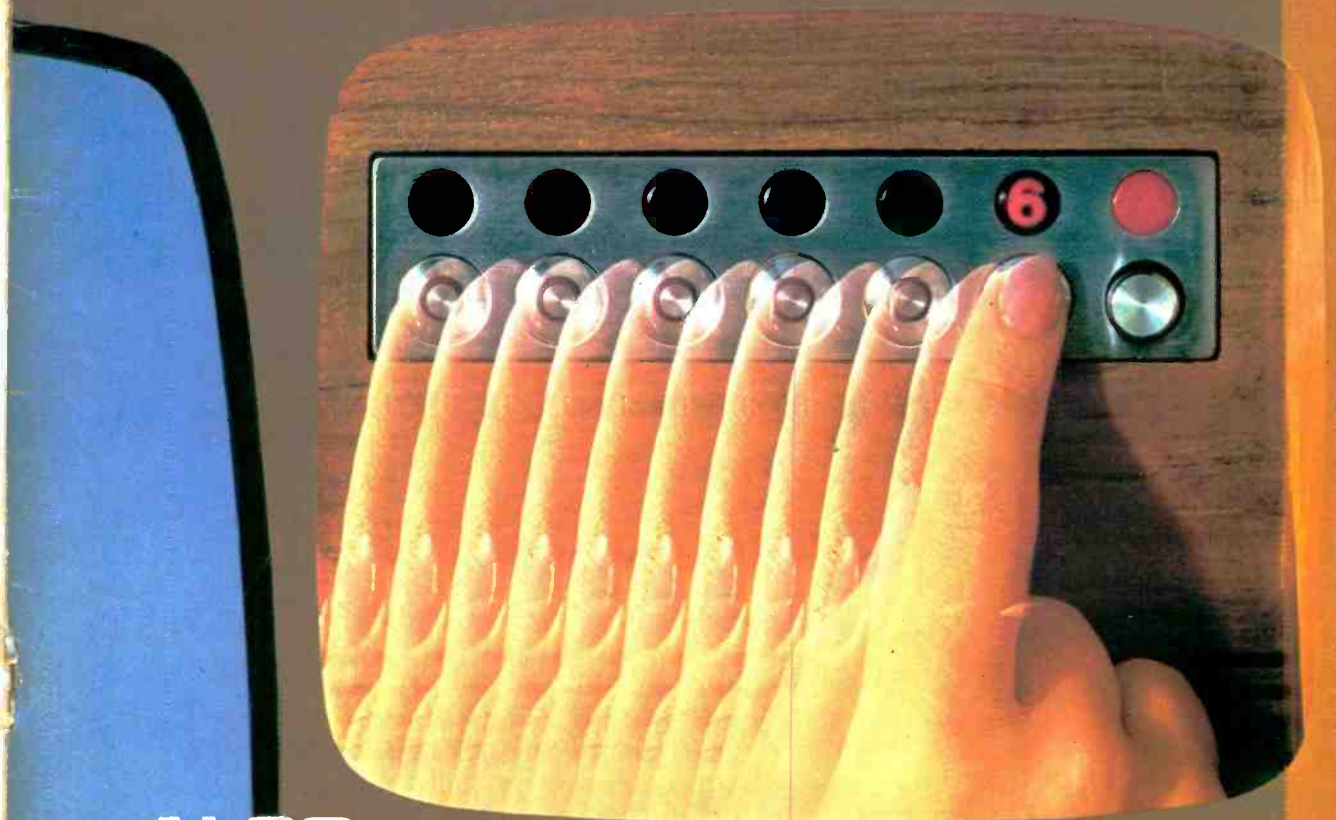
TELEVISION

20p

SERVICING · CONSTRUCTION · COLOUR · DEVELOPMENTS

APRIL 1973

touch-sensitive TUNING



ALSO:

WIDEBAND BAND III PREAMPLIFIER

FAULT-FINDING - ITT/STC LINE TIMEBASES

SERVICING THE BUSH/MURPHY TV181S/V2016S SERIES

Branded TTL I.C.'s

7400	20p	7475	65p	µA 709	34p
7413	30p	7476	45p	µA 710	45p
7420	20p	7490	75p	µA 723	85p
7473	40p	7492	75p	µA 741	65p
7474	40p	7493	75p	µA 748	60p

I.C. Sockets

Dual-in-line or Zig-Zag 14 and 16 pin
Our Price 1p per pin.

VDR's & Thermistors

A15B	75p	GL23	£1·00	VA1005	15p
CZ1	15p	R53	£1·32	VA1026	13p
CZ4	13p	R54	£1·46	VA1033	13p
CZ13A	13p			VA1040	10p
E298 ED/A258	10p			VA1053	10p
E298 ZZ/06	10p			VA1055S	10p
GL16	£1			VA1034	10p

Potentiometers

5KΩ 50KΩ 500KΩ
10KΩ 100KΩ 1MΩ
25KΩ 250KΩ 2MΩ

log or lin less switch (& 1KΩ lin)	12p
log or lin with switch	24p
dual less switch	40p
dual with switch 10K, 100K & 1M log only	62p
10K log +10K antilog less switch	40p

Capacitors

Ceramic – plate 63V (C333)

1·8pf	8·2pf	33pf	120pf
2·2pf	10pf	39pf	150pf
3·3pf	12pf	47pf	180pf
3·9pf	15pf	56pf	220pf
4·7pf	18pf	68pf	270pf
5 6pf	22pf	82pf	330pf
6·8pf	27pf	100pf	

all 5p. each

mylar film 100V

1000pf	2p	·01µF	3p	·068µF	4p
2000pf	2p	·02µF	3p	1µF	4p
5000pf	2p	04µF	3p	·2µF	5p
		·05µF	3p		

metallised polyester 250V (C280)

·01µF	3p	·068µF	3½p	·47µF	8p
·015µF	3p	·1µF	4p	·68µF	11p
·022µF	3p	·15µF	4p	1µF	13p
·033µF	3p	·22µF	5p	1 5µF	20p
·047µF	3p	·33µF	6½p	2·2µF	24p

metallised polyester 400V (C281)

·01µF	4½p	·047µF	6p	·22µF	10p
·015µF	4½p	·068µF	6p	·33µF	14p
·022µF	4½p	·1µF	7p	·47µF	15p
·033µF	5½p	·15µF	8p		

mixed dielectric 600V

·01µF	7p	·047µF	7p	·22µF	16p
·022µF	7p	068µF	8p	·47µF	24p
·033µF	7p	·1µF	8p	1µF	33p

mixed dielectric 1000V

1000pf	6p	6800pf	9p	·1µF	12p
2200pf	6p	·01µF	9p	·22µF	22p
3300pf	6p	·022µF	9p	·47µF	30p
4700pf	6p	·047µF	12p		

Ceramic

12KV.d.c.		8KV.d.c.		HI-K 750V.	
10pf	9p	200pf	9p	1000pf	5p
15pf	9p	220pf	9p	1500pf	5p
22pf	9p	250pf	9p	2000pf	5p
68pf	9p	270pf	9p	3000pf	5p
82pf	9p	300pf	9p	5000pf	5p
100pf	9p	750V DISC		10,000pf	5p
120pf	9p	470pf	5p	feed-	
140pf	9p	1000pf	5p	through	
150pf	9p	5000pf	5p		
180pf	9p	10,000pf	5p	1000pf	5p

Transistors

AC128	16p	BC172	18p	BF184	25p
AC176	15p	BD115	67p	BF185	25p
AF139	28p	BD124	£1·01	BF194	15p
AF239	30p	BD131	70p	BF195	15p
BC107	10p	BD132	70p	BF196	15p
BC108	10p	BD131/2M.P.	£1·40	BF197	15p
BC109	10p	BF115	25p	BF272	53p
BC147	10p	BF167	20p	BFY50	24p
BC148	10p	BF173	20p	BRY39	36p
BC149	10p	BF180	25p	BSX21	26p
BC171	21p	BF181	30p	BU105	£2

Resistors

½ watt 5% Carbon Film – low noise Hi-Stabs

All E24 values 1p each plus p. & p. 7p for up to 50 Resistors and a further 2p for each additional 50. Deduct 33⅓% for 100 of one type or 25% for mixed orders over £1 in value.

1 W	10% Carbon Composition	3p each
2 W	10% Carbon Composition	6p each
2½ W	5% Wire wound	9p each
5 W	Wire wound	9p each
10 W	Wire wound	10p each

plus p. & p. 7p for up to 25 resistors plus 1p for each additional 25

TV Electrolytics

1; 2; 4; 8µF 450V	14p	32µF 450V	20p
16µF 450V	15p	50µF 350V	20p
8+8µF; 450 V.W	18p	32+32µF; 350 V.W	25p
8+16µF; 450 V.W	20p	32+32µF; 450 V.W	43p
16+16µF; 450 V.W	25p	50+50µF, 350 V.W	35p

16+100+100+300µF; 275 V.W	£1.23
32+100+125+200µF; 275 V.W	£1.23
32+100+200+200µF; 300 V.W	£1.23
100+100+100+150+150µF; 320 V.W.	£1.66
175 (400v)+100+100µF; 350 V.W.	£1.66
60+100+200µF; 300 V.W.	93p
100+200µF; 275 V.W.	75p
100+200+200µF; 300 V.W.	£1
100+400µF; 275 V.W.	£1.15

200µF; 275 V.W 50p 300+300µF; 300 V.W. £1.90

Diodes & Rectifiers

AA119	9p	BA156	15p	BY176	£1·50
AA120	9p	BA243	56p	BY182	£1·50
AA129	9p	OA47	10p	BY250	23p
BA102	25p	OA79	9p	IN4001	6p
BA115	17p	OA90	7p	IN4002	7p
BA130	10p	OA91	7p	IN4003	8p
BA145	20p	OA200	10p	IN4004	8p
BA148	20p	BY100	15p	IN4005	10p
BA154	13p	BY126	15p	IN4006	12p
BA155	14p	BY127	15p	IN4007	15p

Power Sections

ohms	
7, 9, 10, 12, 14, 17·5, 20	@ 700mA 20p
22, 25, 28, 30, 33, 36	@ 700mA 25p
40, 47, 52, 56, 60, 63, 66	@ 300mA 20p
75, 87, 100, 120, 140, 160	@ 300mA 25p
180, 200, 220, 250, 270	@ 300mA 25p
300, 350, 400, 470, 560	@ 120mA 20p
726	@ 150mA 25p
1KΩ	@ 100mA 20p
2KΩ	@ 70mA 25p

plus p & p. 7p per section.

Eliminators

9 volt @ 20mA (PP3)	£1.25
6 volt @ 50mA	£1.50
9 volt @ 50mA	£1.50
6+6 volt, 50mA	£2.50
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7½ volt for cassette recorders	£2.00
6, 7½ or 9 volt	£3.00
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Car Battery Converter fully stabilised to provide 6, 7½ or 9 volts	£4.99

(p & p. 15p on all types)

EHT Rectifier Trays

(5 stick version) for BRC Chassis i.e. Ferguson, Ultra, Marconiphone & HMV – 950 Mk II, 960, 970 & 1400 chassis
Our Price £3·60 plus p. & p. 20p

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(1) 37Ω +31Ω +97Ω +26Ω +168Ω	50p
(2) 14Ω +26Ω +97Ω +173Ω	50p
(3) 30Ω +125Ω +2·85KΩ	50p

plus p. & p. 7p per dropper.

Presets

Vertical or Horizontal

0·1 watt 5p		0·25 watt 7p		
100	1K	10K	100K	1M
250	2·5K	25K	250K	2·5M
500	5K	50K	500K	5M

CHROMASONIC electronics

MAIL ORDERS Where no p & p. charge is shown, a minimum of 7p applies, p & p on overseas orders is charged at cost
ADDRESS TO: TV Component Dept. 56, Fortis Green Road, London, N10 3HN.
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We are breaking up the following TV sets
Ferguson Model 506T. Bush TV75. TV85. TV95. TV105. Pye 11U. 13U. Range Murphy V310. V410. V500. Philips 1768U. 17TG100. Thorn 850 Range. We have other popular makes which are too numerous to mention. A S.A.E. with your query please.

The prices of spares for the above and other makes are as follows: L.O.P.T. Tested from £1·60. Tuner with valves less knobs, from 85p. Speaker Output Transformers 22p. Speakers all 3 Ohms 2½ Watts, 6 x 4 ins., 8 x 2½ ins., all 30p. Post on any speaker 12p. Silicon Diode Kits Ex TV BY 100 types 35p Post Paid.

Special Offer
We have just purchased from a TV firm 1,000 EX RENTAL TV SETS. These are complete but untested 12 Channel TV sets, 17 in. £1.10, 19" £3.30. Carriage on any set £1.75.

Reclaimed TV Tubes all with 12 months guarantee
AW43/88 £1·75. AW43/80 £1·75. MW43/69 £1·10. Special offer Brand New Brimar Tubes C17PM £1·10. Many other types in stock. Carr. and Ins. on any Tube £1·75.

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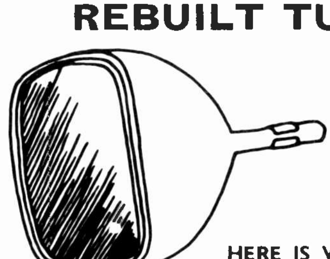
Valve list ex-equipment. All valves tested on a Mullard valve tester before despatch. 3 months guarantee on all valves. Single valves P.P. 3p. Over post paid.

ARP12	6p	PCF80	6p	U191	20p
EB91	5p	PCC84	6p	6BW7	15p
EF80	9p	PCL82	12p	6F23	15p
EF85	15p	PCL83	15p	6U4	12p
EBF89	15p	PCL84	15p	20P3	10p
ECC81	10p	PL36	20p	20P1	20p
ECC82	15p	PY81	8p	20D1	10p
ECL80	9p	PY33	20p	30F5	12p
EF91	5p	PY82	8p	30FL1	20p
EY86	20p	PL82	8p	6/30L2	20p
EF183	20p	PL83	8p		
EF184	20p				

REBUILT TUBES!



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Mono		Rimband & Twin Panel		Colour	
15-17"	£4·75	19"	£6·50	19"	£22·50
19"	£5·00	23"	£8·50	22"	£25·00
21"	£6·00	24"	£9·50	25"	£27·50
23"	£7·00			26"	£29·00

Exchange Basis
Carriage 75p (carriage-ins. £1·50)

Cash or cheque with order, or cash on delivery
Guarantee 1 year

★ Each tube is rebuilt with a completely new gun assembly and the correct voltage heater.

★ Each tube comes to you with a guarantee card covering it for Mono Tubes, two years against all but breakage.

★ Each tube is insured on the journey.

★ Each tube is rebuilt with experience and know-how. We were amongst the very first to pioneer the technique of rebuilding television tubes.

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SPECIFICATION: *The Lawson range of new television tubes are designed to give superb performance, coupled with maximum reliability and very long life. All tubes are the products of Britain's major C.R.T. manufacturers, and each tube is an exact replacement. Tubes are produced to the original specifications but incorporate the very latest design improvements such as: High Brightness Maximum Contrast Silver Activated Screens, Micro-Fine Aluminising, Precision Aligned Gun Jigging, together with Ultra Hard R.F. High Vacuum Techniques.*

DIRECT REPLACEMENTS FOR MULLARD-MAZDA BRIMAR GEC, ETC.

A47-11W	MW43-69	C19/AK	CME1903	172K
A47-13W	MW43-80	C21/1A	CME1905	173K
A47-14W	MW52/20	C21/7A	CME1906	212K
A47-17W	MW53/80	C21/AA	CME1908	7205A
A47-18W	AW47-97	C21/AF	CME2101	7405A
A47-26W	AW53-80	C21/KM	CME2104	7406A
A59-11W	AW53-88	C21/SM	CME2301	7502A
A59-12W	AW53-89	C23/7A	CME2302	7503A
A59-13W	AW59-90	C23/10	CME2303	7504A
A59-14W	AW59-91	C23/AK	CME2305	7601A
A59-15W	C17/1A	CME1601	CME2306	7701A
A59-14W	C17/5A	CME1602	CME2308	A50-120W/R
AW43-80	C17/7A	CME1702	CRM172	MW36/24
AW43-88	C17/AA	CME1703	CRM173	MW36/44
AW43-89	C17/AF	CME1705	CRM212	CRM141
AW47-90	C17/FM	CME1706	CRM211	
AW47-91	C17/5M	CME1901	23SP4	
MW43-64	C19/10AP	CME1902	171K	

LAWSON TUBES

18 CHURCHDOWN ROAD,

MALVERN, WORCS.

Malvern 2100

2 YEARS' GUARANTEE FULL TUBE FITTING INSTRUCTIONS

Tubes are despatched day of order by passenger train, road or goods taking far too long for customers satisfaction.

REBUILT TUBES

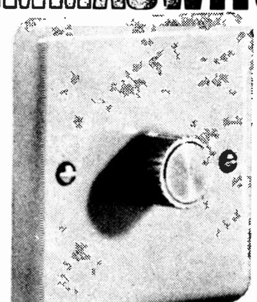
LAWSON "RED LABEL" *CRTS are particularly useful where cost is a vital factor, such as in older sets or rental use. Lawson "Red Label" CRTS are completely rebuilt from selected glass, direct replacements and guaranteed for two years.*

	New Tubes £	Red Label £	Colour Tubes old glass not required
14"	3·50	—	
17"	6·25	4·97	19" £39·50
19"	7·25	5·25	
21"	8·50	6·95	22" £43·50
23"	9·75	7·25	
19" Twin Panel	10·25	8·25	25" £47·50
23" Twin Panel	15·50	9·75	
16" Panorama	8·50	—	26" £49·50
19" Panorama	9·38	6·95	
20" Panorama	10·50	7·50	carr. £1·50
23" Panorama	11·95	8·75	

Carriage/Insurance: 12"-19" **62p.** 20"-25" **75p**
Plus V.A.T. Rate from April 1st.

Vary the strength of your lighting with a

DIMMASWITCH



The DIMMASWITCH is an attractive and efficient dimmer unit which fits in place of the normal light switch and is connected up in exactly the same way. The white mounting plate of the DIMMASWITCH matches modern electric fittings. Two models are available, with the bright chrome knob controlling up to 300 w or 600 w of all lights except fluorescents at mains voltages from 200-250v, 50Hz. The DIMMASWITCH has built-in radio interference suppression.

600 Watt—**£3·20.*** Kit Form **£2·70***
300 Watt—**£2·70***. Kit Form **£2·20***

All plus 10p post and packing. *From 1st April please add appropriate percentage V.A.T. increase.

Please send C.W.O. to:—

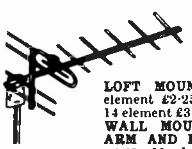
DEXTER & COMPANY

5, ULVER HOUSE, 19 KING STREET, CHESTER CH1 2AH. Tel. 0244-25883

As supplied to H.M. Government Departments, Hospitals, Local Authorities, etc.

U.H.F. TV AERIALS

Suitable for Colour and Monochrome Reception



All U.H.F. aerials now fitted with tilting bracket and 4 element reflector.

LOFT MOUNTING ARRAYS. 7 element £2·25. 11 element £2·75. 14 element £3·25. 18 element £3·75. **WALL MOUNTING c/w WALL ARM AND BRACKET.** 7 element £3·25. 11 element £3·75. 14 element £4·25. 18 element £4·75. **CHIMNEY MOUNTING ARRAYS c/w MAST AND LASHING KIT.** 7 element £4. 11 element £4·50. 14 element £4·75. 18 element £5·25. **MAST MOUNTING** arrays only 7 element £2·25. 11 element £2·75. 14 element £3·25. 18 element £3·75. Complete assembly instructions with every aerial. LOW LOSS coaxial cable 9p yd. KING TELEBOOSTERS from £3·75. LABGEAR all band V.H.F.-U.H.F.-F.M. radio mains operated preamps £7·50. State clearly channel number required on all orders. P.p. on all aerials 50p. Accs. 15p. C.W.O. Min. C.O.D. charge 25p.

BBC-ITV-FM AERIALS

BBC (band 1) Wall S/D £2. **LOFT** inverted 'T' £1·25. **EXTERNAL** 'H' array only £3. **ITV (band 3)** 5 element loft array £2·50, 7 element £3. **COMBINED BBC-ITV** loft 1+5 £2·75. 1+7 £3·50. **WALL AND CHIMNEY UNITS ALSO AVAILABLE.** Pre-amps from £3·75. **COMBINED** U.H.F.-V.H.F. aerials 1+5+9 £4. 1+5+14 £4·50. 1+7+14 £5. **FM RADIO** loft S/D £1. 3 element £3·25. 4 element £3·50. Standard coaxial plugs 9p. Coaxial cable 5p yd. Outlet box 30p. P.p. all aerials 50p. Accs. 30p. C.W.O. Min. C.O.D. charge 25p. Send 5p for fully illustrated lists.

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Rebuilt with new Electron Guns to British Standard 415/1/1967.

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01-640 3133/4/5

Britain's Largest *Independent* TV Tube Rebuilder

TELEVISION

SERVICING · CONSTRUCTION · COLOUR · DEVELOPMENTS

VOL 23 No 6
ISSUE 270

APRIL 1973

HARD EARNED CRUST

What effects would one expect as a result of the introduction of Value Added Tax (VAT) in the UK? Apart from price adjustments there could be far-reaching changes in trading policy generally. In the radio, TV and allied trades in particular there will be trying times ahead for many.

Unlike purchase tax, VAT is dependent on the price charged by the shopkeeper or serviceman. Shops selling at the top recommended retail prices will attract the maximum VAT levy. To be competitive it has always been necessary to keep a careful eye on costs: with VAT this will be all the more so. The trader who can afford to reduce his profit margin and increase his turnover will considerably improve his chances of survival. Many smaller businesses however will find it even harder to compete with the established giants, some of whom are already setting up "hypermarkets"—large discount warehouses. The larger organisations such as Curry's, Civic, Thorn TV Rental Shops, Comet Warehouses, Woolco, GUS and so on are rapidly expanding and this means great pressure on the high street shop and serviceman—undoubtedly to the detriment of service to the public.

The small trader with a turnover of less than £5,000 is exempt from registration under VAT. But because of this he cannot reclaim any VAT that has been passed on to him, whether the goods he supplies are zero-rated or not: he is in the same category therefore as any member of the public who has to pay VAT for goods and services. Further, he cannot pass VAT charges on to his customers since no "official" record of his trading will be kept for tax purposes (unless he is responsible for a limited company). Thus the only recompense he has will be to increase his charges: this could lead to indiscriminate marking up with loss of customer confidence.

It is depressing that money always has the last word. There is no consolation for the individual who is trying to earn a crust through honest hard work in supplying the needs of local or specialist groups.

M. A. COLWELL—*Editor.*

THIS MONTH

THE NEXT ISSUE DATED MAY WILL BE PUBLISHED APRIL 16

Cover : Grateful acknowledgements this month to ITT Consumer Products Ltd. who provided the striking touch-sensitive tuning photograph. The unit shown is used in the KB "Feathertouch 100" 26in. luxury colour receiver.

VAT AND TELEVISION

As newspapers and magazines are zero-rated there is no VAT chargeable on TELEVISION magazine—though we are having to add VAT to our servicing problems charge (now 11p including VAT instead of 10p). The prices quoted in the advertisements in this issue are correct to the best of our knowledge at the time of going to press. From April 1st 1973 however purchase tax is abolished and most of the items in our advertisements will be subject to VAT at the standard rate. Readers should bear this in mind when ordering.

TELETOPICS

EFFECT OF BEAB APPROVAL

Now that the BEAB (British Electrotechnological Approvals Board) scheme for television receivers is coming into operation it is vital for service engineers and dealers to be aware of the effect of the scheme on servicing requirements. Replacement parts in certain sections of receivers that have been given BEAB approval *must be the correct approved components*. BEAB safety certificates are given only after strict testing and certain components which have undergone specific tests may therefore be replaced only with components that satisfy the same requirements (to BS 415, 1972)—otherwise the safety factors for mains-operated domestic electronic equipment guaranteed by the new testing scheme may be cancelled. A BEAB spokesman has commented that following an accident with a receiver an action for negligence could be taken if it could be shown that an unapproved component had been used for replacement purposes. We shall be examining the BEAB scheme in detail later this year.

SERVICEABILITY RATING

While on the subject of testing television sets the serviceability programme started in the USA by the National Electronics Association would seem to merit some close attention over here. Under this scheme serviceability panels, consisting of certificated electronic technicians, assess models to give them a serviceability rating. There is a detailed list of points that have to be checked, all relevant to ease of servicing—for example "are all service controls accessible through and identified through the back of the set and also identified on the chassis?"—and each question has a points rating. Although most modern chassis can be dealt with without too much difficulty nevertheless such a scheme could act as a valuable watchdog in the interests of both the trade and the public.

TRADE SCENE

The latest set delivery figures (for November 1972) released by BREMA show clearly the way in which the colour boom suddenly escalated towards the end of last year: in August 109,000 colour sets were delivered to the trade, in September 186,000, in October 199,000 and in November 214,000.

A new luxury model in the **Siemens** range, featuring touch-sensitive tuning, has been introduced by Interconti Electronics Ltd. The Model FC375 is fitted with a 110° 26in. tube and the suggested price is £399. The first offering from **ITT** this year is a new version of the **KB** Featherlight 12 mains-battery portable. The Featherlight Super 12 as it is called features flush-mounted controls which cannot be altered or broken when the set is caried and has a recommended price of £69.

The **Rank-Bush-Murphy** group has adopted the name **Rank Radio International.**

WHERE THE SETS COME FROM

Once upon a time it was cotton sheets that came from the Far East (as we called it). Then it was watches and cameras, transistor radios and, um, typewriters. And nowadays of course it's television sets. As you probably know the world's leading producer of television sets has for some years been Japan. But now we learn that Taiwan sold no less than 3.5 million monochrome sets last year, representing about 18 per cent of the world market. That did surprise us somewhat.

TOUCH-SENSITIVE TUNING

Our cover this month features the touch-tuning control unit used in the ITT-KB Feathertouch 100 luxury 26in. colour receiver. This model is fitted with the ITT CVC7 chassis, a version of the CVC5 chassis slightly modified to provide for the touch-tuning feature. The CVC5 series has proved to be a reliable design giving excellent pictures and readers may recall that it came out well in the last investigation by *Which?* into colour receivers.

OBSOLETE LINE OUTPUT TRANSISTORS

We hear from Mullard that the widely used BU105/BU105-01/BU105-02/BU108 series of line output transistors is now obsolete. The BU105 and BU105-01 should be replaced with the BU205, the BU105-02 with the BU206 and the BU108 with the BU208.

LONG-DISTANCE TELEVISION BOOK

Congratulations to Roger Bunney on so soon selling out the first edition of his book on *Long-Distance Television*. A second edition has now been produced and can be obtained at 50p including postage from Weston Publishing, 33 Cherville Street, Romsey, Hants, SO5 8FB. The 36-page book provides a complete guide to long-distance television reception possibilities and techniques.

UHF SERVICE EXTENSIONS

The IBA has now brought into operation its **Ridge Hill** main u.h.f. transmitter, on channel 25 with horizontal polarisation carrying ATV programmes. Maximum e.r.p. is 100kW. In addition the following relay stations have come into operation.

Newhaven ITV channel 43 carrying Southern Television programmes. Aerial group B with vertical polarisation.

Bargoed BBC-Wales channel 21 and BBC-2 channel 27. Aerial group A with vertical polarisation.

DIGITAL PERFORMANCE AT ANALOGUE PRICE FROM NEW SINCLAIR MULTIMETER

A compact lightweight digital multimeter which combines the precision of a digital instrument with the convenience and low cost of an analogue one has been developed by Sinclair Radionics Ltd. (London Road, St. Ives, Hunts.). The new 3½ digit meter has been priced at £49 which compares well with professional quality analogue meters: it operates on dry batteries and its price is substantially less than that of rechargeable battery/mains-powered digital meters giving similar performance. The 12mA current drain can be supplied for long periods by the single 9V battery, making it independent of the mains. It is said to be a third the size and a quarter the weight of comparable analogue meters so that it can be easily hand held when making measurements. The finger-plate range-selector switches are an integral part of the case while the nixie tube display which is complete with overload and polarity error indications is recessed into the case.

The d.c. capability extends from 1mV to 1kV and 1nA to 1A while the a.c. capability is 1mV to 1kV and 1mA to 1A. Typical accuracy varies from 0.4% on the d.c. voltage scale to 1% on the a.c. voltage scale, the full-scale error amounting to ±2 digits. The instrument thus offers a voltage resolution 25 times that obtainable with analogue meters while the a.c. and d.c. resolutions are respectively 100 and 500 times better. The 1,000MΩ input resistance is claimed to be 20 times better than a standard analogue multimeter, eliminating errors due to current loading. The 1MΩ resistance scale is sufficiently accurate to permit direct measurement of resistance values without resort to bridging techniques.

COLOUR TUBE DEVELOPMENTS

The most important colour tube development in the immediate future will undoubtedly be RCA's new precision in-line tube. We mentioned this briefly last September and will be giving full details in a later issue. In the longer run the beam-indexing tube holds out considerable promise and we hand over to Ian Sinclair who has sent us the following report:

"An outline of the latest progress in the development of beam-indexing colour TV tubes was given by Dr. Turner of the Electrical Engineering Department of Essex University at a joint meeting of the IEE and IERE in Chelmsford on January 17th. The National Research and Development Corporation has recently provided Dr. Turner with a £20,000 grant to further his work in this field, which has also attracted the attention of firms with a large stake in colour TV tubes. Beam-shadowing tubes such as the shadowmask and Trinitron suffer from two sets of disadvantages. First the shadowing assembly whether it is a shadowmask, aperture grille (as in the Trinitron) or any other that may be devised is an expensive item which is difficult to mount, easily damaged and intercepts much of the beam current causing a loss of brightness compared to a monochrome tube with the same beam current. Secondly the three-gun structure requires co-ordination of three electron beams from separate sources, creating purity, convergence and grey-scale tracking problems.

"Beam-indexing tubes have only a single gun whose alignment is not critical. No purity, convergence or grey-scale tracking adjustments are needed and the brightness is naturally greater than with a beam-shadowing tube. Also magnetic fields do not affect performance as they do with beam-shadowing tubes. This simplicity is obtained at the expense of more elaborate external circuitry: while this was once a major drawback it is no longer so since the additional circuitry can take the form of a few i.c.s. In a beam-indexing tube the phosphor is laid on the screen in the form of vertical stripes in RGB sequence: the tube drive must be switched in the same sequence therefore as the beam traces out the lines. The problem is to synchronise the switching and beam position so that the signal appropriate to the colour phosophor being struck at any instant is applied to the tube. The tube does this by generating an index signal which indicates the position of the beam with respect to the phosphor stripes. This is then used to control the switching. There are various ways in which the required index signal can be generated and though quite successful many earlier attempts to use this technique ran into difficulty in detecting the index signal.

"Early systems attempted to gate the video waveforms with the index signal, requiring very high performance gates with fast rise times. A more recent approach avoids the use of gates. In this three sinewaves whose peak amplitudes occur respectively at the centre of each stripe in the triplets of stripes on the screen are generated from the index signal. The sinewaves are then applied to the RGB video waveforms, in effect switching the appropriate one on when the corresponding phosphor is struck. Since the sinewaves are derived from the index signal synchronism is maintained.

"The tube under development at Essex University uses aluminised interleaving stripes deposited over the phosphor: the index signal is produced as these stripes are struck by the beam. The control sinewaves can be derived fairly easily and the associated circuitry can be constructed in i.c. form. Prototypes are being built and tested but because of the terms of the NRDC contract Dr. Turner was unable to give precise constructional or circuit details.

"All in all it seems that the beam-indexing tube might be rather nearer to being a commercial proposition than seemed likely even a couple of years ago. The possibility of solid-state TV display panels of size acceptable for use in the average living room was discounted by Dr. Turner, at least for the next ten-twenty years."

touch-sensitive TUNING

G. R. WILDING

THE recent introduction of several models featuring touch-sensitive tuning is the culmination of a series of developments in television tuning techniques over a long period of time. In the earliest push-button tuner units (v.h.f.) tuning was effected by the extent to which a multiple slug was inserted into the in-line signal and oscillator coils. This was an improvement over rotary types of tuner and proved to be very reliable though the reset accuracy tended to diminish after prolonged use. The earlier u.h.f. and integrated or multiband tuners were also purely mechanical in operation and though the designs were considerable technical achievements the push-buttons nevertheless required quite some pressure to effect channel changing.

More recently with the introduction of varicap tuners channel changing has been done by electrical means. The capacitance of the varicap diodes associated with each of the tuned circuits is altered by changing the bias applied to them. For this a relatively simple switch unit to select the appropriate potentiometer is all that is required. The lightness of touch needed, elimination of mechanical switching problems and the fact that the tuner can be mounted remote from the switch at any convenient place in the cabinet give considerable design advantages. Varicap tuners have also facilitated the application of a.f.c., which is of particular importance in colour receivers.

Basic Principles

Touch-sensitive control units form a welcome and natural adjunct to the use of varicap tuner units. As they dispense completely with the need for electrical switches and switch contacts they should reduce further the number of service calls for tuning faults. Various circuit arrangements are used in touch-operated tuner control units but all operate when a finger tip bridges a pair of contacts—which incidentally look at first glance like a single contact. When the finger tip completes the circuit forward bias is applied to a high-gain switching transistor. This in turn switches on another transistor or transistors and the net outcome is that the supply to the appropriate tuning potentiometer is connected and held on while the supply to the previously selected potentiometer is switched off. In addition a channel identification bulb is usually brought into circuit.

As skin resistance is high the touch contacts must be incorporated in a correspondingly high-resistance circuit; in practice resistor values in the range 10-22MΩ are used. The switching operations are carried out either by discrete transistors or i.c.s. Transistors form almost ideal switches of course. In the absence of forward base bias the collector-emitter resistance they present is very high—especially with silicon types since there is negligible leakage current with these. On the other hand when a transistor is biased fully on, i.e. is saturated or bottomed, the collector current is maximum, the collector voltage minimum and the collector-emitter impedance is very little. There is very little dissipation since although the collector current is at maximum the collector-emitter voltage is at minimum—generally less than 1V.

Murphy Circuit

Probably the most straightforward touch-sensitive tuning arrangement is that used in the Murphy Model CV2612C. There are six touch buttons (six pairs of touch contacts) and the switch circuit associated with each is shown in Fig. 1. The first transistor VT1 is without forward bias until the touch-button contacts are bridged. When this is done VT1 conducts and the voltage developed across its emitter resistor R3 then switches on VT2 (which was also previously without forward base bias). As a result VT2's collector voltage falls—from 200V to a fraction of a volt —and a negative pulse is applied via C2 to the

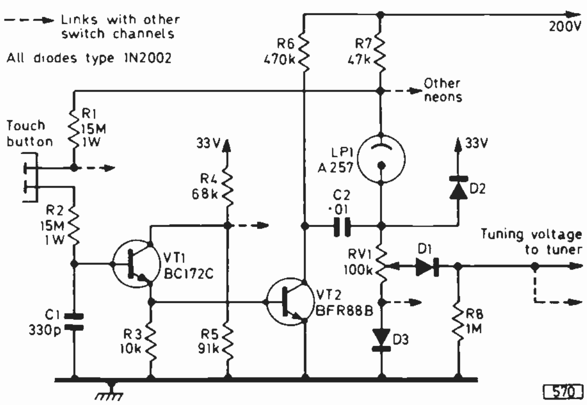

Fig. 1: One of the touch-button switch circuits used in the six-channel tuner control unit fitted in the Murphy Model CV2612C. Bridging the touch button with the finger tip applies forward bias to the first transistor VT1 which in turn bottoms VT2. The resultant negative pulse applied via C2 to the cathode of the neon LP1 causes it to strike. D2 then clamps the top of RV1 to a highly stabilised 33V supply, the tuner tuning voltage being tapped from RV1 slider. When another channel is selected the momentary surge of current through R7 reduces the voltage at LP1 anode below its extinction voltage so that it ceases to conduct, the feed to RV1 thereby being removed.

cathode of the neon LP1 causing it to strike. Although 200V is at all times applied across the neon this is insufficient to make it strike. Neon lamps have the convenient characteristic of requiring a higher voltage to strike than to subsequently maintain conduction. Thus once the conduction initiating pulse has passed LP1 continues to conduct, the circuit latching on. Since LP1 cathode is then at a positive potential D2 also conducts, clamping the junction of RV1 and LP1 to 33V. RV1 is of course the tuning potentiometer and the appropriate voltage is applied via D1 to the tuner unit. D1 isolates RV1 to prevent possible interaction from the other tuning potentiometers. D3 which actually returns all the tuning potentiometers to chassis is of similar type to the isolating diodes and compensates for temperature drift in the latter. The neon also acts as a channel indicator.

When any other touch-button is contacted the appropriate neon strikes and the initial load current through R7, which is common to all the neons in the unit, reduces the voltage across the neon that was previously conducting to below its extinction point so that it switches off. There is then of course no current through the associated clamp diode so that this also switches off and the voltage to the tuning potentiometer previously in operation is removed.

All in all a simple but ingenious circuit!

"Feathertouch 100" Circuit

A rather more complex circuit is used to provide touch-sensitive tuning in the KB "Feathertouch 100". The circuit for one of the touch-sensitive electronic switches is shown in Fig. 2—once again there are six pairs of contacts in all in the unit. It is quite different to the previous example, using four transistors per switch channel, but operates on basically similar lines.

The first transistor Tr21 switches on when the touch-button contacts are bridged to return its base to chassis—being a pnp transistor with its emitter fed from a positive rail this applies forward bias across its base-emitter junction. When Tr21 conducts the current that flows through R41 in its collector circuit develops a voltage which switches Tr11 on as well. Tr1 is in turn switched on as a result of the voltage developed across R1 when Tr11 conducts. The circuit then latches on since the current flowing via Tr1, R11 and R41 holds Tr11 on.

When Tr1 bottoms it not only holds Tr11 on but also connects the tuning potentiometer RV1 to the 31.2V supply so that the appropirate tuning voltage is supplied to the varicap tuner and in addition switches Tr31 on. This latter transistor connects the supply voltage to the tuner via the channel indicator lamp/shunt 470Ω resistor and the zener diode D25 in its emitter lead. In a nutshell then all transistors are switched off until the touch-button is bridged when Tr21 switches on in turn bottoming Tr11, Tr1 and Tr31. When Tr21 switches off the circuit is held latched on since the collector currents of Tr11 and Tr1 keep each other forward biased.

How does the channel which was previously switched on get switched off then? Resistor R91 is common to all channels. When a new channel is selected the increased current through R91 and voltage across it switches off whichever channel was previously on.

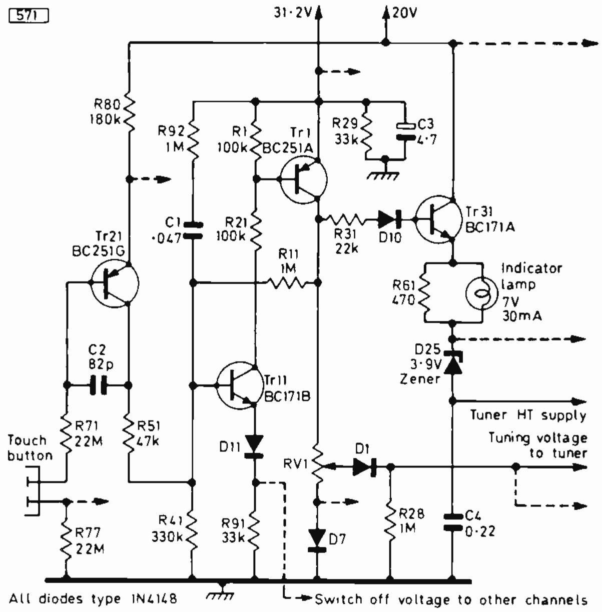

Fig. 2: Circuit of one of the six touch-button controlled switch channels in the tuner control unit used with the ITT CVC7 chassis (fitted in the KB Feathertouch 100 colour receiver).

The tuning voltage output circuit is the same as in the Murphy example previously described: D1 isolates the selected tuning potentiometer from interaction by the other channels while D7, which is common to all channels, provides temperature compensation.

The components R92 and C1 are fitted in one channel only and ensure that when the set is first switched on that channel is automatically operative. As the supply voltage rises following switch-on the voltage across C1 also rises switching Tr11 on.

Use of Integrated Circuits

As an alternative to using discrete transistors several i.c.s designed for this application are now available. These include the SAS560 and SAS570 bipolar types from Siemens and the ETT6016 m.o.s. type from Emihus Microcomponents Ltd. As is usually the case with i.c.s a greater number of transistor elements is used for a given function than would be employed in the equivalent circuit using discrete components. Operation is basically the same however, finger application to the touch contacts switching on a previously non-conducting transistor which in turn brings the associated switch channel into operation so that the appropriate tuning potential is applied to the tuner and the channel indicator lamp illuminated. These i.c.s have in addition provision for remote control operation. In this mode pulses are applied to the i.c. so that the channels are stepped through until the wanted one is selected.

Figure 3 shows at (a) the internal first switch channel in the SAS560 i.c. and at (b) the appropriate external circuit (additional circuitry is required for remote operation). T1 switches on when the touch-button contacts are bridged, in turn bottoming

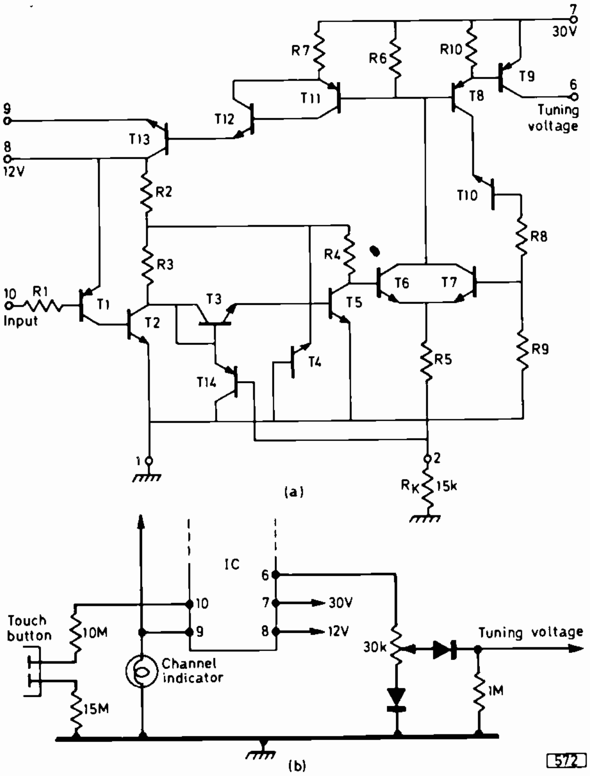

Fig. 3: (a) One of the switch channels of the Siemens SAS560/SAS570 bipolar touch-tuning i.c. series. (b) External connections to the i.c.

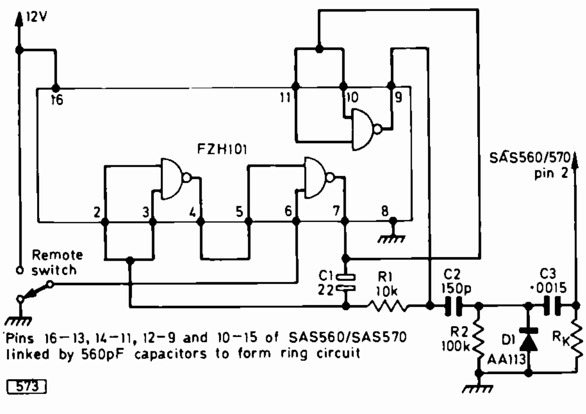

Fig. 4: Use of an FZH101 i.c. as a clock pulse generator to apply remote control to the Siemens touch-tuning i.c.s.

T2. The output at T2 collector is coupled via the diode-connected transistor element T3 to T5 base. When the channel is non-operative T5 conducts as a result of the 12V applied to its base via R2, R3 and T3. When T2 switches on however this bias is removed and T5 switches off. T5's collector voltage then rises to a value set by T4 which acts as a zener diode. When T5 switches off T6, T7, T8, T11 etc. switch on and as a result the 30V supply appears at pin 6 and is fed to the external tuning potentiometer while the voltage appearing at pin 9 provides

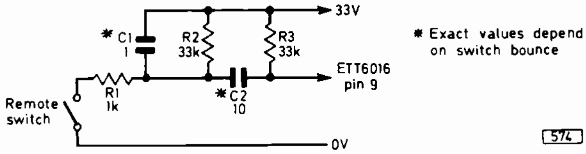

Fig. 5: Circuit for applying remote control to the Emihus ETT6016 m.o.s. touch-tuning i.c.

a 12V power/indicator bulb supply. T7 provides the latching facility, holding the selected channel on as a result of the flow of current through R9, R8 and T10 when T8 switches on. The external 15kΩ resistor connected to pin 2 develops a voltage of 3V: when a new channel is selected this voltage rises momentarily to 4.5V, biasing off the latching action in the previously selected circuit.

There are three other switch channels in the SAS560, giving selection of four channels. If the complementary SAS570 is used with the SAS560 a further four switch channels are available giving selection of eight channels in all. T14 in Fig. 3(a) is in the first channel of the SAS560 i.c. only and ensures that this channel always comes on first when the receiver is switched on. This occurs since at switch on there is no current through Rk so that T14 base is earthed while its emitter is fed with the 12V supply via R2 and R3. Consequently T14 passes current and initiates the switching process.

Remote Control

For remote control (see Fig. 4) these i.c.s are driven by the differentiated output of a logic i.c. connected as a very low-frequency astable multivibrator. The differentiation produces a spikey waveform whose negative excursions are removed by a clipper diode. The remaining positive-going spikes are capacitively coupled to Rk. The circuit is shown in Fig. 4, where C1/R1 set the time-constant of the multivibrator, C2/R2 differentiate the output, D1 clips the negative spikes and C3 couples the signal to Rk. As we have seen channel switch off is effected by increasing the voltage across Rk—so that T7 in the i.c. switches off. The SAS560/SAS570 input pins are linked by 560pF capacitors to form a ring counting circuit and as a result there is continuous channel changing so long as the remote switch is held on.

The Emihus ETT6016 i.c. operates in a similar manner but provides selection of six channels (though there are facilities for eight on the chip). For remote control part of the circuit functions as a bistable which acts as a pulse generator: the pulses produce within the i.c. a channel change when the switch is operated. A suitable remote switch circuit is shown in Fig. 5.

In both cases therefore remote-control channel selection can be had with a two-wire lead and without any physical switching actions at the receiver.

Conclusion

To date touch-sensitive tuning has been used in luxury models only but the advantages of this mode of channel selection make it likely that it will be increasingly used. ■

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SN7483	1·00	0·82	SN74166	4·25	3·72
SN7484	0·95	0·85	SN74167	6·25	6·00
SN7485	2·50	2·30	SN74170	4·18	3·90
SN7486	0·45	0·40	SN74174	2·00	1·74
SN7488	12·40	11·80	SN74175	1·35	1·17
SN7489	4·97	4·40	SN74176	1·50	1·30
SN7490	0·75	0·70	SN74177	1·30	1·10
SN7491	1·00	0·85	SN74178	1·80	1·55
SN7492	0·75	0·70	SN74179	1·80	1·55
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CA3020	1·55	1·28	CA3071	2·01	1·65
CA3020A	2·01	1·65	CA3072	2·07	1·71
CA3021	1·90	1·57	CA3075	1·46	1·21
CA3022	1·61	1·33	CA3076	1·67	1·38
CA3023	1·55	1·28	CA0380	0·58	0·48
CA3026	1·25	1·03			
CA3028A	0·88	0·72			
CA3028B	1·17	0·97			
CA3029	0·52	0·43			
CA3029A	0·63	0·52			
CA3030	1·08	0·89			
CA3030A	1·64	1·35			
CA3033	2·92	2·41			
CA3033A	4·93	4·07			
CA3035	1·52	1·30			
CA3036	0·90	0·68			
CA3038	2·60	2·14			
CA3038A	3·40	2·80			
CA3039	1·00	0·91			
CA3040	2·95	2·43			
CA3041	1·30	1·07			
CA3042	1·30	1·07			
CA3043	1·73	1·43			
CA3044	1·42	1·17			
CA3045	1·50	1·20			
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CA3047	1·59	1·31			

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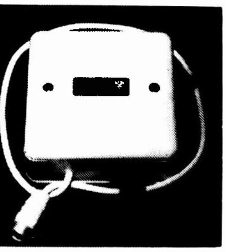

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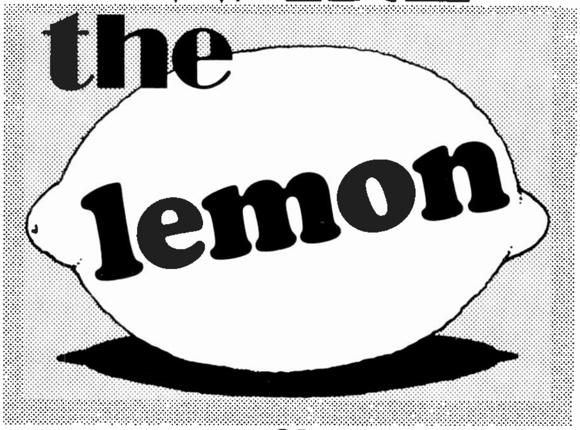
BEWARE the lemon



Chas. E. MILLER

No, this is not going to be a discussion on citrus fruits! The "lemon" in the title is a slang term originally used to describe the occasional car with so many faults in an otherwise normal production run that it had to be written off. Now we who are regularly engaged in the TV trade in reconditioning second-hand sets for sale tend to become a little complacent at times. We know for instance that an "ABC" is a real thoroughbred, certain to give long and reliable service, while the "XYZ" is a load of trouble that should never have been let out of the factory. Inevitably we receive our come-uppance however: an "ABC" comes into the workshop and proves to be virtually irrepairable!

This is our particular lemon then and mine arrived just a few months ago. I shall continue to refer to it as an "ABC" and there will be no prizes whatsoever for guessing its true identity. It was a dual-standard 19in. model, less u.h.f. tuner but with an unmarked cabinet. It happened that I had a (push-button) u.h.f. tuner for this model in stock. So anticipating just an hour or so's work to bring the set to eminently saleable condition I unscrewed the back.

The first sight that greeted my eyes was a fine collection of dropper sections festooned like bunches of grapes all over the rear of the set! A swift mental calculation indicated that the heater side of this tangle was some hundred ohms below par, so before anything else was attempted this had to be remedied. The easiest course was to snip out the lot and start again from scratch: with the aid of the circuit diagram I built up a dropper of exactly the correct resistance, checking at the same time that a certain modification to the positioning of the thermistor had been carried out.

This accomplished I plugged in the u.h.f. tuner and switched on. After some few minutes had elapsed the valve heaters began to glow feebly. It was obvious that they were not going to attain their correct temperature and the meter in fact indicated that all the 6.3V heaters were over 1.5V down (after due allowance for the distorted readings associated with rectifier-fed heaters). A check for heater-cathode shorts, incorrect valves or any other explanation proved fruitless so somewhat sulkily I shorted out part of my nice new dropper—whereupon the valves brightened to their correct level and with them my spirits. I should have been warned however . . . !

The u.h.f. performance was tolerable but in my view it's essential to ensure that the often despised 405 section will work—to cover possible u.h.f. black spots and to enable me to demonstrate a set to customers with only a v.h.f. aerial. Upon pressing the system switch I was confronted with a weak, grainy picture. As the r.f. amplifier was a PCC89 I foolishly imagined that this fault at least would be quickly cured. How wrong I was! I plugged in a new valve and sat back to await results. Nothing! Not a peep! Just my luck I thought, a dud valve. In went another—which also did nothing as did the other two that were in the rack. I replaced the original and got the weak, grainy picture back. Could I have had a bad batch of valves? I borrowed a PCC89 from a set that was working well and tried that. Once again nothing. It's at moments like this that I feel there must be some evil power dedicated to driving TV engineers out of their minds!

A suspicion crossed my mind that the original valve might be a PCC189 with the "1" rubbed off so I checked that. Another waste of time. Out came the tuner unit for checking: the tuning slug had not broken in two as frequently happens and all voltages were exactly right whichever PCC89 happened to be in. That tuner was just not going to work with any but that one particular valve!

At this point I decided that a problem of this type was not for lesser mortals like me so I wrote a letter in detail to the "ABC" service department. A few days later I received a phone call from their chief engineer who with a nice blend of bafflement and scepticism asked a few questions and then suggested that I send the tuner to him for service.

How to Loose a Friend!

It stayed at the factory for two months; in fact I had all but forgotten about it when it arrived back with a C.O.D. fee that comfortably exceeded the price I'd paid for the set! The timing was nevertheless fortunate: a friend—or perhaps I should now say ex-friend—was looking for a TV set.

Rashly, I installed my lemon for his approval. I virtually lived at his house for the next week! It rolled he said. I replaced the PCL85. It slipped sideways he said. I changed the line sync discriminator diodes. The picture did the "hula-hulas" so I replaced the smoothing capacitors. Thereafter in quick succession the line output valve, the line hold control and the system switch failed! The last straw came when the gain on v.h.f. dropped to almost zero again.

A Blaze of Glory

The set was consigned to a dark corner where it lay until I was desperate for a loan set. Miraculously it behaved itself quite well—until that is I'd left the customer's house whereupon the DY86 went off in a blaze of glory. Once a lemon, always a lemon! The set returned to its dark corner where it shall remain . . . unless of course any reader would like to take this unique opportunity of acquiring a fine dual-standard 19in. set, little used, late property of an old lady with weak eyes . . . !

THE 'TELEVISION' COLOUR RECEIVER PART 13 TUBE NECK COMPONENTS

THE most expensive part of the colour receiver—the tube—must now be mounted in position in the cabinet and the various scan and convergence components mounted on the tube neck.

Two very basic facts should be remembered when handling the tube: the first is that it is not unbreakable and the second that should it be damaged in any way during handling there is a very great probability of implosion under the enormous forces present in the glass. The dangers to yourself under such circumstances cannot be over-emphasised.

If you are sure you are physically strong enough to mount the tube and that the tube cut-out is correct for the tube being used, rest the cabinet face down on the floor on a protective surface and with a separate rolled blanket just under the top edge to prevent the tube face resting on the floor later. Check the security of the mounting studs that were created during cabinet making and prepare the tube ready for placing on these studs.

If the tube faceplate has a protective, sticky paper coating leave it there to afford some small protection against scratches while you are handling the tube. If there is no protective surface manufacture one with lengths of greaseproof paper held on the tube face with Sellotape. Avoid running the paper around the edges of the faceplate where it may get trapped in the cabinet.

With your legs a reasonable distance apart, your back straight and wearing non-slip gloves and preferably goggles lift the tube out of its carry-box, always handling it around the flare—*not the neck*! You should already have the tube and cabinet very close together so that the distance you have to move carrying the tube is as small as possible: make sure that the path is completely clear of obstacles.

With your hands around the faceplace manoeuvre the tube into the rear of the cabinet and locate the holes in the tube mounting lugs on the four cabinet mounting studs. The four corner lugs should fall against the nuts on the studs. If they do not do so the tube is not falling far enough down for that purpose, probably because it is as far into the cabinet as it will go. If this is so shim the studs under the tube mounts with an equal number of flat steel washers until the height is correct. A further steel washer should be put over the studs on top of the tube corners and the degaussing shield then put down over the same studs using the four corner plastic pieces supplied. One or more nuts should then be used on each stud to lock the tube and shield in position.

With the tube in position and nothing else in the cabinet or on the neck of the tube the whole thing will tend to be a little front heavy so some care should be taken about its positioning in the family scene. When tightening the nuts on the mounting corners of the tube it is best to use a socket or ring spanner to reduce the possibilities of the tool used striking the flare of the tube.

Alternative Components

A number of different types of deflection/convergence/blue lateral assemblies may be supplied to constructors. We are leaving the choice from the types that are available fairly open to the suppliers themselves but a few notes are necessary on the combinations that are acceptable and those which *cannot* be used for the project.

There are basically two types of radial convergence unit: one type is integral with its mounting assembly which is secured on to the deflection yoke; a second type of unit consists of a "riders" which pushfit into *sockets* on an enlarged deflection assembly. There are no electrical connections to the sockets on the latter: they are just lock-fit receptacles to locate the convergence units at the correct position and alignment on the tube neck. Three of these units are of course required, one each for red, green and blue.

Because of the very large number of types that are available we will confine ourselves to quoting Mullard type numbers. When a Plessey or other manufacturer's part is provided and there is any query

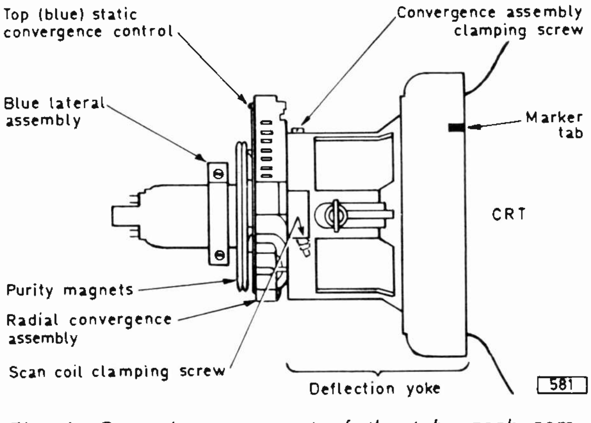
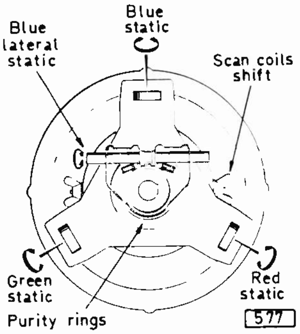
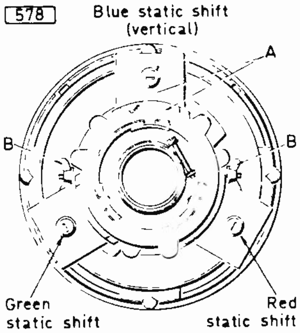
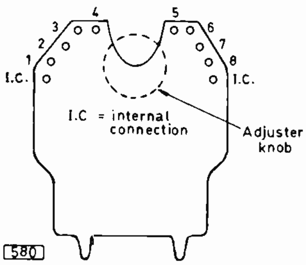


Fig. 1: General arrangement of the tube neck components using the AT1022 type deflection yoke. Note that on this series the marker tab is red: on AT1027 and AT1029 assemblies with convergence "rider" units (see text) the tab is blue.







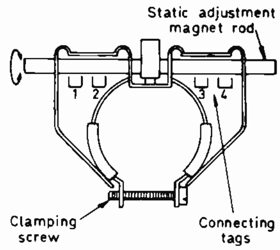
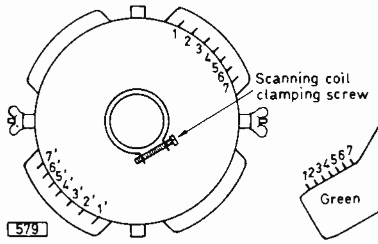


Fig. 2 (left): Rear view of the AT1023 type radial convergence assembly mounted on the tube neck with the blue lateral assembly also shown.

Fig. 3 (right): Rear view of the AT1027, AT1029 series deflection assemblies with AT4046/07 type convergence rider units. Blue lateral assembly not shown.

Fig. 6 (left): Connection numbering for AT4046/07 series convergence units with necessary interconnections to be made (note that the connection numbering in the circuit, Fig. 3 in the November issue, conforms to use of the AT1023 series assemblies and not to these units). Three units are required, one in each of the red, blue and green positions. Interconnections: red 2 to red 7, red 3 to red 6, green 2 to green 7, green 3 to green 6, blue 2 to blue 7, blue 3 to blue 6, blue 3 to red 2, red 3 to green 2 (line, with input at blue 2 and return from green 3); red 1 to red 8, red 4 to red 5, green 1 to green 8, green 4 to green 5, blue 1 to blue 8, blue 4 to blue 5, red 4 to green 1 (field).

Fig. 7 (right): Connections and interconnections for AT1025 blue lateral shift assemblies. AT1025/06 interconnect 1 and 3 (coils in series). AT1025/05 interconnect 1 and 4, 2 and 3 (coils in parallel). The AT1025/05 may in some cases not be satisfactory (see text).



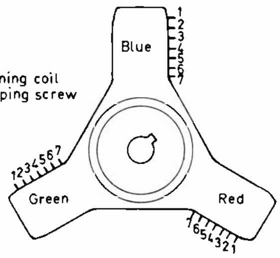


Fig. 4 (left): Connection numbering and interconnections required for all deflection units. Interconnections to be made: field, 5 to 4, 5′ to 4′, 3 to 6′ and 6 to 3′, with input from 4F on the timebase panel to 3 and return from 3′ and 6 to R427 on the convergence panel at 5M and 5N (see Fig. 3, page 17, November issue); line, 1 to 2, with input to 1 from 5B and return from 2′ and 1′ to L402 via 5D and 5C on convergence board.

Fig. 5 (right): Connection numbering and interconnections required with AT1023 series convergence assemblies (check with Fig. 3, page 17, November issue). Interconnections to be made: red 3 to green 2 (field); blue 6 to blue 7, blue 4 to blue 5 to red 6 to red 7, red 4 to red 5 to green 6 to green 7, green 4 to green 5 (line). Line input to blue 6, return to R420/L407 from green 4.

over its use the supplier should be asked which Mullard part number it is equivalent to.

Some deflection units are optimised for use with certain ranges of tube sizes and for best performance should only be so used.

In the range of "separate" neck assemblies three types of deflection unit are available:

AT1022–05 for any 90° colour tube (not optimised).
AT1022/06 for 22in. tubes and larger.
AT1022/15 for 19 and 20in. tubes.

These units should be used together with the convergence unit AT1023–05. This can be identified by its use of finger-rotatable static convergence magnets and purity rings which have a *corrugated* edge (circumference).

In the range of deflection assemblies carrying sockets for the separate convergence rider units there are again three usable types:

AT1027/06 for 22in. tubes and larger.
AT1029/06 for 19 and 20in. tubes.
AT1029/09 for 19 and 20 in. tubes.

The convergence rider units, and remember *three* must be used in each assembly, might be in either the AT4045 or AT4046 range. *But* the AT4045/- - units have d.c. control for static convergence and *are not usable with the present receiver design.* The AT4046/- - units have a knob to control the static shift magnets and are easily recognisable by that feature. However there are two types of AT4046/- -, the AT4046/07 and AT4046/08. The latter (AT4046/08) *cannot be used* in the receiver because of the very much higher impedance of the line coils.

The blue lateral unit to be used with any combination of deflection and convergence assemblies is preferably the AT1025/06 or equivalent. We have in a previous part said that the AT1025/05 unit may be used but we must emphasise that it will not necessarily always give sufficient shift. The suppliers have agreed to replace any /05 unit with an /06 should this be necessary. Our tests indicate that this may be so if the tolerances of the tube, the deflection and the convergence assemblies are all lying in the same direction.

It is virtually impossible to tell the difference between the /05 and /06 units unless they are marked or measured.

Electrical Connections to Components

The interconnecting links that are required between various points on the neck components are best made before they are mounted on the tube so that you are not playing about in the dark with a soldering iron. These connections are indicated in Figs. 4-7. Great care should be taken to ensure that these connections are correctly made.

When soldering to the various tags take care not to overheat plastic mounts or let solder drop inside assemblies where it can do great harm. Interconnections between different sections of an assembly—e.g. red to green connections on the convergence yoke—should be made with lengths of wire that do not cling too closely around the cluster—neither should they be ridiculously free.

Having made the interconnections assemble the components on the tube neck. Push the deflection coils fully forward to the flare of the tube and with the plastic rib vertical and the coloured marker tab at "2 o'clock" tighten up the clamping screw (Fig. 1) through the aperture provided. Do not overtighten and remember that you will have to loosen this clamp again when the receiver is finally set up.

Push the AT1023 type convergence assembly right on to the deflection yoke and tighten the clamping screw (if fitted) with the convergence coils for blue vertical. With the rider type (AT4046/07) arrangement push the separate units home in the receptacles provided.

Mount the blue lateral assembly with the connection tags to the rear of the cabinet and the rod on top of the tube. Tighten the clamping bolt with the assembly as close as possible to the purity rings on the convergence section.

We understand from suppliers that Plessey components will mostly be supplied. These will be illustrated next month.

Matters Arising

C529 supplied in Pack 20 is rated at 30V.

There seems among readers to be a rather odd misunderstanding of the main heater chain operation in the power supply for the colour receiver (see January 1973 issue). The confusion is based on the old problem of the average (mean), peak and r.m.s. values of an a.c. waveform. The significant factor in the consideration of any chain involving heaters is the r.m.s. value of the waveform. Why r.m.s.?—simply because by definition the heating effect of an a.c. waveform is based on its r.m.s. value, not its peak or mean value.

The two confusions arise because of circumstances. It is sometimes thought that the peak value is of importance because this is the story with an h.t. supply. But of course the heater chain is unsmoothed—the d.c. from an h.t. supply reaches the peak voltage only because of the action of the reservoir and smoothing system.

As for average value (mean value) this is an old carrot that we thought had been eaten a long time ago. The mean value of a full cycle of sinewave is of course zero volts. But the output of the rectifier (D501) consists only of negative half-cycle pulses and the mean value would be half the mean value over a half-cycle, that is $\frac{1}{2} \times 2/\pi \times E$max or 0.3185 Emax. And as Emax equals 1.414 Erms the mean value would be 0.3185 × 1.414 × 240 which is 81.5V and indeed this would be the voltage measured at the anode of the heater chain diode if R501 was connected below the rectifier rather than above it. *Measured* voltage is not necessarily the same as *actual* voltage and in this case there is a discrepancy because a moving-coil instrument will measure the mean value of the waveform while we are concerned with the r.m.s. value.

The r.m.s. value of the waveform is quite simply found from our knowledge of the wave shape. We are missing alternate half-cycles and the r.m.s. value over the period when the waveform is present is 240V. During the period when there is no waveform the r.m.s. value is 0V. The average over a complete cycle therefore in terms of the r.m.s. value is 240/2 which is 120V.

When calculating voltage drops etc. from that point onwards everything can be done in r.m.s. values and the voltage drops of 9, 40 and 42V quoted by the manufacturers for the PCF802, PL509 and PY500 are r.m.s. voltages for an r.m.s. current of 300mA. The total drop from the voltage supply of 120V must be made up using a suitable series resistance which is R501. The original article was misleading in referring to a voltage drop of 150V to be provided. R501 has to drop 120-91V which is 29V of course. And at 300mA this will be provided when R501 is $29 \div (300 \times 10^{-3})$ which is 96.6Ω. 100Ω is used therefore. The very small voltage drop created by the forward resistance of D501 (about 0.1V at 300mA) is neglected.

The same theory applies to the heater supply for the c.r.t. This is not wired with the main heater chain because the tube heater connections only permit parallel operation of the three guns. Mention was made in the article of a fuse protecting the heaters and mounted on the c.r.t. base. This was dropped because of favourable operation without it: the circuit diagram is accurate in this respect. The heaters are however a little underrun in normal conditions in order to offer some protection. The r.m.s. voltage supplied by rectifier D505 is again half the supply potential, i.e. $24 \div 2 = 12$V. With 5.7V drop ($12 - 6.3 = 5.7$V) required across the series resistor and thermistor (R516 and R517) a total resistance of $5.7 \div (900 \times 10^{-3}) = 6.33\Omega$ is required. But we must assume that the mains voltage may rise by 10% and that the transformer can only be made to a 10% accuracy. It is possible therefore that under a combination of these conditions the source voltage from the transformer might rise to 29V instead of 24V. This would require a total series resistance of $(14.5 - 6.3) \div (900 \times 10^{-3}) = 9.1\Omega$. Allowing for c.t.r. heater variations this explains the use of 10Ω for R516 with the nominal 1Ω of R517.

It should also be noted that a moving-coil meter reading of voltage across the c.r.t. heater would not be the nominal 6.3V r.m.s. but the mean voltage of the waveform which would be $\frac{1}{2} \times \frac{2}{\pi} \times \sqrt{2} \times 6.3 = 4.84$V.

Some readers have brought to our attention the fact that the line oscillator coil/core assembly instructions were perhaps not as explicit as they might have been. The two areas of doubt appear to concern the glueing of the halves of the core and the assembly of the adjusting screw.

The instructions should have made quite clear that the amount of glue used between the two sections of the core must be minimal—as it should be in most glueing operations. If the gap between the two halves of the core is anything more than nominal the reluctance of the magnetic path is increased and the inductance drops. The proportion of drop is quite large and one reader quotes 23mH measured without the adjusting screw instead of 29mH. This would result in an oscillator frequency increase of about 1.25kHz which could not be brought down to line frequency with the adjusting screw.

The mechanical mounting of the adjusting screw has also raised some problems with readers. It is supplied in two parts: the adjusting screw itself and a small plastic, tapped flange. The flange should be inserted at the bottom of the completed core and the adjusting screw pushed into the centre hole from the top and screwed into the flange with the adjusting tool. When the core is mounted on the printed-circuit base assembly and the spring clip latched home on both sides the flange is held secure and will not rotate with changes in the screw position.

IC Soldering

We are very concerned on the Alignment Service at the relatively large number of TAA350 i.c.s that have been badly soldered on i.f. strips. Although warnings were given they have in these cases been unheeded. This is also worrying from the point that the PA263 i.c. used in the audio module is probably even more sensitive to over-temperature effects.

With the TAA350, overheating and subsequent failure will be apparent in a variety of ways. By far the most common is complete failure due to a general overheating of the i.c. substrate.

With the PA263, the result of overheating is usually apparent as distortion at relatively low audio output levels. As the i.c. is driven harder or the h.t. increased the current taken by the device will usually increase with some rapidity. If this is allowed to continue complete failure is inevitable, usually after a number of "clicks" have been heard. If distortion is not noticed as a sign of overheating when soldering into circuit an alternative symptom is often an inability to control the audio level of the device by feedback and failure after some minutes of operation.

These points are mentioned because some constructors are undoubtedly going to have to replace their PA263s and either replace or pay for replacement TAA350s on the i.f. strip. We would earnestly commend that new constructors carefully read the two relevant parts of the series—in the July and August 1972 issues.

Suppliers are in general unhappy to replace an integrated circuit once it has been soldered into circuit because of the impossibility of checking whether the damage to the device was caused by malfunctioning of the device itself or by the soldering/de-soldering. With the PA263 it is impossible to use any kind of socket; with the TAA350 the prototype originally used an i.c. socket which turned out to be completely unsatisfactory because of capacitances across it. In general we have found that even low r.f. operation of i.c.s is unreliable when using i.c. sockets. For modern television work anyway one of the most important tools that should be considered is a temperature-controlled soldering iron. Next is probably a de-soldering tool!

Alignment Service

By the time this is read a large number of constructors will have received back their fully aligned i.f. strips. It is important to remind these readers that the cores of the coils on the board should not of course be touched.

A number of constructors will also have received repair slips informing them of various fault conditions. It is important we believe to note that components are being charged for only if there is a belief that the fault is due to the constructor's own actions. A faulty coil for example will usually be replaced free of charge though a charge for labour is made. If it was thought however that the constructor had for example desoldered the coil's connections as a result of his own soldering actions then both component and labour are charged. The constructor can then argue any complaint over the component with the original supplier—should he so wish and if he believes he is really not to blame. We have no desire to be judge and jury in this business but we must adopt some general procedure in order to get the work done.

Some of the faults reaching the alignment service are completely unnecessary. We don't wish to imply that every constructor should test every transistor before insertion into his board but only to follow the very few rules given in the articles. The continuity of many coils for example could not possibly have been checked during construction as was suggested. Had this been done by everyone time, money and effort would have been saved all round.

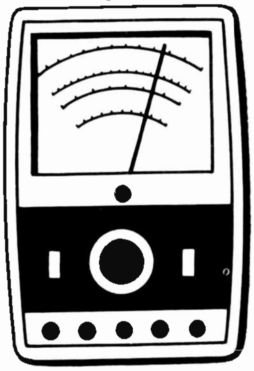
At the time of writing only one board has had to be completely rejected by the alignment service as unservicable but a reasonable number were in a condition which whilst curable involved a very considerable amount of work: some of this was due to things like all components being mounted off the printed-circuit board by $\frac{1}{2}$in., some to the use of clearly unsuitable components. We have been pleased to note that an insignificant number of errors have been made in the actual positioning of components; we think we should add "so far"!

Because of a shortage of cans from Neosid a number of copper cans have been supplied in coil kits. These operate perfectly well in the circuit but the lugs on the cans *must be earthed in exactly the same way as the aluminium cans.*

A small additional modification is being made to boards passing through the Alignment Service. This has been found to reduce intercarrier buzz on weak r.f. signals by reducing stray and very small r.f. signals across the sound carrier i.c. For those aligning their own boards the modification is to wire a short-circuit link—with insulated wire of course—between the earth plane adjacent to pin 3 of IC101 and the earth plane adjacent to pin 10 (see Fig. 1, pages 408-9, July 1972 issue).

As a result of our experiences with constructors' boards we are now in a position to offer a detailed alignment schedule and hope to publish this next month. In general we are very pleased with both the quality of the work that has gone into the construction of the i.f. modules and their performance; the larger proportion of those passing through the service could not be bettered.

TO BE CONTINUED



Servicing POWER SUPPLY CIRCUITS

PART 2

VIVIAN CAPEL

In Part 1 we discussed the half-wave power circuit. Many of the principles described apply also to the circuits which follow. The first is the conventional full-wave h.t. supply. The a.c. is supplied from a transformer (Fig. 1) with a centre-tapped secondary winding the opposite ends of which feed the anodes of two rectifiers. The centre tap is taken to earth/ negative. Both cathodes of the rectifier are connected together or as is often the case with valve rectifiers they are actually physically common.

On one half cycle one end of the secondary will be positive with respect to the centre tap and on the following half cycle the opposite end will be positive. Thus each half of the winding and each rectifier conducts on alternate half cycles. As a result each half cycle produces a positive output and the d.c. waveform is as shown in Fig. 2. This is the same as that produced by the half-wave system except that there are no gaps caused by suppression of the negative half cycles (compare with Fig. 2 in Part 1).

One effect of this is that the reservoir capacitor has to supply current for a much shorter period between peaks than with a half-wave arrangement. Hence its capacitance can be much less. The ripple is of lower amplitude and double the frequency so that the value of the smoothing capacitor can also be less. Typical values in radio circuits where this system is mostly encountered are 8-16μF for the reservoir and 16-32μF for the smoother, though values up to 50μF are often found.

Although used in some early models the full-wave circuit is seldom found in modern TV receivers because of the massive mains transformer needed. Its main use is confined to radio receivers, instruments and amplifiers where the current is less and so the transformer can be of more manageable proportions. The circuit is sometimes found in all-transistor television chassis, especially in mains-battery portables.

Auxiliary Negative Supply

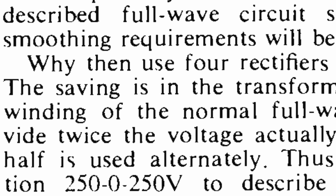
A facility which the full-wave circuit can easily provide is a small auxiliary negative voltage. This can be obtained by including a resistor in the connection between the centre tap and chassis. H.T. current will be flowing back through this resistor and thus a voltage proportional to the resistance value and h.t. current will be produced across it. A decoupling capacitor must be provided. In large amplifiers the grid leaks of the output valves are sometimes taken to this point to provide fixed bias, while transistor circuits could be supplied from this point in hybrid equipment.

Bridge Circuits

Even with the applications mentioned above the full-wave circuit seems to be dying out in favour of the bridge circuit. This is really also a full-wave circuit in as much as both half cycles of the a.c. mains input are used but the term "bridge" is usually applied to distinguish it from the former circuit. The basic bridge circuit is shown in Fig. 3. When a positive half cycle occurs rectifier 1 conducts and the return from the h.t. circuits through the load and chassis takes place via rectifier 4 to the bottom end of the winding. On the next half cycle, which is negative, the bottom end of the winding is positive so rectifier 3 conducts and the return is made through rectifier 2 to the top end of the winding. The output is just the same as with the previously described full-wave circuit so the reservoir and smoothing requirements will be the same.

Why then use four rectifiers to do the job of two? The saving is in the transformer. The centre-tapped winding of the normal full-wave system must provide twice the voltage actually needed because each half is used alternately. Thus we find the designation 250-0-250V to describe a winding that will deliver 250V to each rectifier, a potential difference of 500V being present across the ends of the winding. This means that large transformers with good insulation are needed.

With the bridge circuit the full winding is used for each half cycle so that it only needs to supply the actual voltage required, resulting in a saving of costly copper and iron as well as space. Originally the rectifiers were the problem: twin valve rectifiers were not suitable because of the manner of connection while metal rectifiers capable of supplying heavy current needed cooling fins and so four would be impracticably bulky. The use of the circuit was confined therefore to small current applications where small contact-cooled bridge rectifiers housed in a single unit could be used. The advent of the small



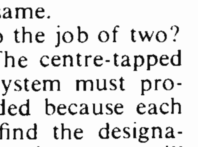
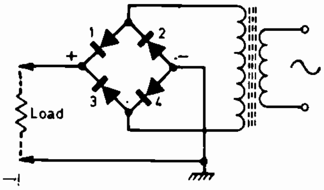


Fig. 1 (left): Basic full-wave power circuit, with valve rectifier.

Fig. 2 (right): The negative half cycles of the a.c. input waveform are inverted at the rectifier output, giving an output which consists of a closely-spaced train of pulses.



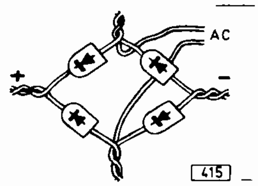


Fig. 3 (left): Basic bridge rectifier circuit. Rectifiers 1 and 4 conduct on one half cycle of the input, rectifiers 2 and 3 conducting on the other half cycle.

Fig. 4 (right): When single silicon rectifiers are used to make up a bridge circuit all must point from negative to positive, as shown here, with the a.c. connected to the intermediate junctions.

silicon rectifier however made the use of bridge circuits for larger applications a more practical proposition and we will no doubt see them increasingly used.

Servicing

With any full-wave circuit lack of smoothing will produce a hum that is twice the mains frequency, unlike the half-wave arrangement. A 100Hz hum would be the result in this country. This provides a useful clue in cases of hum: if it is 100Hz then undoubtedly the trouble is h.t. smoothing but if it is 50Hz then we must consider heater-cathode leaks or open-circuit grids etc.

If with the full-wave arrangement either one rectifier or one half of the mains transformer winding goes open-circuit the circuit effectively becomes a half-wave system. As both the reservoir and smoothing capacitors are of insufficient value for a half-wave circuit the result will be low h.t. voltage and hum.

Similarly with the bridge circuit if one rectifier goes open-circuit its opposite number will also cease to conduct as they are effectively in series and the system will revert to half-wave operation. Should the transformer secondary go open then as it supplies both legs of the bridge the result will be no h.t. at all.

The small bridge rectifiers often used in equipment where there is a limited current drain are rather prone to an increase in forward resistance in one or more of the units: the result is low h.t. voltage. Perhaps the use of four rectifiers—although in the same unit—must be expected to increase the chances of failure. Often the correct replacement is not immediately available. In this case a bridge can be made using single silicon rectifiers. These are cheap enough to make it economically worthwhile to use four in this way. The cost will not be a lot greater than the original unit but much time and energy can be saved by fitting them instead of chasing an exact replacement.

When using single silicon rectifiers it is of course important to get the polarity of each one right. Bridge circuits can be somewhat confusing to connect and a mistake is easy to make. Just remember that the "positive" ends of two rectifiers must be connected to the positive h.t. rail with the "negative" ends of the other two rectifiers going to negative, which in most cases will be chassis. The two junctions which remain and in each case consist of a "positive" and "negative" end are the a.c. input points. By convention the cathode is regarded as the positive connection to a rectifier (the pointed end with standard silicon rectifier encapsulation) while the anode is the negative (flat) end.

Another way of remembering the connections is to start at the negative (chassis) end and connect the two series paths with all the rectifiers pointing toward the positive end as shown in Fig. 4. The a.c. is then tapped in at the half-way points.

There is of course a bonus to be had in using silicon rectifiers in this way. This is that the much higher rating will make future breakdowns less likely. Also if one should fail it can be replaced without having to change the others. Failure in a combined unit means a further replacement of the whole lot.

When wiring the four silicon rectifiers in resist the temptation to use the old unit for anchoring tags. If current is still allowed to flow through it one or more sections may develop high forward resistance and because the others may be passing a fair current unbalance will be introduced which could produce hum. It is best if the old unit is completely isolated or removed as if voltage is present on it there is always the possibility of an insulation breakdown to chassis. If circumstances warrant it and the risk of insulation breakdown is accepted (which in any case does not seem to be so high with small bridge units as it is with the single fin-cooled selenium television rectifier) a compromise can be effected. Leave the a.c. feeds to the rectifier in place and anchor the new rectifiers to these tags. The two new rectifier connections to the negative point can then be wired to the nearest earth tag (assuming a negative earth) while the two connections to the positive point can be self-supporting, the positive lead being taken to their junction. Silicon rectifier wire ends are quite thick and should give adequate support for the rectifiers and the positive lead.

Different types of rectifiers give rise to different types of faults. Valves used for half- or full-wave circuits lose their emission over a period and the result is low h.t. Occasionally a valve will develop an interelectrode fault. This is usually a heater-cathode leak, but sometimes there is an anode-cathode leak or even an anode-heater leak although this is comparatively rare. Such leaks nearly always result in a blown fuse but the difficulty arises when the fault is intermittent as it often is. A flashover occurs in the rectifier and the fuse blows but the rectifier may then work for some considerable period before repeating the performance. A process of elimination is about the only practical method of diagnosis but certainly the valve rectifier should be placed high on the list of suspects.

The fin-cooled selenium rectifier is not used in modern sets but may still be encountered in older models. Here the most common trouble is high forward resistance producing low h.t. A leak to the supporting rod is also common and if the leak is low-resistance the effect will be a blown fuse. Fortunately such leaks are usually permanent so there is no difficulty in diagnosis. There are often visible signs of the leak at some point. High-resistance leaks may not always blow the fuse—especially if a high value is fitted—but will result in overheating: the symptom is unmistakable! Overheated selenium rectifiers give off a very disagreeable odour which seems to hang around the workshop for days. This is undoubtedly one of the easiest faults in the book to diagnose!

Contact-cooled rectifiers enjoyed a period of popularity just before silicon rectifiers came in because they occupy much less space than their finned air-cooled counterparts. The main difficulty is finding them as they are often fitted to a chassis strut or member in a way that defies discovery. High forward resistance is again the main fault but a complete open-circuit is very common. This can often be repaired if one feels so inclined. When the case is prised apart the selenium washers will be found to be arranged in little stacks in holes in a flat bakelite slab. The stacks of washes are held connected in series by means of spring washers at the top and bottom of each stack. These in turn make contact with a printed circuit on a presspahn folder. On opening care must be taken not to let the washers fall out as it may not be easy to see which way they should go back. The fault is usually a break in the print where the presspahn printed circuit is folded. This can be bridged as with normal print faults and the unit reassembled. It is essential when refitting to the chassis to bolt the rectifier tightly in order to achieve sufficient thermal conduction.

The above repair can be carried out in an emergency if no replacement is to hand but it is generally better to replace all defective selenium rectifiers—whether contact or fin-cooled—with silicon ones. These are more reliable and do not generate heat, and anything that reduces the heat produced in a TV receiver is a step in the right direction. When fitting a silicon rectifier always include a series surge limiter of 25Ω 10W rating and if possible shunt the rectifier with a 1000pF capacitor to reduce transient peaks which may exceed the peak inverse voltage rating.

It is some years since silicon rectifiers were first fitted to new receivers—in addition to being used as replacements for selenium types in older sets—so some assessment of their reliability and the faults to be expected can now be made. There were teething troubles with the earliest ones but generally they have proved more reliable than other types of rectifier. Up to the present time they seem to be free from the gradual deterioration, leading to a drop in the h.t. voltage, which is common with all other types. The main fault is a rather violent and decisive one, the development of a complete short-circuit! A fuse that blows immediately upon switching on is an almost certain indication of this. If investigation reveals no circuit fault such as an h.t. short to account for the failure a replacement will work with no further trouble. With h.t. current ratings of over an ampere it would be difficult indeed to overload a silicon rectifier without blowing the h.t. fuse.

Just one final word of warning about silicon rectifiers. It is not unknown for the capsule shape and polarity markings to be wrong. When fitting one therefore always check with an ohmmeter. The lowest resistance reading should occur when a negative potential from the meter battery is applied to the cathode (+ve marking) of the rectifier. In many meters such as the AVOs the positive lead is connected to the negative side of the battery on the resistance ranges and this must be taken into account when checking the rectifier. ■

SERVICING television receivers

L. LAWRY-JOHNS

BUSH TV181S/MURPHY V2016 SERIES

THE models in this series are the Bush TV181S, TV183SS and TV186SS and the Murphy V2016S, V2417S, V2015SS and V2415SS. Similar models but with different (varicap) tuners are the Bush TV195V, TV198V and TV307 and the Murphy V2019S and V2419S.

There is a range of models with similar numbers (obviously not quite the same) which are updated versions of the earlier TV161 series, modified for single-standard working. They have little in common with the receivers covered in this article. The models which we are concerned with have a single panel as opposed to the twin panels of the updated versions of the TV161 series.

Mains Input Circuit

Readers who have not encountered these receivers before are advised first to study the layout and get the mains supply components sorted out. Whilst the mains input fuse 3F1, the rectifiers and the heater circuit dropper 3R72 are at the top of the panel, the h.t. resistors are at the bottom. Note also the positions and purposes of the three diodes at the top. The diode below the fuse, a BY134 or BY126, is the heater circuit supply diode 3D9: its purpose is to pass the positive half cycles of the mains supply only to the dropper 3R72 at the top of the panel. 3R72 of course is in series with the six heaters (five valves and the tube). Above the fuse is a smaller diode 3D12 (type 1N4005) which is included in the circuit in the hope that it will never have to do anything. It is a safety diode wired so that it is non-conductive on the positive half cycles. Should the heater supply become a.c. however due to the supply diode 3D9 being short-circuit 3D12 will conduct and blow the fuse, thus protecting the heaters from overload. This is a lovely idea but the 1N4005 doesn't seem to like the positive half cycles and often shorts on its own account thus blowing the fuse although 3D9 remains innocent of any suggestion that it may have failed its allotted task of chopping the mains input in half. Thus the first weak link: replace the 1N4005 with a stouter fellow (say a BY127 since these always seem to be at hand and are the maids of all work in a busy workshop).

This does not mean to imply that other causes of a blown fuse should not be checked as routine. 3C59 for example can short at the drop of a hat, immediately sealing itself up to proclaim its innocence on a cold resistance test and then shorting again as soon as the mains voltage is applied. 3D9 can short as can 3C57, 3C58 or even 3D11—but not very often.

The HT Supply

We have mentioned 3D11: this is the h.t. supply rectifier which is connected to one side of the fuse and is a type BY127. The positive half cycles from this pass to the surge limiter 3R77 which is the resistor suspended toward the bottom of the panel. Now it is well known that surge limiters lead a hard life. At the moment of switch on the reservoir capacitor 3C56 (call it a tank if you like) takes a great gulp of current which would shatter the poor BY127 were it not for the limiting action of 3R77. As it is the current is sufficient to blow an ordinary wire (quick-blow) fuse and this is why an anti-surge type must be used in the 3F1 position. It is hardly surprising therefore that 3R77 should be the first suspect if the heaters are glowing but the receiver is otherwise inoperative. 3R77 has the value of 6.2Ω but a standard 10Ω type can be used if desired—with due regard to the wattage rating (10W or more). After 3R77 the h.t. divides into two paths for separate smoothing, giving the HT1 and HT2 rails. HT1 then splits again through 3R74 to supply HT3. Thus if there is a picture but no trace of sound check 3R76 which is the smoothing resistor for the sound output h.t. supply HT2.

Poor Contact

It is surprising how often a soldered joint that looks good isn't. This seems to apply especially to these panels. A case in point is the soldered tags of the main smoothing electrolytic which has five contacts, four h.t. plus earth. The solder blobs appear to contact the panel tracks firmly but a meter check may show no contact at all. If there is reason to suspect the smoothing check this and if necessary jump a lead from the blob to the next contact along the same track. This could save a lot of unnecessary work. Also note the metal strips which run from the top to the bottom of the panel. It is worthwhile checking the soundness of the soldering of these to the panel, particularly on the line timebase side toward the bottom in the event of intermittent line oscillator problems.

The Line Timebase

Quite often these sets come in with the complaint that the fuse fails after the set has been on for a

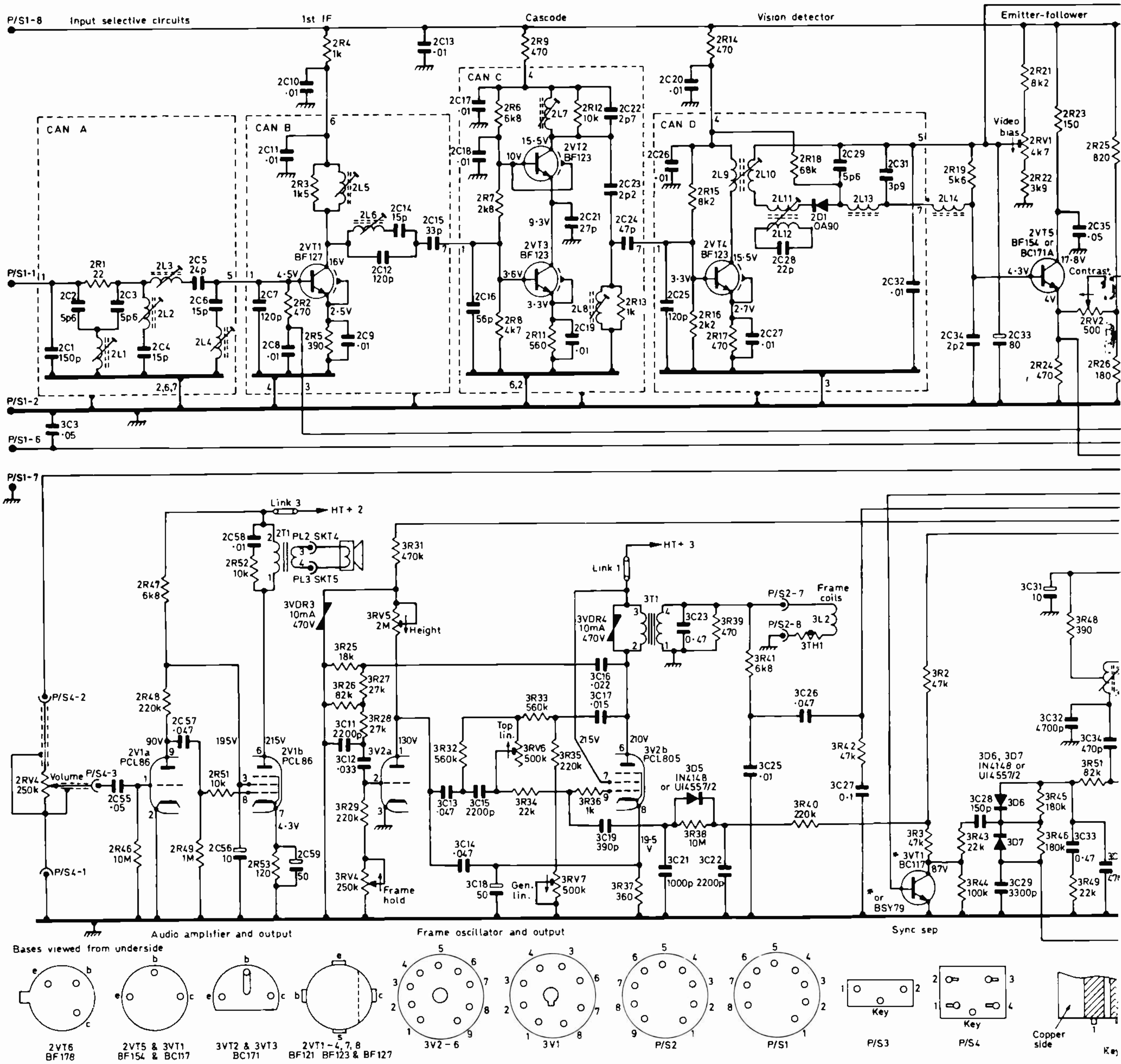
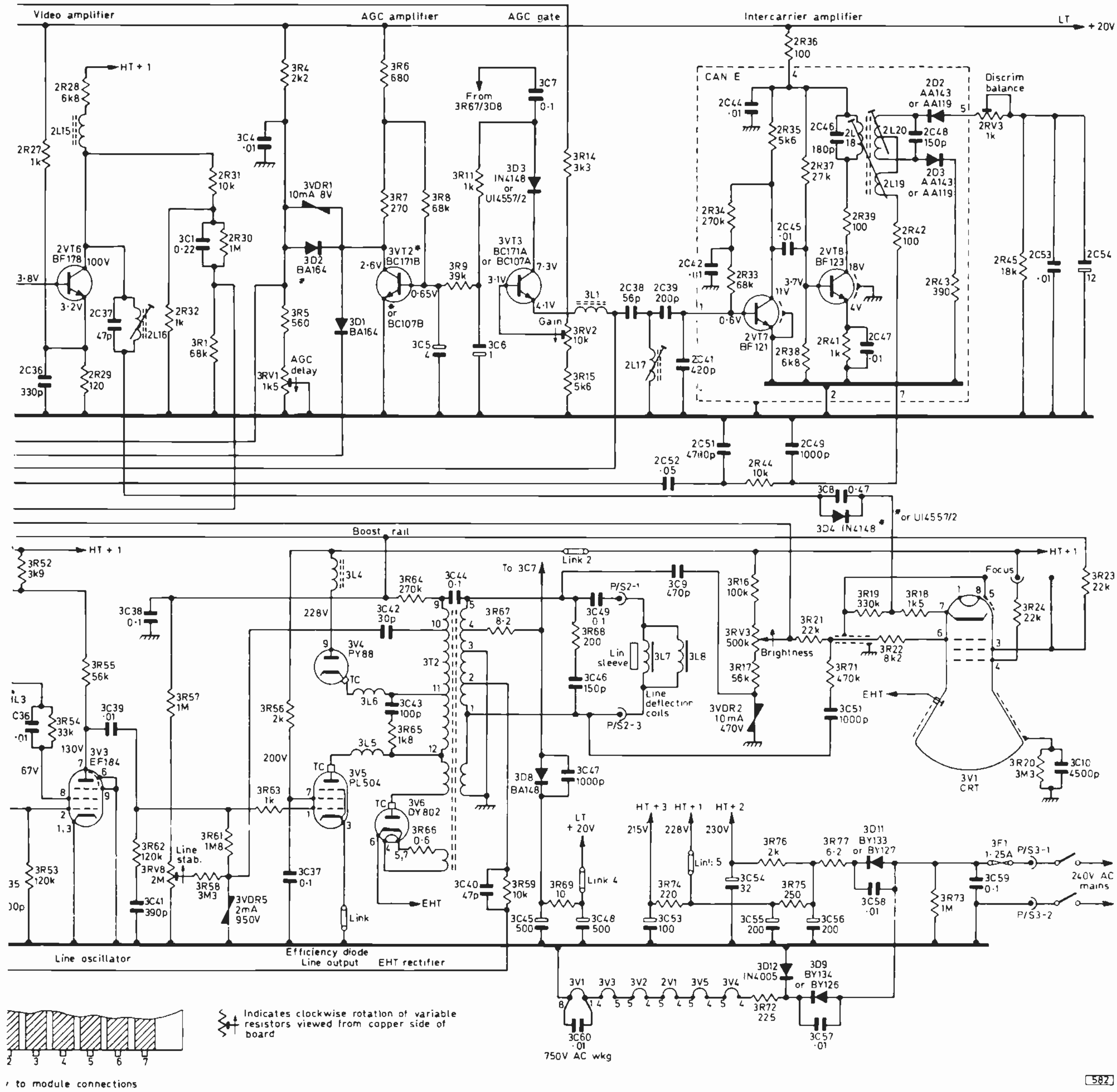


Fig. 1: Circuit diagram, Bush TV181S/Murphy V2016 series. Models include the Bush

short time (just long enough for the PY88 to warm up). In this case it is well worthwhile making a quick check from the top cap of the PY88 to chassis. If a short is evident the most likely culprit is the boost capacitor 3C44 (0.1μF). Disconnect it and try again. If the short is still there, which is unlikely, the line output transformer may have a short between windings.

In addition to performing its usual functions the line timebase also supplies the 20V transistor feed line. Therefore when the timebase is dead so is the signal (no nice rushing noise to show that the signal stages are trying to work). It is worth bearing this in mind when there is a fault in the line timebase. If there are signs of life from the loudspeaker to show that the signal stages are operating, albeit poorly, one knows that the line timebase is working up to a point. This usually clears the line oscillator stage even though the PL504 may be overheating—again up to a point!

Quite obviously if the PL504 is cherry red and the PY88 doesn't look too good either the first suspicion must be that the line oscillator is not functioning and thus not driving the PL504. In this case first check the EF184. If it is not at fault check its voltage supplies (pins 7 and 8) and then the associated components, particularly the tuning capacitor 3C32 which can become leaky. If the PL504 is overheating



TV183SS, TV185S and TV186SS and the Murphy V2015SS, V2415SS and V2417S.

but not too severely and there is some signal noise the chances are that either the line oscillator is running at the wrong speed (if you can hear it clearly it's wrong or you're very young!) or the line output transformer has shorted turns. The line output transformer is more likely to cause trouble in some chassis than others: it is likely to do so in these receivers.

Lack of width can be due to a low-emission PL504, a wrong value resistor in the line stabilising circuit (check 3R58), a shorted s-correction capacitor (3C49), insufficient line drive (again check 3C32) or shorted turns in the line output transformer (gets boring doesn't it?).

Another thing which can get boring is replacement of the line output transformer which requires no less than nine soldered connections to the panel. A must for this job is one of those suck-it-up vacuum-cleaner-cum-solder-gobbler things which whip the solder from each joint and leave a nice clean hole ready for the replacement tags to pop in. **Voltage Data:** The readings shown in Fig. 1 were measured with 240V mains input, average signal input and the brightness and contrast controls set for a high brightness picture (300μA beam current) using a 20kΩ/V meter. E.H.T. 19kV, boost voltage 520V (770V at the junction of 3R64/3C44).

CONTINUED NEXT MONTH

Wideband BAND III PREAMPLIFIER

Roger Bunney

FOLLOWING our wideband Band I aerial preamplifier (see October 1972 issue of TELEVISION) we decided to continue improving our DX-TV receiving installation by constructing a wideband Band III aerial preamplifier. This has been in operation for a while now and gives noticeably improved performance compared to the previous commercially manufactured one (which uses two AF139 transistors) we had been using. Particular thought was given to the noise performance, bearing in mind that the bandwidth required was the complete Band III spectrum, while at the same time retaining reasonable gain.

For long-distance television reception I personally favour the use of a wideband aerial and preamplifier in front of the receiver, thus reducing operations mainly to receiver tuning and aerial rotation. My receivers are usually operated with reduced vision i.f. bandwidths. Thus advantage can be taken of improved signal-to-noise performance while in this way obtaining improved selectivity.

Various transistors were considered for use in this preamplifier, the SGS (UK) Ltd. type BF272 eventually being selected. This is a pnp silicon planar transistor specially designed for use in the r.f. amplifier stages of u.h.f. tuners. It has high gain, low feedback capacitance and a low noise figure. The following figures from the manufacturer's data give an idea of its performance:
At 800MHz: power gain 13dB with 3.5dB noise (narrowband).
At 500MHz: power gain 19dB with 2.7dB noise (narrowband).
For comparison typical figures for the BF180 are as follows: power gain 12dB at 900MHz, 14dB at 500MHz; noise figure at 800MHz 7dB.

Circuit

The circuit adopted (Fig 1) is simple and straightforward. The input signals are fed to the emitter of the first transistor via C1, with the v.h.f. choke Ch providing a static discharge path for the aerial system and an r.f. bypass for signals from powerful medium and short wave radio transmitters. Both transistors are operated in the common-base mode, with R3 and R6 providing emitter bias and the potential divider networks R1/R2 and R4/R5 base bias.

Coil coupling is used between the stages and at the output. The coils are not close-wound: they are spread over $\frac{3}{8}$in. with the secondary wound between the turns of the primary. The trimming capacitors C3 and C6 enable the primary windings to be tuned to the required part of the spectrum and allow slight differences between coils to be compensated.

The base decouplers C2 and C5, the feedthrough capacitors C7 and C8 plus the two ferrite beads provide a high degree of decoupling and stability. The unit consumes 5mA at 9V.

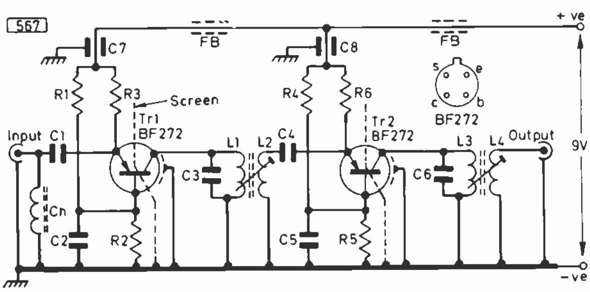


Fig. 1: Circuit diagram of the basic preamplifier. See also modification mentioned in text.

Construction

The unit—see photograph—was constructed on a small tin subchassis. It is essential to provide screening between the stages, with a slot cut in each screen so that each BF272 sits in a slot with its emitter and base connections on one side and its collector and shield connections on the other. The shield lead is soldered directly to the tin screen and also serves to support the transistor. As with all amplifiers of this type the connections must be kept very short to avoid losses. The prototype was housed in a diecast box approximately $4\frac{1}{2} \times 3\frac{1}{2} \times$ 2in. deep. Such boxes are available in the Radiospares, STC, Hellerman and Eddystone ranges.

A mains supply unit was incorporated in the box. Although full-wave smoothing is used (since the transformer was to hand!) half-wave smoothing with a circuit such as that shown in the October 1972 article could just as well be used.

Alignment

Alignment is a simple task. The first stage coil L1 is peaked towards the h.f. end of the band, say channel B12, and the second stage coil L3 to the l.f. end, say channel B7. The actual peak should be

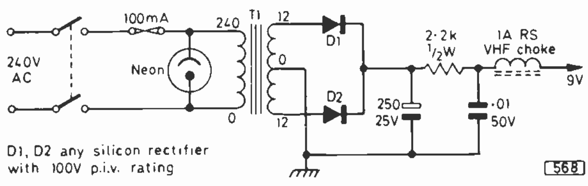
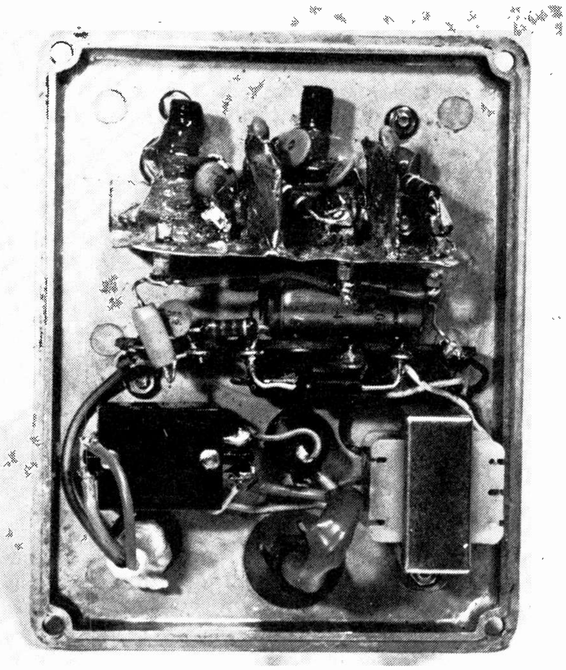


Fig. 2: A full-wave mains power supply was used (T1 is an Eagle miniature mains transformer with 240V primary and 12-0-12V secondary at 100mA). A half-wave circuit could be used if more convenient.



Internal view of the prototype preamplifier.

found to be rather broad. I found it somewhat better to use the Home Radio type Z81B high-Q cores: these are intended for v.h.f. applications over the range 50–200MHz and enable a more noticeable peak to be observed. In view of the slightly increased losses as frequency increases it may be prudent to tune the second stage coil to about channel B9: this will give increased gain over the upper half of the bandwidth with slightly decreased gain over the lower half.

Without the trimming capacitors C3 and C6 the coils will resonate at the top end of the band. Adding the capacitors enables the coils to be resonated within the band. Since it is unlikely that the two coils will be identical the capacitor values used may need to be slightly different. To avoid the coil turns moving cover them with an adhesive such as Bostik no. 1 before fitting them into circuit. Once the unit has been aligned the coil formers can be fixed to the tin subchassis with a liberal application of the same adhesive.

★ Components list

R1 3.9kΩ	R4 3.9kΩ
R2 10kΩ	R5 10kΩ
R3 1kΩ	R6 1kΩ

All $\frac{1}{4}$W 10%
C1 33pF silver mica 20%
C2 1000pF miniature ceramic 20%
C3 4.7pF* silver mica 5%
C4 47pF silver mica 20%
C5 1000pF miniature ceramic 20%
C6 3.9pF* silver mica 5%
C7 1000pF feedthrough (RS)
C8 1000pF feedthrough (RS)
* See text
Tr 1, Tr 2 BF272
Ch 1A v.h.f. choke (RS)
FB Ferrite beads (RS)
L1, L3 5 turns 24/26 s.w.g. en. cu. wire wound over $\frac{3}{8}$in. on $\frac{1}{4}$in. former
L2, L4 $2\frac{1}{2}$ turns 26 s.w.g. p.v.c. covered wire wound between turns of L1, L3 starting $1\frac{1}{2}$ turns in from the dead end
Cores Home Radio type Z81B high Q.
Two coaxial sockets etc.

Performance

The amplifier performs extremely well, and a gain of at least 20dB should be obtained over the band. Unfortunately we have no equipment available for noise measurement but comparison with a commercial unit with the same number of stages shows much reduced noise. Of particular interest is the immediate increase in noise on the TV screen when the wide-band Band III aerial is connected. No instability was found over the bandwidth whether the aerial was connected or not.

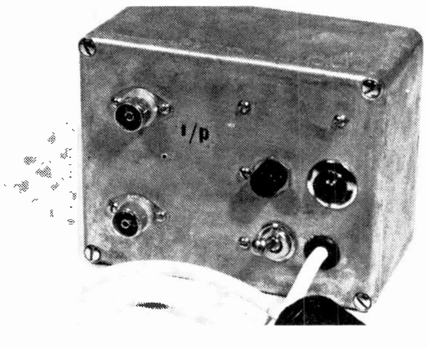
In practical terms a weak BBC-Wales channel B13 signal which was observable as line syncs only was lifted to a solidly-locked, albeit noisy, picture. The gain is maintained down to the bottom end of Band III and a good measure of amplification is still present at channel F5 vision (164MHz).

Modification

Whilst working on a further preamplifier of this type instability which remained despite careful alignment was noted on channel B10. The remedy, which improved the performance of the amplifier and was fitted to the original prototype therefore, was found to be the connection of a small value capacitor between the emitter of each transistor and chassis. A 3.9pF capacitor is used for the first stage and a 5.6pF one for the second stage—both silver mica types. A check to ensure absence of instability over the whole bandwidth should be made with the input both terminated and unterminated.

Component Sources

BF272 transistors can be obtained from most semiconductor mail order houses or from ECS trade outlets. If difficulty is experienced contact SGS (UK) Ltd., Planar House, Walton Street, Aylesbury, Bucks. All other components can be obtained from Home Radio (Components) Ltd., 240 London Road, Mitcham, Surrey CR4 3HD. ■



The prototype is housed in an Eddystone diecast box.

FAULT FINDING GUIDE

2

John Law

LINE TIMEBASE ITT/STC/KB CHASSIS

In the past the majority of UK setmakers have used a blocking oscillator or multivibrator circuit as the line generator in their monochrome receivers. Two odd men out however have been the GEC and ITT-STC groups. For many years these groups have used a sinewave line oscillator, with flywheel sync and reactance valve control of the oscillator frequency. The advantages of using a sinewave line oscillator include a high degree of line frequency stability, immunity from external interference on the sync pulses, absence of bending on verticals under poor signal conditions and very solid line lock.

This month we will deal with the ITT-STC design, outlining the circuit operation and describing typical fault conditions dealt with in our workshops over some years. It is a tribute to the reliability of this circuit that the design has remained virtually unchanged since the introduction of the VC2 chassis in 1964. A wide range of KB, RGD and Regentone models were fitted with the VC2 and the later very similar VC3, VC4, VC51, VC52 and VC53 chassis. The same line circuit was used in the original Featherlight (VC11) portable although the chassis was quite different. They are all hand-wired chassis.

Circuit Operation

The complete line timebase and c.r.t. circuit as used in the VC52 chassis is shown in Fig. 1. The high-Q oscillator coil is L63: it is coupled to the screen grid of V12 pentode section by L64 and to the control grid by C121. The coil inductance determines the nominal frequency of the oscillator on 625 lines: on 405 lines additional capacitance (C115) and the preset C113 are brought into circuit by the system switching. The triode section of V12 acts as a variable capacitive reactance effectively in parallel with the oscillator circuit to give continuous frequency correction.

The picture is basically horizontally synchronised by the voltage tapped from the line hold control R126 and fed via R127, R129 and R130 to the grid of the reactance triode V12A. Negative-going sync pulses are fed via C71 to the junction of the flywheel sync discriminator diodes D8 and D7. The other input to the discriminator circuit is a reference signal from the line output transformer. This consists of line flyback pulses which are integrated by R139 and C112 so that a sawtooth reference signal appears at D8 anode. If the sawtooth and the sync pulses coincide in time D8 and D7 conduct equally and equal but oppositely phased voltages are developed across the diode load resistors R127 and R129. The discriminator does not therefore alter the voltage tapped from the hold control and fed to V12A grid. If the sawtooth and the sync pulses are not coincident however D8 and D7 do not conduct equally and the voltages developed across R127 and R129 are no longer balanced. Thus a negative- or positive-going potential, depending on whether the sawtooth is early or late with respect to the sync pulses, is added to the potential applied to V12A grid. R130/C118/R132/C116 filter the output to V12A grid.

For V12A to act as a capacitive reactance across the oscillator circuit it is necessary to drive it in quadrature with the oscillator signal. This is done by feeding the signal developed across R134 to V12A cathode via C114. The capacitive reactance which V12A presents depends on its conductance which is of course dependent on the voltages applied to its cathode and grid. The cathode d.c. voltage is set by the potential divider R131/R133 while the grid voltage is set by the hold control and modified by the output from the flywheel sync discriminator circuit. In this way the capacitive reactance of V12A is varied to control the oscillator frequency.

The line output stage itself follows normal convention, with e.h.t. stabilisation by means of a v.d.r. in the grid circuit of the line output valve as in most receivers produced in recent years.

Sync Troubles

These line oscillator and output circuits have proved themselves over the years but as with other arrangements they are subject to fault conditions sooner or later. The PCF802 line oscillator valve for example can develop an internal short resulting in loss of hold control. The same symptom occurs when R125 in series with the hold control goes open-circuit.

When sync troubles are experienced a check of the forward and reverse resistances of the discriminator diodes D7 and D8 should be made. Note that the load resistors R127 and R129 can change value, giving misleading readings. A low front-to-back reading across D7 gives good line lock at one end of the hold control track on 405 lines but no lock on 625 lines. A common cause of line sync trouble is change of value of R131: in one case we

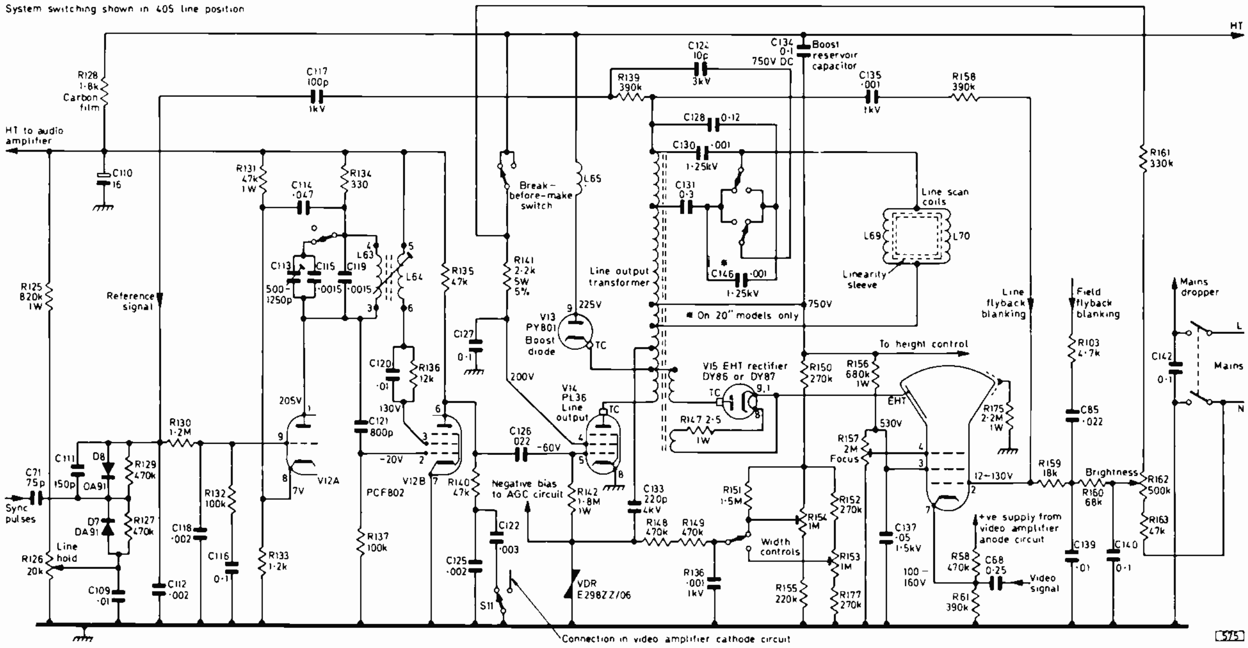


Fig. 1: Line timebase and c.r.t. circuit, STC VC52 chassis. The same basic circuit with only minor component value changes was used from the VC2 chassis on. In earlier chassis the arrangement of S11 is slightly different and the S-correction capacitor C130 is 0.0022μF (3kV).

found that the value had fallen to 27kΩ. If this change in value occurs gradually over a long period of time the symptoms can be temporarily cleared by resetting the core in the oscillator coil and the preset C113. Eventually however the hold control runs out of track. A valve change sometimes masks the cause of the trouble.

An unusual fault which is more prevalent in the Featherlight portable is caused by the oscillator coil sliding down its former after a time. The resulting line slip can be cured by periodically screwing down the core to keep pace with the slipping coil. If the coil reaches the bottom of the former however it can short to the fixing screws, damaging the windings and burning out the h.t. feed resistor R128.

After any repair in the oscillator circuit it is important to set up the circuit in accordance with the maker's instructions. Briefly these are: switch to 625 lines; connect pin 9 of V12A to the junction D7/C109; connect an Avo meter from pin 9 to chassis; set the line hold control for a reading of 3V; tune the oscillator core to give a steady picture; switch to 405 lines and lock the picture with C113; finally centre the hold control (after removing the short-circuit across the flywheel sync circuit).

Lack of Line Drive

The line oscillator output is shaped by the network R140/C125/C122 and passed via the coupling capacitor C126 to the control grid of the PL36 line output valve. Failure of the PCF802 to oscillate will mean no drive voltage at the grid of the PL36. Excessive current will flow through the PL36, the line output transformer and the PY801 boost rectifier, and this will be accompanied by rising temperatures. If the situation is prolonged all three items will be damaged and fire can occur. The absence of drive voltage at the PL36 grid can be quickly checked: an Avo meter should read 60V negative between pin 5 of the PL36 and chassis. Fortunately a replacement PCF802 oscillator valve usually cures the fault.

No EHT

A more common fault is drive voltage at the PL36 grid but no e.h.t. The drill here is to switch off, remove the boost diode top cap and switch on again. If the timebase then shows signs of life which die when the top cap is replaced the boost reservoir capacitor C134 is probably shorting. A meter check across it will prove the point. It is an 0.1μF capacitor rated at 750V: replace it with a 1kV capacitor in the interests of greater reliability.

If removing the top cap of the PY801 has no effect try a new valve. If that doesn't help remove the DY86 e.h.t. rectifier top cap: an internal short in this valve can kill the e.h.t. If there is still no life and a new e.h.t. rectifier gives no improvement check the condition and value of the 2.5Ω resistor R147 in series with the DY86 heater. This is mounted inside the valveholder. It can deteriorate with time, change value or even disintegrate, leaving the e.h.t. rectifier without heater voltage. A small change in value will reduce the heater supply, giving the symptom of ballooning when the brightness control is turned up. A defective DY86 or PL36 can also cause ballooning.

If none of these moves restores the e.h.t. the line output transformer itself may be the culprit, especially if it has been run under fault conditions

—continued on page 272

Assessing RECEIVER PERFORMANCE

PART 3

E.J. HOARE

FRINGE PERFORMANCE

LAST month we completed our survey of a test programme for assessing the performance of a monochrome receiver under strong signal conditions. There are so many different characteristics and defects to look for that we are bound to have overlooked a few items. If in following our tests you found nothing worthy of serious comment however you undoubtedly have a good receiver—if it happens to be a home constructed one then you can congratulate yourself on a really fine effort.

There is a lot more still to do of course. First there is the matter of fringe area performance where the receiver is struggling to make sense out of an incoming signal that is nearly swamped by electrical noise. Then there is the interesting field of colour. Fringe area testing introduces a difficulty that is not nearly so important when the signal is a good one, namely how well should one expect the receiver to perform? With strong signals it is possible to give reasonably clear guidance about what to expect: with poor signals it is more a matter of comparing your receiver against one which is known to perform well or to be typical of present day standards of performance. So before starting the next series of tests see if you can borrow a fairly up-to-date model which is generally regarded as being satisfactory and has the same screen size.

Place the receiver beside your own, under the same lighting conditions, and at each stage of your testing carry out the same adjustments and assessments on each. The comparison can hardly fail to be both helpful and interesting. The same technique can of course be used to advantage in any form of TV testing.

Obtaining a Fringe Signal

Some people are unfortunate enough to live in a true fringe area with nothing but a weak noisy signal. This is ideal for testing purposes but most people would willingly forgo that convenience in the interests of obtaining a good clean picture! In strong signal areas testing fringe performance is not quite so easy. The simplest answer is to plug a coaxial attenuator into the aerial socket and try different values of attenuation until the right strength of signal is obtained. This approach is adequate for most purposes but does not simulate all the defects caused by propagation peculiarities between the transmitter and a distant receiver.

A better method is to refer to a list of BBC and IBA transmitting stations and choose one or more located between fifty and a hundred miles away. Then align your aerial carefully on the appropriate compass bearing and adjust it for best reception. By careful choice of stations it is usually possible to get signals ranging from unusably weak to reasonably acceptable. This is ideal for fringe testing purposes. If you are really stuck for a fringe signal try pulling out the aerial plug and holding it very close to the socket but not actually touching it.

Fringe Area Testing

The reasons for testing a receiver under weak signal conditions are fairly obvious but let us nevertheless be quite clear about the two principle objectives. First to find what is the weakest signal that enables a coherent picture to be obtained with adequate sound. Secondly to establish which aspects of the receiver's performance prevent it from being used with still weaker signals. Is it for example a matter of tuner noise performance, i.f. gain, timebase synchronisation, sound gain, etc.?

First of all adjust both receivers (if you have managed to get hold of a second one for comparison purposes) so that they have the same contrast, brightness, tuning and focusing. Try to make both pictures as similar as possible on a signal which is noisy but which enables proper synchronisation to be obtained so that the field is not slipping and the line scanning is no more than slightly affected by the noise. Adjust the tuning again in order to get the best overall picture quality. With weak signals you will find that if you tune for best resolution of the frequency gratings of a test card the good high-frequency response will enhance the appearance of the picture noise. It is usually better to detune slightly so that although a certain amount of resolution is lost the noise is reduced too and the overall effect is more pleasing to the eye. This procedure becomes more beneficial as the strength of the signal is reduced. Now check the sound output to make sure that this is still adequate.

Assuming that your test receiver is performing

Check list for complete test programme

(a) Monochrome receiver or colour receiver with colour killed.

1/1 *Check:* Make sure that the chassis is earthy and that the receiver is generally safe to handle.
Provide: Good aerial with clean, strong signal.

1/2 CRT Display
Adjust: Field height and linearity, line width and linearity.
Assess: Picture centring; raster shape; focusing—centre and edges at high brightness; field and line blanking—high and low contrast; effect of changes of mains input voltage on above items; line striations or "curtains".

1/3 Customer Controls
Assess: Brightness control—range and centring at high and low contrast; contrast control—range and centring (readjust brightness); volume control no output to maximum output; tuning—mechanical ease of adjustment, reset accuracy, frequency drift during warm-up and life, usable tuning range (electrical and mechanical), does it cover all channels?

1/4 Timebase Synchronisation
Assess: Line hold—centring and electrical and mechanical range; field hold—centring and electrical and mechanical range; line sync—squaring, hooking, tearing, wriggle; field sync—vertical slip, jitter, interlace.

2/1 IF and Video Response
Adjust: Best picture on test card or pattern.
Assess: Response on frequency gratings; smearing; ghosting from aerial or damaged coaxial lead; overshoots; rings; preshoots; effect of detuning on the above items.

2/2 Interfering Beat Patterns
Adjust: Vary tuning very slowly over whole range.
Assess: 4.43MHz; 1.57MHz; 6MHz; others—does the interfering amplitude or frequency vary with tuning?

2/3 Cross Modulation
Check: Ensure proper adjustmont of a.g.c. crossover control.
Assess: Disturbance on picture; buzz on sound. Are these cured by 20dB attenuation of the signal?

2/4 Noise
Provide: Clean signal, comparison receiver if possible, low ambient lighting.
Adjust: Brightness and contrast and tuning for precisely similar pictures on both receivers.
Assess: Electrical noise on picture—examine particularly the mid-grey tones; hiss on sound.

2/5 AGC
Provide: Normal and weak signals.
Assess: Change of contrast with large change of signal strength; effect of aircraft ("flutter").

2/6 Tonal Gradation
Provide: Low ambient lighting.
Assess: Full range of evenly spaced tones from black to white.

2/7 Other Picture Defects
Provide: Low ambient lighting.
Assess: Shading—horizontally and vertically of picture and raster; bars—moving up or down—black or white; stability of black level—with time or warm-up, with picture content and with change of mains input voltage; breathing—change of picture size with brightness, bounce with change of brightness; switch-off spot suppression—*take care* (see text).

2/8 Sound
Assess: Maximum sound output; distortion—electrical, speaker buzz, cabinet resonances; hum and electrical buzz—low and high volume, field synchronised and slipping; tuning range—adequate volume, buzz, whistles, plops etc., effect of different picture content (i.e. captions), correct sound channel; noises at switch on and switch off.

3/1 Fringe Testing
Provide: Variable weak signal and comparison receiver if possible.
Adjust: Both receivers for precisely similar brightness, contrast and tuning.
Assess: Picture noise—subjective annoyance, appearance of noise (pinhead, blobs, smears); line sync—general acceptability, type of defects; field sync—slipping or jitter; field and line hold control ranges; picture resolution—check frequency gratings with best tuning; sound output—volume, noise; usable tuning range; interference beat patterns; spurious vertical lines on picture or raster.

(b) Colour Receiver Working Normally
Provide: Near total darkness for all tests.

4/1 Purity
Provide: Blank noise-free raster.
Assess: Purity—goodness, stability with life.

4/2 Convergence
Provide: Crosshatch pattern or test card.
Assess: Static convergence in centre of picture; dynamic convergence near the edges—goodness and stability of both.

4/3 Grey-Scale Tracking
Provide: Test card or colour bars with colour killed.
Assess: Dark greys—neutral colour; highlights—illuminant D; all tones—correct tracking from black to illuminant D. Note: check stability over a period of a few weeks.

4/4 Colour Fidelity, Controls, Colour Resolution, Patterning
Provide: Colour bars, test card and plenty of programme material.
Assess: Colour fidelity—colour bars and programme; saturation control—range and centring, coupling with contrast control, effect of detuning; colour resolution—sharpness of coloured areas, registration of colour and luminance, effects at colour transitions; patterning—4.43MHz and 1.57MHz on highly saturated colours, others (do they vary with tuning?).

4/5 Other Colour Features
Assess: Blinds—on highly saturated colours (orange and green); ident—switch channels slowly many times; colour switching—(orange and green hues particularly); a.c.c.—check saturation when detuning; colour killer.

4/6 Colour Fringe Signal Performance
Provide: Variable weak, noisy signal.
Assess: Patterning—check for new patterns (are they tunable?); ident; a.c.c.; colour killing; noise; what factor limits the weak signal colour performance?

"Does it have a flywheel-synchronised sinewave line oscillator?"

satisfactorily reduce the signal further and compare the receivers by plugging the aerial into each one in turn. Readjust the controls if necessary in order to maintain similar pictures on each. Make a critical assessment of the subjective appearance of the picture noise, the range of the line and field sync controls, the quality of the line and field sync on the picture, the resolution of the frequency gratings, the quality of the sound and the range of tuning over which adequate sound is obtained. Has the sound got a background hiss? Look also for any isolated narrow vertical bars on the picture caused by line switching disturbances, and for interference beat patterns.

Continue reducing the signal strength in small steps (if this is practicable in your particular circumstances) until things begin to go wrong—either on your test receiver or the comparison one. Make notes at each stage so that you have a clear idea of the deficiencies of each receiver and the order in which they occurred. Carry on in this way until you get to the point where the signal is so weak that both receivers are completely unusable, with no effective line or field sync and inadequate sound.

In a perfectly designed receiver all these things will happen simultaneously. In practice there will be a clearly defined order. You are now in a position to answer these questions: is the fringe performance satisfactory for your purposes; is it fully in line with normal present day standards; what aspects of the receiver's performance need to be improved first to make it still better?

Fringe Problems

Generally speaking it is the line synchronisation that presents the biggest problems to the amateur constructor. If the wrong type of oscillator or flywheel time-constant is used bad line tearing will occur even when the picture information is clearly visible through the noise. Other fairly common problems are spurious oscillations when the receiver is operating at full gain and poor i.f. and video responses causing the noise to appear as long smeary blobs instead of the less objectionable "pinhead" noise characteristic of a well designed signal channel.

NEXT MONTH: COLOUR SET PERFORMANCE

FAULT FINDING GUIDE

—continued from page 269

for some time. A single shorted turn can damp the windings sufficiently to stop it working. Replacement is the quickest way of proving its condition.

CRT Circuit

Whenever there is a dim picture or suggestion of a weak tube the c.r.t. base voltages should be checked. The first anode (pin 3) should read about 500V. If low check the decoupler C137 and the parallel preset 2MΩ focus control R157. If these components turn out to be all right disconnect the lead to pin 3 of the c.r.t. base. If the voltage at the lead is correct but drops when the connection to the c.r.t. is made the likelihood is interelectrode leakage in the tube.

The c.r.t. grid voltage (pin 2) should read 12-130V —under the control of the brightness potentiometer R162. Very low or no voltage here can be caused by leakage in the decouplers C139 or C140. A defective field blanking pulse coupling capacitor C85 can kill the brightness.

The c.r.t. cathode voltage (pin 7) should be 100-160V. If the voltage here approaches the h.t. line voltage check R61.

In later versions R163 on the earthy side of the brightness control is replaced by a v.d.r. (type E299DD/P336) which is taken direct to chassis. There is also an additional 2.2MΩ (1W) resistor connected in series with the feed to the c.r.t. first anode (pin 3).

Miscellaneous Faults

Frequent failure of the line output valve accompanied by low screen grid and boost voltages has been found to be the result of the 2MΩ focus control changing value—to around 750kΩ. Absence of PL36 screen grid voltage is usually due to the feed resistor R141 being open-circuit. A fault occasionally encountered is arcing between two of the boost rectifier valveholder pins: replacement is the only cure.

When dealing with line timebase faults it pays to stop and think about the symptoms before dashing for the soldering iron. Two minutes thought and a logical approach can save hours on the bench.

NEXT: GEC 2000 SERIES SOUND CIRCUITS

RENOVATING the RENTALS

12 BRC 2000 CHASSIS

CALEB BRADLEY B Sc

E.H.T. AND POWER SUPPLIES

The basic e.h.t. generator (see Fig. 4) is very simple and consists of VT7 which is switched at line frequency (the drive is obtained from a separate secondary winding on the output transistor driver transformer in the line timebase and is connected via PLG/SKT11, pins 1 and 2) and drives T1 which steps up the flyback pulse to about 8kV to feed the tripler. This supplies 24kV d.c. to the c.r.t. final anode. The tripler is mounted on the c.r.t. itself whose final anode capacitance forms part of its circuit. W3 acts as an efficiency diode while C9 tunes the "flyback" pulse. A common failure here is the tripler itself; this may in turn damage VT7 causing the power supply trip to operate. An unpleasant brushing effect on the picture can be due to corona in T1.

The e.h.t. regulator circuit occupies the rest of Fig. 4. The e.h.t. voltage is divided down by v.d.r.s Z501, Z500 and R506 and compared by the long-tailed pair VT2/3 with a zener stabilised voltage from R14 (set e.h.t.). The c.r.t. focus voltage (4–5kV) is taken from a slider on Z500: on early sets this focus control becomes intermittent but the trouble can be cured by taking it to pieces and rubbing the slider with fine emery paper.

VT2/3 drive VT4 which drives VT5 which in turn drives the series regulator VT6 for the e.h.t. generator supply. Zener diode W2 prevents excessive drive to VT5 and VT6. If the feedback voltage from R506 is absent VT1 turns off and prevents VT3, VT4 etc. passing excessive current. Do not adjust R13 unless 24kV cannot be obtained with R14. R13 is factory set for 26kV maximum e.h.t. Running at higher e.h.t. than 24kV for any length of time is certain to damage the tripler. Tripler life can be prolonged by setting R14 for an e.h.t. of 22-23kV.

Failures in the e.h.t. regulator are generally con-

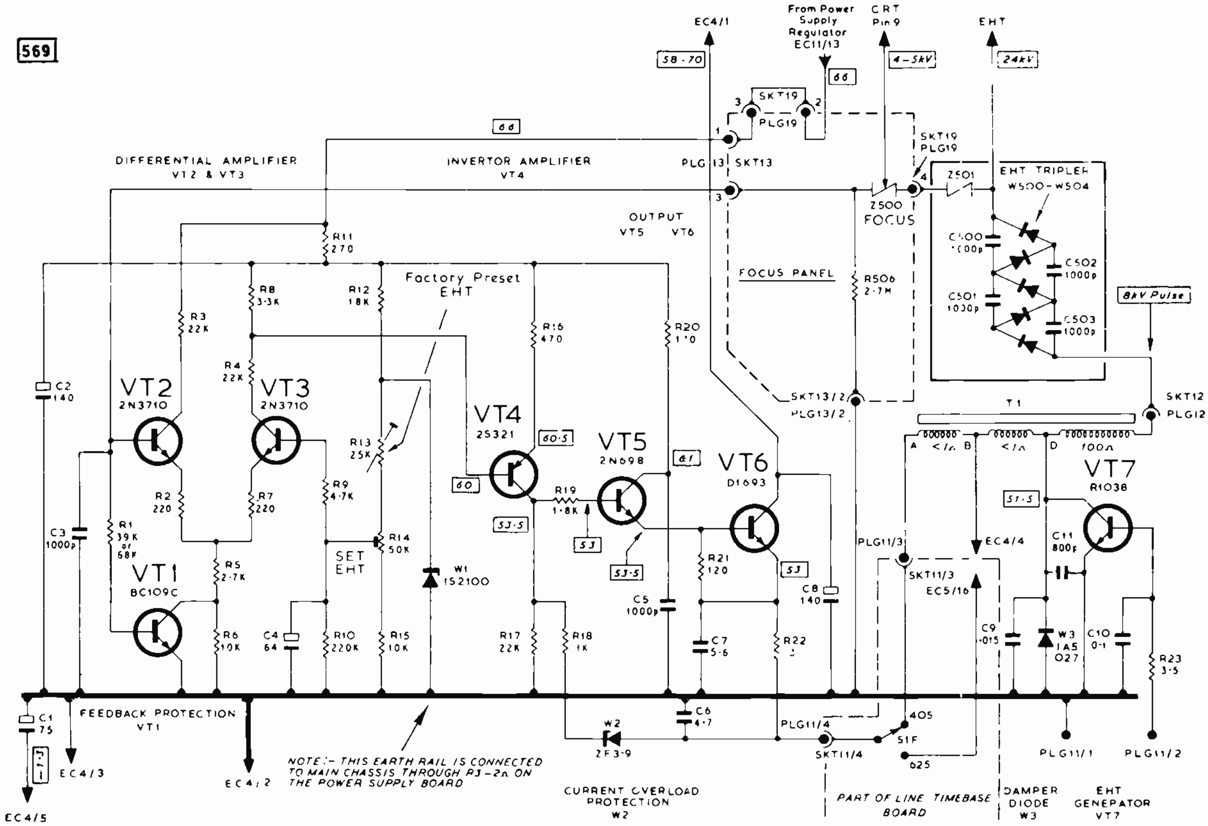


Fig. 4: The e.h.t. generator, regulator and focus circuit. Note that EC4/2 connects to the main chassis via EC10/18 and R3 on the power supply board.

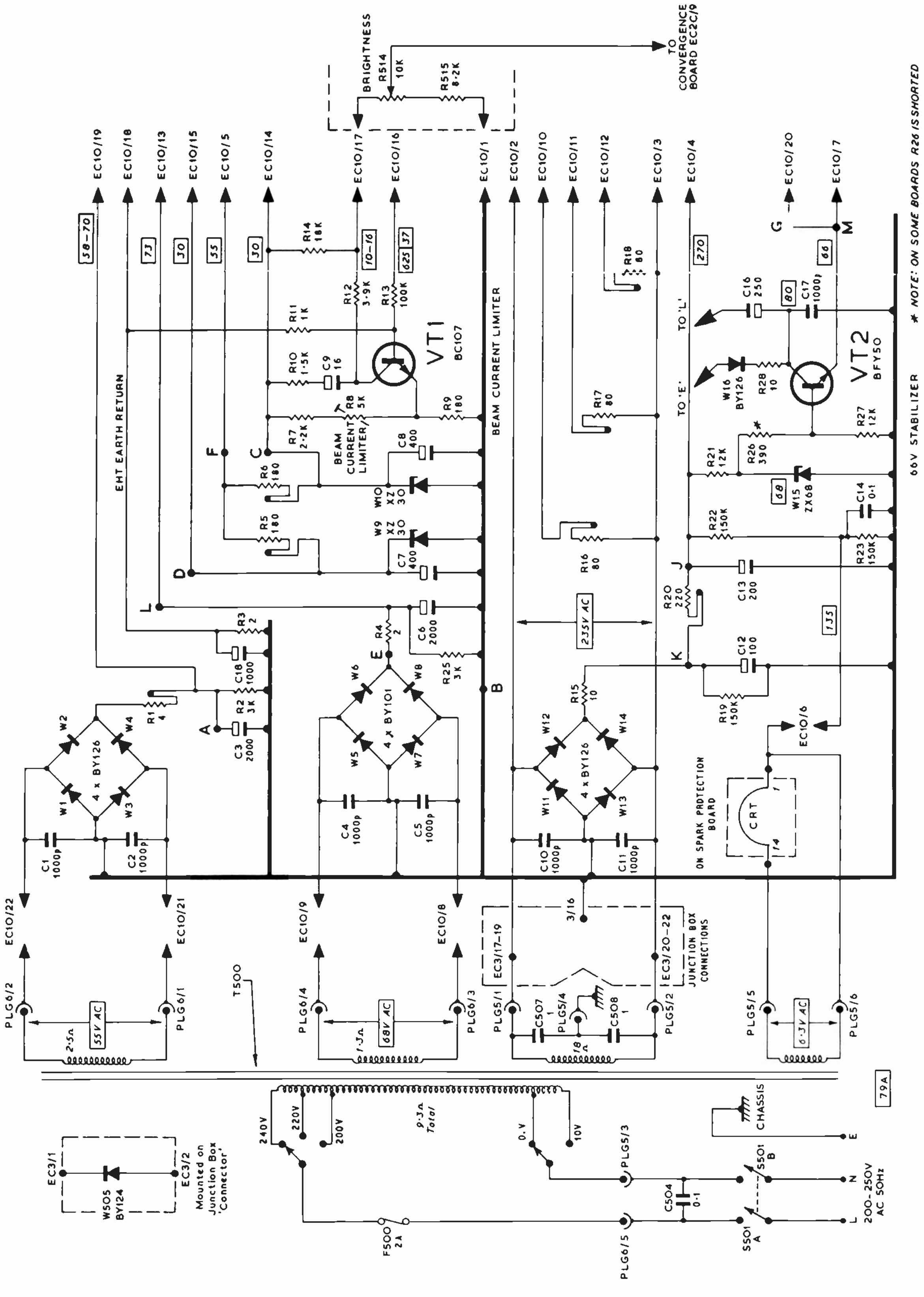
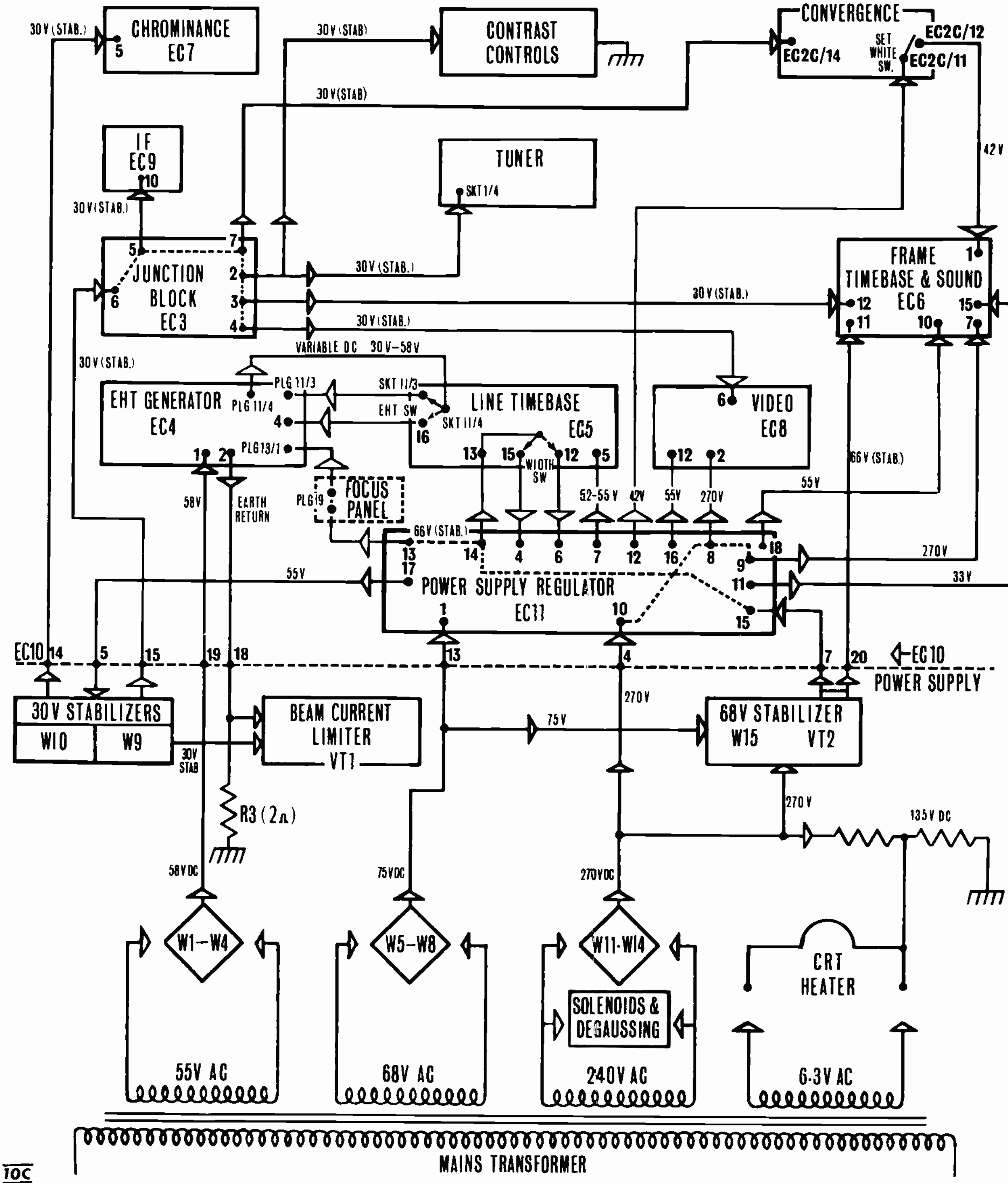


Fig. 5: The power supply circuit.

fined to VT2 (poor e.h.t. regulation, seen as ballooning of the picture with advancing brightness) and



IOC

Fig. 6: Power distribution. The voltages shown are nominal.

VT6 going short-circuit. The latter causes a small picture with sky-high e.h.t. Unadjustable e.h.t. can be due to a faulty W1. C2 and C8 can explode with no apparent reason.

An important servicing note is that the e.h.t. board earth, including the extractor tab, is returned to the main chassis via R3 (2Ω, see Fig. 5) in the power supply circuit, decoupled in Fig. 4 by C1. For correct operation there should be less than 1.5V negative across C1 ; more suggests that VT6 or VT7 is shorted or that the tripler is faulty.

The power supply circuit is shown in Fig. 5 and the power distribution in Fig. 6. Separate bridge rectifiers provide supplies of approximately 58V, 73V and 270V d.c. The only common fault is in bridge W5-8 although mains transformers with shorting primary turns have been encountered.

Most supply shorts cause one of the seven fusible

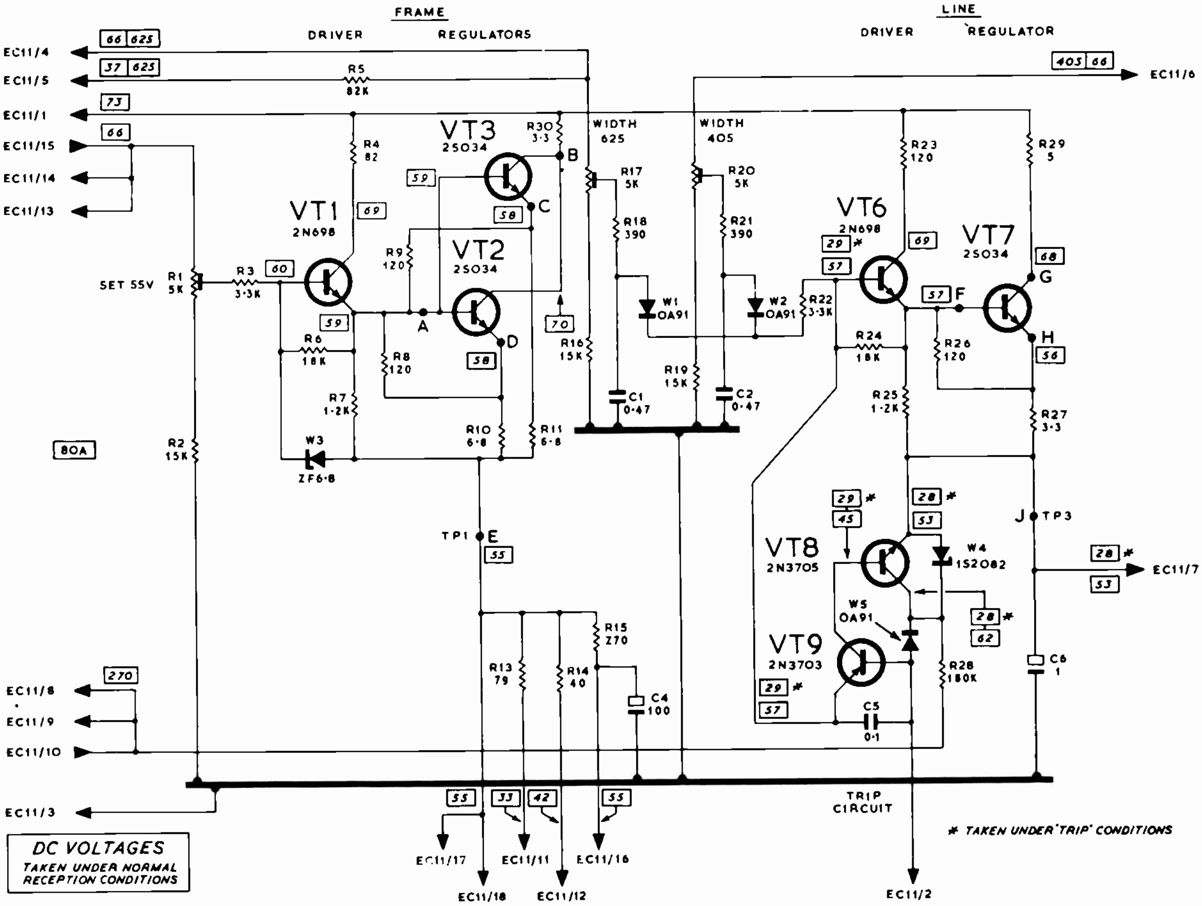


Fig. 7: Power supply regulator circuits.

resistors to go open-circuit: resolder when the fault has been cleared. R4 can go open-circuit—check that a nearby wire cannot touch it, and that C6 is not short-circuit. A fry up of VT2, W16, C16 (which may explode!) and/or R4 can occur: when repairing check C22 on the video board also. W15 also goes short-circuit. Any of the large can electrolytics can dry up causing hum bars.

The beam current limiter transistor VT1 should normally be off. A voltage is tapped down from the 30V rail by the brightness control and fed via the set white switch on the convergence board to the d.c. restorer on the video board. If the current in the e.h.t. generator earth return resistor R3 in Fig. 5 becomes excessive however VT1 turns on to reduce the brightness and prevent excessive c.r.t. beam current. The makers recommend that R8 is set for 850μA at the c.r.t. green cathode (pin 6) lead with a normal contrast picture and the brightness fully clockwise. The lead can be unplugged from the c.r.t. base for this measurement. A faulty VT2 can cause uncontrollable beam limiting.

The c.r.t. heater is kept at approximately 135V by R22/23. This is done to minimise strain on the heater-cathode insulation.

The power supply regulator circuit shown in Fig. 6 receives 75V from the power supply and consists of regulator VT6/7 which supplies 52–55V (depending on the width control setting) to the line timebase and the 55V regulator VT1/2/3 which supplies the field/sound and video boards and also feeds the 30V zener diodes in the power supply. Both regulators use the 66V stabilised line from the power supply circuit as reference. The unijunction-type circuit VT8/9 forms a trip which disables the line regulator if an overload causes excessive voltage between VT8 and VT9 emitters. This causes "sound, no vision" and it is necessary to switch the set off for about 30 seconds to remove the trip action. VT2 and VT3 in the field regulator are connected in parallel to handle the current demand. This regulator is simply protected by W3.

Failures in this circuit tend to be catastrophic, e.g. VT1/VT2/VT3, VT6/VT7/R29 or VT8/VT9/W5 going down together. The cheap 2N3055 can replace VT2, VT3 or VT7. S-shaped sides to the picture and side-to-side line jitter may be caused by VT7 but also check C6 here and C6, W5–8 in the power supply circuit. If the trip circuit is faulty it can of course be cut out to restore the line scan but one should not operate the set this way. Sets have also been seen where VT7 had gone open-circuit and had been simply bridged collector to emitter to restore the line scan (grossly overscanned unless a wirewound resistor is used). This is not good practice! A faulty VT7 or open-circuit width control will cause ripple on picture verticals. With older type e.h.t. boards (square transistors) the trip circuit can be temperamental: reducing R27 (3.3Ω) to 1 or 2Ω cures this.

TO BE CONTINUED

LONG-DISTANCE TELEVISION

ROGER BUNNEY

JANUARY, so often the quietest month of the year, has this time been somewhat more active—at least from what I can make out from reports coming in. The tropospherics in particular have been somewhat above average. Hugh Cocks at Mayfield, Sussex, noted West German v.h.f. and u.h.f. during the first few days of the month and later towards the middle of the month. Of particular note was his reception of Brocken ch.E6 from the GDR (East Germany). La Dole ch.E31 was also received, twice—it seems that the Swiss u.h.f. network is being received more often now. For my part January was one of the quietest months for a long time. Reception was not assisted on the temporary array in use when the new main arrays were assembled and provided rather too efficient screening! I am pleased to report that the new main array went into operation on January 29th—with a startling improvement in signal reception! The log. bleak that it is, is as follows:

1/1/73 BRT (Belgium) ch.E2; NOS (Holland) E4—both trops. (The tropospherics were considerably improved at this time due to fog.)
2/1/73 SR (Sweden) E2—MS (Meteor shower/scatter).
3/1/73 DFF (GDR—East Germany) E4; SR E3—both MS; BRT E2—trops.
6/1/73 BRT E2—trops.
7/1/73 NRK (Norway) E4—MS.
8/1/73 SR E4; NRK E4—both MS.
10/1/73 BRT E2—trops.
12/1/73 NRK E2—MS.
13/1/73 NOS E4—trops.
14/1/73 BRT E2; NOS E4—both trops.
15/1/73 DFF E4—MS; BRT E2—trops.
16/1/73 CST (Czechoslovakia) ch.R1—MS.
19/1/73 SR E2—MS.
20-26/1/73 BRT E2—trops.
27/1/73 WG (West Germany) E2; TVP (Poland) R1; CST R1—all MS. the latter two late night reception: BRT E2—trops.
28/1/73 NRK E2, 4; WG E2—all MS; BRT E2—trops.
29/1/73 BRT E2; NOS E4—both trops. The tropospherics gave a lift this day with most ORTF (France) transmitters "in" from N. France (v.h.f./u.h.f.).
30/1/73 NRK E2—MS; BRT E2—trops. At 1720 a slow-fading weak negative video signal was noted to the SE—possibly ducting.

As noted above the new aerial system is now in use. It consists of a 30ft. self-supporting lattice mast with the aerials as follows: at 40ft. a wideband u.h.f. log-periodic (J Beam); at 37ft. a wideband Band III 13 element aerial (J Beam); and for Band I/II a five element aerial at 33ft. The latter array consists of a four element wideband Band I aerial with a fifth element—a dipole—cut to 86MHz and mounted ahead of the second Band I director. Thus semi-wideband Band II operation is obtained. the second director for Band I acting as a reflector for Band II. A wideband u.h.f. preamplifier using two AF279 transistors (see *Teletopics*, TELEVISION October 1972, page 535) is mounted on the mast.

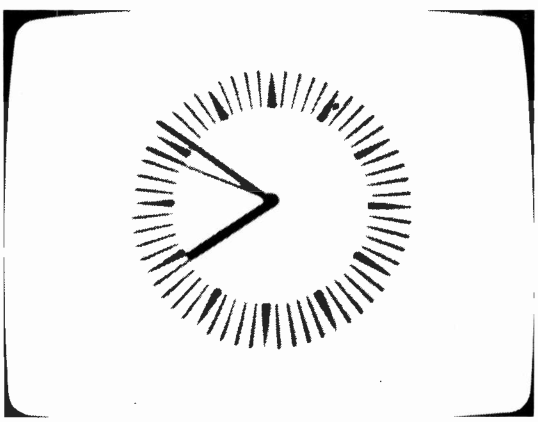
Our grateful thanks to the British Astronomical Association—meteor section—for providing us once again with the following information: Quadrantids 1st-5th January, peak 3rd January; Lyrids 19th-24th April, peak 22nd April; May Aquarids 1st-8th May, peak 4/5th May; Delta Aquarids 15th July-15th August, peak 28th July; Perseids 25th July-18th August, peak 12th August; Orionids 16th-27th October, peak 21st October; Taurids 18th October-30th November, peak 9th November; Leonids 15th-19th November, peak 17th November; Geminids 7th-15th December, peak 14th December; Ursids 17th-24th December, peak 22nd December.

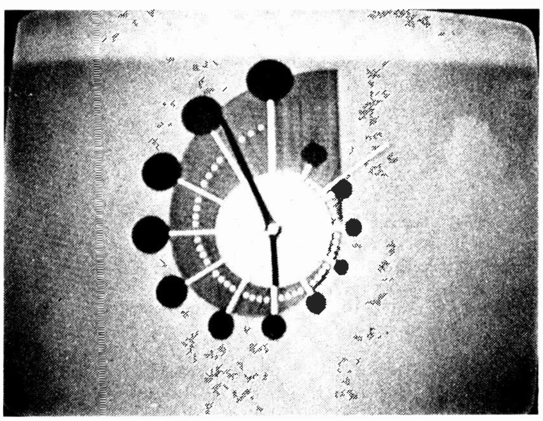
News Items

We understand that Belgium is to start a second TV service. The existing v.h.f. transmitters on channels E2, 3, 8, 10 (Aalter, Liege/Ougree, Wavre) will be used. As soon as further details are available they will be published. (Information courtesy P. F. Vaarkamp.)

South Africa: Following our recent list of u.h.f. transmitter sites information has been passed on from the *International Broadcast Engineer* relating to the Band III sites. In the Transvaal at Constantiaburg, Pretoria, Johannesburg, Welverdiend; in the Cape Province near Cape Town at Villiersdorp. All these transmitters will be 12kW pairs (the e.r.p. will of course be somewhat higher). In addition there will be a 5kW pair in Cape Province at George.

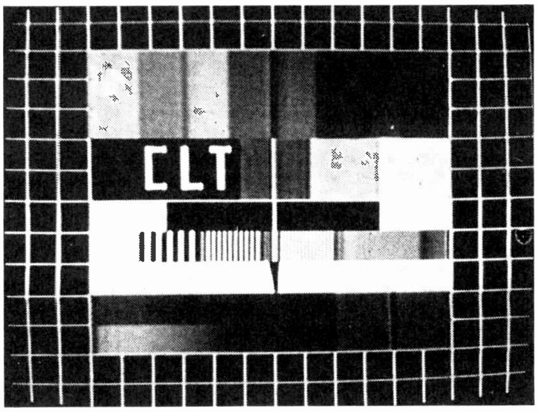
New Zealand: Garry Smith has heard from the NZBC



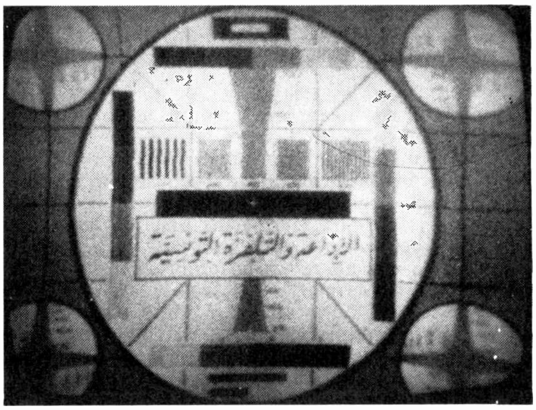


Belgian clocks, RTB (left) and BRT (right). Courtesy Dieter Scheiba.

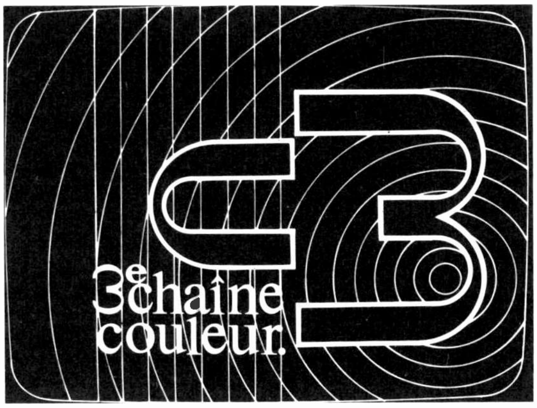
DATA PANEL 21—2nd series



Luxembourg test card (Tele-Luxembourg). Used for both v.h.f. (E7) and u.h.f. (E21).



Tunisian test card (Radiodiffusion Television Tunisienne).



ORTF-3 (France) identification slide.

TVP Katowice (Poland) identification slide.

Photographs courtesy Michele Dolci (Italy), Dieter Scheiba (Belgium) and Keith Hamer.

that colour tests using PAL will commence on April 1st 1973 on a regular basis (using the Philips PM5544!!) with regular programming in colour from October 30th 1973. It is likely that an alternative test pattern will be in use by the latter date—test card F has been mentioned. ABC Australia will commence their colour service on March 1st 1975: it is unlikely that colour tests will start before September 1974.

Dubai: The WTFDA mention that there is a ch.E2 6kW transmitter operating at Dubai, Persian Gulf (Trucial States).

Portugal: Antonio Carvalho lists for us the current RTP transmission times.

V.H.F.: 1115-1145 test pattern; 1145-1330 programmes; 1400-1830 test pattern; 1830-2300 programmes. The 1400-1830 period for test pattern transmission applies to Christmas, Easter and the August/September periods, otherwise programmes are radiated at this time (including weekends all the year round).

U.H.F.: 1400-1900 test pattern; 1930-2300 programmes. There are no test transmissions at weekends. Test patterns include Test Card D/E at v.h.f.; RETMA at u.h.f.; also the checkerboard and EBU pattern for both networks.

Monte Carlo: Yet again we must resurrect the saga of the high-powered ch.E35 transmitter! Radio Monte Carlo is reported to be preparing for full power this year to cover the coast "so far as Rome". Another transmitter on Corsica will cover part of Sardinia along the coast of Italy towards Naples. Reports on this come from Michele Dolci (Italy) and a UK radio trade magazine. An interesting note is that these will be colour broadcasts using SECAM; another encouragement (?) for Italy to go SECAM rather than PAL?

New EBU Listings

The EBU listings in the February column should be amended as follows: Poland Krakow TVP-2 1.5kW vertical (not 1kW); Czechoslovakia Bratislava bi-directional coverage 150kW 80°, 10kW 270° horizontal.

GDR (East Germany): Since e.r.p.s are not given we are listing the complete u.h.f. section from the new supplement—undoubtedly many of the stations are relays: Dittelsdorf ch.E24, Schlottwitz ch.E26, Hemsdorf ch.E28, Wilthen ch.E34, Hoechendorf ch.E35, Jena-Lobeda ch.E36, Zehren ch.E37. All transmissions are

horizontally polarised and except Jena-Lobeda ch.E36 which transmits the DFF-2 service all transmissions are the DFF-1 service.
Belgium: Liege/Ougree ch.E42 1000kW horizontal RTB-1.
Finland: Lahti ch.E40 600kW horizontal YLE-2. This is an increase from 1kW e.r.p.!
Sweden: Oestersund ch.E4 increase to 100kW e.r.p. from 60kW e.r.p. horizontal; Hudiksvall ch.E31 increase to 1000kW e.r.p. from 400W horizontal (located approximately 100 miles NW of Stockholm).

Data Panels

We hope from time to time to include information from various North African and Near East networks, mainly for the benefit of our overseas readers. This month we are featuring the Tunisian test card. Up-dated information has come to hand following recent panels: Holland, the RMA test card carrying identification (either "Nederland 1" or "2") can only be seen in this particular form during the 15 minutes prior to programme commencement; NOS Lopik has been seen recently using the Philips PM5544 card less identification and the colour bars either side of the main circle. Belgium, the RETMA card as shown in Data Panel 19 (top right-hand side) is now little used except by the Antwerp transmitter (ch.E2 100W); the card shown at the top left-hand side is used with the appropriate network identification for 15 minutes prior to programme commencement.

The identification "ORF FS1" used by Austrian TV in fact stands for Oesterreichischer Rundfunk—*Fernshen* 1.

From Our Correspondents

Once again a very full postbag! John Ding (Watford) has written giving his observations on tropospheric signal fading and the selective enhancement of signals at certain frequencies. In particular he notes—being very active with Band II f.m. reception—that at times u.h.f. reception can be very good whilst f.m. propagation is very poor, even from the same transmitting mast (he specifically mentions Caen ORTF and Lopik NOS). At other times the conditions are reversed. He wonders if we have noted such an effect. In fact we have often noted that Band III can be quite mediocre but u.h.f. good—during the tropospherics last November however Band III was favoured. We wonder if other enthusiasts have noted this and can offer an explanation?

Roy Ford (Bristol) who is concerned professionally with aerial structures received a number of Dutch and French u.h.f. transmitters during the recent improved conditions, including the ORTF-3 Lille transmitter. Reports of ORTF-3 signals have been received from a number of enthusiasts, as far North as Derby: it is from our Derby colleague Keith Hamer that an official ORTF line drawing has arrived—see this month's Data Panel (compare with the photograph last month). Dave Bunyan (Sittingbourne) has seen the ORTF-3 Lille transmitter using a form of EBU bar pattern but with the frequency response gratings above the bar replaced "with just a dark grey expanse".

Finally we welcome Anthony G. Mann of Perth, Western Australia. He reports at length on his receptions from "inside" Australasia. These have been on channels 0, 1 and 2, the most distant being TVQ Brisbane ch.0 at 2,300 miles and AKTV-2's relay from Te Aroha (New Zealand) on ch.0 (actually 1MHz offset l.f.) at some 3,800 miles (this is New Zealand's ch.1). Signals from farther distances via F2/TE include various f.m. radio links between 42-45MHz for Radio Peking, KBS Korea and other broadcasters. He has also noted the ch. R1 checkerboard received by George Peterson some time ago (see September 1972 column). We look forward to hearing of Anthony's further successes in this field.

For the Beginner

In previous parts we have discussed how the signal travels between the transmitter and the receiver. We must now consider the signal itself! Amplitude modulation is used for the vision signal, one sideband being partially suppressed (vestigial sideband working). Either *positive* (maximum signal represents peak white) or *negative* (minimum signal represents peak white) modulation is used for domestic television transmission. With the former system 0-30% carrier amplitude represents synchronisation information, with the sync level 0% and black level at 30%. The picture brightness information is contained between the black level and peak white (100%). With negative modulation on the other hand the sync level is 100%, black level 77% and peak white 20%. Thus the information is reversed. (A fuller explanation of television waveforms is given in *Television Engineers' Pocket Book*—Newnes). Either a.m. (amplitude modulation) or f.m. (frequency modulation) is used for sound, the former being used with positive vision modulation and the latter with negative vision modulation. A considerable number of transmission standards is used within Europe. It is normal to prefix a television channel with a letter (e.g. ch.E2, ch.F2 etc.) to indicate the transmission system in use. Table 1 lists the various systems and Table 2 where they are in use.

Table 1: Transmission systems

System	*Lines*	*Channel bandwidth*	*Vision bandwidth*	*Vision/ sound spacing*	*Vision modulation*	*Sound modulation*
A	405	5MHz	3MHz	−3.5MHz	Pos.	AM
B	625	7MHz	5MHz	+5.5MHz	Neg.	FM
C	625	7MHz	5MHz	+5.5MHz	Pos.	AM
D	625	8MHz	6MHz	+6.5MHz	Neg.	FM
E	819	14MHz	10MHz	±11.15MHz	Pos.	AM
G	625	8MHz	5MHz	+5.5MHz	Neg.	FM
H	625	8MHz	5MHz	+5.5MHz	Neg.	FM
I	625	8MHz	5.5MHz	+6MHz	Neg.	FM
K	625	8MHz	6MHz	+6.5MHz	Neg.	FM
L	625	8MHz	6MHz	+6.5MHz	Pos.	AM
M	525	6MHz	4.2MHz	+4.5MHz	Neg.	FM

Table 2: Use of transmission systems

System A, channel prefix B, e.g. ch.B1. Used at v.h.f. in the UK and Eire.
System B, channel prefix E, e.g. ch.E2. Used at v.h.f. in Western Europe, Africa, Asia.
System C, channel prefix E, e.g. ch.E2. Used in Belgium at v.h.f. only.
System D, channel prefix R, e.g. ch.R1. Used in Eastern Europe, USSR, China.
System E, channel prefix F, e.g. ch.F2. Used in France and Monaco at v.h.f.
System F is no longer in use.
System G/H, channel prefix E, e.g. ch.E21. Used in Western Europe at u.h.f. (system H has a 1.25MHz vestigial sideband—used in Belgium).
System I, channel prefix E, e.g. ch.E21. Used in the UK at u.h.f. and Eire at v.h.f.
System K, channel prefix K, e.g. ch.K4. Used in French overseas territories.
System L, channel prefix E, e.g. ch.E7. Used in France at u.h.f. and Luxembourg at v.h.f.
System M, channel prefix A, e.g. ch.A2. Used in the Americas, parts of the Pacific, American Armed Forces bases (AFRTS).

Unfortunately the situation is further confused in that some countries with a common system have alternative frequency allocations. This in turn means another channel prefix. An example of this is Italy where the v.h.f. channels are prefixed I e.g., ch.IA etc. The position can be clarified by referring to the channel allocation charts in the June and October 1972 columns.

YOUR PROBLEMS SOLVED

★ Requests for advice in dealing with servicing problems must be accompanied by an 11p postal order (made out to IPC Magazines Ltd.), the query coupon from page 282 and a stamped, addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets or answer queries over the telephone.

KB TV20

There is an intermittent fault on this set, complete loss of sound and vision on all channels, the screen going brilliantly white all over except for graduated grey areas at the top and bottom. The fault sometimes clears itself after a few moments. Otherwise unplugging then reconnecting the set immediately restores normal reception. The fault sometimes recurs frequently; at other times reception remains normal for many hours.—T. Gross (Sunderland).

The problem is intermittent instability in the i.f. strip. Try wiring an 0.002μF capacitor (with short connections) from the screen grid (pin 8) of the EF183 (V3) and the 6BW7 (V4) to chassis. A decoupler in one of these positions will clear the fault.

PHILIPS G23T211

The original fault was no picture but sound OK. The line timebase valves were tested and found to be in order. After replacing the mains rectifier a picture about seven inches square was obtained.—R. Ilchester (Margate).

First check that the h.t. voltage is correct at the HT1 point. If it is, next try shunting another 0.1μF (1kV) capacitor across the boost reservoir capacitor C2064. Check the system switch for correct operation, and the line output valve screen voltage. If all these points are in order and the valves are known to be good you will have to suspect the line output transformer. It would be worth checking the value of the two 8.2MΩ resistors (R2166/7) in the width circuit.

MARCONIPHONE 4711

This 26in. colour receiver (BRC 3500 chassis) gives excellent pictures apart from the following two faults. First the focus tends to vary, either as the set warms up or sometimes suddenly during the evening's viewing. This can be temporarily corrected by adjusting the focus control. Secondly it is impossible to obtain satisfactory blue lateral dynamic convergence. The blue lateral coil enables either the right- or left-hand side of the picture to be converged but not both together. A compromise setting does not do justice to the rest of the convergence which is remarkably good. Offsetting the blue static control with the compromise setting enables both sides of the screen to be converged, but the results are not good. Shifting the convergence assembly does not help.—T. Saunders (Croydon).

Focus stability is a function of the operating stability of the focus control and the high-value resistors in the associated circuit, one in the tripler tray and the others on the focus panel. These will have to be checked to clear the trouble. The 3500 chassis fitted to 26in. BRC colour models has a separate control R769 to adjust the blue convergence at the left-hand side of the screen. This may be set incorrectly. However the blue lateral socket SKT29 has three positions and the connector can also be reversed if results are unsatisfactory. Otherwise we are inclined to suspect the two 10μF electrolytics in the blue convergence circuit, C755 and C756: the former affects the right-hand side of the screen and the latter the left-hand side.

BUSH TV141

There is no e.h.t. and no line whistle. All valves in the line timebase have been changed, also the line output transformer. I am thinking of changing the flywheel sync diodes. These however seem to be difficult to get, being in a common encapsulation with the field interlace diode.—B. Loveday (Ipswich).

If the flywheel sync diodes were responsible for the fault the oscillator would be stopped and there would be noticeable overheating in the line output stage. Since you don't mention this we feel that the fault is in the output stage and that the diodes are not at fault (replacements however could be type BA144, with another one for field interlace). We suggest you check for drive at the PL504 line output pentode grid (showing as a negative voltage of about 30-40V). If this is present the oscillator is working. In the output stage check that there is h.t. present at the PY88 boost diode anode and the PL504 screen grid (the feed resistor could be open-circuit). The boost reservoir capacitors are unlikely to be faulty since on these receivers they are returned to chassis through the line output transformer and thus blow the mains fuse if they short.

SOBELL 1010

There is normal picture and sound on 405 lines but on 625 lines the picture is only 7in. wide—the sound and height are normal. The PY800 glows red and overheats on 625 lines.—G. Davies (Wolverhampton).

A common cause of low width on 625 lines on this series is a defective winding on the line output transformer. In this case however we suspect poor contacts on the timebase system switch. In order to check that the PCF802 line oscillator is operating correctly on the two systems check the voltages at the following pins: 1 (triode anode) 190V; 6 (pentode anode) 120V; 7/8 (cathodes) 3.4V. These readings should be made with the top caps of the PY800 and PL500 removed.

BUSH TV125R

There is a slight wave on the verticals, the picture moving from left to right and back again all the time. Also when a caption appears on the picture the noise produced almost blots out the sound.—R. Tyson (London E9).

There seem to be two separate problems here. The waviness of the verticals if it persists when the contrast is turned down could be due to a faulty PCF80 line oscillator or poor smoothing—check the main electrolytics. If however the effect stops when the contrast control is turned down check the a.g.c. circuit components, the PCF80s in the receiver unit and the capacitors in both the a.g.c. and video circuits. The vision buzz on sound could be due to faulty a.g.c. but is more likely to be the result of a failing EF80 vision i.f. amplifier (2V3) as this will prevent even a.g.c. action.

GEC BT452

The trouble with this set is excessive h.t. current (520mA), causing low h.t. and no e.h.t. at all. The h.t. returns to normal when the h.t. feed to the line output stage is removed by disconnecting PC11. Removal of the PY800 top cap however makes no difference. The line timebase valves, the line output transformer and the line output valve screen and control grid circuit components have been replaced without effecting a cure.—G. Flynn (Slough).

It is almost certain that the boost reservoir capacitor C97 (0.25μF) is short-circuit. When you have replaced this check the line oscillator (V11 ECC82) voltages to make sure that it is oscillating and the PL36 not drawing excessive current.

HMV 1893

The picture is about half the correct size, also cramped at the bottom and extended at the top. The h.t. reading is about right but the boost voltage is under 500V. All timebase valves have been replaced. The field output stage cathode components, multivibrator coupling capacitors, all likely resistors in the field timebase and the boost reservoir capacitor have also been replaced. The width control L42· has no effect and the height control is at one end of its travel. —T. Wright (Windsor).

Replacing C97 (0.01μF) in the field linearity feedback loop will restore the field linearity. Direct attention next to the boost circuit, i.e. the resistors (R79, R81 and R82) in the width (e.h.t. stabilising) circuit. Then if necessary check the line output valve screen feed resistor R84 and the coupler C61 (0.01μF).

GEC 2018

For some time I have been unable to get BBC-1 or ITV sound or vision on v.h.f. Fitting new valves has made no difference. On taking off the v.h.f. tuner side cover plate and raising the bar which pushes the wires into the coils however I can get sound and vision: on letting go both disappear. There are no broken springs so it is difficult to see why this should be so. All u.h.f. programmes can be obtained but they take a lot of tuning.—D. Uren (Glasgow).

Fine tuning on this series is achieved by pushing in and turning the large outer v.h.f. knob: this couples a drive to one of five threaded rods along which a small cam travels. The guillotine-shaped edge of the platform rests on the cam and as it travels horizontally the core assembly moves up or down. Examining the action of the mechanism should reveal the cause of your problem.

MARCONIPHONE VT170

When the set is first switched on the picture moves downwards and across. After a minute the picture locks horizontally but keeps pulling to the right and the line hold control needs adjustment. After another minute or two the picture locks vertically but the field hold control needs occasional adjustment. Also when an electric kettle is switched on the picture is upset in the same way but returns to normal when the kettle is switched off. The timebase valves have been replaced without obtaining much improvement. Another fault is that the verticals on the left half of the picture are bent.—A. Dudley (Birmingham).

The sync troubles should lead to investigation of the video output stage (V5 PCL84) where you will almost certainly find that the bias stabilising resistor R76 (47kΩ) has changed value. Also check the anode load resistors R74 (2.2kΩ) and R75 (3.9kΩ) as these will also have changed value. Replacement of these three resistors will improve the performance greatly but it would also be worth checking the cathode components R77, R78 and C74. For the bent verticals we suggest you check the line output valve screen grid decoupling capacitor. This is C86 which is 1μF.

PYE V210LB

The set works quite well for 10-15 minutes after switching on, then the vertical hold goes haywire and readjustment will not bring back a normal picture—the best that can be done is to achieve lock with two pictures one above the other and an inch wide black band between them. The PCL82 field timebase valve, also the PCL84 video amplifier/sync separator and EB91 detector/interference limiter have been replaced without any improvement.—T. Rayner (Glossop).

The triode V13A of the ECC82 fitted to this chassis is used as an interlace stage. First try changing this valve then if necessary check and replace the field sync pulse integrating capacitor C53 (180pF) and the resistor (R54 68kΩ) in series with the field hold control.

SOBELL 1029A

This set is now some two and a half years old. For the last few months there has been a vertical bar on the left-hand side of the screen and there are now three further bars to the right of the original one, getting lighter towards the centre of the screen. Could the problem be a ringing line output transformer?—T. Cribbins (Maghull).

The problem could indeed be caused by the line output transformer but we feel it is more likely that the line linearity coil damping resistor R55 is faulty. A similar condition could arise if the line output pentode screen decoupler C705 is suffering from loss of capacitance.

PHILIPS 19TG158A

When the set was switched off it had been operating perfectly on 625 lines for several hours. When switched on an hour later line hold was lost and could only be adjusted to give multiple images at reduced height—405-line operation was all right.—T. Gibbons (Dorchester).

The trouble is likely to be in the 405/625 line hold control switch contacts. Check these and the 625 line hold control, then the series resistors R412 and R464.

KB WV75

All that can be obtained on this set, which is fitted with the STC VC2 chassis, is a broken picture—with the hold control fully anti-clockwise. The line timebase valves and flywheel sync discriminator diodes have been replaced, also R125 in series with the line hold control and R130 and C116 in the flywheel filter circuit. The sinewave oscillator tuning components have been tried but lock cannot be obtained whatever their position.—T. Seale (Melksham).

The cathode of the reactance triode is fed from the h.t. rail via a 47kΩ, 1W resistor (R131). It appears that this has changed value and should be replaced. Use a 2W type as 1W ones tend to overheat in this position.

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TELEVISION APRIL 1973

TEST CASE

124

Each month we provide an interesting case of television servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

? *A Murphy CV2511 colour receiver came in with the complaint of intermittent blurring on colour. On test in the workshop the colour reproduction was without flaw—apart from mild misconvergence which was corrected by normal adjustment—for the first thirty or so minutes of operation. After this time the overall image definition deteriorated suddenly, rather like the effect that was common with some early monochrome receivers (Ultra species) due to an intermittent heater-cathode short in the picture tube.*

On closer examination however it was apparent that the colour had become displaced slightly from the luminance of the display. Gently tapping the tube neck failed to modify the condition but it was found that by tapping the printed circuit panel in the proximity of the luminance preamplifier stage the symptom could be corrected, a further tap bringing it back again.

Apart from this displacement the reproduction was normal under the fault condition, all the controls working correctly and the picture being of acceptable brightness, contrast and colour saturation. It was obvious that the trouble was the result of a loose connection or dry joint somewhere in the signal circuits—but where exactly? The colour technician, observing the symptom, went immediately to the fault area and cleared the trouble within minutes.

What led him to the fault area and where was it in the signal circuit complex? See next month's TELEVISION *for the solution and for another item in the Test Case series.*

SOLUTION TO TEST CASE 123

Page 235 (last month)

As in so many contemporary transistorised models the receiver in question employed a class B field output stage and as with audio stages of this kind crossover distortion can result from incorrect biasing of the output transistors. The biasing adjustment provided should have been checked therefore prior to changing the output transistors, for the symptom described is typical of crossover distortion. In all such cases the correct adjustment procedure is detailed in the service manual and it is imperative to carry out the adjustment in close accordance with these instructions in order to avoid undue power dissipation in the output transistors.

This is just one of the symptoms that are characteristic of transistorised timebase circuits and have no direct parallel in valved circuits.

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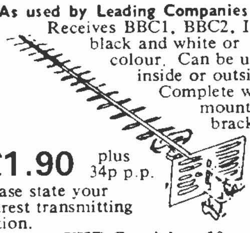

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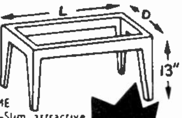

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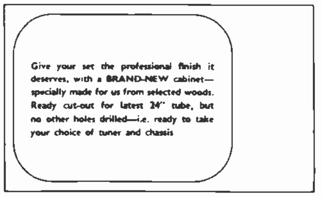

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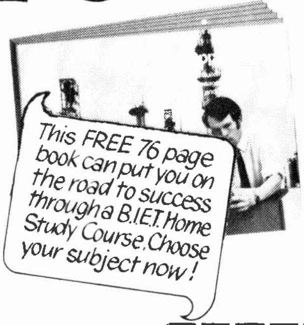

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