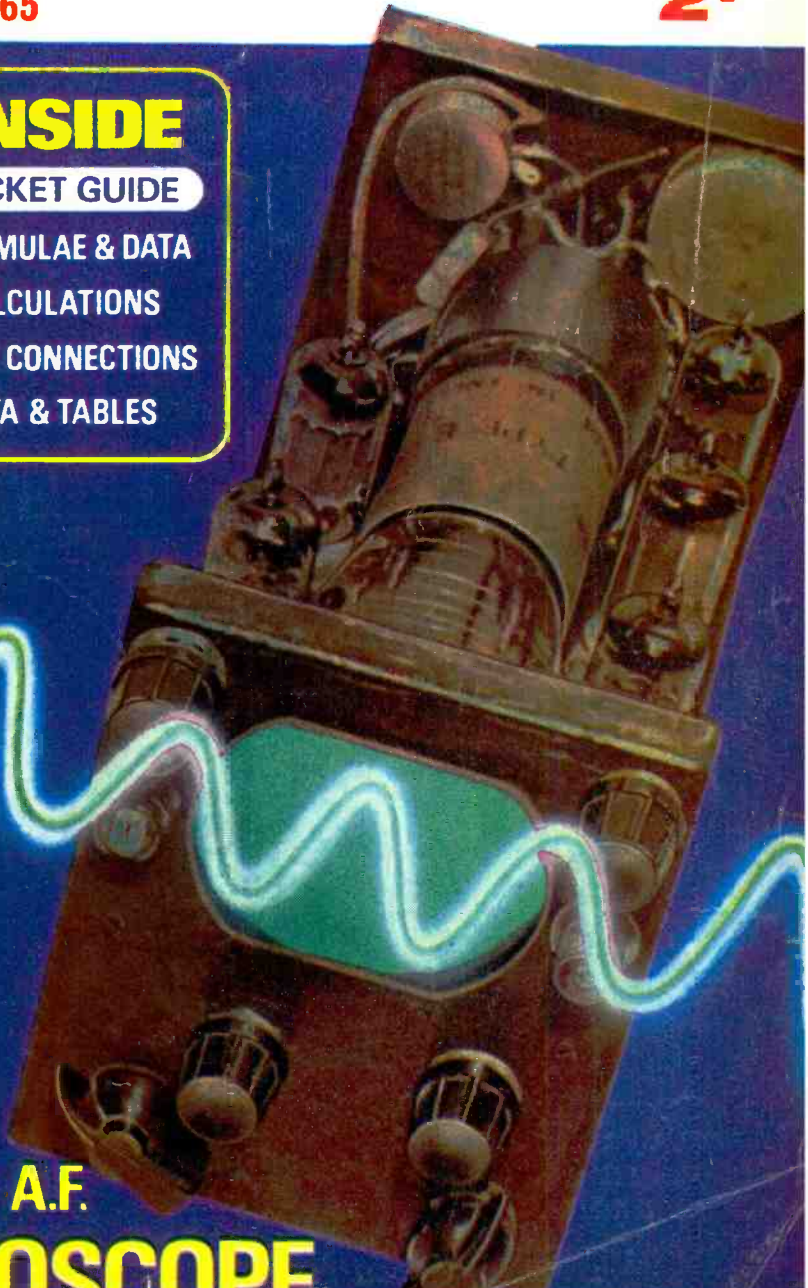
24-PAGE POCKET GUIDE

BASIC RADIO FORMULAE & DATA

OHMS LAW CALCULATIONS

TRANSISTOR BASE CONNECTIONS

WORKSHOP DATA & TABLES



MINIATURE A.F. OSCILLOSCOPE

Tubes

HIGHEST QUALITY
COMPARE OUR PRICES

GUARANTEE

Carr. & Ins. 12/6

MOST MULLARD MAZDA, COSSOR, EMITRON, EMI-SCOPE, BRIMAR, FERRANTI TYPES PROCESSED IN OUR OWN FACTORY

Size	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	
15-17in.	£3. 5.0	£4. 5.0	MW 36/24 £4.15.0
19in.	£3. 5.0	£4. 5.0	
21in.	£3.15.0	£5.15.0	CRM 172 MW 43/64 £6.0.0
23in.	£3.15.0	£5.15.0	

SATISFACTION GUARANTEED

Autochangers, etc.

LATEST GARRARD

All Factory Fresh. All with cartridge. **SRP10** Mono (Single) Player, £4.19.0. **SP25** Semi-Transcription (Single) £11.19.0. **AUTOSLIM** Standard Auto, £5.19.0. **AT6** Auto (Limited Number), £8.19.0. **AT5** Slimline—similar to AT6, £7.15.0. **Model 1,000**—Compact low-priced record changer, automatically playing up to 10 records, £6.19.0. **Model 2,000**—Automatic record changer with large turntable, playing up to 8 records, £7.19.0. **Model 3,000**—Designed for use with high-compliance cartridges; low-mass arm gives exceptionally low record wear, £10.10.0. **AT60**—Automatic or manual operation, has precision arm, bias compensator and heavy turntable, £11.19.0. **A70**—For the critical user—offers automatic playing, with pusher-platform, and many other features, £19.19.0. **LAB80**—An outstanding automatic transcription turntable for professional reproduction, £25. **301**—Transcription Heavy Table, £22. **401**—Transcription turntable with heavy 12in. turntable, machine-cut strobe neon lamp and speed control, £29.19.0. **Model 50**—Automatic record changer with large turntable, weight-counterbalanced arm and plug-in pick-up head, £9.10.0.

B.S.R.

GU7—Single Deck Complete, £4.5.0.
UA14 or U25—Auto Changer, £5.15.0.

PRICES SLASHED

LZ27 TAPE RECORDERS. Famous make, latest Silver/Grey finish. 4 inputs, 2-speed 3¾ x 7½in. Complete with microphone, footage counter, volume level indicator, tone control, spare spool. This machine takes 7in spools and is a full size Recorder, not a toy! Price normally £30.9.0. 5/- p.p. **£17.10.0**

WALKIE TALKIES TYPE RT33. The very latest Silver/Black finish. They gave a fantastic performance with reliability, long telescopic aerial, crystal controlled. Note a licence is required to transmit. They compare with much dearer models. 2/6 p.p. **£8.19.0**

MEMO CALL. Pocket sized battery operated tape recorder, complete with tape, earphone, built-in speaker. Normally £12.10.0. A must for those who want to record telephone conversations ideas, letters etc. whilst travelling or home 2/6 p.p. **£8.10.0**

TELEPHONE AMPLIFIER. "Desk Companion". A larger model complete with pen and holder etc. Fully portable and transistorised. A must for the desk leaving both hands free to deal with papers, etc. etc. 2/6 p.p. **£3.10.0**

25 WATT GUITAR SPEAKERS. Very heavy coned 12in. cast chassis. There is nothing to touch it for power handling and quality at the price. Plus 5/- p.p. **£4.19.0**

BINATONE 10-TRANSISTOR. All wave set, complete with telescopic aerial, earphone, leather case, medium size, superb performance. Not to be confused with cheap sets, amazing value. **£10.19.0**

MULT.-METERS. TK.20.A. 8 Ranges AC/DC/Current/Resistance 0-100K, moving coil. **49/6**

EP.10.K. 10,000 OPV. High quality. 15 Ranges AC/DC/Current/Resistance, Accuracy ±3%. **£3.19.6**

EP.20.K. 20,000 OPV, more sensitive version of EP.10.K. **£4.19.6**

EP.30.K. 30,000 OPV, 18 Ranges, including Resistance to 10 Meg. **£6.19.6**

EP.50.K. Professional Quality, 22 Ranges, AC/DC/Volts/Current/Response/Decibels/Capacitance. **£9.19.6**

TEST EQUIPMENT. IT1-1 Transistorised Signal Injector, complete with Transistor Oscillator with Indicator Lamp, Detachable Test Probe and instructions. **35/-**

IDEAL FOR ANY RECORDER. PRICES SLASHED. GUARANTEED APPROX. ½ PRICE. WORLD FAMOUS MAKE BY ENORMOUS PURCHASE.

★ TAPE ★

We offer you fully tensilised polyester/mylar and P.V.C. tapes of identical quality hi-fi, wide range recording characteristics as top grade tapes. Quality control manufacture. Not substandard in any way. Try one for yourself. They are truly worth a few more coppers than acetate, substandard, jointed or cheap imports. Try one and prove it for yourself!

Standard Play			Double Play		
3"	150ft.	2/3	3"	300ft.	4/-
4"	300ft.	4/6	4"	600ft.	8/-
5"	600ft.	7/6	5"	1200ft.	15/-
5¾"	900ft.	10/6	5¾"	180ft.	19/6
7"	1200ft.	13/6	7"	2400ft.	27/-
Long Play			**Triple Play**		
3"	225ft.	2/9	4"	900ft.	13/-
4"	450ft.	5/6	5"	1800ft.	25/-
5"	900ft.	10/6	5¾"	2400ft.	34/-
5¾"	1200ft.	13/-	7"	3600ft.	44/-
7"	1800ft.	18/6	**Quadruple Play**		
			3"	600ft.	8/-

Postage 1/- or Post Free less 5% on three reels. Quantity and Trade enquiries invited.

AM/FM RADIOS

Latest wonderfully styled, guaranteed top make. 10-transistor with full long and medium waves. Size 9¾ x 6 3/16 x 12 13/16 in. Magnificent reproduction. A pleasure to look at. "An aristocrat in its class". 12 months guarantee against faulty manufacture. Genuine retail price £28.7.6. Unrepeatable. **17 Gns.**

QUALITY PORTABLE TAPE RECORDER

Fabulous quality and reproduction of music. 6 transistor, 1⅞in. and 3¾in. speeds. Output 500mW into high quality speaker. Ingenious single control knob. Fast forward and rewind. Battery level and record level meter. Fast load. Precision capstan drive with dynamic earpiece monitor recording. Radio recording leads. Outside speaker facilities. The most outstanding portable in the country. Size 8 13/16 x 3¾ x 6⅝in. Genuine normal price of 35 gns. Unrepeatable. 12 month guarantee. All spares available. With tape, tape reel, mike, etc. **19Gns.**

VALUE IN VALVES

GUARANTEED 3 MONTHS BY RETURN OF POST

Satisfaction or Money Back Guarantee on goods if returned unused within 14 days. ALL VALVES ARE NEW UNLESS OTHERWISE INFORMED. FREE TRANSIT INSURANCE. POSTAGE 1 valve 6d., 2-11 1/-, Free over 12.

0Z4	4/6	6K8GT	8/3	14S7	14/6	EBC41	6/3	EZ41	5/9	R19	9/6
1A7GT	9/6	6K25	8/6	19AQ5	7/9	EBC81	5/9	EZ80	5/9	SP41	2/3
1C5GT	7/6	6L1	9/6	20D1	8/9	EBF80	7/6	EZ81	6/-	SP61	2/-
1H5GT	8/9	6L6	7/6	20F2	9/6	EFB89	7/9	FC4	8/-	T41	6/9
1N5GT	8/9	6L6G	6/6	20L1	16/-	EBL21	9/9	GZ32	7/6	TDD4	7/-
1S4	7/6	6L18	7/9	20P1	9/6	EBL31	19/6	HVR2	9/-	U14	7/6
2D21	5/6	6L19	12/6	20P3	11/-	EC52	4/9	KT33C	3/9	U18	7/6
3A4	4/-	6LD20	7/9	20P4	17/-	ECC32	4/-	KT36	14/-	U22	6/9
3A5	6/-	6P25	8/6	25A6G	8/-	ECC34	9/-	KT44	6/-	U24	12/6
3D6	4/-	6P28	9/9	25L6GT	7/9	ECC40	6/9	KT45	8/6	U25	8/3
3Q4	5/-	6Q7G	4/-	25Z4G	7/-	ECC81	4/9	KT61	8/6	U26	7/-
5R4GY	8/-	6Q7GT	8/-	30F5	6/-	ECC82	4/9	KT73	5/9	U35	12/6
5U4G	4/-	6SA7	5/9	30FL1	9/6	ECC83	5/9	KT66	12/-	U50	4/6
5Y3G	4/6	6SG7	4/9	30L15	8/9	ECC84	7/6	KT76	8/6	U107	12/6
5Y3GT	4/-	6SK7	5/-	30P4	9/6	ECC85	6/-	KT88	17/6	U191	9/-
5Z4	9/-	6SL7GT	5/6	30P12	7/-	ECC88	9/6	KTW61	5/9	U281	8/6
5Z4G	7/-	6SN7GT	4/6	30PL1	9/3	ECF80	6/-	KTW63	5/-	U282	15/-
5Z4GT	9/6	6SQ7	5/9	35C5	8/6	ECF82	8/3	KTZ63	7/-	U301	12/6
6/30L2	9/-	6U4GT	8/-	35L6GT	8/-	ECH21	11/6	MU14	7/-	U329	8/6
6A8G	7/9	6V6G	4/6	35W4	6/-	ECH35	7/6	N37	10/6	U801	19/-
6A7G	7/6	6V6GT	6/-	35Z4GT	5/6	ECH42	8/6	N78	13/-	UABC80	7/-
6AK5	4/3	6X4	4/6	50L6GT	8/6	ECH81	7/-	N108	13/-	UAF42	7/9
6AQ5	5/-	6X5G	5/-	80	5/-	ECH83	6/3	PC86	10/-	UB41	6/6
6AT6	5/-	6X5GT	5/6	185BT	19/6	ECL80	6/6	PC97	7/6	UBC41	7/6
6AU6	7/-	7B6	9/-	185BTA	19/6	ECL82	8/-	PCC84	6/6	UBC81	6/-
6AV6	6/-	7B7	5/6	807(A)	5/-	ECL83	10/6	PCC85	6/6	UBF80	7/9
6BA6	5/6	7C5	7/3	807E	4/9	ECL86	10/3	PCC88	11/9	UBF89	7/6
6BE6	5/6	7C6	7/6	813	49/-	EF36	3/-	PCC89	8/6	UBL21	9/6
6BG6G	15/-	7H7	5/-	866A	12/6	EF39	4/6	PCC189	13/6	UCC85	7/3
6BH6	5/-	7S7	8/9	954	3/6	EF40	11/-	PCF80	6/9	UCF80	8/6
6BJ6	5/-	7Y4	4/6	955	2/3	EF41	8/-	PCF82	6/-	UCH21	9/3
6BR7	8/6	10C1	9/-	956	2/-	EF54	3/3	PCF84	12/-	UCH42	7/3
6BW6	6/9	10C2	14/6	9001	3/6	EF80	3/6	PCF86	7/6	UCH81	7/9
6BW7	5/-	10F1	4/9	9002	4/9	EF85	6/-	PCL82	7/9	UCL82	8/-
6C4	2/3	10LD11	14/6	9003	5/6	EF86	7/6	PCL83	9/-	UCL83	10/-
6C5	5/6	10P13	8/6	ATP4	2/6	EF89	6/9	PCL84	7/3	UF41	6/6
6C6	5/6	10P14	9/6	AZ31	6/-	EF91	3/-	PCL85	7/6	UF42	4/9
6C9	11/-	12AH7	7/-	B36	4/6	EF92	3/-	PCL86	10/6	UF80	6/3
6CD6G	17/-	12AH8	9/-	CBL31	19/-	EF183	9/9	PEN25	3/9	UF85	7/6
6D6	3/-	12AT6	6/6	CL33	9/-	EF184	9/6	PEN45	8/6	UF89	5/9
6F1	4/9	12AT7	4/9	CY31	7/6	EL32	3/9	PEN46	4/6	UL41	7/6
6F6G	3/6	12AU6	9/-	DAF91	4/6	EL33	6/6	PL33	8/6	UL44	14/-
6F13	4/3	12AU7	4/9	DAF96	7/3	EL34	11/6	PL36	9/6	UL46	8/3
6F14	9/6	12AV6	6/3	DF91	3/-	EL35	6/-	PL38	17/6	UL84	7/-
6F15	9/6	12AX7	6/-	DF92	3/-	EL38	12/6	PL81	7/9	UR1C	7/6
6F23	6/6	12BA6	7/-	DF96	7/3	EL41	8/-	PL82	6/6	UM80	9/6
6J5G	3/-	12BE6	6/6	DK91	5/6	EL42	7/9	PL83	6/6	UU6	8/9
6J5GT	4/3	12BH7	8/9	DK92	7/-	EL84	6/6	PL84	7/6		
6J6	2/6	12E1	17/6	DK96	7/3	EM34	8/6	PY31	8/-	UU8	11/-
6J7G	4/9	12J7GT	8/-	DL92	5/-	EM80	7/9	PY32	10/-	UY21	9/6
6J7G7	7/6	12K7GT	4/-	DL94	6/6	EM81	6/9	PY80	6/6	UY41	6/-
6K6GT	6/-	12K8	9/9	DL96	7/3	EM84	8/9	PY81	5/9	UY85	5/-
6K7	5/9	12K8GT	9/6	EABC80	6/6	EM85	8/6	PY82	5/9	VR105	5/-
6K7G	1/-	12Q7GT	5/-	EAF42	3/3	EY51	7/6	PY83	5/9	VR150	7/9
6K7GT	4/6	12SA7	6/3	EB41	5/-	EY86	7/3	PY88	9/-		
6K8	8/6	12SK7	2/9	EB91	2/-	EY88	8/6	PY800	6/3	X66	7/9
6K8G	5/-	12SQ7	7/6	EBC33	4/9	EZ40	6/6	PZ30	9/6	Z66	8/6

CONNECTING WIRE

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

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

MAINS TRANSFORMERS

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

SPECIAL C.R.T. OFFER
Due to huge Bulk Special Purchase we are offering CRM141 and MW 36/24 Tubes at the unrepeatable price of 39/-. P.P. 12/6. The above are guaranteed for 6 months.

★ BULK BARGAINS ★

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

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

100 RESISTORS 6/6
Excellent. Sizes ½–3 watt.

100 CONDENSERS 9/6
Miniature Ceramic and Silver Mica Condensers, 3pF to 5,000pF. LIST VALUE OVER £5.

25 TAG STRIPS 4/-
2, 4, 6 8-way etc. Unused.

100 HI STABS 9/6
1% to 5% 100Ω to 5 mΩ.

TRANSISTORS

GUARANTEED TOP QUALITY

Huge reduction, Red Spot standard LF 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. or 6/6 doz. **8d.**

Gold Bonded highest quality Individually tested. 9/6 doz. **1/-**

SILICON RECTIFIERS

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

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

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

TECHNICAL TRADING CO.

Retail Only, Hi-Fi Demonstrations, 72 East Street, Southampton Tel. 25851
11/12 North Road, Brighton, Tel. 67999
ALL MAIL ORDER AND RETAIL SHOP
350/352 FRATTON RD., PORTSMOUTH Tel. 22034

LASKY'S RADIO

Offer the Finest Value and HOME CONSTRUCTORS

We consider our construction parcels to be the finest value on the home constructor market. If on receipt you feel not competent to build the set, you may return it as received within 7 days when the sum paid will be refunded less postage.

THE "SKYROVER" RANGE

GENERAL SPECIFICATION

7 transistor plus 2 diode superhet, 6 waveband portable receiver. Operating from four 1.5 v. torch batteries. The SKYROVER and SKYROVER DE LUXE cover the full Medium Waveband and Short Waveband 31-94 M and also 4 separate switched band-spread ranges, 13M, 16M, 19M and 25M, with Band Spread Tuning for accurate Station Selection. The coil pack and tuning heart is completely factory assembled, wired and tested. The remaining assembly can be completed in under three hours from our easy to follow stage by stage instructions.

A simple additional circuit provides coverage of the 1100/1950M. band (including 1500 M. Light programme). All components and detailed construction data. **Only 10/- extra** Post Free. This conversion is suitable for both models that have already been constructed.

Data for Receiver 2/6 extra. Refunded if you purchase the parcel. Four U2 batteries 3/4 extra. *All components available separately.*

NEW—The SKYROVER Mk III

Now supplied with redisigned cabinet, edgewise controls, black and chrome plastic cabinet. Size 10 x 6½ x 3½in. with carrying handle. Can now be built for **£8.19.6** Post 5/-. H.P. Terms: 27/- dep. and 11 months at 15/9. Total H.P. Price £10.0.3.

The SKYROVER DE LUXE

Tone Control Circuit is incorporated with separate Control. In a wood cabinet size 11½ x 6½ x 3in., covered with a washable material with plastic trim and carrying handle. Car aerial socket fitted. Can now be built for **£10.19.6** Post 5/-. H.P. Terms: 33/- dep. and 11 mths at 19/2. Total H.P.P. £12.3.10

The "REALISTIC" Seven

★ 7-transistor Superhet. ★ 350 milliwatt output into 4in. high flux speaker. ★ All components mounted on a single printed circuit board. ★ Full medium and longwave cover. ★ Plastic cabinet with carrying handle, size 7 x 10 x 3½in., Blue/Grey or all Grey. ★ Socket for car aerial. ★ I.F. frequency 470 Kc/s. ★ Ferrite rod internal aerial. Operate. from PP9 or similar battery. ★ Full data supplied. All coils and I.F.'s etc. fully wound ready for immediate assembly. Any outstanding receiver.

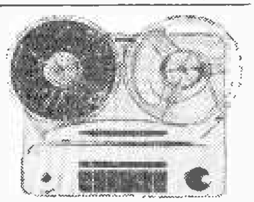
Can be built for **£5.19.6** Post 4/6

PP9 Batt. 3/9. Data and instructions separately 2/6. Refunded if you purchase the parcel. All parts sold separately

REALISTIC Seven DE LUXE

With the same specification as standard model—PLUS a superior wood cabinet in contemporary styling with full vision circular dial. ONLY **£1** EXTRA

COLLARO STUDIO TAPE DECKS



3 speed model—1⅞, 3¾ and 7½ i.p.s., available with either ½ track or ¼ track heads. Fitted with 3 motors; pause control and tape position indicator. Fast forward and rewind. Deck size: 12¼" x 10¼" x 4". For use on 110-125v., 50 or 60 c.p.s. mains but by the simple addition of a step-down auto transformer these decks can be operated direct from normal 200-250v. A.C. mains. State whether 50 or 60 c.p.s. model required when ordering (note: U.K. mains is normally 50 c.p.s.). Brand new and unused.

LASKY'S PRICE ½ track Model **£6.19.6**

LASKY'S PRICE ¼ track Model **£10.10.0**

Carriage and Packing 7/6 extra.

Suitable Mains auto transformer 15/6 if ordered with the deck. (List price 19/6).

Standard Model for 200/250v. mains operation available ½ track £10.10.0; ¼ track £13.19.6. Post 7/6.

ELIZABETHAN LZ 27 PORTABLE TAPE RECORDER

Special Bargain Offer—brand new, unused and fully guaranteed. Brief specification: 2 speeds—7½ and 3¾ i.p.s.; 2 track; 3½ watt output; inputs for mic. and radio; outputs for ext. speaker and additional amp. or monitor; built in 7 x 4in. speaker; tape position and record level indicators: fast forward and rewind. Volume and tone controls also superimpose facilities. Takes 7in. spools For 200/250v. A.C. mains. Attractively styled cabinet with carrying handle and detachable lid, size: 16 x 13 x 7in. Complete with crystal mic., tape and empty spool. **Makers List Price 27 Gns.**

LASKY'S PRICE **18 Gns.** Carriage and Packing 10/-

SINCLAIR MINIATURES

THE MICRO-6

Self-contained pocket radio. Size only 1⅘ x 1⅘ x ½in. Amazing performance. Complete with earphone and detailed construction data. Can be built for only **59/6** Mercury cell 1/11 extra. All parts sold separately

THE SLIMLINE

2-transistor pocket radio. Size only 2¾ x 1⅞ x 1⅛in. Micro alloy transistors on printed circuit. CAN BE BUILT FOR **49/6**

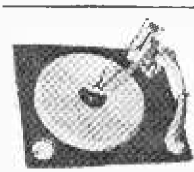
THE NEW X-20 AMPLIFIER

20 watts P.W.M. amplifier and pre-amplifier built on single printed circuit size 8¾ x 3½in.—weight only 4½ ozs. built! Input sens. 1mV for 20 watts out. Output Imp. 7.5 and 15 ohms. KIT PRICE **£7.19.6** Post Free. AVAILABLE READY BUILT AND TESTED £9.19.6. Post Free. 3 pots. for vol. bass and treble, 7/6 the 3 extra mains power pack, if required £4.19.6.

THE X-10 AMPLIFIER

10 watt power amplifier fitted with integrated pre-amplifier. Requires only 1mV. for an output of 10 watts. Only 6 x 3 x 1in. KIT PRICE **£5.19.6** Post Free. AVAILABLE READY BUILT, TESTED AND GUARANTEED, £6.19.6. Post Free. 3 pots for Volume, Bass and Treble. 7/6 the 3 extra. Mains power pack if required 54/-.

B.S.R. AUTOCHANGERS—BRAND NEW AT LOWEST EVER PRICES



Brand new and fully guaranteed—complete with cartridge and stylus.

UA14 4 speed mains model £4.9.6
UA16 4 speed mains model £4.19.6
UA16 9 v. battery model £5.19.6
UA20 4 speed mains model £5.19.6

Add 5/- carriage and packing on each.

U.H.F. TUNERS

Only a few available. Complete with PC86 and PC88 valves. We regret no circuit or data is available. Knobs included.

Lasky's Price 79/6 Post 2/6.

INTERNATIONAL TAPE

Famous American Brand—Fully Guaranteed

3in.	Message tape, 150ft.	3	6
3in.	Message tape, 225ft.	4	11
3in.	Message tape, 300ft.	7	6
3¼in.	Triple play, 600ft., Mylar base	15	0
4in.	Triple play, 900ft., Mylar base	17	6
5in.	Double play, 1,200ft., Mylar base	15	0
5in.	Long play, 900ft., Acetate base	10	0
5in.	Standard play, 600ft., PVC base	8	6
5in.	Triple play, 1,800ft., Mylar base	35	0
5¾in.	Double play 1,800ft., Mylar base	22	6
5¾in.	Long play, 1,200ft., Acetate base	12	6
5¾in.	Standard play, 850ft., PVC base	11	6
5¾in.	Triple play 2,400ft., Mylar base	45	0
7in.	Standard play, 1,200ft., Acetate base	10	0
7in.	Standard play, 1,200ft., Mylar base	12	6
7in.	Long play 1,800ft., Mylar base	19	6
7in.	Double play, 2,400ft., Mylar base	25	0
7in.	Long play 1,800ft., Acetate base	15	0
7in.	Triple play 3,600ft., Mylar base	58	6

P. & P. 1/- extra per reel; 4 reels and over Post Free

GORLER UT 340 FM/VHF TUNING HEART

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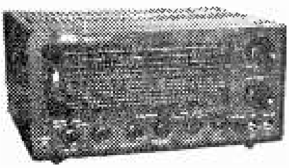

Supplied in sub-assemblies for easy building. Covers range from 540 Kc/s to 30 Mc/s. Ham Band is provided with a scale for direct reading and can also be band spread, 9 valves. Facilities: A.N.L., A.V.C. and M.V.C. Q Multiplier also serves as B.F.O. H.F. stage and two I.F. stages ensure high sensitivity and selectivity (all coils and I.F.s are supplied pre-aligned). 2 Aerial Sockets. Stand-by position for use with a transmitter S meter fitted. 200-250v. A.C. mains. Steel cabinet, grey crackle finish. Size 15 x 8 x 10in. Dial 12 x 4in. All parts new and fully guaranteed. Complete with full construction data and operating manual.

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H.P. Terms Available.

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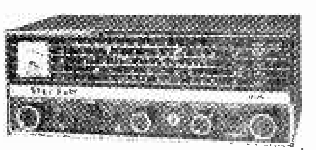

Covers medium wave band and 1.6-4.4 Mc/s. 4.5-11.0 Mc/s., 11.0-30.0 Mc/s. in separate switched band spread ranges. Controls include B.F.O. Sensitivity. A.N.L. Receiver—Stand-by Switch. Tone Switch. S-Meter. For 200-250v. A.C./D.C. Internal loop and telescopic antennae fitted. Valve line-up: 12BE6, 12BA6 12AV6, 50C5, and metal rectifier. Size 13½ x 8½ x 5½in. Instruction manual included. No Kits available.

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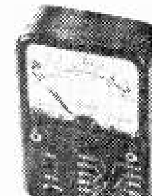
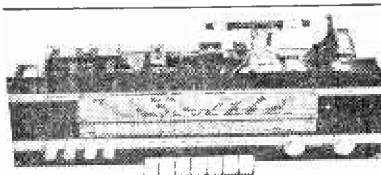
The "Sixteen" Multirange METER KIT



This outstanding meter was featured by *Practical Wireless* in the Jan. '64 issue. Lasky's are able to offer the complete kit of parts as specified by the designer.
RANGE SPECIFICATION: D.C. volts: 0-2.5-25-50-250-500 at 20,000 Ω/V A.C. volts: 0-2.5-50-250-500 at 1,000 Ω/V. D.C. current: 0-50μA. 0-2.5-50-250 mA. Resistance: 0-2,000 Ω. 0-200 Ω. 0-20M Ω. Basic movement: 40μA f.s.d. moving coil. Black plastic case, 3⅞ x 5⅞ x 1⅞in. Controls: 12 position range switch: separate slide switch for A.C. volts—D.C. ohms; ohms zero adjustment pot. meter; meter zero. Complete with all parts and full construction details. Data and circuit available separately, 2/6 refunded if all parts bought. Pair of Batteries. 2/5 extra. H.P. terms available.

LASKY'S PRICE £5.19.6 P. & P. 5/-

THE LATEST "KUBA" IMPORTED AM/FM STEREO RADIOGRAM CHASSIS



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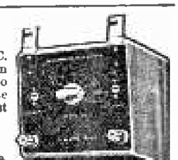

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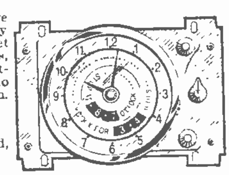

Type 2. An electric clock with combined sequence switching to give automatic switching of an electric appliance to switch on at any pre-set time up to 12 hours ahead and to switch off at any pre-set time up to 9½ hours later. Switch contacts are rated at 25 amps, 200/250 V., 50 c.p.s. and are therefore suitable for cookers and heating appliances as well as tape recorders, radios, lights, etc. Easy to set. 3in. dial. Fully enclosed mechanism—overall size 5 x 3¼ x 2¼ in.

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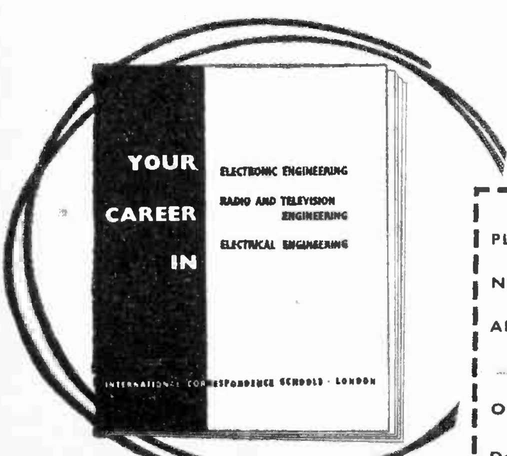

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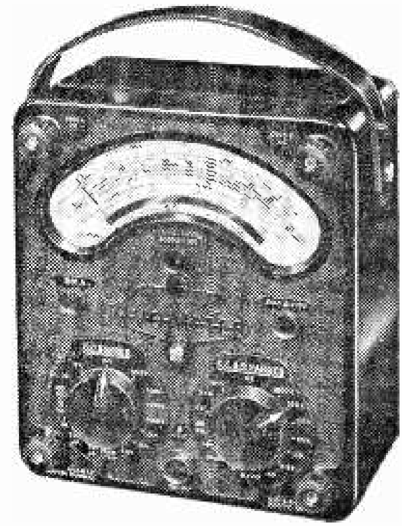

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10C1	9/9
10C2	12/-
10D1	7/-
10D2	11/8
10F1	10/-
10F9	9/9
10F18	9/9
10LD3	6/3
10LD11	9/6
10P13	12/-
10P14	11/6
11D3	17/6
11D5	17/6
11E3	17/-
12A6	2/3
12A8GT	16/6
12AC6	8/6
12AD6	9/6
12AE6	8/-
12AH7	5/-
12AH8	10/9
12AT6	4/6
12AT7	3/6
12AU6	5/9
12AU7	4/6
12AV6	5/9
12AX7	4/6
12AY7	9/9
12BA6	5/3
12BE6	4/9
12BH7	6/-
12E1	16/9
12H6GT	1/6
12J5GT	2/6
12J7GT	7/3
12K5	10/-
12K7GT	3/6
12K8GT	8/6
12Q7GT	3/6
12SA7GT	6/9
12SC7	4/-
12SG7	3/-
12SH7	3/-
12SJ7	5/-
12SK7	3/-
12SQ7	8/-
12SR7	5/-
12U5G	7/-
12Y4	2/-
13D1	5/-
13D3	5/6
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/-
20P1	12/6
20P3	12/-
20P4	13/-
20P5	11/6
25A6G	7/6
25L6	4/9
25U4GT	14/7
25Y5	7/9
25Y5G	7/9
25Z4G	6/6

25Z5	7/3
25Z6GT	8/-
27SU	23/3
28D7	6/9
30C1	6/6
30C15	10/-
30C17	11/9
30C18	9/3
30F5	7/3
30FL1	9/3
30L1	5/6
30L15	10/3
30L17	11/6
30P4	12/-
30P12	7/6
30P16	5/3
30P19	12/-
30PL1	9/6
30PL13	10/6
30PL14	11/3
30PL15	9/6
35/51	12/6
35A5	20/9
35L6GT	6/-
35W4	4/6
35Z3	16/2
35Z4GT	4/6
35Z5GT	5/9
40SUA	6/6
41MTL	8/-
41STH	10/-
42	5/-
43	10/-
45	17/6
45Z6GT	15/-
50A5	21/10
50B5	6/6
50C5	6/6
50CD6G	40/9
50L6GT	6/-
52KU	14/6
53KU	14/6
72	6/6
77	5/-
78	4/9
80	5/3
83V	8/-
85A2	6/6
90AG	67/6
90AV	67/6
90CG	42/-
90CV	42/-
90C1	16/-
150B2	16/6
150C2	5/9
161	15/-
185BT	34/11
215SG	6/6
220B	10/6
301	20/-
302	15/-
303	15/-
304	15/-
305	16/6
306	13/-
956	2/-
1203A	7/-
1622	12/6
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/-
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/-
AC/TH1	10/-
AC/TP	18/-
AC/VP1	12/-
AC/VP2	12/-
ATP4	2/3
AZ1	8/6
AZ31	9/6
AZ41	6/6
B36	4/9
B349	10/3
B719	5/9
BL63	10/6
C1	12/6
CK506	6/6
CL4	19/6
CL33	11/6
CV6	2/6
CV63	10/6
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	7/6
DAF91	3/3
DAF96	6/-
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	6/-
DF97	10/-
DH30	15/6
DH63	4/-
DH76	3/6
DH77	3/6
DH81	23/3
DH101	25/-
DH107	16/11
DK32	7/6
DK40	15/6
DK91	4/-
DK92	8/-
DK96	6/6
DL33	6/9
DL35	5/-
DL63	5/3
DL68	15/-
DL72	15/-
DL75	30/-
DL92	4/9
DL94	5/-
DL96	6/-
DL810	10/6
DM70	5/-
DM71	9/9
DW4/350	8/6
DW4/500	8/6
DY86	6/6
DY87	7/6
E80F	24/-
E83F	24/-
E88CC	13/6
E180F	19/6
E1148	1/9
EA50	1/6
EA76	6/9
EABC80	5/9
EAC91	3/3
EAF42	7/9
EB34	1/-

EB41	4/9
EB91	2/3
EBC3	20/6
EBC33	6/-
EBC41	6/6
EBC81	6/3
EBC90	3/6
EBC91	5/6
EBF80	5/9
EBF83	7/3
EBF89	5/9
EBL21	10/3
EC52	4/3
EC53	12/6
EC54	6/-
EC70	4/9
EC90	2/3
EC91	4/-
EC92	6/6
ECC31	7/3
ECC32	4/6
ECC33	29/1
ECC34	21/7
ECC35	4/9
ECC40	7/-
ECC81	3/6
ECC82	4/6
ECC83	4/6
ECC84	5/6
ECC85	5/9
ECC88	8/9
ECC189	11/6
ECC804	8/9
ECC807	15/-
ECF80	7/3
ECF82	6/3
ECF86	10/-
ECF804	24/-
ECH3	23/3
ECH21	9/-
ECH33	22/8
ECH35	6/-
ECH42	8/-
ECH81	5/9
ECH83	6/6
ECH84	9/6
ECL80	5/9
ECL82	6/6
ECL83	8/9
ECL86	8/-
EF6	20/6
EF9	20/6
EF22	6/6
EF36	3/6
EF37A	7/-
EF39	5/-
EF40	8/9
EF41	6/6
EF42	3/9
EF50	2/6
EF54	3/-
EF73	5/-
EF80	4/3
EF83	9/9
EF85	4/6
EF86	6/6
EF89	4/3
EF91	3/-
EF92	2/6
EF97	10/-
EF98	9/9
EF183	7/3
EF184	6/6
EH90	9/6
EK32	5/9
EL2	19/6
EL32	3/6
EL33	6/6
EL34	9/9
EL35	10/-
EL36	8/9
EL37	12/3
EL41	7/-
EL42	7/9
EL81	8/3
EL83	6/9
EL84	4/6

EL85	7/6
EL86	7/3
EL91	2/6
EL95	5/-
EL360	27/-
EL820	16/4
EL822	22/6
ELL80	13/6
EM4	17/9
EM34	11/6
EM35	12/-
EM71	15/6
EM80	6/3
EM81	7/-
EM84	6/-
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	5/3
EZ40	5/6
EZ41	6/3
EZ80	3/9
EZ81	4/3
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	7/6
GZ32	8/-
GZ33	14/6
GZ34	10/-
GZ37	14/6
H30	5/-
HABC80	9/3
HL2	7/6
HL13C	4/-
HL23	12/6
HL23DD	5/-
HL41	3/9
HL41DD	12/6
HL42DD	12/6
HL133DD	9/6
HN309	25/-
HVR2	8/9
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	6/-
KT36	29/1
KT41	6/6
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	8/-
LN152	5/9
LN309	9/6
LN319	9/6
LP2	9/6
LZ319	6/6

LZ329	6/6
MHD4	7/6
MHLD6	12/6
ML6	5/9
MS4B	20/5
MSP4	12/-
MU12/14	4/6
MX40	8/9
N37	10/6
N78	26/-
N108	26/2
N339	25/-
P41	3/6
P61	2/6
PABC80	6/9
PC86	9/9
PC88	9/-
PC95	6/9
PC97	6/9
PCC84	5/6
PCC85	6/9
PCC88	10/6
PCC89	11/6
PCC189	10/-
PCF80	6/6
PCF82	6/-
PCF84	8/6
PCF86	8/3
PCF801	9/9
PCF802	10/-
PCF805	9/3
PCF806	12/9
PCL82	6/6
PCL83	9/6
PCL84	7/6
PCL85	8/6
PCL86	8/9
PCL88	12/6
PEN40DD	34/-
PEN45	7/-
PEN45DD	12/-
PEN46	4/-
PEN383	10/3
PEN453DD	10/6
PENA4	7/-
PEN/DD 4020	17/6
PFL200	20/5
PL33	9/-
PL36	9/-
PL38	16/-
PL81	6/9
PL82	5/3
PL83	6/-
PL84	6/3
PL500	15/9
PM84	9/3
PT15	10/-
PX4	9/-
PX25	8/6
PY31	6/9
PY32	8/9
PY33	8/9
PY80	4/9
PY81	5/-
PY82	4/9
PY83	5/6
PY88	7/3
PY800	5/9
PY801	7/6
PZ30	9/6
QP21	5/-
QP22B	12/6
QQVO3/10	35/-
QS7520	10/6
QS150/15	9/6
R10	15/-
R12	5/6
R16	29/-
R17	17/6
R18	9/6
R19	6/9
R52	7/6

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	10/-
TH21C	10/6
TH30C	14/6
TH41	10/-
TH233	6/9
TP22	5/-
TP25	5/-
TP2620	7/6
TY86F	11/8
UABC80	5/6
UAF42	6/9
UB41	10/6
UBC41	6/3
UBC81	6/3
UBF80	5/6
UBF89	6/3
UBL21	10/9
UC92	6/3
UCC84	8/-
UCC85	6/6
UCF80	8/3
UCH21	8/-
UCH42	8/-
UCH81	6/6
UCL82	7/3
UCL83	9/3
UF41	6/9
UF42	4/9
UF80	6/3
UF85	6/9
UF86	9/-
UF89	5/6
UL41	7/-
UL46	8/6
UL84	5/6
UM4	17/6
UM34	17/6
UM80	8/3
UR1C	6/6
UU5	7/-
UU6	11/-
UU7	11/-
UU8	14/-
UU9	5/6
UU12	4/3
UY1N	10/3
UY21	7/9
UY41	5/-
UY85	4/9
U10	9/-
U12/14	7/6
U16	15/-
U17	5/-
U18/20	6/6
U19	48/6
U22	5/9
U25	8/6
U26	7/6
U31	6/6
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
U101	19/6
U107	17/6
U191	9/6
U251	9/-
U281	8/9
U282	12/3

U301	11/-
U329	9/-
U339	9/6
U403	9/9
U404	6/-
U801	15/-
U4020	6/6
VMP4G	11/9
VMS4B	12/-
VP2	3/6
VP2B	9/6
VP4	14/6
VP4A	14/6
VP4B	12/-
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	12/-
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	10/-
X61	6/-
X63	5/9
X64	5/6
X65	5/6
X66	7/3
X76M	8/6
X78	26/2
X79	27/-
X81M	29/1
X101	23/6
X109	26/-
X118	9/9
X119	6/6
X142	8/-
Y63	5/-
Y65	5/-
Z63	4/6
Z66	7/3
Z77	3/-
Z729	6/6
Z749	9/3
Z759	36/-
Transistors and diodes	
AA120	4/6
AA129	4/6
AC107	14/6
AC113	8/-
AC114	8/-
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
AFZ12	26/6
BY101	3/-
BY105	7/-
GD3	5/6
GD8	5/6

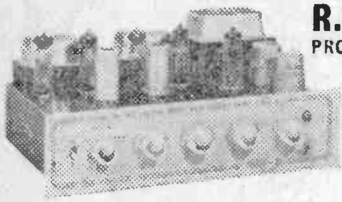
GD14	10/-
GET103	7/-
GET104	10/-
GET106	17/6
GET111	12/-
GET113	6/9
GET114	6/6
GET116	17/-
GET873	9/3
GET874	9/6
GEX13	3/6
GEX35	3/-
GEX36	10/-
GEX45	6/6
GEX64	11/6
GEX66	16/-
MAT100	7/9
MAT101	8/6
MAT120	7/9
MAT121	8/6
OA5	6/-
OA10	6/6
OA70	3/-
OA73	3/-
OA79	3/-
OA81	3/-
OA85	3/-
OA86	4/-
OA90	3/-
OA91	3/-
OA95	3/6
OA200	5/-
OA210	9/6
OA211	13/6
OAZ200	16/6
OAZ203	9/6
OAZ204	9/6
OAZ210	7/6
OC16W	35/-
OC19	25/-
OC22	23/-
OC23	57/-
OC25	12/-
OC26	9/-
OC28	23/-
OC29	16/6
OC35	9/6
OC36	21/6
OC41	8/-
OC42	5/-
OC43	12/6
OC44	4/9
OC44PM	8/3
OC45	3/6
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	5/-
OC82	10/-
OC83	6/-
OC84	8/-
OC139	12/-
OC140	19/-
OC170	8/6
OC171	9/-
OC200	10/6
OC201	29/-
OC203	14/-
OC204	10/6
OC206	10/6
OCP71	27/6
ORP12	12/6
TS2	12/6
TS3	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 26/6. 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. 6/-. 50 x 50/350v. 6/-. 64 x 120/350v. 9/-. 60 x 250/275v. 9/6. 100 x 400/275v. 12/6. 100/275v. 3/-. 200/275v. 4/-. 100 x 200/275v. 8/6. 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/-.
Midget silicon rectifiers. Types BY100. Output 250 volts ½ amp. No larger than a shirt button, 6/6 each. Series limiting resistance 1/6.

EXPRESS POSTAL SERVICE! ALL ORDERS DESPATCHED SAME DAY AS RECEIVED

Terms of business—Cash with order only. No C.O.D. Post/Packing 6d. per item. Orders over £5 post free. All orders cleared day of receipt. Any parcel insured against damage in transit for 6d. extra. We are open for personal shoppers 9.00—5 p.m. Sats. 9.00—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.



R.S.C. STEREO 20/HIGH FIDELITY AMPLIFIER

PROVIDING 10/14 WATTS ULTRA LINEAR PUSH-PULL OUTPUT ON EACH CHANNEL

SUITABLE for "MIKE" GRAM., RADIO OR TAPE. INTENDED FOR THE HOME OR STUDIO BUT SUITABLE FOR LARGE HALLS OR CLUBS

FREQUENCY RESPONSE ± 2dB. 30-20,000 c.p.s.
HUM LEVEL 65dB down.
SENSITIVITY: 5 millivolts maximum.
HARMONIC DISTORTION (each channel) 0.2%.

- ★ Four-position tone compensation and Input Selector switch.
- ★ Will amplify direct from Tape Heads.
- ★ Stereo/Mono switch so that peak monaural output of 28 watts can be obtained.
- ★ Separate Bass "Lift" and "Cut" and treble "Lift" and "Cut" controls.
- ★ Neon panel indicator.
- ★ Handsome Perspex Frontplate.

Send S.A.E. for illustrated leaflet.

Based on a current Mullard design and employing valves ECC83, ECC83, ECL86, ECL86, ECL86, ECL86, EZ81. Output transformers are high-quality sectionally wound to required specification. Output matchings for 3 and 15 ohm speakers on each channel. Complete set of parts with point-to-point wiring diagrams and instructions, or Factory assembled, tested and supplied with our usual 12 months guarantee for 18gns. or DEPOSIT 57/- and 9 monthly payments of 39/10 (total £20.15.6).

13 Gns. Carr. 10/-

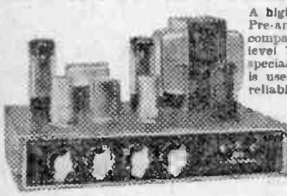
AUDIOTRINE HI-FI TAPE RECORDER KIT 25½ Gns. Carr. 17/6.

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 8½in. 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 4gns and 12 monthly payments of 42/- (Total 28 Gns).

ONLY 3 PAIRS OF SOLDERED JOINTS PLUS MAINS

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



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, BASS, LEAD OR RHYTHM 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. 200-250v. 50 c/s. A.C. Mains output for 3 and 15 ohm speakers Complete kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. Supplied factory built with EL34 output valves and 12 months' guarantee for 14 Gns. If required perforated cover with carrying handles can be supplied for 19/9. **11 Gns.** Carr 10/-
Send S.A.E. for leaflet, also speaker. Terms: DEPOSIT 45/- and 9 monthly payments of 32/4 (Total 16 gns)

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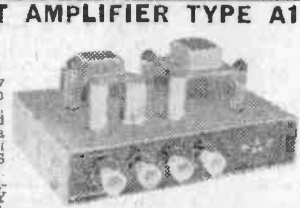
LINEAR TAPE PRE-AMPLIFIER. Type LP/1. Switched Equalisation. Positions for Recording at 1⅞in., 3¾in., 7½in. per sec., and Playback, EM84 Recording Level Indicator. Designed primarily as the link between a Collaro Tape Deck and Hi-Fi amplifier, suitable almost any Tape Deck. S.A.E. for leaflet. 9½ Gns.

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 and 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 300v. 30mA. and 6.3v 1.5a. 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 51/6 extra).
If required louvred metal covers with 2 carrying handles can be supplied for 18/9. **TERMS ON ASSEMBLED UNITS. DEPOSIT** 33/3 and 9 monthly payments of 24/1 (Total £12.10.0). Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Mikes. etc.

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. Full constructional details and price list 2/6. **8 Gns.** Carr. 10/-.
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A complete set of parts to construct a good quality Stereo amplifier with an undistorted output total 8 watts. For A.C. mains input of 200-250 v. Sensitivity 180 m.v. Ganged Volume and Tone Controls. Preset balance control. Full instructions and wiring diagram supplied **5 Gns.**

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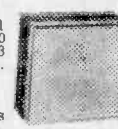
12in. 10 WATT HIGH QUALITY LOUDSPEAKER



In walnut veneered cabinet. Gauss 12,000 lines. Speech coil 3 ohms or 15 ohms. Only **£4.19.6** Carr. 5/6
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W.B. "STENTORIAN" HIGH FIDELITY P.M. SPEAKERS HF1012. 10 watts rating. Where a really good quality speaker at a low price is required we highly recommend this unit with an amazing performance Please state whether 3 or 15 ohm required. **£4.19.6**

R.S.C. JUNIOR BASS REFLEX CABINET. Designed for above speaker, but suitable for any good quality 8in. or 10in. speaker. Acoustically lined and ported. Polished walnut veneer finish. Size 18 x 12 x 10in. Strongly made. Handsome appearance. Superb reproduction **£4.7.6**

R.S.C. STANDARD BASS REFLEX CABINET. For 12in. loudspeaker acoustically lined and ported Size 20 x 14 x 13in. Beautiful walnut veneer finish. Recommended for use with Audiotrine Speaker System. **£5.19.6**

AUDIOTRINE CORNER CONSOLE CABINETS. Strongly made. Beautiful polished walnut veneered finish. Pleasing design. **JUNIOR MODEL.** For up to 8in. speaker. Approx. 20 x 11 x 8in. **49/9**
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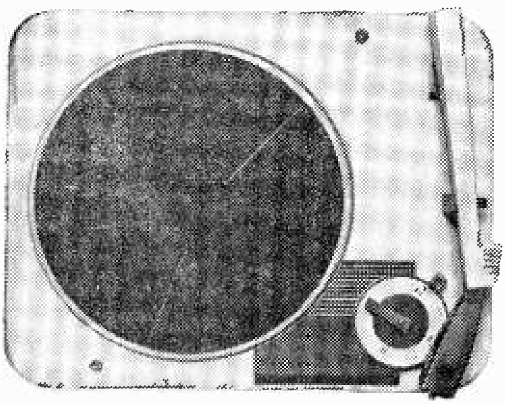
AUDIOTRINE HI-FI SPEAKER SYSTEMS. Consisting of matched 12in. 12,000 line, 15 ohm high quality speaker; cross-over unit (consisting of choke, condenser, etc.) and Tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. Standard 10 watt rating. **£4.19.9** Carr. 5/-.
Or Senior 20 watt, £6.19.6. Carr. 7/6.

An integrated hi-fi turntable unit from only 11 gns?



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Only Goldring's 60 years of experience of making gramophone turntables and pick-ups could lead to a unit like this . . . the ideal integrated turntable, arm and pick-up for do-it-yourself hi-fi aspirants . . . at such a modest price. Just look at the features of this remarkable G.66 unit:

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See the Goldring G.66 at your dealers—or write for descriptive leaflet.

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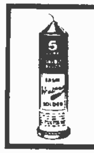

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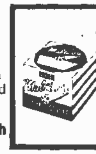

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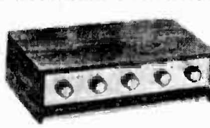

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A must for the tape enthusiast 9v battery. Beautiful walnut cabinet, 4 channels.
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Also wide range of American models. Please send for details.

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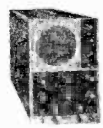

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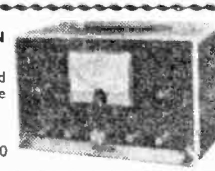

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Send for Full Details.
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Many other instruments in the American range. Full details and catalogue, 1/-, post paid.

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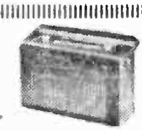

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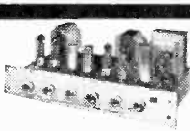

(1) Mullard "10 Plus 10" Stereo Amplifier

A High Fidelity design providing up to 10 watts (per channel).
KIT OF PARTS £20.0.0.
Built and tested £24.0.0 (C. & I. 7/6).
We can also supply the Main Amplifier for operation with our Dual Channel Pre-amplifier.
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(2) Mullard Dual Channel Pre-Amplifier

A four-valve design for both Stereophonic and Monophonic operation.
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(3) The "Twin Three" Stereo Amplifier

Based on a recent design by Mullard Ltd. it is ideally suited for use in Portable Record Players.
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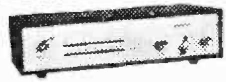
To construct a Stereo Portable Record Player, we offer:
Assembled Amplifier with two 8 x 5in. Loudspeakers and Portable Case for **£16.10.0** (C. & I. 10/-).



(5) Tudor AM/FM Tuner

Self powered VHF/FM long and medium waves. FM 87.5-108.5 Mc/s AM.MW 522-1,630 Kc/s. LW 145-270 Kc/s. Multiplex output.
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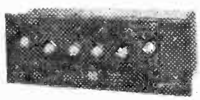

(6) Mullard 3-Valve Pre-Amplifier Tone Control

Designed mainly for the Stern Mullard range of Monophonic Power Amplifiers.
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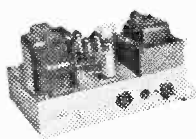
Built and tested £13.13.0 (C. & I. 5/-).



(8) Mullard "5-10" Main Amplifier

For use with Mullard 2- or 3-valve pre-amplifiers with which an undistorted power output of up to 10 watts is obtained.
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Built and tested £13.10.0 (C. & I. 6/6).
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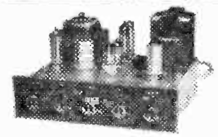

(9) Mullard "5-10RC" Amplifier

The popular "5-10" complete incorporating Passive Control Unit providing up to 10 watts high quality reproduction with an input of 600mV.
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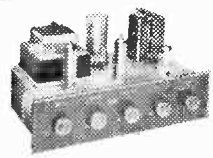

(10) Mullard "3-3RC"

A high quality Amplifier developed from the very popular 3-watt Mullard "3-3" design.
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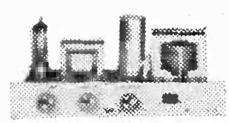
Built and tested £11.10.0 (C. & I. 6/6).



(11) The "Mono-Gram"

A small Amplifier of genuine high quality performance producing up to 3 watts undistorted output.
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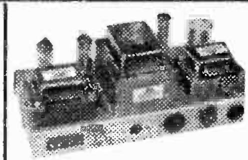
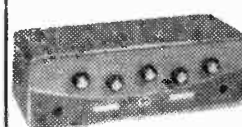
Built and tested £6.0.0 (C. & I. 3/6)



(16) JL10 Power Amplifier

Incorporates the latest diode/pentode ECL86 valves in push-pull, Partridge ultra linear output transformer. Partridge mains transformer and smoothing choke. 10 watts power output, surplus.
Built and tested £12.12.0 (C. & I. 7/6).



(17) Double Feature Pre-Amplifier

Inputs for microphone, crystal or magnetic pick-ups, tuner unit, and in addition offers full facilities for tape recording and high fidelity replay. This unique feature means that should you wish to include tape in your hi-fi system at a later date all that is required is a suitable tape deck.

Built and tested £18.18.0 (C. & I. 5/-).
Prices if both units purchased together:
Built and tested £30.9.0 (C. & I. 10/-)

VERITONE 30

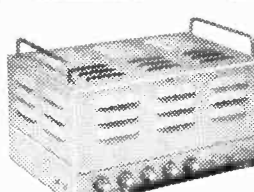
A small versatile 3-4 watts Gram Amplifier suitable for Crystal Pick-up or Radio Tuner, ideally suited for a small domestic installation. Output imp. 3 ohms, volume control, treble control, bass control and middle control. Valve line-up: EL84, EF86, EZ80.
Chassis size 8¼ x 4 x 1¾in. Silver anodised finish. Attractive front panel silver grey finish with contrasting lettering and knobs. Size 8¼ x 2¼in.
Fully assembled and tested 6 Gns. (C. & I. 5/-).

Fully descriptive leaflets available on any of the above items.

Instruction Books and Detailed Price Lists are supplied Free with Kits of Parts but may be purchased separately if required.

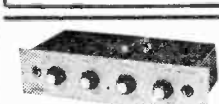
Items 1, 2 and 14, 3/- each; 6 and 13, 3/6 each; 7, 8, 9, 10, 2/- each; 11 2/6 each; 12, 5/-. All Post Free.

VERITONE 30 AMPLIFIER



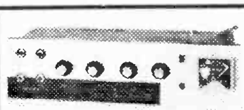
A general purpose amplifier of outstanding quality ideally suitable for Dance Bands, Clubs, Hotels, Factories, Indoor and outdoor Public Address requiring a powerful robust portable Amplifier which will provide high quality reproduction, distortion free. The Amplifier has two standard Jack Socket inputs, high gain and low gain with individual volume controls and with the master volume control the inputs may be mixed and balanced as required. Housed in a really robust steel case finished in smooth grey hammer finish with chrome handles and silver grey front panel with contrasting letters and knobs. Built-in Pre-amplifier and Control Unit. 30 watt Undistorted Output. Switched Output for 3 or 15 ohms Loudspeakers. Fully assembled and tested carriage and insurance 10/-. Ventilated Cover with chrome handles as illustrated, 35/- extra.

Price 18 Gns.



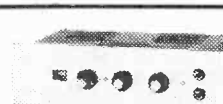
(7) MULLARD 2-VALVE PRE-AMPLIFIER

Employing two EF86 valves and designed to operate with the Mullard MAIN AMPLIFIERS but also perfectly suitable for other makes. Now with new design front panel.
KIT OF PARTS £6.6.0.
Built and tested £9.10.0 (C. & I. 5/-).



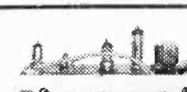
(12) Stereo Tape Pre-Amplifier Model STP-1

For use with current **Truvox, Brenell or Collaro "Studio"** ¼- and ½-track Stereo Decks. Now with new design front panel.
KIT OF PARTS £22.0.0.
Built and tested £28.0.0 (C. & I. 8/6).



(13) Mullard Type "C" Tape Pre-Amplifier

Suitable for most ½-track Mono Tape Decks. Now with new design front panel.
KIT OF PARTS £14.0.0.
Built and tested £19.10.0 (C. & I. 7/6).



(14) Mullard Tape Amplifier Model HF/TR3

Based on Mullard's type "A" design and suitable for most ½-track Mono Tape Decks. Now with new design front panel.
KIT OF PARTS £13.13.0.
Built and tested £19.0.0 (C. & I. 7/6).

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TWO ENTIRELY NEW DESIGNS FOR THE MODERN-MINDED HI-FI ENTHUSIAST

THE VERITONE SATURN TRANSISTORISED FM TUNER

SPECIFICATION: Transistors: 1 x AF125, 1 x AF121, 4 x AF116. Diodes: 4 x OA79, 1 Variable Capacity Diode, 1 1B10J05 Solid State Full Wave Bridge Rectifier, 1 OAZ212 Zener Diode. 4 I.F. Stages. Switchable A.F.C. Tuning Meter. Facility for plug-in Multiplex Stereo Adaptor (available at a later date). Tuning Range: 87.5–108.5 Mc/s. Stabilized Power Supply. Din Outlet Socket. Fully Variable Audio Output Attenuator. Supplied with or without Plastic Laminated Case (Teak). High Sensitivity. Attractive Black and Silver Grey front panel with mirror strip top and bottom.

PRICE 25 GNS. *Carriage & Insurance 7/6*

Teak case optional extra.

THE VERITONE VEGA TRANSISTORISED STEREO AMPLIFIER

SPECIFICATION: Power response, with channels used simultaneously, 13 watt R.M.S. per channel, at 50 c/s and 10 Kc/s the above features are reduced by approximately 2 watts. Loudspeaker impedance 15 ohm. Frequency response on unequalised input, flat $\pm$1dB from 40 c/s to 20 Kc/s.—3dB at 20 c/s. Total harmonic distortion at 10 watts approximately 0.5%. Cross talk, —50dB at 1 Kc $\pm$5dB. Hum and noise—50/60dBs on Radio, Aux, Tape and Magnetic P.U.—50dBs on Ceramic P.U. $\pm$3dB. Controls: Bass, Treble and Balance. Inputs for Radio, Tape, Aux, Magnetic P.U. and Ceramic P.U. Tape Output and Tape Monitor. Mains input 200-220-240 volts. Transistors per channel 5 x OC45, 2 x OC35 or OC29, 2 x ACY17, 1 x 2N696, 6 x Diodes per amp. Dimensions: 11 x 4¼ x 6⅝in. Front Panel: Silver Grey with contrasting Black markings and knobs. Operation: 200/250 v. A.C. 50 c/s.

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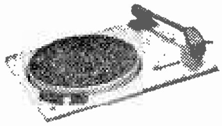
RECORD PLAYER BARGAINS



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B.S.R. UA.15 "Super Slim" 3B 4-speed Autochanger with mono cartridge. £9.19.6

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SP.25 Single Player	..	£13.10.8
AT.60 with cartridge	..	£14.1.1
4HF with GC8 cartridge		£16.17.6
A70 less cartridge	..	£22.11.1
LAB 80 less cartridge	..	£27.10.0
301 Transcription Unit	..	£25.6.4
401 Transcription Unit	..	£32.10.0

(C. & I. 5/- extra all models).

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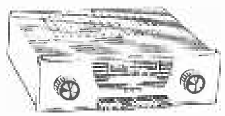
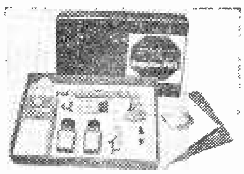


Look at these features:— ● Push-pull output. ● Three latest Mullard transistors plus valve types EBF83 and ECH83. ● No buzz, high output and sensitivity. ● Printed circuit (latest type). ● 7 x 4in. high flux p.m. speaker and baffle. ● Medium and Long Waves. ● Extremely low battery consumption (less than ½ amp.). ● Easy to fit any make car (positive earth only). ● 12-volt operation. ● Compact size, measures only 7 x 7 x 2in. deep. ● Easy assembly, supplied with dial and drive already mounted. ● Push button for finger-tip control includes wavechange, pre-set tone control and provision for switching in an Extension Speaker. ● Attractive new style tuning scale and chrome escutcheon. Price **£7.19.6.** 5/- carriage and insurance.



ETCH YOUR OWN PRINTED CIRCUITS

A complete kit of parts to make your own printed circuit board to your own specification, high quality materials used to ensure perfect results. Price complete with all necessary chemicals and copper clad laminated board. **19/6.** 2/3 packing and postage.

AMERICAN RECORDING TAPE

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5in.	900ft. LP Acetate	..	10/-
5¾in.	1,200ft. LP Acetate	..	12/6
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7in.	1,200ft. Std. Polyester	..	12/6
5in.	1,200ft. DP Polyester	..	15/-
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P. and P. 1/- per reel. 4 or more Reels POST FREE.

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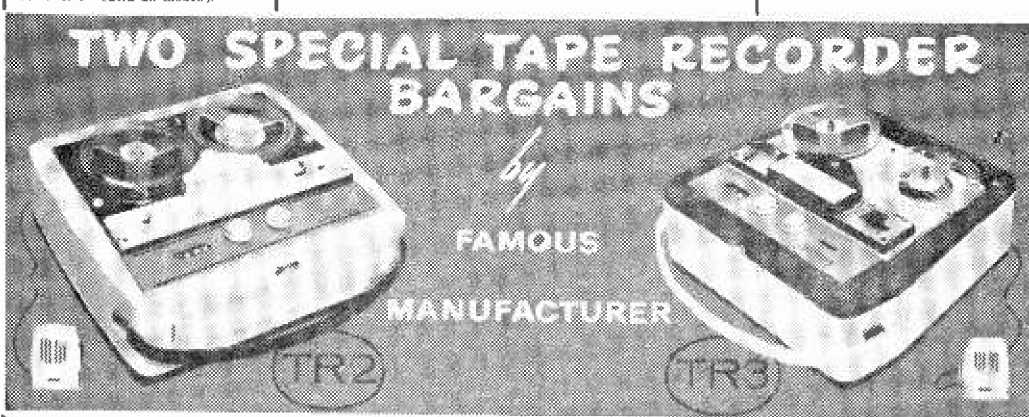
PLASTIC TAPE SPOOLS 3in., 1/3; 4in., 2/-; 5in., 2/-; 5¾in., 2/3; 7in., 2/6.

PLASTIC SPOOL CONTAINERS. For spool sizes 5in., 1/6; 5¾in., 2/-; 7in., 2/3: Any single item plus 6d. P. & P. Orders over £1 post free.

We carry fully comprehensive stocks of Tape Recorders, Decks and Accessories at all Branches or order with confidence by mail.



TR2 PORTABLE TAPE RECORDER. A truly first-class portable machine by famous manufacturer incorporating the renown BSR single speed 2-track Tape Deck.
SPECIFICATIONS: Single speed 3¾ i.p.s. Tape Counter. Record Level Indicator. Volume and On/Off Tone Control. 3 watts output. Inputs for recording from Microphone and Radio. Tape Monitor Socket. Extension Loudspeaker Socket. Attractive two-tone grey/cream rexine covered Portable Cabinet. Supplied complete with Microphone. Reel of Tape and Spare Spool. Carriage and insurance 15/- extra.
Credit Terms: **£2.18.0** deposit and 12 monthly payments of **£1.9.4.** Total credit price **£20.10.0.**

Price 18 Gns.

TR3 PORTABLE TAPE RECORDER. A high quality Portable Tape Recorder to the discerning enthusiast incorporating the latest BSR TD10 3-speed Tape Deck.
SPECIFICATIONS: 3-speed, 1⅞, 3¾ and 7½ i.p.s. 2-Track. Record interlock to prevent accidental erasure. Tape Counter. Record Level Indicator. 3-4 watts output. Volume and On/Off Tone Control. Inputs for recording from Microphone and Radio. Tape Monitor Socket. Extension Loudspeaker Socket. Attractive two-tone blue rexine covered Portable Cabinet with silver trimmings. Supplied complete with Microphone, Lead for recording from Radio or Record Player, Full Reel of Tape and Spare Spool. Carriage and insurance 15/- extra. Credit Terms: **£3.3.0** deposit and 12 monthly payments of **£1.12.3.** Total credit price **£22.10.0.**

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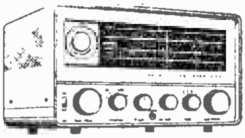
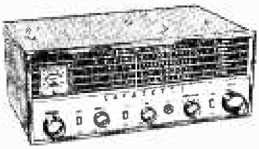


LAFAYETTE HA 63 COMMUNICATION RECEIVER

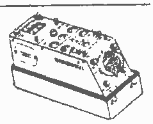
7 valves + Rectifier. 4 Bands 550 Kc/s—31 Mc/s. 'S' Meter-BFO-ANL-Bandspread Tuning. 200/250v. A.C. Brand New. **24 Gns.** carr. paid.



STAR SR 40 COMMUNICATION RECEIVER

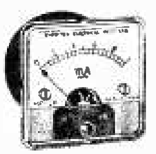
4 Bands 550 Kc/s—30 Mc/s. 'S' Meter-BFO - ANL - Bandspread Tuning-Built in speaker. 200/250v. A.C. Brand New. **18½ Gns.** Carriage 10/-.

OS/8B/U OSCILLOSCOPES



High quality Portable American Oscilloscope. 3in. c.r.t. T/B 3c/s-50 kc/s X Amp: 0-500 kc/s Y Amp:0-2 Mc/s. Power requirements 105-125v. A.C. Supplied in "as new" condition, fully tested.
£25. Carr. 10/-. Suitable 230/115v. Transformer, **15/6.**

CLEAR PLASTIC PANEL METERS



First grade quality. Moving Coil panel meters available ex-stock. S.A.E. for illustrated leaflet. Discounts for quantity. Available as follows. Type MR 38P 1 21/32in. square fronts.

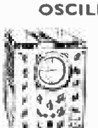
		2mA	22/6	3V. DC	22/6
		5mA	22/6	10V. DC	22/6
		10mA	22/6	20V. DC	22/6
		20mA	22/6	50V. DC	22/6
		50mA	22/6	100V. DC	22/6
		100mA	22/6	150V. DC	22/6
		150mA	22/6	300V. DC	22/6
50µA	32/6	200mA	22/6	500V. DC	22/6
100µA	29/6	300mA	22/6	750V. DC	22/6
200µA	27/6	500mA	22/6	15V. AC	22/6
500µA	25/-	750mA	22/6	50V. AC	22/6
50-0-50µA	29/6	1-0-1mA	22/6	150V. AC	22/6
100-0-100µA	27/6	1A. DC	22/6	300V. AC	22/6
500-0-500µA	22/6	2A. DC	22/6	500V. AC	22/6
1mA	22/6	5A. DC	22/6	"S" Meter 1mA	29/6

POST EXTRA. Larger sizes available—send for lists.
ILLUMINATED "S" METER 1 21/32in. square front. Cal. in S units. 6V. lamp. **29/6.** P.P. 1/-. Ditto 2 5/16in. square **39/6.** P.P. 1/-.

AVOMETERS

Supplied reconditioned, guaranteed perfect. Model D, **£8.19.6.** Post & Ins 5/-.

ERSKINE TYPE 13 DOUBLE BEAM OSCILLOSCOPES



Timebase 2 c/s.-750 kc/s. Separate Y1 and Y2 amplifiers. Up to 5.5 Mc/s. calib. at 100 kc/s. and 1 Mc/s. 110/230 v. A.C. Guaranteed perfect. **£27.10.0.** Carr. 20/-.

MINE DETECTOR No. 4A

Will detect all types of metals. Fully portable. Complete with instructions. **39/6** each. Carr. 10/- Battery **8/6** extra.

BEST BUY!

Send 1/- P.O. for full catalogue and lists. Trade supplied. Open 9 a.m. to 6 p.m. Every day, Monday to Saturday.

TRANSISTORISED TWO-WAY TELEPHONE INTERCOM

Operative over amazingly long distances. Separate call and press to talk buttons, 2-wire connection. 1000's of applications. Beautifully finished in ebony. Supplied complete with batteries and wall brackets. **7 gns. pair.** P. & P. 5/-.

SILICON RECTIFIER

200 P.I.V.	200mA	2/6
1,000 P.I.V.	650mA	7/6
800 P.I.V	500mA	5/6
400 P.I.V.	3 amp	7/6
400 P.I.V.	500mA	3/6
150 P.I.V.	165mA	1/-
70 P.I.V.	1 amp	3/6
95 P.I.V.	3 amp	5/6

Post extra.

AMERICAN TAPE

First grade quality American tapes. Brand new and guaranteed. Discounts for quantities.

3in.	225ft. L.P.	4/-
3¼in.	600ft. T.P. mylar	10/-
5in.	600ft. std. plastic	8/6
5in.	900ft. L.P. acetate	10/-
5in.	1200 ft.D.P. mylar	15/-
5in.	1800ft. T.P. mylar	35/-
5¾in.	1200ft. L.P. acetate	12/6
5¾in.	1800ft. D.P. mylar	22/6
5¾in	2400ft. T.P. mylar	45/-
7in.	1200ft. std. mylar	12/6
7in.	1800ft. L.P. acetate	15/-
7in.	1800ft. L.P. mylar	20/-
7in.	2400ft. D.P. mylar	25/-
7in.	3600ft. T.P. mylar	58/6

Postage 2/-. Over £3 post paid.

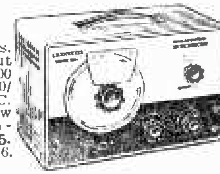
NEW MODEL! LAFAYETTE HA-230 AMATEUR COMMUNICATIONS RECEIVER

Supersedes model HE-30. 8 valves + rectifier. Continuous coverage on 4 bands. 550 Kc/s—30 Mc/s. Incorporates 1 RF and 2 IF stages. Q Multiplier, BFO. ANL. 'S' meter, electrical bandspread. Aerial trimmer, etc. Supplied brand new and guaranteed. **33 Gns.** SAE for full details.
Also available in Semi Kit form **25 Gns.**

NEW MODEL! LAFAYETTE HA-55 Aircraft Receiver

108—136 Mc/s. High selectivity and sensitivity. Incorporates 2 RF stages including 6CW4 Nuvistor. 8 tubes for 11 tube performance, solid state power supply, adjustable squelch control, slide rule dial, built in 4in. speaker and front panel phone jack. 220/240v. A.C. Supplied brand new and guaranteed. **19 Gns.** Carr. 10/-.

TE-22 SINE SQUARE WAVE AUDIO GENERATORS



Sine: 20 c.p.s. to 200 Kc/s on 4 bands. Square: 20 c.p.s. to 25 Kc/s. Output imp. 5000 ohms. 200/240 v. A.C. Brand new Guaranteed. **£15.** Carr. 7/6.

LEADER LSG-10 R.F. SIGNAL GENERATOR

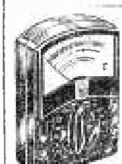
120 Kc/s—260 Mc/s on 6 ranges. Variable R.F. and A.F. outputs. Large clear scale. Size 7¼ x 10¼ x 4½in. 200/250v. A.C. operation. Brand New. **£12.** Carr. 7/6.

LAFAYETTE NUVISTOR GRID DIP METER

Compact true one hand operation. Frequency range 1.7-180Mc/s. 230v. AC operation. Supplied complete with all coils and instructions. **£12.10.0.** carr. 5/-.

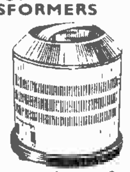
TWO-WAY RADIOS

Superb quality. Complete with all accessories and fully g't'd.
3 Transistor **£9.17.6** pr.
4 Transistor **11** gns pr.
9 Transistor **£25** pr.
10 Transistor **28** gns pr.
Post extra. (S.A.E. for full details).



MODEL TE-12 20,000 O.P.V. 0/.06/6/30/120/600/1,200/3,000/6,000 v. D.C. 0/6/30/120/600/1,200 v. A.C. 0/60µA/6/60/600 mA. 0/6K/600K/6. Meg./60 Meg. Ω. P.F.-.2 MFD. **£5.19.6.** P. & P. 2/6.

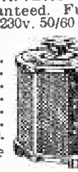
VOLTAGE STABILIZER TRANSFORMERS



Will stabilize your mains voltage. Ideal for TV Receivers and Industrial equipment. Input 80-120 v. and 160-240 v. Constant output 110 v. or 240 v. 250 watts. Brand new guaranteed. **£10.10.0** Carr. 7/6.

MODEL 500 30,000 o.p.v. 0/.5/1/2.5/10/25/250/1000/250/500/1,000v. DC 0/2.5/10/25/100/250/500/1,000 v. AC 0/50µA/5/50/500mA/12 amp DC. 0/60K/6 Meg/60 Meg Ω **£8.17.6** Post Paid. S.A.E. for full details.

VARIABLE VOLTAGE TRANSFORMERS



Brand New Guaranteed. Fully Shrouded. Input 230v. 50/60 c/s, output 0-23v.

1 Amp	£4.10.0.
2.5 Amp	£5.17.6.
5 Amp	£9. 0.0.
8 Amp	£13.10.0.
10 Amp	£17.10.0.
12 Amp	£19.15.0.
20 Amp	£32.10.0.

2.5 Amp Portable Metal Case with Meter Fuses etc. **£9.17.6.**

TE-51 NEW 20,000 Ω/VOLT MULTI-METER 0/6/60/120/1,200 V.A.C. 0/3/30/60/300/600/3,000 v. DC. 0/60µA/12/300 mA. DC. 0/60K/6 Meg. ohm. **£4.5.0.** post & pack. 2/6.

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Phone: GERRARD 8204/9155
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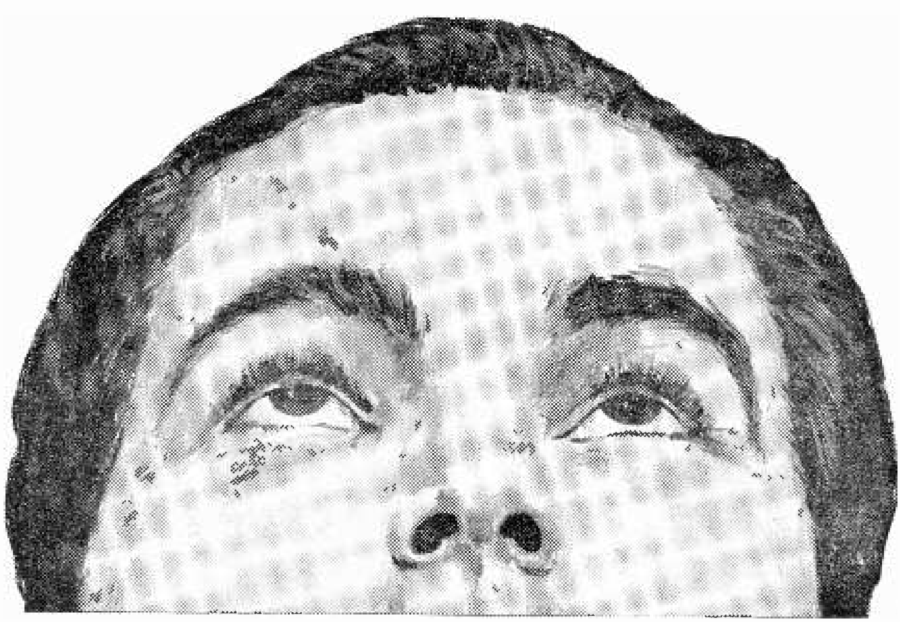


PRACTICAL WIRELESS

NOVEMBER 1965
VOL 41 NO 705

RESOURCEFULNESS

"I wonder if the average radio enthusiast is so resourceful and ingenious as he used to be?" This chance remark, thrown up after a reference to the "hints and tips" columns without which no self-respecting radio magazine would once have been complete, sparked off a lively discussion. It proved inconclusive.

One line was that the *apparent* ingenuity increases as one rolls back the years, for the earlier you made a start the more resourceful you *had* to be. Right back in the early 1920's, the average enthusiast even had to make many of his own components before thinking of wiring them up. Would he have gone to all this trouble if commercial products had been readily and inexpensively available? Is it a case of necessity being the mother of invention?

And what of that fine field of gimmicks? The little self-designed gadgets, the odd uses for conventional bits and pieces, the salvaging of otherwise discarded items for further use, the novel ways to overcome constructional snags—all these used to flourish in an unending stream.

Are constructors no longer interested in such gadgetry or in this affluent society is the saving of the odd pence no longer a driving force? Perhaps the seeming absence of those Hints and Tips is due to the fact that most of them are now common currency and that people *are* still using them, like family heirlooms passed on from previous generations.

On the other hand, it could be that the average constructor is no longer so resourceful since everything is made so very easy for him and he has no need to puzzle over such things. In order to attempt some sort of assessment on this problem we are inviting readers to send along any original ideas they may have. The best of those received will be published.

CONTENTS

All correspondence intended for the Editor should be addressed to: The Editor, "Practical Wireless", George Newnes Ltd., Tower House, Southampton Street, London, W.C.2. Phone: TEMple Bar 4363. Telegrams: Newnes Rand London. Subscription rates, including postage: 29s. per year to any part of the world. **The DECEMBER ISSUE WILL BE PUBLISHED ON NOVEMBER 4th**

PCR Mods

AFTER having read W. V. Wood's article "PCR Mods" in the June issue of PRACTICAL WIRELESS, I have added a noise limiter, a.v.c. switch to my PCR and I am now working on the b.f.o. unit. I have also added another audio stage which was not described in the article.

I do not intend replacing the r.f. or frequency changer valves, but I would like to modify the set to cover the 80 and 160 metre bands so that my receiver will tune 18m to 2,000m.

If possible, I would like to have these extra coils inside the set rather than an external converter. Can anyone help please? I am aged 15.

Terence Wright,
The Bungalow,
Glenbana, Ballyaughlis,
Lisburn, Co. Down,
N. Ireland.

Tagboard Warning

IN the article for beginners in the July issue of PRACTICAL WIRELESS, the use of either paxolin or Formica for a tagboard is specified. May I give a word of warning about Formica being used for this purpose? As it is heat-resistant it has a thin metal foil sandwiched in it, and this foil can cause short-circuits. To be safe, use paxolin and ignore any form of decorative plastic sheet.

Some years ago I hit on what I thought was a bright idea to use Formica for tagboards, but soon found to my cost the damage that the metal foil could do when the power supplies were switched on!

W. E. Thompson, G3MQT,
St. Leonards-on-Sea,
Sussex.

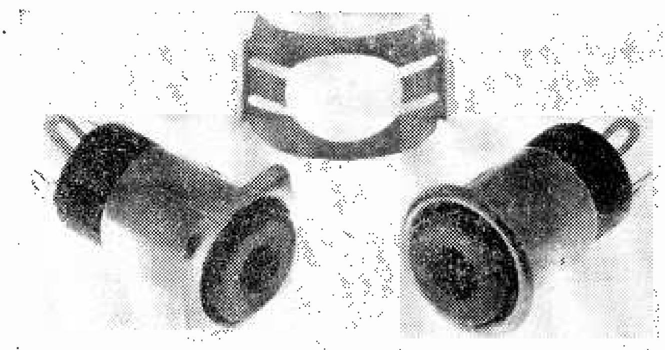
Correspondent

I WOULD like to correspond with someone of my own age (14).

G. Jackson.
50 Bury Street,
Coff Sandy Lane,
Stockport, Cheshire.

NEWS AND..

MINIATURE JACK SOCKETS



A new moulded miniature jack socket from Carr Fastener Co. Ltd., is designed to accept all miniature jack plugs including Carr's jack plug type 83/263. The contacts have a tinned finish for ease of soldering and are fully enclosed within the moulding thus protecting them from damage in handling or transit.

THE HAMS OF EUROPE

According to the IARU (International Amateur Radio Union), the number of licensed radio amateurs in Europe has now risen to over 54,000 including over 11,000 in the UK. The country which boasts the most amateur radio stations is Germany, with 11,465.

FIVE MEN PROBE SPACE SIGNALS

Five experts—two from the Soviet Union, two from the United States and one from Czechoslovakia, have been assigned to the job of making a thorough probe into radio signals received on earth from all over the universe. They will study the signals for six months then report their findings back to the International Astronautical Academy.

Scientists in many countries have received extremely powerful radio signals from outer space, and the signals from one source, called CTA-102 appear to follow a definite pattern which changes every fortnight. One of the Russian scientists in the team says that he cannot rule out the possibility that these signals may emanate from intelligent beings.

BALL BEARINGS IN SPACE

Four foot diameter aluminium "ball bearings" are being placed in orbit round the earth for radar calibrations and signal strength tests and also for experiments to measure the influence of atmospheric conditions on satellite relay communications.

The first "ball bearing", made by the Rohr Corporation of USA was launched last May. A second in the series of five was launched with the experimental communications satellite LES-2.

A useful life of about five years is expected before surface deterioration through micrometeorite bombardment renders the spheres useless.

..COMMENT

TEN THOUSAND USERS OF RADIO CONTROLLED MODELS

The ten thousandth licence for radio controlled model vehicles, ships and aircraft has recently been issued by the Post Office.

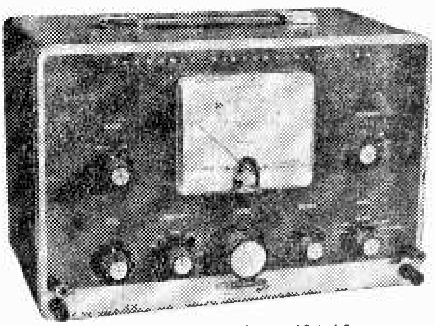
Costing £1 these licences remain in force for five years and were first introduced in 1954, under the Wireless Telegraphy Act of 1949.

WIN A RECEIVER AT THE R.S.G.B. EXHIBITION

At the Radio Communications Exhibition (see News and Comment, P.W., October issue) every visitor has an opportunity to win an Eddystone communication receiver worth £182 if he obtains a free ballot card at the door.

The Exhibition opens daily from 10 a.m. to 9 p.m. and admission is 3s.

HEATHKIT HARMONIC DISTORTION METER



From Daystrom Ltd., of Gloucester, comes model IM-12U Harmonic Distortion Meter. The instrument measures total harmonic distortion, volts, and dBm., has five distortion ranges covering 1% to 100% full scale and covers the complete audio frequency spectrum.

There are four voltmeter ranges covering 1V to 30V full scale and oscilloscope monitoring facilities. The unit, assembled, costs £34 and in kit form £24 15s.

RADIO GOES TO YOUR HEAD

Hats with a pocket for a transistor radio so that the wearer can listen-in while walking down the street or hear a boxing commentary while watching a football match, are being marketed by the Hat Corporation of America. The hat is made of imitation black Persian lamb in "Cossack" style. A pocket in the side carries the small radio and a thin wire leads to a miniature earpiece.

MERCURY SPACE CAPSULE AT SCIENCE MUSEUM

The Science Museum, South Kensington, is exhibiting for several months the Mercury Space Capsule, Freedom 7, in which Commander Alan B. Shepard made the first manned Mercury flight on 5th May, 1961.

The capsule incorporates many features which have been found essential for manned space flight, such as capsule altitude controls, environment requirements for the astronaut and communication between capsule and ground.

A set of panels giving details of the United States lunar and manned space flight programmes with emphasis on the Mercury programme is also exhibited.

The exhibition has been made possible by the courtesy of the Smithsonian Institution in Washington, who have kindly lent the capsule.

more News and Comment on page 596

Hawaiian Guitar

I HAVE successfully built the Hawaiian Guitar from your June issue. However, instead of just making the frets on the guitar body, I have constructed a fretboard which I have stuck on to the guitar. The board was made from a piece of black formica 2in. wide. The frets were cut with a saw and gold paint was rubbed into the cuts to make a really professional finish.

M. Edwards.
Herne Bay,
Kent.

Correspondent

I AM interested in transistor circuitry and in radio in general. I would like to correspond with anyone who shares my interests and who is about my own age (16).

Donal Gabriel.
43 Oliver Plunkett St.,
Bandon,
Co. Cork, Ireland.

Offer of Components

I HAVE in my possession certain components that I would like to offer to *Practical Wireless* readers. They are valves: EF80, 6Q7G, HL133/DD, 6A8G, DAF96, EF39, ECL80, MHD4, 6F6G, DH63, DL96, D77, PY81, W42, ECH35, 25A6G, DF96, PCC84, 20F2, 10F1.

Also I have most values of resistors, all 20%, and electrolytic capacitors: 8μF 500V, 12/4μF 450V, 100μF 6V, 32/32/8μF 350V, 100/200μF 275V, 16/32μF 350V, 16μF 350V, 200μF 12V, 40/30/20μF 275V.

In addition I also have a selection of precut chassis.

D. J. Geer.
The Caldecott Community,
Mersham-le-Hatch,
Ashford,
Kent.

We must stress that ample postage *and a* stamped addressed envelope *must accompany all requests for components sent to Mr. Geer. First come will* ***be*** *first served.*—Editor.

COVER SUBJECT

MINIATURE OSCILLOSCOPE

by

H. T. Kitchen

THE miniature oscilloscope about to be described was designed and built to fulfil two functions: (1) To provide an adequate a.f. response and (2) to occupy the minimum of bench space.

There were two different ways of achieving the objective: (a) by designing the circuit and then compressing it into as small a space as possible and (b) by deciding on the maximum size permissible and designing a suitable circuit to fit into it. Although both methods have their disadvantages the author felt that the first method held a better chance of success. A circuit was therefore evolved and ways and means sought of compressing this into the minimum space possible. The restrictions governing length, breadth and height soon became apparent. The minimum length was dependent upon the length of the c.r.t. and the breadth and height upon the diameter of the c.r.t. plus the number of controls it was necessary to have on the front panel.

The author has always subscribed to the belief that too many oscilloscopes have too many seldom-used controls on the front panel—even if they do look impressive! Reducing the number of controls can materially assist in reducing the size of the equipment as well as improving operational efficiency. In the present design the most used controls (in the author's case anyway) are mounted on the front panel and the two least used ones on the rear panel.

Where the oscilloscope is to be confined to one work bench or where extreme portability is not an outstanding consideration the use of a separate power pack has much to commend it. The oscilloscope proper can be made very much smaller and lighter and the absence of the heat generated by the mains transformer and rectifiers can considerably improve the frequency stability of the timebase. The magnetic field of the mains transformer, which can cause such waveform distortion, will also be absent, so that a mumetal c.r.t. screen can be dispensed with, resulting in a fair saving in cost, for good mumetal screens are by no means cheap. In accordance with this philosophy the design under consideration was built in two parts.

The first part, which can be regarded as the

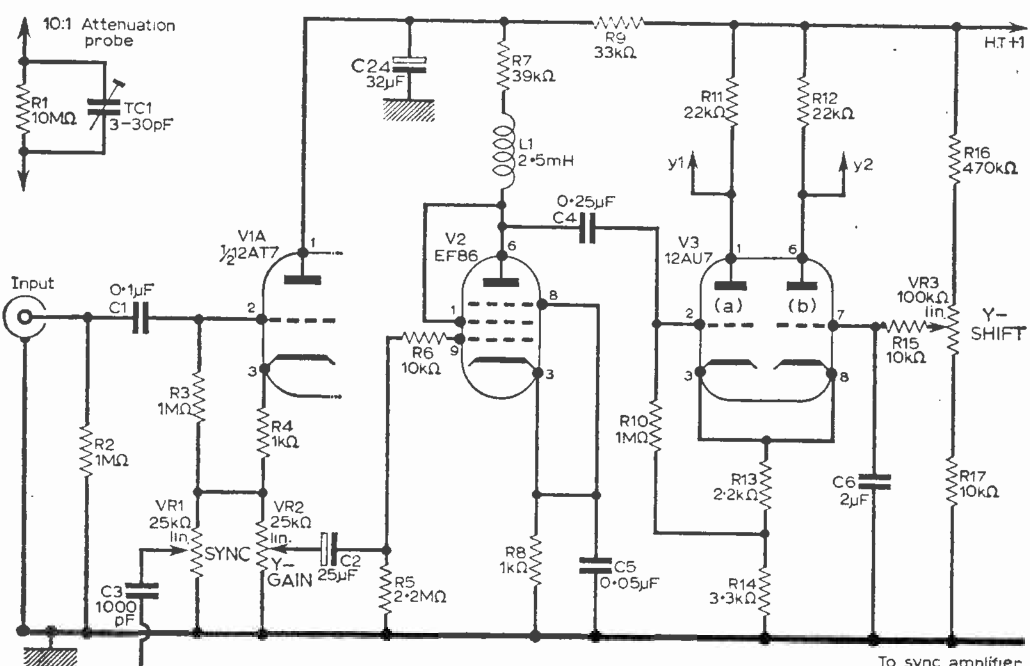


Fig. 1. Vertical amplifier (Y-amp) with symmetrical deflection and probe unit.

oscilloscope proper, occupies a bench space of 9 x 4 x 5in. (high) and contains the c.r.t., Y-amp and timebase. The power supply was built on a chassis 8 x 4 x 2in.

COMPONENTS LIST

Resistors:

R1	10MΩ	R21	47kΩ
R2	1MΩ	R22	47kΩ
R3	1MΩ	R23	1kΩ
R4	1kΩ	R24	68kΩ
R5	2·2MΩ	R25	1MΩ
R6	10kΩ	R26	2·2kΩ
R7	39kΩ	R27	3·3kΩ
R8	1kΩ	R28	47kΩ Hi Stab. 5%
R9	33kΩ	R29	47kΩ Hi Stab. 5%
R10	1MΩ	R30	22kΩ
R11	22kΩ 5% Hi Stab.	R31	10kΩ
R12	22kΩ 5% Hi Stab.	R32	330kΩ 5% Hi Stab.
R13	2·2kΩ	R33	27kΩ 5% Hi Stab.
R14	3·3kΩ	R34	470kΩ
R15	10kΩ	R35	1MΩ
R16	470kΩ	R36	1MΩ
R17	10kΩ	R37	1Ω 1W (See text)
R18	1MΩ	R38	1·5kΩ 3W
R19	100kΩ	R39	1·5kΩ 3W
R20	68kΩ	R40	100kΩ

All 20% ½W except where stated

Potentiometers:

VR1	25kΩ	VR5	2MΩ
VR2	25kΩ	VR6	1MΩ
VR3	100kΩ	VR7	100kΩ
VR4	100kΩ		

All linear

Capacitors:

TC1	3-30pF trimmer
C1	0·1μF 350V paper
C2	25μF 25V electrolytic
C3	1000pF silver mica
C4	0·25μF 350V paper
C5	0·05μF 350V paper
C6	2μF 150V electrolytic
C7	1000pF silver mica
C8	0·01μF paper
C9	100pF silver mica
C10	500pF silver mica
C11	2500pF silver mica
C12	0·01μF 350V paper
C13	0·05μF 350V paper
C14	0·25μF 350V paper
C15	0·1μF 350V paper
C16	32μF 350V electrolytic
C17	32μF 350V electrolytic
C18	32μF 350V electrolytic
C19	32μF 350V electrolytic
C20	16μF 350V electrolytic
C21	0·1μF 750V paper
C22	0·1μF 750V paper
C23	0·1μF 1000V paper
C24	32μF 350V electrolytic

Valves:

V1 12AT7 V2 EF86 V3; V5 12AU7
V4 EF86 V6 6X4 V7 E4205-B-7 or VCR139

Miscellaneous:

S1, 1p 5W or 2p 5W (see text). D1, OA81, D2 D3 K3/40. L1, Repanco 2·5mH, L2 10H 60mA. Mains transformers 200-240V Primary, 250-0-250V at 60mA, 6·3V at 2·5A, 5V or 4V at 1A.

SPECIFICATION

Y Amplifier:

Sensitivity	150mV/cm adjustable
Frequency response	25c/s–50Kc/s ±1dB
	15c/s–200Kc/s ±3dB

Timebase:

Timebase	10c/s–100Kc/s
X-Amplifier	15c/s–50Kc/s ±3dB

The Y Amplifier

The circuit of this is shown in Fig. 1, from which it will be seen to be quite conventional and straightforward. The input valve V1a is a 12AT7 double triode the other half of which is used as the sync amplifier. V1a is arranged as a cathode follower input stage with the fine gain control VR2 forming the cathode load. This is connected "back to back" with the sync amplitude control. Of the two attributes of a cathode follower, namely high input and low output impedances, use is made of the low output impedance only by connecting, as already described, the gain control across it. The high input impedance has been sacrificed in order to provide a coarse input attenuator in the grid circuit. This is necessary because a high-amplitude signal would overload the stage, and, although VR2 would reduce the signal sufficiently to fill the c.r.t., the waveform would contain distortion that was introduced by the oscilloscope itself due to V1a overloading. Since panel space was at a premium the input attenuator was made in the form of a probe which could be plugged in as and when required. This probe consists of a high-value resistor R1 and low-capacity trimmer TC1 in parallel. At low frequencies R1 and R2 form the potential dividing elements but, as the frequency is increased, the stray capacities to earth play an ever-increasing part so that the attenuation factor is increased. The attenuator can in fact be said to be frequency conscious. The inclusion of TC1 alters this considerably and allows an attenuator to be constructed that is for practical purposes, not frequency conscious. The optimum value for TC1 is when the time-constant of C1 R1 is equal to the time constant of R2 x strays and, since the strays cannot be calculated, TC1 is made a trimmer with a maximum capacity of 30pF. An incidental though important advantage of using such a probe is the reduction in the input capacity of connecting cable plus strays imposed upon the circuit under test.

V2 provides the bulk of the Y amplifier gain and comprises a triode connected EF86. Two minor modifications to this stage can increase the input sensitivity but at the expense of a much-curtailed h.f. response. These are increasing the value of the anode load and connecting the valve as a pentode. The h.f. response is further extended by the frequency conscious characteristics of L1 and C5. The impedance of L1 increases with increasing frequency and, since it is in series with R7, the o/p tends to increase. Similarly the impedance of C5 decreases, so shunting or bypassing R8 more and more, their combined result being to increase the o/p from V2, thus compensating for the h.f. losses incurred elsewhere in the circuit.

The E4205-B-7 in common with many other c.r.t.'s benefits from the use of symmetrical deflection. V3 is accordingly connected as a push-pull o/p stage, the anodes being directly coupled to the c.r.t.'s Y1 and Y2 plates. Vertical movement of the trace is accomplished by altering the grid bias on V3b by means of VR3, which causes the d.c. potential of V3b anode to alter with respect to V3a anode. Since these anodes are directly coupled to the Y1 and Y2 plates the change in the d.c. potential causes the trace to move up or down. It must be noted that too much vertical movement is very undesirable, requiring as it does an excessive change in the valves' grid bias with the attendant danger of waveform deformation.

The Sync Amplifier

Although some sync signals could have been introduced from the Y-amp to the t.b. by means of a simple capacitive coupling the inclusion of an amplifying and limiting stage was considered to be well worth the slight increase in cost and complexity. The sync take-off point is by means of VR1, which as the sync amplitude control allows just the right amount of sync to be selected. V1b operates with zero grid bias and so tends to amplify only positive-going signals which emerge from the anode in an amplified and phase-reversed form, i.e. negative going. These are then fed to the suppressor grid of V4 via C7, thus synchronising it to the waveform under examination. Since D1 clamps any positive-going signals which may have escaped the limiting action of V1b, V4 is synchronised by negative-going signals only, obviating the jitter caused by double synchronising by positive and negative peaks.

The Timebase

This is a comparatively simple circuit but still provides an adequately linear sawtooth waveform. The five coarse speeds are selected by S1, which switches the appropriate integrator capacitor into circuit. Fine speed is controlled by VR5, which provides a small overlap from range to range. In the interests of simplicity and space economy the flyback capacitor consists of just C8 instead of being switched in step with C9 to C13. This has the disadvantage that the flyback speed varies from range to range, though the value finally selected for C8 was a reasonable compromise. Constructors wishing to switch in different flyback capacitors could use a two-pole switch and arrange it to select capacitors having values of 1/3 to 1/5 of those integrators they are in step with. Flyback suppression was not included in the prototype but can be added quite easily if desired and is shown dotted in the t.b. circuit. The values shown may require adjustment, particularly the 0·001μF capacitor to the c.r.t. grid, the value of which should be no higher than is necessary for adequate blanking.

The timebase output is taken from the slider of VR4, which is the X gain or width control and is fed via C14 to V5, the t.b. amplifier stage, which is similar in design to the Y o/p stage. Since an extended h.f. response is unnecessary here the anode loads have been increased in value to

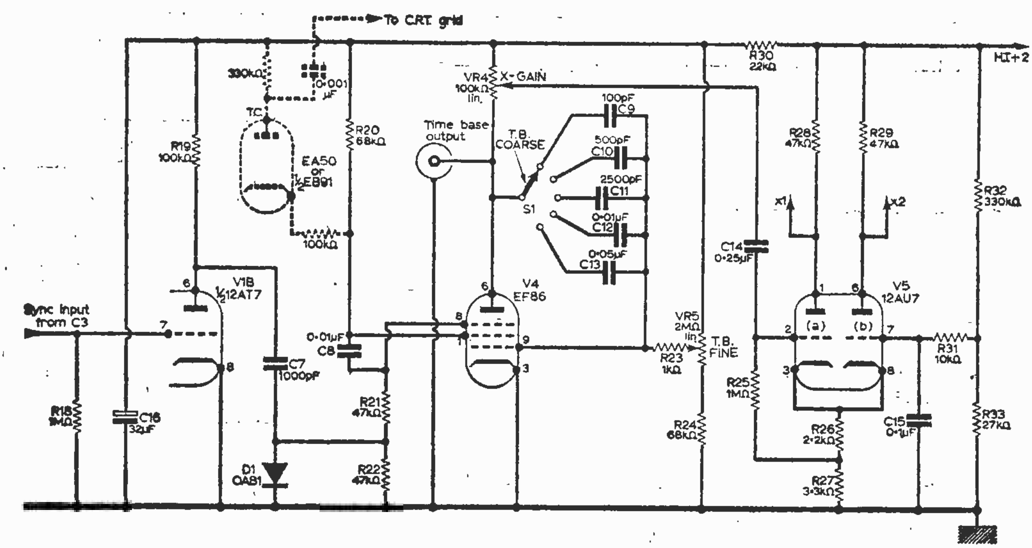


Fig. 2: The timebase and symmetrical deflection amplifier (X-amp). The dotted components comprise the flyback blanking circuitry.

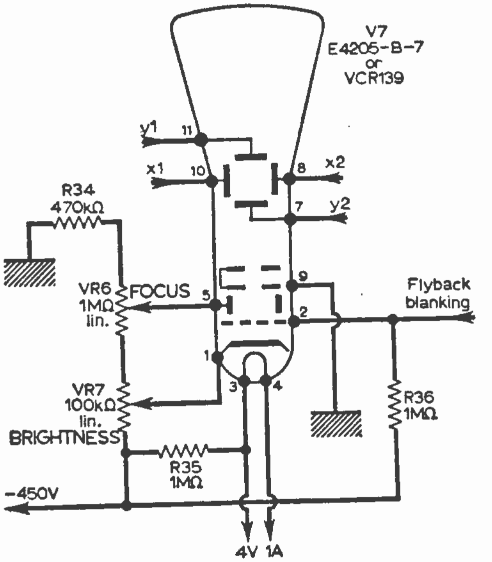


Fig. 3: The c.r.t. network including brilliance and focusing controls.

provide rather more o/p. Any apparent non-linearity in the t.b. waveform can thus be got rid of by increasing the t.b. o/p and using only the central portion of the trace. Horizontal movement of the trace was not required and so V5b grid is taken to a potential divider formed by R32 and R33, the values of which will almost certainly require adjustment in individual cases to bring the trace to a central position on the screen.

The C.R.T. Circuit

This does not call for any particular comment except for saying that the capacitor used for coupling the flyback pulses to the grid must be of impeccable character. The tube will almost certainly be damaged if this should break down and allow a comparatively large positive voltage to be impressed upon the grid for any length of time.

Power Supply

The power supply circuit is quite conventional. Two separate, well filtered and decoupled (from each other) h.t. supplies are provided for the Y amplifier and t.b. circuits. By using a 6X4 or U78 rectifier and running its heater from the common 6·3V line the 5V winding is left available for the c.r.t. and, since its heater requires 4V at 1A, a 1Ω 1W resistor (R37) is used to drop the surplus volt. This expedient will not, of course, be necessary where the transformer already has a suitable 4V winding. The normal rectifier heater windings are well insulated and are eminently suited to feeding the c.r.t., the heater of which is at a quite high potential with respect to chassis. A voltage doubler comprising C23 and D2. D3 provides some −450V e.h.t. and although the trace is not as bright as it would be with 1,000V e.h.t. it is still adequate in all but the brightest light. The current demands are very modest and so a simple filter comprising R40 and C21. C22 is all that is necessary for adequate e.h.t. smoothing.

PART 2 NEXT MONTH

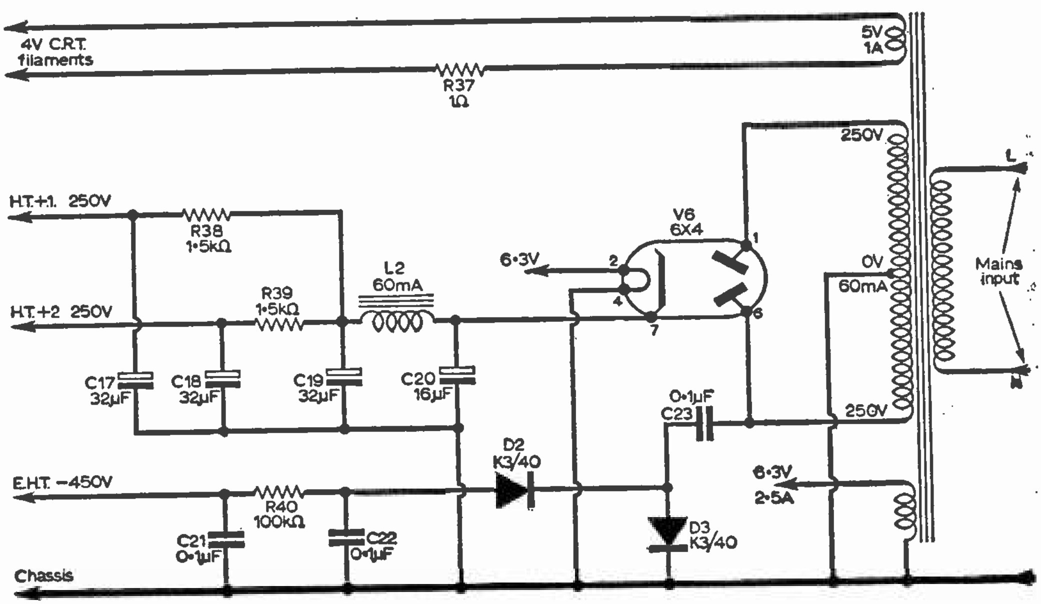


Fig. 4: The oscilloscope power supply unit.

HAM FEATURE

REDUCING TRANSMITTER BCI/TVI

BY F. G. RAYER G3OGR

IT is a great inconvenience to everyone when television or broadcast band interference is caused by one's own transmitting equipment as this imposes limits on operating. However, after some experiment the writer found it possible to operate a 150W transmitter, with full high-level modulation on all bands from 1·8Mc/s to 14Mc/s, with no interference to the radio or television receivers in the same house.

The complete removal of all broadcast band or TV interference seems often to be extremely difficult. But it is hoped that some of the causes and possible cures given here will be helpful.

Broadcast Images

Very many domestic broadcast band receivers are superhets with a frequency changer as first stage and an i.f. of about 470kc/s. These receivers are susceptible to second channel or image frequency interference. Points at which this will arise are easily calculated.

As an example suppose the wanted broadcast station uses 1,000kc/s (300m). If the receiver i.f. is 470kc/s the receiver oscillator is tuned to 1,470kc/s. The second channel is 470kc/s above 1,470kc/s or 1,940kc/s. This is in the 1·8-2·0Mc/s amateur band. So if the transmitter is operating around 1,940kc/s it will probably be heard on the receiver.

This interference is tunable on the receiver. It may easily be possible to use a transmitter frequency which does not result in the unwanted signal falling on or near a wanted broadcast station.

Receiver oscillator harmonics cause similar trouble. Suppose the broadcast band receiver is tuned to 1,100kc/s. The receiver oscillator is then on 1,570kc/s if the receiver i.f. is 470kc/s. The second harmonic of 1,570kc/s is 3,140kc/s. This will beat with an amateur signal on 3,610kc/s to produce a 470kc/s output. So the amateur signals in the 3·5-3·8Mc/s band can also be tuned in on the receiver.

Again this trouble can be avoided by using frequencies which do not result in such spurious receiver responses falling on or near wanted stations. With troubles of this nature any steps which reduce the power of the amateur signal at the receiver will help alleviate the interference.

If the transmitter radiates harmonics these will probably cause television interference. Multiples of frequencies in the h.f. band easily fall near TV channel frequencies. A harmonic detector such as that in Fig. 1 will help check for unwanted output at multiples of the transmitter frequency. Many crystal and other oscillators produce strong harmonics and may in fact be designed to do so for multi-band work. So it is wise to have several tuned circuits after the oscillator.

In the home-built transmitter mentioned a 7Mc/s v.f.o. was followed by a 7Mc/s buffer, working into a 14Mc/s doubler-amplifier, which in turn was followed by the 14Mc/s p.a. Each stage was tuned and with this line-up no harmonic output could be detected. When using an end-fed aerial an aerial tuner was also added to provide one further tuned circuit.

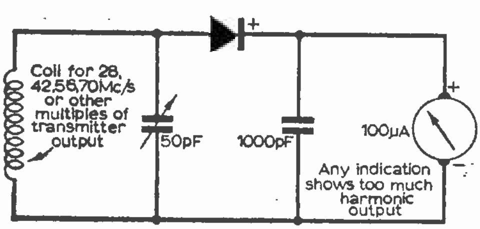


Fig. 1: Harmonic Detection.

Little Suppression

If the transmitter has much harmonic output this may well be due to some of the broad-banded or untuned types of coupling which are often used to simplify band changing. Some of these circuits offer little suppression of unwanted harmonics.

Harmonics may be reduced by adding a harmonic filter in the transmitter. One simple circuit is shown in Fig. 2. It is a series tuned acceptor and can be adjusted with a grid-dip oscillator or by reference to the offended TV receiver or a harmonic detector.

An aerial which is a good harmonic radiator will naturally increase troubles from this cause. An end-fed aerial will often work effectively as a harmonic radiator. A coaxial or twin-lead-fed dipole may also be fairly effective at odd multiples (3, 5, etc.) of the transmitter frequency.

In some tests changing from an end-fed aerial to a 14Mc/s dipole very greatly reduced TVI. In these tests TVI was less when using the end-fed aerial with a tuner. With a popular commercially made transmitter TVI was bad with an end-fed aerial but slight with a dipole. This also seemed to be bound up with the presence of stray radio frequency currents in house wiring, etc.

Stray RF

With an end-fed aerial the return r.f. path must be through earth, the earth connection, mains wiring to the transmitter, etc. With a system such as a balanced dipole this return r.f. path is not employed as the r.f. power is applied to the two halves of the dipole, not to an aerial and earth.

In tests balanced dipoles were always found much less likely to cause interference than end-fed aerials. End-fed aerials were at their worst when in part near house mains wiring, etc. That is, when causing strong r.f. currents in other circuits.

A separate good r.f. earth for the transmitter was also found helpful in reducing TVI. In some tests TVI was extremely bad when earthing of the transmitter was via the mains earth. Here no other change than providing a good r.f. earth almost wholly removed TVI. The actual length of the earth connection can be important and, if long or near resonant frequency on transmitter frequency or harmonics, then two or three alternative earths of different length can be provided.

Blanketing

The amateur signal may be so strong in the immediate vicinity that it breaks through on broadcast band or TV receivers, even if no spurious or harmonic responses arise. This was experienced on 80m when an end-fed aerial downlead ran within a few feet of a room in which a broadcast band receiver was used. The transmitter signal completely blanketed reception and was not tunable.

This was completely cured by changing to a dipole, though the dipole feeder ran over exactly the same path as the original downlead.

Blanketing will be reduced by steps which reduce the strength at the receiver of the offending signals. Single-wire downleads which radiate may cause the trouble. Or it may help to remove the transmitter aerial from near the receiver or its aerial. When this fails filters or wavetraps are often added at the receiver.

For a TV receiver a high-pass filter is probably most suitable. But no such filter was found necessary when taking the other precautions so far described here.

Mains Suppressors

Where r.f. is passing from the transmitter to the receiver through the mains a suppressor such as that in Fig. 3 may be helpful. Something of this kind is often present in commercially made equipment. The chokes are probably best placed inside the transmitter but immediately adjoining the point where the mains power lead enters.

A suppressor may be added at the receiver if this is found helpful. But it is probably better to keep r.f. out of the mains by measures at the transmitter itself or by using some balanced aerial system.

If a driver or power amplifier stage is operated at an unnecessarily high level of grid drive this is supposed to increase the chances of harmonic

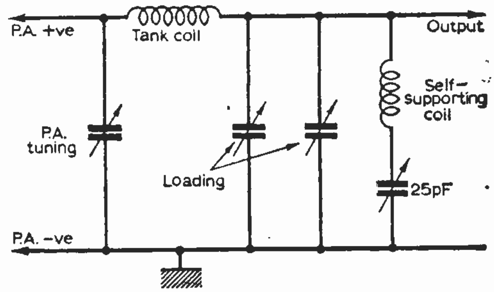


Fig. 2: Tunable Harmonic Trap.

output. In the home-built transmitter mentioned the grid drive on each stage was kept just about at the level needed for efficient working.

Later it was found that no interference troubles arose even if drive was increased to twice that normal. But with other transmitters it may be worth running each stage with the minimum drive which does not cause a loss of efficiency.

If interference is bad it may be worth running the transmitter into an artificial aerial for a first test. For a.m. equipment this can be a 100W or other suitable domestic-type lamp. It may be screened with an old cabinet, metal box or other means if required.

If interference ceases or is much reduced with the a.a. then the transmitter aerial or aerial/earth system, including the aerial feeder, are suspected. But if interference remains very bad, then the offending signals are probably travelling on the mains or reaching the receiver by direct radiation from the transmitter.

Radiation from the transmitter can be much reduced by good screening. But it was found that totally unscreened transmitters could quite often be operated with no broadcast band or TV interference to receivers only a few feet away.

When testing the effect of various aerials it was generally found that a tuned doublet with an open-wire feeder had the same advantages as a dipole with low-impedance feeder. As the tuned doublet can be used for several bands it may be preferred.

A watch should be kept for individual, unnecessary forms of coupling between transmitter and receiver. One set of equipment, used for many months, always caused TVI. This transmitter was placed near a wall and the TV receiver aerial

—*continued on page 576*

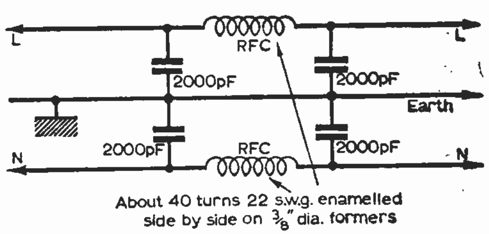


Fig. 3: Mains Suppressor.

FOR THE BEGINNER

SELF REGULATING TRANSISTOR CIRCUITS

BY G. R. WILDING

PARALLEL with the dramatic improvements in transistor performance over the past few years has been the improvements in transistor circuitry with especial emphasis on self regulating and stabilising arrangements to protect and enhance portable design.

Thus current designs now incorporate circuitry to stabilise the output transistors bias, compensate for cabinet temperature rises, protect against overloads, extend a.g.c. characteristics, stabilise power supplies in battery/mains versions, and stabilise the v.h.f. oscillator voltage in f.m. models.

To this end small diodes and transistors connected as diodes are mainly used, but miniature thermistors and voltage-dependent-resistors (v.d.r.'s) are also utilised.

Probably the most important self-regulating device is that which controls the base bias of the output transistors within quite wide battery voltage variations and also increases battery economy.

As is well known, particularly with push-pull output stages, it is very important to obtain correct base biasing. Insufficient bias causes cross-over distortion due to the extremes of the half-cycles not being fully amplified, while excess biasing causes an unnecessarily high no-signal standing current.

Thus if biasing is just right when a new battery is fitted it tends to fall off with falling battery voltage.

To avoid this, a transistor connected as a diode, is wired from the lower end of the base biasing resistor to chassis thus forming the bottom end of a potential divider. (Fig. 1).

However, the internal resistance of a transistor so connected, increases as the applied voltage decreases, so that as the terminal battery voltage falls, a relatively larger proportion of it is developed across transistor Tr1.

This voltage is also the biasing voltage to the two power transistors so that over a longer period of time than usual, the battery can correctly work the output transistors.

Furthermore, should the temperature rise excessively so that the output transistors reduce their normal internal resistance and pass excessive collector current, the control transistor Tr1 will similarly be affected, its volts-drop will reduce and thus bias back the output stage.

Other makers use somewhat similar schemes to provide bias stabilisation but all generally operate on the same principle, the variation of a diode or diode-connected transistors internal resistance with applied voltage.

However, one or two models made by Berec and Ever Ready, and quite a few Car Radios made by Radiomobile, Ekco and Motorola etc. which are of course especially liable to extremes of temperature, employ miniature thermistors to keep the output transistors correctly biased in spite of excessive cabinet temperature.

The basic circuit is very simple and merely comprises the shunting of the thermistor across the bottom section of the resistor potential divider that biases the output transistors.

Thermistors type KS2Y, VA1040 and VA1039 are usually used and in Fig. 2 can be seen the typical arrangement as used in some Ever Ready "Sky Prince" and "Brigand" receivers where the thermistor is paralleled across the bottom 33Ω resistor of the 1 2K/33Ω voltage divider combination.

As temperature increases, the ohmage of the thermistor

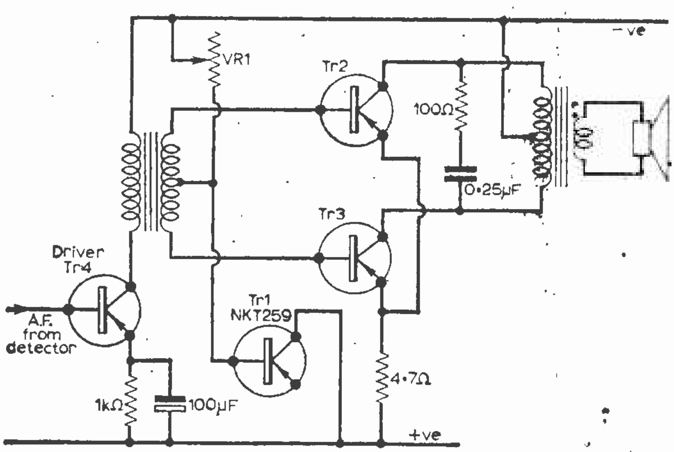


Fig. 1: Typical bias stabilisation circuit (Ferranti). As battery voltage falls it increases internal resistance developing a higher proportion of the available e.m.f. and thus maintaining output transistor bias constant over a wide battery voltage range.

decreases and reduces the potential developed across it, thus biasing back the output transistor pair.

A really effective a.g.c. system is probably the most difficult section of a small transistor portable to design, since transistors are essentially current and not voltage operated devices, while a.g.c. bias can only usually be applied to an r.f. or i.f. stage since application of the bias to the frequency-changer would result in mis-tuning with variations of voltage.

It is often the practice to augment the normal a.g.c. control with a transformer damping arrangement so that on these high inputs the "Q" of an i.f. transformer can be cut down.

In practice it is usually the primary of the first i.f. that is selected and Fig. 3 shows a very typical arrangement.

The series combination of the OA79 diode and 680Ω resistor links the live end of the i.f.t. 1 primary to the junction of the decoupling resistor and capacitor of the i.f. amplifiers collector.

Under normal no-signal conditions the anode connection to the rectifier is slightly more negative than the cathode so no conduction occurs, the combination is virtually open circuit and no loading is imposed of the i.f.t. primary.

However, should a very strong signal be received so that the i.f. transistor is fed with a heavy a.g.c. bias, its collector current will reduce and its collector voltage rise to approaching that of the frequency-changer. Partial conduction through the rectifier and resistor occurs, loading i.f.t.1 primary, and reducing gain.

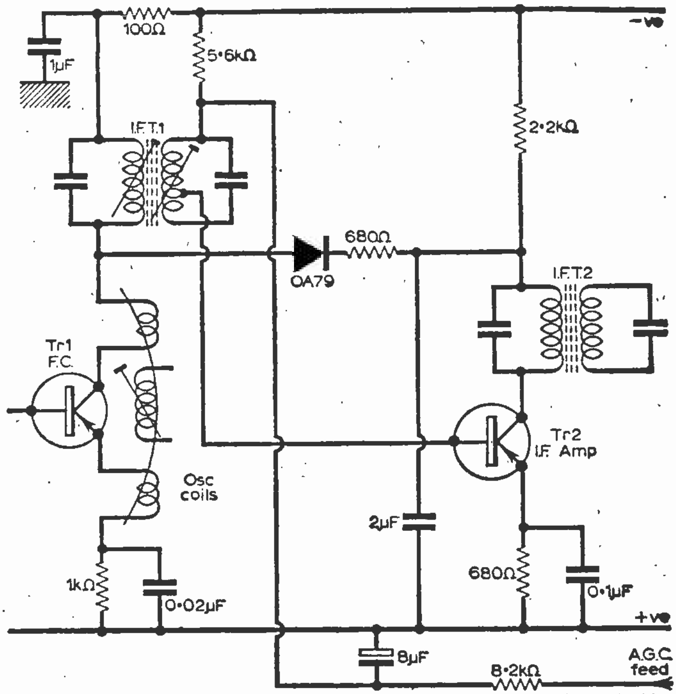


Fig. 3: Typical a.g.c. circuit incorporating transformer loading (Sobell). Normally anode connection to OA79 is more negative than cathode connection and no conduction occurs. However as a.g.c. voltage on strong signal reduces T2 collector current, T2 collector voltage increases above that of T1, conduction occurs through the rectifier and the combination of rectifier and 680Ω resistor loads the I.F.T.1 primary via 2μF capacitor.

Particularly strong inputs will raise the Tr2 collector voltage above that of Tr1 and so bias the rectifier that it acts almost like a short circuit in series with the limiting 680Ω resistor heavily curtailing "Q" and gain. Naturally, this transformer damping results in some slight loss of selectivity, but the freedom from over-loading more than compensates.

Other makers vary the design by tapping the rectifier across a section of the i.f. winding or by completely eliminating the series resistor, while one or two designers shunt the rectifier across the aerial coils and control it from the emitter resistor of the i.f. amplifier.

Most all - transistor Car Radios employ an r.f. stage, not merely to provide extra gain, and maintain volume over widely varying reception conditions, but also to help maintain the signal input voltage to the frequency-changer within fairly close limits as big changes in input strength can cause mistuning in a transistor mixer stage.

To this end, the r.f. stage is

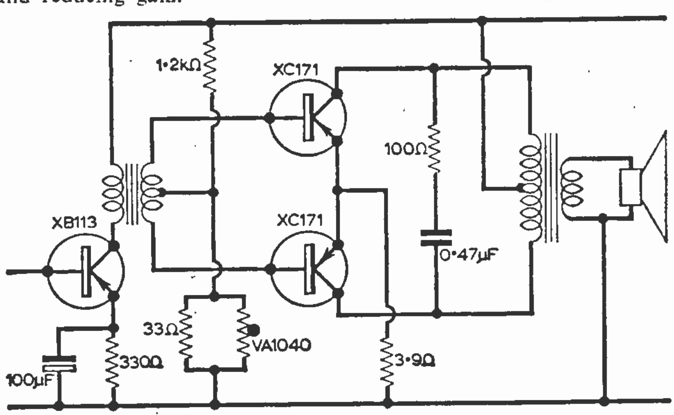


Fig. 2: Bias stabilisation circuit using thermistor (Ever Ready Berec) thermistor VA1040 decreases the p.d. developed across the 33Ω resistor as temperature rises thus biasing back the twin output transistors.

a.g.c. controlled by a separate diode from the detector, and is fed by a small capacitor from the collector of the i.f. transistor.

Fig. 4 shows a typical a.g.c. circuit to the r.f. stage and it will be noted that the diode is shunted *across* the a.g.c. line to provide the rectifying action.

Also present in the circuit is a voltage dependent resistor paralleled across the aerial tuned circuit but in no way connected with the a.g.c. action.

Car radios invariably operate on a low signal/noise ratio and on many occasions can be subject to very heavy brief bursts of interference, which apart from its aural objections can momentarily over-run the transistors. The v.d.r. prevents this for while acting as a very high value load on low value signals, performs as a much lower one on high value signals and thus effectively cuts down their strength.

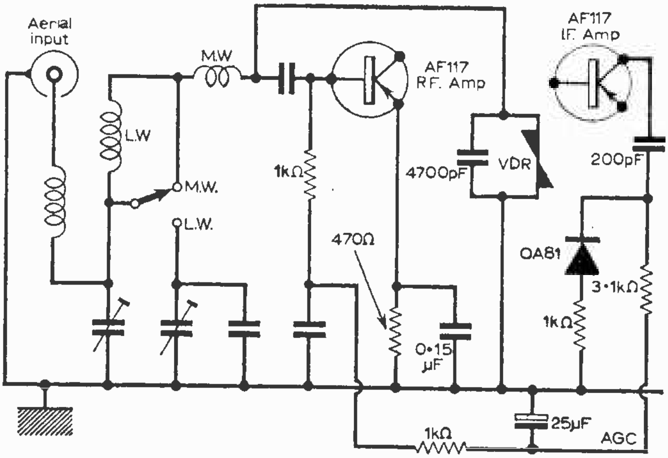


Fig. 4: Skeleton r.f. amp and a.g.c. circuit all-transistor car radio (Motorola). Separate a.g.c. circuit controls r.f. stage only while v.d.r. shunted across aerial coils clamps down on heavy interference peaks.

Quite a number of table-size transistor receivers are available in mains/battery versions, and while the power supply circuits in these is always orthodox, the associated voltage stabilising system is often a new development.

In the eight transistor Ferranti MBT1089 receivers for instance, a conventional quadruple rectifier bridge circuit provides the rectified d.c. power for the receiver, but it is fed to the circuit via a NKT251 power transistor.

The smoothed output from the rectifiers is fed to the transistors collector and taken off at the emitter, so that it is virtually in series with the d.c. supply.

However a separate small rectifier produces a separate reference voltage from another secondary winding which is used to bias the base of the transistor, so that increases or decreases of mains voltage increase or decrease this base bias and vary its internal resistance to provide a very constant output indeed.

Adjustment of the 5kΩ potentiometer selects the optimum output voltage which is then automatically maintained by this simple circuitry.

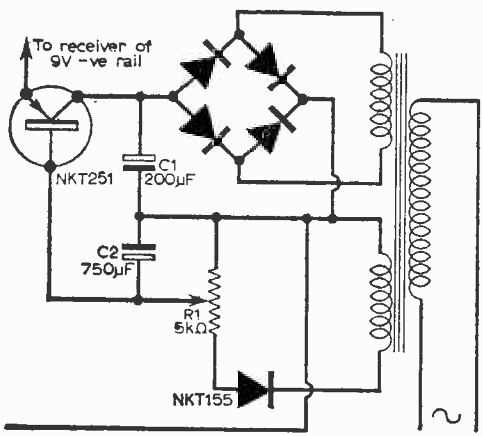


Fig. 5: Stabilised power supply circuit for battery/mains transistor sets (Ferranti). The entire d.c. output passes through the NKT251 power transistor to the receiver's negative rail. Variations in mains voltage produce similar variations across R1 which are applied to the base of the transistor so that its internal resistance is varied accordingly. When mains voltage rises its internal resistance increases, taking up a larger volts drop, and maintaining output within very close limits.

REDUCING BCI/TVI

(continued from page 573)

feeder ran on the outside of this wall only a few feet from the transmitter. With this set of equipment merely moving the transmitter to the other side of the room reduced TVI very much.

It will be noted that licence conditions stress that "every precaution shall be taken to avoid over-modulation". When making tests it was found that any over-modulation often immediately caused bad interference.

In the circumstances described it was found possible to operate on the 14Mc/s and lower frequency bands with no TVI on a receiver a few feet away in another room. As these bands were those most wanted only a little attention was given to possible TVI from working on 21Mc/s and 28Mc/s bands.

The home-built transmitter covered the 21Mc/s band and gave no broadcast band interference but bad TV interference on this band. As the third harmonic of 21Mc/s (63Mc/s) was not very far removed from the particular BBC-TV frequency it was felt this problem would have to be examined separately.

A commercially made transmitter also gave bad TVI on 21Mc/s and 28Mc/s but not on 14Mc/s. When using the latter band TVI was not experienced on either BBC or ITA channels. ■

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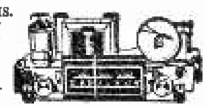

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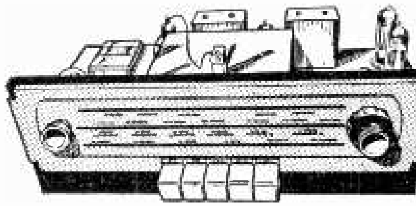

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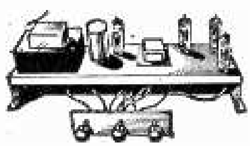

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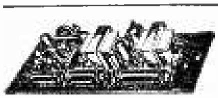

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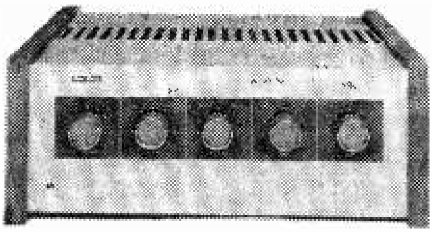

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THE MORSE BOGEY

By John Colley

I HAD always wanted to be a Radio Ham; anyway, ever since I was 14. Curiously enough that was 46 years ago. Those that are mathematically minded will see that I am now 60.

Well, last year I dragged myself to an evening institute where the instructor revised my ideas of radio completely. As a result I passed the R.A.E. I rubbed my hands at this and listened to all the gossip about the Morse Test.

Impossible, Difficult, Hard . . .

From different people I gathered that it was impossible, difficult, moderately hard, easy and a piece of cake. Some despondent people assured me that I'd just as well ask for a "B" licence because, at my age, I'd never do it.

But I am an obstinate old coot. I asked questions as to the best way to master the mystery Morse and again I had different advice. One smart-looking Royal Air Force sergeant said airily: *"Just listen to ordinary commercial Morse on the air and after a time you'll find yourself picking out various letters and symbols and in no time you'll know it".*

As I didn't know any Morse at all except the "V" sign, which seemed to be made with two fingers, I thought hard how this chap could have been made a sergeant. Perhaps he had got full marks for ingenuity.

So I asked another chap, who said: *"Just latch on to the slow Morse transmissions of the R.S.G.B.—you'll find yourself learning in no time".* I pondered.

Another bloke in a pub (I remember him particularly well because I bought him two pints) told me to buy some Morse records and play them on my gramophone. Well, I have no gramophone and the price of beer being what it is I thought I would have to find a method of my own.

Labour and Perseverance

I looked at the symbols in an old Boy Scout diary and decided that it would entail a bit of good old-fashioned labour and perseverance. I had a tape recorder and I knew that this must come into it somewhere. So I scouted around to see what method I could find of making the noise.

From a book I got a transistor circuit that was supposed to simulate the actual sound of a Morse transmission on the air. It was soon after this that I was afflicted with sorrow for all c.w. wireless operators, because this transistorised thingummy made notes between the mooing of a sick cow and the soft sighing of an asthmatic donkey. Never once did it sound like a real live Morse note and it had a habit of changing its note whilst you waited.

I spent hours manipulating the potentiometer of this crazy device and then gave it up. In Tottenham Court Road I bought an ex-Army telephone buzzer, a Mark 76 ten stars and an asterisk or two, I think it was. And a Morse key, also ex-Army, which only set me back sixpence. Then I bought a cycle lamp battery and wired up. Now this note was good and even became better when I connected the secondary winding of the buzzer to the radio input terminals of the recorder.

I was now ready. I had heard one Public Bar Pundit say: *"Never touch a key until you can read 20 words a minute".* So, as I thought this would mean that I would never touch a key at all in this life, I ignored him as well. I opened the Boy Scout diary, adjusted my specs, switched to "Record" and I was off. With a nice new spool of tape I started on the figures *"Dit . . . Dah . . . Dah . . . Dah . . . Dah".*

On the dots—E, I, S and H

In a little while I had a tape covered with haphazard numbers and I played it back at odd hours for several days. There was a gap after the fourth day when I agreed to wear headphones if my wife would promise not to run away. But I soon memorised the numbers and started on the dots, you know, the "E", "I", "S" and "H".

I was some weeks at it, I hummed Morse to myself all day, and any advertisements on hoardings I hummed their message as I stood staring. I realised that Samuel Morse had been a genius. Well, at 60 you are not as bright at picking things up as at 26, but I persevered and one day I put my system to the test.

I went up to St. Martins Le Grand and did the Morse test. I passed and I walked away around the back of Smithfield Meat Market with such a broad smile that the meat porters thought I was the owner of the lot and got on with their work even quicker.

I now have a licence and I enjoy thumping out a little Morse. Advice? Yes. Ignore the old wives' tales, get a buzzer and a key and a battery and, if you haven't got a recorder, borrow or buy one. Oh, yes. A piece of advice from an old radio comedian: "Don't be fright!"

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SHOWTIME

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A SUMMARY OF THE NEW MODELS

IN the absence of a Radio Show this year, many manufacturers booked hotel suites to display their new season's models to the trade. There were hundreds of new radio receivers, record players, tape recorders and radiograms, many of them extremely attractively presented. There was little, however, to excite us technically and the main trend noticeable was the obvious one of the spread of transistors to more and more record players, radiograms and tape recorders. There was a good deal more stereo equipment and more bandspreading (not only the h.f. end of the m.w.), more multiband sets and more sets with more than one speaker.

It would be impossible to cover all the new sets in the space available, but the following are a few notes on some of the more interesting models we noticed, intended to show the overall picture rather than be a detailed summary. The new TV sets are described in the October issue of PRACTICAL TELEVISION.

RADIO RECEIVERS

Where to begin? Perhaps to give an unqualified bouquet to practically every manufacturer for a dazzling display of first-rate styling. The latest transistor radios look good and, generally, are very good. We must admit, however, to being very disappointed at the almost complete lack of mains operated transistor sets although there were many models intended primarily for home use only.

Full marks, then, to **PYE** for their *Trans-Continental*, Model 1110, an elegant table model incorporating 15 semiconductors and covering long, medium, short and v.h.f./f.m. bands. Output is 3W to a 7 x 5in. speaker. Three internal aerials are fitted and there are sockets for external aerials, tape recorder, gram pickup. The set operates from standard a.c. mains supplies and sells at 32 gns.

Novel feature of the **MURPHY** *Magna* B818 is a pre-tuned position which gives Luxembourg reception at the push of a button. It has 8 semiconductors, a 6 x 4in. speaker, 1W output and sells at 15 gns. Another attractive new one from Murphy is the *Magna* B837, intended as a "home portable", covering l.w., m.w. and v.h.f./f.m. bands, plus the now customary bandspread for pop station coverage. This set retails at 23 gns.

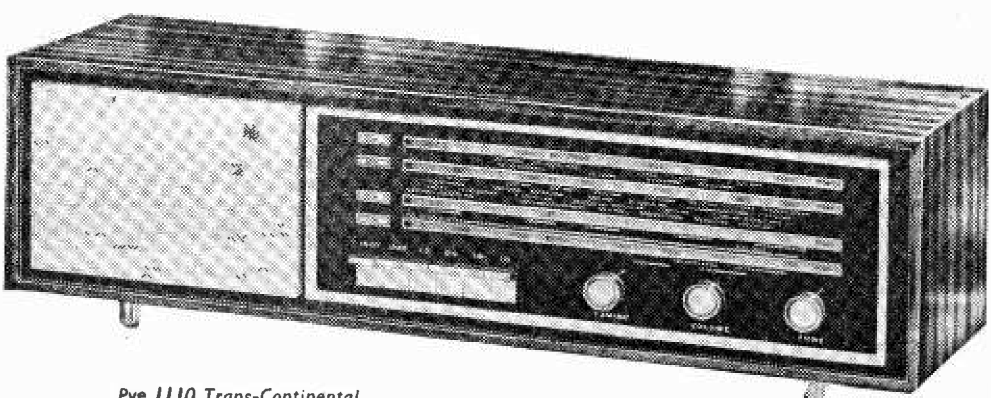
Another example of really good value is the new **McMICHAEL** M126 which has push button selection of l.w., m.w., s.w. and bandspread, and features a dust-proofed speaker and telescopic aerial. Housed in an unbreakable cycolas case it sells at 14½ gns.

From **PHILIPS** comes the new *Le Mans*, which incorporates a "power boost" switch—at maximum the output is 1W (for group listening) and on minimum the output is reduced to 400mW, thus reducing battery drain. It costs 15½ gns. Also new from Philips is the *Cadiz*, an interesting two band portable featuring microtechnique. It has a battery check button. Price 11 gns.

HMV have added several to their range, including the Model 2124. This features a "car" button which switches in permeability tuned front end for use in a car, and an illuminated scale for night driving. Price, 18½ gns. An innovation is the 2130, which also incorporates the 2124 features but has v.h.f./f.m. coverage and is housed in fashionable teak cabinet. It incorporates a dual speaker system and retails at 26 gns.

STELLA showed their new ST7228T, described as a 3-band, a.m./f.m. sports portable. It features a special biasing circuit to reduce distortion as the battery voltage falls and has automatic frequency control for f.m. Incorporating 16 semiconductors it sells at 25½ gns.

DECCA introduced several high quality radio



Pye 1110 Trans-Continental

sets, most unusual being the *Diadem*, a 15-semiconductor set with 7 x 3½in. speaker, covering m.w., l.w. and v.h.f./f.m. bands. It is fitted into a teak or rosewood cabinet of novel design, styled like a music box. It costs 30 gns. The four new portables, TP85, TP86, TP89 and TP90 cover m.w., l.w. and v.h.f./f.m. bands. The TP90 (20 gns.), has 10 semiconductors. The TP85 and TP86 (both 25 gns.) have 15 semiconductors and feature a "mute" control for low volume level listening. The TP89 at 30 gns., incorporates 17 semiconductors and also has short wave coverage. It has mechanical bandspread on *all* bands. It is interesting to note that all Decca receivers now carry a two-years' guarantee for all components, including transistors.

The new **GEC** models G826 and G828 (both 14½ gns.), cover l.w., m.w., Luxembourg bandspread and s.w. (though this coverage is only over the 31, 41 and 49m bands). There were also two new ones in the **ALBA** range—the *Trans-Continental* 838, covering m.w., l.w. and s.w. (16—50m), bandspread on *all* bands and telescopic aerial. Price 16 gns. The Alba *Scout* 737 sells at 14 gns., and covers l.w., m.w. and Luxembourg bandspread, housed in a wooden cabinet.

Another one with short wave coverage is the **BUSH** TR116, which has a two-transistor mixer for efficient s.w. operation. It also covers m.w. and l.w. bands and incorporates pre-tuned Luxembourg. Ouput 500mW via a 6 x 4in. speaker. Price, 17 gns. The new TR130 at 15 gns. has a 1W output, 6 x 4in. speaker, and covers m.w. and l.w.

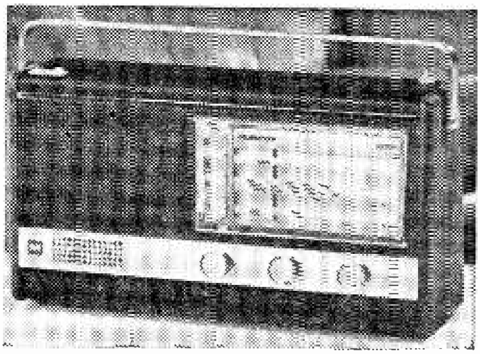
GRUNDIG introduced two new luxury radio sets. The *Ocean Boy* incorporates 23 semiconductors, two speakers, a tuning meter, a.f.c., fine tuning on s.w., bass and treble tone controls, and covers v.h.f., l.w., m.w. and four s.w. bands (10—185m). The set measures only 15 x 8⅝ x 4¾in. and weighs 10½ lb. The cost is 87 gns. Even more luxurious is the *Satellit* which operates from batteries or from a.c. mains. It has 28 semiconductors, and covers no less than 13 wavebands (six of them bandspread s.w. bands). It has fine tuning for s.w., a.f.c. on v.h.f., two speakers, a tuning and battery power meter, sockets for almost everything! Price? 119 gns.

Another new one with s.w. coverage is the **ULTRA** 6120—9 semiconductors, l.w. and m.w. reception also, plus bandspread Luxembourg, retailing at 13½ gns. V.H.F., plus m.w. and l.w. is covered by the 6122 (17 gns.) and the 6128 (at 23 gns.) has a wooden cabinet, v.h.f., m.w., l.w. and Luxembourg bandspread, 15 semiconductors.

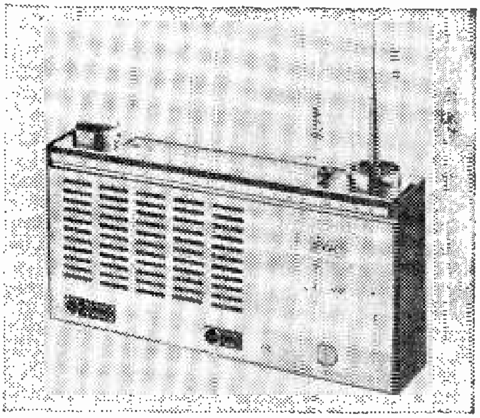
RECORD PLAYERS AND GRAMS

Everyone seemed to have a good range of attractive record players and radiograms. Here is a quick selection of some of them.

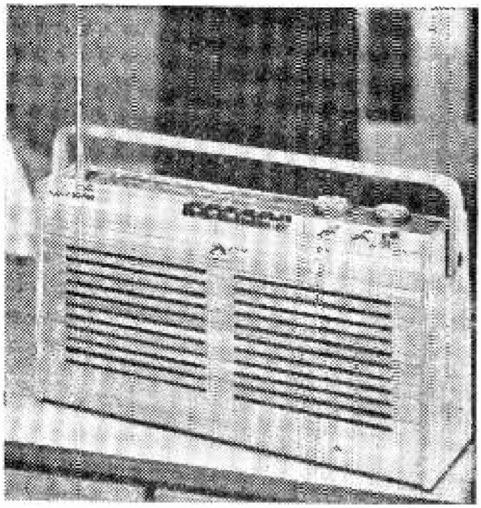
ALBA showed a smart new 5-transistor record player with 3W output via an 8 x 5in. speaker and separate bass and treble controls. The 328 has a BSR UA15 autochanger and sockets for microphone and tape recorder, the mic' can be used in conjunction with the amplifier as a baby alarm. Price is 24 gns. Also new is a range of *Gold Star*



Murphy Magna B837.



G.E.C. G819.



H.M.V. 2130

stereograms, ranging in price from 69½—134 gns. The *Viscount* (134 gns.) and *Viking* (129 gns.) have 8W per channel, four speakers (two in tuned enclosures), l.w., m.w., v.h.f./f.m. and two short wave bands.

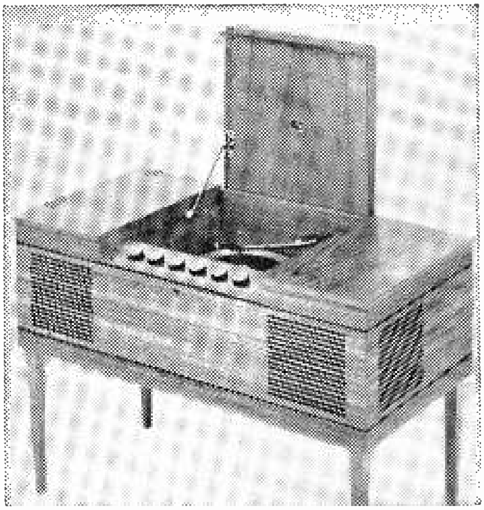
At the other end of the (price) scale is the radiogram described by **PHILIPS** as "Britain's Smallest" and which could be carried inside most ladies' handbags. Based on the AG4000 *Disc Jockey* player it incorporates a two-band radio within the space of the original lid, which also houses the 4in. round speaker. It measures 11 x 7¾ x 4⅝in., and sells at 21 gns.

"Upright" model from **RGD** is the RP233 stereo record player, housed in a suitcase-type cabinet with top carrying handle. Transistor amplifiers feed 8 x 5in. speakers at 3W each channel. The changer is a BSR UA15. Price 36 gns. **FALCON** now introduce "solid state" radiograms, ranging from the mono FT65 at 31 gns. to the *Galaxy, Concerto* and *Fiesta* stereograms (from 47-62 gns.). **BUSH** add the SRG107 luxury stereogram to their range; the speaker system has six units in an acoustically balanced network with 5W per channel. Twelve semiconductors are incorporated and the radio covers l.w., m.w. and v.h.f. Price is 125 gns., but other Bush stereograms range down to 65 gns.

GEC have two new stereograms, G980 and G981. Both have a Garrard changer and 5-band a.m./f.m. radio sections feeding 14W twin channel amplifiers into 10 x 6in. and 4in. speakers. The v.h.f. tuner has a.f.c. Price 110 gns.

ULTRA also have an "upright" record player in Model 6010, a completely self-contained 20-semiconductor stereo system. Separate, bass and treble, indicator lamp, tape and radio sockets, both speaker units detachable. Price 36 gns. Also new are 6008 (15½ gns.) and 6006 (29 gns.) record players and 6316 (61 gns.) and 6320 (86 gns.) stereograms.

Novel design from **K-B** is the KP033 stereo record player with 3W transistor amplifiers. The wooden cabinet has a rear hinged lid and has a compartment for the extension speaker unit when not in use. Price 34 gns. **SOBELL** showed their new S680 stereogram, with all-transistor circuitry and 7W per channel (85 gns.).



H.M.V. 2018 "Stereomaster"

Two new record players for **MARCONIPHONE**. The *Mirabelle* has a BSR *Superslim* deck and gives 2¼W output (15 gns.). The *Major* has separate bass and treble controls and gives 2¼W via an 8 x 5in. speaker (19 gns.). Also new were the 4314 a.m./f.m. stereogram (56 gns.), and the Model 4310—a m.w., l.w. and v.h.f. "solid state" stereogram at 83 gns.

GRUNDIG came up with two luxury stereograms. The KS680 has ten speakers in an infinite baffle enclosure and incorporates the Grundig HF10 tuner, NF10 stereo amplifier and a transcription autochanger. The tuner has a.f.c. on v.h.f. and the set is fitted with a stereo decoder for possible future stereo radio broadcasts. Space is provided for incorporating a TM45 tape recorder chassis and there is provision for a reverberation unit. The KS740 incorporates a four-band a.m./f.m. radio chassis and feeds 3W per channel to large *Superphon* speakers. Prices for both models not available at time of going to press.

Highlighted by **HMV** was their new 2018 *Stereomaster,* a compact unit (33in. wide) incorporating four soft - suspension speakers, Garrard 300 autochanger, low mass arm-high compliance pickup, 7 watts per channel, treble and bass controls; price 59 gns. Also seen was a new solid state portable record player with Garrard 2000 autochanger, 8 x 5in. speaker (Model 2012, 25 gns.) and a range of radiograms from the popular priced a.m./f.m. stereogram 2320 (56 gns.) to the 22-

—continued on page 588

R.G.D. RP233.

Practical Substitutes

by M. L. Michaelis, M.A.

THE lists of parts for constructional articles are those found satisfactory in the prototypes. Queries which the Editor receives show that many beginners regard these lists as strictly binding down to the last detail.

It is the aim of these articles to help beginners make on-the-spot substitute decisions when their dealers do not have specific components on stock. The information should also help when replacing obsolete components and making use of junkbox parts.

PART FOUR

Zener Diodes and Neon Stabiliser Tubes

Zener diodes are now marketed with graded zener voltages (Vz in Fig. 13) from one or two volts up to 180V or more at current ratings from a fraction of a milliamp up to 1A or more.

The circuit of a zener diode connected as voltage stabiliser (Fig. 14a) is essentially the same as that of the familiar neon tube stabiliser circuit (Fig. 14b). The input voltage is applied to the zener diode through a suitable series resistor such that the anode is negative and the cathode positive wherewith inverse current flows through Di and Vz and Rz of Fig. 13.

Since Rz is small for a good zener diode it may be neglected to a first approximation. so that the output voltage across the zener diode is then largely independent of the current through the diode and is equal to Vz.

Provided that the maximum current rating and the zener voltage of a given zener diode are the same as the current rating and operating voltage of a particular neon tube the zener diode may always be substituted for that neon tube in a voltage stabiliser circuit.

This leads to further advantages, since zener diodes do not manifest a striking voltage higher than their running voltage and there is no lower limit to the stable range of zener currents. Thus zener diodes can be connected in series without any need for auxiliary starter resistors as in the case of series-connected neon tubes and they can operate down to zero zener current.

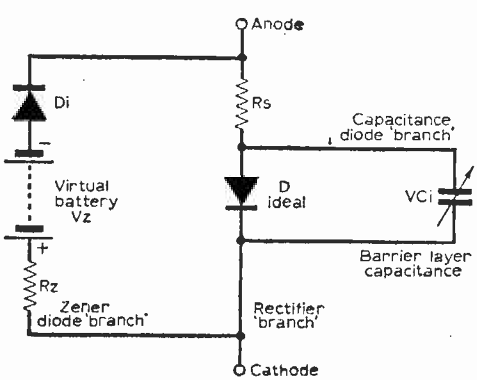


Fig. 13: Equivalent circuit of any semiconductor diode.

Neon tubes tend to oscillate when starved of current. It is for this reason not always possible to substitute a neon tube of the same operating voltage for a specified zener diode. If the operating current is too low the neon tube may oscillate and if the input voltage is not sufficiently high the neon tube may refuse to strike. Apart from these limitations zener diodes and neon tubes of similar ratings may be interchanged.

Zener diodes at present have somewhat greater differential resistances Rz (Fig. 13) than neon tubes of the same voltage ratings and the temperature coefficients of zener diodes are somewhat greater.

Neither neon tubes nor zener diodes may be connected in parallel to achieve increased current ratings, since in both cases even the slightest differences of characteristics will lead to grossly unequal current sharing.

Relays, Meters, Switches

Relays and meters may be shunted in the same manner to achieve higher current values for energising or for full-scale deflection respectively. Thus if a relay or a meter of a certain sensitivity is specified for a piece of equipment it is always possible to use more sensitive components with suitable shunts as substitutes.

If a definite internal resistance is also specified for the relay or meter then any other component of lower resistance may be used if the difference is added as an external series resistor. Both adjustments may be used simultaneously.

A simple example will suffice to make this clear. Suppose a relay of 100mA sensitivity and 150Ω resistance is specified for a piece of equipment. A relay of 25mA sensitivity and 120Ω resistance is available as a substitute.

The shunt must be such that 75mA of the total 100mA flow through it, leaving the required 25mA for the relay coil. Since 75 is three times 25 the shunt must have one-third as great a resistance as the relay coil, i.e. 40Ω. The shunted relay then has an effective resistance of 40Ω in parallel with 120Ω. which is equal to 30Ω.

Thus an external series resistor of 120Ω must be added to reach the specified total figure of 150Ω. Note that the relay must first be shunted before any required external series resistor is subsequently determined. Exactly the same procedure is used to shunt a meter for a higher current range.

If a relay is fitted with insufficient contacts for a particular purpose any required number of similar relays may be energised in series or in parallel or a master relay can energise various slave relays via its own contacts. The latter procedure is useful if a very sensitive relay cannot be obtained with contacts of sufficient voltage or current rating; it is then merely used to energise a larger, more robust relay which in turn has the required rugged contacts.

If a specified multi-contact wafer switch is unobtainable it is possible to use a simpler switch energising suitably disposed multi-contact relays. Such measures are often useful for other reasons too, e.g. to perform switching operations at each stage of a piece of equipment without the need for long signal current leads of intolerable stray capacity and stray couplings to a central manual switch.

Loudspeakers and Output Transformers

It is always possible to substitute N smaller loudspeakers for a single larger one. In such cases it is convenient to make N a perfect square, e.g. 4, 9, 16 or more, so that $\sqrt{N}$ groups or $\sqrt{N}$ series-connected speakers (Fig. 15) may be wired in parallel. The power rating is then N times that of a single speaker but the matching impedance is quite unchanged.

If N speakers of smaller size are disposed on a large baffle in a well-designed cabinet the quality of reproduction is at least as good as that of a single, much larger speaker. Make sure that all speakers are identical in such a case and that connection polarities are the same for all speakers so that all speech cones move in sympathy. If the speakers are in separate rooms the polarity of connection of each speaker is immaterial.

If an amplifier or receiver design is published with an output transformer for a specified speaker impedance then an output transformer for any other speaker impedance may be substituted provided it matches the specified output valves or the latter are substituted with ones matching the available output transformer.

The only other point to watch when substituting other output transformers is to correct any negative feedback circuit taken from the output transformer secondary to the amplifier input. Such a negative feedback circuit should be examined to determine the attenuation ratio of the signal through the connection from the output transformer secondary to the amplifier input.

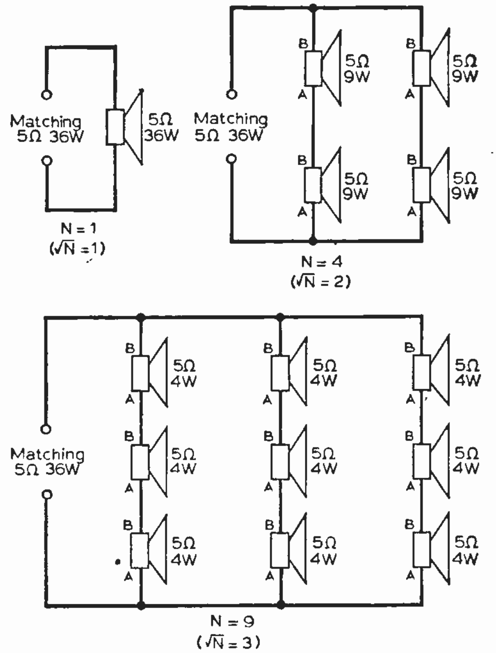


Fig. 15: Loudspeaker groupings

This attenuation factor must be changed by the square root of the factor by which the output impedance (speaker matching impedance) is changed and in the same sense. For example, in Fig. 16 the negative feedback attenuation factor is given by R1/R2=50 for the depicted output impedance of 3-4Ω. If the output transformer is changed to match a 15Ω speaker, i.e. the output impedance is now about four times as great, the negative feedback attenuation must be doubled, i.e. a 10kΩ resistor must be substituted for R1. There is generally no need to be over-critical in this kind of correction.

If the output impedance of an amplifier or receiver is arranged to match a 15Ω speaker three 5Ω speakers may be connected in series to the same output without any need for modifications. The three speakers should be identical, at least electrically, and each must be capable of handling one-third of the total output power of the amplifier.

If the output impedance of the amplifier is 5Ω three mutually identical 15Ω speakers may be connected to it in parallel and each must again be able to handle one-third of the total power output of the amplifier. Any similar matching combinations of identical speakers may

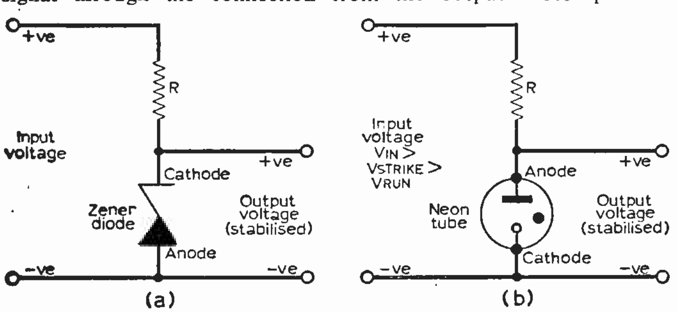
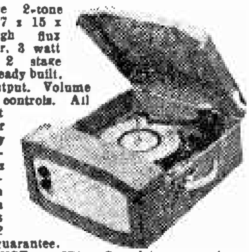


Fig. 14: Simple voltage stabiliser circuits (a) Zener diode stabiliser circuit; (b) Neon tube stabiliser circuit.

DESPATCH-TODAY?-PHONE-R.C.S.!

DE LUXE RECORD PLAYER KITS



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10 watt } WIRE-WOUND RESISTORS { 1/9
15 watt } 10 ohms—6,800 ohms { 2/-
10 K., 15 K., 25 K., 10 w. 3/-
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5Y3GT	4/6	6F13	5/-	6X4	3/6	12SG7	3/6	50B5	6/6	DF92	2/6	ECH21	19/-	EZ35	4/9	PCF806	12/-	U26	10/-	VT31	59/-
5Z4GT	8/-	6F14	12/6	6X5G	4/9	12SH7	2/9	50C5	6/3	DF96	6/-	ECH35	13/-	EZ40	5/6	PCF808	12/6	U191	11/-	VU111	6/-
6/30L2	10/-	6F23	9/6	6X5GT	7/6	12SJ7	3/9	50CD6G	24/9	DH77	8/6	ECH42	8/-	EZ41	6/-	PCL82	6/6	U251	11/6	VU120	10/-
6A7	15/-	6G6	2/6	7B6	11/-	12SK7	2/9	50L6GT	6/-	DK32	7/9	ECH81	5/6	EZ80	5/6	PCL83	8/-	U301	12/-	VU508	25/-
6A8G	6/6	6H6	1/3	7B7	7/-	12SR7	5/-	75	5/-	DK91	5/-	ECH83	6/6	EZ81	3/6	PCL84	7/-	U403	6/6	W81M	5/-
6AC7	3/-	6J5M	6/6	7C5	10/-	14S7	20/-	78	4/6	DK92	7/9	ECL80	6/-	GZ30	8/6	PCL85	7/3	U801	18/6	X78	26/6
6AK5	4/6	6J5G	2/6	7C6	6/-	19AQ5	7/6	80	5/-	DK96	6/6	ECL82	6/6	GZ32	9/-	PCL86	8/9	UABC80	5/6	X79	25/-
6AL5	3/-	6J5GT	4/3	7D5	8/-	20D1	10/-	813	80/-	DL70	7/-	ECL83	9/-	GZ34	9/9	PENA4	20/-	UAF42	7/-	XH1-5	5/-
6AM5	2/6	6J6	3/-	7H7	5/-	20F2	11/-	85A2	8/6	DL92	4/9	ECL86	8/6	KT36	22/6	PENB4	20/-	UBC41	6/6	XP1-5	5/-
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6B8G	2/-	6K7G	1/3	10C2	12/-	25Y5	6/-	866	10/-	DY86	7/-	EF50	2/-	KTZ41	8/-	PL83	6/-	UCF80	8/6	CV1526	40/-
6BA6	4/9	6K7GT	4/6	10F1	12/6	25Z4	6/3	954	4/-	DY87	7/9	EF80	4/6	ML4	17/6	PL84	6/3	UCH42	7/-	ACR13	£3.0.6
6BE6	4/9	6K8M	8/6	10F9	9/9	25Z5	7/-	1625	5/-	E88CC	14/-	EF85	4/6	ML6	12/6	PL500	14/6	UCH81	6/3		
6BH6	7/-	6K8G	3/-	10L1	10/-	25Z6	8/6	4022AR	15/-	EA50	2/-	EF86	6/6	MSP4	12/6	PX4	8/6	UCL82	7/9		
6BJ6	6/6	6K8GT	8/3	10F3	12/-	28D7	5/-	5763	10/6	EABC80	5/6	EF89	4/-	MU14	4/-	PY33	8/6				
6BQ7A	7/6	6K25	20/-	10F18	9/-	30C15	9/6	7193	1/6	EAF42	7/6	EF91	2/9			PY81	5/6				

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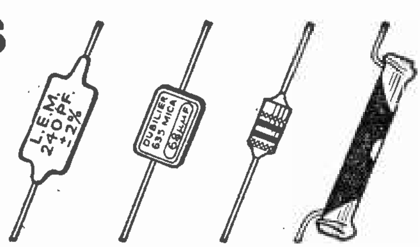

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HOME RADIO LTD, Dept. PW, 187 LONDON RD., MITCHAM, SURREY be used as required.

In all such cases, where the correct matching impedance is preserved, it is never necessary to modify any negative feedback circuit connected to the secondary of the existing output transformer.

Whilst reasonably good matching should be aimed at in audio output stages it is not necessary to be over-critical. Thus if an output transformer of 8kΩ anode matching impedance is specified any other available item with a value between 7-9kΩ will usually be quite satisfactory. Simple equipment may well tolerate even greater departures, especially if the low-impedance secondary of the output transformer has several tappings for obtaining optimum results by trial and error selection.

Interchangeable Stages

It would be useful to discuss one final problem —the interchangeability of entire stages from various independent published designs to constitute a new design meeting the particular requirements of the constructor.

There exists a very large scope for such measures and it is the aim of the magazine to provide readers with ideas for "circuit bricks" as much as to provide complete designs for copying as they stand. Many published constructional articles implicitly cater for both these requirements, even if a design happens to be for a piece of equipment complete in itself.

If a reader wishes to use individual stages from one design with ones from another or even with others of his own devising he must be able to discern the input and output positions of each stage. In general an amplifier stage commences with the input coupling capacitor from the previous stage (which thus belongs to it) and ends with the output load component (e.g. the collector or anode load resistor in the conventional type of RC-coupled amplifier stage).

The coupling capacitor from the output load to the next stage *belongs to the next stage*. This is because it determines the frequency response of the next stage in conjunction with the input load resistor (e.g. a gridleak) of the next stage, which has nothing to do with the function of the stage from which the output is being taken through this coupling capacitor.

If a piece of electronic equipment uses some stage to drive a relay, and the next stage consists of some device actuated by the relay contacts, then any other actuated stage may be substituted, even if of a completely different function.

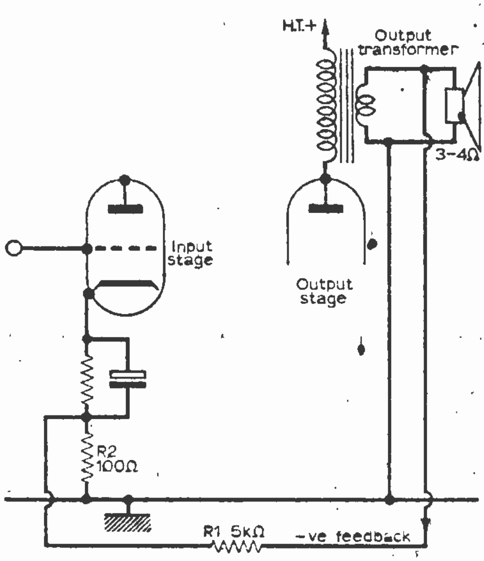


Fig. 16: Correcting a negative-feedback loop when changing an output transformer to a different loudspeaker matching impedance (see text).

Simple Matching Measures

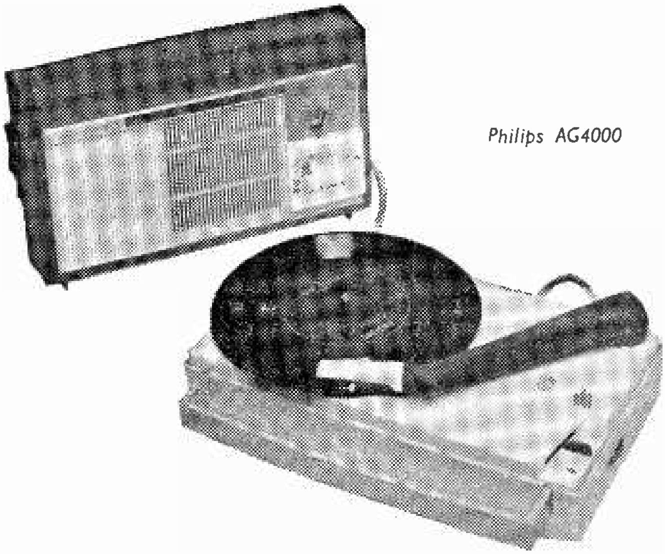
Any sound radio tuner may be connected to any audio amplifier of sufficient quality in relation to the tuner output. Normally only simple matching measures are required which are in many cases completely non-critical. If an amplifier is published with a microphone preamplifier stage this can always be omitted if only a radio or pick-up is to be used as input signal source. Or some quite different preamplifier circuit may be substituted. Auxiliaries such as a magic eye may be added or dispensed with according to individual desires. ■

SHOWTIME

—continued from page 582

semiconductor 4-band 2318 (86 gns.).

DECCA has three new grams. MRG525 is a mono radiogram at 45 gns. SRG545 is a three-band a.m./f.m. stereogram with 25 semiconductors, 8 x 5in. speakers, 3W per channel (57 gns.). Model SRG565 is similar electrically (66 gns.). These grams carry a year's guarantee on components plus a 5-year guarantee on the Decca auto-changer.



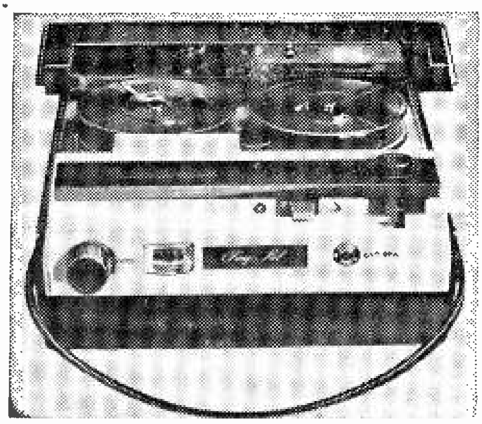
Philips AG4000

TAPE RECORDERS

FIDELITY introduce their new *Playmatic,* a 3-speed, 7in. recorder in a teak, metal and plastics housing. It has separate bass and treble controls, monitor and external speaker sockets, separate inputs (which can be mixed) for mic and radio/gram, magic eye level indicator, and optional automatic or manual recording level. It is available for 2-track at 28 gns. or 4-track at 31 gns.

Teak styling is also used on the new **PHILIPS** EL3556, a 4-track, 4-speed recorder with separate bass and treble controls (62 gns.). **GRUNDIG** showed their TK27L, designed to fit into the recorder compartment of a Grundig stereogram. It is similar to the TK23L and has optional automatic/manual facilities for recording. Price is 69 gns.

New from **ELIZABETHAN** is the LZ012, 4-track, 3 speed solid state recorder. Maker's spec. claims wow and flutter not greater than 0·15% at 7·5 i/S, frequency response 60—15,000c/s ±4dB at 7·5 i/S, signal-to-noise ratio 40dB. The machine features VU meter, mic' and gram inputs, hi-fi and external LS/headphone outputs, bass and treble controls, 4W output, two speakers. Price is 49 gns. Also new is the LZ711—a stereo recorder with 3W per channel to two 8 x 5in. speakers, VU recording level meters, four inputs, four speaker outputs, 5% distortion at full gain, separate channel selector switches, monitoring facilities, sound on sound and dub-in system. Price 75 gns.



Standard SR-F21T.

DENHAM & MORLEY displayed the new *Standard* SR-F21T, a 6-transistor miniature tape recorder measuring 7 x 6 x 3in., giving 500mW output. It has a 2-track sytem at $1\frac{7}{8}$ i/S and incorporates a recording level and battery life meter. Price is 15 gns.

PERDIO enter the tape recorder field with their T26 (2-track) and T46 (4-track) models. Maximum spool size, $5\frac{3}{4}$in. 3-speed Deck. Model T46 incorporates a parallel track switch. Prices, 29 and 33 gns. **ULTRA** exhibited their new Model 6204, a 2-speed 4-track recorder with two-way tape inching, straight-through amplifier facilities, various auxiliary sockets (34 gns).

STELLA showed their smallest-ever tape recorder, weighing only 3 lb., and battery operated. (Five U11's.) About 20 hours' playing time is claimed. This camera-styled recorder uses Philips tape casettes, Fast Rewind, Playback and (linked with a safety interlock button) Record. There is a combined modulation level meter and battery condition indicator. Price of the ST472 is 26 gns.

TAPE
TAPE
TAPE TERMINOLOGY
TAPE

PART FOUR

by H. W. Hellyer

PRE-RECORDED

THIS term is used indiscriminately to mean a tape record or a tape being replayed on which a recording has been made (e.g. for test). The tape record made by reputable engineers should conform to international specifications (see Standards).

PRESSURE PADS

Felts pads mounted on sprung arms, making contact with the back (polished) surface of the tape, pressing the tape into intimate contact with the head facing during recording or replay.

Alternative methods are the *pressure sling*, a strip of material sprung to engage tape and heads in the same way; *tape pins*, which press the tape inward at intermediate points, forming a "wrap-around" contact with the heads.

A method of screening, making use of the pressure pad system, is the provision of a mumetal shield on the pad spring, completely closing off the face of the playback head.

PRESSURE ROLLER

Free-running roller wheel of rubber or composition which engages the tape and holds it against the revolving capstan spindle to obtain drive. The pressure roller (or pinch wheel) is mounted on a sprung bracket or arm to ensure correct pressure and obviate tape slip (see also Pinch Wheel).

PRINT THROUGH

When tape is tightly spooled, magnetism from one spot on the tape can affect the field at a corresponding spot of the adjacent layers. This produces spurious effects which at their extreme cause *pre-* and *post-echo;* i.e. a replica of the original at a short interval before or after the correct signal is replayed. Modern tapes of good quality are not so prone to this effect as some older types.

PUSH-PULL OSCILLATOR

For good-quality recording it is necessary that the bias waveform be free from distortion. If one side of the wave, for example, has greater amplitude than the other, second harmonic distortion results and the tape becomes partially magnetised.

To reduce second harmonic distortion a push-pull bias oscillator is used in place of the tuned anode or tuned grid Class C oscillator generally employed (see Fig. 15).

QUARTER TRACK

Loosely used as a synonym for four-track. Correctly used to denote the type of head, i.e. quarter-track head designed for standard (¼in.) tapes has two windings and two gaps and records the first and third tracks (top to bottom) of a four-track system. (E.g. a quarter-track head is used to make a four-track recording.) (See also Tracks.)

REPLAY

Playing back recordings: strictly those made on the same machine. Loosely used to denote play-back.

RESONANCE

Particularly regarding loudspeaker cones: resonance occurs when the natural frequency of a

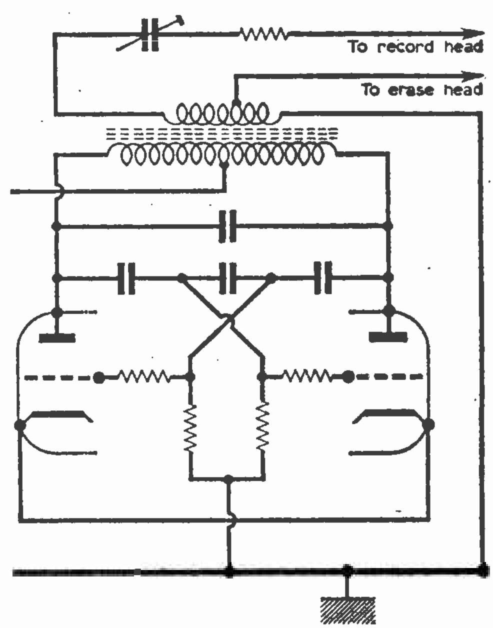


Fig. 15: Push-pull r.f. oscillator to minimise second harmonic distortion.

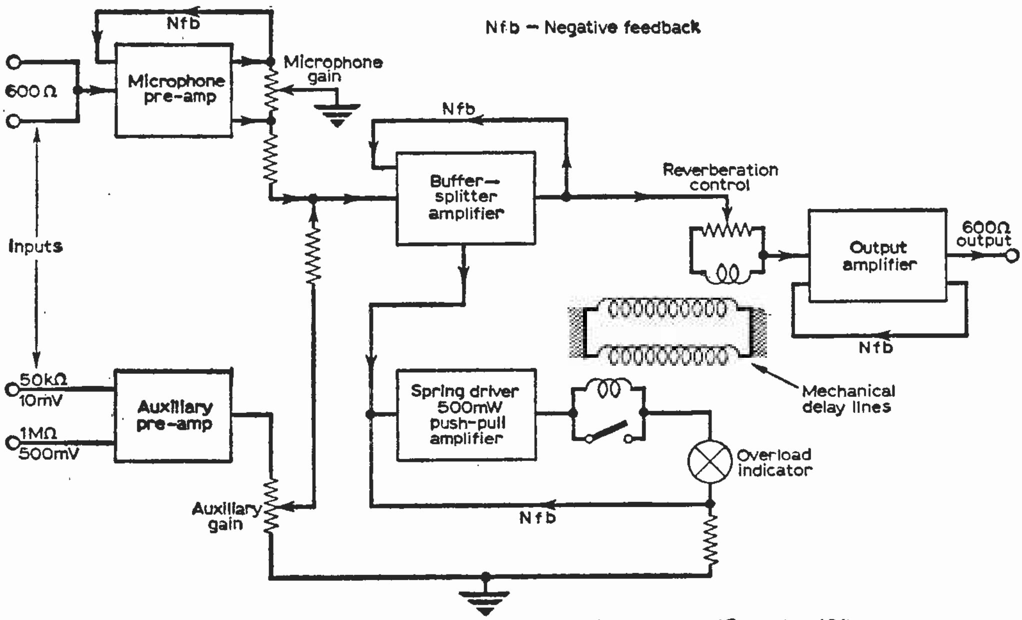


Fig. 16: Schematic diagram of commercial reverberation unit (Grampian 636).

system such as the vibrating cone coincides with the frequency of the stimulus such as the signal source. The output at this frequency is greater. Distortion is thus produced.

Enclosure design concentrates on balancing out the resonances of loudspeaker, "box" and enclosed air and keeping any resonance that may introduce distortion to a frequency below that usefully employed.

A resonant peak below 50c/s is not unusual with bookcase-type enclosures or larger columns with acoustic damping.

REMOTE CONTROL

Method of switching the functions of a tape recorder when at a distance from the apparatus. May consist of electrical switching to actuate solenoids or of mechanical devices such as Bowden cables or torque connectors. Widely used with dictating and transcribing machines where the operator has a foot control to select "stop", "start" and "backspace".

Type of remote control used on many machines is a simple on/off switch in the microphone housing.

REVERBERATION

To recapture the ambience of the concert hall or other site of recording, various methods of delaying the reproduced sound slightly have been developed. Reverberation units, so called, can consist of simple delay spring devices or complicated tape loop methods with circuitry that also allows variable characteristics.

The schematic diagram of a portable reverberation unit (Grampian 636) is given in Fig. 16. This is a transistorised device using spring delay lines driven from a split signal derived from the input via a push-pull Class B amplifier and a direct signal from the splitter, making the unit also useful as a mixer.

REVERBERATION TIME

A measure of the acoustic properties of a room or hall. The time it takes for a sound to die away to one-millionth of its original strength. Typical figure for a hall may be three to five seconds when empty, less than a second with a full audience.

REWIND

The action of winding tape back to the feed spool.

REWIND TIME

The time taken to respool a complete reel of tape.

SAFETY SWITCH

A method of preventing accidental selection of the recording function by fitting an interlocking switch or by requiring a double switch action to select "record".

SENSITIVITY

The voltage of input signal required to produce a fully modulated tape (or other specified output, where stated) Correctly, should be qualified by the distortion figure at this level.

SERVO BRAKE

Method of braking where the rotation of the brake drum is used as variable force, aiding or opposing the wrap of the brake according to direction of rotation. Very effective for smooth, rapid halting of fast-winding function.

SIGNAL-TO-NOISE RATIO

The ratio between the output level of a fully modulated recording (1kc/s signal, undistorted) and the inherent noise in the system with no signal played back. Stated in decibels. Should be greater than 45dB unweighted (see also Weighted). Professional standards demand better than 70dB.

SINGLE TRACK

Recording full width of the tape. Used for certain professional applications.

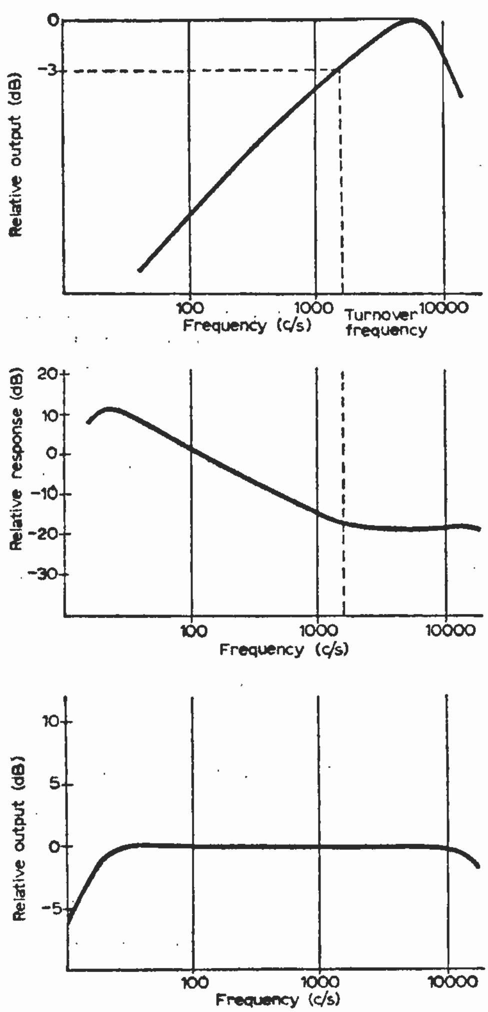


Fig. 17 (a): Playback head curve showing response for signal of constant recording level.

Fig. 17 (b): Playback amplifier response.

Fig. 17 (c) Final response curve.

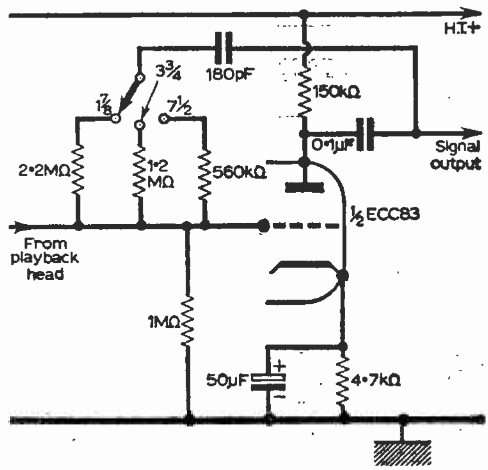


Fig. 18: Playback equalizing circuitry for three speeds.

SLEEP-LEARNING

Method of replaying instructional matter via a pillow loudspeaker, using either a time switch or loop cassette system. With correct preparatory study this method of learning is effective by its impression on the subconscious mind.

SOUND-ON-SOUND

Trade term for cross-track or multiplay recording. Output from one track is applied to input of another and mixed with existing signal. The process is more effective and easier to control than super-imposition and can be used to build up quite complicated recordings from simple sources.

SPEED

Tape speeds have evolved arbitrarily. After the successful development of the German AEG Magnetophone during the Second World War, which had a tape speed of 76 cms/sec., it was necessary to adapt machines with compatible systems to replay pre-recorded tapes. The nearest whole number was then 30in./sec., which became the original standard.

Improvement in tapes and recording and playback heads, and reduction of gap widths made reduction of speed possible with no loss of quality. The reductions were made by halving speeds successively. Speeds are 15, $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ and $\frac{15}{16}$in. per second. The highest speed is generally used for high-quality work, the lowest mainly for dictation or other speech-only work.

In general the higher the speed the better the high-frequency response. Doubling the speed of a pre-recorded tape raises the tone one octave, halving the speed lowers the tone an octave. The standard speed for domestic use is $3\frac{3}{4}$in./sec. at present.

(To be concluded)

BANDSWITCHING 1·67 — 5·0

Details of a unit that will enable you to dispense with the plug-in method of band changing.

BECAUSE the "Ten-Five" receiver was the first complete double-conversion transistorised communications type model to be described in this magazine it aroused considerable interest. Correspondence shows that the receiver has already been built by a great many PRACTICAL WIRELESS readers and it is pleasing to note that models other than the prototype are giving good results. Full details relating to the "Ten-Five" appeared in the October and November, 1964, issues of the magazine, whilst a further short article suggesting some minor changes to certain sections appeared in the April, 1965, issue.

The "Ten-Five" may be run either from the domestic mains supply of 220-240V a.c. or from a battery; in the latter case this can be the car battery, thereby facilitating /P or /M working. Bearing this last point in mind it is noted that some readers have enquired whether a switched "front end" is feasible, since in the original scheme a plug-in band changing method was adopted.

In the original "Ten-Five" a total of nine transformers (coils)—three per band—have to be moved around to obtain complete gap-free coverage of the frequency range 1·67-31·5Mc/s and, whilst the system used is a simple one to set up and operate, losses via the pins can degrade performance. The loose coils are also apt to become mislaid or their core settings may become disranged.

Trimmer adjustments are also likely to become a compromise, although this is overcome somewhat by the inclusion of panel-fitted TC4. Although some improvement would result from adopting a "unit-built", three-coil, plug-in assembly for optimum results a switched front end is to be preferred.

Physical Considerations

Assembling a suitable switched front end, however, is tricky, since to cover the range of frequencies quoted a total of nine individual transformers must be used, whilst the switch itself must have not less than nine "pole" tags and 27 "way" tags. These "poles" and "ways" should be available via a three-way rotary switch carrying three wafers each having identical three-pole, three-way characteristics.

Incorporating the switched circuitry into a

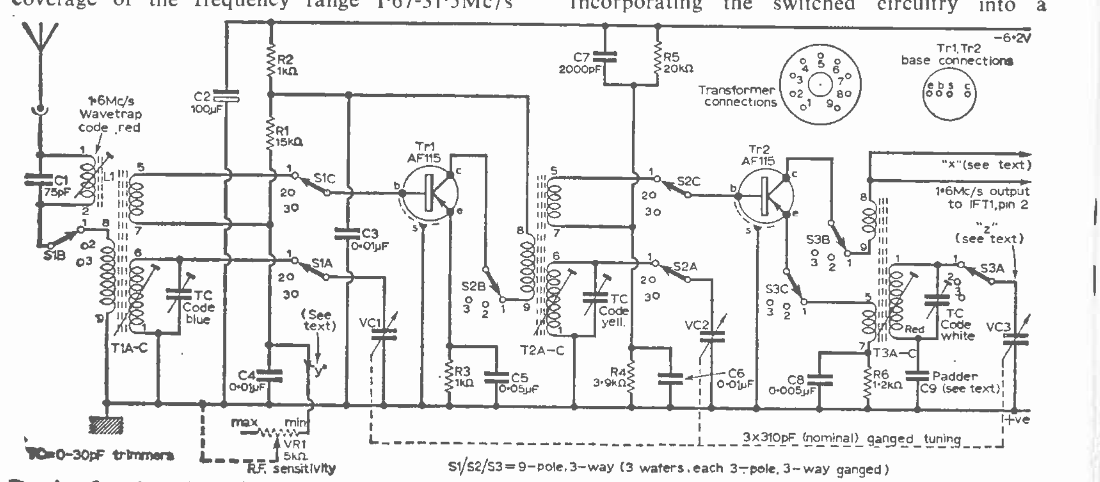


Fig. 1: Complete theoretical circuit diagram of the bandswitched front end. In the interests of clarity only one transformer for each range is shown.

5·3

15·0

the 'TEN-FIVE'

A. S. CARPENTER, G3TYJ

"Ten-Five" already built also requires consideration, for it is inadvisable to disturb the receiver wiring unduly. At first sight it would seem a simple matter to remove the existing front end wiring, etc., and mount the nine coils in the vacated space, but in practice this is not easily accomplished.

An alternative is to construct a separate unit as a sub-assembly carrying the minimum number of outlets and although this scheme is also open to criticism it does seem to be the best of the two. Such a unit can be wired separately and on completion be fitted to the receiver with the minimum of trouble.

It should be noted, however, that considerable effort is required to construct a suitable unit, for the work needs concentration and thus tends to become tedious. Patience, a miniature bit soldering iron, and a pair of strong tweezers are essentials. Each joint, too, must first be made mechanically firm before solder is applied.

Circuitry

The circuit of the complete switched front end is shown in Fig. 1 and closely follows that portrayed earlier. Component designations are also kept identical. Only one transformer is shown for each range in the interests of clarity but the locations of the necessary switching positions are clearly indicated.

The slightly amended (external) r.f. sensitivity control wiring necessitates but one lead-out and this is taken from point "y"; the original panel fitted "oscillator trimmer" control, if used, may finally be connected at point "z".

Output at 1·6Mc/s i.f. appears at pins 8, T3A-C, and is then fed to pin 2 of the original i.f. transformer, IFT1 (see Fig. 2a, P.W., October, 1964), whilst the original damping diode, D1, is also connected there via R14 (see Fig. 2b as above).

In passing it may be noted that this particular switched unit may be used as a front end for other receiving apparatus capable of accepting 1·6Mc/s signals *provided* VR1 (5kΩ) is incorporated; in such cases the connections marked "x" and "z" can be ignored. For essential details regarding the frequency ranges available refer to Table I.

Construction

The unit is most conveniently built on a small L-shaped piece of 16s.w.g. aluminium suitably drilled and cut to size. It is not recommended that a thinner gauge be used since a high degree of rigidity is desirable in the interests of stability.

In Fig. 3a the switch and its associated transformers are shown mounted. At first sight it would seem impossible to reach contacts of switch wafers "b" and "c" (see Fig. 3b) with the soldering iron, but the transformer stems are less thick than the pin ends and so no such difficulty arises. Tagstrips "A" and "B" are not wired until the remainder of the unit is completed, nor are any trimmers mounted.

An attempt has been made to secure minimum transformer interaction and although some degree of absorption might be present the compact wiring enables the majority of the leads to be no longer

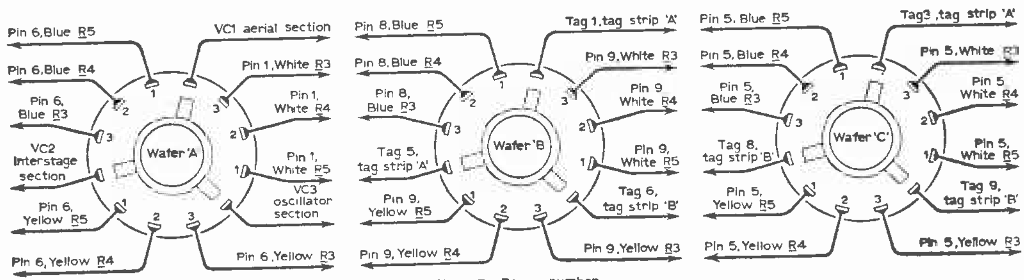


Fig. 2: (a) Connections made to wafer "a". (b) Wafer "b" connections, (c) Connections required at wafer "c".

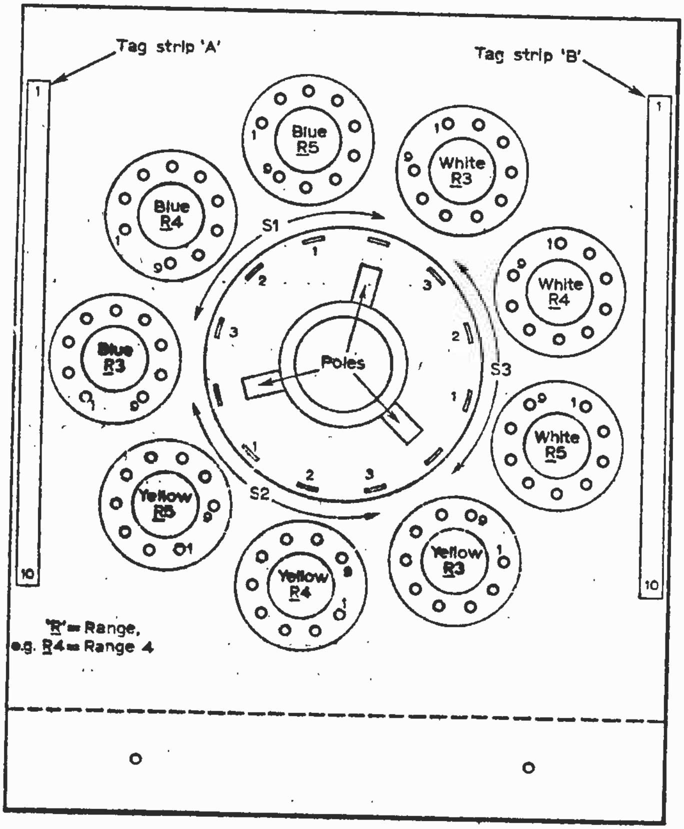


Fig. 3: The way in which the transformers and switch should be orientated.

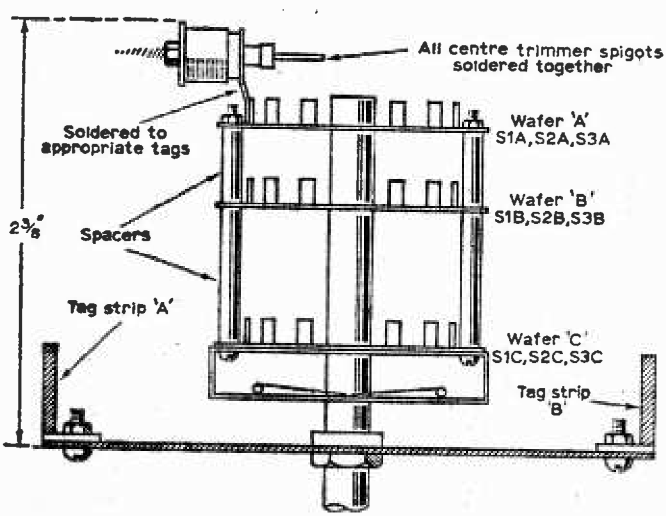


Fig. 4: Switch wafer arrangement and trimmer location.

than ½in.! This point is further favoured by the transformer orientation.

Commence wiring with wafer "c", proceed to wafer "b" and finish on wafer "a". Owing to confusion which may arise, constructors are strongly advised to wire in this order and for each wafer use wire with a different shade of insulation, since this will considerably assist final checking. Do not overheat the transformer pins whilst soldering but should the polystyrene soften due to this cause leave the particular pin for a few minutes to enable the material to reset.

When most of the wiring associated with the various switch wafers has been completed the tagstrips may be mounted and then wired to agree with Fig 5. Most of the associated items are already available from the existing "Ten-Five".

To find the required values of the padder capacitors (C9) and the pins to which they should be connected refer to Table 1. For the external connections that will be required use flying leads with distinctive insulations; these leads may be shortened later but the lead carrying the 1·6Mc/s i.f. signal should be screened or spurious signals may be received later.

Mounting of Trimmers

Trimmers are afterwards mounted as is indicated in Fig. 6, the centre spigots being brought together sufficiently close to enable a copper wire ring to be soldered to them. The other trimmer connections are soldered to the appropriate tags of wafer "a" on the lines shown in Fig. 4.

The finalised unit should feel physically rigid and before it is bolted to the receiver a thorough check should be made.

First remove all the original front end material except the wavetrap and first i.f. transformer, together with the three valveholders which previously held the transformers, and if necessary reinforce the base board. Bolt the switched unit in so that its control shaft will project through the cabinet side—looking at the receiver from the front.

Check that the moving vanes

of VC1 cannot foul the trimmers, then solder the eight flying leads in position, shortening them as required. The eight leads are: (1) +ve line, (2) negative line at point "C" (original Fig. 2a), (3) "Y" to VR1, (4) to pin 2 of IFT1 (screened), (5) to pin 2 of wavetrap, (6) to VC1, (7) to VC2, (8) to VC3.

Remove any trimmers associated with VC1-3 and if the original trimmer, TC4 is to be used connect this to VC3.

Alignment

This is carried out on the basis of core adjustments at the low frequency end of the bands, followed by trimmer adjustments at the high frequency ends. Commence with the lowest switched range, i.e. range 3, and if TC4 is being used set this to about 25% capacity.

Use of a signal generator is necessary and, although results can be achieved without one, these are likely to be sub-optimum. When using a generator always attenuate its output sufficiently to give but the smallest detectable indication on the "S" meter or other indicator in use. Core locking is achieved by means of a 6BA nut fitted to each transformer stem.

(1) Connect the generator via a standard dummy load (or 400Ω resistor) to the aerial socket and, using Table II as a guide, inject a 1·67Mc/s signal with the tuning capacitor vanes fully enmeshed.

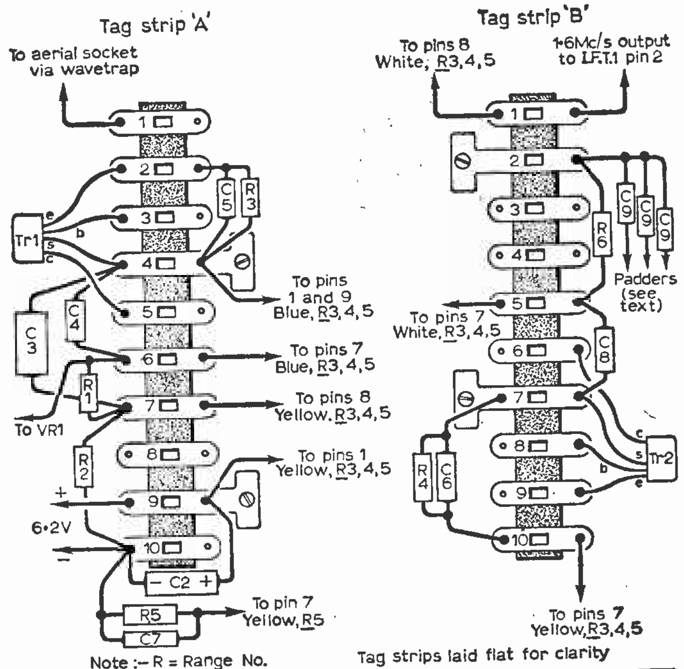
(2) Adjust the core of White R3 to resolve the signal (see note on "Second Channel" later).

(3) Set generator to 5·3Mc/s and fully disengage tuning capacitor vanes. Set White R3 trimmer for maximum output.

(4) Repeat (2) and (3) above.

(5) Set generator to low frequency (LF) tracking point (see Table II) and tune in signal using VC1-2-3. Adjust Blue R3 and Yellow R3 cores for maximum output. (See note on "pulling" later).

(Continued on page 624)



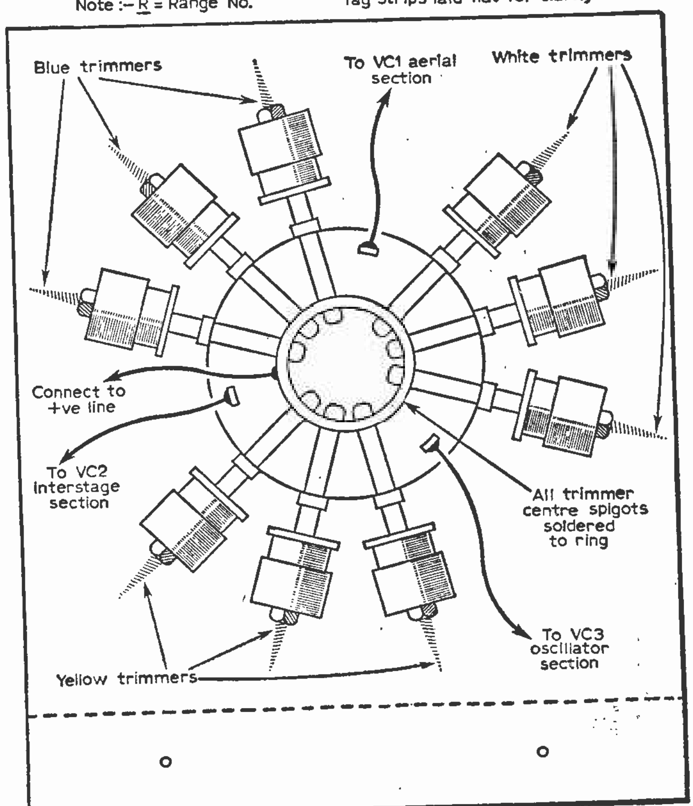


Fig. 5 (top): Type of tagstrip required and wiring details. Fig. 6: The trimmers in position. Note the central ring made from copper wire.

C.W. Standards

I WOULD like to reply to F. Taylor's letter in the August issue as I am such a person to which he refers, i.e. an old ex-Service operator keen to do a spot of operating.

Over the years I have followed the arguments in PRACTICAL WIRELESS for and against the R.A.E. and have kept an open mind.

Last year I took a six-month course for the R.A.E. at the local Technical College and sat the examination last May. I am pleased to say I passed this and in addition have since passed the G.P.O. Morse Test.

Perhaps this proves that if you are keen enough, you are not too old at 40 to pass the R.A.E. and do a spot of operating.

Conway Parker,

Bath,
Somerset.

Tape Terminology

I WOULD like to congratulate Mr. H. W. Hellyer on his series of articles, Tape Terminology. So often one sees references in books to Modulation, Noise Levels, Monitoring etc., and to the uninitiated, like me, these terms conjure up all sorts of weird ideas.

Mr. Hellyer's articles do help a great deal by explaining exactly what things are and what they do. I think it would be a good idea to publish them as a separate booklet which would really help beginners like myself understand some of those many " Mysteries " of radio.

A. Read,

Walthamstow,
London, E.17.

Correspondents

I WOULD like to correspond with anyone who is interested in making crystal sets.

Nanubhai Patel.

33 Princeville St.,
Bradford 7,
Yorkshire.

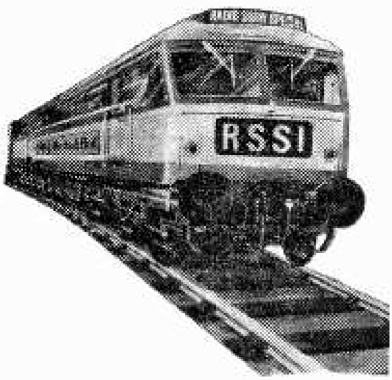
I AM interested in radio and electronics and would like to correspond with other P.W. readers of any age and country.

Omar bin Abdullah.

203 Arab Street,
Singapore 7.

NEWS AND...

THE RADIO SHOW SPECIAL



This year's Radio Show is over 200 yards long, runs on wheels and comes direct to the public in their own towns and cities.

The Radio Show Special, a thirteen coach train, is touring Britain for three weeks and spending two days each at Southampton, Cardiff, Bristol, Birmingham, Manchester, Glasgow, Newcastle, Nottingham and Norwich.

In one coach, a complete local broadcasting station is showing just how local radio works and the form it will take when it comes to this country. Another coach will supply pictures on both 405 and 625-lines to television sets all over the train. A third coach will show working demonstrations of radio-telephones and other communications equipment. The remaining coaches will display the full range of Pye/Ekco domestic products.

SEMICONDUCTOR DIODE CIRCUITS

Mullard Educational Service announce a new 27-frame filmstrip entitled "Semiconductor Diode Circuits". Intended for use in universities, technical colleges, training establishments and industry, this film forms part of a series covering advanced electronic circuitry.

"Semiconductor Diode Circuits" describes the theory and construction of semiconductor diodes and their use in power supply circuits, computers, and radio and television.

Copies of the film cost 25s. per strip including fully comprehensive teaching notes and may be ordered from *Unicorn Head Visual Aids Ltd., 42 Westminster Palace Gardens, Artillery Row, London, S.W.1.*

LARGEST COMPUTER FOR BRITISH INSURANCE

English Electric-Leo-Marconi announces that the largest computer system ordered by a British insurance company has been installed at the Sun Life Assurance Society's head office in London.

The computer, a KDF 9, will be used to maintain the records of more than half a million insurance policies. This large file will be interrogated and brought up to date each day by the computer in under two and a half hours.

The machine was built and tested at English Electric-Leo-Marconi's factory at Kidsgrove, near Stoke-on-Trent. It brings the total value of computers delivered by the company to insurance offices to nearly £2 million.

Sun Life's KDF 9 is a multi-programming machine (able to carry out more than one job at a time). It has nine magnetic tape deck units each capable of transferring 80,000 characters per second, a magnetic drum store, two 1,000 lines per minute on-line printers and paper tape and punched card equipment.

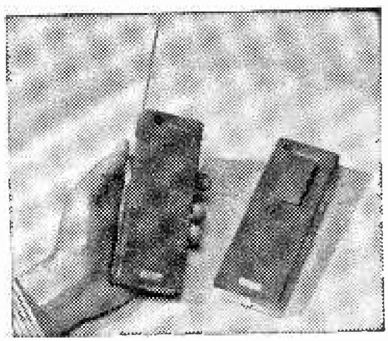
CATALOGUE RECEIVED

Lind-Air (Supplies) Ltd., 53 Tottenham Court Road, have produced a new catalogue of transistors, motors and servo equipment and separate lists are included on pen recorders, transducers and accelerometers, industrial plugs and panel meters.

..COMMENT

BECAUSE OF THE LARGE NUMBER OF OUTSTANDING "SELL OR LOAN" REQUESTS NOW HELD BY US, WE REGRET THAT FOR THE NEXT FEW MONTHS WE WILL NOT BE ABLE TO ACCEPT ANY LETTERS FOR THIS COLUMN.

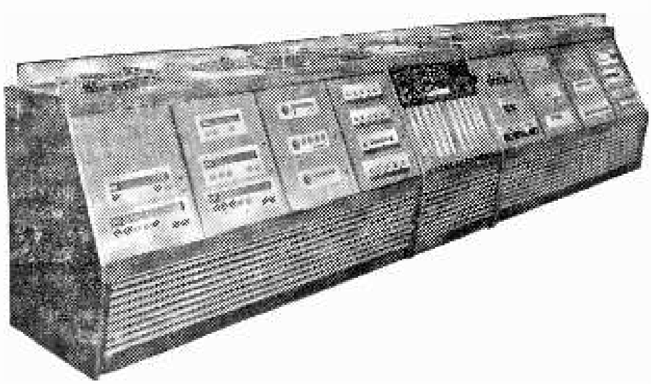
PYE MINIATURE RADIOTELEPHONE EQUIPMENT



Pye Telecommunications of Cambridge announce their new u.h.f. radiotelephone, the Pye Pocketfone. Coming in two separate units, the receiver unit fits into the breast pocket, has its own power supply and loudspeaker and contains a built-in concealed aerial. The transmitter, a similar small unit, is normally carried in the side pocket. To make a call, the transmitter is held in front of the mouth and when the transmit button is pressed, a small rod aerial, about 6in. long, springs out. Very high quality two-way communication may then take place over ranges up to a distance of two to five miles depending on the kind of installation provided.

An outstanding feature of the Pocketfone is the long battery life that has been achieved. A new and patented battery economy circuit enables a battery life of several times that of a more conventional receiver to be realised. The tiny receiver battery, which measures only 1·8 x 1 x 0·55in. and weighs only 1·6oz has been made to give continuous receiver operation of thirty hours. Either chargeable or replaceable batteries may be used.

LARGS NEW COMPARATOR



Largs of Holborn have installed a new Comparator which enables customers to hear and compare different types of hi-fi equipment. It was designed by Arthur Burrows, the company's chief engineer, and constructed by the company's engineers and cabinet workshop team.

Expressly intended for stereo equipment, the Comparator permits a virtually uncountable number of permutations of equipment under demonstration. There are facilities for combining 16 pickup arms, 16 tuners, 16 amplifiers, 12 tape recorders and 16 auxiliary inputs, playing through 50 loudspeakers. 4,750 yards of wire are used and the whole unit is built on 20 different chassis.

Sir, I would be grateful if any reader could sell or loan me . . .

. . . service sheet, circuit diagram for Kolster Brandes Model No. BR30T table radio.—G. Missen, 8 Russell Drive, Ampthill, Beds.

. . . any information on Claviolines Concert Model.—D. E. Jones, 31 Heath Road, Timperley, Altrincham, Cheshire.

. . . circuit diagrams and details of headset and battery connections of the type 38 transceiver.—P. C. Bateman, 42 Buckingham Road, Port Elizabeth, South Africa.

. . . any information at all about the "McMichael moving coil mains Receiver", especially the coil pack. Set is about 30 years old, 3 valve, regenerative. V1=12A2 V2=3 x 23 V3=?—N. D. Benyon, "Westleigh", 3 Elmfield Road, Audenshaw, Lancashire.

. . . information of any kind on v.h.f. receiver type 62H, Ref. No. AP61357, Ser. No. 2216, Modification No. 7085 A/10.—K. J. Martin, Belmont Hall, Dundee, Angus.

. . . any information on indicator type 62 Ref. No. 10Q/13000—A.M., Ser. No. GO61219.—Tony H. Yassa, Abbassyin Street No. 8, Heliopolis, Cairo, United Arab Republic.

. . . details of conversion of V.H.F. RXR.1132 from 100-125mc/s to 65-86mc/s.—W. Stockburn, 40 Netherburn Road, Sunderland, Co. Durham.

. . . information on assembly of National HRO tuning dial.—N. H. Punford, 93 Sunny Gardens Road, Hendon, London, N.W.4.

. . . circuit diagram and details of P.C.R. communications receiver.—T. Wright, The Bungalow, Glenbana, Ballyaughlis, Lisburn, Co. Down, N. Ireland.

. . . the plans for a battery tremolo unit.—I. H. Wesley, 16 Emperors Gate, London, S.W.1.

. . . details of the Synchrodyne Receiver, produced in brochure form about 1946.—L. A. Wilkinson, Radio Designer, Field Aircraft Services Ltd., Wymeswold Aerodrome, Burton-on-the-Wolds, Nr. Loughborough, Leicestershire.

. . . the circuit of the transmitter type 5AH, No. 162, made in 1949.—S. Powell, 7 Commercial Road, Hereford.

. . . any information on comparison of performance between HE-30 Lafayette and Eddystone 840C.—F. W. Brown, 79 Glebe Road, Stoneferry, Hull.

. . . any data on the P.104 (R1392) Receiver Model No. 62H, Navy version I.F.9.72mc/s. I would particularly like to know the aerial input impedance and the phone output impedance.—N. A. Couroy, 7 Nab Lane, Shipley, Yorkshire.

. . . any information or circuit of Globe King 1 valve plus add-on amplifier.—S. L. Holding, Roselea, Tideford, Saltash, Cornwall.

. . . BC312M manual circuit modifications or correspondence on the receiver.—R. Wilson, 11 Sulgrave Close, Liverpool 16, Lancashire.

. . . circuit of the "Regency" transistor radio.—J. Owens, 26 Ardd Fawr, Dolgelly, North Wales.

. . . a circuit diagram and information on Govt. Surplus Power Unit Type 633 Ref. No. 10KB/6205 using valve nos. CV45 and CV572.—P. J. C. Payne, 33 Strawberry Vale, Twickenham, Middlesex.

MW DX

W. N. STEVENS
Editor, Practical Wireless

★ SOME NOTES FOR BEGINNERS

MANY of us become involved in the business of radio in the oddest ways. My introduction was accidentally listening to KDA in Pittsburgh on the medium waves. It was one in the morning and the set was the family radio.

This phenomena fired my schoolboy enthusiasm. The die was cast. Like an addict needing a "fix", I wanted American stations and since late night listening was restricted, the family was persuaded to buy a short wave converter and I was thus exposed to the infinite fascination of DX.

Since then, there have been many exciting moments—receiving the first QSL cards . . . obtaining an amateur licence . . . working DX myself. There have been moments of triumph—being first to report reception of low power broadcast stations . . . acquiring coveted DX certificates . . . making two-way with America using a 1-valve receiver and 1-valve transmitter . . . working exotic DX stations.

Yet, even so, some of the best moments have been in pulling through a difficult medium wave DX station. For despite the perennial pleasures of the short waves, there is a special something about m.w. DX which cannot be explained, as might be imagined in the writer's case, as nostalgia.

Most of the older hands at the game are well familiarised with the world of m.w. DX, but the newcomers (and potential newcomers) may find some basic notes of interest. And as the "season" is now with us, this is the time to get organised.

When to Listen

By virtue of the range of frequencies involved, optimum results are obtained with paths of maximum darkness. Thus, the winter months are the best for all-round reception; the atmospheric noise level is lower, too, during the colder months. You *can* still hear some DX through the summer but this means very late night (or more precisely, early morning!) sessions. Conditions will also vary from season to season and, quite naturally, the best years for m.w. DX are those with low sunspot activity. We are in such a trough now, and conditions can be expected to be quite good for at least several years.

In many ways, m.w. DX listening is much less predictable than s.w. listening. Conditions can be really good for several days, then really bad. Some *days* North Americans will be good and South Americans poor. Some *years* may be good for North America, others good for South America. Skip distance effects are very pronounced; peak times for different areas may be short lived. There are numerous permutations of possible conditions. Life is exciting, if at times frustrating!

Here is a, necessarily, brief outline of what to expect from different parts of the world.

North America

USA: The East Coast stations of the USA are there, to some extent, all through the year. In the summer, the openings may be in the period around 0430. As the hours of nightly darkness increase, so will the openings start early, and last longer. In the actual winter months, some of the stations will be heard from midnight or earlier but QRM from European stations may be troublesome. They will "stay" until dawn or later. Last year there was one fantastic opening when many of the East Coasters were still coming through at 1000 in the morning—though this was unprecedented.

There are a few regular stations from the central States, but the best chances are around 0300. The West Coast represents really first rate DX and the openings are quite rare; when they do occur they are usually around dawn (0300—0600).

There are three major networks—NBC, ABC, CBS, but many stations are independently owned, though they may carry network programmes at times. Most US stations have a callsign beginning W, some have K. The callsign is invariably used as identification. Many of the East Coast stations are received very regularly during the best months and often reach quite surprising strengths.

Canada: Similar remarks apply. They tend, however, to break through much earlier and a few of them are often heard as early as 2100 hours in the winter, and reception as early as 1900 is not unknown. There is a national State-owned network, rather BBC-ish—the Canadian Broadcasting Corporation. There are also numerous privately owned and operated stations. Most CBC stations have a three-letter callsign (such as CBA, CBF, etc), all the others have four-letter callsigns (CJCX, etc). The callsigns are invariably used for identification.

Important note for newcomers: Many of the Canadian stations broadcast *only* in French!

Normally, Canadians will be heard when the U.S.A. is good but this is not an invariable rule. Many occasions will occur when the USA is poor and Canada good—and vice versa.

Latin America: Harder to identify, but experienced short wave listeners should not have too much trouble. Call signs are usually used, together with other means of identification. Best times for the Latin Americans is usually an hour or two after the North Americans are well established. This again depends on conditions and last season many of them were heard at reasonable strength before midnight. Central American, how-

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ever, is usually best later on (around 0230—0330 for example). Again not a general rule, they will often be heard at their best when North America is below average. Regular s.w. DX'ers will find a familiar scene with Venezuela and Colombian Republic well to the fore.

Africa: Winter evenings can produce a large number of North Africans, plus things like Kaduna (Nigeria) and Dakar (Senegal). They often reach superb strength. Liberia is another possible, later in the evenings. Kenya has been heard signing on around 0300 and one or two South African stations have been logged at around 0130—but these are *not* easy by any means.

Asia: A surprising number of Asian stations can be heard, with patience and perseverance. Middle East stations are fairly plentiful, some being quite regular—last season for instance Kuwait was heard night after night (small hours). Although they can be heard in the late evening, some have been logged in the afternoons in winter. A good time is during the Feast of Ramadan when they operate all through the night!

Further afield, India and Pakistan are worth searching for. Best times for All India Radio and Radio Pakistan stations last season were around 0000—0100, 0100—0200 and similar hour-long peaks. On good days, they can sometimes be heard during the afternoons. English announcements and news bulletins are helpful in identification, but are not of long duration. Some, particularly Indians often have strong signals.

China is more difficult but some stations are quite well received. Best times are from 2200 and at various times from early afternoon onwards, according to time of year. Japan is very rare but several were heard last season, mostly during afternoon Far East openings. Other stations in this area have been heard, mainly during the afternoon/early evening.

General: Having acquired a general idea of what to expect, from actual listening sessions, and having located a few key stations, the band is yours to search. Expectation of conditions can often be fairly well assessed by the signals of a few star performers. Judging from last season, these are worth checking as a guide to conditions on a particular day:

CBA, Sackville, N.B., Canada on 1,070kc/s. Probably the most consistent North American, heard night after night, sometimes even before Paris on the same frequency has closed down. If CBA is not coming in, not much else will be heard from North America; at least Canada. Another good check is CJON, St. John's, Newfoundland, on 930kc/s, usually earlier even than CBA—sometimes from 2000 or so in peak conditions. By midnight, in winter, these (and others) should be very strong in good conditions.

South Americans are difficult to judge since skip seems to vary through the season. LR1, Buenos Aires, for instance, is on the same frequency as CBA and whereas it was hardly heard (by the writer at least) early in the season, it was often dominant over CBA later in the season. The subcontinent is a vast area and you can expect good periods of, say, Argentinians and others of, say, Brazilians, etc.

For the Caribbean areas, however, there is no better than the Spanish-speaking propaganda station *Radio Americas* on Swan Island (1,160kc/s) which is very consistent and very strong. Another pointer is Bonaire, Netherlands Antilles, which has been putting out phenomenal signals on 800kc/s.

A key station for Far Eastern prospects is the *Voice of America* station in Okinawa on 1,178kc/s. This is often surprisingly strong and is heard during the winter from early afternoon onwards, closing around 1630. Programmes are in Eastern tongues, but there are English announcements.

Of the Indians, the best last year were Rajkot (910kc/s) and Sangli (1,250kc/s). From China, the most consistent were Kiangsi (840kc/s) and Anwhei (940kc/s).

Equipment

A standard transistor portable is virtually useless and a communications receiver is ideal. Between the two extremes there is a good deal of scope. Main requirements are high sensitivity and high selectivity; remember that many European stations are on the air till 0200 and many start up again around 0400. Most Americans (South and North) operate on even 10kc/s channels (i.e. 770, 780, 790kc/s) whereas Europeans, Africans and Middle East stations are on 9kc/s channels (i.e. 764, 773, 782kc/s). Even so, selectivity is a major requirement for serious DX work.

Fortunately there are still a number of very good war surplus communications receivers on the market at bargain prices. The more experienced may also find that some of the vintage domestic valve radio sets have good possibilities, especially if they can be hotted up.

Calibration is another aspect. A set without reasonably accurate calibration (in kc/s) can be supplemented with a simple frequency meter, but this is inconvenient except where specially precise measurements are wanted.

Really good slow motion tuning is essential. Variable selectivity in some form (and/or crystal filters) and noise limiters are useful features.

These features are all desirable to some extent, depending on how serious one takes his m.w. DX.

Aerials need thought. Simplest is a random long wire, erected as long and as high as possible. And clear from obstructions such as trees, roofs, etc. Various systems should be tried, and results evaluated. Indoor aerials are not completely useless and, in fact, can give quite good results if sufficient wire is used (routed around picture rails, etc). Vertical aerials have some advantages. A good earth is worth while, too.

Many serious DX enthusiasts use tuned loops and aerial tuning units, useful in view of their variable direction properties. If sufficient readers are interested we hope to publish some fuller data on aerials, tuner units and loops.

Practical Experiment

Should the desirable features of the receiving equipment scare off potential m.w. DX'ers, let them take heart from the following! Last season (from September 1964 to March 1965) the writer undertook a fairly intensive survey of m.w. DX using only a home built tuner (r.f. amp, f.c., two i.f. amps, variable selectivity) into an audio amplifier and feeding the tuner from the downlead of the chimney-mounted TV aerial!

The list which follows shows the large number of DX stations from all over the world which were received on this less-than-ideal set up. We hope it will encourage others to give the neglected medium wave band a good search during the coming months. It leaves out semi-DX such as Egypt, Morroco, Algeria, etc.

Reference Material

(1) World Radio TV Handbook. This contains, by country, details of all the broadcasting stations of the world. A wealth of invaluable information. Cost is 26s.

(2) World Medium Wave Guide. Essential for all m.w. DX fans. Gives complete listings of all m.w. stations by frequency as well as North America stations by location.

These two books are published in Denmark (written in English throughout) and obtainable through specialist book shops.

(3) Medium Wave News. A privately distributed newsletter published during the main DX season containing all the latest news. Details from the Editor—Ken Brownless, 7 The Avenue, Clifton, York.

LOG FOR SEPTEMBER 1964—MARCH 1965

Kc/s	Call	Location
560	LVI	Mendoza, Argentina
	CKCN	Seven Sisters, P.Q.
570		Godthab, Greenland
580	CJFX	Antigonish, N.S.
	CFRA	Ottawa, P.Q.
		Tiruchi, India
	LWI	Cordoba, Argentina
590	VOCM	St. Johns, Newfoundland
		Peking, China
600		Ajmer, India
	CFCF	Montreal, P.Q.
610	CHNC	New Carlisle, P.Q.
620	CKCM	Grand Falls, Newfoundland
		Peking, China
		Santa Cruz, Canary Is.
630		Lahore I, Pakistan
	CFCY	Charlottetown, P.E.I.
	WKYN	Rio Pedras, Puerto Rico
638		BBC Relay, Cyprus
640	CBN	St. Johns, Newfoundland
	CMQ	Havana, Cuba
		Peking, China
		Point-a-Pitre, Guadeloupe
650	YVQO	Puerto la Cruz, Venezuela
		Indore, India
	ELBC	Monrovia, Liberia
		Godhavn, Greenland
	WSM	Nashville, Tennessee
656		Tel Aviv, Israel
660	WNBC	New York
	CE660	Santiago, Chile
	YVLH	Caracas, Venezuela
668		Damascus, Syria
677		Jerusalem, Jordan
680	CJCM	Grand Bank, Newfoundland
	WNAC	Boston, Mass.
	WAPA	San Juan, Puerto Rico
690	CMBC	Havana, Cuba
	CBF	Montreal, P.Q.
		Dacca I, Pakistan
692		Nicosia, Cyprus
701		BBC Relay, Perrim Is.
700	WLW	Cincinnati, Ohio
710	WOR	New York
	CJOX	Grand Falls, Newfoundland
		Jullunder, India
746		Aleppo, Syria
749	CBL	Toronto, Ontario
	PRA4	Salvador, Brazil
750	WSB	Atlanta, Georgia
	YVKS	Caracas, Venezuela
760	ZFY	Georgetown, British Guiana
		Lucknow, India
	WJR	Detroit, Michigan
764		Dakar, Senegal
		Baghdad, Iraq
770	WABC	New York
		Hupeh, China
775	PJA8	Aruba, Netherlands Antilles
777		Zaheden, Iran
785		Damascus, Syria
790	CFDR	Dartmouth, N.S.
800	PJB	Bonaire, Netherlands Antilles
	CHRC	Quebec City, P.Q.
		Amman, Jordan
810	WGY	Schenectady, N.Y.
	WKVM	San Juan, Puerto Rico
		Delhi, India
820	HJED	Cali, Columbian Rep.
	WBAP	Fort Worth, Texas
830	CMCA	Havana, Cuba
	JOBB	Osaka, Japan
835		Belize, British Honduras
840		Kiangsi, China
		Radio Caribbean, St. Lucia
	WHAS	Louisville, Kentucky
850	CKVL	Verdum, P.Q.
	CX16	Montevideo, Uruguay
		Ahmedabad, India
		Pyongyang, North Korea
860	PRA3	Rio de Janeiro, Brazil
	CBH	Halifax, N.S.
	CJBC	Toronto, Ontario
		Lanchow, China
		Sambalpur, India
870	WWL	New Orleans, La.
880	WCBS	New York
890	WLS	Chicago, Ill.
	YVLW	Valencia, Venezuela
900	XEW	Mexico City, Mexico
	CJBR	Rimouski, P.Q.
908		Baghdad, Iraq
910		Rajkot, India
	WABI	Bangor, Maine
	YVPF	Marquetia, Venezuela
920	CJCH	Halifax, N.S.
930	CJON	St. Johns, Newfoundland
940	CBM	Montreal, P.Q.
	WINZ	Miami, Florida
		Anwhei, China
		Kaduna, Nigeria
950	CKNB	Campbellton, N.B.
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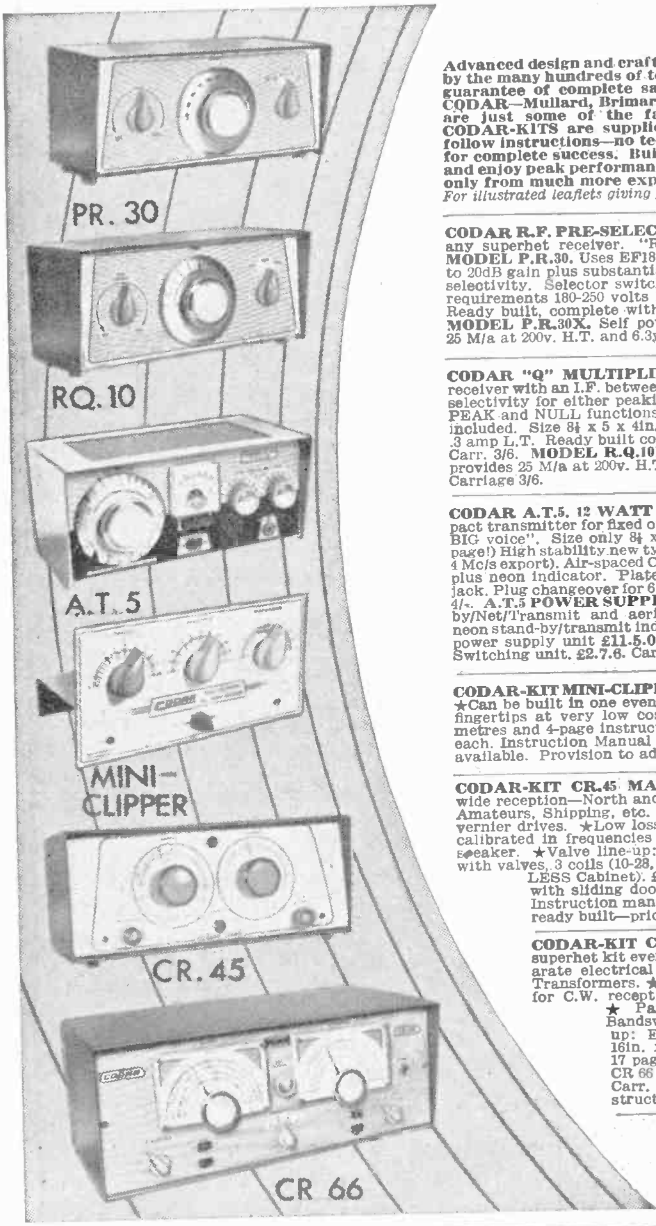

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G3IRE G3HGQ
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Canada: Codar Radio of Canada, Tweed, Ontario

Kc/s	Call	Location
950	LR3	Buenos Aires, Argentina
953		Aleppo, Syria
955	XZK	Rangoon, Burma
960	CHNS	Halifax, N.S.
	WEAV	Plattsburg, N.Y.
970	WCSH	Portland, Maine
	HLGA	Suwon, Korea
990	CBY	Corner Brook, Newfoundland
1000	XEOY	Mexico City, Mexico
	CKBW	Bridgewater, N.S.
	WCFL	Chicago, Ill.
	KOMO	Seattle, Washington
1010	WINS	New York
	CFRB	Toronto, Ontario
		Hyderabad, Pakistan
1020	KDKA	Pittsburg, Penn.
	YVQT	Cumana, Venezuela
1030	WBZ	Boston, Mass.
1040	VUB	Bombay, India
1050	CHUM	Toronto, Ontario
	WHN	New York
1060	CJLR	Quebec City (F)
	CB106	Santiago, Chile
1070	CBA	Sackville, N.B.
	LR1	Buenos Aires, Argentina
	VUD	Delhi B, India
	WMIA	Arecibo, Puerto Rico
1080	WTIC	Hartford, Conn.
1090	WBAL	Baltimore, Maryland
	CX28	Montevideo, Uruguay
	KING	Seattle, Washington
1100	PRG9	Sao Paulo, Brazil
	KYW	Cleveland, Ohio
	YVKE	Caracas, Venezuela
1110	CBD	St. John, N.B.
	WBT	Charlotte, N.C.
1120	KMOX	St. Louis, Missouri
1130	WNEW	New York
	WDGY	Minneapolis, Minnesota
	YVMF	Maracaibo, Venezuela
1140	CBI	Sydney, N.S.
		V.O.A., Philippines
1150	CHSJ	St. John, N.B.
		Rawalpindi, Pakistan
	XEJP	Mexico City, Mexico
	CKTR	Three Rivers, P.Q.
1160	WJJD	Chicago, Ill.
	HJCK	Bogota, Colombian Rep.
1165		Radio Americas, Swan Island
1170	WWVA	Wheeling, West Virginia
1178		V.O.A., Okinawa
1180	WHAM	Rochester, N.Y.
1190	WOWO	Fort Wayne, Indiana
	HJCT	Barranquilla, Colombian Rep.
1200	WOAI	San Antonia, Texas
	YVOZ	Caracas, Venezuela
	BED88	Taiwan, Formosa
1210	WCAU	Philadelphia, Penn.
1230	VUB	Bombay, India
1235	ZBM1	Hamilton, Bermuda
1240		Aden, Forces Broadcasting Service

K/cs	Call	Location
1250	WKBR	Manchester, N.H.
	CKBL	Matane, P.Q.
		Sangli, India
	WRYT	Pittsburg, Penn.
1260	WEZE	Boston, Mass.
	LT9	Santa Fe, Argentina
	WAME	Miami, Florida
1270	CJCB	Sydney, N.S.
	LS11	Buenos Aires, Argentina
1280	CJMS	Montreal, P.Q.
	WADO	New York
	PRG3	Rio de Janeiro, Brazil
1290	WKNE	Keene, N.H.
1300	WERE	Cleveland, Ohio
	CBAF	Monkton, N.B.
1310	CHGB	St. Anne, P.Q.
	WLOB	Portland, Maine
	WORC	Worcester, Mass.
	CKOY	Ottawa, P.Q.
		Radio Martinique, Martinique
1315	HJAK	Barranquilla, Colombian Rep.
1320	CKEC	New Glasgow, N.S.
	CJSO	Sorel, P.Q.
	WZOK	Jacksonville, Florida
	LU6	Mar del Plata, Argentina
1325	4VW	Port-au-Prince, Haiti
		Teheran, Iran
1330	WPOW	New York
	WCRB	Waltham, Mass.
		Bikaner, India
1340		
	PRH6	Belo Horizonte, Brazil
1345		Kuwait
1350	WAVY	Portsmouth, Va.
	WEZY	Cocoa, Florida
1360	CKBC	Bathurst, N.S.
	WDRC	Hartford, Conn.
1370	CFLV	Valleyfield, P.Q.
	WSAY	Rochester, N.Y.
1375		REF, St. Pierre
1380	CFDA	Victoriaville, P.Q.
	WLCY	St. Peterburgh, Florida
1385	4VS	Port-au-Prince, Haiti
1390	WCSG	Charleston, S.C.
	WEGP	Presque Is., Maine
		Arwaz, Iran
		Imphal, India
1400	WOND	Pleasantville, N.J.
1410	WPOP	Hartford, Conn.
1420	WOC	Davenport, Iowa
	WCOJ	Coatsville, Pa.
1430	WENE	Endicott, N.Y.
1440	CKPM	Ottawa, P.Q.
	WHHH	Warren, Ohio
1460	CKRB	Ville de St. Georges, P.Q.
	WHEC	Rochester, N.Y.
	WOKO	Albany, N.Y.
1470	WLAM	Lewiston, Maine
	CFOX	Pte. Claire, P.Q.
1480	CBZ	Fredericton, N.B.
1490	WLDB	Atlantic City, N.Y.
1500	WTOP	Washington, D.C.
1510	WMEX	Boston, Mass.
1520	WKBW	Buffalo, N.Y.

A COMMENTARY BY HENRY

PRACTICALLY WIRELESS

No. 14 The Import Gap

THIS month, dear reader, I beg your leave to indulge in what an editorial colleague has called a "typical Henry Carp".

There are several subjects that rouse Henry's spleen. Among them, as hinted in September during a dissertation on the Metric System, is the imported radio receiver or other associated equipment.

Not that imports are wrong in themselves. Not even that the price-cutting techniques of some makers allow batches of cheap rubbish to be spawned upon the supermarket shelves. To be realistic about this, we can hardly expect a healthy export business unless we accept some sort of reciprocal trade.

My objection is to the indifference, almost contempt, of British distributors who unload foreign gear on us and, having made their profit from its sale, want nothing more to do with the product. Lip service is paid to "*specialised service facilities*", or "*distribution backed by one of the largest manufacturers . . . etc*". But just try, as a private individual, as a purchaser, obtaining spares or service information and see what happens.

This is no sour grape contention. Henry is in the trade, and has had the bitter experience of having to return goods to customers because repair was impossible—or at least, economically unsound. And why?

"Fancy buying that rubbish"

Because the importers could do no more than forward the equipment to its source of origin when repairs were needed.

In the case of tiny radios this may have seemed sound policy: but a half-hour with some service information and the appropriate spare parts would in many cases have solved the problem. And would have suited the customer far better than the protracted wait while his precious unit sailed half across the world.

If the bona fide members of the radio service fraternity cannot get as much as a polite acknowledgement from some distributors, what hope is there for the man in the street? Hardly surprising that some radio dealers turn such service work away with the implied comment: "*Fancy buying that rubbish.*"

The annoying fact is that so much imported equipment is by no means rubbish. And the foregoing remarks certainly do not apply to the better foreign manufacturers who take great trouble to ensure service facilities and information to back their sales. Although even they cannot always keep the spares rolling.

It should be the absolute rule that imported goods must always be backed with service information—and this information should be available on request to *any* accredited service agency. Not just to the so-called service agents of the importers, who are anybody willing to accept the franchise at the terms these astute gentry are prepared to offer.

They need have no special training in dealing with the equipment, and very often their facilities are unquestioned. Bill Jones in the next street is as likely to be accepted as Messrs Mendit with branches in every major city. The customer is not to know. Not, that is, until his equipment goes wrong and it is too late for tears.

"Succumb to rough treatment . . ."

Needless to say, there are notable exceptions. The larger companies have admirable service facilities. To the extent that we regard a couple of them as British as anything on the market. There is seldom any difficulty with Grundig spares, nor lack of information; and it is interesting to note that the recent Philips' challenge to the Hong Kong portables is a fist-sized *Popmaster* designed and produced at Croydon.

We do not ask for massive tomes of data pinned to every set. No need for a Guide Littéraire with every model. Not even for the sort of instruction book, complete with thirty-six full-page illustrations, that accompanies the Beocord 2000 tape recorder. (Yet it is worth noting that this quality manufacturer has always insisted on inserting a service diagram in the bowels of even the least of their portables.)

All we want is the common courtesy of our money's worth. After all, what's cheap about a set that has to be thrown away when it goes wrong, merely because nobody in town has the facilities to repair it?

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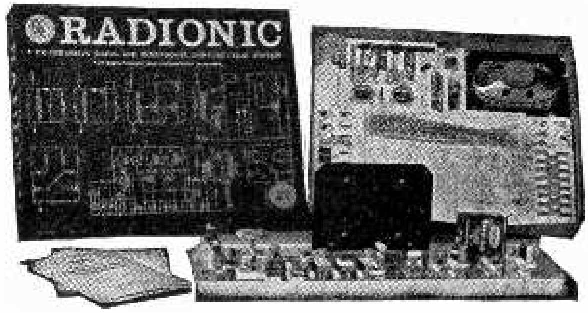
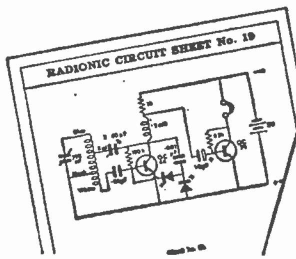
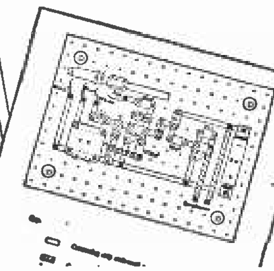


A No. 4 SET and 6-TRANSISTOR SUPERHET



Theoretical Circuit



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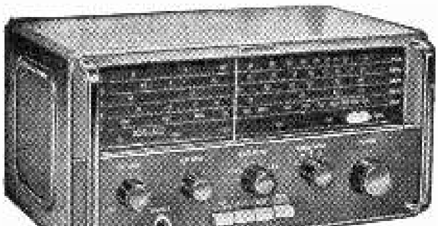

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on the Short Waves

MONTHLY NEWS FOR DX LISTENERS

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

The Broadcast Bands—by John Guttridge

Tunisia: *Radiodiffusion Television Tunisienne* (139 Avenue de Paris, Tunis), gives full QSL details. English from 2200—2300 is often audible on 962.

Cyprus: BBC—East Mediterranean Relay has an English transmission from 1845—1900 on 9,580. After 1900 this channel carries a relay of the BBC World Service in parallel with 9,625 until close down at 2115.

Iran: *Radio Iran* (Ministry of Information, Meydan Ark, Tehran), keeps drifting around the 19 and 25 m.b. with its foreign service from 1730—2130 (English 2000— 2030). Most reported outlets are 11,760/15,110, although 11,750, 15,135, 15,145 and 15,150 have also been reported. The clandestine station *Radio Peyk-e Iran* (Radio Free Iran), has been heard from 1500—1600 on 11,410/11,695.

Iraq: *Broadcasting Station of the Republic of Iraq* (Salihiya, Baghdad), now has Arabic on 6,905 until 1930 when its foreign service starts with an English transmission. The latter is also on 6,030.

Israel: *Kol Israel*, now uses 9,725 to Europe and 9,009 to South Africa during its 2045—2115 English transmission. 9,625 has been dropped. Full QSL.

Japan: N.H.K., Tokyo, has replaced 11,940 by 6,140 for General Service transmissions from 2100—0030. Other frequencies used are 2100 and 2200 transmissions 9,605/15,195; 2300 and 0000 transmissions 15,105/15,425. The European service from 0615—0845 (English 0800) is on 15,135/17,875. Frequencies for the South Asian transmission at 1500—1630 (English 1525) are 7,195/9,525/9,765. Several new QSL's have been issued by this station.

Korea (North): *Radio Pyongyang*, has French from 2000—2100 on 6,540/7,580/9,875/11,750.

Pakistan: *Radio Pakistan* (71 Garden Road, Karachi 3), now uses 11,672/9,615 in English to Europe from 1945—2030.

Taiwan: *Voice of Free China* (New Park, Taipei), now uses 15,125 in its transmissions from 1530—1800. The English broadcast at 1530—1610 has been heard in the U.K. on this outlet.

New Zealand: New Zealand Broadcasting Corporation (P.O. Box 98, Wellington), gives full QSL.

Canada: Canadian Broadcasting Corporation (P.D. Box 6000, Montreal), has been using 17,820/15,320/11,720 for the English and French transmission to Europe from 2000—2150 during the summer but is expected to replace 17,820 by 9,630 during the winter. CHNS (Halifax) has been heard on 960 at 0330—0400.

U.S.A.: Armed Forces Radio and TV Service (250 West 57th Street, New York, New York 10019), uses 15,430/15,350/15,330 from 1330—2245. From 1800—2245 17,855 is used also.

Radio New York Worldwide (4 West 58th Street, New York City 19, N.Y.). English frequency utilization is 15,155 1200—1515; 15,310 1500 (1200 Saturday and Sunday)—2200; 15,440 1200—2400; 17,755 1800—2145; 17,880 1245 (1200 Saturday and Sunday)—1745; 11,790 1200—1515 Saturdays and Sundays. From 2200—2400 11,970 is also believed to be in use. Has formed a SWL Club, membership of which costs $1 a year. Members will be offered QSL report forms in Spanish, German, French, Arabic and English; the use of a station identification bureau; a station address bureau and a monthly DX bulletin.

Voice of America (U.S. Information Agency, 330 Independence Avenue, S.W. Washington 25, D.C.), is transmitting to Europe as follows during the autumn: On 1,196 Munich 0400—0430, 0500—0700, 1600—1830, 2200—2330; 3,980 Munich 0300—0700, 1400—2330; 5,965 Tangier, 5,995 Greenville, 7,200 BBC and 7,270 0300—0700; 5,995 Tangier 1630—2330; 9,540 and 9,740 BBC 0430—0730; 9,760 1830—2245; 11,790 Tangier 0600—0730; 15,205 Greenville, 1400—2215; 15,290 Tangier 1400—2000; 15,295 Tangier 0600—0730; 17,780 Greenville 1400—1745.

Windward Islands: Windward Islands Broadcasting Service (St. George's, Grenada, W.1.), now uses 15,130 for its evening transmission to Europe.

Argentina: *Radio Belgrano* (Cerrito 941, Buenos Aires), has been heard over LR3 on 950 at 0330—0400 with a fairly good signal.

Ecuador: *La Voz de los Andes* (HCJB, Casilla 691, Quito), has been trying different frequencies for its evening European transmission. English 1845—2030, and Swedish 2030—2100 are on 17,890/15,105 and German 2100 and Spanish 2130—2200 are on 17, 850/15,105.

Austria: *Osterreichischer Rundfunk* (Wien IV, Argentinierstrasse 30a) has a music programme for 2300—2400 on 9,770. There is an English transmission on Tuesdays and Thursdays at 1705 and every other Sunday at 1830 on 6,155/7,245. Also October 18 at 1230 on 6,155/7,245/9,770; October 22 at 1300 on 6,155/9,770; October 28 at 0920 on 6,155/7,245/9,770/11,785 and October 23 at 1700 on 6,155/7,245. Full QSL.

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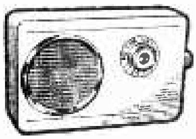

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● 8 stages—6 transistors and 2 diodes

This is a top performance receiver covering full Medium and Long Waves and Trawler Band. High-grade approx. 3in. speaker makes listening a pleasure. Ferrite rod aerial. Many stations listed in one evening, including Luxembourg loud and clear. Attractive case in grey with red grille. Size 6½ x 4½ x 1½in. (Uses PP4 battery, available anywhere.) Carrying strap 1/- extra.

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● 9 stages—7 transistors and 2 diodes

Covers Medium and Long Waves and Trawler Band. The ideal radio for home car, or can be fitted with carrying strap for outdoor use. Completely portable—has built-in Ferrite rod aerial for wonderful reception. Special circuit incorporating 2 R.F. Stages push-pull output. 3in. speaker (will drive large speaker). Size 7½ x 5½ x 1½in. (Uses 9v battery available anywhere.)

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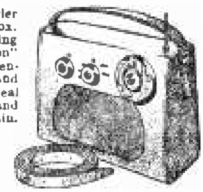

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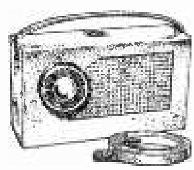

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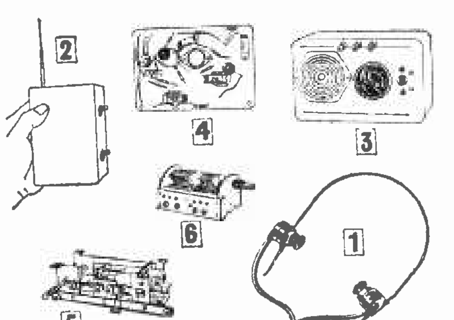

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The Amateur Bands—by David Gibson G3JDG

WHAT a month. A colossal mailbag from just about everywhere on all frequencies. The 160 metre specialists are out in force and reports on all bands all modes have arrived from topband transatlantics to the v.h.f. n.f.d. which finished today. (I was on at 0300 hrs—no justice anywhere these days). **A. Botley** writes to say that ZB4 callsigns are illegal, certainly up till 29.7.65. Alan's just returned from Cyprus where he was active under ZC4GT. Congratulations to **Alan Dailey** (Leeds) who got his ticket, call to listen for on 160 and 80 is G3UMH. L.F. DX news from **E. Rawlands** (Liverpool) 9M20V (Malaya) on 7Mc/s s.s.b. between 2130—2300. ZL2BCG (New Zealand) has skeds with G's on 3800kc/s 0530—0600 hrs. If they can hear him perhaps you can. OX3JV on 7Mc/s most nights, his QTH 600 miles from the N. Pole and running 600W.

One Hundred and Sixty

If you've heard only G's on this band have another listen. **Alan Baker** (Welwyn) R107+PR30 60ft. long wire; times given for would-be topband DX hounds—GM3—EGW 2235, HUN 2125, KDT 2300, GW, 3NMZ 2200, 5BI 2330, OK—1KRL2300, 3BU2230, OL3—ABD 2300, ABO 0300, PAØPN 2315 and 0950, VO1FB 0330, W1BB 0330.

A very interesting letter from **I. Ross** GM3TMK. Ian says that the 4U1—4U6ITU stations are on the band and have worked VO1FB in Newfoundland. Also on is K1LMO, VE3DM, and of course, W1BB. He says "Stew's" new antenna is a "big un". Inverted V 265ft. high at the apex. (Wonder what he uses on 28Mc/s?) 3TMK has worked W1BB, the Scilly Isles expedition, and VO1FBB, the latter on 18 occasions since last November. Ian's antenna is 260ft. long and 39ft. high and he's about 60 miles s.s.w. of John O' Groats. **Robert Nelson** (Nr. Blackpool) B34, 60ft. longwire, says he hears many mobiles up there. From further afield on phone GM3RYO, and GW3—HUM/M, MDK, NNF, TFN

Eighty and Forty

Fared better this month and just shows what's about if you are prepared to search for it as opposed to 20 where "it" finds you.

E. Rawlands (Liverpool) 52 set 71ft. longwire, says "Good for W/VE after 2300 hrs", his best on s.s.b. K1NAC, K4LDR/M, VE1—MA, WH, VO1EL, W4INL, while on 40 the same set up raised MP4BAA, OX3JV, PY7AOT, YV5BPJ, at 58 too. ZS1JA, ZS1KJ, 4X1DK, 5A2TR. **G. Watson** (Sheffield) reports hearing over 200 G, GC, GI, GW stations on 80 since April, with only ¼in. bandspread on his transistor portable, while **Chris Woodrow** (Norwich) tells of almost a world-wide net on 7015kc/s with GW3AX and many DJ's, DL's, ON's, OH's and a Zs. Chris also logged a fine signal from VK2KM and 4X1DK. **P. Edwards** (Birmingham), Hammerlund comet, pre-selector, 33ft. longwire, started quietly on 80 with DL1FI, F2WS, GD3RFK, and SM5ABO when who should come in but EA9AZ, K1GXU/P/7, W9JLH, YV5BPJ, ZP5—KT, OG.

Expensive gear isn't necessary for DX. A three valve t.r.f., 132ft. longwire, and **Steve Wilson** (Nr. Wakefield) between the headphones August 1st—4th. CP5EZ, CX3JV, KØBAT, K4NET, K7PDZ, OA4SE, OY7X, (Faroes), PY5UL, TF2BR, VE3BLU, WA—1NOJ, 2SHK, 4PUB, 8FFO, W5—MCO, JXC, XE1DD, YV5—BK, CET, ZP5CF all c.w. on 40, Vy fb OM.

"40 opens up around 0030 hrs", so states **M. Jolley** (Stafford). 19 Set, 66ft. longwire, numbers are standard r.s.t. to show just how they're coming in. HR1FD 569, K1LPL 579, K3JJG 579, PY1CJL 569, VE3FTM 449, VK8KA 559, VO1HS 569, VP6AK 559, 4X4NVE 449, 4X5VB (Israel?), 5X5UD 569. **R. Hall** (Worksop), SX28, PR30, 80ft. of 14s.w.g. HK—4EB, 41X, 7X1, LU3BLK, VE—2NI, 7AC, WA5KAJ.

Royal Twenty

Yes royal, because it's hard not to hear the distant ones. Almost misery to try local working because the Europeans are blotted out by the DX. Well, not quite, but take **Bob Garvey** with his trusty S640 and 90ft. longwire, the result is CN8BW, CO2JB, CP5EZ, CR3AD (Portuguese Guinea), CR—4BC, 6CH, FG7XS, FM7WP, HK3RQ, HP1PV, K5AEU, KG4AN, KH6DQ, KZ—5AY, 5BC, LU4AA, LX1AN, OH2AM/OHØ, TF3EA, UB5ARTEK, VE3AR, VK6WT, VP3AC, VS9OG, VU2CO, WA5IZT, W6CYV, YAØH (Gus Browning), ZB2AM, ZC4TX, ZS5UP, 7X2AP, 9J2W, 9M2BM, 9M4ML. **B. Wilde** (Wirral) 52 Set, ground plane CT1NL, EP2TF, HZ1AB, K2CAP, PY7ABW, VE2BL, VK6XXX, W2MM, 4X4HJ, 5A1TK, 7Q7PBD, 7X2MD, 9M4MX.

Stephen Beal (N.10) t.r.f. 66ft. indoor antenna as per P.W., May 1964. HB9, K—1, 2, MP4, W—2, 3, 4, 6, YA4, 4U1. **Martin Davies** (Alnwick) 52 Set, dipole, all a.m. or s.s.b. HC, HK, HV, JA, KA3, LU, OHØ, OX4, PJ2, PZ1, VE3/P, VK9, VO1, VP2, VP7, W5, XE1, YV1, 3A8, 5R4, 9Q5. **Jim Dunnett** (Royston) Racal RA17, 60ft. longwire, c.w.—CO2, CP5, CR6, KH6, KL7, KP4, KZ5, MP4, PJ3, SL6, UH8, VS9, 6Y5/P, 7X3, 9M4, 9M6, 9Q5; s.s b.—EA6, EPZ, FG7, HB9/P, KZØ, KZ5, 9H3, 9Q5. **I. Black** (Gillingham) HE30, window frame (I wondered how long it would be). CN8, EL8, ET3, FG7 (Guadaloupe), FM7 (Martinique) HS1 (Thailand), KA6, KG4, LA8 (Jan Mayen Is.), PJ1 and 2, VP2, VS6, ZB2, 4X4, 5A4, 5Z4, 6Y5, 7Q7, 7X2, 9M2, 9M4, 9Q5.

Fifteen and Ten

Poor old 15, so popular a few months back, isn't getting much attention these days. Exceptions to the rule—**G. Wood** (Grimsby) AR88D, PR30, 2-ele. beam or quad, all phone—CE3QB, CR—5SP, 6EP, 7FM, EA3HL, EL8D, HB9FU, HC1DM, IT1DJ, KV4CX, KZ5AY, OA5C,

—continued on page 618

by R. F. Farley, G3SSJ

A Thumbnail History of Radio

PART 2: FROM SPUTTERING SPARK TO SPOKEN WORD

IN 1901 the Marconi Company began installing spark stations in ships. The detector was still the coherer but many experiments were being made to improve its efficiency. Particularly notable were those of Chunder Bose, of Calcutta, who found that potassium would decohere without tapping. Unfortunately the potassium proved vulnerable to oxidisation and had to be used in a vacuum or under paraffin oil.

During the same year P. Castelli, of the Italian Navy, invented a greatly improved detector of the coherer type. It consisted of a glass tube containing a globule of mercury between two electrodes of polished copper. The spacing between the electrodes could be adjusted by a micrometer screw. This coherer decohered automatically in the absence of signals and this eliminated the cumbersome tapping mechanism.

Trans-Atlantic Tests of 1901

For the transatlantic tests of 1901 between Poldhu and Newfoundland a power of 20kW was used. Dr. Ambrose Fleming (later Sir Ambrose Fleming) was in charge of engineering design. Fleming is perhaps best known for the invention of the thermionic diode but he was without question one of the first great wireless engineers.

The transmitter at Poldhu was an a.c.-operated set, using an alternator in conjunction with a transformer to power the spark. It is claimed that this was the first time that this method was used but De Forrest also used it in America during the same year and American historians claim that he was the first to use a.c. power.

The great advantage of this method was that the troublesome primary circuit interrupter of the d.c.-powered spark coil was eliminated. The Poldhu transmitting aerial consisted of a large inverted cone, 200ft high, supported between four towers. The receiver in Newfoundland consisted of a Castelli mercury detector used in conjunction with a telephone receiver, together with an aerial tuning inductance and an aerial and earth system. The aerial was carried aloft by a kite à la Loomis. Tuning had been introduced by Sir Oliver Lodge in the 1890's and was now becoming universally adopted.

Although the world was astounded by the results of these tests they were only of experimental value, the received message consisting of the single letter "S" in Morse code, i.e. three dots. Even these were hardly distinguishable from the high background of static; in fact some sceptics suggested that Marconi and his assistant, Kemp, had imagined they heard it. Marconi's prestige was, however, high and among those who believed his claim was the inventor, Edison.

Shortly after these tests signals were picked up on the American liner "Philadelphia" from a source 2,000 miles away. The world was awakening to the possibility of world-wide wireless communication, but it was not until the development of continuous wave transmission that reliable transatlantic communication was realised.

Spark Stations Open

The next few years were to witness the opening of a number of high-powered long-distance spark stations. Notable among these were the German stations at Nauen and Nordeich. The French station on the Eiffel Tower was transmitting regular time signals and was heard throughout Europe.

Perhaps the most famous of the great spark stations was that built by the Marconi Company at Clifden in Ireland, although the site is now better known as the place where Alcock and Brown crash-landed in 1919. Clifden was powered by a 15,000V bank of accumulators which were kept charged by three generators connected in series and powered by a steam engine. The cells were used to charge a huge condenser through series resistor. The condenser discharged through a rotary spark gap via the primary winding of the aerial transformer or "jigger" as it was then called. The power drawn from the cells was 300kW and the sparking rate was 500 per second.

"An Exciting Rescue at Sea"

In 1908 the newspapers carried accounts of an exciting rescue at sea in which wireless had played an important part. On a foggy January night the steamship "Florida" collided with the "Republic". The "Republic's" hull was badly damaged and she began to sink. Her Marconi operator was an Englishman, John R. Binns. He began calling CQD, which was then the distress call. The ship's lighting system had failed but fortunately the transmitter continued to operate (probably from batteries).

The call was received by a station in Massachusetts, the land operator there then notified several other ships in the area and all aboard were rescued. When Binns landed he was astonished to find the dockside crowded with cheering people; he had become a hero overnight.

It is almost certain that the CQD of Binns was

—continued on page 617

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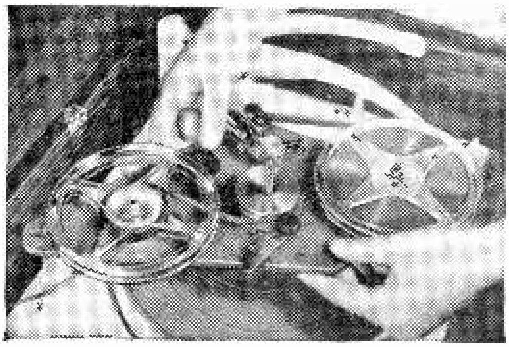

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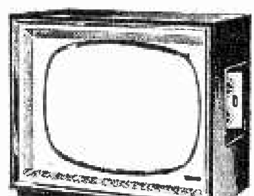

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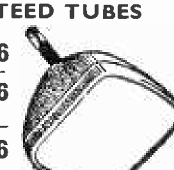

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Thumbnail History of Radio
—continued from page 614

not heard directly by the ships in the vicinity due to skip effects. Heaviside had already published his theory about the reflecting layers above the earth but it was treated with scepticism. In 1912 the theory was expanded by Dr. Eccles, of the Marconi Company, and this time caused a storm of controversy.

The value of wireless was probably emphasised most strongly by the part it played in the "Titanic" disaster of 1912. There followed a sharp increase in the number of licensed stations and it became necessary to establish the first International Radio Telegraphic Conference. As a result it became international law that all vessels of a certain size should carry wireless installations and trained operators.

Meanwhile much had been done to improve the efficiency of the spark transmitters. Ionisation was a frequent source of trouble with the early spark gaps. When this occurred damped oscillations from the primary circuit of the spark coil were fed into the aerial circuit.

The contacts of the primary interrupter also tended to become pitted so that the general tone (which in any case was low pitched) was wavery. This was overcome by the introduction of the synchronous rotary gap in which a number of interrupter and discharger electrodes were evenly spaced circumferentially on two insulating discs. These were rotated on a common shaft.

In marine installations the equipment was required to operate from the ship's d.c. main supply. A.C. power for the spark was usually derived from a motor generator set used in conjunction with a transformer having a synchronous gap mounted on the generator shaft. An input frequency of 500c/s would give a steady sparking rate of 1kc/s which was easily identified through the high static on marine frequencies.

Marconi's Chief Competitors

The German Telefunken Company were Marconi's chief competitors and produced the ultimate in spark transmitters. A German physicist, Max Wien, invented the quenched spark gap, which was highly efficient because of its superb heat dissipation.

In 1906 Colonel Donwoody invented the carborundum crystal detector. Other crystal detectors soon followed and were commercially produced. The Fleming diode was patented in 1904 but was little used.

The Marconi magnetic detector was very popular in ship installations on account of its reliability, although its efficiency was lower than that of the crystal detector. It consisted of an endless band of soft iron wire which passed through a coil carrying the received current. A secondary coil was wound over the primary coil and connected to a pair of telephone receivers.

A magnetic field was provided by two powerful horseshoe magnets and the iron band was kept moving by an arrangement of two wooden pulleys and a clockwork motor which the operator had to rewind every half-hour or so. Due to hysteresis effects in the iron wire a rectifying action took place.

It was first devised by Rutherford in 1895 but the popular version was greatly improved and patented by Marconi in 1903. It was finally ousted by the thermionic valve during the First World War.

Experimental work with wireless telephony had been going on since the turn of the century. The spark transmitters generated damped waves at a recurrence frequency of about 1kc/s at the most and were, of course, useless as carriers for speech frequencies, having a spectrum of from 300 to 3,000c/s.

A Danish engineer, Valdemar Poulsen, developed a d.c. arc for use as a continuous wave generator. It was with this device that R. A. Fessenden transmitted speech over a distance of one mile in 1902.

Musical Headphones

On Christmas Eve, 1906, marine operators were astonished to hear music in their headphones. It was followed by a short speech inviting everyone to write to R. A. Fessenden at Brank Rock, Mass., several hundred miles away from many of his listeners. Again Fessenden was using a d.c. arc to excite the aerial circuit. Modulation was by a carbon button directly connected to the aerial circuit. By this time most detectors consisted of rectifiers of one form or another which, unlike the coherer, would demodulate.

In 1907, in America, De Forrest added a third electrode, now known as the grid, to the Fleming diode and soon discovered that it would amplify besides detecting. At first De Forrest believed that his valve (or "audion", as it was called) amplified by controlling ionisation caused by wireless waves within the bulb and it was several years before its action was understood.

Meanwhile a fierce battle developed between the Marconi Company and De Forrest over patent rights, since the Marconi Company held the patents of the Fleming diode. The final outcome was that neither could use the "triode" without the consent of the other party.

Much controversy still exists as to who discovered the triode's potentiality as regenerative detector and oscillator. Mr. K. W. Alford, then a student at the London School of Telegraphy, observed that signals were accidentally hetrodyned by a De Forrest audion he was experimenting with in 1913 (he was later known for his pioneer work on superhets and is still well known as G2DX in the field of amateur radio) but he did not know why. Meisigner developed a triode oscillator in the same year in Germany.

Edward Armstrong announced his first claims around this time. Armstrong's subsequent inventions included the superhet. In 1914 he filed a patent for a regenerative audion circuit. It was soon followed by another patent from De Forrest, claiming that his circuit could be used for regeneration and oscillation. After prolonged legal proceedings the Supreme Court upheld De Forrest's claim. During this year the Marconi Company in England marketed a combined telephony transmitter and receiver using valves. ■

BOOKS REVIEWED

CLOSED CIRCUIT TELEVISION HANDBOOK.
Leon Wortman. W. Foulsham & Co. Ltd., Slough, Bucks.
273 pages. Size 8¾in. x 5¼in. Price 42/-.

THE title of this book raised my hopes of some interesting reading, together with some practical circuitry, as the name handbook usually implies.

At 42s. I thought I was at least entitled to one or the other. As it happens this book, in my opinion, provides neither. It is a long-drawn-out account of the hundreds of different ways to use CC-TV. Chapters such as cameras, video recording techniques are entirely commercial and there is very little of interest to the amateur or practically minded enthusiast.

The professional engaged in this field might find it interesting but for me it was one long, hard 273-page slog.—*D.L.G.*

BASIC ELECTRONIC CIRCUITS.
Published by The Technical Press Ltd.
112 Westbourne Grove, London, W.2. Price 42/-.

HAVE you ever opened a text book and found the type so small you almost had to use a magnifying glass to read it? And circuit diagrams tyrannically reduced until they looked more like a street map of Hong Kong? Those who like such miniaturisation will be disappointed in this book!

The type is large and easily readable, the circuit diagrams and illustrations are bold and clear. Add careful thought and planning, as has obviously gone into this book.

Clearly intended for the would-be technician, it offers a near-ideal work for the purpose. Each circuit has a group of waveforms and has a step-by-step explanation showing clearly what is happening at various stages. Nearly all circuitry is shown with valves, followed by the equivalent using transistors, and again the circuit action and waveforms are shown step by step at each instant of time.

Commencing with the response of CR circuits to pulses it proceeds to diodes and thence to multivibrators. The clear way in which the latter are dealt with make the book worth having on the shelf.

Part 2 covers timebase circuitry, again with the same thorough treatment, with separate consideration for both electrostatic and electromagnetic deflection. The later sections of the volume tend towards radar circuitry and give the same meticulous treatment to strobe pulse markers.

All good basic reading and offering a very sound basis on which to build later knowledge. For technicians, engineers or indeed anyone wanting a good basic primer in electronics this book is a good buy. The price may be high but, compared with some others, it becomes a decided bargain.—*D.L.G.*

SOLID-STATE PHOTOFLASH

With regard to the Photoflash unit which should have appeared in the October issue, we regret that just before publication we learnt that the photoflash tube had been discontinued by the manufacturers.

We are investigating the possibility of redesigning this equipment to use a tube which is in current supply, and should this be possible the article will appear without delay. In the meantime we trust that our readers will accept our apologies.

ON THE SHORT WAVES

—*continued from page 613*

PX1JS, PY5ACB, SV1DL. TR2DE, VO1BD, W7HH/MM, ZD8TV, ZS6BRG, 4X1DK, 5A1TK, 5N2SMV, 5Z4AA, 9L1MJ, 9Q5DL, 9U5BB. On 28Mc/s **P. Baker** (Pontypool) HE30, 14ft. whip CM3TDS, CT1GE, DJ—2UC, 8XQ, 9EV, DM3WEK, EA7BD, EL2JT, F9IE, I1LCE, LA—4AX, 5WU, W4ZZZ (Florida) 9Q5WB all a.m. Note the W's starting to appear.

News

9M8KS is reported low end of 20 seeking G's, VKØ on Macquarie Is. around 14,200, a PYØ is rumoured active on Fernando de Noronha and/or Trinidad Is. same prefix, ZS2MI for the vigilant on Marion Is., and ZD9 on Gough Is.

If you're contest minded, then the following happenings are forecast for October 2/3rd VK/ZL contest (phone section): 2/3rd WADM (c.w.); 9/10th Raynet Rally 1·8, 3·5, 70 and 144Mc/s. Times for this one—9th 1800—2200 and 10th 0800—1200, 1500—1900. 9/10th VK/ZL (c.w.); 10th Northern Radio Society's Convention at Belle Vue: 16/17th 7Mc/s DX contest (phone). 16/17th Eighth Jamboree-on-the-Air; 23/24th CQ World Wide contest (phone); 30/31st VU2/4S7 contest (c.w.). Nov 6/7th VU2/4S7 (phone); Nov. 6/7th 7Mc/s DX (c.w.) 73 good DX and deadline for this month is 28th.

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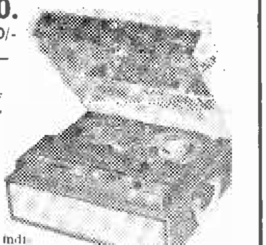
carr. 10/-



Bargain of the Year Offer— Cancelled Export Contract

Famous manufacturer's brand new unused and factory tested 2 speed, $3\frac{3}{4}$ and $7\frac{1}{2}$ i.p.s. twin track tape recorder 3 Watt output. Tape position Rev-counter, fast forward and rewind, takes 7" reels, mike and gram input. Straight through amplifier facilities. Output sockets for ext. speaker, monitor or external amplifier. Super-imposed switching magic eye recording level and mains neon indicator. Volume and tone controls 7"x4" speaker. Attractively styled cabinet with detachable lid mike and reel storage facilities. AC 200/250 volts operation. Complete with crystal mike, tape spare reel and screen lead etc.

L.P. RECORDING TAPE BARGAIN OFFER

By leading British Manufacturers Professional Grade Double Sided (each side coated) $5\frac{3}{4}$-in. reels only. Special Price Offer 1.450 feet (2 reels) 20/- post free.

Ideal for the experimenter who wants to record both sides, and a good L.P. tape for the enthusiast who wishes to record single side only.

Jack Plugs. Standard $2\frac{1}{2}$" Igranic Type. **2/6.** Screened Ditto, **3/3.** Miniature scr. $1\frac{1}{2}$", **2/3.** Sub-min. **1/3. Jack Sockets.** Open Igranic Moulded Type, **3/6.** Closed Ditto. **4/-.** Miniature Closed Type, **1/6.** Sub-min. (deaf aid) ditto, **1/6.** Stereo Jack Sockets. **3/6.** Stereo Jack Plugs, **3/6.** **Phono Plugs, 9d.** Phono Sockets (open), **9d.** Ditto (closed), **1/-.** Twin Phono Sockets (open), **1/3.**

Grundig Continental. 3 p. or 5 p. plug, **3/6.** Sockets, **1/6.** **Soldering Irons.** Mains 200/220V or 230/250V. Solon 25W Inst., **24/6.** Spare Elements, **5/6.** Bits, **1/3.** 65W, **29/6,** etc. **Alumin. Chassis.** 18g. Plain Undrilled, folded 4 sides, 2" deep, 6" x 4", **4/6,** 8" x 6", **5/9,** 10" x 7", **6/9,** 12" x 6", **7/6,** 12" x 8", **8/-,** etc. **Alumin. Sheet.** 18g. 6" x 6", **1/-,** 6" x 9", **1/6,** 6" x 12", **2/-,** 12" x 12", **4/6,** etc.

6 VALVE AM-FM TUNER UNIT

Med. and VHF 190m-550m, 86 Mc/s-103 Mc/s, 6 valves and metal rectifier. Self-contained power unit. A.C. 200/250V operation. Magic-eye indicator, 3 push-button controls, on/off, Med., VHF. Diodes and high output Sockets with gain control. Illuminated 2-colour perspex dial $11\frac{1}{2}$"x4", chassis size $11\frac{3}{4}$"x4"x$5\frac{3}{4}$".

A recommended Fidelity Unit for use with Mullard "3-3" or "5-10" Amplifiers. Available only at present as built-up units, aligned and tested ready for use.

This popular unit will be available in kit form within the next few weeks.

Circuit and constructor's details. 4/6. Free with kit.

BARGAIN PRICE £12.10.0

Carr. & Ins. 7/6.

Condensers—Silver Mica. All values 2pF to 1,000pF, **6d.** each. Ditto Ceramics **9d.** Tub. 450V T.C.C. etc. 0.001 mFd to 0.01 and 0.1/350V., **9d.** 0.02-0.1/500V. 1/-. 0.25 Hunts **1/6,** 0.5 T.C.C. **1/9,** etc., etc. **Close Tol. S/Micas**—10% 5pF-500 pF **8d.** 600-5,000pF, 1/-. 1% 2pF-100pF, **9d.** 100pF-500pF. **11d.** 575pF, 5,000pF. **1/6. Resistors**—Full Range 10 ohms-10 meg. ohms 20% $\frac{1}{4}$ and $\frac{1}{2}$W. **3d.** $\frac{3}{4}$W **5d.** (Midget type modern rating) 1W, **6d.,** 2W, **9d. Hi-Stab.** 5% $\frac{1}{4}$W $\frac{1}{2}$W. **6d.** (100 ohms-1 meg). Other values **9d.** 1% $\frac{1}{2}$W **1/6,** etc., etc.

Volume Controls—5K-2 Meg. ohms. 3in. Spindles. Morganite Midget Type $1\frac{1}{8}$in. diam. Guar. 1 year. LOG or LIN. ratios less Sw. **3/-.** DP. Sw. **4/6.** Twin Stereo less Sw **7/6** 100k to 2M ohms with DP Sw. **9/6.**

WAVECHANGE SWITCHES. 1 p. 12-way 2p. 2-way. 2 p. 6-way. 3 p. 4-way, 4 p. 2-way, 4 p. 3-way, long spindle. **3/6** ea.

EXPANDED ANODISED METAL.

Attractive gilt finish $\frac{1}{4}$in. x $\frac{1}{4}$in. diamond mesh **4/6** sq. ft. Multiples of 6in cut. Max. size 4ft. x 3ft., **47/6** plus carr. Do., finer patterned mesh, **4/6** sq. ft., multiples of 12in., max. size 3 ft. x 2 ft., **27/6** sheet.

ENAMELLED COPPER WIRE— $\frac{1}{4}$lb. reels 14g-20g, **3/-;** 22g-28g, **3/6;** 36g-38g, **4/9;** 39g-40g, **5/-,** etc.

JASON FM TUNER UNITS

Designer-approved kit of parts. **FMT1,** 5 gns. 4 valves, **20/-** **FMT2, £7.10.0,** 5 valves, **35/-. JTV MERCURY** 10 gns. 3 valves **22/6. JTV2 £13.19.6.** 4 valves. **28/6.** **NEW JASON FM HANDBOOK, 2/6.** 48 hr. Alignment Service **7/6.** P. & P. 2/6.

TRIMMERS. Ceramic (Compression Type)—30pF, 50pF, 70pF, **9d.;** 100pF/150pF **1/3;** 250pF, **1/6;** 600pF **1/9.** **PHILLIPS.** Bee Hive Type (conc. air spaced)—2-8pF. **1/-;** 3-30pF, **1/-.** **KNOBS**—Modern Continental types Brown or Ivory with Gold Centre; 1" dia., **9d.** each: $1\frac{3}{4}$". **1/-** each; Conc. knobs ivory with Gold Centre $1\frac{1}{4}$" dia. **2/9** per pair. Matching ditto **2/6** ea.

LARGE SELECTION AVAILABLE.

METAL RECTIFIERS, STC Types— RM1. **4/9.** RM2. **5/6** RM3. **7/6;** RM4, **16/-;** RM5, **21/-;** RM4B, **17/6.**

TUB-ELECTROLYTICS-CAN

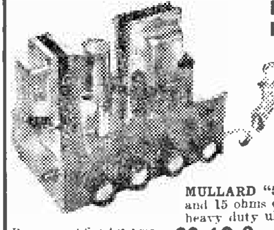
25/25v. 50/12v. 1/9; 8+8/450v. 4/6; 50/50v.100/125v. 2/-;32+32/275v.4/6. 8/450v. 4/350v. 2/3; 50/50/350v. 6/6 16+16/450v. 5/6; 60/250/275v. 12/6 32+32/450v. 6/6; 100+200/275v. 12/6

TRS

Est. 1949

MULLARD "3-3" & "5-10" HI-FI AMPLIFIERS

3 ohm & 15 ohm output



"3-3" Amp. 3 valve, 3 watt hi-fi quality at reasonable cost. Bass Boost and treble controls quality sectional output transformer, 40 c/s-25 kc/s + 1 dB. 100mV for 3W, less than 1% distortion. Bronze escutcheon panel **Complete Kit only £6.19.6.** Carr. 5/- Wired and tested **£8.10.0.**

MULLARD "5-10" AMPLIFIER. 5 valves 10W 3 and 15 ohms output. Mullard's famous circuit with heavy duty ultra-linear quality output transformer

Basic amplifier kit price **£9.19.6** Carr. and Ins. 7/6.

Ready built $11\frac{1}{2}$ gns.

CONTROL PANEL KIT. Bass, Treble and Volume controls with 4-position selector switch for radio tape and 11in. x 4in. escutcheon panel.

AMPLIFIER KIT AND CONTROL PANEL KIT. £11.19.6. Ditto, really wired. **£14.19.6.**

2-VALVE PRE-AMP. UNIT. Based on Mullard's famous 2-valve (2xEF86) circuit with full equalisation, with volume, bass, treble and 5-position selector switch. Size 9x6x$2\frac{1}{4}$in. Complete Kit **£5.19.6.** carr. 3/6. Ready Built **£7.19.6.**

DE-LUXE RECORD PLAYER KIT

Incorporating 4 Sp. Garrard Auto-Slim unit and Mullard latest 3 watt printed circuit amplifier (ECL 86 and EZ 80), vol., bass and treble controls, with 8" x 5" 10,000 line speaker.

Contemporary styled 2-tone cabinet, charcoal-grey and off-white with matching blue-relief. Size $17\frac{1}{4}$" x 16" x 8". A stylish unit capable of quality reproduction. Circuit and const. details **2/6** (free with kit)

COMPLETE KIT £13.19.6

Carr. and ins. **12/6**

Illuminated perspex control panel escutcheon, **7/6** extra. Ready wired **30/-** extra. Four contemporary mounting legs 6in. **10/6:** 9 in. **11/6,** 12in. **12/6** extra

TRANSISTOR COMPONENTS

Midget I.F.'s—465 Kc/s 9/16in. diam. first, second or third . .5/6

Osc. Coil M. & L.W 9/16 in. dia. **5/0**

Midget Driver Trans. 9:1 . . . . . . **6/-**

Midget Output Trans. Push-Pull—3 ohms **6/-**

Elect. Condensers—Midget type 1 mFd.-50 mFd. ea. **1/9,** 100 mFd. **2/-,** 12V.

Condensers 150 v. working: .01 mFd., .02 mFd., .03 mFd., .04 mFd. **9d;** .05 mFd., .1 mFd., **1/-** .25 mFd., **1/3;** .5 mFd. **1/6.** etc. **Midget Tuning Condensers.** J.B. "OO" 208 pF and 176 pF, **8/6,** ditto with trimmers, **9/6.** J.B. 220 pF and 105 pF conc. slow motion **10/6.** 365pF single **7/6.** Sub. min. $\frac{3}{4}$in. Dilemin 100 pF, 300pF, 500pF. **7/-** each.

FERRITE AERIALS, M. & L.W. car aerial coil **9/3.**

Midget Vol. Control with edge control knob, 5 K/ohms, with switch **4/9;** Ditto less switch **3/9.** Speakers: P.M.; 2in. Plessey 75 ohms **15/6.** $2\frac{1}{2}$in. Continental 8 ohms, **13/6.** 7 x 4in. Plessey 35 ohms, **23/6.**

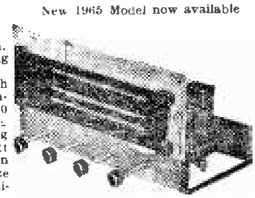
Ear Plug Phones—Min. Continental type 3ft. lead, jack plug and socket. High Imp., **8/-.** Low Imp., **7/6.**

Brand New. Mfrs. 1st grade; 1 OC44 & 2 OC45, **15/6.** 1 OC81D & 2 OC81, **15/6.** All above and OA81, **32/6.** Post Free.

7 VALVE AM/FM RADIOGRAM CHASSIS

Valve line-up ECC85, ECH81, EF89 EABC80, EL84, EM81 EZ80.

New 1965 Model now available



Three Waveband and Switched Gram. positions. Med. 200-550 m. Long 1,00 2,000 m. VHF/FM 88-95 Mc/s. Phillips Continental Tuning Insert with permeability tuning on FM and combined AM/FM IF transformers. 400 Kc/s. and 10.7 Mc/s. Dust core tuning all coils. Latest circuitry including AVC and Neg. Feedback. Three watt output. Sensitivity and reproduction of a very high standard. Chassis size $13\frac{1}{2}$ x $6\frac{1}{2}$in. Height $7\frac{1}{4}$in. Edge illuminated glass dial $11\frac{1}{2}$x$3\frac{1}{2}$in. Vertical pointer. Horizontal station names. Gold on brown background A.C. 200/250v. operation. Magic-eye tuning. Circuit diagram now available.

Aligned and tested ready for use £13.19.6. Carr. & Ins. 7/6

Comp. with Tape O/P socket, ext. spk'r and P/U sockets and indoor F.M. aerial and 4 knobs—walnut or ivory to choice. 3Ω P.M. Speaker only required. Recommended Quality Speakers 10" Rola, **27/6.** $13\frac{1}{2}$" x 8" E.M.I. Fidelity, **37/6.** 12" R.A. with conc. Tweeter. **42/6.** Carr. 2/6.

BONDACOUST Speaker Cabinet Acoustic Wadding (1 in. thick approx.) 18in wide, any length cut, 2/3 per ft., **6/-** per yard. **TINNED COPPER WIRE.** 16-22g. 2/6 $\frac{1}{4}$lb. **ERSIN MULTICORE SOLDER.** 60/40 **4d.** per yard. Cartons 2/6 etc.

TYGAN FRET (Contem. pat.), 12 x 12in. **2/-;** 12 x 18in. **3/-;** 12 x 24in. **4/-,** etc

We manufacture all types Radio Mains Transf., Chokes, Quality O/P Trans., etc

Enquiries invited for Specials. Prototypes for small production runs. **Quotations** by return. Send for detailed bargain list, 3d. stamp.

RADIO COMPONENT SPECIALISTS

70 Brigstock Rd., Thornton Heath, Surrey. *Hours:* 9 *a.m.*-6 *p.m.,* 1 ***p.m. Wed.***

THO 2188. *Terms C.W.O. or C.O.D. Post and Packing* ***up to*** $\frac{1}{2}$ ***lb. 1/-; 1 lb. 1/9;*** 3 *lb* **3/-. 5 *lb.* 3/9; 8 *lb.* 4/6.**

No. 1 DERBY AND DISTRICT AMATEUR RADIO SOCIETY

CLUB SPOT

IT is an established fact that the first wireless club in the country was formed in Derby during 1911. In the spring of that year, Professor G. P. Bailey gave a lecture in the Guildhall, entitled "Scientific Progress In Our Time" and demonstrated the ringing of bells and lighting of lamps by means of wireless waves. This prompted local experimenters to form a group and with the guidance of S. Grimwood-Taylor and A. T. Lee (whose sudden death was reported on 10th June, 1965), the Derby Wireless Club (QIX) was formed.

In the following year, books were purchased and a lending library started, and in 1913, the Club moved to new rooms. An exhibition was presented which received full-page coverage in the 6th February issue of the "Daily Sketch". On 7th May, in the "Daily News and Leader", there was a column devoted to the Club and in the 9th July issue of the same paper, under the heading "Aerial Music", reference was made to the Club and to a cigar-box crystal receiver made by A. T. Lee.

The February 1913 issue of "Model Engineer" carried a letter with a plea for other towns to start radio clubs and correspondence ensued in which the Club helped in the formation of several others.

The Club continued during the next few years, although the 1914-18 war reduced its activities. In 1921 there were transatlantic tests on the short waves and several members co-operated in these.

In 1922, on 12th May, the local newspaper featured a paragraph on the Club with an illustration showing A. T. Lee's sister broadcasting to members the result of the Carpentier-Lewis fight, which had taken place the previous night.

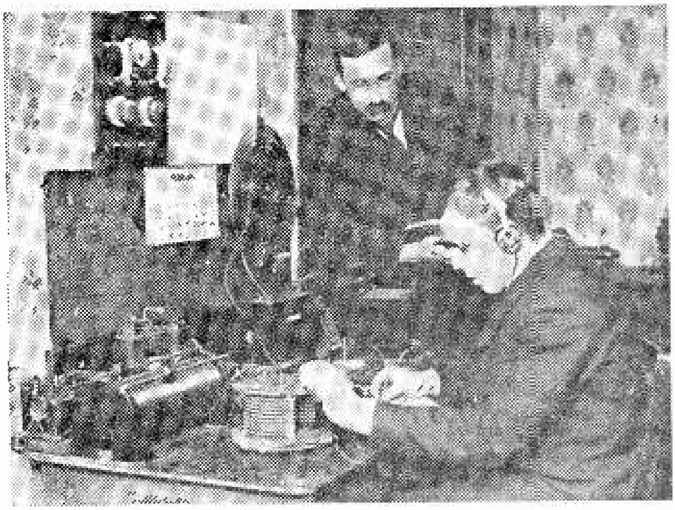
Wireless for Hospital

The main project in 1926 was the provision of wireless for the patients in Derbyshire Royal Infirmary. This was carried out in co-operation with several other local organisations and the installation was officially presented on 15th November. It included 300 pairs of headphones and several loudspeakers.

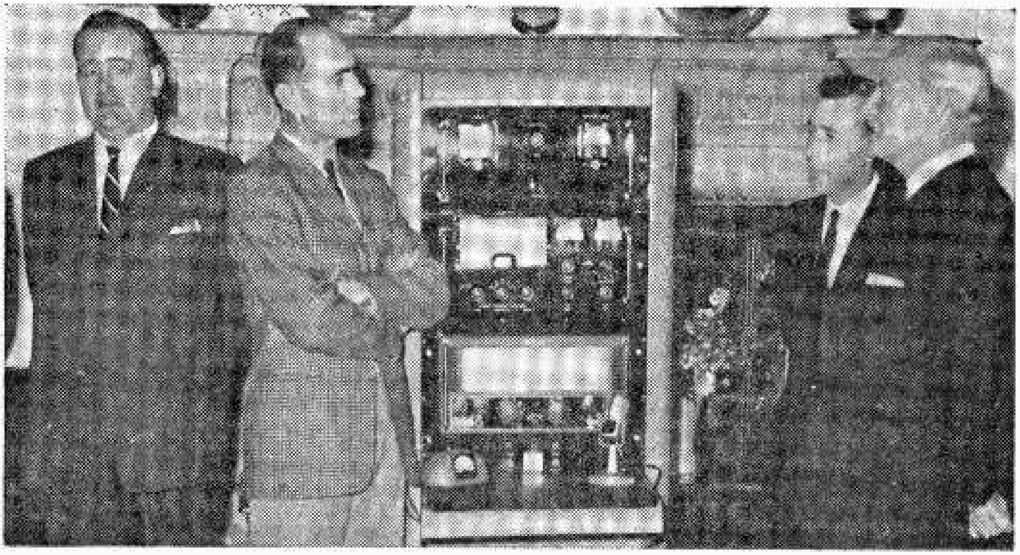
The Club celebrated its coming-of-age with a dinner on 8th February, 1932, and many of the founder and early members were present. In 1936, the Silver Jubilee was celebrated with a dinner on 28th October, and a presentation was made to the founder members S. Grimwood-Taylor and A. T. Lee.

In 1937, 10th April saw the erection of an aerial on the Police Headquarters Building, for experiments in communication on the 5m band.

With the outbreak of the Second World War, transmitting activity ceased, all apparatus being confiscated by the authorities. After the war, in 1947, it was decided to form the Derby and District Amateur Radio Society to cater for all aspects of radio and electronics, both technically and socially. Membership was to be open to all, on payment of a 5s. annual subscription (the same incidentally as today and when the Derby Wireless Club started in 1911).



A. T. Lee (seated) operating the Derby Wireless Club transmitter in the Full Street, Derby, Club Room in 1913. Looking on is another founder member S. Grimwood-Taylor.



Near Derby, at Staunton Harold, is one of the Group Captain Cheshire Homes, and a project undertaken by the Society in 1960 was the provision of a complete amateur station at the Home. The prime mover in this project was J. Ballinger, G3NAJ, who constructed an all-band transmitter in a console cabinet. The parts for the transmitter were given by local and national firms and members of the Society. A sale of donated items organised by the Society realised £60 which was used to provide a receiver for the station.

The picture shows (left to right) J. Ballinger; Group Captain Cheshire, V.C., D.S.O., D.F.C.; F. C. Ward (Secretary); and Sir Denning Pearson, who presented the equipment to the Home on behalf of the Society.

At the Annual Dinner, held in 1949, A. G. G. Melville, F.R.C.S.(E.), Consultant Radiologist at Derbyshire Royal Infirmary, accepted office as the Society's President, a post which he continues to hold.

Interest in the society continued to grow, and in 1954, at a meeting between the Committee and the founder members of Derby Wireless Club, it was agreed that the Society should incorporate in its title "Derby Wireless Club 1911".

Mobile Rally

It was in 1958 that the first of the Society's Annual Mobile Rallies was held at Rykneld School, Derby. This proved to be a very popular event. In the next year, the second rally was held and was an even greater success than the first had been, with over 1,000 visitors. (Recent rallies have often attracted as many as 4,000 visitors.)

Near Derby, at Staunton Harold, is one of the Homes founded by Group Captain Leonard Cheshire, V.C., D.S.O., D.F.C., and a project undertaken by the Society in 1960 was the installation of a complete amateur station at the Home.

History

As may be seen from the foregoing, the members of the Society are keen on keeping track of its history and many of the items constructed by Club members in the first days of amateur radio are preserved together with original documents and photographs, and items of correspondence.

Club Room

The present Club room is in the sub-basement of Derby College of Art, and the limited accommodation restricts the activities of the Club, at least so far as transmitting from the premises is concerned. However, it is hoped that the Club will be provided with better accommodation in the not too distant future.

The Society's call-sign was originally G3ERD (Experimental Radio Derby) and this is still in use. However, the Society has recently been fortunate enough to acquire another call-sign—G2DJ—which it is hoped will shortly be as well known on the air as G3ERD.

Meetings

Meetings are held once per week, at 7.30 p.m., on Wednesdays, at 119 Green Lane, Derby (near the College of Art) and visitors are always welcomed. Details of meetings are issued four times per year with full information on the next quarter's events.

A popular annual function is the Dinner and Dance. This year the attendance was 186, the members travelling from as far afield as Stamford, Bristol and Marlow.

The Derby and District Amateur Radio Society has now flourished for many years, due to a very keen membership and the continuing existence of an enthusiastic Management Committee. Present members and committee are as keen as the earlier ones were and see no reason why the Society should not continue to expand and preserve its position in the forefront of amateur radio.

COMPONENTS LIST

Note: The majority of the following items are already present in the "Ten-Five".

Resistors

R1	15kΩ	R4	3·9kΩ
R2	1kΩ	R5	20kΩ
R3	1kΩ	R6	1·2kΩ
VR1	5kΩ pot.		

Capacitors

C1 75pF mica
C2 100μF electrolytic
C3 0·01μF ceramic or paper
C4 0·01μF ceramic or paper
C5 0·05μF paper
C6 0·01μF ceramic or paper
C7 2000pF mica or ceramic
C8 5000pF mica or ceramic
C9 See Table I
TC 0-30pF Beehive trimmers (9)

Semiconductors

TR1/2 AF115

Switch

3-wafer, 3-pole, 3-way rotary (Radiospares, etc.)

Coils and Transformers

T1A Miniature Dual purpose transistor coil—Blue. Range 3
T1B Miniature Dual purpose transistor coil—Blue. Range 4
T1C Miniature Dual purpose transistor coil—Blue. Range 5
T2A Miniature Dual purpose transistor coil—Yellow. Range 3
T2B Miniature Dual purpose transistor coil—Yellow. Range 4
T2C Miniature Dual purpose transistor coil—Yellow. Range 5
T3A Miniature Dual purpose transistor coil—White. Range 3
T3B Miniature Dual purpose transistor coil—White. Range 4.
T3C Miniature Dual purpose transistor coil—White. Range 5
L1 Miniature Dual purpose valve type coil—Red. Range 2

Note: All the above coils and transformers are by Denco (Clacton) Ltd.

Oddments

Piece aluminium 4 x 3¼in., Control knob, 6BA nuts (15), 6BA bolts (6), Tagstrips (2), Connecting wire, insulated and assorted colours.

Continued from page 595

(6) Set generator to HF tracking point and tune in signal using VC1-2-3. Adjust trimmers of Blue R3 and Yellow R3 for maximum output.

Exactly the same procedure as outlined above is used for aligning the other two ranges, always taking care not to upset the adjustments already made. Final locking of the cores and trimmers is not recommended until each range has been rechecked in case interaction has introduced changes.

TABLE I

Maker's Range Number	Coverage (Blue/Yellow transformers) Mc/s	Metres	C9 (White transformers)	Padder Pin Number
3	1·67—5·3	57—180	340pF	3
4	5·0—15·0	20— 60	960pF	4
5	10·5—31·5	9·5—28	2000pF	6*

* Harmonic mixing used on this range, the 2nd harmonic being automatically present.

TABLE II

Tracking Points

Range	LF Band End	LF Tracking Point	HF Band End	HF Tracking Point
3	1·67 Mc/s	1·83 Mc/s	5·3 Mc/s	4·5 Mc/s
4	5·0 Mc/s	5·50 Mc/s	15·0 Mc/s	13·5 Mc/s
5	10·5 Mc/s	11·50 Mc/s	31·5 Mc/s	28·5 Mc/s

Second Channel

Two responses can usually be found on short wave ranges and the one requiring minimum core or trimmer in circuit is the correct one. To check move the generator pointer on completion above and below its setting (3Mc/s), when a second response will be noted. This should be higher in frequency than the one used for initial adjustment.

Detuning of the oscillator can occur when aligning the signal circuits (pulling) but may be overcome by slightly rocking the tuning capacitor when making adjustments.

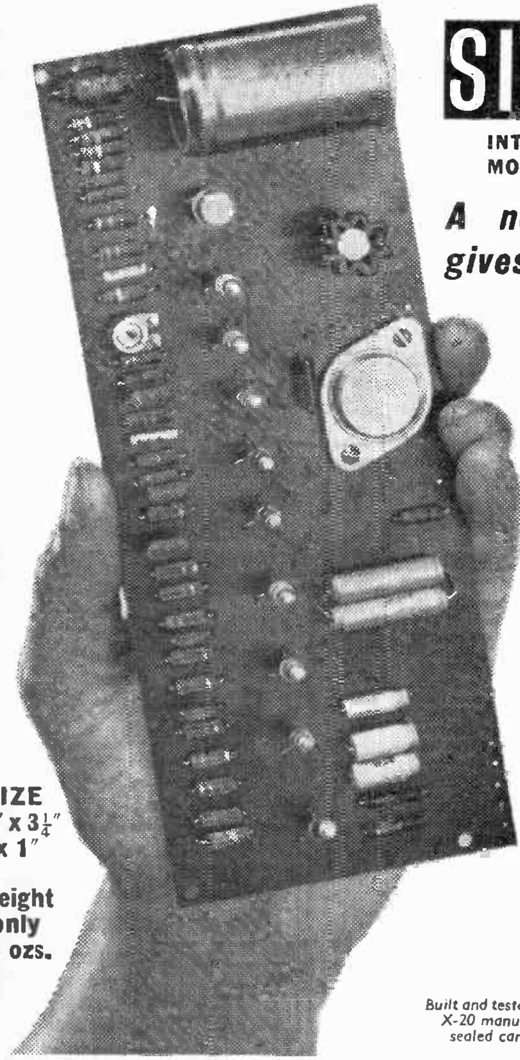
Conclusion

It is now merely necessary to retrim the wavetrap against 1·6Mc/s signals if necessary and to cut out a hole in the receiver casing to accommodate the switch shafting. The casing now requires no hinged or removable lid, of course, but screening against self pick-up is necessary. This means that if the casing is not metal its interior must be lined with metallised foil that is grounded.

Proof of adequate screening is easily found by adjusting the switched section to the highest frequency range and noting if any signals are received when the aerial is left disconnected.

MORE UNIQUE DESIGNS FROM

BRILLIANT PERFORMANCE • ADVANCED CIRCUITRY • EASY



SIZE $8\frac{1}{4}$" x $3\frac{1}{4}$" x 1"

weight only $4\frac{1}{2}$ ozs.

SINCLAIR X-20

INTERGATED 20 WATT PULSE WIDTH MODULATED AMPLIFIER AND PRE-AMP

A new type of amplifier that gives you 20 watts output RMS

By the use of Pulse Width Modulation in circuitry developed exclusively by Sinclair Radionics, the unique X-20 achieves standards never before reached by any audio amplifier in the world. From the input of the integrated pre-amp through to the power output stage, this amazing amplifier gives quality and power far ahead of anything in its class to make it the most original and interesting design in years. You use your X-20 like any conventional quality amplifier, but it occupies far less space, costs less, behaves perfectly and brings a refreshingly new approach to audio that is setting the standard for the whole industry. Build it for yourself—you will be delighted with the results, whilst its extremely compact size enables you to build equipment in the slimmest and most modern styling without heating or ventilating problems.

- ★ 12 transistors
- ★ Output stage — silicon epitaxial planars
- ★ Constant square wave amplitude
- ★ 95% conversion efficiency at output
- ★ Superb quality and reliability
- ★ 20 to 20,000 c/s $\pm$ 1dB
- ★ Total harmonic distortion —0.1% at 10 watts R.M.S.
- ★ Input sensitivity — 1mV into 5kΩ
- ★ Signal to noise ratio—better than 70dB
- ★ Power requirements — 36V d.c. at 700mA
- ★ **Output into 7.5 ohms** 20 watts R.M.S. music power; 15 watts R.M.S. continuous
- ★ **Output into 15 ohms** 15 watts R.M.S. music value; 10 watts R.M.S. continuous
- ★ Makes ideal guitar or P.A. amplifier
- ★ Built-in low-pass filter ensures wide tolerance of load at output
- ★ Add tone and volume control, mono or stereo, system to choice
- ★ Easily built in an evening

QUALITY AND POWER FOR SUCH VERY SMALL OUTLAY

Complete kit of parts including transistors and X-20 manual in sealed carton **£7.19.6**

Built and tested with X-20 manual in sealed carton **£9-19-6**

X-20 Power Pack sufficient to drive two X-20's **£4-19-6**

X-20 MANUAL
Details various tone and volume control systems, stereo operation, input switching stage, etc. Supplied FREE with every X-20. Available separately, 2/- post free.

A UNIQUE TUNER FOR A UNIQUE AMPLIFIER

See previous pages for details of the amazing Sinclair Micro FM Tuner/Receiver. Ideal for use with the X-20.

Full service facilities available to all Sinclair customers

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COMBERTON, CAMBRIDGE

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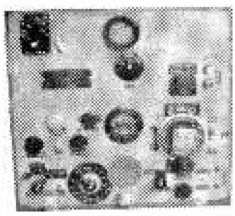

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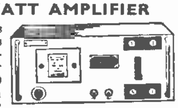

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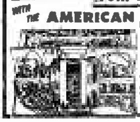

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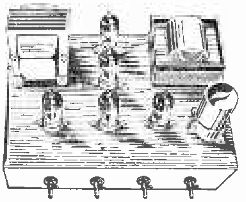

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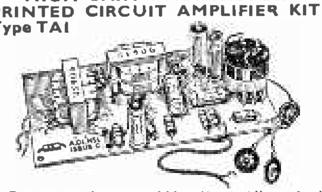
Also available ready built and tested complete with standard input sockets. £8.15.0. P. & P. 8/6. Carrying Case for above 28/6. P. & P. 7/6

SPECIAL HARVERSON OFFER ! ! !

BRAND NEW HEAVY DUTY 12in. SPEAKERS Response 45 c/s-13 Kc/s. 1½in. voice coil. Available in 3 to 15 ohms. 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 And 35 watt Guitar Model £8.3.0.

HIGH GAIN 4-TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT Type TAI



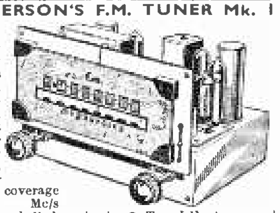
● Peak output in excess of 1½ watts. ● All standard British components. ● Built on printed circuit panel size 6 x 3in. ● Generous size Driver and Output Transformers. ● Output transformer tapped for 3 ohm and 15 ohm speakers. ● Transistors (GET114) or 81 Mullard OC81D and matched pair of OC81 o/ps ● 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. 3/-.

Also ready built and tested 52/6. P. & P. 3/-.

A pair of TAI'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 5½in. ● 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 Black or Green. To fit Mark I, 25/-, P. & P. 3/-. To fit Mark II 17/6. P. & P. 3/-.

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. 3/9.

GORLER F.M. TUNER HEAD

88-100 Mc/s 10.7 Mc/s L.F. 15/-, plus 2/- P. & P. (ECC85 valve, 8/6 extra).

4-SPEED PLAYER UNIT BARGAINS

All Brand New in Maker's Original Packing

SINGLE PLAYERS

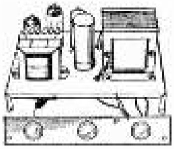
GARRARD SP25 De Luxe.... £12.10.6. Carr. 5/6
B.S.R. GU7 with unit mounted pick-up arm. £4.18.8. Carr. 5/6
E.M.I. with unit mounted pick-up arm. £4.9.6. Carr. 5/6

AUTO CHANGERS

LATEST B.S.R. UA25 Super Slim mono. £6.2.6
B.S.R. UA15. £6.19.6. B.S.R. UA16. £6.19.-
LATEST GARRARD AT5 .... £8.8.0
Standard GARRARD Autoslim £6.10.0
GARRARD AT6.... £10.10.0. Carr. 6/6 on each.

All the above units are complete with t/o mono head and sapphire stylii or can be supplied with compatible stereo head for 12/6 extra.

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, micro phone or record player. ● Provision for remote mounting of controls or direct on chassis. ● All this builds onto a chassis size only 7½in. 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. 6/-

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

QUALITY RECORD PLAYER AMPLIFIER

A top-quality record player amplifier. Size 7in. w. x 2½in. d. x 5½in. h. This amplifier (was 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. 4/9

ALSO AVAILABLE. Mounted on board with output transformer and 6in. speaker ready to fit into cabinet below. PRICE 89/6, P. & P. 5/9.

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 8½in.

PRICE £3.9.6. Carr. 7/6

6 TRANSISTOR AND DIODE SUPERHET

A first-class 2 waveband transistor superhet ● Printed circuit panel (size 8½ x 2¾in.). ● 3 pre-aligned IF 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 2/- (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. 2/- per spkr.

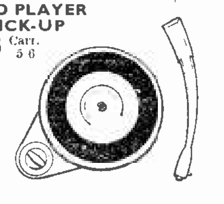
Portable CABINET .

Size approx. 9½ x 6¾ x 3½in. Suitable for above using 3½in. speaker. 25/-. P. & P. 2/6.

COIL AND TRANSFORMER SET FOR TRANSISTOR SUPERHET

3 IF transformers one oscillator coil one driver transformer and wound Ferrite aerial (med. long and car aerial coupling) 32/6 complete post 2/-. 6 transistor printed circuit board to match 8/6. Post 1/-. Circuit diagram 1/6 extra.

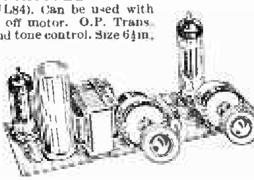
LATEST MODEL B.S.R. TU/12 4-SPEED PLAYER AND PICK-UP



ONLY **69/6** Carr. 5/6

7in. metal turntable Low flutter performance. 200/250 v. shaded pole motor with 90 v. tap for valve heaters. High gain crystal pick-up with turnover LP/78 head complete with sapphire stylii.

TWO VALVE GRAM AMPLIFIER ON PRINTED CIRCUIT BOARD



(UY85, UL84). Can be used with 80 v. tap off motor. O.P. Trans. volume and tone control. Size 6½in. wide x 2in deep x 3½in high overall. ONLY 39/6. P. & P. 2/6 Mains dropper res. for filaments if required. 2/6 extra.

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FROM LEADING HI FI MANUFACTURERS

7-10 watt OUTPUT TRANSFORMERS to match pair of ECL86's in push-pull to 3 ohm output. ONLY 11/-. P. & P. 2/6.

7-10 watt ULTRA LINEAR OUTPUT TRANSFORMERS to match pair of ECL82's in push-pull to 3 ohm output. ONLY 15/-, P. & P. 2/6.

SPECIAL MAINS TRANSFORMERS to match either of the above. Tapped primary. Secondary 250v. 80mA half wave and 6.3v. 2 amps. ONLY 12/6, P. & P. 3/6.

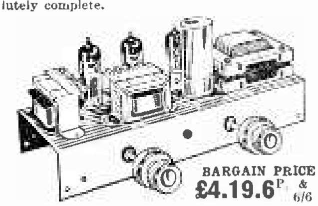
NEW CARTRIDGE BARGAINS

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

GARRARD GC2 Mono complete. List price 24/11. OUR PRICE 12/6, P. & P. 1/-.

STEREO AMPLIFIERS

Incorporating 2 ECL82's 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. 6/6

SUPER DE LUXE version of above incorporating ECL86 valves separate bass and treble controls and full negative feedback. 8 gns., P. & P. 6/6.

SPECIAL BRAND NEW TRANSISTOR BARGAINS

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Set of Mullard 6 transistors OC44, 2—OC45 OC81D matched pair OC81 25/-, ORP12 Cadmium Sulphide Cell 10/6.

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PXA101 6/6; XA103 6/6.
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