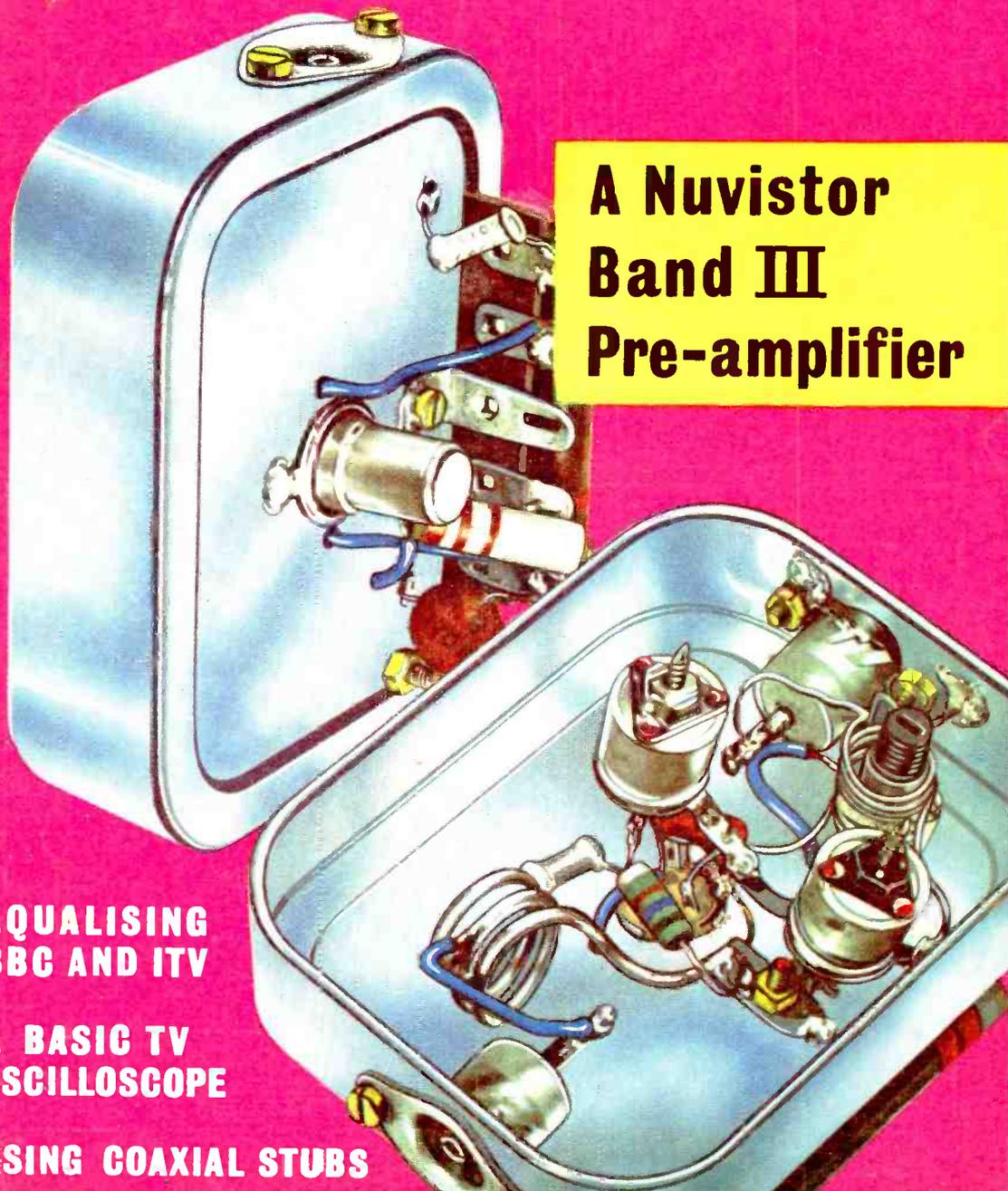


# Practical

JULY  
1961

1/6

# TELEVISION



**A Nuvistor  
Band III  
Pre-amplifier**

**EQUALISING  
BBC AND ITV**

**A BASIC TV  
OSCILLOSCOPE**

**USING COAXIAL STUBS**



another NEW instrument  
from Salford, the  
**minitest**  
POCKET-SIZED MULTIRANGE TEST SET

A new compact instrument suitable for the measurement of D.C. voltages and currents, A.C. voltages and ohms. Its high sensitivity renders it suitable for testing and fault location in all types of electrical and electronic circuits. It is well built to ensure long and satisfactory service. The instrument is economically priced and supplied with test leads with plug connections at one end. (Leather carrying case available as an extra).

- RANGES:** A.C. Volts. 2.5, 10, 25, 100, 250, 1000.  
D.C. Volts. 2.5, 10, 25, 100, 250, 1000.  
D.C. Amps. 50  $\mu$ A, 1mA, 10mA, 100mA, 1A.  
Ohms. 2000, 200,000, 20 M $\Omega$ .
- ACCURACY:** D.C. Volts & Amps.  $\pm 2\%$  of full scale deflection  
A.C. Volts  $\pm 3\%$  of full scale deflection  
 $\pm 5\%$  at centre scale.

Send for leaflet MIN/6009, PT

neat and compact... with large instrument performance

**SALFORD ELECTRICAL INSTRUMENTS LIMITED**  
Peel Works · Silk Street · Salford 3 · Lancs · Tel: Blackfriars 6688  
London Sales Office: Magnet House, Kingsway, W.C.2. · Tel: Temple Bar 4668  
A Subsidiary of THE GENERAL ELECTRIC CO. LTD. OF ENGLAND



**HARVERSON SURPLUS CO. LTD.**  
83 HIGH ST., MERTON, S.W.19. Cherrywood 3985/6/7

**F.M. TUNER KIT**

At last a quality F.M. Tuner Kit at a price you can afford. Just look at these fine features which are usually associated with equipment at twice the price!



- ★ F.M. Tuning Head by famous maker. ★ Guaranteed Non-drift. ★ Permeability Tuning. ★ Frequency coverage 88-100 Mc/s. ★ OAB1 Balanced Diode Output. ★ Two I.F. Stages and Discriminator. ★ E.M.84 Magic Eye. ★ Self-powered, using a good quality mains transformer and valve rectifier. ★ Valves used ECC85, two EF80's, EMB4 (Magic Eye) and EZ80 (rectifier). ★ Fully drilled chassis. ★ Everything supplied, down to the last nut and bolt. ★ Size of completed tuner 8 x 6 x 5 1/2 in.

All parts sold separately. **★ £4.19.6** Plus 8/6 P.P. & Ins.  
Circuit diagram and illustrations, 1/6 post free.  
**Note:**—To show the chassis clearly the attractive dial supplied is not shown.

**TELEVISION TUBE BARGAINS**

**COSSOR** 108K 10-in. New & boxed, 15/-, plus 6/- P. & P.  
75K 10-in. New & boxed, 15/-, plus 6/- P. & P.  
Ion trap magnets to suit the above, 2/9, 3d. P. & P.

**17in. MAZDA CRM 172**

Not a Regun. Picture tested—**£3.17.6** P. & P. 12/6  
12 months' Guarantee.

**THOUSANDS**

OF SATISFIED PEOPLE

VIEW ON **E.M.S.**

**REBUILT TELEVISION TUBES**

- ★ A NEW GUN IN EVERY TUBE
- ★ BUY DIRECT FROM THE FACTORY
- ★ 18 MONTHS' GUARANTEE

**12 inch £5.0.0 14 inch £5.10.0**  
**17 inch £6.10.0**

Immediate dispatch on receipt of Remittance  
Carriage and insurance 12/6 extra  
**£1 Refunded on receipt of your old Tube**

SPECIAL TERMS TO THE TRADE

**MARSHALL'S for TELEVISION LTD.**  
131 St. Ann's Road, Tottenham, London, N.15  
STAMFORD HILL 3267 & 5555

# Radio & TV Engineers' Reference Book

**FREE**  
 to every keen radio man  
**FOR A WEEK**  
 WITHOUT  
 OBLIGATION  
 TO BUY



Now you can have for free examination the new and revised 3rd Edition of this very practical engineering and servicing work. If you are a Radio Engineer, Technician, Mechanic, Instructor, Student, Keen Amateur, or engaged in the electronics field, this great wealth of data in all branches of radio and television will prove invaluable. It covers a most comprehensive range of subjects, new developments and techniques.

**BROADCASTING · COMMUNICATIONS**  
**SERVICING · NAVIGATION**

**High Fidelity Recording and Reproduction. Components**

Written for you by nearly 50 Specialists

Including L. S. Allard, B.Sc., A.Inst.P. (G.E.C. Cathode-ray Tube Group); S. W. Amos, B.Sc.(HONS.), A.M.I.E.E. (B.B.C. Tech. Instructions Section); E. S. Bacon, M.Sc.(LOND.), A.R.S.C. (Chief Supervisor Elec. Labs. Ever Ready Co. (G.B.) Ltd.); W. T. Blackband, M.Sc. A.M.I.E.E. (Aerials Research R.A.E., Farnborough); R. H. Burdick, A.C.G.I., A.M.I.E.E. (Marconi's); L. Driscoll, B.Sc., A.M.I.E.E., A.M.BRIT.I.R.E. (Murphy Radio); E. A. Fielding, B.Sc.TECH.(HONS.), A.M.C.T., M.I.E.E., A.I.R.E.E. (Salford Electrical Instruments Ltd.); D. H. Fisher, A.M.I.E.E. (Regentone); L. S. Foskett (E.M.I.); R. C. Glass, M.A., B.Sc., A.M.I.E.E. (Lecturer Applied Physics, No-thampton Coll. Adv. Technology, London); F. J. Grimm, A.M.BRIT.I.R.E. (Pye); P. Jones (Aerialite Ltd.); J. M. Kirk, M.B.E., B.Sc.(HONS.), D.I.C., A.C.G.I., M.I.E.E. (Standard Telephones and Cables Ltd.); L. A. Moxon, B.Sc.(ENG.), A.M.I.E.E. (R.N. Scientific Service); D. F. Urquhart (Erie Resistor Ltd.); V. Valchera (Valradio Ltd.); A. H. B. Walker, B.Sc.(ENG.), D.I.C., A.C.G.I., M.I.E.E. (Westinghouse Research Lab.).

**1,800 PAGES, 47 SECTIONS**

Includes:—Formulæ, Calculations, Communication Theory, Electron Optics, Colour TV, Materials, Studio Equipment, Transmitter Power Plant, Broadcasting and Communication Transmitters, V.H.F. Equipment, Amateur Radio Equipment, TV Transmitters and Aerials, Radio-Frequency Transmission Lines, Wave-guides, Broadcasting Receivers, TV Receiver Design, Commercial H.F. Radio Links, Broad-band Systems, Radio Navigation and Radar, Aero Radio and Radar, Radio Astronomy and Satellite Communication Aerials, Valves, Tubes, A.C. Rectification and Ripple Filters, Transistors, Diodes, Resistors, Capacitors, Inductors, Transformers, Gramophone Pick-ups, Speakers, Interference, Recording, Batteries and Conversion Equipment, H.F. Reproduction, Measuring and Test Equipment, R/TV Installation and Servicing, Noise, Projection TV, Oscillators, Industrial TV, Units and Symbols, Progress & Developments, etc. **2,000 DIAGRAMS AND TABLES**

**POST NOW**  
**7-DAY**  
**FREE**  
**TEST**

GEORGE NEWNES LTD., 15-17 LONG ACRE, LONDON, W.C.2.  
 Please send me Newnes RADIO AND TELEVISION ENGINEERS' REFERENCE BOOK without obligation to purchase. I will either return the work within eight days or I will send the first payment of 5/- eight days after delivery, then ten monthly subscriptions of 10/- until the sum of £5 5s. has been paid. Cash price within eight days is £5.

Name \_\_\_\_\_  
 Address \_\_\_\_\_  
 Occupation \_\_\_\_\_  
 Your Signature \_\_\_\_\_  
 (Or your Parent signs if you are under 21)

Tick (✓) where applicable

HouseOWNER	<input type="checkbox"/>
Householder	<input type="checkbox"/>
Living with Parents	<input type="checkbox"/>
Lodging Address	<input type="checkbox"/>

**RBIU**

# BENTLEY ACOUSTIC CORPORATION LTD.

38 CHALCOT ROAD, CHALK FARM, LONDON, N.W.1.

Telephone: PRIMROSE 9090

EXPRESS POSTAL SERVICE ALL ORDERS DESPATCHED SAME DAY AS RECEIVED. TELEPHONE AND TELEGRAM ORDERS FOR CASH ON DELIVERY SERVICE ACCEPTED UP TO 3.30 P.M.

OA2	17/6	6F6G	7/1	10C2	26/6	35A5	21/3	DH76	5/-	EF40	15/-	HN309	24/7	PL83	9/-	U4020	16/7	XFY12	9/6	
OB2	17/6	6F11	17/3	10D2	12/-	35L6GT	9/6	DH77	7/-	EF41	9/-	HVR2	20/-	PL84	12/8	UABC80	9/-	XFY34	17/6	
OZ4	5/-	6F12	4/6	10F1	26/6	35W4	7/6	DK32	12/-	EF42	10/6	HVR2A	6/-	PL820	17/7	UAF42	9/-	XH(1.5)	6/6	
IA5	6/-	6F13	11/6	10F9	11/6	35Z3	10/6	DK91	6/-	EF50(A)	7/-	KF35	8/6	PM84	17/3	UB41	12/-	XSG(1.5)	6/6	
IA7GT	12/-	6F15	15/3	10LD3	8/6	35Z4GT	6/-	DK92	9/-	EF50(E)	5/-	KL35	8/6	PX4	10/6	UBC41	8/6	Y63	7/6	
ICS	12/6	6F23	10/6	10LD11		35Z5GT	9/-	DK96	8/6	EF54	5/-	KLL32	24/7	PY31	16/7	UBC81	11/4	Z63	7/6	
ID6	10/6	6F24	18/7		15/11	43	10/-	DL33	9/6	EF73	10/6	KT2	5/-	PY32	12/6	UBF80	9/-	Z66	17/6	
IG6	17/6	6F32	10/6	10P13	15/-	50C5	10/-	DL66	17/6	EF80	6/-	KT33C	10/-	PY80	7/6	UBF89	9/6	Z77	4/6	
IHSGT	10/6	6F33	7/6	10P14	19/3	50CD6G36/6		DL68	15/-	EF85	6/-	KT36	29/10	PY81	8/6	UBL21	23/3	Z719	6/-	
IL4	3/6	6G6	6/6	12A6	5/-	50L6GT	9/6	DL72	15/-	EF86	10/6	KT41	23/3	PY82	8/6	UCB84	14/7	Transistors		
ILD5	5/-	6H6	3/-	12AC6	15/3	53KU	19/1	DL92	7/6	EF89	9/6	KT44	12/6	PY83	8/6	UCC85	9/6	and diodes		
ILN5	5/-	6J5	5/-	12AD6	17/3	77	8/6	DL94	7/6	EF91	4/6	KT61	12/6	PY88	13/3	UCF80	16/7	CGIC	7/6	
IHSGT	10/6	6J6	5/6	12AH7	13/1	78	6/6	DL96	8/6	EF92	4/6	KT63	7/6	PZ30	19/11	UCF89	23/3	CG4E	7/6	
IRS	6/6	6J7G	6/6	12A8H	12/6	81	8/0	DM70	7/6	EF97	13/3	KT86	15/-	QP21	7/6	UCH42	9/6	CG6E	7/6	
IS4	9/1	6J7GT	10/6	12A8E	12/6	83	15/-	E80F	20/-	EF98	13/3	KT88	24/-	QP25	14/6	UCH81	9/6	CG7E	7/6	
IS5	6/-	6K7G	5/-	12A76	7/6	85A2	25/-	E83F	37/6	EF183	18/7	KTW61	6/6	QS150/15		UCL82	11/6	CG10E	7/6	
IT4	3/6	6K7GT	6/-	12AT7	6/1	101	13/6	EA50	2/-	EF184	18/7	KTW62	7/6		10/6	UCL83	19/3	CG12E	7/6	
IU5	6/-	6K8GT	10/6	12AU6	23/3	150B2	15/-	EA76	9/6	EK32	8/6	KTW63	6/6	R12	9/-	UF41	9/-	GD3, 4, 5,		
2D21	15/-	6K8G	6/6	12AU7	6/6	161	10/6	EABC80	9/-	EL32	5/-	KTZ41	6/6	R18	14/-	UF42	12/6	6, 8,	4/-	
2P	26/6	6K25	19/11	12AV6	12/8	185B7	33/2	EAC91	4/6	EL33	12/6	KTZ63	7/6	R19	19/11	UF80	10/6	OA70	3/-	
2X2	4/6	6L1	23/3	12AX7	7/6	304	10/6	EAF42	9/-	EL34	15/-	L63	6/-	RG1/240A		UF85	9/-	OA73	3/-	
3A4	6/-	6L6G	8/6	12BA6	8/-	305	10/6	EB34	2/6	EL38	26/6	MHL4	7/6		45/-	UF86	17/11	OA79	3/-	
3A5	10/6	6L6M	9/6	12BE6	9/-	807	7/6	EB41	8/6	EL41	9/-	MHLD6	12/6	RK34	7/6	UF89	9/-	OA81	3/-	
3B7	12/6	6L7GT	7/6	12BH7	21/3	956	3/-	EB91	4/-	EL42	10/6	ML4	8/6	S130	22/6	UL41	9/-	OA86	4/6	
3D6	5/-	6L18	13/6	12E1	30/3	1821	16/7	EB93	23/3	EL81	16/7	MS48	23/3	SP4(7)	14/6	UL44	26/6	OA91	3/6	
3Q4	7/6	6L19	23/3	12J5GT	4/6	4033L	12/6	EBC33	5/-	EL83	19/11	MU12/14	8/-	SP41	3/6	UL46	14/6	OA95	3/6	
3Q5GT	9/6	6LD3	8/6	12J7GT	9/6	5763	12/6	EBC41	8/6	EL84	7/6	N37	23/3	SP42	12/6	UL84	8/6	OA120	11/6	
3S4	7/6	6LD20	15/11	12K5	17/11	7193	5/6	EBC81	8/-	EL85	13/11	N178	19/11	SP61	3/6	UM4	17/3	OA211	20/-	
3V4	7/6	6N7	8/-	12K7GT	5/6	7475	7/6	EBF80	9/-	EL86	17/3	N108	23/3	SP25	26/6	UM34	17/3	OC16	48/-	
5R4GY	17/6	6P25	12/6	12K8GT	14/-	9002	5/6	EBF83	13/11	EL91	5/-	N308	20/7	T41	9/-	UM80	15/3	OC19	48/-	
5U4G	6/6	6P26	19/11	12Q7GT	5/-	AC/PEN		EBF89	9/6	EL95	10/6	N339	15/9	TDD4	12/6	URIC	18/7	OC23	87/-	
5V4G	10/-	6P28	26/6	12SA7	8/6	5-pin 23/3		EBL1	29/6	EL820	18/7	P61	3/6	TH41	3/6	UU6	19/11	OC26	25/-	
5Y3	6/6	6Q7G	6/6	12SC7	8/6	7-pin 15/3		EBL21	23/3	EL822	25/6	PABC80			TH233	3/6	UU7	17/7	OC28	25/-
5Z3	19/11	6R7G	11/6	12SG7	7/6	AC/PEN/1		EBL31	23/3	EL824	25/6	PABC80			TP22	15/6	UJ8	26/6	OC35	25/6
5Z4G	9/-	6R7G	10/6	12SH7	8/6	DL 12/6		EC52	5/6	EM71	23/3		13/11	TP25	15/6	UJ9	7/6	OC44	11/-	
6A7	10/6	6S4GT	8/6	12SJ7	8/6	AC6PEN 7/6		EC54	6/-	EM80	9/6	PCC84	8/6	TP2620	33/2	UY1N	18/7	OC45	10/6	
6A8	9/-	6SCT	7/6	12SK7	6/-	AC/TP 33/2		EC70	12/6	EM81	9/6	PCC85	9/6	TY86F	13/3	UY21	16/7	OC65	22/6	
6AC7	4/-	6S7GT	8/-	12SQ7	11/6	ATP4 5/6		EC92	13/3	EM84	10/6	PCC88	18/6	UI12/14	8/6	UY41	7/6	OC66	25/-	
6AG5	5/6	6SH7GT	8/-	12SR7	8/6	AZ1 18/7		ECC32	5/6	EM85	17/3	PCC89	11/6	U16	10/-	UY85	7/6	OC70	6/6	
6AG7	7/6	6S1GT	8/-	12TY	10/6	AZ31 10/6		ECC33	8/6	EN31	37/6	PCF80	9/6	UI8/20	8/6	YMP4G	15/3	OC71	6/6	
6AK5	8/-	6SK7GT	6/-	1457	27/10	AZ41 13/11		ECC34	24/7	EY51	9/-	PCF82	10/6	U19	36/-	YMS48	15/6	OC72	8/6	
6AL5	4/-	6SL7GT	6/6	19AQ5	10/6	B36 15/6		ECC35	8/6	EY83	16/7	PCF84	15/7	U22	8/6	VP2	12/6	OC73	16/6	
6AM6	4/6	6SN7GT	5/6	19H1	10/-	BL63 7/6		ECC40	23/3	EY84	14/-	PCL82	10/6	U24	29/10	VP4	15/-	OC75	8/6	
6AQ5	7/6	6SQ7GT	9/6	20D1	15/3	C1 12/6		ECC81	6/-	EY86	9/6	PCL83	10/6	U25	17/11	VP2B	14/6	OC77	15/6	
6AT6	7/-	6SS7GT	8/-	20F2	26/6	C1C 12/6		ECC82	6/6	EZ35	6/-	PCL84	12/6	U26	10/6	VP4B	23/3	OC78	8/6	
6AU6	10/6	6U4GT	12/6	20L1	26/6	CB1L 26/6		ECC83	7/6	EZ40	7/6	PCL85	16/7	U31	9/6	VP13C	7/6	OC81	8/6	
6AV6	12/8	6U5G	7/6	20P1	26/6	CB131 23/3		ECC84	9/-	EZ41	7/6	PCL86	16/7	U33	26/6	VP23	6/6	OC170	13/6	
6B8	5/-	6U7G	8/6	20P3	23/3	CCH35 23/3		ECC85	8/6	EZ80	7/6	PEN4A	23/3	U35	26/6	VP41	6/-	OC200	16/6	
6BA6	7/6	6V6G	7/-	20P4	26/6	CK506 6/6		ECC88	18/-	EZ81	7/6	PEN8A	26/6	U37	26/6	VR105	8/6	OC203	24/-	
6BE6	6/-	6V6GTG	8/-	20P5	23/3	CL33 19/3		ECC91	5/6	FC4	15/-	PEN4DD	U43	9/6	VR150	7/6	OC291	29/6		
6BG6G	23/3	6X4	5/-	25A6G	10/6	CV63 10/6		ECF80	10/6	FW4/500	8/6		26/6	U45	9/6	VT61A	5/6	TJ1	40/-	
6BH6	8/-	6X5GT	6/-	25L6GT	10/6	CY1 18/7		ECF82	10/6	FW4/800	8/6		26/6	U50	6/6	VT150	5/6	TJ2	45/-	
6BJ6	6/-	6/30L2	10/6	25Y5G	10/-	CY31 11/-		ECF86	19/11	GU50	27/6	PEN25	4/6	U52	6/6	W76	5/6	TJ3	50/-	
6BQ7A	15/-	7A7	12/6	25Z4G	9/6	D1 3/6		ECF83	26/6	GZ30	9/6	PEN40DD	U54	19/11	W81M	6/6	TP1	40/-		
6BR7	23/3	7B6	21/3	25Z5	9/6	D15 10/6		ECH21	23/3	GZ32	10/6		25/6	U76	6/6	W107	18/7	TP2	40/-	
6BS7	25/6	7B7	8/6	25Z6G	10/6	D33 5/6		ECH35	6/6	GZ33	19/11	PEN44	26/6	U78	5/6	WY29	19/11	TS1	10/-	
6BV6	8/6	7C5	8/6	27SU	19/11	D77 4/6		ECH42	9/-	GZ34	14/-	PEN45	19/6	U107	16/7	X24M	24/7	TS2	12/6	
6BW7	6/-	7C6	8/-	28D7	7/-	DAC32 10/6		ECH8	9/-	GZ37	19/11	PEN46	7/6	U191	16/7	X41	15/6	TS3	15/6	
6C4	5/-	7H7	8/-	30C1	8/-	DAC91 6/6		ECH83	3/11	H63 12/6		PEN383	23/3	U201	16/7	X61(C)	12/6	TS4	24/-	
6C5	6/6	7R7	12/6	30F5	6/-	DAF96 8/6		ECL80	9/-	HABC80		PEN453DD	U251	14/-	X63	9/6	VT0/10P	28/6		
6C6	6/6	7S7	9/6	30FL1	10/6	DD41 13/11		ECL82	10/6				U281	19/11	X65	12/6	XA101	23/-		
6C9	13/6	7V7	8/6	30L1	8/-	DET25 7/6		ECL83	19/3	HL2 7/6	PEN/DD	U282	22/7	X66	12/6	XA102	26/-			
6C10	9/6	7Y4	7/6	30L15	11/6	DF33 10/6		ECL86	16/7	HL23 15/3	4020	33/2	U301	23/3	X76M	14/-	XA103	15/-		
6CD6G	36/6	8D2	3/6	30P4	12/-	DF66 15/6		EF9	23/3	HL23DD	7/6	PL33	19/3	U329	14/6	X78	23/3	XA104	18/-	
6CH6	9/-	8D3	4/6	30P12	7/6	DF91 3/6		EF22	14/-	HL41DD		PL36	12/-	U339	16/7	X79	23/3	XB102	10/6	
6D6	6/6	9BW6	15/3	30P19	12/-	DF96 8/6		EF36	4/-		19/3	PL38	26/6	U403	16/7	X109	17/3	XB103	14/-	
6E5	12/6	9D2	4/6	30PL1	10/6	DF97 9/6		EF37A	8/-	HL42DD		PL81	10/6	U404	8/6	XD(1.5)	6/6	XB104	10/6	
6F1	26/6	10C1	13/-	30PL13	16/6	DH63 6/6		EF39	5/6		19/3	PL82	7/6	U801	29/10	XFG1	18/-	XC101	16/-	

ALL GOODS BRAND NEW AND SUBJECT TO FULL MAKERS' GUARANTEE. PLEASE NOTE THAT WE DO NOT SELL SECONDHAND GOODS OR MANUFACTURERS' REJECTS.

### VOLUME CONTROLS

All with Long Spindle and Double-throw Switch, 400 each.

10K 25K 50K 100K

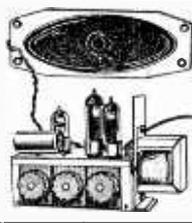
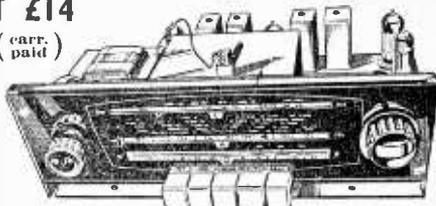
1/2 mg. 1 mg. 1 meg. 2 meg.

DRM1B 13/-	RM-1 5/3	14A86 17/6	14B130 35/-
------------	----------	------------	-------------

## BRAND NEW AM/FM (V.H.F.) CHASSIS AT £14

Tapped input 200-225 v. and 226-250 v. A.C. ONLY. Chassis size 15 x 6½ x 5½ in. high. New manufacture. Dial 141 x 4 in. in gold and black. Pick-up. Extension Speaker. A.E., E., and Dipole sockets. Five "piano" push buttons—OFF, L.W., M.W., FM., and Gram. Aligned and tested. With all valves & P.O. Transformer. Tone-control fitted. Covers 1,000-1,900 M.; 200-530 M.; 88-99 Mc/s. Valves EZ80 rect. BCH91, EF89, EAB030, EL84, ECC85. Speaker & Cabinet to fit chassis, 47/8 (post 3/6), 10 x 6 in. ELLIPT. SPEAKER. 20/- **TERMIN:**—(Chassis) £5.0-0 down—and 5 monthly pymts. of £2. or with Cabinet and Speaker £5.0-0 down and 6 monthly pymts. of £2.

(carr. paid)



**3-VALVE AMPLIFIER (INC. RECT.).** Capable of giving 4 watts. Mains and output transformers. Valves ECC83, EL84, and EZ80, 3 Controls, volume, bass and treble. On/Off switch. Fully guaranteed. Chassis size 6½ x 3 x 2½ in. 6½ in. round or 7 x 4 elliptical speaker, state which. Not suitable for microphone input. **67/- 3/- P. & P.**

**STEREO AMPLIFIER £4-15.0.**  
p. & p. 3/-.

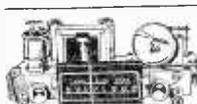


Brand new, 200-250 A.C. Tone and volume controls each channel. EZ80, ECC83; and 2-EL84; giving 2 x 4W. Size 12 x 3½ x 3¼ ins. O.P. Trans. for 2-3Ω speaker. Separate on-off switch to allow balancing to remain set. Monaural push/pull amplifier giving 8W same price.

**SAVE 10/-.** Swiss made Unic Shaver operating from 1.5 v. battery, usual price 69/8. Our price, 50/-. Including battery. Not a toy, but a shaver (carr. paid). Uses standard U2 cell.

**MAINS TRANSFORMER.** 6.3v 11A and 200 v. 30 ma. 7/- (post 1/6).

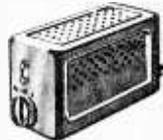
**NEW CONSOR 10in. tube 108K.** Special price 10/-, 5/- post.



**SELF-POWERED VHF TUNER CHASSIS**

Covering 88-96 Mc/s Mullard Permeability Tuner Dims. 10½ x 4½ x 5½ in. high. ECC85, EF91, EF91 and 2 diodes. Metal Rectifier, Mains transformer. Fully wired and tested. Only £7.14.0 (carr. pd.). Room dipole 10½-300 ohm twin feeder 6ft. v.d. Tuner without power pack £8.14.0 (carr. paid).

**£7.14.0 (carr. pd.)**



**"READY TO USE" ITA CONVERTER** Direct switching ITA to BBC, metal rectifier, co-axial plug. Can be fitted in 5-10 mins., and needs no alteration to your set. **ALL AREAS. ALL SETS. ALL CHANNELS.** 12 months' guarantee (3 months on valves) Balancing control on ITA. 2 valves. Switch position off-ITA-BBC. Bakelite moulded cabinet 8½ x 4 x 6 in. **70/- (3/- P. & P.).**

**PANEL OF 7 POTS**

10 x 1½ in.—4 x 1M & 3 x 2M. 4/- (post 1/-)



**6 DIFFERENT PRE-SET POTS.** 5K to 500K 3/- (post 1/3).

Delivery by return. C.O.D. 2/- extra. All new goods unless stated. Send 6d. for NEW 20-page catalogue.

## GLADSTONE RADIO

(Camberley closed Sats., Bristol & Portsmouth closed Weds.)

POSTED ORDERS TO CAMBERLEY PLEASE

58A HIGH STREET, CAMBERLEY, SURREY. Tel. 28791  
56 Stokes Croft, Bristol, and 247 NEW RD., PORTSMOUTH

## CLARKSON'S TUBE CHANGE

6A DENISON ROAD, LEEDS 2

Tel. Leeds 24576.

We are now able to offer SUPER SCREEN TV TUBES with 12 months' guarantee at the keenest exchange price ever.

Example:

Tubes all types	Cash allowance on return of old tube	Actual Cost of Tube
12" — 14" £5	15/-	£4. 5. 0
15" — 17" £6	25/-	£4. 15. 0
21" £8	30/-	£6. 10. 0

Carriage and Insurance 10/- extra

These tubes are COMPLETELY REBUILT by experts, with the most up-to-date electronic equipment, and are fitted with the famous American Golden Grid Electron Gun. Many thousands of these tubes are in service today. Our factory is open to inspection to readers of "Practical TV". Technical advice and queries are answered free of obligation. All tubes are dispatched with adhesive paper and return labels. Cash allowance is sent on receipt of old tube.

With a Valtock automatic Blowlamp YOU can do

## So MANY JOBS so WELL

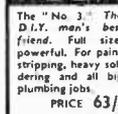
plumbing, soldering, paint stripping, modelmaking, etc.



The "2000" Ideal for model makers, the hobbyists and service engineers for fine delicate work, soft soldering, glass bending etc. **PRICE 14/7**



The "Major" — A larger version of the "2000" fitted with flame shield to give large flame; for most big soldering jobs about the house. **PRICE 30/-**



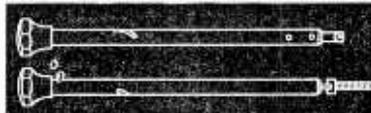
The "No 3" The D.I.Y. man's best friend. Full size, powerful. For paint stripping, heavy soldering and all big plumbing jobs. **PRICE 63/-**



Soldering iron attachment. Fits the "Major" and "2000". Gives you a soldering iron anywhere—away from electrical supplies. **PRICE 5/-**



And the SLOTGRIP Torsion Screwdriver the D.I.Y. Man's Latest Aid positively grips screws on the end of its blade.



For putting screws in awkward places. Automatic action. Push—it grips. Pull—it's released. **PRICE 5 7/6 10 12/-**

See them at your usual suppliers or send for details to:

### VALTOCK LTD

REGENCY HOUSE, 1-4 WARWICK STREET, LONDON, W.1. Telephone: GERrard 1667

# The A.T.R. Group

## Rebuilt and Rescreened

### Cathode Ray Tubes

**SUFFOLK TUBES LIMITED**  
1/3 UPPER RICHMOND ROAD  
PUTNEY, LONDON, S.W.15.  
Tel: Vandyke 4304/5267

**MIDLAND TUBES LIMITED**  
37 GEORGE STREET  
MANCHESTER, 1.  
Tel: Central 4568/4569

**VIDIO REPLACEMENTS LIMITED**  
HALES STREET  
DEPTFORD HIGH STREET  
DEPTFORD, S.E.8.  
Tel: 2177/4506

**Scotts Radio Ltd.**  
4 Church Street  
Brighton  
Tel: Brighton 26891

**Weston Hart Ltd.**  
236/8 Fratton Road  
Portsmouth  
Tel: Portsmouth 24125

**Lawsons Ltd.**  
36 Cornhill  
Bury St. Edmunds, Suffolk  
Tel: Bury St. Edmunds 3304

**J. H. Sunderland**  
11 Clements Street  
Rochdale, Lancs.  
Tel: Rochdale 48484

**Wizard Productions**  
16 Withy Grove  
Manchester  
Tel: Dea 2772

**J. Charlesworth & Son**  
14 Hightown  
Crewe, Cheshire  
Tel: Crewe 2535

**Taylor's**  
162 Eastney Road  
Milton, Portsmouth  
Tel: Portsmouth 35000

**Wanda Electrics**  
9 Manor Road  
Gravesend  
Tel: Gravesend 3766

**Stowmarket Co-operative**  
Bury Street  
Stowmarket, Suffolk  
Tel: Stowmarket 51/52

**Frank H. Hunt & Co.**  
Stepcote Hill  
Exeter, Devon  
Tel: Exeter 56687

**H. Knowles**  
54/56 Chester Road  
Manchester  
Tel: BLA 9031

**Radio Services Ltd.**  
30 Mona Street  
Amlwch, Anglesey  
Tel: Amlwch 594

**Hi-Lite Ltd.**  
89 Southbourne Grove  
Southbourne, Bournemouth  
Tel: Bournemouth 44344

**R. Watson**  
Leathern Bottel  
Wavenden, Woburn Sands, Bucks  
Tel: Woburn Sands 2027

**R.E.S. Ltd.**  
17/19 Paynes Lane  
Coventry  
Tel: Coventry 28781

**Gwalia Radio & T.V.**  
Llanstephan  
Carmarthen  
Tel: Llanstephan 284

**J. Wildbore Ltd.**  
6-12 Peter Street  
Oldham  
Tel: Mai 4475

**Tele-Car Ltd.**  
66 Osborne Street  
Glasgow, C.1  
Tel: Bell 1912/3

**BEST VALUE**

**FINEST QUALITY**

**12 MONTHS' GUARANTEE**

# Practical Television

AND TELEVISION TIMES

VOL. 11, No. 130, JULY, 1961

Editorial and Advertisement  
Offices:

**PRACTICAL TELEVISION**

George Newnes, Ltd., Tower House  
Southampton Street, W.C.2.

© George Newnes Ltd., 1961

Phone: Temple Bar 4363.

Telegrams: Newnes, Rand, London.

Registered at the G.P.O. for Post-  
mission by Canadian Magazine Post.

## SUBSCRIPTION RATES

including postage for one year

Inland - - - - £1.2.0 per annum  
Abroad - - - - £1.0.6 per annum  
Canada - - - - 19s. per annum

## Contents

	Page
Editorial ... ..	497
Telenews ... ..	498
Equalising BBC and ITV ... ..	500
A Capacitance-Resistance Bridge ... ..	502
TV Interference ... ..	505
Add-on Colour Tests ... ..	506
A Basic TV Oscilloscope ... ..	510
A New Mast at the ITA's Black Hill Station in Scotland ... ..	513
Using Coaxial Stubs ... ..	514
A Nuvistor Band III Pre-amp Servicing TV Receivers ... ..	516
Underneath the Dipole ... ..	523
Letters to the Editor ... ..	527
Trade News ... ..	531
Your Problems Solved ... ..	532

The Editor will be pleased to consider articles of a practical nature suitable for publication in "Practical Television". Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for the manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed to: The Editor, "Practical Television", George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2.

Owing to the rapid progress in the design of radio and television apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Copyright in all drawings, photographs and articles published in "Practical Television" is specifically reserved throughout the countries signatory to the Berne Convention and the U.S.A. Reproductions or imitations of any of these are therefore expressly forbidden.

## Colour TV and Line Standards Discussed at Scottish Conference

REPRESENTATIVES in many fields of the radio and television industry attended the Scottish Radio Congress, which was held recently at Rothesay, Isle of Bute. It is interesting to note that, although the meeting consisted of many short addresses on subjects affecting all sides of the industry, the main theme of most of the speeches was the television line and colour controversy.

Once again this important subject has been a major topic for discussion at a meeting dealing with radio and television, as it has done at so many recent conferences of similar nature. At this congress, however, several speakers emphasised the confusing and unsettling effects which this controversy has had on the public, rather than pointing out difficulties and complications involved in providing either colour or 625 line TV in this country; most of which everyone already knows.

The opinion of J. M. Weir, president of the Congress, and of many other speakers, was that repeated reference to these two problems, in the National Press and elsewhere, has confused so many people that sales of television receivers had suffered.

S. E. Allchurch, director of B.R.E.M.A., was of the opinion that a quick decision in this matter is called for if the industry is to benefit from these possible changes. Mr. Allchurch considered that the public were naturally more interested in colour than in line definition.

At this point it is interesting to note the views of the Brit. I.R.E. on the subject of colour and line standards, which it made in a memorandum submitted to the Pilkington Committee. The Institute would favour a final decision on the line system to be adopted in this country, before any actions are taken to provide colour TV transmissions.

## CONTRIBUTIONS

THOSE of our readers who wish to submit articles should send them direct to the Editor at the address given on this page. Manuscripts should be typewritten with double spacing although legible hand-written articles are also acceptable. Articles should be between 1,000 and 2,000 words in length, be written on one side of the paper only, and deal with the home construction of equipment to do with television. We do not require articles of a theoretical nature unless these are written expressly for the amateur constructor. Clear drawings of the apparatus should be included with the article and need only be sufficient for our draughtsmen to prepare suitable illustrations. We also like to include with articles photographic illustrations. Large clear prints, or preferably negatives, should be sent if possible but we are prepared to take the necessary photographs ourselves if the apparatus can be sent to us for inspection. An illustrated article is always of more appeal as the methods of construction are shown more clearly.

Our next issue, dated August, 1961, will be published on July 21st.

# Telenews

## Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of April, 1961, in respect of television receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	Total
London Postal .. .. .	1,918,484
Home Counties.. .. .	1,587,983
Midland .. .. .	1,689,136
North Eastern .. .. .	1,827,182
North Western .. .. .	1,484,504
South Western .. .. .	961,083
Wales and Border Counties .. .. .	883,709
<b>Total England and Wales .. .. .</b>	<b>10,141,941</b>
Scotland .. .. .	1,015,144
Northern Ireland .. .. .	183,428
<b>Grand Total .. .. .</b>	<b>11,320,513</b>

## Electronic Guns from new Irish Factory

A MODERN new factory manufacturing American-designed magnetic and electrostatic electronic guns, for television cathode ray tubes, has gone into production at Bray, County Wicklow, on the east coast of Eire. It is the only one of its type in the country and aims at supplying a wide range of markets in the United Kingdom, Europe and the British Commonwealth.

Griffiths Electronic Guns, Ltd., Ireland, is the newest of the Sam Carpenter Group of Companies, which has its headquarters in Birmingham.

Initial production capacity is at the rate of 10,000 guns per week, but swift expansion is contemplated to meet the demand anticipated from the Continent, Scandinavia and a number of Commonwealth countries. Sample orders have already been despatched to West Germany, Belgium, Italy and Denmark and many other overseas inquiries are receiving attention.

## O.B. Unit Drives to Moscow

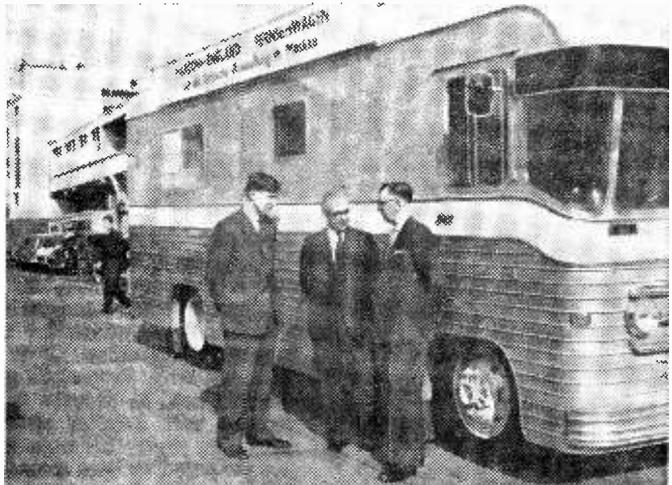
A TELEVISION outside broadcast vehicle recently travelled across Europe to the Russian border to join a convoy making its way to the British Trade Fair in Moscow, which was held from May 19th to June 4th. The O.B. unit started out from the Chelmsford works of the Marconi company on April 26th on its 1,750-mile journey to Moscow's Sokolniki Park.

## Post Office Links to New Television Stations

WHEN the Independent Television service was extended to the South West of England, in April, five new Post Office vision links came into operation. The first link connects London

and Bristol by coaxial cable, and the second connects Bristol and Plymouth by line-of-sight radio link. Two shorter links, using line-of-sight radio transmission, connect Plymouth with the new ITA broadcasting stations at Stockland Hill in Devon, and Caradon Hill in Cornwall. Finally, the studios of the programme company, "Westward Television Ltd.," are connected by coaxial cable to the national television network at Plymouth.

The radio equipment used on these links operates on frequencies of about 4,000Mc/s. Each radio link is provided with protection equipment which will be automatically switched into service in the event of a breakdown.



This television outside broadcast vehicle recently travelled across Europe to the Russian border to join a convoy making its way to the British Trade Fair in Moscow. The O.B. unit started out from the Chelmsford works of the Marconi company on April 26th on its 1,750-mile journey to Moscow's Sokolniki Park, and arrived on Saturday, May 6th.

At each end of the main radio link, vision signals are extended distances of approximately four miles from the radio terminals into the Post Office television centres in Bristol and Plymouth by means of coaxial cables equipped for unbalanced vision transmission.

#### 625-Line TV from Crystal Palace

**T**HE British Broadcasting Corporation plans to transmit further experimental television pictures from the Crystal Palace station on the 625-line standard in Band V. These transmissions will include colour pictures.

For this purpose, the Corporation has placed an order with EMI Electronics Ltd. for carrying out the necessary modifications to the ten kilowatt ultra high frequency transmitter which was used at Crystal Palace for the BBC's experimental 405-line and 625-line monochrome transmissions in Band V during 1957 and 1958.

#### Queen Mother at Aldermay House Ceremony

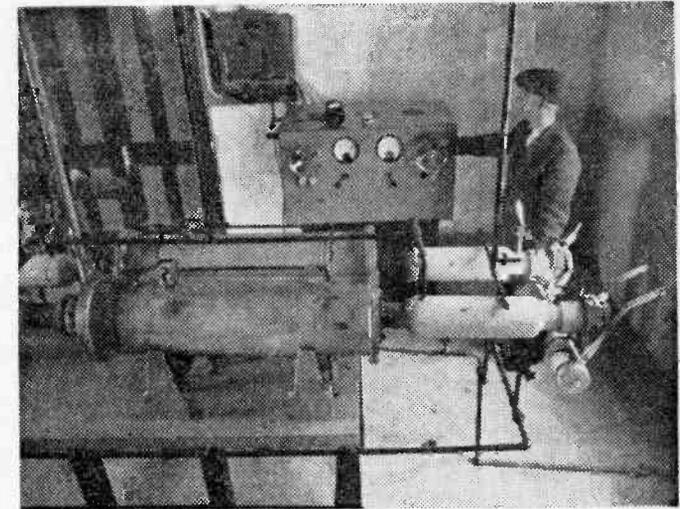
**W**HEN the Queen Mother laid the foundation stone of the British Insurance Association's new building, Aldermay House, on May 4th, closed-circuit television, installed and operated by Rank Precision Industries Ltd., enabled more than 500 guests at the Guildhall a mile away to watch the ceremony.

Fourteen 21in. Bush television receivers were installed in the Guildhall to ensure optimum viewing conditions for all the guests. Special lines were provided by the G.P.O. to relay picture and sound from the television cameras and microphones covering the ceremony at Aldermay House.

#### Colour TV Display System

**S**CIENTISTS of the Mullard Research Laboratories presented a series of papers on a novel colour television display system, at a meeting of the Electronics and Communication Section of the Institution of Electrical Engineers on May 15th. The display system has been given the code name "Banana", because of the shape of the cathode ray tube.

The inventor of the Banana Tube system, Dr. P. Schagen, set



*In this furnace at the new Griffiths Electronic Guns, Ltd. factory in Eire, all the stainless steel parts of the electronic guns are hydrogen fired.*

out some years ago to overcome the major disadvantages of present display devices. Some success has been achieved, but the system has fundamental drawbacks of its own. The meeting on the 15th was a scientific meeting and in no way an announcement of a new product.

The advantages of the Banana Tube system are:—a relatively cheap and simple cathode ray tube, high picture contrast, and shallow cabinet.

Its disadvantages are a narrow viewing angle and the incorporation of optical and moving parts.

The authors emphasise, in their papers, that the system in the form that it is demonstrated, is not a practical proposition for a domestic receiver.

#### Acquisition of TV and Radio Firm

**A**N announcement by Thorn Electrical Industries Ltd. states that they have acquired from Ultra (Holdings) Ltd. the entire share capital of Ultra Radio and Television Ltd. and Pilot Radio and Television Ltd. and their subsidiaries. The transaction is for cash and includes Ultra's factory at Gosport and other premises at Ruislip, Eastcote and Park Royal.

It is intended to preserve the separate identities of Ultra and

Pilot as working and marketing units, and the management will remain substantially unchanged. This acquisition of Ultra and Pilot by the Thorn Group further consolidates their position as the largest group in the industry.

#### Queen's Portrait on Colour TV at Moscow Fair

**C**OLOUR television was the highlight of EMI Electronics Ltd's display at the British Trade Fair recently held in Moscow.

A colour TV camera housed in a special viewing room on the Company's stand—C8—showed a varied programme, including a portrait of the Queen in the Robes of the Order of the Bath, Yuri Gagarin the Russian astronaut, and a working display of electric model trains set in a typical British countryside scene.

Monochrome TV equipment on show included 4½in. Image Orthicon cameras in an EMI Outside Broadcast Vehicle sited on an outside stand. This is the first time that an EMI O.B. unit has been sent to the U.S.S.R.

The EMI television cameras also televised a special Russian language film showing some of the varied uses for which EMIDEC computers are being supplied to leading British Industrial organisations.

**W**HEN switching from a BBC programme to an ITA programme, it is necessary in many areas to increase the setting of the contrast or sensitivity control in order to obtain a Band III picture of the same contrast as the Band I picture. There are several reasons for this. One is that most sets have a greater sensitivity on Band I channels than they have on Band III channels, for it usually follows that the sensitivity of a receiver falls slightly with increase in frequency.

Another reason is that the Band III sensitivity of early multi-channel sets is usually three to five times below the Band I sensitivity. This may not necessarily mean that the Band III signal has to be three to five times greater than Band I signal to provide comparable pictures. Provided the aerial signal of the Band III transmission is relatively high (in the region of  $500\mu\text{V}$ ) and the receiver features vision AGC, then it really does not matter if the Band I signal is two or three times higher than this, for the receiver's AGC system will iron-out the difference and balance the pictures.

Problems arise, however, when the Band III signal is below about  $500\mu\text{V}$ , for, then, when the set is switched from BBC to ITA, a distinct deterioration in picture brightness, and possibly quality, is seen. In some cases the ITA picture is covered with grain due to first stage valve and frequency changer noise.

#### Various Factors

There are other various factors which contribute to the unbalance of the two signals. One is the greater fall-off in local Band III signal strength with distance, as compared with Band I. Moreover, there may not be a "local" Band III station and, whilst the local BBC station may provide a millivolt or so of aerial signal, the distant ITA station may give only a few microvolts. These

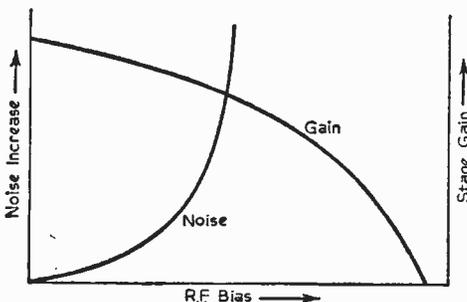


Fig. 1.—Noise from the R.F. valve rises steeply with increase in bias, while the stage gain follows a gentle decline, as illustrated by the two curves above.

factors can only be equalised adequately by the use of a high-gain Band III aerial system. As it would be wrong to reduce the signal strength and quality of the Band I picture to equal a relatively poor Band III picture, the first move under these

# Equalising BBC and ITV

By G. J. King

conditions, therefore, should be to try and improve the ITA reception. When this is accomplished, then the BBC picture can be equalised to give a better match to the ITA picture.

#### Aerial Signal Balance

With co-sited BBC and ITA transmitters of approximately equal effective radiated power, the signal pick-up on a Band III four-to-six element aerial is approximately equal to the signal pick-up on a Band I two-to-three element aerial within the service area of the stations. Outside the service area, conditions may alter—local screening may affect the ITA signal more than the BBC signal—and a double-six or a twelve element array may be required on Band III and a three or four element on Band I.

Feeder loss is also important. With an average run of, say, 50ft of good quality cable, a loss of something like 1dB may be introduced on Band I, but this will rise to 2dB on Band III, owing to the higher frequency. Although 2dB may not sound very much, in a weak signal area, it could make the difference between a poor picture and a reasonable picture. Assuming equal aerial signals and a common download, 2dB would mean that, at the set, the Band III signal is approximately 13per cent below the Band I signal.

If a combined aerial results in severe unbalance between the two signals, it would be desirable to employ a separate high-gain aerial for Band III. This aerial should be mounted as high as possible and carefully orientated for maximum signal pick-up. By the use of such an array with low-loss feeder an extra 6dB of signal can invariably be secured.

In shielded areas, where standing-waves are troublesome, the labour of probing for the best signal is often well rewarded. There remains the difficulty of finding somewhere to secure the aerial after the best pick-up position has been established. The chimney stack is not always the best site now that it is called upon to support so many arrays. Proximity effects between the aerials often detract from the pick-up efficiency, and this is one of the reasons why R.F. television relay systems are becoming so popular.

#### Improving Band III at the set

It can thus be seen that signal equalisation should start first at the aerial system by giving due attention to the aerial and its positioning, to the download and also to the diplexer or triplexer which may be used to combine the signals to a common lead for connecting to the receiver.

When all possible has been done to improve the Band III aerial signal, and the ITA picture is still poor, some improvement is possible at the receiver. Most multi-channel sets employ AGC on the R.F. cascode valve in the tuner. This is usually fed to the tuner on a green lead from the receiver's AGC line, and even on a very weak signal some bias is produced which decreases the R.F. gain. This is of no consequence so far as the I.F. stages are concerned, since these are working at a fairly high signal level, but on the R.F. stage, even a very small bias tends to impair its noise factor, and give rise to gain on the picture. This effect is shown in Fig. 1. It will be seen that the noise rises steeply

Fig. 2.—The circuit of a Band I equaliser.  
(Coil L may be tuned by a dust-core.)

with increase in bias while the stage gain follows a gentle decline. As a normal standing bias is provided on the cascode R.F. stage by its cathode resistor, the bias produced by the AGC can be removed without causing any damage, but with a considerable improvement in performance. The AGC wire to the tuner should simply be disconnected and the vacated tag connected direct to chassis. The AGC feed wire itself should either be removed or well insulated so as to avoid shorting to other parts of the set.

It should be noted, however, that on some sets a delay is given to the bias on the R.F. valve, so that a bias is not produced until the aerial signal reaches a certain pre-determined value. On sets of this nature the alteration detailed above would not assist as much as on sets with no delay.

The need for R.F. stage AGC arises when the aerial signal is very strong. It removes overloading troubles which cause sound-on-vision and vision-on-sound. Should it be found that overloading of this kind occurs after removing the R.F. AGC bias—this would, of course, occur only on Band I—the process of Band I equalisation, described later in this article, would eliminate it.

### Tuner adjustments

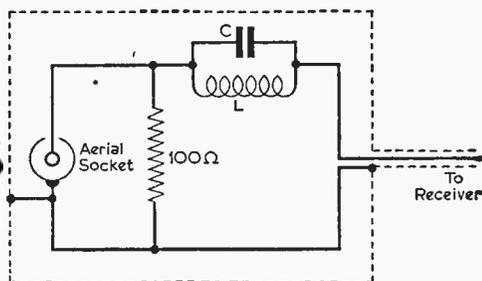
Further improvement in the performance on Band III is often possible by adjusting the core in the output transformer of the tuner unit or turret in the set. The Band III picture and sound should first be tuned in by the fine tuning control for the best possible picture, and then the tuner I.F. core should be very carefully adjusted to improve the picture. It will be found that a compromise will be necessary to maintain sound and vision balance on the channel. Nevertheless, a worthwhile improvement is often possible, which will have virtually no effect on the stronger BBC signal.

Fig. 3.—The response curve given by the equaliser in Fig. 2.

In modern receivers, the sensitivity difference between the two bands has been reduced by circuit improvements and by the use of frame-grid valves, which provide in the region of a 5dB gain increase and a 2dB reduction in noise over the older type of tuner valves. It should be clearly noted, however, that this improvement is not possible simply by replacing the old type of valves with frame-grid specimens. In addition to valve changes, alteration to the circuit of the tuner is usually required.

### Signal Balancing at the set

Where the set features separate aerial sockets for the Band I and Band III aerials, it is simply necessary to interpose a line-type attenuator between the Band I downlead and the Band I aerial socket. There are also variable attenuators which can be



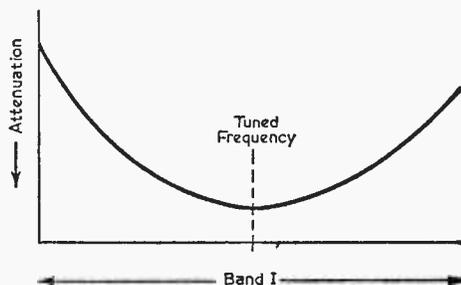
adjusted to provide the correct degree of balance.

If the installation uses a diplexer near to the set, then, again, the Band I signal, as applied to the diplexer, can be suitably attenuated. If a combined aerial is in use or if the diplexer is mounted close to the aerial, which in both cases demand the use of a common downlead carrying both signals, some other means is usually necessary to produce the requisite signal balance.

One way is to use a low-Q retractor circuit after the style of that shown in Fig. 2. Here L and C are arranged to resonate in Band I, and the core adjustment of L should allow the circuit to tune over the whole of Band I. This will produce a response curve as shown in Fig. 3 with sides which do not rise very sharply.

### Variable attenuation

When the circuit is adjusted to tune to the frequency corresponding to the local Band I channel, the signal passed from the downlead to the set is very heavily attenuated, and only in districts very close to a powerful station would such great attenuation be required. However, when the circuit is tuned either side of resonance, the whole



response curve is shifted in relation to the Band I frequency and the signal then falls on the sloping side of the curve, which corresponds to a smaller value of attenuation.

(Continued on page 504)

# A Capacitance-Resistance Bridge

THIS INSTRUMENT WORKS WITH THE AID OF AN AUDIO OSCILLATOR AND AN AMPLIFIER

By G. L. Kermez

A VERY simple way to measure an unknown resistor is to use a Wheatstone bridge, and compare the unknown resistor with a standard. The basic arrangement, which will be familiar to many, is the use of a metre bridge, i.e. a metre of resistance wire mounted on a scale, a sensitive centre-zero galvanometer, and a battery of small voltage, as shown in Fig. 1.

Let R1 be the unknown resistance, R2 the known standard, and point Z on the wire at which no deflection is obtained on the galvanometer, then as the resistance of wire is proportional to the length,

$$\frac{R1}{R2} = \frac{L1}{L2}$$

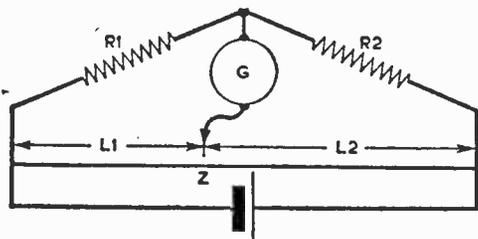


Fig. 1.—The basis of this instrument is the well-known metre bridge.

From this, the value of R1 can be found. In a similar bridge for capacitors, called the De Sauty bridge, R1 and R2 can be substituted for the unknown and known capacitors respectively, then again at balance point—

$$\frac{C1}{C2} = \frac{L1}{L2}$$

—if an A.C. source is used instead of the battery.

Hence, given the instruments, standards, and patience, any capacitor or resistor can be measured. The accurate manipulation of a metre bridge is both laborious and difficult, so a 10k wire-wound linear potentiometer is used as the bridge wire, an audio tone as the battery and any reasonable amplifier as the zero point detector. A 6-way, 2-pole switch is used to bring into the network different standards, so that the complete instrument measures from 1.0Ω to 10M to 1per cent accuracy, and from 10pF to 10μF, to within 2per cent approximately. Moreover, a useful indication can be

obtained from 0.01 to 100 times the value of the standard for each range. Provision is also made for matching two resistors, capacitors, or even coils, by substituting a 2-pin socket for a capacitance standard. The full circuit is shown in Fig. 2.

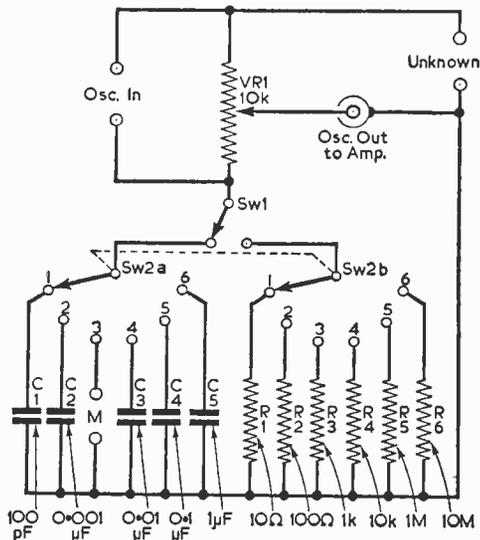


Fig. 2.—The complete circuit diagram.

The audio oscillator, working at about 500c/s, can be any good quality instrument, the phase shift oscillator as described in the June 1960 issue of PRACTICAL WIRELESS being very suitable. As far as the amplifier is concerned, any reasonable 2-valver will give perfect results, because hi-fi response is

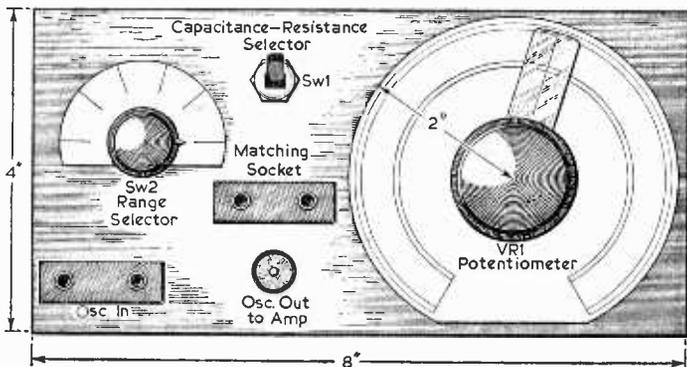


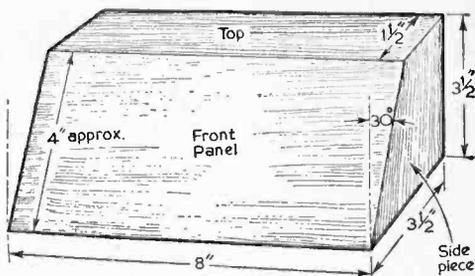
Fig. 3.—The layout of controls on the front panel.

not required, and even a little ripple on the H.T. line can be ignored. If the oscillator is to be built, it could be made an integral part of the bridge, hence making the whole self-contained.

**Construction**

All controls and input-output sockets, except the screw terminals for the unknown input, are

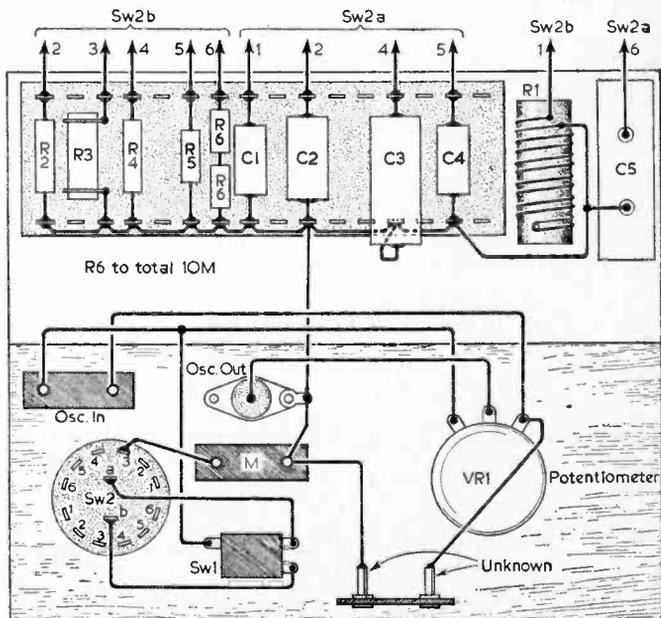
Fig. 4.—The dimensions of the cabinet.



grouped on a front panel 8 in. x 4 in. made of 1/4 in. ply, as shown in Fig. 3. This is then built into any convenient box, either with, or without, the oscillator. The original box shape was as shown in Fig. 4, the front panel being glued to a base 8 in. x 4 in. of 3/4 in. wood, and the sides, of 1/4 in. ply, being cut to give a rake of 30° to the front so as to make it easier to read the dials when used at bench level.

The "unknown" input terminals are mounted at the top of the box, which is covered with Rexine or painted a suitable colour. The potentiometer and range switch dials are cut from white card, and can be of any shape or size, to suit the knobs in use. The dial knob for the potentiometer should be of 1 1/2 in. x 2 in. diameter variety and have a hairline fitted; if one cannot be

Fig. 5.—The layout of components and wiring diagram.



bought, it is an easy matter to stick a strip of 1/8 in. Perspex, on which a straight line has been scored, on the back of the knob. Careful use of black and red Indian inks can make the dials very impressive and, perhaps more important, easy to read.

**Assembly**

The wiring up of the circuit follows normal practice. For convenience, all the standards, except the 10Ω and 1μF components, are mounted, printed circuit fashion, on to a bakelite sheet. For neatness in wiring up, these should be positioned in the order shown in the circuit. The two standards mentioned are wired loose because the 10Ω resistor is home made and bulky, and 1μF capacitor, a paper component, again bulky.

To wind the 10Ω resistor, a 56 1/2 in. length of 31s.w.g. insulated Eureka or Constantan wire is wound on a bakelite former (non-inductively), and then mounted, together with the other components as shown in Fig. 5.

(Non-inductive winding of the resistor is achieved by doubling the 56 1/2 in. length of resistance wire to 28 1/4 in. and winding this double wire on to the bakelite former—see Fig. 5.)

**Calibration**

When the circuit has been checked, the bridge should be connected up to its auxiliaries, and, with the volume control on the amplifier held ready for adjustment, allowed to warm up. The range switch is then turned to the 1k range, and, using a 1k standard resistor, the potentiometer rotated until the tone volume level decreases to zero, or as near to zero as possible (the null point). It is usually found that the fundamental note does disappear, but the harmonics, if present, can still be heard. This point, when located, is then marked 1, and corresponds to the centre of the potentiometer track. This procedure is then repeated, using the appropriate standards, to mark off the main points from 0.01 to 100. As a matter of interest, the values of resistors required to do this are 1k, 2k, 2k, 5k, 10k, 20k, 20k, 50k, using these in various parallel-series arrangements. All the main points can be marked; e.g., for the 9 point, the 2k and 2k and 5k resistors would be used in series, and for the 0.5 mark, the 1k, 2k and 2k resistors would be used in parallel, etc., etc. If the calibration procedure has been accurately carried out, all the resistance ranges should now be calibrated.

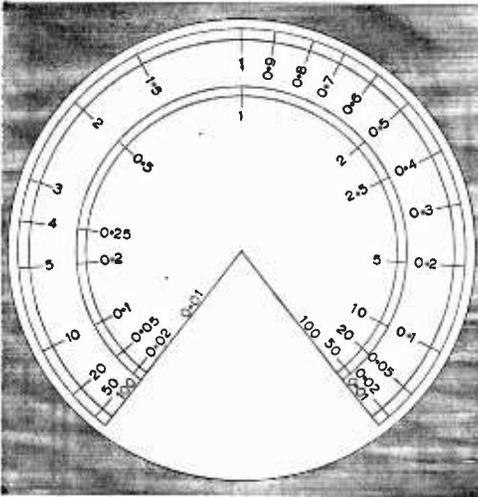


Fig. 6.—Assuming that the potentiometer, VRI, is linear, the calibrations on the scale should be similar to this.

Now, a second scale is drawn on the inside of the resistance scale (different coloured back-

ground paper could be used here to good advantage) and the main points transferred to it. This is the capacitor scale, which does not require calibration, as the marking points on it are the reciprocals of the points on the resistance scale; i.e., 0.5 on the resistance scale would correspond to 2 (1/0.5) on the capacitor scale and so on.

The calibration is now complete and the scales should look like Fig. 6. If the standards cannot be obtained, then the internal standards could be connected in turn across the unknown terminals, all, of course, except the 1k, and the 100, 10, 0.1 and 0.01 points found. For the other points assuming the potentiometer is linear, Fig. 6 should be a very good approximation of the scale, and can be used ready marked. If this is done, the 100 and 10 points should match when tried with the internal standards; if they do not, the scale should be rotated until they do.

The matching socket can be used with the potentiometer set at 1, to match any two components. It can be very useful in matching, say, the two grid leak resistors on a push-pull output circuit, and if a coil of known inductance, i.e. an M.W. frame aerial, is placed across the unknown input, another coil can be wound to the same inductance, at any multiple or sub-multiple thereof. For convenience, two lengths of flexible wire, fitted at one end with crocodile clips, and at the other with wander plugs, should be made up for the matching socket. ■

## CROYDON TV TOWER

**M**R. HENRY BROOKE, Minister of Housing and Local Government, has given the Independent Television Authority planning permission to build a 500ft television tower at Beaulieu Heights, South Norwood Hill, Croydon. The consent is for a period of five years only.

The Minister directed that the application be referred to him for decision, and a public inquiry was held on 10th January.

In this report to the Minister, the inspector who held the inquiry wrote that there was substantial agreement on the design of the tower, but there was some difference on its setting, its proximity to other buildings and its suitability to the neighbourhood. He did not consider it would be practicable or reasonable to insist on a non-residential area when the choice of site was so restricted.

He considered that it was a matter of opinion whether such a structure should be free-standing or have a podium or "foil" of buildings at its base. The tower should be set back as far as possible on the site. A question of principle was raised by the use for a purpose of this kind of land acquired for public open space but the undertaking was of a very special, if not unique, kind, and in his view the loss of potential open space would be negligible. He did not consider that a proposed block of flats off South Northwood Hill would be adversely affected. The need for the tower could be accepted, but the Authority's recognition that uncertainty about the needs of a permanent station must continue for

several years, convinced him that the proper course was to give permission for five years only, during which period future television needs in general would have been determined.

The Minister agreed. He gave planning permission subject to the conditions that the tower be set back as far as possible within the site, that the site be laid out as a garden on open lines, and that the tower be removed from the site not later than 30th April, 1966.

## Equalising BBC and ITV

(Continued from page 501)

The circuit will not offer a great deal of attenuation to the Band III signals, which are well removed in frequency from Band I. Adjustment should be effected by first tuning the set to the Band I station with the circuit connected. The dust slug should then be adjusted until the reception on Band I is comparable to that on Band III. As the unit is frequency-selective, it will discriminate between sound and vision on Band I, but a compromise setting can quickly be established on the core.

For experimenters wishing to construct such a unit, the coil should be 1μH and the capacitor 10pF. The coil can be made up of 8 turns, close wound, of 22s.w.g. enamelled-covered wire on an Aladdin Type PP5892 former, which contains an adjustable dust-iron slug.

The components should be mounted in a small screened can with the coaxial connecting leads, suitably terminated, brought out at each end. ■

# Television Interference

## RECOGNITION, CAUSES AND CURE

By L. E. Higgs

(Continued from page 474 of the June issue)

### Pulling

**T**HIS is a side effect of negative images. The inverted picture can upset the clean front edge of the horizontal sync pulse causing early triggering of the line—only in certain sections of the raster depending on the picture content at the extreme right-hand side of the raster. The result is sections of the picture slithering and wobbling horizontally by  $\frac{1}{4}$  in. or so as the scene varies. The aerial needs adjusting here.

### Patterning

Herringbone patterns of criss-crossing lines over the picture silently changing direction similar to patterns from moiré silk as one moves it (Fig. 10)



Fig. 10. (above left).—R.F. interference gives moving patterns on the screen rather like moiré silk.

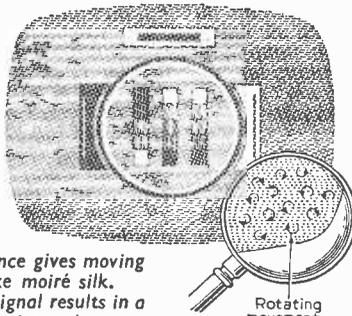


Fig. 11. (above right).—Insufficient signal results in a decreased signal-to-noise ratio—the picture becomes grainy and weak.

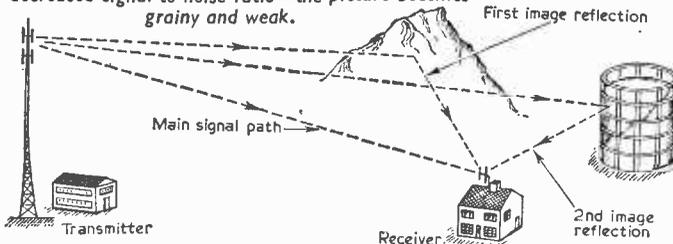


Fig. 12.—When the signal proceeds to the receiver by two or more different paths, the result is a succession of images on the screen—see Figs. 8 and 9, last month.

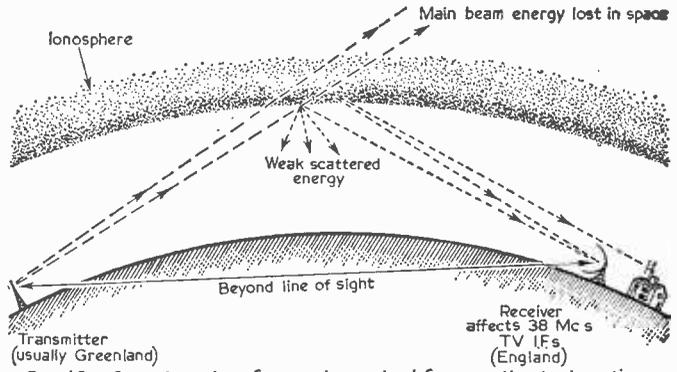
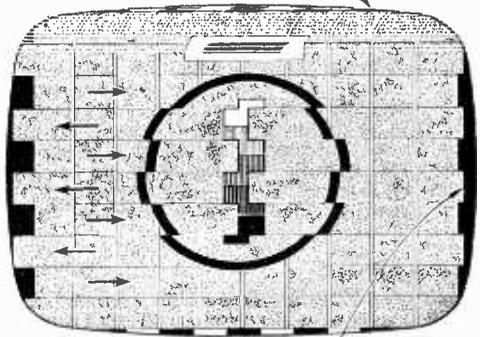


Fig. 13.—Sometimes interference is received from scatter propagation transmitters in remote countries.

Some times with top of picture tearing



Ghost of this edge fouling Line sync pulse

Fig. 14 (above).—Line "pulling"; this is a series of horizontal displacements of various sections of the picture.

is the symptom of radio frequency interference from a transmitter, oscillator or a local Band III converter. If the announcer apologises, then it is abnormal reception of distant radio stations. If a trace of Band III sound can be heard, then, probably, an incorrectly installed Band III converter is radiating some Band III on a Band I frequency—this will only occur when the offender is viewing on Band III. Thus, there is freedom from this trouble when popular programmes are on Band I.

The local oscillator in some nearby short wave radios and hospital diathermy R.F. apparatus can also give this effect.

(Continued on page 510)

# ADD-ON COLOUR TESTS

## (1)—TWO-COLOUR ANALYSIS

By A. O. Hopkins

**T**HE system of colour television, "Add-On Colour", which I described in the June, 1960, edition of PRACTICAL TELEVISION, should appeal to readers who have experimented with closed-circuit scanning, since it offers an easy way to convert from the familiar "monochrome". Briefly, my method is to scan the focused image or coloured slide through a cyan (blue-green) filter. Although red components are missing, the picture signals are suitable for monochrome receivers because we are used to red being represented by a darker grey than blue or green of similar brightness.

### Foundation Picture

This cyan-filtered "foundation picture" looks well in black-and-white because all such pictures, printed or screened, depend entirely upon contrast, only possible when all colours are converted to numerous shades of grey in order to register. I instanced a strongly contrasting pattern of green and red of similar "luminance" which disappears completely if given "panchromatic" treatment. A cyan filter handles this and other "freak" colour problems, generally improving the contrast.

### Colour Receivers

The foundation picture would also be received and traced in full cyan by colour receivers, which would receive an extra transmission (of narrower bandwidth) of a red-filtered scan of the same scene for them to "add-on". The two traced pictures, in cyan and red, would be optically combined to present a picture in colour from the two scans sharing one screen or traced on two tube faces. Coloured filters could be used with an ordinary "white" screen, or two separate phosphors, fluorescing in cyan and red, could be employed.

Change-over to colour would only mean adding to your existing receiver—converting it, not scrapping it for a colour set at perhaps treble the price. No interference between "plain and coloured" could occur, because no fancy electronics are necessary in this dual system. Were there a demand for a colour system easy to instal, inexpensive to transmit and receive, reliable and free from complication, I believe the "add-on" principle would satisfy it.

Were three-colour analysis insisted upon, the green scan would be excellent for the monochrome-

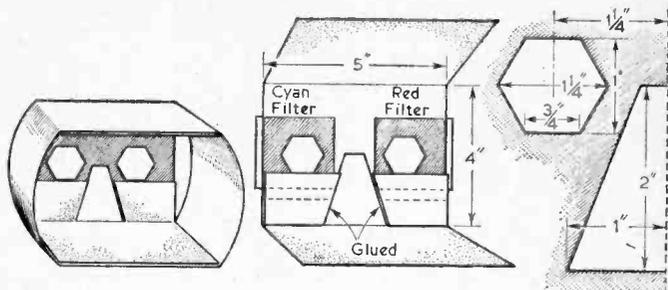


Fig. 1.—A binocular-type viewer with two colour filters—dimensions of the apertures are given on the right.

foundation picture, with narrow-band blue and red add-on scans for colour. Colour quality would equal the N.T.S.C. standard, without the complicated circuitry and high cost of the R.C.A. shadow-mask phosphor-dot screen system.

### Colour Standards

Comparison between two- and three-colour analysis can be made by anyone who can spare a quarter hour to construct a colour-viewer from inexpensive materials. How much (or little) is lost by combining blue and green should be judged by everyone who expects to buy a colour receiver in the future. Apart from its scientific value, non-technical friends will want to see how their screens would look in two colours. The actual scene they look at can be considered as three-coloured, so comparison is easy. When colour does eventually arrive we cannot know too much about it.

### Simple Construction

The colour-viewer is very easy to make, as Fig. 1 shows. A piece of stiff cardboard, about 14in. by 5in., is cut and bent as illustrated. A strip of thinner card, about 20in. by 5in., is bent and glued to the stiff top and bottom to form the "binocular" case. Each eye-aperture is then covered by a coloured filter. If this material is flimsy such as Cellophane, these coloured "windows" should be stuck along the edges by adhesive strip. An improved viewer could have slots beneath each eye-aperture to receive pieces of glass (red and "peacock blue"), stiff "gelatin" (colour-photography filter), or "nitrate" filter (used in studio and stage-lighting effects), allowing a range of colour combinations to be tried.

If one of the two-colour cardboard spectacles used for "3D picture" anaglyphs is available, the job becomes even simpler. If cyan is unobtainable, two layers—one blue, one green—in not too strongly coloured material can give the blue-green to balance the red. If the cyan is too blue, place a light yellow over it. Light yellow will also correct the red if it is too near crimson or magenta.

### Using the Viewer

In daylight or by artificial illumination, the viewer provides quite an exciting look into a two-colour world. Scenery, faces, clothes, furniture all appear in attractive tones, sometimes differing but

very acceptable if your screen could reproduce them instead of the monotonous monochrome. Facial tints are of primary importance, especially in close-up. Through these filters they glow quite attractively, flattering the person "viewed". Similarly the whole range of hair-colouring appears surprisingly true to life. Brightly reflecting objects (with "highlights" furnished chiefly by the "foundation" colour) appear exactly as they are.

The subjects for this two-colour test (which also tests whether the add-on principle is practical) are as limitless as those appearing on your monochrome screen. The loss suffered by colourless television is only realised if the televised scene in the studio or outdoors, often glowing with colour, could be seen for comparison.

**Colour Balance**

The two filters chosen for colour analysis must together cause the superposed light from two sources of equal brilliance to appear as nearly white as possible. This second test can also be made with simple apparatus. If two lenses, say the two parts (plano-convex) of a condenser lens, are available with an "opal" lamp behind each and a filter in front they form a double projector for testing colour balance.

A single lens is enough for this experiment if the two filters are arranged as in Fig. 2, which shows them covering opposite halves of the lens face. A cardboard mask in front of the lens carries two strips, partly glued on, which act as a slip-in frame for the colour filters. At a distance of a few feet the two-coloured light should blend as white.

**Picture Tests**

Your two-colour projection lamp can now analyse pictures printed in three colours, to find what chromatic changes can occur. The large well-coloured close-up portraits and figures on the covers of several magazines are excellent for this test.

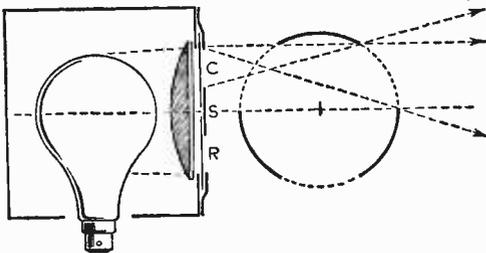


Fig. 3.—A two-colour projector with filters (C: cyan; R: red) in a frame with a strip S and a rotary shutter. Each colour is exposed separately.

Having compared the projection effects with ordinary room lighting, cover each half-lens in turn. With cyan filter obscured, strongly lit with red, the picture seems very bright, but the darker parts are obviously in the wrong places. It almost seems like a negative, quite unsuitable for the foundation-monochrome picture.

Lit strongly in cyan its suitability for presentation in monochrome will be obvious. Now uncover the obscured red filter and you have "added on" red, showing your picture in full colour!

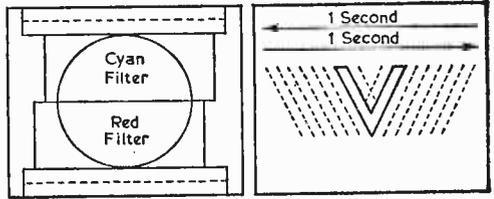


Fig. 2 (left).—A mask for a lens, with a slip-in frame for colour-filter experiments.

Fig. 5 (right).—An illuminated figure on a moving screen to test picture flicker.

**Flicker**

All scanning generates flicker. Two different kinds of flicker can occur in monochrome scanning, and three kinds in colour TV. The three can be called "picture", "frame" and "colour" flicker. Each inflicts discomfort on the eye in a different way, and each can be remedied by increasing the repetition rate of either interlaced picture, scanning frames or colour fields. Since repetition costs channel bandwidth, it is important to know what minimum frequency will smooth out each kind of flicker. Readers will know that the current controversies about increasing our line total for higher definition, and also introducing colour, arise from the expenditure of bandwidth involved.

Fair questions could be:—

Is monochrome scanning using its channels economically (just enough pictures and frames to suppress its two kinds of flicker)?

If not, could colour occupy the hitherto wasted space (with colour flicker suppressed)?

**Rotary Shutter**

The divided lens arrangement can be used to test the three flicker speeds, and both questions can be answered.

Artificial flicker can be generated by a rotary shutter, usually with radial blades. A more useful shutter, with abrupt light switching, can be used with your lens and colour filters as shown in Fig. 3. It is an apertured drum, with three openings separated by their own height. The diameter of the drum should be slightly larger than that of the lens. I cut my drum from a cardboard-sided custard "tin" (without the lid), and this shutter is easily driven by a small model motor. Fig. 4 shows the apertured drum attached to the motor shaft. A strip of cardboard 1in. wide is fixed across the lens centre.

During rotation, two apertures become level with each part of the lens above and below the strip in turn, releasing a flash. The boundary rays of the cyan flash are indicated. Each rotation releases six flashes, the two colours alternating, with short dark periods between. This is a severe flicker test. Scanning is more smoothly illuminated, but brilliance can be greater on modern screens, so these flicker tests form a useful guide.

Each type of flicker can be tested by means of an easily prepared screen. This is a white card, about 6 by 8 inches, at the centre of which a figure, say a "V", is cut, as shown in Fig. 5. Thin tracing paper is stuck behind the "V", and a touch of grease makes the figure translucent.

### Colour Flicker

Cyan and red are complementary colours, their light exciting different receptors (rods and cones) of the retina, according to optical theory. In practice, violent colour contrast occurs, and persistence of vision cannot smooth out the light pulsations and blend them if these two colours alternate at too low a frequency. Colour flicker will not cease until the succession is fast enough for the retina to accept the two colours as occurring simultaneously. Five or six rotations of the shutter per second, giving at least 15 flashes in each colour, will be found to illuminate the screen as from a white light source. The total flicker frequency is then at least 30.

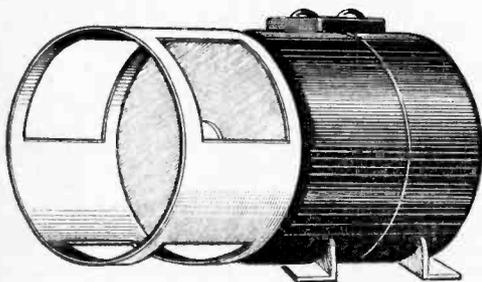


Fig. 4.—A rotary shutter driven by a small motor.

A second unwanted colour effect called "fringing" can be treated as flicker and tested. "Fringing" is the visible separation of colours at the edges of fast-moving close pictorial objects. Observe the "V" from the back of the screen, where it should glow brightly. The screen card should then be moved nearly its own width from side to side at about one traversal per second. The "V" then simulates a close white object moving quickly across a dark background, the most severe test possible. At a shutter speed lower than 5 rotations per second, with 15 flashes in each colour, "fringing" will be clearly seen along the sides of the "V". This is represented in Fig. 5 by dotted lines, with arrows showing the horizontal movement and timing. Normally such fast-moving close objects are avoided by film and TV technicians, even in monochrome. Ordinary movement gives no "fringing" trouble.

### Picture Flicker

Monochrome scanning is based on current film technique, the 25 interlaced pictures being copied from the 24 film frames, chiefly for telecine purposes. All that must really be satisfied is persistence of vision, the visual blending of a succession of superposed images upon the retina.

It was established years ago that bright images for film and similar purposes need the highest repetition rate, about 16, whereas dull intermittent pictures are free from "jerkiness" with fewer exposures. The perfected "silent" films used 16 frames per second, and were only speeded up to 24 to accommodate the early "talkie" sound-track. This film expenditure gave no visual benefit, but film technicians have never restored the economical picture speed, 16.

To test this, remove the two colour filters from the frame. Each rotation of the shutter now releases 6 flashes of white light. Watch the "V" from the back of the screen as before, moving the card in the same way at the same speed. The "V" moves jerkily until about 3 shutter rotations are reached, when more than 16 exposures of the "moving object" are found to smooth its progress. Every cine enthusiast uses this economical "pull-down" speed.

### Frame Flicker

If the projected light is strong, the front of your card will seem white with 16 or so flashes, yet an overall flicker will continue. This form of flicker has nothing to do with visual persistence, and takes about three times the repetition to suppress. Slow flicker on the whole screen is painful because the iris muscles of the eye try to contract and expand the pupil in an effort to convert the fluctuating light to a steady value. This function of the iris protects the retina from excessive light which would violently stimulate the perceptive system, and could even damage the delicate network of the optic nerve. At a suitable speed the iris cannot follow the fluctuations, so settles down with "fixed aperture" for the average illumination.

This problem was solved for the cinema when the 16 frame projections were "light chopped" into 48 by means of a three-bladed shutter before the lens. When "sound" frames were increased to 24, these were "chopped" into 48 by a two-bladed shutter. Interlaced scanning then matched the televised films with 50 frames, also chosen because they permit locking with the mains.

In our test this frame flicker disappears when the shutter rotations reach 7 or 8, when the flash frequency is between 40 and 50. Our screen then appears lit with steady white light, although actually lit by flashes in the same way as the cinema screen.

### Space for Colour

Had 35mm film technique restored the scientific 16-frame speed, "triple-interlacing", which has been demonstrated as practical, would doubtless have been adopted for television in order to match it. The 50 interlacing frames would form  $16\frac{2}{3}$  pictures of 3 frames each, saving  $\frac{1}{3}$  of the video side-band by reducing it from 3 to 2Mc/s for our 405-line standard. The whole megacycle freed on every channel by this economy would have made colour experiments possible on simple, inexpensive lines. Is it not probable that colour television would have become standard practice by now, enjoyed by the millions who must instead be content with monochrome?

### Three-Colour Analysis

Keen experimenters who have made the two-colour viewer, and have tested the surprising coverage possible with cyan (blue-green) and red, will want to compare the limitless range which the three primary colours, blue, green and red, can attain.

The BBC's experimental transmission of the adapted N.T.S.C. system has been tailored to suit the R.C.A. phosphor-dot tube, which complicates reception for display on simpler (and cheaper) colour tubes. Demonstration of colour TV will

be the special attraction at the Radio Show this year, and should stimulate the interest of every home constructor and experimenter in monochrome. Sale of this "compatible" system dragged in the USA, which our own manufacturers have noted. Hard economics have put colour TV back to the pioneer stage, giving a chance for a simpler system to be developed in time for colour to be enjoyed in Britain in a less distant future.

### Colour Principles

To advance from monochrome to colour a few basic principles and theories of coloured light will be found valuable. Newton's spectroscope splits white light into the whole "rainbow" of colours, which explains why rays from a white source can penetrate any coloured filter. Six distinct hues can be seen in the visible spectrum; violet, blue, green, yellow, orange, red. These gradually merge with their neighbours, forming five more hues. Red is widely separated from blue and violet, but is found in nature combined with them in purples, magenta and crimson. All these hues are found also in "pale" or pastel tones (such as pink, cream, mauve), in browns, in greys (which contain all three primaries), and in dark shades (which contain little light).

Young and Helmholtz discovered that three colours, now called "primary", were sufficient in combination to stimulate the eye to see the whole range of colours. The perceptrs of the retina, the "rods" and "cones", were considered to respond individually to only one primary, which divided them into three groups. Their response is represented as being in bands which span the whole visible spectrum but which peak strongly in one of the three primary regions. Fig. 6 illustrates this theory, and shows the approximate wavelengths, in milli-microns, of the seven most easily separated colours. Cyan, between blue and green, seems right, but yellow as a blend of green and red is unexpected when first met. Near the centre, green takes command, peaking symmetrically, whereas blue and red weaken rapidly to the extremes of the range.

### Colour Problems

One criticism of these response curves is that no pure primary could be separately perceived owing to the overlap of the other two primary regions. Yet how otherwise might be filled in the range of colours between the primaries? Cyan light from a single source, for example, has the same visual effect as blue and green from two sources. This requires the curves to sustain smooth transition in both colour change and light value, free from "dips".

Another snag is that every colour would contain some white (blue+green+red) preventing saturation. My idea is that the blue and red curves do not overlap, but reach their inner zero near green peak frequency, freeing all colours from unwanted white. I would also reduce the spread of the green curve, allowing it to reach its two zero frequencies near peak blue and peak red, purifying these two

colours. Theory would then match experimental fact.

### Green Foundation Picture

The overall sensitivity of the eye is greatest in the green-yellow region, as shown by the broken line curve in Fig. 6, and reaches zero at the extreme frequencies of violet and red. The proximity of the green and sensitivity peaks is doubtless responsible for the fact that the eye can accept a green-filtered image as natural when presented in monochrome, that is in brightness or "luminance" only. This is the principle of "add-on" colour (with three-colour analysis), in which monochrome receivers could trace the green "foundation" picture in

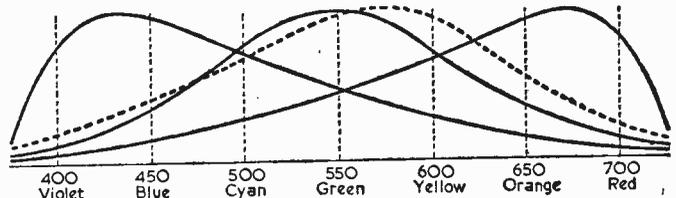


Fig. 6.—The colour response of the eye (Young-Helmholtz Theory). The three primary colours curves peak at blue, green and red. The chief spectrum colours are shown with approximate wavelengths in milli-microns. The sensitivity curve is shown dotted.

"black and white". Colour receivers would reproduce this in green, and would also receive two other colour signals, for the blue- and red-filtered images, combining the three optically to form a picture in full colour.

### White Light

Another colour perception theory should be mentioned, that of Hering, who considered that blue and yellow light excite one set of perceptrs, while green and red excite another set. These form two overlapping curves, and a third curve spans them both, similar in shape to the sensitivity curve. Hering's third curve represents a group of perceptrs which are sensitive to white light only—almost a built-in "compatibility" system for the eye. This theory does not help analysis and synthesis by the accepted three primary colours, although experiment has proved that yellow is a separate visual sensation, not depending upon the presence of green and red.

### Modern Optical Theory

According to modern optical theory only the retinal cones are sensitive to colour. The part of the retina which gives detail vision, the centre of focus or "fixation point" (the foveal pit of the macula) contains only cones. Rods become more numerous further from the centre, and are sensitive only to brightness, to the "luminance" of light whatever its colour. This accounts for changes in light patterns, such as are caused by movement, being easily detected from the corner of the eye, as we all know. The rods seem to be related to the "sensitivity" and "white" curves, perhaps in a "compatible" arrangement far simpler than N.T.S.C. circuitry.

(To be continued)

# A Basic TV Oscilloscope

TESTING THE  
COMPLETED  
INSTRUMENT

By H. Peters

(Continued from page 474 of the June issue)

**F**URTHER saving of space is possible by dismantling the contact-cooled type of rectifier and stacking the discs on a well insulated 2B.A. rod. The writer uses a 14RA1283, which, if carefully dismantled, will disclose a bakelite honeycomb of 12 sections. In each section are seven washers. The top one is bronze and curved, and is only used to compress the others. The second one and the bottom one are plain steel washers. Between these two are the stack of four rectifying washers, each washer having a bright metallic upper side (the positive) which is bevelled, and a rather rusty and dull underside, which is the negative. Each disc will handle 15V so that the total of 48 is suitable for a 720V A.C. input, which if adequately smoothed will give a negative H.T. line of approximately 900V.

## Test Leads

These can be made up to suit individual needs, but three basic leads about a yard long are adequate for most purposes. Terminate the oscilloscope end appropriately with wander plug or spade terminals, and fit crocodile clips to the other end of two of them, and a probe to the third. A spent ball-pen makes an ideal probe. Remove the refill and pass the flex down the empty case from the top. Solder the lower end to the brass turning which holds the ball and refit to the case. With a little skill a working ball-pen can be adapted and this will provide a test prod which both reads and writes.

## Testing

Before switching on check for shorts on the H.T. lines. A resistance reading should give about  $\frac{1}{4}M$  from H.T. positive to chassis and  $2\frac{1}{2}M$  from H.T. negative to chassis. Set the two shift controls, the fine frequency control, focus, sync and sweep to midway, and the brightness to maximum. A bright green line should appear, and the two shift controls should be used to bring this line into the centre of the screen. Connect a suitable lead from the input terminal to the 6.3V calibrating voltage.

This will produce a rectangular patch of light the height of which will correspond to 20V peak to peak. Switch the coarse frequency switch S1 to a slow position and by rotating fine frequency control VR2 a 50c/s sine wave trace should be produced.

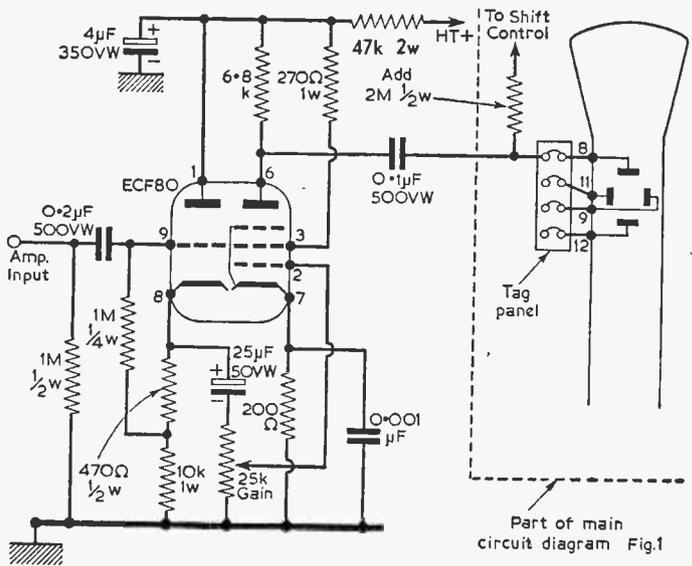


Fig. 4.—The circuit of a suitable Y-amplifier.

Adjust sync and sweep until it is locked and the correct size. It will be found that sync and sweep affect the speed of the scanned trace and that it may be necessary to readjust the fine frequency control once more. The 'scope is now ready for use.

## Television Interference

(Continued from page 505)

### Scatter Interference (see Fig. 13)

This is characterised by patterning, as above, fading spasmodically, with a pulsating "brr, brr, brr" in the sound rising and falling in volume and it occurs mostly in the afternoons during daylight, and on Band 1. Thirteen channel receivers with 38Mc/s I.F. circuits are most affected. The best cure is to fit a commercial 38Mc/s rejector filter in the aerial input lead or cut a 38Mc/s rejector stub from a length of coaxial cable and connect it in parallel with the aerial input.

### Grain

A moving background to the picture (Fig. 11) may fairly be described as "interference" as it was not broadcast with the picture, but originates mainly from the noise in the frequency-changer valve. If the input signal is weak, then the picture is seen against a background of noise or "snow". The remedy is to increase the input signal to the frequency changer. If in an area of good signal strength, the aerial, feeder, or, more likely, the cascade R.F. valve is at fault.

**More** for less...



**19 Ranges**

- |                     |                     |
|---------------------|---------------------|
| <b>D.C. Voltage</b> | <b>A.C. Voltage</b> |
| 0—100mV.            | 0—10 V.             |
| 0—2.5 V.            | 0—25 V.             |
| 0—10 V.             | 0—100 V.            |
| 0—25 V.             | 0—250 V.            |
| 0—100 V.            | 0—1000 V.           |
| 0—250 V.            |                     |
| 0—1000 V.           |                     |
| <b>D.C. Current</b> |                     |
| 0—100µA             |                     |
| 0—1 mA              |                     |
| 0—10mA              |                     |
| 0—20,000 Ω          | 0—100mA             |
| 0—2M Ω              | 0—1 A               |

MM12

List Price: **£9:10s.**  
complete with Test Leads and Crocodile Clips.  
Leather case if required 39/-

Size 5½ x 3½ x 1½ in.  
Weight: 1 lb. approx.

Designed to offer the widest possible range of accurate and reliable measurements at the lowest possible price, the versatility and usefulness of the Multiminor are now further extended by specially designed leads. These new leads, available at no extra cost, will accept crocodile clips or PRODCLIPS. The Multiminor takes full advantage of the possibilities of printed circuit techniques to achieve outstanding compactness and economy of weight. The scale is clear and open. The fine red coloured pointer and effectively dampened movement facilitate easy and rapid reading. For use in Radio, TV, Electronics, Motor Vehicles, domestic appliances, workshop equipment, you'll find the Multiminor a great little meter.

Use PRODCLIPS with the MULTIMINOR (Pat. No. 748811)

These cleverly designed spring-loaded insulated prods are the complete answer to a long-standing problem. Press the trigger to open, release to grip. Keep your hands free, no matter how difficult of access your test points may be. 15/- per pair.

...with the

**MULTIMINOR**

Write now for illustrated literature to:—

**AVO LTD**

AVOCET HOUSE - 92-96 VAUXHALL BRIDGE ROAD  
LONDON - S.W.1  
VICtoria 3404 (12 lines)



A MEMBER OF THE METAL INDUSTRIES GROUP OF COMPANIES

**“TELFAC”**

**Regunned TV Tubes**

Supplied from stock and despatched per British Railways **SAME DAY**. COMPLETE NEW GUNS fitted in every tube and fully guaranteed for TWELVE MONTHS.

	Mullard	Mazda
12 in. ...	£4. 0.0	£4.10.0
14 in. MW ...	£4.10.0	£5. 0.0
14 in. AW ...	£5. 0.0	£5. 0.0
15 in. 2 Volt ...	£5.10.0	£5.10.0
15 in. 12 Volt ...	£5. 0.0	£5. 0.0
16 in. ...	£5.10.0	
17 in. MW ...	£5. 0.0	£5. 0.0
17 in. AW ...	£5.10.0	£5.10.0
21 in. MW ...	£6.10.0	£6.10.0
21 in. AW ...	£7. 0.0	£7. 0.0

MW = Magnetic Focus  
AW = Electrostatic Focus  
Plus 10/- for Carr. & Ins.

Other types not listed available. Please contact:—

**J. P. WRIGHT**

Television Factors

103 Carr House Road, Doncaster  
Sole Distribution Agent  
Phone: DON 2636

**VALVES SAME DAY SERVICE**  
**NEW! TESTED! GUARANTEED!**

**SETS** IR5, IS5, IT4, 3S4, 3V4, DAF91, DF91, DK91, DL92, DL84 .. Set 4 for 19/6  
DAF96, DF96, DK96, DL96 .. .. .. 4 for 27/6  
6K7G, 6K8G, 6Q7G, 6V6G, 6X5G, or 5Y3G .. .. .. 5 for 24/6

1A7GT 11/6	6P1 13/6	35A5 14/-	ECC81 5/-	EZ90 6/3	T41 9/6
1D5 8/-	6P25 9/-	35L6GT 9/-	ECC82 7/-	E281 7/6	U22 7/6
1H5GT 10/-	6Q7G 8/-	36Z4GT 6/9	ECC83 9/-	FW4/500 8/-	U24 17/6
1N5GT 10/-	6Q7GT 9/6	35Z5GT 9/6	ECC84 9/-	GZ30 8/6	U25 13/-
IR5 5/6	6SL7GT 8/9	60L8GT 8/9	ECC85 8/3	GZ32 8/6	U26 10/6
IS4 3/3	6SN7GT 4/9	AC/TH1 16/9	ECC86 8/6	HBC90 7/-	U50 6/-
IS5 5/3	6U4GT 11/-	AZ31 9/6	ECC87 8/6	KT139C 7/6	U52 4/6
IT4 3/6	6V6G 5/-	B36 8/6	ECH21 13/6	KT41 11/6	U78 4/6
IU5 5/9	6V6GT 6/6	CL33 12/3	ECH42 8/9	KT44 6/6	UABC80 7/9
3A5 9/-	6X4 4/9	DAC32 10/-	ECHL1 8/-	KT81 10/-	UAF42 9/-
3Q4 7/-	6X5GT 5/-	DAF91 5/3	ECL80 7/6	KT93 8/6	UB41 8/6
3S4 4/6	7B8 9/-	DAF96 7/6	ECL81 7/6	MU14 7/6	UBC41 7/9
3V4 7/-	7B7 7/6	DCC90 9/-	ECL82 6/6	MX40 9/6	UBF80 8/9
5U4G 4/6	7C5 7/6	DP33 10/-	EP33 9/6	N18 7/-	UBF98 8/-
5V4G 4/6	7C8 7/6	DF91 3/6	EF40 15/6	N37 10/6	UC62 12/6
5Y3GT 6/-	7H7 7/6	DF96 7/6	EF41 8/3	PC95 10/-	UCC84 18/9
5Z4G 7/9	7S7 9/-	DH76 4/9	EF42 9/6	PC98 7/6	UCC85 7/6
6AL5 3/9	7Y4 7/-	DHT 6/9	EF60 5/6	PCF39 8/-	UCF80 14/-
6AM6 3/6	10C2 17/6	DK92 11/6	EF85 5/6	PCF80 7/9	UCH21 13/6
6AQ5 9/-	10P13 14/6	DK91 5/6	EF86 9/9	PCF82 8/-	UCH42 8/-
6AT6 6/9	12AT8 7/-	DK92 7/6	EF89 7/6	PCF88 14/-	UCH81 8/-
6BA6 6/-	12AT7 5/-	DK96 7/6	EF91 3/6	PCL82 9/-	UCL82 10/9
6BE6 5/9	12AU6 8/6	DL33 9/-	EF92 4/3	PCL83 11/6	UCL83 13/3
6BH6 5/9	12AU7 6/3	DL35 9/6	EF183 14/-	PCL84 7/6	UF41 8/9
6B36 6/9	12AX7 7/-	DL92 6/-	EL33 10/-	PEN44 11/6	UF85 8/6
6BW6 8/-	12K7GT 5/3	DL94 7/-	EL41 3/6	PEN38C 8/-	UF89 7/-
6CD6G 26/9	12K9GT 11/6	DL96 7/6	EL42 9/-	PL31 11/6	UL81 8/-
6P1 12/6	12Q7GT 4/9	EAB090 7/-	EL44 7/-	PL81 8/6	UL84 7/6
6P6G 6/6	12X3 7/6	EAF42 8/6	EM34 6/9	PL82 7/6	URIC 8/-
6P13 11/-	14S7 18/6	EB91 3/9	EM90 8/6	PL83 7/6	UV21 11/3
6P14 16/6	20F2 17/6	EBC33 5/-	EM81 8/6	PL84 10/6	UV41 6/6
6K7G 2/6	20L1 17/6	EBC41 8/-	EM84 10/-	PY32 11/6	UV85 9/6
6K7GT 5/-	25A8G 8/-	EF80 8/-	EY51 7/6	PY80 7/6	VP4B 8/6
6K8G 6/3	25L8GT 7/9	EF88 8/9	EY94 10/-	PY81 6/9	VP41 5/-
6K8GT 9/3	25V4G 7/6	EFL21 13/6	EY96 7/9	PY82 6/6	W76 5/3
6L18 10/3	25Z6GT 9/6	EC92 11/-	EZ40 6/9	PY83 7/9	WT7 4/6
6LD20 8/-	30L15 11/-	ECC40 15/-	EZ41 7/-	PZ30 8/6	Z77 3/6

**READERS RADIO**  
24 COLBERG PLACE, STAMFORD HILL,  
LONDON, N.16. STA. 4587

Post 6d. per valve extra.  
Any Parcel insured Against Damage in Transit 6d. extra.  
Any C.O.D. Parcel 3/- extra.

FOR THE FINEST, FASTEST SERVICE IN THE COUNTRY, CONTACT—

# D. & B. TELEVISION

Phone: Cherrywood 3955

131a KINGSTON ROAD, SOUTH WIMBLEDON, S.W.19

## OUR COMPREHENSIVE SERVICE INCLUDES:

12 CHANNEL TURRET TUNERS, 10, 16, 38 Mc/s. 40/-; VALVES, PCF80 and PCC84, 7/- each. Cabinets, Glasses, Masks, Condensers, Resistors, Ion Traps, Speakers.

RECLAIMED C.R. TUBES (Not boosted or reactivated)  
8in. and 12in., 35/-; 14in., 50/-; 17in., 60/-. All picture tested, taken from stripped TVs.

REGUNNED C.R. TUBES (12 months' guarantee): 12in., 80/-; 14in., 90/-; 17in., 100/-.

### EXAMPLE OF TRANSFORMER LIST

L.O.T.		SCAN COILS		P.Y.E.		L.O.T.		SCAN COILS	
(New)	(Used)	(New)	(Used)	(New)	(Used)	(New)	(Used)	(New)	(Used)
103T, 105T	69/9	35/-	60/-	35/-	V1, V4, V7	52/6	35/-	55/-	35/-
5824/6/8	69/9	35/-	60/-	35/-	V7, CTM4	52/6	35/-	55/-	35/-

These are only examples of stocks, we have many thousands more, and would be pleased to quote for any component you may require.

We pride ourselves that we can obtain and supply any TV spare.  
**OUR GIGANTIC STOCKS INCLUDE:** LINE OUTPUT, FRAME OUTPUT, SOUND OUTPUT, LINE AND FRAME BLOCKING, OSC. TRANS. AND SCAN COILS, FOR ANY MAKE OR MODEL TELEVISION. SOME OF OUR VALVES:

AZ31 8/6	ECF80 8/-	KT33C 8/-	PY31 7/-	U801 22/6	5V4 9/-	10P13 9/-
B36 5/6	ECH33 8/-	KT36 8/6	PY32 10/-	UAF42 8/-	5Y3 10/6	10P14 9/-
D77 3/-	ECH81 6/-	KT86 15/-	PY80 6/6	UBC41 7/9	3Y4 10/-	12A77 5/6
DH77 4/6	EP39 5/9	PCC84 7/-	PY81 8/-	UCH2 7/-	6AL5 3/-	12AU7 5/9
DK91 5/9	EP39 3/9	PCC89 8/6	PY82 6/6	UF41 8/6	6AM6 3/-	20D1 8/6
DK92 8/6	EP39 4/6	PCF80 7/-	PZ30 10/-	UF42 3/9	6CD6 27/6	20F2 9/-
DK96 7/8	EP91 3/8	PCL82 10/9	U22 9/6	UL41 7/3	6D2 3/-	20L1 12/6
DL92 5/9	EP92 5/9	PCL83 11/3	U24 10/-	UL46 7/3	6F1 5/-	20P1 10/8
DL94 8/9	EL33 8/6	PCL84 9/6	U26 12/-	UL41 11/6	6F12 3/-	20P3 12/-
DL96 7/6	EL38 14/6	PCL84 9/6	U31 9/6	UL41 6/6	6F13 7/-	20P4 16/6
EB91 3/-	EL94 7/-	PL33 8/6	U50 8/6	UD9 6/6	6F15 9/6	27SU 14/-
EB93 5/-	EY51SE 5/-	PL36 10/9	U52 7/-	SP41 2/3	6L1 12/6	30C1 7/-
EBF80 9/6	EY51 6/-	PL38 14/8	U191 9/-	SP61 2/3	6V6 5/-	30L1 7/-
ECC81 5/9	EY86 7/6	PL82 6/9	U231 4/6	W77 5/6	10F1 4/6	30P4 10/9
ECC82 5/9	EZ40 6/8	PL83 7/-	U382 20/-	Z77 3/-	10C2 10/-	135BT 14/8
ECC84 8/-			U301 20/-	U54 5/-	10C2 13/-	

These are only examples of our valves: if you do not see what you require send stamped addressed envelope for special quotation.

And that's not all—WE ARE OPEN FROM 10 a.m. UNTIL MIDNIGHT.  
For any information or problems you have Call or Phone, we are always pleased to help.

TERMS: S.A.E. all enquiries. C.W.O. or C.O.D. 3/- extra.  
Postage on Valve 6d. each. C.R.T.s 12/6 inc. Insurance.

SATISFACTION ASSURED. RETURN POST SERVICE.

## NEW 7th EDITION RADIO VALVE DATA

Characteristics of 4,800 valves & transistors, rectifiers & cathode ray tubes. Compiled by staff of "WW".

6/-, Postage 10d.

TELEVISION SERVICING HANDBOOK, by G. J. King. 30/-, Postage 1/3.

THE RADIO AMATEUR'S HANDBOOK, 1561 ed. by A.R.R.L. 32/6, Postage 2/-.

PIN POINT TV TROUBLES IN 10 MINUTES. 31/6, Postage 1/-.

TELEVISION ENGINEERS' POKKET BOOK, by J. P. Hawker. 12/6, Postage 6d.

TELEVISION SERVICING Vol. 4, by G. N. Patchett. 7/6, Postage 6d.

SERVICE VALVE EQUIVALENTS and R.S.G.B. Pub: 2/-, Postage 4d.

A BEGINNER'S GUIDE TO TELEVISION, by F. J. Camm. 7/6, Postage 6d.

TAPE RECORDER MANUAL, by W. S. Sharps. 21/-, Postage 1/-.

## THE MODERN BOOK CO.

BRITAIN'S LARGEST STOCKISTS of British and American Technical Books

19-21 PRAED STREET  
LONDON, W.2

Phone: PADdington 4185  
Open 6 days 9-6 p.m.

**FREE THIS BOOK WILL INTEREST YOU!**

**LEARNING the PRACTICAL WAY**

**Radiostrucor EQUIPMENT COURSES**

**FOR**

- .. Your Career
- .. Your Own Business
- .. An Absorbing Hobby

## A NEW-PRACTICAL WAY of UNDERSTANDING Radio : Television Electronics

Including: Transistors; VHF/FM; Hi-Fi equipment; Computers; Servo-mechs; Test instruments; Photo-electrics; Nucleonics, etc.

Radiostrucor—an organisation specialising in electronic training systems—offers a new self-instructional method using specially designed equipment on a "do-it-yourself" basis. You learn by building actual equipment with the big kits of components which we send you.

You advance by simple steps, performing a whole series of interesting and instructive experiments—with no complicated mathematics! Instructional manuals employ the latest techniques for showing the full story of electronics in a practical and interesting way—in fact, you really have fun whilst learning! Fill in the coupon below, for full particulars.

### POST NOW

TO RADIOSTRUCOR (DEPT. G.40)  
READING, BERKS.

Please send brochure, without obligation to:

★ Name \_\_\_\_\_  
Address \_\_\_\_\_

★ BLOCK  
CAPS  
PLEASE

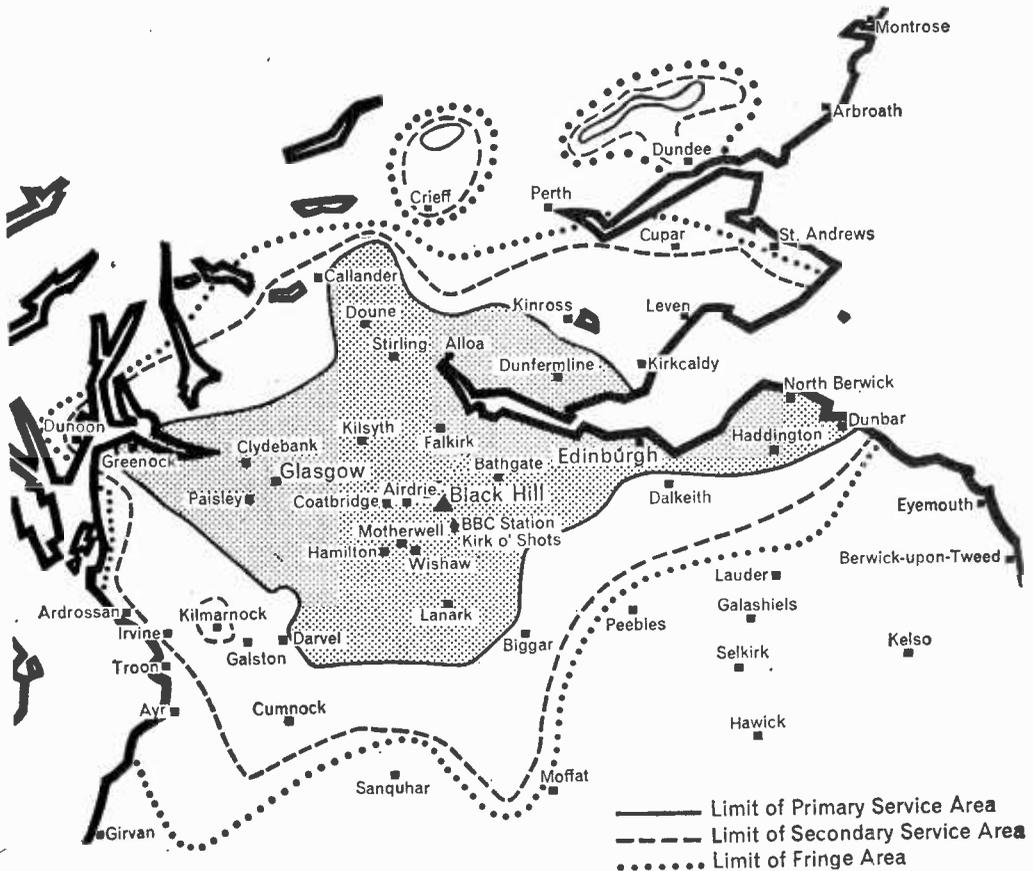
(We do not employ representatives)

7/61

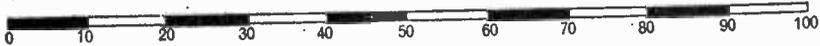
# RADIOSTRUCOR

LEADS THE WORLD  
IN ELECTRONICS TRAINING

# A New Mast at the ITA's Black Hill Station in Scotland



Scale of Miles



The estimated coverage of the new mast.

This month programme transmissions from the Independent Television Authority's Black Hill station, in Scotland, will come from a new 1,000ft mast and directional aerial, which replaces the old 750ft mast and aerial.

The effect of the new mast will be to increase the overall coverage of the station and to improve reception in many parts of the present service area.

Nearly four million people will now be able to receive ITA programmes from the Black Hill station, on channel 10.

Owing to the fact that the signal in some parts of the area, notably Ayrshire, has so far been, in part, horizontally polarised, some receiving aerials

have been installed in a horizontal position. The new transmitting aerial will radiate in the vertical plane with no significant horizontal component, and so horizontal receiving aerials will have to be re-aligned to pick up the vertical signal. The removal of the horizontal signal component is necessary in order to conform to national and international technical agreements.

The effective radiated power of the new directional aerial is 475kW to the North East; 250kW to the South West; and 150kW to the North West and South East. The vision frequency is 199.7305Mc/s, and the sound frequency is 196.2395Mc/s.

# USING COAXIAL STUBS

TUNED LINE FILTERS FOR REJECTING UNWANTED SIGNALS

By P. Rules

WHEN coaxial cable is used in unmatched conditions, it can perform some remarkable functions because of its unusual behaviour at radio frequencies. The three electrical parts of a uniform coaxial cable are: a cylindrical tube (which may be considered "electrically solid"); and a centre conductor coaxial with it (see Fig. 1). Thus, for each unit length of cable, there will be a uniform capacity between the inner and outer conductor and a uniform inductance from the combined effect of the length of the two conductors. All good coaxial cables have uniform physical dimensions and hence uniform electrical characteristics along their length; so uniform, in fact, that the cable makers quote their various cable types as having so much capacity in picofarads and so much inductance in microhenries to the yard. As inductance and capacity lumped together form tuned circuits, we can cut off to order tuned circuits "by the yard".

Just as tuned circuits can be connected in two basic forms—series and parallel—so coaxial cable

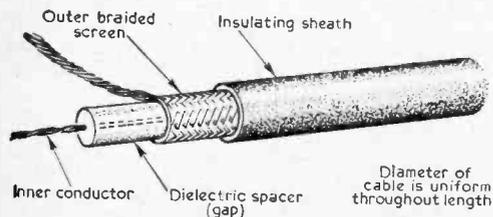


Fig. 1.—The construction of coaxial cable.

tuned circuit can be so connected. Just as a series tuned circuit acts as an acceptor to one particular frequency, so can a length of coaxial cable cut to one quarter of a given wavelength—if left open circuited at one end. By shorting this same length of cable at the end, the electrical characteristics reverse from an acceptor circuit to a rejector circuit. These tuned circuits are very efficient and conveniently short at TV frequencies and can be put to use in the following ways on domestic TV.

## I.F. Interference rejection (single channel)

Interference breaking through directly to the I.F. stages of a single channel T.V. set (in the form of R.F. patterning) can best be dealt with in this way. The break through is usually from a harmonic of a powerful local radio transmitter and only affects TV receivers with a particular value of I.F. As the TV is only a single channel type, or if there is only one worthwhile channel in the district, then if a rejector circuit is connected directly across the input to the receiver and tuned to this required channel, then only signals from this channel can appear across the aerial socket. All other stations (and interference) will be

absorbed in the "stub". The adjustment of the tuned stub is easy and it can be made from an old length of coaxial cable.

Take a length of coaxial cable 6ft long and neatly prepare the ends as shown Fig. 2. Solder the inner across the inner connection of the TV aerial socket (at the rear), and the outer of the cable across the outer of the TV aerial socket. Switch on the set and observe the type of picture obtained—the aerial must be plugged in. (The picture will be reduced in strength owing to the losses of the inserted length of cable.) The length suggested (6ft) is necessary to tune to Band I, Channel 1. For channels higher in frequency (and number), a shorter length can be used from the start, but 6ft covers any channel.

Now snip off 1in. lengths of cable from the remote end of the stub, carefully watching the screen. The picture should steadily deteriorate as each increment is clipped off. If there is no AGC on the receiver then it will be necessary to keep raising the gain, contrast or sensitivity control as the picture fades out. If there is AGC on the receiver then the background to the picture will become steadily more grainy until a point is reached where vision and sound disappear, with only a rushing sound and grain on the screen. This is what is required—maximum rejection of the

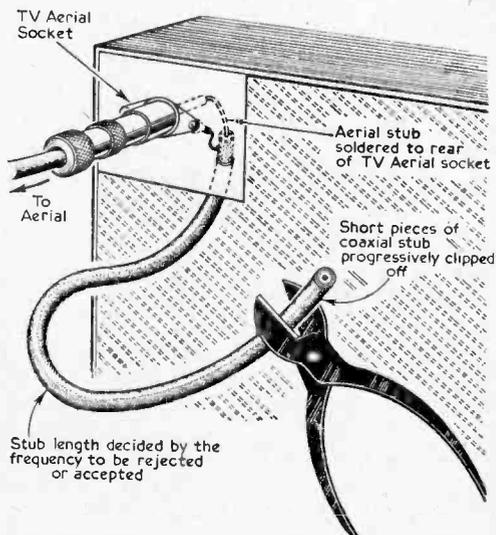


Fig. 2.—A method of adjusting an aerial stub.

channel; as the critical point is reached, make each piece of clipped off cable very small to avoid clipping past the point of maximum attenuation. If you do find the picture increasing as more is clipped off then it means the critical point has been passed and you must start again with another length.

Having reached minimum channel strength all

that is needed now is to strip back slightly the clipped end and twist the last  $\frac{1}{4}$  in. together shorting out inner and outer of the cable and solder.

This action of short circuiting the end of the acceptor stub reverses its function and turns it into a rejector tuned circuit causing the signal to reappear with the picture at least as bright as it was without the stub. However, all frequencies on either side of the channel will be attenuated together with I.F. interference.

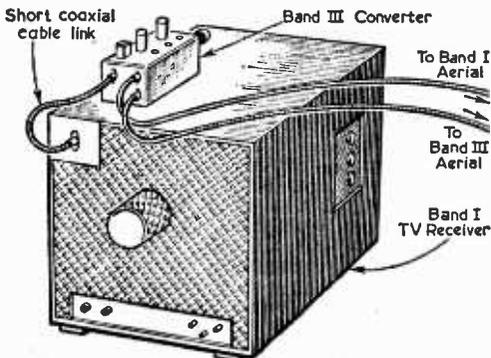
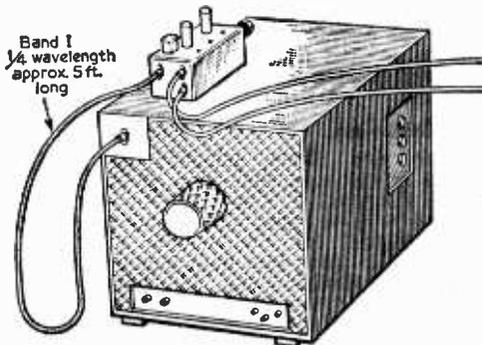


Fig. 3a. (above)—A normal Band III converter installation.

Fig. 3b. (below)—A converter installation with a Band I rejector coaxial link.



**I.F. Interference rejection (multi-channel)**

The above method allows only one frequency to reach the TV screen and is only suitable for single channel reception. When more than one station is to be received the following method can be employed. Follow the instructions given above, but adjust the length in the following way. The object here is to connect an acceptor circuit across the TV socket to accept and absorb the interfering frequency only, letting all other channels pass unaffected to the set. It must be known what frequency is causing the main interference. As the interference itself is usually too weak and unreliable through fading for direct reference in cutting the stub, it must be simulated by a signal generator. Wait for an occasion when the interference is prevalent and couple the signal generator loosely to the aerial cable inner wire via a high resistance, and adjust the output from the generator to pro-

**Table 1**  
This table lists one quarter wavelength for a given frequency. Find the frequency to be tuned, and start with a stub 25 per cent longer.

Frequency	Quarter Wave-length
30 Mc/s	2.5 m
45 Mc/s	1.65 m
60 Mc/s	1.25 m
90 Mc/s	83 cm
120 Mc/s	62.5 cm
150 Mc/s	50 cm
180 Mc/s	35 cm
210 Mc/s	14.3 cm

duce a beat note in the sound, or stronger screen patterning identical to that given by the interference. Generally this frequency will be in the region of the TV I.F. or some sub-harmonic. Once found, pull out the external aerial and plug in the signal generator and feed in a strong signal. Now adjust the stub by clipping off pieces of cable to produce a minimum of interfering signal on the TV sound and vision—the input from the signal generator can be progressively raised as the minimum point is approached.

When a minimum has been found remove the signal generator and plug in the aerial—do not short out the end of the cable this time, in fact, make sure no whiskers of wire can bridge between the inner and outer. The stub should have little or no effect on the channels normally used but will absorb the frequency to which it was adjusted. Be prepared to start with up to ten feet of cable if the interference is from 30Mc/s upward.

**Band III Converter Interference**

Band I receivers using aerial lead converters are prone to patterning on Band III owing to breakthrough from the local Band I station. Very often, the lead (coaxial) from the converter to the TV aerial socket is kept short for tidiness and to reduce Band I pickup. If this is the case, try making the lead approximately one quarter of a wavelength (of the local Band I channel). In many cases the lead will act as a rejector circuit to the Band I breakthrough (Fig. 3). If it is found that there is an improvement, then experiment to find the length of connecting cable that cancels out the interference. Table 1 gives approximate lengths for various channels, but the final length for any particular installation will depend on the local receiver and converter—however, they should not vary much from the  $\frac{1}{4}$ -wavelength.

**Optimum Aerial Matching**

Weak reception is sometimes caused by incorrect aerial matching. This possibility can be checked by a matching stub tuned to the poorly received channel as described for single channel interference rejection. If the aerial is in order, with good matching, then there will be no improvement in results. But, if a considerable improvement is obtained when the stub is connected then the aerial system should be investigated. If the stub is left in position at the rear of the aerial socket then the alternative channels used will most likely be weakened. (The stub might be wired direct across the diplexer or aerial in some cases).



An under-chassis view.

# A Nuvistor Band III Pre-amp

BY EMPLOYING A NEW LOW-NOISE-FACTOR VALVE, THIS PIECE OF EQUIPMENT WILL GIVE ALL THE AMPLIFICATION NECESSARY ON BAND III, IN AREAS OF POOR SIGNAL STRENGTH, WHERE RECEPTION WAS PREVIOUSLY OF NO ENTERTAINMENT VALUE.

By R. E. F. Street

**A**LTHOUGH there are many new TV transmitters, there are many areas where television is of poor entertainment value owing to weak signals, resulting in noise on both picture and sound. The obvious way to improve results in such areas is to pre-amplify the signal before it is fed into the receiver. However, a limit is set in the application of this method by the noise in the pre-amplifier. (The current flowing in the valve is not constant but continually varying and gives rise to a signal in the anode circuit.) Normally, this noise is insignificant compared with the signal being amplified by the

valve, and is of no importance. In fringe areas, though, the signal received may be of the same order as the noise in the valve.

The noise in the pre-amplifier valve thus sets a limit to the useful amplification which may be obtained: the signal received must be sufficiently strong to override the noise in the input valve. With the introduction of new valve types, each with a reduced noise factor, the design of pre-amplifier circuits for more remote areas becomes possible.

### The Noise Factor

With the above principle in mind, an article in the June 1960 issue of Practical Television described a Two-band Pre-amp using a PCC89 valve—a frame grid double triode—which was designed for amplification at VHF, and features low noise and high gain when used in the cascode configuration. This pre-amplifier has been built in many parts of the country and has given very good results, often enabling pictures of good entertainment value to be received for the first time. However, results on Band I have been found to be better than on Band III—signals on Band I have a greater range than those on Band III and are less affected by physical objects. A large hill may cast a “shadow” and prevent ITV from being received on the side of the hill remote from the transmitter, although BBC signals may still be received—considerably weakened, of course.

To obtain good results on Band III in such areas, a pre-amplifier which has a low noise factor is required. When the Two-band Pre-amp was described, the PCC89 was the best valve for the purpose then available to the home constructor. In this latest circuit, a new valve—the 6CW4 American Nuvistor Triode—is employed in a single valve circuit, which, incidentally, makes construction and adjustment easier compared with a two-valve cascode circuit. The 6CW4 has a metal envelope with a ceramic base upon which all the internal electrodes are supported. The

small size (about  $\frac{3}{16}$  in. x  $\frac{1}{8}$  in. high) enables a small, neat and efficient layout to be employed.

**Circuit**

The simplicity of the circuit used should be apparent from Fig. 1. Power requirements are 0.15A at 6.3V and 8mA (H.T.) at 80V. A conventional power supply may be used if the resistance R3 is calculated to give 70V at the anode of the 6CW4. (In the prototype, with 180V H.T., R3 needed to be 8.2k.)

As might be expected, the circuit needs neutralisation, and capacitive, rather than inductive neutralisation is provided by VC1 and VC2. The components used are not critical, but VC1 and VC2 must have low minimum values. Effective neutralisation cannot be obtained with 3-30pF concentric trimmers, and types having a minimum capacity of 1pF or less *must* be employed. If the minimum capacity is greater than above 1pF, it will be unstable and it will be impossible to obtain good results.

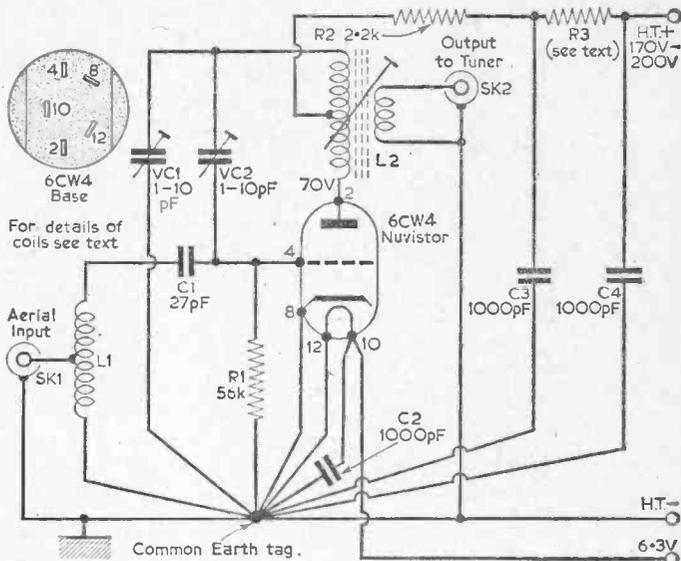


Fig. 1 (above).—The circuit diagram.

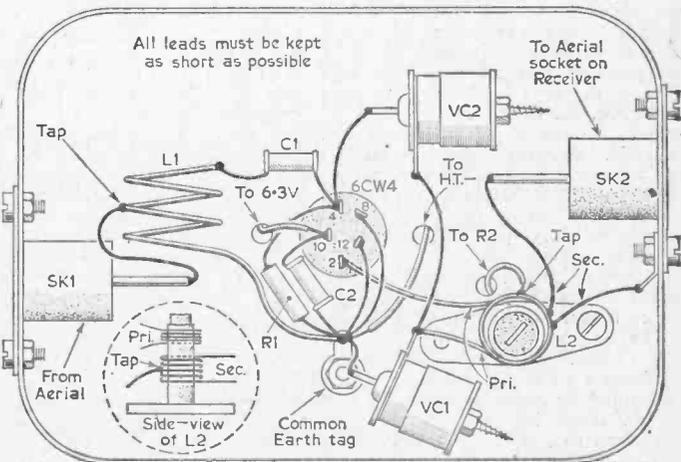
Fig. 2 (below).—The under-chassis wiring diagram.

**Construction**

The prototype was connected using a small cough lozenge tin as a chassis, this being used as it was quite large enough to accommodate all the components and the tin-plated surface enabled components, including the valveholder, to be soldered directly to the chassis. The thin metal also enables all necessary holes to be made using a sharp-pointed instrument and, thus, no drilling was necessary.

The layout and wiring given in Figs. 2 and 3 should be followed exactly, particularly the wiring of the heater circuit. The heater leads are not brought through the chassis in the positions shown for convenience, but to avoid decoupling troubles. Note that the "earthy" side of the heater is taken to the common soldering tag, and pin 10 of the valve is also earthed to this tag. The heater wire should not be taken to pin 10 and from there to earth. Likewise, all components shown wired to the common earth tag in Fig. 1 should be wired separately to the tag as shown in Fig. 2. This procedure prevents certain impedances from being made common to two or more circuits.

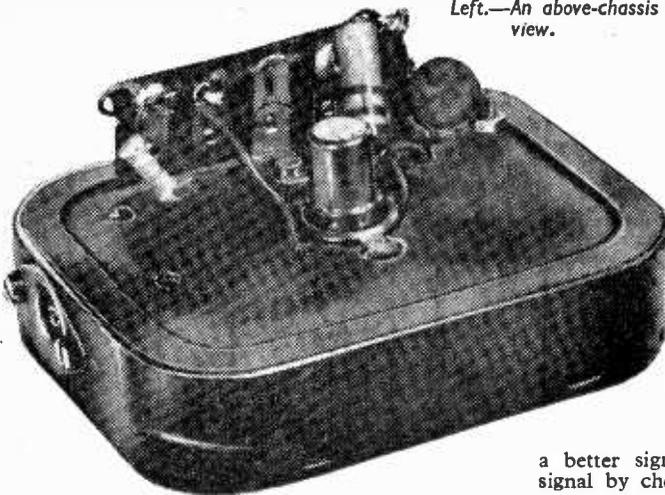
At first, it may not be apparent that C3 and C4 are wired to the common earth tag. In fact, they are soldered above the chassis next to the bolt which is used to hold the common earth tag to the under-



side of the chassis; see Fig. 3. If desired, the common earth tag may be soldered to the chassis for extra rigidity.

**Adjustment**

If it is possible to obtain a Band III picture without the use of a pre-amp, the receiver should be set to give the best picture possible. If a Band III picture cannot be obtained, the TV receiver should be set to the correct channel number and the fine tuner control turned to the midway position.



Left.—An above-chassis view.

to keep L2 at resonance — if the core is moved into the coil, the capacity of VC2 must be decreased and vice versa.

After each change in the setting of the core of L2, and VC1, VC2 is increased in capacity until any further increase results in instability — shown when the screen of the receiver becomes uniformly bright and a hum is heard from the loudspeaker. The optimum settings for the core of L2, VC1 and VC2 will soon be found, although perseverance may be necessary if the signal is weak.

#### Adjusting L1

When results may be improved no further, the tapping point of the aerial input on L1 may be altered in an endeavour to secure a better signal. Coil L1 may be tuned to the signal by checking whether it is at resonance by

The aerial lead is then removed from the set and plugged into the input socket of the Nuvistor pre-amp. A short lead is then prepared with a coaxial plug on each end; this is used to link the output of the pre-amp to the aerial input socket of the receiver.

At first, the aerial input tap in the pre-amp (on L1) is set to the centre of L1. The H.T. feed from R2 to L2 is soldered initially to the centre point of this coil. The trimmer VC2 is set to minimum capacity and VC1 to about half capacity—say 5pF. The unit is then linked to the set using the prepared cable.

Upon switching on, it may be found that results are as they were before or even worse. Screw in the core of L2 for best results. Once some indication of the signal has been seen or heard, the core of L2, VC1 and VC2 must be adjusted to obtain optimum neutralisation. Alteration of the setting of the core of L2 will mean that the setting of VC1 must be altered

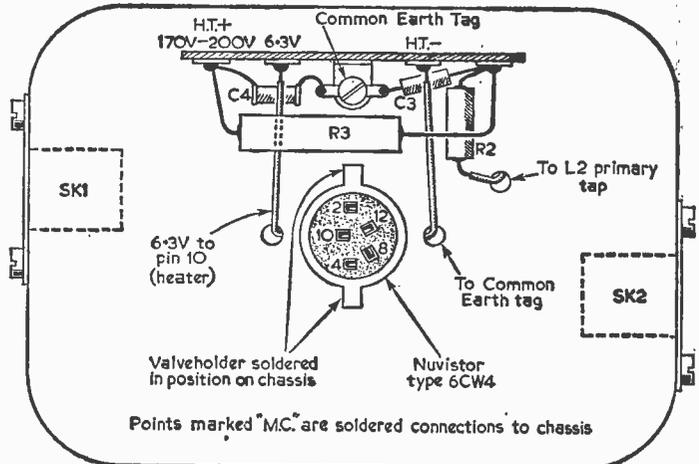


Fig. 3.—Details of the above-chassis component layout.

holding a dust core near to it; if results improve, then the inductance of L1 needs to be increased and the turns of L1 should be squeezed together. If results deteriorate when the dust core is held near to L1, then the turns will need to be spaced further apart.

It will be noted from Fig. 2 that L2 is wound with a larger diameter than its former (which serves to hold the dust core rather than to support the coil) and the H.T. tap may easily be moved along the coil (soldering it each time). Altering the tap may mean altering the settings of the core of L2 and VC1 and VC2 again for best results.

It cannot be emphasised too greatly that in areas of poor signal level, all these adjustments are quite critical for optimum results to be obtained; and they are, to some extent, interdependent, although adjustments in the input circuit have less effect

#### COMPONENTS LIST

##### Resistors

R1 56k  $\frac{1}{2}$ W R3 1W (see text)

R2 2.2k  $\frac{1}{2}$ W

##### Capacitors (ceramic)

C1 27pF C3 1000pF

C2 1000pF C4 1000pF

VC1, 2 1—10pF concentric trimmers, with a minimum capacitance of 1pF or less

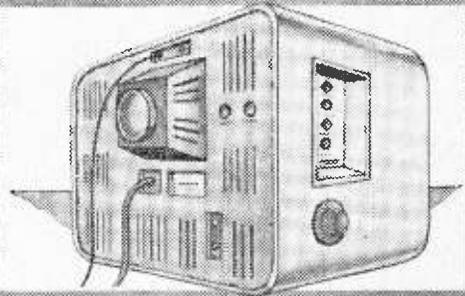
SK1, 2 Coaxial sockets

6CW4 Nuvistor triode valve

Coil former and dust core ( $\frac{1}{4}$  in.)

(Continued on page 528)

# Servicing Television Receivers



No. 69—THE REGENTONE TR177 AND ASSOCIATED MODELS By L. Lawry-Johns

**T**HE models covered by this article are the TR177, the 58C, the RGD Deep Seventeen and Deep Seventeen C, the Argosy 17C41 and the 14in. versions, the Regentone Ten-8, RGD 502 and the Argosy 14K41. There are several differences between these and models having the suffix A and slightly different numbers.

There are several "usual" troubles which may be outlined before discussing possible circuit faults.

### PY32 Failure

The usual symptoms of a failing PY32 are an excessive warming-up period, sometimes resulting in a delay of an hour or more before the sound is at full strength and the picture appears. The width may be reduced, also. The PY32 will often have a blue glow in the envelope and, although this may indicate overloading, this is very rarely the case and a replacement valve will nearly always restore normal conditions. All PY32 valves produced in recent years have had a single section in place of the double assembly of the early version. The diagram shows the connections to pins 3 and 5 through separate surge resistors. When a new PY32 is fitted pins 3 and 5 should be strapped together.

### EY51 Failure

The EY51 is V15 in the layout diagram, and this, of course, is the EHT rectifier. The heater of this often becomes o.c., resulting in no picture being displayed on the screen. These symptoms

could, of course, be caused by many factors, but a few simple tests will quickly determine whether the EY51 is at fault or not. The first thing to do is to release (not remove) the two screws holding the mains dropper plate. Lift this up and leave it suspended by the leads. Remove the packing (sound insulating) pieces to expose the top of the line output transformer to which the EY51 is wired, single wire end to the left, double wire end to the right. If the EY51 is at fault a strong spark will be drawn from the left side connection. There will be no spark available at the right side. A complication occurs when the act of drawing a spark temporarily welds up the break in the heater element, thus restoring the EHT and the picture. Normally this does not last long, and the heater again fails. It is not easy to replace the valve with the chassis in the cabinet, and it takes only a matter of minutes to withdraw the chassis.

### Unboxing

Remove the cabinet back. Remove the aerial input socket (two P.K. screws holding the panel to cabinet). Remove the front control knobs; the inner channel switch and volume knobs have grub screws, but the fine tuner and contrast pull off. Remove the loudspeaker leads by pulling the clips off the speaker tags. Remove the two rear side flange 2B.A. screws which are held at an angle by the shaped bracket under each. Withdraw the chassis complete. (Two wood screws may be found on the rear edge which will prevent the chassis moving.)

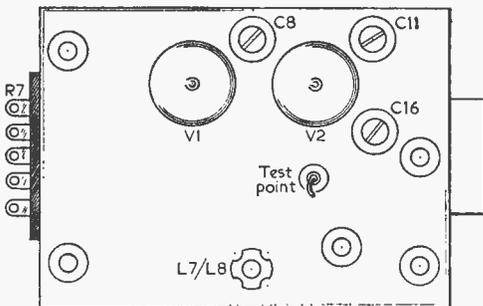


Fig. 1.—The above-chassis layout of the tuner unit.

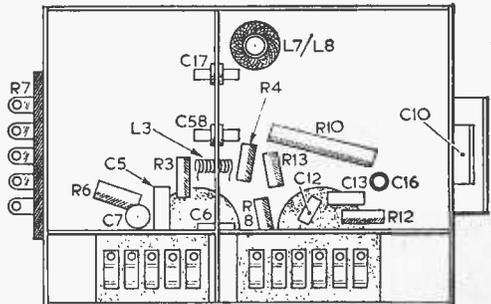


Fig. 2.—The under-chassis layout of the tuner unit.

On some models it is also better to remove the loudspeaker to avoid tilting the chassis unduly.

**Tuner Unit**

The contacts of the tuner unit usually require attention at frequent intervals as difficulty may be found in locating the desired channel on the selector switch.

With the cabinet on its side and the bottom cover removed, the lid of the tuner can usually be sprung off, although on some models the bottom of the cabinet interferes with this, and it is sometimes easier to remove the chassis. With the tuner lid off, the coil biscuits of the turret are exposed and the tarnish on the silver studs can be seen. All studs should be cleaned and polished and then lightly smeared with MS4 silicone grease. The contact springs do not normally require attention, but the recent articles on tuner units by G. J. King should be studied. If it is found necessary to retension the bow of the springs slightly, do this

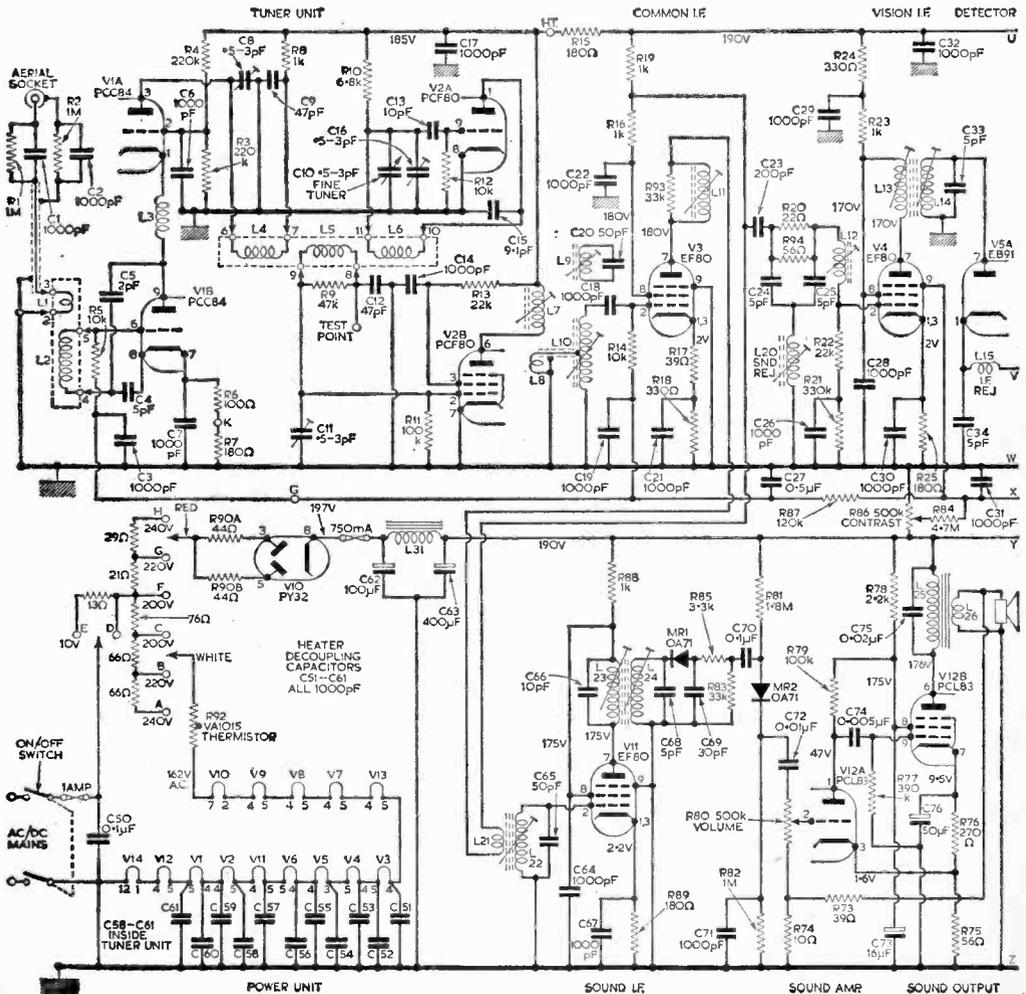
with great care as the tuner can easily be ruined by distorted springs.

**Weak Signals**

In some situations, although an efficient aerial is in use, reception may still be poor. This often involves frequent replacement of the PCC84 to keep a tolerable picture, particularly on Band III. We are often asked whether a PCC89 can be used to replace the PCC84, and the answer to this is no. The input capacity of the PCC89 is too high to allow the circuits to be tuned. However, it is possible to fit a Mazda 30L15, which does give a useful increase in gain when the circuits are properly trimmed. The trimmer C8 will need to be unscrewed a couple of turns and the aerial coil core (L2) adjusted from the rear of the tuner.

It is also possible to increase the I.F. (V4) stage

Fig. 3a (below) and Fig. 3b' (next page).—The complete circuit diagram of the Regentone TR177.



gain by disconnecting pin 9 from the AGC line and connecting it to chassis (6) or cathode (1 and 3). As the circuit stands, pin 9 of V4 (suppressor grid) acts as a clamp diode to prevent the AGC line becoming positive. The lead to pin 9 may be connected to a crystal diode, say an OA71, the positive end of which may then be connected to chassis. Valve V4 will then work at full gain, but if the connection of pin 9 to pins 1 and 3 results in instability, connect pin 9 instead to chassis (pin 6).

**Sudden Loss of Sound**

This is usually caused by V12 (PCL83) developing on o.c. electrode and although a smart tap on the valve envelope may restore signals temporarily, the valve should be replaced. As a general rule, the I.F. stage EF80 valves do not give trouble.

When there is no sound from the speaker at all, and the PCL83 is not at fault, check the H.T.

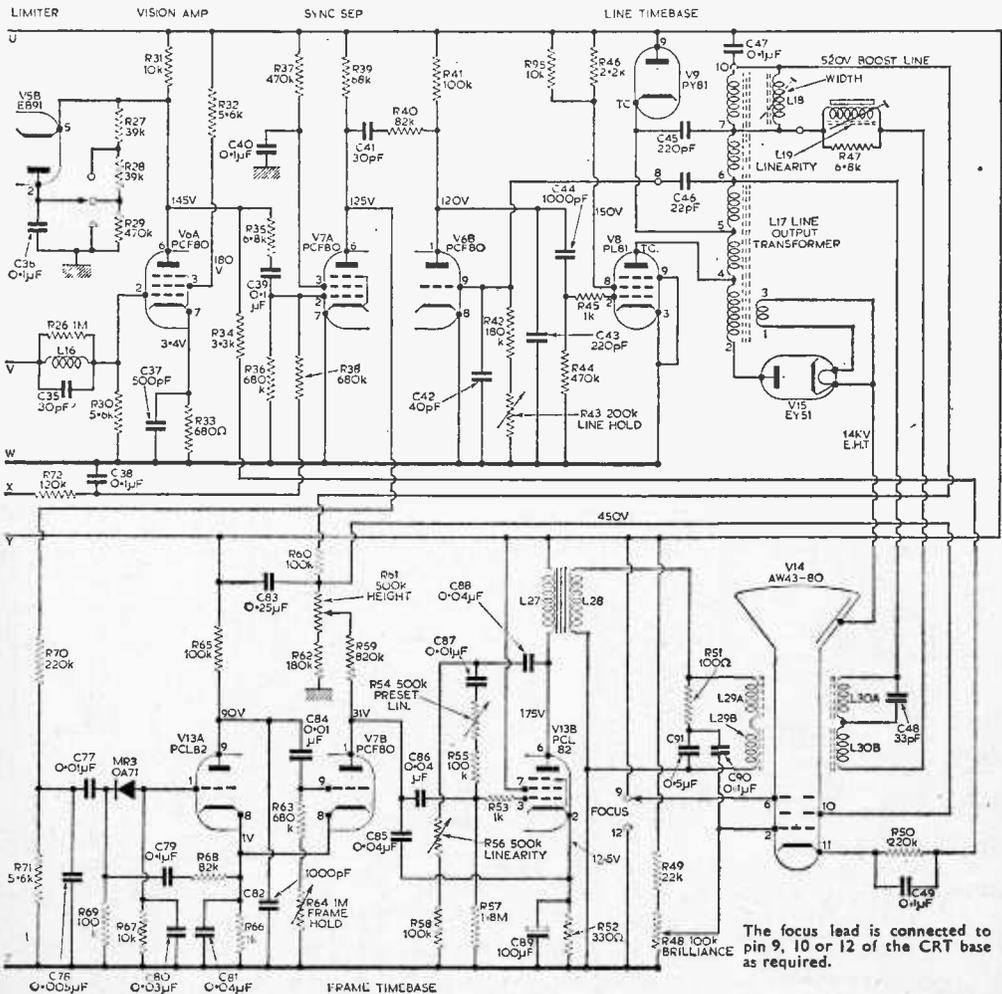
voltage to pin 6 as the sound output transformer (L25) sometimes becomes o.c.

The more common faults have now been dealt with, and it is now necessary to outline the more routine methods of fault finding in order to rectify the less common, but still quite likely, troubles which can occur.

**Line Hold**

When the screen is filled with a mass of lines which cannot be resolved into a locked picture at either extremity of the line hold control, check V6 (PCF80) and R42 (180k). This resistor should also be suspected when the hold control is at one end of its travel and the hold is still unstable.

The PL81 could be at fault, but this is less likely. If the condition is accompanied by lack of width and perhaps compression at the bottom of the picture, the H.T. voltage should be checked and, if this is low, the PY32 changed.



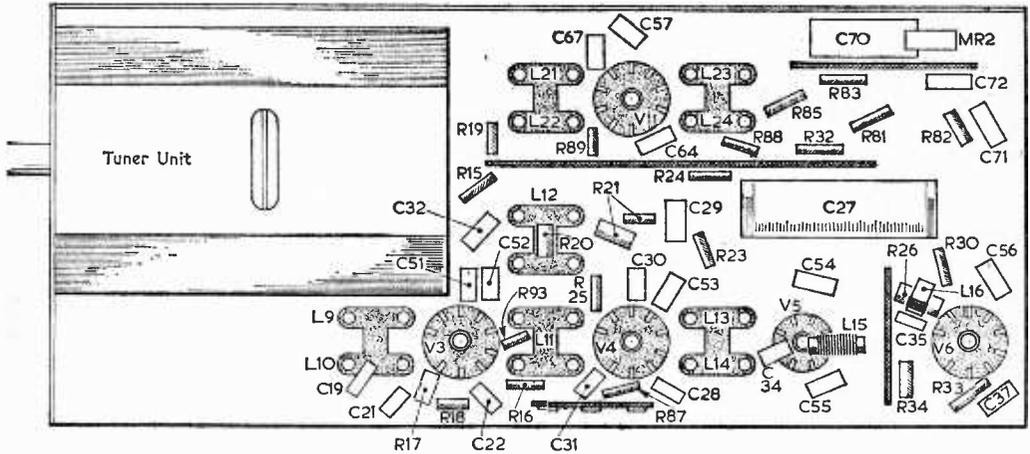


Fig. 4.—The under-chassis layout of the I.F. section.

**Lack of Width**

If the H.T. Voltage is not much below 190, the PY32 need not be suspected, and the PL81 and R46 (2.2k) should be the first suspects. It is important to check R46, since although width may be restored by replacing the PL81, this may only be temporary and the same conditions may manifest themselves again within a short time. This results when the PL81 is being overrun by R46 falling in value, usually to about 500Ω. To avoid a repetition of this it is better to replace R46 with a 2.2k 5W wire-wound resistor. R95 plays little part in all this, and when R46 is replaced by a wire-wound resistor it can be disconnected altogether.

**Striations**

When the vertical rulings are observed down the left-hand side of the screen, attention should be directed to R47 (6.8k), which is wired across the linearity coil.

**No Picture**

No raster when the brilliance is advanced, and no whistle from the line time-base, normally denote a faulty PL81, but V6 (PCF80) and V9 (PY81) should be checked if necessary. If the valves are not at fault, check C47. If the PL81 is overheating check C45 (220pF 5kV).

(To be continued)

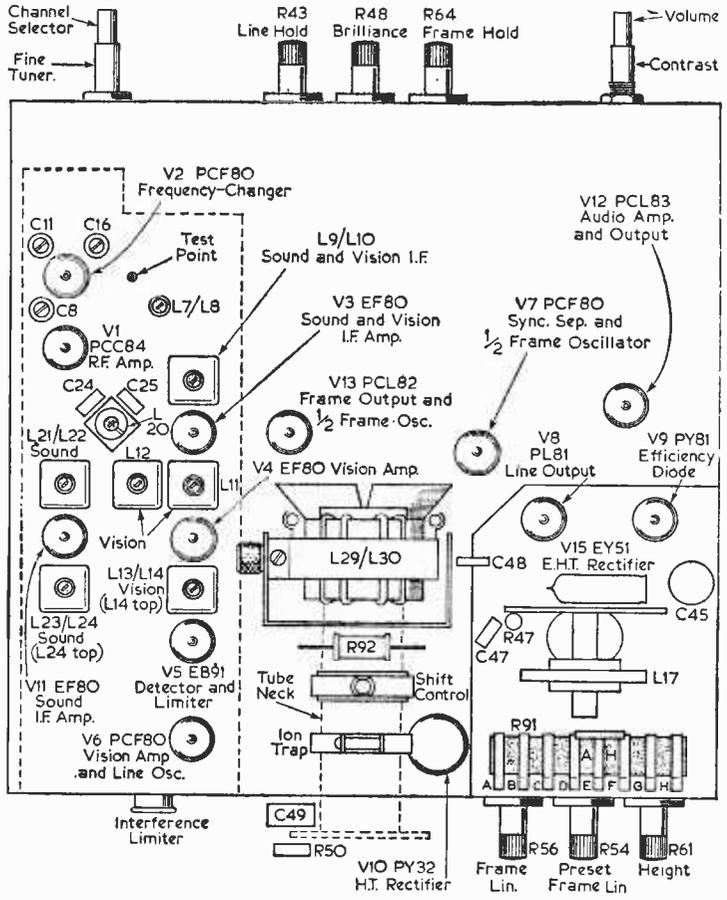


Fig. 5.—Plan view of the chassis.

# Underneath the Dipole

A MONTHLY  
COMMENTARY

By Icons

**R**ELIGIOUS programmes have not been mentioned very often in this column other than in connection with royal weddings and similar important news events. But the attention that is now being given to their artistic and reverent presentation prompts me to refer to one or two morning services of particular interest.

Curiously enough, my bouquets go to ITV Companies who have devored much thought to this type of programme lately. There was, for instance, the service on the ITV network relayed from St. Clement Danes, London, known as the R.A.F. Church. The simple and moving service of dedication by the Lord Bishop of Maidstone was beautifully photographed, with superb sound reproduction of choir and organ and a reverently spoken commentary. The ceremony of the handing-over of the Royal Air Force Books of Remembrance was smoothly followed in the presence of a large congregation, including H.R.H. the Duchess of Kent, and the ritual was simple yet impressive. There were pleasing shots of the choir, with strong back-lighting of a bright Sunday morning through the church windows.

## Ritual

The following Sunday morning another fine religious outside broadcast took place when Westward Television (in co-operation with Southern Television) took viewers to a service at Buckfast Abbey. This remarkable community of abbots, priests and monks completed the building of the abbey only twenty-four years ago on the site of an ancient Benedictine settlement, and though it is modern in many ways, the ritual of the service was traditional, closely followed by strategically sited cameras and microphones under the direction of Berkeley Smith. Close-ups of

the monks carrying out the devotions of high mass were impressive, every detail of the symbolism being explained in the restrained commentary by Monsignor G. A. Tomlinson. Long shots of the abbey were particularly impressive.

This kind of Sunday morning offering adds much to the prestige of ITV generally.

## Colour

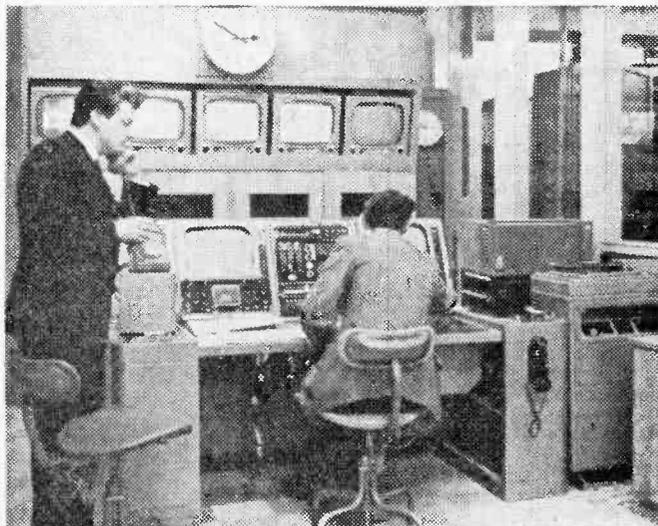
Certain newspapers are campaigning for colour television in Britain as soon as possible—if not sooner. I sometimes wonder if the people who so ardently write about the necessity for colour television would be prepared to give financial backing to a colour television service at the present time. Certainly, the major technical problems have been overcome to a large degree, excepting the cost and reliability of mass-produced sets.

Somebody remarked recently that even in America, where colour television has been operating for two or three years, it is desirable to have a receiver with a "built-in" maintenance man to keep a colour set in adjustment! Just how much money has been sunk in initiating and maintaining the colour television service there up to now I would not know, but it must be millions of dollars.

In Britain, we are still wedded to the 405 line standard and our BBC and ITV networks are largely based upon co-axial cable distribution designed for this standard. On the Continent and in America, microwave links are the accepted method of distribution, already set up for 625 or 525 line standards, which makes a change-over to colour far easier.

## Timing

There are some peculiar quirks of programme timing on



The master control of the Westward TV studios. From here there is a good view of the studios through the windows on the right.

both BBC and ITV networks these days. Cowboys and Indians and the "horse operas" of the Wild West are popular items with children as well as grown-ups, but some of the more recent series have been marred by scenes of violence, whippings and stabbings which would not have been tolerated by the British Board of Film Censors a few years ago. They might even make Lord Morrison, chief censor, flinch now.

Well-produced dramas, excellently staged and photographed, make good television material for late evening. "Cheyenne" is a case in point. But for the fascinating adherence to the stock situations originally created in the silent film days of Essanay's Bronco Billy, give me "Lawman", with John Russell as the wooden-faced marshal, Dan Troop.

There is nothing very original about the stories in this series and the outcome of almost every situation can be anticipated; yet the production is so excellently carried out that one's interest is not merely held—it is gripped. The introduction of the very young deputy sheriff, Johnny McKay, is a gimmick that hasn't been used for some years and undoubtedly gives additional appeal to teenage viewers. Much of the technical polish of this series is due to first-class film editing of picture and expert dubbing of music and effects. "Lawman" is on my list of "musts".

#### Vintage Films

I must say that I thought Associated Rediffusion were scraping the barrel a bit when they put on "Forty Second Street", one of the earliest American musical films, starring Ginger Rogers, George Brent, Bebe Daniels, Ruby Keeler and Warner Baxter. At least, that was what I thought until I saw it again after twenty-five years or so had elapsed!

Old though it was, in style and production values, it still held attention as a robust entertainment about theatrical back-stage life; it was a film which turned out to be the prototype of so many American films with the same theatrical background. This is the original film about temperamental stage folk, and, in particular, about a Broadway producer who was facing-up to his

last chance in "big time" shows, after a series of failures. When his star, played by a youthful Bebe Daniels, breaks her ankle in the final rehearsal of the show, all seemed to be lost. However, Ruby Keeler as the inexperienced understudy, steps into the part and saves the show and also the future of the producer.

The part of the producer was played, or rather, overplayed, in the grand manner by Warner Baxter—and a fine flamboyant character he gave us. This is just the kind of cast-iron role all actors long for, a part that gives them an opportunity to rant and rave in the "hammiest" fit-up manner, and get away with it!

"Forty Second Street" contained no "Method" school of acting, and in spite of an early sound recording system being used (Warner Vitaphone sound on disc as an alternative to the normal sound track) every word was audible.

#### Cup Tie

BBC and ITV are fighting fairly evenly in most regions for the Saturday audience, particularly in the afternoon when the BBC's "Grandstand" seems to score the highest marks in the research polls. It was interesting to watch the Cup Tie Final with BBC and ITV versions side by side on different receivers in a radio shop. I visited several

radio shops that were within a few yards of one another and compared results under differing reception conditions.

On the whole, I thought the ITV picture was better, but that the BBC had the best commentary and sound treatment. This must have been the general opinion because almost every shop put on the BBC sound to pictures from both ITV and BBC.

Both organisations covered the victorious goals by Tottenham Hotspur, with skilled following by cameras with zoom lenses. The ITV version was produced for Associated Television by Anthony Flanagan, and a fine job he made of it.

This rivalry reminds me of the days when the four cinema newsreels used to compete for being the "first out" with their films of the Derby, the Boat Race and the Cup Tie Final. At that time, if you asked anyone in Wardour Street who had won the Cup Tie Final, you would probably get the "Pathe Gazette" or "Gaumont Graphic" — whichever firm's motor cycle despatch rider, with the precious film in his haversack, turned the corner out of Shaftesbury Avenue. So far as this year's Cup Tie Final is concerned, I would say it was a 1-1 draw between the BBC and ITV, with "sound" scoring for BBC, and "sight" for ITV.

## PRACTICAL WIRELESS

### Chief Contents of the July Issue

#### Now on Sale, 1/6

- AN INEXPENSIVE AMPLIFIER
- AN INTRODUCTION TO STEREO
- ADDING COMMUNICATIONS FEATURES
- A VALVE/TRANSISTOR SHORT WAVE
- PHASE SPLITTERS AND PHASE REVERSERS
- DESIGNING MULTIMETER CIRCUITS
- AN AMATEUR COMMUNICATIONS RECEIVER
- TRANSISTORISED SIGNAL TRACER
- A TOP-BAND TRANSISTOR TX
- TRANSMITTING TOPICS
- CLUB NEWS
- ETC., ETC., ETC.

# TUBES

HIGHEST QUALITY—NEW LOW PRICES  
Carr. & Ins. 12/6

	8 Months Seconds	12 Months REGUNNED	12 Months NEW TYPES
<b>MOST MULLARD.</b> MAZDA, COSSOR, EMITRON, EMI- SCOPE, BRIMAR, FERRANTI TYPES, PROCESSED IN OUR OWN FAC- TORY.			
New Mullard, Mazda + U.S.A. Guns used.			
9/10in.	£1-10-0	£3- 0-0	£4-0-0
12in.	£1-15-0	£3-10-0	MW 36/44, MW 36/24.
14in.	£2- 0-0	£4- 0-0	£5-0-0
15/17in.	£2-15-0	£4-15-0	CRM 172, MW 43/64.
21in.	£3-15-0	£5-15-0	£6-0-0

100 Condensers 10/-,  
100 Resistors 6/6.  
RECTIFIERS RM4, 15/6, RM5,  
21/-, 14A86, 17/-, 14A100, 25/6,  
14A91, 20/-, 14A1-2-5-9-2, 17/-,  
14A1-2-6-3, 20/-, (P.P. 1/6).  
Spares for all Sets, Scan Coils,  
Line, Block and Frame Trans-  
formers, etc., etc. S.A.E.

**TEST SETS TYPE 74A**  
£4-10-0 Complete worth £10  
A Service Scope 200/250 V.A.C. all  
Valves, ECR30 Tube Brand new.

**13 CHANNEL TV'S**  
Table Models. Complete with  
Valves and Tube. They are  
untested, not guaranteed to be in  
working order. 12 in. £2.19.0,  
(P.P. 12/6). 14 in. £4.19.0,  
(P.P. 15/-).

**5 CHANNEL TV'S**  
12 in. 39/-, 14 in. 59/-, (P.P. 12/6).  
**5 CHANNEL CHASSIS**  
12 in. 15/-, 14 in. 35/-, (P.P. 4/-).  
Speaker, L.O.T. Cabinet.

**VALVES**  
BY RETURN OF POST  
GUARANTEED 3 MONTHS  
NEW LOW PRICES

**10% DISCOUNT** SPECIAL OFFER  
TO PURCHASERS  
of any SIX VALVES marked in black type  
(15% in dozens). Post-1 valve 6d., 2-11, 1/-.  
FREE TRANSIT INSURANCE. All valves  
are new or fully guaranteed after-  
government or ex-equipment origin. Satisfaction  
or Money Back Guarantee on goods if  
returned unused within 14 days.

071	5/10L1	9/9 20P3	12/6	EB41	7/-	11B30	7/6	U71	8/-
1A71T	11/3 619G	7/3 20P4	17/-	EB81	3/6	HL14D	U74	8/-	8/-
1C67T	9/8 617D	6/- 20P5	15/-	EC33	3/3	619	U76	5/6	5/6
1F5GT	9/8 6118	8/6 25A60	9/-	EC41	4/9	HV22	7/6	U78	7/6
1L4	3/6 6119	12/6 25L6G	6/9	EC44	3/9	KT33C	6/6	U82	7/6
1N5GT	9/8 6119P3	8/6 25L6GT	9/-	EC46	7/8	KT36	9/-	U107	11/-
1R6	5/6 6P25	8/6 25Z4G	7/3	EC49	3/6	KT44	7/6	U118	6/6
1R4	3/6 6P3	12/6 25A6	3/6	EC52	3/6	KT45	8/6	U119	6/6
1B5	4/9 6G7G	6/6 30P6	6/6	EC53	2/1	KT49	8/6	U122	6/6
174	3/9 6G7GT	8/9 30P11	9/-	EC54	3/6	KT49	8/6	U124	9/9
2A3	7/8 6SA7	5/9 30P4	12/6	EC55	9/8	KT48	12/6	U145	6/6
2121	4/9 6SH7	4/9 30P12	8/6	EC56	4/9	KT49	5/9	U147	5/6
21A	4/9 6SH7	1/6 30P13	10/6	EC57	3/6	KT49	5/9	U149	7/6
344	7/- 6G47	4/9 35L6GT	9/-	EC58	9/-	KT49	5/9	U150	6/6
381	6/- 6K7	5/3 35V1	6/9	EC59	6/-	KT63	5/6	U151	8/6
3V4	6/8 6SL7GT	6/- 34Z4T	5/3	EC61	5/6	MU4	9/-	U152	7/-
3E1G	6/8 6SN7GT	4/6 30C19G	9/-	EC62	8/-	N18	7/3	U153	6/6
3T4	5/9 6BQ7	6/-	19/-	EC63	6/9	N37	1/1	U154	14/6
5U4G	4/9 6SS7	4/6 50L6GT	9/-	EC64	9/9	N74	15/-	U121	11/-
5V4G	8/9 6U1GT	10/6 61BT	16/-	EC65	7/9	N108	16/-	U241	9/6
5Y3GT	5/9 6V8G	5/6 818PT	11/-	EC66	8/6	PC44	7/6	U301	15/-
5Y3GT	6/- 6V8GT	6/6 80A8	9/-	EC67	8/6	PC45	9/3	U308	7/6
6A4G	8/6 6V4	5/- 150BT	6/6	EC68	12/6	PC48	19/-	U229	6/6
6Z4GT	11/- 6X5G	5/- 30T(A)	5/6	EC69	8/6	PC49	13/6	U319	11/-
6A4	8/- 6V3GT	5/6 80T(A)	3/9	EC70	8/6	PC40	7/6	U403	9/6
6A8A	9/8 6V6G	7/8 953	3/9	EC71	8/-	PC42	7/3	U409	8/6
6A7	4/3 7B6	9/- 958	2/6	EC72	6/-	PC43	19/-	U400	8/6
6A8B	9/8 6V4	5/- 150BT	4/6	EC73	9/8	PC42	7/3	U402	6/6
6A17	7/9 7C5	7/8 9003	4/6	EC74	12/6	PC43	10/6	U404	7/9
6A85	6/8 7E8	7/3 ATP4	2/9	EC75	7/-	PC44	7/6	U406	8/6
6A15	6/8 7H7	7/6 A31	9/-	EC76	2/3	PC25	7/3	U409	7/9
6AM6	3/- 7E7	9/- B36	8/6	EC77	4/6	PC45	7/3	U401	14/6
6A95	6/- 7V4	7/6 9001	4/6	EC78	4/6	PC46	5/3	U402	12/6
6A78	6/- 10C1	11/- C1C	8/6	EC79	6/-	PC3	8/3	U404	7/9
6A06	7/8 18C2	13/6 18C31	21/-	EC80	6/9	PC36	10/6	U401	8/6
6H8G	3/6 10F1	5/9 CCH35	14/-	EC81	3/-	PC38	18/6	U402	11/3
6H6A	5/9 10L11	14/6 CL13	11/9	EC82	4/6	PC1	8/9	U403	13/6
6H6B	5/9 10P13	9/9 EL22	13/6	EC83	12/6	PC2	6/9	U401	14/6
6G8G	12/6 10P14	9/- D63	1/6	EC84	4/6	PC3	6/9	U402	5/6
6H6V	7/8 12A17	8/9 DA80	2/6	EC85	3/6	PC4	8/6	U400	7/6
6H7	5/8 12A18	8/9 DA92	3/9	EC86	11/6	PC4	7/9	U403	8/9
6C9	3/6 12A19	7/6 DA92	4/9	EC87	11/6	PC4	11/6	U406	6/9
6C9	4/9 12A17	5/8 DA96	7/3	EC88	12/6	PC4	7/9	U400	7/6
6C9	8/8 12A17	6/- DF33	3/9	EC89	11/6	PC4	7/9	U401	7/6
6CD6G	21/- 12A17	6/9 DF31	3/9	EC90	6/3	PC4	11/6	U401	11/3
6C6	8/3 12A16GT	3/6 DF92	2/6	EC91	7/6	PC3	7/8	U404	9/9
6E1	4/9 12K7G	5/- 125BT	6/6	EC92	4/6	PC4	9/6	U404	7/6
6E1	4/9 12K8GT	DH77	6/6	EC93	8/6	R18	11/6	U400	9/6
6F12	3/-	DH19	9/9	EC94	8/9	R19	11/6	U6	12/6
6F13	6/9	DN32	11/3	EC95	8/9	T41	7/6	U7	9/6
6F14	9/8	DK91	5/8	EC96	10/6	T44	7/6	U11	11/-
6E15	8/9	DK92	7/6	EC97	10/6	U11	8/6	U41	9/6
6H8	2/-	EN8K1	8/6	EC98	18/6	U14	9/-	U45	6/6
6J5G	2/9	EL33	3/6	EC99	11/6	U23	6/9	VR105/30	9/6
6J3TG	3/9	EL25	9/6	Small 8/-	U24	15/-	5/6		
6T7G	3/-	EL91	8/6	8/-	U25	12/6	VR150/30		
6K7G	2/9 13D3	7/6 EL92	4/9	6/6	U26	9/6	6/9		
6K8GT	6/6 1487	22/6 DL93	4/6	EL91	7/6	U31	7/9	X63	9/6
6K7G	2/9 19B0G	DL94	6/9	EL92	6/6	U34	X66	11/-	
6K7GT	4/9	DL96	7/3	EL91	6/6	U35	11/-	X76H	12/-
6K80	5/8 20D1	8/6 EA50	6/6	EL92	7/6	U37	20/6	X78	14/6
6K8GT	6/9 20F2	5/- EB36	7/6	EL91	11/6	U50	5/9	X79	18/6
6K25	7/6 20L1	18/- EAF43	8/6	G232	8/9	U52	4/9	X63	6/6
6L1	12/6 20P1	9/9 EB34	1/6	HABC80	9/6	U70	5/6	Z68	9/6

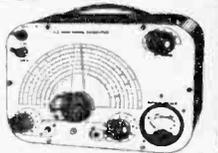
AMAZING VALVE AND COMPONENT LIST 6d.  
**TECHNICAL TRADING CO.**  
350/352 FRATTON ROAD, PORTSMOUTH

# RADIO BARGAINS

## SIGNAL GENERATOR



£6.19.6 or 25/- deposit and 6 monthly payments of 21/6. P. & P. 6/- extra. Coverage 100 kc/s-100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Metal case 10 x 6 1/2 x 5 1/2 in., grey hammer finish. Incorporating three miniature valves and Metal Rectifier, A.C. Mains 200/250. Internal modulation of 400 c.p.s. to a depth of 30%; modulated or unmodulated R.F. output continuously variable 100 milli-volts. C.W. and mod. switch, A.F. output and moving coil output meter. Grey hammer finished case and white panel. Accuracy plus or minus 2%.



Cash £4.19.6 or 25/- deposit and 4 monthly payments of 21/6. Plus Postage and Packing 5/-. Coverage 120 kc/s-54 Mc/s. Metal case 10 x 6 1/2 x 4 1/2 in. Size of scale 6 1/2 x 3 1/2 in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30%; modulated or unmodulated R.F. output continuously variable 100 milli-volts. C.W. and mod. switch variable A.F. output and moving coil output meter. Grey hammer finished case and white panel. Accuracy plus or minus 2%.

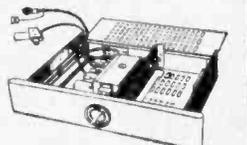
## ALIGNMENT ANALYSER

A.C. mains 200/250 v. Provides "Wobulator" (Sweep Frequency) Operation, for FM/TV alignment linear frequency sweep up to 12 Mc/s. From 400 kc/s-80 Mc/s. Capacitance Measurement. Two ranges provided 0-60pF and 0-12pF. Special Facility enables true resonant frequency of any tuned ckt. i.F. transformer, etc., to be rapidly determined. Cash price £6.19.6, plus 5/- P. & P. H.P. terms 25/- deposit. plus 5/- P. & P. and six monthly payments of 21/6.



## CHANNEL TUNER

Will tune all Band I and Band III stations. BRAND NEW by famous manufacturer. Complete with P.C.C. 34 and P.C.P. 30 valves (in series). I.F. 16.19 or 33.33. Also can be modified as an aerial converter (instructions supplied). Complete with knobs. 32/6 Plus 3/6 P. & P.



## HEATER TRANSFORMER

To suit the above, 200-250 v., 6/-, plus 1/6 P. & P.

## LINE E.H.T. TRANSFORMERS

With built-in line and width control, 14kV. Scan coil, 50m. deflection on ferrite yokes. Frame O.P. transformer pl. 18 kV smoothing condenser. Can be used for 14in., 17in. or 21in. tubes. Complete with circuit diagram. 29/6 Plus 4/- P. & P.



## FOCUS MAGNET

Suitable for the above (state tube), 10/- plus 2/6 P. & P.

## A.C./D.C. POCKET MULTIMETER KIT

2in. moving coil meter, scale calibrated in A.C./D.C. volts, ohms and milliamperes. Voltage range A.C./D.C. 0-50, 0-100, 0-250, 0-500. Milliamps 0-10, 0-100. Ohms range 10-10,000. Front panel, range switch, wirewound pot (for ohms zero setting), toggle switch, resistor and rectifier, 19/6. P. & P. 1/6. Wiring diagram 1/-, free with kit.



**RADIO & T.V. COMPONENTS (Acton) LTD.**  
23c HIGH STREET, ACTON, LONDON, W.3  
All enquiries S.A.E. Goods Not Despatched Outside U.K.

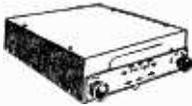
## EDDY'S (Nottm.) LTD.

Dept. PT 172 ALFRETON ROAD, NOTTINGHAM  
**POCKET RADIO.** 2 Transistors with miniature speaker. Complete with all parts wiring diagram and full instructions. 27/6. Batteries 1/- P. & P. 1/6.

**NIFE ACCUMULATORS.** 1.25 v. size 3 x 2 1/2 x 1/2 amp hrs. weight 13 ozs. 1/11 ea. P. & P. 1/6, one only add 9d. per cell.

## Build your own CAR RADIO!

★7 Transistors ● Long and Medium Waves ● Two Watts Output ● R.F. Stage and Automatic Gain Control



**10 1/2 Cns.**  
 P & P 5/- extra

6 or 12 volts (state which)  
 Supplied with full instructions  
 Size 7 1/2 x 7 1/2 x 2 1/2 in.  
**SPEAKER, extra 17/11**

**V.H.F. AERIALS.** Expanding complete and easy to fit. No technical knowledge required, 6/11. Post 10d.

**ACOS CRYSTAL PICK-UPS.** Turnover heads (2 sapphire styli) 32/6. P. & P. 2/6.

**ALL ABOVE ARE NEW AND GUARANTEED**

**GUARANTEED NEW OR SURPLUS VALVES BY RETURN POST**

ID5	7/6	20P3	12/6	EAF42	8/6
IL4	3/6	25A6G	8/6	EY51	7/11
IR5	5/6	25L6GT	7/6	EY86	7/9
IS5	4/9	35L6GT	8/11	EZ81	6/9
IT4	3/11	35W4	6/11	HL23DD	
3A4	6/-				7/11
354	5/11	35Z4	5/3	KT33C	6/6
3V4	6/9	30F5	8/6	MU14	7/-
5U4G	4/9	954	1/6	PCC84	7/3
5Y3G	5/9	955	2/6	PCC85	9/3
5Z4G	7/6	956	3/6	PCC89	10/6
6A55	4/-	AC2/		PCF80	7/3
6B8G	2/11	PENDD	7/6	PCF82	7/6
6C4	3/6	DAF91	4/6	PCL83	12/6
6F34	6/6	DAF96	6/11	PCL84	9/6
6J5G	2/9	DF91	3/11	PCL85	12/6
6J5GT	3/-	DF96	6/11	PENA4	12/6
6J5M	4/3	DK91	5/6	PEN36C	8/-
6K7G	1/11	DK92	7/6	PEN46	7/6
6K8G	5/3	DL96	6/11	PL33	8/3
6Q7G	5/9	DM70	5/11	PL36	10/9
6SA7M	5/9	EB41	6/11	PL81	9/-
6SG7M	4/9	ECC85	6/11	PL82	7/-
6SJ7M	5/9	ECH42	7/9	PL83	7/-
6SL7GT	6/6	ECL80	7/-	PL84	9/6
6SN7GT	4/3	ECL82	9/6	PY81	6/6
6U4GT	10/6	EF36	3/-	PY82	6/6
6V6G	4/9	EF40	12/3	PZ30	9/6
6V6GT	6/-	EF41	7/6	TD44	7/6
10F1	6/6	EF42	7/6	UCH42	7/6
12A6	5/3	EF80	5/-	UF41	7/9
12AT6	7/6	EF85	5/11	VP23	6/3
12K7	5/3	EF86	9/6	R19	18/6
12Q7	5/3	EF92	4/6	UY41	6/3
20D1	8/6	EL84	6/6	UY85	6/3
20P1	9/6	EL91	4/6	TY86F	11/6

Any parcel insured against damage in transit for only 6d. extra per order. All uninsured parcels at customers risk. Post and Packing 6d. per valve extra. C.W.O. or C.O.D. Only C.O.D. charge 3/- extra, S.A.E. with enquiries.

## COYNE'S NEW PIN-POINT TV TROUBLES

**TAKES HEADACHES OUT OF ALL SERVICING PROBLEMS!**



Your most useful on-the-job "tool"! Quickly and easily pin-points the exact trouble in any TV set. Covers 70 symptoms, 700 trouble spots. Over 540 cross-indexed pages; 50 time-saving Check-Charts; 290 diagrams and photos; explanation of circuits and designs.

### SIMPLE CHECK-CHART SYSTEM SAVES TIME!

This amazingly practical handbook shows you how to find the trouble in any TV circuit FAST! Simple cross-index tells you in what section you'll find cause of trouble. Handy Check-Charts then help you accurately locate the EXACT trouble spot. Cut waste time, eliminate hours of aggravation, get right to the heart of the trouble in minutes.

### USE THIS BOOK RIGHT ON THE JOB—NO NEED TO MEMORIZE!

This Pin-Point Book was designed especially for on-the-job trouble-shooting. You simply turn to the indexed section, locate the circuit description and Check-Chart, and in minutes you have the trouble spot located and ready for repair. No complicated theory or mathematics. Down-to-earth, practical circuit description, service methods and trouble-shooting techniques. Published by the famous Coyne Electrical School and approved by leading authorities in the field.

J.E.G. Grover of Streatham says: "Immediately I glanced through this book I was convinced that your claims concerning the merits of this work were justified, for it is, without a doubt, the finest book of its kind that I have ever come across. It is not only unique in its presentation but it is also superbly produced."

G. Axam of London S.E.9. says: "I have spent nearly £50 on technical books over the past 5 years, all of which I feel has now been wasted as your book is the best I have yet had the pleasure of examining. It is practical, to the point, with just the right amount of technical information needed, covering almost every aspect of TV servicing."

### SEND NO MONEY!

Just mail coupon for free trial. After 7 days send only low price or return book and pay nothing.

### FREE TRIAL OFFER!

Mail Coupon NOW!

Mail Order Division, SIM-TECH BOOK COMPANY, Dept. P.I., Cater's Mill, West End, Southampton, Hants.

RUSH. TV Troubles 31/6d. plus 1/3d. postage for 7 day FREE TRIAL as per offer.

Tick here if enclosing full price, we pay postage; Same 7 day money back guarantee

Name .....

Address .....

.....

City..... County.....

## REBUILT TV TUBES

FULLY GUARANTEED  
 12 MONTHS

Complete New Gun fitted in every Tube

12in. ...	...	£4.00
14-15in. ...	...	£4.10.0
17in. ...	...	£5.00
21in. ...	...	£7.00

Immediate Delivery

Carriage and Insurance 10/- extra  
 Allowance on old tube

## NU-GUN TELETUBES LTD.

3 The Mews, Duckett Rd.

Harringay, London, N.4

Telephone: MOUNTVIEW 2903

## ALUMINIUM, LIGHT ALLOYS BRASS, COPPER, BRONZE

IN ROD, BAR, SHEET, TUBE, STRIP  
 WIRE, ANGLE, CHANNEL, TEE

3,000 STANDARD STOCK SIZES

## H. ROLLET & CO. LTD.

6 CHESHAM PLACE, LONDON, S.W.1.  
 BELGRAVE 4300

Works:

36 ROSEBERY AVE., LONDON,  
 E.C.1

Branches at Liverpool, Manchester,  
 Birmingham, Leeds.  
 No Quantity too small

## P.P. COMPONENTS LTD.

219 ILFORD LANE, ILFORD, ESSEX.

Stamp for FREE Catalogue.



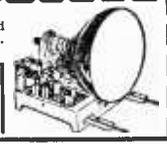
### VALVES

8d. ea. 7/8 doz.  
 2D21, 8AL5, 6X5,  
 6D2, 6H6, 6S7,  
 6H7, 6S7,  
 8P1, 8D2, T41,  
 9D2, 10C2, 12Y4,  
 FB31, EF38,  
 EF50, TT11, 266,  
 1/8 ea. 1/76 doz.  
 6F1, 6K25, 6F15,  
 6H7, 88Q7, 7Y4,  
 6AT6, EB41,  
 EBC30, EBC41,  
 EF91, PEN45,  
 PEN46, 2/8 ea.  
 30/- doz. 10D1,  
 10F1,  
 1,000s more.  
 P. & P. 1-7d.,  
 6-1/8.

Tube Cabinet, ONLY 19/9.  
 Exclusive design. Two-tone  
 rexine det. lid. Can be adapted  
 to 11/4 Player cabinet. Siz.: 14 1/2  
 x 13 x 9 1/2 ins. & Carr. 4/8.

T.V. CHASSIS, 5/8  
 Piecey, less valve and  
 tube. Circuit inc. Ins.  
 and Carr. 7/6.

Speaker—Sale 8/9 ea.  
 5", 6", 8", 7" x 4". Ex-  
 Manufacturers' sal-  
 vage. Money Back  
 Guaranteed. P.P. 2/9.



# Letters to the Editor

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

**SPECIAL NOTE:** Will readers please note that we are unable to supply Service Sheets or Circuits of ex-Government apparatus, or of proprietary makes of commercial receivers. We regret that we are also unable to publish letters from readers seeking a source of supply of such apparatus.

## LINE CONVERSION

**SIR,**—I read recently, in the daily Press, that a German engineer had developed a unit which would enable any receiver, no matter for what line system it was designed for, to be converted to any other line system. Perhaps you could print some details, or one of your more knowledgeable readers could enlighten us as to how such a scheme can be used. It does not appear possible to include any form of electronic device in a set to change the line data, and I feel that this is another case where a non-technical journalist has been either hood-winked or has misunderstood what has been told to him. I think I am right in saying that the European transmissions are radiated to us in this country by the simple expedient of having two sets facing each other, one receiving the Continental transmission, and the camera opposite then picking up the received picture and retransmitting it to us.—**R. E. BRIGDEN (N.W.).**

## AERIAL MATCHING

**SIR,**—I recently had an aerial installation put up by a local service-man, and it consisted of two separate aerials with a single down-lead. Results were fair, but I did not think they were the best which could be obtained. I decided to experiment, and after trying two separate leads and finding these were capable of much better results, I decided to try to make adjustments at the single lead receiver end. I found that odd lengths of coaxial played a vast part in the signals received. I finally got best results with two feet of coaxial, and I feel that there is some grounds for this and should be glad if any readers could let me have some data on the way this arrangement works. It does not seem to be the standard type of matching stub.—**R. TRENT (Swansea).**

## TRANSISTOR TV

**SIR,**—Many transistors have now been available for a considerable time, and all these different types would appear to make it possible to design a television receiver round them. Why has no set manufacturer yet brought out such a receiver? Is there some major snag? The overall size is controlled by the actual tube, but the weight, and also the generated heat could be

greatly reduced by a transistor arrangement, and I think it is time one of the firms did something in this connection.—**R. E. BURTON (Cardiff).**

## TELEVISION PROGRAMMES

**SIR,**—During a discussion at our works club the other day a most interesting thing developed as a result of an argument. It transpired that so far as we can trace there is not a single television programme on the air! This does sound a rather dramatic statement, but during our discussion we came to the conclusion that this is, in fact, the case, and when you consider all the programmes that are radiated you find that the majority are just sound programmes, put on TV without any modification, or they are stage or film plays. We could not find one programme that was pure TV. It is true that some of the film and stage plays are entertaining, but they are produced in the former case with the large screens in mind and mass entertainment audiences—not for a small screen at home. The plays also, are originally written for large audiences and pauses to permit laughs etc., are worked in. But we had to admit that we could not think of anything ourselves which would be pure TV.—**R. G. HALCROW (Perth).**

## HEADPHONES AND TV

**SIR,**—I recently had a relative staying with me who was very hard of hearing, and we had to have the set turned up very loud. I tried to find a way to include headphones in the set, but thought it might be risky on account of the fact that it was an A.C./D.C. set. I finally carried out what I think was a simple modification and should be glad to hear whether there are any snags to the idea. I found an old broken B9A valve in my spares box, and I removed all the glass leaving the supporting wires intact. To these I attached a short piece of dowel and a B9A holder and tracing out the electrodes in the valve in the set, I wired an ordinary output transformer so that it would come in at the anode circuit of the first L.F. stage. I included it in series with the normal anode load-resistor. To the secondary I wired two lengths of flex and took these to a small paxolin strip mounted on the side of the cabinet and over this I screwed a lozenge box as a screen, and to prevent accidental contact with the terminals. The headphones are joined by long leads (low-impedance) and are thus not overloaded, and give just the right strength of signal without the rest of the viewers being deafened. The inclusion of the transformer primary has not affected the signals so far as I can trace. The original valve is inserted in the holder mounted on the top of the dowel. I hope the idea will be of interest to others.—**F. R. TREWEN (Colindale).**

### OLD TUBES

SIR,—I have read one or two articles in your magazine, in which one is told to rejuvenate an old tube which is nearing the end of its useful life by running it from a transformer which has the function of driving the heater at a percentage above its normal rating. I was told some time ago of another idea for carrying out the same purpose, only in this case it was to be used with a tube which had passed beyond the stage at which the above-mentioned arrangement was carried out. Here one had a tube which had practically given up the ghost entirely, but a new spell of activity could be obtained by driving the heater at very much above its rating. The idea, as it was explained to me, was to take a D.C. source of over 100V (an H.T. battery for instance) and to attach two leads to the positive and negative ends. A clip was fitted to one of these ends which was then clipped on to one of the heater pins of the old tube. The remaining wire was then taken (the covering of course being removed to expose the bare wire), and this was then very carefully held and swept across the exposed tube base pins so that it made, very momentarily, contact with the remaining heater pin. This application of a high voltage for an infinitesimally short time was supposed to burn off the deposit of the heater and rejuvenate it. Has somebody been pulling my leg, or is this a legitimate "trade secret"?—D. E. WINNINGTON (Bradford).

### A READER'S THANKS

SIR,—I suppose you often receive brickbats from dissatisfied readers, but for the first time in my life I am writing to the editor of a magazine, and this time it is with a word of thanks for a recently published servicing article. My set had failed and a local man had looked at it and suggested it was time I bought a new set, but soon after this your magazine appeared and I saw the article on my set. I tried it with much trepidation, and you will be glad to know that as a result I found the fault, which cost me 7/6 to repair, and the set is now working as good as ever. I cannot resist saying "thanks" as we now have the "old faithful" and are quite an appreciable amount in pocket.—R. E. BATES (Southampton).

### LINE SCANNING AND COLOUR

SIR,—I cannot see why the Pilkington Committee has to be quite so long-winded in their decision about line definition for colour television. After even a number of meetings and discussions on the matter, I would have thought that the ultimate outcome can be simply a Yes or a No on 625 lines, and as quite good pictures are received on 405 lines I see no reason why the same can't apply with colour. For heaven's sake let's have a decision now, not next year.—K. R. CRASKE (Lincoln).

# A Nuvistor Band III Pre-amp

(Continued from page 518)

than those in the output circuit. However, alterations to the setting of the core of L2 *must* be followed by alterations to VC1 and VC2.

The adjustment procedure is long to set out, but is quite easy once initial adjustments have been tried.

### Curing Mis-Match

Note that if there is a mis-match between the receiver input and the output of the pre-amp, then the length of the cable linking them may influence results — try increasing or decreasing its length. It is also worth remembering that low-loss downlead is essential — in areas of weak signal, more than half of the received signal may be lost between the aerial and the receiver.

It is hoped shortly to describe another pre-amp which will cover Bands I and III (BBC and ITV) and as soon as development work and field tests are complete, full constructional details will be given. ■

### COIL DETAILS

L1 : 3 turns of tinned, or silver-plated, copper wire (the single stranded wire sold as "earth" wire is very suitable). The turns are spaced by the diameter of the wire and the coil is wound on a  $\frac{3}{8}$ in. former which is then removed. One end of the coil is left long for soldering to the common earth tag. The aerial tapping on to L1 is arranged to give optimum results during the alignment of the unit.

L2 : primary— $4\frac{1}{2}$  turns of tinned copper wire (about 22s.w.g.).  
secondary—3 or 4 turns of DCC copper wire (about 34s.w.g.) positioned at the VC1/VC2 end of the primary.

Note: As mentioned in the text, L2 is wound with a diameter of about  $\frac{5}{16}$ in.—larger than that of the former used which serves to accommodate the dust-core, rather than to support the coil. This is to enable the H.T. feed easily to be tapped on to L2 at the position.

The number of turns on the coils may have to be altered to secure best results, but the above data should be used for initial experiments.

**RECORDING TAPE—  
SPECIAL OFFER**

Famous American COLUMBIA (C.B.S.)  
Premier Quality Tape. Leader and atoy  
colls. Brand New and boxed. Double  
Play and other sizes in stock.

Standard	Long/Play
5in. 900ft. ... 15/-	900ft. ... 19/8
5in. 900ft. ... 18/8	1200ft. ... 22/8
7in. 1200ft. ... 21/-	1800ft. ... 32/8

Plastic Tape Spools  
3in., 2/9; 5in., 3/-; 5 1/2in., 3/8; 7in., 3/6

Redwood Prices	VALVES	Guaranteed	All
IT4 6/-	ECL82 10/8	PCF80 9/8	
1R5,1S5 7/8	EF80 8/-	PCL83 12/8	
384, 3V4 7/8	EF86 12/8	PL81 12/8	
DAF96 9/-	EL84 3/8	PL82 9/8	
DF96 9/-	EY61 3/8	FL53 10/8	
DK96 9/-	EV36 10/-	PV81 9/8	
DL96 9/-	EZ80 7/8	PY82 7/8	
ECL80 10/8	PCC84 9/8	U25 12/8	

**"6 plus 1" TRANSISTOR RADIO KIT  
— UNBEATABLE VALUE —**

Mrs. Current Production Offer—A fortunate bulk purchase enables us to offer one of the season's most outstanding bargains in Portable Transistor Radio Kits. This kit is a modern, sensitive quality circuit Receiver Unit with all the latest features. Six latest Transistors and 1 Diode, Printed Circuit, Med. and Long Waves, Ferrite Aerial, Car Radio Input,  $\frac{1}{2}$ w. Push-Pull output into 3 ohm Speaker, Calibrated Dial and Slow Motion Tuning, etc. Size: approx. 9 x 2 1/2in.



Kit, including printed circuit and components **£5. 5.0** p. & p. 2/6  
Set of 6 Transistors and 1 Diode..... **£2. 5.0** p. & p. 6d.  
Complete Kit—Bargain offer—only..... **£6.19.6** p. & p. 2/6  
3 ohm Speaker 7" x 3 1/2" 15/8.

Send for leaflet (3d. stamp) and judge for yourself

**TRANSISTOR BARGAINS!**

Sensational NEW REDUCED PRICES!  
LATEST TYPES — 1st GRADE BVA Mullard G.E.C.

OC44 10/6	Mixer	874	9/8
OC46 6/6	I.P.	873	9/-
OAS1 3/6	Diode	GEX34	3/8
OAS1D 2/8	Driver	GET114	6/8
2 x OC81D 17/8	2 x GET114	15/8	
Set of Mullard 6 Trans.	1 Diode, 48/8		
Set of GEC 6 Trans.	1 Diode, 46/-		

All Post Free.  
**DON'T MISS THESE BARGAIN PRICES—ORDER NOW!**

**LIMITED BARGAIN OFFER!**



**PORTABLE TRANSISTOR RECORD PLAYER**



- BARGAIN OFFER**
- 6 v. operation (2 E/R Type 900 batts.)
  - 1 watt Push-Pull output
  - 4 latest G.E.C. Transistors
  - 3 ohm 7 x 4in. Quality Speaker
  - GARRARD Fidelity Gram. Unit

**COMPLETE RECORD PLAYER KIT**

(3 Units) only **£7.19.6** Carr. 3/8.  
Circuit diagram, full technical spec. and constructional details (free with kit), 2/6, post free.  
Size: 11 x 9 x 5in.  
Colour: Two-tone Red/White with Polka Dot relief. Alternative Blue/Fawn with Polka Dot relief.

★ CABINET incl. Motor Board and 7 x 4 in. Speaker, 38/6. Carr. 2/8.

★ GARRARD BA 1 Gram unit, 59/8. Carr. 2/8.

**1 Watt 4-Transistor Amplifier**  
High quality unit with negative feedback giving 1 watt Audio output into 3 ohm Speaker.

AMP KIT only **£3.19.6** Carr. 2/6.  
Wired and tested, 17/6 extra.

**SEND FOR DETAILS NOW**

ONLY A FEW ITEMS ARE LISTED FROM OUR COMPREHENSIVE STOCK.  
WRITE NOW FOR FULL BARGAIN LISTS, 3d.



**RADIO COMPONENT SPECIALISTS**

70 Brigstock Road, Thornton Heath, Surrey

Phone: THO 2188. Hours 9 a.m.—6 p.m. 1 p.m. Wed. Open all day Saturday. By Thornton Heath Station.

Terms. C.W.O. or C.O.D. post and packing up to 1/2lb. 7d.; 1lb. 1/1; 3lb. 1/6; 5lb. 2/-; 10lb. 2/9; 15lb. 3/6.

**VALVES**

SALVAGE GUARANTEED

2/9 each 80/- doz.  
6AK5, 6AM6, 6F1, 6F12, 6F13, 6F14, 6F15, 6K7, 6K25, 6L18, 6L1D, 6P25, 6P28, 6SL7, 6SN7, 6SQ7, 6U4, 7A7, 7B7, 7C7, 7Q7, 7S7, 10D1, 10F1, 10P13, 10P14, EAB080, EOC34, EOC81, EF39, EF41, EF80, EF91, EY61, KTM1, PEN45, U22, UF41, UF42, UL41, UL46, UF41, VP133.

5/9 each 60/- doz.  
5P6, 6K9, 6Q7, 6V6, 12AU7, B4T7, 12K7, 12K8, 12Q7, 20D1, 20F2, 20F1, RBC33, EBF80, EOC31, EOC81, EOC82, EOC83, EOC84, ECF80, ECH35, EOL80, EL33, EL35, EL41, EL42, EZ40, G292, KT33C, POC84, PCF80, PLS1, PL82, PL83, PY80, PY81, PY82, PZ30.  
Post on 1—7d. On 6—1/6. On 12—2/6.

**— SPECIAL OFFER —**

SIX MULLARD TRANSISTORS AND DIODE

ONLY 47/6 per set.

- 1 OC81D ... .. 6/9 Each
- 2 OC81 ... .. 6/9 "
- 1 OC44 ... .. 9/9 "
- 2 OC45 ... .. 8/9 "
- and Diode ... .. 1/9 "

G.E.C. Types available.  
Post Free.



**COMPLETE 17in. TV £11.10.0**

An excellent 15-valve ex-Rental Table Model, Famous manufacturer. Tuned B.C.I.T.A. Guaranteed 12 months. Personal collection or delivered by arrangement up to 50 miles, special rate, or despatched in 3 parcels for easy assembly, 25/- Terms available.

**ELLIPTICAL SPEAKERS 15/9**

New. Slot type 7 x 4 and 8 x 3 inch. Post and packing 2/9.

**SPEAKER SALE 8/9**

Manufacturers salvage. 5, 6, 8 and 7 x 4 inch. Post and packing 2/9.

**MINIATURE SPEAKERS 16/9**

Brand new. 2 1/2 and 3 inch. Post and packing 1/-.

SEND FOR LATEST FREE LIST

**DUKE & CO. (LONDON) LTD.**

621/3 Romford Road, Manor Park, E.12. Phone: ILFord 6001/3

HOURS 9 a.m. to 6 p.m. Half day Thurs.



**"SABRINA" STILL WELL IN FRONT**

LOWER PRICES for 12 Months guaranteed tubes.

**COMPLETELY REBUILT**

ALL TYPES (including electrostatics)

FOR ONE MONTH ONLY TERMS, extended to cover this month's issue of Practical Television.

12" to 17", One Price **£5.10.0** (C.W.O.)  
21" also available at **£8.0.0**

Including Free Passenger Transit and Insurance. (Old tubes not required.)

**SABRINA C.R. TUBE CO.**

Electron Works, North Bar BANBURY, OXON

Telephone 2390

# BRAND NEW TUBES

12 months' guarantee  
TOP CLASS MAKE  
CARR. & INSURANCE PAID

12" MW 31-74 etc. **£5.5.0**

14" MW 36-24 etc. **£6.6.0**  
(in short supply)

17" CRM 171, 172 **£7.0.0**

## COMPLETELY REPROCESSED

to makers' specifications!

Rebuilt, Rescreened, Realuminised

14" . . . . . **£5.5.0**

15"—17" . . . . . **£5.10.0**

21" . . . . . **£8.0.0**

Carriage FREE

These are tubes of the HIGHEST QUALITY

That "difficult" tube? Let us quote.

TRADE ENQUIRIES INVITED

# LINE OUTPUT TRANSFORMERS

Direct Replacements for 500 sets.

Baird. T29, T163	53/-
T164, T167, T172, 2014, 1712	60/-
Bush, TV 11A, E, 1, 1A, B; TVF 12A, TVG12A, B, TRG 12A, B, TV12AM, TV22, 24; TRG24, TUG 24	45/-
Cossor, 930, 931, 932, 934, 949, etc.	58/-
Ekco, TS146; TS113-114; T161	47/6
T221, 231; TSC911, etc.	55/-
Ferguson, 841, 2, 3; 941 to 945	55/-
990T-998T; 103-145T; 203-248T	66/6
Ferranti, 14T3, 14T4, 17K3, 17T3	45/-
14T2, T1205, T1215, T1225, T1325, T1405, T1415, T1425, T1505, T1525	85/-
G.E.C. and H.M.V. mostly 55/- to	60/-
Invicta, T101-104; T108-110	52/-
T114-126; T133-142	60/-
Murphy, V114C, V116C, V118C, V120C, V130C, V180, V178, V200, V202C	45/-
Philips, 114 UFUM, 1115, U, 1437 U, 1446 U, 1726 U, 1746 U, 1747 U	65/-
383A, 463A, 563A, 683A	60/-
Pye, LV30, 16T, CS17, VT17	60/-
CRM, V4, V7, V7, VT7	53/8
Ultra, 815,917 (with rect. etc.)	85/-
Add Post 2/6.	

**SPECIAL! NEW L.O.T. COMPLETE** with:—Linearity and width controls. —EY86 base and top cap. — Valve connectors. — E.H.T. leads. — Circuit diagram. Beautifully made **ONLY £1** Post 2/6.

### IS IT THE L.O.T.?

Be SURE with the SKANTEST. The most compact low priced line output and time base component shorting turn tester. Will indicate even one shorting turn. £7.10.0. Carriage 5/-.

## VALVES! UNUSED. GUARANTEED.

ECC81	5/-	6CH6	8/-
ECC82	6/-	6F1	12/6
ECC83	6/-	6F14	15/-
ECC84	8/6	6CGT	8/6
ECF90	8/4	7C6	9/-
EB91	3/6	7H7	7/-
EF91	3/-	12E1	12/6
OZ4	5/-	85A2	12/6

Post 6d. per valve. Insur. 6d. extra.

## WONDERFUL VALUE 20,000 OHMS PER VOLT!! POCKET MULTIMETER

Ranges:  
A.C. volts: 10, 50, 100, 500, 1000.  
D.C. volts: 5, 25, 50, 250, 500, 2500.  
D.C. current: 0-50 micro/a, 0-2.5 m/a, 0-250 m/a.  
Res: 0-6k, 0-6 meg (300 ohm, 30k mid-scale). Cap: 10PF to 0.01mFd; 0.01mFd to 1 mF. Decibels: —20 to +20. Size 4 1/4" x 1 1/4". Large scale, knife edge pointer. A top quality instrument. Fully guaranteed. **Only £6.19.6** inclusive of test prods, operating instructions, battery. P. & P. 1/8. Optional extra, attractive carrying case, 13/6.

### RECORD PLAYER

Famous B.S.K. U.S. Autchanger. 4 speeds, plus manual play. Intermixes 7, 10 and 12in. discs. With Full-FJ crystal turnover head. **£6.15.0**. Carriage 5/-.

### TAPE RECORDER DECK

The Collaro "Studio" Transcriber. Latest model. 3 speeds—3 separate motors digital counter, press button switching, provision for external head. Brand new—guaranteed. With spare 7in. spool. **£12.10.0**. Carr. 5/- (list price £16.16.0).

S.A.E. with enquiries please.  
**5 Westward Way**  
Preston Road, Harrow, Middx.  
Tel: WOR 2663

# WESTWAY RADIO

## FIRST-CLASS TELEVISION and RADIO COURSES

GET A CERTIFICATE!

After brief, intensely interesting study—undertaken at home in your spare time—YOU can secure your professional qualification or learn Scientific and Theory. Let us show you how.

### FREE GUIDE

The New Free Guide contains 132 pages of information of the greatest importance to those seeking such success-compelling qualifications as A.M.Bric.I.R.E., City and Guilds Final Radio, P.M.C. Radio Amateurs' Exams., Gen. Cert. of Educ. London B.Sc. (Eng.), A.M.I.P.E., A.M.I.Mech.E., Draughtsmanship (all branches) etc., together with particulars of our remarkable Guarantee of

### SUCCESS OR NO FEE

Write now for your copy of this invaluable publication. It may well prove to be the turning point in your career.

FOUNDED 1885—OVER 150,000 SUCCESSES

NATIONAL INSTITUTE OF ENGINEERING (Dept. 462), 148 HOLBORN LONDON, E.C.1

S. Africa: P.O. Box 8417, Jo'burg. Australia: P.O. Box 4570, Melbourne.

## RES/CAP. BRIDGE 38/-

p. & p. 2/- Checks all types of resistors, condensers 6 RANGES

Built in 1 hour. Direct reading

### READY CALIBRATED

Stamp for details of this and other kits.

### RADIO MAIL (Dept. NP)

Raleigh Mews, Raleigh Street, Nottingham

Still available—a comprehensive, practical "basic" course in TV transmission and reception . . .

# A BEGINNER'S GUIDE TO TELEVISION

by F. J. CAMM. Covers:—Persistence of Vision and Scanning . Cathode-ray Tube . The Timebase . Receiving and Transmitting Systems . The Aerial . Tracing the signals through the Receiver . Video Section . The Television Camera . The tuning Signal Test Card C. and tracing faults . Colour . The N.T.S.C. System—Tricolour Tubes explained . Teletext—Video Tape Recording . Stereoscopic Television . Technical Terms . Index.

With 61 illustrations

ONLY 7s. 6d. FROM ALL BOOKSELLERS

. . . or in case of difficulty send 8s. 6d. to GEORGE NEWNES LTD., Tower House, Southampton St., London, W.C.2.

## NEW VALVES!

Guaranteed Set Tested 24 HOUR SERVICE

1R5	1S5	1T4	3S4	3V4	DAF91	DF91	DK91
DL92	DL94	SET of 4	18/6				
DAF96	DF96	DK96	DL96	SET of 4	26/6		
1D5	7/-	DL92	5/11	PCF80	7/6		
1R5	5/-	DL94	6/9	PCF82	7/6		
1S5	4/6	DL96	6/9	PCL82	8/3		
1T4	3/3	EB91	7/6	PCL83	11/6		
3S4	5/11	EB94	7/6	PCL84	7/6		
3V4	6/9	EBP80	7/9	PL36	10/9		
5U4G	4/3	EBL21	12/6	PL81	9/-		
5Y3GT	5/6	ECC40	14/6	PL82	7/-		
5Z4G	7/3	ECF81	4/9	PL83	7/-		
6AM6	2/9	ECC82	5/9	PL84	9/6		
6K7G	1/9	ECC83	6/3	PY32	10/3		
6K8G	4/9	ECC84	8/-	PY80	7/-		
6Q7G	5/6	ECC85	7/9	PY81	6/6		
6V6G	4/9	ECF80	8/3	PY82	8/3		
6V8GT	6/6	ECF82	8/3	PY83	7/3		
6X5GT	4/9	ECH21	12/6	U25	12/-		
12K7GT	4/9	ECH42	7/9	UABC80	7/6		
12K8GT	11/-	ECL90	7/6	UAF42	8/6		
12T7GT	4/9	EF91	12/6	UCL41	7/-		
35L6GT	8/6	EF41	7/3	UBF90	8/6		
35Z4GT	5/9	EF80	4/9	UCC85	7/-		
AZ31	8/9	EF85	5/9	UCH41	12/6		
CL35	11/9	EF96	8/6	UCH42	7/6		
DAC32	9/6	EF91	7/3	UCB81	8/6		
DAF91	4/6	EF91	2/9	UCL82	10/-		
DAF96	6/9	EL41	7/-	UCL83	13/-		
DF33	9/6	EL84	6/3	UP41	7/9		
DF91	3/3	EY51	7/3	UP83	9/6		
DF96	6/9	EY86	7/6	UP89	6/6		
DH77	6/6	EZ40	8/-	UL41	7/-		
DK32	11/-	EZ41	6/9	UL34	7/6		
DK91	5/-	EZ30	5/9	UY21	11/-		
DK92	7/3	EZ31	6/9	UY41	5/6		
DK96	6/9	MU14	7/3	UY85	6/3		
DL33	8/6	PCF84	7/3	VP4B	8/6		
DL35	9/6	PCC89	10/-	Z77	2/9		

Postage 6d. per valve extra. Any Parcel insured Against Damage in Transit 6d. extra. Any C.O.D. Parcel 3/- extra.

Office address, no callings.  
**GERALD BERNARD**  
(Note new address—formerly of Leeds)  
**NEWBURY ROAD**  
**HIGHAMS PARK, LONDON, E.4**



# Trade News

## New Range of Receivers

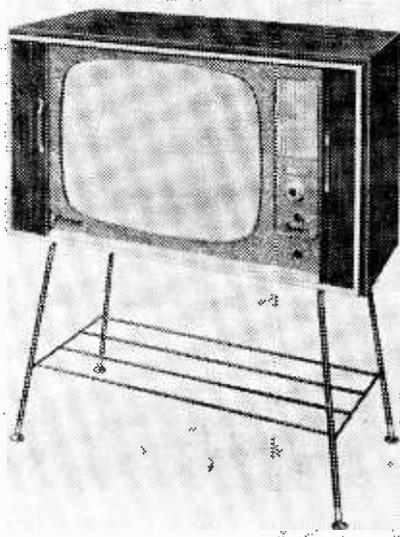
SEVERAL new television receivers are now available from Pam Radio and Television Ltd., including Model 120A, a 19in. receiver featuring automatic tuning and a remote control unit which permits the viewer to select the channel and to adjust the brightness and volume from a distance. This model has sliding tambour doors which cover the control panel and the screen when the receiver is not in use.

Also from the new range of receivers is the Model 119A which features a 19in. 110° tube. Available with this model—and with Models 120A and 123A—at a cost of 2 guineas, is a slim metal stand which is intended for part use as a magazine rack.

Model 123A is a 23in. model (110° tube) which

is finished in a high gloss walnut veneer, with a contrasting fascia.

All of these three models feature transistorised sync stages and printed circuit chassis. The Model 120A costs 79 guineas, the 119A costs 69 guineas, and the 123A costs 82 guineas. These receivers are made by Pam Radio and Television Ltd., 295 Regent Street, London W.1.



The Model 120A television receiver made by Pam Radio and Television Ltd.

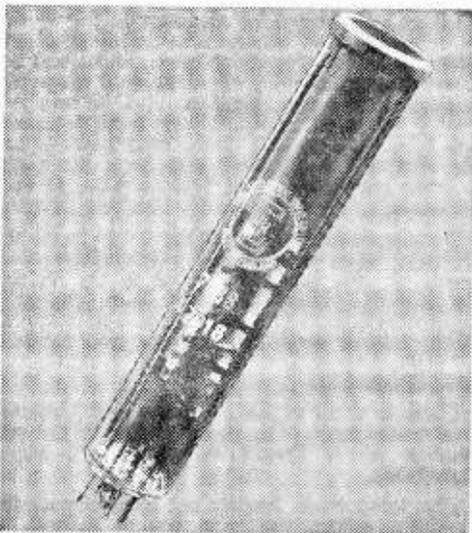
## 110° TV Components

A NEW range of 110° television scanning components has recently been introduced by Direct TV Replacements Ltd. The 110° Line Output Transformer, Type AL is primarily intended for use with the Mullard 110° cathode ray tubes—AW43/89 and AW53/89. The transformer is of the desaturated type. Suitable valves to be used for the circuit are ECC82 for the line oscillator, PL81 for the line output, PY81 diode and EY86 EHT rectifier.

Type BL is similar to the type AL, but is designed to work in conjunction with Mazda valves and cathode ray tubes. Both these transformers are made by Direct TV Replacements Ltd., 138 Lewisham Way, New Cross, SE14.

## Vidicon Pick-up Tube

THE 7038 Vidicon television pick-up tube has been introduced by the English Electric Valve Co. Ltd. to meet the increasing diversity of vidicon applications. This tube is sufficiently comprehensive in design for it to be used in film scanning, studio broadcasting and industrial applications, where several specialised tubes have been used previously. The 7038 has a resolution capability of approximately 600 lines in the centre of the faceplate, and a uniform photoconductive layer is used as the light sensitive element. The Vidicon tube is manufactured by The English Electric Valve Co. Ltd., Chelmsford, England.



The 7038 Vidicon television pick-up tube which has recently been introduced by the English Electric Valve Co. Ltd.



Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. **WE CANNOT UNDER-TAKE TO ANSWER QUERIES OVER THE TELEPHONE.** The coupon from p. 536 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

#### COSSOR 938

How can I convert this set from flywheel sync to direct sync? This set has suffered from line jitter from when it was first installed. The overall gain of the set is inclined to be low. All vision valves and voltages have been checked and are in order.—J. Hammond (Malton).

Our own method of disconnecting the flywheel sync is to earth the anode (pin 6) of the ECL80 coincidence detector and take a suitable value of condenser from the triode anode (pin 1) to the second triode grid of the ECC82 line oscillator. This is the grid to which are connected 220pF and 220k components. A suitable value to begin with as sync coupler is 10pF. Low gain may sometimes be overcome by fitting a frame grid 30L15 in place of the present PCC84 (7AN7) carefully retuning the preset condensers along the top of the tuner.

#### G.E.C. BT1252

Whilst the picture on ITV is quite steady, on BBC it is completely distorted. Now and again on a close-up it is clear, but apart from that it is broken up to such a degree that we are unable to decipher what the picture actually is. We have an outside aerial for BBC and also an outside aerial for ITV.

Another fault is the height—the picture is continually contracting; we can alter this by adjusting the height control, but it soon slips again.—W. Ellis (Sheffield 6).

Adjust the Band I oscillator trimmer on the tuner unit for loudest sound. Adjust the aerial and R.F. trimmers for optimum picture, then readjust the oscillator for minimum sound on vision. The slipping is probably due to the fact that the set is mistuned and should be clear when it is retuned.

#### MURPHY V230

I have had this set for 4½ years and the only replacement has been a U801 twelve months ago.

Recently the picture disappeared except for a 2in. band at the top of the screen which was broken up into lines—the rest was black. All valves except the U25 have been checked and the 20P4 has been replaced. The sound is still working but a bubbling noise can be heard when the sound is turned down.—J. Thompson (Canning Town, E16).

Your symptoms indicate mains hum on picture and sound. Check the 500mA fuse and the main electrolytic smoothing block, and if neither of these components cause the fault suspect a heater-cathode leak in one of the tuner valves. This may not show on a tester and rotating the fine tuner should vary the depth of the hum.

#### PYE V14C

The picture on this set has suddenly developed a fault exactly as shown in one of your "Servicing" articles. The picture has become distorted and it shakes from time to time across the screen. I cannot trace any magnetised object near the set and the picture reverts to its normal steady and proper picture at intervals.—E. Brazel (Swansea).

Your trouble is not likely to be caused by magnetisation as this would produce symptoms which did not move from their initial position. Suspect instead the sync separator and line oscillator stages, which are the two PCF80 valves at the top of the chassis either side of the focus assembly. The one nearest the postage stamp trimmer is the line oscillator, and the other one is the sync separator, and this latter may on some models be a PCF82 instead of a PCF80. Should replacement of this pair not cure your fault, a progressive check of the sync stages with a scope and service sheet is the most rewarding course to take.

#### EKCO T342

I have had this set for nine months but recently the following fault occurs: after switching on, the picture is perfect for about four minutes and then commences to break up vertically, as if the vertical height or hold needs adjusting. A slight manipulation of the height control always rectifies matters. But I have to do this every time now. I may add that if I am patient and leave the picture to jump about for about half an hour or so, it automatically rights itself.—G. Brackher (Beeston).

We suggest that you check the 30P13 frame scan generator valve, which is on the right of the printed panel. If this valve is satisfactory try replacing the 2μF and 500μF frame timebase decoupling condensers housed in a common can in the middle of the printed panel, but on the opposite side.

#### FERGUSON T103

There is slight sound on vision and I presume a valve is at fault. Can you please quote the valve number which should be tested.—R. Malpas (Aylesbury).

This symptom is possibly not caused by a valve. Carefully adjust the fine tuning control for maximum sound consistent with minimum sound on vision. If this cannot be achieved by adjustment, turn the volume control to minimum and if

**Transistors for R.F., F.M., T.V. and U.H.F.**

Frequencies quoted are approx. cut-off.

SB 078 15-20 Mc/s	8/6
SB 305 20-30 Mc/s	9/-
SB 231R 40-50 Mc/s	15/-
American 2N1727 100-150 Mc/s	15/-
American 2N1738 100-150 Mc/s	12/6
American 11832 1000-1300 Mc/s	25/-
American 11833 1000-1300 Mc/s	25/-

**SUB MINIATURE COMPONENTS**

Push-pull driver with Sep. Secondaries for transformerless output 6/6.  
3 I.F. transformers and oscillator and circuit 23/6.

Smallest possible electrolytics 1/9 each. 1 mfd., 2 mfd., 8 mfd., 10 mfd., 20 mfd., 30 mfd., 50 mfd., 100 mfd., 200 mfd.

Smallest 1 watt resistors 5d. each. Miniature 0.1 mfd., 1/-, 0.05, 0.01 5d. values up to 0.005 ed. each.

Miniature slide switch 2/6.

Edgewise Volume controls, 2K., 5K., 10K., 20K., all 2/6 each or 4/6 with Switch.

Set of 6 transistors for superhet in original packets guaranteed. Mullard OC44, OC45, OC71 matched pair OC72, 22.0.0 the set.

3in. Speakers 3 ohm 18/6.

3in. Speakers 80 ohm 18/6.

2in. Speakers 3 ohm 19/6.

Elliptical Speaker, 5in. 35 ohm 19/6.

**POCKET LOUDSPEAKER TRANSISTOR RADIO**

Available Again at 42/6

**READ THESE TESTIMONIALS**

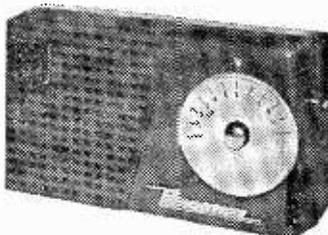
**Mr. J. Bell, Wolverhampton.**  
I am writing to express my satisfaction at the standards of your kit for your Pocket 4 Transistor set and also to state that it has come up to my expectations in regard to performance.

**Mr. R. Bell, Newcastle-on-Tyne.**  
"I have built your Pocket 5 Transistor set. I am very pleased with it."

**Mr. F. Jackson, Ickenham, Middx.**  
"I have built the Pocket 4 and am more than pleased with the results."

**GOOD RESULTS EVERYWHERE**

Nothing can be more disappointing than to find that despite care in making up, your radio just will not work or needs a long high aerial and water pipe earth. We can prove good results in all areas and we guarantee all components are top quality. Read just a few of the hundreds of testimonials we have received from constructors who have made these sets. Send in confidence. Money refunded if not up to your expectations. Plans free with parts, or separately 1/6. More details S.A.E.



Circuit comprises 2 HF transistors reflexed to equal 4 stages. Permanent germanium diode and high gain AF output stage, fitted with miniature speaker. Proper tuning condenser, volume control and in case with handle as illustrated (less monogram), completely portable. No aerial or earth required. Pocket 4 uses 3 transistors and 1 diode, price 42/6, plus 2/6 post and insurance. Pocket 5 uses 4 transistors and 1 diode and has feedback control, price 55/-, plus 2/6 post and insurance. Prices are for medium wave models, long or medium versions 8/6 extra.

**TRANSISTOR AMPLIFIER COMPLETE WITH HI/FLUX SPEAKER**

Uses four first grade Mullard Transistors including matched pair of OC81's (with heat sink) on printed board with transformer and connected to Hi/flux 5in. round speaker. Price 23.12.6 complete. Post and packing 2/6 or in wooden cabinet with 7 x 4 speaker, 24.17.6. Post and packing 4/6.

**ELECTRONIC PRECISION EQUIPMENT LTD.**

post orders are dealt with from Eastbourne, so for prompt attention please post your orders to 66 Grove Road, Eastbourne, marked Department 7. Callers may use any one of the Companies below.

366 London Road, Croydon Phone: CRO 6558 Half day Wednesday	29 Stroud Green Rd., Finsbury Park, N.4. Phone: ARCHWAY 1049 Half day Thursday	520 High Street North, Manor Park, E.12. Phone: LFPORD 1011 Half day Thursday	42-46 Windmill Hill, Ruislip, Middx. Phone: RUISLIP 5790 Half day Wednesday	246 High Street, Harlesden, N.W.10. Phone: ELGAR 4444 Half day Thursday
---	--	---	---	---

**EXPRESS ELECTRONICS**

**ROSEDENE LABORATORIES**

KINGSWOOD WAY, SELSDON, SURREY

**VALVES** NEW TESTED AND GUARANTEED FOR THREE MONTHS

1C1	7/6	6BA6	7/-	787	9/6	DF96	8/-	EF80	8/-	PCL84	7/-
1C2	8/-	6BE6	7/-	8D3	4/-	DH76	7/6	EF86	8/-	PLA1	12/6
1F1	8/-	6BH6	5/6	12AH5	10/-	DH77	6/-	EF91	4/6	PL82	7/-
1F3	7/6	6BJ6	5/6	12AT7	6/-	DH142	8/6	EF93	5/6	PY81	6/6
1FD1	8/-	6BR7	8/9	12AU7	5/-	DH150	10/-	E141	9/6	PY82	7/6
1FD9	7/6	6B87	10/6	12AX7	7/6	DK91	7/6	E144	7/-	PY83	7/6
1L4	6/9	6BW6	7/6	12BE6	8/6	DK92	7/6	EM34	7/-	R19	11/6
1P1	8/-	6BW7	7/-	12BH7	10/6	DK96	8/-	EM88	10/-	U26	8/6
1P10	7/6	6C10	9/-	12K8GT1	11/-	DL92	7/6	EY51	7/6	U52	7/6
1P11	7/6	6D2	4/-	12Q7GT	7/6	DL94	7/6	EY81	10/-	U76	7/6
1R5	6/-	6F12	4/-	16A5	9/-	DL98	8/-	EZ40	7/6	U78	5/-
1R5	6/-	6H6GT	2/-	25A6G	8/6	EB1	4/-	EZ80	5/6	UCB41	8/6
1T4	7/6	6J7GT	7/6	25L6GT	7/6	EB41	10/-	EZ81	9/9	UCH49	9/6
1U5	6/-	6K70	5/6	25Z4G	9/-	EBF80	8/6	KT33C	9/8	UF41	8/6
3Q4	8/-	6K8G	6/-	30C1	6/9	ECC81	6/-	KT66	11/8	UL41	8/6
384	7/6	6Q7GT	8/6	30L1	7/-	ECC82	5/-	N17	7/6	UY41	7/6
3V4	7/6	6SL7GT	8/-	35W4	8/6	ECC83	7/6	N18	8/-	W76	6/6
5U4G	7/6	6SN7GT	6/-	35Z4GT	8/-	ECC80	8/6	N19	7/6	W142	8/6
5Y3GT	4/8	6V60	7/6	58K10	10/6	ECC82	6/9	N37	10/8	X17	7/6
5Z4G	9/6	6X4	5/-	5793	7/6	ECH42	9/-	PCC84	6/9	X142	9/-
6AK5	6/6	6X5G	5/-	80	8/-	ECH41	10/-	PCF80	6/9	X150	9/-
6AL5	4/-	6X5GT	6/-	DAF91	7/6	ECL80	8/6	PCF82	7/-	Z77	4/6
6AM6	4/-	7B7	7/6	DAF96	8/-	ECL82	9/6	PCF82	7/-	ZD17	7/6
6AT6	6/-	7C5	7/6	DF91	7/6	EF41	9/-	1PCL83	7/-	ZD17	4/6

COAX. SUPER QUALITY 1in. 6d. 7d. PLUGS 6d. SOCKETS 9d.

VOLUME CONTROLS MIDGET SIZE LONG SPINDLES. D.P. switch 4/- Less switch, 2/6. Values 10K to 2M. B9A, B7G v. Holders 9d., Screens 9d., Contact Cooled Rectifiers 250v. 50mA, 8/6. 85mA, 8/6.

**MATCHED PAIRS**

EL84 17/-, 6V6G 17/-, 6BW6 18/- per pair. Push Pull O.P. Transformers for above 3.15G 14/6, P & F 1/6. 12in. F.M. Speakers 3P 24/6, Baker's "Selhurst" 12in. 15G 18/6. 90/-, P & F 2/6. 12in. Stereo Model 27.7.0.

**SETS OF VALVES**

DK91, DF91, DAF91, DL92 or DL94. 19/6	ECH42, EF41, EBC41, EL41, EZ40. 37/6
DK96, DF96, DAF96, DL96. 27/6	EL42, UF41, UBC41, UBC41, UF41. 35/-
1C3, 1F1, 1FD1, 1P1. 27/6	C.O.D. 2/6.
1R5, 1T4, 1R5, 384, or 3V4. 19/6	

Postage and packing 6d. Over 21 post free

VACUUM ELECTRONIC LIMITED

**KEEPS YOU IN THE PICTURE**  
WITH THE FINEST REBUILT CATHODE RAY TUBES

12 MONTHS GUARANTEE

12" - 14" £4-15-0	15/-
15" - 17" £5-5-0	
21" £7-15-0	

CASH WITH ORDER OR PRO FORMA, ADD 12/6 FOR CARRIAGE AND INSURANCE.

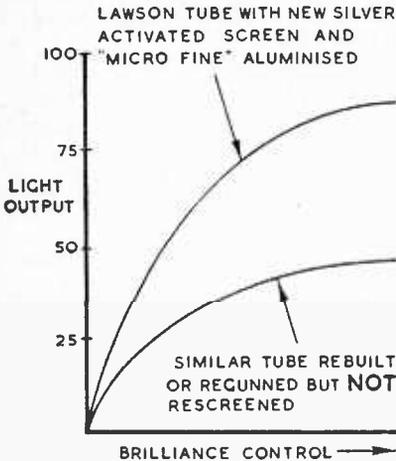
DELIVERY FREE IN LONDON AREA

ALLOWED ON RECEIPT OF OLD TUBE

WRITE PHONE OR CALL  
**VACUUM ELECTRONIC LTD.**  
35, SACKVILLE STREET LONDON, W.1  
REGENT 6404

# LAWSON

## DIRECT REPLACEMENT Reprocessed TUBES



FULLY GUARANTEED 12 MONTHS

## ENGINEERS WITH EXPERIENCE

Know that as a tube gets old, not only does it become Low Emission, but the light efficiency of the Phosphor Screen also deteriorates (up to 10% per year). This deterioration of the Screen obviously continues if the tube is only rebuilt or regunned. Don't risk a "DEAD SCREEN", enjoy the brilliant crisp high definition of a LAWSON TUBE. Tubes which are absolutely BRAND NEW throughout (excepting the glass), and which incorporate the very latest CRT improvements. New silver activated screens, micro fine aluminising, high efficiency gettering, plus Brand New electron guns by Britain's premier manufacturers, Mullard, Mazda, Emicope, etc.

ALL MAKES AND TYPES FROM STOCK

EXPRESS SERVICE—  
Orders received by 3 p.m. are dispatched same day.  
Special direct service to Scotland and Ireland.

**LAWSON TUBES**  
156. PICKERSLEIGH RD. MALVERN. Worcs.  
TEL. 3798

12" - £4.10.0  
14" - £5.5.0  
15-17" - £5.15.0  
CARR. and INS. 7/6

C.O.D. or C.W.O.  
10/-  
Gladly refunded  
if you wish to return  
your old tube  
(excepting 12")

### RST

MAIL ORDER DEPARTMENT  
211 Streatam Road, Mitcham, Surrey  
ALL VALVES LISTED ARE NEW STOCK  
& Terms C.W.O. or C.O.D. Postage 3d. per valve.  
MITCHAM 6201

AZ1 15/6	EP92 5/-	PCF82 8/6	UY85 6/6	6K8G 7/6
B65 8/6	EL42 10/-	PCL82 10/-	VP48 17/6	6K8GT 7/6
DAF91 7/6	EP84 7/-	PCL83 10/-	W81M 5/9	6L1 12/6
DAF96 10/-	EL90 8/6	PENA4 12/6	W142 9/-	6L1 15/6
DF91 4/-	EM80 10/-	PENA4 12/6	W719 7/6	6L6G 7/6
DH719 7/6	EM81 10/-	PEN4VA 17/6	W727 7/6	6L18 12/6
DK91 9/-	EY81 10/6	PEN4VA 17/6	X78 21/-	6L13 21/-
EABC80 7/8	EY86 9/6	PL36 15/-	Z21 12/6	6N7G/GT 7/6
EAF4210/-	EY91 9/-	PL81 14/9	Z77 4/9	6SL7GT 6/6
EBS1 5/-	EZ35 7/-	PL82 8/-	Z152 9/6	6SN7GT 6/6
EBC41 9/6	EZ40 7/8	PL83 10/6	Z152 9/6	6S1 5/6
EBF80 9/6	EZ41 7/8	PY80 8/-	IR5 9/-	6V6G 5/-
EBF98 7/6	EZ80 7/8	PY81 7/6	U4G 4/6	6X5GT 5/-
ECC1 9/6	EZ81 7/6	PY82 8/-	5V4G 9/6	757 10/6
ECC33 5/-	FC2 21/-	PY83 8/6	5Y3GT 8/6	7Y4 7/6
ECC81 6/-	FC4 17/6	R10 21/-	524G 10/-	8D3 4/-
ECC83 9/6	FC13 17/6	R19 19/6	6A8GT 10/-	10LD11 15/-
ECC84 9/6	FC32 21/-	TD24 17/8	6A15 10/-	12AH8 10/-
ECC85 8/-	G232 11/6	TP22 17/6	6AM6 9/-	12AT6 9/-
ECF80 12/6	H30 5/6	U142 3/-	6AN5 7/6	12AT7 6/-
ECF82 12/6	HC90 9/6	U147 7/-	6AQ5 8/3	12AU7 9/-
ECH4210/-	HL92 6/6	U153 9/6	6BA6 7/6	12AX7 9/6
ECH81 9/-	HL33D 10/-	UABC80 7/-	6BE8 7/8	12BA6 9/-
ECL80 9/-	KT3C 10/-	UAF42 9/6	6B36 7/6	12BE5 9/6
ECL82 12/6	KT6 17/6	UBC41 9/6	6BR7 15/-	12BH7 15/-
EP37A 8/6	LZ319 12/6	UBW6 5/-	6BX6 5/-	12K7GT 9/6
EP40 15/-	MK74(3) (Or 7) 17/8	UCH80 9/6	6D2 5/-	12K8GT 8/6
EP41 9/3	ML4 15/-	UCH81 8/6	6E1 15/6	12Q7GT 8/6
EP42 10/6	MSP4 17/6	UCL83 13/6	6F12 3/-	12Q7GT 8/6
EP50(A) 4/-	MU14 9/6	UF41 9/-	6F13 17/6	35ZAGT 7/6
EP80 5/-	MX40 17/6	UF89 8/6	6J5G 4/6	50L6GT 9/-
EP85 5/8	N142 9/6	UL41 9/-	6J7GT 9/6	
EP86 11/-	N153 11/6	UL84 7/6	6K7 4/6	
EP89 10/-	PCF84 9/-	UY41 7/6	6K7G 3/-	
EP91 4/-	PCF80 9/6		6K7GT 10/6	

## AERIALS

BAND I BAND II BAND III

Combined Arrays I and III

- 1+3 Element Loft Mounting .. 38/3
- 1+5 Element Loft Mounting .. 48/9
- 1+3 Element Wall Mounting .. 45/3
- 1+5 Element Wall Mounting .. 61/-
- 1+3 Element Chimney M'ting .. 57/10
- 1+5 Element Chimney M'ting .. 68/9

Band I

- Single Dipole Wall Mounting .. 24/7
- Single Dipole Chimney M'ting .. 40/8
- X Aerial Chimney Mounting .. 62/3
- H Aerial Chimney Mounting .. 67/7

Band III

- 3 Element Yagi Wall Mounting 33/-
- 6 Element Yagi Wall Mounting 43/-
- 9 Element Yagi Wall Mounting 58/-
- Chimney Lashing Mounting add 10/-
- Double 6 Array, only with clamp 83/-

Band II

- Single Dipole Wall Mounting .. 20/5
- Single Dipole Chimney M'ting .. 29/9
- H Array Chimney Mounting .. 52/4

### REPAIR KITS

- Band III Folded Dipole With Insulator, Complete .. 9/3
- Band I Insulator With Two 1/2 inch Dipoles For 1 or 1/2 inch Booms, Complete .. 19/5
- 6 inch Lashing Kit, 12/11, 7 1/2 inch Lashing Kit .. 14/8
- 6 inch Wall Bracket With U Bolts .. 7/10
- 1-1/2 inch Clamps, 3/10, 1-2 inch Clamps Universal .. 5/4
- Bracket Repair Kit, J Bolts; U Bolts; 20it Lashing .. 6/-
- Wire; Thimbles; Corner Plates .. (Enquire)
- Insulators, All Types .. .. .. Plugs 1/2
- Co-Ax. Semi Air Spaced 7d. yd. .. .. .. Send 6d. for Lists. Please state Channel when ordering.
- Cash with Order. Post and Packing 3/- extra.

## SATISFACTION OR MONEY BACK GUARANTEE WALKER & SQUIRES

PINNOX STREET, TUNSTALL, STOKE-ON-TRENT  
Phone: Stoke-on-Trent 88767

trouble persists have the turret oscillator coil adjusted to provide maximum sound consistent with minimum sound on vision when the fine tuning control is set at mid-position. We suspect microphony in the frame amplifier valve is the cause and if so, turning down the volume control will eliminate the fault.

#### REGENTONE 14T

All the valves in this set are in good condition but there is little or no spark from 6X2. On switching on, the picture and sound are all right but, after a moment or so, the 6X2 goes out and there is no picture. Also the PL81 (21A6) becomes red hot internally.—A. Prentice (Motherwell).

Change the PL81 and if necessary the V9 ECL80 line oscillator. If the trouble persists replace the 300pF capacitor wired from the drive control to chassis and check the 750pF. Disconnect the EHT lead to check the tube.

#### FERRANTI 14T5

With a full screen, the picture is good. But when switching on in the evening it shows a raster only, with flyback lines and no picture. The flyback lines are stationary. Also, whilst this condition exists, the brilliance control is ineffective whichever way it is turned. I may have to remove the set from the case as the volume control is very noisy. Could you please advise me how to do this, particularly the focus control knobs in the front as they seem to resist any normal efforts to remove them.—J. Pearl (East Dulwich, S.E.22).

The tube is apparently at fault with a heater-cathode short (check the EB91 noise limiter also). This will necessitate fitting a 6.3V isolating transformer to supply the tube heater separately. The front knobs pull off but if they are stubborn, remove the two rear P.K. screws and the speaker plug and pull out the chassis. This action will push off the front knobs.

#### PAM T954

The picture is ragged around the edges of figures on the screen, and if I brighten the picture it bends to the left. The hold control is at the limit. I have fitted a new PL81, but this has made no improvement.—R. Daniels (Cumbran).

If the ragged edges are not due to insufficient signal (aerial input and first stages are in order) and the effect worsens when the brilliance is increased, change the EY51 which may be passing A.C. If this does not help, check the electrolytic capacitors, 12 $\mu$ F, as well as the main smoothers. Check the 5.6k 1W screen resistor from H.T. to the PL81 pin 8 winding of the oscillator transformer.

#### AMBASSADOR 17in.

There is no picture or sound on this set, but there is a good raster indicating that there may be some trouble with the input.—C. Cook (Rugby).

Assuming the receiver is a model TV17, we would suggest you replace the 30C1 (PCF80) valve in the tuner unit. Also check the 30L1 (PCF84).

#### COLUMBIA C506

I wish to add a tuner to this receiver. What

type of tuner would be best to use and what are the I.F.'s? The tone of this set is not very good. I checked the output valve ECL80. Could the trouble be in the bias of the output valve?—R. Brown (Macherafelt).

The Columbia C506 has an I.F. of 16Mc/s-19.5Mc/s. The Cyldon P16M or Brayhead 16s turret tuners are directly suitable and some of the surplus 16-19Mc/s tuners can be adapted. Poor sound should direct attention to the loud-speaker and to the noise limiter diode wired from pin 1 of the ECL80 (check pin 1 resistors, etc.).

#### SOBELL SC24

On this receiver, there are a series of light vertical bands on the left hand side. Can you suggest the cause of the trouble? Unfortunately, I do not possess a circuit diagram.—T. Plant (Romford).

A 0.1 $\mu$ F capacitor decouples pin 3 of the CRT base and this is wired from the 470k boosted H.T. line resistor to the normal H.T. line. Check it by shunting with a similar capacitor.

#### INVICTA 123

For some time there has been an up and down vibration of the picture (just enough to make everything double). I have replaced the frame oscillator valve and also the frame output valve but it has made no difference. Lately, the picture does not fill the screen as there is a space at the top and bottom which no manipulation of the frame amplitude control or the line linearity control can put right. If I alter the frame control the picture seems to stretch up but instantly shrinks back.—D. Hutchinson (Oxford).

If you are sure the ECC82 and PL83 valves are not at fault, check the 2.2M resistor from pin 6 of the ECC82 to the vertical amp. control. Check the 1 $\mu$ F decoupling electrolytic of the height control, the 2.2M grid leak resistor of the PL83 and the linearity capacitors. Also check the V311Y interlace diodes and the associated filter capacitors 220pF, 0.001 $\mu$ F, etc.

#### WHITE IBBOTSON 2015

The above set has developed electrolytic trouble in the H.T. circuit; none of the large cans give any indication as to what capacity and voltage working they are as the chassis is isolated and the H.T. rectifier is a pair of GZ32 valves.—W. Laine (Angus).

The electrolytics are two cans of 60+100 $\mu$ F 450VW (all large can electrolytics have adequate ripple current rating). The original version had one of the above cans rated at 450VW and one at 350VW but we prefer to fit 450VW rating in both positions.

#### BUSH TV24

This set has not been in use for some months. It was in perfect working order when it was put away, but I can now obtain sound only. I had the vision and sound demodulator valves tested (EB91), one of them had low emission so I replaced it.—A. Tyson (Manchester).

The trouble is probably in the line output stage. Check the PZ30 and PL38 valves in the top right

screened section (removed when lid and rear p.k. screws are released). Note whether the line whistle is audible or not and whether the EY51 on the line output transformer lights up. If the PL38 is very blue inside, check the hold control (over the brilliance control) at the front.

#### ELECTRONIC ECV1527

There is good sound on this set but no picture, just a bright white line  $\frac{1}{2}$  in. wide, horizontal across the centre of the tube. When switching on the set, V8, a 6AL5, lights up very brightly for a second or two.—N. Connell (Ashton).

You should check both of the 7C5 valves, the continuity of the frame output and blocking oscillator primary windings. Check H.T. to pin 2 (linked to 3) of the output 7C5 and to pin 3 of the oscillator 7C5. Also check H.T. to pin 2 of the latter base as the frame size (height) control could be o.c. Check the scanning coils if necessary, and also the frame hold control, etc. The bright light from the 6AL5 is not a fault.

#### ALBA 324

The picture on this receiver is very much stretched on the left-hand side. Although it can be improved by means of the horizontal form control it also introduces severe striations of light bars almost half-way across the screen. The line output valve and efficiency diode (PY81) have been checked, the screw fixed to the line output valve has also been checked. Which coil needs to be adjusted to reject vision on sound; L9 or L12? —J. Horner (Clapham, S.W.4).

You should check the 10k 3W resistor wired across the horizontal form coil. This is probably o.c. There is no vision rejector coil. The sound I.F. coils are peaked for maximum sound at 38Mc/s. Check the 0.001 $\mu$ F decoupling capacitors (from pin 8 of the EF80 valve bases) by shunting each with a similar capacitor.

#### PHILIPS 115 U-15

Although the frame hold is full clockwise, I can only steady the picture by turning both brightness and contrast controls right up and of course the picture is useless. Before this trouble started, I noticed that the picture jumped a couple of frames whenever the scene was changed or a dark scene appeared, even someone with black hair on the screen caused this effect. All the valves have been checked and found to be in order. Is it safe to check capacitors by bridging suspect ones with a good one?—L. Litchfield (Nottingham).

Check the 1M resistor situated under the chassis near the connecting socket. This is wired from the hold control to the frame blocking oscillator transformer. Check the 0.015 $\mu$ F decoupling capacitor in the supply to the control and the electrolytic capacitors associated with the video amplifier under the rear of R.F. chassis (10 $\mu$ F and 100 $\mu$ F). Capacitors may be checked by shunting a near value across each in turn, e.g. 8 $\mu$ F to 16 $\mu$ F for testing the 10 $\mu$ F and 32 $\mu$ F to 100 $\mu$ F for testing the 100 $\mu$ F.

#### REGENTONE 177

Since fitting a new tube to this set there has been bad streaking on white pictures. When white titles are shown on the screen they are accompanied by a black line. It is possible that this condition existed with the old tube but the picture was so dark that it was not noticed?—P. Vine (Coventry).

Check the components associated with the centre EF80 valveholder including the small crystal diode which connects via a 1k resistor to pin 2. The 6.8k resistor to pin 7 and the cathode components including the 250 $\mu$ F electrolytic should be suspect. Note effect of disconnecting pin 1 of the EB91 (noise limiter). Check the 16 $\mu$ F which decouples pin 8. This is part of a double capacitor under the chassis in front of the metal rectifier, but is best checked by shunting pin 8 to chassis with a test capacitor.

#### BUSH TV24C

This set is not very old. When it is first switched on it is satisfactory for about half an hour then a low buzzing noise is heard from the loudspeaker. This increases over a period of about half a minute until it completely distorts the sound. The horizontal and vertical holds slip and the picture drops and disappears. On slight retuning of the oscillator control, the sound can be obtained again with the buzzing superimposed as previously, and a distorted picture can be returned for a period of about 15 seconds. Then the fault returns again.—N. Payer (Thorpe Bay).

First try the effect of a new PCF80 valve in the tuner. This is the left side valve on the lower deck as viewed from the rear. Check by replacement the PCC84 to its right to be sure. Then try the effect of connecting a fairly high value smoothing capacitor (say 60 to 100 $\mu$ F) across the H.T. line. The EF80 valves could be responsible but are less likely to be a fault.

#### FERRANTI 14T3

On ITV the Band III contrast is full up and on Band I half-way. On switching on, the picture is fine but after about three minutes it disappears leaving a dark screen. There is no change in the picture size. If the Band I contrast control and brightness controls are turned fully up, the picture is reasonable, but not as good as normal. When the aerial is removed, there is no raster and the screen is still black, even with the brightness control fully up.—A. Norman (Crawley).

The symptoms suggest a short in the heater element of the tube. Sharply tap the base end of the tube neck and note the effect. Whether or not this has any effect, the only real remedy is to replace the tube.

### QUERIES COUPON

This coupon is available until JULY 21st, 1961, and must accompany all Queries sent in accordance with the notice on page 532.

PRACTICAL TELEVISION, JULY, 1961.

**SERVICE SHEETS**

**SERVICE SHEETS.** Radio, TV, 5,000 models. Lists 1/-. S.A.E. enquiries: TELRAY, 11 Maudland Bk., Preston.

**FAULTFINDER FILES (TV)** showing common faults that each receiver is prone to and other useful servicing information, 2/- each. List 9d., plus postage. S.P. DISTRIBUTORS, 44 Old Bond Street, London W.1.

**SERVICE SHEETS, TV 4/- ea.** Radio 3/- ea. List 1/-. All orders dispatched on day received. Also Manuals for sale and hire. SULTAN RADIO, 29 Church Road, Tunbridge Wells, Kent.

**SERVICE SHEETS from 3/-.** Some for hire. S.A.E. DARWINS, 45 South Street, St. Helens, Lancashire.

**SERVICE SHEETS (1930-1961)** from 1/- with Free Fault-Finding Guide. Catalogue 6,000 models 1/-. 125 Radio/TV Sheets covering 370 popular models 20/-. S.A.E. enquiries. HAMILTON RADIO, Western Road, St. Leonards, Sussex.

**SERVICE SHEETS** — We have the largest stock of Radio and TV Service Sheets in the country for sale at 4/- each. Why tolerate delay in obtaining your supplies when we will dispatch by return? Service Sheet List 1/-. Also Manufacturers' Manuals for sale and hire. 1961 List now available 1/-. S.A.E. please. Mail orders only to: S.P. DISTRIBUTORS, 44 Old Bond Street, London W.1.

**SETS & COMPONENTS**

**C. EDWARDS**

1070 Harrow Rd., London N.W.10. Ladbroke 1734.

500 S/H TV Sets must be cleared as taken part exchange. Condition unknown.

**ALL SETS COMPLETE.**

- 12in. BBC 25/- 13 Channel 50/-
  - 14in. " 50/- " " 75/-
  - 17in. " 85/- " " 125/-
- Plus 15/- carriage.

**Guaranteed Valves**

- 10C2 10/-, 20D1 6/-, 6K25 8/-,
- PL38 10/-, PL81 8/-, PY81 8/6,
- PY80 7/6, PZ30 10/-.

**RECLAIMED VALVES.** tested and perfect; all one price, 5/- plus 6d. postage each. Also surplus new valves, guaranteed. S.A.E. for list. New valves bought. LEWIS, 46 Woodford Avenue, Ilford, Essex.

**GUARANTEED VALVES**

- |          |           |           |
|----------|-----------|-----------|
| 1L4 2/6  | 12AT7 6/6 | EF91 3/-  |
| 6F1 6/6  | 20D1 6/6  | EL32 3/-  |
| 6F13 5/6 | 20F2 7/6  | PCC84 6/6 |
| 6F14 7/6 | 20L1 8/6  | PY80 6/6  |
| 6F15 7/6 | D77 3/6   | PY82 6/6  |
| 10C1 7/6 | EAB80 7/6 | UF41 8/6  |
| 10F1 6/6 | EF50 5/-  | UL46 7/6  |

**SERVICE SHEETS**

List 6000 Models, 1/-. S.A.E. Enquiries. Hamilton Radio (T), 13 Western Rd., St. Leonards, Sx.

**RATES:** 4/- per line or part thereof, average five words to line, minimum 2 lines. Box No. 1/- extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Television" Tower House, Southampton St., London, W.C.2.

**SETS & COMPONENTS**

(continued)

**Television Tube Shop**

now stock

**Tubes for every make of set— OVER 600 TUBES ALWAYS IN STOCK**

- 12 inch Mullard type ... .. £4. 5.0
- 12 inch Mazda type ... .. £4.15.0
- 14 inch Mullard type ... .. £5. 5.0
- 14 inch Mazda type ... .. £5.10.0
- 15 inch Mazda type ... .. £5.15.0
- 16 inch G.E.C. & Mullard type £6.12.6
- 17 inch Mazda & Mullard type £6.10.0
- 17 inch G.E.C. & Brimar type ... £6.15.0
- 21 inch Mullard type ... .. £8. 0.0

Add 10/- for insured carriage to your door within 48 hours, or 5/- via B.R.S.

All tubes tested before despatch and guaranteed for 12 months. Guarantee cards enclosed with each tube.

**Special Purchase of 110", 17 inch tubes—** Slight mark. Guaranteed for 12 months. Mazda CME1703 } replace AW43-88, £6.  
GEC 7405A }

**Shop Soiled Tubes.** (Slight scratches or marks) Guaranteed 12 months ideal for second set. 12in. 3/18, 3/31 37/6. MW31-74 50/-, 14in. MW 36-44 52/6. CRM141 55/-. 17in. CRM171, MW43-64 60/-.

Others available from time to time. Please enquire.

**TELEVISION TUBE SHOP**

48 Battersea Bridge Road, S.W.11 BAT 6859

Just South of the Bridge Open Saturdays.

**TELEVISION TUBES!** 1st quality, new guns. Year's guarantee, most 75/- exchange. Rescreened from 85/-, 3 Pank Ave., New Barnet. BAR 1934.

**TUBES — AERIALS — VALVES** Regunned tubes, guaranteed one year, prices from £4.12.6. Revacuumed tubes, all sizes, 50/-; guaranteed 4 months. Full range of aerials at trade prices, double five costs only 85/-. Full range of valves, example PCC84 cost 8/-. ITV pre-amplifiers, £3.15.0. Self-contained in case, ITV converters, £5. Brayhead tuners, £4.12.6. New TV sets and transistor radios supplied, ask for quotation. Low loss co-axial, 1/1 yd. Standards 8d. yd.

Diplexers 8/8 each, Chromed car aerials, 19/- each completed with head and plug, all types quoted for. All items carriage extra. S.A.E. for lists.

**G. A. STRANGE** BROADFIELD, NORTH WRAXHALL, Nr. Chippenham, Wilts. Tel. Marshfield 236

**B.V.A. NEW** and rebuilt TV tubes. S.A.E. REDWATT TUBE DISTRIBUTORS, 41 Denmark Street, Wakefield, Yorks.

**SALVAGED VALVES TESTED ON A MULLARD HIGH SPEED VALVE TESTER TO 100% STANDARD**

- |            |   |
|------------|---|
| AS0N 9/6   | <b>POTENTIOMETERS</b>                             |
| AC/P 2/6   | Carbon Pots, 25k ... .. 1/- ea.                   |
| AC044 2/6  | V/C and SF/SW 500k ... .. 2/6 ea.                 |
| ACSPEN     | <b>RESISTORS</b>                                  |
| DD 2/6     | Card of 4W Resistors, 72 Per                      |
| AO/TP 2/6  | values covering complete card                     |
| APV4 2/6   | 10% range ... .. 24/-                             |
| A231 2/6   | Full range of Separate Resistors                  |
| B36 2/6    | available   |
| B05 2/6    | <b>CONDENSERS</b>                                 |
| D1 2/6     | 100µf + 200µf 275 v. D.C. 9/-                     |
| D08 2/6    | 100µf 350 v. D.C. ... .. 7/6                      |
| D77 2/6    | 16µf 450v. D.C. ... .. 8/8                        |
| DD4 2/6    | 16µf 350v. D.C. ... .. 8/-                        |
| DD41 2/6   | 100µf 150v. D.C. ... .. 2/-                       |
| DDL4 2/6   | 0.1µf 500v. D.C. Paper ... 1/-                    |
| DP91 2/6   | 0.01µf 500v. D.C. Paper ... 10d.                  |
| DH7 2/6    | 0.001µf 500v. D.C. Paper ... 10d.                 |
| DK96 2/6   | <b>VARIABLE CONDENSERS</b>                        |
| DW/430/6   | 0.0005 Double-throw 2 1/2" dia. 8/6               |
| EA50 1/3   | 3-50pF concentric trimmers 3/- doz.               |
| EB34 1/3   | Banks of six compression                          |
| EB41 1/3   | trimmers, 3-30pF ... .. 6d.                       |
| EB91 1/3   | <b>VALVE HOLDERS</b>                              |
| EBCC3 2/6  | American Octal ... .. 5/- doz.                    |
| EBCA1 2/6  | Noval ... .. 9d. ea.                              |
| ECC32 2/6  | <b>METAL RECTIFIERS</b>                           |
| ECC34 2/6  | RM4 New and Boxed 15/- ea.                        |
| ECC31 4/-  | RM4 Salvaged ... .. 2/- ea.                       |
| ECC32 4/-  | <b>SILICON TYPE</b>                               |
| ECH3 2/6   | 250v. 300mA, dia. 4", L 1 1/2", H 3/4"            |
| EP50 1/3   | 125v. 300mA, dia. 1 1/2", H 1 1/2"                |
| EP80 2/6   | ORT Converter Caps ... .. 6d. ea.                 |
| EP91 1/3   | Standard Crocodile Clips ... .. 6d. ea.           |
| EL3 2/6    | Miniature Crocodile Clips ... .. 6d. ea.          |
| HLA1DD 2/6 | 1 1/2" Brown Knobs ... .. 6d. ea.                 |
| KT380 1/3  | Isometric Jack Plugs ... .. 4/6 ea.               |
| KT42 2/6   | <b>CATHODE RAY TUBES</b>                          |
| KT81 2/6   | <b>SPECIAL OFFER</b>                              |
| KTZ41 2/6  | 16in. G.E.C. 650 ... .. 20/-                      |
| L63 2/6    | 12in. G.E.C. 7108 ... .. 16/-                     |
| MH4 2/6    | Salvaged but good tubes.                          |
| MP4 2/6    | Personal Calls Only.                              |
| N30 2/6    | <b>25M/6s and 10M/6s TUBE</b>                     |
| P41 2/6    | <b>TUNERS</b> , less valves taken from            |
| P81 2/6    | sets ... .. 12/6 ea.                              |
| PCC84 4/-  | <b>TRANSFORMERS</b>                               |
| PCF80 4/-  | CRT Roset Transformers 12/6 ea.                   |
| PCF84 4/-  | Heavy Duty Output Trans-                          |
| PCL83 4/-  | formers, 8 ratios from 12 : 1                     |
| PEN45 1/2  | to 45 : 1   |
| PEN46 2/6  | Miniature Output Trans. 2/6 ea.                   |
| PNDD 2/6   | Standard Output Trans. 2/6 ea.                    |
| 4029 2/6   | formers, Multi-match 10/- ea.                     |
| PL38 2/6   | Transformer Drivers: 1-1 CT 10/- ea.              |
| PL81 4/-   | 3.6-1 CT 12/6 ea.                                 |
| PL82 4/-   | Transformer Output: 6.6-1 CT 10/- ea.             |
| PL83 4/-   | 6.6-1 CT 10/- ea.                                 |
| PY31 2/6   | Microphone Transformers                           |
| PZ30 4/-   | ratio 65 : 1 ... .. 35/- ea.                      |
| SP41 1/3   | <b>I.F. TRANSFORMERS</b>                          |
| SP42 2/6   | Standard 455kc/s ... .. 12/6 per pair             |
| SP81 1/3   | Midget 455kc/s ... .. 16/- per pair               |
| TD13C 2/6  | <b>AUTO TRANSFORMERS</b>                          |
| TN230 2/6  | 250W ... .. 67/6 ea.                              |
| TP220 2/6  | 100W ... .. 27/6 ea.                              |
| U18 2/6    | 50W ... .. 20/- ea.                               |
| U31 2/6    | <b>TRANSISTOR FAULT FINDER</b>                    |
| UF42 2/6   | Enables faults to be located                      |
| U7 2/6     | quickly. Consists of a two-                       |
| V927 2/6   | transistor, multi-vibrator in a box.              |
| V94 2/6    | Complete with battery. 28/6                       |
| W77 2/6    | <b>VALVES New and Buzzed 10/- ea.</b>             |
| X91 2/6    | <b>CRYSTALS</b>                                   |
| Z63 2/6    | <b>GENUINE MULLARD, Bored</b>                     |
| Z77 1/3    | OA5 6/- OA81 3/-                                  |
| Z90 1/3    | OA70 3/- OA85 2/-                                 |
| Z719 2/6   | OA79 2/- OA91 2/6                                 |
| 2D4A 2/6   | <b>TRANSFORMERS</b>                               |
| 4T31 2/6   | <b>GENUINE MULLARD, Bored</b>                     |
| 6AL5 2/6   | OC10W 49/- OC75 6/-                               |
| 6AM6 1/3   | OC19 49/- OC72 8/-                                |
| 6BW7 2/6   | OC26 25/- OC76 8/-                                |
| 6BX6 2/6   | OC44 12/- OC78 8/-                                |
| 6C6 2/6    | OC45 10/- OC81 8/-                                |
| 6D2 2/6    | OC70 6/- OC82 12/-                                |
| 6D8 2/6    | OC71 6/- OC170 12/6                               |
| 6F18 1/3   | <b>10 WATT HI-FI AMPLIFIER KIT</b>                |
| 6F13 1/3   | using valves from our salvage                     |
| 6J5 2/6    | range. Complete with treble and                   |
| 6J7 2/6    | bass units. Inc. valves. 27.5/6                   |
| 6P25 2/6   | <b>TERMS: C.W.O. ONLY.</b>                        |
| 6P38 2/6   | Orders under £1, P. & F. 1/-.                     |
| 8D3 1/3    | Open bill 11 p.m. most days.                      |
| 9D6 2/6    | <b>S.A.E. for list or 9d. for full catalogue.</b> |
| 10P1 2/6   |   |

**Arion Television**  
4 Maxted Road, S.E.15 NEWX 7152  
23 Northcross Road, S.E.22

**SETS & COMPONENTS**  
*(continued)*

**TV SPARES**

Britain's Largest  
Range—New or Used

**LINE OUTPUT TRANSFORMERS and SCAN COILS**

for nearly every make and model,  
New from 45/- Used from 20/-

Just a few examples from our extensive range **IN STOCK**. Add 2/6 for P. & P. TELEPHONE ORDERS SENT SAME DAY C.O.D.

**NEW LINE OUTPUTS**

Pye V4/7, VT4/7, LV30, FV1, V14, 55/-.  
Ferranti 14T3/4/5, 47/6; 14T2/T1225, 62/6.  
Ferguson 992/6/8, 66/9; 941-55, 57/6.  
Ekco T221/231, 311, 284, 330, 55/- Scan 50/-.  
H.M.V. 1824/9, 58/6; 1840-8, 59/6.  
Cossor 930-9, 58/6 (new), 30/- (used).  
Murphy V240/250/280, 62/6; V200, 49/6.  
Ultra VT9-17, etc., 108/6 with U25.  
Bush TV53, 69/6; TV24C, 89/6; TUG34, 5 gns.  
Philips 1114U, 91/8; 1768U, 102/6.  
Masteradio T917, TE7T, etc., 58/6.  
Decca D14/17, 58/6; DM14/17, 55/-.  
Sobel TS17, T346, 58/6; T171, 80/-.  
Baird P2014/7, 2114/7, 58/6.  
New Scan Coils for Pye V4/7, VT4/7, 65/-.

**ITA TURRETS** Ferguson type A, B, 30/- (used); Murphy, Pye 47/124, all tested (used) 30/- Chassis for VT4 jess LOPT and Scan, 30/-.

**COMPLETE T/Vs**, not tested but complete, callers only. Cossor 938, 30/- We stock or can obtain most LOPT's, Scan Coils, Frame O.P.'s and spares.

PLEASE SEND S.A.E. FOR IMMEDIATE QUOTE.

**TELEVISION CONSUMER SERVICES LTD.**

28 BROCKLEY CROSS, S.E.4.  
TIDeway 5394

112 CAMBERWELL RD., S.E.5.  
RODney 7917

**ST. HELENS 4246** for Television tubes. S.A.E. list. DARWINS, 45 Shaw St. St. Helens Station, Lancs.

**REBUILT TELEVISION TUBES**—12in. £5; 14in. £5/10/-; 17in. £6/10/-. Twelve months' guarantee. 10/- car. TRANSISTORS, WHITE SPOT 5/-; RED SPOT 5/-; YELLOW/GREEN 5/6; RED/YELLOW 7/6; CRYSTAL DIODES 1/-, 2/-, 4/6. ELECTROLYTICS, all values; CONDENSERS, silver and paper. RESISTORS, all types; RECLAIMED VALVES, most types, 5/- each. AIRSPACED CO-AXIAL CABLE from 6d. per yard. **B R A Y H E A D T U R R E T T T U N E R S** £6/10/6; REPLACEMENT VOLUME CONTROLS, TRANSFORMERS, TELEVISION and MAINS; SMALL PARTS REPLACEMENTS and numerous SECOND HAND COMPONENTS. Stamped addressed envelope please with all enquiries.

**DEVIZES TELEVISION SERVICE**  
29-30 The Nursery, Bath Road,  
Devizes, Wilts. Tel.: Devizes 1100.

**SETS & COMPONENTS**  
*(continued)*

"HEATHKITS" can now be seen in London and purchased on easy terms. Free brochure DIRECT TV REPLACEMENTS LTD., Dept. PT/22/6. 138 Lewisham Way, S.E.14. Tideway 6666.

**H.P. on Regunned C.R.T.s**

At No Extra Charge  
12 Months' guarantee

12" & 14" .. £3.10.0  
17" .. £4.10.0  
21" .. £5.10.0

Phone or Call only:  
Rod 7778

**P. J. F. Andrews**  
61-63 ROSEMARY RD.  
LONDON, S.E.15

14in. TELEVISIONS, BEO/ITA, newly fitted rebuilt tubes. To clear £8. Tube guaranteed 12 months. Callers only. NU-GUN TELETTUBES LTD., 3 The Mews, Duckett Road, N.4. MOU 2909.

**ELECTRICAL - - - - FACTORS**

OFFER THE FOLLOWING  
UNREPEATABLE BARGAINS

Brand New Television 12in. Tubes, Type M.W. 31-74. £2.19.6 (Carr. & ins. 12/6)

8-watt Push-pull Amplifiers, EL84 x EL84, ECC83, EZ80. Complete production line purchased, enables us to sell at £2.15.0 (carriage 2/6).

Beautifully made American Telescopic Car Aerials, heavily plated. Were £2.10.0. OUR PRICE 24/- (carriage free).

Fantastic clearance of Stereo Amplifiers, including two Mullard ECL82 and EZ80, pilot lights, knobs, one speaker circuit diagram, etc. £2.19.6 (carriage 3/6).

Rigidly tested Television Valves, individually boxed, 3/- to 7/6 each. Television Chassis, complete less valves, 30/- (carriage 5/-).

TELEVISION COMPONENTS AT  
BARGAIN PRICES

Please write for your individual requirements.  
S.A.E. for Free Lists.

4 HENDERSON ROAD  
EASTNEY : PORTSMOUTH

**SETS & COMPONENTS**  
*(continued)*

**In Scotland . . . . .**

**RENVUE**  
for Better Value

COMPLETELY REPROCESSED TUBE  
(NEW GUN, RESCREENED,  
ALUMINISED)

12.6v. and 6.5v. 0.3 amp.,  
17 and 15in. Types ... .. £6.10.0  
12.6v. and 6.5v., 0.3 amp.,  
14in. Types ... .. £6. 0.0  
12v., 15in. Types ... .. £7. 0.0  
2v., 12 and 15in. Types ... .. £6. 0.0

Electrostatic 90 degree and 110 degree tubes  
10/- extra. Carr. paid.

10/- ALLOWED ON OLD TUBE  
Terms arranged

**FERGUSON**

14in. BBC and STV Consoles ... £12.10.0  
14in. BBC and STV Receivers ... £10.10.0  
17in. BBC and STV Receivers ... £19. 0.0

COMPLETELY OVERHAULLED AND  
FITTED WITH COMPLETELY

**REBUILT TUBE**

with One Year's Guarantee

£5 Deposit. Terms on Balance

**Renfrew Electronics Ltd.**

Anderson Drive

Renfrew : Scotland

Tel.: Renfrew 2642

**FOR SALE**

VALVE CARTONS at keen prices. Send 1/- for sample and list. J. & A. BOXMAKERS, 75a Godwin Street, Bradford 1.

**Star TV Tubes**

70/-

all sizes up to and including 17in. includes old glass or plus 7/6 without C.W.O. Carriage 7/6.

**WHY PAY MORE?**

new guns, 12 months' guarantee.

also 20/- each

12in., 14in., Part Exchange Televisions

**ARTHUR SLARK**

43-45 Thicketford Road, Tonge Moor, Bolton.

Phone: 6684.

**SERVICE SHEETS:** also Current and Obsolete Valves for sale. JOHN GILBERT RADIO, 20 Extension, Shepherd's Bush Market, London W.12 (Phone: SHE 3052).

(Continued on facing page)

**FOR SALE**  
(continued)

**PETERBOROUGH!** Suffering from BBO interference? Our Channel 5 rejector gives 40dB attenuation of unwanted signal at ITA aerial socket. 10/- post free! **AJAX ELECTRONICS**, 572 Fulham Road, London S.W.6.

**100 BAYS** of brand new adjustable steel shelving, 72in. high by 34in. wide by 12in. deep, stove enamelled dark green. Send unassembled. Six shelf bay—£3/15/0. Sample delivered free. Quantity discounts. **N. C. BROWN LTD.**, Eagle Steelworks, Heywood, Lancs. Tel.: 69018.

**TV's FOR SALE**

Examples BBC/ITA	C.R.T.
In good working order	Good Rebuilt
14in. Ultra V7816: KB LVT 30	£17 £21
14in. Ekco T221 or T283...	219 £23
14in. Ferguson 992 .. ..	214 218
17in. Plessey: BGD etc. ..	219 224

Send for Lists. Carr. Paid.

**CADMANS**

Bryan Street, Hanley.  
Phone: Stoke-on-Trent 23557.

**1,000 TELEVISIONS**, all makes, from £3 working, 10/- not. Callers only, 9 till 6 including Sats. 39 Whitehorse Lane, Stepney, London.

**TURRET TUNERS**

BRAYHEAD £3.10.6

Brand New, any area, complete with fitting instructions. State set and 2 channels, 10 Mc only. **EXTRA COILS** 10/6 per channel. **RECTIFIERS—CONTACT COOLED.**  
14A1289 (PC101) type, 250 v., 250 mA, 18/6;  
14A1288 (PC31) type, 250 v., 300 mA, 17/6;  
250 mA, 19/6.

**RECTIFIERS—FIN TYPES**  
Equivs. for M4 250 v., 250 mA, 14/-; RM5 250 v., 300 mA, 17/8; 14A989 250 mA, 18/6;  
14A98 16/8; 14A97 20/-; 14A100 22/6 14A124 25/6.

**CALYNETERS** A10, £4.17.6; B20, £4.10.0, with either meter 36 mixed resistors, 6d. only. **ARMCHAIR EXTENSION VOLUME CONTROL** unit for TV, Radio Amplifiers, etc. Easily fitted, perfectly safe. 15/6. **TRANSISTOR** OC18 18/-; OC71 6/-; OC81 6/-; OC48 7/-. Cash with order, Post Free. C.O.D. 2/6.

**DURHAM SUPPLIES**

175 Durham Road, Bradford 8, Yorkshire.

**WANTED**

**WANTED** Service Sheets. No quantity too large, highest prices paid. **SULTAN RADIO**, 29 Church Road, Tunbridge Wells, Kent.

**A PROMPT CASH OFFER** for your surplus Brand New Valves, Speakers, Components, Test Instruments, etc. **R.H.S.**, 155 Swan Arcade, Bradford 1.

**NEW TV VALVES WANTED.** Send valves, cash by return, to **P. J. F. ANDREWS**, 61-63 Rosemary Road, London S.E.15.

**NEW VALVES WANTED.** — EY51, ECL80, PCC84, PCF80, PCL83, PL51, PCL82, PY81, R19, U801, 30P4, etc. Best cash prices by return. **DURHAM SUPPLIES**, 175 Durham Road, Bradford 8, Yorkshire.

**LINE OUTPUT TRANSFORMERS SPECIALISTS**

Makes	Models	Prices
<b>ACE:</b>	Spares available.	
<b>ALBA:</b>	T301, T304, T394, T484, T494, etc. . . . .	39/6
<b>AMBASSADOR:</b>	Spares supplied.	
<b>ARGOSY:</b>	Most models available.	
<b>ARMSTRONG:</b>	Spares supplied.	
<b>BAIRD, BANNER, BEETHOVEN:</b>	Spares supplied.	
<b>BUSH:</b>	TV11A, 11B, 12A, 12B, TVG12A, 12B, TRG12A, 12B TVG35, TV32, TV33, TVG34 TVG34A, TV36, TV36, TVG36 TV36C, TVG36C, TV43 ..	45/- 89/6
	TV53, TV56, T57, TV57, Rew'd TVG68, TV62, TV63, TV69, only TV97, etc. . . . .	69/6
<b>COSSOR:</b>	930 & F 931, 932-4-5, 937, 938A & F, 939 & A & F ..	59/6
	943T, 940-948, 946, 945B, 949	69/6
<b>CHAMPION, COLUMBIA:</b>	Spares supplied.	
<b>DECCA:</b>	D17 & F .. .. .	69/6
	DM2, DM2C, DM3, DM4/C ..	85/-
	DM5, DM14, DM17, 444, 556	65/-
	TR1463, TR1753 .. .. .	59/6
<b>DEFIANT:</b>	Spares supplied.	
<b>DYNATRON:</b>	Spares supplied.	
<b>EKCO:</b>	TS93, TC8102, TS105, T8114 TRC124, TC139, TS189, TS193 .. .. .	55/-
	TRC139, TC140, T141, TV142 T101, TC162, T164, T165, etc. TCC206, TV209, T231, T221, T231F, T248, T285, T284, T293, etc. . . . .	47/6
<b>ENGLISH ELECTRIC/ETRONIC:</b>	Spares supplied.	
<b>FERGUSON:</b>	103T, 105T, 113T, 135T, 145 .. .. .	66/6
	941T-953T inclusive .. .. .	67/6
	991T-997T inclusive .. .. .	66/6
	203T-246T inclusive .. .. .	69/6
	306T, 308T .. .. .	59/6
<b>FERRANTI:</b>	14T1, 14T3E, 14T4 .. .. .	45/-
	17K3 & F, 17T3 & F .. .. .	45/-
	17K4 & F, 17SK4 & F .. .. .	45/-
	17T4 & F .. .. .	45/-
	14T5, 17SK5, 17K5 .. .. .	45/-
<b>G.E.C.:</b>	BT1251, BT1252, BT1740, BT1748, BT3473 .. .. .	49/6
	BT4643, BT5147, BT5246-48	89/6
	BT5343-BT5643B inclusive	49/6
	and 89/6	
<b>H.M.V.:</b>	1824 & A to 1831 inclusive ..	87/6
	1840, 1841, 1842-1848 .. .. .	67/6
<b>INVICTA:</b>	T118, T119, T120 .. .. .	58/-
	All other models available.	
<b>K.R.:</b>	LFT500, LVT30, LFT50, MV50 .. .. .	107/6
	All models available, etc.	
<b>MARCONI:</b>	All models available.	
<b>MASTRADIO:</b>	All models available.	
<b>McMICHAEL:</b>	All models available.	
<b>MURPHY:</b>	V200, V202C .. .. .	57/6
	V240, V250 .. .. .	95/-
<b>PAM, PETO SCOTT, PHILCO:</b>	All models available.	
<b>PHILIPS:</b>	1768U, 2198U .. .. .	105/-
	All models available.	
<b>PILOT:</b>	All models available.	
<b>POSTADYNE:</b>	All models available.	
<b>PYE:</b>	CTM4, FV4C, FV4COL .. .. .	55/-
	V4, VT4, V7, VT7 .. .. .	55/-
	LV30, FV1, FV1C .. .. .	69/6
	CS17E, CTM17F, CW17 ..	69/6
	CW17C, CW17CP, CW17F, etc. . . . .	69/6
	All models available.	
<b>RAYMOND:</b>	All models available.	
<b>REGENTONE:</b>	All models available.	
<b>R.G.D.:</b>	6017T, 7017, C54, etc. .. .. .	69/6
	All models available.	
<b>SOBELL:</b>	TS17, T346 .. .. .	85/-
	All models available.	
<b>STELLA:</b>	ST5721U .. .. .	105/-
	ST8617U, ST8621U, .. .. .	105/-
	ST8917U .. .. .	105/-
<b>STRAD, TELEVOICE, TRUVIEW:</b>	Available.	
<b>ULTRA:</b>	35 series, 4315 series, with U25 etc. complete .. .. .	70/6
	All models available.	
<b>VALRADIO:</b>	Spares available.	
<b>VIDOR:</b>	CN4217-CN4231 inclusive ..	65/-
<b>WESTMINSTER:</b>	Spares available.	
<b>WHITE-IBBOTSON:</b>	Spares available.	
	Scanodia, Osc. and Output Tx. for all above makes available.	
	Post and Packing 2/6. O.O.D. 3/- extra. All Enquiries S.A.E.	

**WYNDSOR TELEVISION**

Dept. P.T.  
ST. ALBANS ROAD, BARNET, HERTS.  
BAR 1769

**BOOKS**

**FIND TV SET TROUBLES IN MINUTES** from that great book "The Principles of TV Receiver Servicing" 10/6 all book houses and radio wholesalers. It not in stock from: Secretary, I.P.R.E., 20 Fairfield Road, London N.8.

**EDUCATIONAL**

**FREE FROM THE I.P.R.E.** Syllabus of famous radio and TV courses. Membership Condition booklets, 1/-. Sample copy the Practical Radio Engineer 2/- post free. Secretary, 22 Fairfield Road, London N.8.

**"HOW AND WHY"** of Radio and Electronics made easy by a new non-maths practical way. Postal instructions based on hosts of experiments and equipment building carried out at home. New courses bring enjoyment as well as knowledge of this fascinating subject. Free brochure from Dept. 12, P.T. RADIOSTRUCTOR 40 Russell Street, Reading.

**Radio Television & Electronics**

Learn at home with the world's largest home study organisation. **Brit. I.R.E.**; **City & Guilds**; **R.T.E.B.**, etc. Also Practical Courses with equipment. No books to buy.

Write for FREE prospectus stating subjects to

**I.C.S.**

Dept. 516  
Intertext House, Parkgate Road, London, S.W.11

★ **LEARN** ★

**RADIO & TV SERVICING**

for your **OWN BUSINESS/HOBBY**

● by a new exciting no-maths system, using practical equipment recently introduced to this country

**FREE Brochure from:—**  
**RADIOSTRUCTOR**  
DEPT. G78  
READING, BERKS. 7161

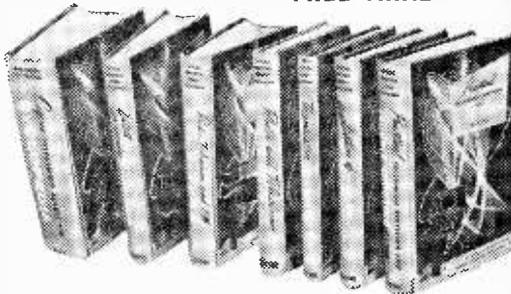
**SITUATIONS VACANT**

**TELEVISION EXPERIMENTER** with wide practical experience required to assist spare time or full time with development of interesting prototype, central London. Experience with photomultipliers useful. **REGENT 0707.**

# SIMTECH

## BOOK SERVICE

FREE TRIAL OFFER!



### NOW YOU CAN GET TOP U.K. & U.S.A. BOOKS ON FREE TRIAL, EASY PAYMENT PLAN!

Yes it's true! Now for the first time ever! You can select from a whole new range of books by famous authors!

Look over the list of books and select the first three books you would like to examine. Circle the book numbers on the coupon. Additional books you would like to see may be entered on a separate piece of paper and these will be sent on to you after completion of the first transaction.

*Note.*—Volumes 1, 2, and 3, are highly recommended for the beginner.

**No. 1. APPLICATION OF RADIO AND TELEVISION PRINCIPLES.** Coyne.

Covers Frequencies, Inductive Reactance, Resonance and tuning coils, Electronic Tubes and valves, Electrons, Amplifiers, Rectifiers, Oscillators, Modulators, Circuits, Couplings, Transformers, etc. 300 pages. Vinyl cloth covers. 26/-.

**No. 2. RADIO-TELEVISION AND F.M. RECEIVERS.** Coyne.

Rectifiers, Power Supplies, Antennas, Super-Heterodyne Receivers, Car radios, Public Address Systems, High Frequency, Short Wave, F.M./VHF Receivers, etc. 400 pages. Vinyl cloth covers. 26/-.

**No. 3. RADIO AND TELEVISION CIRCUITS.** Coyne.

Amplifiers, Power Tubes, Phase Inverters, Transformers, Decoupling and Shielding, Tuning and Tracking Tests, Testing Methods, Distortion and Noise, Contact Rectifiers—Detector, Photo-tubes—Special Uses. 335 pages. Vinyl Cloth covers. 26/-.

**No. 4. LATEST INSTRUMENTS FOR SERVICING RADIO AND TELEVISION.** Coyne.

Indicating meters, Operating and Care of Meters, Measurements, Analyzers and Multi-meters, Electronic Voltmeters, signal Generators, Oscillators, Testing Methods. 350 pages. Vinyl cloth covers. 26/-.

**No. 5. PRACTICAL TELEVISION SERVICING AND TROUBLE SHOOTING MANUAL.** Coyne.

A How-to-do-it approach to Tuners, Alignment Methods, Video I-F Amplifiers, Traps, Video Detectors and Amplifier, Picture Tubes, Power Supplies, Test Patterns, Antennas, Colour T.V. and U.H.F. 34/-.

**No. 6. COYNE TELEVISION SERVICING CYCLOPEDIA.** Coyne.

Quick and Concise Answers to TV Problems in alphabetical order, cross indexed, fully illustrated. Covers hundreds of facts on servicing. Over 800 pages. Vinyl cloth covers. 47/6.

**No. 9. TRANSISTOR CIRCUIT HANDBOOK.** Louis E. Garner.

Practical—Technical Reference Book covering Modern Transistor Applications. Covers Control Circuits, Amplifiers, Receivers, Test Instruments, Special Purpose Circuits, Wiring Techniques, etc. Fully illustrated—more than 200 circuit Diagrams. 410 pages. Vinyl cloth covers. 39/6.

**No. 10. TELEVISION RECEIVER SERVICING. Vol. 1.** by E. A. W. Spreadbury. 1961 Edition.

An excellent book, thoroughly covering Time Base Circuits, including the Cathode Ray Tube. How to check the Waveform at the Input and Output of each Section—Faults—Blank Screen—Obtaining a Raster, Applying a Signal, Synchronization, Interface Quality, etc. (Recommended.) 362 pages. 25/-.

**No. 11. PRINCIPLES OF TRANSISTOR CIRCUITS.** S. W. Amos.

Introduction to the Design of Amplifiers, Receivers and other Circuits, how to sheldrite input resistance, stage gain, optimum Load, Power Output, values of Coupling Capacitors and Transformer Winding Inductances. Details of Photo-sensitive Devices and Transistor Relaxation Oscillators. 21/-.

**No. 12. RADIO DESIGNER'S HANDBOOK.** Fourth Edition. F. Lansford-Smith.

A Comprehensive reference book, the work of 10 Authors and 23 Collaborating Engineers, containing a vast amount of data in a readily accessible form.

**No. 13. TELEVISION EXPLAINED.** Miller & Spreadbury.

In simple terms and non-mathematical language gives a step-by-step survey of modern television receivers and aerial systems, including A.G.C. and Flywheel Synchronising. 164 pages. 12/6.

**No. 14. RADIO CIRCUITS.** Miller & Spreadbury.

Introduction to Superheterodyne Receiver Circuits, includes transistor and F.M. Receiver, Battery Receivers, Car Radios. Mathematics and obscure theoretical details are entirely omitted. 172 pages. 16/-.

**No. 15. WIRELESS SERVICING MANUAL.** W. T. Coking. 9th Edition.

Over 110,000 copies of this publication already sold. This is a standard work recognised as a reliable and comprehensive guide for amateur and professional alike. Essential testing apparatus is described, and logical methods of reducing and remedying faults are explained. 263 pages. 17/6.

**No. 16. PRINCIPLES OF FREQUENCY MODULATION.** B. S. Garner.

Basic Principles of F.M. Theory of F.M. F.M. and Interference, Generation of F.M. Waves, Detection of F.M. F.M. Receivers, K-F Amplifier, Mixer, Oscillator, F.M. Tuner, Aerial. 115 pages. 21/-.

**No. 17. ELECTRONIC COMPUTERS. Principles and Applications.** T. F. Ivall. 2nd Edition.

Circuitry and Construction of Digital and Analogue Computers. Latest Applications in Industry, commerce and Science outlined. A non-mathematical introduction to computers, designed to appeal to technicians, engineers and students who have some knowledge of electronic engineering. 260 pages. 32 plates. 25/-.

**No. 18. REFERENCE MANUAL OF TRANSISTOR CIRCUITS.** Mullard.

Features 60 circuits you can build, 241 diagrams. 308 pages. 12/6. Just mail coupon for free trial. After 7 days send only low price or return books and pay nothing. If you keep more than one book send £1 after 7 days and £1 each month until completed (maximum three books).



No. 7  
*Pin-Point*  
**TV troubles**  
**in 10 minutes**

Find the exact sound or picture trouble in ANY TV set from 700 possibilities! Latest edition now has 332 pages of solid TV servicing information; 300 diagrams, check charts. 31/6.

**SPECIAL OFFER**

Circle Book No. 7 on coupon, send only 16/3 after 7 days, and 16/3 in 30 days, making a total of 32/6 including postage.

No. 8  
*Pin-Point*  
**Transistor**  
**troubles in 12**  
**minutes**

Trouble-shoot every type of circuit in ALL transistorized equipment! 525 pages; hundreds of illustrations; 120 check charts. 47/6. Circle Book No. 8 on coupon.



**LIMITED OFFER! ACT NOW!**

To SIM-TECH BOOK COMPANY  
Mail Order Division, DEPT. PTV11, Gaters Mill, West-End, Southampton, Hants.

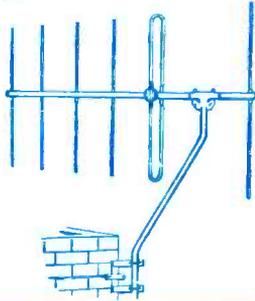
Rush the books circled below for 7-day FREE TRIAL as per offer.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----

Name.....  
Address.....  
City..... County.....

Tick here if enclosed full price. Same 7-day money back guarantee Postage £2 or less, 1/5; £3 or more, 2/-.

# Build your own Aerials...



## AT HOME

**AERIAL FITTINGS FOR BAND III, BAND I & RADIO F/M.**  
 Useful formulæ and hints for constructing your own aerial quickly and cheaply. Catalogue illustrating our increased range of Diecast Alloy Fittings, including Band III to Band I Mast Couplers, Reflector and Director Rod Holders, Insulators (both "Inline" and "H" types), Masthead Fittings, Masts and Elements, Chimney Brackets, etc. Send 1/- in stamps for the above, to:—

# Fringevision Ltd.

MARLBOROUGH, WILTS. Phone: 657/8

# FREE TO AMBITIOUS ENGINEERS

— THE LATEST EDITION OF ENGINEERING OPPORTUNITIES

### Have you sent for your copy?

**ENGINEERING OPPORTUNITIES** is a highly informative 156-page guide to the best paid engineering posts. It tells you how you can quickly prepare at home for a recognised engineering qualification and outlines a wonderful range of modern Home Study Courses in all branches of Engineering. This unique book also gives full details of the Practical Radio & Electronics Courses, administered by our Specialist Electronics Training Division—the *B.I.E.T. School of Electronics*, explains the benefits of our Employment Dept. and shows you how to qualify for five years promotion in one year.

**We definitely Guarantee "NO PASS — NO FEE"**

Whatever your age or experience, you cannot afford to miss reading this famous book. If you are earning less than £25 a week, send for your copy of "ENGINEERING OPPORTUNITIES" today—FREE.

**BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY** (Incorporating *E.M.I. Institutes*)  
 (Dept. SE/20), 29 Wright's Lane, London, W.8

### WHICH IS YOUR PET SUBJECT?

Mechanical Eng.,  
 Electrical Eng.,  
 Civil Engineering,  
 Radio Engineering,  
 Automobile Eng.,  
 Aeronautical Eng.,  
 Production Eng.,  
 Building, Plastics,  
 Draughtsmanship,  
 Television, etc.

### GET SOME LETTERS AFTER YOUR NAME!

A.M.I. Mech. E.  
 A.M.I.C.E.  
 A.M.I. Prod. E.  
 A.M.I.M.I.  
 A.I.O.B.  
 A.F.R. Ae.S.  
 B.Sc.  
 A.M. Brit. I.R.E.  
 City & Guilds  
 Gen. Cert. of Education  
 Etc., etc.

### PRACTICAL EQUIPMENT

Basic Practical and Theoretic Courses for beginners in Radio, T.V., Electronics, Etc., A.M. Brit. I.R.E. City & Guilds Radio Amateurs' Exam. R.T.E.B. Certificate P.M.G. Certificate Practical Radio Radio & Television Servicing Practical Electronics Electronics Engineering Automation

### INCLUDING TOOLS!

The specialist Electronics Division of *B.I.E.T. (Incorporating E.M.I. Institutes)* NOW offers you a real laboratory training at home with practical equipment. Ask for details.

### B.I.E.T. SCHOOL OF ELECTRONICS



### POST COUPON NOW!

Please send me your FREE 156-page "ENGINEERING OPPORTUNITIES"  
 (Write if you prefer not to cut page)

NAME .....

ADDRESS .....

.....

.....

SUBJECT OR EXAM THAT INTERESTS ME .....

(SE/20.)

**THE B.I.E.T. IS THE LEADING ORGANISATION OF ITS KIND IN THE WORLD**

**C.R.T. BOOSTER TRANSFORMERS**  
 TYPE A. OPTIONAL 25% and 50% BOOST.  
 2 V. OR 4 V. OR 6.3 V. OR 10.8 V. OR  
 13.3 V. MAINS INPUT. 12/6

**TYPE A2. HIGH QUALITY, LOW CAPACITY,  
 10/15 p.p. OPTIONAL BOOST 25%, 50%,  
 75%. MAINS INPUT. 18/6**

**TYPE B. MAINS INPUT, MULTI OUTPUT 2,  
 4, 6.3, 7.5, 10 and 13 VOLTS. BOOST 25%  
 AND 50%. LOW CAPACITY. 21/6**  
 Full instructions supplied.

**TRIMMERS.** Ceramic. 30, 50, 70 pF. 9d.; 100 pF.  
 150 pF. 1/3; 250 pF. 1/6; 500 pF. 700 pF. 1/6.

**RESISTORS.** Preferred values. 10 ohms to 10 meg.  
 1. 4d.; 1 w. 4d.; 1 w. 6d.; 1 1/2 w. 3d.; 2 w. 1/2.

**HIGH STABILITY.** 1 w. 1%, 2/-; Preferred values.  
 10Ω to 10 meg. Ditto, 9Ω, 100Ω to 5 meg. 0.9d.  
 0 watt } **WIRE-WOUND RESISTORS** { 1/8  
 5 watt } 25 ohms—10,000 ohms { 1/6  
 1.5K to 50K 10 w. } 2/-

**AMERICAN "BRAND FIVE"  
 PLASTIC RECORDING TAPE**

Double Play 7in. reel, 2,400ft.	60/-	Spare
5in. reel, 1,200ft.	37/6	Plastic
Long Play 7in. reel, 1,800ft.	35/-	Reels
9in. reel, 1,200ft.	22/6	3 in. 1/6
9in. reel, 900ft.	18/6	4 in. 2/-
		5 in. 2/-
Standard 7in. reel, 1,200ft.	25/-	5 1/2 in. 2/-
5in. reel, 600ft.	16/-	7 in. 2/6

"Instant" Bulk Tape Eraser and Head De-  
 fluxer, 200/250 v. A.C.C. 27/8. Leaflet, S.A.E.

**O.P. TRANSFORMERS.** Heavy Duty 50 mA. 4/8.  
 Multiratio, push-pull. 7/8. Ditto, 10 w. 15/6. Mini-  
 nature, 384, etc., 4/6. L.F. CHOKES 15/10 H. 60/65  
 mA, 5/-; 10 H. 85 mA. 10/8; 10 H. 160 mA. 14/-

**MAINS TRANSFORMERS 200/250 v. A.C.  
 STANDARD.** 350-0-250, 80 mA. 1 s. 3 v. 3.5 a.  
 tapped 4 v. 4 a. Rectifier 6.3 v. 1 a. 3 v. 3.5 a.  
 2 a. or 4 v. 2 a. ditto, 350-0-350. 22/8

**MINIATURE 200 v. 20 mA. 6.3 v. 1 a. 10/8**  
**HEDT.** 220 v. 45 mA. 6.3 v. 2 a. 15/8

**SMALL.** 220-0-220, 60 mA. 6.3 v. 2 a. 12/6

**STD.** 250-0-250, 65 mA. 6.3 v. 3.5 a. 17/8

**HEATER TRANS.** 6.3 v. 1 amp. 7/8  
 8/6, tapped sec. 2, 4, 6.3 v., 1 1/2 amp. 8/6  
 Ditto, sec. 6.3 v. 3 amp. 10/6

**GENERAL PURPOSE LOW VOLTAGE.** 2a.  
 3, 4, 5, 6, 9, 10, 12, 15, 18, 24, 30 v.

**AUTO TRANSFORMERS.** 150 w. 22/8  
 0, 10, 120, 200, 230, 250 v. 22/8

**ALADDIN FORMERS** and core, 4in., 8d.; 4in., 10d.  
**FORMERS 5837/8** and Cans TV7/2. 7in. sq. s.  
 2in. and 4in. sq. 1in., 2/-; with cores

**SOLDERING IRON, 200 or 240 v. 25 w. 24/-**  
**MAINS DROPPERS.** 3in. x 1 1/2in. A.I. Sliders.  
 \*3 amp., 1,000 ohms, 4/3. \*2 amp., 1,000 ohms, 4/3.  
**LINE CORD.** 0.5 amp., 60 ohms per ft., 0.2 amp., 10c  
 ohms per ft., 2 amp., 6d. per ft., 3-way, 7d. per ft.

**LOUDSPEAKER P.M. 3 OHM.** 5in. Rola, 17/8  
 5in. Plessey, 19/8. 6in. x 4in. Rola, 18/-, 6in.  
 Rola, 19/8. 10 in. x 6in., 27/8. 10in. 30/-

4in. Hi-Fi Tweeter, 25/-; 12 in. R.A., 30/-  
**TENTORIUM HI 1012.** 10m. 2 to 15 ohms, 10/-, 85/-  
**12in. BAKER** 15 watt 3 ohms, or 15 ohms, 80/-  
**CRYSTAL DIODE G.E.C. 2/-.** GEX34, 4/-  
**HIGH RESISTANCE PHONES.** 4,000 ohms, 15/-  
 per. MIKE TRANSF. 50, 1/3, 3/9 a.e.; 100, 1/1, Potenti. 10/6.  
**SWITCH CLEANER.** Fluid squirt sprout, 4/3 tin.

**TWIN GANG TUNING CONDENSERS.** 365 pF  
 miniature 1in. x 1 1/2in., 10/-, 500pF Standard  
 with trimmers, 9/-; midjet, 7/8; with trimmers, 9/-  
**SINGLE.** 50 pF, 2/8; 75 pF, 100 pF, 160 pF, 7/-  
 10d. dielectric 100, 300, 500 pF, 3/6.

New and Boxed **VALVES** 90-day Guarantee.

1R5	7/6	6R8G	7/8	FABC80	8/8	HABC90	
185	7/6	6L6G	10/8	EB91	8/8		12/6
1T4	6/-	6X7M	6/8	EB33	8/6	HVR2A	6/6
2X2	3/6	6U7G	8/8	EC41	8/6	MI14	9/6
25A	7/6	6BA7	6/8	EBF80	10/-	1P61	3/6
27A	7/6	6BS7M	6/8	EC34	8/6	PC84	8/6
5U4	7/6	6BS7	6/8	EC30	5/6	PC80	9/6
5Y3	7/6	6V8G	6/8	ECH42	8/6	PC182	11/8
5Z4	9/6	6X4	7/8	ECL82	10/6	PC25	6/6
6AM6	5/-	6X5	6/8	EF39	5/6	PL82	10/8
6BS	5/-	12AT7	8/-	EF41	9/6	PV80	7/8
6BE6	7/6	12AU7	8/-	EF30	5/6	PV81	9/8
6BE7	9/6	12AX7	8/-	EF50	3/6	PV82	7/8
6BW6	9/6	12BE6	6/8	EF80	8/6	SP61	3/6
6D6	6/-	12K7	8/8	EP92	5/6	UC41	6/6
6CG	7/6	12Q7	6/8	EL32	5/6	UC142	9/6
6GH	3/6	6AL5	6/8	EL84	8/8	UL41	9/6
6J5	5/6	85Z4	7/8	EL84	8/8	UL41	9/6
6L6	5/8	80	9/8	EM81	9/8	UY41	8/6
6U7G	6/8	807	5/8	EZ40	7/8	Y22	8/6
6XGGT	6/8	954	1/8	EZ80	7/8	VR103	9/8
6K7G	5/8	EA50	1/6	EL148	1/6	VR150	9/8

## "REGENT" 4 VALVE "96"



**RANGE  
 VALVES  
 KIT PRICE  
 £6. 6. 6.**  
 Carr. 4/-

## PRINTED CIRCUIT BATTERY PORTABLE KIT

Medium and long wave. Powerful  
 7 x 4in. high Flux Speaker. T.C.C.  
 Printed Circuit and condensers. Com-  
 ponents of finest quality clearly iden-  
 tified with assembly instructions. Os-  
 mor Ferrite Aerial Coils. Rexine covered  
 attache case cabinet. Size 12in. x 8in. x  
 4in. Batteries used B126 (L5512) and  
 AD35 (L5040), 10/- extra. Instructions  
 9d. (free with kit). Mains Unit ready  
 made for above, 39/6. Sold separately.

## TV REPLACEMENT LINE OUTPUT TRANSFORMERS

FROM 45/- ea. Most makes avail-  
 able. S.A.E. with all enquiries.

**LINE BLOCKING TRANSFORMERS, from 10/-**  
**FRAME BLOCKING TRANSFORMERS, from 13/8.**

**FRAME OUTPUT TRANSFORMERS, from 27/8.**

**NEW MULLARD TRANSISTORS**  
 Audio OTC 10, RF OC44 15/8  
 OC72 12/8 OC45 12/8

**Sub Miniature Electrolytics, 15 volt.**  
 1, 2, 4, 5, 8, 25, 50, 100 mfd. 3/- each.  
 Weyrad Printed Circuit Components in stock.  
 7 x 4 in. Speaker 35/1 25/-

**HIGH GAIN TV PRE-AMP KITS**  
**BAND I BBC**

Tunable channels 1 to 5. Gain 18dB.  
 EC84 valve. Kit price 29/8 or 49/8 with power  
 pack. Details 6d. (PC84 valves if preferred).

**BAND III ITA** - Same prices.  
 Tunable channels 8 to 13. Gain 17dB.  
 EC84 valve. (PC84 valves if preferred).

**CRYSTAL MIKE INSERT** by Aeos precision  
 engineered. Size only 1/2in. by 3/16in., 6/6.

**ALUMINIUM CHASSIS.** 18 s.w.g. un drilled.  
 With 4 sides, riveted corners and lattice fixing  
 holes, 2 1/2in. sides, 7 x 4in., 4/6; 9 x 7in., 5/8;  
 11 x 7in., 6/9; 13 x 9in., 8/6; 14 x 11in., 10/6;  
 15 x 14in., 12/6; 18 x 16 x 3in., 16/6.

**ALUMINIUM PANELS.** 18 s.w.g. 12in. x 12in.,  
 4/6; 14 x 9in., 4/-; 12 x 8in., 3/-; 10 x 7in., 2/3.

**JASON P.M. TUNER COIL SET.** 29/-, H.F.  
 coil, aerial coil. Oscillator coil. Two I.F. trans.  
 10.7 Mc/s Ratio Detector and heater choke.  
 Circuit book using four RAMB, 2/8.

**COMPLETE JAS IN F.M. KIT.** FMTI, with  
 set of 4 valves, etc., 28.5.0.

**BBC TRANSISTOR RADIO.** Med. and Long  
 Wave. Two transistors and diode. Complete  
 kit, 32/6, phones 7/6 extra. Deaf Aid Earpiece  
 with Special Lead, 12/8. Details 6d.

**CYLDON TURRET TELETUNER**  
 I.F. 33/88 megs, complete with frame-grid  
 valve, 500L1, 30L15. With coils for TV and FM  
 Channels 1 to 13. Brand new, price 45/-  
 operating data and circuit supplied. IDEAL  
 for P.T. "OLYMPIC".

**I.F. TRANSFORMERS 7c pair**  
 465 Kc Slug Tuning Miniature Can 1 1/2 x 1 x 1  
 in. High Q and good bandwidth. Data sheet  
 supplied.

## RECORD PLAYER BARGAINS



The Brilliantly Successful  
**Maranch**  
 World's Best-Selling Automatic

4 Speed Autochangers, B.S.R., U.A.8	26.15.0
4 Speed Autochangers, B.S.R., U.A.14	27.10.0
Collaro Autochanger	27.19.6
Garrard Model 210, GCR Head	210.10.0
4 speed Single Player, L.M.I.	28.5.0
Garrard TA Mk. II, GCR Head	28.0.0
Garrard Model 48P GCR	29.17.6
Garrard Stereo Head, £2 extra	
Suitable player cabinets (except 4 H.F.)	49/6
Amplifier player cabinets (except 4 H.F.)	63/-
2-valve amplifier and 6 1/2in. speaker	79/8
3-valve amplifier and 6 1/2in. speaker	95/-

Wired and tested ready for use with above.

## Volume Controls 80 ohm COAX

Long spindles. Guarant- Semi-air spaced. 4in.  
 1 year. Magnet Losses cut 50%.  
 2K ohms to 2 Meg. 40 yls/17.8 6d.yd.  
 No sh. D.P.5P. 60 yls. 25/-  
 3/- 4/6 Fringe Quality 1/- yd.  
 Linear or Log Tracks. Air Spaced.

**COAX PLUGS 1/- LEAD SOCKET 2/-**  
**PANEL SOCKETS 1/- OUTLET BOXES 4/6**  
**BALANCED TWIN FEEDER yd. 6d. 80 or 300 ohms.**  
**DITTO SCREENED per yd. 1/8. 80 ohms only.**  
**WIRE-WOUND POTS, 3 WATT. Preset. Min.**  
 TV Type. 30 value 25 ohms to 25 K., 3/-  
 30 K., 60 K., 4/- (Carbon 30 K. to 2 meg, 3/-)  
**WIRE-WOUND 4 WATT. Pots Long Spindle**  
 values. 50 ohms to 50 K., 6/8; 100 K., 7/8.  
**CONDENSERS.** New Stock. 0.001 mfd. 7 kv.  
 T.C.C. 5/6; Ditto, 20 kv., 9/8; 0.1 mfd., 7 kv., 9/8;  
 Tubular 500 v. 0.001 to 0.05 mfd., 8d. 0.1, 1/-  
 0.25, 1.5/8; 0.5/500 v. 1/8; 0.1/550 v., 9d.; 0.01/2,000 v.  
 1/1,000 v., 1/8; 0.1 mfd., 2,000 volts, 3/6.  
**CERAMIC CONDS.** 500 v., 0.3 pF to 0.01 mfd., 9d.  
**SILVER MICA CONDENSERS.** 10% 5 pF to 500 pF,  
 1/-; 600 pF to 3,000 pF, 1/3. Close tolerance  
 ±1 pF, 1.5 pF to 47 pF, 1/8. Ditto 1% 50 pF to  
 115 pF, 1/8; 1,000 pF to 5,000 pF, 2/-.

## NEW ELECTROLYTIC. FAMOUS MAKES

TUBULAR	TUBULAR	CAN TYPES	5/-
1/350	2/1	50/350	2/8
2/450	2/3	100/250	2/-
4/450	2/3	250/250	2/6
10/450	2/3	600/120	3/-
20/450	2/8	8/450	3/8
30/450	3/1	16/450	3/8
50/500	4/1	16/300	5/8
22/450	3/8	16/450	4/3
25/250	1/8	16/1500	6/1
30/500	1/2	32/250	4/6

100 x 200/275 12/8

**RECTIFIERS** Selenium 400 v., 85 mA, 7/8.  
**CONTACT COOLED** 230 v., 50 mA, 7/-; 60 mA, 8/8.  
 85 mA, 9/8; 200 mA, 21/-; 300 mA, 27/8.

**COILS** Weatite "P" type, 3/- each. Osamor Midjet  
 "Q" type, add. Dist. core 4/6. All ranges

**TELETRON L.** Med. T.P.F. with reaction, 2/8.  
**FERRITE ROD AERIALS.** M.W., 8/8; M. & L. 12/6.  
**I.R.F. COILS A/H.P.** 7/- pair. H.F. CHOKES, 2/8.

**FERRITE ROD.** 8in. x 1in. 4in., 2/8.  
**WAVE WAVE BRIDGE** Selenium Rectifier.  
 5, 6 or 12 v. 1/4 amp., 8/8; 2 a., 11/3; 4 a., 17/8.

**CHARGER TRANSFORMERS.** Tapped input 200/  
 250 v. for charging at 2, 6 or 12 v., 11 apps., 15/8.  
 2 apps., 17/8; 4 apps., 22/8. Circuit included.

**VALVE and TV TUBE equivalents boxes, 9/6.**  
**TOGGLE SWITCHES.** S.P. 2/-, D.P. 3/6. D.P. D.T. 4/-  
**WAVECHANGE SWITCHES**

2 p. 4-way 2 water long spindle 6/6  
 2 p. 2-way or 3 p. 2-way short spindle 2/6  
 2 p. 6-way, 4 p. 2-way, 4 p. 3-way long spindle 3/6  
 2 p. 4-way or 1 p. 12-way long spindle 3/6

**VALVE HOLDERS.** Pax Int. Oct. 4d. EF50, EA60,  
 6d. B12A, CRT. 1/3. Eng. and Amer. 4, 5, 6 and  
 2 pin. 1/- MOULDED MAZDA and Int. Oct., 6d.  
 87G, 88A, 88G, 89A, 9d. 87G with can., 1/8.  
 89A with can., 1/8. BERRYLOD EF50, 87G, 89A.  
 Int. Oct., 1/- SCANS B12G, 89A, 1/- ea.  
**SPEAKER FRET.** GOLD CLOTH. 17in., 25in., 5/-  
 26in. x 35in., 10/-. Tysan 22in. wide, 10/- ft.; 26in.  
 wide, 5/-. Green or red. Samples S.A.E.

# RADIO COMPONENT SPECIALISTS

Post and Packing 1/4, over £2 free. (Export post extra.) C.O.D. 1/6. (Wed. 1 p.m.) THO 1665. Buses 133 or 68