Practical TELEVISION

MAY 1962

1/9

Extensions from A.C./D.C. sets
Light-sensitive resistors
Commercial aspects of standards-switching

★ VALVES ★

BY RETURN OF POST

THE MOST COMPREHENSIVE & COMPETITIVE VALVE LIST IN THE COUNTRY

10% DISCOUNT SPECIAL OFFER TO PURCHASERS of any SIX VALVES marked in black type (15% in dozen). Post: 1 valve, 6d., 2-11, 1/-.

NEW LOW PRICES GUARANTEED 3 MONTHS

FREE TRANSIT INSURANCE. All valves are new or of fully guaranteed ex-Government or ex-equipment origin. Satisfaction or Money back Guarantee on goods if returned unused within 14 days.

OZ4	5/-	6J5GT	4/-	12E1	17/6	DF35	9/9	EM85	10/-	TDD4	7/6
1A5GT	5/-	6J6	4/-	12J7GT	9/-	**DF91**	3/6	EN31	16/-	U14	8/-
1A7GT	11/-	6J7	8/6	12K7GT	4/9	DF96	7/3	EY51		U18	8/-
1C5GT	9/-	**6J7G**	4/9	12K8	11/-	DH63	6/-	Small	7/9	U22	6/9
1D5	8/-	6J7GT	7/6	12K8GT	9/6	DH76	5/-	EZ86	7/6	U24	16/-
1D6	9/9	**6J8**	9/6	12Q7GT	5/-	DK32	11/-	EY86	5/6	U25	11/6
1F5GT	9/9	6K6GT	6/6	12SA7	7/-	DK91	5/6	EZ35	6/6	U26	9/9
1L4	3/3	6K7	5/9	12SG7	5/-	DK92	7/-	EZ41	7/-	U31	7/-
1LD5	3/6	**6K7G**	2/3	12SH7	3/6	DK96	7/3	EZ80	6/-	U33	14/-
1LN5	4/9	6K7GT	4/6	12SJ7	5/6	DL33	8/-	EZ81	6/6	U35	12/6
1N5GT	9/9	6K8GT	8/9	12SK7	4/9	DL35	9/-	FW4/500	8/-	U37	26/-
1R5	5/6	6K25	7/6	**12SN7GT**	7/9	DL65	6/-	FW4/800	8/-	U50	5/9
1S4	8/-	6L1	12/6	13D3	9/-	DL75	6/-	GT1C	7/-	**U52**	4/9
1S5	4/6	6L6G	6/6	14S7	14/9	DL82	9/-	GZ32	8/9	U76	5/6
1T4	3/6	6L18	9/-	19AQ5	7/6	DL91	8/-	GZ34	12/6	U78	5/-
2A3	6/6	6L19	11/-	19BG6	19/-	DL92	6/-	HABC80	9/6	U191	12/6
2A7	9/6	6LD3	8/-	20D1	9/6	DL94	6/9	HL41DD		U281	9/6
3A4	4/9	6LD12	6/9	**20F2**	9/6	DL96	7/3		8/3	U282	15/-
3A5	9/-	6LD20	7/9	20L1	16/-	EABC80	6/9	HN309	19/-	U301	15/-
3D6	4/6	6N7	7/6	20P1	8/9	EAC91	4/6	HVR2	10/6	U309	6/9
3Q4	7/-	6P1	7/6	**20P3**	12/6	EAF42	8/-	IW4/350	7/6	U329	6/9
3Q5GT	8/-	**6P25**	8/6	20P4	18/-	**EB41**	7/-	IW4/500	7/6	U339	11/-
3S4	6/-	**6P28**	12/6	20P5	15/-	**EB91**	3/-	KLL32	8/6	U801	19/-
3V4	6/9	**6Q7G**	6/-	25A6G	8/-	EBC33	4/9	KT32	6/9	UABC80	8/-
5R4GY	12/6	6Q7GT	8/6	**25L6G**	6/9	EBC41	8/-	KT33C	4/6	UAF42	7/9
5T4	8/-	6R7G	8/6	25L6GT	7/9	EBC81	7/9	**KT36**	12/6	UB41	7/9
5U4G	4/9	**6SA7**	5/6	25Y5G	8/-	EBF80	7/9	**KT44**	7/6	UBC41	7/9
5V4G	7/9	**6SG7**	4/9	25Z4G	7/-	EBF83	9/6	**KT45**	8/6	UBC81	9/6
5Y3G	5/9	6SH7	3/-	25Z5	8/-	EBF89	8/6	KT61	8/6	UBF80	8/-
5Y3GT	5/9	6SK7	5/-	25Z6G	8/-	EBL21	12/6	KT63	5/9	UBF89	7/6
5Y4G	11/-	6SL7GT	5/9	30C1	7/-	EBL31	17/6	KT76	8/6	UBL21	14/6
5Z4	11/-	6SN7GT	4/6	30F5	6/-	EC91	4/6	KTW61	5/9	UCC84	14/6
5Z4G	7/6	6SQ7	5/9	30FL1	9/6	ECC31	7/6	KTW62	5/9	UCC85	7/-
5Z4GT	11/-	**6SS7**	3/6	30L1	6/9	ECC32	4/-	KTW63	5/9	UCF80	15/-
6/30L2	9/-	6U4GT	10/6	30P4	9/6	ECC33	4/6	**KTZ63**	5/6	UCH21	12/-
6A6	4/9	6V6G	5/-	30P12	7/6	**ECC34**	9/-	**L63**	2/9	**UCH42**	7/3
6A7	10/-	6V6GT	6/-	30P16	6/6	ECC35	6/-	**LN152**	7/-	UCH81	8/-
6A8G	8/6	6X2	7/9	30PL1	9/6	ECC40	14/-	MU14	7/6	UCL82	9/9
6A8GT	13/6	6X4	5/-	35L6GT	8/6	ECC81	5/6	N37	11/-	UCL83	13/6
6AB8	7/-	6X5G	5/-	35T	25/-	ECC82	6/-	N78	13/-	UF41	7/6
6AC7	3/3	6X5GT	5/6	35W4	6/9	ECC83	6/6	N108	16/-	UF42	5/6
6AG5	3/-	6Y6G	7/6	35Z4GT	5/6	ECC84	8/-	N152	8/6	UF80	7/-
6AG7	7/6	7A7	8/6	35Z5GT	8/-	ECC85	7/9	P41	4/6	UF85	7/6
6AK5	5/-	7B6	9/-	41	7/6	ECC88	16/-	P61	2/9	UF86	14/6
6AL5	3/-	7B7	7/9	42	7/6	ECC91	4/-	PABC80		UF89	7/-
6AM6	3/-	**7C5**	7/3	50C5	9/-	ECF80	8/6		11/6	UL41	7/-
6AQ5	6/-	7C6	7/6	50CD6	19/-	ECF82	8/6	PCC84	6/9	UL44	11/-
6AT6	5/9	7H7	7/3	50L6GT	8/6	ECH21	12/6	PCC85	8/3	UL46	9/9
6AC6	7/6	7K7	9/6	52KU	10/6	ECH35	7/6	PCC88	14/-	UL84	7/-
6B7	8/6	7Q7	8/6	53KU	10/6	ECH42	8/6	PCC89	9/-	UM80	9/6
6B8G	3/-	7R7	10/6	61SPT	11/-	ECH81	7/9	PCF80	7/-	URIC	8/-
6BA6	5/9	7S7	9/-	62BT	13/6	ECH83	8/3	PCF82	7/3	UU6	12/6
6BE8	5/9	7V7	7/9	75	6/6	ECL80	6/-	PCF84	16/-	UU7	9/6
6BG6G	15/-	7Y4	6/9	78	6/6	ECL82	9/6	PCL82	7/3	UU8	17/-
6BH6	6/-	7Z4	7/-	80	5/9	ECL83	11/7	PCL83	10/6	UY1N	11/-
6BJ6	6/-	**8D3**	3/-	83	9/6	EF22	7/-	PCL84	7/6	UY21	11/-
6BR7	9/6	10C1	11/6	185BT	19/6	EF36	3/3	**PEN45**	8/6	UY41	6/-
6BW6	7/6	10C2	14/6	803	19/-	EF39	4/6	PEN46	5/-	UY85	6/6
6BW7	5/6	10C14	8/-	807(A)	5/6	EF40	12/-	**PL33**	8/3	VP41	5/6
6BX6	4/9	**10F1**	5/9	808	7/6	EF41	8/-	PL36	9/6	VR105	6/9
6C4	3/6	10F9	10/6	813	55/-	**EF42**	7/6	PL38	16/6	VR150	6/9
6C5	5/6	10L14	7/-	832A	14/-	**EF50-BR**	2/-	PL81	8/6	W61M	11/-
6C6	3/9	10LD3	7/9	866A	11/6	**USA**	3/-	PL82	6/6	W76	4/9
6C9	11/-	10LD11	14/6	954	2/-	**EF54**	3/3	PL83	6/6	W81	7/3
6CD6G	19/6	10LD12	8/-	956	2/6	**EF80**	4/9	PL84	8/-	X61M	11/-
6CH6	7/6	10P13	11/-	9004	2/-	EF85	6/6	PL820	8/6	X63	8/6
6D2	3/-	**10P14**	9/-	ATP4	2/9	EF86	9/-	PX4	12/6	X65	11/-
6D3	9/6	10P18	7/-	AZ31	8/-	EF89	6/9	PX25	9/6	X66	11/-
6D6	4/3	12A6	4/9	**B36**	7/9	**EF91**	3/-	PY31	9/-	X76M	11/-
6F1	4/9	12AC6	15/-	C1C	9/6	**EF92**	4/6	PY32	10/-	X78	21/-
6F6G	5/9	12AD6	17/-	CBL1	26/6	EF96	3/-	PY80	6/9	X79	16/6
6F12	3/-	12AE6	13/9	CBL31	21/-	EL32	4/6	PY81	6/6	X81M	9/-
6F13	6/9	12AH8	9/-	CCH35	14/-	**EL33**	7/9	PY82	6/-	Y63	6/3
6F14	9/6	12AT6	7/6	CL33	9/6	EL35	7/-	PY83	7/-	**Z63**	4/9
6F15	9/6	12AT7	5/6	CY31	9/-	EL41	8/-	PZ30	9/6	**Z68**	9/6
6F16	8/-	12AU6	9/6	**D77**	3/6	EL42	8/9	R18	11/-	**Z152**	4/9
6F19	6/6	12AU7	6/-	D152	5/9	EL83	11/-	R19	11/-	**Z719**	4/9
6F23	6/6	12AX6	6/6	DA30	12/6	EL84	7/-	**SP41**	2/6	ZD152	7/9
6F32	6/6	12BA6	7/6	DAC32	9/9	**EL91**	4/-	**SP61**	2/6		
6F33	6/6	12BE6	7/6	DAF91	4/6	EM80	7/9	SU25	16/-		
6J5	4/3	12BH7	9/9	DAF96	7/3	EM81	8/6	SU2150	4/6		
6J5G	8/-	12C8	6/6	DET19	2/9	EM84	9/-	**T41**	7/6		

Tubes

Carr. & Ins. 12/6.

HIGHEST QUALITY—COMPARE OUR PRICES

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

	GUARANTEED 6 Months	12 Months	NEW TYPES
12in.	£2. 0.0	£3. 5.0	MW 31/74 £4-0-0
14in.	£2.10.0	£3.15.0	MW 36/24 £5-0-0
15/17in.	£3. 5.0	£4.10.0	CRM 172 MW 43/64
21in.	£3.15.0	£5.15.0	£6-0-0

RECORDERS. "Verdik" Track Deck, Collaro 3 Speed Transcription, Superior reproduction, Streamlined Portable Case. Complete with Mike. Market value approx. £45. OUR SPECIAL PRICE 29 gns.

B.B.C./I.T.A. TUNERS
Famous makes complete with PCF80, PCC84 valves. 38 M/c I.F. Fantastic value **19/-**

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

RECTIFIERS. Silicon Diodes 125 v. 500 mA. 2 in series make superior replacement for R.M.4 and R.M.5, etc., 8/- each. 12 volt 3½ amps., 9/6; 250 v., 80 mA, 5/-; RM1, 5/3; RM2, 6/9; RM3, 7/6, RM4, 19/6; RM5, 19/6; 14A86, 17/-; 14A97, 19/6; 14A100, 19/6; 16RC1-1-16-1, 7/9; 18RA1-1-1-16-1, 6/-; 18RD2-2-8-1, 14/-; 14RA1-2-8-2, 17/-; 14RA1-2-8-3, 20/-.

GERMANIUM DIODES, general purpose, 9d. each, 8/- dozen.

LINE TRANSFORMERS. Most types available from stock from 19/-. Also frame and blocking oscillator transformers. S.A.E. enquiries.

100 RESISTORS 6/6

100 CONDENSERS 10/-
Miniature Ceramic and Silver Mica Condensers 3 pF to 5,000 pF. LIST VALUE OVER £5.

MULTI-METERS. "Jenneu" Model 200H. D.C. Voltage. 5-25-50-250-500-2.5K (20,000 ohms per V.) A.C. Voltage. 10-50-100-500-1000 volts, (10,000 ohms per V.). A.C./D.C. Current. 0-50 μA, 0-2.5 mA-0-250 mA, £5.19.0. "Jemco" Model M.T.-316. D.C. voltage. 0-10-50-250-500-1000 volts, (20,000 ohms per V.). A.C. voltage. 0-10-50-250-500-1000 volts, (5,000 ohms per V.). D.C. current. 0-50μA, 0-25-500 mA, £5.19.0

EXTERNAL I.T.V. Convertors, with Power Pack. Very compact. 39/-. P.P. 2/-.

NEW SPEAKER CABINETS, covered in attractive Rexine, Gold Metal front 11/-. Or complete with Speaker. 19/- P.P. 1/6.

PERSPEX fronts for 17in. T.V. Sets. Brand new, 7/6. P.P. 1/6.

TAG STRIPS from 3 way to 12 way. Mixed parcel of 25, 3/9. This is the cheapest way to buy!

RESISTORS, your selection, 4/6 doz. Condensers, Silver Mica and Ceramic, 6/- doz. Most values in stock.

ALADDIN Type Slugged Formers with Screen and Tags. Small 5/- doz. Tall 6/- doz.

KNOBS. Black, Brown or White, with Gold Insets, 1/- and 1/3 each.

VALVE HOLDERS, B76, 6d. ea., with Screen 8d. ea. B9A, 6d. ea. with Screen 8d. ea.

SPECIAL RM4. Ex-equipment, guaranteed, 7/6 each.

13 CHANNEL TV's. Table Models—Famous Makes Absolutely complete. These sets are unequalled in value due to huge purchase direct from source. They are untested and are not guaranteed to be in working order. CARR., ETC., 15/-.

12"—£2.19.0

14"—£4.19.0

ALSO 12in. 5 CHANNEL TV'S 39/-. 14in. 5 CHANNEL TV'S 59/-.

NEW SPEAKER CABINETS. Covered in attractive Rexine. Gold metal front, 11/-. Or complete with Speaker. 19/-. P.P. 1/6.

CO-AX. standard and low loss, 25 yds., 12/6; 50 yds., 22/6; 100 yds. 42/6. Co-ax Plugs 1/3. Wall outlet boxes 3/6.

4-SPEED RECORD PLAYERS. Latest Turntable, together with lightweight Staar Galaxy dual sapphire crystal turnover pick-up head. Amazing value (pick-up only 19/-). £3.10.0. Carr. 3/-.

TRAV-LER TAPE RECORDER
Superior, Transistorized, Portable Fast Rewind. Built-in High Output Speaker. Unrepeatable, Listed 29 gns. OUR PRICE 15 gns.

UA20 Autochangers. Latest B.S.R. 10 mixed records. Brand New. Unrepeatable, £6.19.0. Also UA14. A Proven Choice £7.19.0 P.P. 4/-.

"GARRARD" Slimline. Very latest Compact Autochanger. Just released. Amazing value, £8.19.0. Also available, Garrard Model 209, £9.17.6, P.P. 4/-.

P.V.C. CONNECTING WIRE. 100 yds., 30 mil: Special Price 7/6, 200 yds. 30 mil: special price, 12/6. 25ft. Coil, 1/-, 5 Coils different colours, 4/-. Connecting flex. Prices as above.

CONDENSERS. 25 mixed. Electrolytic. Many popular sizes. List value £5. Our price 10/-.

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

U.S.A. SIMPSON. Universal Test Meter, A.C./D.C.. £4.10.0.

P.M. SPEAKERS. 3 ohm Performance guaranteed. 5in., 7 x 4in., 11/-; 6½in., 8in., 9/-.

V.C.R. 517. Standard 6in. Electrostatic C.R.T. Ideal for Oscilloscope, 9/6. Carr. 6/-.

AVO MODEL 40. Universal Standard Test Meter A.C./D.C. Limited quantity, £3.10.0.

NEW L.O.T. Wide angle using EY86. Including Line and Width Controls, 25/-. P.P. 1/6.

TEST PROD, Lead Kits, comprising complete leads, plus 2 extra prods, and 2 Crocodile Connectors, in plastic Case, 9/6. P.P. 6d.

F.M. TUNER KITS. Well known make. Comprising F.M. Tuning Lead, guaranteed non drift. Frequency coverage 88-100 mc/s, OA81 balanced diode output, Magic Eye Tuning, Two I.F. Stages and discriminator, £6.9.6. P.P. 4/-.

TECHNICAL TRADING CO.

Post: 2 lbs. 2/-, 4 lbs. 2/6, 7 lbs. 3/6, 15 lbs. 4/- etc. No C.O.D
ALL ITEMS LESS 5% AND POST FREE IN DOZENS.
(Callers always welcome). LIST OF 1000 SNIPS, 6d.

350-352 FRATTON ROAD, PORTSMOUTH.

Practical Television

AND TELEVISION TIMES

VOL. 12, No. 140, MAY, 1962

Editorial and Advertisement Offices:
PRACTICAL TELEVISION
George Newnes Ltd., Tower House
Southampton Street, W.C.2.

Phone: Temple Bar 4363.

Telegrams: Newnes, Rand, London.

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

SUBSCRIPTION RATES
including postage for one year

Inland - - - - £1.5.0 per annum
Abroad - - - - £1.3.6 per annum
Canada - - - - £1.2.0 per annum

Contents

New TV Services

MUCH has recently been written and spoken about the possibility of the introduction of one or more new TV services. However, most of the discussion on the subject has dealt with the question of whether a change should be made in the transmission standards used. So far as the general public is concerned, the controversy appears to have been centred around a possible increase in the number of lines of which the picture is composed. The fact remains, nevertheless, that if more programmes are to be provided, new frequencies will have to be used for the transmissions because Bands I and III are already fully occupied. Any new transmitters will presumably operate on frequencies higher than Band III. This will give rise to a number of problems so far as reception is concerned. These problems have already been felt on Bands I and III—especially the latter—but on higher frequencies (Bands IV and V), the effects will be even greater.

The first problem concerns the range of the signals. The higher the frequency of transmissions, then the more are they limited in range—Band III signals have less range than Band I signals—and, in Bands IV and V, the range approaches the optical. In other words, the signals act like light and if the receiving aerial is not within the line of sight of the transmitter, good signals may not be received. These high frequency signals are also more readily absorbed by solid objects, around, or through which low frequency signals pass without difficulty. This will result, of course, in more elaborate aerials being used quite close to the transmitter.

The second problem concerns reflection effects; "ghosts" are already well known, especially on Band III. Any large object can act as a reflector of TV signals provided it is larger than about half a wavelength. When frequencies are increased, the wavelength becomes shorter and many more objects become reflecting. Therefore, in order to discriminate against unwanted reflected signals, more efficient aerials will be required. It can thus be seen that when the future of television in this country has been settled, the amateur television enthusiast will find much to occupy his time.

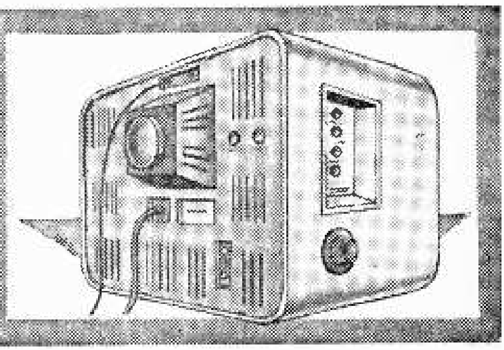
P.W. BLUEPRINTS

Included in each copy of the May issue of *Practical Wireless*, (published on April 4th) was a free, double-sided blueprint giving full constructional details of the latest P.W. designs—the Britannic Two and the Mercury Six. The Britannic Two is a two-valve mains-operated receiver and intended as an introduction to mains valves techniques and circuitry. The simplicity of the circuit makes the set suitable for those constructors who have only dealt with simple sets so far.

The Mercury Six is a six-transistor superhet which has been designed for those readers who are not confident of building a small pocket-sized set. It is not a miniature receiver and incorporates a loudspeaker of larger size than usual.

Our next issue, dated June, will be published on May 22nd.

Servicing Television Receivers



No. 78—BUSH TV77 SERIES

By L. Lawry-Johns

(Continued from page 327 of the April issue)

HAVING dealt with lack of width, which is generally due to a faulty metal rectifier, or to a low emission ECC82 or PL81, we now discuss the compete absence of the picture with no EHT, the EY86 not lighting and the sound remaining normal. Whilst this does direct attention to the timebase valves, and, if the timebase whistle is quite audible, to the EY86 in particular, we have often found the boost capacitor 0·25μF (C122 in the TV77) to be at fault. This is suspended on its own on the lower front centre of the chassis and it is necessary to remove the chassis to gain access to it.

Tube Defect

A rather unusual tube defect can and does often give rise to misleading symptoms. This sometimes shows as an extremely dark picture at maximum brilliance or no raster at all with the aerial disconnected or the contrast turned down. A voltage check at the tube base should soon reveal the cause and we assume here that the ion trap magnet is securely clamped in its original position and has not been disturbed. The CRT grid reading at pin 2 should read from zero to approximately 195V with the operation of the brilliance control. A reading at pin 11 (cathode) should reveal the cause of the trouble. The correct reading should be between 120V and 150V but, with the tube defect being described, the recorded voltage will probably be

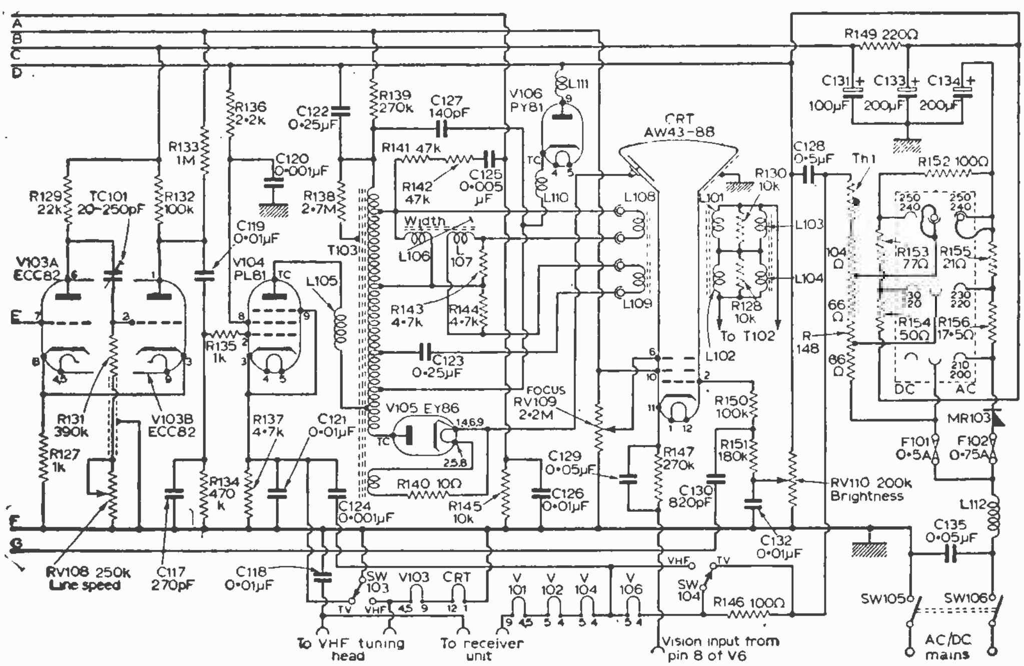


Fig. 4—The line timebase and tube circuitry.

well over 200 which is higher than the H.T. line and thus gives a clue as to what is happening.

A check at pin 10 (first anode) which should be over 400V will probably show this to be much lower and approximately the same as pin 11. The cause is therefore a short or heavy leak between the first anode and cathode in the tube. This is not generally as serious as it sounds or seems, since it is usually caused by a small particle which can usually be blown clear. A rapid and normally effective way of doing this is to connect pin 11 directly to pin 1 which is a chassis connection (the receiver is, of course, working during this operation). The result is usually a small flash from inside the tube neck as the short is blown clear and normal working can then be resumed.

We do not mean to indicate that the absence of a raster should immediately direct attention either to C122 or to the tube itself and the normal routine tests should always be followed. First ensure that the sound is normal which is a fair indication that the H.T. is also somewhere near its rated figure. Listen for the line timebase whistle which is generally audible to anyone of normal hearing. The presence of this whistle denotes that the line timebase is working at least to a degree and it is the work of moments to remove the right-hand side screening cover to expose the line output section. A neon screwdriver merely brought near this section will light if the line output stage is working normally and if it does the chances are that EHT is being applied to the top cap of the EY86.

The top cap of this valve is fairly well insulated and thus a long sizzling spark cannot be expected to jump to the blade of a proffered screwdriver. A blue glow will appear around the plastic insulation however when the blade is advanced to it and this is sufficient indication for a rough check.

If no glow can be seen in the EY86 it is reasonable to assume that the valve is at fault with an o.c. heater and another should be tried. If the heater glow is visible, it is again reasonable to assume that the EHT is in fact being applied to the tube and that the fault is not in the line timebase system at all.

One should always pay attention to the condition of the tube neck when making preliminary checks. Flashing in the gun assembly or a mauve glow in the neck should be sufficient to warrant changing the tube before proceeding further.

Assuming however that the line timebase whistle is not present, or is very faint, observe the PL81 and PY81 valves. If there is a faint whistle audible in the TV76 and TV77 series (not TV75 and TV75c), the PL81 will probably present a normal appearance but may in fact be at fault as may the PY81 or the previously mentioned 0·25μF (referred to as C122 in the TV77 only, C119 in the TV75, C22 in the TV76 series). If there is no line whistle at all the PL81 may well appear red-hot, and this should immediately direct attention to V103 (ECC82) or, in the case of the TV75, V101 which is a PCL83. Although the PL81 can become red-hot due to an internal short, the usual cause is lack of line drive due to an inoperative line oscillator.

The screen resistor of the PL81 (R136) is rarely at fault in this series as it is adequately rated at 6W.

Lack of Height

A frequent cause of insufficient height is a defective focus control element. This is not as surprising as it may appear at first sight since this element is connected from the boosted H.T. line to chassis (pin 1 of the tube base). The boosted line

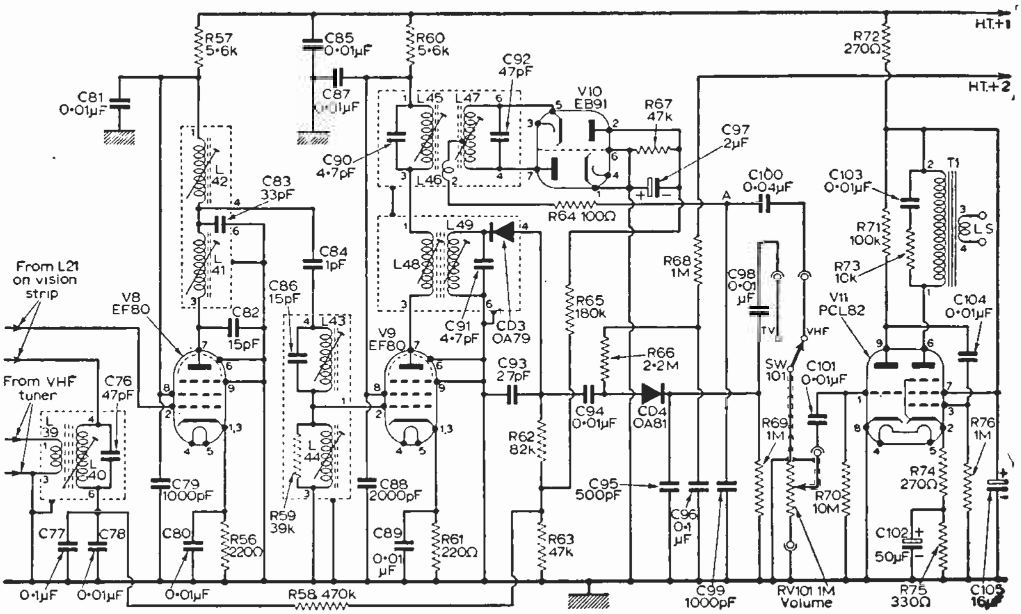


Fig. 5—Sound I.F., detector and output circuits.

is connected to pin 10 and the slider of the control supplies the focus electrode at pin 6. If the element changes in value, the boost line feed (not only to pin 10 but also to the frame oscillator anode via R117) will fall and the height will therefore be inadequate. Similar effects could be caused by several other components changing value, but the focus control seems a common offender. We should make it quite clear that by lack of height, we refer to equal loss top and bottom not merely bottom compression.

Bottom Compression

When the lines at the bottom are more closely bunched than those at the top, which may appear opened out, the effect is that objects appear distorted, elongated at the top and compressed at the bottom. The face of a news reader for example would have a very small and flat chin, opening out to a very high forehead and stretched hair. This should first direct attention to V102 (PCL82), then R124 (360Ω) and C115 (100μF). If necessary check C114 (particularly if the bottom is folded up into a light band) C111 and C112.

Distorted Sound on TV

If the VHF sound is clear but the TV sound is distorted, check R66 and GD4 (OA81), GD3 (OA79) if necessary.

Distorted Sound on VHF; TV Sound Clear

Suspect unsuitable F.M. aerial and try the effect of a directional horizontal dipole. If the distortion remains, check V10 and associated components and ensure that the F.M. I.F. alignment has not been disturbed.

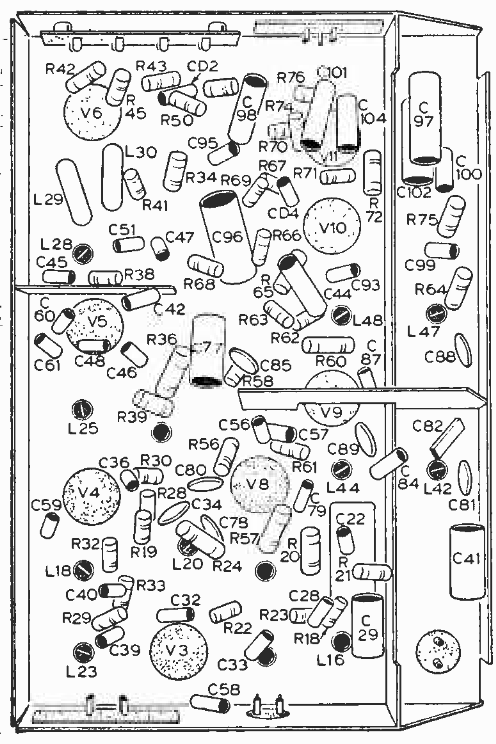


Fig. 6—Underchassis layout of the vision I.F. section.

Distorted Sound At All Times

Check V11 (PCL82), leakage through C104 (0·01μF) pin 9 to pin 3, and check the switch banks for H.T. tracking across the insulation.

No VHF Sound

Check V7 PCC85, and V10 EB91.

VHF in Order; No TV Signals, Raster Present

Check the tuner unit valves V1 PCC84 and V2 PCF80. Check the H.T. supply to the tuner unit.

BBC places Contract for five new Television Mobile Control Rooms

THE BBC has placed an important contract for equipment for its television outside broadcasts which will extend their scope and provide improved facilities. Five mobile control rooms built to a specification incorporating the BBC's latest production and engineering experience have been ordered from Pye Ltd., Cambridge. Four, each with four camera channels, are for use in the BBC's Welsh, Scottish, West of England, and Midland Regions, where they will replace existing three-camera mobile control rooms. The fifth, also with four camera channels, will be used to augment the BBC's outside broadcast facilities in the London area.

These new mobile control rooms will have a body width of 8ft and an overall length of 25ft and each will be built on a 7-ton commercial vehicle chassis Good working conditions are assured in the design by separating the production area, which is air-conditioned, from the equipment compartment. Power consumption and heat dissipation from the equipment will be minimised by the use of transistors instead of valves wherever possible, notably in the sound equipment, pulse generators and inter-communication installation, and also in the vision mixer which is of a type developed by the BBC.

Each mobile control room will be equipped with four Pye 4½in. image-orthicon camera channels. Each will be capable of operation with up to 2,000ft of camera cable. Four pre-set values of contrast law may be selected by a switch on the camera control panel to allow for changes in scene contrast.

The mobile control rooms are capable of operating on the European 625-line or American 525-line standards as well as on the United Kingdom standard of 405-lines. This will facilitate contributions to Eurovision or the making of video-tape recordings for use in other countries, without standards conversion.

It is expected that the first of these new equipments will be delivered in the latter part of 1962.

405 / 625 Switching

THE COMMERCIAL ASPECTS OF STANDARDS SWITCHING

By T. M. Stanley

PREVIOUS articles in these pages have dealt with the CCIR standards in some detail and compared them with the 405-line standards of the existing British television system (see, for example, "The 'Lines' Battle", November and December, 1961, and "Intercarrier Sound," March, 1962).

It is the purpose of this article to examine the practical means devised by various manufacturers to enable recent receivers to be switched from the 405-line system to the CCIR system, and vice versa. This should not only lead to a closer understanding of the CCIR system, about which we are likely to hear much in the future, but it will also give service technicians an insight to the diverse problems involved and will undoubtedly assist experimenters in changing over their own receivers should the CCIR system eventually be adopted.

Vision Detector Switching

In the 405-line system, the picture signal is positive-going. That is, the picture signals rise positively from a black level reference datum, while, relatively, the sync signals rise negatively from the other side of the datum, as shown in Fig. 1(a).

Because the black level datum corresponds to the cut-off voltage of the picture tube, and as this voltage is maintained at a constant level at the tube input (grid or cathode), the picture signals cause beam current and produce a mean picture brightness corresponding to the mean level of the picture signals. In that way, the tones of the picture are created on the screen of the tube; the detail of the picture is produced by the rate of change of the picture signal and the resulting instantaneous signal applied to the tube.

The picture signal is invariably applied to the cathode of the picture tube, and the brightness control in the grid circuit serves to set the tube to cut-off at zero signal (e.g., with the aerial removed or the contrast turned right down). The tube cathode receives a *negative-going* picture signal from the output of the video amplifier stage (which is the same as if the tube grid received a positive-going signal); the tube, therefore, passes beam current and illumination appears on the screen governed directly by the value of the applied picture signal.

In the CCIR system, the opposite happens. The picture signals are negative-going relative to the black level datum, while the sync pulses are positive-going, as shown in Fig. 1(b). This means that the whole action from the vision detector to the input to the picture tube must be reversed, and this is one of the problems that the "standards switch" must overcome.

In order for the tube cathode to receive a negative-going picture signal, the control grid of the video output valve must receive a positive-going picture signal from the vision detector—the video valve itself produces a change in phase of the signal.

Video Output Valve Action

As the positive-going picture signal from the vision detector is directly coupled to the control grid of the video output valve, an increase of positive voltage at the control grid (caused by an increase of mean picture brightness) results in an increase of anode current in the video output load resistor. This in turn causes an increase of voltage drop across the load resistor, and, since the tube cathode is also directly coupled to the anode end of the load resistor, the tube cathode has a decrease of voltage with increase of "white" signal.

This takes the tube away from cut-off as already described, and produces illumination on the screen. This is the normal action of a 405-line video output stage.

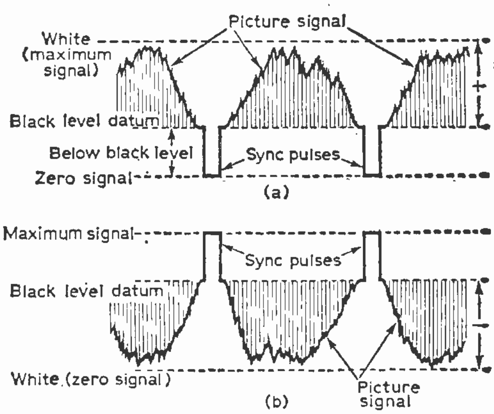


Fig. 1(a)—The positive-going 405-line picture signal; (b) the negative-going CCIR picture signal.

Switched Detector Circuit

In Fig. 2 is shown the detector switching arrangements of a dual-standards receiver. With switches S1A and S1B in the "405" position, as shown, the vision detector works in the way that all ordinary vision detectors of the 405-line receivers work.

Diode D1 is the germanium vision detector which receives the vision signal from the secondary of the final vision I.F. transformer in the usual way. Capacitor C1 is the detector reservoir capacitor, R1 is the detector load resistor and L1 and L2 are small filter inductors.

It will be seen that switch S1B short-circuits resistor R2, which is superfluous on the 405-line system. The "anode" side of the diode D1 is thus connected to the IFT, while the "cathode" or positive side is connected to the diode load. This produces positive-going picture signals across R1 relative to chassis, as shown by waveform A. These signals are directly coupled to the control grid of the video output valve V2 through switch S1A, and the arrangement works in the way previously explained.

On CCIR signals the switches change over. The normal detector load R1, which is now redundant, is shorted out by S1B, while the original short across R2 is removed. Resistor R2 now becomes the detector load and, as this is connected to the negative side of the diode, the phase of the video signal is changed, but, because the phase of the CCIR signal is the inverse of that of the 405-line signal, the signal demodulation across R2 is almost the same for the video output valve as that derived from a 405-line transmission, as shown by waveform B. Again, the signal across R2 is directly coupled to the control grid of the video output valve via S1A.

Switch S1C modifies the biasing conditions of the video output valve by short-circuiting the cathode resistor and associated by-pass capacitor—R3 and C2. This change of biasing is necessary to accommodate the CCIR signal characteristics.

This method of standards switching at the detector enables the picture tube to be driven uniformly irrespective of the picture signal polarity, and it also avoids switching in the sync separator circuits when changing from one standard to the other. The tube remains fed at the cathode, and the picture signal at that point is always negative-going, as shown by waveform C.

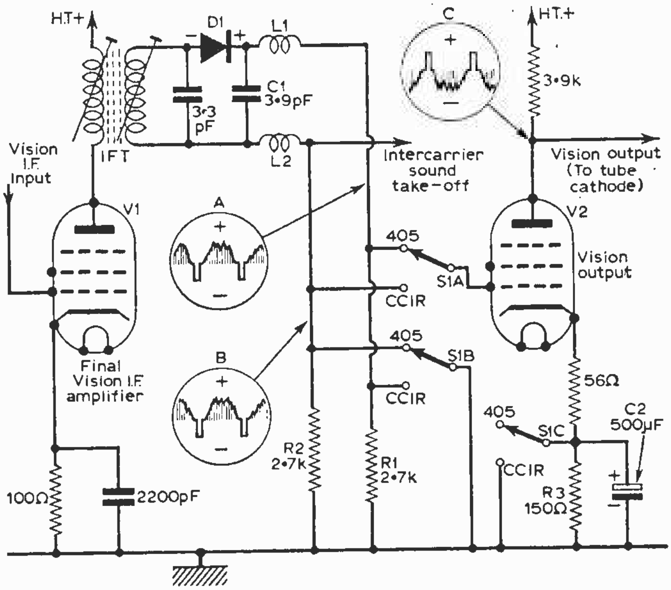
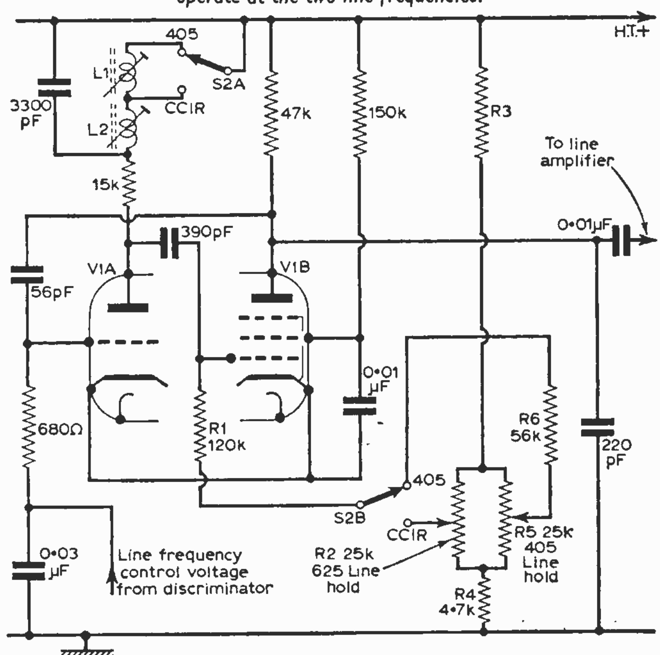


Fig. 2 (above)—The 405/625 switching in the vision detector stage of a dual standards receiver.

Fig. 3 (below)—This circuit shows how the line oscillator is switched to operate at the two line frequencies.



Line Switching

With 405 lines at 25 interlaced pictures per second, the line timebase locks at 10,125c/s (e.g., 405 x 25). With 625 lines at 25 interlaced pictures per second, the line timebase is required to work at 625 x 25c/s, that is 15,625c/s. This is rather a large change and not many sets are capable of covering the two frequencies on the line hold control. Some early models can be changed almost over that range simply by rotating the line hold control and (probably) by adjusting the pre-set line hold control if fitted.

Indeed, some experimenters have received Continental transmissions on 819 or 625 lines by such simple adjustment to the line timebase, but invariably the efficiency of the line amplifier and EHT circuits is impaired by this relatively large change in line frequency. This results in insufficient picture width and poor EHT regulation, and the resulting picture is probably negative owing to the different polarity of the signal. However, this latter shortcoming can be remedied by reversing the detector diode which, in effect, is what happens in switched dual-standards sets.

The line frequency problem is solved on some commercial receivers by the use of two line hold controls—one for 405 lines and the other for 625 lines (CCIR). A circuit using this method (Pye V700D) is shown in Fig. 3. Here V1 is cross-coupled to form a horizontal oscillator, the frequency of which is locked by a control voltage applied to the grid circuit of V1A from a phase discriminator. The latter compares the phase of the line sync pulses and the timebase pulses and, when it differs, a control voltage is produced which brings the timebase frequency back into step with the sync pulses.

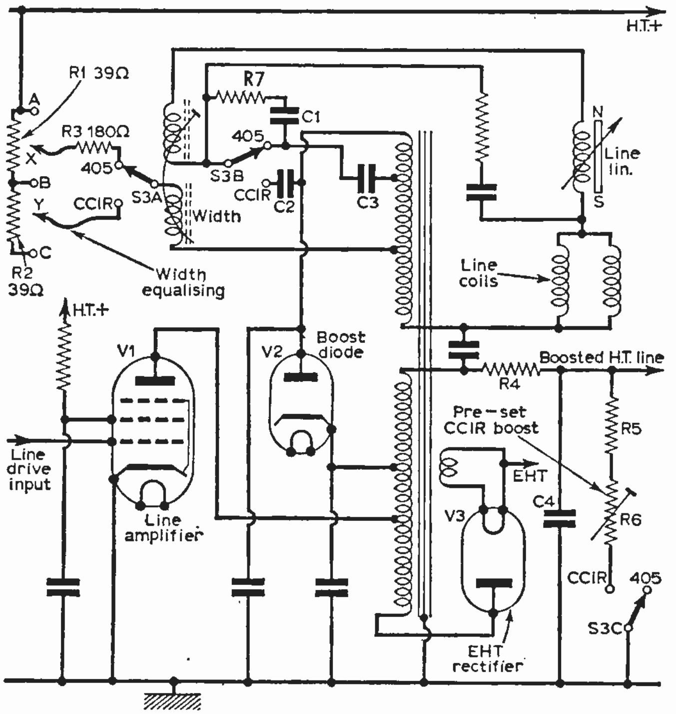


Fig. 4—In order to retain full efficiency at 405 and 625 lines, the line output stage is switched as shown in this circuit.

The resistive element of the manual frequency or hold control on 405 lines is made up of R1, R6, R5, R4 and R3, and the values of the components are arranged so that the correct frequency (10,125c/s) will occur with R5 at the centre of its range.

On 625 lines, S2B changes over and R2 is placed in circuit instead of R5 and R6 is eliminated. This alters the time-constant so that the oscillator will work at 15,625c/s when R2 is at the centre of its range.

This particular circuit has also a flywheel characteristic produced by a resonant circuit in the anode of V1A. L1 and L2 in series resonate correctly for 405 lines, while L2 only resonates correctly for 625 lines — switch S2A performs the change-over function here.

The advantage of this two-control arrangement is that the receiver can be pre-set on both standards so that an immediate line lock occurs when switching from one standard to another.

Line Amplifier Switching

On receivers of 405 lines only, the line amplifier (or output stage) is peaked for maximum efficiency at 10,125c/s. In most circuits the line output transformer employs an arrangement called "third harmonic tuning". This greatly increases the efficiency and tends to reduce the peak voltage on the line output valve and efficiency (or booster) diode.

If the input frequency to the amplifier is altered substantially from 10,125c/s, the third harmonic tuning is no longer useful, and the overall efficiency of the stage is considerably impaired. On dual-standards receivers this problem is resolved by several switching arrangements. The stage is designed normally for 405-line working, but several critical circuit elements are changed when the set is switched for 625 lines (CCIR).

The circuit in Fig. 4 shows the line amplifier switching arrangements used in the Pye V700D. There are three switch actions. Switch S3A equalises the width of the picture so that the same horizontal scan amplitude is obtained on both standards. On 405 lines the extra resistor R3 is present in the H.T. feed to the line amplifier, and flylead X is connected to A, B or C on the potential-divider R1/R2 to provide the correct width in relation to the width control proper.

On 625 lines, S3A changes over and flylead Y comes into play and R3 is eliminated. Flylead Y is connected to A, B or C of the potential-divider to give the same width as on 405 lines without altering the width control.

Switch S3B is concerned mainly with the tuning of the line output transformer. On 405 lines, C3 is in circuit, while on 625 lines, C3 is switched **out**

(Continued on page 378)

Telenews

Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of February, 1962, in respect of television receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	*Tota.*
London	1.961.859
Home Counties	1.653.281
Midland	1.748.063
North Eastern	1,877.592
North Western	1.536,819
South Western	1.007,677
Wales and Border Counties	710.885
Total England and Wales	10,496.176
Scotland	1,073.474
Northern Ireland	175.359
Grand Total	11,745,009

CCTV Helped Conference Organisers

ONE of the latest aids to conference organisers shown to delegates at the first British Symposium of Conference Management at Brighton was closed circuit television.

The Rank Kalee Division of the Rank Organization were using their mobile unit in co-operation with the GPO to show how this modern form of communication can assist in events of this nature.

One of the most important operations at Brighton was a closed circuit link using a GPO landline between the conference taking place in the Royal Pavilion Buildings and the Winter Garden in the Hotel Metropole where an exhibition of conference aids was being held. It enabled exhibition visitors to follow every aspect of the conference.

British Cameras for Los Angeles Television Station

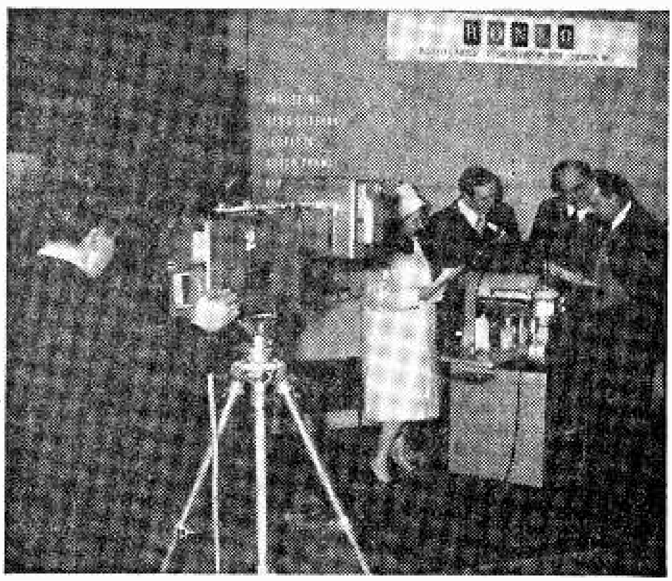
THE latest EMI 4½in. image orthicon broadcast television cameras will form the nucleus of improved technical facilities in a new modernisation programme announced for Los Angeles television station KTTV.

This United States television station selected the British EMI Type 203 cameras as a result of a study which showed, according to Robert W. Breckner, vice-president and general manager of the station, that the cameras are the most advanced in the industry, providing for higher resolution and lower "noise" level than could be obtained previously.

KTTV will use the EMI cameras—which will be purchased from EMI/US, Los Angeles—for videotaping of programmes and commercial productions. Long recognised as a leader in television programming in the Western United States, KTTV reserves a large part of its coverage for on-the-scene reporting which goes out as live and tape telecasts.

TV in Las Vegas Bank

DELAYS in obtaining signature verifications and other customer account details from central records have been eliminated at the First Western Savings and Loan Association, Las Vegas, Nevada, by EMI Electronics cameras installed as part of a Fairbanks-Morse closed-circuit television system. Now a teller has only to call the central accounting office on the house telephone to have the actual document in question flashed on to a television receiver alongside his counter.



Closed circuit television cameras formed part of a television service provided by the Rank Kalee Division of the Rank Organisation at the exhibition held in connection with the first British Symposium of Conference Management in Brighton.

Two EMI cameras in the accounting room—operating on a 525-line definition system—provide excellent pictures. The cameras are mounted vertically to look up into a document scanner. Clerks in the central accounting room simply insert the card containing the requested information into a holder. Under normal conditions the cameras will be left " live " throughout the business day. TV screens are positioned between tellers and in the offices of executives.

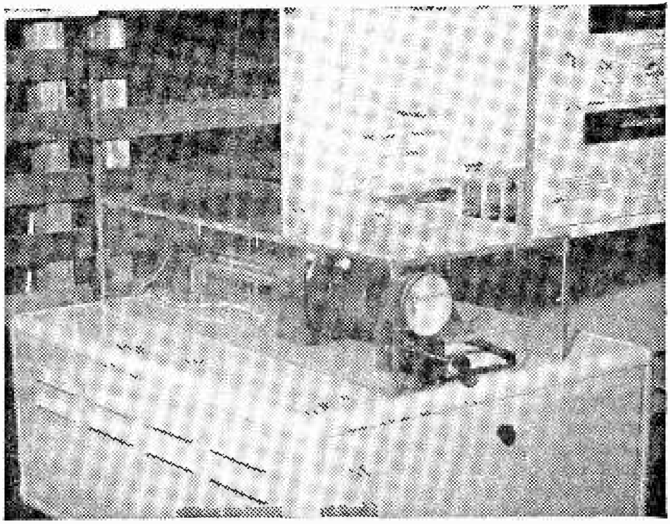
Fibre Optic Faced CRT

A WORKING demonstration of a new prototype 3in. circular fibre optic faced cathode ray tube was recently given for the first time in Western Europe at an Electronics Conversazione held by the Electronics Department of Ferranti Ltd.

In this tube, which is 19in. long, the normal glass face plate has been replaced by a fibre optic one. This causes the image formed on the blue ultra short phosphor to be transmitted through the glass giving a focused image on the front of the tube. As a result direct optical printing at high speeds on film and light sensitive materials can be achieved.

In the demonstration direct print-out paper was used to obtain prints direct from the face of the tube. The tube has an extremely small spot size of only 0.0005in., and a definition of 6,000 lines. It can be operated from 8-20kV and still give the same resolution, the brightness increasing with increasing voltage.

The light gathering efficiency is approximately 100 times better than an *f*2·8 lens on a 1:1 magnification ratio. This tube has many potential applications on print-out readers, airborne radar devices and film scanning. Electromagnetic focusing and deflecting is employed and the heater voltage is 6.3 and current 0.3A.



The new Ferranti prototype fibre optic faced 3in. cathode ray tube which was demonstrated for the first time at an Electronics Conversazione held by the Electronics Department of Ferranti Ltd. in London.

British Colour TV for Greek University

ONE of the most modern surgical clinics in Greece—the " B " Surgical Clinic in the University of Thessaloniki—is to be equipped with EMI colour television. EMI Electronics Ltd has obtained an order through the Company's representatives, Atha Electronics, for a complete installation of a colour camera and associated equipment for installation in an operating theatre.

To avoid unnecessary encumbrance of the floor of the operating theatre, the remotely-controlled EMI camera will be suspended from a track on the ceiling. This will facilitate movement across the theatre. This is the first time that an EMI colour TV camera has been installed in an operating theatre in this manner.

Cameras for Egypt

THE United Arab Republic Broadcasting and Television Service has placed an order with Marconi's Wireless Telegraph Company Limited for the supply of five Mark IV camera channels and associated equipment. English Electric Valve Company Limited 4½in. image orthicon camera pick-up tubes will be incorporated.

The cameras, to be installed in the latest of a series of new television studios in Cairo, will be used in the production of plays and theatrical shows and, in general, for any programme which involves audience participation. The studio covers an area of 9,720sq. ft., including a theatrical stage.

The Marconi Mark IV camera is now in use in many parts of the world; last year this British equipment gained a premier American award for its design and performance.

BBC's New Station near Oxford

A NEW television relay station which has recently been opened by the BBC at Beckley, near Oxford, has improved reception for 300,000 people living in the Oxford area who previously received a fringe area service from the BBC's high-power stations at Crystal Palace or Sutton Coldfield. For this new station, Band I aerial arrays to BBC specification have been supplied and installed by EMI Electronics Ltd. on the 500ft mast.

A Band II aerial has also been supplied and installed by EMI on the same mast for the BBC's VHF sound transmitting station which will later be brought into operation. This will radiate the West of England Home Service, the Midland Home Service, the Light Programme, and the Third Programme with Network Three. The combining equipment, which uses 28 resonant cavities to enable these four sound transmissions to be radiated by the one aerial, has also been supplied by EMI Electronics Ltd.

applications of the LIGHT-SENSITIVE resistor

AUTOMATIC ADJUSTMENT OF CONTRAST OR BRIGHTNESS TO SUIT ROOM LIGHTING

By P. H. Henry

LIGHT-dependent resistors have the property of decreasing in resistance when the light falling upon them is increased. They are composed of cadmium sulphide, and a change of illumination from a very low level to that equivalent to a well lit room can cause the resistance to change by as much as 750k.

Such resistors have been exploited in recent months as the basis of a control which automatically adjusts the contrast or brightness (or both) of a television receiver to suit the lighting of the room.

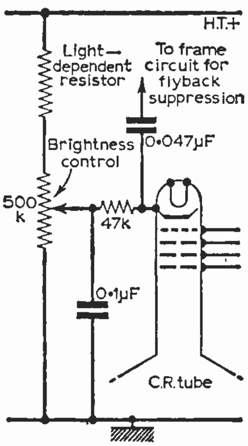


Fig. 1 (right)—The inclusion of a light sensitive resistor in the brightness control chain enables the brightness value of the picture to be corrected automatically with changes in the brightness of the room lighting.

Differing Control Settings

Under normal conditions, of course, it is usually necessary to adjust a television set manually so that the screen illumination is suitable for the ambient light. When the room is well lit, then quite a high level of brightness and contrast is necessary to maintain a picture of satisfactory contrast ratio. That same setting, however, would be far too high in the event of the room lighting being reduced, and it would be necessary to make a manual adjustment to compensate for the change in ambient light.

The light-dependent resistor avoids such manual adjustment, and once the receiver is adjusted, the contrast or brightness of the picture is altered automatically for normal changes in room lighting, which may be caused by switching on or off an extra light, or even by switching off all the lighting.

The resistor is fitted on the front of the cabinet where it is influenced by the room lighting but not by the illumination from the screen. It can be arranged in the circuit either to control the picture brightness or the overall contrast, but there is a method whereby the brightness is also corrected when the resistor causes a change in effective contrast.

Simple Brightness Control

Fig. 1 shows how a light-dependent resistor can be introduced into the brightness control circuit of a typical receiver to provide brightness correction. Here it is connected in series with the H.T. side of the brightness control. On most receivers there is already a resistor in this position and this should either be removed completely or reduced in value to compensate for the nominal value of the added resistor.

The resistance should be measured under normal lighting conditions and that value subtracted from the value of the existing brightness control resistor. If the nominal value of the light-dependent resistor is more or less the same as the existing resistor, however, it can simply be connected in its place.

Adjustment

The operation is quite simple. The brightness control is adjusted to provide the correct black level at average room brightness. Now, if the room lighting increases, the value of the light-dependent

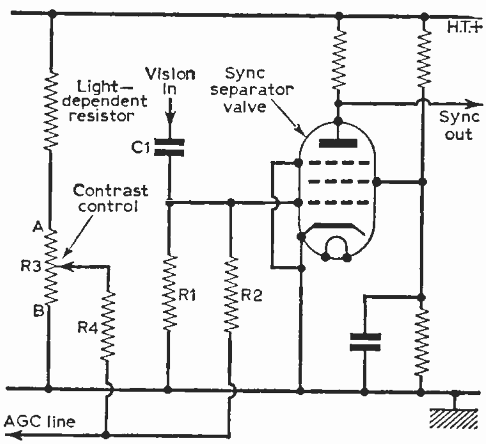


Fig. 2—A light-sensitive resistor connected to a mean-level vision AGC system to correct the contrast with changes in room lighting.

resistor will decrease and cause a proportionally greater positive potential to be applied to the tube grid. This will increase the picture brightness, as the effect is the same as turning up the brightness control.

The correct black level for the picture is best established in an averagely lit room by turning down the contrast control, removing the aerial and gradually increasing the setting of the brightness control to the point of screen illumination. The brightness should then be backed off a very small amount until the illumination just disappears.

Obtaining Correct Control Range

At this point the operation of the circuit can be checked, for if all is well the screen illumination (raster) should become visible by increasing the light falling on the LDR. If the control appears to be far too great for small changes in ambient light, it may be necessary to connect a resistor in parallel with the light-dependent resistor and adjust its value, in conjunction with a series resistor, until the required range of automatic control is achieved. It is important to maintain the correct resistive value in the H.T. side of the brightness control so that the manual control will work correctly. The total resistance, including the light-dependent resistor parallel and series resistors, should be equal to that originally used in the circuit. An incorrect value will, of course, prevent the manual control from operating correctly over its range.

Contrast Control

A better idea is to use the technique to control the contrast of the picture. A method adopted in some commercial sets for accomplishing this is shown in Fig. 2. Here the mean-level type of vision AGC system is employed in conjunction with the sync separator valve. Due to the charging and discharging of C1, a negative potential, with respect to chassis, is developed across R1. This potential is fed through R2 to the I.F. and R.F. valves as a control bias in the usual manner.

Manual contrast control in this circuit is provided by feeding a positive potential to the AGC line from the contrast control R3 through resistor R4. Thus, when the contrast control is at position A, maximum positive voltage is fed to the AGC line and most of the negative AGC bias is neutralised. The set is then working at maximum contrast.

As the contrast control is turned towards position B, the positive voltage fed to the AGC line is reduced and there is less cancellation of the negative AGC voltage. In this way the contrast (or the gain of the vision channel) is reduced.

Now the light-dependent resistor is connected in the H.T. feed to the contrast control and automatically adjusts the contrast depending on the amount of light falling on it. At low light levels, the resistance is relatively high, meaning that there is less positive voltage fed to the AGC line so that the set is working at low contrast. However, the opposite effect occurs at higher light levels—as the resistance drops—and the contrast is automatically increased.

This arrangement is not unduly difficult to fit in any receiver which uses the mean-level type of AGC system described and which also uses a contrast control across the H.T. supply, as shown in Fig. 2. In order to secure the best ratio of control, the various resistive elements may have to be adjusted slightly, and it may also be necessary to include a resistor in series with the light-dependent resistor to provide the correct range of manual control. However, the total resistance introduced by the various elements must be equal to the original resistance of the circuit.

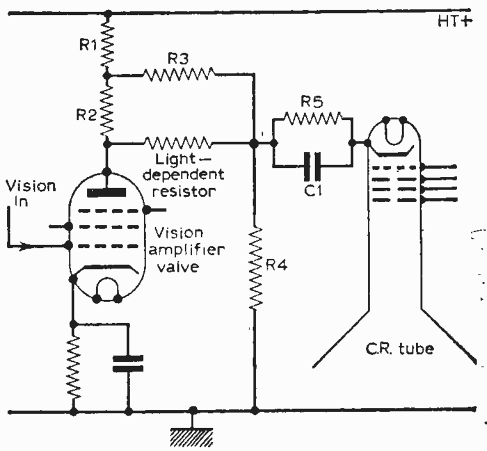


Fig. 3—In this circuit, the light-sensitive resistor controls the video drive to the picture tube, while also correcting the brightness to suit.

Video Drive Correction

A light-dependent resistor is also sometimes included in the video feed circuit to the cathode of the picture tube, as shown in Fig. 3. It should be noted, however, that the video circuit shown is in its basic form, and does not reveal the various peaking and phase correction inductors which are often found in the anode and tube feed circuits.

The circuit operates in the following manner; at low levels of brightness the resistance of the light-dependent resistor is relatively high so that most of the signal applied to the cathode of the picture tube from the video amplifier valve will be that developed across R1 and fed to the tube through R3.

However, as the room illumination increases, progressively more signals will be fed to the tube for the resistance of the light-dependent resistor is now decreasing. The signal fed via this resistor is that developed across R1 and R2 in series which, of course, is greater than that developed across R1 alone. Thus, the tube will receive a higher level video signal when the room is well lit—and the picture will be of greater contrast—than when the room lighting is less.

Brightness Correction

It will be seen that the circuit operates around the potential-divider formed by R1 and R2—causing the ratio of signals fed via R3 and the light-dependent resistor to alter with changes in ambient light.

This arrangement also provides a degree of brightness correction. The tube cathode is fed

(Continued on page 395)

transistorised PRE-AMP

COMPLETING AND USING THE UNIT

By D. N. Hanley

(*Continued from page 338 of the April issue*)

WITH the recent development in VHF transistors, there are several types which are suitable. The original design incorporated Mullard OC171's, but for Band III operation the latest Mullard AF102's are recommended. Type T1832 and 2N502 by Semiconductors Limited and types 2G101 and 2G102 by Texas Instruments have also been used at Band I frequencies. It is, of course, essential to employ VHF transistors. The ordinary medium-frequency and low-frequency components are no good at all for this application.

Coils

The coils are wound on polystyrene formers of height 0·87in. and diameter 0·31in. The actual number of turns required to tune over a particular channel depends very much on the construction of the unit and on the type of transistors used, and the coil winding table must be used only as a guide. In most cases, however, provided the layout has been followed fairly faithfully, the required channel will be within the range of the cores if the turns given against a particular channel in the table (page 337, last month) are adopted.

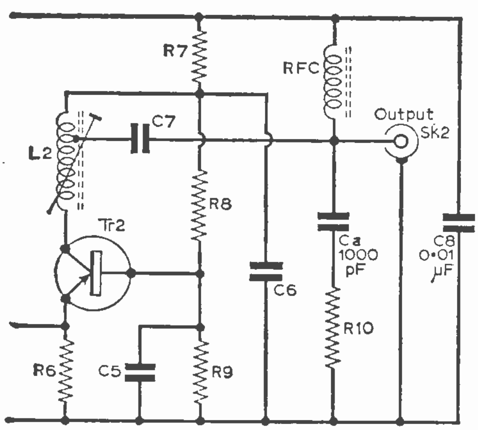


Fig. 4—Revised output circuits of the pre-amp for remote powering.

The tapping point on the coils affects both the overall gain and bandwidth of the amplifier. For television channels, with a good response to both sound and vision signals, the tapping point should be 25% along the length of the actual coil wire from the resistor end of the coil (i.e. from the end remote from the collector).

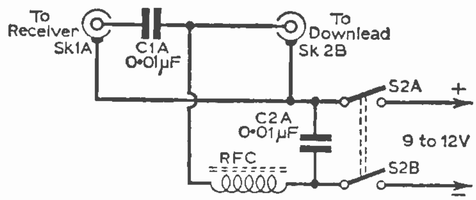


Fig. 5—The circuit diagram of the local control unit and power source.

It is best to wind the coil first without the tap to find out the length of wire required *for the winding proper,* and then measure off a quarter of that length. At the appropriate point the enamel should be scraped off the wire with a pen-knife, taking extreme care to avoid cutting the wire. The tapping wire, which should be of the same gauge as the coil wire, should then be soldered to the coil wire, using the smallest possible amount of solder but avoiding a dry joint.

The coil may then be rewound correctly, and the windings may be anchored with polystyrene cement or similar low-loss adhesive.

Heat Shunts

Owing to the small length of lead-out wires from the coils, transistors and other components, an instrument-type soldering iron should be employed for the construction, and heat shunts should be clamped on the lead-out wires when performing the soldering. This applies particularly to the transistor lead-out wires.

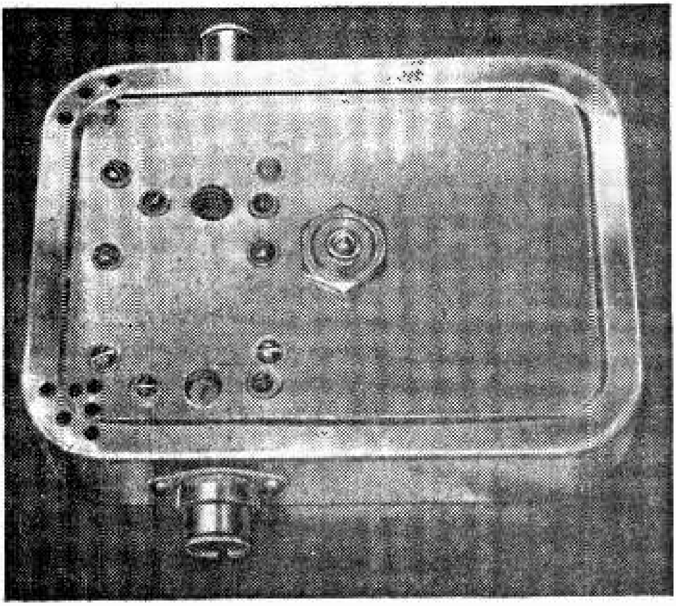
CONTROL UNIT COMPONENTS LIST
(for Fig. 5, above)

C1A, C2A 0·01μF

S2, Round-dolly toggle d.p.s.t. switch

One 1A TV suppressor choke (RFC)

2 coaxial sockets, suitable box, wire, etc.



A view of the completed pre-amp.

Setting-up

Make sure that the battery is connected the correct way round, as otherwise the transistors will almost certainly be ruined. Connect the amplifier between the aerial and the receiver and, with the receiver switched to the appropriate channel, adjust the cores in L1 and L2 for the best possible sound and vision.

If tuning of any coil appears to occur with the core fully removed, a turn or so should be taken from the coil (increase the turns spacing on Band III channels), while if the circuit only just comes into tune with the core fully in the coil, a turn or so should be added (decrease the turns spacing on Band III channels).

The power gain between the loaded sockets is of the order of 30dB on Band I channels and somewhat below this (depending on the type of transistors used on Band III channels. Nevertheless, a very useful increase in gain is achieved with an excellent noise figure.

Remote Powering

For remote powering, the output arrangements should be altered a little as shown in Fig. 4. Here Ca has been added in series with R10 to avoid short-circuiting the supply current, and a small R.F. choke (RFC) has been introduced between the inner of Sk2 and the battery negative line.

The choke allows the unrestricted passage of battery current (from the remote end), while acting as a high impedance to the signal.

At the remote end, battery current is fed into the downlead via the system shown in Fig. 5. Signal continuity from the downlead to the receiver (or distribution system, which may include another amplifier at this point) is maintained via Sk2B, C1A and Sk1A. Power from a local battery is applied to the downlead through S2A/B and the R.F. choke (RFC), the positive connection on the battery being applied to the braid of the coaxial cable. Capacitor C1A acts as a D.C. isolation device and prevents the battery current from being short-circuited by D.C. continuity across the aerial socket of the receiver or second amplifier, while C2A acts as an R.F. by-pass.

The circuit of Fig. 5 can be made up in a small metal box which will also house the battery, and by this means the pre-amplifier, which may be mounted several hundred yards from the set, can be energised and controlled at a convenient point—usually adjacent to the receiver.

Systems

Fig. 6(a) shows how two self-contained pre-amplifiers may be used in order to amplify the

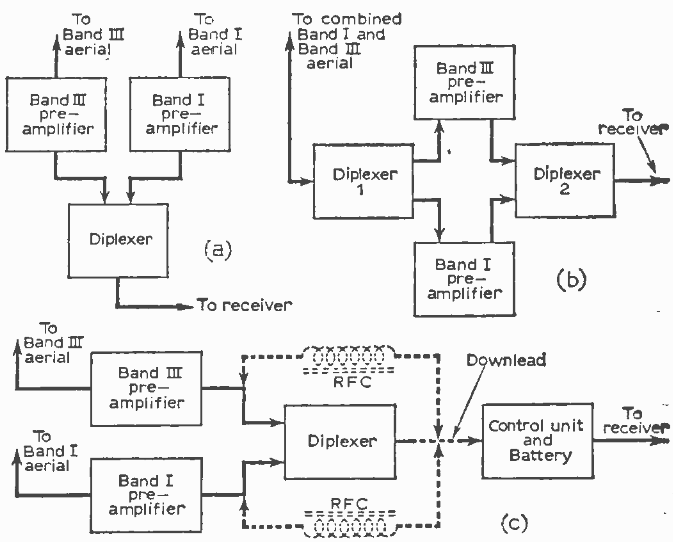


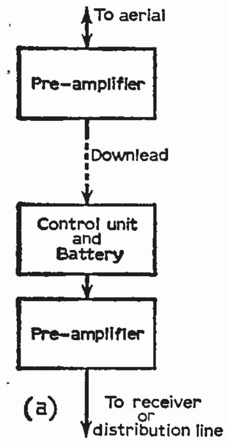
Fig. 6—Applications of the pre-amp; (a) two self-contained pre-amplifiers used for two-band amplification where separate downleads are used for BBC and ITV; (b)—two pre-amplifiers used where there is a common downlead for BBC and ITV signals; (c)—using remote powering to enable the pre-amplifiers to be used at the aerial end of the downlead.

signals in Bands I and III. Here it is assumed that separate downleads are employed and that these are combined to a common set socket through a diplexer.

If a common downlead is used, as from a combined aerial, for example, then two diplexers are required to separate the signals for individual amplification, as shown in Fig. 6(b).

Fig. 6(c) shows how two pre-amplifiers may be energised remotely through a common distribution cable or extended downlead. There must, however, be D.C. continuity from the common socket of the remote diplexer to the Band I and Band III outputs (or inputs, when the diplexer is used round the other way). If continuity does not exist between the inner conductor terminals of the diplexer employed, small R.F. chokes must be connected between the inner conductor of the downlead and the Bands I and III inner conductor terminals of the diplexer as shown. The chokes provide a D.C. path for the powering current and have little effect on the operation of the diplexer.

If it is required to power a second amplifier at the set end of the downlead from the control unit and battery (Fig. 5), as shown in Fig. 7(a), slight alteration to the input of the second amplifier is required, as shown in Fig. 7(b). This allows the voltage on the line to be fed into the second amplifier via its signal input socket. The extra components are the R.F. choke (RFC) and the isolating capacitor C1B. For this application, it is also necessary to remove C1A from the circuit of Fig. 5. This, then, allows battery power to be fed from both sockets. Power-feed filters must only be used where line powering is required, because the chokes, although of fairly high impedance at signal frequencies, nevertheless by-pass some of the signal, particularly at Band III frequencies.



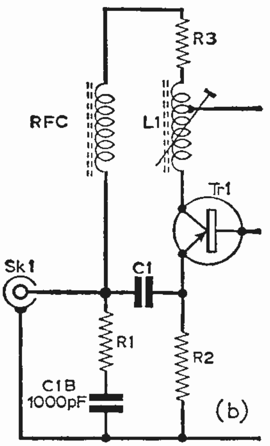
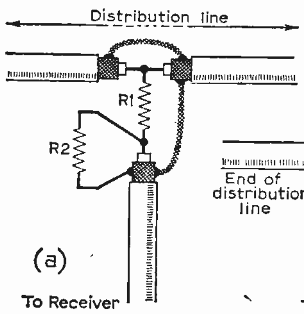


Fig. 7a (left)—Block diagram of the arrangement required where two pre-amps are needed, one at each end of the downlead—the control unit supplies power to both pre-amps.

Fig. 7b (right)—In order to use the arrangement shown in (a), the input circuit of the second pre-amp should be altered as shown here.



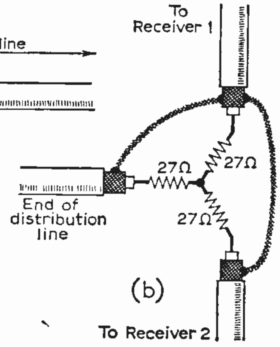


Fig. 8a (left)—Feeding a series of receivers from the amplified signal in the distribution cable.

Fig. 8b (right)—Terminating the end of the distribution cable to feed two sets.

In Fig. 8(a) is shown how sets may be fed from the distribution line. Two resistors are used, and R2 usually has a value of 100Ω while the value of R1 determines the amount of signal fed to the set—680Ω gives about 20dB of attenuation, 330Ω 15dB and 180Ω 10dB. The value selected, of course, depends on the strength of the signal at the point on the cable where the tap is made.

The end of a downlead or distribution line may be terminated as shown at Fig. 8(b) to feed two receivers. Each receiver in this case will receive approximately half the signal which is present at the end of the line.

It should be noted that loading the cable as at Fig. 8(a) adds to the overall losses in the cable. This loading loss, which averages 0·5dB per tap with the values for R1 given above, must be taken into account when working out the required amplifier gains. ■

405/625 SWITCHING

(Continued from page 371)

and C2 takes its place. C1 and R7 also come into circuit in the latter position. This action ensures that the efficiency of the line amplifier is fully maintained at both line frequencies.

The boosted H.T. line on this model feeds both the tube first anode and the frame timebase via R4—C4 being the boost smoothing capacitor. At the higher CCIR frequency the boost voltage tends to rise above that produced at 405 lines, but this is equalised by the operation of switch S3C. On 625 lines this switch connects R5 and R6 across the boosted H.T. lines, and these two resistors in conjunction with R4 form a potential-divider, enabling the boost voltage to be equalised by the pre-set resistor R6.

The line output stage otherwise follows conventional practice, but it should be noted that all the "standard-change" switches are ganged so that one control knob can be used to perform all the functions simultaneously.

This article has so far dealt with the switching of the vision detector and the line timebase. A subsequent article will detail the various switches involved in the sound channel and in the I.F. stages.

(To be continued)

extensions from A.C./D.C. Sets

WAYS AND MEANS TO INCREASE THE USEFULNESS OF YOUR RECEIVER —SAFELY

By A. E. Clayton

ALMOST all recent and new television receivers use the so-called A.C./D.C. technique, and therefore there is a danger of serious electric shock by taking circuit extensions from such receivers without adequate precautions so far as isolation is concerned.

These "A.C./D.C." sets are those in which the chassis is connected to one side of the mains supply. In true A.C./D.C. models, a high-wattage resistor is connected in series with the valve heaters, and the heater current is taken direct from the mains supply. The basic power circuit of a receiver of this kind is shown in Fig. 1. It will be seen that there is no mains transformer, for such a transformer is suitable only for A.C. mains and not for D.C.

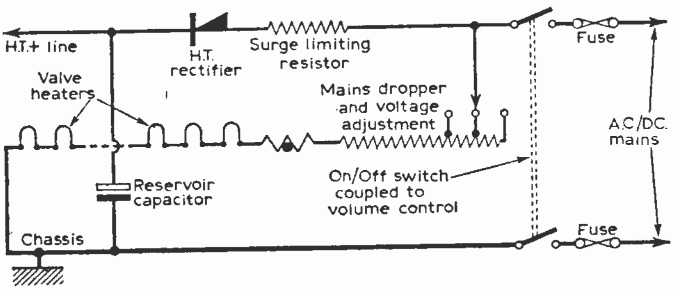


Fig. 1 (above)—With the true A.C./D.C. set, a large-wattage resistor is connected in series with the tube and valve heaters, and the chassis is connected direct to one side of the mains supply.

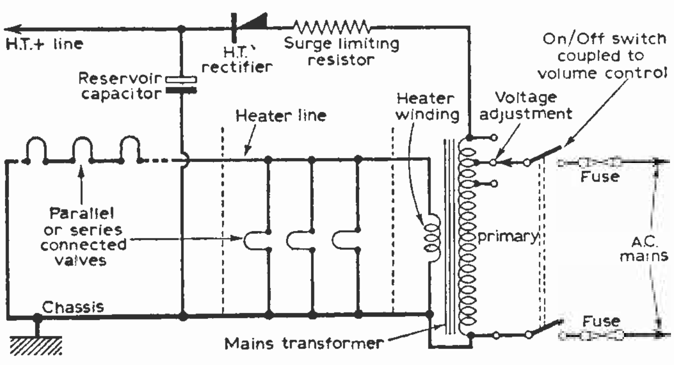


Fig. 2—Some A.C.-only sets also have a mains-connected chassis, as this circuit shows. Here the mains transformer is used to supply either series- or parallel-connected valves and the primary winding acts as an auto-transformer to give an H.T. boost on low voltage inputs. In some sets there may be only one mains fuse.

A.C.-only Sets with Mains-Connected Chassis

It must not be concluded from the foregoing that all TV sets featuring a mains transformer have an isolated chassis. This is far from being true, as quite a number of earlier models used a mains transformer for supplying heater power with the primary acting as an auto-transformer booster for the H.T. supply to the rectifier. The basic power section of sets of this nature is shown in Fig. 2. Again, it will be seen that one side of the mains supply is connected direct to the chassis—although a transformer is present.

The true A.C.-only set has a fully isolated mains transformer; the primary, which is connected via the fuses and on/off switch to the mains supply, has no other connection at all with the set. There are really two reasons why these sets are rarely made. One reason has to do with economics, for a mains transformer is a very expensive item in these days of keen competition; the other reason is size and weight. It will be appreciated that an adequate-rated transformer designed to handle between 150W and 200W is quite a large device.

It should be noted that very high-quality receivers, such as those used for monitoring purposes and the like, still incorporate a fully isolated mains transformer, but sets of this kind, of course, are well outside the price range of the domestic market.

Checking for a Mains-connected Chassis

Most experimenters and all service technicians can tell at a glance inside the set (or by reason of its model number) whether or not the chassis is connected to the mains supply. The presence of a mains dropping resistor and the absence of a mains transformer are major clues.

If there is any doubt so far as receivers with a mains transformer are concerned, the best thing to do to make sure is to connect an ohmmeter or any other continuity tester between the chassis and each mains wire in turn, with the set *disconnected from the power* but switched on.

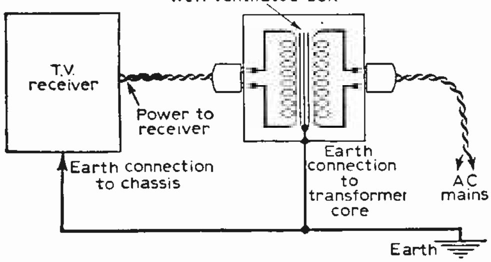


Fig. 3—A safe solution to the problems that arise when taking extensions from a set, is to isolate the receiver completely from the mains supply by a fully isolated 1-to-1 ratio double-wound isolating transformer. The core of the transformer and the set's chassis may then be connected to an efficient earth point.

Sets with a mains-connected chassis will, of course, show a short-circuit between the chassis-connected wire and chassis, but a higher resistance on the other lead—this reading being the D.C. resistance of the transformer primary.

Some early sets had three conductors in the mains cable. These are the sets with a fully isolated mains transformer, the third wire (usually coded green) is the earth conductor, which is connected to chassis and should be returned to a good earth point.

Chassis to Neutral Mains

All sets with the mains connected to the chassis should be connected so that the neutral side of the mains supply is connected to the conductor which goes to chassis. This makes the set (and any unofficial extensions) safer to handle, for if the "live" side of the mains were connected to chassis the full mains potential would exist between the chassis and any earth connection external to the set—an extremely dangerous situation. Similarly, any extension would also be at full mains voltage, which would be the same as plugging a wire in the "live" side of the mains and trailing it round the room.

Nevertheless, all is not well even if the chassis and extensions are at neutral mains potential, for this is not a true earth, and it has been known that quite high potentials relative to true earth have existed on the neutral of the mains on some systems. Moreover, an extension usually requires a true earth to remove or prevent hum and other interference, and it is very much against the law to connect the neutral of the mains to true earth at the consumer's premises.

A Safe Solution

What, then, is the solution to such problems? By far the best idea is to isolate the set completely from the mains supply by a fully isolated 1-to-1 ratio double-wound transformer (see Fig. 3). The set will then always be absolutely safe to handle whichever way round the mains is connected. Also, which is an important point for taking sound recordings from TV, the set's chassis itself may be connected to an efficient earth.

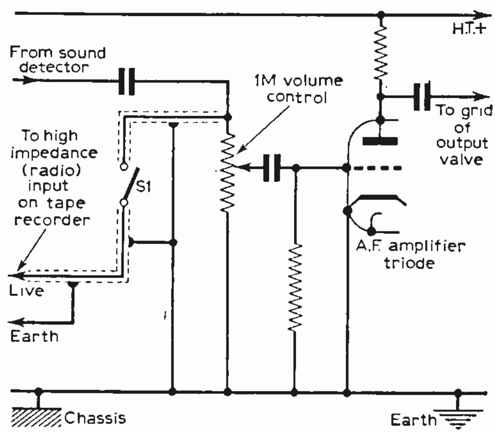


Fig. 4—This shows how a tape recorder may be connected to a television receiver.

Most sets use around 160W of power from the mains, so the transformer selected must be adequately capable of handling this power continuously without overheating. There are several transformers on the market suitable for this application, and the type used by the author and which has always been found adequate is that marketed by Radiospares Limited. This is designated "Heavy-Duty Isolating Transformer", and is rated at 200W. It has tappings to suit an input range of 200/250V.

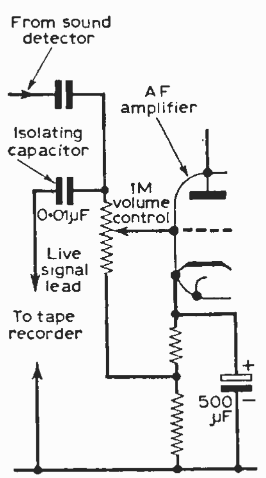
By the very nature of their design, most tape recorders and hi-fi amplifiers are themselves fully isolated from the mains supply, so a separate transformer is not usually required for these. But it should be remembered that the isolating transformer must only be used on the TV set. If other equipment is also powered from its secondary, crossed leads may well put a dangerous potential between each equipment. As the isolating transformer is large, it should not be mounted inside the TV receiver's cabinet (even if there were room); it should be housed in a well-ventilated box near the mains outlet.

Tape Recorder Output

It is often required to tape the sound of a TV programme. Assuming the set to be isolated as described above, the tape output is best taken from across the volume control, as shown in Fig. 4. A simple on/off toggle switch is useful for removing the connection without having to disconnect the tape recorder each time, as shown by S1.

The circuit should be wired with screened cable to reduce the effects of hum pick-up, and the braid of the cable should be connected to the "earthy" side of the tape recorder input, while the inner conductor should go to the " live " side.

On almost all sets, the volume control is usually 0·5M or 1M, which represents a high impedance and matches well to the high impedance or "radio" input of the recorder.



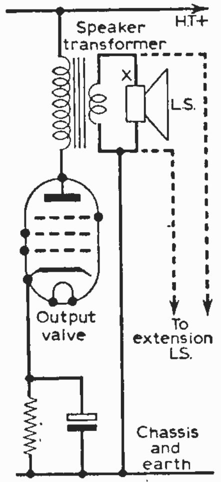


Fig. 5 (left)—An isolating capacitor should be used if the bottom of the volume control is not connected to chassis.

Fig. 6 (right)—Extension loudspeaker connections.

The A.F. voltage across the volume control is of the order of 0·5V r.m.s. (on a good strong aerial signal), so there is enough signal available to work a low-level input.

It will be appreciated that the receiver's volume control will not affect the level of signal arriving at the recorder, which means that this control can be set to give a low-level monitoring signal—or may be turned right down if required and the monitoring performed on the tape recorder if such a facility is available.

The " lower " end of the volume control is not connected direct to chassis on some sets, but may be returned to the cathode circuit of the A.F. amplifier valve, as shown in Fig. 5. To avoid disturbing the D.C. conditions of the receiver in sets of this kind, the " live " signal lead should be connected to the top of the volume control through an 0·01μF capacitor, as shown in Fig. 5.

Extension Loudspeaker

An extension loudspeaker is easily connected, as shown in Fig. 6. The extension is connected straight across the speech coil terminals of the existing speaker, and the only condition is that the extension loudspeaker should have an impedance between 3Ω and 15Ω.

Most TV sets provide sufficient audio to work at least two loudspeakers simultaneously, but if a permanent fixture is called for, a simple on/off switch can be connected in series with the extension line so as to cut out the extension when not required. Similarly, the set's loudspeaker can be switched off by introducing a simple switch at the point marked "X" on the circuit.

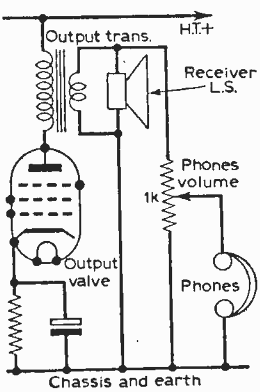
Always make sure that at least one loudspeaker is connected, otherwise the output transformer will most likely be damaged.

Headphones

Fig. 7 shows the best way of connecting headphones. A 1k potentiometer is used as the headphones volume control, and the audio is taken, at low impedance, from across the secondary of the output transformer, making sure that one side of the winding is connected to the chassis of the receiver (adequately earthed and isolated). The headphones can have an impedance anywhere between a few ohms and several thousand ohms.

If it is required to cut out the set's speaker when listening on the headphones, then a single-pole change-over switch should be connected as shown in Fig. 8. This disconnects the loudspeaker while at the same time putting a resistive load across the secondary.

In conclusion it must be stressed that all the circuits given in this article are based on a properly isolated and earthed chassis. By using them without proper regard to isolation is dangerous and, although frequently practised, representative of bad engineering practice. *It is not possible adequately to secure both isolation and good performance with capacitors, which is the reason why this method has not been considered in this article.* ■



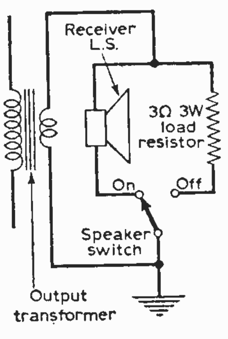


Fig. 7 (left)—Connections for headphones.

Fig. 8 (right)—This circuit shows how the internal speaker may be muted when operating on headphones.

TV SOUND for your radio

A SIMPLE CONVERTER UNIT

By A. Sydenham

THIS small and completely self-contained unit enables the family radio receiver to perform an additional function—viz., that of reproducing BBC TV sound signals. Where a good quality broadcast receiver exists and *provided it is not of the A.C./ D.C. variety* and it is reasonably sensitive, it is possible to make use of this for TV sound by changing the signals to a frequency covered by the receiver and injecting them into the aerial socket. The unit described here does this by converting the transmissions radiated in Band 1 to 1·5Mc/s. The signals are then fed to the aerial socket of a standard superhet and the resulting audio is heard at more than adequate volume via the loudspeaker of the radio set, quality being surprisingly good despite the necessarily narrow bandwidth of the I.F. amplifier. Although the signal/oscillator frequency ratio is low, no operational difficulties have been experienced.

Some drift occurs when the unit is first switched on but may be catered for by suitably retuning the oscillator, for which purpose a reduction drive mechanism (to be described later) is fitted to the front panel.

The Circuit

This is given in Fig. 1 where a high slope pentode amplifies the received signal. Use of this stage is desirable not only to give added gain but also to act as a buffer to prevent oscillator radiation that may otherwise reach the aerial. Where the gain is too great, as may occur in an area close to the transmitter, control may be effected by fitting a 5 or 10k wire-wound variable resistor in series with R4 at its chassis end. L2 is tuned partly by means of its core and partly by means of TC3, which is effectively connected across it via C3.

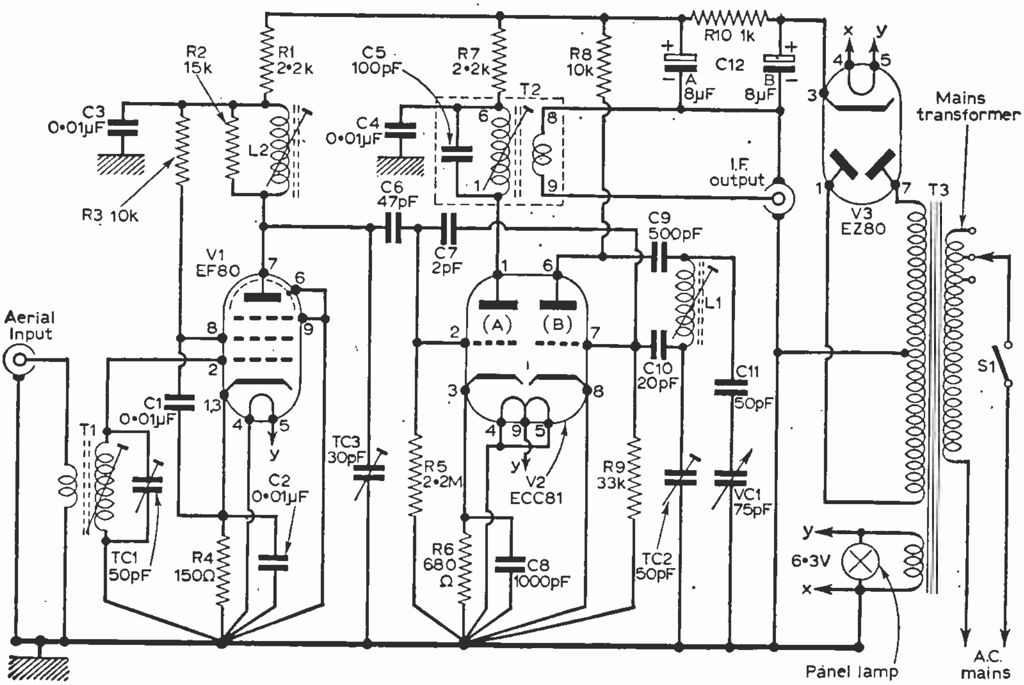
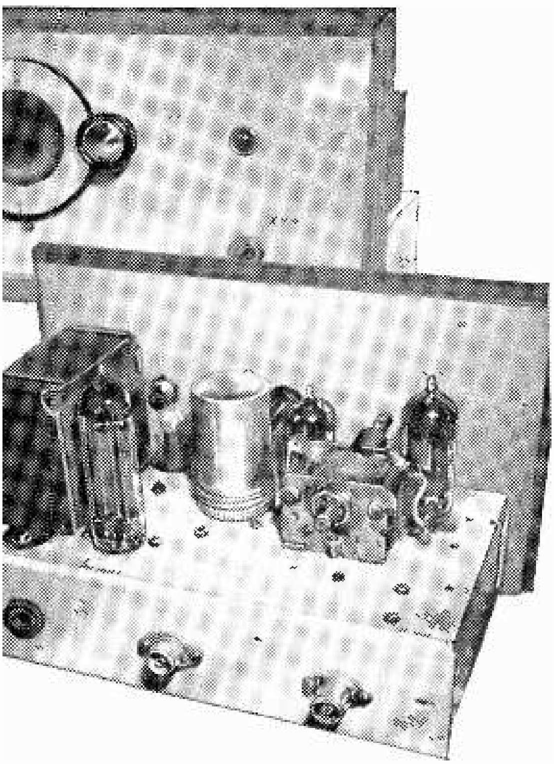


Fig. 1—The circuit diagram of the unit.



V2A operates as a conventional additive mixer, the requisite non-linearity being introduced by means of R6, etc., oscillations being introduced from V2B via C7. In some cases sufficient inter-electrode capacitance may make C7 unnecessary, in which case it may be omitted.

The oscillator circuit is so arranged that the cathode of V2B is tapped into the tuning inductance, since TC2, C11 and VC1 form a capacitive potentiometer across the coil L1. Both sections are adjustable, VC1 being connected to a panel control. The purpose of C11 is mainly to reduce the maximum capacitance value of VC1, but where a variable capacitor of 30pF is available this may be used instead of the two items shown in the diagram. Although, theoretically, C9 may be omitted, its inclusion is desirable to prevent D.C. from reaching TC2, which could, if faulty, short-circuit the H.T. supply to chassis.

Frequency

The oscillator may operate above or below the signal frequency and when the coils are suitably tuned an intermediate frequency of 1·5Mc/s appears at the anode of V2A and is developed across the main winding of transformer T2 which is tuned to this frequency. The impedance at this point is not suitable for connection to the receiver with which the unit is used, necessitating use of a low impedance winding. When the impedance transformation is complete the signals are conveyed to the output socket and thence via coaxial cable to the main receiver.

Two important points noted are: (1) T2 must be suitably screened, and (2) coaxial (television feeder) cable *must* be used to convey the signals to the receiver. If these points are not observed direct pick-up of unwanted signals at the converter I.F. (1·5Mc/s) is likely and will give rise to interference. Fortunately, screened coils are available and T2 consists of a Denco Yellow miniature coil, range 2 (medium wave type). These coils are supplied in round metal containers designed to act as screening cans. They are also fitted with adjustable dust cores and a fixed capacitor, C5, is connected across the main winding instead of a trimmer, final tuning being accomplished by means of the core.

COMPONENTS LIST

Resistors ($\frac{1}{2}$W, 10%):

R1	2·2k	R6	680Ω
R2	15k	R7	2·2k
R3	10k	R8	10k
R4	150Ω	R9	33k
R5	2·2M	R10	1k 1W

Capacitors:

C1	0·01μF ceramic or paper
C2	0·01μF ceramic or paper
C3	0·01μF ceramic or paper
C4	0·01μF ceramic or paper
C5	100pF ceramic or mica
C6	47pF ceramic or mica
C7	2pF ceramic or mica
C8	1000pF ceramic or paper
C9	500pF ceramic or mica
C10	2pF ceramic or mica
C11	50pF ceramic or mica
C12	8+8μF 275VW elec.
VC1	75pF variable
TC1	50pF ceramic trimmer
TC2	50pF ceramic trimmer
TC3	30pF concentric trimmer

Valves:
V1 EF80 V2 ECC81 V3 EZ80

Valveholders: Three B9A

Mains transformers (see text): Mains A.C. input. Secondaries—180-0-180V 35mA 6·3V 2A

Coil formers with tag rings and VHF-grade dust cores—Neosid or Aladdin, $\frac{3}{8}$in. diameter.

T2: Denco Yellow medium wave coil, Range 2.

Chassis: 16s.w.g. aluminium, 8in. x 4in. x 2in.

Tuning drum: $2\frac{3}{4}$in. diameter and Cord Drive (see text)

Switch: Mains on/off type

Miscellaneous: Spire clip; tag strips (2); grommets; wire; spindle coupler; nuts; bolts; tags, panel and cabinet material; coaxial cable: two coaxial sockets, etc.

Power for the Unit

Although, in some cases, supplies for the converter may be taken from the main receiver, it is generally best to use an independent supply provided by a separate or built-in unit. The latter method was adopted here partly for the sake of completeness and partly because a transformer with a secondary voltage rating of 180-0-180V was available to provide full-wave rectification. A half-wave type pre-amplifier transformer can be used instead, but in this case, pins 1 and 7 of V3 should be wired together. An alternative is to dispense with V3 altogether, using in its place a small metal rectifier, but for various reasons the method adopted is preferred. The complete power section is shown on the right in Fig. 1, and the components are kept at one end of the chassis.

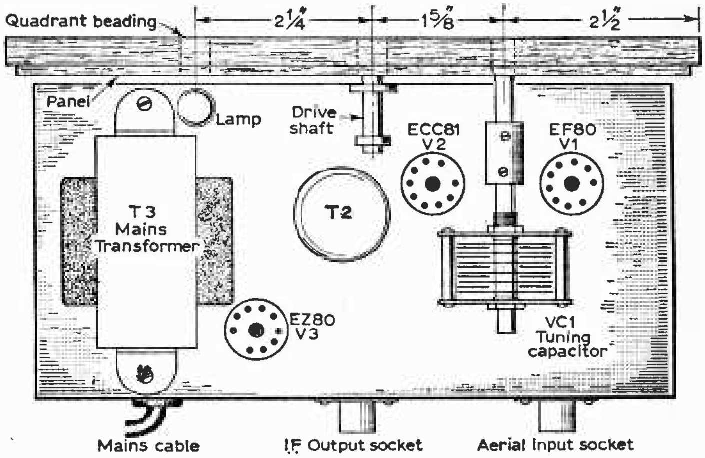


Fig. 2—The above-chassis layout.

(To be continued)

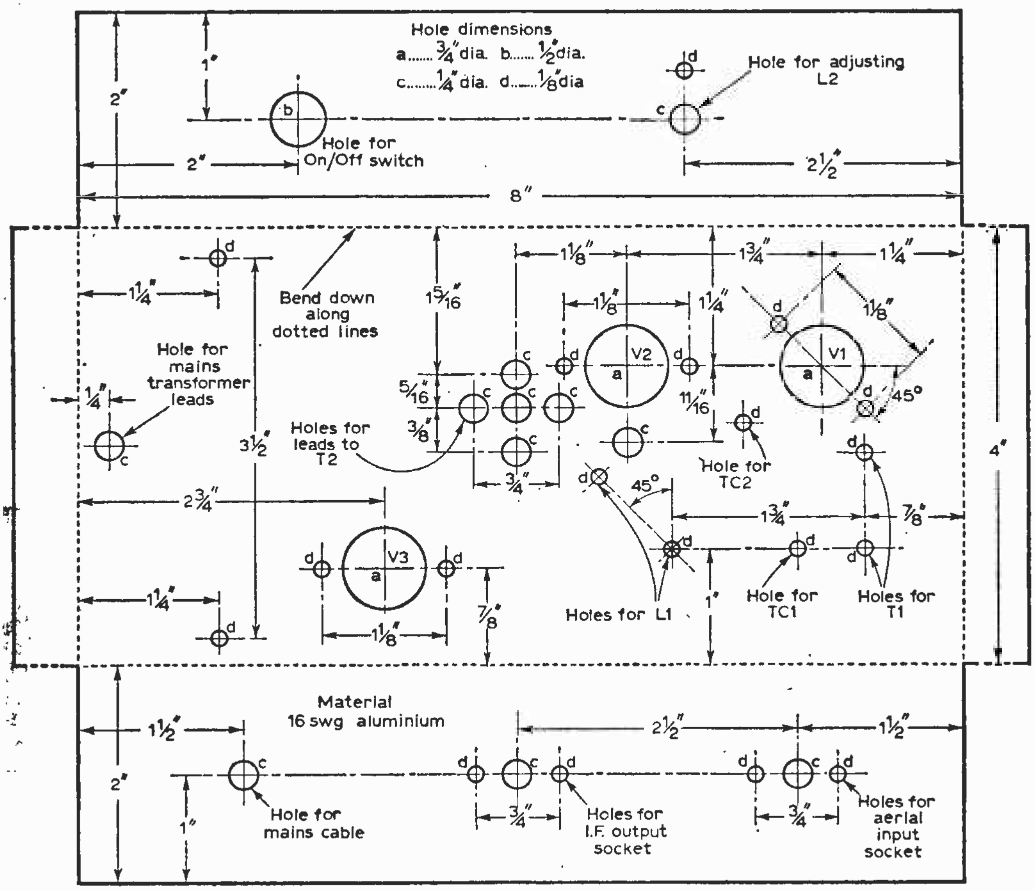


Fig. 3—The chassis drilling details.

Underneath the Dipole

A MONTHLY COMMENTARY

By Iconos

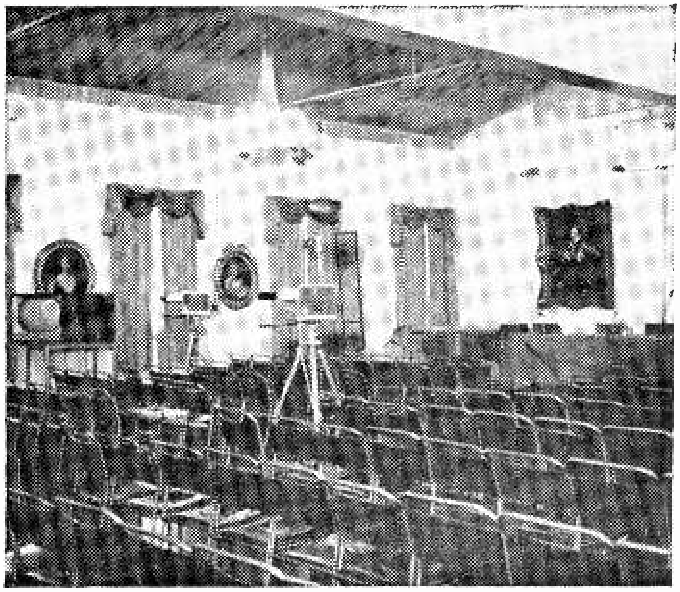
VISITORS returning from America do not enthuse about the quality of the average picture on the average commercial TV receiver in the average American home. On the contrary, they comment upon its exceedingly poor quality, a state of affairs which has provoked the American Society of Cinematographers to carry out an investigation, which was recently mentioned in these columns. The film cameramen were shocked by the quality deterioration of their work, and placed the blame mainly upon the set manufacturers for dispensing with D.C. restoration circuits, which were part of the standard equipment of almost all the receivers marketed at the beginning of the TV era. They want blacks to be black—not dark grey—and all the tonal values from black through the greys to white to be correctly reproduced.

Monitoring the Pictures

Though the dispensing of D.C. restoration from receivers is a big factor in causing a deterioration of picture quality, particularly on low-key scenes, it is not the only factor which is hampering the final quality result which it is now possible to obtain. In the early days of television, receivers were not fitted with flyback suppression, and on very dark scenes the presence of flyback lines was naturally considered to be objectionable. Because of this and the problems of signal-to-noise interference, there came about an operating philosophy that demanded that the picture should be "filled" at all costs with a signal, even those parts which were nominally black. In England, the BBC introduced a 5% safety margin, so that, regardless of the picture content, there was always a small gap between the blanking level and the darkest part of the picture. This situation no longer applies, as the BBC now dispense with this safety margin, which, for many years has been scrupulously watched on waveform monitors by vision control engineers. Almost a tradition had grown up over the years in which the performance on meters and waveform monitors was virtually considered of greater importance than the subjective and artistic valuation of the picture itself! The same meter-minded philosophy was applied to the sound side of television, in spite of the fact that volume indicators of every kind, whether peak recording or of r.m.s. type, are notoriously misleading as to the actual volume of sound likely to come from the loudspeaker.

Subjective Valuations

There has been a change of attitude in television monitoring at BBC studios, both for picture and sound, and final quality results are to be dependent mainly on what the engineers see and hear. Meters will be used for checking purposes only. Thus, the way is now clear for set manufacturers to design receivers that will take advantage of the fine pictures and sound now being transmitted. The ITV companies are following the lead of the BBC in this respect. Anyone who has seen the superb results obtainable with the latest British $4\frac{1}{2}$in. image orthicon cameras in the studios, even on 405 lines with the present bandwidth, will appreciate the feelings



Two Rank Kalee closed circuit television cameras were used inside the hall at the Royal Pavilion Buildings, Brighton recently for demonstration purposes, and to relay proceedings at the first British Symposium of Conference Management to an exhibition being held at the Hotel Metropole (another picture appears on page 372).

of many engineers that much better pictures can be obtained on present standards. On 625 lines, the results are even better, but the main improvement then is due to the line structure being less visible.

Control Room Loudspeakers

The natural trend in television control rooms (as in sound radio control rooms) is to make use of the best possible hi-fi loudspeakers, with bass and treble units which provide a smooth and even response over a wide frequency range. Compare this with many modern home receivers, which have tiny little loudspeakers stowed away in their sides, which are usually sited in the corner of a room so that the sound blows straight into the folds of a curtain! This sound cannot bear any relation whatever to that which is heard by the sound operator in the studio control room. This is not intended as a suggestion for the studio people to degrade the sound reproduction to lose "top", but as a reminder of the colossal differences. No wonder the diction of actors seems faulty on the poorer receivers, when sibilants, consonants and transient sounds are mopped up in this manner. There has recently been an improvement on some of the modern receivers which now fit frontal loudspeakers. Nevertheless, even these loudspeakers do not do justice to the good quality sound which is transmitted. Without degrading their monitor room loudspeakers very much, I think that a little less top and extreme bass would give a much more accurate idea of how the sound is likely to be heard in the outside world, where large output amplifiers, cross-over networks, bass and treble units and huge loudspeaker enclosures are only found in the homes of the sound hi-fi devotees and specialists.

The "Compleat Viewer"

Izaak Walton wrote a lot about fishing, and his "Compleat Angler" is the traditional classic on the gentle art of stalking the trout. It has been left to Dave Freeman and Benny Hill to write about the gentle art of viewing in their script for "The Constant Viewer" in the Benny Hill series. This was another vehicle which gave Benny Hill plenty of scope to exploit his clever and amusing "disguises". As the inveterate viewer who cannot take his eyes off his set, he identified himself with Maigret, Dr. Kildare, a violin soloist, Eamonn Andrews and other television characters to complete exclusion of the life which is going on around him. This was absolutely first-class entertainment, which gently poked a finger of fun at many of Benny's own fans, who may also spend two or three (or four) hours each night staring at the "box". As usual, Duncan Wood's production was immaculate and the strong supporting cast, including Jeremy Hawk, Peter Cavanagh, Jennifer Browne and Hugh Lloyd, were excellent. The videotape recording reproduced the fine photographic qualities of the camerawork with no degradation.

Eurovision

Eurovision relays are steadily improving, but still have a long way to go before their technical excellence will justify regular use for entertainment purposes as distinct from items in which the news value is the main ingredient. The World Ice Skating Championships at Prague, on Wednesday, March 14, was just the right subject for this purpose, and was a very good example. Skilled camera operation and judicious use of the zoom lens gave a wonderful sense of smooth movement as the dancing skaters glided around the rink, performing elaborate figures. The news value of this broadcast led one to excuse softness and other discrepancies in the picture, but it was much more difficult to excuse the dreadful sound. This was probably picked up from the loudspeaker in the rink and subjected to acute distortion along the lines and radio links to London. These European broadcasts require a great deal of staff work, involving many broadcasting authorities when the picture has to be sent from the other side of the Continent. The cost, too, is enormous. The BBC have set up a special master control centre for dealing with European TV programme exchanges together with their standards conversion, but whether the ITV companies will follow suit is a moot point. Here is surely a case where a co-operative use of a control centre by both BBC and ITV would save a lot of time and money for both organisations. International exchanges of programmes are not everyday affairs, but when they are required, they must be good. Experimental work for improvement in picture, sound standards conversion and other matters could also be the subject of close co-operation between all British television authorities and manufacturers.

a replacement unit for the U801 rectifier valve

By S. E. Janes

USING SEMICONDUCTOR DIODES TO REPLACE A VALVE

THE ECKO T161 and T164 have proved to be reliable receivers. In order to standardise and reduce upkeep costs the author has equipped several relatives with a receiver from this series, duly brought up-to-date by means of a turret tuner.

The most expensive item of upkeep, and by far the most common, has been the U801 H.T. rectifier efficiency diode. Therefore, the recent availability of silicon diodes has been put to good use by making a direct replacement unit for this valve.

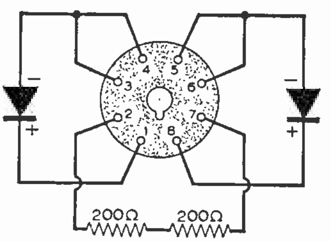
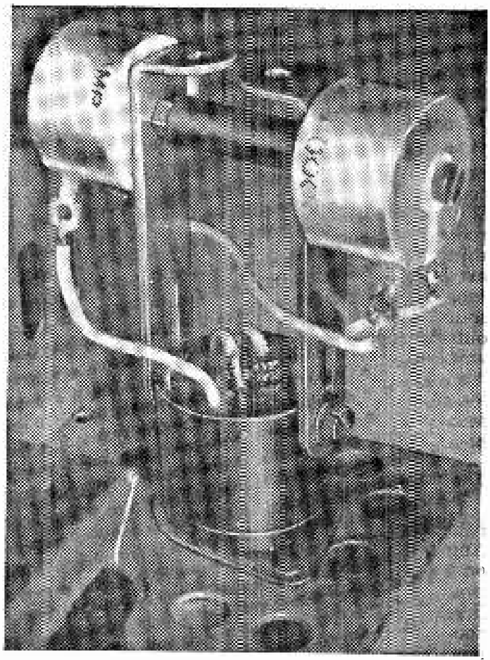


Fig. 1—The unit for the T161 and T164, viewed from the underside.



The unit in place on a TV chassis.

Heater Chain

In order to preserve the heater chain· two 200Ω mains dropper resistance units have been connected in series. These have been mounted on metal brackets as shown in the illustration. In this way, a heat-sink has been provided and, as can be seen, the brackets also serve as a handle for extracting the unit.

For the receivers mentioned in the first paragraph, this unit may be of simple construction (Fig. 1) and does in fact then cost less than the valve it replaces. However, if a unit is required to be of universal use, then the circuit shown in Fig. 2 should be followed. Because of the extremely low forward resistance of silicon diodes, a surge resistor must always be in series somewhere in the circuit. This is usually made up of a combined series resistance plus source resistance, the two not being allowed to total less than some 10Ω. (This requirement is satisfied by surge limiting devices already in the T161 and T164-resistances and transformer windings).

Voltages

By using one of these units it is certain that H.T. voltages will be of a higher value and will remain so for an indefinite period. Provided the ratings are not exceeded, this unit should have a life longer than that of the receiver. At the same time it will always provide the full rectified voltage, the drop across each diode being no more than half a volt at the maximum current rating of 250mA.

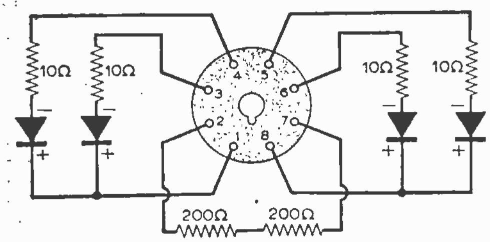


Fig. 2—The 'universal' unit viewed from the underside.

COMPONENTS REQUIRED FOR FIG. 2

4 silicon diodes (Lucas type DD008; max. PIV 800V; mean forward current 250mA)

These are obtainable from

G. & E. Bradley, Ltd.
Electral House,
Neasden Lane, London, N.W.10

in association with

Joseph Lucas (Electrical) Ltd.

4 resistors—10Ω 1W

2 mains-dropper units 200Ω 20W rating (Radiospares)

Octal valve base; 2 metal brackets, nuts, bolts, etc.

This idea may well be applied to the requirements of receivers using valves other than the U801. Note should be taken, however, of the peak inverse voltages likely to be encountered. If necessary it is possible to connect two silicon diodes in series so that the peak inverse voltage (PIV) may be doubled. At the same time parallel resistors of equal value must be included to equalise the voltage distribution. These resistors should be of the order of 200k or 270k, 1W types being satisfactory. ■

Servicing Data and Modifications

SOME "TEETHING" TROUBLES OF RECEIVERS AND HOW TO CURE THEM

By D. Elliot

(Continued from page 335 of the April issue)

THERE are still many thousands of Ferguson receivers of the 203, 103 and 991 series owned by readers of these pages. These all incorporate flywheel line sync circuits of the same basic design, and invariably give a great deal of trouble to their owners in terms of both adjustment and repair. As this series is concerned with servicing data as well as modifications, it is intended to devote most of this article to flywheel line sync circuits.

The Ferguson Circuit

In Fig. 15 is shown the circuit of the Ferguson models, which may differ in detail as will be discussed later. The circuit operates in exactly the same way in all models, however, and may be divided into three sections.

Firstly, there is the line oscillator proper. This is the triode (V16B) oscillator circuit in conjunction with windings L126 and L128 on transformer T1. The tuned frequency is determined by the inductance of L126 and the parallel capacitance C171, and a small amount of frequency adjustment is provided by the dust-iron core in L126.

Oscillation, which, incidentally, is of a sine wave nature, is produced by positive feedback from the anode winding to the grid winding. The time-constant of C170 and R186 is adjusted to suit the line frequency of 10,125c/s.

Because a pure sine wave is unsuitable for driving the line output stage, the line signal from the anode of V16B is passed through a pulse-shaping stage before being applied to the line output valve.

Reactance Valve

Secondly, there is a reactance valve (V15) connected in parallel with the tuned circuit of L126 and C171. It will be seen that the anode of V15 is connected to the " live " side of L126, and since the cathode is connected to chassis, from the signal point of view this is the same as the H.T. line, so the cathode can be considered as being connected to the " earthy " side of L126.

The important components in the reactance valve circuit are C160 and the control grid circuit resistance. The fact that C160 is connected between the anode and control grid causes the valve (between anode and cathode) to exhibit characteristics which are almost identical to a pure capacitance. This means, then, that the tuned oscillator circuit also has in parallel with it the virtual capacitance of the reactance valve. The line oscillator frequency can now be adjusted simply by altering the bias applied to the control grid of the reactance valve, since a change of bias produces a change of virtual capacitance.

Let us investigate this in a little more detail. The reactance valve has across it signal at

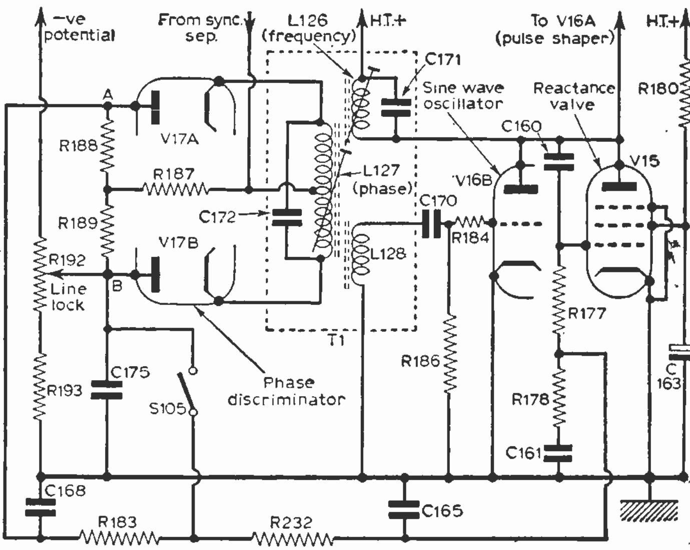


Fig. 15—The flywheel line sync circuit used in the Ferguson 203 series receivers. This differs a little in detail from the circuit used in models of the 991 and 103 series, but mainly in that an EF80 is used as line oscillator instead of a triode section of an ECC81. Switch S106 is not fitted in the earlier models.

oscillator frequency, but also some of the signal is applied to the control grid through C160. In the anode circuit, therefore, occurs an oscillatory voltage picked up direct from the oscillator, and also an oscillatory current arising from the oscillator signal applied to the control grid. Both the valve and the capacitor (C160) produce a phase change and the net result is that the oscillatory current flowing in the valve leads the voltage by 90°, which is precisely the same as the action of a capacitor.

The value of the capacitance so obtained is determined by the mutual conductance of the reactance valve, and as the mutual conductance can be altered by varying the grid bias, it clearly follows that a control of frequency is possible by that means.

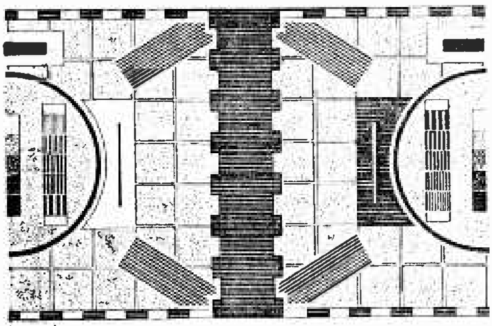


Fig. 16—With the sync pulses shorted as described in the text, L126 should be adjusted to obtain an almost stationary picture as shown.

Phase Discriminator

The third section of the flywheel circuit is the phase discriminator. In the circuit of Fig. 15, this comprises the double-diode V17, the tuned circuit L127 and C172 and associated components.

The phase discriminator, which is rather like a Foster-Seeley F.M. discriminator and works in a very similar manner, receives two signals. It receives some of the line oscillator signals coupled from L126 into L127, and also the line sync pulses from the sync separator stage.

Now, when the oscillator is *in phase* with the incoming sync signals, the voltage developed by the discriminator across its loads R188 and R189 is zero. However, if the oscillator frequency attempts to vary above or below the repetition frequency of the sync pulses, thereby causing a change in the relative phases of the two signals, a positive or negative voltage is produced at point "A" with respect to point "B".

Point "B" is connected to chassis through the line lock control R192 and R193, so the voltage occurring at point "A" is relative to chassis. It is applied to the control grid of the reactance valve through the filter circuit R183, R232, R177, C168, C165, R178 and C161, and in this way any attempted alteration in line frequency is automatically corrected by the discriminator voltage altering the capacitance of the reactance valve.

Manual Adjustment

In operation, point "B" of the discriminator load receives a negative voltage via the line lock control, and the value of this voltage can be adjusted by the control so as to provide a manual control of frequency—bearing in mind that this voltage is also reflected into the control grid of the reactance valve.

The rather complicated filter circuit detailed above possesses a long time-constant, and it is this filter in essence which endows the system with a "flywheel" effect. It thus ensures that the reactance valve responds only to the average of a number of transmitted sync pulses and that it is largely insensitive to random noise pulses or fading.

User's Adjustment

The circuit in Fig. 15 relates to the 203-series of receivers. In this model a switch (S106 in Fig. 15) is incorporated in the line lock control which closes when pressure is applied to the control knob. This action also causes the control to engage with the line lock potentiometer. When the switch closes, the control voltage from the discriminator is short-circuited, which results in the oscillator falling out of lock. Very careful adjustment of the line lock control is then necessary to hold the picture almost at the point of line lock. As the knob is rotated, the whole picture will move horizontally across the screen, and as the correct setting for the control is approached the picture will move only slowly across the screen and almost stop. This is the correct adjustment, at which point the knob should be released. The picture will then lock correctly and will remain locked when changing from channel to channel.

Owing to the nature of the flywheel circuit, the picture will often lock even if the line lock control is not adjusted correctly. What happens is that the picture is displaced horizontally and will immediately go out of lock on a burst of interference, if the aerial is removed and replaced, or if the channel selector switch is operated.

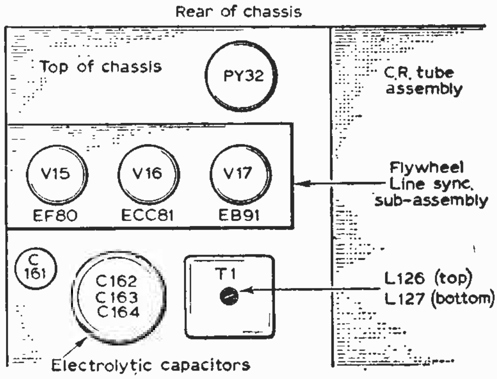


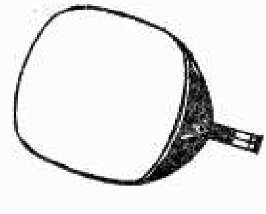
Fig. 17—The transformer T1, the core positions and the sub-assembly relating to the flywheel line sync circuit of the Ferguson 203 series receivers. The layout is slightly different in models of the 991 and 103 series and the core positions are reversed.

(Continued on page 400)

ALL TUBES GUARANTEED 12 MONTHS

Carriage Free

Speedy Passenger Train despatch.



NEW

12"	MW 31-74 etc.	£5.5.0
14"	MW 36-24/44 Limited quantity	£6.6.0
17"	MW 43-69 (limited) CRM 171, 172	£7.7.0

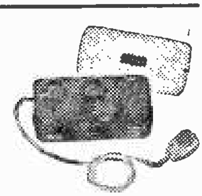
COMPLETELY REPROCESSED

REBUILT, RESCREENED, REALUMINISED TUBES OF THE HIGHEST QUALITY

14"	£5.5.0
15"—17"	£5.10.0
21"	£8.0.0

"CLARION" TRANSISTOR BATTERY TAPE RECORDER

Push-button controls. Capstan drive. 3¾ i.p.s., constant speed. 50 hours on four U.2 torch batteries. Portable. Durable plastic case. Free illus. leaflet. Complete with mike and tape. List Price 25 Gns. Our Price ONLY **16** GNS. Carr. 7/6



LINE OUTPUT TRANSFORMERS

Direct Replacements for 500 sets.

Baird. T29, T163 .. .. 53/-
T164, T167, T172, 2014, 1712 .. .. 60/-
Bush. TV 11A, B; 12A, B; TVF 12A, TUG12A, B; TRG 12A, B 45/-
TV12AM; TV22, 24; TRG24, TUG24 .. 60/-
Cossor. 930, 931, 933, 934, 948, etc. .. 58/-
Ekco. TS146; TS113-114; T161 .. .. 47/6
T221, 231; TSC311, etc. 55/-
Ferguson. 841, 2, 3; 941 to 945 .. .. 55/-
990T-998T; 103-145T; 203-246T.. .. 66/6
Ferranti. 14T3, 14T4, 17K3, 17T3-4 .. 45/-
14T2, T1205, T1215, T1225, T1325, T1405, T1415, T1425, T1505, T1825 .. 65/-
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 45/-
V120C, V180, V178, V200, V202C .. 57/6
V240, 250 .. 62/6; V214, 216 .. 69/-
Philips. 114 UF/UM, 115 U, 1437 U, 1446 U, 1726 U, 1746 U, 1747 U 73/-
383A, 463A, 563A, 663A 60/-
Pye. LV30, 16T, CS17, VT17 .. .. 60/-
CTM4, V4, VT4, V7, VT7 .. .. 52/6
Ultra. 814, 815, 817, 915, 917, VW80 Y/YA730, YVW84, VWY720, V710 (complete assembly with U25) .. 77/6
14/53, 15/60, 17/50, 17/53, 17/60, 17/63-4, 17/70-1-2, 21/50, 21/60, 21/70-1-2.. .. 60/-
All **Ultra Frame** O.P.T.'s 26/6

Add post 3/6.

100 mixed resistors. ¼W-2W—6/6 post 1/-.

TIME BASE COMPONENTS

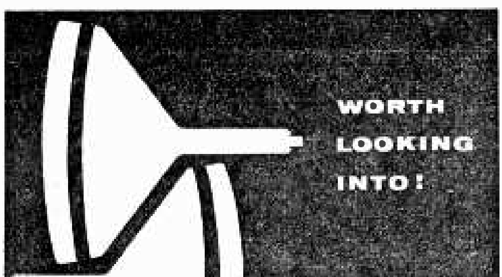
Suitable for P.T. "Olympic" etc. For 17in. or 21in. 90° tube.

L.O.P.T. (EY86 base etc.)	30/-
F.O.P.T.	15/6
Scan coils	19/6
ALL NEW. Connection data supplied.	
Focus Magnets (Elac.)...	15/6
Post etc. on each item	2/9

S.A.E. with enquiries please.

WESTWAY RADIO

5 Westward Way
Preston Road, Harrow, Middx.
Tel: WOR 2663



OUTSTANDING OFFER!

While stocks last

GUARANTEED REBUILT CATHODE RAY TUBES

12" & 14". Types MW31—74 : MW 36—24 : SE 14—70 : 4/14 : C14FM

59/6 each Carriage Paid
CASH WITH ORDER

Your old tube not required.

TATES ELECTRONIC SERVICES LTD

3 Waterloo Road, Stockport, Cheshire. Tel.: Sto. 7301.

EXPRESS ELECTRONICS

ROSEDENE LABORATORIES

KINGSWOOD WAY, SELSDON, SURREY

VALVES NEW TESTED AND GUARANTEED FOR THREE MONTHS

1C1	7/6	6BA6	6/-	12AT7	6/-	DH77	6/-	EF86	9/-	PL81	12/6
1C3	8/-	6BE6	7/-	12AU7	6/9	DH142	8/6	EF91	4/-	PL82	7/-
1F1	8/-	6BH6	5/9	12AX7	6/9	DH150	10/-	EF92	5/6	PL83	7/6
1F3	7/6	6BJ6	5/9	12BE6	8/6	DK91	7/6	EL41	9/6	PY81	6/9
1FD1	8/-	6BR7	8/9	12BH7	10/6	DK92	7/6	EL84	7/-	PY82	7/6
1FD9	7/6	6BW6	7/6	12K8GT	11/-	DK96	8/-	EM84	10/-	PY83	7/6
1L4	6/9	6BW7	7/-	12Q7GT	7/6	DL92	7/6	EM85	10/-	R19	11/6
1P1	8/-	6D2	4/-	16A5	9/-	DL94	6/6	EY51	7/6	U26	9/6
1P10	7/6	6F12	4/-	25A6G	8/6	DL96	8/-	EY81	10/-	U37	11/6
1P11	7/6	6H6GT	2/-	25L6GT	7/6	EB91	4/-	EZ40	7/6	U52	7/6
1R5	6/-	6J7GT	7/6	25Z4G	9/-	EBC41	10/-	EZ80	6/-	U76	7/6
1S5	6/-	6K7G	5/6	30C1	7/6	EBF80	8/6	EZ81	6/9	U78	5/-
1T4	7/6	6K8G	6/-	30L1	7/6	ECC81	6/-	HVR2	9/6	UBC41	8/6
1U5	5/6	6Q7G	5/6	35L6GT	9/-	ECC82	6/9	KT33C	6/-	UCH42	9/6
3Q4	8/-	6SL7GT	6/-	35W4	8/6	ECC83	6/6	KT66	11/6	UF41	8/6
3S4	7/6	6SN7GT	6/-	35Z4GT	8/-	ECC84	7/6	N17	7/6	UL41	8/6
3V4	6/6	6V6G	7/6	53KU	10/6	ECF80	8/6	N18	8/-	UY41	7/6
5U4G	7/6	6X4	5/-	5763	7/6	ECF82	8/-	N19	7/6	W76	4/6
5Y3GT	5/-	6X5G	5/-	80	6/-	ECH42	9/-	N709	7/-	W142	8/6
5Z4G	9/6	6X5GT	6/-	DAF91	7/6	ECH81	10/-	PCC84	7/6	X17	7/6
6AK6	6/6	787	9/6	DAF96	8/-	ECL80	8/6	PCF80	7/6	X142	9/-
6AL5	4/-	8D3	4/-	DF91	7/6	ECL82	9/-	PCF82	7/6	X150	9/-
6AM6	4/-	12AD6	11/6	DF96	8/-	EF41	9/-	PCL82	8/-	Z77	4/-
6AT6	6/-	12AH8	10/-	DH76	7/6	EF80	8/-	PCL84	7/6	ZD17	7/6

High Stability Resistors ¼W 5% 50 Ω to 1M, 9d. Midget Ceramics 500 v. 9d Coax. Super quality ¼in., 6d. yd. Plugs 9d. Sockets 9d. Silicon H.T. Rects. 250v. 300 MA 1in. x ¼in. 17/6. Contact Cooled 250v. 50 MA 6/6. 85 MA 8/6.

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.

VALVES MATCHED IN PAIRS

EL84 17/-, N709 17/-, 6V6G 17/-, 6BW6 18/- per pair. Push Pull O.P. Transformers for above 3-15 Ω 14/6, P. & P. 1/6. 12in. P.M. Speakers, 3 Ω 24/6. Baker's "Selhurst" 12in. 15 Ω 15W, 90/-. 12in. Stereo Model, £7.7.0.

SETS OF VALVES

DK91, DF91, DAF91, DL92 or DL94 ..19/6
DK96, DF96, DAF96, DL96..........27/6
1C3, 1F1, 1FD1, 1P1..................27/6
1R5, 1T4, 1S5, 3S4, or 3V4..............19/6
ECH42, EF41, EBC41, EL41, EZ40......37/6
UCH42, UF41, UBC41, UL41, UY41......35/-

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

Letters to the Editor

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

SPECIAL NOTE: Will readers please not 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.

COMPATIBILITY TEST

SIR,—I was extremely interested in Mr. G. Rogers' letter in "Practical Television" March issue on the satisfactory reception of the BBC's colour experimental transmissions. Although primarily intended for manufacturers of colour sets, I feel most strongly that the general public has a great part to play with regard to compatibility tests, as a large proportion of the population, I should well imagine, will not be in a position to purchase initial pilot colour sets because of their high cost. However, if they are going to get better monochrome reception, then I think it is high time that we had these experimental transmissions on a regular national scale and, as I am unfortunate enough to be outside the present limit of these transmissions, I was inspired by Mr. Rogers' letter to write to the engineering department of the BBC to request that this was carried out at the earliest possible moment.—G. BLOOM (Hull).

SIR,—I fully agree with Mr. Rogers (March issue) concerning the quality of the transmitted colour pictures. I, too, have found that the pictures are very much to be preferred from the tonal gradation point of view and I certainly would prefer to receive colour on my black and white set than ordinary black and white transmissions. Talking of colour, what will happen to the most popular "Black and White Minstrel Show" when colour comes in?—R. KIMBALL (Perth).

DECCA DM45

SIR,—Further to my letter published in Your Problems Solved pages regarding the above set, I notice suggestions for cure of loss of frame height have been given.

As the fault may affect many similar sets, below is the necessary modification which may be of interest to some of your readers:

Remove thermistor 2 from its position across L28 and short the terminals together. Replace R122 by a 100k resistor. Place thermistor 2 across this resistor in parallel with it, using long tags to ensure that the thermistor is not affected by heat, as in its original position across L28.—C. A. C. BLURTON (Sussex).

VALVEHOLDER TROUBLE

SIR,—I think Mr. Barker could remedy the trouble he is experiencing with some valveholders very simply (January issue). Special valve retainers are on the market and can be obtained from certain surplus dealers in the London area. Two small holders drilled in the printed circuit near to the valveholder will hold the small spring-bolts, and a fitting goes over the top of the valve and holds it very firmly. In addition I have found that the pins may conveniently be bent slightly inwards to make better contact in certain types of valveholder.—R. TURNBULL (N.9).

The Light-sensitive Resistor

(Continued from page 375)

from the junction of a potential-divider given by R3 or the light-dependent resistor and R4, so when the video drive increases due to the light-dependent resistor decreasing in resistance, the voltage applied to the tube cathode through R5 becomes more positive. As this is the same thing as the tube grid going more negative, the greater video drive also serves to increase the overall contrast ratio by effecting a reduction in brightness. Capacitor C1 simply passes the higher video frequencies with little attenuation.

Light-operated Remote Control

Light-dependent resistors have also been used in recent receivers for sound muting and channel changing. They are mounted on the front of the cabinet behind light traps to prevent the room lighting from affecting the remote control. There are several arrangements but they all require an ordinary hand torch as the "control unit".

In one set, two resistors are used, one for sound muting and the other for channel change. When the torch is beamed on the channel changing resistor, a relay trips out of circuit and appropriate contacts switch on the turret drive motor. This is accomplished by the relay being normally energised through a dropping resistor from the H.T. line and the light-dependent resistor being in parallel with the relay winding. When the light from the torch causes the resistance to fall, the relay current is by-passed and the action outlined above takes place.

A somewhat more complicated pulse-responding circuit, incorporating a relay and neon lamp, is employed in the sound muting innovation. Pulses produced by flashing the torch on the light-dependent resistor actuate the relay and cause a neon to pass current from the H.T. line. The resulting current or low impedance of the neon by-passes the A.F. signal across the volume control. ■

Your PROBLEMS Solved

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 UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 400 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

STELLA ST.8617U

I am having trouble with the brilliance control on this set. When I switch on I can only get a dark, dull picture, but when the set is warmed up the brilliance comes back and the picture is normal. This happens every time I switch on. I have a service sheet for this set.—G. Kendall (Caterham).

We should suspect the tube of failing emission from your description. If during the initial, dull period, advancing the brilliance or contrast causes the picture to blur and turn negative the tube is almost certainly at fault, but you should check the mains adjustment to see that it is set to agree with the mains supply, which has been generally low in the early evening during the recent cold spell.

ALBA T744FM

The trouble is non-linearity of the frame scan. Quite a good picture can be obtained, but there is a 2in. gap at the bottom of the screen. Adjusting the height control opens the picture out to touch the bottom, but the top is then off the screen. The frame linearity control does not help matters at all—it just cramps the top of the picture. The ion trap magnet is correctly set. The scan coils on this receiver are mounted in a kind of housing. This I have moved right up the tube neck. I have substituted all the valves in the frame circuit.—J. B. Worthington (Rotherham).

Since you say the picture is "quite good," we presume there is no bottom compression. It is therefore only necessary to adjust the picture shift lever on the focus assembly to drop the picture by the required amount.

EKCO T205/1

I have had this set given to me recently by a friend who told me it had been working well with him except that the tube was boosted and would soon need replacement. The trouble is that after it has been switched on for about 15 minutes the picture goes off suddenly and I either have to switch it off and let it cool or remove the back cover and screening cans from the tuner valves PCC84 and PCF80. These two valves seem to get very hot and when I keep the screening cans off, the picture stays on twice as long. I have found as long as I can keep cool air flowing into the set to control the temperature the tuner works well. I have also noticed that when I reverse the A.C. mains plug, leaving the chassis live, the aerial socket (both centre and outer) is live, too. When I touched them with a neon screwdriver it glowed as brightly as when touching the chassis.—G. E. Mullan (Dungannon, Ireland).

It is quite common for the two tuner valves to run so hot that they cannot be held in the hand. We suggest that you try replacing the PCF80, which appears to have developed an intermittent inter-electrode short.

As there are two small 1,000pF condensers between chassis and the aerial socket, inner and outer, it is quite possible to obtain a bright glow on a neon tester with the mains the wrong way round and without the aerial system being connected to earth.

COSSOR 927

On switching this set on, everything is quite normal with a good picture, but after 10 to 15 minutes the bottom of the picture starts to creep up, showing a fold-over ½in. wide. This goes on all evening, filling and cramping the screen.—E. Watson (Rossendale, Lancashire).

The symptoms indicate a faulty valve in the frame timebase. This comprises two 6AB8 valves on the upper deck on the right as viewed from the back. It is normally the one near the chassis edge which gives rise to your trouble.

PYE CONTINENTAL

The set receives sound on BBC Channel 1 only but no vision. I have renewed a PCF80 and now have BBC sound and vision perfect but no sound or vision on Channel 9. Can you please suggest any possible causes? The set was at one time working perfectly on both channels.—D. C. Cannon (London, N.12).

It is possible that in renewing the PCF80 local oscillator you have put the ITA coils out of adjustment. To correct this, adjust the brass trimmer accessible via No. 13 hole in the series of holes around the fine tuner cover. This hole is the uppermost of the left-hand semi-circle around the fine tuner.

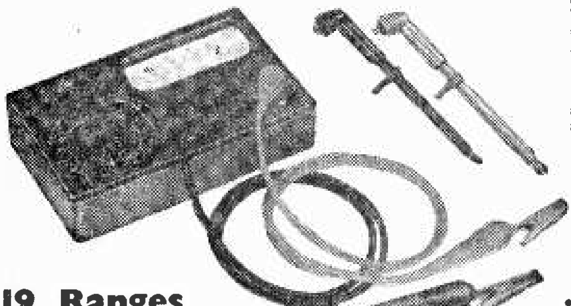
BUSH TV95

On first switching on, the picture fails to fill the screen, leaving a 1in. gap at top and bottom. It gradually increases in height, and after about five minutes the picture is quite normal. I should be grateful if you would kindly let me have your opinion on the possible cause. Can you also let me know how to clean the tube face?—H. Grimstead (London, E.6).

We would advise you to check the thermistor wired in series with the height control, and the ECC82 frame generator valve if necessary.

(Continued on page 399)

More for less...



Designed to offer the widest possible range of accurate and reliable measurements at the lowest possible price, the versatility and usefulness of the Multiminor is 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 technique to achieve outstanding compactness and economy of weight. The scale is clear and open. The fine red coloured pointer and effectively damped 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

19 Ranges

D.C. Voltage	A.C. Voltage
0— 100 mV.	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.	**D.C. Current**
	0— 100µA
	0— 1mA
Resistance	0— 10mA
0—20,000	0— 100mA
0—2M	0— 1A

List Price: **£9:10s.**
complete with Test Leads and Crocodile Clips.
Leather case if required 39/-
Size: 5⅝ x 3⅜ x 1¾in.
Weight: 1 lb. approx.

MM12

...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)

TUBE CHECKS MADE EASY!

NO DO-IT-YOURSELF TV ADDICT CAN AFFORD TO BE WITHOUT THE EVER-USEFUL

DIAMOND 5" MONITOR TUBE

Ideal for test purposes, super speedy tube checks or TV experiments.

ELECTROSTATIC OR MAGNETIC SILVER ACTIVATED SCREEN from the **DIAMOND "ALL NEW" RANGE.**
"Only the glass is not new"
Duodecal Base: Neck Diameter 34mm.

6v. or 12v., .3 amp. Guaranteed 1 year.
Cash with order. P.P. 7/6 U.K. only. EACH **£4**

DIAMOND ELECTRONICS CO.
SIRON WORKS, 96a WELLINGTON ST., MANCHESTER 18. Tel.: East 3669

VACUUM ELECTRONIC LIMITED

KEEPS YOU IN THE PICTURE

WITH THE FINEST REBUILT CATHODE RAY TUBES

12 MONTHS GUARANTEE

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

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

15/- ALLOWED ON RECEIPT OF OLD TUBE

DELIVERY FREE IN LONDON AREA

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

(Continued from page 396)

To clean the tube face, the chassis must be removed. To do this, first remove the cabinet back and pull off the brightness and volume control knobs. Place the receiver on its side and remove the small cover on the bottom of the cabinet. Loosen, but do not remove the two escutcheon-retaining screws. Withdraw the front moulded button escutcheon.

Place the receiver upright. Remove the loud-speaker leads from the output transformer sockets. Place the cabinet with the base overlapping the edge of the bench and remove the two rear screws under the bottom. Turn the cabinet round and remove the front two. Remove the top centre bolt and slide the chassis from the cabinet.

HOME-BUILT SET

My set, which I constructed nearly six years ago from an early kit used an English Electric metal cone CRT type T901A; this used has developed an intermittent heater-to-cathode short. I was extremely interested to read the article in January's edition of your journal entitled "New Tubes for Old" as I feel it will be useful in my case. However, after suggesting that this fault can be cleared by tapping the neck of the tube (which does not work in my case), a method is described whereby the debris can be flashed off. It is then stated that all pins except the first grid should be connected together and a high voltage applied between the control grid and the shorted pins. It seems to me that with a heater-cathode short all pins except the cathode (pin 2) should be strapped together and the momentary high voltage applied to the cathode. Perhaps you will be good enough to clarify this point for me. Should this method not prove successful I understand that an isolating transformer can be fitted to the heater However, I believe that this method will not be successful with a tube that is cathode modulated, as is the case with mine. Will you please confirm whether an isolating transformer will restore the picture definition to my set or will it make no difference as the heater is already fed from a separate winding on the mains transformer?—P. L. Kimber (Scampton, Lincolnshire).

The voltage pulse should be "fired" between the heater and cathode in your case. We should warn you, however, that the process is not always successful and in some cases it results in heater failure. An isolating transformer can be used, but with cathode modulation (as is nearly always the case) the transformer should be of the low-loss variety to avoid bypassing the video signal from the cathode to the receiver chassis. The transformer should have its own mains primary and a secondary to suit the tube heater and to give a boost if required. The existing heater feed should be abandoned.

PYE VT17

The sound is perfect but the picture is of very poor quality. There is a vertical black band on either side of the picture. The one on the left-hand side is covered by the raster but no picture. The one on the right-hand side is completely blank. Also, when the brightness is advanced the picture goes out of focus. When the contrast control is advanced the picture goes negative. I have replaced the line output valve (PL81), the booster diode (PY81) and the EHT rectifier (EY86), but with no result. Please could you advise me as to what to do?—D. Stileman (Henley-on-Thames, Oxfordshire).

The symptoms suggest low H.T. and we advise you to try replacing the H.T. rectifier, which is a contact cooled FC31 (14RA1283) and is just below the EHT rectifier.

FERGUSON 305T

The fault in this set is intermittent lack of line hold. The sync separator, line discriminator and line automatic frequency valves have all been changed with no effect. The line sync feed capacitor and diode were also changed. Voltages on the anode and screen pins of the sync separator appear to be low, but for no apparent reason. On loan to a friend for a fortnight he reported no trouble at all except a slight "shiver" of the picture. There is no lack of signal strength as the picture, both on ITV and BBC, is usually very good.—R. Bolton (Hitchen).

The trouble is obviously that of line sync failure to the line oscillator. This could happen due to a fault in almost any component between the sync separator and the discriminator. This is one of those faults which may require a series of substitution tests in order to bring to light the intermittent culprit. An oscilloscope, of course, connected to the various parts of the circuit when the fault occurs, would reveal the point where the line sync disappears and would thus considerably aid diagnosis.

BUSH TV85

On advancing either the brightness or contrast control the picture turns negative. The set has a booster fitted to the heater circuit, giving 7·4V. Without the booster the heater circuit is at 5·8V. The initial trouble was with the metal rectifier, but this has been renewed with an LW15 component in place of the 14A949 which is not now in production. The focus control seems to have no noticeable effect in any position. Full white objects are followed and preceded by dark bands stretching the full length of the screen either side. Close-ups are good but faces in the distance are white blobs with no content. I realise it is probably the tube but would like to make sure. If it is low emission in the tube and it cannot be rectified could you please give a replacement tube number?—W. Dent (West Cornforth, Co. Durham).

The tube fitted in the TV85 is an AW43-80 (electrostatically focused). This is most definitely in need of replacement. Restore the original heater wiring when this is done.

ULTRA V815

There are 2in. of blank space at the bottom of the picture which I think you call cramping. I've been told that a valve needs replacing. The sound is also weak on ITV but good on BBC. Could it be the PCC84 valve in the tuner?—A. Williams (Garndiffaith, Monmouthshire).

We should advise you to replace the 20P3 front right-hand side frame output valve. Its associated components should be checked if necessary. The

PCC84 on the tuner unit should be replaced if necessary and the cores of the horizontal coils retrimmed to receive maximum sound.

ALBA T394

I wish to fit a turret tuner to my television set and would be very grateful if you would recommend a suitable one to me.—J. Sinclair (South Nutfield, Surrey).

We would suggest you fit a Cyldon P16H turret tuner, replacing V1 and V2 EF80 valves with the R.F. and mixer plugs which are supplied as part of the tuner.

EKCO T284

This set has developed severe frame cramp with some fold-over at the bottom and has a very weak frame lock. Severe buzzing occurs on sound which alters as the vertical hold control is turned. When the picture height is reduced to about 1in. the buzzing sound nearly disappears. I have changed the frame valves with others, but this makes no difference whatsoever. I would appreciate any help you could give me on this problem. —N. J. Wiseman (Cowplain, Hampshire).

The fold-over on the frame timebase of the T284 is usually due to a faulty 500μF electrolytic capacitor in the frame output valve cathode bias circuit. The fact that you have a buzz on sound indicates that the main smoothing condenser, just in front of the EHT unit, may also have lost some capacity.

K.B. HV40

After the set has warmed up two pictures appear, one across the top half of the tube and one across the bottom half. They are both complete pictures but, of course, cramped. It is also difficult to lock the vertical hold.—W. Burnett (Ingrow, Yorkshire).

You should replace the 2μF capacitor which decouples the height control and check the 270k resistor which is wired in series with the hold control. Check both controls.

PYE FVI

This set has developed a constant line break up and multiple images that cannot be shifted on the control. The line output valve and line oscillator valve have been changed without improving results.—P. G. Skelton (Jarrow).

Suspect low H.T. as the cause of your fault. Check especially the 14A86 H.T. rectifier which is in the lower half of the line output compartment.

QUERIES COUPON

This coupon is available until MAY 22nd, 1962, and must accompany all Queries sent in accordance with the notice on page 396.

PRACTICAL TELEVISION, MAY, 1962.

SERVICING DATA AND MODIFICATIONS

(Continued from page 392)

If it is found that a point of near-stability cannot be obtained within the range of the line lock control with S106 closed, a simple internal adjustment will often clear the trouble.

Line Oscillator/Discriminator Transformer Adjustment

The cores of L127 and L126 are located at each end of the screening can housing T1. The position of T1 is shown in Fig. 17 (page 392), and the top core adjusts L126 and the bottom core (accessible from below the chassis) L127.

If the effect in Fig. 16 (page 392) cannot be obtained with the line lock control towards the centre of its range with the knob depressed to close S106, L126 should be carefully adjusted with a suitable screwdriver first one way and then the other to find the point of correct line frequency—first making sure that the line lock control is at the centre of its range.

If the correct line frequency cannot be obtained over the entire adjustment of L126, there are three possible reasons for this. One is that C171 may be faulty or of incorrect value. The second is that the winding L126 may have moved on the former and require refixing, and the third is a severe change in characteristics of V16.

Phasing Adjustment

When the correct line frequency has been established it may be found that the picture is displaced horizontally in the raster. This *must not* be recentred by the picture shift adjustments on the focus unit nor by readjusting the line lock control.

With the line lock control as previously set, L127 should be carefully adjusted to move the picture to the centre of the raster. This is best undertaken by reducing the picture width and adjusting the contrast and brightness controls so that the vertical strips of unmodulated raster on each side of the picture are visible. The core should then be adjusted until the widths of unmodulated raster at each side are equal. If this adjustment is incorrectly performed the picture may be folded over on one edge accompanied by shading effects across it.

The above details refer to all Ferguson models, but those of the 991 and 103 series do not incorporate a sync shorting switch, in which case it is necessary to short out the appropriate circuit internally before making the frequency adjustment. The positions of the cores on the transformer T1 are also reversed. That is, L126 is below the chassis and L127 is above. Moreover, on these earlier sets an EF80 pentode is used for the oscillator instead of a triode section of an ECC81.

(To be continued)

Published on the 22nd of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, London, W.C.2, and printed in England by WATMOUGHS LIMITED, Idle, Bradford; and London. Sole Agents for Australia and New Zealand: GORDON & GOTCH (A/sia), Ltd. South Africa and Rhodesia: CENTRAL NEWS AGENCY, LTD. East Africa: EAST AFRICAN STANDARD LTD. Subscription rate including postage for one year: Inland £1.5.0. Abroad £1.3.6 (Canada £1.2.0). Registered at the General Post Office for the Canadian Magazine Post.

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

LINE OUTPUT TRANSFORMERS

See End Column

SCAN COILS SPECIALISTS

Make	Models	L.O.Tx. Prices
ALBA:	T301, T304, T394, T484, T494, etc. ...	47/6
BUSH:	TV11A, 11B, 12A, 12B, TVG12A, 12B, TRG12A, 12B ...	45/-
	TVG26, TV32, TV33, TVG34, TVG34A, T36, TV36, TVG36, TV36C, TVG36C, TV43 ...	89/6
	TV53, TV56, TS7, TV57 ... TVG58, TV62, TV63, TV66, TV67, etc. ...	95/-
	TV80 with EY51 ...	110/-
COSSOR:	930 & T, 931, 933-4-5, 937, 938A & F, 939A & F ...	62/6
	943T, 940-946, 945, 945B,	59/6
	945F, 947, 949 ...	69/6
DECCA:	D17 & C ...	69/6
	DM1, DM2C, DM3, DM4/C	75/-
	DM5, DM14, DM17, 444 555 ...	75/-
DEFIANT:	TR1453, TR1753 ...	59/6
DYNATRON:		
EKCO:	TS93, TC8102, TS105, TS114, TRC124, TC138, TS188, TS193 ...	55/-
	TRC139, TC140, T141, TV 142 ...	79/6
	T161, TC162, Y164, T165, etc. ...	79/6
	TC208, TV209, T231, T221 T231F, T248, T283, T284, T293, etc. ...	59/6
FERGUSON:	103T, 105T, 113T, 135T, 145T ...	66/6
	941T-953T inclusive ...	59/6
	991T-997T inclusive ...	69/6
	203T-246T inclusive ...	69/6
	306T 308T ...	65/-
FERRANTI:	14T3, 14T3F, 14T4 ...	48/6
	17K3 & F. 17T3 & F. ...	48/6
	17K4 & F, 178K4 & F. ...	48/6
	17T4 & F. ...	48/6
	14T5, 17SK5, 17K5 ...	48/6
G.E.C.:	BT1251, BT1252, BT1746, BT1748, BT4743 ...	49/6
	BT4643, BT5147, BT5246-48 ...	89/6
	BT5348-BT5643R inclusive	49/6 and 89/6

Scancoils, Osc. and Output Txs. for all above makes available.

Post and Packing 3/6. All Enquiries S.A.E.

See End Column

WYNDSOR TELEVISION

Dept. P.T.

ST. ALBANS RD., BARNET, HERTS.

BAR 1769

SETS & COMPONENTS
(continued)

C. EDWARDS

Surplus Stocks

139 GOLDHAWK RD., LONDON, W.12.

1,000 S/H TV Sets, condition unknown, **could be working.**

14in., 13 Channel **55/-**
17in., ,, ,, ... **125/-**

Plus 20/- carriage.

Guaranteed Valves

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

13 CHANNEL Turret Tuners. Brand new **39/6.** P and P and Insurance 2/6. C.W.O. OSBORN ELECTRONICS, 382 Brockley Road, Crofton Park, S.E.4.

"HEATHKITS" can now be seen in London and purchased on H.P. Free brochure. DIRECT TV REPLACEMENTS LTD., 138 Lewisham Way, SE14. TID 6666.

TUBES - VALVES - SPARES

Reclaimed Valves and Tubes. Most comprehensive selection at keenest prices. All valves re-tested before despatch and guaranteed to be in good working order.

1A7	10/-	7S7	7/6	EF39	4/6
1D5	7/6	10C1	7/6	EF94	4/6
1H5	7/6	12A6	6/-	EF95	4/6
1N5	7/6	12E1	12/6	EK2	7/6
2A3	5/-	12J7	7/6	EK32	7/6
4THA	5/-	12K7	4/6	EK90	4/6
5U4	4/6	12Q7	6/-	EL33	6/-
5V4	6/-	12SN7	6/-	EL41	6/-
5Z4	6/-	25A6	6/-	EL81	4/6
6A7	7/6	25L6	6/-	EL90	6/-
6A8	7/6	25Z4	6/-	EL91	4/6
6AG5	3/-	25Z5	6/-	EM34	7/6
6AK5	6/-	25Z6	6/-	EY91	6/-
6AQ5	6/-	35L6	6/-	EZ90	4/6
6AU6	4/6	35Z4	6/-	KT61	6/-
6AV6	4/6	43	5/-	KT66	7/6
6BA6	4/6	50C5	4/6	KT67	7/6
6BE6	4/6	50L6	6/-	KT81	7/6
6BJ6	6/-	75	5/-	KTW61	4/6
6BQ7A	7/6	78	5/-	KTW63	4/6
6BW6	6/-	80	6/-	L63	4/6
6C5	4/6	85A1	6/-	MH4	5/-
6C6	5/-	807	5/-	MU12	5/-
6C9	6/-	954	3/-	N78	6/-
6D6	5/-	5763	6/-	N108	7/6
6F6	4/6	7475	6/-	OA2	6/-
6J5	4/6	9002	3/-	OA3	6/-
6J6	4/6	9003	3/-	OB3	6/-
6J7	4/6	AZ1	7/6	OC3	6/-
6H6	2/-	AZ31	7/6	OM4	4/6
6L6	7/6	CBL31	15/-	OM6	6/-
6L7	6/-	CCH35	7/6	OM9	4/6
6LD20	6/-	CL33	10/-	OM10	7/6
6K7	4/6	CY31	7/6	Pen 36C	7/6
6N7	6/-	DH63	4/6	Pen 45	4/6
6P1	7/6	DL63	4/6	U50	6/-
6Q7	4/6	EAC91	4/6	U52	4/6
6SA7	5/-	EAF42	6/-	UAF42	6/-
6SH7	4/6	EBC33	4/6	UBC41	6/-
6SJ7	4/6	EBC41	6/-	UBL21	12/6
6SL7	6/-	EBC90	4/6	UCH21	12/9
6SN7	4/6	E88C	6/-	UCH42	6/-
6SS7	4/6	ECH35	6/-	UF41	6/-
6U5	6/-	ECH42	6/-	UU6	7/6
6V6	4/6	EF36	4/6	UU7	7/6

Postage and packing (all valves) 6d. each. Send stamps with enquiries or for full list of 1000 valves, tubes, transistors, etc., to:

"ST. JOHN'S RADIO," 3 Jews Row, London SW18. *Phone:* VAN 8822

LINE OUTPUT TRANSFORMERS

SCAN COILS SPECIALISTS

See First Column

Make	Models	L.O.Tx. Prices
H.M.V.:	1824 & A to 1831 inclusive	67/6
	1840, 1841, 1842-1848 ...	67/6
	All models available.	
INVICTA:	T118, T119, T120 ...	55/-
	All other models available.	
K.B.:	LFT50, LVT50, LFT60, MV60 ...	107/6
	All models available.	
MARCONI:	All models available.	
MASTERADIO:	Most models in stock.	
McMICHAEL:	Most models in stock.	
MURPHY:	V200, V202C ...	57/6
	V240, V250 ...	95/-
PETO SCOTT, PHILCO:	Most models in stock.	
PAM:	908, 909, 952, 953, 958 ...	55/-
PHILIPS:	1768U, 2168U ...	105/-
	1100V, 1200V ...	75/-
	122GU, 1236V, 1238V ...	75/-
	114UF, 114UM, 115U ...	75/-
	1437U, 1446U ...	75/-
	Most models in stock.	
PILOT:	Most models in stock.	
PYE:	CTM4, FV4C, FV4COL ...	55/-
	V4, VT4, V7, VT7 ...	55/-
	LV30, FV1, FV1C ...	69/6
	C817F, CTM17F, CW17 ...	69/6
	CW17C, CW17CF, CW17F, etc. ...	69/6
	Most models in stock.	
RAYMOND:	Most models in stock.	
REGENTONE:	All models available.	
R.G.D.:	6017T, 7017, C54, etc. ...	59/6
	Most models in stock.	
SOBELL:	TS17, T346 ...	65/-
	Most models in stock.	
STELLA:	ST5721U ...	105/-
	ST8617U, ST8621U ...	105/-
	ST8917U ...	105/-
	ST6414U, ST6417U ...	95/-
	ST8314U ...	75/-
ULTRA 917:	U25, etc., complete ...	79/6
	Most models in stock.	
VIDOR:	CN4217-CN4231 inclusive	65/-

Scancoils, Osc. and Output Txs. for all above makes available.

Post and Packing 3/6. All Enquiries S.A.E.

SEE FIRST COLUMN

WYNDSOR TELEVISION

Dept. P.T.

ST. ALBANS RD., BARNET, HERTS.

BAR 1769

SALVAGED VALVES TESTED ON A MULLARD HIGH SPEED VALVE TESTER

AC/P	2/6
B36	2/6
B329	4/-
D1	2/6
D63	2/6
D77	2/6
DAF91	4/-
DD4	2/6
DD41	2/6
DDL4	2/6
DF91	4/-
DH77	4/-
DK91	4/-
EA50	1/3
EB34	1/3
EB41	1/3
EBC33	2/6
EBC41	4/-
ECC33	2/6
ECC34	2/6
ECC81	4/-
ECC82	4/-
ECL80	4/-
EF50	1/3
EF80	2/6
EF91	1/3
KT33C	1/3
KT42	2/6
KT61	2/6
KTZ41	2/6
L63	2/6
MPT4	2/6
P41	2/6
P61	2/6
PCC84	5/-
PCF80	5/-
PCL82	4/-
PCL83	4/-
PCL84	4/-
PEN45	2/6
PEN46	2/6
PL33	4/-
PL81	5/-
PL82	4/-
PL83	4/-
PL84	4/-
PY31	4/-
PY81	4/-
PZ30	4/-
SP41	1/3
SP42	2/6
SP61	1/3
U31	4/-
U251	4/-
UF42	2/6
VP4	4/-
VP4B	4/-
W77	2/6
X81	4/-
Z63	2/6
Z66	2/6
Z77	1/3
Z90	1/3
Z719	2/6
4TPB	2/6
6AL5	2/6
6AM6	1/3
6BW7	4/-
6BX6	2/6
6C6	4/-
6D6	4/-
6F12	1/3
6F13	1/3
6J5	2/6
6J7	2/6
6P25	2/6
6P28	2/6
8D3	1/3
9D6	2/6
10C1	4/-
10C2	4/-
10F1	4/-
10P14	2/6
12BH7	4/-
20F2	4/-
20L1	4/-
20P1	2/6
20P3	4/-
20P5	4/-
25L6	2/6
30C1	5/-
30E1	5/-
30PL1	4/-
30PL13	4/-
32	2/6
42	2/6
43	2/6
807	4/-

EXAMPLES

FULL CATALOGUE 9d.

VALVE HOLDERS

American Octal .. ..5/-doz.
Noval .. .. ..9d. ea.

RESISTORS

Card of ½W Resistors, 72 valves covering complete 10% range. 24/- per card.
Full range of separate Resistors, Condensers, etc.

VARIABLE CONDENSERS

3-50pf concentric trimmers 3/- doz.

GEC CRT'S (SALVAGED)

SPECIAL OFFER
16in. G.E.C. 6901 .. ..30/-ea.
12in. G.E.C. 7102 .. ..10/-ea.
Personal Callers Only

FEW ONLY LEFT

35M/cs, 16M/cs, 10M/cs TURRET TUNERS, less valves (Ex receivers) 12/6
We can often supply for the actual set you want to fit the tuner in, providing set is old enough to be stripped.

TRANSFORMERS

CRT Boost Transformers. 2V, 4V, 6V, 10V, 13V
State which required 12/6 ea.
Heavy Duty Output Transformers. 6 ratios from 13 : 1 to 43 : 1 .. .. ..25/-ea.
Miniature Output Trans. .. 3/9ea.
Standard Output Transformers, Multi-match ..10/-ea.
Transistor Driver: 1·1 CT 10/-ea. 3.6-1 CT 12/6 ea.
Transistor Output:6.6-1 CT 10/-ea. 9.2-1 CT 10/-ea.
Microphone Transformers, ratio 65 : 1 .. ..35/-ea.

I.F. TRANSFORMERS

Standard 465 kc/s .. 12/6 per pair
Midget 465 kc/s .. 16/- per pair

AUTO TRANSFORMERS

250W .. .. 67/6 ea.
100W .. .. 27/6 ea.
50W .. .. 20/- ea.

TRANSISTORISED FAULT FINDER

Enables faults to be located quickly. Consists of a two-transistor, multi-vibrator in a box. Complete with battery. 32/6

CRYSTALS

GENUINE MULLARD. Boxed

OA5	6/-	OA81	3/-
OA70	3/-	OA85	3/-
OA79	3/-	OA91	3/6

TRANSISTORS

OC16W	48/-	OC75	8/-
OC19	48/-	OC72	8/-
OC26	25/-	OC76	8/-
OC44	11/-	OC78	8/-
OC45	10/-	OC81	8/-
OC70	6/6	OC82	18/-
OC71	6/6	OC170	17/6

TERMS: C.W.O. or C.O.D.
Orders under £1, P. & P. 1/3.
Open till 11 p.m. most days.

3d. stamp for list or 9d. for full catalogue

Dept. PTA

Arion Television

Maxted Road, S.E.15 NEWX 7152

SETS & COMPONENTS *(continued)*

B. E. HAMPSHEIR

RADIO and TELEVISION

23 NORTHCROSS ROAD, LONDON, S.E.22

NEW BOXED VALVES GUARANTEED 12 MONTHS

B36	10/-	ECL80	10/-	PL81	12/6	UF41	8/6	6BR7	12/-
B65	10/-	EF50	7/6	PL82	10/-	UF42	7/6	6D2	10/-
DAC32	10/-	EF80	7/6	PL83	10/-	UF85	10/-	6F1	10/6
DAF91	7/6	EF91	7/6	PY80	9/-	UF89	7/-	6P28	15/-
DF91	7/6	EL33	10/-	PY81	12/-	UL41	10/-	7K7	10/-
DK91	8/6	EY51	12/-	PY83	12/-	UL81	7/6	7Y7	10/-
DK92	8/6	EY86	10/-	R19	15/6	UY41	10/-	9BW6	8/-
DK96	8/6	HD14	9/-	RM4	15/-	UY85	10/-	10P13	14/-
DL35	9/6	KT33C	8/-	U25	13/6	W77	7/6	12AT6	9/6
DL94	7/6	KT36	8/-	U403	10/-	Z77	6/6	12AT7	10/-
DL96	7/6	N17	8/-	UAF42	10/-	1D5	9/-	19BG6G	13/-
EB91	7/6	PCF80	11/-	UBC41	10/-	1F09	8/6	20D1	8/6
ECC81	9/-	PCF82	11/-	UBF80	10/-	1P11	8/6	20F2	14/6
ECC82	9/-	PCL82	11/-	UCH42	10/-	1S5	7/6	20L1	14/6
ECC84	9/-	PCL83	11/-	UCH81	10/-	6AL5	7/6	20P5	14/6
ECH21	11/6	PENA4	18/-	UCL82	10/-	6AT6	7/6	30C1	10/-
ECH35	11/6	PL36	11/6	UCL83	10/-	6BA6	10/-	35W4	6/6
ECH81	11/6								

SALVAGED VALVES 10 for £1
TESTED 100%

EF80	EB91	6F13	L63	ECL80
EF91	6AL5	10F1	KT33C	6AM6
EF50	D77	6P25	6P28	6F12

C.W.O. 1/- POSTAGE ALL ORDERS UNDER £1

VALVES EX-TV sets, 6/- doz. Lists free.—14 Cricklade Rd., Swindon.

BRAND NEW VALVES AND TUBES!

12/14/17 in. £4/£5. Mullard, EMI, Mazda, etc. U25/PY32 9/11. PL81 8/6, U801 17/6, ECC81/2/3 5/-, EB91 3/-, PCC84/PCF80 8/6, ECL80 7/6, EY51/EY86 7/9, etc., etc.

P. BEARMAN

3 PANK AVENUE, NEW BARNET HERTS.
Tel: Bar 1934
(& Ansaphone Service)

TUBES-AERIALS-VALVES

Regunned tubes, guaranteed one year, full range of aerials and fittings. I.T.V. boosters, valves, brayhead tuners, T.V. sets, transistor radios and all electrical appliances. Co-axial cables and house wiring cables, fluorescent fittings.
All quotations without obligation. Special terms to the trade and Home Engineers. S.A.E. for Catalogue.

G. A. STRANGE

BROADFIELD, NORTH WRAXHALL, Nr. Chippenham, Wilts. Tel. Marshfield 236

L.O.P.T's

SCAN COILS, FRAME O.P.'s

Ekco T231, T221, T311 .. 62/6
Murphy V240-50, 65/-; V280, 70/-
Alba, Baird, Bush, Cossor, Decca, Ferguson, Ferranti, HMV, Philips, Vidor, etc. Quote by return. P. & P. 3/6. C.O.D. or C.W.O.
H. A. SPARES, 19 Cromwell Road, Caterham, Surrey. Caterham 5680.

BOOKS & PUBLICATIONS

FIND TV SET TROUBLES in minutes from the great book, "The Principles of TV Receiver Servicing", 10/6 all book houses and radio wholesalers. If not in stock from Secretary I.P.R.E., 20 Fairfield Rd., London N8.

FOR SALE

100 BAYS of Brand New adjustable Steel Shelving, 73in. high by 34in. wide by 12in. deep, stove enamelled dark green. Sent unassembled. Six shelf bay—£3/15/-. Sample delivered free Quantity discounts. N.C. BROWN LTD., Eagle Steelworks, Heywood, Lancs. Tel: 69018.

BARGAIN OFFER!

14in. TELEVISIONS B.B.C. and I.T.A. IN WORKING ORDER
EX-RENTAL
Famous Manufacture

£4.19.6

Carriage extra 15/- C.W.O.
CAPITAL TV
55 HONOR OAK PARK FOREST HILL, S.E.23.

TELEVET TYPE 877, extremely versatile instrument, excellent condition. WHH, Box 32.

METAL RECTIFIERS

RECTIFIERS—CONTACT COOLED
14RA1282 (FC101) type 250 v., 250 mA, 13/6; 14RA1283 (FC31) type 250 v. 300 mA, 17/6; 350 mA, 19/6.

RECTIFIERS—FIN TYPES
Equivs. for RM4 250 v., 250 mA, 13/6; RM5 250 v., 300 mA, 17/6; 14A989 400 mA, 18/6; 14A86 16/6; 14A97 19/-; 14A100 22/6; 14A125 19/6; LW7 17/6.

MULTIMETERS FROM **54/-**

CABY M1, 13 ranges, £2.14.0; A10, 16 ranges, £4.17.6; B20, 20 ranges, £6.10.0; 200 H, 20,000 ohms per volt, £6.19.6.
Stamped envelope for full details and bargain offers.
Under £1 P. & P. 6d., over £1 Post Free. C.O.D. 2/6.

DURHAM SUPPLIES

175 Durham Road, Bradford 8, Yorkshire.

FOR SALE *(continued)*

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.
Callers only.

ARTHUR SLARK
43-45 Thicketford Road, Tonge Moor, Bolton
Phone: 26684

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

WANTED

WANTED: NEW VALVES and Transistors, any quantity. S. N. WILLETS, 43 Spon Lane, West Bromwich, Staffs. Tel: WES 2392.

A PROMPT CASH OFFER for your surplus brand new Valves and Transistors.—R.H.S., Beverley House, Mannville Terrace, Bradford 7.

WANTED—New Valves and Transistors, any quantity.—Phone: Cherrywood 3955, D. & B. Television, 131 & 131a Kingston Road, South Wimbledon, S.W.19.

NEW VALVES WANTED — EY51, ECL80, PCC84, PCF80, PCL93, PL81, PCL82, PY81, R19, U801, 30P4, etc. Best cash prices by return. DURHAM SUPPLIES, 175 Durham Road, Bradford 8, Yorks.

HIRE/BUY SERVICE DATA for Spencer West series 19 T.V.—Box No. 31.

SERVICE SHEETS

WHY TOLERATE DELAY when we can supply your Radio or T.V. Service Sheet by return of post at 4/- each, plus postage. List 1/-. Also Manuals for sale and hire. List 1/-. S.A.E. with inquiries, please. Mail orders only to S.P. DISTRIBUTORS, 44 Old Bond Street, London, W.1.

GENUINE SERVICE SHEETS. Radio/TV for Sale/Hire. S.A.E. please to: REDWATT TUBE DISTRIBUTORS, 41 Denmark Street, Wakefield, Yorks.

SERVICE SHEETS

For all makes of Radio and Television—1930-1962. Prices from 1/-.
Free fault-finding guide with all Service Sheets. Please send S.A.E. with enquiries.
Catalogue of 6000 models. 1/6.

Special offer of 125 Radio/TV Sheet covering 370 popular models, 20/-.

HAMILTON RADIO
Western Road, St. Leonards, Sussex

SERVICE SHEETS
(continued)

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

SERVICE SHEETS; also Current and Obsolete Valves for sale. JOHN GILBERT RADIO, 20 Extension, Shepherd's Bush Market, London W12. (Phone: SHE 3052).

If TV is your LIVING OR PLEASURE you cannot afford to be without

ESSENTIAL SERVICING DATA
TV 10/6 RADIO 13/6

Major items of hundreds of sets listed also

TELEVISION SERVICING HANDBOOK 30/-

Learn to clear TV faults quickly and SAVE POUNDS
Fault Charts pin-point trouble spots
— Don't delay, order today —
Return of post from
GORDON J. KING
KINGSFORD, SOUTH FURZEHAM RD. BRIXHAM, Devon.

SERVICE SHEETS, Radio and TV 4/- each. List 1/-. All orders despatched on day received. Also manuals for sale and hire. List 1/-. S.A.E. please. SULTAN RADIO, Pantiles Chambers, Tunbridge Wells, Kent.

SERVICE SHEETS. Television 4/3; Radio 2/9. DARWINS, 19 George St., St Helens, Lancs.

SERVICE SHEETS, Radio, TV, 5,000 models. List 1/-. SAE enquiries.—TELRAY, 11 Maudland Bk., Preston.

SITUATIONS VACANT

UNITED KINGDOM ATOMIC ENERGY AUTHORITY ATOMIC ENERGY ESTABLISHMENT, WINFRITH

ELECTRONIC/INSTRUMENT MECHANICS

A.E.E. Winfrith require experienced men with knowledge of electronic equipment and/or industrial instrumentation for fault diagnosis, repair and calibration of a wide range of instruments used in nuclear reactors and association experiments.

Men with Services, Industrial or Commercial background of radar, radio, Television, industrial or aircraft instruments are invited to write for further information. Training in Specialised Techniques is provided for successful applicants having suitable background.

Married men living beyond daily travelling distance may be eligible for housing and this will be determined at time of interview A lodging allowance is payable whilst waiting for housing. Working conditions are good and include sick pay and pension schemes.

An application form may be obtained by sending a post card quoting your name, address and the reference EL/INST/SK to the

THE LABOUR DEPARTMENT,
A.E.E., WINFRITH, Nr. Dorchester, Dorset.

EDUCATIONAL

"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 Reading.

THE INCORPORATED Practitioners in Radio and Electronics (I.P.R.E.) Ltd. Membership Conditions booklet 1/-. Sample copy of I.P.R.E. official journal 2/- post free. Secretary, 20 Fairfield Road, London N8.

ELECTRONICS
Key to YOUR Future?

An exciting career—A new Hobby—Your own spare- or full-time BUSINESS?

New experimental course includes big kits for building test gear and a complete AM/VHF receiver.

FREE
brochure from

RADIOSTRUCTOR
DEPT. E78, READING, BERKS.

RADIO CONTROL HANDBOOK
Completely New and Revised Edition. 300 pages, & Hundreds of Illustrations. by Howard McEntee.
40/-. Postage 1/-.

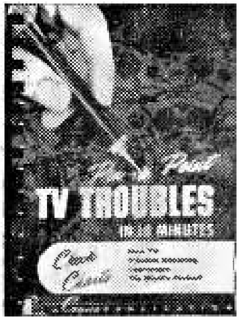
- **THE RADIO AMATEUR'S HANDBOOK 1962 Ed.,** by A.R.R.L., 36/-. Postage 2/6.
- **ELEMENTS OF ELECTRONIC CIRCUITS,** J. M. Peters. 21/-. Postage 1/-.
- **A BEGINNER'S GUIDE TO TELEVISION,** by F. J. Camm., 7/6. Postage 6d.
- **HINTS & KINKS FOR T.V., RADIO, & AUDIO,** by Martin Clifford, 18/6 Postage 1/-
- **AN ELECTRONIC ORGAN FOR THE HOME CONSTRUCTOR,** by A. Douglas. 15/-. Postage 1/-.
- **THE MICROPHONE GUIDE,** by J. Borwick, 7/6. Postage 6d.
- **TRANSISTOR AUDIO AMPLIFIER MANUAL,** by C. Sinclair. 6/-. Postage 6d.
- **RADIO VALVE DATA, 7th Ed,** Compiled "WW" 6/-. Postage 10d.
- **COMPLETE CATALOGUE,** 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.

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 340 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. C. 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."

FREE TRIAL OFFER!

Mail coupon now for fast return service! To S M-TECH TECHNICAL BOOKS, Dept. P.9, Gater's Mill, West End, Southampton, Hants.

RUSH TV Troubles for free seven day trial. If not satisfied I may return book and owe nothing. If I keep the book I will send full amount of 33/- including postage within 7 days *OR* two payments of 17/- within 30 days.

SAVE! Send only 31/6 if paying cash with order. (We pay postage.) Same 7-day-money-back guarantee.

Name ____________

Address ____________

____

City ____________ County ____________

VALVES *SAME DAY SERVICE*

NEW! TESTED! GUARANTEED!

SETS 1R5, 1S5, 1T4, 3S4, 3V4, DAF91, DF91, DK91, DL92, DL94 .. Set 4 for 19/6
DAF96, DF96, DK96, DL96 .. .. 4 for 27/6

1A7GT	11/-	6L19	10/-	30F5	7/-	EBF89	8/9	EZ41	7/6	U26	9/3
1D5	8/-	6LD20	8/-	30L15	11/-	EBL21	13/6	EZ80	6/3	U50	6/-
1H5GT	9/-	6P1	10/-	30PL1	10/-	ECC40	15/-	EZ81	6/6	U52	4/6
1N5GT	9/-	6P25	8/6	30P19	14/6	ECC81	5/-	KT33C	7/-	U78	4/6
1R5	6/-	6P28	12/-	35A5	14/-	ECC82	6/3	KT41	11/6	U191	14/6
1S4	8/-	6Q7G	6/-	35L6GT	8/3	ECC83	7/-	KT44	5/9	U281	17/-
1S5	5/3	6Q7GT	8/6	35Z4GT	5/6	ECC84	8/3	KT61	9/6	U291	16/6
1T4	3/6	6SL7GT	5/9	35Z5GT	8/3	ECC85	7/9	KT63	6/6	UABC80	6/6
1U5	5/9	6SN7GT	4/9	50CD6G	27/3	ECF80	7/6	MU14	6/6	UAF42	8/3
3A5	9/-	6U4GT	9/9	50L6GT	8/3	ECF82	8/6	N18	7/-	UB41	8/6
3Q4	7/-	6V6G	4/6	AZ31	9/6	ECH21	13/6	PC95	10/-	UBC41	7/9
3S4	6/-	6V6GT	7/-	B36	8/6	ECH35	6/3	PC97	10/-	UBF80	8/3
3V4	7/-	6X4	4/6	CL33	12/3	ECH42	8/9	PCC84	7/6	UBF89	8/-
5U4G	4/6	6X5GT	4/9	DAC32	9/-	ECH81	7/9	PCC89	9/3	UCC84	13/3
5V4G	8/9	7B6	9/-	DAF91	5/3	ECL80	7/6	PCF80	7/9	UCC85	7/6
5Y3GT	6/-	7B7	7/6	DAF96	7/6	ECL82	9/-	PCF82	8/-	UCF80	14/6
5Z4G	9/-	7C5	7/6	DCC90	9/-	ECL86	15/-	PCF86	14/-	UCH21	13/6
6AL5	3/9	7C6	7/6	DF33	9/-	EF39	4/6	PCL82	9/-	UCH42	8/-
6AM6	3/6	7H7	7/6	DF91	3/6	EF40	12/6	PCL83	11/6	UCH81	8/9
6AQ5	6/-	7S7	9/-	DF96	7/6	EF41	7/9	PCL84	10/-	UCL82	9/9
6AT6	6/9	7Y4	6/-	DH76	4/9	EF42	10/-	PCL85	13/6	UCL83	13/3
6BA6	5/9	10C1	12/-	DH77	6/9	EF80	4/9	PENA4	11/-	UF41	7/-
6BE6	5/9	10P13	14/6	DH81	9/-	EF85	4/9	PEN36C	8/-	UF42	5/6
6BH6	5/9	12AT6	7/-	DK32	11/-	EF86	9/9	PL36	11/6	UF89	7/-
6BJ6	5/9	12AT7	5/-	DK91	6/-	EF89	7/-	PL81	9/6	UL41	8/-
6BR7	12/6	12AU7	6/3	DK92	7/6	EF91	3/6	PL82	7/-	UL84	6/6
6BW6	8/-	12AX7	7/-	DK96	7/6	EF92	3/9	PL83	7/6	UM4	14/-
6CD6G	27/3	12K7GT	4/9	DL33	8/-	EL33	9/6	PL84	8/6	UR1C	8/-
6F1	10/-	12K8GT	9/6	DL35	9/6	EL41	9/6	PX4	10/-	UY21	13/6
6F6G	6/6	12Q7GT	4/9	DL92	6/-	EL42	9/-	PX25	9/-	UY41	6/6
6F13	10/-	12SN7GT	7/6	DL94	7/-	EL84	6/6	PY32	11/6	UY85	6/6
6F14	10/-	12Z3	10/6	DL96	7/6	EM34	7/3	PY80	7/6	VP4B	9/6
6F23	10/-	14S7	19/6	EABC80	5/6	EM80	8/-	PY81	7/-	VP41	5/-
6K7G	1/11	20F2	17/-	EAF42	8/6	EM81	8/-	PY82	6/6	VP1321	16/6
6K7GT	5/-	20L1	17/-	EB91	3/9	EM84	9/6	PY83	7/9	W76	4/9
6K8G	5/-	25A6G	8/-	EBC33	5/-	EY51	7/6	T41	9/6	W77	3/9
6K8GT	9/-	25L6GT	7/9	EBC41	8/-	EY86	7/9	U22	7/3	X81M	9/-
6L13	10/-	25Z4G	8/6	EBF80	8/-	EZ40	6/9	U25	12/-	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.

TUBES

All types

12"-17" ONLY 30/-

WHY PAY MORE?

These tubes are ex rental stocks, each one fully tested before despatch. Guaranteed to give excellent results, and complete satisfaction, or money refunded. Please state type required, or Model No. of set, and name of nearest railway station.

Carr. up to 17in. 10/-

SEND NOW WHILE STOCKS LAST TO

REGENT SUPPLIES Dept. P.T.
124, Athelstan Rd., Southampton

T.V. SPARES

SEND NOW FOR OUR

1962

CATALOGUE

SEND 1/- IN STAMPS TO

ALPHA RADIO SUPPLY CO. LTD.
103 LEEDS TERRACE, WINTOUN ST.
LEEDS, 7 TEL. 25187

NYLON · P.T.F.E.

ROD, BAR, SHEET, TUBE, STRIP, WIRE

No Quantity too small
List on application

ALUMINIUM, LIGHT ALLOYS, BRASS, COPPER, BRONZE

H. ROLLET & CO., LTD.

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

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

Branches at Liverpool, Manchester, Birmingham, Leeds.

TRANSISTOR POCKET RADIOS

ONLY 32/6
No more to pay

BULK PURCHASE ENABLES US TO MAKE THIS FANTASTIC OFFER—AND WITH MONEY BACK GUARANTEE! (Even if set built) The "SAN REMO" .. so tuned that it brings the voices of **star entertainers and vocalists** dramatically to life—in your home, office, etc. . . . Only 4¾ x 2¾ x 1¼in. fits easily into your pocket. **Works for months off 8d. battery.** Should last a lifetime. Anyone can assemble it in an hour or two with our easy plan. Complete set of parts including miniature speaker, carrying case—everything only 32/6 plus 2/6 P. & P. C.O.D. 2/6 extra. (Parts can be bought separately.)
Order now ! Limited offer only. Demonstrations daily

CONCORD ELECTRONICS (Dept. B13/4)
210 CHURCH ROAD : HOVE : SUSSEX

C.R.T. BOOSTER TRANSFORMERS for cathode ray tubes having heater cathode short circuit, and for C.R. tubes with failing emission. Full instructions supplied.

Type A optional 25% and 50% boost. 2v. or 4v. or 6.3v. or 10.8v. or 13.3v. Mains input. PRICE 12/6.

TRIMMERS. Ceramic. 30, 50, 70 pF, **9d.**; 100 pF, 150 pF, **1/3**; 250 pF, **1/6**; 500 pF, 750 pF, **1/9.**
RESISTORS. Preferred values. 10 ohms to 10 meg., ¼ w., **4d.**; ½ w., **4d.**; 1 w., **6d.**; 1½ w., **8d.**; 2 w., **1/-.**
HIGH STABILITY. ½ w., 1%, **2/-.** Preferred values. 10 Ω to 10 meg. Ditto, 5%, 100 Ω to 5 meg. Ω, **9d.**

5 watt	**WIRE-WOUND RESISTORS** 25 ohms—10,000 ohms	**1/3**
10 watt		**1/6**
15 watt		**2/-**
12.5K to 50K 10 w.		**3/-**

AMERICAN "BRAND FIVE" PLASTIC RECORDING TAPE

			Spare Plastic Reels
Double Play	7in. reel, 2,400ft	**60/-**	
	5in. reel, 1,200ft	**37/6**	
Long Play	7in. reel, 1,800ft	**35/-**	
	5¾in. reel, 1,200ft	**23/6**	3 in. **1/6**
	5in reel, 900ft	**18/6**	4 in. **2/-**
			5 in. **2/-**
Standard	7in. reel, 1,200ft	**25/-**	5¾ in. **2/-**
	5in. reel, 600ft	**16/-**	7 in. **2/6**

"Instant" Bulk Tape Eraser and Head Defluxer, 200/250 v. A.C., **27/6.** Leaflet, S.A.E.

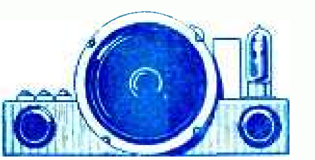
O.P. TRANSFORMERS. Heavy Duty 50 mA, **4/6.** Multiratio, push-pull, **7/6.** Ditto, 10w, **15/6.** Miniature, 3S4, etc., **4/6. L.F. CHOKES** 15 10 H, 60/65 mA, **5/-**; 10 H, 85 mA, **10/6**; 10 H, 150 mA, **14/-.**

MAINS TRANSFORMERS 200/250 v. A.C.
Postage 2/- each transformer.

STANDARD, 250-0-250, 80 mA, 6.3 v. 3.5 a. tapped 4 v. 4 a. Rectifier 6.3 v. 1 a. 5 v. 2 a. or 4 v. 2 a. **22/6** ditto, 350-0-350 ..	**29/6**
MINIATURE 200 v. 20 mA, 6.3 v. 1 a.	**10/6**
MIDGET. 220 v. 45 mA, 6.3 v. 2 a. ..	**15/6**
SMALL, 220-0-220, 50 mA, 6.3 v. 2a. ..	**17/6**
STD., 250-0-250, 65 mA, 6.3 v. 3.5 a. ..	**17/6**
HEATER TRANS. 6.3 v. 1½ amp. ..	**7/6**
Ditto, tapped sec. 2, 4, 6.3 v., 1½ amp. ..	**8/6**
Ditto, sec. 6.3 v. 3 amp. ..	**10/6**
GENERAL PURPOSE LOW VOLTAGE. 2a, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24, 30 v...	**22/6**
AUTO TRANSFORMERS. 150 w. ..	**22/6**
0, 120, 200, 230, 250 v., 500 w. ..	**82/6**

ALADDIN FORMERS and core, ¼in., **8d.**; ⅜in., **10d.** 0.3in. **FORMERS 5937/8** and Cans **TV1/2.** ⅜in. sq. x 2⅛in. and ⅜in. sq. x 1¾in., **2/-** ea., with cores.
SOLON Soldering Iron, 200 or 240 v. 25 w. **24/-.**
MAINS DROPPERS. 3in. x 1½in. Adj. Sliders, 0.3 amp., 1,000 ohms, **4/3.** 0.2 amp., 1,000 ohms, **4/3.**
LINE CORD. 0.3 amp., 60 ohms per ft., 0.2 amp., 100 ohms per ft., 2-way. **1/-** per ft., 3-way, **1/-** per ft.
LOUDSPEAKER P.M. 3 OHM. 2½in., 3in., 4in., **19/6.** 5in. **17/6.** 8in. Plessey, **19/6.** 7in. x 4in. Rola, **18/6.** 6½in. Rola, **18/6.** 10 x 6in., **27/6.** 10in. **30/-.** 4in. Hi-Fi Tweeter, **25/-.** 12 in. R.A., **30/-.**
STENTORIAN HF1012, 10in. 3 to 15 ohms, 10w., **95/-** 12in. Baker 15 watt 3 ohms, or 15 ohms, **90/-.**
CRYSTAL DIODE G.E.C., **2/-. GEX34, 4/-.** OA81, **3/-.**
HIGH RESISTANCE PHONES. 4,000 ohms, **15/-** pr.
MIKE TRANSF. 50 : 1, **3/9** ea.; 100 : 1, Potted, **10/6.**
SWITCH CLEANER. Fluid squirt spout, **4/3** tin.
TWIN GANG TUNING CONDENSERS. 365 pF miniature 1in. x 1½in. x 1¾in., **10/-.** 500pF Standard with trimmers, **9/-**; midget, **7/6** with trimmers, **9/-.**
SINGLE, 50 pF, 75 pF, 100 pF, 160 pF, **5/6.** Solid dielectric 100, 300, 500 pF. **3/6.**

COMPLETE RADIO
£4.19.6 post free



4 Mullard valves, 5in. speaker, frame aerial. 4 pre-set stations. 1 long, 3 med. wave. Superhet Circuit. Size 9 x 6 x 5½in. high. Tested ready for use. 200/250 v. A.C.—D.C. Mains.
DE-LUXE MODEL. With illuminated dial and slow-motion tuning drive. Medium and long-wave, brand new, tested. **£5.19.6.**

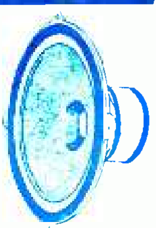
TV REPLACEMENT LINE OUTPUT TRANSFORMERS

FROM **45/-** ea. Most makes available. S.A.E. with all enquiries.

LINE BLOCKING TRANSFORMERS, from 10/-.
FRAME BLOCKING TRANSFORMERS, from 13/6.
FRAME OUTPUT TRANSFORMERS, from 27/6

HIGH GAIN TV PRE-AMP KITS
BAND I BBC
Tunable channels 1 to 5. Gain 18dB. ECC84 valve. Kit price **29/6** or **49/6** with power pack. Details **6d.** (PCC84 valves if preferred.)
BAND III ITA—Same prices.
Tunable channels 8 to 13. Gain 17dB. ECC84 valve. (PCC84 valves if preferred.)

BAKER SELHURST LOUDSPEAKERS



12in. Baker 15w. Stalwart 3 or 15 ohms, 45–13,000 c.p.s. .. **90/-**
12in. Baker Stalwart foam suspension, 15 ohms, 40–13,500 c.p.s. .. **£6**
12in. Stereo, 12 w., 35–16,000 c.p.s. .. **£6.17.6**
12in. Baker Ultra Twelve, 20 c.p.s. to 25 kc/s. **£17.10**
15in. Bass Auditorium Mk.II, 35 w. .. **£18**

NEW MULLARD TRANSISTORS
Audio OC71 .. **6/-** RF OC44 .. **10/6**
OC72 .. **7/6** OC45 .. **9/6**
Sub Miniature Condensers. 0.1mF 1, 30v. **1/3.** 1, 2, 4, 5, 8, 25, 50, 100 mfd. 15 volt, **2/6** each. **Weyrad** Printed Circuit Components in Stock. Book **2/-.** 7 x 4in. Speaker 35 Ω **25/-.**

CRYSTAL MIKE INSERT by Acos precision engineered. Size only 1½in. by ½in., **8/6.**

ALUMINIUM CHASSIS. 18 s.w.g. undrilled. With 4 sides, riveted corners and lattice fixing holes, 2½in. sides, 7 x 4in., **4/6**; 9 x 7in., **5/9**; 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 F.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 6AM. 6. **2/6**
COMPLETE JASON F.M. KIT, FMTI, with set of 4 valves, etc., **£6.5.0.**

BBC TRANSISTOR RADIO. Med. and Long Wave. Two transistors and diode. Complete kit. **22/6,** phones **7/6 extra** or Deaf Aid Earpiece **7/6.** Details 6d.

465 Kc/s. SIGNAL GENERATOR. Total cost **15/-.** Uses B.F.O. Unit ZA 30038 ready made, with valve. **POCKET SIZE** 2½ x 4½ x 1in. Slight modifications required, full instructions supplied. Battery 7/6 extra. 69 v. + 1½ v.

I.F. TRANSFORMERS 7/6 pair
465 Kc/s Slug Tuning Miniature Can. 1¾ x ⅞ x ⅞in. High Q and good bandwidth. Data sheet supplied.

New and Boxed. VALVES 90-day Guarantee.

1R5	7/6	6K8G	7/6	EABC80	8/6	HABC80	12/6
1S5	7/6	6L6G	10/6	EB91	6/-		
1T4	6/-	6N7M	6/6	EBC33	8/6	HVR2A	6/6
2X2	3/6	6Q7G	8/6	EBC41	8/6	MU14	9/-
3S4	7/6	6SA7	6/-	EBF80	10/-	P61	3/6
3V4	7/6	6SJ7M	6/-	ECC84	9/6	PCC84	9/6
5U4	7/6	6SN7	6/6	ECF80	9/6	PCF80	9/6
5Y3	7/6	6V6G	6/6	ECH42	10/6	PCL82	11/6
5Z4	9/6	6X4	7/6	ECL82	10/6	PEN25	6/6
6AM6	5/-	6X5	6/6	EF39	5/6	PL82	10/6
6B8	5/-	12AT7	8/-	EF41	9/6	PY80	7/6
6BE6	7/6	12AU7	8/-	EF50	5/6	PY81	9/6
6BH6	9/6	12AX7	8/-	EF80	8/-	PY82	7/6
6BW6	9/6	12BE6	8/6	EF86	12/6	SP61	3/6
6D6	6/-	12K7	6/6	EF91	5/-	UBC41	9/6
6F6G	7/6	12Q7	6/6	EF92	5/6	UCH42	9/6
6H6	3/6	35L6	9/6	EL32	5/6	UF41	9/6
6J5	5/6	35Z4	7/6	EL84	8/6	UL41	9/6
6J6	5/6	80	9/6	EM81	9/6	UY41	8/6
6J7G	6/6	807	5/6	EZ40	7/6	U22	8/6
6K6GT	6/6	954	1/6	EZ80	9/6	VR105	9/6
6K7G	5/6	EA50	1/6	E1148	1/6	VR150	9/6

RECORD PLAYER BARGAINS

Postage 2/- each.

4 Speed Autochangers, B.S.R., U.A.14	£7.10.0
B.S.R., U.A.12 Stereo/Mono ..	£8.5.0
Garrard Model Autoslim	£8.17.6
4 Speed Single Players, EMI ..	£6.5.0
Garrard TA Mk.II, GC8 Head ..	£8.0.0
Garrard Model 4SP GC8 ..	£6.17.6
Garrard Stereo Heads, £2 extra.	
Amplifier player cabinets (except 4 H.F.)	63/-
2-valve amplifier and 6½in. speaker ..	90/-
3-valve amplifier and 6½in. speaker ..	105/-

Wired and tested ready for use with above.

All sapphire styli available from **6/-.**

Volume Controls. Long spindles. Guaranteed 1 year. Midget 5K ohms to 2 Meg. No. Sw. **3/-**, D.P.Sw. **4/6**. Linear or Log Tracks.

80 ohm CABLE COAX Semi-air spaced, ¼in. Losses cut 50%. 40 yds. **17/6**, 60 yds. **25/-**. **6d.** yd. Fringe Quality Air Spaced **1/-** yd.

TRIPLEXERS Bands I, II, III	**12/6**
COAX PLUGS .. 1/-	**LEAD SOCKETS .. 2/-**
PANEL SOCKETS 1/-	**OUTLET BOXES .. 4/6**

BALANCED TWIN FEEDER yd. 6d. 80 or 300 ohms.
DITTO SCREENED per yd. 1/6. 80 ohms only.
WIRE-WOUND POTS, 3 WATT. Pre-set Min TV Type. All value 25 ohms to 25 K., **3/-** ea. 30 K., 50 K., **4/-.** (Carbon 30 K., to 2 meg., **3/-**).
WIRE-WOUND 4 WATT. Pots Long Spindle Values, 50 ohms to 50 K., **6/6**; 100 K., **7/6.**
CONDENSERS. New Stock. 0.001 mfd., 7 kV. T.C.C., **5/6**; Ditto, 20 kV., **9/6**; 0.1 mfd., 7 kV., **9/6.** Tubular 500 v. 0.001 to 0.05 mfd., **9d.**, 0.1, **1/-**; 0.25, **1/6**; 0.5/500 v., **1/9**; 0.1/350 v., **9d.**; 0.01/2,000 v. 0.1/1,000 v., **1/9**; 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, **1/6.** Ditto 1% 50 pF to 815 pF, **1/9**; 1,000 pF to 5,000 pF, **2/-.**

New Electrolytics. Famous Makes

TUBULAR		TUBULAR		CAN TYPES	
				16/450v.	3/-
1/350v.	2/-	50/350v.	5/6	32/350v.	4/-
2/450v.	2/3	100/25v.	2/-	100/270v.	5/6
4/450v.	2/3	250/25v.	2/6	2,500/3v.	4/-
8/450v.	2/3	500/12v.	3/-	5,000/6v.	5/-
16/450v.	3/-	8+8/450v.	3/6	32+34/450v.	6/-
32/450v.	4/9	8+16/450v.	3/9	32+32+32/350v	7/-
25/25v.	1/9	16+16/450v.	4/3	50+50/350v.	7/-
50/50v.	2/-	32+32/350v.	4/6	64+120/350v.	11/6
				100+200/275v.	12/6

RECTIFIERS SELENIUM 300 v. 85 mA, **7/6.**
CONTACT COOLED 250 v. 50 mA, **7/-**; 60 mA, **8/6**; 85 mA, **9/6**; 200 mA, **21/-**; 300 mA, **27/6.**
COILS Wearite "P" type, **3/-** each. Osmor Midget "Q" type adj. dust core from **4/-.** All ranges.
TELETRON. L. & Med. T.R.F., with reaction, **3/6.**
FERRITE ROD AERIALS. M.W., 8/9; M. & L. 12/6.
T.R.F. COILS A/HF, **7/-** pair. **H.F. CHOKES, 2/6.**
FERRITE ROD, 8in. x 5/16in. dia., **2/6**
FULL WAVE BRIDGE SELENIUM RECTIFIER: 2, 6 or 12 v. 1½ amp., **8/9**; 2 a., **11/3**; 4 a., **17/6.**
CHARGER TRANSFORMERS. Tapped input 200/250 v. for charging at 2, 6 or 12 v., 1½ amps., **15/6.** 2 amps., **17/6**; 4 amps., **22/6.** Circuit included.
VALVE and TV TUBE equivalent books, **9/6.**
TOGGLE SWITCHES. S.P. **2/-.** D.P. **3/6.** D.P.D.T. **4/-**
WAVECHANGE SWITCHES

8 p. 4-way 2 wafer 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	2/6
3 p. 4-way, or 1 p. 12-way long spindle	2/6

VALVEHOLDERS. Pax Int. Oct., **4d.** EF50, EA50, **6d.** B12A, CRT, **1/3.** Eng. and Amer. 4, 5, 6 and 7 pin, **1/-. MOULDED MAZDA and Int. Oct., 6d.** B7G, B8A, B8G, B9A, **9d.** B7G with can., **1/6.** B9A with can., **1/9. CERAMIC EF50, B7G, B9A.** Int. Oct., **1/-. S/Cans** B7G, B9A, **1/-** ea.
SPEAKER FRET. GOLD CLOTH. 17in., 25in., **5/-.** 25in. x 35in., **10/-.** Tygan 52in. wide, **10/-** ft.; 26in wide, **5/-.** Samples S.A.E.

RADIO COMPONENT SPECIALISTS

OUR ONLY ADDRESS
337 WHITEHORSE RD., WEST CROYDON

Post 1/-, unless otherwise stated. C.O.D. 2/- extra. (Export post Extra.) (Wed. 1 p.m.) THO 1665. Buses 133 or 68.