Practical TELEVISION

JUNE 1962

1'9

SYSTEMS FOR PAY-TELEVISION

Curing Instability

Servicing TV Receivers

Your Problems Solved

★ 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	DF33	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
1H5GT	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	[illegible]/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	[illegible]/-	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	[illegible]/-	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
6AU6	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	618PT	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	/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	[illegible]/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	[illegible]/-	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	**Z66**	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	3/-	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, EMISCOPE, BRIMAR FERRANTI TYPES. PROCESSED IN OUR OWN FACTORY

GUARANTEED	6 Months	12 Months
12in.	£2. 0.0	£3. 5.0
14in.	£2.10.0	£3.15.0
15/17in.	£3. 5.0	£4.10.0
21in.	£3.15.0	£5.15.0

NEW TYPES

MW 31/74 £4-0-0

MW 36/24 £5-0-0

CRM 172 MW 43/64 £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. "Jennen" 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, B7G, 6d. ea., with Screen 8d. ea. B9A, 6d. ea. with Screen 8d. ea.

SPECIAL RM4. Ex-equipment, guaranteed. 7/- 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, £7.10.0.

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. .6.P.P. 4/-.

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

TECHNICAL TRADING CO.

All Mail Order enquiries to: **DEVONIAN COURT, PARK CRESCENT PLACE, BRIGHTON 7, SUSSEX.**

Callers only welcome at: **350-352 FRATTON ROAD, PORTSMOUTH.**

Practical Television

AND TELEVISION TIMES

VOL. 12, No. 141, JUNE, 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

Lines and Definition

MUCH publicity has been given to the subject of future television transmissions in this country and the public is now highly conscious that a new service is inevitable, but all the facts have not been clearly explained. The public is demanding sets that it thinks will be suitable for a new service as well as for the existing one. Manufacturers have had to satisfy this demand and have been producing sets with a control marked "UHF" or "625". However, at the time of writing no one yet knows what form a new system would take. This decision will be taken by the Pilkington Committee and, so far as many new sets are concerned, there is nothing more exciting behind the "magic control" than a partially connected switch wafer.

If new television transmissions are to be provided, then the existing ones must continue for several years at least so that receivers at present in use are not rendered obsolete, and it is this fact that is the main reason behind the need for a new television system. Bands I and III are crowded and any new transmissions must be in the UHF bands.

The necessity of securing greater channel capacity in the UHF regions has revived the old question of line standards and a possible increase in the number of lines of which the picture is composed has been given great prominence. However, it is not generally realised that a simple increase in the number of scanning lines would not necessarily improve the definition of the picture. The overall definition of a television picture is made up of the horizontal and vertical definitions, and a balance must be kept between these two if the picture is to be satisfactory.

In this issue, on page 419, appears an article entitled "Lines in Perspective" in which are set out the author's views on the present lines controversy. The points for and against a change in the lines standard are stated and the considerations involved are explained very clearly.

PRACTICAL WIRELESS BLUEPRINTS

The June issue of *Practical Wireless* was published on May 4th and every copy contained a free double-sided blueprint—the third in the present series. The designs on the blueprint were numbers 3 and 6 in the *Practical Wireless* series of six graded constructional articles. Design No. 3 (The Troubadour) is a seven-transistor pocket portable receiver which has been designed to fit into a readily available plastic cabinet. The diagrams on the blueprint are considerably larger than the actual receiver and simplify the construction of the set.

The Everest Tuner—Design No. 6—is a six-valve unit for reception of the Home, Light and Third (or Network Three) programmes on the BBC's VHF/F.M. service. The use of switch-tuning for the three programmes simplifies the tuning of the receiver.

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

Telenews

Television Receiving Licences

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

Region	*Total*
London	1,977,917
Home Counties	1,668,867
Midland	1,764,985
North Eastern	1,885,339
North Western	1,547,873
South Western	1,015,801
Wales and Border Counties ..	716,545
Total England and Wales	10,577,327
Scotland	1,078,247
Northern Ireland	178,133
Grand Total	11,333,712

Television Starts in Northern Nigeria

NORTHERN NIGERIAN television and sound broadcasting began on March 15 this year.

Initial broadcasting is coming from Kaduna, which forms the first of several stages of a scheme to provide sound broadcasting in the whole of Northern Nigeria and television in the main areas.

EMI Ltd., together with Granada and the Northern Nigeria Radio Corporation—a Government body—have formed a company to provide equipment, programme material and finance for the new service.

The initial installation includes an educational television system, a low-power transmitter to provide a public service and a medium-power short-wave sound broadcasting system.

Later stages will include a high-power television station at Jaji and a microwave link system linking Kaduna with Kanu.

New Zealand TV Equipment

NEW ZEALAND Broadcasting Service—the television corporation of New Zealand—have, at the moment, four television stations in operation throughout the country. They are sited at Auckland, Wellington, Christchurch and Dunedin. All the transmitters and studio camera equipment for these four stations was supplied by Marconi's Wireless Telegraph Co. Ltd. as well as a television outside broadcast vehicle.

The equipment was supplied through Marconi's New Zealand associates, Amalgamated Wireless (Australasia) N.Z. Ltd.

Television Link for Jersey

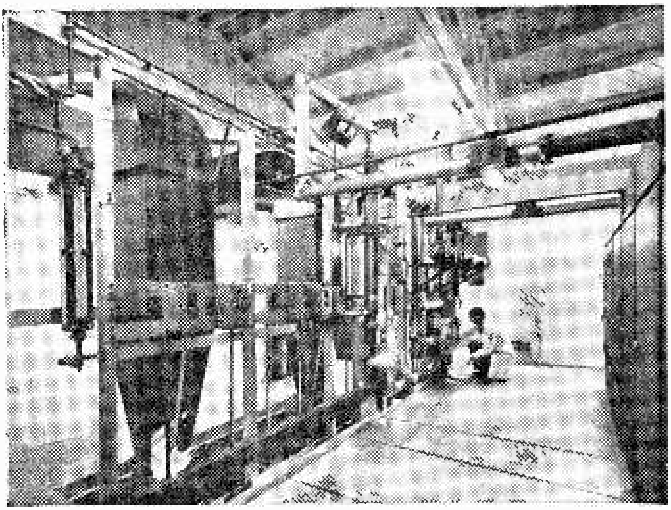
A POST OFFICE contract for microwave link equipment to be used temporarily in the Channel Islands has been awarded to Pye Telecommunications Ltd., of Cambridge.

ITV television transmissions from Cornwall will be received on the Island of Alderney and relayed over the 6,000Mc/s microwave link to Jersey. Complete stand-by equipment will also be provided.

The 6,000Mc/s microwave equipment will be suitable for 405- or 625-line television transmissions and will be installed by Pye engineers as part of the contract.

International Television Conference

MAY 31st, 1962, will see the opening in London of the International Television Conference organised by the Electronics and Communications section of the Institution of Electrical Engineers in association with the Institute of Radio Engineers (N.Y.), the Television Society and the British Kinematograph Society. The



The combining unit and vestigial sideband filter assembly in the transmitter hall of the New Zealand Broadcasting Service's Channel 3 station at Christchurch which has been equipped by Marconi's Wireless Telegraph Co. Ltd.

association of the Institution with the Institute of Radio Engineers in the conference will provide an important example of Anglo-American co-operation in the professional electronic field which, it is hoped, will set a pattern for the future.

Lord Brabazon of Tara, president of the Radio Industry Council, will open the conference, which has already received wide support. It is estimated that at least 1,500 delegates will attend, representing some 23 different countries.

Arrangements are being made for delegates to visit industrial organisations during the conference.

British TV Equipment for Australia

TWO vidicon cameras, manufactured by EMI Electronics Ltd., will soon allow Richmond Tweed TV Ltd's new television studio centre at Goonellabah, New South Wales, Australia, to telecast a variety of live programmes.

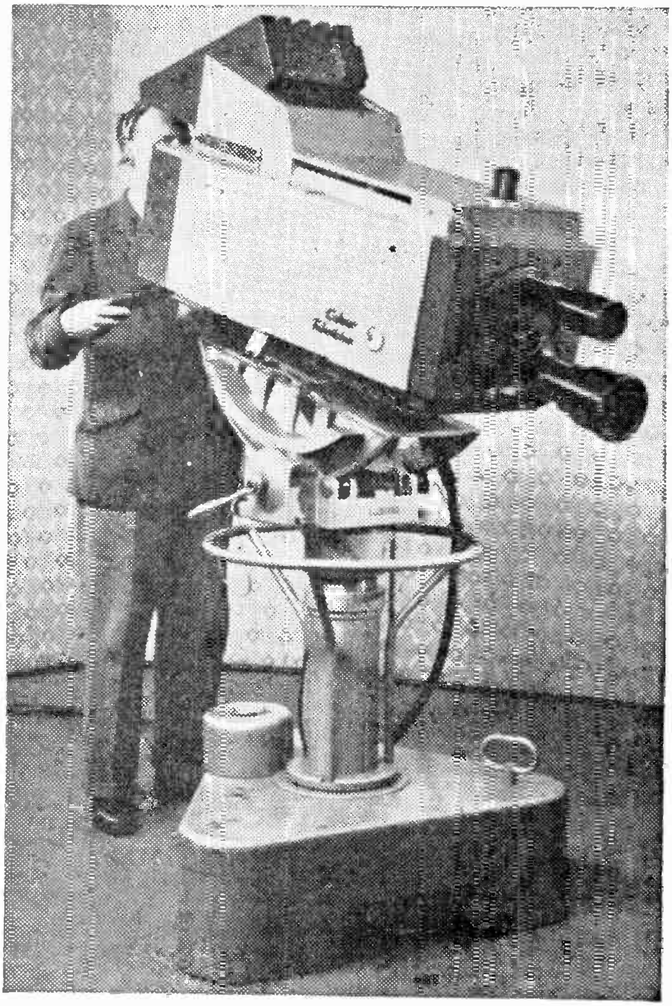
In this television station, which will be one of the most modern of its kind in the world, filmed shows will be handled by two EMI vidicon telecine machines. These are being provided to give continuity of programme and the cameras are interchangeable with those in the studio.

The telecine machines and associated cine and slide projectors will be accommodated in the main operational room. The area is to include a main control console, all camera control units, equipment racks and microwave links. The microwave links to carry the programme picture and sound from Goonellabah to the transmitter at Mount Mathieson are high-powered links developed by EMI. This studio installation will be closely followed by a similar one at Toowoomba, Queensland.

BBC Orders More Camera Channels

THE British Broadcasting Corporation has ordered six more Marconi Mark IV 4½in. image orthicon television camera channels to add to those already in use at the BBC Television Centre and at Belfast.

A feature of particular technical interest is that all these camera channels can be simultaneously switched from 405 lines to 525 or 625 by the operation of a single control. The BBC will be the first to have this facility in Britain, although in Washington, USA, Marconi's have supplied the United States Government Information Agency with four cameras having such a capability. The Washington studio uses simultaneous switching to make 525-line and non-synchronous 405- and 625-line Videotape recordings.



The new Marconi 3 in. image Orthicon colour television camera channel Type BD 848 which recently made its first appearance in public at the National Association of Broadcasters' Convention in Chicago.

Image Orthicon Colour TV Camera

A NEW television camera, the Type BD848, has been introduced by Marconi's Wireless Telegraph Co. Ltd. It employs three 3in. English Electric Valve Co. image orthicons, provides good colour pictures and is suitable for studio or outside broadcasts. In this camera the design philosophy has been to make it so stable that the cameraman has no more controls to operate than on a black-and-white image orthicon equipment.

This camera recently made its first public appearance at the National Association of Broadcasters' Convention in Chicago, where it attracted considerable attention.

TV SOUND for your radio

A SIMPLE CONVERTER UNIT

By A. Sydenham

(Continued from page 386 of the May issue)

THE chassis layout and drilling details were depicted in Figs. 2 and 3 last month and, as mentioned in last month's article, the power supply components occupy a distinct position so that anyone who does not want to include the section may quite easily omit it and use a chassis suitably smaller in size without in any way affecting the rest of the arrangement.

As may be seen from Fig. 6, nearly all the wiring has been kept below chassis and is so compact that no signal-carrying lead is longer than 1in.; most are shorter than this, for it must be noted that in Fig 6 the chassis front and rear flanges are shown pressed out flat in the interests of clarity. Note that short, direct wiring is essential in apparatus such as this designed for high frequencies.

The coils, which are wound on dust-cored formers of $\frac{3}{8}$in. diameter fitted with push-on tag-rings, are positioned so that they may be removed and replaced easily without upsetting the rest of the wiring, so enabling adjustments to be made at the setting-up stage if found necessary. For details of the coils see Table 1 and Fig. 4. The trimmers are also easily accessible. T2 is retained by a 0B.A. polystyrene locking nut, the externally threaded section of the coil stem being passed first through the coil container lid and then through the chassis so that the container body may eventually be turned upside down over the coil and screwed into the lid to form a rigid screening can.

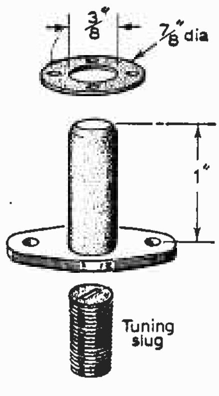


Fig. 4 (right)—The type of coil former used in this unit.

TABLE 1

Coil details: 30s.w.g. enamelled copper wire. (Turns spaced by diameter of wire.)

Channel No.	No. of turns			
	T1		L1	L2
	Sec.	Pri.		
1	6	2¼	5	6
2	5½	2¼	4¾	6
3	5	1½	4½	5½
4	4½	1½	4	5
5	4¼	1½	3¾	5

Four small holes are also needed to carry the leads from the coil spills, the identification of which may be obtained from Fig. 1 (last month). A panel is bolted to the front flange and carries the warning lens, on/off switch and drive mechanism, a frame of $\frac{3}{8}$in. quadrant being glued to the top, bottom and sides and allowed to overlap by $\frac{1}{8}$in. to form a rabbet for the simple cabinet sections, dimensions of which are detailed in Fig. 7. Plywood or hardboard may be used for this, the inside of the panel being lined with metal foil chassis connected.

Reduction Drive

This is very simple and effective. A standard tuning drum of the type used in conjunction with a cord drive is attached to the end of the tuning capacitor spindle via a short length of $\frac{1}{4}$in. rod and a coupler, these two items being necessary because the drum is mounted with its locking bolts close to the panel (see Fig. 5), which makes them inaccessible otherwise. The drum rim, grooved to accept cord, here conveniently works

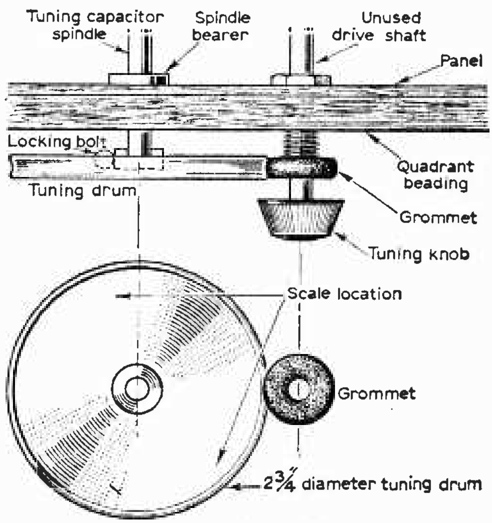


Fig. 5—Details of the tuning mechanism.

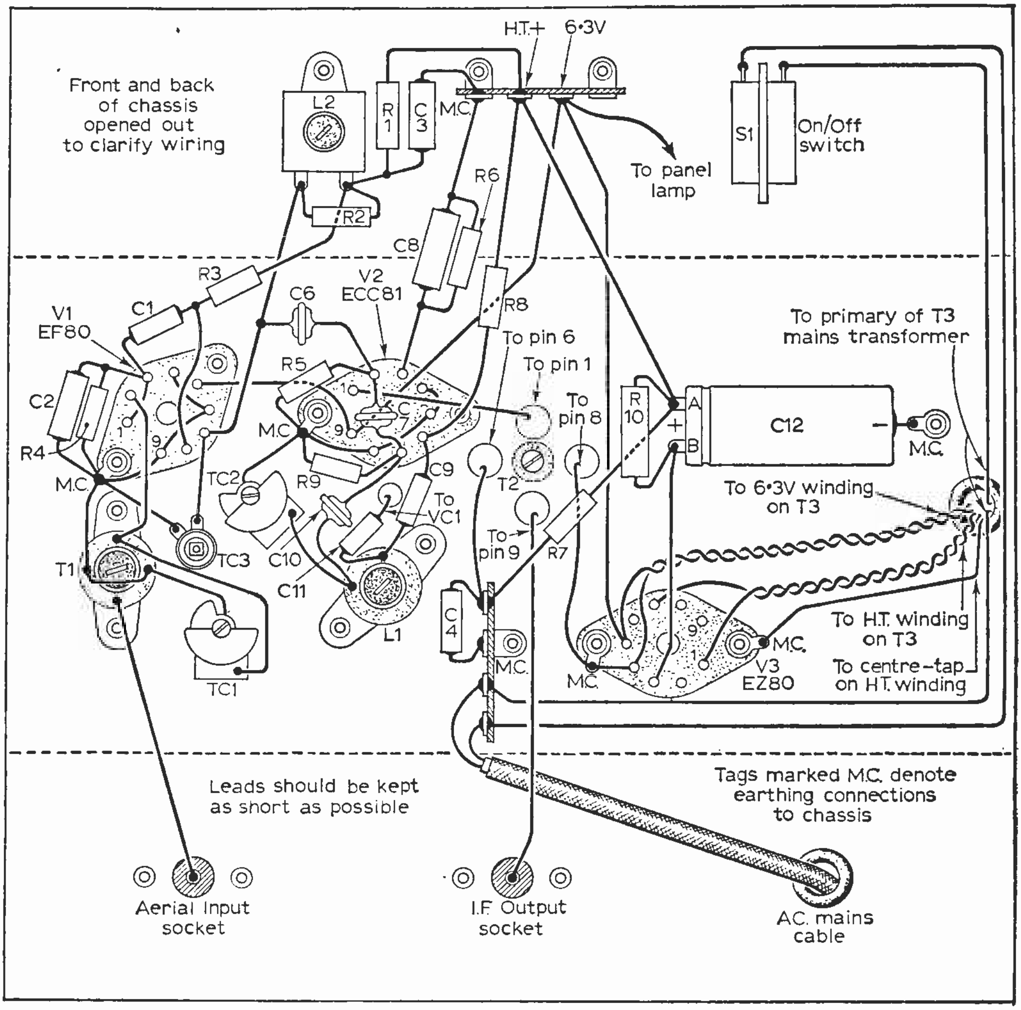


Fig. 6—The underchassis wiring diagram.

in conjunction with a rubber grommet forced over the control spindle of a cord drive shaft which is brought close enough to the drum to cause sufficient friction for it to be rotated. Provided the grommet is of a suitable size, fits tightly and is held securely by the shaft, a non-slip reduction drive of approximately 6:1 is secured, but the use of a ¼in. diameter metal bearer for the tuning capacitor spindle is desirable to prevent it from becoming distorted.

Setting Up

On completion, a length of coaxial cable is fitted with aerial and earth plugs to the inner conductor and the braiding respectively at one end and a standard coaxial plug at the other. The converter and the receiver are then inter-connected and both switched on. The receiver is then adjusted to a quiet point on its dial around 200m and the volume control turned up, when a loud crackle should be heard via the loud-speaker when a penknife blade is scraped across the aerial input socket of the converter.

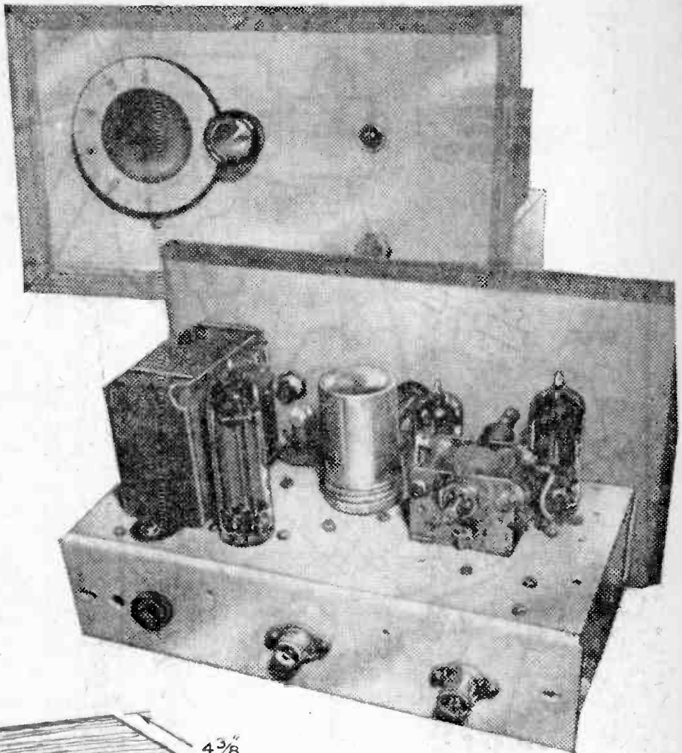
Few constructors are likely to possess a signal generator operative at the frequencies to be received, so trial and error must be adopted. The TV aerial is plugged into the converter and an attempt made to obtain a signal by rotating the tuning capacitor, but, if silence obtains, as is most likely, VC1 should be set to mid-travel and TC2 adjusted very slowly and carefully, when it is possible that a weak signal will be obtained. This should be strengthened either by trimming the core of T2 or by moving the receiver pointer slightly or both. If the signal sounds very distorted it is quite likely to be an F.M. transmission, thus indicating that the converter is tuned to too high a frequency. The core of L1 should then be screwed in a little more and a fresh attempt made.

A certain amount of patience is needed and it will be found a good plan to use TC2 to search for the vision signal (which will be heard as a low-pitched buzz) instead of the sound signal with VC1 set so that its vanes are almost disengaged. If no signal is obtained when TC2 has been fully rotated, T1 and L2 should be adjusted slightly and another attempt made. Once the characteristic sound of the vision signal is heard, VC1 may be rotated slowly to a greater capacity, when the sound signal should be heard, and this may then be peaked up by using TC1, TC3 and the appropriate cores, not forgetting the core of T2.

No Results

If the converter fails to operate in an area where a signal may normally be received, switch off and insert a meter set to read 0—50mA between R8 and the H.T. rail. Switch on and observe the current reading and if this is not excessive, switch the meter to read 0—10mA. Next, short-circuit L1 momentarily with a metal tool and note if the meter reading increases. If it does all is well, but if no change is detected switch off and investigate the oscillator components and circuit as this must be faulty. The fact that the oscillator might perform well at certain settings of TC2 and VC1 and not at others should be remembered when making the above test.

When the oscillator section is functioning correctly the meter may be disconnected and a fresh attempt made at receiving transmissions.



(Above)—Two views of the completed unit.

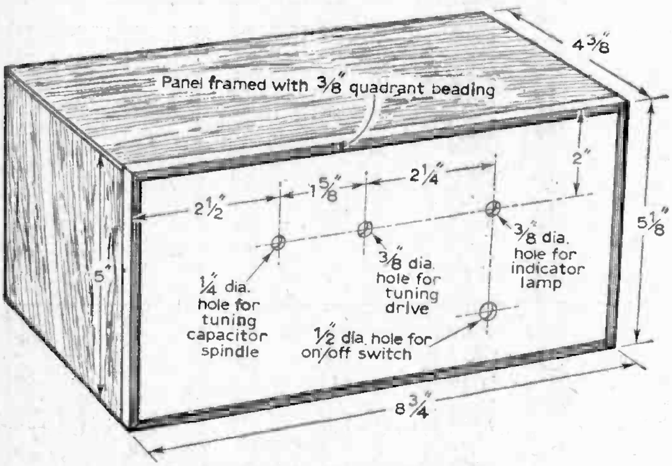


Fig. 7—Cabinet and panel dimensions.

Correct Tuning

Incidentally, the operation of the unit can also be tested by switching the receiver to a quiet section of the long waveband or to around 600kc/s on the medium waveband and, once operation is obtained, little difficulty will be experienced in manipulating the transmission to the 1·5Mc/s region by moving the receiver pointer in step with TC2. On completion a scale should be drawn up on white card and glued to the tuning drum. ■

LINES IN PERSPECTIVE

WOULD A CHANGE TO 625-LINE TV IN THIS COUNTRY REALLY BE A CHANGE FOR THE BETTER?

By S. E. Chambers

WOULD there really be any great improvement by a change from 405 lines to 625 lines (or any greater number of lines)? Would the expense of establishing an entirely new television transmission system be justified? Why are certain groups enthusiastically in favour of increasing the number of lines? What is the reason behind the line controversy? This article sets out to answer these and other questions that are now utmost in the minds of all who are interested in television.

Parallel Transmission

The Government has given its word that, even in the event of a new system being established, the existing 405-line system will operate alongside the new system for years to come. It has been said that the old system would have to operate for ten years, at least, before it could possibly be abandoned. That is, ten years from the start of a new system, and it would take a year or so, at least, to start a new system. And it would be years after that before the country could be covered by the new system as it is covered today by the existing system.

Usable 10 Years from Now

An ordinary 405-line set purchased today would still be usable in ten years' time; about that there is no doubt. It will be recalled that a similar panic cropped up in 1955 when Band III went on the air. But even today—six years later—vintage Band I-only sets are still giving good service, whether or not they have Band III converters or tuners fitted.

The prime reason behind the new system is to seek space for additional television transmissions. Bands I and III are now crowded, and several stations in different parts of the country share the limited number of channels available. This must now cease, for further channel sharing would worsen the already serious problem of co-channel interference. That is, interference from distant stations using the same channel, which is particularly bad in fringe areas during some weather conditions, as many viewers well know.

Other bands available for television are in the ultra-high-frequency region, divided into what are known as Bands IV and V. In these bands there is room for nearly a hundred new channels. These bands are not totally clear, however, as certain parts of them are used for Government and commercial activities. Moreover, the service area of UHF stations is considerably less than that of VHF stations so, in spite of the potentially large channel capacity, there will still need to be a certain amount of channel sharing to provide country-wide coverage.

Range

This means, in effect, that each largish town will require its own UHF station, and one can well realise from that that it is going to be quite a long time before all the country could be embraced by the new service.

So far, the number of lines does not enter into the matter. Indeed, it need not. An extension of television could well happen in the UHF bands on 405 lines. This would then be the same as the 1955 extension of television by the use of Band III. Existing sets would require only UHF converters, while new sets could either have simple provision for the inclusion of a UHF tuner, or such a tuner could be included. The latter idea is rather pointless, of course, since a large number of sets would be almost worn out before use could be made of the UHF facility. This is the converse of the thoughts of some viewers, and it is up to those more conversant with television to explain the situation as clearly as possible.

Would More Lines Help To-day ?

It was in the early part of 1937 that the present television standards were adopted, and since then the 405-line system has been in daily operation, interrupted only by the war. After the six-year break, many were of the opinion that the time was ideal for a change of line standards, and there were strong recommendations that the service be resumed on a greater number of lines. A controversy similar to that which exists today was then also in evidence. The lay Press was badly informed, and rumours implying that the 405-line system was only an interim measure and that drastic changes were likely detracted from the smooth launching of the post-war television service.

Committee

To clear the air and remove all uncertainty, the Postmaster-General, on the advice of the Television Advisory Committee, and with the full support of the industry issued an unequivocal statement in the middle of 1948 that the BBC standards would remain unchanged indefinitely and certainly for a number of years. That promise has been kept. But the situation today is different from what it was thirteen years ago. Improved valves of the frame grid variety provide greater gain-to-bandwidth figures for receivers, and transmission system and cameras have undergone considerable development and the progressive increase in receiver EHT and tube improvements have resulted in a much smaller scanning spot than was possible directly after the war. These things coupled with UHF are strongly in favour of a greater number of lines.

Would More Lines Improve Picture Definition?

A simple increase in number of scanning lines would *not* improve the picture definition. Indeed, the opposite may occur and the effective definition may be impaired. The overall definition of a television image is made up of the "vertical definition" and the "horizontal definition", and any substantial unbalance between these two definitions can result in a most disturbing picture.

The scanning lines are traced on the screen by the scanning spot produced by the tube, and the lines effectively slice the picture into horizontal strips. The number of scanning lines used, therefore, essentially determines the picture definition only in the direction which is almost at right-angles to the scanning lines; that is, the vertical definition.

Limits

As the number of strips traced by the scanning spot is increased the better will become the vertical definition up to the point where the size of the scanning spot is insufficiently small to trace individual lines. The lines then overlap and no further improvement is obtained.

Modern tubes and modern circuit techniques easily enable 625 lines to be traced without overlap. Just after the war this was barely possible as the spot size was too large. The horizontal definition, on the other hand, has nothing at all to do with the number of lines. This is governed essentially by the overall bandwidth of the transmitting and receiving system and, in the same way as the vertical definition, by the size of the scanning spot.

Equal Resolutions

Now, perfect balance between the two definitions and thus optimum definition of the overall picture can only be secured by a system that is capable of resolving vertical lines equally as narrow as the horizontal scanning lines. The vertical lines or "elements" of an image are produced by the changing brightness of the scanning spot as it traces out each line. The bandwidth of the system as a whole sets a limit to the maximum rate at which the brightness of the spot can change, and it is thus the bandwidth which governs the horizontal definition.

For example, perfect horizontal definition would require the brightness of the scanning spot to change instantaneously from, say, peak white to black (spot cut-off) when the equivalent spot in the camera tube passes across a white-to-black edge in the scene being televised. It is, therefore, impossible to secure perfect horizontal definition since this would require infinite bandwidth, and a definite period of time is required to accomplish a change in spot brightness. This means that a sharp shade transition as in Fig. 1(a) would be reproduced on a practical system as at (b).

Ocular Effects

The greater the bandwidth, the greater the rate at which the spot brightness can change. Owing to certain shortcomings in the resolving power of our eyes, the magnified white-to-black transition in Fig. 1(b), although, in effect, a progressive shading from white to black, is seen on the screen by our eyes as a definite vertical line.

This is not to say that an improvement in overall system bandwidth would not give even better horizontal definition. Indeed, it would. This shows up more when there are a series of shade transitions close together, such as the vertical lines in the 3·5Mc/s frequency gratings of Test Card C. At these frequencies the contrast of the bars is relatively poor, and it would not be improved in the slightest by a simple increase in number of lines, but would be improved by improving the overall bandwidth of the transmitting and receiving system.

So far, then, we have shown that improved vertical definition is possible by increasing the number of lines, and that improved horizontal definition is possible by increasing the bandwidth. We have also shown that improved *overall* definition is *not* possible simply by increasing the number of lines.

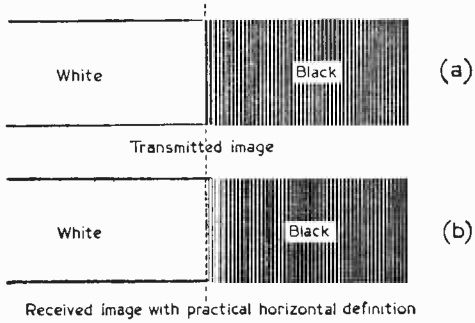


Fig. 1—A sharp shade transition at the camera (a) would be reproduced on a practical system as at (b).

Optimum Overall Definition

As has already been intimated, optimum definition is possible only when the horizontal and vertical definitions are equal. With the 405-line system the 2·5-3Mc/s bandwidth employed in the system as a whole is about correct to balance the horizontal and vertical definitions to provide the optimum overall definition. However, if the number of lines were increased, and the existing bandwidth retained, then there would be a marked *decrease* in the horizontal definition.

This is because the velocity of the scanning spot in tracing out a greater number of lines in the existing frame period (which cannot be altered) would be increased, and so the spot would travel a greater distance over the screen during brightness changes, which is the same as a reduction in horizontal definition. The vertical definition would be improved, and so the unbalance between the horizontal and vertical definitions would be aggravated. The effect on the picture would be rather like that of astigmatism, which often occurs due to the scanning spot being elliptical rather than perfectly round.

Bandwidths

Various figures can be tied to these vertical and horizontal definitions in relation to line standards and bandwidth, and it can be shown that to provide balanced definition on a 405-line system the overall

(Continued on page 426)

SERVICING TELEVISION RECEIVERS

No. 79—REGENTONE TEN-17

By L. Lawry-Johns

A LARGE number of receivers use this and a similar chassis with the addition of VHF radio facilities. The chassis layout and circuit diagrams presented in this article are those of the Ten-6 and Ten-17, Ten-21 (21in. model); RGD 610, 611, 611L, 606 and 710; Argosy 17K10, 17K11.

The Regentone R3 is a modified version whilst the 17-18 is a "touch-tune" version of the R3. The RGD 591 is the same as the R3 and the 612 is the same as the 17-18. The 711 is a 21in. version. The Argosy 17K14 also uses the R3 chassis and the 17K12, the 17-18. All models suffixed F.M. have facilities for receiving VHF radio transmissions in Band II. Except where stated this article refers to the Ten-17—RGD 610 models.

Features

All models have 110°-deflection-angle tubes and use silicon power diodes (two in series) for H.T. rectification. The width and linearity controls are at the lower part of the right-hand side line output transformer and take the form of protruding wires which operate slugs inside the coils L13 and L19.

The R3 and equivalent models have the width control in this position but the linearity control is a shorted turn sleeve on the tube neck. The tuner unit uses valves 30L15 and 30C1. Whilst a PCF80 will replace the 30C1, it should be noted that a PCC84 does not have the same gain as the 30L15 and some loss of sensitivity will be experienced if a PCC84 is fitted. A PCC89 is not equivalent to the 30L15 and should not be used.

Chassis Removal

Remove the rear cover and front control knobs. The channel selector and volume control knobs are secured by grub screws, the fine tuner and contrast knobs pull off. Remove the loudspeaker lead clips and the loudspeaker itself by removing the wing nut and spring clip. (The chassis is secured by a screw at each side flange.) The chassis can then be withdrawn completely.

Fault Symptoms

Receiver dead. If there is no sound or vision and no valves light up, check the fuse which is a 1A anti-surge type. Check that the mains leads are correctly connected so that the fuse is in the live side, with the neutral connected to chassis. If a neon lamp or screwdriver lights when touched on the chassis, reverse the mains leads or plug. If mains is applied, the neon should light when

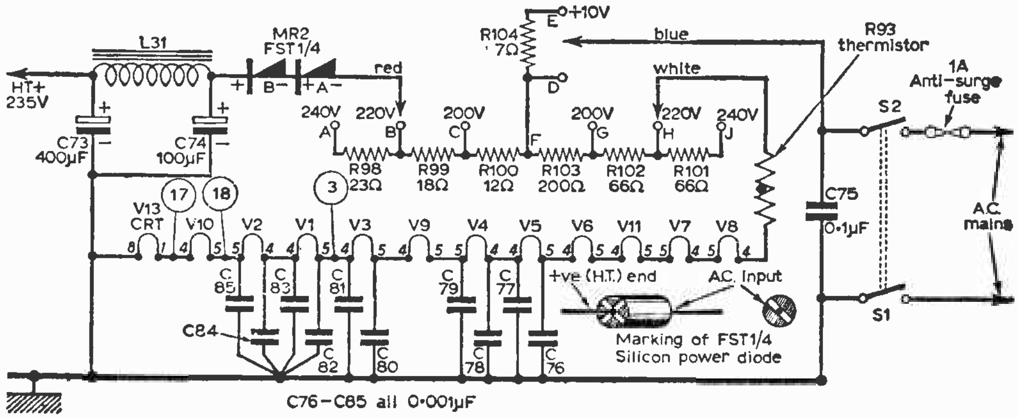


Fig. 1—The power circuit and heater chain, and the end markings of a silicon power diode.

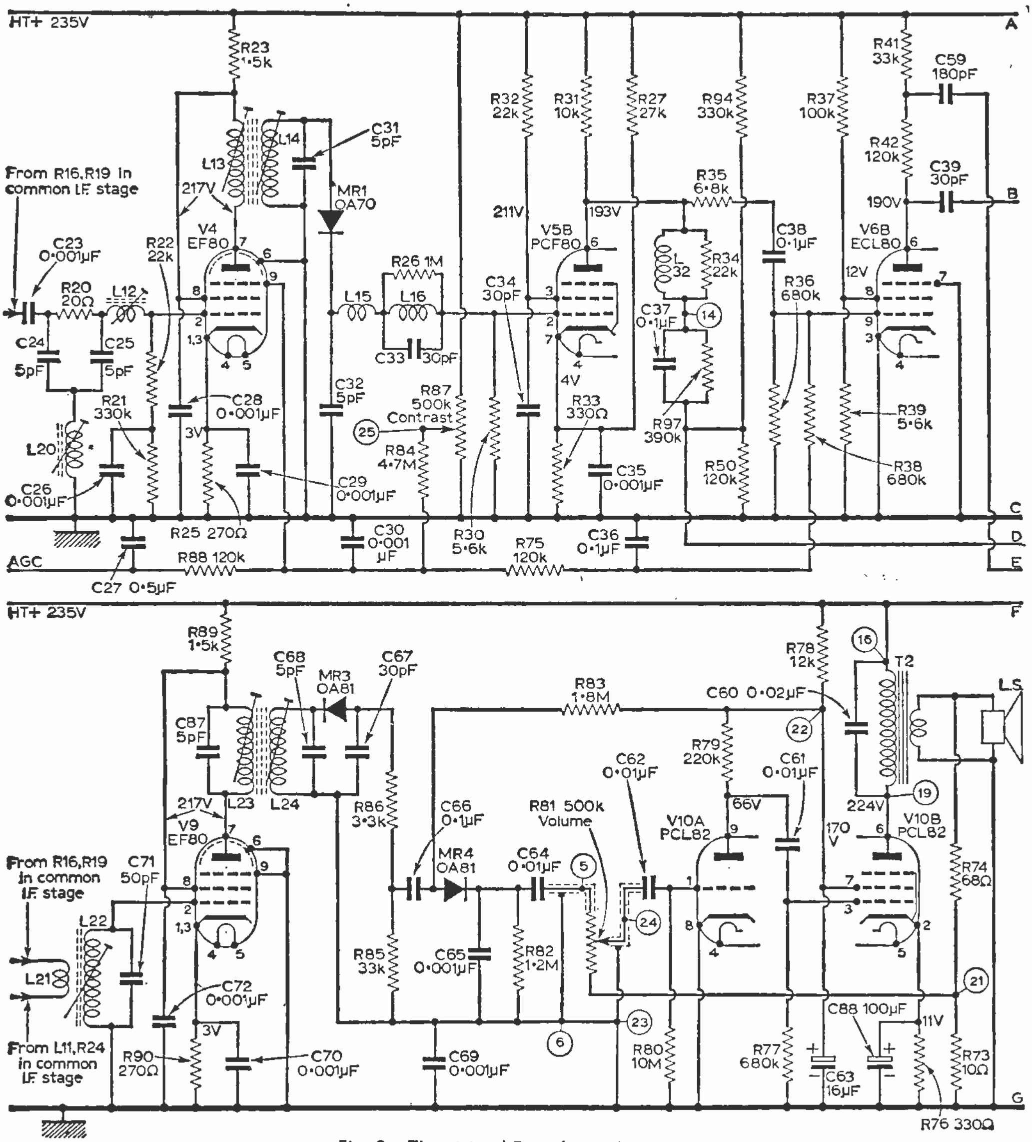


Fig. 2—The vision I.F. and sound stages.

applied to either end of the fuse. If it does so, continue checks along R98—101 (the mains dropper on the right-hand side) ensuring that an indication is obtained on each tag. If the neon glows at one tag but not at the next or an A.C. voltage reading on a meter is obtained at one tag but not at the next, the section of the dropper between these points is o.c. The resistance values of each section are given in the power circuit diagram (Fig. 1).

If the tags all give an indication, proceed to the valveholder of V8 (PY81), pins 4 and 5. If no indication is obtained at either pin check the thermistor R93 which may be fractured. If indication is obtained at one pin but not the other V8 is at fault with an o.c. heater. If V8 is in order proceed to V7, thence to V11, V6, etc., through the valve chain until the faulty valve heater is located. The CRT is the final heater in the chain, the heater pins being 1 and 8.

No H.T.

If the valves do light up, but there is no other sign of life it is quite likely that the H.T. supply is absent. The fuse will be in order and checking should start at R98—101 at the *red* lead tag to ensure that the surge limiter sections are intact. If indication is obtained at the red lead, it can be assumed that A.C. is reaching the silicon power diodes. As previously stated there are two of these in series. A.C. is applied to the negative end of rectifier A (see Fig. 1), and the positive end of this diode is connected to the negative end of rectifier B, the positive end of which supplies the H.T. (D.C.) to C74 and L31 where indication of H.T. should be obtained if the diodes are in order. Note that H.T. (D.C.) voltage will not cause a neon screwdriver to glow as brightly as A.C.

If a meter is used it should be switched to D.C. (250V range or over) for this test, of course.

PL81 and PY81 valves; undo the rear screw and unhook the front. If the PL81 is red hot internally, check the PCF80 V5, the triode section of which functions as part of the line oscillator. Also check the PL81 itself which may be internally shorted. Note that a defective line output transformer will in this type of circuit cause the PL81 to overheat since it is included in the oscillator circuit.

Also, disconnect the top cap of the EY86 in the screened right-hand section as a short in this valve will cause heavy damping of the line output transformer. Also check the PY81 and 0·25μF

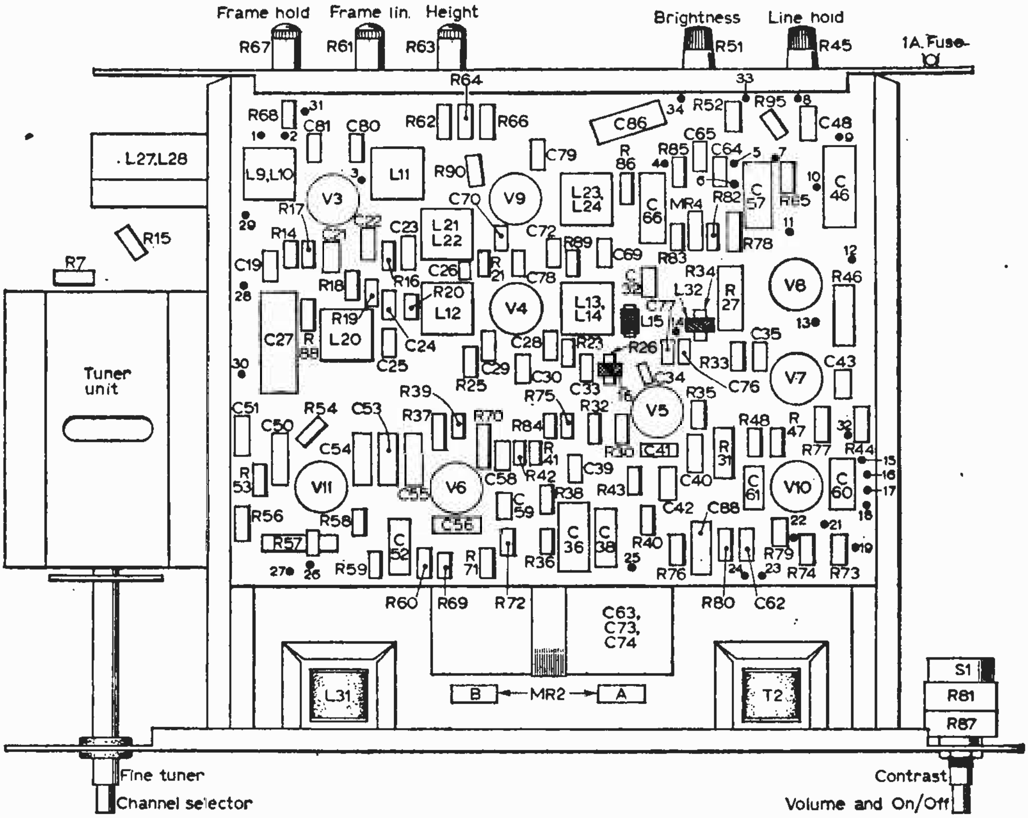


Fig. 3—The underchassis layout of components.

The choke L31 rarely becomes o.c., and, if the diodes are passing current, some indication of H.T. will be obvious even if a short is present as this will cause overheating of some component or of R98—101 before the fuse fails.

Sound Present, No Picture or Raster

It should be noted here that the contrast control is at the front and the brightness control at the rear. If advancing the brightness control does not show a raster on the screen, first check the line timebase operation and EHT.

If the characteristic whistle of the line timebase cannot be heard, remove the screen round the boost-line capacitor C46. If there is no sign of overheating, check R46 (2·2k screen dropping resistor to pin 8 of the PL81).

Resistor R46

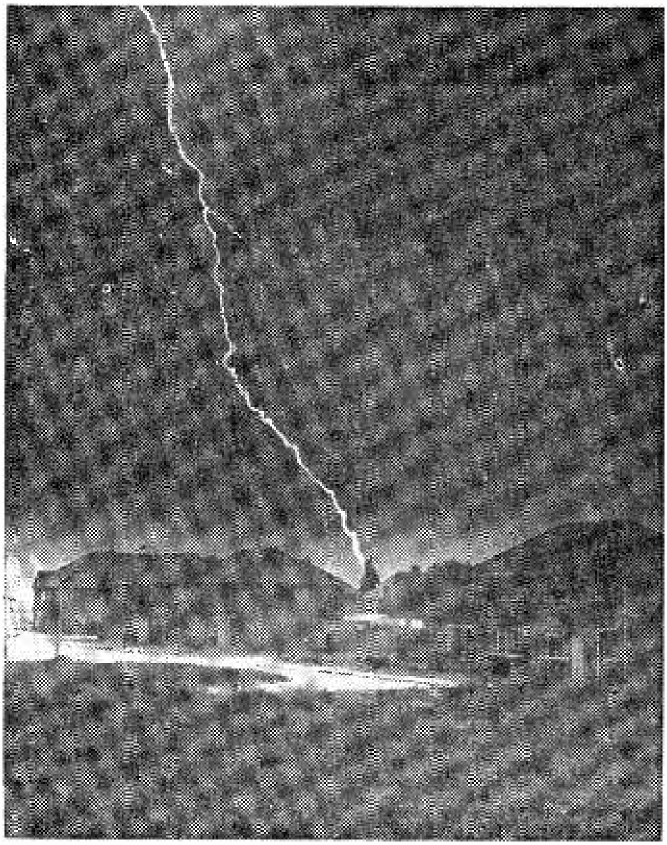
This resistor is mentioned particularly since in early models it was somewhat liable to become overheated and alter in value. This causes early failure of the PL81 due to overrunning and lack of width. The width can be temporarily restored by fitting a new PL81 only to recur within a short time. We prefer to see a wire-wound resistor used in this position as this type does not change in value.

(To be continued)

LIGHTNING

HOW MUCH DOES HAVING A TV AERIAL ATTACHED TO A BUILDING INCREASE THE LIKELIHOOD OF ITS BEING STRUCK BY LIGHTNING?

T. R. Kaine explains the factors involved.



The main discharge, branch discharges and a small inter-cloud discharge of lightning. In spite of the television aerials on the houses, the main discharge went to earth on a nearby hill.

IN recent years, the author has carried out a series of investigations concerning the possible danger of lightning striking a television aerial, and whether or not a high television aerial installation encourages a local discharge.

Virtually No Risk

Before proceeding further it should be stressed that the risk of a lightning discharge as the result of an average domestic television aerial installation is considerably less than the risk to which one is subjected as a pedestrian on an ordinary traffic-laden road.

Indeed, it would seem that the risk of a house being struck is somewhat less where there is a correctly erected outside aerial installation than in those cases where there is either an indoor aerial or no aerial at all.

It is fairly safe to say that there is no increase in lightning risk at an ordinary suburban site due to an outside aerial, and that the risk that does exist anyway is probably diminished by a soundly installed aerial on the chimney stack. This is contrary to expectations, but if we investigate the matter in a little detail we shall see why it is so.

How Lightning Occurs

Throughout the world there are several hundred flashes of lightning each second, and sufficient power is continuously liberated to provide most of the country with "free" electricity for ever, but, unfortunately, no method has yet been devised for harnessing this great power.

It thus goes unused, and dissipates itself in the form of great flashes which, in some cases, are several miles long and 6in. or more in diameter. What happens is that moisture particles in the upper atmosphere become charged with electricity due to various atmospheric disturbances. All these charges add together to form one very large charge. This continues to grow until, in the end, the stress between the charge in the atmosphere and the opposite charge of the earth is so immense that the air can no longer act as an insulator. At that instant the air ionizes and the charge is dispelled via the ionized path in the form of a flash which contains thousands of kilowatts of electrical power. The great intensity of lightning is due to the fact that all the power of the charge is released suddenly during a very short period of time.

Flash Path

It is seen, therefore, that, before the flash actually occurs, its approximate path is already traced out by the ionized air. As the main flash takes place, so other subsidiary paths are ionized and small branch flashes occur.

If it happens that the main discharge occurs, say, through a tree, then there is not much that can be done about it. The tree will explode and burst into flames. The same would apply in essence to any other object through which the main discharge occurred.

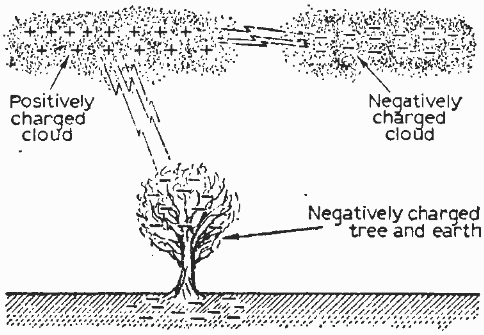
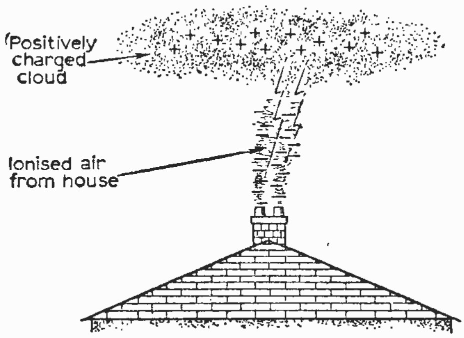


Fig. 1 (above)—A solitary tree, fully exposed on a hill, is an ideal target for lightning. After the main discharge, an adjacent cloud may go negative and give rise to an inter-cloud discharge.

Fig. 2 (below)—The flow of warm, moist air from a chimney is slightly ionized and is of a nature that affords an easy target for lightning. The air flow can be reduced by closing all doors and windows.



Fortunately, it is only on exposed and elevated sites that the main discharge reveals its full fury, and even then it may decide to go direct to earth rather than through some object. A solitary tree, fully exposed on a hill, for example, is an ideal target for lightning, whereas a house on a hill near the tree is somewhat protected. Similarly, a man walking across a flat field during a violent thunderstorm is more foolish than brave.

If a tree had the conductivity of copper, then it would never be struck. Even if such a tree suffered the full force of the main discharge it would most likely not be greatly damaged—being of good conductivity a major discharge would not be encouraged, as we shall see. Trees have relatively poor conductivity and thus offer a high resistance to the discharge. A person standing below the tree is not going to help from the conductivity angle, so that, should the tree be struck, the person beneath it would also be burnt.

In the Suburbs

The main discharge rarely finds its way into the suburbs though, nevertheless, houses at such sites are struck as we well know. This is often caused by the main discharge breaking up into relatively small branches, but the power in these is still sufficient to knock down chimney stacks and take off roofs. When a bad storm is above a built-up area, there are very many points which offer a small discharge resistance for the charge.

Lightning Conductors

There are tall buildings and spires which almost certainly feature some kind of lightning conductor. These consist of a large metal rod, pointed at one end, and attached to the highest point. A good connection to earth is provided by a heavy copper ribbon. Its purpose is really not to act as a lightning conductor in the strict sense of the word —this would happen in the extreme case when it were actually struck—but it achieves its object of protecting the building in a less spectacular manner by allowing the electrical charge in a closely situated thunder cloud to drain away quite safely before it can build up to the high level necessary to promote a flash.

It is found that lightning invariably strikes the chimney stacks of houses. Investigation into this

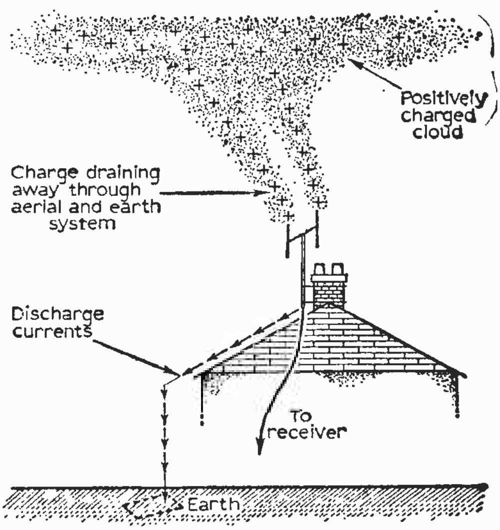


Fig. 3—A television aerial would appear to act as a "lightning conductor", in that it progressively drains away electrical charges in proximity to the house thereby making a local discharge less probable.

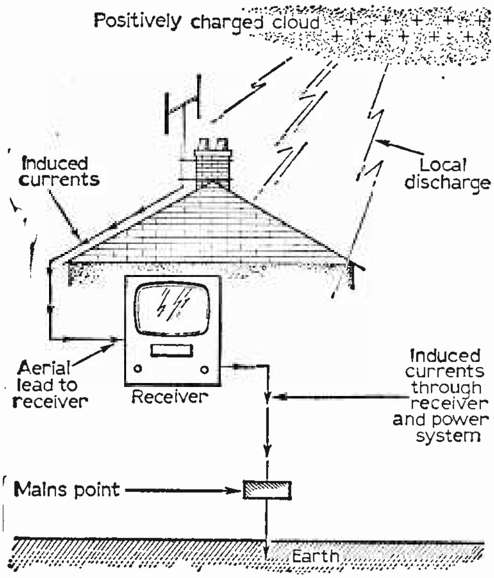


Fig. 4—If the aerial system is inadequately earthed, induced current from a nearby discharge may flow through the set and mains system, and cause unnecessary damage.

matter has revealed that this is not always because the chimney is the highest point of the building, especially in suburban areas where there are numerous taller buildings and trees in proximity. The real reason is that the temperature of the atmosphere outside the building during a storm is usually below the temperature of the air in the rooms, and this encourages a perpetual flow of warm air from the chimney, even though a fire may not be alight.

This current of slightly moist warm air forms a cloud close to the chimney of a nature that affords an easy target for lightning—since the cloud is slightly ionized. Thus, half the conditions necessary for a discharge are present.

However, if there exists a television aerial on the chimney, although not earthed nearly as efficiently as a lightning conducter, it may serve on this occasion to disperse the electric charge immediately above the house and in that way dispel the conditions for a lightning flash.

Damage to Television Equipment

The few cases of damage to television equipment by lightning have nearly all been caused by an abnormally heavy discharge from the aerial through the receiver and back to the mains supply. Much of this danger can be eliminated by connecting the aerial system (e.g., the metal pole, the director(s) and reflector and one half of the dipole itself) to an efficient earth point through the shortest possible run of stout copper wire.

The television aerial installation then looks even more like a so-called lightning conductor, and if there happens to be an extra heavy flow of current it will find its way direct to earth without having to resort to the receiver and mains system for a path.

Induced Currents

A heavy discharge fairly close to a television aerial may well induce large currents into the aerial system wiring, in rather the same way as a current in the primary of a transformer induces a current into the secondary. Unless the aerial system is adequately earthed as described above the current may well have to go through the set and the mains to find an earth path.

Similar current induction takes place in overhead cables, such as power, telephone and relay cables. These currents are sometimes strong enough to result in failure, but in the majority of cases they are by-passed to earth through a special protection device which breaks down to earth only in the event of the cable being heavily charged with static electricity. As soon as the charge has been exhausted then the by-pass effect is automatically removed. In the old days of long-wire broadcast aerials it will be recalled that a large aerial earthing switch was invariably employed and was brought into action to earth the aerial during a bad storm.

Conclusions

From the foregoing it is clear that if a main discharge occurs through a television aerial system, then there will almost certainly be considerable damage. If the aerial is earthed efficiently, the earth wire may well be able to handle a smaller branch discharge without the slightest trace of trouble. But, more important, a television aerial would appear progressively to drain away electrical charges in proximity to the house so that the total charge rarely becomes sufficiently large to cause a very local flash. Perhaps insurance companies understand this! ■

LINES IN PERSPECTIVE

(Continued from page 420)

bandwidth must be only a little below 3Mc/s. To provide balanced definition on a 625-line system the overall bandwidth must be about 4·5Mc/s.

Provided the receiver is able to respond, then 625 lines and a 4·5Mc/s bandwidth will undoubtedly give pictures of technically better quality than those from a 405-line system and 3Mc/s bandwidth. Whether or not the pictures would be "subjectively" better can only be answered by the viewers.

Overall Bandwidth

It should be remembered that in many cases the programme material will have to be carried by landlines and radio links to the many UHF stations that will be required to serve this country, and that the term "overall bandwidth", used extensively in the foregoing, is related to the transmitting arrangements as well as to the receivers themselves. Unless the links are capable of handling the requisite wide range of vision modulation frequencies smoothly, there may barely be even marginal technical improvement by going over to 625 lines. This applies also to so-called wired television systems and the "piped" arrangements that are becoming popular in this country. ■

405/625 Switching

THE COMMERCIAL ASPECTS OF STANDARDS SWITCHING

By T. M. Stanley

(Continued from page 378 of the May issue)

LAST month's article examined the various switching functions related to the vision detector and line timebase sections of a dual-standard receiver. In this article it is proposed to investigate the 405/625 switching arrangements in the sound channel and also the switching which is concerned with changing the vision I.F. response when the receiver is switched to 625 lines.

Most true dual-standard receivers now being manufactured provide facilities for frequency modulated "inter-carrier sound" when the set is switched for 625-line operation. This method of sound working is possible on the CCIR system because frequency-modulation of the sound carrier is adopted.

Inter-carrier Sound

Inter-carrier sound was dealt with in some detail in the March issue; it is a system whereby both the sound and vision signals are carried and amplified simultaneously by the vision I.F. stages, and the "beat" produced by the two carriers (at their difference frequency), due to the action of the vision detector, is fed back to the sound I.F. channel either from the output of the vision detector or from the output of the video amplifier stage.

In practice the response of the vision I.F. stages is such that the sound signals are given only a limited amplification with respect to the vision signals—the latter are usually some twenty to thirty times stronger than the sound signals at the output of the vision detector.

The fact that the sound signals are mixed up with the vision signals in the vision I.F. stages does not impair the vision performance or cause sound-on-vision troubles because there is no change in *amplitude* of the sound signal since the sound uses F.M. The sound I.F. is thus formed by the difference in frequency between the sound and vision carriers, and the difference proposed for

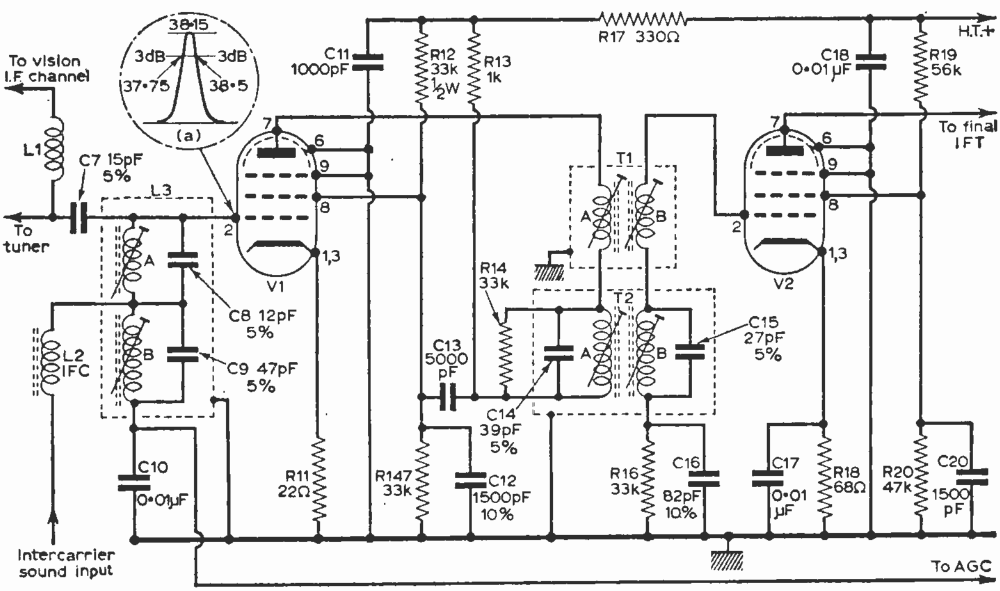


Fig. 5—The sound I.F. channel of a dual-standard receiver. The circuit features series-connected I.F. transformers, one which tunes to the 405-line I.F. (38.15 Mc/s) and the other which tunes to the CCIR inter-carrier I.F. (6 Mc/s).

such a system launched in this country is 6Mc/s. Therefore, at the output of the vision detector (assuming that the proposal is adopted) will appear the ordinary vision signals, as explained in last month's article, and a frequency modulated sound signal at a frequency of 6Mc/s.

The vision signals are passed to the picture tube through filters which remove the 6Mc/s signal, while the sound signals are sent to the sound I.F. channel through filters which remove the vision signal.

The Sound Channel

The circuit in Fig. 5 shows the sound channel used in the Pye V700D. On 405 lines the normal I.F. from the tuner (sound 38·15Mc/s) is fed to V1 through C7. The tuned circuit comprising inductor A and C8 tunes to 38·15Mc/s, and the resulting sound response is shown in inset (a) in Fig. 5. The 405-line sound I.F. is fed to the final sound I.F. amplifier valve V2 via the I.F. transformer T1. The anode of V2 is coupled to the final I.F. transformers, T3 and T4 in Fig. 6, and T3 is concerned with the 405-line A.M. sound signal. This is applied to the A.M. detector diode D1, and the A.F. output is developed across the load resistor R25.

The A.M. detector is conventional; C22 is the I.F. secondary tuning capacitor, C25 the reservoir capacitor and inductors L4 and L5 I.F. filters. One end of R25 is connected to chassis, while the A.F. at the other end of the resistor is fed to the A.F. stages in the ordinary manner when switch S4B is in the "405" position. Switch S4A short-circuits the inter-carrier sound take-off point when the set is working on 405 lines. The D.C. from the load resistor R25 is filtered through R27, C24 and R15 and is used as an automatic gain control voltage.

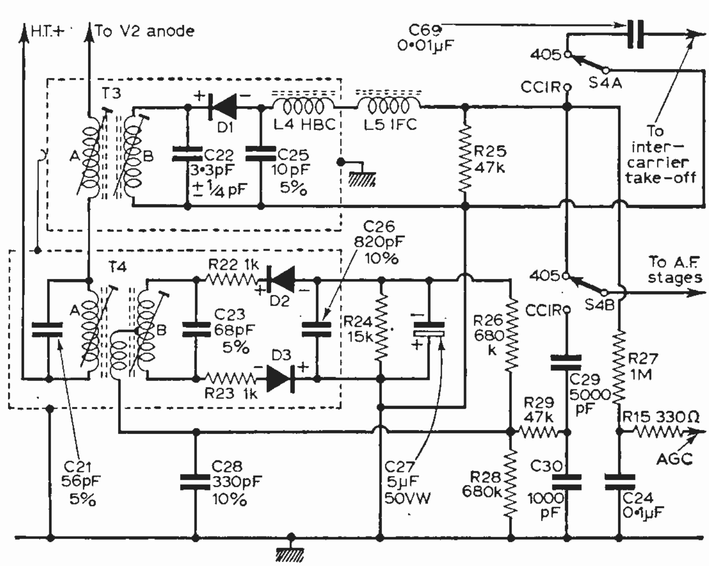


Fig. 6—The sound detector stages; diode D1 and associated components form the A.M. sound detector, while diodes D2 and D3 form the ratio detector for the CCIR F.M.-sound signals.

CCIR Arrangements

When the set is switched to 625 lines, the inter-carrier sound signal is applied via L2 (Fig. 5) to the tuned circuit comprising inductor B and C9—this resonates at 6Mc/s. The signal is amplified by V1 and is coupled to V2 through I.F. transformer T2.

In Fig. 6 the 6Mc/s F.M. signal is developed across winding A of T4, which is the primary of a ratio detector transformer. Winding B is the secondary of the transformer which feeds the ratio detector diodes D2 and D3 in the normal way. C23 is the secondary-tuning capacitor, R22 and R23 are diode balancing resistors, C26 is an R.F. filter capacitor, R24 is the load resistor and C27 is the conventional electrolytic stabilising capacitor.

The ratio detector time-constant is made up of R24 and C27, and it is the "flywheel" effect of this which endows the circuit with good A.M.-limiting properties.

The A.F. from the 6Mc/s F.M. signal occurs across C28, and this is fed to the A.F. stages via S4B when it is in the "CCIR" position. R28, R29, C29 and C30 provide suitable de-emphasis. The CCIR pre-emphasis at the transmitter is 50μsec., while in the American FCC system the value is 75μsec.

It will be seen that S4B performs the A.F. change-over operation, while S4A short-circuits the A.M. detector and removes the short from the inter-carrier take-off in the "CCIR" position.

The Vision I.F. Stages

The circuit of the vision I.F. stages of a dual-standard receiver is given in Fig. 7. The 405-line vision carrier is 34·65Mc/s, being 3·5Mc/s down from the sound I.F. (which is 38·15Mc/s—see Fig. 5). The 3·5Mc/s is, of course, the consistent difference in frequency between the sound and vision carriers of the 405-line system.

As already intimated, the difference between the sound and vision carriers of a proposed CCIR system is 6Mc/s, but here the sound carrier is *above* the vision carrier (as actually radiated at the transmitter), which is opposite to the 405-line system. It should be noted that although the sound I.F. is *above* the vision I.F. on 405 lines, this is brought about by the *local oscillator* in the tuner operating *above* the signal frequency. The carrier positions are thus reversed. When the oscillator is operating below the signal frequency

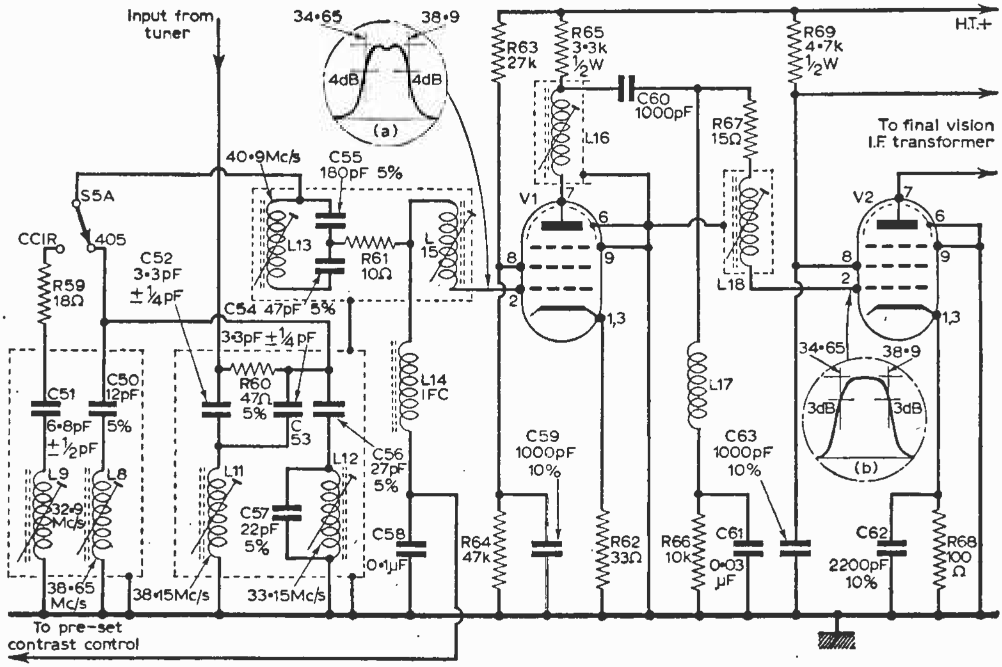


Fig. 7—The vision I.F. stages of a dual-standard receiver (Pye—V700D). The responses in (a) and (b) represent the overall response of the channel, which is reduced in bandwidth by the operation of S5A on 405 lines, as shown in Fig. 8

(which is used only in very old sets) then the carrier positions at the I.F. remain the same as they are when transmitted—e.g., vision *above* sound. Thus, when the set is adjusted to receive a CCIR transmission (with the oscillator in the UHF tuner operating above the signal frequency) the *vision* I.F. will fall *above* the sound I.F.

This factor is exploited in dual-standard sets. The responses in Fig. 7 [(a) and (b)] relate to the overall vision I.F. passband, and the one in (b) is redrawn in Fig. 8 to bring out some interesting points.

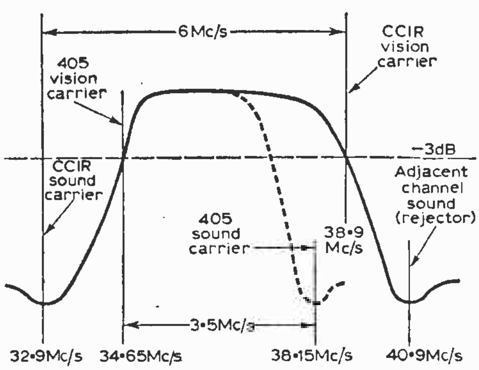


Fig. 8—How the bandwidth of the vision I.F. channel is decreased (dotted line) on 405 lines, and the relative positions of the various carriers. Note the reversal of sound and vision carriers on CCIR.

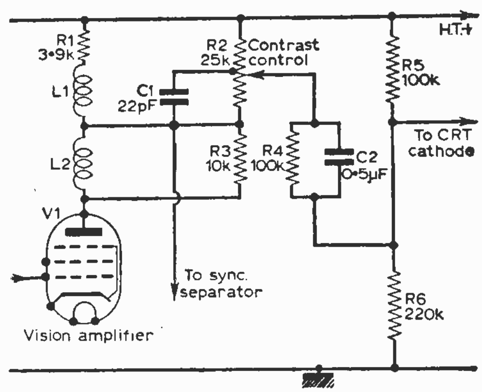


Fig. 9—How the contrast is controlled by varying the actual vision signal level applied to the tube cathode from across the vision amplifier anode load.

The left-hand side of the curve and the right-hand completion by the broken line represents the vision channel response of the I.F. stages on 405 lines. Here it will be seen that the 405-line vision carrier at 34·65Mc/s falls 3dB down on the response curve, while the sound carrier (3·5Mc/s away) falls in the trough produced by the sound rejector (L11 in Fig. 7) at 38·15Mc/s.

On a CCIR transmission the response opens out to that of the full-line curve. The 405-line

(Continued on page 451)

SYSTEMS FO
PAY-
TELEVIS

IT is thought by many that the Pilkington Committee is likely to recommend to the Government an entirely new system of television. This Committee, as some will be aware, has been investigating the future of broadcasting in Great Britain. It has been studying hosts of reports of both a commercial and technical nature from all corners of the radio and television industry, from educational authorities, from the film people and from many other interests that appear likely to have some association with radio and television broadcasting in the future.

The Pilkington Committee' negotiations with the Postmaster-General were begun in 1958, and it is only of very recent months that the activities have been completed, but even now (at the time of writing) the final recommendations have not been made public. However, there would also appear to be quite a possibility that certain of the recommendations will be implemented with the very minimum of delay. One point which will emerge is whether or not Britain is to retain the existing 405-line system of television or whether there will be a change to 625 lines—or some other number of lines. Many other things will also emerge, including a recommendation—or otherwise—of "pay-TV".

What is Pay-TV?

Pay-TV goes under several other names, including "toll-TV", "pay-as-you-view TV", "subscription TV" and so on. As it seems highly likely that we shall be hearing quite a lot about this system in the future, a preview of the system is and how it works would not be amiss at this time.

Pay-TV has no connection with so-called "coin-in-the-slot-TV" which some rental firms are now fitting to their receivers simply to facilitate payment of the rentals. This system is nothing more than a time clock which is connected in the power input circuit of the receiver. The insertion of a coin starts the clock mechanism and after a predetermined period of time the clock operates a switch which removes the power from the set. To continue viewing it is thus necessary to insert a further coin. The clock only operates, of course, when the receiver is switched on.

Pay-TV, on the other hand, is a method of financing TV programmes in an entirely different way from that used at present. With the existing

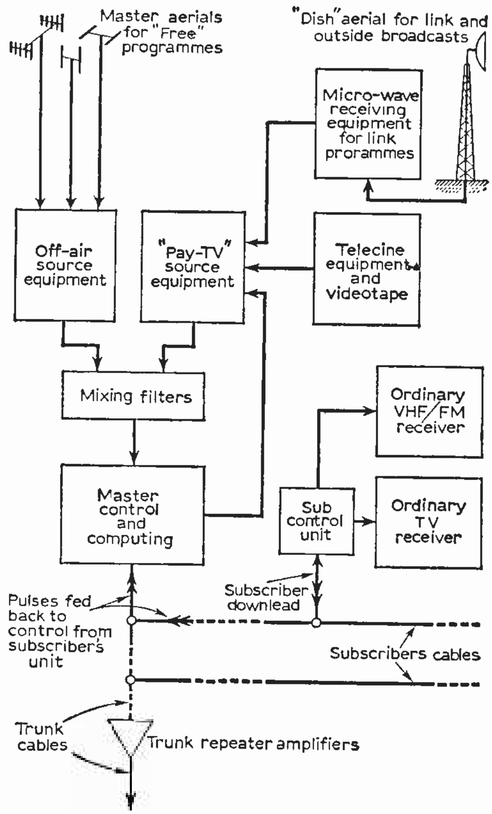
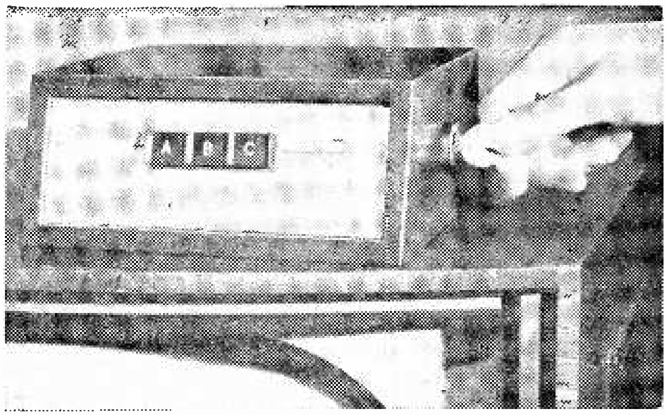


Fig. 1—The basic principles of a "piped" television system handling both "free" and "pay" programmes.

ION



(Above)—The subscriber's control unit of the PayVision system.

By L. P. Raynes

arrangements, programmes of the BBC are financed by a small proportion of the licence revenue, while those of the ITV are financed from advertising revenue, but in spite of the seemingly large profits made in the past by the commercial TV companies, only a small proportion of the total revenue is available for programme production. With the BBC things are even more difficult, and its average expenditure per hour of TV time cannot rise much above £3,500. Some programmes cost more than this, of course, but some cost much less!

Should the Government give its permission for the operation of pay-TV, this would work side-by-side with the "free-TV" programmes. The pay-material would include current release films, locally derived concerts and plays and probably top-rating sports events. Pay-TV would obviously have to provide material of a greater entertainment, and more topical value than that available on the free channels, otherwise viewers just would not pay to see it!

In the present phase, only old films eventually find their way on to TV, and really good films are side-tracked from the TV ciné equipment by an organisation called "FIDO" which purchases the television rights of such films made in Britain. This organisation (Film Industry Defence Organisation) was established by the British film industry specifically to avoid the showing of certain films on TV.

Should pay-TV come to pass, however, the situation would be reversed. Outstanding films would be made specifically for TV, which would receive the first showing, and afterwards the films would probably be directed to the ordinary cinemas. The Paramount film people are already in the course of setting up a unit to produce top-rate feature films solely for television.

How would Pay-TV Work?

From the foregoing it will be understood that pay-TV would bring to the home entertainment of a value outside the scope of that usually available on the "free" channels. The "pay" channels would be programmed with specialised material, such as new feature films, music hall and variety programmes, opera, ballet, educational and hobby material. There could also be sound or vision channels, or both, programming items of local interest, advertising and shopping information.

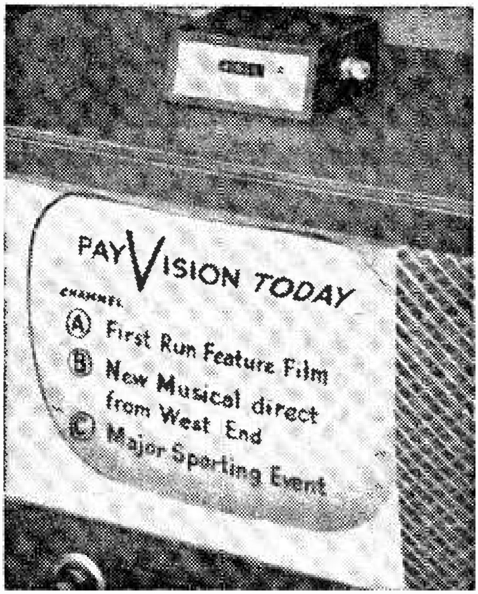
Such a system would go far to eliminate the criticism of existing television, where the majority of the programmes have to be designed for mass appeal. It would also solve the problems of cost of production, for it is estimated that even if only a small percentage of the millions of viewers bought pay-TV programmes for the modest sum of, say, two shillings and sixpence per complete programme, there would be sufficient revenue available to produce TV programmes of a standard hitherto unknown.

Pay-TV would use the subscriber's television receiver as the display medium, and this could be an ordinary domestic model or a receiver designed specifically for pay-TV, depending upon the type of system adopted. If it were a special receiver, however, it would probably be suitable also for the "free" programmes of the BBC and ITV, since pay-TV would not set out to supplant the existing services, but rather to augment them with programmes of enhanced value.

The "pay" programmes could either be piped throughout a community by means of coaxial cable, after the style of the existing coaxial relay systems, or transmitted over the air from local, low power UHF stations. Piping has much to commend it, since it does not take up air-spectrum-space which is at a premium at the present time. In coaxial cable exists a full "radio" spectrum from D.C. up to, at least, 200Mc/s, and within this a very large number of "pay" channels (and "free" channels) could be accommodated without interfering in any way with the existing "off-air" services.

Piping also means that there is considerably less chance of interference and "pirating" of the "pay" material. "Off-air pay-TV" would call for special scrambling of the signals so that they could not be received on a receiver tuned to the "pay channels" without a de-scrambling unit, which would possibly be brought into operation by dialling or by the insertion of a suitable coin in a small coin box fitted to the side of the receiver.

With a piped system, scrambling would be unnecessary, as also would a coin box, for "information" indicating that a subscriber was viewing a specific "pay-programme" could be fed back from the subscriber's receiver over the cable network to a central automatic accounting point. The subscriber would then be billed monthly for the programmes that he had viewed—this would be rather like the method used by the Post Office for telephone accounts. Moreover, a piped system would eliminate the capital costs of special "pay-TV" transmitters, and would also allow the interference-free distribution of "free" programmes.



How the "preview" channel of the PayVision system may appear on the screen.

Pay-TV Systems

"Pay-TV" has been the subject of considerable debate both in America and Canada. Both "off-air" and "piped" systems are on trial operation over there, and reports seem to differ somewhat. It would seem, however, that the "off-air" systems are tending to run into the red, but this is put down to the initial costs of launching, though it has been suggested that very large networks would be essential to provide the revenue requirements to balance the high cost of installation and operation. Nevertheless, experimenters in "pay-TV" continue in association with such organisations as Home Entertainment, TelePromTer, Trans Canada Telemeter and others, and "off-air" experiments have recently been begun at Hartford in Connecticut.

In anticipation of the "green light" for piped "pay-TV" in this country, several systems have been evolved. Although many firms are undertaking laboratory and practical work in connection with "pay-TV", there are three major systems at present available. These have been produced by "Choiceview", which partners the Rank Organisation (interested in films) and Rediffusion Limited (interested in multiwire relay and TV rentals), by Tolvision Limited and by PayVision, the latter a system designed by Marconi's Wireless Telegraph Co., Limited.

Cable or Off-air

The Choiceview system can be adopted either for cable or off-air applications, though it is anticipated that cables would possibly be used in the first instance, and the cables already existing in Rediffusion relay systems could be utilised.

There are two types of control unit for subscribers, one to handle cash (on a coin box basis) and the other to give credit. The cash unit allows coins to accumulate to give a total credit of £1 and, conversely, allows a total debit of £1 before switching off the "pay" signals.

This system features a separate "announcement channel"—operating a small speaker on the control unit—for giving details of forthcoming programmes and for five- and two-minute warning prior to the start of the programme. Other features include a warning light which starts flashing as a programme draws to an end, a three-position switch for selecting either the "free" programmes, which would be directed to the receiver either through cable or from aerials in the ordinary way, or one or two "pay" programmes.

The controls of each unit are worked by pulses transmitted over the cable network at the finish of each programme sequence, and each pulse actuates a "programme cost" dial in units of twopence, thereby giving the viewer the cost of the programme.

Central Monitor

The Tolvision system is of American origin, and has been developed and tested over a period of seven years. The design is based on a coaxial relay network which could also carry "free" programmes of the BBC and ITV. There is no coin box, as the subscriber's payments are handled by a central monitor which also provides billing facilities.

Ultra-Wideband System

The recently evolved PayVision system is designed for ultra wide band coaxial systems which are able to carry up to 20 channels. Thus, apart from the three new "pay-TV" channels which the system is able to provide immediately, the network would also be suitable for sound programmes and the "free" television programmes of the two authorities.

The subscriber's control unit is in the form of a wooden box of modern styling and contains three push buttons, marked A, B, and C on the front and a key-operated switch on the side. It is designed for use with any existing multi-channel receiver and is simply connected in series with the downlead from the piped TV system.

One channel on the coaxial network is given over solely to previews of the "pay" programmes. This is, of course, a "free" channel and is obtained simply by adjusting the programme selector on the ordinary receiver to the "preview" channel number. The preview gives details of the programmes on the three "pay" channels A, B, and C,

(Continued on page 444)

SERVICING DATA AND MODIFICATIONS

By D. Elliot

CHECKING FOR SHORTED TURNS IN LINE OUTPUT TRANSFORMERS

(Continued from page 400 of the May issue)

FAILURE of the line output stage always results in the symptoms of no raster and no EHT voltage, with the sound unaffected. As these symptoms are often caused by shorting turns in the line output transformer, there is a tendency to forget about other possibilities, and fit a replacement transformer. However, this procedure can be costly and time-consuming if it is later proved that the transformer is without fault.

Testing

Line output transformers are rather difficult to test conclusively, and eventually there may be little more left to be done except check the suspect transformer by substitution. Modern transformers have three or four separate windings (some have less) and, although it is a simple matter to check these for continuity and resistance, the change in resistance due to a few adjacent turns shorting is impossible to detect with an ordinary ohmmeter.

The problem is further aggravated by the tolerance which is allowed by the makers on the resistance values of the various windings. For example, the EHT overwind may be given a value of, say, 15k in the service manual or data sheet. The tolerance is often in the region of $\pm5\%$ and therefore the actual measured value on a good transformer may be anywhere between about 14,250Ω and 15,750Ω. This means that even though there may be shorting turns, they could never be revealed with an ohmmeter or even with an accurate resistance bridge.

Effects of Shorting Turns

There are various ways of revealing shorting turns, but rather specialised equipment, together with a knowledge of the normal characteristics of the component under test, is necessary. A transformer ceases to operate when one of its windings has a shorting turn because the shorting turn is, in effect, reflected across the other windings as a short-circuit, and most of the power in the other windings is dissipated in the shorting turn.

This can easily be proved by winding several turns of PVC-covered wire around the core of a line output transformer, leaving the turns open-circuit for normal operation of the receiver and then simply applying a short-circuit across them while the set is working. In most cases, this action will completely stop the line timebase, or at least severely damp its action and almost certainly cut off EHT voltage.

Shorting turns reduce the inductance of windings, so that if the normal inductance is, say, 1H, a single shorting turn may well cause this to drop to a fraction of 1H. Here, then, is one way of checking for shorting turns, but it is rarely ever practised by the experimenter or service technician because (a) he is unlikely to have an inductance bridge at hand and (b) even if he has, he will probably not know the normal inductance values. These parameters are not published and, in any case, depend to some extent on the amount of direct current flowing in the windings.

Oscilloscope Test

Line output transformers are probably more critical than any other type of transformer. Shorting turns, for instance, in a simple loudspeaker transformer would undoubtedly reduce the power applied to the loudspeaker, but they would be unlikely to cut off the sound altogether. They might also reduce the bass response. However, owing to the necessarily high efficiency demanded of line output transformers, shorting turns generally cause total failure of the line amplifier.

Since line output transformers have such a high efficiency, they can be caused to produce "damped oscillations" quite easily—provided they are in good order, of course. If they are not, and their efficiency is low, then they will not oscillate nearly as well. With these things in mind, an oscilloscope can be used to provide a comparative test.

In Fig. 18, a high efficiency winding is connected to a battery via a key. Now, the winding has an inductance value and also a value of shunt capacitance due to the capacitances between the windings. This means, then, that the winding is really an electrical tuned circuit. It has a resonant frequency as determined by its L and C elements.

This is analogous to a piano string, for example, for this also has a resonant frequency as determined by the length and tension of the string. If such a string is plucked it will vibrate and produce a note equal to its resonant frequency. The vibrations will be vigorous at first and will gradually decay. This is called a damped oscillation, and as a waveform, it looks like that shown in Fig. 18.

It is, of course, impossible to "pluck" an electrical tuned circuit in the same way, but exactly the same effect can be caused by feeding the circuit with bursts of current. Thus, when the key in Fig. 18 is operated, the tuned winding will have developed across it a voltage waveform of the type shown. This can be seen on an oscilloscope, and represents the basis of the line output transformer test.

Circuitry

Fig. 19 shows the general set-up for the test. It is not very convenient to "key" current through the transformer while at the same time causing triggering of the timebase of the oscilloscope, so pulses from the timebase are fed to the winding under test. There are usually sufficiently large pulses at the "sync" terminal of the "scope to do this job, it simply being a matter of connecting the "sync" terminal to the "Y-amplifier" terminal, as shown. The "Y-amplifier" terminal is then connected to the end of one winding and the "earth" terminal to the other end of the same winding.

The best winding for the test is the EHT overwind, for a short will be shown up on any of the other windings, irrespective of the winding to which the oscilloscope is connected. The EHT overwind is chosen because it has the most inductance and, therefore, has developed across it

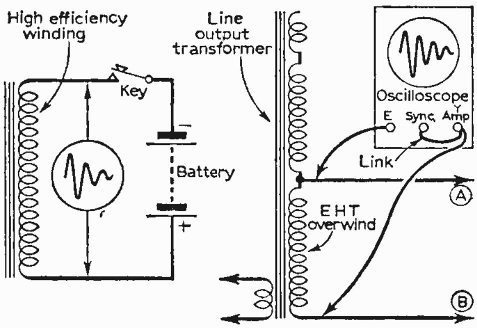


Fig. 18 (left)—Due to the L and C elements in a high efficiency winding, the circuit will tend to produce a damped oscillation when subjected to current pulses. The oscillation will have a frequency equal to the natural frequency of the winding, and the waveform produced is of the type shown.

Fig. 19 (right)—Showing how a line output transformer may be checked for efficiency by observing the waveform of the damped oscillation on an oscilloscope. The winding can be "triggered" into oscillating by the timebase in the 'scope, and sufficient voltage is usually available for this purpose at the "sync" terminal (but see text). The set must NOT be switched on when making this test.

an amplitude of damped oscillatory voltage which is greater than that across any of the other windings. This makes the display readily visible on most oscilloscopes which have reasonable Y-amplification.

Initially, the timebase should be set for a repetition frequency of about 5,000c/s, and the maximum value of Y-gain should be applied. When the waveform is revealed, the timebase and Y-gain controls should be readjusted to produce a display of almost full-screen size. A tracing should then be made of this, with notes as to the settings of the timebase and Y-gain controls. This should be kept for future reference.

The idea is to produce the original statistics on transformers known to be in good order so that comparison tests may be made with future components which are suspected. It should be noted that all transformers (e.g., if they differ in type and make) will not produce identical waveforms. Some will be of slightly different frequency and amplitude.

If it is found that a reasonable "trigger" voltage cannot be obtained from the "sync" terminal, a feed can sometimes be taken from the "X" terminal, almost direct from the output of the timebase, but, in this case, a resistor of 10k to 50k should be connected in series with the link. The effect of a shorting turn on the waveform can easily be shown by shorting the leads of the EHT rectifier heater winding.

No Raster—Sound Normal

First check that the ion trap magnet is adjusted correctly on the neck of the tube. The retaining strap sometimes fractures and loosens the magnet, or the position my be disturbed during transit or subsequent servicing. If the magnet is out of adjustment, the electron beam will be deflected away from the face of the tube. Moreover, if the set is run under this condition for any length of time there is a possibility that gas will be released into the tube, due to electrons impinging on the gun assembly, thereby impairing the vacuum and causing a poor picture. There is no cure for this trouble apart, of course, from replacing the tube.

It is essential, therefore, that the ion trap magnet is very carefully adjusted to give the brightest possible picture when the brightness control is turned approximately half towards maximum setting.

If the magnet has obviously not been disturbed (as often indicated by continuity of the dust deposit on the neck of the tube), the line output valve and the booster diode should be checked, preferably by substitution with valves known to be good.

If in order, a check should be made of the EHT voltage at the tube final anode. If a meter is not available for this purpose, a vigorous spark of, at least, ¼in. in length should occur when the EHT connector is held close to the chassis (take extreme care to avoid electric shock). If EHT is present with the connector removed from the tube final anode, but collapses when the anode connection is made, there may well be a fault in the tube biasing circuits. The control grid (brightness) and cathode (video) feed circuits and associated components should be checked. If all is well here, a tube defect could cause the trouble.

Rectifier Short

A short in the EHT rectifier (between anode and cathode) sometimes results in a pulse voltage being applied to the tube final anode. This will not produce a raster, and the pulse voltage may well collapse when the connection is made to the final anode. Sparks may also occur between the external conductive coating of the tube and the earthing clips or spring.

Any line output stage fault, will, of course, prevent the heater of the EHT rectifier from lighting, as this is energised by the flyback pulse.

If the foregoing tests still fail to reveal the trouble, then there is a very good possibility that the line output transformer is, in fact, to blame and, if possible, tests should be made as detailed in the first part of this article. If this is not possible, the only thing left is to check the transformer by substitution.

(To be continued)

UNDERNEATH THE DIPOLE

A MONTHLY COMMENTARY

BY ICONOS

SLOW motion video tape! The BBC produced a real trump card when they broadcast the Grand National from Aintree. First, we saw the actual race, followed by the finish, leading in the winner and an excellent interview with Fred Winter, the winning jockey. Then we saw a video-taped repeat of the exciting last minute of the race—a good though not new method of presentation. However, a few minutes later, there was an exciting re-cap of the run, to the winning post, in which the BBC video tape machine was played back at half-speed. There was a slight flicker due to the use of a standards converter to get the picture back into a form suitable for transmission, but this was not at all objectionable, bearing in mind the special nature of the shot. Indeed—it was not only special, it was an historic moment in television progress and a triumph for the BBC engineering department.

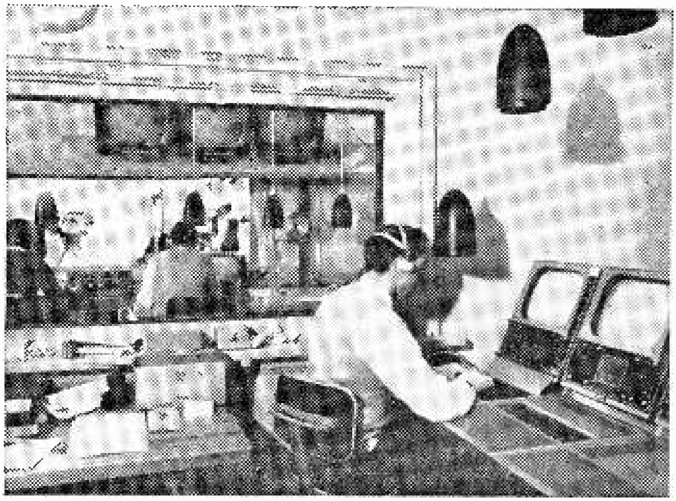
Television Tape Progress

The Aintree broadcast was not only notable for the slow-motion stunt, which was a valuable highlight. The whole presentation, use of a mobile camera on a car running beside the course plus dozens of other cameras, and the perfect co-ordination of sight and sound, with first-class commentators, resulted in a smooth and exciting broadcast which was "professional" in every way. The announcement that the slow-motion device would be used for other sporting events this summer will give added interest to these events. I wonder whether further progress will be made with this technical gimmick. For instance, could the replay video tape speed be made even slower than half-speed? And could a "frozen" frame of any part of a taped scene be presented, such as the highest clearance point of a pole jump, the winning punch of a boxing bout or the impact of a cricket ball on the middle stump in an important match? Scope for comedy effects could be provided by running in reverse, if that were possible. Both the Ampex and the R.C.A. have been working on improvements and developments of their television tape recording machines, both for black-and-white and for colour pictures. These developments include the use of transistors for reducing the size and weight, provision (by Ampex) of "Amtec", a device which automatically corrects geometric picture distortion, long-life air-bearing headwheel (by R.C.A.) and several other operational improvements.

The newest R.C.A. television tape recorder mobile van is itself a wonderful example of the rapid pace of development which has been applied to the problems of recording pictures. On a miniature scale, Ampex have designed a 30lb video tape recorder which occupies less than one cubic foot, for use by the U.S. National Aeronautics and Space Administration. This will be able to record, transmit, and erase a thirty minute programme of information, and then begin again. Video tape machines of three years ago look like antiques compared with these latest designs. Fortunately, many of the modifications and improvements can be added to existing equipments to keep them up-to-date. Tape itself has improved, too, with less drop-outs to produce that annoying effect of a horizontal snow-storm!

8mm Telecine

There is a wide range of film gauges now used in the cinemas and in home movies. The principal ones are the wide 70mm gauge used for the big "road-show" spectacular films like "Oklahoma" and "Around the



The Marconi Mark IV image Orthicon cameras and control equipment in use at the New Zealand Broadcasting Service's Channel I station at Wellington.

World in Eighty Days", the 35mm film. Recent improve- similar large screen projection, running horizontally across the gate and revealing a larger area picture, and, of course, the standard 35mm film projected in the normal way. In the home, in industry and in the schools, 16mm, 9·5mm and 8mm gauges are used. On television, the first two super-large screen gauges are not used, but telecine machines in England can take both 35mm and 16mm film of normal type, with optical (photographic) sound tracks. There are new moves afoot in the film industry to use magnetic striping for the sound on these tracks, to obtain better quality sound. At all television stations in Britain, use is already made of magnetic striping on 16mm films for newsreel and magazine stories and other locally produced material, but all commercials are still shot and printed on 35mm film. Recent improvements in film stocks, both for black-and-white and colour, have prompted both the BBC and certain of the ITV companies to explore the possibilities of using the 8mm gauge, with magnetic striping for the associated sound. The newest ITV programme company, Channel Television, operating in the Channel Islands, has been experimenting with the 8mm gauge, and will probably make use of it for local newsreel items from Guernsey, Alderney, Sark and Herm, as an addition to its 16mm film coverage in the Island of Jersey. Excellent picture quality is obtainable if the film is correctly exposed and processed, but the speed of 16⅔ frames per second on this gauge presents certain difficulties for sound.

However, here again the use of magnetic striped sound on the same film as the picture, or magnetic sound on a separate tape or film, used synchronously, provides the answer. The provision of 8mm telecine facilities at television stations will give an opening for the use of the many "hot news" items that are shot by amateurs who happen to be on the spot. The British Standards Institution has not yet agreed to the specifications, but it is likely that there will be two speeds of shooting: 25 frames per second for professional use, and 16⅔ frames per second for amateur use.

16mm Sound

Most of the film series imported from U.S.A. are sent on 16mm prints with optical sound tracks, often of inferior quality. It is high time that this was changed and striped magnetic tracks were applied to the film instead of the photographic sound. The improvement in sound quality would be enormous. When you hear poor sound on an American-made television film, it is invariably due to a badly printed 16mm photographic sound track, but the increased cost is insignificant when compared with the amount paid for the rights to transmit the film on television in England. Most imported film series are actually shot on 35mm film, but reduced to 16mm prints for cheapness in transport, import duties and storage. This is understandable. But the adherence to the old optical track on the 16mm prints is not so understandable.

"The Rag Trade"

Television is a close-up medium. Get close to your actors and you are able to appreciate all the smallest nuances of characterisation. This applies to farce just as much as straight drama, and underplaying is the rule for the best effect. However, when the viewers become thoroughly acquainted with all the characters, as in Granada's "Coronation Street" and BBC's "The Rag Trade", then the producers can allow their actors to "ham" a little without ruining the show. "The Rag Trade" has now reached the stage when "hamming" seems to be the order of the day, as, indeed, it should be in farce. With the excellent cast headed by Peter Jones, Miriam Karlin, Sheila Hancock and Esma Cannon, the comedy relationships of capital and labour in a dress factory, acquire a slapstick flavour.

Good scripting, amusing situations and expert direction are resulting in much laughter at the receiving end. The players are all playing at the camera— and not to an auditorium—and that makes a difference. Quite a different attitude to the camera is seen in the BBC's "Charlie Chester Music Hall", where the players seem much more interested in their live audience and their reactions, than in the end product at the receiving sets. This particular show is not helped by the settings, which might look fine in the Television Theatre, but merely dazzle on the television screen. The Temperance Seven, for instance, had a background that would have done credit as zig-zag war-time camouflage for the hull of a ship. When will art directors or designers realise that "busy" backgrounds are distracting and hideous.

SOME WAYS AND MEANS OF CURING INSTABILITY IN TELEVISION RECEIVERS

By K. Royal

IT is simple to establish that instability is present in a TV circuit, though it is often difficult to cure. It shows itself either on the sound or vision or on both in various ways. The common symptom on vision is extreme patterning and "water marks" across the picture which alter in formation as the contrast control is adjusted. On the sound channel, the symptom is either a harsh buzz (not to be mistaken for vision-on-sound) or complete cut-off of sound as the contrast control is turned beyond a critical point.

Symptoms

In many cases, instability occurs on both sound and vision channels simultaneously. This does not necessarily mean that there is trouble in both channels, because sound instability, for instance, is often reflected into the vision channel. There are various degrees of instability, and in severe cases it can result in a peak white screen and complete removal of the picture.

It often happens that the picture is fairly normal at low settings on the contrast control, but when the control is turned up to secure a better contrast ratio (black and white ratio) a point is reached where further increase of contrast becomes impossible as the picture cuts off and the screen becomes bright. This may give the impression that the contrast control is open-circuited a little way along the track, but one soon learns otherwise after replacing the control.

Oscillation

Instability is nothing more than the R.F. or I.F. amplifier stages changing from amplifiers to oscillators. For this to happen there must be a feedback path between the output and the input of the amplifier or amplifiers concerned. Instability can often be made to occur in a perfectly good amplifier by purposely displacing a wire connected, say, to the anode circuit of the final valve so that it runs close to the grid circuit of the first valve. A little of the output signal is then transferred back to the input in such a way that it adds to the input signal (if it is in phase). This gives a positive feedback loop and if the coupling is sufficiently tight (and it need not be very tight in a high-gain amplifier) sustained oscillation results.

The frequency of the oscillation is usually fairly close to the frequency of the tuned circuits in the amplifier, and if the oscillation is not very strong (very small output/input coupling), then the stage or stages may continue to pass signal in spite of the oscillation. This means that there are then two signals in the amplifier, the signal being amplified and the oscillation signal. These beat together and the difference frequency resolved by the vision detector "looks" to the video stages and picture tube like a picture signal component, and in that way patterns are formed on the picture.

If the oscillation is very strong, then the required picture signal has little chance of passing through the amplifier. The large amplitude oscillations have more effect, and are subsequently rectified by the vision detector. A large positive voltage is thus reflected on to the control grid of the video amplifier valve. This causes a very heavy current in the valve which greatly reduces the voltage at its anode and therefore at the cathode of the picture tube—which, of course, is the reason why the screen goes very bright.

In some sets the illumination remains even at the minimum setting of the brightness control and may lead to an incorrect (and expensive) diagnosis, since the symptom is likely to possess all the characteristics of a heater/cathode short in the picture tube. Owing to the heavy video valve anode current, the video load resistor may start overheating and the anode of the valve itself may be red hot.

Circuits

In Fig. 1(a) is shown the circuit of the tuner of a typical receiver. The sound I.F. signal is taken direct from the tuner output and with such an arrangement instability in both the sound and vision channels would first lead to careful examination of the tuner, since this is the only element common to both signals. On sets which use a common I.F. amplifier, similar trouble could be either in the tuner or common stage.

The various decoupling capacitors in the tuner which, if open-circuit, could cause instability are mainly the "lead-through" capacitors, C15A and C16A. These have a habit of breaking mechanically. The heater decoupler C15 and the screen by-pass C16 are other possibilities. The cathode by-pass capacitors do not often cause the trouble by themselves—unless they result in a phase shift—since without them degenerative feedback usually occurs.

Spurious-Frequency Instability

There is another form of instability which is worth examination; this is when a feedback path results in oscillation which is considerably removed in frequency from the tuned frequency of the amplifier. Even if the oscillation is of fairly large amplitude, the required signal passes through the oscillating amplifier section, and as the difference frequency resolved by the vision detector is far outside the pass-band of the video amplifier, and resolution capabilities of the picture circuits, a pattern is not produced. Two things happen, however; first the vision detector is heavily biased by the rectified spurious signal. And secondly, the video amplifier valve receives a standing positive bias which tends to outweigh the negative bias produced by the cathode resistor.

The effect on picture performance is also two-fold. Distortion of the overall video signal occurs in the detector and upsets the sync, chiefly the line lock, and the disturbed biasing of the video amplifier valve aggravates the effect and in addition considerably impairs the contrast ratio of the picture. A picture lacking in contrast and brilliance accompanied by poor synchronising is, therefore, the symptom which usually results.

Checking for Instability

Instability often appears when the gain of the amplifier is increased by turning up the contrast control as already described. The effect is sometimes modified by moving the aerial downlead about at the back of the set. For example, if the instability is causing patterning, then the pattern formation and strength is likely to change by moving the downlead.

Instability could be caused by a poor aerial system or unstable feeder, and in certain cases a feedback path is created via a set-mounted portable aerial system. However, a set exhibiting symptoms of instability which seem to be related to the aerial installation, must be fairly critical in operation at all times, even though instability may clear by altering the aerial or downlead.

In a set which is just on the point of oscillation, the picture quality is bound to be extremely poor due to inevitable distortion of the vision response curve caused by the positive feedback. If the picture definition (try on Test Card C) changes when the aerial feeder is moved about or if car interference appears as ill-defined dashes instead of pin-point focused spots of light, then the set is almost certainly on the point of oscillation.

Oscilloscope Check

A good check for oscillation is to couple an oscilloscope loosely to the anode of the vision detector diode. If the Y-amplifier will work at the frequency of oscillation and provided the 'scope does not load the detector input too much (which could restore stability), the oscillation will be displayed on the trace. The aerial should be removed and the input terminal loaded with a 68Ω resistor. The contrast should also be turned up full for this test.

(To be continued)

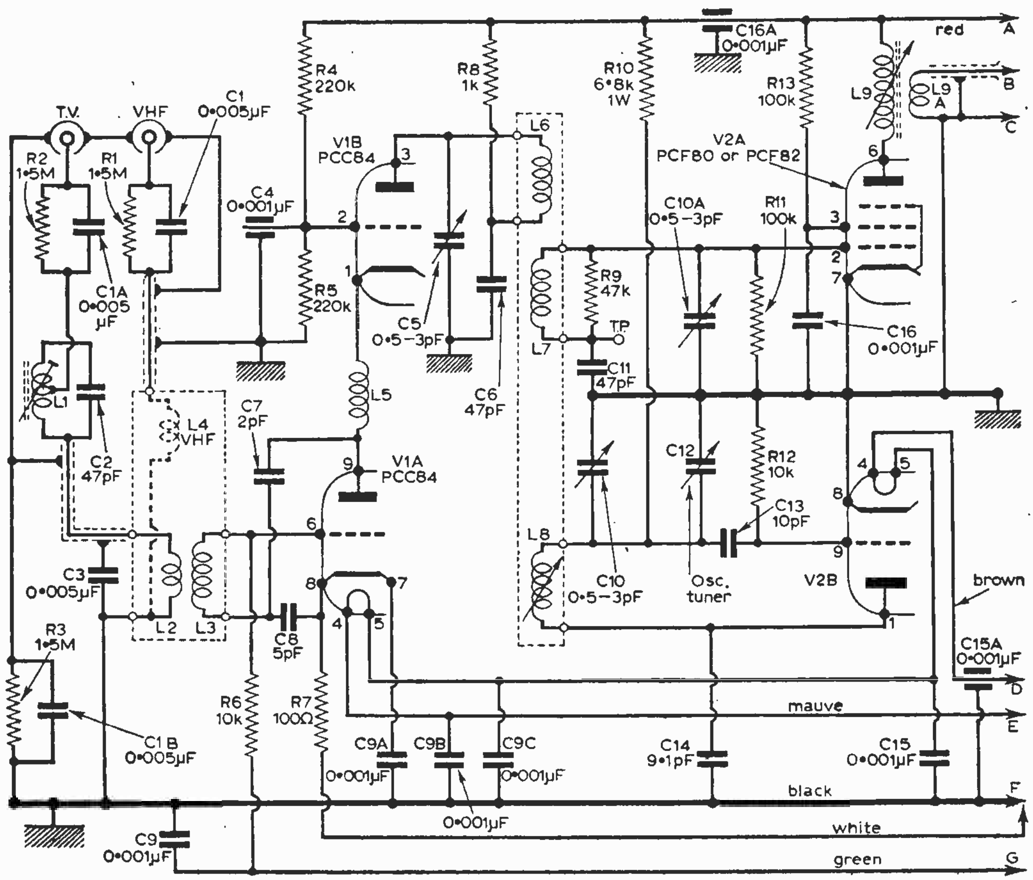


Fig. 1 (a)—The tuner circuit.

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

RST

MAIL ORDER DEPARTMENT
211 Streatham Road, Mitcham, Surrey
ALL VALVES LISTED ARE NEW STOCK
& Terms C.W.O. or C.O.D. Postage 3d. per valve.
MITCHAM 6202

AZ1 15/-
B65 8/6
DAF91 7/6
DAF96 8/9
DF91 4/-
DH719 6/-
DK91 8/-
EABC80 6/-
EAF42 9/6
EB91 4/-
EBC41 9/-
EBF80 8/6
EBF89 8/6
EC91 9/6
ECC33 5/-
ECC81 5/9
ECC83 7/6
ECC84 8/6
ECC85 8/-
ECF80 8/6
ECF82 8/6
ECH42 9/6
ECH81 8/-
ECL80 9/-
ECL82 9/6
EF37A 8/-
EF40 15/-
EF41 8/-
EF42 10/-
EF50(A) 4/-
EF80 5/-
EF85 5/-
EF86 10/6
EF89 9/-
EF91 4/-

EF92 4/-
EL42 10/-
EL84 6/9
EL90 8/6
EM80 8/6
EM81 8/6
EY81 8/6
EY84 10/-
EY86 8/6
EY91 4/-
EZ35 6/-
EZ40 7/-
EZ41 7/-
EZ80 7/-
EZ81 7/-
FC2 21/-
FC4 15/-
FC13 21/-
FC13C 21/-
GZ32 10/6
H30 5/-
H63 9/-
HBC90 9/6
HL92 8/6
HL133D 10/-
KT33C 8/-
KT66 15/-
LZ319 12/6
MKT4(5) (or 7) 17/6
ML4 8/6
MSP4 17/6
MU14 9/-
MX40 15/-
N142 9/6
N153 10/-
PCC84 9/-
PCF80 9/6

PCF82 7/-
PCL82 9/6
PCL83 12/6
PENA4 17/6
PEN4VA 17/6
PL36 15/-
PL81 12/-
PL82 8/-
PL83 10/6
PY80 7/6
PY81 7/6
PY82 7/6
PY83 8/6
R10 10/-
R19 19/-
TDD4 12/6
TP22 15/-
U142 7/6
U147 7/-
U153 8/6
UABC80 7/-
UAF42 8/6
UBC41 8/6
UBF80 8/6
UCH42 9/6
UCH81 8/-
UCL83 13/6
UF41 7/6
UF89 6/6
UL41 8/6
UL84 7/-
UY41 7/6

UY85 7/-
VP4B 17/6
W81M 6/-
W142 8/6
W719 7/6
W727 7/6
X78 21/-
X79 21/-
Z21 12/6
Z77 4/-
Z152 5/-
Z719 5/-
1R5 7/6
5U4G 4/6
5V4G 9/6
5Y3GT 8/6
5Z4G 10/-
6A6GT 13/6
6AL5 6/-
6AM6 4/-
6AN5 7/6
6AQ5 6/6
6BA6 6/-
6BE6 6/-
6BJ6 6/-
6BR7 12/6
6BW6 7/-
6BW7 5/-
6BX6 5/-
6D2 4/-
6F1 10/6
6F12 4/-
6F13 10/-
6F5G 4/6
6J7GT 7/6
6K7 2/-
6K7G 3/-
6K7GT 8/6

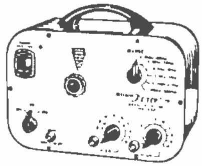
6K8G 7/6
6K8GT 9/6
6L1 13/-
6L8G 7/6
6L18 10/-
6L19 17/6
6N7G/GT 6/6
6SL7GT 6/-
6SN7GT 5/6
6V6G 5/-
6X5GT 8/6
7S7 10/-
7Y4 7/6
8D3 4/-
10LD11 15/-
12AH8 9/-
12AT6 7/6
12AT7 5/-
12AU7 8/6
12AX7 7/6
12BA6 7/6
12BE6 7/6
12BH7 10/-
12J7G/GT 8/6
12K7GT 5/-
12K8GT 10/-
12Q7 8/6
12Q7GT 6/6
35Z4GT 7/6
50L6GT 9/-

SEND FOR LISTS.

Quotations given for any types not listed. Obsolete and old types a speciality.

RADIO BARGAINS

SIGNAL GENERATOR



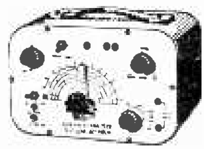
£7.5.0 or 30/- deposit and 6 monthly payments of **21/6. P. & P.** 5/6 extra. **Coverage 100 Kc/s. 100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics.** Metal case 10 x 6½ x 5¼ in. grey hammer finish. Incorporating three miniature valves and Metal Rectifier. A.C. Mains 200/250. Internal modulation of 400 c.p.s. to a depth of 30%; modulated or unmodulated R.F., output continuously variable. 800 millivolts. O.W. and mod. switch variable A.F. output. Incorporating magic-eye as output indicator. Accuracy plus or minus 2%.

OSCILLOSCOPE FOR D.C. and A.C. APPLICATIONS

A high gain, extremely stable differential Y-amplifier (30 mV/C.M.). Provide ample sensitivity with A.C. or D.C. inputs. Especially suitable for measurements of transistor operating conditions where maintenance of D.C. level is of paramount importance. Push-pull X amplifier; Flyback suppression; Internal Time-base Scan Waveform available for external use; pulse output available for checking TV line O/P Transformers, etc. Provision for external—I/P and C.R.T. Brightness Modulation. A.C. mains 200/250v. **£18.18.0.** P. & P. 8/- or **£4.13.0** deposit, plus P. & P. 8/- and 12 monthly payments of **26/6. Full 12 Months' Guarantee including Valves and Tube.**

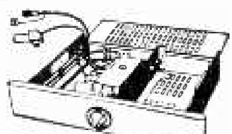
ALIGNMENT ANALYSER

TYPE MC12



A.C. mains 200/250 v. Provides: **"Wobbulator" (Swept Frequency) Operation,** for FM/TV alignment linear frequency sweep up to 12 Mc/s. From 400 kc/s -80 Mc/s. **Capacitance Measurement.** Two ranges provided. 0-60pF and 0-12pF. **Special Facility** enables true resonant frequency of any tuned oct. I.F. transformer, etc., to be rapidly determined. Cash price £7-5-0, plus 5/6 P. & P. H.P. terms 30/- deposit, plus 5/6 P. & P. and six monthly payments of 21/6.

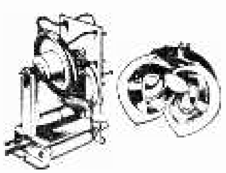
CHANNEL TUNER



Will tune to all Band I and Band III stations. BRAND NEW by famous manufacturer. Complete with P.C.C. 84 and P.C.F. 80 valves (in series). **I.F. 16-19** or **33-38.** Also can be modified as an aerial converter (instructions supplied). Complete with knobs. **32/6** plus 4/6 P. & P.

HEATER TRANSFORMER
To suit the above, 200-250 v., 6/-, plus 2/- P. & P.

LINE E.H.T. TRANSFORMERS



With built-in line and width control, 14kV. Scan coil, 90in. deflection on ferrite yokes. Frame O.P. transformer pl. 18 kV smoothing condenser. Can be used for 14in., 17in. or 21in. tubes. Complete with circuit diagram.

29/6 Plus 4/6 P. & P.

Focus Magnet suitable for the above (state tube). 10/- plus 3/- P. & P.

CHANNEL TUNER

I.F. 16-19 Mc/s continuously tunable from 174-216 Mc/s. Valves required, PCF 80 and PCC 84 (in series). Covers B.B.C. and I.T.A. ranges, also Police, Fire and Taxis, etc.

Brand new by famous manufacturer

10/- plus 3/- P. & P.

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

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

All enquiries S.A.E. **Goods Not Despatched Outside U.K.**

Trade News

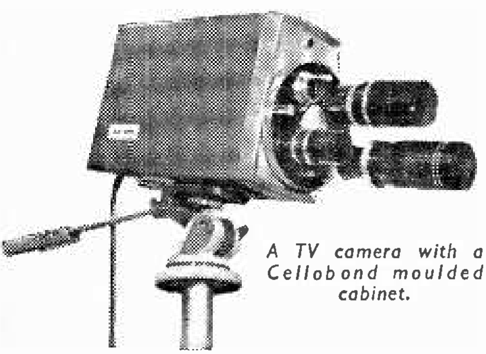
Closed Circuit Television

VISITORS to the Distillers Plastics Group stand at the Engineering Materials and Design Exhibition were able to operate a set of three Murphy cameras with Cellobond polyester/glass casings which were focused on to various parts of the stand and fed into a Murphy 23in. monitor. By operating a simple push button switch, visitors could look in on the various stand activities.

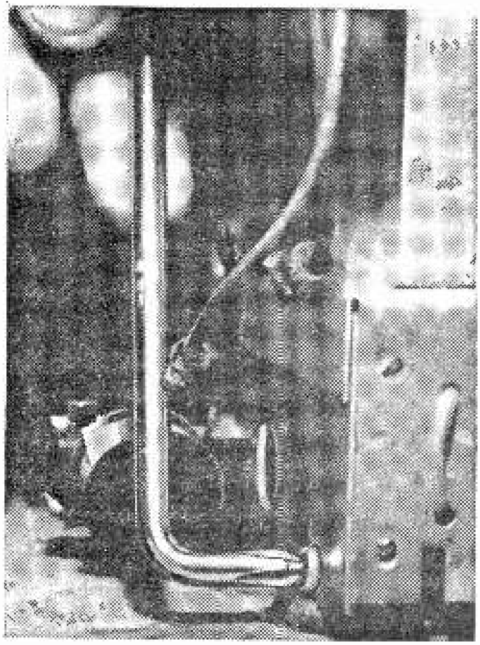
The basic equipment, supplied by Murphy Radio Ltd., Welwyn Garden City, consists of camera, power unit and monitor. The camera has a one piece casing, moulded in Cellobond fire retardent polyester resin reinforced with glass fibre. It measures approximately $7\frac{1}{2}$in. high x $4\frac{1}{2}$in. wide x $10\frac{1}{2}$in. deep and weighs only 7lb. The camera is designed to use either a single lens or a four lens turret.

If desired, the camera may be plugged directly into a domestic television set, instead of using a Murphy monitor, and a satisfactory picture can be obtained.

Cellobond polyester resins are manufactured and marketed by *British Resin Products Limited, Devonshire House, Piccadilly, London, W1.*



A TV camera with a Cellobond moulded cabinet.



A Stanley Screwdriver designed to reach Phillips screws in awkward places.

Phillips Screwdriver

TO cope with awkward-to-get-at screws—on television chassis, for example—Stanley have produced a double off-set Phillips screwdriver.

One end has a No. 1 point tip and the other end a No. 2 point tip, enabling the screwdriver to deal with the most popular sizes of Phillips screws in general use. The overall length is four inches, and it costs only 2s. 6d.

The screwdriver is manufactured by *Stanley Works (G.B.) Ltd., Rutland Road, Sheffield 3.*

Television Maintenance Aid in Aerosol Pack

AMBERSIL MS.4 is a new aerosol-packed silicone compound for use by television maintenance engineers. It is particularly suitable for lubricating, protecting and sealing disconnectable plugs, sockets and cable harnesses, for maintaining high surface resistance in humid conditions, for lubricating turret tuners and for preventing leakage around the anode caps of tubes. It can also help to improve reception by sealing aerial connectors.

Line output transformers and other open type components also benefit from the protection given by this silicone grease spray.

Ambersil MS.4 is a non-melting, highly water-repellent silicone grease, which is expelled from the pack as a fine spray containing a solvent which evaporates rapidly, leaving a thin protective film. By this means, protection can be given to inaccessible parts, with no risk of contamination from handling.

Ambersil MS.4 is made by *Amber Oils Ltd., 11a Albemarle Street, London, W.1.*

Letters to the Editor

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

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

EHT FAULT

SIR,—I thought that other readers might be interested to hear of an EHT fault, which appears to be fairly common, although not always recognised.

It takes the form of a "blooming out" and disappearance of the raster, as well as the extinction of the EHT rectifier filament glow. A few seconds later the raster reappears. This may continue for a long time before the final demise of the valve. It would seem that a break occurs in the heater and the two broken ends bend apart, breaking the circuit. As the valve cools, they bend together again, and the valve operates normally — G. J. POWELL (Marden, Herefordshire).

COLOUR TELEVISION

SIR,—In answer to Mr. Rogers' letter in the March issue, which I read with interest, I must agree with him. The definition is better on colour especially the young lady with the picture hat—every detail stands out perfectly in black and white. I have a Pye 9in. LV30 that is over 12 years old. I have taken out the tinted screen and replaced it with a clear glass and now have a good black and white picture. I have had many surprised comments on a fine picture. However, I have not noticed any stereoscopic effects during the colour transmissions.—H. SALMON (Catford).

VALVE SUBSTITUTION

SIR,—Thank you for your reply to my query concerning the curious fault on my Ferguson 968T. It may be recalled that the set worked fairly well with the efficiency diode disconnected—a most odd occurrence.

Having now carried out a complete check of the circuit I have found the explanation and it occurred to me that it might be of interest to other readers.

I had previously changed the PY31 for a 25Z4 and this proved to be the cause of the trouble. Whereas the PY31 has its anode connected only to pin 5, I have found that the 25Z4 anode is connected to both pins 3 and 5. In the set, the spare tag on pin 3 is used as a connecting point for the junction between sections 'd' and 'e' on the L.O.T. Thus, section 'd' was shorted out and the sequence of events is clear.

It occurrs to me that this is a trap which other people may fall into when substituting a 25Z4 for a PY31.—E. S. GREENFIELD (Bromley).

AERIAL PRE-AMPS

SIR,—Shortly after the end of the war there were a number of small amplifiers on sale in the surplus stores which were used by amateurs as aerial pre-amplifiers. I believe these had at least one valve included in the special boat-shaped housing, and power was supplied through a multi-cable running up the down lead. Now that the transistor has come into its own it appears to me that this will be a useful source for redesigning such an amplifier, for which, I believe, great claims were made. It prevented certain forms of "snow" or interference by providing a very high signal at the aerial in areas of weak signal strength and thus fed a strong signal to the aerial lead. Has anyone tried this idea or has a unit of the type mentioned which could be modified to try the scheme? Surely three or more transistors would provide a really hefty signal and give improved results.—G. BAKER (Truro).

[The "Transistorised Pre-amp" described in the April and May issues can be operated as a mast-head pre-amplifier.—Ed.]

SYSTEMS FOR PAY-TELEVISION

(Continued from page 434)

it then being necessary to press the button corresponding to the required programme.

However, at this stage the programme would not be received, for in order to bring the "pay" system into operation it is first necessary to insert the key and turn the key-switch on the side of the control unit. This action will "buy" the programme selected. The idea of the key is to avoid inadvertent "buying" of programmes that are not really required and to prevent the younger members of the household from running up an account or viewing unsuitable material when the older members of the family are not around!

When the key-switch is operated, pulses from the subscriber's unit are sent back over the cable network to electronic computing devices at a central point, where the data is collected and processed into individual subscriber accounts. The computing devices also provide an instantaneous and accurate viewer rating for each programme, which is a very important requirement of all "pay-TV" systems. ■

CLARKSON'S TUBE CHANGE

6A DENISON ROAD, LEEDS, 2

Tel.: LEEDS 24576

SUPER SCREEN TV TUBES
with 12 months' guarantee

Tubes all Types	Cash allowance on return of old tube	Actual Cost of Tube
12"—14" £5	15/-	£4. 5.0
15"—17" £6	25/-	£4.15.0
21" £8	30/-	£6.10.0

Carriage and Insurance 10/- extra.

Better, Brighter Picture Tubes

BRAND NEW THROUGHOUT—excepting glass

12in.	£4.10.0	14in.	£5. 5.0
15-17in. ...	£5.15.0	21in.	£7.15.0

New Silver Screen and Aluminising. All makes Mullard, Mazda, Emiscope, Cossor, Brimar, Emitron, etc.

REBUILT MULLARD AND MAZDA TUBES

12in.	£3. 0.0	14in.	£4. 0.0
15-17in. ...	£4.10.0	21in.	£6.10.0

All Tubes Fully GUARANTEED 12 MONTHS. Dispatch same day. Cash with Order. Carriage and Insurance 10/-.

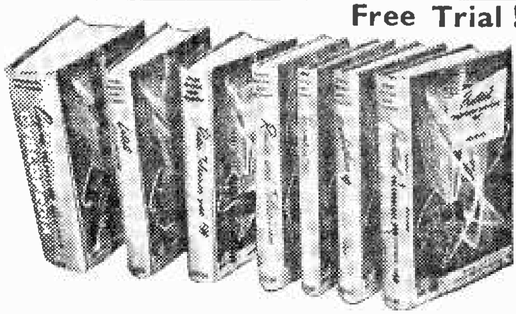
S.T.S. Ltd.

35 POUND STREET, CARSHALTON, SURREY

Telephone: WALLINGTON 9665

COYNE'S NEW JOB TRAINING BOOKS

Free Trial !



Put Money-Making Time Saving Know-how At Your Fingertips!

Just Like Having An Electronics Expert Right At Your Side !

Shows you the way to easier TV—Radio repair—time saving, practical working knowledge that helps you to repair sets faster! How to install, service and align ALL radio and TV sets, even colour-TV, UHF, FM and transistorized equipment! New photo-instruction shows you what makes equipment "tick." No complicated maths or theory—just practical facts you can put to use immediately right in the shop, or for ready reference at home.

Look over the list. Select up to three books you wish to see. List them by number on the coupon in order of preference. Books will be sent one at a time. When the first book has been paid for, the next will follow automatically. Customers who wish to see all three books at one time should include approximately one third of the total purchase price with their order. (Money refunded if not satisfied after 7 days examination). Balance of order may be paid for at 5/- per week or £1.0.0 per month. No interest charges are made.

No. 1. SPECIAL OFFER COYNE ELEMENTARY PRACTICAL RADIO-TELEVISION SET OF THREE VOLUMES total 1,038 pages, sturdy Vinyl washable covers. £3 12s. 6d. the set!

These three volumes present the principles of construction, operation and testing of radio and television equipment in a SIMPLE, EASY TO FOLLOW manner.

One very important way in which these books differ from many other radio and television books is that the publishers did not try to assume the "extent of technical knowledge" of the reader. Every subject is explained COMPLETELY—while at the same time keeping it brief and to the point.

You will find hundreds of photos, charts, diagrams, etc., in these books. These have been provided to make it easier to understand the explanations.

No. 6. COYNE TELEVISION SERVICING CYCLOPEDIA. Harold P. Manly.
Quick and concise answers to TV problems in alphabetical order, cross indexed, fully illustrated, covers hundreds of questions involving radio TV, electronics operation and repair. 450 illustrations; photos, diagrams, charts, test patterns, etc., 860 pages. Vinyl washable cloth covers. Price 47/6

No. 19. REFRIGERATION SERVICE MANUAL. H. P. Manly.
Learn Refrigeration! This manual is a course in itself. Packed solid with information to enable you to do that repair job yourself. Used by many leading refrigeration firms as a standard reference. Features 364 pages together with 157 illustrations bound in cloth. An excellent buy at only 24/- plus postage.

No. 8. PIN POINT TV TROUBLES IN 10 MINUTES.
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. Thousands already sold. This is a *must* for every TV enthusiast. 31/6.

No. 7. TRANSISTOR CIRCUIT HANDBOOK. Louis E. Garner, Jr.
A practical Transistor Circuit Reference Handbook by the eminently qualified Louis E. Garner, Jr., one of the greatest writers on transistor applications. Dozens of how-to-do-it illustrations with more than 200 circuit diagrams. Over 400 pages. Vinyl washable cloth covers. Price 47/6.

No. 4. LATEST INSTRUMENTS FOR SERVICING RADIO AND TELEVISION.
This up-to-the minute book tells all about modern radio, TV and electrical testing equipment and how to use it. Money-making short cuts on trouble-shooting, servicing, construction, and other jobs. Over 350 pages, 220 photos and diagrams. All data has been pre-tested in the Coyne radio shops. Washable Vinyl cloth covers. 26/-.

No. 5. PRACTICAL TELEVISION SERVICING AND TROUBLE SHOOTING MANUAL.
A book of fast time saving methods for servicing TV receivers. Includes dozens of new testing ideas all of which have been proven on the job. Contents include TV Servicing methods, TV Servicing Instruments. Tuners, Video I.F., Amplifiers, alignment, etc., with 200 crystal clear photos and diagrams. 437 pages. Vinyl washable cloth covers, Price 34/-

No. 9. PIN POINT TRANSISTOR TROUBLES IN 12 MINUTES.
Trouble-shoot every type of circuit in ALL transistorized equipment! 525 pages; hundreds of illustrations; 120 check charts. 47/6.

No. 39. SIM-TECH RADIO & ELECTRONICS BASIC COURSE. 36/-.

MAIL COUPON NOW FOR

Free Trial Offer !

To **SIM-TECH BOOK COMPANY (U.K.)**
Mail Order Division, DEPT. PTV22, Gaters Mill, West-End, Southampton, Hants.

☐ SEND (Insert Book numbers here) (   ) (   ) (   )

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

☐ ENCLOSED please find ONE-THIRD purchase price amounting to £   :   s.   d. with order. I agree to remit the balance as per offer.

NAME ____________________

ADDRESS ____________________

City ____________ County ____________

Postage charges: Orders under £3 allow 1/6. Over £3 allow 2/- extra.

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. 451 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

BUSH TV80

On advancing the contrast or brilliance controls, the picture increases in size and fades progressively. Increase in white content of the scene causes a proportionate increase in size and decrease of illumination. The best adjustment gives a low overall illumination. There is no really gross defocussing, though there is some distortion.

On switching off, the picture collapses, not to a rectangle or spot, but to a short brilliantly illuminated horizontal line.

This fault was previously obscured by a grainy weak signal effect found to be due to a faulty PCF80 which of course also gave weak sound. The sound is now normal. There is some vision-on-sound present too.—N. Webber (Ilford, Essex).

First ensure that the ion trap magnet on the rear of the tube neck is set correctly for maximum brilliance. If there is no improvement, replace the EY51 valve which is wired to the top of the line output transformer. Soldered connections must be carefully made with a hot iron to ensure well rounded connections with no sharp edges or wire ends.

ALBA T372

The top part of the picture pulls across the screen to the left and although I have adjusted the controls there is no improvement. The top-half of the picture also seems cramped. I have changed a good number of the valves.—C. Wallis (Rhondda).

You should check the components associated with the sync separator—V7 EF80—particularly to pins 2 and 7. Also check the main electrolytic capacitor 60 + 250μF and the frame output valve V12 ECL80 and associated components.

ULTRA V815

I seem to be unable to control the height of the picture on this set. Whatever I do with the height control the picture is always about 1½in. up from the bottom of the screen and the top of the picture is out of sight. In some cases we cannot see the heads of people on the picture. In other words, the lines in the composition of the picture are cramped up very close at the bottom, but wide apart at the top. Also at the top right-hand corner of the screen there appears a dark patch when the set is on. The quality of the picture is good otherwise. I have tried the focus control, but that doesn't appear to help at all.—J. E. Davis (Derbyshire).

You should check the frame output valve 20P3 by substitution and if necessary check the 0·5μF capacitor to pin 5 and the 50μF electrolytic capacitor across the frame form control. Centre the picture by means of the shift control associated with the focus assembly.

DECCA DM2/C

I am experiencing a form of "motor-boating" on my set which I cannot trace.

It is present when any of the frame controls are moved and appears at different pitches. When the frame linearity is at the "earthy end" the noise goes altogether.

The picture and sound are both good apart from this noise.—J. E. Day (Fife).

Whilst the trouble appears to be due to an open circuited electrolytic capacitor, check 100 + 200μF and sound output 8μF (particularly the latter—trace from pin 8 of the PCL83, front right). You should also check the bonding and screening on the front control panel, on the volume control and note the effect of moving the cable-forms from these controls.

RGD 6014T

Would you please explain how I could boost the emission of the tube on this set?—H. Cotcher (Wallsend-on-Tyne).

You should wire a 5k 10W resistor from the 1·5A (Blue) fuse holder to pin 1 of the CRT base.

PYE V4

This set has a MW 36/44 tube. I should like to change it with a MW 36/24. Could you please inform me if any alterations are required to the tube base?—W. Moore (Barwell, Leicestershire).

The V4 receiver is wired to take either an MW 36/44 or an MW 36/24 without any circuit alterations.

BAIRD D2117

Lately, after first switching on, I get sound on vision unless I turn the fine tuner right away from sound. After the set has thoroughly warmed up I can turn the tuner practically right back without any further trouble.

I have tried resetting the oscillator slug without success and I wondered if it was a faulty valve contact inside the valve which heating up makes good.

I should be grateful for your advice.—F. J. Lineton (Wellington, Shropshire).

It would appear that the sound rejectors are out of alignment and either require resetting or the capacitors across the coils replaced. The coils are L9 and L10 and a 56pF capacitor is shunted across each. The alignment frequency is 38Mc/s adjusting for minimum vision. Alternatively adjust on the loud tuning note. Check the main electrolytics and 0·002μF decouplers.

BUSH TV56

The fault is cramping at the top accompanied by a little brighter patch at about 1½in. from the top. The added brightness is most noticeable when the set is switched to a vacant channel.

I have changed the frame output valve PCL83, and R107, R106, R103, R97, R105, C90, C88, C85, C84, and C57.

Do you think it could be shorted turns in the frame output transformer?—C. W. Jones (Burry Port).

We should suggest you try another PCL83 before suspecting the frame output transformer. Whilst this could be at fault as you suggest, the PCL83 is most often responsible.

INVICTA 127

The BBC picture when first switched on is covered with a "snowstorm" which gets less as the set warms up. It seems as if the aerial is all right as it gives a good picture on another set.

The horizontal hold is so critical that it needs frequent adjustment. Also any writing on the screen slopes to one side and all circles are very distorted.

At times on ITA only I have observed a flashing at the right-hand side accompanied by wavy lines.—D. J. Searle (Bodmin, Cornwall).

It would appear that the snowstorm effect is caused by the fact that the contacts in the tuner unit are faulty. The chassis should be removed and the tuner cover released to give access to the contacts which should be cleaned and adjusted if necessary.

You should straighten the picture by rotating the scan coils to the correct position. Replace the rear centre PCF80 valve (line oscillator sync separator), check the rear right side PCL82 and replace its 270Ω bias resistor (R81) if necessary.

KB NEW QUEEN OV30

I have recently replaced the EHT rectifier but since doing this, black borders have appeared at each side of the picture. As no further width adjustment is possible, can you suggest any means of increasing it?

Also, I would like to know if the coils in the turret tuner can be retuned without the use of special equipment.—J. Meryl (Stoke-on-Trent).

The lack of width could be due to a deteriorating H.T. metal rectifier (RM4) or to a low emission 50CD69 line output valve. Check the H.T. line voltage which should not be under 210V. If it is, suspect the metal rectifier. If it is over 210V check the 50CD69.

The oscillator coil cores can be retuned from the front by switching to the desired channel, removing the knob and inserting a fairly long knitting needle through the hole exposed to trim the recessed core. The knitting needle should have a shaped end like a screwdriver tip and should be non-metallic.

ALBA T493

The sound is excellent but when the picture comes on, it appears as if there are three distinct vertical panels of equal size—the centre one being the brighter.

I have tried the three knurled knobs situated at the end of the tube, turning each one half a turn at a time, but this does not give a full picture. —M. R. Adams (Glencraig).

This fault is caused by the line timebase working at the incorrect speed and the correct speed being outside the range of the line hold control. Suspect an increase in the value of one of the resistors connected to the line hold control.

SOBELL TS17

The picture will not lock, no matter how carefully the frame hold control is operated.

V7 and V13 have both been changed without any improvement.—D. E. Williams (London, S.W.6).

Replace the OA71 semi-conductor diode which is connected in the anode circuit of the triode section of the frame oscillator.

FERGUSON T103

This set has a poor picture although the raster is normal. The frame and line hold controls are critical and there is no response to the contrast control. All the valves and tuner contacts have been checked. I suspect the vision detector, but I haven't a service sheet.

Could you also tell me how to adjust ITV channel 12 coils for fitting to a Ferguson portable TV, and if channel 9 coils could be adjusted or rewound to suit? Only the slug at the front has been touched.—E. W. Freeman (Plymouth).

We regret that we cannot help regarding a service sheet, but you should be able to obtain one from one of our advertisers. The vision detector could be responsible, but since the contrast fails to operate, we feel that the trouble is caused by impaired sensitivity or lack of input signal. If the aerial system is in good order and works well on another set, have a look in the tuner for a burnt resistor. This sometimes happens due to a short in an associated by-pass capacitor. In this event, both components should be replaced.

The only adjustment that should be attempted on any turret coil is the oscillator slug. This should be adjusted for maximum sound consistent with minimum sound on vision with the fine tuning control at the centre of its travel. It is not feasible to rewind coils for a different channel.

PILOT

I can get a good picture or good sound by tuning the oscillator core but not both at once.

The fine tuner makes no difference whatsoever. —A. Cooper (Guildford).

This is caused either by a weak aerial signal or by misalignment of the sound and vision I.F. stages. The trouble would, of course, result from the use of the incorrect tuner.

(Continued on page 451)

EARN THE

SIMTECH

CERTIFICATE OF PROFICIENCY IN ELECTRONICS

NOW *ANYONE* CAN AFFORD TO TRAIN TO BE AN EXPERT IN RADIO & ELECTRONICS

EVEN QUALIFY FOR A CERTIFICATE

It's the most exciting news of the year! Just imagine. You can get 35 large, fact-packed lessons for little more than 1/- per lesson! The lessons are crystal clear, practical easy to master and use. Early lessons make fundamentals clear even to the beginner, while other lessons will give you the practical 'know-how" of an expert.

Compares favourably with some courses costing ten times as much. You save because you receive all the lessons at one time and are not required to purchase equipment you do not need.

This is a real home-study course that has been bound into one giant 8 x 11in. 216 page manual. Each page is divided into two columns. A wide column features the text, while a narrow column at the side has the instructor's comments, helpful suggestions and additional pictures to simplify the difficult parts.

Everyone can benefit from this practical course. No old fashioned (or psuedo modern) methods used here, just straight forward, easy to understand explanations to help you make more money in electronics.

As an optional extra, you can pay a further fee if you wish to complete the questions set at the end of each lesson and have an expert check your answers. Students who attain a minimum of 60% correct answers can qualify for a certificate of proficiency in basic radio and electronics. Details sent with each course ordered.

You must be convinced that this is the best value you have ever seen in electronic training, otherwise your money will be refunded without qualm or quibble on return of the course (in clean condition) after you have examined it in your own home for a period of seven days.

The price? Only 13/6 deposit with order and two one monthly payments of 12/-. Total 37/6. The last shipment of this course sold out within 10 days and hundreds of customers had to await our next consignment. Avoid delay! Send right now to reserve your copy.

To SIM-TECH TECHNICAL BOOKS, Dept. TC.2, Gater's Mill, West End, Southampton, Hants.

☐ RUSH Radio and Electronics Course for seven days examination. I enclose deposit of 13/6, which you promise to refund if I am not completely satisfied. If I keep the course I will forward the balance of 24/- in two payments of 12/- monthly.

☐ SAVE! Send only 36/- if paying cash with order. (We pay postage). Same 7-day money-back guarantee.

Name ____________

Address ____________

____

City ________ County ________

D. & B. TELEVISION

Phone: Cherrywood 3955
Dept. B5

131 & 131a KINGSTON ROAD, South Wimbledon, London, S.W.19

"Compare our prices with any others"

For the **FINEST, FASTEST SERVICE** in the **COUNTRY**. We are open from **10 am.. Until 7 p.m. (1 p.m. Wednesday)** For any information or problems you have, Call or Phone, we are always pleased to help.

HUGE PURCHASE ENABLES US TO SELL TRANSISTORS AT THESE ASTONISHING PRICES

Mullard: OC44, 9/-; OC45, 8/-; OC71, 5/-; *OC72, 6/-; *OC76, 7/-; *OC77, 12/-; *OC81 7/-; OC81D, 6/-; **G.E.C.:** GET875, 11/3; GET874, 6/11; GET873, 6/10; *GET115, 7/6; *GET114, 4/8.

* Available in matched pairs at 1/- extra.

Mullard Diodes: OA81, 2/9; OA90, 2/9; OA91, 2/9; **G.E.C.**; GEX34, 3/3.

Ekco 221/283 Tuners. Special Price **£2.10.0**, including valves.

ALL VALVES ARE SOLD SUBJECT TO FULL GUARANTEE—**CURRENT VALVE LIST**

AZ31	8/6	EBC41	7/6	EF92	4/-	PCF80	7/6	SP61	2/3	UCH81	8/3	6CD6	25/6	10P14	8/9
B36	5/6	EBF80	7/6	EL33	7/6	PCF82	7/9	U22	6/6	UCL83	12/6	6D2	3/-	12AT6	7/3
CBL31	20/-	EBF89	8/3	EL38	12/-	PCF86	14/6	U24	10/-	UF42	3/9	6F1	4/6	12AT7	4/6
CCH351	2/6	EBL31	20/-	EL41	7/9	PCL82	7/-	U25	12/-	UL41	7/-	6F12	3/-	12AU7	5/6
CL33	10/-	ECC81	4/6	EL84	6/9	PCL83	9/9	U26	9/6	UL44	10/9	6F13	6/6	12AX7	6/6
D77	3/-	ECC82	5/6	EM80	8/6	PCL84	7/6	U31	7/-	UL46	7/-	6F14	9/-	19BG6	14/6
DAF91	5/-	ECC32	6/3	EM81	8/6	PCL85	15/-	U37	17/-	UL84	7/3	6F15	9/-	20D1	8/6
DAF96	7/-	ECC84	7/9	EM84	9/6	PL33	8/-	U50	5/6	UU8	14/6	6F33	6/3	20F2	8/3
DF91	3/9	ECC85	7/6	EY51	7/9	PL36	9/9	U52	5/-	UU9	6/3	6L1	12/-	20L1	12/6
DF96	7/3	ECF80	8/-	EY86	7/6	PL38	14/6	U191	9/6	UY41	6/-	6L6	9/9	20P1	9/6
DH63	6/-	ECH21	15/-	EZ40	6/3	PL81	9/-	U281	9/-	UY85	6/6	6L18	8/-	20P3	12/-
DH77	4/6	ECH35	9/-	EZ41	6/9	PL82	6/6	U282	14/6	W77	4/-	6L19	12/-	20P4	16/6
DK91	6/-	ECH42	7/6	EZ80	6/6	PL83	6/6	U301	17/6	Z77	3/-	6SN7	4/6	20P5	14/6
DK92	7/6	ECH81	7/6	GZ32	8/9	PL84	8/9	U801	22/-	5U4	4/9	6V6	5/-	27SU	14/6
DK96	7/3	ECL80	7/3	GZ34	12/6	PY31	7/-	UABC80	8/6	5V4	8/9	6U4	10/-	30C1	7/6
DL91	8/3	ECL82	9/9	KT33C	6/-	PY32	10/-	UAF42	8/-	5Y3	6/3	7C5	7/3	30FL1	9/3
DL92	6/3	ECL83	11/9	KT36	8/6	PY80	6/-	UB41	7/9	5Z4	10/-	7C6	7/6	30L1	7/6
DL94	7/-	EF39	4/3	KT61	8/3	PY81	6/-	UBC41	7/9	6AL5	3/-	7S7	9/3	30P4	11/3
DL96	7/-	EF50	1/3	KT63	6/3	PY82	6/-	UBF89	7/9	6AM6	3/-	7Y4	7/6	30P12	8/-
EABC80	7/3	EF80	4/6	KTW61	5/9	PY83	8/-	UCC84	12/6	6AT6	5/6	10F1	4/6	52KU	10/-
EAF42	7/9	EF85	6/3	KTW63	5/9	PY88	12/-	UCC85	7/9	6BG6	12/-	10C1	10/-	53KU	10/-
EB41	6/6	EF86	8/9	L63	2/9	PZ30	8/-	UCF80	14/6	6BW6	7/6	10C2	13/-	54KU	8/6
EB91	3/-	EF89	6/6	PCC84	7/6	R18	10/-	UCH21	12/3			10P13	8/9	185BT	14/6
EBC33	4/6	EF91	3/-	PCC89	8/9	SP41	2/3	UCH42	7/-						

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

We pride ourselves that we can obtain and supply any TV spare, OUR GIGANTIC STOCKS INCLUDE: Line, Frame and Sound Output, Line and Frame Blocking Osc., Trans., and Scan Coils for any make or model Television.

Please ask us for ANY components you may require we are almost certain to have them.

TERMS: S.A.E. all enquiries. C.W.O. or C.O.D. 3/- extra. Postage on Valves, 6d. each. C.R.T.s 12/6 inc. insurance. SATISFACTION ASSURED. RETURN POST SERVICE.

FIRST-CLASS TELEVISION and RADIO COURSES

GET A CERTIFICATE!

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

FREE GUIDE

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

SUCCESS OR NO FEE

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

FOUNDED 1885—OVER 150,000 SUCCESSES

NATIONAL INSTITUTE OF ENGINEERING

(Dept. 462), 148 HOLBORN LONDON, E.C.1

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

NEW VALVES!

Guaranteed Set Tested

24-HOUR SERVICE

1R5, 1S5, 1T4, 3S4, 3V4, DAF91, DF91, DK91, DL92, DL94. SET of 4, 18/6.
DAF96, DF96, DK96, DL96. SET of 4, 26/-.

1D5	7/-	DL35	9/6	PCC89	9/-
1R5	5/6	DL92	5/11	PCF80	7/9
1S5	4/6	DL94	6/9	PCF82	7/6
1T4	3/3	DL96	6/9	PCL82	8/3
3S4	5/11	EB91	3/-	PCL83	10/-
3V4	6/9	EBC41	7/6	PCL84	9/9
5U4G	4/6	EBF80	7/9	PL36	10/9
5Y3GT	5/9	EBL21	12/-	PL81	8/6
5Z4G	8/6	ECC40	13/-	PL82	6/6
6AM6	2/9	ECC81	4/9	PL83	6/6
6K7G	1/9	ECC82	5/9	PL84	8/-
6K8G	4/9	ECC83	6/9	PY32	11/-
6Q7G	5/6	ECC84	8/-	PY80	7/-
6V6G	4/-	ECC85	7/6	PY81	7/-
6V6GT	6/6	ECF80	7/3	PY82	6/-
6X5GT	4/6	ECF82	8/3	PY83	7/3
12K7GT	4/3	ECH21	12/-	U25	11/-
12K8GT	9/-	ECH42	7/9	UABC80	6/-
12Q7GT	4/6	ECL80	5/9	UAF42	8/-
12SN7GT	7/3	EF40	11/-	UBC41	7/-
35L6GT	8/-	EF41	7/6	UBF80	8/-
35Z4GT	5/-	EF80	4/3	UCC85	7/-
AZ31	8/9	EF85	4/6	UCH21	11/6
CL33	11/-	EF86	8/6	UCH42	7/6
DAC32	8/6	EF89	6/9	UCH81	8/9
DAF91	4/6	EF91	2/9	UCL82	9/3
DAF96	6/9	EL41	9/-	UCL83	13/-
DF33	8/6	EL84	6/3	UF41	6/6
DF91	3/3	EY51	7/3	UF89	6/9
DF96	6/9	EY86	7/6	UL41	7/6
DH77	6/-	EZ40	6/-	UL84	6/6
DK32	10/6	EZ41	7/6	UY21	13/-
DK91	5/6	EZ80	5/9	UY41	5/6
DK92	7/3	EZ81	6/-	UY85	6/3
DK96	7/3	MU14	6/-	VP4B	8/6
DL33	7/6	PCC84	7/-	Z77	2/9

Postage 6d. per valve extra. Any Parcel Insured Against Damage in Transit 6d. extra Any C.O.D. Parcel 3/- extra.
Office address, no callers.

GERALD BERNARD

(Note new address—formerly of Leeds)
83 OSBALDESTON ROAD, STOKE NEWINGTON, LONDON, N.16

(Continued from page 448)

PYE

Just recently the picture on this set tends to fold in at both sides and the hold controls will not rectify this fault.

I would be pleased if you could advise me on this matter.—J. Tighe (Manchester).

The trouble is due to low H.T. This is generally caused by a faulty H.T. rectifier, which is to be found clamped to the side of the chassis below the EHT unit on some receivers, or which is a PY32 valve on others.

RGD R1

The trouble occurs on the ITV channel. The set is tuned to Westward TV on Channel 9.

The aerial has been tuned directionally and is in the best position for reception. The interference takes place only when there is foggy weather. It is a "venetian blind" effect which runs up and down the screen, also slipping from side to side.

When the weather here recently was really foggy the picture was completely covered by these lines, and also sound break-through was experienced. Could this fault be due to TWW, whose channel number is 10, breaking through? I have tried to make a filter to overcome this, but with no success. —M. Stevens (Weymouth).

The correct treatment for the fault is realignment of the I.F. stages, but from your description we would hesitate to say that it is TWW break-through. The type of effect which you can see is very similar to co-channel interference. in which case the offending station will be also on channel 9.

HOME-CONSTRUCTED SET

I intend, in the near future, to convert my home-constructed 9in. television set to a 14in. model. I realise that the timebases will have to be completely rebuilt.

I hope to use an electrostatic focused tube—either the AW36/80 or CME1402, which are both 90° deflection types.

With an electrostatic focused tube, I realise that no focus magnets are required, but what arrangements are made for picture shift controls, or will these not be necessary? If this is the case, will there be nothing on the tube neck other than the ion trap and the deflection coils?

I intend to use a line output transformer/scan coil set advertised in "Practical Television," and I would be most grateful for your help over these points.—I. S Massey-Crosse (Sussex).

This will necessitate a complete rebuild, of course. A picture shift assembly is required on the tube neck. Most firms specialising in timebase components are able to supply such an item to suit the type of tube eventually selected.

ALBA T301

This set has acquired a fault which I cannot solve. The symptom is reduced picture size—the picture is about 4in. square in the centre of screen.

I have checked all the valves with my Avo Multi-minor tester and all voltages seem near enough correct in accordance with the service sheet.

The EHT seems to be in order, I get quite a good spark from the tube anode. I have replaced the following valves—PL81, PY81, PY82 and PL82, but with no improvement.

The sound section of the receiver is unaffected. —L. J. Thurlow (Tingewick, Buckinghamshire).

We doubt if all valve voltages are quite correct and we would direct your attention to the boosted H.T. line at the junction of the width coil, the transformer, the 0·1μF boost capacitor and the 39k resistor, to the height control, etc. You will probably find that this voltage which should be over 400V is probably nearer 200V which could well indicate that the 0·1μF is shorted or leaky.

405/625 SWITCHING

(Continued from page 431)

carriers disappear, of course, and the CCIR carriers (vision at 38·9Mc/s and sound at 32·9Mc/s) occur as shown. It will be seen that there is a reversal of carrier positions and that the separation on CCIR is 6Mc/s.

The switching which is required to cause this to happen is not too involved. This is S5A in Fig. 7. In the "405" position the various rejectors are in circuit and narrow the right-hand side of the response, as already explained, while in the "CCIR" position the rejectors are switched out and the CCIR sound rejector (L9) is switched in.

Contrast Control

A rather interesting contrast control is adopted in the Pye V700D. A pre-set arrangement works in conjunction with the vision AGC on V1 (Fig. 7) of the vision I.F. amplifier. The manual control, however, is situated in the anode load circuit of the video amplifier valve, as shown in Fig. 9.

The contrast control R2 is connected in parallel with the video load R1 and the compensating inductor L1, and the amount of signal required for correct contrast is tapped off via the slider of the control through the D.C.-reducing circuit R4 and C2 and fed to the cathode of the picture tube. A potential-divider comprising R5 and R6 stabilises the D.C. at the cathode.

A degree of compensation at high contrast settings is provided by C1 and the tap on the contrast control. As the control is turned towards the tap (e.g., towards maximum) progressively more shunt capacitance is applied across the signal to the cathode. ■

QUERIES COUPON

This coupon is available until JUNE 22nd, 1962, and must accompany all Queries sent in accordance with the notice on page 447.

PRACTICAL TELEVISION, JUNE, 1962.

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.

SITUATIONS VACANT

VACANCY EXISTS for TV. Radio mechanic. Country town, Southern Ireland. Box No. 33.

Central Electricity Generating Board

South Eastern Region
North Thames Division

required at

Bradwell (Nuclear) Generating Station Essex

Maintenance Craftsmen (Instruments)

Rate of Pay 6s. 3d. per hour.

Craftsmen are required for the Instrument Maintenance Department for routine and breakdown maintenance for the following:—

1. Mechanical and Electrical Instruments.
2. Electronic equipment, radio and television.
3. Telecommunication type equipment.

Applicants should have a thorough knowledge of one of the above fields and should be willing to learn new techniques.

Rented housing accommodation is available to the applicants appointed.

Permanent superannuable posts; increase of wage after 2 years' service; holidays with pay; sick pay scheme; canteen.

Applications, stating age, qualifications, present position and past experience to be sent to the Station Superintendent, Central Electricity Generating Board, Bradwell Generating Station, Bradwell-on-Sea, Essex.

F. W. SKELCHER
Assistant Regional Director.

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

MISCELLANEOUS

MUSIC and MUSICAL ACCESSORIES Catalogue 1/-. Agents wanted. Darwins, 19 George Street, St Helens, Lancs.

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 N.8.

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

ROTARY CONVERTERS for TV: input both 12V and 24V; Splendid reception; High Efficiency Units. £5/10/-. Delivery 4/6. TEDDINGTON ENGINEERING CO. LTD., Elleray Road, Teddington, Middx. TEDdington Lock 5454.

QUALITY is CHEAPEST

We supply all BVA rebuilt TV tubes. Completely remade as new, by the ORIGINAL MANUFACTURERS and fully guaranteed. S.A.E. enquiries to:—

REDWATT TUBE DISTRIBUTORS
(BVA Specialists)
41 Denmark St., Wakefield, Yorks.

NEW AND SURPLUS VALVES, fully guaranteed, from **3/6** each. Also reclaimed valves, perfect, from **1/6** each. Many genuine valve bargains. S.A.E. for complete list. LEWIS, 46 Woodford Avenue, Ilford, Essex.

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

Please send S.A.E. for Free List of 1000 valves and terms of Business. All letters S.A.E. please.

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

TRANSFORMERS

Line – Frame – Output – Oscillator – and Scan Coils

COMPARE THESE PRICES!

L.O.P. Txs.

ALBA: T301, T304, T394, T484, T494, etc	46/6
BUSH: TV11A, 11B, 12A, 12B, TVG12A, 12B, TRG12A, 12B	44/-
TVG26, TV32, TV33, TVG34, TVG34A, T36, TV36, TVG36, TV36C, TVG36C, TV43	88/6
TV53, TV56, TV57, TVG58, TV62, TV63, TV66, TV67, etc.	94/-
TV80 with EY51	109/-
COSSOR: 930 and T,931, 933-4-5, 937, 938A, and F, 939 and A and F	61/6
943T, 940-946, 945, 945B	58/6
945F, 947, 949	68/6
DECCA: D17 and C	68/6
DM1, DM2C, DM3, DM4/C	74/-
DM5, DM14, DM17, 444, 555	74/-
DEFIANT: TR1453, TR1753	58/6
DYNATRON:	
EKCO: TS93, TC8102, TS105, TS114, TRC124, TC138, TS188, TS193	54/-
TRC139, TC140, T141, TV142	78/6
T161, TC162, T164, T165, etc.	78/6
TC208, TV209, T231, T221, T231F, T248, T283, T284, T293, etc.	58/6
FERGUSON: 103T, 105T, 113T, 135T, 145T	65/6
941T-953T inclusive	58/6
991T—997T inclusive	68/6
203T—246T inclusive	68/6
306T, 308T	64/-
FERRANTI: 14T3, 14T3F, 13T4	47/6
17K3 and F, 17T3 and F	47/6
17K4 and F, 178K4 and F	47/6
17T4 and F	47/6
14T5, 178K5, 17K5	47/6
G.E.C.: BT1251, BT1252, BT1746, BT1748, BT4743	48/6
BT4643, BT5147, BT5246-48	88/6
BT5348-BT5643R inclusive	48/6 and 88/6
H.M.V.: 1824 and A to 1831 inclusive	66/6
1840, 1841, 1842-1848	66/6
All models available.	
INVICTA: T118, T119, T120	54/-
All other models available.	
K.B.: LFT50, LVT50, LFT60, MV60	106/6
All models available.	
MARCONI: All models available.	
MASTERADIO: Most models in stock.	
McMICHAEL: Most models in stock.	
MURPHY: V200, V202C	56/6
V240, V250	94/-
PETO SCOTT, PHILCO: Most models in stock	
PAM: 908, 909, 952, 953, 958	54/-
PHILIPS: 1768U, 2168U	104/-
1100V, 1200V	74/-
1220U, 1236V, 1238V	74/-
114UF, 114UM, 115U	74/-
1437U, 1446U	74/-
Most models in stock.	
PILOT: Most models in stock.	
PYE: CTM4, FV4C, FV4COL	54/-
V4, VT4, V7, VT7	54/-
LV30, FV1, FV1C	69/6
C817F, CTM17F, CW17	68/6
CW17C, CW17CF, CW17F, etc.	68/6
Most models in stock.	
RAYMOND: Most models in stock.	
REGENTONE: All models available.	
R.G.D.: 6017T, 7017, C54, etc.	58/6
Most models in stock.	
SOBELL: TS17, T346	64/-
Most models in stock.	
STELLA: ST5721U	104/-
ST8617U, ST8621U	104/-
ST8917U	104/-
ST6414U, ST6417U	74/-
ST8314U	74/-
ULTRA: 86 series, 815 series, with U25, etc, complete	78/6
Most models in stock.	
VIDOR: CN4217-CN4231 inclusive	64/-

Also: USED O.P. Txs., SCAN COILS etc.

ALL GUARANTEED 90 DAYS

Post and Packing 3/6. (*All enquiries S.A.E.*)

Write for SAME DAY DISPATCH to:—

MARLEY SUPPLIES · 21 PITLAKE · CROYDON · SURREY

Croydon 8800 And at 2 Wellfield Road, S.W.16 (near Streatham Library)

SETS & COMPONENTS
(continued)

TELEVISION TUBE SHOP

We have the following

Unused, Guaranteed Tubes

in stock now

Carriage up, but prices down.

AW36-20,21	£5. 2.6
AW36-80	£5. 7.6
AW43-80, 88	£6. 7.6
C12A, C12B	£4.12.6
C14BM, FM	£5. 5.0
C17BM, FM, HM	£6. 7.6
C17LM, PM, SM	£6.12.6
C21 HM, SM, TM	£7.17.6
CME1402	£5. 7.6
CME1702, 1703	£6.12.6
CRM121, 2, 3, 4	£4.12.6
CRM141, 2, 3, 4	£5. 7.6
CRM152, 153	£5.12.6
CRM171, 2, 3	£6. 7.6
MW22-16	£4. 2.6
MW31-16, 74	£4. 2.6
MW36-24, 44	£5. 2.6
MW41-1	£6.12.6
MW43-64, 69	£6. 7.6
MW53-20	£7.17.6
MW53-80	£7.12.6
T901A	£6.12.6
14KP4A, 141K	£5. 2.6
171K, 172K, 173K	£6. 7.6
7201A, 7203A	£5. 2.6
7204A	£5. 5.0
7401A	£6. 7.6
7405A	£6.12.6

All tubes tested before despatch and guaranteed for 12 months.

CARRIAGE 7/6, via B.R.S. or 12/6 via passenger train.

TERMS £2 down balance £1 per month.

Send for our **EQUIVALENT LIST** for tyoes not shown. Almost every type can be substituted.

Shop Soiled Tubes

(Subject to Availability)

12in. 3/18, 3/31 **45/-** Others **57/6**
14in. CRM141, 2 **60/-** Others **57/6**
17in. CRM171, MW43-69, 43-64, **75/-**. Plus Carriage. Guaranteed for 12 months.

TELEVISION TUBE SHOP

48 BATTERSEA BRIDGE ROAD S.W.11

BAT 6859

South of the Bridge. Open Sats. until 4 p.m.

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 9d. 6AL5, 6AM6, 6D2, 6F12, 6F13, 6F14, 6F15, 8D3, 9D2, 15D2, 78, D1, D77, D152, DD6, DD41, EB91, EF50, EF91, P61, SP61, UB41, UF42, VR35, VR51, VR107, VR137, Z77. More at 1/9, 2/9, and 5/9. Post 1—9d., 6—1/6. Stamp tor FREE List.

P.P. COMPONENTS LTD.,

623 Romford Rd, Manor Pk, London E.12.

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.

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.

RADAR 202 CRT Tester/Reactivator. —LAYTON, 58, Kings Ave, Holland-on-Sea, Essex.

FOR SALE

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

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.

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

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

Continued facing page

FOR SALE
(continued)

SERVICE SHEETS

SERVICE SHEETS
(continued)

EDUCATIONAL

PLEASE MENTION PRACTICAL TELEVISION WHEN REPLYING TO ADVERTISEMENTS