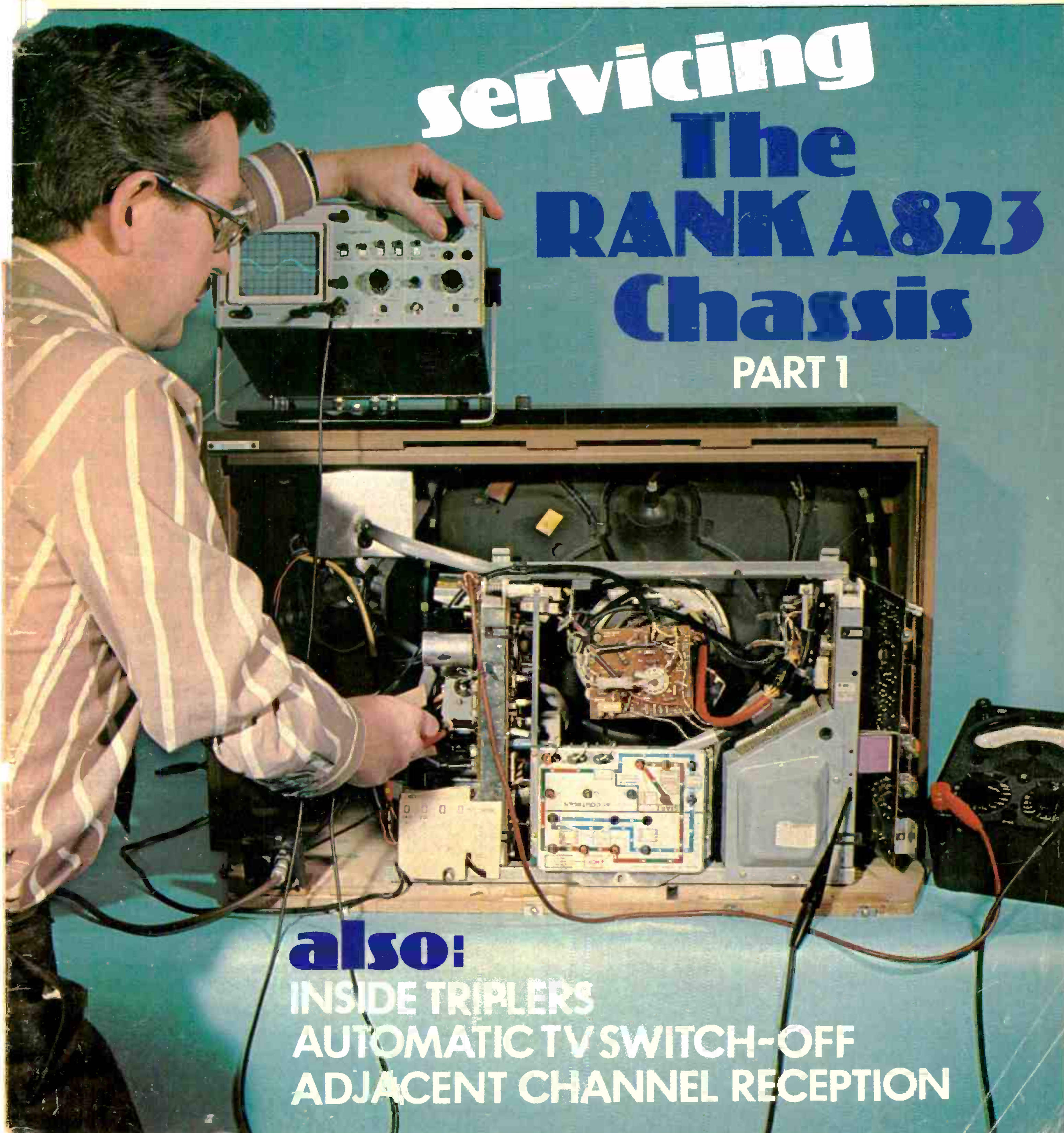
NOVEMBER 1977

Australia 75c New Zealand 75c South Africa 70c Malaysia $2.25 50p

TELEVISION

SERVICING·VIDEO·CONSTRUCTION·COLOUR·DEVELOPMENTS



servicing The RANK A823 Chassis

PART 1

also:

INSIDE TRIPLERS

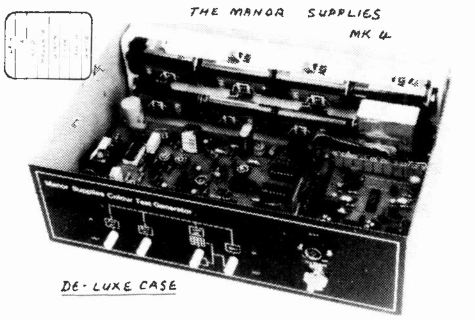
AUTOMATIC TV SWITCH-OFF

ADJACENT CHANNEL RECEPTION

MANOR SUPPLIES

COLOUR BAR GENERATOR

plus CROSS HATCH KIT (Mk. 4)



- ★ Output at UHF, applied to receiver aerial socket.
- ★ In addition to colour bars, all R–Y, B–Y and Lum. Combinations.
- ★ Plus cross hatch grey scale, peak white and black levels.
- ★ Push button controls, small, compact battery operated.
- ★ Simple design, only five i.c.s. On colour bar P.C.B.

PRICE OF MK4 COLOUR BAR & CROSS HATCH KIT £35.00 + 8% VAT + £1.00 P/Packing.

CASES, ALUMINIUM £2.40, DE-LUXE £4.80, BATT. HOLDERS £1.40. ADD 8% VAT TO ALL PRICES!

ALSO THE MK3 COLOUR BAR GENERATOR KIT FOR ADDITION TO MANOR SUPPLIES CROSS HATCH UNITS. £25.00 + £1.00 p.p. CASE EXTRA £1.40. BATT. HOLDERS £1.40. ADD 8% VAT TO ALL PRICES.

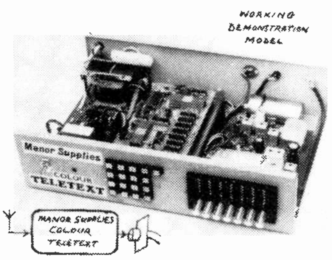
- ★★ Kits include drilled P.C. board, with full circuit data, assembly and setting up instructions.
- ★★ All special parts such as coils and modulator supplied complete and tested, ready for use.
- ★★ Designed to professional standards.
- ★★ Demonstration models at 172 West End Lane, NW6.
- ★★ Every kit fully guaranteed.

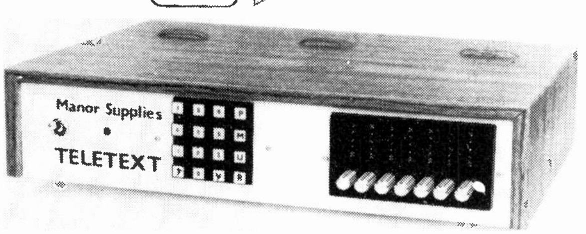
ALSO NOW AVAILABLE

MK4 DE LUXE (BATTERY) BUILT & TESTED £58.00 + 8% VAT + £1.20 P/Packing.

ALTERNATIVE MAINS SUPPLY KIT £5.78 + 8% VAT + 65p P/P.
VHF MODULATOR (CH1 to 4) FOR OVERSEAS £3.50.
INFORMATION ON VIDEO TAKE-OFF FOR C.C.T.V.

MANOR SUPPLIES TELETEXT 77 KIT (incl TEXAS DECODER). Full facilities in colour. External unit. AE input to set. Write or call for further information. See working demonstration model!





COLOUR, UHF & TELEVISION SPARES

TV PORTABLE LOPT, SCANCOIL, DRIVER £12.50, PAIR VIS GAIN, VIS SELECT (TESTED) £3.80 p.p. 85p.

TELETEXT 77, MANOR SUPPLIES NEW "EASY TO ASSEMBLE" KIT, INCL. TEXAS DECODER. AERIAL INPUT, COLOUR, MIXED T.V. PROGRAMME & TELETEXT, NEWSFLASH, UPDATE, AND MANY SPECIAL FEATURES NOT FOUND IN OTHER UNITS. DEMONSTRATION MODEL IN OPERATION AT 172 WEST END LANE, N.W.6. CALL OR WRITE FOR FURTHER INFORMATION.

CROSS HATCH UNIT KIT, AERIAL INPUT TYPE, INCL. T.V. SYNC AND UHF MODULATOR. BATTERY OPERATED. ALSO GIVES PEAK WHITE & BLACK LEVELS. CAN BE USED FOR ANY SET **£11.00** + 45p. p.p.* (ALUM. CASE **£2.00** p.p. 75p.*) COMPLETE TESTED UNITS, READY FOR USE (DE-LUXE CASE) **£19.00** p.p. 90p.* ADDITIONAL GREY SCALE KIT **£2.90** p.p. 30p*

"NEW TYPE" UHF SIGNAL STRENGTH METER KIT £18.00 p.p. 90p. (**VHF VERSION £18.80** p.p. 90p.*)

CRT TESTER & REACTIVATOR PROJECT FULL KIT £18.80 p.p. £1.30.*

"TELEVISION" COLOUR SET PROJECT. MARK II DEMONSTRATION MODEL WITH LATEST IMPROVEMENTS. WORKING AND ON VIEW, LISTS AVAILABLE.

"TELEVISION" PROJECT CROSS HATCH KIT £3.60 p.p. 20p.*

VIDEO PRE-AMP MOD. KIT (Oct. '75 Article) **£1.20** p.p. 20p.

SPECIAL OFFER I.F. Panel, leading British maker, similar design to "Television" panel. Now in use as alternative inc. circuit and connection data, checked and tested on colour **£14.80** p.p. 95p. Also **DECODER** panel checked and tested on colour, full details, **£19.80** p.p. 95p.

"FIVE in ONE" PANEL replaces Tuner IF, Decoder, RGB, and sound boards of original project. Tested on colour, with all data. **£35.00** p.p.£1.20.

MAINS TRANSFORMER 280W for "T.V." Colour Set **£11.50** p.p. £1.50.

TRIPLER £6.00 p.p. 75p, **ERIE FOCUS £2.20,** p.p. 30p, **NEW AUDIO UNIT £2.60** p.p. 30p. Original packs still available. List on Request.

STABILISER UNITS, "add on" kit for either 40V or 20V, **£2.80** p.p. 35p.

GEC 2040 Surpl Panels, ex-rental, Decoder **£5.00.** T.B. **£5.00** p.p. 90p.

BRC 3000 Surplus/Salv Panels, Decoder **£7.50, Video £7.50** p.p. 90p.

DECCA Colour T.V. Thyristor Power Supply. HT, LT etc. **£3.80** p.p. 95p.

BUSH CTV25 Power Supply Unit **£3.20** p.p. £1.50.

PYE 697 Line T.B. P.C.B. for spares, **£1.50** p.p. £1.00.

MULLARD AT1023/5 convergence yoke. New **£2.50** p.p. 75p.

DLIE delay line. New **90p** p.p. 40p. AT1025/06 blue lat. **75p** p.p. 30p.

PHILIPS G6 single standard convergence panel, incl. 16 controls, switches etc., and circuits **£3.75** p.p. 85p, or incl. yoke, **£5.00. PHILIPS** G8 panels for spares, decoder **£2.50** p.p. 85p.

VARICAP, Mullard ELC1043 UHF tuner **£4.50,** ELC1043/05 **£5.50,** G.I. type (equiv. 1043/05) **£3.50** p.p. 30p. UHF & VHF salvaged varicap tuners **£1.50.** Control units, 3PSN **£1.25,** 4PSN **£1.80,** 5PSN **£2.30. Special offer** 6PSN **£1.00,** 7PSN **£1.80** p.p. 25p. TAA 550 **50p** p.p. 15p.

VARICAP VHF PHILIPS £3.80, ELC1042 £4.80, p.p. 30p, ELC1042 on **PYE P.C.B. £5.40,** Plug in 6 posn. control unit **£2.50** p.p. 65p.

VARICAP UHF/VHF ELC 2000S **£12.50** p.p. 65p.

UHF/625 Tuners, many different types in stock. Lists available. **UHF** tuners transistd. incl. s/m drive, indicator **£3.85;** 6 posn. or 4 posn. push-button **£4.20** p.p. 85p. Integrated tuners **BUSH, PYE 40** 6 posn. **£4.50** p.p. £1.20. AE ISOL **30p** p.p. 20p.

TRANSISTORISED 625 IF for T.V., sound tested (as featured in Practical Wireless, Nov. '75). **£6.80** p.p. 65p.

PHILIPS 625 I.F. Panel incl. cct **50p** p.p. 50p.

TURRET TUNERS, KB "Featherlight" VC11, Philips 170 series. GEC 2010 **£2.50.** GEC 2018, 2019, 2038, 2039 5 position **£4.20** p.p. 85p.

TBA "Q" I.C.s. 480, 530, 540, **£2.20,** 550, 560C, 920 **£3.20** p.p. 15p.

HELICAL POTS, 100K. 4 for **£1.20** p.p. 20p.

BRC 1500 Mains Droppers, two for **90p** p.p. 50p.

LINE OUTPUT TRANSFORMERS. New guar. p.p. 85p.

BUSH 105 to 186SS, etc.	**£6.80**
DECCA DR1, 2, 3, 121/123, 20/24, etc.	**£6.40**
DECCA MS2000, 2400	**£5.80**
FERG., HMV, MARCONI, ULTRA 850, 900, 950 Mk. 1	**£7.30**
950II, 1400, 1500, 1590	**£5.90**
GEC 2000, 2047 series, etc.	**£6.40**
INDESIT 20/24EGB	**£6.40**
ITT/KB VC2 to 53, 100, 200, 300	**£6.20**
MURPHY 849 to 2417, etc.	**£6.80**
PHILIPS 19TG121 to 19TG156	**£4.80**
PHILIPS 19TG170, 210, 300	**£6.40**
PYE 11U, 368, 169, 769 series	**£6.40**
PYE 40, 67 series (36 to 55)	**£3.80**
PAM, INVICTA, EKCO, FERRANTI equivalents as above.	
SOBELL 1000 series	**£6.40**
STELLA 1043/2149	**£6.40**

SPECIAL OFFERS

BUSH TV53/86, 95/99	**£1.00**
EKCO 380 to 390	**£1.00**
EKCO 407/417	**£1.00**
FERR. 1084/1092	**£1.00**
FERG. 506 to 546	**£1.00**
GEC 448/452	**£2.50**
KB VCI, VCII (003)	**£2.80**
P/SCOTT 733 to 738	**£1.00**
REG 10-6, 10-17 etc.	**£1.00**
SOBELL 195/282/8	**£2.50**

MANY OTHERS STILL AVAILABLE

COLOUR LOPTS p.p. £1.00.

BUSH 182 to 1122 etc	**£9.80**
MURPHY Equivalents	**£7.60**
DECCA "Bradford" (state Model No. etc)	**£7.80**
GEC 2028, 2040	**£9.20**
PYE 691, 693, 697	**£15.80**
THORN 8500	**£8.80**

THORN 850 Time Base Panel, Dual Standard **50p** p.p. 80p.

MULLARD Scan Coils **Type AT1030** for all standard mono 110° models, Philips, Stella, Pye, Ekco, Ferranti, Invicta **£2.00** p.p. 85p.

PHILIPS G8 Tripler (1174) **£6.00** p.p. 75p. Others available.

6·3V CRT Boost Transformers **£2.90** p.p. 75p.; Auto type **£1.80** p.p. 45p.

CALLERS WELCOME AT SHOP PREMISES

THOUSANDS OF ADDITIONAL ITEMS AVAILABLE NOT NORMALLY ADVERTISED

MANOR SUPPLIES

172 WEST END LANE, LONDON, N.W.6.

(Near W. Hampstead tube stn: 28, 59 159 Bus Routes) 01-794 8751

Mail Order: 64 GOLDERS MANOR DRIVE, LONDON N.W.11.

PLEASE ADD 12½% VAT TO PRICES (EXCEPT * 8%)

TELEVISION

November 1977

Vol. 28, No. 1
Issue 325

CORRESPONDENCE
All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", Fleetway House, Farringdon Street, London EC4A 4AD. All other correspondence should be addressed to the Editor, "Television", Fleetway House, Farringdon Street, London EC4A 4AD.

BINDERS AND INDEXES
Binders (£2.85) and Indexes (45p) can be supplied by the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF. Prices include postage and VAT. In the case of overseas orders add 60p to cover despatch and postage.

BACK NUMBERS
Some back issues, mostly those published during the last two years, are available from our Post Sales Department (address above) at 70p inclusive of postage and packing to both home and overseas destinations.

QUERIES
We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them. All correspondents expecting a reply should enclose a stamped addressed envelope.
Requests for advice in dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Your Problems Solved".

this month

OUR NEXT ISSUE DATED DECEMBER WILL BE PUBLISHED ON NOVEMBER 21

TRANSISTORS, ETC.

Type	Price (£)
AC107	0.48
AC117	0.38
AC126	0.36
AC127	0.40
AC128	0.35
AC128K	0.35
AC141	0.35
AC141K	0.40
AC142	0.34
AC142K	0.39
AC151	0.31
AC152	0.34
AC153	0.42
AC153K	0.43
AC154	0.31
AC176	0.42
AC178	0.42
AC179	0.48
AC187	0.42
AC187K	0.46
AC188	0.42
AC188K	0.42
AC193K	0.48
AC194K	0.52
ACY17	1.20
ACY19	0.95
ACY28	0.98
ACY39	2.02
AD140	0.68
AD142	0.69
AD143	0.71
AD149	0.86
AD161	0.65
AD162	0.70
AF114	0.35
AF115	0.35
AF116	0.41
AF117	0.32
AF118	0.98
AF121	0.50
AF124	0.38
AF125	0.38
AF126	0.36
AF127	0.45
AF139	0.48
AF147	0.52

Type	Price (£)
AF149	0.45
AF178	0.75
AF179	0.78
AF180	0.75
AF181	0.72
AF186	0.99
AF202	0.27
AF239	0.60
AF240	1.40
AF279S	0.91
AL100	1.10
AL103	1.13
AU103	2.10
AU107	1.90
AU110	1.90
AU113	2.40
BC107*	0.16
BC108*	0.15
BC109*	0.17
BC113	†0.16
BC114	†0.20
BC115	†0.21
BC116*	†0.21
BC117	†0.20
BC118	†0.17
BC119	0.32
BC125*	†0.22
BC126	†0.24
BC132	†0.17
BC134	†0.20
BC135	†0.19
BC136	†0.20
BC137	†0.20
BC138	†0.30
BC140	0.90
BC141	0.95
BC142	0.29
BC143	0.33
BC147*	†0.12
BC148*	†0.11
BC149*	†0.13
BC152	†0.25
BC153	†0.20
BC154	†0.20
BC157*	†0.13
BC158*	†0.12

Type	Price (£)
BC159*	†0.14
BC160	0.78
BC161	0.80
BC167B	†0.15
BC168B	†0.14
BC169C	†0.15
BC170*	†0.15
BC171*	†0.15
BC172*	†0.14
BC173*	†0.22
BC174A & B	†0.26
BC176	0.22
BC177*	0.20
BC178*	0.22
BC179*	0.28
BC182*	†0.14
BC182L*	†0.14
BC183*	†0.14
BC183L*	†0.14
BC184*	†0.14
BC184L*	†0.14
BC186	0.25
BC187	0.27
BC192	0.56
BC207*	†0.14
BC208	†0.12
BC212*	†0.17
BC212L*	†0.17
BC213*	†0.16
BC213L*	†0.16
BC214*	†0.17
BC214L*	†0.17
BC237*	†0.16
BC238*	†0.15
BC239C	†0.23
BC251A & B	†0.27
BC252A*	†0.25
BC253B	†0.38
BC261A	0.28
BC262A*	0.26
BC263B	0.27
BC267	0.16
BC268C	0.14
BC294	†0.37
BC300	0.60

Type	Price (£)
BC301	0.35
BC303	0.60
BC307A & B	†0.17
BC308 & A	†0.17
BC309*	†0.17
BC317*	†0.22
BC318C	†0.23
BC319C	†0.26
BC320	†0.28
BC322	†0.24
BC323	0.68
BC327	†0.23
BC328	†0.23
BC337	†0.24
BC338	†0.19
BC347A*	†0.17
BC348A & B	†0.17
BC349A & B	†0.17
BC350A*	†0.20
BC351A*	†0.18
BC352A*	†0.18
BC360	0.24
BC377	0.22
BC441	0.59
BC461	0.78
BC477	0.20
BC478	0.19
BC479	0.19
BC547*	†0.13
BC548*	†0.12
BC549*	†0.15
BC550	†0.15
BC556	†0.18
BC557*	†0.14
BC558*	†0.13
BC559*	†0.15
BD115	0.93
BD123	0.98
BD124	0.88
BD130Y	1.56
BD131	0.49
BD132	0.54
BD133	0.51
BD135	0.42

Type	Price (£)
BD136	0.46
BD137	0.48
BD138	0.52
BD139	0.55
BD140	0.59
BD144	2.24
BD145	0.75
BD157	0.51
BD160	1.65
BD163	0.67
BD177	0.58
BD178	0.59
BD181	1.04
BD182	0.90
BD183	1.18
BD184	1.43
BD187	0.61
BD188	0.65
BD189	0.71
BD201	1.15
BD202	1.50
BD222	0.78
BD225	0.91
BD232	2.20
BD233	0.52
BD234	0.75
BD235	0.69
BD236	0.62
BD237	0.69
BD238	0.70
BD253	2.58
BD410	1.65
BD437	0.98
BD438	1.17
BD517	0.41
BD518	0.43
BD519	0.88
BD520	0.88
BD599	0.87
BD600	0.92
BDX14	1.02
BDX18	1.55
BDX32	2.75
BDX64A	1.89
BDX65A	1.69
BDY16A	0.43
BDY18	1.55

Type	Price (£)
BDY20	1.07
BF115	0.30
BF117	0.45
BF120	0.55
BF121	0.85
BF123	0.58
BF125	0.55
BF127	0.68
BF137F	0.78
BF152	†0.19
BF157	0.32
BF158	†0.25
BF159	†0.27
BF160	†0.22
BF161	0.45
BF162	†0.65
BF163	†0.65
BF164	†0.95
BF166	0.38
BF167	0.52
BF173	0.30
BF177	0.36
BF178	0.38
BF179	0.42
BF180	0.36
BF181	0.35
BF182	0.44
BF183	0.52
BF184	0.31
BF185	0.28
BF194*	†0.12
BF195*	†0.11
BF196	†0.14
BF197	†0.15
BF198	†0.29
BF199	†0.29
BF200	0.65
BF218	0.42
BF224J	†0.20
BF240	†0.32
BF241	†0.31
BF244	†0.37
BF245B	†0.68
BF255	†0.58
BF256L*	†0.49
BF257	0.49
BF258	0.53

Type	Price (£)
BF259	0.61
BF262	0.64
BF263	0.62
BF270	0.47
BF271	0.52
BF273	†0.33
BF274	†0.34
BF333	0.67
BF336	0.43
BF337	0.46
BF338	0.58
BF355	0.52
BF362	†0.62
BF363	†0.62
BF457	0.68
BF458	0.84
BF459	0.91
BF594	†0.16
BF596	†0.17
BF597	†0.17
BFR39	0.33
BFR40	0.29
BFR41	0.26
BFR60	0.35
BFR61	0.29
BFR62	0.28
BFR79	0.36
BFR80	0.32
BFR81	0.28
BFT41	0.48
BFT43	0.55
BFW11	0.66
BFW30	2.17
BFW59	†0.19
BFW60	†0.20
BFW90	0.28
BFX29	0.33
BFX84	0.30
BFY18	0.53
BFY50	0.33
BFY51	0.31
BFY52	0.30
BFY90	1.37
BLY15A	1.09
BR101	0.47
BRC4443	0.76
BRY39	0.48

Type	Price (£)
BRY55	†0.48
BRY56	†0.44
BT106	1.50
BT109	1.99
BT116	1.45
BT119	5.18
BU102	2.85
BU105	1.95
BU105/02	1.95
BU108	3.15
BU126	2.18
BU133	1.77
BU204	2.02
BU205	2.24
BU206	2.97
BU208	3.15
BUY77	2.50
BUY78	2.65
BUY79	2.85
D40N1	0.64
E1222	0.47
E5024	†0.19
GET872	0.46
MC140	†0.36
MJE340	0.68
MJE341	0.72
MJE370	0.74
MJE371	0.79
MJE520	0.85
MJE521	0.95
MJE2955	1.20
MJE3000	1.95
MJE3055	0.78
MPF102	†0.40
MPS6566	†0.31
MPSA05	†0.47
MPSA06	†0.48
MPSA55	†0.50
MPSA56	†0.53
MPSU05	0.66
MPSU06	0.76
MPSU55	1.26
MPSU56	1.32
OC26	0.90
OC28	1.19
OC35	0.93
OC36	0.88

Type	Price (£)
OC42	0.55
OC44	0.34
OC45	0.32
OC71	0.73
OC72	0.73
OC81	0.53
OC81D	0.57
OC139	0.76
OC140	0.80
OC170	0.34
OC171	0.34
ON236A	0.72
R2008B	2.25
R2010B	2.65
TIC44	†0.29
TIC46	†0.44
TIP29A	0.49
TIP30A	0.58
TIP31A	0.62
TIP32A	0.67
TIP33A	0.99
TIP34A	1.73
TIP41A	0.80
TIP42A	0.91
TIP2955	1.78
TIP3055	0.67
TIS43	†0.38
TIS73	†1.36
TIS90	†0.23
TIS91	†0.25
ZTX108	†0.13
ZTX109	†0.14
ZTX213	†0.21
ZTX300	†0.16
ZTX304	†0.24
ZTX500	†0.17
ZTX502	†0.19
ZTX504	†0.30
2N696	0.30
2N697	0.36
2N706	0.16
2N708	0.35
2N914	0.21
2N916	0.24
2N1164	3.60
2N1304	0.55
2N1711	0.45

Type	Price (£)
2N1893	0.40
2N2102	0.51
2N2221A	0.50
2N2222A	0.52
2N2369A*	0.44
2N2484	0.55
2N2646	0.75
2N2696	1.30
2N2904*	0.42
2N2905*	0.33
2N2926G	†0.15
2N2926O	†0.14
2N2926Y	†0.14
2N2955	1.12
2N3053	0.25
2N3054	0.62
2N3055	0.70
2N3702	†0.19
2N3703	†0.18
2N3704	†0.18
2N3771	1.85
2N3772	1.92
2N3773	2.90
2N3819	†0.35
2N3866	1.72
2N3904	†0.24
2N3905	†0.26
2N4032	0.57
2N4036	0.60
2N4058	†0.18
2N4291	†0.27
2N4392	2.84
2N4902	2.40
2N4921	0.61
2N5060	†0.32
2N5294	0.46
2N5296	0.62
2N5496	1.05
2N6178	0.71
2N6180	1.39
2SC643A	1.38
2SC1172Y	2.80
2SD234	0.89
40361	0.48
40362	0.50
40595	1.39
40654	0.81

*Alternative gain versions available on items marked **

LINEAR IC's

Type	Price (£)
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CA3005	1.80
CA3012	1.45
CA3014	1.80
CA3018	1.06
CA3020	1.86
CA3028A	1.06
CA3028B	1.26
CA3045	1.35
CA3046	1.02
LM309K	1.98
MC1307P	†1.32
MC1310P	†2.94
MC1312P	2.20
MC1314P	3.85
MC1315P	4.15
MC1327P	†1.86
MC1327PQ	†1.86
MC1330P	†0.93
MC1350P	†0.85
MC1351P	†0.90
MC1352P	†0.90
MC1353P	0.92
MC1355P	1.15
MC1357P	1.42
MC1358P	†1.80
MC1358PQ	†1.85
MC1458G	0.98
MC1496L	0.88
MC3051P	0.58
MFC4000B	0.85
MFC4060A	0.98
MFC6040	1.11
MIC1P	†2.58
ML231	†4.60
ML232	†4.60
NE555	0.72
SAS560A	†2.01
SAS570	†2.01

Type	Price (£)
SC9503P	0.95
SC9504P	0.97
SL414A	1.91
SL432A	2.52
SL450	5.10
SL901B	†4.10
SL917B	†5.50
SN72440N	†0.96
SN76001N	†1.45
SN76003N	2.24
SN76013N	1.50
SN76013ND	1.25
SN76023N	1.50
SN76023ND	1.25
SN76033N	2.24
SN76110N	†2.30
SN76226N	†3.15
SN76227N	†1.85
SN76502N	†0.92
SN76530P	†1.85
SN76533N	†1.20
SN76544N	†1.85
SN76660N	†0.60
SN76666N	†0.90
TA7073P	†3.51
TAA300	†3.85
TAA320	0.94
TAA350A	†1.96
TAA435	1.70
TAA450	†3.39
TAA550	†0.60
TAA570	†2.30
TAA611A	1.70
TAA611B	1.85
TAA621AX1	2.43
TAA630Q	3.91
TAA630S	4.18
TAA661B	1.75
TAA700	†3.90
TAA840	†3.38
TAA861A	0.95

Type	Price (£)
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TAD100	†2.66
TBA120A	†0.90
TBA120S	†0.99
TBA240A	†3.98
TBA281	†2.07
TBA395	†2.58
TBA396	†2.40
TBA480Q	†1.84
TBA500	†1.99
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TBA530	†1.98
TBA530Q	†2.50
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TBA540Q	†3.20
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TCA270Q	†3.55
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TDA440	†3.70
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BA102	0.25
BA104	0.19
BA110	0.80
BA111	0.70
BA112	0.85
BA115	0.15
BA121	0.85
BA129	0.39
BA145	0.19
BA148	0.19
BA154	0.19
BA155	0.19
BA156	0.15
BA157	0.25
BA158	0.28
BA201	0.13
BAX13	0.08
BAX16	0.10
BAY72	0.18
BB104B	0.52
BB105B	0.52
BB105G	0.45
BB110B	0.45
BR100	0.40
BY100	0.35
BY103	0.35
BY118	1.10
BY126	0.16
BY127	0.18
BY133	0.35
BY140	1.40
BY164	0.75
BY176	2.80
BY179	0.83
BY182	1.14
BY199	0.29

Type	Price (£)
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BY238	0.25
BYX10	0.31
FSY11A	0.58
FSY41A	0.51
ITT44	0.08
ITT210	0.63
ITT827	0.80
ITT921	0.12
ITT922	0.12
ITT923	0.18
ITT1075	0.15
ITT2001	0.12
ITT2002	0.13
ITT2003	0.25
OA10	0.37
OA47	0.15
OA81	0.17
OA90	0.10
OA91	0.12
OA200	0.10
OA202	0.13
S2M1	0.38
S6M1	0.49
TV20	2.25
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IN916	0.09
IN1184	1.10
IN1185	1.30
IN4001	0.05
IN4002	0.06
IN4003	0.07
IN4004	0.08
IN4005	0.09
IN4007	0.14
IN4148	0.06
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IN5401	0.17
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/A260	†0.18
/A262	†0.18
/A265	†0.18
/P268	†0.18
E298ZZ	
/05	†0.20
/06	†0.18
E299DD/P116–P354	all †0.17
E299DH	
/P230	†0.72
2322 554 02221	†0.59
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PCC84	†0.65
PCC85	†0.79
PCC89	†0.74
PCC189	†0.94
PCF80	†0.65
PCF86	†0.74
PCF200	†1.16
PCF801	†0.74
PCF802	†0.79
PCL82	†0.65
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PCL84	†0.65
PCL86	†0.74
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John A. Reddihough

TECHNICAL EDITOR
Luke Theodossiou

ART EDITOR
Peter Metalli

ADVERTS MANAGER
Roy Smith 01-634 4383

CLASSIFIED ADVERTS
Colin R. Brown 01-261 5762

PRICE INCREASE

We regret that it was not possible to warn readers last month of the increase in the price of *Television* to 50p, as the application was with the Prices Commission at the time of going to press. The reason for the increase is simply the effects of inflation on our costs, in particular the price of our printing paper which has to be imported. We hope that the steadier economic conditions will enable us to avoid further increases.

FRONT COVER

Our front cover shows a rear chassis view of a Bush receiver fitted with the Rank A823 chassis. What's the matchbox on the right-hand side doing? Well, this is an early production set in which the pincushion phase coil on the scan control panel and the fly-wheel line sync discriminator transformer on the scan drive panel were in close proximity and tended to interact, causing hooking at the top of the picture. The matchbox separating the panel cures! In subsequent production the scan drive panel was mounted the other way round ....

Where do we go from here?

Diligent readers of this magazine will notice a slight change this month in the arrangements listed immediately to the left. They may wonder whether this signifies any impending alterations in the magazine, and if so what? The answer is that it doesn't – unless, that is, an overwhelming number of you write to ask for some particular change in our coverage or emphasis. For the moment we propose to continue our present policy, which is to provide a service for all those interested in the technical side of domestic television, while evolving with the industry we serve and the changing technology.

What the change of editorship means is simply a break in our traditional link with our sister magazine Practical Wireless. This link goes back to the earliest days of this magazine, which was called Practical Television up to October 1970. Practical Television's initial appearance antedated the start of television transmissions in 1936. It first appeared in the early thirties, at a time when public interest in the possibility of the new medium and the form it would take was considerable. But the economic situation in the late thirties – and the technology – were such that television did not catch on in the way that colour did in the UK in the early seventies. By the outbreak of war in 1939 there were certainly no more than 20,000 television sets in the UK, nearly all in the London area since Alexandra Palace was the only transmitter. With the industry and the number of sets so small, there was hardly scope for a magazine devoted to the subject. Practical Television became a part of Practical Wireless, with a joint editor. The shared editorship continued when Practical Television was relaunched in April 1950, and has continued to the present day, though it's true to say that Television has enjoyed a considerable measure of independence for many years, certainly over the last decade. With the Practical group of magazines undergoing a certain amount of re-organisation however, Practical Wireless and several other titles leaving London for offices in Poole, Dorset, it was considered an appropriate time for Television to become completely independent.

The "Practical" was dropped from our title in October 1970, at the same time that we added the subheading "servicing, video, etc.". The change was not meant to suggest any lack of concern with practical matters, far from it, but simply to make it clear that with advances in television technology our scope was necessarily widening.

At the present time the role of the television set in the home is undergoing a major change. The first extension of its usefulness came with TV games and domestic videotape recorders, which enabled the public to feed signals into the set from sources other than the aerial (admittedly Baird had a video disc, but we've seen the pictures (?) it gave and will say no more about that!). A lot of development work is at present going into seventies' style video discs, and with the price of VCRs going ever upwards video discs and players may become a common feature of the domestic television scene before long. Then there's Teletext, now accepted by the Home Office as a permanent part of the transmitted signal, and the allied Viewdata system which will enable almost any information you can dial up on the telephone to be displayed on the screen of your TV set. The technology of television is in fact developing rapidly at present, which will give us plenty to report and comment upon for the foreseeable future.

And plenty of scope for constructional projects too, as the current Teletext decoder series shows. There is no sounder way of getting to grips with a subject than by building equipment. This takes us back to the earliest purpose of the magazine: to encourage experimentation and to enable those interested to become familiar with the technology through practical experience.

Teletopics

RANK'S NEW COLOUR CHASSIS

Rank have now released the circuit of their new T20A colour chassis, which uses the 20AX colour tube. It's interesting to compare this with Rank's other current colour chassis, the Z718, which employs the Toshiba RIS colour tube – both these tubes are of the in-line gun variety of course. At first glance the circuits look very similar, especially as the same signal (decoder/i.f./audio) panel is used. The field timebase and line oscillator (TBA950) are also much the same, and the overload trip works in the same way, earthing the base of the line driver transistor when it operates.

There are important differences however. The convergence circuitry is simplified, and while the EW modulator is retained NS correction is not required. The single BU208A line output transistor drives a transformer with a split primary winding (part in the collector and part in the emitter circuit), while the stick e.h.t. rectifier is replaced by a conventional tripler which also provides the focus and the c.r.t. first anode supplies – in the manner explained later in this issue.

The most significant change is the adoption of a switch-mode power supply to provide a stabilised 200V h.t. rail for the line driver and output stages and the RGB output stages. The basic circuit is shown in Fig. 1, and differs in several respects from other switch-mode circuits in common use. It consists basically of a chopper transistor Tr1 (BU326) which is connected as a blocking oscillator. When it switches on, current flows in the output winding of the oscillator transformer T. When it switches off, the collapsing magnetic field around the output winding produces a positive pulse which is rectified by D2. The trigger/control circuit consists of a BR103 silicon controlled switch which cuts Tr1 off. The point at which it fires is controlled by a BC252C transistor whose conduction is governed by a voltage proportional to the h.t. rail. The circuit is fail-safe in that no power is delivered to the load

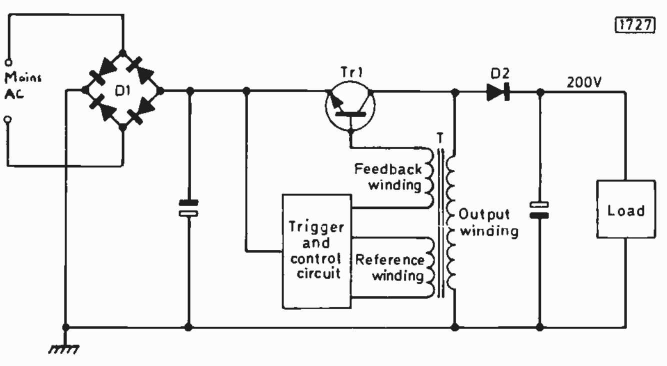


Fig. 1: The basic elements of the switch-mode power supply used in the new Rank T20A colour chassis. The chopper transistor Tr1 is connected as a blocking oscillator. It's controlled by a negative-going trigger pulse, supplied by a BR103 silicon controlled switch, which adjusts the timing of the blocking oscillator circuit by switching Tr1 off. The pulse developed across the reference winding is rectified and used to control the conduction of a transistor which in turn controls the point at which the BR103 fires.

whether the chopper transistor goes short- or open-circuit. In the event of a short-circuit load, the frequency rises thus reducing the average current to a safe value. Dead-set fault-finding is simplified in comparison to the Z718 in that with the line driver transistor fed from the h.t. rail the only start-up supply required is that to the TBA950. As before, this is provided by a capacitor charging from the h.t. supply.

Four models using this chassis have been announced so far, the 20in. BC6240, 22in. BC6340 and BC6348, and the 26in. BC6448. The latter two models feature ultrasonic remote control and touch tuning.

The circuit of the new Rank 12in. monochrome portable has also been released. It has two features in common with the recently announced Thorn portable (1690): continuous rotary tuning of the varicap tuner, and an e.h.t. rectifier which is encapsulated with the e.h.t. overwinding on the line output transformer. Also a couple of points in common with another well known portable: the use of a TBA800 i.c. to drive the field scan coils, and a BU407 line output transistor. The set is being produced at Plymouth.

TELETEXT AND VIEWDATA

The BBC and IBA Teletext transmissions have to date been officially regarded as experimental, though everyone involved considered them as having been established on a long-term basis. The Home Office has now officially confirmed to the British Radio Equipment Manufacturers' Association however that the services are "here to stay". Rank, who at present have the only set on the market fitted with a Teletext decoder as a standard feature, say that demand is currently in excess of output. Thorn are to release a Teletext receiver shortly.

Meanwhile the PO has announced that a substantial contract for the supply of Viewdata equipment and technology has been signed with the West German Post Office. The Viewdata system works on a similar basis to Teletext, but with the signals distributed via the telephone system. Under the terms of the contract, German firms will not be permitted to compete with UK firms in exporting Viewdata equipment until March 1980. It's hoped that this three-year lead in export markets will provide significant opportunities for UK firms.

CORRECTIONS

On page 651 last month, in the article on the Rank Z718 chassis, the part number of the field output transistor flash-over protection ferrite core was incorrectly given as 3421.0177 instead of 3241.0177. On the monochrome portable circuit last month (pages 644/5) Tr10 was incorrectly shown as an npn instead of a pnp transistor.

A RECAP

The progession from 90° delta gun colour tubes to 110° delta gun types and then to 90° and 110° in-line gun colour tubes has occurred at such a rate that one or two points

may not have registered properly. For instance, when and why was the degaussing shield first incorporated within the tube? Answer, with the introduction of 110° delta-gun tubes, because more effective magnetic shielding is required with the increased deflection angle. The shield is built into the 110° 20AX and PIL tubes, but is external on the 90° PIL tube. With in-line gun tubes two further changes occurred. First, due to the fact that beam landing errors are in the horizontal plane only, the degaussing coils are mounted horizontally instead of vertically. Secondly, due to the fact that the slotted shadowmask does not interrupt the degaussing field, the number of coil turns required is substantially reduced.

Another point: how does pincushion distortion compare between delta and in-line gun tubes? Answer, the astigmatic deflection fields used to give self-covergence with in-line gun tubes result in greater EW raster distortion but reduced NS raster distortion. Hence EW correction is used with all in-line gun c.r.t.s. With the 20AX tube NS distortion correction is not essential and is not found in the Philips G11 and Rank T20A chassis for example. NS correction is generally used with PIL tubes but is not strictly necessary with the smaller screen 90° versions of the tube.

Then you all thought that the PIL tube has a toroidal yoke, didn't you? And you're quite right. But there are now versions using semi-toroidal yokes – toroidal field coils and saddle wound line coils.

CES NOW PHILIPS

Combined Electronic Services Ltd., the servicing organisation for the Philips and Pye groups, has been renamed Philips Service Ltd. Improvements planned to coincide with the change include the introduction of a new computerised order handling system.

STATION OPENINGS

The following relay stations are now in operation:
Armagh (N. Ireland) BBC-1 channel 39, BBC-2 channel 45, ITV (Ulster Television) channel 49. Receiving aerial group B.
Bellingham (Northumberland) BBC-1 channel 21, ITV (Tyne Tees Television) channel 24, BBC-2 channel 27. Receiving aerial group A.
Guisborough (Cleveland) BBC-1 channel 57, ITV (Tyne Tees Television) channel 60, BBC-2 channel 63. Receiving aerial group C/D.
Kilkeel (N. Ireland) BBC-1 channel 39, BBC-2 channel 45, ITV (Ulster Television) channel 49. Receiving aerial group B.
Killowen Mountain (N. Ireland) ITV (Ulster Television) channel 24, BBC-2 channel 27, BBC-1 channel 31. Receiving aerial group A.

All the above transmissions are vertically polarised.

SERVICE CHARGES

The RETRA no longer recommends minimum servicing charges, but to provide guidance for dealers has carried out a survey amongst members in order to ascertain current average charges. It's understood that this exercise will be conducted at regular intervals in order to provide up-to-date guidance. The present average minimum charge for a call within a six mile radius was found to be £5·08 – calculated from a low of £3 to a high of £10. The £3 charge was for monochrome however and covered only the first quarter of an hour, while the £10 charge was quoted by a London dealer for colour sets (his monochrome charge was £7·50). This initial survey covered only a limited number of dealers – 54. The average minimum repair charge was £3·66, while workshop charges averaged £5·09 for the first hour and £4·55 for the second. The average annual colour maintenance contract fee was £27·83 (lowest £24, highest £40): for monochrome the average was £12·91 (lowest £9, highest £26) though not all dealers will enter into contracts for monochrome sets.

HALF YEAR RESULTS

The latest set delivery figures released by BREMA cover the first six months of this year. Of 700,000 colour sets delivered, 550,000 were UK produced and 150,000 imported. The increase of 14% compared to the first half of 1976 was accounted for mainly by imports. Deliveries were running at 85% of the 1975 level and only 53% of the 1973 boom year level. On the monochrome side, total deliveries amounted to 515,000, with 240,000 UK produced and 275,000 imported. This represents a slight (5%) increase compared to 1976, but here again the increase compared to earlier years consists mainly of imported sets.

BEST CATALOGUE

A new catalogue has been received from Best Electronics (Slough) Ltd., Unit 4, Farnburn Avenue, Slough, Bucks., SL1 4XU. The company specialises in all types of spare parts for TV sets, including semiconductors, tubes and valves, as well as tools and measuring instruments. The catalogue is available free of charge from the above address.

Inside Triplers

Harold Peters

"YOU'LL have to excuse the dog, it's not well." Those of you who repaired your way through the old 405-only days will remember the awful smell that greeted you when the selenium h.t. rectifier went up, and the customers' excuses for the aura of organic decomposition that hung about the place for hours afterwards. There were sighs of relief all round when it was displaced by the BY100 silicon diode and its successors. A while after however one was struck by a puzzled "I've smelt that before". In about 1965 Thorn started to use selenium rectifier sticks for e.h.t. rectification. Then, a year or two after the start of colour television, selenium e.h.t. tripler trays came into wide use in colour sets. This time it meant not a two quid repair job but five times as much money changing hands with the replacement of the tripler.

Surprisingly little has been written about triplers themselves and their associated circuitry. Let's take a look therefore at how they work, why they sometimes don't, and what if anything can be done to stop failures setting you back anything up to £50 in repairs.

Triplers started to replace the shunt stabiliser/valve rectifier combination used in most early colour sets in about 1969-70. The valve combination consumed about 120W of line scan power, and emitted X-rays if not correctly set up. We had become accustomed to pencil type semiconductor e.h.t. rectifiers in monochrome sets, but these were required to deliver only about 100μA, whereas the colour set needed up to a milliamp and a half at an e.h.t. of 25kV, some 7kV higher than monochrome.

To obtain this without the special screening the shunt stabiliser needed, and without having to wind a thin line output transformer overwinding, 8·5kV was generated and then tripled up. E.H.T. regulation always presents a problem when you triple, but can be brought to acceptable limits by tuning the line output transformer's leakage inductance to the fifth harmonic rather than the usual third harmonic of the line frequency. This has the effect of producing a broader, flat-topped flyback pulse, containing more energy than the spiky third harmonic one, and the addition of an efficient beam current limiter circuit ensures that the tripler's capabilities are not exceeded.

Circuit Operation

The basic tripler circuit, which works like a three stage pump, is shown in Fig. 1. The 8·4kV flyback pulse charges C1 through D1. During the next scan line the input drops to near chassis potential, and the charge across C1 is transferred via D2 to C2. The second flyback pulse arrives, also charging C1 via D1, but at the same time pushing the far end of C2 up to twice the flyback pulse amplitude (16·8kV). This action also charges C3 via D3, and so on the second line scan C3 puts this charge on to the far end of C4 via D4. At this instant the voltages across C2 and C4 are (from left to right) 0kV, 8·4kV, 16·8kV. The third flyback pulse, like another stick on the sweep's brush, pushes these potentials up another 8·4kV, D5 charging the final capacitor – the c.r.t. glass – to 25·2kV.

Practical Improvements

Fig. 1 is the theoretical circuit, but can be improved upon in practice. For a start, C3 can be returned to the C1/D1 junction (see Fig. 5), permitting all the capacitors to be of the same voltage rating. Then an extra capacitor of the same type, C5, takes the place of the c.r.t., improving the regulation and permitting a safety resistor of about 50kΩ to be fitted in the e.h.t. lead (or the tripler). If we now tap off at the junction of C1/D1 we have a suitable focus voltage for the tube. Again, did you notice that we ended up with 0·2kV too much at the c.r.t. anode? If we take the bottom of C1 to a point in the set at about +67V instead of chassis, it will charge up to that amount less than 8·4kV, namely 8·33kV, which tripled makes 25kV exactly. C1 is therefore usually brought out on a tap of its own.

Clipper Diode

Most modern triplers also have a clamping diode across the input terminals – generally drawn in circuit diagrams in such a manner that it looks as if it's one of the tripler's rectifier elements, which is confusing. The purpose of this diode is to remove the negative overswing (see Fig. 2) which follows the flyback pulse, thus improving the e.h.t. regulation. The arrangement shown in Fig. 3 is common in solid-state colour sets with transistor line output stages. The earthy end of the line output transformer's e.h.t. overwinding is taken to chassis via a resistor (R1), thereby obtaining a voltage proportional to the e.h.t. for beam limiting purposes. C1 provides smoothing. The clipper diode is D1 and its load C2/R2. The result of D1's clipping action is to produce a voltage of about −1kV across C2. What to do with it? If the networks R1/C1, R2/C2 are rearranged as shown in Fig. 4, we get a positive voltage of about 1kV at the earthy end of the e.h.t. overwinding. Just what we want to feed the tube's first anode potentiometers. We have also added 1kV to the final e.h.t., but this factor can be readily accommodated in the design of the line output transformer or by changing the point to which C1 (Figs. 1 and 5) is connected.

Faults

The most common trouble with early triplers was the smell mentioned at the beginning, due to one of the selenium rectifier rods failing. Local heating generated by one of the little discs being the wrong way round is the invariable

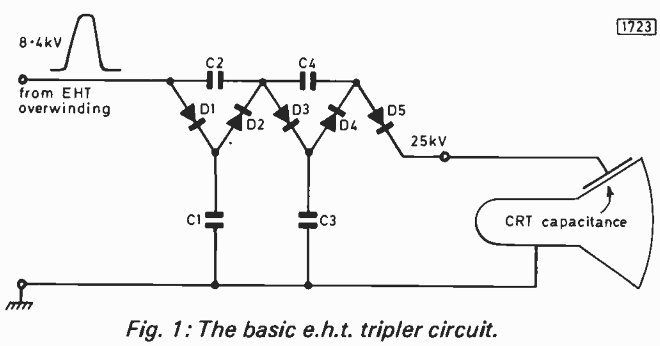


Fig. 1: The basic e.h.t. tripler circuit.

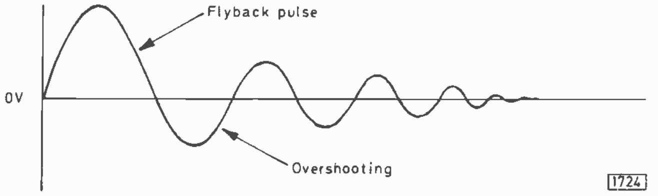


Fig. 2: The flyback pulse is followed by an overswing which, if not removed, impairs the e.h.t. regulation.

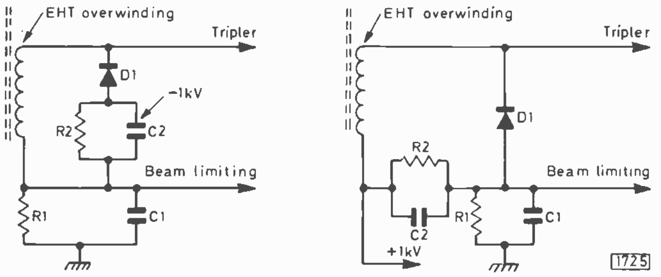


Fig. 3 (left): Clipper circuit (D1/R2/C2) to remove the overswing. D1 conducts when the input to the tripler tries to swing negatively, and as a result the upper plate of C2 is changed to a voltage of about −1kV. The c.r.t. beam current returns to chassis via R1: in consequence a voltage suitable for driving a beam limiter circuit is present across R1/C1.

Fig. 4 (right): By rearranging the circuit as shown here a 1kV voltage suitable for supplying the c.r.t. first anode preset controls is obtained on the left-hand plate of C2.

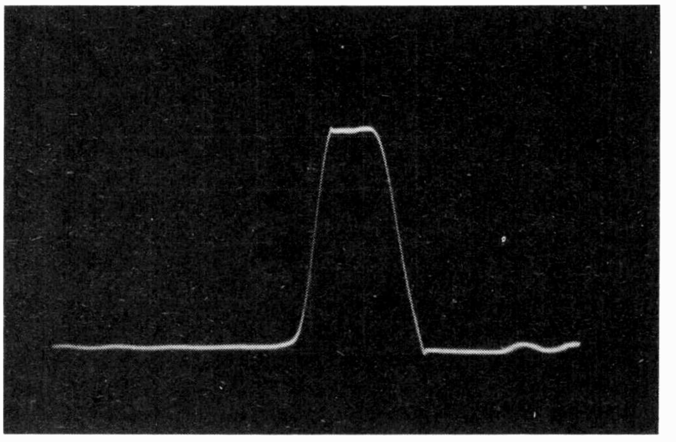


Fig. 6: Tripler input voltage pulse. Note flat top due to fifth harmonic tuning, and the absence of a negative-going overswing due to the use of a clipper diode. Vertical scale 2kV/cm, horizontal scale 5µsec/cm. Pulse scoped with zero beam current.

prime mover: this disc will break down on the forward stroke. Modern triplers use the more reliable silicon diodes. Today's troubles usually begin with the flashover of one of the capacitors. Invariably this or any other failure will burn out the safety resistor in the c.r.t. anode cap or in some cases inside the body of the tripler, which will bulge and crack. Avalanche conditions can make the repair expensive. A failure of the focus assembly say could destroy not only the tripler but impair tube emission and take with it the line output transformer and line output transistor.

Precautions

Avoiding such failures is not an easy matter, especially if it isn't your set. Make sure that the beam limiter works, and that it limits the current to below the tripler's capabilities. 1·1mA is a good low value, and you will find very few sets with sufficient video drive to get above this level without crushing part of the signal.

If it is your own set, make sure that it is adequately ventilated – the cooler the chassis the better. If the set has not been used for a little while, e.g. after a holiday, air the room first to avoid risk of internal condensation. Turn the set off as soon as it fails, to reduce avalanching effects – dozens of viewers continue to watch a faulty set, waiting for the broadcaster to apologise. Train the family to check on another channel, and to recognise transmitter failure by removing the aerial for a second or two. "Open plan" houses seem to invite you to leave the set on all the while, and just go round and look at it when you want to view. This is inviting avalanche faults. Never watch a set unless you are looking at it!

Beam Limiting

Fig. 5 shows a widely used circuit with a simple beam limiter arrangement. The current limit is set at 1mA by applying 150V to 150kΩ. This 1mA passes through diode D7 which is forward biased and thus looks like a short. The beam current, struggling to get back from the tube to the bottom of the line output transformer, passes through the diode in the opposite direction, reducing the total current flowing through it in a manner that would delight Kirchhoff. When the beam current exceeds 1mA the diode is reverse biased and ceases to be a short. The voltage at the junction R2/R3 becomes negative, and is applied to the c.r.t.'s grids to turn the picture down to the point where only 1mA flows and the diode becomes a short once again. To vary the limiting one has merely to vary the value of the 150kΩ resistor. ■

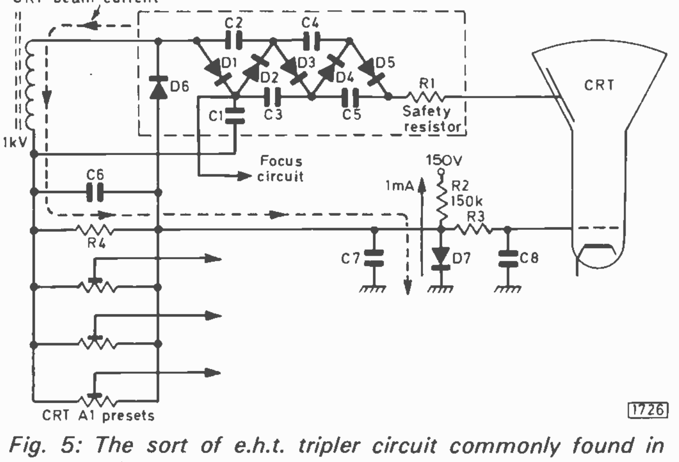


Fig. 5: The sort of e.h.t. tripler circuit commonly found in current colour receivers, with D7 providing beam limiting.

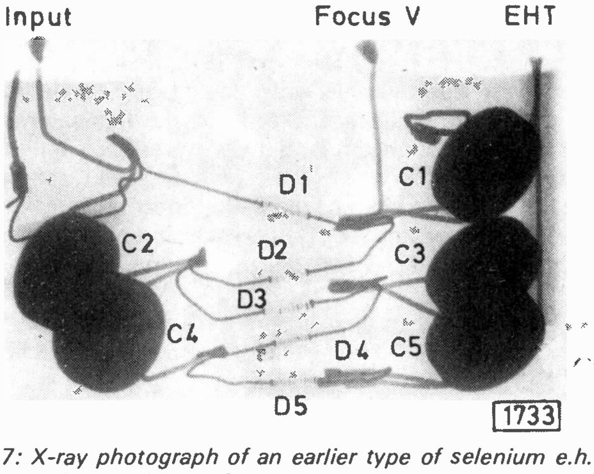


Fig. 7: X-ray photograph of an earlier type of selenium e.h.t. tripler, without a clipper diode.

Toil and Trouble...

Les Lawry-Johns

I MUST admit that I am never at my best first thing in the morning. The world then seems to me to be conspiring to cheat me out of my cup of tea and piece of toast, and when the world beats a path to my door before the humours have settled it's greeted with snarls and grunts. After say 9.30 (a.m.) a transformation takes place and I am once again the obliging, polite, helpful fellow that most know well (so they think). In short, before 9.30 I see the world as it is. After 9.30 I see it through rosy coloured glasses and I can then face almost anything. Almost, but there are limits.

Then, puff, it stopped speaking

Take the other morning. Just after nine, as I was busy thrashing the dog for fun, in walked a couple of gentlemen carrying a Bush TV161. Their command of English was not good.

"There is nothing wrong with the television you know", said beardy. "It will take you only a few minutes to put it right."

Non-beardy was equally helpful. "I think it is perhaps a fuse, as it was perfectly all right you understand and then, puff, it stopped speaking." I struggled for a few moments and then managed "Ah yes, there is a lot of it about you know".

Beardy was not distracted. "How much will it cost to replace this fuse?" I thought for a moment. There was an axe under the counter, or I could accidentally let off the fire extinguisher. "Perhaps we had better find out why the fuse failed?" I suggested, having considered the mess that would be caused by either of the above two alternatives. "Would you like to come back later when I have found the reason?"

Non-beardy was stubborn. If it was a fuse, he wanted to see it fitted with no hanky panky. Quick as a flash, my lightning sharp mind added up the possibility of a bit of fun. If the fuse had popped it was probably the mains filter capacitor, a shorted rectifier diode, or perhaps a shorted boost capacitor (returned to chassis in this model). Why not let them see that fuses do not just blow by themselves (except in some makes of colour sets, but that's neither here nor there)? Why not, why not?

In a trice the set was on the bench and the back was off. Beardy's head peered in at one side while non-beardy's head peered in at the other. I removed the shattered fuse from the lower right side. So that I would not get caught in any atomic fall out, I quickly checked with the ohmmeter: mains filter capacitor seemed o.k., but you never know with these, the rectifier diodes were not short-circuit, no h.t. shorts, and 1MΩ from the top cap of the PY88 boost diode to chassis (boost capacitor not shorted). So that it would not fail too easily I put in a 2·5A fuse, plugged the set in and switched on.

Valves started to heat up nicely. Beardy beamed. "The fuse does not fail!" Feeling slightly bemused, I switched the meter to the 300V range and went to check the voltage at the main smoothers on the lower left side. At that moment there was a loud hiss and a jet of vapour shot out of the main smoothing can and hit me dead amidships (clean shirt that morning no longer clean). Pop went the fuse and the two enthralled spectators vanished for a moment.

Beardy reappeared. "What did you do to our television set to make it go bang like this?" he demanded. "What did I do?" I screamed. "Look what your bloody set's done to my shirt." Non-beardy howled with laughter. "Do it again please, just once more." I scowled at him, slackened off the clamp holding the electrolytic, snipped off the tags and pulled it out, holding it with a pair of pliers. "Here it is, it's all yours."

Non-beardy took it and dropped it in one go. It was beardy's turn to laugh. "Hot, you know", he confided in me.

"Right", I said. "Now let's get down to it. If you want it done, say so." Anyway, after this it all passed off without further incident and away they went carrying their Bush which now spoke instead of hissed. I removed my shirt to ensure that I had not been permanently injured. "Look", I said to the chief squaw. She wasn't very sympathetic. "I wish I'd have seen it" she giggled. Resplendent in another clean shirt (we've got two, one now a different colour around the navel), we tackled the next job.

Dud rectifiers

This was a Philips G17T320. Many of these are now coming in with a shattered mains input fuse. This tends to direct attention to the mains filter capacitor which has not however been found at fault so far. Instead the fault has in each case been the bridge rectifier, which shorts from the negative end to the a.c. input. The power panel is secured by two screws and is easily removed without loss of the screws or the insulated stand off spacers – well done Philips. With the panel turned, the bridge can be removed quite easily. Note that the replacement should be a BY179. Check the voltage rating of any other type you use and also which end is positive and which is negative. Otherwise fit four BY127 or equivalents. Incidentally, the mains input filter capacitor is clipped to the side wall near this panel and is not near the on/off switch. Since we dealt with this series of receivers in the December 1976 and January 1977 issues we will not add servicing notes here.

Liquid problems

Just as we were wrapping up the Philips, a grey Renault 16 drew up outside, gleaming in the sun. Out hopped Derek, who is a river pilot and a regular customer. He looked decidedly wet on this dry, sunny day.

"Hallo Derek", we greeted him. "Did they make you walk the plank?"

"No" said Derek. "I've just come from the car wash."

"Wouldn't it have been better to take the car in with you?", we asked reasonably.

"Very funny" said Derek savagely. "I was in the car all right but the bloody fool I lent it to over the weekend hadn't shut the sunshine roof properly. Anyway, that heap of rubbish that I bought from you some time ago has gone wrong. Can I bring it in when I've been home and dried out?"

Assuring him of our utmost co-operation, we watched him climb back into his car and drive off, little knowing that he was to baptised yet again later that evening when a pint of beer placed on a high shelf would be accidentally knocked off smack on to poor Derek's head just as he stood back from the shove ha'penny board to admire his winning effort. Gusts of laughter filled Harold's bar, and some wit shouted "Consider yourself launched, God bless you and all who sail in you". This has little to do with the day's work, however: just thought you might like to know about it.

A nasty surprise

We then turned our attention to an ITT colour set which we had taken to be a CVC8 or something of that ilk. When we removed the rear cover however a cold hand clutched our heart. Not a valve in sight! The moment of truth was at hand. Our first CVC20.

"Help!", I yelled to the chief squaw. "Bring some strong coffee and blow the expense." The chief squaw appeared as though by magic, carrying the required tranquiliser. "What are you carrying on about now?", she asked sympathetically.

"It's this, this set. We haven't had one in before and I haven't done my homework and I'm frightened."

"Never mind, you'll sort it out. Do you think my hair looks all right this way or should I do it like I normally do?"

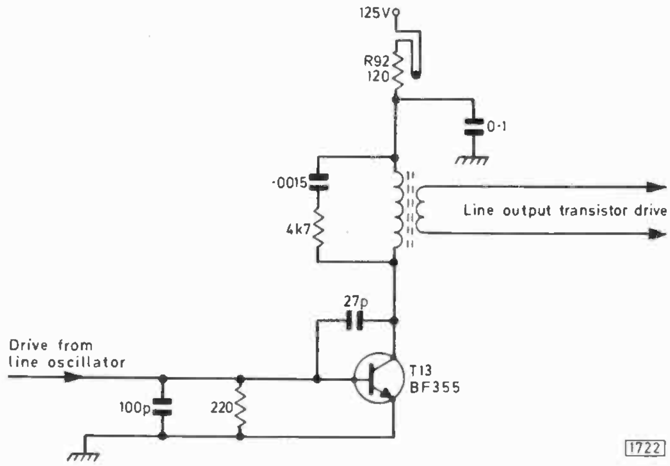


Fig. 1: Line driver stage, ITT CVC20 chassis.

This was it then. Alone and friendless. What about these women though? If they cared half as much about the inside of their heads as they do about the outside they'd all be rated as geniuses. Still they're not so bad really. Some are really quite useful. Back to the CVC20 however.

E. Trundle did a nice write up on the switch-mode power supply used in this receiver in the September issue, and readers not familiar with the circuit could well profit from a study of this.

The set we had on the bench had no e.h.t., although the

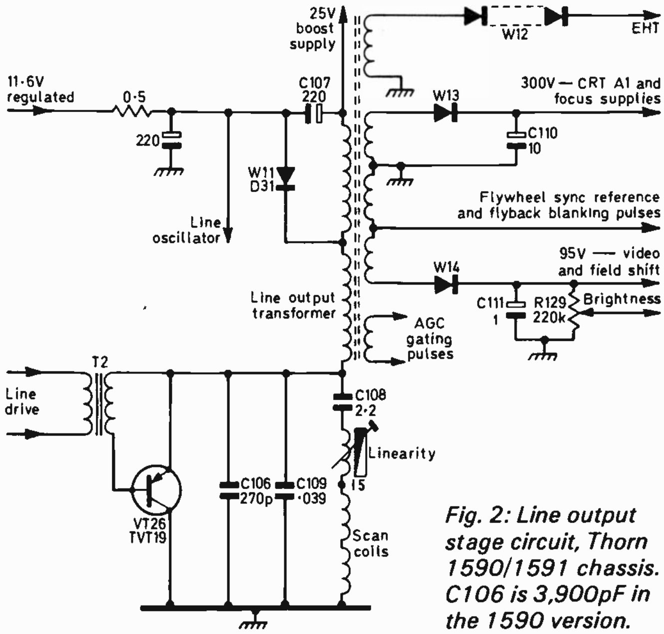


Fig. 2: Line output stage circuit, Thorn 1590/1591 chassis. C106 is 3,900pF in the 1590 version.

supply was present to the line driver and output transistors and there was a continuous note coming from the loudspeaker. This suggested that either the line oscillator was not functioning or the line driver transistor (see Fig. 1) was at fault. Its collector feed resistor R92 was not open-circuit so we took the easy path and noted that there was no voltage drop across it. Cold testing the driver base-to-emitter and base-to-collector did not at first show the correct readings, but then did so on the second attempt. Switching on again produced full e.h.t., full sound and full colour....

Having been fooled by transistors in the past (cold testing often seems to bring them back to conduction), we immediately accused the driver transistor T13 (BF355), of being the culprit and whipped it out before it could say a word. We didn't have a BF355 to hand, so we used our favourite transistor of this type (high-voltage, medium-power npn), which is the BF337, and were rewarded by good results and have had no comeback so far.

No EHT again

The feeling of relief encouraged us to tackle the next job, which we thought was going to be an easy one, without delay. It was an Ultra Model 6816, which uses the 1590 Thorn chassis. The note said "very narrow and dark picture".

With the set on the bench there was no picture or raster at all, with not very much activity around the line output transformer. The supply line was correct at around 11·5V however. Checking for shorts around the rectifier diodes W13 and W14 (see Fig. 2) produced no fruitful results.

With these symptoms either one of those diodes or its smoothing electrolytic (C110 for W13, C111 for W14) is usually found to be at fault. Checking the boost diode W11 and capacitor C107 again produced little cheer. Disconnecting the scan coil coupling capacitor C108 merely produced a faint vertical line down the centre to show that the woeful loss of line output efficiency was still present. The AU113 line output transistor next received the best check of all – replacement – but the fault still persisted.

As the line oscillator was obviously working we were beginning to think in terms of a faulty line output transformer. There were other possibilities still to check however. Disconnecting the e.h.t. rectifier stick W12 produced no better response. We then did what we should have done in the first place and checked the waveform at the base of the AU113. This was quite weird looking. Thus armed we attacked the driver VT25. This is a TIS90 and although it read reasonably on a cold test a replacement restored normal working.

Two drivers in a row! Decidedly back seat types. Still suspicious, we left the set on test but it behaved itself, thus proving that the drivers of today are not what they used to be.

Arcing, and a smell

The next item on the agenda was a large Ultra set fitted with the Thorn 3500 chassis. Arcing noise they said, and a smell. Easy we thought: the tripler. Removing the tripler lead to the e.h.t. transformer should restore normal timebase working and the correct voltage drop across the 1·5Ω monitoring resistor R907 on the beam limiter board. The voltage drop remained at over 3V however instead of 1·3V, and to prove the point the spring cut out sprung. At this the weak BBC-1 sound became loud ITV as the voltages went up with the load going down.

Making a few tests around the line timebase turned out to be fruitless (no the driver wasn't guilty, neither was the line output transistor). Capacitors were checked and all shouted their innocence. Still the suspicion lingered ... arcing and smell. Brave to the last we unhooked the e.h.t. transformer and reconnected R907. It ran cool. Lunchtime.

During lunch a lady rang to say that the wood veneer on the front of her new TV set was buckled and could we let her have another set today as her grandchildren were coming at five o'clock and if they saw the buckle sticking out they would pull it off altogether. We complied with her request and only wish that we could get such prompt attention from the people who supplied us with the set. No such luck, it is still here and is likely to be for some time unless we get a carpenter on the job ourselves. Never mind, it's our problem.

Back to the 3500. We obtained and fitted a new e.h.t. transformer and were then in a quandary. Whether to connect the tripler and see, or to fit another one thus putting up the charge considerably. We decided to approach with caution. With the set on, we advanced the tripler lead towards the nipple of the transformer. The spark was not nice, it was more of a flame. We feared for the new transformer and some of the more responsive transistors. On fitting a new tripler all was well and the only difficult thing left was to write out the bill.

Hari Kari or Marta Hari?

We will not bore you with a description of the rest of the afternoon's activities except to say that they consisted of attending to intermittent faults on stereo units. These nearly caused us to commit Hari Kari (or is it Marta Hari, where you plunge a knife deep into a block of cheese).

Problems with a 1500

It was getting near closing time when an HMV mono set (1500 chassis) came in (all on its own, it just walked in) followed by its owner who had trained it well. He had just acquired it. Would we give it the once over?

Switching on produced a plain raster with no sound. This normally leads one to the i.f. transistors or the a.g.c. circuit of course. The a.g.c. amplifier transistor is VT3, which controls the second i.f. amplifier transistor VT5 which in turn controls the base of the first i.f. amplifier transistor VT4 (no tuner a.g.c.). Checking voltages showed some funny readings of around 20V on the legs of VT4 and VT5, i.e. both saturated, and incorrect voltage at the base of VT3. VT3 is driven by the a.g.c. detector diode, which is fed from the slider of the preset contrast control in the emitter circuit of the first video transistor VT8. So we went on to VT8, where there was nothing at the emitter and very little at the base. The base bias is filtered by R30/C32 (see Fig. 1, page 40), and checking back we found nothing at the junction of R79/R136. R79 is the left-hand section of the dropper, and should have a value of 317Ω. It was open-circuit, leaving a high voltage at the input to the transistor supply line smoothing resistor R78. Fitting a replacement wirewound resistor restored normal voltages, but still no signals except for some short-wave noise creeping through the sound i.f. Checking through revealed that the fourth i.f. amplifier transistor VT7 was faulty. Replacing it restored sound and vision signals (this transistor often fails when the transistor supply line rises excessively after R79 goes open-circuit), but. . . .

There was a nasty hum bar drifting up the screen, with the picture pulling and rolling. Check transistor supply line electrolytics. C58 proved to be faulty, not surviving the effect of R79 going open-circuit.

Replacing C58 restored near normal conditions, but on adjustment the local/distant tuner gain control R74 fell apart. A new one put us on the road again except for occasional picture roll, which as usual was cured by replacing R44, the upper resistor in the potential divider network feeding the screen grid of the 30FL2 sync separator.

All now seemed well except for an unpleasant smell which however proved not to be issuing from the e.h.t. tray but from the sewerage works across the river. The owner lacked transport, having come in a taxi. Would we phone for a cab? No taxi available at this time of the evening. Wait fifteen minutes. Then run him home, and his set. Reached the pub just in time to see Derek annointed.

Which Valves to Stock?

Peter Duncan

WITH valves no longer being used in current production TV receivers it is becoming increasingly important to decide what to keep in stock. The problems are roughly: which valves are worth laying in for future repairs, which ones aren't worth re-ordering, and which ones will probably never be used and should be stored out of the way?

The last two UK setmakers to produce hybrid colour chassis were Decca and ITT. The valves used in their final hybrid chassis are as follows: PCF802, PL509, PY500A, PCL86, PCL82, PCL805, PL508, PCF80. A set of these costs around £7·68 (based on the prices quoted by Bentley Acoustics in their August 1977 advertisement) and this represents the minimum stock required to be able to offer an efficient colour repair service. It seems to us that the future of any valve as a profitable spare is in some doubt if it's not one of these.

With the exception of Thorn, all UK setmakers started off by producing hybrid colour receivers. The additional valves required in order to be able to cater for these earlier colour chassis are as follows: PL504, ECC82, EF184, EF183, EF80, DY86/87, PCF805, PC97, PCL84, PL802, PFL200, GY501, PCF200, ECC81, PCC85, PCC88, EY51, PD500, EB91. Some of these are to be found in only the earlier, dual-standard chassis. The important ones are the PCL84, PL802 and ECC82. The Philips G6 chassis is still regularly encountered however and had a rather unusual valve line up. To be able to deal with these sets you'll need to have the following in stock: EF183, EF184, EF80, PFL200, PCC85, PCF200, ECC81, EY51, GY501 and PD500 – in addition to some of those listed in the second paragraph.

Service enthusiasts who worry when they cannot do an immediate repair to an old set requiring a replacement valve not in stock should relax: the RETRA code of practice allows up to fifteen working days for a repair, and valves can be obtained by return post from advertisers in *Television.* When ordering a valve specially for an old set it's wise to order a couple since new valves can unfortunately also be faulty. The cost of repairs carried out on old sets should allow for the fact that you may be left with valves that are unlikely to be used.

There is a belief that foreign sets are constructed with infinite care to stringent, all-transistor quality specifications and are thus absolutely reliable. Not so! Foreign sets do fail, and when you take the back off you may be surprised to find a host of good old unreliable valves. Depending on which makes you may handle, the following is a list of some of the valves you may require – we're not repeating the types so far listed.

Bang and Olufsen: 12HG7, PL84, EAA91 (an EB91 will do however), ECL84, PY88.
Telefunken: ECH84, PL519.
Saba: PL519, PL95, PC92.
Sanyo: 3BS2A.
Kuba Porta-Colour (also known as the Granada Colourette): PC900, PY83, 1AD2.
Teleton: 3AT2, 6GH8A, 8FQ7, 10GK6, 17DW4A, 17JZ8A, 21LU8, 31JS6A, 40KD6.

The odd balls are mainly in early Japanese sets, due to the American influence. Note that the PL519 is an up-rated version of the PL509 and may be stocked in its place. Unless specialising in the repair of foreign sets it's best to regard these valves as "special order" types and quote five-fifteen days for repairs.

When it comes to monochrome sets the situation is more difficult, due to the greater variety of valves that have been used in them. To appreciate this it's only necessary to think of the Thorn 1400 and 1500 chassis which used such valves as the 6F28 and 30FL2. Stocking up to be able to deal with an extensive range of monochrome sets can be expensive, though many of the valves used will already be in stock for use in colour sets. The following are the main valves required, in addition to those listed in paragraphs two and three, to be able to deal with most of the valved and hybrid monochrome sets produced since 1970: PY88, PY801, DY802, PL36, PL81A, 6F28, 30FL2, 30FL14, 30PL1, 30PL14, ECL80 and, if you deal with Grundig sets, the PL95 and PCH200. ■

LONG-DISTANCE TELEVISION

ROGER BUNNEY

AUGUST was a rewarding month, with sustained Sporadic E activity throughout. This was not as intense as in June and July however. At the time of writing the usual decline experienced at this time of the year is taking place.

It seems that two enthusiasts may have experienced really long-range reception this month – a signal that appears to have come from the Gwelo, Rhodesian ch. E2 transmitter. The signal was received along the southern UK coast on August 17th, between 1800-1845 BST, from a southerly direction. The programme was in English and consisted of a quiz programme with white participants. We have written to the Rhodesian authorities to check on their transmissions at the time and will report further as soon as we have definite news.

The following brief log summarises the main events here at Romsey during the month.

4/8/77	Sp.E opening with signals from TSS (USSR) on channels R1 and 2, CST (Czechoslovakia) ch. R1, TVP (Poland) chs. R1 and 2 and SR (Sweden) ch. E2. A new electronic pattern was noted in use by TVP. It consists of a grey scale with three horizontal rows of black and white squares superimposed.
5/8/77	An excellent Sp.E opening all day! Most countries in Europe were received, and two new stations logged – YLE (Finland) ch. E4 and TSS Stalino ch. R4.
8/8/77	Sp.E reception from RAI (Italy) on chs. IA and IB, and JRT (Yugoslavia) ch. E3.
11 and 12/8/77	Many signal pings were noted during the Perseids Meteor Shower, some in Band III (ch. E5).
14/8/77	Evening Sp.E reception with ch. IA and several unidentified stations.
16/8/77	TVP ch. R1 noted with PM5544 test pattern with identification "TVP NTD 1" in lower rectangle. Also excellent evening Sp.E reception from NRK (Norway).
20/8/77	SR chs. E2 and 3 via Sp.E.
27/8/77	MTV (Hungary) chs. R1 and 2 via Sp.E.
29/8/77	CST ch. R1 via Sp.E.

News Items

Holland: It seems that the NOS Lopik ch. E4 transmitter will close at the end of 1978, with a change to ch. E37. A new network, NOS-3, will start transmissions in 1980. Channel details next month.

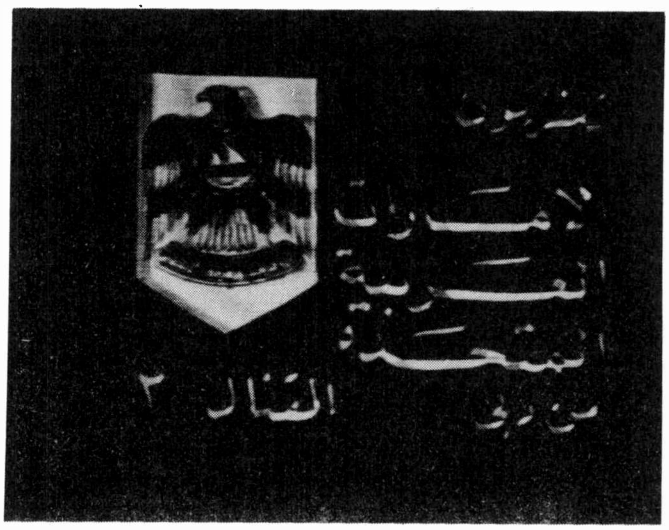
France: Listeners to BBC News on August 13th will have heard that the Bastia ch. F2 transmitter has been destroyed by two explosions. It will be out of action until early 1978. The Ajaccio transmitter on ch. F4 remains in operation. These transmitters are located in Corsica.

Satellites: We understand that the USSR has launched another direct broadcasting TV satellite Statsionar 2. This relays both mono and colour transmissions. The famed ATS-6, which provided so much excitement last year with its 860MHz transmissions, is continuing its experiments over North America. Using its s.h.f. link transmitters it provides Alaskan TV in both Anchorage (KAKM-TV) and Fairbanks (KUAC-TV) with live programmes from the Public Service Satellite Consortium at Denver, via a link at Morrison, Colorado.

A Mariner's Report . . .

We were extremely pleased to hear from Chris Ellison who lives near Derby. Chris is in the Merchant Navy and has considerable experience of TV installations on the various tankers that trade to the Gulf and elsewhere. At one stage aerial rotor units were employed, but due to the heavy weather often encountered these have fallen from favour and a Japanese copy of the RCA "Mini-state" omnidirectional array (an active array described in the December 1976 *Television*) is now generally used, enclosed in a circular fibreglass dome. Receivers are usually British hybrid chassis with switchable video modulation and inter-carrier sound spacings – and both v.h.f. and u.h.f. tuners of course. Line switching is sometimes fitted for American system M transmissions.

TV viewing can be frustrating due to receiver faults which at times lead to the system being out of commission for 50% of the time. Chris comments that a great time can be had since the aerials are often 150ft. a.s.l. – a



The Dubai ch. E2 station indentification slide, featuring eagle and arabic script. Photo courtesy Alan Latham.

supertanker's bridge may be 100ft. a.s.l. plus another 50ft. for the aerials. Extensive use is also made of video cassettes.

Whilst on the subject of shipboard reception, John Lawrence (GW3WEZ) has sent us information from his company, IVS (UK) Ltd., of Redan Place, London W2. They can supply a television receiver called the Barco "Seagull". I feel that this is the receiver for the TV-DX enthusiast who either owns a luxury yacht or a luxury bank balance or both! The receiver is a multistandard colour one which switches between all known colour systems and most of the world's transmission standards (not 405 lines), namely B, C, D, E, G, I, K, L, M. If anyone has used one of these receivers we would be most interested to hear of their experiences.

The Arabian Gulf

I was delighted to welcome Alan Latham who has been home on leave from Abu Dhabi. During our discussion further information came to light on TV activities in the Gulf. There are three u.h.f. transmitters in operation, Saudi Arabia on ch. E23, thought from Damman, and Dubai on chs. E33 and 41. Saudi Arabia is transmitting PAL, not withstanding earlier suggestions that they were using SECAM. Iran is the only country known to be radiating SECAM, on chs. E3, 4 and 8.

In the September column reference was made to Hetesi Laszlo's reception, thought to be Egypt. It's more likely to have been Dubai, due to the eagle and script. The ch. E2 Dubai caption is shown in the accompanying photograph. Interesting to note that the low-powered Ras Al Khaima transmitter with jamming signal are one and the same: the jammer is radiated from the transmitter itself! Alan has also succeeded in receiving the suspected ch. E3 Greek transmitter from Thessaloniki, as the illustration shows. A specialised receiver has been put into use for TV-DX, with a very restricted bandwidth.

From our Correspondents . . .

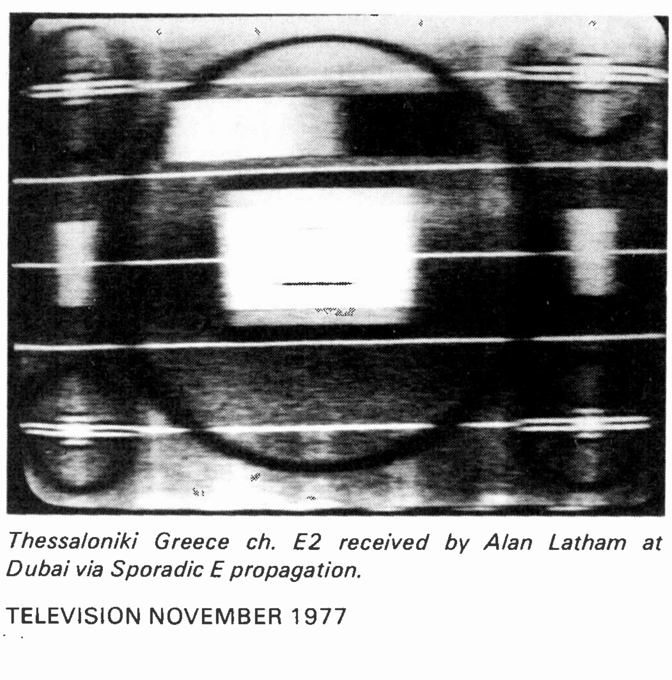
Andrew Emmerson has sent us a shot of his aerial system – at u.h.f. a Vorta VP91 wideband unit and at v.h.f. the Antiference MH308 combined Band I/III array. The f.m. array below is under test. Andrew (Faversham, Kent) has enjoyed a most successful Sp.E season and is considering the use of stacked Wolsey Colour Kings to assist with co-channel rejection. I feel I must comment on the aerial system as illustrated: the arrays are far too closely spaced – where possible a 3ft. spacing should be provided as a minimum to avoid mutual absorption effects between arrays. A close examination of the original photograph also revealed that one of the phasing rods between the Band I and III dipole terminations is missing! Andrew recently visited Boulogne on a hovercraft day trip and noted that in-line Band III/u.h.f. arrays are popular, with many u.h.f. arrays fixed on Dover. TV prices are high: a Sony 18in colour set at 3950 francs (Model KV1811DF) and at a Hypermarket PAL/SECAM receivers at 4990 francs (Telefunken) and 4890 francs (Philips) – there are approximately 8 francs to the UK £. Aerials are generally 75Ω, the coaxial plugs being similar but slightly smaller.

With increasing sunspot activity, Bob Copeman of Sydney, Australia has invested in a receiver with coverage over 30-50MHz in the hope of receiving several of the KBS (Korean Broadcasting System) radio links below 45MHz. There may also be paging station reception from the USA on 35.22 and 35.58 MHz.

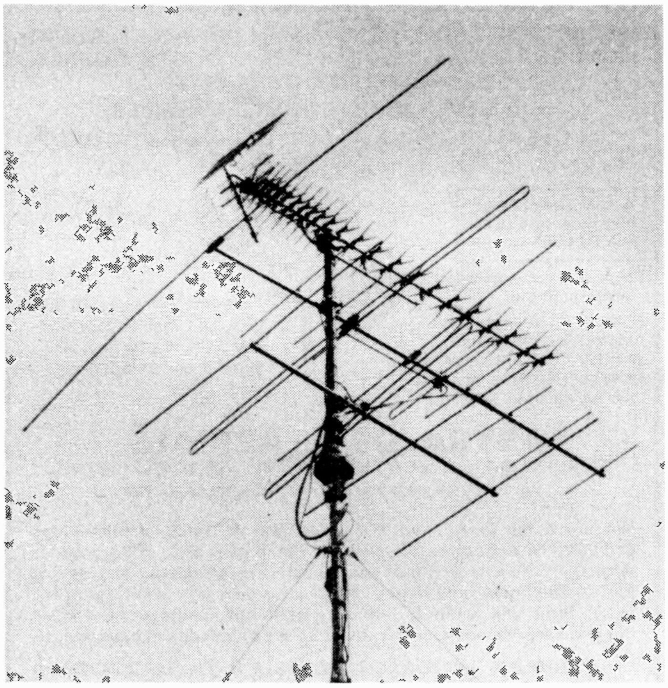
Ray Davies (Lighthouse Close, Norwich) reports reception of a RETMA test card on ch. E4 on June 11th at 0820. I wonder whether this may be the Syrian transmitter again? He also received Nigeria (NTV) ch. E3 on the same day, from 1415-1500, with caption, announcer and music. Ray uses a semi-wideband Band I array with the reflector cut to ch. E2, the dipole to ch. R1 and the director to ch. E3.

Log-Periodic Array

We have been giving thought to a wideband log-periodic array for chs. E2-4 inclusive. If anyone has built one we



Thessaloniki Greece ch. E2 received by Alan Latham at Dubai via Sporadic E propagation.


Andrew Emmerson's aerial system.

would be interested to have details, specifically on the mechanical problems associated with element mounting and boom insulation.

F2 Layer Reception

Various layers of ionised air surround the earth at heights between 80 and 400km. The F2 layer is at about 300km (200 miles) on a winter day and 450km (280 miles) on a summer day. At night the F2 layer combines with the F1 layer at about 350km (220 miles) during both the summer and winter. These – and the other layers in the ionosphere – reflect incident radio signals, their ability to do so being directly related to the Sun's ultra-violet radiation. As this radiation increases, so the ionosphere's ability to reflect signals at increasing frequencies improves. Since the F2 layer is the highest, a signal reflected from it will have the longest single-hop distance – some thousands of miles in fact.

The Sun's ultra-violet radiation is related to sunspot activity: more sunspots mean more radiation, in turn increasing the ionisation in the F2 layer so that the m.u.f. (maximum usable frequency) rises, hopefully into the lower TV spectrum. We are now well advanced into sunspot cycle number 21, and speculation (based on scientific research) suggests that the count may reach a high level this time, peaking in late 1978/early 1979. If this does happen, we could experience an upsurge in very long-distance TV signals on the lower TV channels. Sunspot cycle 20 had a low peak count in the late 60s unfortunately, with the m.u.f. reaching only 40MHz, but in 1957 there was an all-time record which resulted in the m.u.f. reaching the low 60MHz region. As a result, European TV was commonly received in the USA and as far distant as Australia.

Whilst it's unlikely that we shall experience such high m.u.f.s in the immediate future, we can nevertheless prepare for such a possibility. For maximum m.u.f.s over a given path the Sun must see the path and preferably be at noon over its midpoint. For example, for a propagation path to be established between the UK and the USA, with a six hour time difference, the midpath noon will be at 3p.m. UK time (assuming GMT). For optimum UK reception from Africa however noon will be at roughly the same time along the whole path. So a north-south path is not so critical as an east-west one – indeed the latter may give reception for only a short time. This was born out by experience in 1957 of BBC TV reception on ch. B1 in Chicago: the signal tended to arrive at a particular time, remain for a period approaching thirty minutes, then fade out.

Vision signals received via F2 layer reflection (more accurately refraction) tend to be smeary, suffer from multiple images, and usually lack h.f. detail. Completely inferior in fact to the signals we normally experience via Sp.E. Success in this type of reception demands attention and study in order to determine the correct time and signal direction. Some days give enhanced results, followed by days with minimal results. Often the 27 day rotation period of the Sun gives a "repeat performance" the second time round.

Another consequence of high sunspot activity is transequatorial skip (sometimes called Spread F). In the early evening following a reasonably active day clouds of diffused ionisation capable of reflecting incident v.h.f. signals, often at frequencies 50% higher than the daytime m.u.f., occur as the two F layers merge. Although mainly confined to the Equatorial belt, it's possible for signals propagated in this way to arrive in southern UK. Again the signal is diffused and reflected via several clouds of ionisation, resulting in multiple images.

Both F2 layer and transequatorial skip reception tend to occur mainly during the late autumn through to the early spring. The first signs of improving F2 layer propagation appear in the short-wave bands, specifically the 13 and 11m broadcast bands and the 27MHz citizens' band used in the USA and certain European countries. Propagation is such that very small signals can travel over very long hop paths.

Coverage of the 30-40MHz spectrum is difficult since most communications/general purpose receivers only go up to 30MHz while UK v.h.f. TV transmissions start in the low 40MHz region with ch. B1. A wealth of signals can be present between 30-40MHz during periods of high sunspot activity however. There are US paging stations at 35·22 and 35·58MHz. These serve subscribers with various business/domestic calls and are generally confined to a given town or urban area. Stations that have been familiar in the UK are KIY508 Orlando and KIF650 Fort Lauderdale, both in Florida: their strength was such that during the last sunspot maximum they put in their appearance on the domestic TV set as direct breakthrough at i.f.! I have monitored as far west as KKI445 Houston and KKM248 Oklahoma City. Reception was always between 1600-1900 GMT. During the morning period signals were usually present from deep into the USSR. Harmonics are also commonly received from many Middle Eastern SW broadcast stations.

I'm exploring ways of covering this elusive spectrum (apart from buying an expensive receiver such as the Eddystone 990R!) and hope to report further shortly. For the record I initially modified an old RF26 unit, feeding its output into an elderly B40 communications receiver – with I must say considerable success. The following year a special converter was constructed (see design in *Practical Wireless* September 1970), again feeding into the B40 receiver.

If any reader has made or is at present using equipment which enables the 30-40MHz spectrum to be monitored I would be most grateful for details with a view to passing the information on for the benefit of others.

In talking about sunspot activity it's important to emphasise that the sun must not be observed directly or through a telescope as this will cause immediate and permanent eye damage.

Automatic TV Switch Off

A light-operated switch-off circuit

A. Youssefkhani

THE television light switch design featured in this article enables the television set to be automatically switched off when the light in the room is put out. It can be used in any set which has a mains transformer to provide a 6·3V supply, for example the many hybrid colour receivers which have a mains transformer with a 6·3V secondary winding to supply the c.r.t. heaters. Other sets can be adapted by fitting a separate 6·3V heater transformer. Switching the set on again has to be done manually.

The light switch is useful for anyone watching in bed: switching the light off then automatically switches off the television set.

Circuit Operation

The circuit is shown in Fig. 1. The power for the switching circuit is obtained from a bridge rectifier (RS Components type 261-491) which is fed from the 6·3V heater winding on the transformer. The reservoir capacitor C1 is 10μF, 25V but may need to be varied to take into account the type of relay and light-sensitive resistor used (it provides the current required to energise the relay). In the author's version an RS Components 349-125 relay is used. This requires an energising current of 9·5mA and a holding current of 6·5mA. The light-sensitive resistor is a Mullard type RPY18. Its resistance increases as the light falling on it decreases – the light/resistance characteristic curve is shown in Fig. 2. The ambient light level in a room is generally about 20 lumens per square foot: at this level the resistance of the light-sensitive resistor is 807Ω.

To switch the set on, switch S1a/b is closed, thus supplying the receiver and shorting out the light-sensitive resistor R. Once the reservoir capacitor C1 has charged, the relay becomes energised and its contact (S2) closes. Open switch S1 and the set remains on with the light-dependent resistor now in circuit. If the room light is then switched off, the resistance of the light-dependent resistor rises to a very high value. Consequently the current through the relay coil falls below the hold-on value and S2 opens, switching the set off. To switch on again, S1a/b has to be closed.

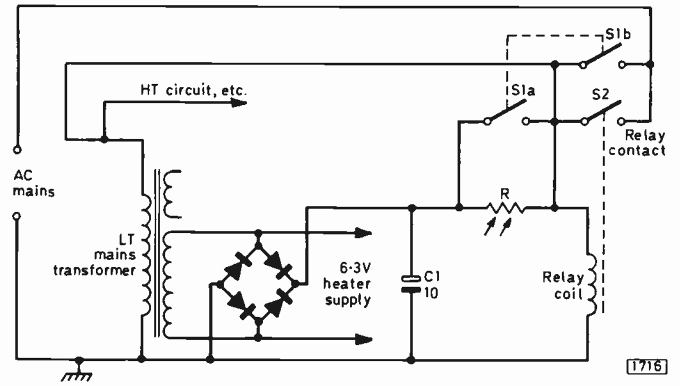


Fig. 1: Basic circuit, powered by a bridge rectifier fed from the 6·3V winding on the mains transformer. When the set has been switched on by means of S1, the relay energises and its contact S2 closes. When S1 is opened the relay continues to be energised via the light-dependent resistor R, so S2 remains closed and the set remains on. When the room light is extinguished, R's resistance increases and there is insufficient holding current for the relay to remain energised. So S2 opens and the set switches off.

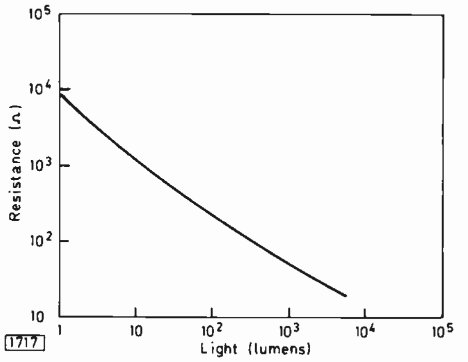


Fig. 2: Typical light/resistance characteristic curve for the Mullard RPY18 light-dependent resistor.

Alternative Arrangements

Should the circuit be powered from a winding providing a different voltage, a suitable resistor can be added in series with the light-sensitive resistor or the value of C1 altered to compensate.

Unfortunately in this particular arrangement the neutral mains connection has to be permanently made. The more elaborate circuit shown in Fig. 3 can be used to overcome this problem, using a three pole switch such as the type commonly found in mains/battery portables and a relay with two contacts. ■

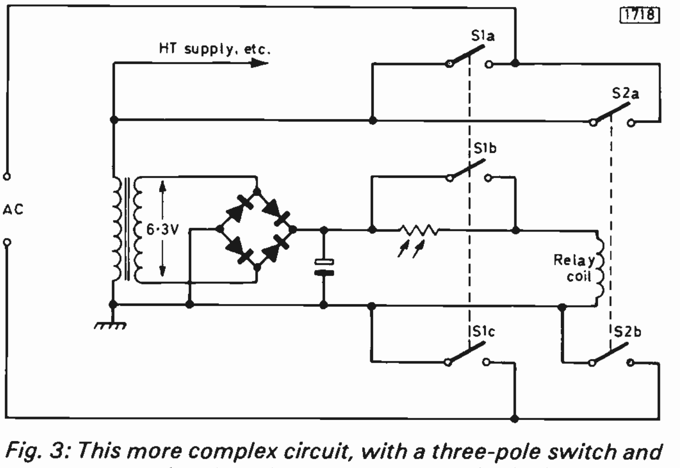


Fig. 3: This more complex circuit, with a three-pole switch and two-contact relay, has the advantage that both the live and neutral sides of the mains are switched.

The Television MONOCHROME PORTABLE RECEIVER

Part 2 **Keith Cummins**

WE ended last month with the basic power supply circuit which provides a regulated 11V line. This voltage is set by RV3, and if exceeded by half a volt or so the crowbar thyristor conducts, blowing the main protective fuse F4. We need rather more than 11V in a TV set however, so further "scan-derived" supplies are provided by the line output stage. These depend upon the line output transformer and tolerances in the line output stage, but are roughly as follows. First a 25V boost rail which powers the line output stage, the line driver stage, the field output integrated circuit and, as we have seen, is applied as a monitoring potential to D17 in the regulator circuit. Secondly a 95V rail for the video output transistor: the stabilised 32V line for the tuning circuit is also derived from this. Thirdly a 550V line for the c.r.t. first anode and focus electrodes. Fourthly the e.h.t., which is provided by the usual overwinding. And finally the pulses from pin 8 on the line output transformer are, in addition to being used to gate the a.g.c. circuit, rectified by D21 to provide a −5·6V rail for the video circuits.

IF Modules

The prototypes were fitted with the well known Mullard ELC1043/05 varicap u.h.f. tuner. The following i.f. strip consists of two modules which were designed for use in the Philips G8 colour chassis. The first, the "input selective" or "vision sensitivity" module, contains the initial, gain-controlled i.f. amplifier and the tuned circuits which shape the i.f. passband – the circuit is shown in Fig. 3. Forward a.g.c. is applied to the base of the BF196 transistor.

The majority of the i.f. gain is provided by the second module, which consists of three i.f. amplifier stages plus the detector diode. The first two stages are *RC* coupled. The third has a tuned circuit to drive the detector.

In the Philips G8 chassis a positive-going video output is required from the detector diode (with negative-going sync pulses – see Fig. 4). What we require however is a negative-going video output (positive-going syncs), so the detector diode has to be turned round so that the output is taken

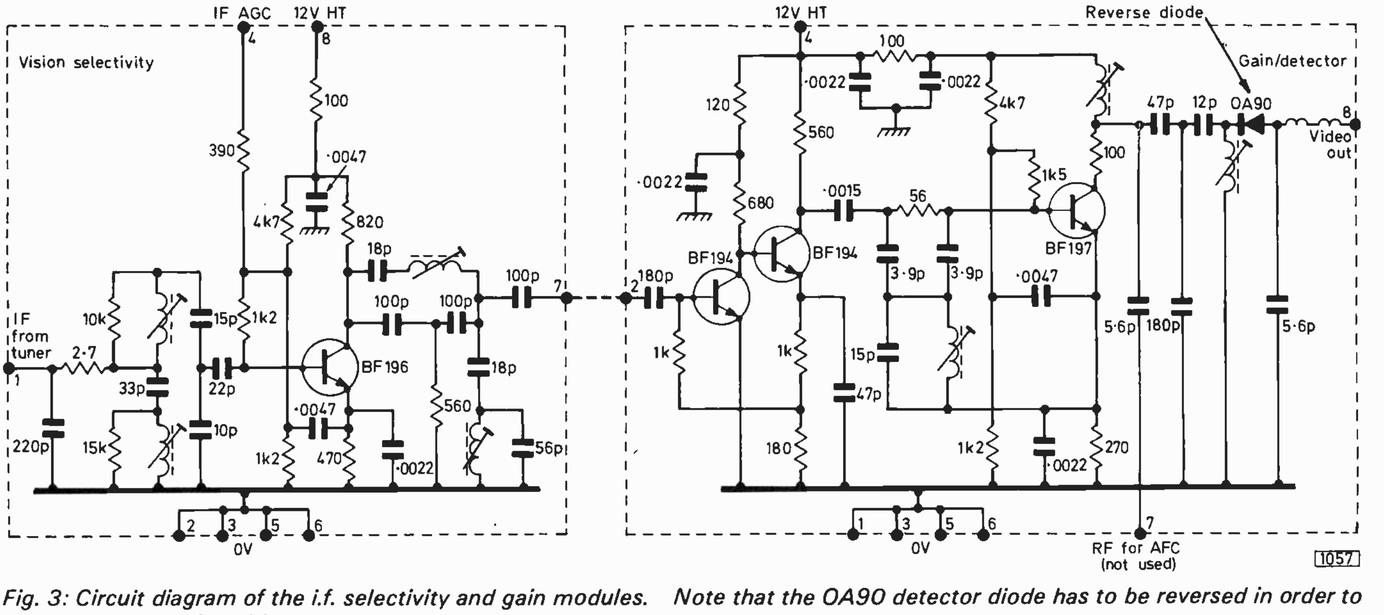


Fig. 3: Circuit diagram of the i.f. selectivity and gain modules. Note that the OA90 detector diode has to be reversed in order to give a negative-going video output.

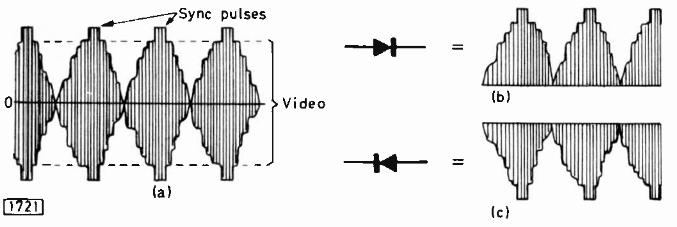


Fig. 4: Demodulating the negative-going 625-line vision signal. (a) Modulation, with negative-going video and positive-going sync pulses (maximum carrier amplitude); (b) the detector diode this way round provides a negative-going video output (positive-going sync pulses); (c) detector diode this way round gives a positive-going video output with negative-going sync pulses.

from its cathode instead of its anode. This is the only modification required, and the modules do not normally need alignment.

Video Circuits

Just to summarise then, the output from pin 8 of the gain and detector module consists of a signal with negative-going vision and positive-going sync pulses. This composite vision signal also contains the 6MHz intercarrier sound signal. The detector's load resistor R49 is external to the module. The signal developed across this is first applied to an emitter-follower Tr7, whose high input impedance reduces the loading on the detector.

In order to simplify the design of the video stages while still retaining the elegance of d.c. coupling this section of the receiver operates with both positive and negative supplies. The stabilised 11V provides the positive supply for Tr7, while negative-going 8V pulses from the line output transformer are rectified by D21, smoothed by C45, and clamped at −5·6V by zener diode D22. This latter supply is highly stable, since the zener diode characteristics are most stable at around 5V.

Output Stage

Tr7 collector is supplied directly from the 11V line while its emitter is returned to the −5·6V line via its load resistor R61. The composite video signal, at about 1·25V peak-to-peak, is developed across this resistor and is fed to various parts of the receiver. We'll deal first with the video output transistor Tr11. Its base is driven directly with the video from R61 while its collector is fed from the 95V line via its collector load resistor R64. The transistor amplifies and inverts the video signal, which emerges in a positive-going form suitable for driving the grid of the c.r.t.

The video amplifier's emitter load consists, d.c.-wise, of R63, RV9 and R62 in series. This leads directly to the stabilised −5·6V supply. The a.c. gain of the stage is greater than the d.c. gain, since C46 decouples an amount of the emitter load determined by the setting of RV9, the contrast control. This attenuation of the d.c. component would cause black-level stability problems if d.c. coupling to the tube grid was employed, so instead a.c. coupling (C49) with d.c. restoration (D25) is used. This ensures that a genuine restoration to black occurs, whatever the amplitude of the video signal. Furthermore, shifts in d.c. level caused by working-point changes are not conveyed to the tube. As a result the displayed picture is very stable.

DC Restoration

The use of d.c. restoration with a.c. coupling enables a simple means of brightness control to be employed. The pedestal voltage for the d.c. restorer diode and its load is made variable by use of the brightness control potentiometer, which thus sets the d.c. restored video on the correct point of the tube's characteristic so that the black level causes beam extinction. This idea is by no means new. It was very popular in the early days of TV and has much to commend it. We have improved the circuit however by rendering it less susceptible to interference. Otherwise it is the same as that used by the writer 25 years ago for driving a VCR97 electrostatic tube!

We'll now examine this crucial part of the circuit in greater detail.

R68 feeds current through D26 into the brightness control line via the control potentiometer RV2. This line is decoupled to earth a.c.-wise by C50. Therefore, R69 and the anode of D25 are effectively connected to earth via D26 and C50 so far as the video signal is concerned. Under normal conditions, the positive-going video "sits" on the brilliance control voltage, with the d.c. level restored by the conduction of D25 on the tips of the negative-going sync pulses. By this means, the video signal presented to the grid of the tube maintains its correct black level. Unlike the cathode, the grid of the c.r.t. has no current flowing in it to upset the process of d.c. restoration. It will now be seen why grid drive was chosen in this design.

Interference Suppression

Since negative video modulation is employed for the 625-line transmissions, noise peaks will drive into the area of the sync pulses. Unchecked, such pulses would disturb the black level. But in our design, once the pulses exceed the normal level, the current flow through R68 is cancelled and the anode of D25 is driven negatively, so disconnecting the brightness control line by reversing the bias on D26, the noise limiter diode. Since R68 is now effectively in series with D25, normal d.c. restoration no longer takes place and C49 undergoes a much smaller change in charge level as a result. By this means the effect of interference on the black level is much reduced, as evidenced in harsh tests on the prototypes.

Beam Limiter

The action of the beam limiter, which safeguards the tube and the e.h.t. rectifier D11 against the effects of maladjustment, operates in a manner similar to that described above. Normally the tube cathode is held at about 95V by the conduction of D24. Once the tube's cathode current exceeds approximately 180μA however, the voltage across R72 is more than 95V and D24 is reverse biased. The tube now acts as a cathode-follower, with a large cathode resistor (R72), and little more current flows even though the grid drive may be increased. The cathode is decoupled to earth by C51.

Flyback Blanking

In order to blank out the field flyback lines an 8V pulse at field rate from pin 14 of the timebase integrated circuit IC105 is applied to the anode of D27. This charges C52 and the change in level is conveyed to the tube cathode via C51. Consequently D24 is reverse biased, and the tube cathode voltage shifts to about 98V. This blanks out the flyback lines. C52 then discharges through R73 and the circuit reverts to normal.

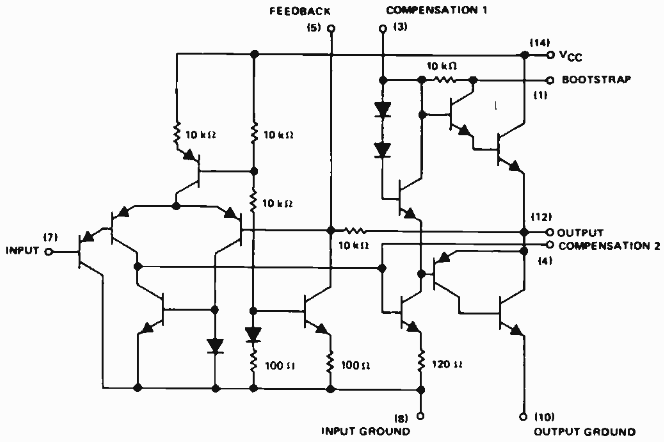


Fig. 5: Internal circuit of the Texas SN76001N i.c. which is used to drive the loudspeaker.

Tuning Voltage

We have now dealt with the path of the video signal to the picture tube. The 95V supply is "potted down" for the brilliance control, and as the feed is taken from the junction of R66 and R67 it's partially stabilised since R66 feeds the 32V voltage stabiliser IC101, which provides the tuning voltage for the varicap tuner via the tuning head. This stabilised voltage is also used to feed the oscillator section of the tuner, thus maintaining a very stable oscillator frequency. C47 is shunted across IC101 as a precaution against spurious oscillations in this device.

Video Distribution

Since we are dealing with the receiver section, we should now return to the video distribution point – the emitter of Tr7 – and find out the other functions that have to be fed from it.

A direct feed is taken to the timebase i.c. IC105 via R57 for the purpose of noise-cancelling – more of this later.

Sound Channel

Another feed, via R53, is taken to CF1, a 6·0MHz ceramic filter which accepts only the 6·0MHz intercarrier sound signal and efficiently rejects everything else. CF1 passes the 6·0MHz sound signal to the TBA120S amplifier, limiter and demodulator i.c.

The use of a ceramic filter and i.c. in this way makes the sound system very simple. The demodulator in the i.c. needs a quadrature tuned circuit tuned to 6·0MHz (L8, C66) and this forms the only adjustment that needs to be set up – a far cry from the sound circuits of a few years ago! The TBA120S contains a balanced, six-stage amplifier/limiter for the 6·0MHz signal. This is followed by the quadrature detector circuit which demodulates the f.m. sound. Only a few peripheral components are needed, mounted around the i.c. The i.c. incorporates audio pre-amplification circuitry, and the d.c. volume control acts on this – via pin 5. The a.f. output appears at pin 8, with de-emphasis provided by C62, and is coupled via R43 and C58 to the following audio output i.c., IC103, a Texas SN76001N.

The internal circuit of this is shown in Fig. 5. There is a total of twelve transistors, a buffer emitter-follower at the input, a long-tailed pair for feedback stabilisation, drivers and the output stage. There is a d.c. feedback path within the i.c., between pins 12 and 5 via a 10kΩ resistor. The feedback is adjusted by the values of the components connected to pin 5. The audio output appears at pin 12 and is coupled to the 8Ω loudspeaker via C54 which also acts as the bootstrap capacitor. Compensation is required in order to maintain the h.f. stability and is effected by feedback to pins 4 and 3 via C56 and C55.

Note that the speaker leads are "hot" at 11V: care should be taken to avoid accidental short-circuits. Details for setting up the quadrature coil L8 appear later in the series. In order to ensure stability, special earthing arrangements have to be made for the output sections of i.c.s – these "special earth" connections must be routed to their appropriate points. This is taken into account in the design of the printed circuit board.

Sync Separation

We now return to the remaining circuits fed from the video distribution point. Basically these consist of transistors Tr9 and Tr10 which are both driven via the network C42, R54 and R55. We shall deal with Tr10 first.

This is the first stage of sync separation, and is driven at its emitter with negative-going video. This means that the emitter of this pnp transistor (shown incorrectly as an npn type in Fig. 2 last month) has positive-going sync pulses applied to it. The resultant emitter-base current produced by the sync pulses charges C43 which has a slow discharge path to the negative rail via R58. This "sliding bias" arrangement ensures that the transistor conducts on only the tips of the sync pulses, with the result that positive-going sync pulses appear at its collector. This again is fed from the negative rail. These pulses are completely clean with a strong input signal but a little noisy and with some video content on a weak input. The SN76544N i.c. fed from this circuit contains its own separator however: if the feed from Tr10 is noisy or not completely separated, the i.c. finishes the job off.

This double sync separator arrangement was arrived at during the development of the receiver, because the i.c. was rather reluctant to accept the low-level video directly from Tr7's emitter, and was working at its limits. The system described is highly satisfactory and should give good results with indifferent signal inputs.

AGC Circuit

The final video feed is to the base of the a.g.c. gate transistor Tr9. This is normally switched off, but is switched on to sample the video signal during the sync period by the 8V negative pulse fed from pin 8 of the line output transformer via R56, the set a.g.c control RV8 and D19 to its emitter. We have therefore a sync tip system which operates by measuring the amplitude of the received sync pulses. These are an accurate indication of signal strength of course.

As a consequence of this gating action C41 is charged to a voltage dependent upon the vision carrier amplitude: it holds a charge dependent upon signal strength therefore. The following d.c. amplifier Tr8 turns on harder the greater the strength of the received signal. As a result its collector voltage rises towards the 11V rail. This voltage is fed to the base of the first i.f. transistor, in the vision selectivity module, via pin 4, providing forward a.g.c. action. A smaller proportion of this signal – attenuated by the potential divider action of R44 and R47 – is fed to the tuner unit. As the rate of change of gain in the controlled i.f. stage decreases with increasing a.g.c. bias voltage, the control in the r.f. amplifier stage takes over. The cross-over point is determined mainly by the value of R47. On test the a.g.c. system showed a control range in excess of 40dB.

★Components List

Resistors:

		R31	270 1W	R62	180
R2	1k	R32	680k	R63	47
R3	10 11W	R33	15k	R64	3k3 2W
R4	270	R35	56k	R65	10k
R5	1k	R36	560	R66	1k8 1W
R6	100k 1W	R37	1k2	R67	3k9 1W
R7	330	R38	220	R68	100k
R8	1 4W	R39	33	R69	470k
R11	4k7	R40	1	R70	1k5
R12	10k	R41	10	R71	1k5
R13	10k	R43	1k	R72	470k
R14	1k	R44	3k3	R73	8k2
R15	1k	R46	6k8	R74	150
R16	220	R47	4k7	R75	22k
R17	100	R48	6k8	R76	470
R18	47	R49	4k7	R77	100
R19	270	R50	1k	R78	15
R20	10k	R51	4k7	R79	10k
R21	2k2	R52	47	RV1	5k log
R22	1M5	R53	330		(with SW1)†
R23	2M7	R54	180	RV2	25k lin
R24	47k	R55	1k	RV3	5k preset
R25	330k	R56	2k2	RV4	470 preset
R26	1k5	R57	330	RV5	100k preset
R27	8k2	R58	470k	RV6	470k preset
R28	330	R59	22k	RV7	470 preset
R29	150	R60	47	RV8	1k preset
R30	47	R61	1k	RV9	220 preset

Resistors ½W 5% unless otherwise stated.
All presets are subminiature horizontal mounting types.
† *Incorrect value shown on circuit.*

Capacitors:

		C27	330p ceramic
C1	2200/25	C28	100/25
C2	2200/25	C29	1000/25
C3	4µ7/35 tantalum	C30	100n ceramic
	bead	C31	10n ceramic
C4	1000/16	C32	1/35V tantalum
C5	470/16		bead
C6	470/16	C33	22n ceramic
C7	10n 1000V	C34	100n ceramic
C8	1/250	C35	100n ceramic
C10	2µ2 polyester	C36	100n ceramic*
C11	33n400V polyester	C37	100n ceramic
C12	22/16 tantalum	C38	100n ceramic
	bead	C39	100n ceramic
C13	100n ceramic	C40	470/16
C15	2n2 ceramic	C41	4µ7/35 tantalum
C16	4µ7/35 tantalum		bead
	bead	C42	47n polyester
C17	10/35 tantalum	C43	100n ceramic
	bead	C44	82p ceramic
C18	5n6 polystyrene	C45	220/16
C19	470/16	C46	47/10 tantalum
C20	100n polyester		bead
C21	220n polyester	C47	1n ceramic
C22	4n7 polyester	C48	3n3
C23	330n polyester		polystyrene
C24	47/16 tantalum	C49	470n polyester
	bead	C50	1/250
C25	22/16 tantalum	C51	470n polyester
	bead	C52	100n ceramic
C26	100n ceramic	C53	100n ceramic

C54	470/16	C62	2n2 ceramic
C55	100p ceramic	C64	Integral with
C56	330p ceramic		yoke
C57	22/16 tantalum	C65	2n7 ceramic
	bead	C66	Integral with L8
C58	1/35 tantalum	C67	220/16
	bead	C68	100n ceramic
C59	100n ceramic	C74	10n polyester
C60	100n ceramic	C75	2200/25
C61	220/16	C76	10n 1000V

**Omitted from circuit: decouples tuner tuning volts pin.*

Semiconductors:

		D12	BYX71-600
Tr1	AD149	D13	BYX71-600
Tr2	BU407	D14	ZF9·1
Tr3	BC143	D15	BY206
Tr4	BC108	D16	BY206
Tr5	BD131	D17	BY206
Tr7	BC108	D19	OA91
Tr8	BC212L	D20	BY206
Tr9	BC108	D21	BY206
Tr10	BC212L	D22	ZF5·6
Tr11	BF179	D24	BY206
D1-4	RS 261-457	D25	OA91
D5	Red l.e.d. (0·2")	D26	OA91
D6	BY206	D27	BY206
D7	BY206	IC101	TAA550
D8	Green	IC102	TBA120S
	l.e.d. (0·2")	IC103	SN76001N
D9	BY206	IC104	TBA800
D10	BY207	IC105	SN76544N
D11	70CSD11	THY1	C106

Miscellaneous:
CF1 SFE 6·0MA
Selectivity module Philips G8, part no. 3113-108-2382-9
Gain & demodulator module Philips G8, part no. 3113-108-2455-1. LS, 5 x 3 in. 8Ω.
Tuner Mullard ELC1043/05
Tube CME1520 or A38-160W
Heatsink for TBA800 – Staver type V8-800
Heatsink for AD149 – Redpoint type TV3
Heatsink for BU407 – Redpoint type TV1
Heatsink for BF179 – Clip-on TO5 type
Scan coils: type GI1020*
Line output transformer: ITT VC300 chassis*
Driver transformer: ITT VC300 chassis*
L1: 3A mains type filter choke
L8: 6MHz coil*
Mains transformer: Primary – 240V
Secondary – 12V @ 3A
Relay: RS Components type 349-131
Fuseholders (4) for 20 mm fuses
Mains input socket: miniature Bulgin
Battery input socket: non-reversible 2-pin
Printed circuit board reference no. DO32
Channel selector assembly – 6 channel miniature type complete with fascia plate, available from Sendz Components.
Cabinet kits (varnished teak veneer with matt black front) are available by mail order only from C K Cabinet Services, 66 Park Avenue, Barking, Essex at £14.50 including postage & packing.
* *Available from Manor Supplies*

Because of the tightness of the control, the damping components C40 and R52 have to be included to prevent the a.g.c. system hunting intermittently after changing channel etc.

Returning to the a.g.c. gate, D20 acts as a clamp and D19 is included to prevent excess reverse emitter-base voltage being applied to Tr9 outside the gating period.

Adjustment of RV8 can be carried out either by using a 'scope and setting up to the point just short of sync crushing (viewing the video at Tr7's emitter), or by simply over-advancing until the receiver overloads (field slip, bent verticals, etc), then backing off until correct operation is restored.

Before passing on to the timebases – next month – what is the network C42, R54 and R55 for? R55 limits the current loading on the video emitter-follower Tr7 under all conditions, while C42 provides a.c. coupling. R54 limits the inrush current to Tr9 and Tr10. If the receiver is used under good signal conditions the network could be omitted, but the performance under poor conditions is enhanced by this approach.

CONTINUED NEXT MONTH

Servicing the Rank A823 Colour Chassis

Part 1

R. W. Thomson

THE Rank A823 chassis was one of the first all solid-state colour chassis to appear, being introduced in 1969. It remained in production for many years, though substantial modifications were made to it. The second version, the A823A, incorporated a completely different scan panel and a decoder with two instead of a single i.c. The next version, the A823AV, used a varicap tuner. The final version, the A823B, incorporated changes in order to meet BEAB requirements. There were several minor modifications, particularly in the power supply section, at various times. Many of the bugs found in the initial A823 occur with monotonous regularity in the later versions however. To start with in this series we'll keep to the A823, taking in subsequent versions later.

Features

When it first appeared the A823 chassis was of very advanced design, with a thyristor stabilised power supply circuit, an i.c. in the decoder and another for intercarrier sound amplification, almost completely modular construction (very compact too, as our cover photograph shows), and last but not least all-transistor reliability. For those of you more used to later solid-state chassis a couple of points can be made immediately. First, the l.t. rails are mainly provided by the power supply board rather than the line output stage, though the latter does provide the 40V line which powers the field timebase. The c.r.t. heater is supplied from the mains transformer, so you can get the c.r.t. heater lighting up but nothing else happening. There is an over-voltage trip on the scan panel: this stops the line oscillator and thus the line output stage, with the result sound but no raster. An unusual thing is that the line driver stage, which can be troublesome, is powered from one of the l.t. rails.

Physical Arrangements

The chassis is virtually wrapped around the c.r.t. neck. Looking from the rear, the left-hand upright supports the power and the i.f. panels, with the decoder panel mounted on the reverse side. The field timebase circuit, plus the line oscillator, driver and excess voltage protection circuit, are to be found on one panel to the extreme right of the receiver, with the line output and e.h.t. unit, plus the scan controls, assembled to the left of this, nearest the c.r.t. neck. The convergence panel is very conveniently mounted between the uprights, and swings up for easy observation of the c.r.t. screen whilst making adjustments.

Tuner

Up to the sync separator, the receiver is fairly conventional. Like its contemporaries in the very early seventies it used a mechanical tuner. Designated type A770, this tuner soon established itself as highly reliable, with high-gain performance right through Bands IV and V. Station selection is effected by four push-buttons. Like almost all the major components of the set the tuner is easily removed for servicing, plugs and sockets being used for all connections.

Two silicon transistors are used as r.f. amplifier and oscillator/mixer respectively. Both are npn types used in the grounded-base mode. Tuning is effected in the normal manner by means of a ganged variable capacitor in conjunction with four quarter-wave resonant lines. In the interests of high signal-to-noise ratios the r.f. stage does not come under control by the a.g.c. system until fairly high input signals are received. The point at which a.g.c. is applied to the r.f. amplifier in the tuner is set by adjusting a preset control on the i.f. panel. Other than occasional cleaning there are normally no servicing problems with the A770 tuner, though the occasional need for transistor replacement has to be carried out with care and precision. Once it's been proved that a tuner is defective, diagnosis follows the well-known formula: clean raster, no output signal at all, change the mixer transistor; noisy reception, snowy vision and fading, hissing sound, change the r.f. transistor. Care should always be taken before condemning the r.f. transistor however in case the symptoms are due to an aerial fault – including the socket and the connections to the tuner itself.

The tuning of these sets suffers from an old Bush failure which manifested itself for years on many models. For some reason, Bush have a penchant for using knobs made of material that doesn't stand up to a great deal of use. The

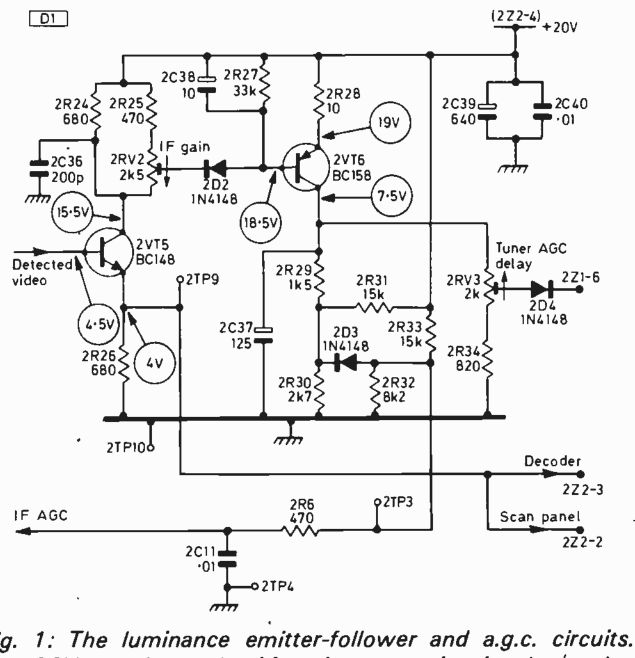


Fig. 1: The luminance emitter-follower and a.g.c. circuits. The 20V supply to the i.f. strip comes in via plug/socket 2Z2-4. 2Z1-6 feeds an a.g.c. bias to the tuner unit. The collector voltage of 2VT5 depends on the setting of 2RV2 while the collector voltage of 2VT6 depends on the setting of 2RV3. Later 2R30 1kΩ, 2R31 6·8kΩ, 2R34 1·5kΩ.

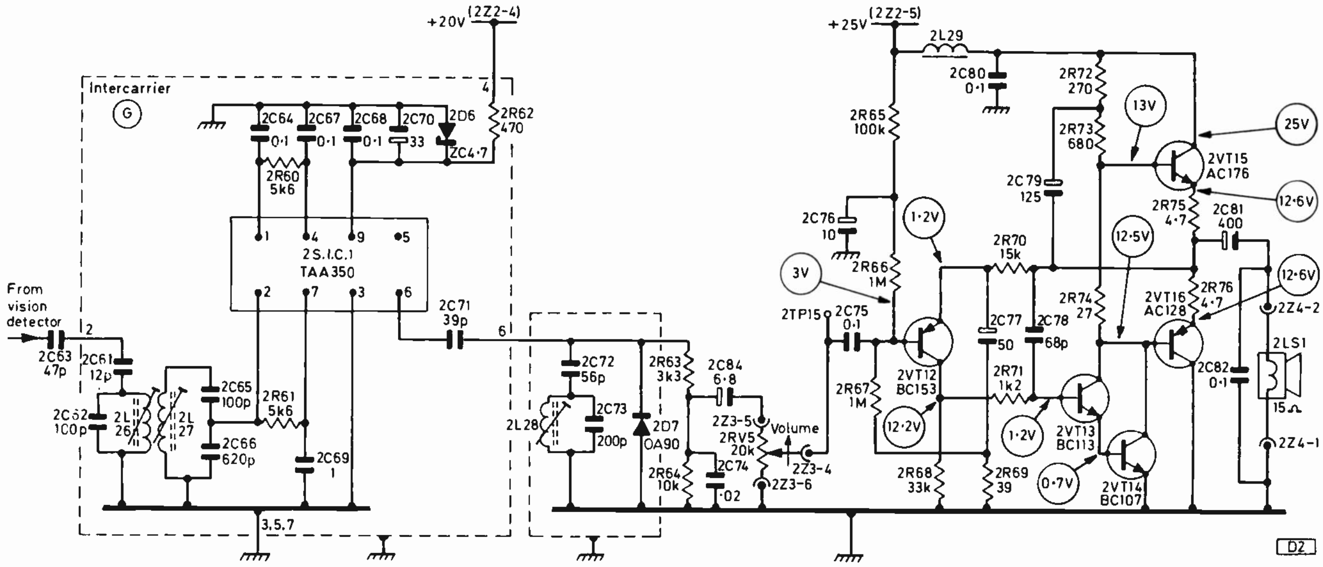


Fig. 2: The sound circuits. In later versions 2D6 was omitted and 2R62 increased to 680Ω. 2C65 changed to 120pF.

consequent wear on the inside of the knobs shows up as a refusal to engage the tuner spindle when fine tuning. The only cure is replacement, though a temporary repair can be effected by cutting an eighth of an inch off the clutch end of the offending knobs, thus allowing the small protrusions on the spindles to engage on fresh material inside the knob.

IF Stages

The i.f. circuitry is conventional too, using the familiar three-stage circuit with a cascode pair in the middle. In common with its black-and-white contemporaries, the A823's i.f. strip is built in the form of a series of small modules containing the various stages. This type of assembly was standard Bush/Murphy practice for years, and results in a clean, tidy receiver section which remains clean and tidy no matter how much gooey dust accumulates on the printed board. It doesn't lend itself to voltage tests on the various sections and transistors however. Test points are provided for checking gain, but as most readers won't have the equipment necessary for such tests it becomes necessary to check out the stages with an ohmmeter rather than a voltmeter when faults arise. As faults are very uncommon here, this is no great cause for tears.

AGC System

The a.g.c. and the intercarrier sound sections, complete with the audio stages, are also on this panel, which is known in the A823 chassis as the A809 panel. The a.g.c. is of the now common forward-bias type.

Looking at the circuit (Fig. 1), it will be seen that bias for the a.g.c. amplifier 2VT6 is obtained from diode 2D2. Negative bias is provided by rectifying the negative-going sync pulses appearing in the collector load of the luminance amplifier 2VT5. Under low or no-signal conditions, the peak rectifier circuit consisting of 2D2, its load resistor 2R27 and reservoir capacitor 2C38 produces insufficient voltage to turn 2VT6 on, so this transistor is inoperative. Diode 2D3 is permanently biased on under these conditions, the voltage at its anode from the potential divider 2R32/2R33 being greater than that at its cathode from the potential divider 2R30/2R31. The voltage on the a.g.c. line at the test point provided, TP3, is then approximately 3·5V.

When the signal at the collector of 2VT5 increases, diode 2D2 rectifies the sync pulse tips and produces an increasingly negative voltage across the base/emitter junction of 2VT6, turning this transistor harder on as the signal strength increases. The current through 2VT6 increases, causing an increase in voltage at the cathode of 2D3. This increases the impedance of the diode and, because there is less current through it, the voltage at its anode rises. This voltage is applied to the base of the first i.f. amplifier, so the current through it increases, lowering the gain of the stage. At this point the voltage across TP3 to deck will be approximately 4·5V positive, and no further increase is possible. The delayed tuner control system takes over if the signal strength is so high that it needs further attenuation.

This function is carried out by diode 2D4. The cathode side of this diode is connected to the r.f. amplifier's bias network in the tuner itself, the positive voltage available at that point providing the delay action. By suitably adjusting 2RV3 on the i.f. panel, the anode voltage of 2D4 can be selected so that the tuner a.g.c. action comes into effect only after full control has been exerted on the gain of the i.f. stages. In this way the tuner runs at full gain, reducing the mixer noise to an acceptable level, until the input signal is so great that cross-modulation would be a problem.

Correct adjustment of the two presets 2RV2 and 2RV3 is quite simple. With a signal properly tuned and the contrast turned fully up, rotate 2RV2 until the set locks "out", giving no signal conditions. Turn the control back again until the receiver again operates properly, with no picture judder, then continue to turn it back a fraction more. Adjust 2RV3 for minimum noise and no cross-modulation.

Sound Channel

A common detector, 2D1, in the final i.f. can (can K) is used for the luminance and the intercarrier sound signal. The latter passes via a bandpass tuned circuit (see Fig. 2) to the TAA350 intercarrier sound amplifier/limiter i.c. The output from this is demodulated by a slope detector circuit (2C72/2C73/2L28/2D7) and is then a.c. coupled to the volume control which in turn is a.c. coupled to the audio preamplifier 2VT12. The following stages are d.c. coupled – the Darlington pair driver stage 2VT13/14 and, in the output stage, our old friends the AC176/AC128. These

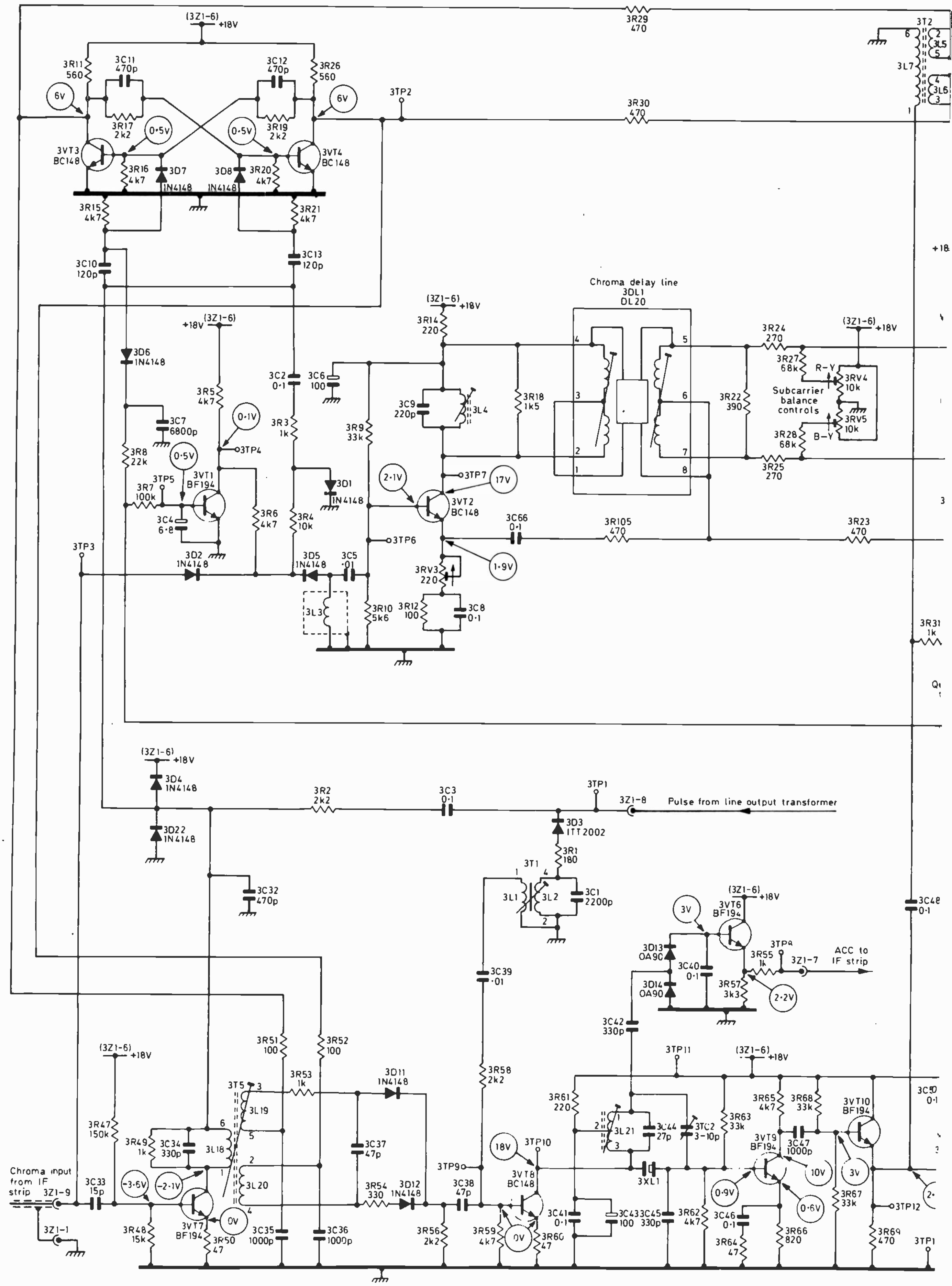
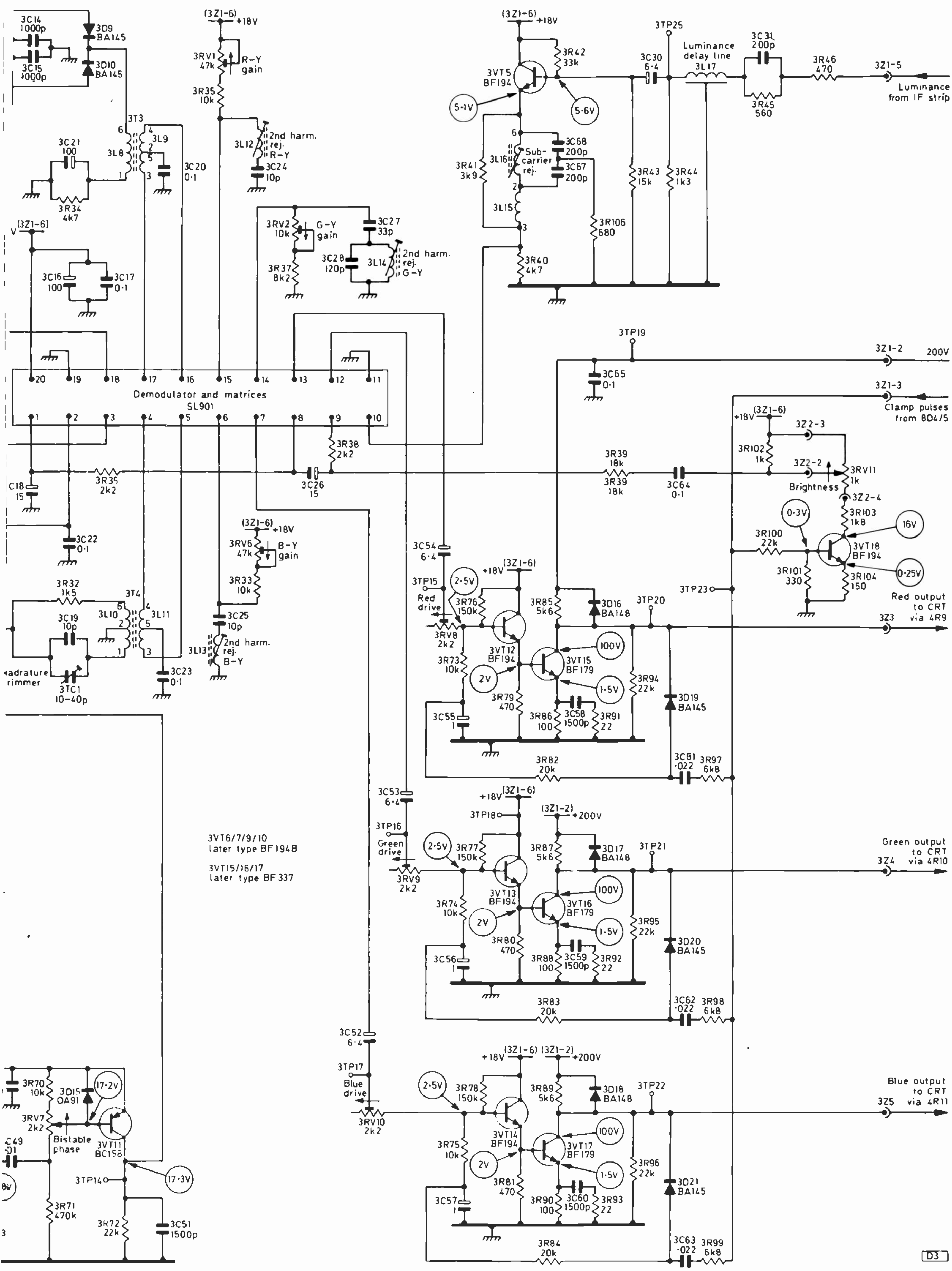


Fig. 3: Circuit diagram of the A807 decoder/RGB output panel. Vc setting of 3RV3. 3VT3, 3VT4, 3VT9 and 3VT11 voltages measured Vb 0·8V; 3VT9 Vc is 10V, Vb 2·1V, Ve 1·5V; 3VT11 Vc is 0·6V, Vb brightness the driver emitter voltages are 1·4V and the base voltag 1·7V and emitter voltages 0·8V.



ltages measured with a 20kΩ/V meter. 3VT2 voltages depend on the with colour: with colour off, 3VT3 Vc is 12V, Vb 0V; 3VT4 Vc is 0·5V, 17·4V. 3VT12-17 voltages apply at maximum brightness. At minimum es 2V, the output transistor collector voltages are 125V, base voltages drive a 15Ω speaker and, thanks largely to the fact that 2VT12 is also used to provide good d.c. stabilisation (very important in d.c. connected transistor circuits), and the fact that the sound output is limited to 1·5W, the output gives few causes for complaint. 1·5W may seem laughable in these days of 50 × 50W stereo outfits, but there is more than enough volume for the average room and with a large speaker the sound quality on these sets is good.

IF Panel Faults

Faults are not common on the A809 i.f. panel. There are some regulars however. Poor field sync for example is commonly due to a dud 2C37 in the a.g.c. circuit. The same capacitor can be responsible for a.g.c. flutter, this time due to excessive capacitance: reduce its value from 125μF to 25μF. Low gain but with clean pictures and good sound and 2·2V a.g.c. bias at 2TP3 is due to 2C13 being defective: this 0·01μF decoupling capacitor is in the collector circuit of the first i.f. stage, in can J. The a.g.c. reservoir capacitor 2C38 can dry up to cause overloading (negative picture). The latter fault can also be caused by 2VT6 of course.

Sound Faults

No sound with loud hum is usually either the audio output transistors 2VT15/16 (which can also be responsible for low, distorted sound) or a dud TAA350 i.c. Less common causes of no sound are the driver transistors 2VT13/14, the slope detector diode 2D7 or the electrolytic coupler 2C84. The TAA350 can also be responsible for buzz and distorted sound.

If the TAA350 i.c. is suspect, check the following voltages:

(1) Supply voltage to pin 9. This should be between 5 and 8V. If not within these limits, check the supply circuitry.

(2) The following voltages should be obtained with a 20kΩ/V meter: pin 1 4·9V; pin 2 4·9V; pin 3 chassis earth line; pin 4 4·9V; pin 5 5·0V; pin 6 5·0V; pin 7 4·9V.

(3) If any of these voltages are wrong, check the values of 2R60/61.

(4) Check the current taken by the i.c. by inserting an Avo between pin 9 and the supply. It should be within the limits of 15-30mA for 6V supply at pin 9. The current is proportional to the supply voltage at this pin.

(5) If errors are found during the above checks, replace the i.c. – bearing in mind that when new the i.c. has ten leads, only nine of which are used in the A823. Cut off the lead opposite the spigot before fitting.

If instability occurs after replacement, fit a 1μF electrolytic in place of the existing 2C69. This should have a minimum working rating of 30V. On later receivers, 2C64/67/68 were all changed to 0·05μF.

Severe crackling on sound is nearly always due to 2C64/67/68/69 on the A809 panel, but it should be borne in mind that as the type of capacitor used in these positions is of the semiconductor (barrier-layer) type, resistance tests are not conclusive, replacement being the only reliable method of testing.

Chrominance IF Stages

In addition to the main i.f. circuit, the luminance emitter-follower 2VT5, the a.g.c. circuit and the sound circuit, two of the cans on the A809 i.f. board are concerned with the chrominance signal – so no colour or intermittent colour can be due to a fault on this board.

The chrominance i.f. signal is taken off between the cascode i.f. stage and the final vision/sound i.f. stage and fed to can L. This contains an i.f amplifier transistor 2VT8 (BF196) and a second transistor 2VT7 (BC148) which is used to apply a.c.c. to the base of 2VT8. The colour control acts on the base of 2VT7, the a.c.c. potential from the decoder board being applied to its emitter. The second module, can M, contains the final chrominance i.f. transistor 2VT9 (BF197), the chrominance detector diode 2D5 and the two-stage chrominance amplifier 2VT10/11 (both type BC148). Problems here are few and far between, but the transistors can be responsible for no colour or intermittent colour while the electrolytics 2C41 and 2C42 (both 10μF) which decouple the base and emitter of the a.c.c. transistor 2VT7 can be responsible for faulty colour control operation or fluctuation of the colour content.

Filter Fault

The only remaining source of trouble that comes to mind on the A809 i.f. panel is the input selective can H. Slight misalignment of the large core at the bottom of this module can give noisy chrominance and a sharply tuned buzz on sound. Very slight tweaking of this core usually cures this annoying fault, which is sometimes complained of as being intermittent buzz, the customer being unaware that very slight tuner retuning gets rid of it!

The Decoder

So we come to the decoder, which is probably one of the most reliable produced by a UK setmaker. This panel (A807) is easily distinguishable from the one used in later versions of the chassis since it has just one large i.c. instead of two. The RGB channels are also mounted on this board. Decoding errors are nearly always attributable to a faulty electrolytic, transistor or i.c., in that order, though most non-decoding faults (i.e. colours missing or predominant) are usually the result of defective RGB output transistors.

Before we go farther we had better mention that the decoder employs some rather unusual techniques. These all revolve around the use of a passive circuit instead of the usual feedback oscillator with a.f.c. loop to generate the reference signal. The bursts are applied direct to the passive crystal oscillator circuit, which thus rings and continues to do so throughout the active line until the next burst appears. For this to work effectively, the alternating PAL bursts have to be converted to a constant phase signal. This is achieved by a switching circuit which is driven by the same bistable that drives the PAL switch. It's worth taking a detailed look at the decoder circuit therefore (see Fig. 3).

The signal from the chrominance section of the i.f. strip arrives at pin 9 of plug 3Z1, where it takes two separate paths, one concerned with chroma processing – to the delay line driver 3VT2 and then to the i.c. – the other concerned with generating the reference signal. This latter path starts with the gated burst amplifier 3VT7.

Burst Blanking

The first step in the chrominance path is to blank out the burst signal, which would otherwise affect the clamping action in the RGB output circuits. Blanking is effected by feeding a pulse from the line output transformer to pin 8 of plug 3Z1: this pulse is of approximately 110V amplitude, but is clipped to 18V by 3D4 whose cathode is connected to the decoder's 18V rail.

The 18V pulse thus derived is used to switch off diodes 3D2 and 3D5 which are connected back to back in the chroma signal path to the base of 3VT2, the delay line driver. These diodes therefore switch off the chroma signal feed to this transistor during the burst period, removing the burst from the chroma path.

Delay Line Circuit

From 3VT2 the amplified signal passes into the delay line, while the direct path signal from the emitter of this transistor is fed to the centre-tap of the output from the delay line, where the normal addition/subtraction produces the R – Y and B – Y signals ready for insertion into the i.c. Balancing of the delayed and direct signals is obtained by adjusting the gain of 3VT2 by 3RV3.

Burst Processing

The other signal path is via 3C33 to the base of 3VT7, the first burst gate. As the collector supply voltage for this transistor consists of the same 18V pulse previously mentioned, it follows that this transistor conducts only during the burst period. The chroma information is therefore blocked at this point and only the burst appears across the primary of the phase switching transformer 3T5.

This transformer has two secondaries feeding two diodes, 3D11 and 3D12, which convert the swinging burst to a constant phase burst. Correct switching of these two diodes is accomplished by the squarewave output from the bistable circuit around 3VT3 and 3VT4. These two transistors are controlled by the steering diodes 3D7 and 3D8, which are in turn switched on by the 18V pulse already mentioned.

Passive Subcarrier Regenerator

To get back to the constant-phase burst at the cathodes of 3D11 and 3D12, this passes via 3C38 to the base of 3VT8, the second burst gate and crystal driver. In this decoder there is no local oscillator as such, a ringing circuit tuned to the subcarrier frequency being used instead. 3VT8 carries out this function, by supplying a constant-phase burst and "ringing" the crystal 3XL1 and its associated choke 3L21. 3VT8 is biased so that it will conduct only when a positive pulse is applied to its base, thus preventing the passage of signals during the line-scan periods. This positive pulse comes from the secondary of 3T1, which generates an overswing when 3D3 is switched off by a pulse from the line output transformer – yes, you guessed, the same old pulse again! The purpose of 3T1 is to delay the pulse in time so that 3VT8 conducts accurately during the whole of the burst period. When 3VT8 conducts, the constant-phase subcarrier burst "rings" the oscillator crystal, the resultant 4·43MHz regenerated carrier then being fed to 3VT9 for amplification.

The purpose of 3TC2 is to tune-out the residual burst, by feeding a controlled amount of burst into the base of 3VT9 in anti-phase with the original. After amplification, the subcarrier passes to the emitter-follower 3VT10 and from there to the i.c.

Automatic Chrominance Control

A.C.C. is effected by sampling the subcarrier present at the regenerator stage and doubling its voltage by 3D13, 3D14 and 3C40. This voltage biases the emitter-follower 3VT6 which supplies a gain-control voltage to the chroma module on the i.f. strip.

Colour Killing and Bistable Phasing

It will be remembered that diodes 3D2 and 3D5 were switched off during the burst period to stop the burst reaching the delay-line driver 3VT2. Obviously this is an ideal place to cut off the colour signals in the decoder, and this fact is made use of for colour killing purposes on monochrome reception. 3VT11 controls the phase of the bistable circuit and also biases the colour-killer transistor 3VT1.

If no subcarrier is present, as in monochrome reception, there will be no negative voltage developed at the anode end of 3D15 and, provided 3RV7 is properly adjusted, there will be no bias on the base of 3VT11. This transistor will be switched off therefore and its collector will be at chassis potential. The base of 3VT1 is connected directly to the collector of 3VT11 and is therefore also switched off, its emitter also being at chassis level. The collector of 3VT1 is taken to the 18V supply, and as this is connected via 3R6 to the cathodes of 3D2 and 3D5, these are both switched off, thus opening the chroma path and killing all colour. With the subcarrier present on colour, 3VT11 and 3VT1 switch on. 3R6 is then returned to chassis instead of the 18V rail, and 3D2/5 switch on.

Bistable phase is controlled by 3VT11 in the same way. If diodes 3D11 and 3D12 are switching at the wrong times – as would be the case if the bistable was out of step – their output will almost cancel out and a low output will be obtained from the regenerator circuit. If 3RV7 is properly set, the negative voltage generated by diode 3D15 will be insufficient to switch on 3VT11, its collector voltage will drop to chassis potential and, besides switching off the colour-killer, this will switch diode 3D6 hard on, bypassing the 18V pulse from its normal path to 3D7 and instead diverting it via 3C7 to chassis. The absence of this switching pulse from the anode of 3D7 means that 3VT3 is not switched, therefore the bistable circuit "misses a beat" and the phase is corrected.

Phase Shifting

When we left 3VT10, we had an amplified subcarrier of correct frequency at its emitter. Before we can feed this into the i.c. and let that piece of micro-technology do the rest, it's necessary to do a bit of phase-fiddling. The B – Y subcarrier has to be shifted through 90°, and this is the purpose of 3T4 and 3TC1 plus their associated components. The resultant is fed to pins 4 and 5 of the i.c.

The R–Y subcarrier needs a bit more done to it however. In order to demodulate the PAL signal correctly its phase must be reversed on alternate lines, in step with the alternations at the transmitter. The 180° phase change is carried out by alternately switching the two diodes 3D9 and 3D10 in such a way that the subcarrier output from 3T2 is always in the correct sense. The diode switching is done by the squarewaves from the bistable 3VT3/4. After further modification by 3T3, the phase-alternating subcarrier is fed to pins 16 and 17 of the i.c.

The SL901 IC

The SL901 integrated circuit carries out demodulation plus matrixing of the R and B signals to produce the G output. We've seen how the necessary information is

Table 1: SL901 Voltages

The voltages on the pins of the SL901 i.c. should be within the limits shown below, when measured with an 20kΩ/V meter (Avo 8) under normal signal conditions. Irreparable damage to the i.c. can be caused by shorting adjacent pins, so great care is required when making these voltage checks: it's best to take measurements from adjacent print areas.

Pin	*Voltage*	*Pin*	*Voltage*
1	1·8-2·6V	11	Chassis
2	4·5-5·5V	12	3·5-9V
3	4·5-5·5V	13	3·5-9V
4	6·5-7·8V	14	11-14V
5	6·5-7·8V	15	9·8-14V
6	9·8-14V	16	6·5-7·8V
7	3·5-9V	17	6·5-7·8V
8	1·8-2·6V	18	4·5-5·5V
9	Approximately 0·7V below pin 10	19	Chassis
10	4-6V	20	17-19V

extracted from the chroma signals ready for feeding into the i.c. All that remains is to supply the actual picture information and we're away! The video or luminance signals are supplied via pin 3Z1-5 to the delay line 3L17 from where they pass via 3C30 to the base of emitter-follower 3VT5. The signals at the emitter then pass through a subcarrier rejector 3L15/16 to the i.c.

RGB Channels

The red, green and blue video outputs obtained from the i.c. are fed to three identical output stages, each of which is provided with a preset control for grey-scale purposes. The three output transistors 3VT15, 16 and 17 have their collector voltages clamped by diodes 3D19, 20 and 21, the clamp pulse from the line output transformer coming into the decoder at pin 3Z1-3.

This same pulse is used to drive 3VT18, the brightness pulse inverter. The inverted pulse, of amplitude set by the brightness control 3RV11, is fed in to pin 8 of the i.c. where it is mixed with the decoded signal. As the clamp pulse occurs at the same time as the brightness pulse, it follows that the brightness control sets the voltage at which the three output transistor collectors are clamped. As this is also the c.r.t. cathode potential, picture brightness control is achieved.

Decoder Servicing

It may seem that undue attention has been given to the operation of this decoder. This is not because this decoder is particularly difficult to understand, the main object being to make clear what happens in each stage. How anyone can gaily start out on fault-finding if he doesn't know the function of each stage is beyond the writer to understand!

The main snag with this decoder as far as servicing goes is that it is impossible to work on it to any great extent without removing it from the chassis and operating it with extended leads. Special leads are available from Rank Radio International for this purpose.

Preliminary Tests

As with any decoder, voltage tests at relevant places usually indicate fault areas and narrow the field down when chasing colour faults. The first step is always to demobilise the colour-killer and see what then gives. It's surprising how many decoders suffer from defective colour-killers, the fault disappearing as soon as the culprit is disarmed! On this decoder shorting 3TP11 to 3TP14 over-rides the colour-killer action, by switching 3VT1 on and removing the reverse bias on diodes 3D2/5. It takes a little time to decide whether the fault lies in the SL901 i.c., but as always voltage readings will usually indicate where the fault lies (see Table 1).

Common Faults

In cases of no colour, first make sure that the decoder's 18V supply is present. The 18V zener diode 8D1 in the power supply and 3C16 are both suspect.

Some of the stock faults on the A807 decoder panel are as follows.

Very low luminance, colour o.k.: Check the luminance delay line 3L17 and its connections, or coils 3L15 and 3L16. If shorting pins 9 and 10 of the i.c. cures the trouble, the i.c. is faulty.

No luminance, colour o.k.: Usually 3VT5, may be 3C30.

Intermittent colour: Apply freezer to the i.c. If the colour returns, replace it. If not check the setting of 3RV7, or 3VT11 and 3D15. Other possibilities are 3C43 (100μF) which decouples the supply to the crystal driver; 3VT6; 3C49. The trouble may be in the i.f. strip (2VT7-2VT11).

No colour: Check the 18V supply. Almost any of the transistors can be responsible, including those on the i.f. board handling the chrominance signal: 3VT11 seems to be the most common offender however, as over-riding the colour-killer will prove. Note that in this decoder the bistable transistors can be responsible for loss of colour, since the burst feed to the carrier signal regenerator will be affected. 3D14 in the a.c.c. detector circuit may be short-circuit.

Unstable colour at high saturation: Check 3VT6.

Colour bands: Check 3D3.

Streaky colour at high saturation settings: 3D11 and 3D12 out of balance.

Hanover bars: Check the setting of 3RV3, then 3VT2.

One colour missing, poor monochrome: I.C. faulty, but check the RGB signal coupling electrolytics 3C52/3/4.

One colour missing, monochrome wrong: Check RGB driver and output transistors.

One colour predominant: Compare RGB output transistor collector voltages. The low reading indicates the faulty channel. Check output and driver transistors and replace if either one shows a leakage on the ohms range of an ordinary Avo. If both are o.k. check the appropriate clamp diode 3D19/20/21, capacitors 3C55/6/7 and 3C61/2/3, and resistors 3R82/3/4. The diodes 3D17/8/9 are not required and may be removed.

Low brightness: Check 3VT18 and its emitter resistor 3R104.

Uncontrollable brightness: Check the clamp/brightness pulse feed capacitor 8C11 (0·1μF, 1kV) on the main chassis.

Luminance ringing: Dry-joint on luminance delay line.

As with all modern equipment, it pays to suspect any very small electrolytics in a faulty circuit: even tantalum types fail fairly frequently, but drilytic ones have a limited life.

If one is working from the Bush/Murphy service manual, note that in one of their modification sheets it states that the pulse clipper diode 8D4 is shown the wrong way round in the circuit on page H-3: this is very naughty, H-3 is perfectly o.k., it's page E-3 that's wrong!

TO BE CONTINUED

Adjacent Channel Reception

Hugh Cocks

TRYING to receive a weak station on a channel adjacent to a strong local transmission can be a problem. As is all too often the case nowadays, most of us have very strong local signals. So if a non-local ITV or a continental station we wish to receive is on a neighbouring channel, the picture may be marred by patterning and other overloading effects. When the aerial and preamplifier (assuming one is being used) have been lined up towards the distant station, excessive sound splatter from the local station may break up the picture if the weaker channel is immediately above it (we'll consider u.h.f. reception first).

UHF Reception

There is less trouble when the desired weak signal is on the channel immediately below the local one. In this case the very strong vision carrier is just above the much weaker f.m. sound carrier. One might imagine that "buzzing" would be heard on the weaker transmission, due to the strong neighbouring vision carrier, but in practice this doesn't happen since the f.m. discriminator for the most part rejects the a.m. vision carrier. Unfortunately this advantage is not present with French stations due to their use of a.m. sound. The writer has a struggle with the Caen channel 25 sound due to Stockland Hill on channel 26. There is buzz on sound most of the time unless Caen is very strong. Caradon Hill (Cornwall) channel 25 vision and sound are received without difficulty on the other hand.

Preamplifier Problems

A preamplifier will exaggerate the local channel spread, and in severe cases it's best to use an amplifier made out of an old tuner unit – see the writer's article in the March 1975 edition of *Television*. One peculiar form of interference is caused by internal intermodulation of the TV signal. For example, at u.h.f. the vision carrier lies 6MHz below the sound carrier. If they are strong enough, the sound and vision carriers will beat together at 6MHz above the sound carrier, that is at 4MHz into the video spectrum of the next higher channel. There will also be a beat at 6MHz below the vision carrier. When a saturated colour is transmitted, all manner of beats may appear – see Fig. 1.

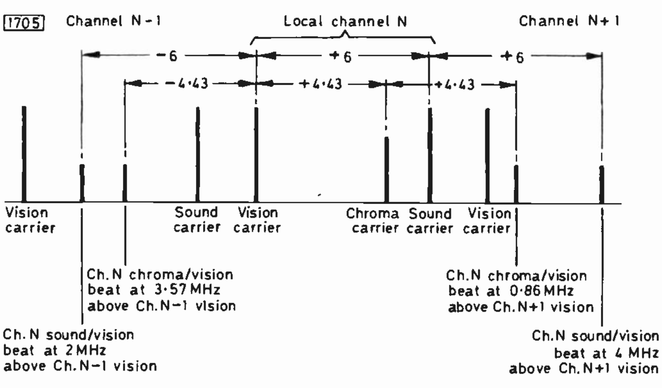


Fig. 1: Intermodulation beat frequencies at u.h.f.

A method of improving the performance of a wideband preamplifier "under stress" (so to speak) from a strong interference signal is to reduce its supply voltage. If the voltage is reduced by about one-third, a good measure of gain is left but a lot of the spurious effects are removed. The simplest way to do this is to insert a potentiometer in the power supply: the optimum point is easy to find.

Aerial

An aerial with a very narrow forward lobe should ideally be used as this will reject a high proportion of the unwanted signal – providing the wanted transmitter is over 30° off beam to the strong local signal. Reception will prove very difficult indeed if the local signal and the wanted signal lie in virtually the same direction.

The Tuner Unit

The tuner unit is a most important part of the receiving chain if excessive interference is to be avoided under these conditions. It should preferably be a rotary type, with four-gang tuning – i.e. with a tuned aerial input circuit – as this will greatly reduce interference from adjacent channels. A varicap tuner may be tried, but in general a four-gang rotary tuner will give the best performance.

The IF Strip

Having checked these points, the weak station should be almost clear of patterning. If any further improvements are needed we must consider the i.f. strip in the receiver. It is essential to have the manual for the set. Check that the adjacent sound rejector is on tune at 41·5MHz, and that the adjacent channel vision rejector is at 31·5MHz. If the cores are easy to move and you feel confident in this part of the receiver, a turn either way will do no harm and the effect on the picture and sound should be noted. If the effect is beneficial, leave the core at its new position. If no difference is observed, return the core to its original position. If one does not feel brave enough to tamper with the i.f. strip, or tweaking the rejectors brings about a certain improvement but the depth of the notch in the i.f. response is not deep enough, the best solution is to fit an additional filter in the lead from the tuner to the i.f. strip.

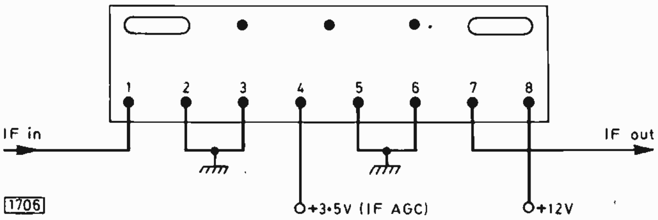


Fig. 2: Connections to the Philips U800 i.f. selectivity module, viewed from the base. The voltage for pin 4 can be obtained from a potential divider connected across the 12V supply. The power supply can be obtained within the receiver by dropping from a suitable point.

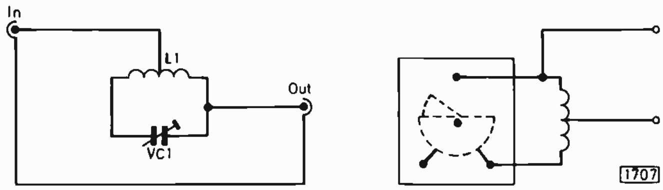
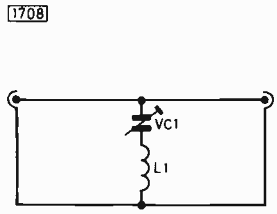


Fig. 3: Band III notch filter, tuneable from 160-220MHz. L1 consists of three turns of coaxial cable inner conductor wound across VC1, with a diameter of ¼in. per turn. VC1 is a Jackson type C804 trimmer with a maximum capacitance of 25pF.



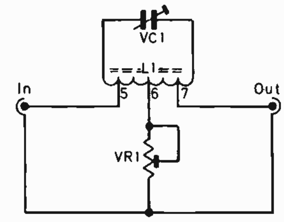


Fig. 4 (left): Acceptor circuit for f.m. radio rejection. L1 consists of five ¼in. diameter turns of coaxial cable inner conductor. VC1 is a 3-30pF concentric trimmer..

Fig. 5 (right): Single frequency notch filter for use in Band I. VR1 is a 470Ω miniature preset and VC1 a 3-30pF concentric trimmer. L1 consists of 11 turns of 26 s.w.g. e.c.w. wound on a ¼in. coil former with dust core, spaced over the full length of the former and tapped at turns 5, 6 and 7.

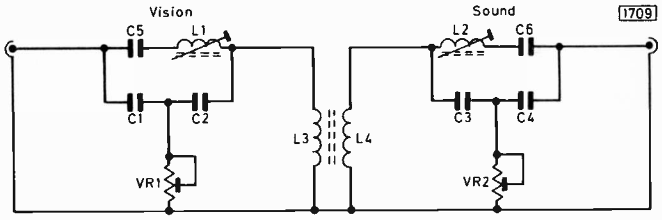
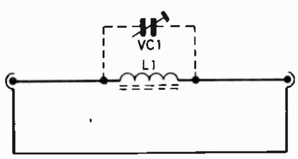


Fig. 6: Band I notch filter. C1/2/3/4 are 120pF, C5/6 22pF, all ceramic. VR1/2 are 470Ω miniature presets. L1 and L2 consist of 8 turns of 26 s.w.g. wire wound on a ¼in. coil former with dust core, medium spaced. L3/4 consist of 3 turns (each) of 26 s.w.g. wire wound on a ferrite bead or old dust core (hexagonal with hole in). The coil turns for L1/2 are optimised for ch. B2/3: for ch. 4/5 only five or six turns may be needed.



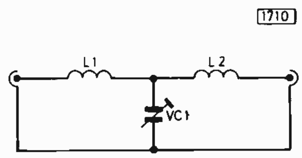


Fig. 7 (left): Wideband rejector to remove Band III break-through in Band I. L1 consists of 5 turns of coaxial cable inner conductor wound on a ferrite core. The optional trimmer, say 2-20pF, can be used if the attenuation is insufficient without it.

Fig. 8 (right): Absorption filter to remove u.h.f. breakthrough in Bands I/III. L1/2 consist of 2 turns of coaxial cable inner conductor, each ¼in. diameter, air spaced over ¼in. VC1 is a 10pF trimmer (or a fixed 10pF capacitor).

IF Filtering

The easiest filter to use is the Philips G8 selectivity module which is available from Manor Supplies and has been featured in several articles in these pages during the past few years.

There are four cores accessible from the top of the can. One of the two cores in the centre gives a very sharp notch and may be tuned to the rejection frequency required (depending on which side of the local channel the weak station is). The other three cores have a very broadband effect and may be adjusted for maximum noise on the screen. Two of these units can be placed in series to give a notch of exceptional depth. The unit may be powered from within the set itself, and in addition each unit introduces a small amount of gain. Fig. 2 shows the pin connections required.

UHF Filter

By this time the long-distance signal which was at first virtually swamped by the much stronger local one should be free of interference. One might be tempted to consider putting a filter in the aerial lead, but u.h.f. aerial filters tend to introduce a high loss.

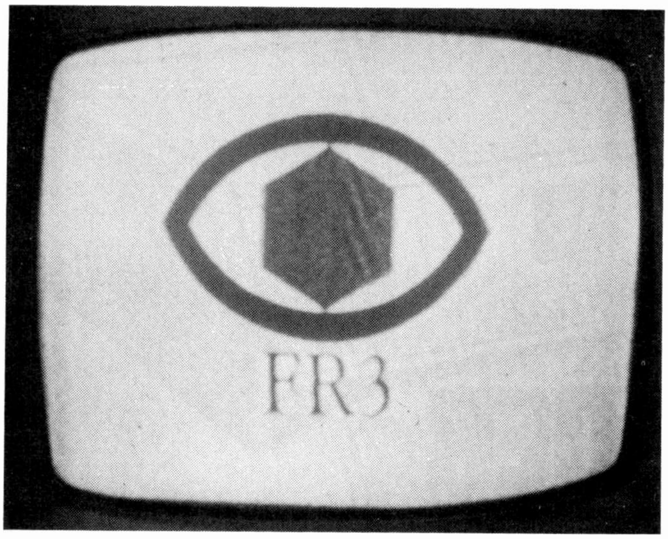
Band III Reception

Band III continental stations generally use horizontal polarisation whilst most of our Band III signals are vertically polarised (apologies to those in East Anglia). This gives an immediate reduction in interference from the local station. I have found that using the filter shown in Fig. 3 in the aerial lead helps a great deal – it's essential to put it before any amplifier. The filter produces a very deep notch, and is generally tuned to the mid-frequency of the interfering station. When working close to the higher frequency side of the local channel, it's best to tune the filter as far l.f. as possible in order to reduce the inevitable slight loss close to the notch.

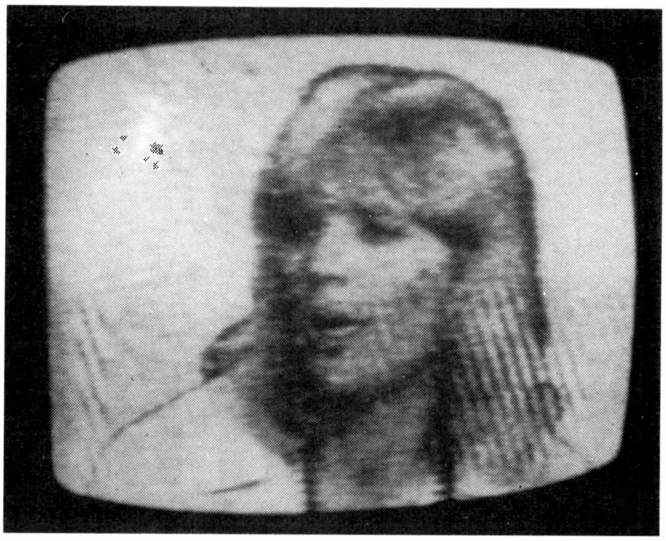
At the writer's location, where there is a high-level channel B9 signal, it's possible to receive channel B10 vision (channel B10 sound is virtually impossible). At the l.f. side of channel B9 it's possible to work as close to the ch. B9 sound carrier as 750kHz (ch. F9 vision).

In the i.f. strip the G8 selectivity panel is again very useful. Channel E7 vision (about 1·75MHz below channel B9 sound) was cleaned up tremendously by using one of the units. As the rejection frequencies required are not the standard ones it is impractical to adjust a standard i.f. strip since it couldn't be used on any other range of frequencies. The writer now employs a transistor preamplifier with the supply voltage reduced from 9V to about 6V (having abandoned the valve type mentioned in the March 1975 *Television*). Plenty of gain is still provided but the cross-modulation effects are much reduced.

It's possible to use two of the filters shown in Fig. 3 in series, one tuned to the sound carrier frequency and the other to the vision carrier frequency of the local channel. The insertion loss will double however and this is not desirable on Band III.



FR3 (France) from Brest on channel 24, with ch. 23 chroma/vision beat interference. The ch. 23 burst can be seen half way across the screen.



Brest ch. 24 on programme, with a saturated chroma/vision beat pattern from ch. 23 at the bottom right-hand side. The burst is down the left-hand side.

At some locations one may be plagued by breakthrough of f.m. transmissions in the bottom end of Band III, even when living only moderately close (say 20 miles) to an f.m. station. The filter shown in Fig. 4 should greatly assist with this problem. Tune VC1 for minimum f.m. breakthrough.

Band I Reception

Band I is possibly the band most used by DXers, and most are unfortunate enough to have a strong local station.The author is lucky in this respect. At some locations a channel 1 signal will be present. This presents only a small problem, and the vision carrier can be notched out by using the single-frequency Band I notch filter shown in Fig. 5.

Channels 2-5 coincide with the European channels however (consult Roger Bunney's DX TV book for a full diagram if you are unsure). The double-frequency notch filter devised by Graham Deaves (Norwich), who has been kind enough to supply us with his design, is shown in Fig. 6.

Table 1: PO Suppression Filters

38A	High attenuation below 40Mhz.
45A	High attenuation below 45Mhz.
48/1A	Tunable notch filter, 35-50Mhz.
48/2A	Tunable notch filter, 45-100 Mhz.
48/3A	Tunable notch filter, 110-220Mhz.
49A	Aerial braid filter, tunable 16-40Mhz.
51A	Double-wound ferrite cored inductor, 0·75A rating.
52A	Double-wound ferrite cored inductor, 2·5A rating.
57A	Mains filter 150khz-25Mhz, 1·5A.
64/1A	Aerial braid filter 3-40Mhz.
64/2A	Aerial braid filter 40-220Mhz.
69A	Band-stop 120-170Mhz.
69B	Band-stop 120-170Mhz (deeper notch at 150Mhz.)
72A	High-pass above 460Mhz.

At the sound and vision frequencies it gives a notch of roughly 50dB, with an insertion loss of about 1dB.

To set the filter up, first adjust the variable resistors to their maximum value, then tune the ferrite cores to the sound and vision frequencies respectively. The notch is very sharp indeed and, ideally, a non-metallic tool should be used to adjust the cores, otherwise some detuning will be noted on removing the screwdriver. After the notch has been set, slowly adjust the resistors. A deeper notch will appear at about half resistance. The cores and resistors should then be glued firmly into place otherwise detuning may occur after a period of time. By using the filter, R1 vision should be received with ease by those with a local station on ch. B2.

Fig. 7 shows a wideband rejector to remove Band III breakthrough in Band I.

PO Filters

The Post Office has been kind enough to supply us with a list of filters they can provide. These are particularly useful to those living close to a high-powered short-wave or v.h.f. public service band transmission. One can obtain these filters from local Post Office Radio Interference groups, but the Post Office say they cannot cope with a sudden large demand. See Table 1.

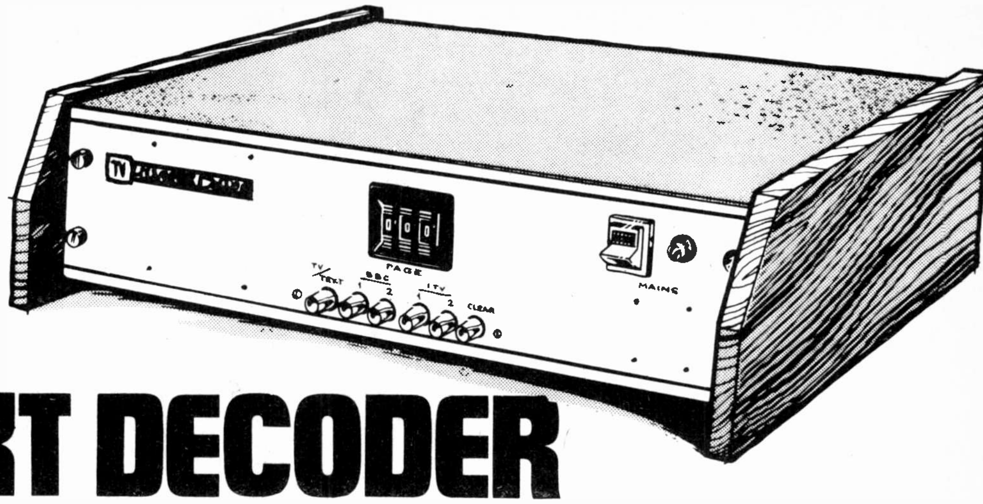
Preamplifier Overloading

A good quality amplifier should be used at all times if overloading and its associated effects are to be avoided. Early wideband types were prone to interference from virtually all frequency bands. Not too uncommon was the reception of the Police all over the u.h.f. bands. Nowadays manufacturers are more aware of the problem and produce higher overload capability types. A regular problem is the presence on Bands I and III of u.h.f. local stations: the u.h.f. absorption filter shown in Fig. 8 should alleviate this problem.

Acknowledgements

Finally, thanks are due to Mr. J. Ramsey of the Post Office, Graham Deaves and Roger Bunney for their valuable assistance. ■

THE TV TELETEXT DECODER



Steve A. MONEY T. Eng. (CEI)

Part 9

HAVING completed the construction of the power supply, circuit cards and other sub-assemblies, the final stage of construction is to install the interwiring cables between the various sections. The decoder unit will then be complete and ready for alignment and setting up.

Interwiring

As a mother board arrangement has been used for joining up the main circuit cards, no interwiring is needed between them but three interconnecting cables are required to join the mother board to the power unit and the switch assemblies. Flat multicore ribbon cable is recommended for this purpose since it produces neat cable forms with the minimum of effort.

Fig. 1 shows the interwiring connections between the mother board and the other assemblies.

Although the individual cores of a ribbon cable are readily separated, it has been found in practice that some care is needed in carrying out this operation. It is advisable to practise on a short length of cable first to get the technique right before starting on the actual cables for the decoder. When making the cables start off with about 2 to 3 inches more cable than you need to allow for a second attempt at splitting the ends in case of accidents.

The individual cores of the ribbon cable will need to be separated for two or three inches at each end to allow them to be spread out to their proper connecting points on the board. Start the split between adjacent cores by carefully making a short cut between them using a razor blade or sharp knife. This small cut will allow the wires to be gently pulled apart when the cores should separate cleanly leaving fully insulated but separate wires. At this stage the cores should be split apart for about an inch to see that the separation is running cleanly. Sometimes the wire core will tear through the insulation, leaving a piece of bare wire exposed if the splitting process does not start correctly. If this happens make a new cut between the cores and try again. Separate each of the cores at each end of the cable so that the splits are running smoothly, and then split the cores back at each end to allow enough free wire for each core to run to its appropriate fixing position and cut off the individual cores to a length to give a neat lay of the cable when it is installed. At this point the ends can be bared and the wires tinned and soldered into position.

The main run of the cable should be left as a ribbon and some slack must be allowed to make installation easier. Approximate lengths of cable required are shown in Fig. 1.

Mother Board end	Power Cable (24 inches long)	Power Unit
0v IF Bd	Black	0v
0v IF Bd	Brown	0v
5v Disp Bd	Red	+5v (2)
5v IF Bd	Orange	+5v (1)
0v IF Bd	Yellow	0v (1)
0v Disp Bd	Green	0v (2)
−5v IF Bd	Blue	−5v
+12v IF Bd	Violet	+12v
+60v IF Bd	Grey	+60v
−12v Disp Bd	White	−12v

Mother Board end	Switch Cable (1) (12 inches long)	Switch Panel
Clear I/P PCB	Black	Clear
33v (IF PCB)	Brown	33v
0v (IF PCB)	Red	0v
TV (IF PCB)	Orange	Tuning V
0v (IF PCB)	Yellow	0v
Pic. O/P (IF PCB)	Green	Picture video
0v (Modulator)	Blue	0v
Input (Modulator)	Violet	Video to modulator
0v (Display PCB)	Grey	0v
Text O/P (Display PCB)	White	Text video

	Switch Cable (2) (12 inches long)	Page Switch
SW1 (I/P PCB)	Black	SW1
SW2 (I/P PCB)	Brown	SW2
SW4 (I/P PCB)	Red	SW4
SW8 (I/P PCB)	Orange	SW8
Mag (I/P PCB)	Yellow	Pole Mag SW
PU (I/P PCB)	Green	Pole P.U. SW
PT (I/P PCB)	Blue	Pole P.T. SW

Fig. 1: Interwiring connections.

Where the cables go to the mother board the ribbon is left intact to a point about halfway across the mother board and some of the cores will be folded back under the cable to run to their connection points on the board. This gives a neater cable run outside the mother board since the split ends will lie between the board and the front panel of the case.

The ribbon cable used has ten cores which are coded in the colours of the resistor colour code running from black through brown, red etc. to white. The colours chosen for each signal or supply feed are arranged to give the neatest layout at the mother board end. For the cables where less than ten cores are needed the unused cores can be stripped off the cable.

At this point the power unit, mains switch and fuse can be mounted on to the front panel and connected up. Also the cable from the u.h.f. modulator output can be connected to the output socket on the back panel of the case. Note that the page selection switch will need to be fitted to the front panel before its interconnecting cable is joined up.

The case used for the prototype was supplied by Catronics Ltd. We understand that this Company will be making supplies of the case available to constructors.

Initial Checks

For the first stages of checking it will be helpful to have the case dismantled so that only the front and back panels are being used. The mother board should not be fitted to the front panel at this stage in order to allow access to the track side for monitoring purposes. Lay the various parts of the decoder out so that none of the tracks or connections can be short circuited by contact with either the front or back panels.

A television receiver, preferably colour, will now be needed to provide the display. Connect a coaxial cable from the u.h.f. modulator output socket on the rear of the case to the aerial socket of the receiver. Switch on the receiver and if it has push button channel selection set it to one of the unused channels.

Only the i.f. board should be plugged in to the mother board for these initial tests. Switch on power to the unit and check that all power supply lines out of the power unit are working and that the correct voltages are present on the power feed at the mother board.

Set the u.h.f. modulator tuning potentiometer on the mother board to roughly midscale. Tune the selected button on the receiver until the carrier signal from the modulator is picked up. Normally there should be noise all over the screen and this will disappear as the carrier from the modulator is tuned in and activates the receiver a.g.c. Next adjust the modulator tuning potentiometer until the signal is received on a channel well away from the normally used local TV channnels. For most purposes a point somewhere around channel 40 is usually quite suitable.

I.F. Alignment

The next stage in the proceedings will be to align the i.f. section of the decoder receiver card and for this a signal generator capable of producing a signal at 39·5MHz will be required. It is possible to carry out this process by using the second harmonic from a signal source running at 19·75 MHz if a high frequency generator is not available. Whilst a sweep generator might be helpful its use is not essential for i.f. alignment with this unit.

To inject the signal disconnect the 2n2 capacitor which

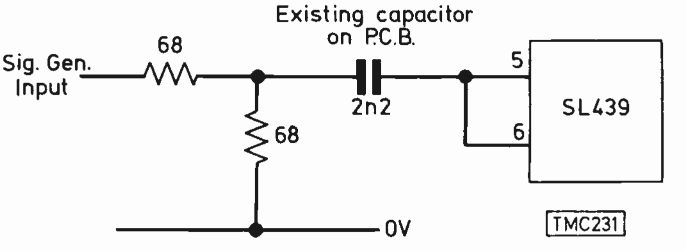


Fig. 2: Signal generator input arrangement.

couples the ELC1043/05 tuner output to the input of the SL439 preamplifier stage and insert the resistor network shown in Fig. 4. Connect a d.c. voltmeter or oscilloscope to pin 7 of the CA3046 and set it to measure the voltage at this point relative to 0V.

Set the a.g.c. delay and picture level potentiometers on the i.f. board to roughly midscale. With power off insert the board into its socket on the mother board and turn on the power again.

With an input signal level of about 100mV adjust the detector coil to give minimum d.c. voltage output from the point being monitored. It may be necessary to reduce the signal input to get a sharp tuning peak at the detector coil. Under these conditions there may be quite a bit of noise on the oscilloscope trace because the i.f. will very likely be running at maximum gain.

Next the a.f.c. coil needs to be tuned. For this monitor the d.c. voltage at pin 8 of the SN76660. Starting with the core out of the coil gradually insert it and note that the output voltage will change at pin 8 of the SN76660. At some point the a.f.c. voltage will swing in the other direction and rapidly change by some 5 or 6 volts as the a.f.c. circuit is tuned through the central part of its N curve. The coil should be adjusted so that the a.f.c. is on this central part of its characteristic. It will be necessary to slightly readjust this setting later in order to get optimum a.f.c. action.

This completes the basic i.f. alignment and the unit can now be switched off, the signal generator input removed and the tuner feed capacitor reconnected. We are now ready to test picture reception using an off air signal.

Plug an aerial into the tuner input of the decoder and switch on again. Set the mode switch to TV and select one of the channel selector switches. At this stage there should be a fairly noisy display on the TV receiver. Tune the channel tuning potentiometer associated with the selected channel until a signal is received. A picture should now appear on the display receiver. Adjust three of the channel selector switches and their potentiometers to produce the three local television pictures. With one of the channels selected set the a.g.c. delay until the picture just becomes noisy, then move the potentiometer back slightly from this position. This will set up the a.g.c. delay for the u.h.f. tuner. If the sync on the display receiver is erratic, the picture level control on the i.f. strip of the decoder may need to be reset. This control should normally be set up so that there is a 3V peak-to-peak video signal at the CA3046 pin 7 output point. The sync pulse amplitude should be approximately $\frac{1}{3}$ of the total amplitude.

If an oscilloscope is available the sync and the data slicer circuits can be roughly checked out at this stage. Check that a negative-going combined sync pulse train is present on pin 1 of the board edge connector. On pin 5 of the connector there should be a clean negative-going field sync pulse. If either of these signals is not present work back through the sync circuit sections of the CA3046 until the correct signal is found and this will indicate the area in which the fault lies.

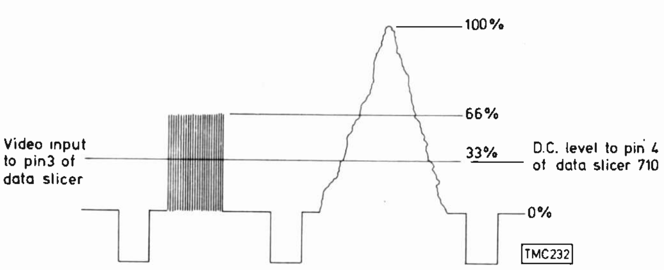


Fig. 3: Setting the data slicer d.c. reference level.

If everything checks out at this stage the unit can be assembled into its case and the page roll switch can be replaced by a wire shorting link. If desired the switch can be left in circuit and mounted on the rear panel of the decoder. The rolling page facility can sometimes be useful if you want to take a quick look through the transmitted magazine to see if anything interesting catches the eye. By making a note of the page numbers near the interesting page it is simply a matter of trying a few page numbers in that area until the desired page is found.

Slice Level Setting

Check that there is a video signal at pin 3 of the data slicer. This is the 710 comparator near the CA3046. Now the d.c. voltage at pin 4 of the 710 should be monitored. Adjust the Slice Level potentiometer (1k multiturn) until the d.c. level at pin 4 of the 710 is set at a point roughly 50% of the total amplitude of the video signal being fed in at pin 3. The amplitude of the video signal is measured from the sync tips upward towards peak white.

The sound trap can now be set up by looking at the video input to 3 of the slicer 710 and then adjusting the core for minimum 6MHz sound subcarrier at that point.

Text Mode Checks

For setting up the Text mode of operation it is useful to wire a switch across the Page Roll link connections on the input logic card and to remove the link if one has been inserted.

Switch off the power and insert the three logic cards into the mother board taking care that they are inserted the right way round. The component side of the boards should be facing the power unit end of the case.

Switch on again and check that picture reception is still working correctly. Switch the mode control to TEXT and a text/graphics display should appear on the screen of the display receiver. This will probably consist of a random pattern of symbols.

Set the Page Roll switch so that it leaves the link open circuit. At this stage some of the symbols on the display should begin to change and it is possible that whole or partial pages of text will start rolling down the screen.

Adjust the data slice level potentiometer to give the maximum rate of change in the display. Next adjust the clock generator tuned circuit on the i.f. board to give more sensible data and at this stage more or less correct pages of text should be appearing. Now readjust both the slice level and clock tuning settings until there is a minimum of errors on the displayed pages.

At this point the Page Roll switch can be closed to stop the rolling page display. Select page 100 on the PAGE switch (page 200 on BBC2). This page is a title page and is transmitted more frequently than the others. Press the CLEAR button on the front panel which should blank out the screen except for the header row. On the header row the page number should be changing as the various pages are received. After a short time page 100 (or 200) should be displayed on the screen. The page number in the header row should now be constant but the clock display at the end of the row should still be updating once every second.

Check text operation on all three channels. It may be necessary to slightly readjust the tuning or the a.f.c. coil setting for optimum results. The slice level and data clock coil settings should be the same on all three channels.

Fault Finding

In the above description of the setting to work of the decoder it has been assumed that everything is correct first time. On many units this is likely to be the case but on some there will be some faults due to the complexity of the project.

Many integrated circuits are only batch tested and it is possible that one of the devices in the unit may not meet its full specification. In many cases this will have no effect because the particular circuit is not being used to its full capacity. Most of the faults experienced will be found to be due to assembly errors which can easily be made on a complex logic board, *and missed on subsequent visual inspection.*

It is not possible here to cover all of the faults that could occur since the possibilities are very nearly infinite. Some of the more common problems likely to be encountered will however be dealt with.

If no display is produced in the TEXT mode this will usually be found to be a failure of the sync pulse feed to the display board. Check both line and field syncs and then track back through the circuit to find where they have disappeared.

Picture breakthrough on text and loss of sync on text are often caused by mistuning of either the i.f. or the tuner which results in attenuation of the sync pulses in the video signal. An incorrect setting of the picture level control on the TDA440 can produce a similar effect.

Incorrect setting of the data slicer produces more or less random bursts of errors all over the displayed page whilst incorrect data clock tuning will tend to give errors along one or two lines of the page.

If the data gate monostables on the input card have incorrect timing this usually results in alternate lines of text being accepted and displayed or in bad cases may stop the acceptance of all text. Check the relative timing of the data gate pulse and the teletext data using an oscilloscope, and adjust the time constants of the monostables until the two text lines sit within the data gate period.

Failure of one of the 2102 memory devices will give a single bit error in the code presented to the display board. This has the effect of changing half the symbols in the text so that for instance all the Bs might be presented as Cs and all the Ds would become Es and so on. This type of error is easily recognised and by working out from the context what the incorrect symbols should be and referring to the symbol code table it is possible to work out which bit of the code is incorrect and therefore which memory circuit needs to be investigated.

When the text display seems to be working correctly the width and position controls on the display board can be adjusted to centre the display on the screen. At this point the unit is ready for use and the constructor can sit back and spend many an hour looking through the various magazines being transmitted. Happy viewing! ■

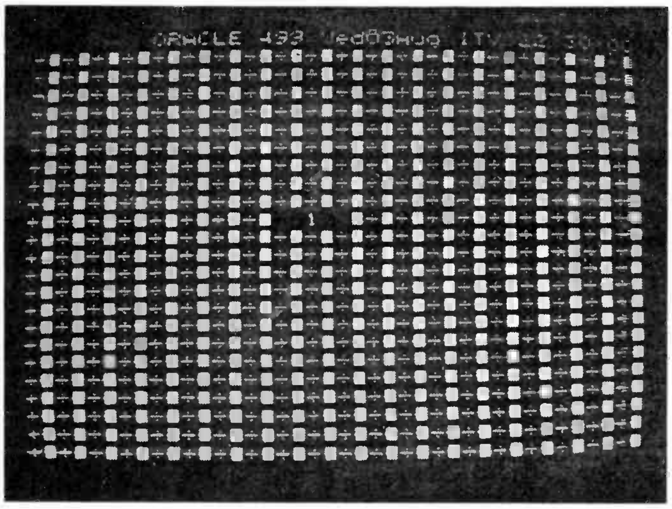


Fig. 4: Correct display of the clock cracker page.

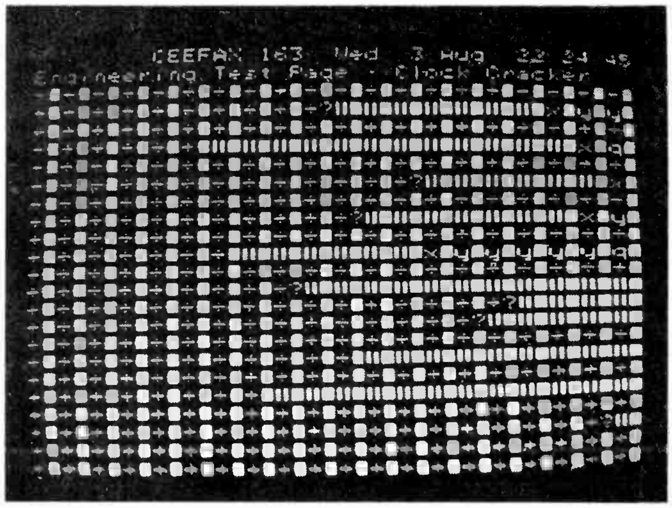


Fig. 7: Effect produced by incorrect data clock frequency.

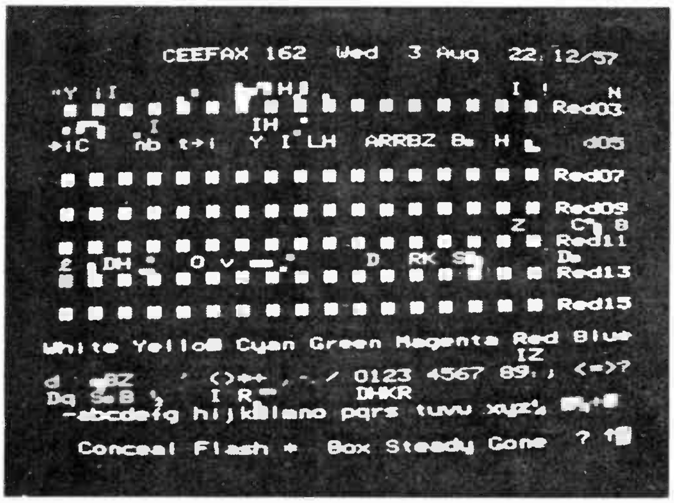


Fig. 5: Result of incorrect data input gate timing.

CORRECTIONS

Please note the following modifications which must be carried out on the mother board (D027).

Link pin 3 of the i.f. board to pin 3 of the display board.

The clear switch should be connected to pin 22 of the input logic card *only*, i.e. the copper track joining pin 22 to an adjacent pad for a wire link should be cut.

On the i.f. board (D041) contact 30 of the edge connector has been deleted. The connections to contacts 28 and 32 are transposed on the circuit and the board layout shown last month. The boards supplied to readers will be correct in these respects.

R30 (modulator) may be 3k3 or 4k7.

In a further brief article on the decoder next month we shall be summarising a number of points which have arisen from letters received from constructors.

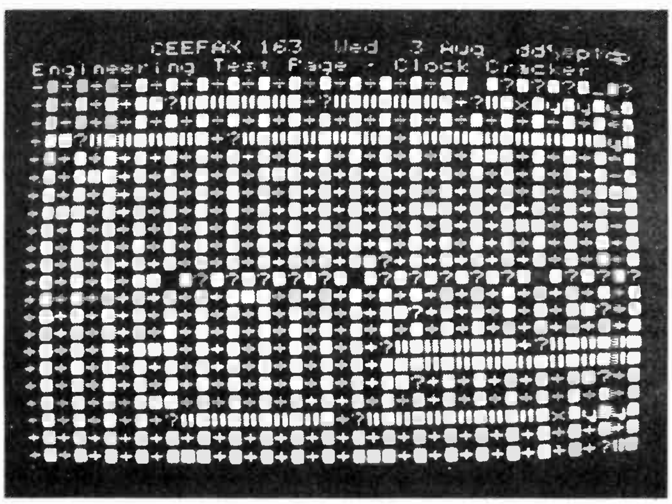


Fig. 6: Effect of incorrect data slicing level.

TROUBLE-SHOOTING AND REPAIR SERVICE

Television Technical Services have informed us of their charges for dealing with the remaining modules in this project (see p.654 last month). These are as follows:

Modulator	£2.00
Input Card	£4.50
Memory Card	£3.50
Display Card	£4.50

The cost includes the replacement of *minor* components and return by registered post. Constructors will be informed of any major expensive component failures and given the option of replacement at additional cost or have the module returned. Please forward your module, with full remittance, to the address below, ensuring that the package will withstand the return mailing. As mentioned last month, the charge for aligning and fault-finding on the i.f./data recovery board is £4.50. If you wish to send all four boards for testing, write or phone for a quotation.

Television Technical Services
P.O. Box 29,
Plymouth, Devon.
Tel: 0752-813245

TV Servicing: Beginners Start Here...

Part 2

S. Simon

Last month we got as far as TV receiver valve heater chains. Let's take a practical example. One of the most common chassis in the black and white table model category is the Thorn 1500. It's used in many Ferguson, HMV, Ultra, DER and Marconiphone models employing 20 and 24in. tubes. There are five valves in the heater chain plus the c.r.t. heater of course (see Fig. 1). Say the complaint is that the set is dead, or appears to be, with the valve heaters not alight. How do you proceed? Answer: with caution.

With the rear cover removed, note that the mains supply lead is wired to the on/off switch via the brown (live) and blue (neutral) leads. With the receiver switched on, the two live switch contacts should bring a glow to your neon tester and the two blue contacts should not. We have already discussed the possibility of the plug being improperly wired, or a two-pin plug being connected the wrong way round, so get this right at this stage. Don't proceed further until you get a glow from the two brown leads and no glow from the two blue leads. Check the mains supply, the plug fuse and wire and the on/off switch if necessary.

Tracing the Open-circuit

Having obtained these correct conditions you then follow the live supply up to the 1·6A fuse (F1) which is roughly at the top centre of the main panel where you can see it because of the hole in the panel. The panel itself can be swung open by removing the lower right screw and slackening the upper right one. If the neon lights at both sides of the fuse holder the fuse is obviously intact and this means that the set is by no means as dead as it appears. Hence the note of caution.

A glance at the circuit (Fig. 1) or even the print on the panel shows that the live supply continues up to two diodes. W7 supplies the valve heaters etc. and W8 the h.t. circuit. The fact that the heaters are not glowing means that we have an open-circuit on our hands. So you follow the circuit along to ascertain where the neon ceases to glow. If diode W7 is intact the glow will be present at both ends and up to one end of R111 which is roughly the centre section of the black mains dropper, at the top. It's more than likely, however, that there will be no glow at the other end of R111, and close examination may show visually where the fracture is. We have then established the cause of the open-circuit: not the fuse, not the diode, not a valve (or tube) heater but a fracture in the heater circuit dropper.

Now you have two alternatives. Either replace the whole dropper with its several sections, or shunt the defective section with the correct value wire-wound resistor of the right ohmic value. The value is usually marked on the dropper, and always on the circuit diagram. In this case it's 148Ω, so you would fit a replacement of about this value (say between 140 and 160Ω) and with a wattage rating in excess of say 150 times the current squared – 0·3A times 0·3A = 0·09, say 0·1 times 150 = 15W. Most types that are suitable are marked with either their current carrying ability or their safe wattage dissipation.

Getting the correct item is one thing, fitting it is another. Since it dissipates considerable heat, hooking it on with a dob of solder is not quite the thing. It must have a sound

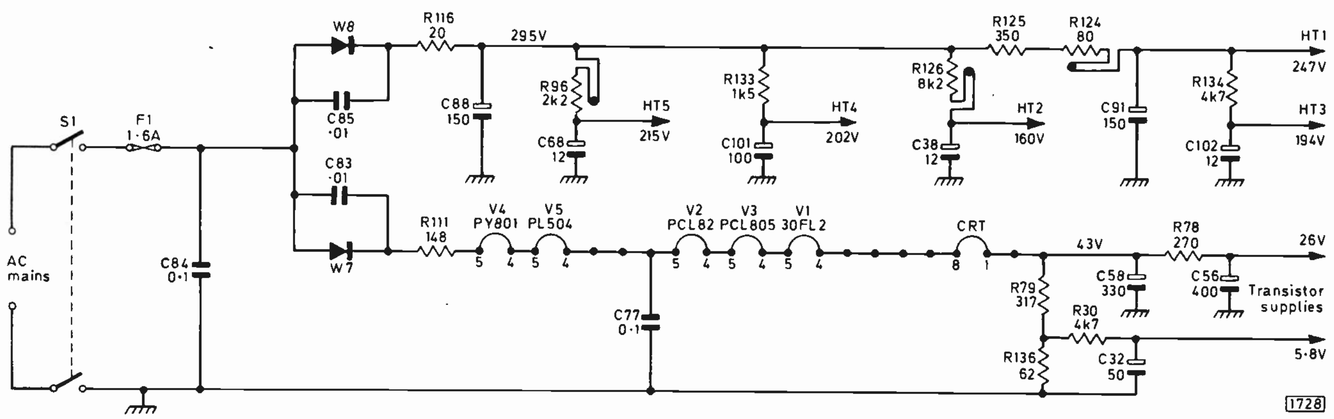


Fig. 1: The power supply circuits of the Thorn 1500 monochrome chassis. Rectifier diode W8 provides the h.t. supplies, with its surge limiter resistor R116, reservoir capacitor C88, and subsequent smoothing circuits to provide the HT1-HT5 rails. Rectifier diode W7, with the dropper resistor R111, feed the valve and tube heaters. The earthy end of the heater chain is connected to chassis via resistors R79 and R136, this arrangement being a convenient way of providing 26V and 5·8V supplies for the transistor circuits. C83 and C85 protect the rectifier diodes against transient spikes on the mains supply (if you look at the mains input waveform on a scope you'll see that it isn't quite of the clean sinewave form you might expect).

mechanical connection, either bolted on with small screws and nuts or connected with stout single 20 gauge or lower copper wire, wound tightly and soldered with high melting point solder.

The Heater Chain

We tend to get so used to the heater circuit dropper resistor in this type of set failing that it comes as some surprise when we find it intact. If you do, where do you go next? You follow the print on the panel along to the first valve base in the chain. This is usually either the efficiency diode (PY800, PY88, PY801 or the like) or the line output valve (PL504, PL500, PL36 or whatever). In this case it's the PY801 efficiency diode. It's only a matter of moments therefore to flit from pin 5 to pin 4 (these are the heater pins on most, not all, valves) to find where the neon fails to light – or your voltmeter fails to record a voltage. Quite often you hit the jackpot first time with pins 4 and 5 of the PY801 (in this case) and you fit a new valve – having ensured that there was no contributory cause for the failure. We will come back to this later. Assume that you are not one of the lucky ones and that the neon bravely glows at both PY801 heater pins. You go on to the PL504, nip smartly down to the bottom right PCL82 – maybe only to find that you also have full glow at pins 4 and 5 here. The circuit shows that the next valve in line is the PCL805, followed by the 30FL2. With a sinking heart you find that the neon still glows. What comes next? Ignoring any little dots on the circuit – these indicate wiring points and junctions – the c.r.t. is next. In the centre, with its neck sticking out invitingly. The heater pins are 1 and 8. If there is a glow at pin 8 but not at pin 1 your worst fears are confirmed, the tube has an open circuit heater. Personally we are such cowards that having found the heater dropper to be intact we always check the tube heater pins next in order to cut short the agony – at the price of being logical. What happens when the tube heater pins also light? That's another story.

Clearing up this story, the heater pins 1 and 8 are on either side of the locating slot on the base socket of tubes having a B8H (eight-pin) base. Pins are counted clockwise from the slot or gap in the case of both tubes and valves.

The Triode Valve

So far we've considered valve heaters and, when we came across rectifiers in Part 1, the cathode and anode. It will be recalled (I hope) that if the anode is connected to a voltage which is positive with respect to the cathode, the electrons given off by the heated cathode will travel through the evacuated valve to the anode and then pass into the external circuit. Just in passing, if there is any gas (air) in the valve this will absorb electrons and the device's efficiency will be impaired – it probably won't function properly at all. There are tell-tale signs: a blueish or purple glow as the vacuum is impaired and, as the amount of air increases, the silvery part of the valve's envelope turns white.

Two-electrode valves (anode and cathode – the heater isn't regarded as an "electrode") are called diodes and do little other than rectify. We need something more elaborate in order to generate, amplify and process signals. If we wind a fine wire in the form of a grid and mount it between the cathode and the anode, close to the cathode, we can use it to influence the flow of current between the cathode and anode – by varying the voltage we apply to this grid. You'd never believe it, but this is called a control grid. A three-

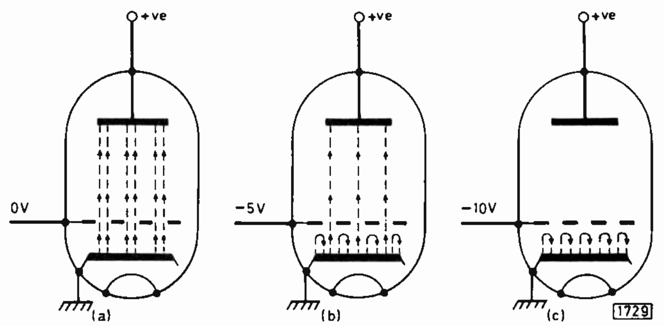


Fig. 2: The triode valve has a control grid between the cathode and the anode. Varying the voltage applied to it varies the current through the valve, as shown here. For maximum effectiveness the control grid is much closer to the cathode than the anode. In practice a bias voltage is applied to the valve in order to set the valve's working point (see later), and the signal waveform to be amplified is superimposed on this.

electrode valve (cathode/grid/anode) is called a triode. If the control grid is short of electrons, i.e. the voltage applied to it is positive with respect to the cathode, it will collect the electrons given off by the cathode and "grid current" will flow. Not at all what we want. So we take care to ensure that the grid is kept negative with respect to the cathode. In this condition it will not only not collect electrons: it will repel them (see Fig. 2), thus reducing the current flow between the cathode and the anode. The more negative we make the grid, the less current will flow through the valve to the anode. Valve action in other words . . . a pause here for cries of disbelief!

Amplification

Since the control grid is close to the cathode, only a small change in control grid voltage is required to produce a large change in anode current. In other words amplification: a small voltage change at the control grid produces a much larger voltage change at the anode – due to the varying anode current flowing through whatever we place as a load in series with the anode (either a resistor or a winding of some sort). See Fig. 3. The triode valve is a handy, simple device which is suitable for many purposes – for example as the line or field oscillator in a television receiver. It has limitations however. Improved results are obtained by inserting another grid between the control grid and the

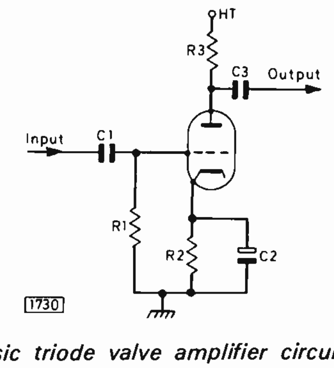


Fig. 3: Basic triode valve amplifier circuit. C1 couples the signal to the control grid, C3 coupling the amplified signal developed across the load resistor R3 to the following circuit. R1 provides a chassis return path for any electrons ending up on the control grid. The bias voltage is developed by R2 in the cathode circuit. The current flow through this makes the cathode positive with respect to the grid, which is effectively the same as applying a separate negative voltage to the grid to make it negative with respect to the cathode. C2 smooths the voltage developed across R2.

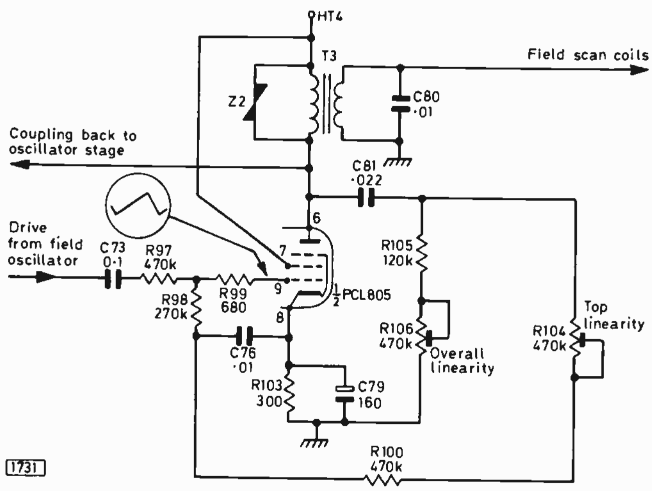


Fig. 4: A practical pentode amplifier circuit: the field output stage used in the Thorn 1500 chassis.

anode. This is termed the screen grid and a positive voltage is applied to it in order to improve the characteristics. The addition of this fourth electrode gives us the tetrode valve. There is still a problem however, since the varying anode potential gives rise to a tendency for the electrons to mill about between the screen grid and the anode. This effect is suppressed by adding a further grid (the suppressor grid . . . oh no!), or a pair of plates, between the screen grid and the anode. In the former case we have the pentode valve, in the latter the beam tetrode. Since the screen grid is supplied with a positive voltage it will collect some of the current flowing from the cathode, whose current equals the combined anode and screen grid currents therefore – the former large and the latter small (if all is well).

Cathode Bias

In practice a resistor may well be connected in series between the valve's cathode and chassis. The idea is that the cathode current, flowing through this resistor, produces a voltage across it – positive with respect to chassis and, if the control grid is returned to chassis, positive with respect to the control grid as well since the control grid does not (or should not) be passing current and there should therefore be no voltage across any resistor(s) connected between the control grid and chassis. Now making the cathode positive with respect to the control grid is the same as making the control grid negative with respect to the cathode – the condition we want.

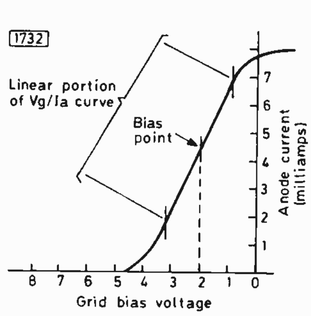


Fig. 5: The basic valve characteristic curve – a plot of anode current against grid voltage. The curve is linear over its centre portion, the bias voltage being used to ensure that the valve operates over this portion of its curve only. For example, if the input signal consists of a 1V peak-to-peak sinewave, then with −2V bias the signal will move the grid voltage between −1·5V and −2·5V, well within the linear part of the curve.

Different valves require different operating conditions (voltages on the various electrodes) and these are specified by the valve makers. Obviously valves required to handle large input voltage swings will require more negative *bias* (as it's called) than those handling small signal swings.

Practical Circuit

As a practical example, consider the field output stage used in the Thorn 1500 circuit (see Fig. 4). The valve here is the pentode section of a PCL805. The job of this section is to turn the sawtooth drive voltage applied to its control grid into a large sawtooth current which is sufficient to drive the scanning spot from the top to the bottom of the screen in a linear manner and then rapidly back to the top (the field flyback, which you don't, or shouldn't, see) ready for the commencement of the next field scan. If this worries you (since we haven't mentioned the field output transformer and the scanning coils and their part in all this) don't let it bother you since at this stage we are concerned only with the even build up of current in the valve and its rapid cut off as the grid is swung heavily negative.

Each type of valve has its own characteristics which can be shown in graphical form. The basic characteristic is a plot of anode current against control grid voltage, showing how the anode current rises from zero as the grid is made less negative (see Fig. 5). The plotted curve is not straight at the start and finish, and if we attempted to make use of the whole of the curve during the scan instead of only the straight part we would have distortion at the beginning and end of the scan, giving very poor linearity at the top and bottom of the picture. In practice this would mean that the picture would be compressed at the top and at the bottom, with the centre appearing normal; or the top or the bottom would be opened out, with wider spacing of the lines which make up the picture.

So we must confine the operation to the nice straight part of the curve. This is where the bias comes in, and timing is important. Timing brings us into realms not yet considered, but we are not concerned with this for the moment. What we are worried about is whether the pentode is working properly.

Loss of Emission

Obviously for a start the valve must have good electron emission from its cathode, otherwise there won't be enough current available to do the job we want it to do. If the cathode's emitting surface is covered with dead material, very few electrons will be emitted and little current will flow, resulting in reduced scan particularly at the bottom (maximum current should flow at the *top* of the slope of the sawtooth drive voltage applied to the control grid, at which point the scanning spot is being pushed to the *bottom* of the screen). We have fault possibility number one therefore: a worn valve can cause loss of height, the loss being more apparent at the bottom of the picture as a rule.

Defective Cathode Resistor

There are other and indeed more likely possibilities however. Remember for a start that the valve has to be biased (so that it operates on the straight part of the slope). This can be done in either of two ways. The grid can be made negative by actually applying a negative voltage to it, and again there are several ways of doing this. Or as we have seen the cathode can be made positive with respect to the grid, which is the same thing and is more common. The resistor inserted in the cathode circuit for this purpose is of a value determined by dividing the required bias voltage by the current normally flowing in the cathode circuit. This works out at something like 300Ω, usually a little more, depending upon the drive from the preceding stage. In Fig. 4 it's R103 and is in fact 300Ω.

So to fault possibility number two. The bias resistor can change value, either because it feels like it or because of damage done to it by being subjected to a heavy current greater than its rated value. Resistors are rated in Watts, which indicate the maximum power they can dissipate. You will remember that this is calculated by multiplying the voltage by the current. For example, if the current is 100mA (0·1A) and the voltage across the resistor is 20V the resistor would have to be able to dissipate 2W. In fact the current here is about half this, so a 1W resistor would be working flat out and therefore a 2W type would be more comfortable and able to deal with a certain amount of overloading without breaking down.

Safety Features

To digress for a moment, there are some sets in which these bias resistors are so mounted that when they overheat they melt the solder holding them and literally drop off. There are others where the resistor is so made that if an overload is presented it disintegrates in order to prevent further damage (the fact that it is no longer there breaks the circuit). A refinement on this theme is to have a wirewound resistor which can carry the excess current but after heating up sufficiently it melts the solder on a spring which flies open to break the circuit. R96 is an example of this in the 1500 chassis (see Fig. 1), also R124 and R126. The point about this is that it lets you know in which circuit the overload is occurring.

Bypass Capacitor

To get back to the PCL805's cathode resistor however (Fig. 4). You will see that it has a large value capacitor wired across it (C79, 160μF). The purpose of this is interesting and in fact we have already briefly dwelt upon it when talking about the rising and falling output voltage from a rectifier. We said that to smooth out the voltage a capacitor could be added. This charges and holds most of its charge, thus filling in the troughs in the output from the rectifier and acting as a reservoir when the rectifier is not conducting or as a smoother when the voltage rise and fall is less marked.

Now the bias resistor has a fixed value, but as the current passing through it is varying (as the grid is driven by the sawtooth waveform) the voltage across it must also be varying – unless steps are taken to prevent this. In fact we may sometimes not wish to prevent this, but that's another story. In this case we don't want the bias, i.e. the cathode voltage, to vary and the purpose of the capacitor is to provide the necessary smoothing action: it smooths the voltage across the resistor, and you could say that it decouples it from variations occurring elsewhere.

While the capacitor retains its capacitance the bias is held steady. Unfortunately however several things can happen. The capacitor can "dry up", and it's then no longer what it's supposed to be and therefore cannot do what it's supposed to do. Alternatively, the capacitor may be chemically o.k. but may have parted company with one of its lead out wires. This amounts to the same thing in practice. Further, soldering is not always what it's supposed to be and the lead out wires may not be making good electrical contact to the circuit (the blobs of solder on the panel). Quite often if a wire is not properly tinned (cleaned and solder dipped) it will make contact all the time it is "clean" but as it is chemically attacked, due to the lack of a soldered bond, the contact becomes poor and we have a "dry-joint" – this is not the result of a strike of brewers' draymen as you previously thought.

Fault possibility number three then: lack of decoupling across the bias resistor causes a drastic loss of height, mainly at the bottom. In fact about a third of the picture may be compressed upwards (but not *folded* up to give a brighter double scan), and the top is affected to a lesser extent.

In fact this third possibility is the most common condition met, and it's only a moment's job to hold another capacitor across the suspect (cathode to chassis) in order to prove it. The rules are simple. Use a capacitor of the same voltage rating or higher (say 25V or more) and of very approximately the same capacitance (say 250μF). The positive end goes to the cathode, the negative end to chassis or to a convenient earth return (electrolytic capacitors have to be connected the right way round).

Resistor Checks

If the cathode resistor is suspect (and it should be), measure its value with an ohmmeter and examine it for signs of stress – usually shown up by discolouration. If in doubt replace it, as it can cause trouble. If it falls below 300Ω in value it will cause bottom compression with perhaps fold up, and the valve will be over run, thus shortening its life. If it rises in value to say 500Ω, the bottom of the picture will appear to stretch and the top compress, but above this value the overall height will be severely affected and the increased voltage developed across it will strain the decoupling capacitor which may then leak and act as a resistor in its own right, or explode to cause a nasty mess of silver foil and waxed paper (by now dried up) which splatters everywhere.

Field Collapse

It's quite common for the resistor to become completely open-circuit while the capacitor just sits there doing nothing. The net result is a horizontal white line across the centre of the screen since the valve is unable to pass current. This condition (of not passing current) need not be due to a fault in the cathode circuit however. It's usually due to a faulty valve, but a meter check will often prove that there is no h.t. voltage on the anode (pin 6). The first thing then is to check the voltage at pin 7 (screen grid). If this is present then the HT4 supply is intact and the fault is somewhere around the T3 primary winding area.

Notice we didn't say that the T3 primary winding is faulty. It could be, but usually the fault is simply poor contact on the print where the tags are soldered. Close examination often shows a crack around the connections (possibly due to rough handling).

So there you have one example of the use of a pentode valve as an amplifier, and the defects which can spoil its performance. We have not touched on the fault conditions which can affect the control grid, such as leakage through C73 or C81 cancelling the bias, but this will obviously have a similar effect to loss of cathode bias, i.e. bottom compression and fold up.

TO BE CONTINUED

LETTERS

I'd like to follow up A. Denham's excellent article on the hybrid Pye colour chassis in the September issue with the following comments, having had considerable experience of these sets.

Taking the sections of the chassis in the same order as in the article, the clamp diode D39A (type OA47, not present in earlier sets) in the brightness control circuit on the control panel is sometimes responsible for intermittent brightness variations while when it goes short-circuit it prevents the beam limiter working. The luminance d.c. restorer diode D39 can cause a plastic picture with cogging if it becomes leaky. The AC128 driver transistor in the earlier audio modules can be replaced with a silicon device (BC143, BFX88 etc.) with no further alterations, and no heatsink is required.

A fairly common decoder fault is intermittent colour due to C110 and C112 (both 390pF) in the reference oscillator circuit going open-circuit – they provide the base-emitter feedback. C114 (680pF) also gives trouble, causing weak chroma with a 90° phase shift. This capacitor is the lower section of the a.c. potential divider between the reference oscillator and the emitter-follower which comes after it. The easiest way to defeat the colour-killer on the chassis is to remove PL8 and refit it so that only the orange lead connects. On earlier sets the bistable was sometimes reluctant to work if the PL509 or the PY500 was sufficiently low-emission: this can be cured by connecting a 1,000pF capacitor across the trigger pulse coupling resistor R153 so as to partially differentiate the pulse. Another problem on earlier decoders was the burst gate pulse transformer L28 which provided a very narrow pulse: it's worthwhile replacing it with the later type which has a single winding and gives a broader pulse.

The CDA panel has always been the main trouble spot with these sets. Most of the trouble can be cured by a very simple modification however: reduce the values of the colour-difference output pentode grid leak resistors R380/1/2 from 2·2MΩ to 680kΩ. This prevents the PCL84s drawing grid current and the 12kΩ anode load resistors overheating. It's an idea to reduce the value of the luminance output pentode's grid leak resistor R352 from 4·7MΩ to 2·2MΩ for the same reason. A 6F28 makes a good replacement for the PL802 if the latter is not to hand – but cut the print to pin 6 or R356 and R357 will disappear in a cloud of smoke!

These sets and a few others using PCL84 colour-difference output stage/clamp circuits suffer from coloured smearing when the tube emission gets a bit low – usually two green bars on the test card when the contrast and/or the colour are turned up. This effect is due to the c.r.t. passing grid current via the 8·2MΩ clamp triode anode load resistors. It can be cured by increasing the values of the colour-difference signal coupling capacitors C368/9/70 from 680pF to 0·01μF, thus increasing the time-constant of the clamp circuits to more than a field period. First check that the first anode preset controls are not turned right down however.

In the field timebase, D45 (OA47) between the blocking oscillator and the field charging circuit can be responsible for excessive height, as also can the driver transistor VT25 (AC128) if it's leaky between its collector and base. With both these faults the set-white switch will not completely collapse the field. VT25 can be replaced by a silicon device (e.g. BC126) provided a silicon diode is connected in the emitter lead of the lower output transistor VT27, with its anode to VT27's emitter for forward bias. Lack of height, with top and bottom cramping, is usually due to C455 (400μF) going open-circuit. It provides the a.c. return path for the field scan current and is mounted on the convergence panel. Lack of height with no cramping is usually the 20V zener diode D52 in the power supply section. Intermittent field bounce and loss of sync is sometimes due to the field sync pulse integrating capacitor C41 (0·0047μF) and interlace diode D4 (BA155) which are both on the i.f. panel.

Finally, a few headscratchers!

Weak field sync and bent verticals, with the sync separator transistor's (VT7, i.f. panel) collector voltage high, occurs when the value of the contrast control increases to around 2kΩ. The result is that all the signal is developed in the emitter circuit of the second phase splitter transistor, leaving nothing in its collector circuit for feeding to the sync separator transistor.

No raster with negative voltages at the c.r.t. grids is the result when the 295V h.t. rail smoothing capacitor C315 (300μF) goes open-circuit. Line pulses then appear on the h.t. rail and are d.c. restored by the CDA clamps so that negative voltages appear at the anodes of the PCL84 triodes.

Overloading and weak sync with the a.g.c. working occurs when the gain of the final i.f. amplifier transistor VT4 (BF197) is very low. This results in the sync pulses being clipped, so that insufficient a.g.c. is developed. – **M. Phelan,** *Holmfirth, W. Yorkshire.*

HALF MAINS VOLTAGE?

Many current television chassis use a transformerless bridge rectifier in the mains h.t. supply circuit in order to overcome the derating effect which half-wave rectification has on electricity supply generators, and technicians working on such receivers should be aware of the shock potential this arrangement presents – i.e. from chassis to earth.

The basic circuit is shown in Fig. 1. It has been stated in many places that the a.c. voltage present between the chassis and earth is half that of the mains, i.e. 120V a.c. On inspection however this turns out not to be the case. If we take voltage measurements with an Avo Model 8 on the 300V a.c. range we duly find 240V a.c. mains input (points A-B), and 120V a.c. between chassis and earth. But what must be remembered is that although the scale is calibrated in r.m.s. the meter reads mean values. So what is the meter telling us? Basically the Avo Model 8 and most other a.c. multimeters depend on the waveform being truly sinusoidal. If it's not, the form factor of the waveform must be taken into account. The same measurements made with a moving-iron meter, which indicates the true r.m.s. value, gives 240V a.c. across the mains but 170V a.c. from chassis to earth, a difference of 50V a.c. Which meter are we to believe?

Using an oscilloscope to see the mains and the chassis-earth waveforms we find that the peak-to-peak value of the latter approaches that of the mains supply while, as Fig. 2 shows, when the two are superimposed the effective power of the mains is not substantially greater.

To demonstrate the power involved, take two 25W 240V bulbs. Power one from a 120V a.c. source (measured with an Avo Model 8 and a moving-iron meter) obtained from a variac as shown in Fig. 3, and connect the other between chassis and earth. It will be found that the 120V half mains

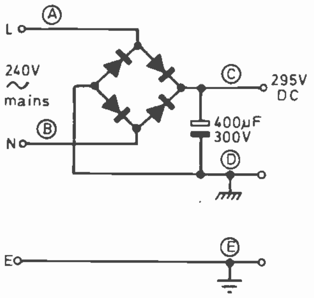


Fig. 1.

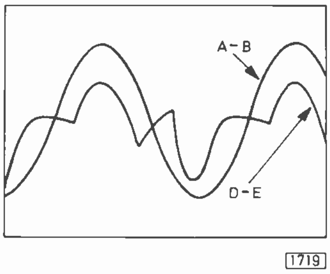


Fig. 2.

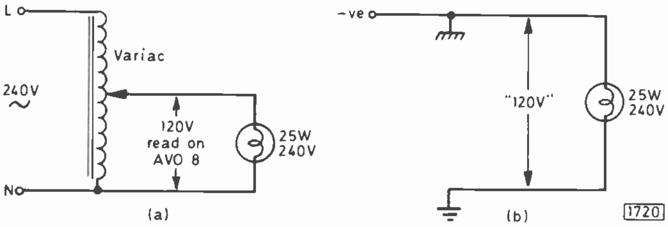


Fig. 3.

bulb just glows whereas the chassis-earth bulb shines quite brightly. As the bulbs respond to power and not to the shapes of the current or voltage waveforms, we have here perhaps a true indication of the shock potential. Using a photographic light meter to measure the relative light outputs, the 120V half mains bulb gave a reading of $7\frac{1}{2}$ and the chassis-earth bulb $9\frac{1}{2}$, two steps higher which indicates four times the light output.

Technicians working on such receivers should treat the receiver chassis in the same way as the mains therefore, and not believe the "half mains" reading given by their meters. – **T. I. Birnie, Tech (CEI), AMSERT,** *Lancaster.*

Editorial comment: That chassis-earth waveform looks as if it's due to the use of a thyristor regulated power supply following the bridge. Readers comments on this subject would be welcome.

SPLITTER PROBLEMS

In the August issue you gave advice in Your Problems Solved on connecting two aerials which are receiving two different transmitters to a common downlead. There can be problems however when using a resistive star matched splitter as suggested. Both aerials will pick up a certain amount of signal from say transmitter A. The aerial intended for transmitter A will of course be of the correct frequency group and pointed in the right direction, thus delivering the greater output voltage, but a smaller signal voltage will also be fed to the splitter by aerial B. Now depending on the relative phases of the two signals fed to the splitter an addition or subtraction process can occur. Thus the signal arriving at the receiver may be less than what you would expect as a result of the normal loss incurred by an arrangement of this sort. The aerial for transmitter B would probably be of a different group and pointing in another direction, but even so from my experience an appreciable signal can be obtained from an aerial of the wrong group receiving broadside on to the transmitter.

One cure for this is to cut the lengths of the coaxial leads from each aerial so that an in-phase condition is achieved, but in practice this is not so easy. In my own case I've solved the problem by having two separate downleads to the rear of the set, with an aerial changeover switch at the back of the set.–**B. C. Alabaster** *(Haverfordwest, Pembs).*

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TELEFUNKEN 511/711 CHASSIS

The set was bought in Germany in 1975. The fault is that the picture bends to the right, the bend moving up or down the screen. There is only one bend on the screen at any time, the shift being about half an inch – slightly larger to the right than to the left of the screen.

As the set is of continental origin it's probably set up for the lower continental mains voltage (220V). Consequently operation in the UK may have resulted in the premature failure of components in the power supply, resulting in the hum bar described. A number of components can be responsible, those usually failing being in the electronic smoothing circuit centred around T421 (2N3055). Check this transistor, and the associated transistors T422 (BD137) and T423 (BC182A), for leakage – usually from the collector to the emitter. If all is well, check R434 (56kΩ) in T423's base circuit – it tends to go open-circuit – and the 43V zener diode D426 which sometimes goes short-circuit. If the trouble persists, check C427 (10μF) and the reservoir capacitor C428 (1,000μF) for low capitance – they are often responsible for a slight hum bar.

Having located the fault, it's most important to set up the power lines correctly. Set R403 for 12V between test point M401 and chassis, then R421 for 174V between M421 and chassis. The set should then operate more satisfactorily on the 240V mains supply.

ITT VC200 CHASSIS

The set takes anything from three to ten minutes to come on, because the line timebase is slow to start working. All the line timebase valves have been replaced.

C124, C126 and C127 in the line oscillator circuit can all be responsible for this, especially if they are of the polystyrene (see through) type. Check also the high-value resistors (R159A and B) in the width circuit, replacing them if necessary with a single 10MΩ, 2W high-stability resistor.

THORN 8500 CHASSIS

The height has reduced to a band about two inches high across the centre of the screen, the extreme top and bottom of the picture appearing to be folded over. Adjustment of the height control to maximum increases the height of the upper half of the picture by about a quarter of an inch.

This fault could lie almost anywhere in the field timebase unfortunately, but most faults occur in the driver and output stages. The voltage at TP25, the centre point of the output circuit, is a good guide to the health of the preamplifier, driver and output transistors, VT408-VT411. It should be about 24V. If incorrect, remove the driver transistor VT409 and the output pair VT410 and VT411 and check them with a transistor tester. The simplest oscilloscope will display waveforms 27 and 28 – the field charging and output waveforms – and should be a great help in diagnosis.

DECCA 30 SERIES

After about ten minutes the green background control has to be adjusted as the picture goes very green. Later, the control has to be readjusted as the set settles down to normal working. Narrow green bands also occasionally flicker on and off.

A defective green output transistor (TR216) is often responsible, but its load resistor R297 is worth checking as well. Dry-joints on the board in the area around TR216 could be causing the problem, and the MC1327P i.c. is a remote possibility. Check the condition of the controls (VR317 and VR321) in the green output transistor's emitter circuit as well.

THORN 1400 CHASSIS

The trouble with this set is intermittent field collapse. After spending some hours checking and searching in the field timebase circuit however I can find nothing wrong. The set sometimes works all right for five minutes or so, at other times for half an hour. Tilting the set or tapping the cabinet restores the field scan, but I can't find any loose connections or faulty valves.

The fault is not necessarily in the field timebase itself. There is a separate h.t. supply (HT3) for the field output pentode for example (it comes from the centre section, R135, of the dropper resistor), while the oscillator triode is supplied from the boost line. Check whether these supplies are present when the fault occurs. Then check the print in the area of the field output transformer – this heavy component stresses the printed board, causing hairline cracks. Check the PCL805's valveholder – change it if in doubt. If all else fails, the trouble should come to light by monitoring the PCL805 voltages while tapping the board in the vicinity of the valve.

RANK A823 CHASSIS

The problem was sound but no raster. The 20V supply to the scan panel was found to be missing, with the feed resistor 8R2 on the power supply panel open-circuit. Replacing 8R2 produced a picture, but this collapsed twice so we switched off. We then found that the BD131 line driver transistor was short-circuit from collector to emitter – hence the original absence of the 20V rail and the open-circuit 8R2. The d.c. resistance of the line driver transformer's primary winding is only 0·2Ω. Is this correct or should the transformer be replaced along with the driver transistor?

It's unlikely that the driver transformer is faulty. D.C. resistance readings are not quoted in the manual, but they would be small. What is more likely is that the driver transistor became defective due to failure of one of the damping components across the driver transformer's primary winding. These are 5C25 (0·22μF) and 5R35 (22Ω). These can develop intermittent faults, so replacement of both, with adequately rated parts and a new BD131, should cure the trouble.

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4002	.16	4049	.39	4451	3.22
4006	1.00	4050	.39	4490	7.83
4007	.16	4051	.85	4501	.16
4008	.91	4052	.86	4502	.81
4011	.16	4053	.85	4503	.67
4012	.16	4066	.57	4507	.34
4013	.39	4068	.16	4508	2.27
4014	.94	4069	.16	4510	1.14
4015	.94	4070	.16	4511	1.42
4016	.43	4071	.16	4512	1.05
4017	.94	4072	.16	4516	1.14
4018	.94	4073	.16	4517	3.37
4020	1.04	4075	.16	4521	1.78
4021	.94	4076	1.21	4522	1.31
4022	.85	4077	.16	4526	1.11
4023	.16	4078	.16	4527	1.49
4024	.69	4081	.16	4528	.98
4025	.16	4082	.16	4529	1.08
4027	.46	4093	.57	4530	.64
4028	.84	4160	1.08	4536	3.30
4032	.94	4161	1.08	4541	1.27
4035	1.02	4162	1.08	4543	1.47
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PYE 713 CHASSIS

The fault seems to be tuner drift. The picture appears in monochrome when the set is switched on, gradually drifting until a full-colour picture is achieved. Pressing the tuning button fully home to switch off the a.f.c., then tuning in the station and releasing the button, results in an off-tune picture – the picture can be tuned in only when the button is not pressed fully home.

The trouble could be in the TCA270Q i.c. which provides the a.f.c. potential, but before replacing this we suggest you check R209 (22kΩ) which feeds the TAA550 stabiliser i.c., then the stabiliser i.c. itself, and also make sure that there is good contact on the 100kΩ tuning head potentiometers.

DECCA SERIES 10/30

There are alternate vertical light and dark bands on the left-hand side of the screen. The line linearity coil damping resistor R487 has been changed, but the fault persists.

The usual cause of this trouble, apart from the resistor you've changed, is a poor connection to the linearity coil. Check that it's intact, with no dry-joints, then check the line output valve's screen grid decoupling capacitor C432. Try connecting a 250pF, 12kV capacitor from the slider of the focus control to chassis, i.e. across R470. If necessary, check the line blanking circuit.

BAIRD 700 CHASSIS

The trouble with one of these dual-standard colour sets is lack of width and insufficient brightness – on both systems. The set e.h.t. controls are both at maximum, and replacing the line timebase valves has made no improvement.

The trouble is usually due to the two high-value (2·7MΩ), series-connected resistors in the width circuit (R486A and B). Check whether they have increased in value. Also check the 1·8MΩ resistor which links the width v.d.r. to the PL509's control grid circuit if necessary.

DECCA CTV25

The problem is a red band down the right-hand side of the screen. The band is about three inches wide and ragged when the set is switched on, but after warming up the band covers half the screen, with a sharp edge. The picture on the other half of the screen is fair, but doesn't have any white in it while the background is tinted green. I've changed the three PCL84 colour-difference output valves and checked that the decoder board is properly earthed. When the receiver is tuned off station there is a split-screen effect, with the left-hand side dark and the right-hand side illuminated.

We presume from what you say that the fault is still present with the colour turned down. In this case the trouble would seem to be in the flyback blanking circuit in the PL802 luminance output pentode's cathode circuit. This can be checked by shorting out the blanking transistor TR204 – from collector to emitter. If this restores the picture to normal, though with flyback lines visible, check TR204, its base-emitter junction protection diode D203 and the associated components. If the fault remains, check the components in the R – Y PCL84's anode circuit – R663/C647/R664 – and C401 which decouples the feed to the c.r.t. first anode presets in the line output stage.

PYE 697 CHASSIS

We are having difficulty tracing a short-circuit immediately the set is switched on. It blew the printed circuit foil from pin 2 of the multi-plug back to the 2·5A mains fuse right off the board. The capacitors in the power supply, also C224 in the line output stage (boost rail decoupling) and all valves have been checked.

There are only a few things which will cause this severe blowing. The first is the mains filter capacitor C301, on the rear of the on/off switch, secondly a short between the print tracks around the fuse on the top of the panel – this requires removal of the tracks, then wiring the fuse holder separately from the edge connectors. Thirdly there's the h.t. rectifier (BY127) and just possibly its parallel protection capacitor (C304). A short-circuit l.t. bridge rectifier would blow the fuse, but not so violently – and the h.t. rectifier doesn't normally go short-circuit. If C301 is not short-circuit therefore (disconnect to prove) probably either the on/off switch is internally shorted (it follows the mains fuse in these sets) or the print at the top of the panel is at fault.

THORN 8500 CHASSIS

The convergence on this set is faulty, the first three vertical lines on the test card appearing in the primary colours, with red on the right. Except for slight misconvergence at the extreme right-hand edge, the rest of the picture is perfect.

The problem is due to an R/G line convergence error and is usually cleared by adjusting the R/G amplitude and tilt controls R503 and L502 at the bottom right-hand corner of the tube-mounted convergence panel. Intermittent operation of R503 usually means that it has gone "noisy" and is in need of replacement. If you cannot get correct convergence and R503 is intact, the clamp diode W501 is suspect.

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.

The problem with an early Thorn 1500 chassis was line drift. When the receiver was first switched on all was well for an hour or so, but after this time the picture would start tearing horizontally.

The chassis employs flywheel line sync, so attention was directed to this area, including replacement of any resistors and capacitors which, if changed in value with temperature, could cause a change in the line oscillator frequency. Replacements were made using high-stability components. These certainly helped to increase the stability, but the trouble still returned eventually.

The circuit includes a d.c. amplifier transistor (VT10, BC109). Any d.c. drift introduced by this device could well cause the trouble, so this transistor was also replaced. This again helped, but failed to cure the trouble completely.

It was noticed that the receiver would function normally for quite a long time with its back removed, so the fault was certainly a temperature-sensitive one.

Various other tests in and round the line timebase circuit were conducted and it was not until one other component was examined in greater detail that the fault came to light. What else could cause the trouble? See next month's Television *for the solution and for a further item in the* Test Case *series.*

SOLUTION TO TEST CASE 178
– Page 666 last month –

The HMV Model 2647 in last month's Test Case has earthing interconnections coupling the front control panel, the shields of the tuners, and the external conductive coating of the picture tube. This group of interconnections is then taken to chassis via a wrap-round type of connection. By pulling on this the symptoms could be temporarily cleared.

There was clearly a high-resistance joint here which was in some way causing the supply ripple to be increased due to the minute current flowing. It has been known before for wrap-round connections to develop a diode effect, and this could well have been happening in this case. Anyway, the symptoms were completely cleared by remaking the connection and soldering.

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TELEVISION NOV 1977

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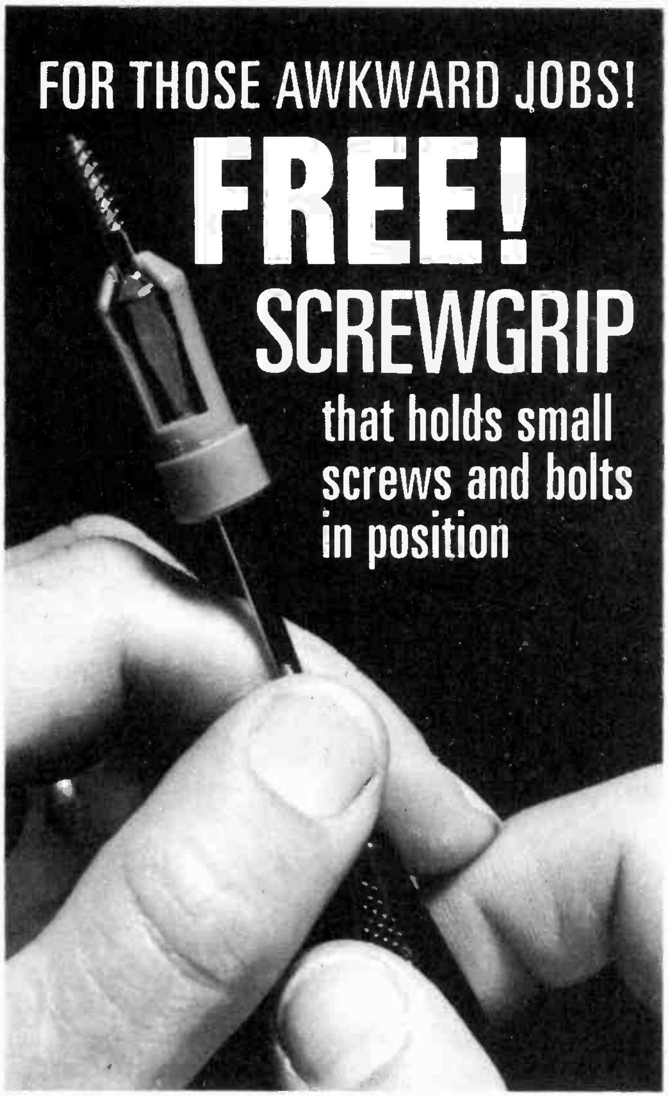

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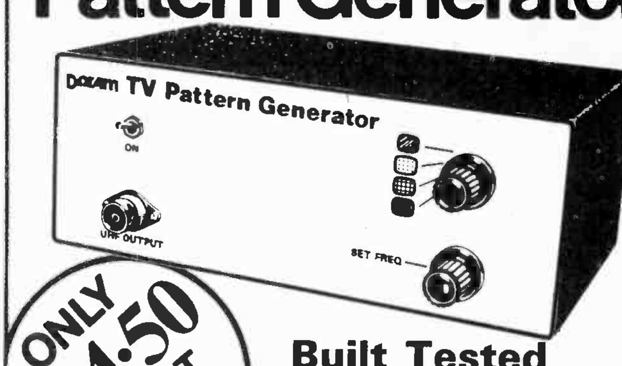

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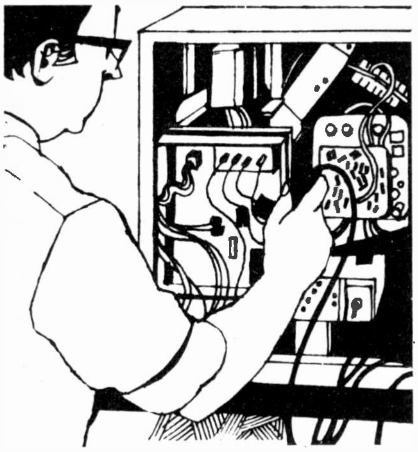

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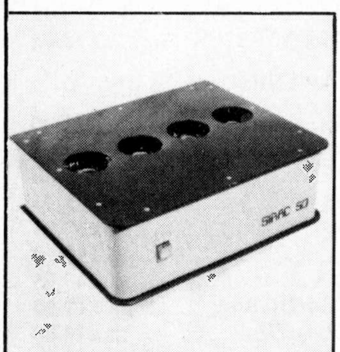

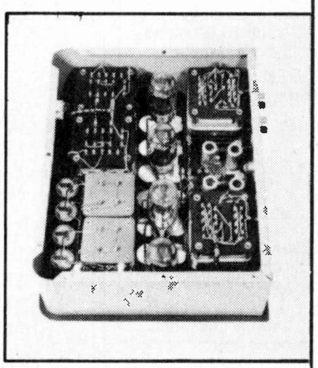

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Win some Aiwa Super-fi

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Listening with Beyer

A special review of the **Beyer** infra-red headphone system.

Amplifiers Examined

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