TELEVISION

20p

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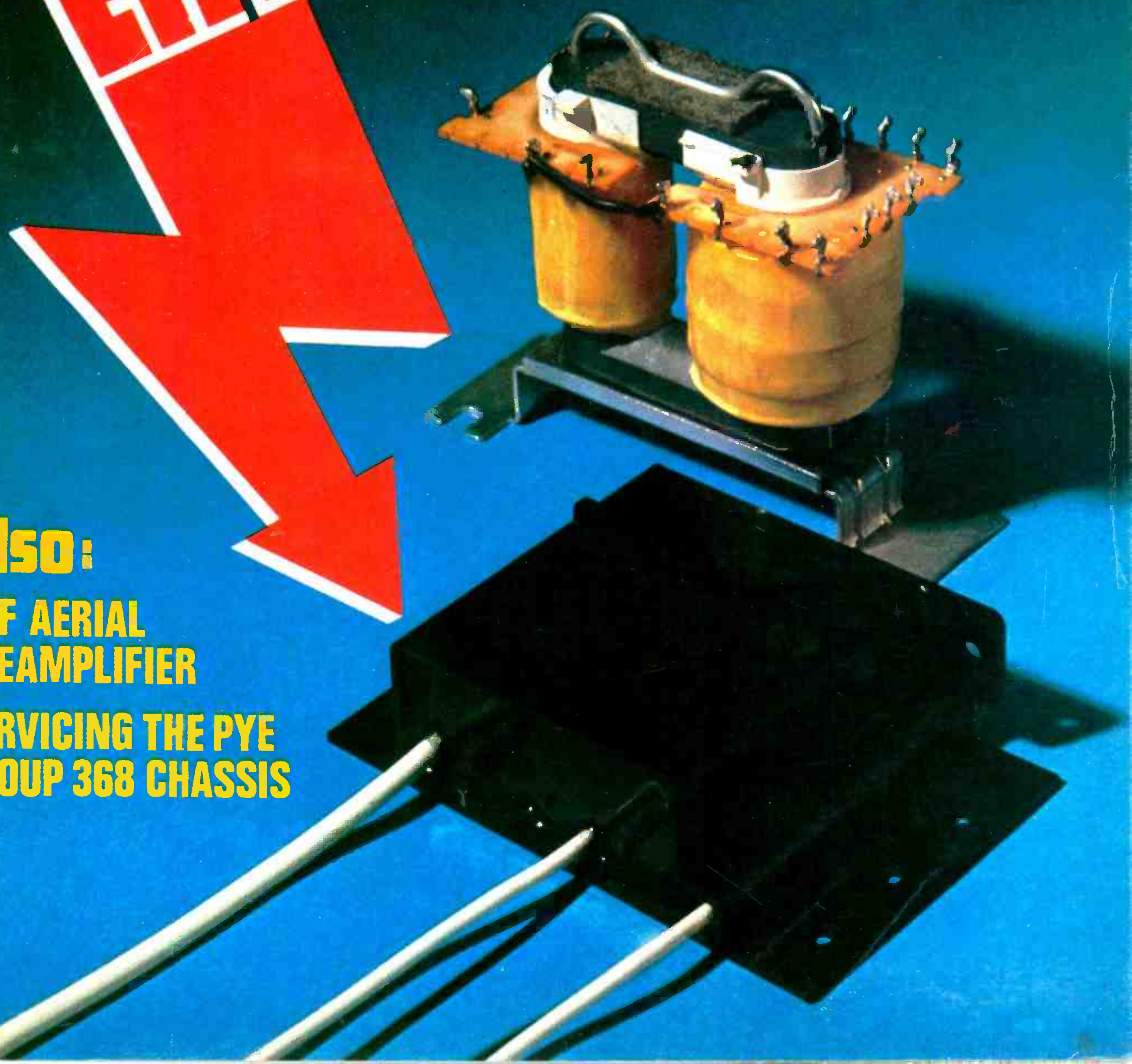
DECEMBER 1972

EHT SYSTEMS for TV SETS



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OA2	0·30
OB2	0·30
OZ4	0·25
1A3	0·23
1A5	0·25
1A7GT	0·32
1B3GT	0·35
1D5	0·38
1D6	0·48
1G6	0·30
1H5GT	0·33
1L4	0·13
1LD5	0·30
1LN5	0·40
1N5GT	0·37
1R5	0·26
1S4	0·22
1S5	0·20
1U4	0·29
1U5	0·48
2D21	0·35
2GK5	0·50
3A4	0·25
3B7	0·25
3D6	0·19
3Q4	0·38
3Q5GT	0·35
3S4	0·23
4CB6	0·50
5CG8	0·50
5R4GY	0·53
5T4	0·30
5U4G	0·30
5V4G	0·33
5Y3GT	0·25
5Z3	0·45
5Z4G	0·33
5Z4GT	0·38
6/30L2	0·53
6A8G	0·33
6AC7	0·15
6AG5	0·25
6AK5	0·25
6AK6	0·30
6AM6	0·17
6AM8A	0·50
6AN8	0·49
6AQ5	0·21
6AR5	0·30
6AR6	1·00
6AT6	0·18
6AU6	0·19
6AV6	0·28
6AW8A	0·54
6AX4	0·39
6B8G	0·13
6BA6	0·19
6BC8	0·50
6BE6	0·20
6BG6G	1·05
6BH6	0·43
6BJ6	0·39
6BK7A	0·50
6BQ5	0·21
6BQ7A	0·38
6BR7	0·79
6BR8	0·63
6BS7	1·25
6BW6	0·72
6BW7	0·50
6BZ6	0·31
6C4	0·28
6C6	0·19
6C9	0·73
6C12	0·25
6C17	0·63
6CB6A	0·26
6CD6G	1·06
6CG8A	0·50
6CL6	0·43
6CL8A	0·50
6CM7	0·50
6CU5	0·30
6CW4	0·63
6D3	0·38
6D6	0·15
6DE7	0·50
6DT6A	0·50
6EW6	0·55
6F1	0·59
6F6	0·63
6F6G	0·25
6F13	0·33
6F14	0·40
6F15	0·65
6F18	0·45
6F23	0·65
6F24	0·68
6F25	0·51
6F28	0·60
6F32	0·15
6GH8A	0·50
6GK5	0·50
6GU7	0·50
6H6GT	0·15
6J5G	0·19
6J5GT	0·29
6J6	0·18
6J7G	0·24
6J7(M)	0·38
6JU8A	0·50
6K7G	0·10
6K8G	0·16
6L1	0·98
6L6GT	0·39
6L7	0·38
6L12	0·32
6L18	0·44
6L19	1·38
6LD12	0·29
6LD20	0·48
6N7GT	0·40
6P15	0·21
6P28	0·59
6Q7(M)	0·43
6Q7GT	0·43
6R7	0·55
6R7G	0·35
6SA7GT	·35
6SA7	0·35
6SC7GT	·33
6SG7GT	·33
6SH7	0·53
6SJ7	0·35
6SK7GT	·23
6SQ7GT	·38
6U4GT	0·60
6U7G	0·53
6V6G	0·17
6V6GT	0·27
6X4	0·20
6X5GT	0·25
6Y6G	0·55
6Y7G	0·63
7AN7	0·27
7B6	0·58
7B7	0·32
7C6	0·30
7F8	0·88
7H7	0·28
7R7	0·65
7V7	0·25
7Y4	0·60
7Z4	0·50
9BW6	0·50
9D7	0·78
10C2	0·49
10DE7	0·50
10F1	0·75
10F9	0·45
10F18	0·35
10LD11	·53
10P13	0·54
10P14	1·08
12A6	0·63
12AC6	0·40
12AD6	0·40
12AE6	0·48
12AT6	0·23
12AT7	0·16
12AU6	0·21
12AU7	0·19
12AV6	0·28
12AX7	0·21
12BA6	0·30
12BE6	0·30
12BH7	0·27
12J5GT	·30
12J7GT	·33
12K5	0·50
12K7GT	·34
12Q7GT	·28
12SA7GT	·40
12SC7	0·35
12SG7	0·23
12SH7	0·15
12SJ7	0·23
12SK7	0·24
12SQ7GT	·50
14H7	0·48
14S7	0·75
19AQ5	0·24
19BG6G	·80
19G6	0·50
19H1	2·00
20D1	0·49
20D4	1·05
20F2	0·65
20L1	0·98
20P1	0·50
20P3	0·76
20P4	0·89
20P5	1·00
25A6G	0·29
25L6G	0·20
25Y5	0·38
25Y5G	0·43
25Z4G	0·28
25Z5	0·40
25Z6GT	·43
30A5	0·44
30C1	0·26
30C15	0·55
30C17	0·74
30C18	0·58
30F5	0·61
30FL1	0·58
30FL2	0·58
30FL12	·67
30FL13	·47
30FL14	·66
30L1	0·27
30L15	0·55
30L17	0·65
30P4MR	·95
30P12	0·69
30P16	0·28
30P19/30P4	0·55
30PL1	0·57
30PL12	·29
30PL13	·75
30PL14	·62
30PL15	·87
35A3	0·48
35A5	0·75
35D5	0·70
35L6GT	·42
35W4	0·23
35Z3	0·50
35Z4GT	·24
35Z5GT	·30
50B5	0·35
50C5	0·32
50CD6G	2·17
50EH5	0·55
50L6GT	·45
72	0·33
85A2	0·43
85A3	0·40
90AG	3·38
90AV	3·38
90CG	1·70
90CV	1·68
90C1	0·59
150B2	0·58
301	1·00
302	0·83
303	0·75
305	0·83
306	0·65
807	0·59
1821	0·53
5702	0·80
5763	0·50
6060	0·30
7193	0·53
7475	0·70
A1834	1·00
A2134	0·98
A3042	0·75
AC2/PEN	0·98
AC6PEN	·38
AC2/PEN/DD	0·98
AC/PEN(7)	0·98
AC/TH1	·50
AC/TP	0·98
AL60	0·78
ARP3	0·35
ATP4	0·12
AZ1	0·40
AZ31	0·46
AZ41	0·53
B36	0·33
B319	0·27
CL33	0·90
CV6	0·53
CV63	0·53
CY1C	0·53
CY31	0·29
D63	0·20
DAC32	0·33
DAF91	0·20
DAF96	0·33
DD4	0·53
DF33	0·37
DF91	0·14
DF96	0·34
DH76	0·28
DH77	0·18
DH81	0·58
DK32	0·32
DK40	0·55
DK91	0·26
DK92	0·35
DK96	0·35
DL33	0·35
DL92	0·23
DL96	0·35
DM70	0·30
DM71	0·38
DW4/500	·38
DY87/6	0·22
DY802	0·29
E80CC	1·65
E80F	1·20
E83F	1·20
E88CC	0·60
E92CC	0·40
E180F	0·90
E182CC	1·00
E1148	0·53
EA76	0·88
EABC80	·29
EAC91	0·38
EAF42	0·48
EAF801	·50
EB34	0·20
EB91	0·10
EBC41	0·48
EBC81	0·29
EBC90	0·18
EBC91	0·28
EBF80	0·30
EBF83	0·38
EBF89	0·26
EBL21	0·60
EC54	0·50
EC86	0·59
EC88	0·59
EC92	0·34
ECC32	1·50
ECC33	1·50
ECC35	0·95
ECC40	0·60
ECC81	0·16
ECC82	0·19
ECC83	0·21
ECC84	0·28
ECC85	0·32
ECC86	0·40
ECC88	0·35
ECC189	·48
ECC804	·53
ECC807	1·70
ECF80	0·27
ECF82	0·25
ECF86	0·64
ECF804	2·10
ECH21	0·63
ECH35	0·50
ECH42	0·57
ECH81	0·25
ECH83	0·38
ECH84	0·34
ECL80	0·28
ECL82	0·28
ECL83	0·52
ECL84	0·54
ECL85	0·54
ECL86	0·33
EE80	0·60
EF22	0·63
EF40	0·49
EF41	0·58
EF42	0·33
EF73	0·75
EF80	0·21
EF83	0·54
EF85	0·25
EF86	0·27
EF89	0·23
EF91	0·17
EF92	0·28
EF97	0·55
EF98	0·65
EF183	0·25
EF184	0·27
EFP60	0·50
EH90	0·34
EL32	0·18
EL34	0·44
EL35	1·00
EL37	0·74
EL41	0·53
EL42	0·53
EL81	0·50
EL83	0·38
EL84	0·21
EL85	0·40
EL86	0·38
EL91	0·23
EL95	0·32
EL360	0·49
ELL80	0·75
EM80	0·37
EM81	0·37
EM83	0·75
EM84	0·31
EM85	1·00
EM87	0·34
EY51	0·29
EY81	0·35
EY83	0·54
EY84	0·50
EY87/6	·27
EY88	0·40
EY91	0·53
EZ35	0·25
EZ40	0·40
EZ41	0·42
EZ80	0·19
EZ81	0·20
FW4/500	0·75
FW4/800	0·75
GY501	0·75
GZ30	0·33
GZ32	0·39
GZ33	0·70
GZ34	0·47
GZ37	0·67
HABC80	·44
HL23DD	·40
HL41DD	·98
HL42DD	·50
HN309	1·40
HVR2	0·53
HVR2A	·53
IW3	0·38
IW4/350	·38
IW4/500	·38
KT2	0·25
KT8	1·75
KT41	0·98
KT44	1·00
KT63	0·25
KT66	0·80
KT74	0·63
KT76	0·63
KT81	2·00
KTW61	·63
KTW62	·63
KTW63	·50
LZ319	0·26
LZ329	0·26
LZ339	0·55
M8162	0·63
MHL4	0·75
N308	0·95
N339	0·44
N359	0·42
P61	0·44
PABC80	·32
PC86	0·44
PC88	0·44
PC95	0·53
PC97	0·36
PC900	0·29
PCC84	0·27
PCC85	0·24
PCC88	0·39
PCC89	0·42
PCC189	0·46
PCC805	0·55
PCC806	0·65
PCF80	0·26
PCF82	0·30
PCF84	0·40
PCF86	0·44
PCF87	0·74
PCF200	·67
PCF800	·55
PCF801	·28
PCF802	·37
PCF805	·58
PCF806	·55
PCF808	·66
PCH200	·62
PCL82	0·29
PCL83	0·54
PCL84	0·32
PCL805/85	0·37
PCL86	0·36
PCL88	0·62
PCL800	·75
PCL801	·57
PD500	1·44
PEN4DD	1·38
PEN45	0·40
PEN45DD	0·75
PEN46	0·20
PEN453DD	0·98
PENA4	·98
PEN/DD/4020	0·88
PFL200	·50
PL33	0·38
PL36	0·46
PL81	0·42
PL81A	0·48
PL82	0·28
PL83	0·30
PL84	0·28
PL302	0·55
PL504/500	0·60
PL505	1·30
PL508	0·90
PL509	1·30
PL802	0·75
PM84	0·31
PY33/2	·50
PY80	0·33
PY81	0·24
PY82	0·23
PY83	0·26
PY88	0·31
PY301	0·56
PY500	0·95
PY800	0·31
PY801	0·31
PZ30	0·48
QQV03/10	1·20
QS75/20	·63
QS95/10	·49
QS150/15	0·63
QVO4/7	·63
R10	0·75
R11	0·98
R16	1·75
R17	0·88
R18	0·50
R19	0·28
R20	0·53
R52	0·33
RK34	0·38
SP61	0·33
TH4B	0·50
TH233	0·98
TP2620	·98
UABC80	·30
UAF42	0·49
UBC41	0·45
UBC81	0·40
UBF80	0·28
UBF89	0·28
UBL21	0·55
UC92	0·35
UCC84	0·33
UCC85	0·33
UCF80	0·31
UCH21	0·60
UCH42	0·57
UCH81	0·29
UCL82	0·30
UCL83	0·48
UF41	0·50
UF42	0·60
UF80	0·35
UF85	0·34
UF86	0·63
UF89	0·27
UL41	0·54
UL84	0·28
UM80	0·33
UR1C	0·53
UU5	0·38
UU9	0·40
UU12	0·20
UY41	0·38
UY85	0·23
U10	0·45
U12/14	0·38
U16	0·75
U17	0·35
U18/20	0·75
U19	1·73
U22	0·39
U25	0·62
U26	0·53
U31	0·30
U33	1·50
U35	0·83
U37	1·75
U45	0·78
U47	0·62
U49	0·53
U50	0·25
U52	0·30
U76	0·24
U78	0·20
U191	0·56
U193	0·31
U251	0·62
U281	0·40
U282	0·40
U301	0·40
U403	0·33
U404	0·38
U801	0·76
U4020	0·38
VP13C	0·35
VP23	0·40
VP41	0·38
VT61A	0·35
VT501	0·15
VU111	0·44
VU120	0·60
VU120A	·60
VU133	0·35
W76	0·34
W107	0·50
W729	0·60
X41	0·50
X63	0·33
X66	0·50
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XH/1·5	·48
Z329	0·61
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TUBES GUARANTEED 2 YEARS, COLOUR 4 YEARS ! ALL EX STOCK

Every tube tested before it leaves our premises. Open Saturday mornings

FOR EXAMPLE : * Rebuilds

Types	Size	Price	Cge.
CME1702, AW43-80, CRM173, MW43-80, MW43-69* CRM172, AW43-88, AW43-89, CME1705, CME1703 C17AF	17"	£5·87p	55p
CME1903, CME1902, CME1901, AW47-90, AW47-91, A47-14W, C19AH	19"	£6·87p	60p
CME2101, AW53-88, AW53-89, CRM211, CRM212, MW53-20, MW53-80, CME2104	21"	£7·87p	65p
CME2303, CME2301, AW59-90, AW59-91	23"	£9·50p	65p

Type	Size	Price
*TSD282	11"	£12·50
A28-14W(Mullard)	11"	£11·00
MW31-74	12"	£3·00
TSD290/CM1201	12"	£9·80
*13BP4	13"	£14·00
MW36/24 & 44	14"	£4·75
CME1601	16"	£7·50
CME1602	16"	£10·00
CME1906 / A47-13W	19"	£11·00
A47-11W & 26W	19"	£8·50
A50-120W/ CME2013	20"	£10·50
CME2306 / A59-13W	23"	£15·00
A59-11W&25/23W	23"	£11.50
CME2413	24"	£13·00
CME2501		£17·00

We do not normally supply rebuilt rimband types as, in our opinion, only the makers can maintain the high band tension essential to safety

COLOUR TUBES

4 YEAR GUARANTEE

19" A49.11X,	A49.120X	**£49·00**	plus £1 carriage
22" A55.141X,	A56.120X	**£53·00**	plus £1 carriage
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All prices net trade, old glass not required.

Rebuilt CME1908 / 1903 **£5·50**, CME2308 / ,, 2303 **£7·50**

Plus carriage, but if sea journey, 50p extra

We endeavour to maintain prices but all are subject to alteration without notice. Enquiries s.a.e.

NOTE From 1st April 1973, a tax of probably 10% will be added for all tube prices.

6 POTTERS ROAD, NEW BARNET, HERTS. TEL: 01-449/1934 (Robophone) and 449/1935

All enquiries welcomed. All prices NET trade

REBUILT COLOUR TUBES

19"	£22.50	22"	£25.00
25"	£27.00	26"	£28.00

Exchange prices: Tubes supplied without exchange glass at extra cost, subject to availability.

Colour Tubes demonstrated to callers.

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New RCA Type A49-15X: £30.00

Full range of rebuilt mono tubes available, Standard, Rimband and Twin Panel

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Complete with 13 channel tuners. Good cabinets. Carriage £1·50 extra.

19"/21" slimline (110° tube) ..	£5·00
23" slimline	£7·50
19" BBC 2 sets	£14·50

TUBES EX-EQUIPMENT TESTED

SINGLE PANEL

19"/21" any type	£3
23" any type	£4

TWIN PANEL (BONDED)

19" bonded	£5

All tubes add £1 carriage

VALVES EX EQUIPMENT

EB91	5p	30L15	12½p	PL36	22½p
EBF89	12½p	30P4	12½p	PL81	17½p
ECC82	12½p	PC97	17½p	PY81	15p
EC180	7½p	PCF86	17½p	PY800	15p
EF80	12½p	PC84	7½p	PY82	7½p
EF85	12½p	PCF80	7½p	PY33	22½p
EF183	12½p	PCC89	12½p	U191	17½p
EF184	12½p	PCL85	22½p	6F23	17½p
EY86	17½p	PCL82	17½p	30PL1	22½p
30PL13	20p	PCL86	17½p	30P12	20p
630LZ	12½p	PCL83	12½p	30F5	10p

Add 2½p per valve p. & p., orders over £1 p. & p. free

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For Ferguson 850 900 chassis. Adaptable for most U.H.F. Chassis **£2·50**, p. & p. 50p.

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(as published in P.T.—April issue)

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Component Pack No. 8 (Semiconductors, Resistors, Capacitors) **£6·05** with Silicon Grease, **£5.85** without Grease, inc. P. & P.

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TELEVISION

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SERVICING·CONSTRUCTION·COLOUR·DEVELOPMENTS DECEMBER 1972

SERVICING EXAMS

If you were interested in becoming a professional TV service engineer you would naturally consider taking the appropriate C & G examination. Maybe in preparation for this you would do some apprentice servicing; try in the process to find out about TV faults; maybe read issues of TELEVISION in which fault-finding procedures are outlined and hints passed on. We think all this would be useful. You would in particular find out a lot about stock faults. These will always exist since they result from practical things such as high temperatures in parts of a receiver, high currents, pulse voltages, weak mechanical links and so on. There are many teasers as well of course: but fortunately for us all the majority of faults fall into the stock category and sound guidance from an experienced engineer will indicate the sorts of things to expect. So you get some practical experience of fault conditions then: good for you and your future customers. But will it help when you come to that exam you feel you should pass?

We ask this very seriously because we know of some of the things that go on in setting the questions. A standard chassis must of course be used—you can't design and produce a special one just for examination purposes! But then, the examiners say, you can't set stock fault questions in case someone who knows the chassis knows the answers! (Isn't that rather the case with any examination though?) Anyway, what, in their idea of fairness, do our examiners do? Why start creating a few faults! Pull this and that out and see what happens. Then write the questions. After all if removing that capacitor or blowing that transistor produces a definite fault condition you should be able to diagnose it!

Maybe. But those who know about TV faults know that all manner of strange results can be produced by unusual component failures. Sometimes different faults can occur as a result of different conditions in a single faulty component. So it's not really all that clever to butcher a chassis and use the results as an exam paper.

We strongly suspect that the distrust of paper qualifications and the poor examination results over the years are not unconnected with the setting of wholely unrealistic examination papers.

W. N. STEVENS — *Editor*

THIS MONTH

THE NEXT ISSUE DATED JANUARY WILL BE PUBLISHED DECEMBER 18

Cover: Our cover photograph this month shows the Mullard AT2055 line output transformer and Mullard LP1174-10 e.h.t. tripler—components used in the TELEVISION Colour Receiver Project. They were kindly lent to us by **Manor Supplies.**

TELETOPICS

PHILIPS' VLP SYSTEM

The recently announced Philips video long-playing (VLP) disc system enables a 30-45 minute colour video programme to be recorded on one side of a new kind of record which however resembles and is made of similar material to an ordinary gramophone record of the usual LP size. The main technical problem with such a system is to devise a means of packing the information into the space available (storage density as it is called). The Philips engineers have solved this problem by using optical instead of mechanical scanning of the disc. The information is stored in the record track as a series of microscopically small oblong pits of equal depth and width, the modulation consisting of variations in pit length, i.e. this is apparently an f.m. system. The light spot which scans the track is centred on it by means of an opto-electronic control system. These techniques make possible the extremely fine track pitch that enables the information to be stored on the disc with the density necessary to give a reasonable playing time. The record is played at 25 revolutions/second, each revolution containing the information needed to reproduce one complete frame. The manufacture of a VLP record closely resembles that of an ordinary audio gramophone record but after pressing it is coated with a thin reflective metal layer.

To obtain a replay signal with a good signal-to-noise ratio a high-intensity light source for scanning the disc is required: this is provided by a small, inexpensive helium-neon laser which Philips can mass-produce by newly developed production techniques. The reflected, modulated beam is detected by a photodiode whose output, after amplification and processing, consists of a composite video signal for feeding directly to a television set.

The opto-electronic tracking makes the system very flexible: a picture can be frozen, picture sequences can be speeded up or played back in slow-motion—even to the extent of being viewed picture-by-picture or in reverse motion—while parts of a programme can be easily and immediately selected.

Since there is no mechanical contact between the disc and the scanning system there is no wear—especially important in reproducing stills. The sound signal can be suppressed during slow-motion etc. reproduction.

Philips' aim is to make the VLP system commercially available "within a few years." It should considerably reduce the price of audio-visual programmes and could well be competitive with the Philips' VCR system, though without offering the recording facility. It seems that Philips have taken the lead in both main approaches to video recording for domestic entertainment, educational, business and information retrieval use.

NEW IDEAS

Sharp have introduced on the US market a set which shows the channel number at the corner of the screen for two-three seconds after channel selection. A special i.c. is used to generate the characters. Sharp have also shown a set with an on-screen digital clock display which can be made to appear in any corner of the screen.

SERVICE EXTENSIONS

The following relay services are now in operation:

Kendal (Westmorland) BBC-1 on channel 58, BBC-2 on channel 64 (receiving aerial group C).

Whitehaven (Cumberland) Border Television channel 43 (receiving aerial group B).

These transmissions are all vertically polarised.

WHICH? ON COLOUR TV SETS

A recent *Which*? survey reports that reliability is considered by viewers to be more important than the picture or sound quality provided by a colour set. The average number of service calls was found to be under two a year with rented sets and slightly less in the case of viewers who own their sets. The survey reveals that imported sets were of above average reliability—only one UK produced brand, ITT-KB, featured among the top six in the reliability ratings. Although over 80% of viewers reported that they were satisfied with the performance of their sets a check carried out on test card revealed that most were not getting as good a picture as they should. A post installation service visit was required by 40% of users while some found that it was several weeks before the set worked properly. *Which*? concludes that the best rental proposition would be a Visionhire set, with good value obtainable from Rumbelows and local dealers.

ISOLATORS FOR TV LS EXTENSIONS

R. W. Dixon and Co. are introducing three mains isolator units specially designed for simple fitting to colour sets with transistor audio output circuits—they can however also be used with monochrome sets, radio sets, etc. The units provide an output for feeding hearing aids, extension loudspeakers or loop induction systems and the on-off switch enables the set's internal speaker to be muted if required. The three models, which measure approximately 3 × 3 × 1½in., are: Model 1, 1:1 ratio for 3-12Ω speakers; Model 2 2.6:1 ratio for 12-30Ω speakers; Model 3 8.2:1 ratio for 70-80Ω speakers. The recommended retail price is £5.95: trade and quantity discounts are available. The firm's address is Winton, Beacon Road, Crowborough, Sussex.

NEW COLOUR SET WITH NEW GUARANTEE

Pye have launched a new colour model, the CT200, with a recommended retail price of £218 and an all-inclusive twelve-month guarantee—any component replacements necessary and any labour charges will be completely free during this period. Pye claim that this is the first time that a UK setmaker has given such a guarantee—full-year labour-inclusive guarantees are becoming the common practice in the USA at present. If public reaction is favourable Pye say they will review their full range of Pye and Ekco colour and monochrome models with similar guarantees in mind. The CT200 is fitted with an 18in. tube and uses a new chassis, the Pye group 713 series chassis, which incorporates eight i.c.s and is divided into five printed panels mounted on nylon runners.

TELEPHONE NUMBERS

The ITT-KB Service Department has now moved to Paddock Wood, telephone 089-283 4422. Teleton have moved to Waterhouse Lane, Chelmsford, Essex: the telephone number of the Service Department is 0245 58791.

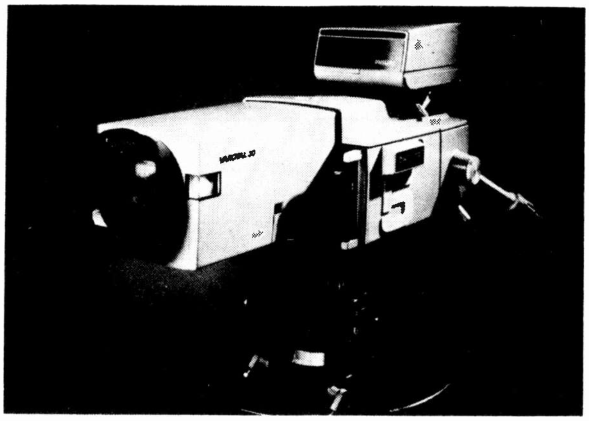
KOREAN SETS NEXT?

We're used by now to TV sets from every corner of Europe, from Japan and Hong Kong, but another far-East entrant looks as if it may soon be turning out TV sets: a number of Korean firms are engaged in discussions with leading Japanese electronics corporations with a view to commencing local production of colour sets for export. Firms reported to be involved include Toshiba, Hitachi, Sanyo and Crown. Since these negotiations are understood to have the approval of the Korean government we can expect Korean sets to be in production before long.

NEW PRODUCTS

A new line output transformer, type AT2048/00, has been introduced by Mullard for use in 110° monochrome fully-transistorised TV sets. The e.h.t. overwinding, which is intended to feed a silicon rectifier, is wound on the same limb of the core as the other windings.

A new u.h.f. masthead aerial amplifier, the Star, has been introduced by Belling-Lee. There are three versions to cover the various channel groups. Type /A covers channels 21-34, type /B channels 39-51 and type /C channels 49-68. The amplifier is said to increase the signal level by approximately four times. The recommended retail price of the amplifier and its associated power unit is £7.50.



The recently introduced Philips LDK5 colour camera, shown here with Varotal 30 lens system.

Siemens have introduced two touch-tune i.c.s, types SAS560 and SAS570. The former incorporates a memory facility so that the viewer's preferred channel is always selected on switching on. The i.c.s are suitable for use with remote control systems and give selection of up to 12 channels. They will operate with a finger-tip resistance in excess of 100MΩ.

Antiference have introduced a range of six in-line aerial attenuators in the form of a combined coaxial plug and socket for insertion in the aerial connection at the rear of a set. The recommended price is 48p each and the attenuation values available are 3, 6, 12, 18, 24 and 36dB. The attenuators are designed to reduce excessively high signal levels at both v.h.f. and u.h.f.

PUBLICATIONS

The first two volumes of a new series of publications on television engineering have been published by the Independent Broadcasting Authority. The series has the general title *IBA Technical Review* and two new volumes will be published each year. The first two titles are *Measurement and Control*, which includes six full-length engineering papers, and *Technical Reference Book*, which brings together in one convenient handbook many of the specifications and Codes of Practice used by the IBA—including the new Code of Practice for Independent Local Radio. The books are lavishly illustrated (with colour) and are being produced for British and overseas professional broadcasting engineers, technical and other educational centres and for libraries—copies can be obtained from the IBA Engineering Information Service, 70 Brompton Road, London SW3 1EY. They are inevitably somewhat specialist but we feel that a reprinting of the *Technical Reference Book* with its handy and well laid out presentation of basic data and parameters will soon be called for.

The British Amateur Television Club has published a 12-page booklet entitled *Slow Scan Television* by B. J. Arnold, M.A., G3RHI. This sets out the background and principles of SSTV and provides constructional articles on monitors and flying-spot scanners, detailing every aspect of generating and displaying slow scan pictures. It is available at 25p from A. M. Hughes, Editor CQ-TV, 93 Fleetside, West Molesey, Surrey.

The BRC 1500 Chassis further faults

Chas. E. MILLER

ALTHOUGH the BRC 1500 chassis has been clearly and comprehensively covered (see August and September 1972 issues) by L. Lawry-Johns the fact is that not every possible or even common fault is likely to be encountered by a single engineer. The following notes on this widely used chassis are intended to supplement L. Lawry-Johns' article—and are recorded as part of the campaign to prevent service engineers from suffering premature grey hairs!

Field Timebase Faults

A fair proportion of the faults I have had trouble with have been in the field timebase. At one time I made a point of changing C89—the capacitor which smooths the boost feed to the field oscillator—as a matter of course prior to delivering a set. Three times I have installed 1500s previously checked on the bench only to be confronted by a fine white line across the screen: on two occasions the cause was merely a recalcitrant PCL805 but on the third . . . A new valve having proved unhelpful a few quick voltage checks were made. The voltage at C89 was normal at 270V. The grid of the triode section was very slightly negative and the anode voltage just a little under par. The pentode anode and screen voltages were higher than normal, which seemed odd if the triode was not oscillating "full blast". The pentode cathode voltage was only about 4V instead of 16.5V. Could the notorious cathode bias resistor R103 have changed value? No, it read precisely 300Ω! Returning to the anode I found that there was no difference between the reading here and at the screen: there should have been a drop of 6V across the primary of the output transformer T3. I replaced the PCL805 again just in case. Still no field scan, still no voltage drop across T3. Had it gone dead short? Again, no: it read the correct 260Ω. The shunt v.d.r. was, somewhat half-heartedly, removed but to no avail. There seemed only one solution, that although the voltage was ok on the print side of the valve holder it was not actually reaching the valve itself. Accordingly the valve was withdrawn and the AVO prod moved to the other side of the holder: all the pins read correctly! By now I was almost ready for the men in white coats to come and lead me gently away. Clutching at straws I even tried another output transformer. No difference. Darn it, it just had to be the valve holder! I levered the PCL805 halfway out and got the prod on to the actual valve pins in case they were not making contact with the holder. But they were! I tore my hair and retired for a cup of tea. Suitably refreshed, I returned to the fray and to cut a long story short eventually discovered that the anode pin of the valve holder disconnected itself when the PCL805 was pushed fully home. I won't tell you how I cured this one because it was really rather naughty of me! It did not involve a new valve holder but it did involve some 5A fuse wire . . .

Miscellaneous Faults

Another brute of a fault was intermittent loss of picture: there was a strange sort of patterning on the screen on these occasions, as though an i.f. stage had gone unstable. Curiously enough the sound continued almost unabated. Tapping or flexing the printed board anywhere around the i.f. detector/video stages restored the status quo. It was a considerable time before the fault condition lasted long enough for me to discover that there were unusual voltages on the vision detector W2 and the video driver VT8 when the fault was present. At length I found that the ends of the winding on the video choke L10 had never been soldered to the former!

Loss of line sync has been due on some occasions to the flywheel d.c. amplifier VT10. Should the BRC TVT7 not be to hand experience has shown that a BC107 gives a good account of itself in this position.

The heater rectifier W7 seems to be somewhat more long-lived than its counterpart in the previous 1400 chassis but it can nevertheless fail usually resulting in brilliant valve heaters. I prefer to fit a replacement on the print side of the board away from the mains dropper and other heat-producing items.

Replacements

Now a word of advice which is a painful necessity. Over the years I have become increasingly disillusioned about replacement components—resistors and capacitors—that have been fitted in sets. Certain types have proved to be so unreliable that it is now routine for me to check all such items in chassis not previously repaired by myself. In the 1500 chassis I have in particular come across the field output valve cathode resistor R103 having been replaced by a well-known make of 330Ω value. Although showing no discoloration whatsoever these have been found to have gone up to many times their correct value.

I can assure Mr. Lawry-Johns that he is not alone in having tuner troubles on the 1500. In my case it has usually taken the form of a drift off station. That is one can tune a button to BBC-1, then switch to the next for BBC-2 and on returning to the first button it is found to be way off tune. The only remedy here is to pack the tuner off to BRC. It is pleasant to record that they make a first class job of all tuner repairs, both valve and transistor types. The waiting time is normally no more than 10 days and the results fully justify the moderate charges. ■

SYSTEMS for TV Sets

C.R.Boggis

ALL television receivers currently produced in the UK generate the e.h.t. voltage required for the final anode of the c.r.t. by rectifying the line timebase flyback pulses. These pulses result from the high-voltage energy which is available when the line output valve/transistor is abruptly cut-off at the end of each scanning line: the current in the coils reverses rapidly, giving the flyback period, and as a result a large voltage pulse is produced at the anode/collector of the line output valve/transistor. The pulses are stepped up by means of an overwinding on the line output transformer and are fed to either a half-wave rectifier or voltage multiplier to produce the d.c. e.h.t. voltage required. The capacitance between the c.r.t. final anode and earth is sufficiently large (over 1,000pF) in relation to the load current to ensure that the ripple voltage is of negligible proportions.

Until recently most half-wave systems employed a thermionic diode rectifier mounted close to the line output transformer in a heavily insulated moulding. The heater current required was supplied by an additional winding around the transformer core. Ceramic tube selenium semiconductor rectifiers are now available for use in monochrome receivers of all sizes. Semiconductor rectifiers are also used in colour receivers but generally in multiplier arrangements. The selenium rectifier has the following advantages over a valve rectifier: no need for a heater winding on the line output transformer; power saving in the deflection stage as a result of the elimination of the valve heater; simpler mounting assembly; improved e.h.t. regulation.

Typical Circuit

A typical transistor line output circuit is shown in Fig. 1. The transistor operates as a switch and is driven hard on about a third of the way through the forward scan: when it switches on it effectively connects the line output transformer across the h.t. supply, current then building up linearly in the scan coils. At the end of the forward scan the transistor is abruptly cut off. The current in the scan coils must then rapidly reverse to return the spot to the left-hand side of the screen. When the transistor is cut off the tuned circuit formed by the transformer inductance and capacitor C oscillates—the value of C is chosen so that the duration of the initial half-cycle of oscillation, which results in a positive voltage pulse at the collector of the transistor in the circuit shown, is slightly less than the line blanking period. When the circuit tries to swing negatively the shunt efficiency diode D switches on, once again connecting the line output transformer across the h.t. supply: a linearly decaying current then flows, giving the initial portion of the forward scan. The efficiency diode can and indeed often is left out since its action can be performed by the collector-base diode of the line output transistor—reverse current flowing through this into the transistor's base circuit. A separate efficiency diode is nearly always used in smaller transistorised TV sets however in order to reduce the demands on the line output transistor.

Since the line output transistor is operated as a switch which is on during the latter part of the line scan, variations in h.t. voltage could cause alterations in picture width. Consequently a stabilised h.t. supply is necessary.

Pulse Waveform

The voltage waveform of the e.h.t. pulse generated by this circuit is shown in Fig. 2. E1 is the voltage amplitude of the first positive peak, E2 the voltage amplitude of the following negative overshoot and V the smoothed d.c. voltage applied to the c.r.t. The maximum peak inverse voltage applied to the rectifier is the sum of the smoothed d.c. and the negative overshoot, i.e. $V + E2$: this can generally be taken as $1{\cdot}1 \times V$. The load current in monochrome receivers is usually some 100μA, with peaks up to 400μA on some picture highlights: in small colour receivers currents of around 1mA are encountered.

Third Harmonic Tuning

The efficiency of the transformer can be maximised, i.e. the e.h.t. voltage made as high as possible for a given turns ratio, by tuning the leakage inductance between the primary winding and the e.h.t. overwinding so that the third harmonic of the e.h.t. pulse frequency is added to the fundamental, thereby peaking the e.h.t. pulse. One result of this technique is that the peak voltage across the primary is reduced, allowing a greater safety margin—particularly valuable in semiconductor circuits—in the peak voltage rating of the line output device. A disadvantage is that the e.h.t. regulation is worsened, though this does not cause difficulties with monochrome receivers.

Voltage Multiplication

At voltages over 20kV the half-wave system is for several reasons not now generally used: the design of the transformer overwinding becomes critical; the high voltage necessitates a large winding, the heavy insulation required adding to the bulk; the large inductance and capacitance make harmonic tuning difficult; losses produce undesirable heat.

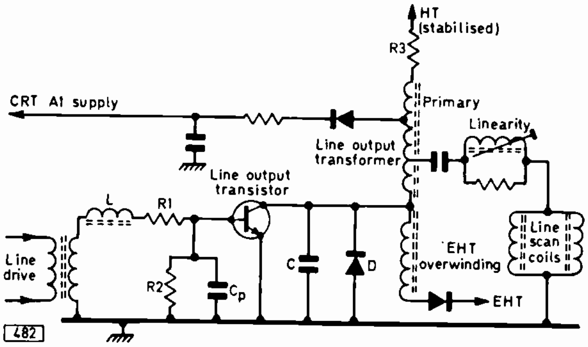


Fig. 1: Typical transistor line output/e.h.t. circuit. The undecoupled resistor R3 is connected in the h.t. supply feed to the stage to protect the collector junction of the transistor against the effects of e.h.t. arcing and tube flashovers; capacitor Cp protects the base-emitter junction in the event of flashover pulses appearing at the base via the collector-base capacitance of the transistor. L delays the drive signal, R1 limits the turn-on voltage and R2 damps the input circuit to prevent ringing.

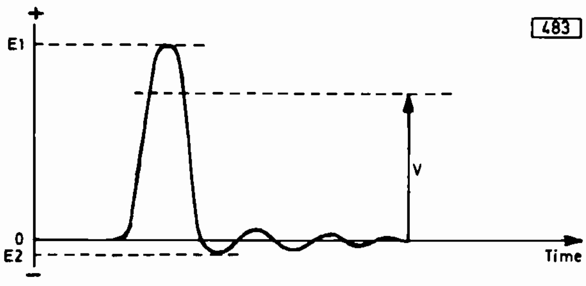


Fig. 2: E.H.T. voltage pulse waveform.

The alternative method of obtaining the e.h.t. from the flyback pulse is to use a small overwinding together with a voltage multiplier. With very few exceptions this system has been adopted for the current generation of colour receivers made in the UK. It is also used in some monochrome chassis for increased reliability. Shadowmask colour tubes require an e.h.t. voltage of about 25kV at beam currents up to 1.5mA: good regulation is essential since e.h.t. voltage variations not only impair picture quality and cause excessive breathing (changes in picture size with changes in picture brightness) but also result in convergence errors with changing spot size, producing colour fringeing.

Circuit Action

The basic voltage doubler circuit is shown in Fig. 3. Suppose we have a pulsed d.c. input of 10kV. The first applied pulse raises the input (A) to +10kV. D1 conducts, charging C1, so that terminal B is raised to 10kV above earth. When the input pulse terminates A is effectively earthed and D1 reverse biased. D2 is now forward biased by the voltage at B and charge is transferred from C1 to C2 so that C is raised to 10kV above A. When the next input pulse arrives the charge on C1 is replenished and at the same time the voltage at C becomes the sum of the input 10kV pulse plus the charge stored

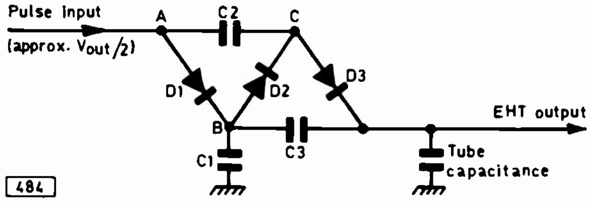


Fig. 3: Basic voltage doubler circuit.

by C2, i.e. 10kV + 10kV = 20kV. This voltage results in D3 conducting, charging the tube capacitance and C3 in series with C1 to 20kV. The input voltage is thus doubled. In practice of course several pulses are required for the circuit to reach equilibrium and losses due to rectifier leakage currents result in an output voltage that is only about 1.9 times the input voltage.

By adding further diodes and capacitors higher order multipliers can be obtained. Due to the losses previously mentioned and additional capacitor losses however only triplers (×3) and quadruplers (×4) are generally used at the currents required in television receivers.

EHT Regulation

As we have already noted good e.h.t. stabilisation is essential in a colour receiver. The first colour receivers made in the UK used a half-wave thermionic e.h.t. rectifier with a shunt regulator triode (PD500) to stabilise the e.h.t. In addition to the problems with the transformer mentioned above this system required X-ray shielding since the electron velocity in valves operated at much in excess of about 20kV gives rise to X-ray radiation: the use of voltage multiplication solves these problems but we still need regulation.

A television set's e.h.t. supply regulation depends on the source impedance of the line output stage, the receiver h.t. supply and the e.h.t. rectifier. The regulation performance is the extent to which the e.h.t. voltage drops from an initial level at zero beam current as the load current increases. Regulation determines the extent by which the picture size varies with picture brightness changes (breathing) since the tube scanning sensitivity is a function of the applied e.h.t.—as the e.h.t. is reduced the deflection sensitivity increases and the tube is overscanned.

The lower impedance of a semiconductor voltage multiplier compared to a thermionic valve and the smaller overwinding assist regulation. Further improvement is obtained by the use of fifth harmonic tuning.

Fifth Harmonic Tuning

The shape of the e.h.t. pulse greatly influences the e.h.t. regulation. If the leakage inductance between the primary and the e.h.t. overwinding is tuned to the fifth harmonic of the pulse frequency a fifth harmonic component is added to the fundamental. The result of this is a flat-topped e.h.t. pulse and effective prolongation of the conduction time of the rectifying system. With an untuned pulse the d.c. e.h.t. tends to rise to a value near the peak pulse voltage input when the tube beam current is small: then as the tube current increases the loading flattens the e.h.t. pulse and the d.c. voltage falls. If the pulse is always flat-topped however, as it is with fifth harmonic tuning, the e.h.t. voltage drop is reduced and the regulation improved.

Fifth harmonic tuning is also employed in monochrome sets which use an e.h.t. multiplier.

Stabilisation

With a valve line output stage it is usual to employ feedback to adjust the bias on the line output valve to help stabilise the e.h.t. Since as we have seen line output transistors act purely as switches this technique cannot be used with them: reliance must instead be placed on operating them from a stabilised h.t. supply line.

Focus Supply

A further function of the multiplier in a colour set is to supply the 4·2-5kV voltage required for the shadowmask tube focus electrode. Once set for optimum focus this voltage should track with the e.h.t. so that it remains a constant percentage of the e.h.t. voltage. The focus current drawn by the tube is very small.

In some early UK produced colour sets the focus potential was tapped from a voltage-dependent resistor connected between the tube final anode and earth. This arrangement was both costly and bulky though the performance was very good. In other early designs a separate focus rectifier was used.

With a multiplier it is convenient to take the focus voltage from the cathode of the first rectifier in the chain. The tracking of this voltage with the e.h.t. is not so good but is adequate. Several arrangements are possible, the most usual being shown in Figs. 4-6. The simple resistor chain networks in the circuits shown in Figs. 4 and 5 can be made in three ways: (1) Special high-voltage resistors can be mounted directly on a printed panel together with a high-voltage potentiometer: such resistors are fairly costly and the board needs to be of fibreglass to reduce the chance of tracking. (2) Low-cost carbon resistors may be included inside the multiplier and the whole assembly filled with resin to eliminate air around the components and prevent flashovers: the thermal properties of the resin can be selected so that the components run much cooler. (3) The potentiometer and resistors can be deposited by thick-film techniques on a ceramic substrate: high resistance values with good stability and small size are obtained by this technique.

Refinements

The need for high component density in today's compact receivers has led designers to seek new ways of improving reliability while at the same time reducing the size of the high-voltage multiplier. Resin encapsulation or "potting" as it is called fulfils these requirements.

The most common causes of multiplier failure are: (1) capacitor or rectifier flashover due to accumulated dust and/or moisture (from condensation); (2) corona discharge due to ionisation of the surrounding air by the high voltages present; (3) corona discharge due to poor soldering; (4) rectifier overheating under overload conditions.

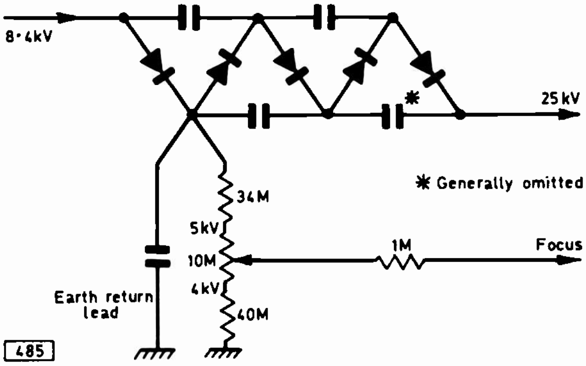


Fig. 4: Tripler circuit with simple focus network.

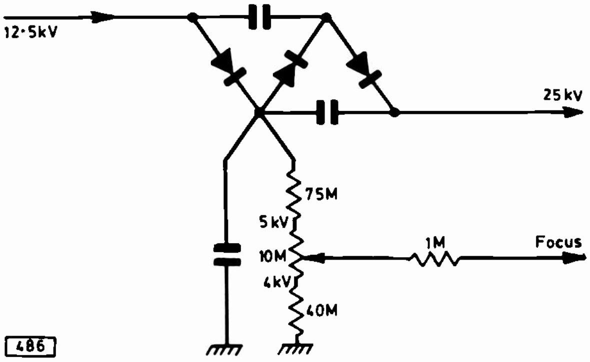


Fig. 5: Doubler with simple focus network.

The resin compound, which is flame-retardent and chosen to have very high insulation and high thermal conductivity, eliminates air from around the multiplier components so that corona discharge is impossible within the assembly. As the components are sealed in, dirt and moisture cannot accumulate so that the chances of flashovers are greatly reduced. The rectifiers are totally encapsulated over their entire length so that heat produced within them is conducted away. In addition to these electrical improvements the resin makes the whole assembly immensely robust. There is one drawback: failure of any one component renders the whole unit useless since recovery of parts after resin encapsulation is impossible. The failure rate is so reduced by potting however that this disadvantage is not important.

The basic tripler circuit shown in Figs. 4 and 6 is perfectly satisfactory with valve timebase circuits although a resistor (470Ω) should be included in the earth return lead to reduce the current through the multiplier in the event of e.h.t. flashover (R605 in the TELEVISION colour receiver!). To reduce costs the final capacitor in the network is often left out, the anode-to-earth capacitance of the tube taking its place.

With the advent of transistor line output circuits for colour TV the suppression of these surge currents became much more important. A series resistor (47kΩ—see Fig. 7) is usually included in the e.h.t. output lead to keep the surge within the operating limits quoted for the transistor. The inclusion of this resistor degrades the regulation but the provision of the final capacitor in the chain to a large degree

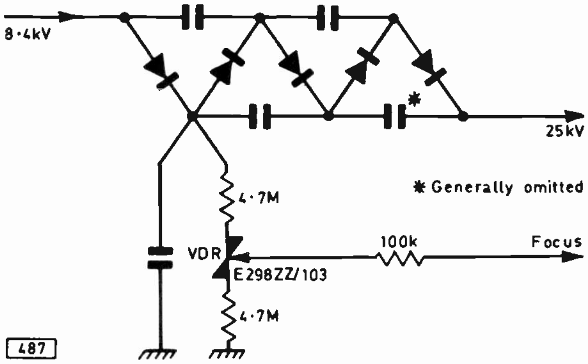


Fig. 6: Tripler with v.d.r. focus system.

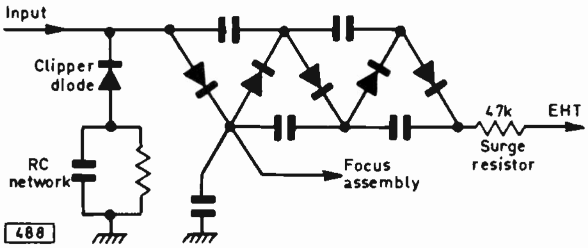


Fig. 7: Tripler circuit incorporating a clipper diode and surge limiting resistor.

corrects this.

The inclusion of a clipper diode (Fig. 7) improves the regulation further by removing the e.h.t. pulse waveform overshoot (see Fig. 2) and also protects the line output transistor by providing an alternate path for flashover current surges, the power being dissipated in the associated resistor-capacitor network instead of at the collector-base junction of the transistor.

Practically every semiconductor half-wave e.h.t. rectifier used in monochrome receivers to date has been a selenium device. Silicon rectifiers for this application are now becoming available but at the time of writing are 60% more expensive than their selenium counterparts.

Both selenium and silicon devices are currently used in multipliers. Selenium units are larger but less expensive. Silicon units require protective resistors in solid-state receivers (see Fig. 7): selenium rectifiers have a higher impedance and need less protection but due to their resistance they run warmer and give slightly worse regulation. Some multipliers use both silicon and selenium rectifiers.

A major factor affecting the regulation with multipliers is the value of the capacitors used. Until recently almost all UK designs have utilised disc ceramic capacitors of 0·001-0·0015μF rated at 10-12kV. Higher capacitance values were not practical without making the multipliers much larger physically. High-voltage film capacitors using the familiar rolled tubular construction are now becoming widely available however. The dielectric is generally Mylar film and values of around 0·0025μF at 12kV are currently available at a reasonable price in relation to the ceramic 0·001μF types; due to their construction they are small enough for multiplier use. ■

SERVICE NOTEBOOK

G. R. WILDING

Blank Raster

NORMAL sound with an unmodulated raster may be due to faulty tube supplies or the tube itself or in 405-only or dual-standard models when switched to v.h.f. a fault in the vision only i.f. amplifier(s), the vision detector or the video stage. Where a separate intercarrier sound detector diode is used in a single-standard model or a dual-standard model on u.h.f., normal sound with a blank raster may be caused by a video stage or video detector fault but when, as is usually the case, such sets employ a single detector for both signals and take the intercarrier signal from the anode of the video amplifier the possible causes of the fault are limited to the c.r.t. feed circuits. Concentrating however on 405-only and unconverted "dual-standard" models—since they still constitute a high proportion of the sets in use today—what, if changing all the relevant valves fails to restore the picture, is the best procedure for locating with the minimum expenditure of time and energy the cause of the trouble?

Much naturally depends on layout and accessibility but the first thing to do is to make sure that the raster is unmodulated as soon as it develops and that the brilliance control is working normally. Quite often in older receivers a grid-cathode leak develops in the tube and rapidly increases in severity as the cathode temperature rises: thus on switching on from cold *some* screen modulation may be apparent but rapidly disappears as the tube warms up fully, the brilliance level simultaneously rising until it is eventually impossible to kill the raster. If the tube is ok. and the brilliance can be varied from black to peak white it can be taken that the video output pentode is passing about normal anode current and has approximately correct anode and screen voltages and an intact cathode bias resistor—probably little changed from its original value—since in these older models the video pentode is generally d.c. coupled to the c.r.t. cathode.

As the vision detector diode on such older models is almost always d.c. coupled to the video pentode grid a good move is next to check for the presence of a small positive voltage at this point. This voltage, developed by the diode, should vanish on removing the aerial or switching the tuner to a dead channel. If this voltage is present then clearly the video output stage is defective. Note whether applying the ohmmeter test prods across the valve's grid and chassis alters the brilliance level. If the video pentode is a.c. coupled to the c.r.t. cathode this ohmmeter application will of course result in only a momentary screen flash. Where such a.c. coupling is used and the valve's voltages are normal an open-circuit or disconnected capacitor must be one of the first suspects. Grid and anode circuit peaking coil connections sometimes go open-circuit so these should also be checked.

A less common cause of 405-only video output stages failing to operate is a complete short across the valve's cathode components. This of course removes all bias and the positive-going detector output then merely produces pentode grid current and scarcely affects the anode current. This type of fault in receivers employing d.c. coupling to the c.r.t. is usually evident by inability to reduce the brilliance to a normal level—the heavy pentode anode current reduces its anode voltage and thus the c.r.t. cathode voltage to an abnormally low figure.

If there is no positive output from the detector diode then the detector itself is suspect. It is usually possible to test it by checking that the d.c. resistance from the video pentode grid to chassis is a few kilohms with the ohmmeter one way round but only that of the i.f. coil and chokes plus the i.f. stopper if fitted the other way round. This doesn't accurately check the condition of the diode in terms of forward to reverse resistance ratio but we are here considering only *complete* absence of picture.

If the detector diode is in order the next move must be to check the anode, screen and cathode voltages of the i.f. valve(s). The cathode voltage is the most important since if it is correct it shows that the valve is passing normal current and therefore that the valveholder connections to all pins are being maintained. Connection to the control grid is proved since an open contact would remove all bias and result in a higher than normal cathode voltage.

If all voltages are normal and the detector and video stages are operational the only likely possibilities remaining are a short in a fixed trimmer across one of the i.f. coils or transformer windings, an open-circuit fixed trimmer or an open-circuit signal feed capacitor. The first two of these possibilities would however more likely result in weak rather than zero screen modulation. The possibility of a short in a fixed trimmer can easily be checked with a low-reading ohmmeter but the only sure check for a suspect open-circuit picofarad value capacitor is substitution.

Distorted Sound

DISTORTED sound with a smell of burning were the complaints with a Pye Model 40F. A first-class picture with good sound were obtained on switching on but by the time the back of the set was removed and the hinged chassis lowered the sound had become very distorted and the PCL82 pentode anode was beginning to glow red. The development of the fault in this way could be caused by a soft valve, a slight leak in the pentode control grid coupling capacitor or by a progressively increasing leak in the pentode cathode bypass electrolytic reducing the bias developed across its cathode resistor. The smell of burning was the result of this resistor and the audio

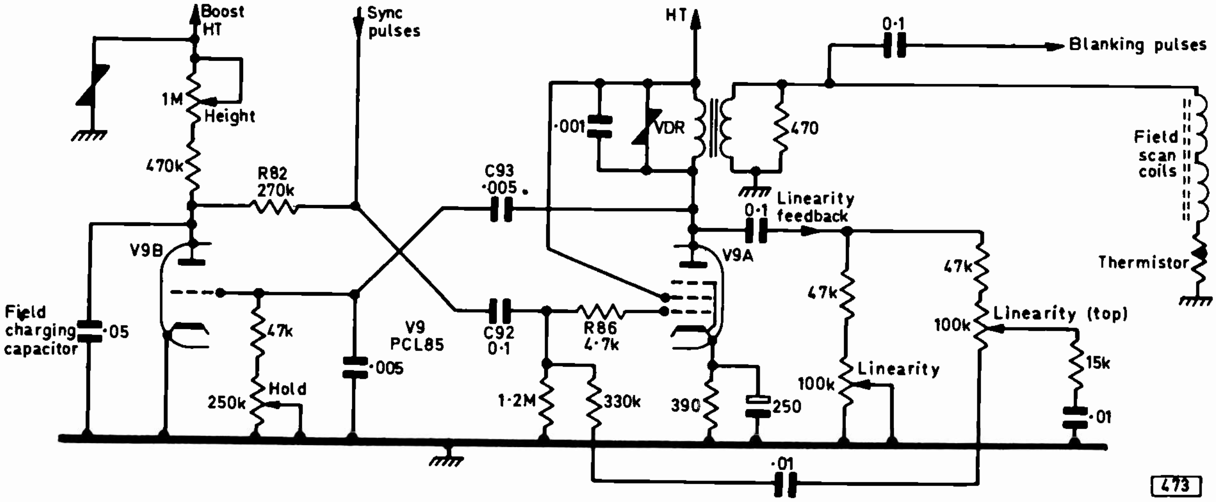


Fig. 1: The field timebase circuit used in many GEC/Sobell group receivers. The fault was field collapse a few minutes after the set was switched on. Tests showed that this was due to failure of the circuit to oscillate rather than failure of the output section. The fault was tracked down to a faulty coupling capacitor (C92).

output transformer overheating, so the electrolytic was ruled out as a suspect. As the PCL82 looked fairly old we replaced this and, on switching on again, measured the voltage developed across the pentode cathode resistor. The voltage remained at the correct level—16V—for a few minutes then increased rapidly. On transferring the test prod to the pentode control grid there was virtually no needle deflection: but this is usually the case—even with a comparatively heavy leak since the effect of this will be offset by the resulting grid current. Clearly the 0.01μF coupler from the triode anode was leaky and on replacing this and leaving the new valve in place the pentode cathode voltage was found to remain constant. On putting the old valve back again the cathode voltage started to climb rapidly: as expected the leaky capacitor had made the valve soft.

When a grid coupling capacitor is suspected of being leaky the only ways to check are to measure the valve's cathode voltage, as in this case, or to remove the valve, short out the valveholder heater connections and check for the tell-tale small positive voltage at the grid pin.

Failing Field Scan

THE problem with a dual-standard Sobell Model ST290DS was that while a normal picture developed on switching on within a few minutes the raster drastically reduced from the bottom and then finally collapsed to a thin white line. Our first move of course was to replace the PCL85. This restored the picture but within minutes the raster again collapsed. After reducing the setting of the brightness control to avoid screen burn we checked all relevant voltages in the field timebase circuit (Fig. 1) but found these to be reasonably close to those quoted in the manual. Contacting the pentode control grid however caused considerable vertical movement of the horizontal white line. Our first clue: clearly the fault was due to failure of the circuit to oscillate, not failure of the output pentode section to amplify!

As the circuit shows the field timebase consists—as with so many receivers—of a triode-pentode with the pentode acting in conjunction with the triode as a multivibrator in addition to acting as the output stage. The fact that all voltages were normal indicated that all current-carrying resistors were in order and that the voltage-carrying capacitors were neither leaky nor short-circuit. The cause of the failure to oscillate could therefore only be an open-circuit feedback component between the two sections of the valve: the possibilities were C93, R82, C92 and R86. Meter tests quickly confirmed that the resistors were OK and as C93 was the more likely suspect this was replaced. This did not solve the problem so C92 was then replaced and a constant raster was obtained.

In all cases of field collapse therefore first check voltages, noting whether test prod application at the pentode grid indicates a live stage, then test non current-carrying resistors in the feedback loop: this reduces to the minimum the need for suspect capacitor replacement, saving much time and trouble.

Suppose however that meter application to the pentode grid failed to produce any line movement: what then? With roughly the correct pentode anode voltage present the field output transformer primary must be either continuous or shorted by a shunt capacitor: a meter test will indicate whether the latter has occurred. Even if a partial short does exist across the primary there will be field output, though of greatly reduced amplitude and badly cramped. In such cases the prime suspect is neither the field scan coils nor the output transformer secondary but an open-circuit thermistor in series with the scan coils and mounted almost underneath them so that as the coil temperature rises its resistance decreases to compensate for increase in the resistance of the windings. These thermistors can be shorted out until an exact replacement is obtained but their absence is always shown up by the way in which the raster creeps up from the bottom of the screen after some minutes of use.

TO BE CONTINUED

TV TEST REPORT

E. M. BRISTOL

LABGEAR CM6016/SM SIGNAL-STRENGTH METER

THE spread of the u.h.f. network and the success of colour television have produced a boom for aerial riggers. All too often however it is a case of sticking up an aerial in the most convenient position and then if reasonable results are obtained on to the next job. This is all very well in areas of good signal strength but in fringe areas and those frequent pockets of poor reception in the lee of hills and tall buildings rather more care is needed.

For colour reception a good signal is required if noisy chrominance is to be avoided. In poor reception areas it is often found that moving the aerial vertically or horizontally has an appreciable affect on the picture; even lowering the aerial sometimes increases the signal. But altering the aerial position and then checking the results on the set is time consuming, fiddling and not always conclusive because the a.g.c. action in the receiver tends to smooth out signal variations. The answer to the problem is a signal-strength meter and the Labgear CM6016/SM is an example of this type of instrument.

Front-end

The "front-end" consists of a standard transistor u.h.f. television tuner. Thus the aerial feeder termination is the same as would be provided by a television receiver. The tuner output is then detected and amplified by a circuit which responds to the peak signal amplitude. Consequently there is no variation in the detected signal as a result of varying programme content, a factor which can give very misleading results with simple instruments that do not operate in this way.

Meter

The amplified output is applied to a taut-band meter which gives direct readings in micro or millivolts depending on range. The four ranges provided are 30-100μV, 30-300μV, 0-1mV and 0-3mV. The scale markings are clear with the lower ranges at the top; microvolt calibrations are inscribed in red while the millivolt ones are in black. There is also a check marking for the condition of the internal batteries (two PP6): this is selected by a fifth position on the range switch. The batteries are series connected and the total current is 32mA. The battery check is conducted with normal loading thus avoiding misleading off-load readings. The voltage is zener diode stabilised during the normal working life of the batteries.

On-off Switching

The on-off switch is spring-loaded and mechanically linked to a shutter across the coaxial input socket. To operate the switch is depressed and the coaxial plug then inserted in the socket. When the plug is removed the switch automatically returns to the off position thus making it impossible to leave the meter switched on. Because of the conditions and distractions when working in the field (or on the roof) it is very easy to forget to switch a test instrument off; this is a sensible and useful provision therefore.

Sound Carrier Rejection

Another very useful facility is the sound carrier rejection feature. The sound carrier at u.h.f. is above the vision carrier and of roughly half the strength. Thus with three programme services in operation there will be six carriers present. In some areas there will be relay stations and/or nearby adjacent area main transmitters, so that there could well be a jungle of carriers making channel identification difficult. The rejection circuit is activated by a press button on the control panel: when this is depressed the signal being measured if a sound carrier drops to almost zero reading; if on the other hand the signal is a vision carrier the reading drops only slightly. This therefore gives a positive identification of the vision carrier.

Housing

The case is made of mild steel sheets riveted together and can be removed for battery replacement by unscrewing two large screws at the base. The internal construction is sound and I noticed that the batteries are held securely in place and are thus not liable to cause damage by coming adrift although they can still be quickly released. The control knobs are solidly made and should withstand the rough use likely in this application. The channel markings are clearly inscribed from 25-65 in increments of 5 on a strong perspex disc fitted to the tuning spindle. There is a slow-motion tuning drive with a reduction of approximately 6 to 1.

The whole outfit is housed in a khaki canvas container with a stitched-webbing shoulder strap and a flap-down lid with press fastenings. There is on the inside of the flap a transparent pocket in which the operating instructions are contained, a position where they can be seen and read without becoming dog-eared and dirty. The container is padded with highly resilient material which should absorb bumps and knocks. Furthermore the panel is protected by metal flaps at the top and bottom: these effectively recess it. In short everything has been done to make the instrument as durable as possible and it is difficult to see how it could come to grief except by being dropped off a roof (one test I didn't apply!)

The Labgear CM6016/SM signal-strength meter.

although even then I would anticipate a good survival chance.

Performance

How then did it perform in the field? Over a period of a few months it has been used in many different situations, in conditions of good signal strength and in fringe conditions, and over a range of different channels from 23 up to 64. Accuracy is claimed as $\pm$6dB. It wasn't possible to check this—accurate laboratory equipment would have been required for this—but the instrument was found to be consistent in its readings both on the same aerial on different occasions and also on the different scales where the ranges overlap so that a reading can be made on two adjacent ranges. Consistency is more important than absolute accuracy in this application.

The readings were rather uncertain at the lower end of each range. On the lowest range the needle reads about 30μV with no signal which is why this value is quoted as the minimum in the specification. Signals as low as this would however be of little practical use for viewable reception so this lower limitation is no real disadvantage. It was found that in fringe locations a signal reading of 70μV or more was necessary for a viewable picture on an average monochrome set. Signals sometimes gave no indication at all on a high range but would give a readable indication on the next lowest one—hence the comment about uncertainty at the lower reaches. Here again though there is no real drawback—all instruments tend to be inaccurate at the ends of their scales, especially the lower end. All one has to do is to remember to switch down through the ranges from the highest until a reading is obtained.

In good signal areas the problem was in the other direction—with signals greater than 3mV. In my own home about 20 miles from the transmitter and with a loft aerial I get signals of 4 to 5mV with an Antiference 10-element kit. No doubt larger signals could be obtained outside and nearer the transmitter. To measure these an attenuator is necessary so it would be wise to carry a 6dB and a 12dB plug-in attenuator such as those made by Radiospares in order to extend the upper range by twice and four times. This gives conveniently 6 and 12mV. The accuracy of these attenuators I found to be rather poor but of course they are intended merely to attenuate a too-strong signal, not to provide accurate measurements. A rigger who normally keeps a stock of attenuators could sort through a few to find ones that give the closest to half readings for 6dB and quarter readings for 12dB and mark these for meter use.

Channel Identification

The sound carrier rejection facility worked perfectly and was a big help in quickly identifying which was the sound and which the vision carrier. Tuning calibration is fairly accurate though not of hair-line standard. The dial is inscribed with channel numbers only without actual channel position markings. Also the reference line is about $\frac{1}{8}$in. thick. I found however that the top edge of this line gave quite an accurate indication of the channel at the bottom end of the scale while the bottom edge was nearer the mark at the top end. This would probably be true of only the particular instrument tested; there would most likely be slight variations in tuner alignment between different instruments. Once again however exact calibration is not really necessary: one knows the three channels in use in one's particular area and the calibration is certainly close enough to be able to identify which is which.

Tuning

The only adverse comment I have to make on this meter is that the tuning tends to be rather sharp even with the 6 to 1 reduction. In fact the adjustment is sometimes quite critical and it is not easy to tune to the peak: having to fumble with cold fingers among the chimney pots to get the tuning right could be a little trying! The calibrated portion of the disc does not even occupy 180°. One would have thought this could have been extended say to 270° and the drive gearing reduced. As it is one can cover the entire tuning range in less than three turns of the tuning knob. This is not really necessary because most of the instrument's use will be over the limited range of the three stations in operation in any particular area. A really useful refinement would have been a varicap diode tuner with preset pushbuttons set to the local stations as is now common practice with TV receivers.

Conclusion

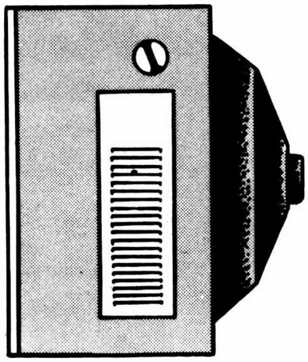
I do not want to make too much of this however: the tuning though sharp is by no means unmanageable and I would not wish to discourage any would be purchasers because of this one point. Obviously much thought and good design have gone into the instrument and I would unhesitatingly recommend it. In fact I would encourage all aerial riggers as well as TV service departments to invest in one: I am sure that reception standards, especially in poor signal areas, would improve as a result.

The instrument will not of course detect ghosting. But at least one can start from the position of highest signal level before experimenting to reduce multipath reception.

Final details: dimensions approximately $9\frac{3}{4} \times 4 \times 7\frac{1}{2}$in.; weight 5lb.; price £40 trade. Manufactured by Labgear Ltd., Cromwell Road, Cambridge.

FEATURE TO BE CONTINUED

Renovating the RENTALS



CALEB BRADLEY BSc

9 BUSH/MURPHY CTV25/CV2510 contd.

THE DECODER

Connoisseurs of decoders seem to love or hate the circuit used in this chassis. These passions are roused by such things as the unusual colour killer which depends on careful setting up, and the inscrutable layout of the manufacturer's circuit diagram. The latter point we have remedied in Fig. 12 which includes everything concerned with decoding the chrominance signal, including the first, gain-controlled chrominance stage which is on a small board under the i.f. board, the decoder board proper and the reference oscillator with its a.p.c. loop (components prefixed 6) which is on the colour-difference and luminance board.

Apart from the colour killer the decoder is conventional as the block diagram (Fig. 8) shows. Colour killers generally consist of an arrangement which supplies forward bias to one of the transistors in the chroma signal chain *only* when the ident signal is present. Since the ident signal is only produced in the decoder when the 4.43MHz burst is transmitted (to control the receiver reference oscillator for colour reception) this arrangement prevents signals reaching the chroma detectors when the programme is monochrome, thus avoiding colour noise (confetti) on the screen. The simplest colour killer is simply a diode which rectifies the ident signal to obtain the required bias potential. The circuit used in this model is fancier and involves the PAL bistable. The circuit centres around 5D5 and 5D6 in Fig. 12 and operates as follows.

The half-line frequency (7.8 kHz) squarewaves of opposite polarity at the collectors of the bistable transistors 5VT5 and 5VT6 are coupled via 5C29 and 5C30 to 5D5/6 in series. Therefore 5D5/6 conduct on alternate lines. Now provided the ident diode 5D8 has done its job of phasing the bistable with the ident signal, *positive* swings at 5VT6 collector (i.e. 5D5/6 conducting) coincide with *negative* swings of the ident signal. If this phasing seems the wrong way round observe that the ident signal is delayed by the integrator formed by 5RV3, 5R35 and 5C33 before reaching 5D8. The ident signal is fed to 5D5/6 junction via 5C31, where 5R32 sets the mean level to the 15V rail. If all is well therefore only negative ident swings pass through the diodes and 5R30, 5R31, and are then smoothed by 5C43 to drive 5VT8 base negative with respect to the 15V rail. This turns on 5VT8 which supplies forward bias via 5R58 to the chroma delay line driver 5VT2, enabling the chroma channel for colour reception. With this arrangement the waveforms at the outer ends of 5D5/6 are revealing since they are composed of sinewave (ident) and squarewave (from the bistable) on alternate lines.

The virtue of this circuit is that colour reception is possible only if both the ident signal is present in strength *and* the PAL bistable is correctly phased. Thus the familiar symptoms of incorrect bistable phase (green faces) should never be seen on these sets. If the transmission is monochrome only noise is gated through 5D5/6 on alternate lines: this

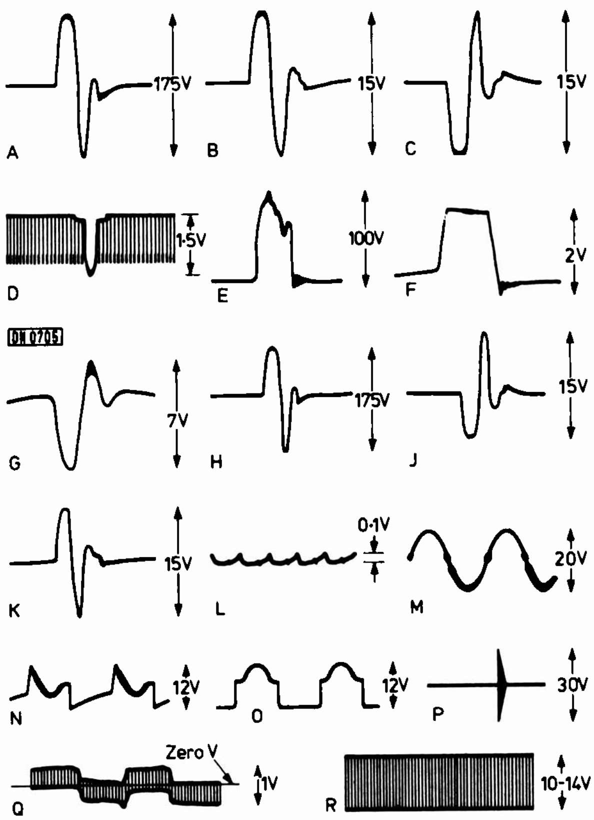


Fig. 7: Decoder and colour-difference amplifier test waveforms. A–R correspond with appropriate points indicated in the circuits.

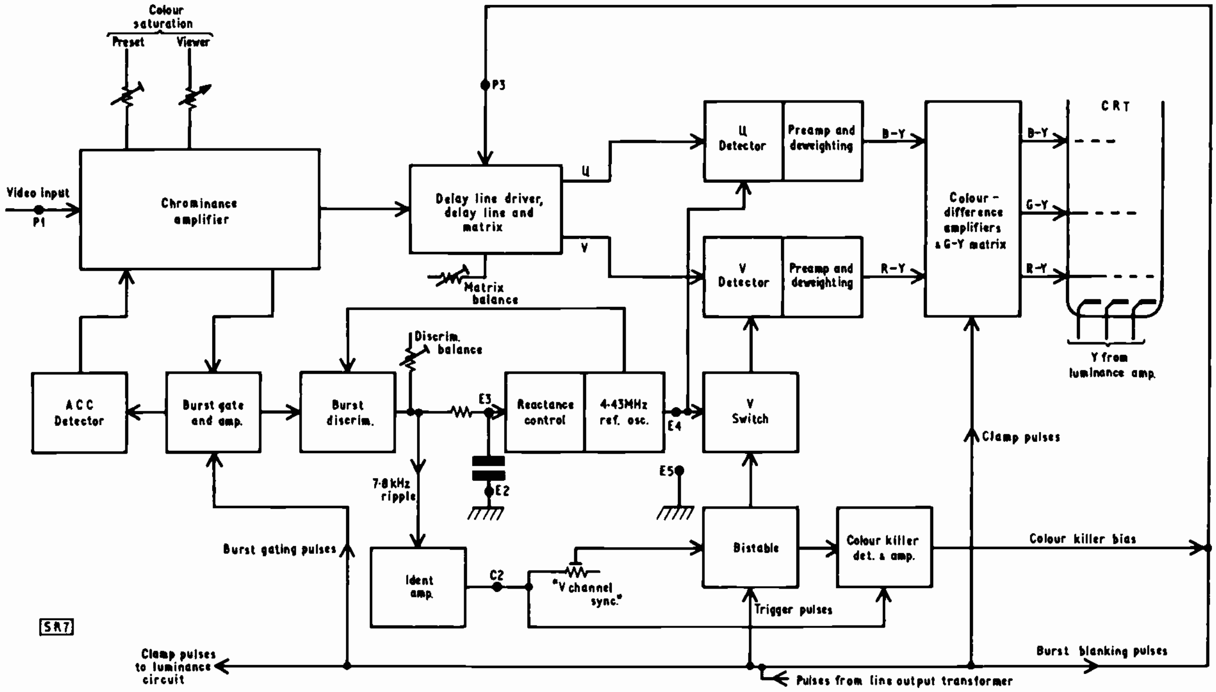


Fig. 8: Block diagram of the decoder used in the Bush/Murphy CTV25/CV2510 series.

averages to zero across 5C43 and 5VT8 does not turn on.

The weakness of the circuit is that there is little gain to spare in the colour killer so the delay line driver 5VT2 receives sufficient forward bias only if the entire decoder is aligned quite precisely to obtain a strong ident signal. Insufficient forward bias to 5VT2 can often be compensated by increasing the gain of the first chroma stage 5VT9 by reducing the setting of 5RV4 (preset colour saturation): this may explain why many of these sets show some chroma noise.

Another symptom of poor alignment common on this model is that the colour control must be turned on full to get colour to appear, whereupon the control range is normal until the channel is changed when colour is lost again. This situation arises because the burst is fed to the burst channel from a point in the chroma channel *after* the saturation control. Thus boosting the saturation can increase the burst enough to make a reluctant reference oscillator lock properly.

Tuning for maximum colour killer voltage at test point P3 is a sensitive way which does not require a scope of trimming the burst gate, discriminator and ident stages.

The proper procedure for setting up the decoder or starting fault-finding is as follows. With a 625 colour transmission tuned in and correctly synchronised connect a 15kΩ–22kΩ ¼W resistor between test points P2 and P3 on the board. This over-rides the colour killer. The same result might also be achieved by earthing 5VT8 base but this is less convenient. Locked or unlocked colour should now be seen.

Next earth test point E3. This can be conveniently done by connecting it to E2 nearby. Since this shorts out the a.p.c. potential to the reference oscillator-varactor reactance control system the colour may "flicker through" the picture too fast to be seen.

Connect a scope capable of giving some indication at 4.43MHz to the oscillator output point E4. A high-impedance voltmeter with diode probe could be used instead. Trim 6L10/6L11 for maximum output. One may run into immediate trouble here since this coil is a fragile little thing which regularly comes loose from its former or has its tiny core cracked by use of the wrong screwdriver. Fortunately replacements cost only a few bob and anyone regularly working on these sets keeps a few in stock. Other stock faults in the reference oscillator circuit include failure of one of the 560pF capacitors 6C30/32/33 any of which stops oscillation; 6VT3 being slow to start oscillating; deterioration of 6C31 which damps oscillation; 6C27 short-circuit which again stops oscillation.

Having peaked the oscillator coil tune 6TC1 so that the frequency is as nearly correct as possible, i.e. colour only just beating through the screen. A non-metallic screwdriver is essential for this. Note the unusual use of a neon lamp in the reactance control stage: it provides a stabilised 60V supply which is divided down by 6R51/53 to give reverse bias for the cathodes of both the varactor diodes 6D5/6. The controlled capacitances of these diodes form part of a resonant circuit comprising primarily the 4.43MHz crystal, trimmer 6TC1 and 6C27. The neon provides a useful sign that the 280V rail, which is also used in the timebases, is live.

If the reference oscillator is far off tune the effect on the screen can be mistaken for severe Hanover blinds and in consequence the bistable or PAL phase switch wrongly suspected. Unless blessed with a frequency counter it is tricky to know whether the frequency is too high or too low. In such a case

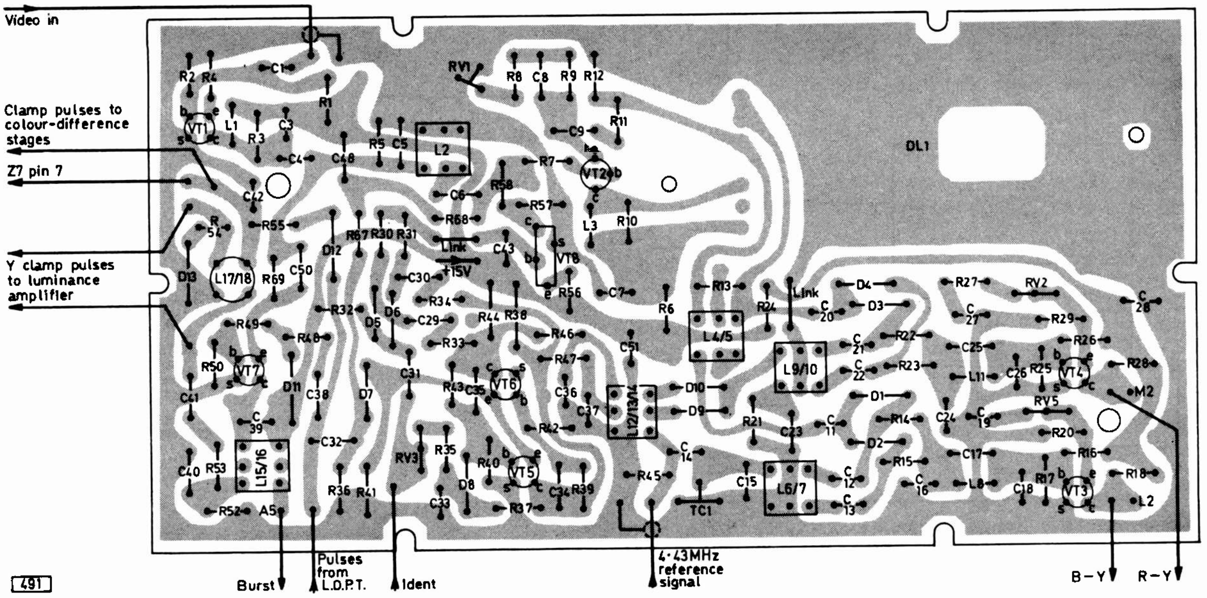


Fig. 9: Track side view of the decoder board. The components on this board are prefixed 5. Other decoder components are mounted on the colour-difference and gain-controlled chroma amplifier boards.

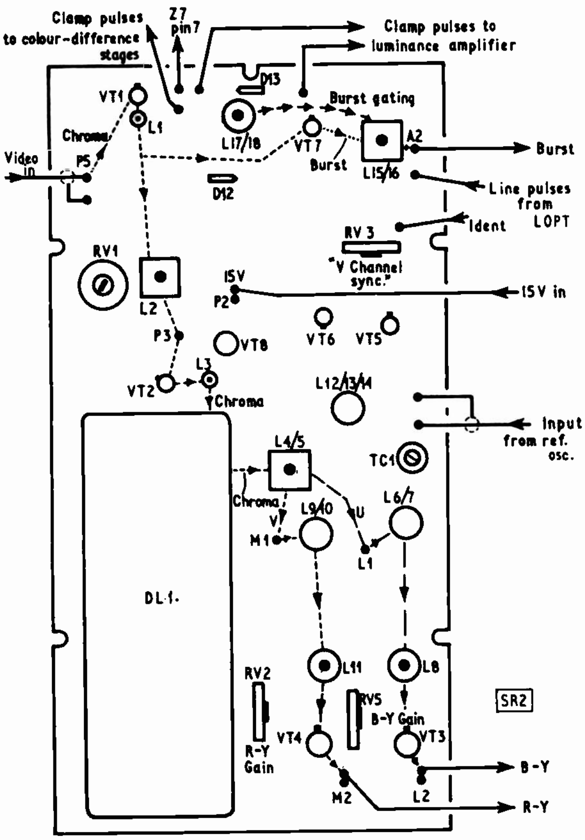


Fig. 10: Decoder board layout, component side. All components on this board are prefixed 5. Dotted lines show the signal paths.

suspect the small capacitors associated with the crystal: they have different values in some sets and

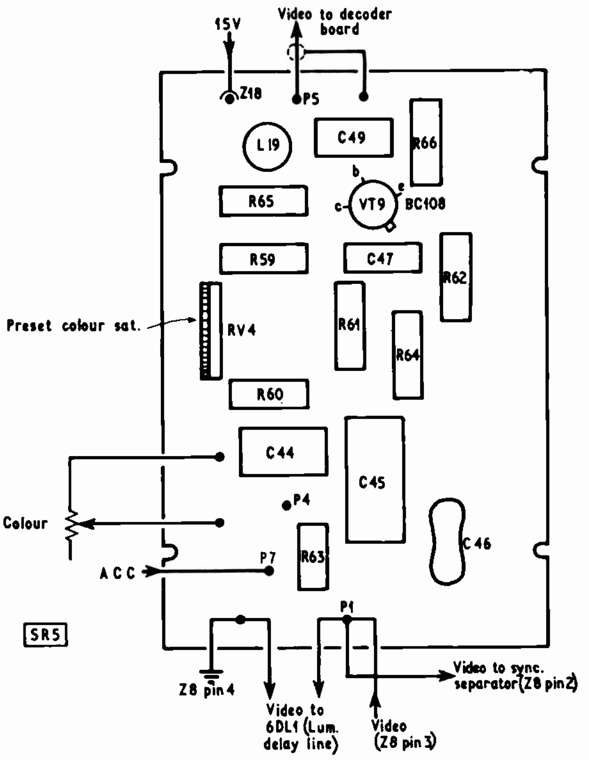


Fig. 11: Component layout, gain-controlled chrominance amplifier board. Components have prefix 5.

the same value should be used when one is replaced.

Remove the earth at E3. The oscillator may lock correctly. Now stop the oscillator by shorting its output which can be conveniently done by putting a single crocodile clip across both conductors of the

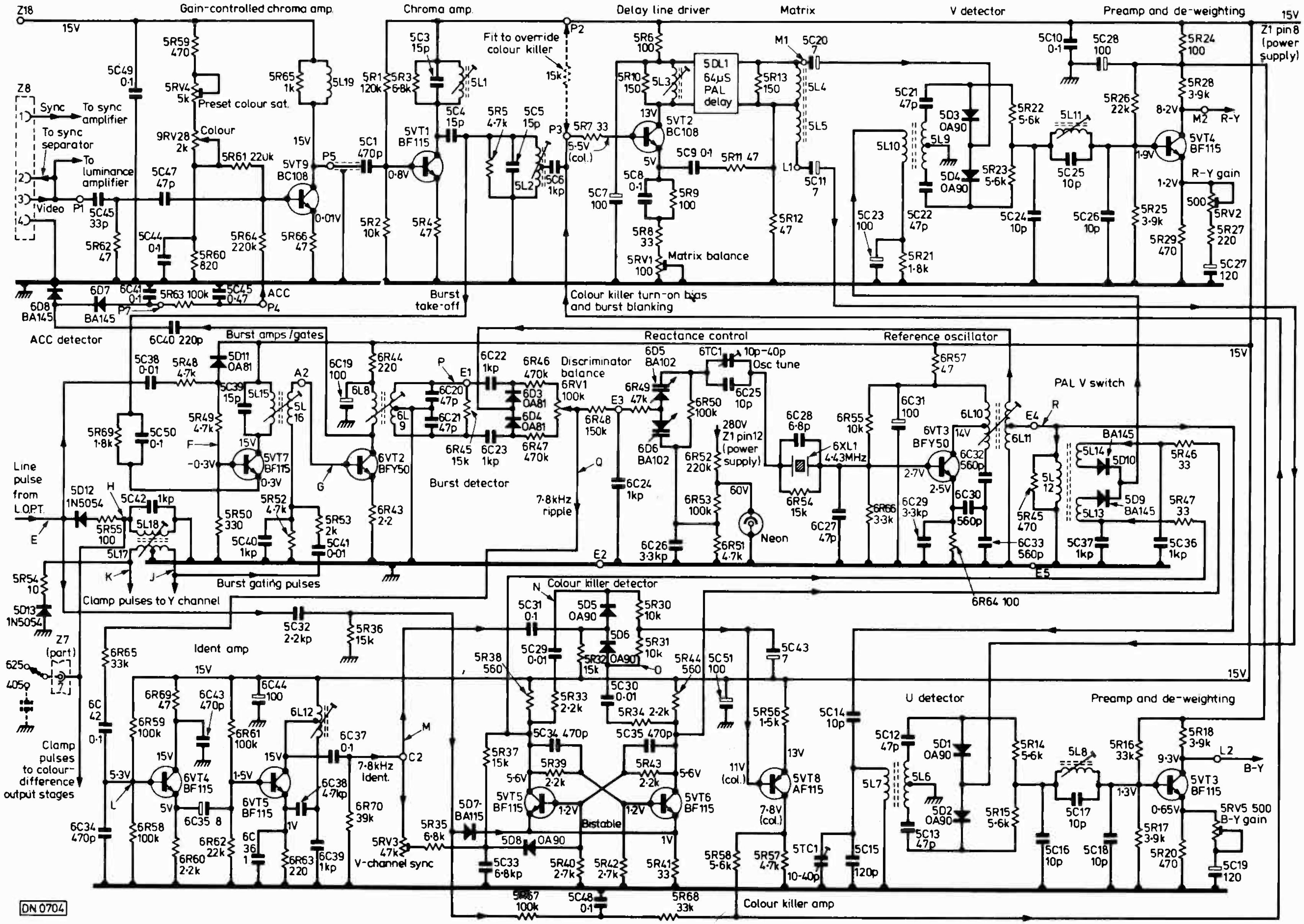


Fig. 12: Circuit diagram of the decoder.

coaxial lead at E4. This does no harm but obviously removes colour. Adjust the discriminator balance preset 6RV1 for zero volts at E3. A high-impedance voltmeter or d.c. oscilloscope should be used. Remove the meter from E3 and the short from the oscillator output: the colour should lock properly with E3 close to 0V. If the colour is in horizontal bands on the screen the oscillator is off tune and is locking to the burst frequency plus or minus a multiple of field frequency. If colour does not lock bring the preset colour saturation (5RV4 at bottom right of set) to maximum and check whether any burst is getting to the discriminator. Without a scope one can verify this by disconnecting the automatic chrominance control (ACC) lead to point P7 and checking for several volts negative on 6C41.

Failure of the burst to reach the discriminator is probably due to any of 5L15/16 (4.43MHz tuning), 5L17/18 (line pulse ringing) or 6L8/9 (4.43MHz discriminator tuning) being off tune: they can be trimmed for maximum negative voltage on 6C41 or the strongest ident signal. If they are changed much the discriminator may need rebalancing. If the burst gating is erratic suspect 5R55 which changes value —a higher wattage replacement should be used. Also watch out for different layouts of the burst gate circuit on different sets: older models have a diode which can go short-circuit at 5VT7 collector.

With the colour locked there should be a healthy ident sinewave at test point C2 with the burst points visible ideally at its mid-points. Set 5RV3 ("V channel switch sync") fully clockwise (from rear of set) so that the ident signal is unable to phase the bistable. Interrupt the signal a few times until the colours are incorrect. Very slowly turn 5RV3 anticlockwise until the bistable phases correctly, but no farther. Remove the 15kΩ colour killer over-ride resistor since the colour killer circuit should be supplying a positive voltage to P3. Trim 6L12 for maximum voltage here.

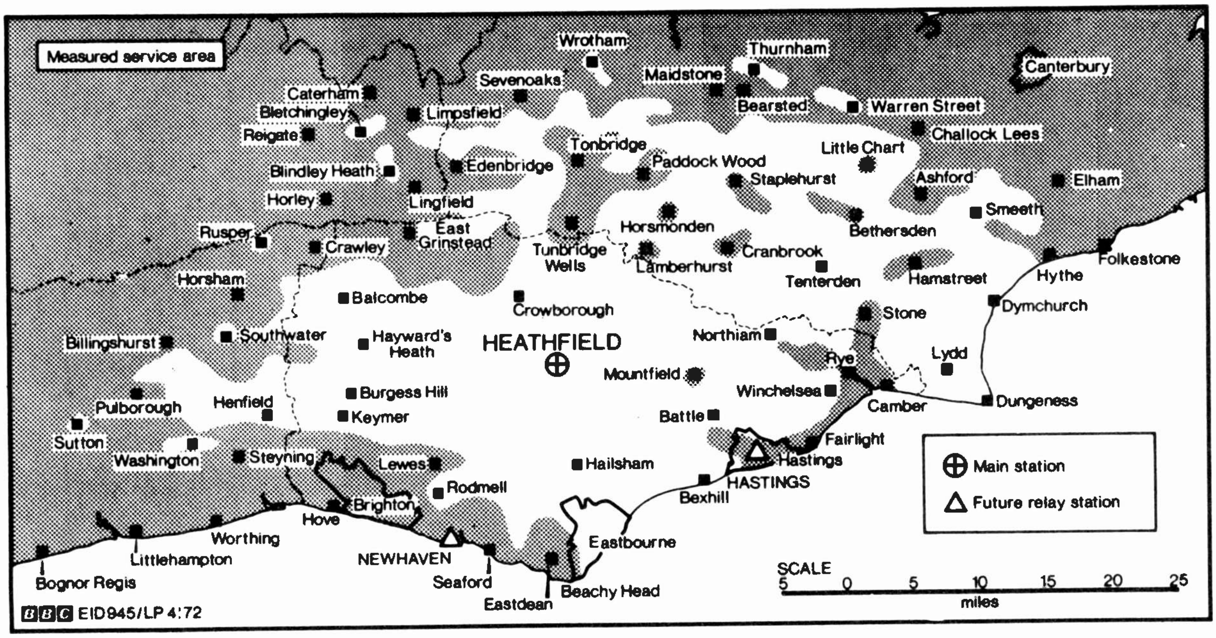
In the ident amplifier circuit 6C35 can fail causing weak or zero ident. In the colour killer circuit 5C43 deteriorates causing no colour or colour slow to come: this failure is probably due to the continuous a.c. passed by 5C43 and the reverse bias it receives if the bistable is out of phase. Also 5VT8 can fail giving of course no colour.

The earth lead from the c.r.t. shield to the c.r.t. base *must always be in place* to provide a path for flashovers in the tube: bitter experience suggests that if it is not in place the bistable and the sync separator transistors are always among those to go at the first flashover.

The 100V pulse from the line output transformer entering at the left of the decoder circuit does a lot of jobs. It is clipped by 5D11 to perform rough burst gating in 5VT7. It causes the tuned circuit 5L18/5C42 to ring and supply a positive burst gating pulse to 6VT2 on the backswing, a high-voltage positive clamp pulse to the clamp triodes in the colour-difference output stages and both positive and negative clamp pulses to the luminance amplifier clamp. The line pulse is also differentiated by 5C32/5R36, the rising edge giving a positive pulse which triggers or "toggles" the bistable via 5D7. Stopped bistables have been due to a faulty 5C32. The falling edge produced by the differentiation provides a negative pulse which is stretched by 5R67/5C48 and added to the colour killer voltage to blank out the burst which would otherwise appear as a vertical band of misty colour on the screen.

TIMEBASES & POWER SUPPLIES NEXT MONTH

HEATHFIELD UHF SERVICE AREA MAP



*The approximate service area of the **Heathfield** u.h.f. transmitter is indicated by the unshaded part of the above map. Channels are BBC-1 49, BBC-2 52, ITV 64, fourth 67. Polarisation horizontal, receiving aerial group D, maximum vision e.r.p. 100kW. Map courtesy BBC Engineering Information Service.*

THE 'TELEVISION' COLOUR RECEIVER PART 9 CONVERGENCE BOARDS

PUTTING the convergence boards together is more of a mechanical than an electrical problem. In the main this is due to the varied lengths of the controls used in the convergence circuitry. The inductors are the longest while the convergence potentiometers are the shortest. The result is the necessity for *three* boards (see Fig. 6) mechanically mounted together.

The design has been simplified as far as is possible to minimise the number of board interconnections. However some care must still be taken to observe the directions given. The result is a convergence and drive adjustment control panel which has all the controls at the same level.

General Arrangement

The three circuit boards are mechanically linked and held at the required heights by the use of 2BA studding; the complete subassembly is mounted on a hardboard base. The control panel—which will be commercially available later—is suspended between wooden battens in the convergence drawer. The spaces left on either side of the battens are hardboard filled to give an almost flat drawer surface. The general arrangement of the assembly is shown in Fig. 6 but we will look at this in more detail later.

The Inductor Board

The layout of board no. 1 is shown in Fig. 1. In addition to the inductors and the transductor there are only a few components on the board and these few should be mounted first—after the board is drilled. The inductor pin holes should be $\frac{1}{16}$in. while 2BA clearance holes should be made at the four marked positions near the board corners. 2BA clearance is just $\frac{3}{16}$in. but if you are a little unhappy or unsure about the drilling position use a $\frac{7}{32}$in. bit. The clearance holes for the other components can be $\frac{1}{32}$in. except for the test point sockets which should have $\frac{1}{16}$in. clearance.

Drill six $\frac{3}{32}$in. holes for the edge connections A-F. Bend over the leads on R422, C405 and C406, insert them in the correct positions and solder down with R422 standing off the board by about $\frac{3}{16}$in.

The inductors on the board can be identified by appearance and marking. The CCF800 centring choke L401 has a 6-pin base and no variable core. L402, L405, L406 and L408 are similar in appearance to one another with 5-pin bases and the type suffix is marked on one side of the base: i.e. 50, 75 or 77 to indicate AT4040/50 or /75 or /77. The remaining two inductors are mounted on board no. 2.

Each inductor should be inserted into the board in turn and pushed down as far as it will go so that it is resting on the corner plastic lugs. If you are happy that it is standing upright solder it down.

Then insert the transductor (AT4041/07) and solder down on the board. Note that this component is not reversible because of the assymmetric pin spacing.

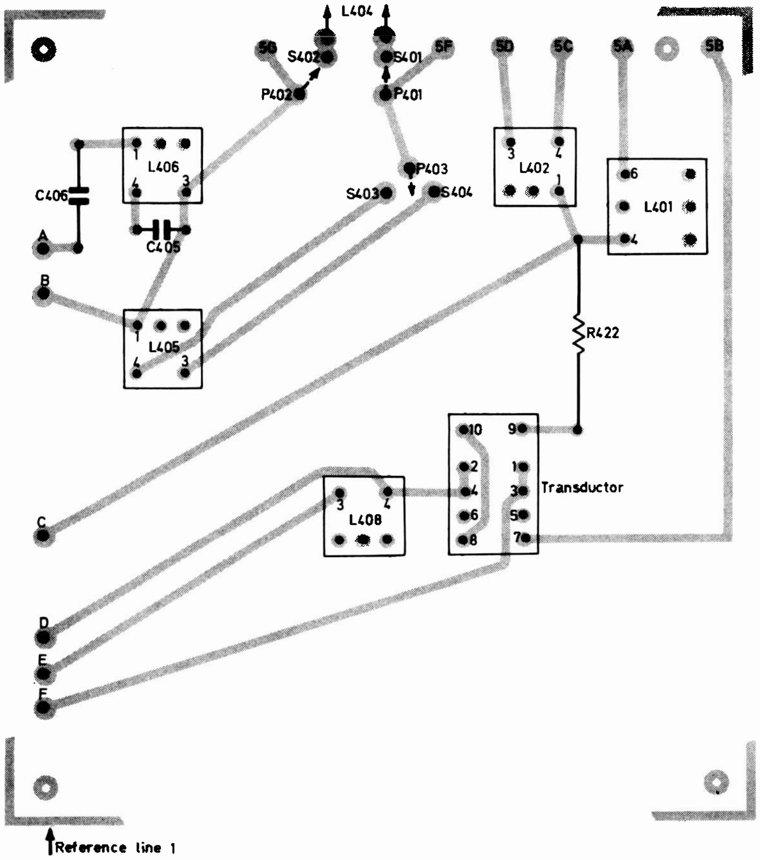
The last items to be inserted are the test point sockets and plug leads. Mount the four sockets first, making sure that the bent-over connecting lug makes good mechanical contact before soldering. Each of the three plugs can then be soldered to short insulated wire lengths—say $2\frac{1}{2}$in. each—and the free ends cleaned off for about $\frac{1}{4}$in., inserted through the board and soldered.

Before leaving board no. 1 cut off any surplus wire ends and protruding base connecting pins to leave the underside of the board as clean and free from obstructions as possible. The reason for this is that the board has to rest on the base of the subunit and the heights allow for very little "solder-blob" space under the board itself.

The Potentiometer Board

The potentiometer board (board 2) is rather more complicated and because of the mechanical layout it is essential that all holes are drilled before assembly is attempted. Drill the four corner mounting holes first (2BA clearance again), the $\frac{1}{8}$in. mounting holes for the potentiometers (as indicated on Fig. 2) and then holes for the potentiometer knobs to pass through the board—$\frac{5}{16}$in. Then move to the hole ($\frac{3}{16}$in.) through which the linearity adjuster can be moved, the $\frac{1}{16}$in. holes for the printed-circuit slide switches and the $\frac{1}{32}$in. holes for the component leads. A few of the capacitors will require $\frac{1}{16}$in. rather than $\frac{1}{32}$in. holes: check against the components supplied. Drill the nine $\frac{3}{32}$in. edge connector holes A-J.

The convergence potentiometers can be mounted first. Insert these through the board from the plain paxolin side with the knob, the connecting pins and the mounting pins all protruding through on the copper side. It is the copper side that is the upper side of this particular board when it is all mounted and of course the knobs then point upwards. Note that the convergence potentiometers will be supplied with the connecting tags horizontal. They should be carefully bent upwards in the same direction as the knob before the unit is inserted through the board.



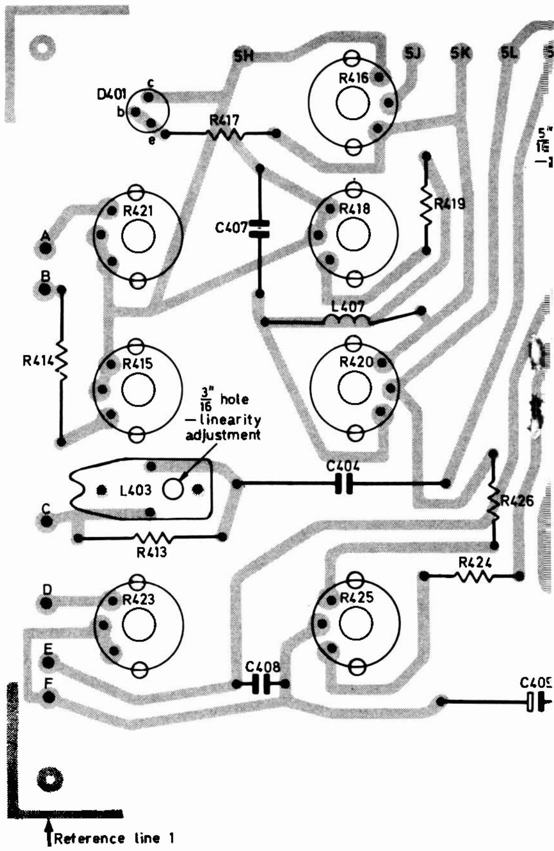


Fig. 1 (left): Layout of the inductor board. Fig. 2 (centre): Layout of the potentiometer board. Fig. 3 (right): Layout of the (see Fig. 6) the copper side of board 2 faces upwards while the copper sides of boards 1 and 3 face downwards. All boa

Do not try to force the potentiometer too far through the holes. If the correct drill has been used for the mounting lug holes there should be a resistance at the correct point at a "cheek" on each of the lugs.

With the potentiometers in place the mounting lugs should be bent over against the board to secure them and each of the three connecting tags should then be soldered down. There is no necessity to solder the mounting lugs if they have been bent over hard enough: this will ease potentiometer replacement should it ever be necessary.

With the thirteen potentiometers in place move on to the linearity control L403. This is mounted on the plain side of the board so that in the final assembly it points downwards. Mount the control so that the aperture of the movable magnet is visible through the already drilled hole in the board. Solder down the two connecting points on the control and the two mounting pins at each end.

Then move on to the fixed components—the resistors, the capacitors and the choke L407. Note that the resistors must not be mounted flush against the board: a space of about $\frac{3}{16}$in. should be left so that heat from them passes to the surrounding air. All these components are inserted through the board from the plain side but will be upside down in the completed unit. Note the polarity of the electrolytics carefully: C411 is a reversible type and it is immaterial which way round this one is mounted. If you are collecting the components individually rather than buying the packs note that if a reversible electrolytic is not available you can achieve the same result by connecting two ordinary 32μF electrolytic capacitors in series with the negative ends connected together. Note also that the rating given in the Components List for C404 is the *a.c. rating*. This must also be a high-quality capacitor in terms of leakage. If you use a capacitor which does not have

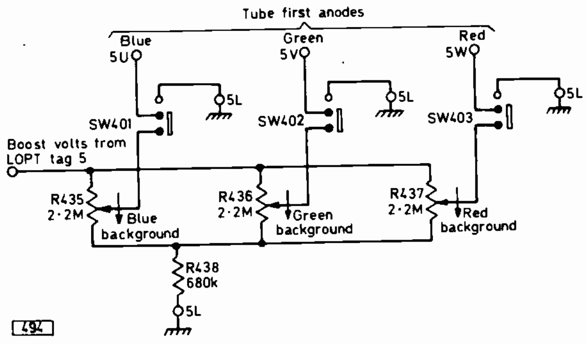
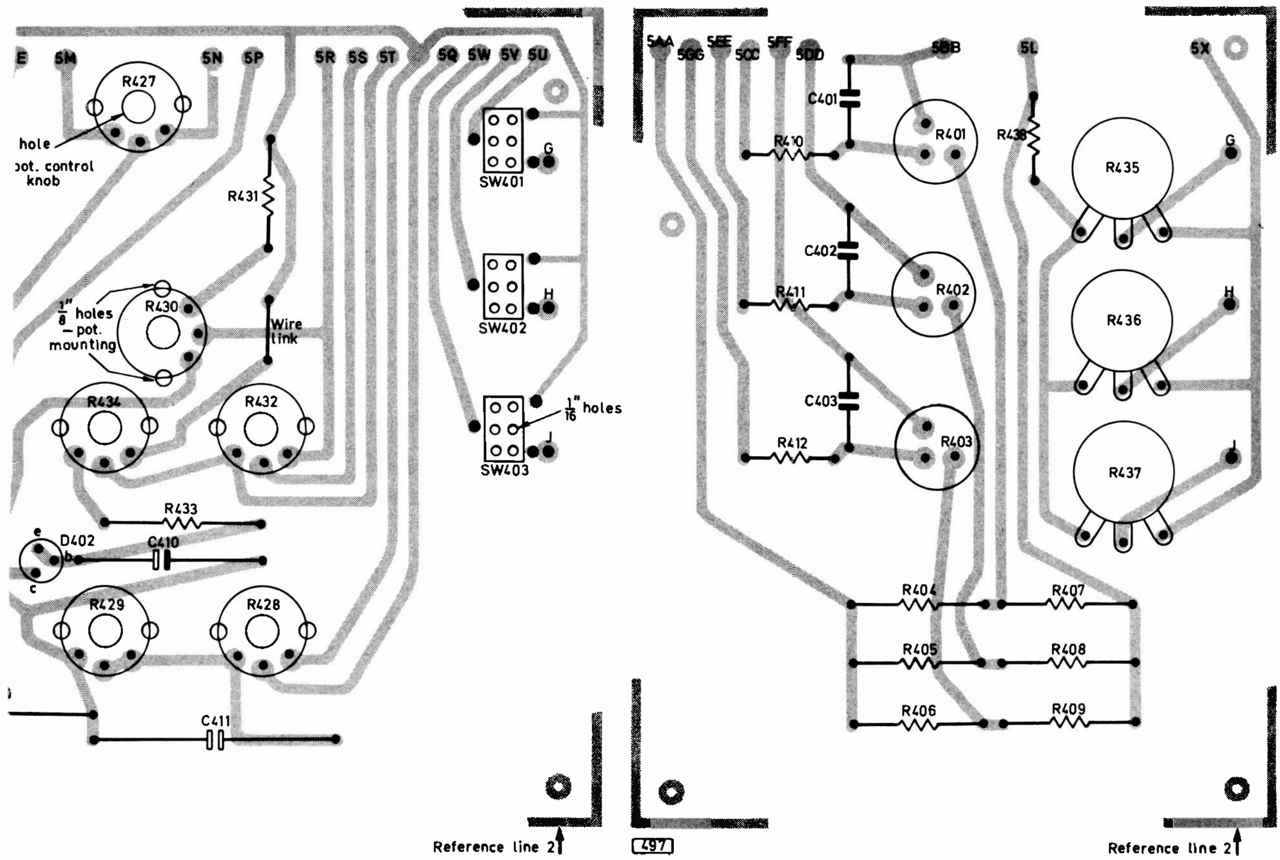


Fig. 4: Tube first anode supply circuit, incorporating the background presets R435–R437.



drive and background controls board. All boards are shown viewed from the copper side; note that in the final assembly
rd dimensions are indicated in Fig. 6.

an a.c. rating quoted the d.c. rating should be at least 600V.

The two "diodes" D401 and D402 can be mounted next, from the plain side of the board again. If the NKT279T is supplied instead of the AC128 note that the emitter and base leads are already spot-welded together—one board hole is redundant in each case therefore.

The only other items left on this board are the slide switches. These are inserted through the pre-drilled holes from the *copper* side of the board so that the toggles are on the operating side. The pins should be bent hard over against the back of the board so that each switch is secured mechanically.

A wire link should then be taken from *each pair* of switch contacts across and through the board to be soldered on the copper side. A good stiff wire link in each case will further enhance the mechanical security of the switch fittings. This manoeuvre is necessary because it is well nigh impossible to solder the switches on the copper side of the board.

Drive and Background Board

The arrangement of the third board is shown in Fig. 3. This carries the basic circuitry of the RGB drive level controls and the tube first anode "background" preset controls.

The circuit of the background presets is shown in Fig. 4. The boost potential from the line output transformer is fed in at point 5X on the board to three separate potential divider chains—R435, R438; R436, R438 and R437, R438. These make it possible to adjust the potential on each of the shadowmask tube first anodes in order to set up accurately the cut-off point of each gun during alignment. For this purpose a beam switch is fitted in the feed to

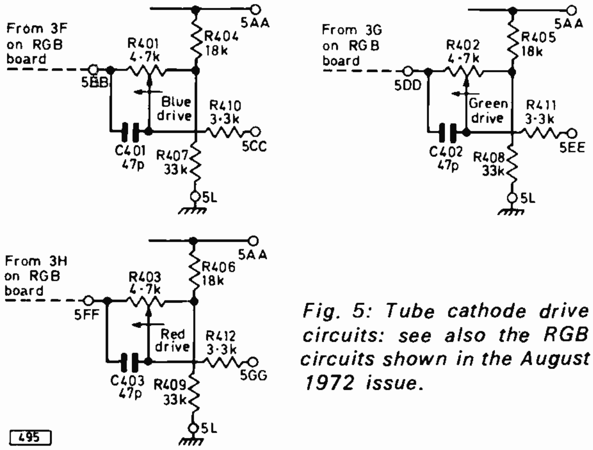


Fig. 5: Tube cathode drive circuits: see also the RGB circuits shown in the August 1972 issue.

Table 1: Components List

Component-Pack 16

L401 Centring choke (CCF800)
L402 R/G Line Symmetry (AT4040/77)
L403 Line Linearity (AT4042/02)
L405 Blue Lateral Amplitude (AT4040/75)
L406 Blue Line Shape (AT4040/75)
L407 180μH R/G Choke
L408 Pincushion N–S Phase (AT4040/50)
Transductor (AT4041/07)

Note: Blue Lateral Unit AT1025/05 or AT1025/06 supplied with later Pack.

R413 1·5kΩ 2½W W.W.
R414 2·2Ω, 4W
R415 10Ω pot.
R416 10Ω pot.
R417 8·2Ω 2W
R418 7Ω pot.
R419 1·5Ω 2W
R420 5Ω pot.
R421 10Ω pot.
R422 120Ω 4W
R423 15Ω pot.
R424 330Ω 1W
R425 1kΩ pot.
R426 390Ω 1W
R427 5Ω pot.
R428 20Ω pot.
R429 500Ω pot.
R430 7Ω pot.
R431 3·3Ω 2W
R432 200Ω pot.
R433 4·7Ω 2W
R434 5Ω pot.

Note: Potentiometers are special types for convergence use.

C404 680nF 280V r.m.s. wkg
C405 100nF 250V
C406 1μF 250V (non-electrolytic)
C407 470nF 250V
C408 47nF
C409 400μF 40V electrolytic
C410 160μF 25V electrolytic
R435 2·2MΩ 1000V insulated pot.
R436 2·2MΩ 1000V insulated pot.
R437 2·2MΩ 1000V insulated pot.
R438 680kΩ ½W

C411 16μF 63V reversible electrolytic (15μF may be supplied)
D401 AC128 or NKT279T (emitter and base already connected)
D402 AC128 or NKT279T (emitter and base already connected)
SW401–SW403 DPDT switches (p-c mounting)
1ft. length 2BA threaded rod
30 off 2BA nuts
30 off 2BA washers
2 off 2BA bolts

Component-Pack 17

R401 4.7kΩ 2W 5% p-c mounting, at least 500 turns resolution
R402 as R401
R403 as R401
R404 18kΩ 2W
R405 18kΩ 2W
R406 18kΩ 2W
R407 33kΩ 2W
R408 33kΩ 2W
R409 33kΩ 2W
R410 3·3kΩ ½W
R411 3·3kΩ ½W
R412 3·3kΩ ½W

All resistors (fixed) are 5% carbon film.

C401 47pF 400V
C402 47pF 400V
C403 47pF 400V

Above are low-inductance types.

IC TAA550
S401 – S404 test-point sockets (p-c mounting)
P401 – P403 test-point plugs
"00" printed-circuit fuseholder

Suppliers

No. 16 Forgestone Components, Low Street, Ketteringham, Wymondham, Norfolk.
Cost: £11.35 including postage.

No. 17 East Cornwall Components, PO Box No. 4, Saltash, Cornwall, PL12 4AL.
Cost: £3.20 including postage.

Printed Circuit Boards (⅛in.):
E. J. Papworth & Son Ltd., 80 Merton High Street, London, SW19.
Cost: £3.25 including postage.

each first anode (the slide switches mounted on board 2). It is not always necessary to have a red background adjustment but we have provided this because when used correctly it can give a slightly better overall picture.

The feeds from the first-anode presets do not pass direct to the tube from 5U, 5V and 5W: they are applied via current limiting resistors and of course have spark-gap protection on the tube base.

The drive circuit which terminates the RGB channels is repeated in Fig. 5. This diagram should be compared with the circuit of the RGB matrix and output stages in the August issue. This month's circuit indicates the connection point numbers used on this board.

Board 3 should first of all be drilled with the usual 2BA clearance holes at the corners as marked in Fig. 3 and the component holes—$\frac{1}{16}$in. should be used for all these.

Then drill the three $\frac{3}{32}$in. board interconnection holes G-J.

On this board the fixed resistors can be mounted first. The copper in this case is on the lower side after mounting so the components are all on the upper, plain surface. The resistors should again be mounted a little distance off the surface of the board to prevent board damage. Put in the 47pF capacitors next and then move on to the potentiometers. Note that the stability of the RGB output stages is *absolutely dependent* on the quality of these few com-

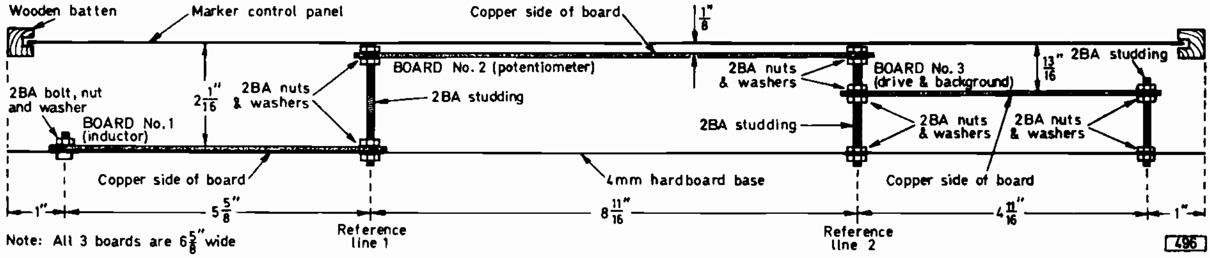


Fig. 6. Assembly of the three convergence boards on the hardboard base.

ponents and that the h.f. peaking has been evaluated for the potentiometers supplied for R401—R403 in Component-Pack 17. The fixed resistors must be carbon-film types and the 47pF capacitors low-inductance types. The drive potentiometers are for printed-circuit mounting and can be inserted directly into the board and soldered on the copper side. Try to avoid too much heat being transferred along the connection pins when soldering.

The background potentiometers are a rather different story. They are tag-ended types and must be both mechanically secured and electrically connected. We suggest that they are glued to the board with Evostik. Do this with the tags sitting above the holes through which the interconnections are made to the board. Wire up the potentiometers after allowing a reasonable drying period, using a fairly heavy gauge wire. It is most important that the potentiometers are mounted at the correct positions on the board so that the spindles will pass through the appropriate holes on the control panel.

Complete Assembly

The layout of the three-board assembly is shown in Fig. 6 which indicates how the boards are connected together mechanically. You must first cut a piece of hardboard—we suggest 4mm. thickness—$6\frac{5}{8}$in. wide by 21in. long. Mark off lines along the length at 1in., $6\frac{5}{8}$in., $15\frac{5}{16}$in. and 20in. from the left-hand side.

Lay board 1 on the hardboard with the left-hand front securing hole on the 1in. line. Mark the mounting hole positions at both ends of the board and make 2BA clearance holes. Then mark and make mounting holes along the $15\frac{5}{16}$in. and 20in. lines. At the left-hand end secure board 1 with 2BA bolts, with the head under the hardboard.

Next cut the studding provided—use a Junior Hacksaw—into the correct lengths. When doing this always have a nut on *each* side of the cutting point so that the rather rough cut ends can be burred off by unscrewing the nuts from the cut ends of the thread. Four lengths of $2\frac{1}{4}$in. and two of $1\frac{1}{8}$in. should be cut.

Insert two of the longer lengths at the right-hand end of board 1 with just enough thread below the hardboard surface to take a nut and washer. The board is secured on top by tightening down a further nut and washer.

Next screw a nut down the studding from the top so as to leave just $\frac{3}{16}$in. of thread. Drop a washer down each of the pieces of studding to rest on the nuts. Repeat the stud mounting at the $15\frac{5}{16}$in. length and the 20in. length points. In these two cases however the nut and washer are put on to leave $1\frac{1}{8}$in. and $\frac{3}{16}$in. of threading respectively. Board 3 is then wriggled on to the right-hand nest of four studs and securing washers and nuts tightened down on the board. The potentiometers on board 3 should of course point upwards.

On the studs at the $15\frac{5}{16}$in. length a further nut is screwed down to leave just $\frac{3}{16}$in. of thread. The centre board—board 2—can then be eased down on to the four nuts and washers which support it. This board must of course be mounted so that the potentiometer and switch controls face upwards, i.e. with the copper side on top. Insert locking washers and nuts to lock the centre board in position.

If there is any lopsidedness in the mounting of the boards this should be taken up by small adjustments of the nut positions. Any threading left on the studs at the corners of board 2 should be sawn off so that there is a flat surface for the control panel to lie on.

Finally make the interconnections between the three boards (A-F and G-J) using lengths of 16 s.w.g. tinned copper wire soldered to the copper side of the boards. To allow the joints to be made on board 1 the hardboard base will have to be temporarily removed.

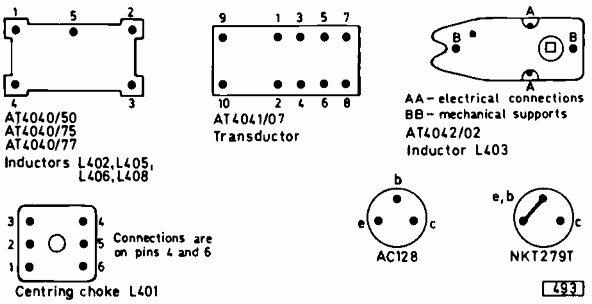


Fig. 7: Component base connections, viewed from below.

Layouts

As usual master layouts will be available from the magazine offices for those making their own boards. The charge is 10p and requests should be accompanied by a large stamped, addressed envelope.

Sets of blank boards ($\frac{1}{8}$in. thick) are available from Servitronix Ltd., 26 Killarney Road, London SW18 at £1.40 including post and packing.

Next Month: We construct the aerial input and tuner panel and look at the wiring of the push-button channel unit. We also construct the power supply for the receiver.

SERVICING television receivers

L. LAWRY-JOHNS

PYE GROUP 368 CHASSIS

THIS chassis is used in a large number of Pye group receivers including the **Pye** Models 58, 59, 62, 63 and 64, **Ekco** Models T520 and T521 (and with different tuners the T524 and T525), **Ferranti** Models T1173, T1174, T1175 and T1176 and **Invicta** Models 7348 and 7045. The presentation and layout follow the style of the earlier 40F series covered in this journal in 1970 (October and November issues) but there are many circuit differences and no further reference will be made to these earlier models.

The system switch is operated by a solenoid controlled by switches SW3 and SW5. It is well worthwhile studying the action of the switch selector as one is often asked to change the factory-set combination of four 405 and two 625 channels (two BBC-1 on 405, two ITA on 405 and two Band IV or V channels on 625). This is done by altering the selectors on the front and rear cams, the front selector knob being removed by depressing the spring loaded-key from the inside of the cabinet. Full details will be given next month.

Power Supply Circuit

The power supply circuit follows a fairly conventional pattern with two diodes, one for h.t. (BY127) and the other (giving a negative feed) for the heaters and the transistor supply (BY126). There are two fuses, one in the mains supply (1A delay) and the other in the solenoid circuit (1A)—this latter one however is not fitted on all chassis. It should be realised that it is essential to fit a delay fuse in the mains supply as there is a considerable load imposed at switch-on and this would melt a quick-blow 1A type.

The weak link in the supply circuit is the mains filter capacitor C64 which seems to short out at the drop of a hat, shattering the mains fuse in no uncertain manner. If the fuse is found blackened, denoting a very heavy current flow, this capacitor (rated at 400V a.c.) is most likely to be the cause even if no short is revealed by an ohmmeter test. Another thing which can shatter the fuse is a direct h.t. short. This happily doesn't occur very often. The BY127 sometimes shorts to produce these symptoms: this will be shown up by a cold ohmmeter test of its back-to-front resistance.

Things are a little more awkward when the BY126 shorts. This does not blow the fuse but there will of course be no sound or vision signals as the transistor supply will be shorted at C63 while pin 8 of the c.r.t. base will be at chassis potential instead of about 20V negative—thus all the heaters will be glowing excessively indicating the cause of the trouble.

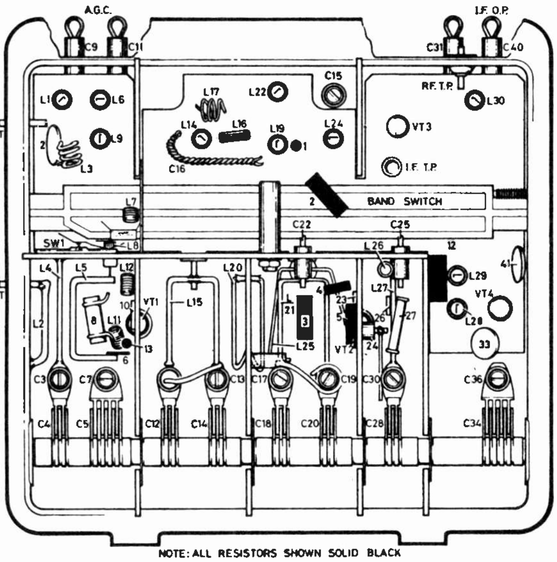


Fig. 1: Internal view of the tuner unit.

The Tuner Unit

The tuner unit (Fig. 1) is likely to cause headaches due to its necessarily complicated construction. Since it operates at both v.h.f. and u.h.f. it cannot be tackled in the straightforward manner that can be adopted with a tuner designed to receive u.h.f. only. As usual it is the first transistor VT1 (BF180) which comes to grief more often than the others. This functions as r.f. amplifier on both v.h.f. and u.h.f. so a serious or complete loss of signals on both systems should direct attention to it. If a quick injection of signal at the collector shows more response than the same signal applied to the base the transistor should be changed. If this is not the case check the aerial sockets and cable terminations before proceeding.

VT2 is not used on v.h.f., functioning as oscillator-mixer on u.h.f. only. One of the habits of a transistor (in this case a BF181) used for this purpose is that it operates more happily with a higher frequency signal than a lower one. For example if BBC-2 is on channel 33 and IBA is on 23 the former channel may be received without fault for

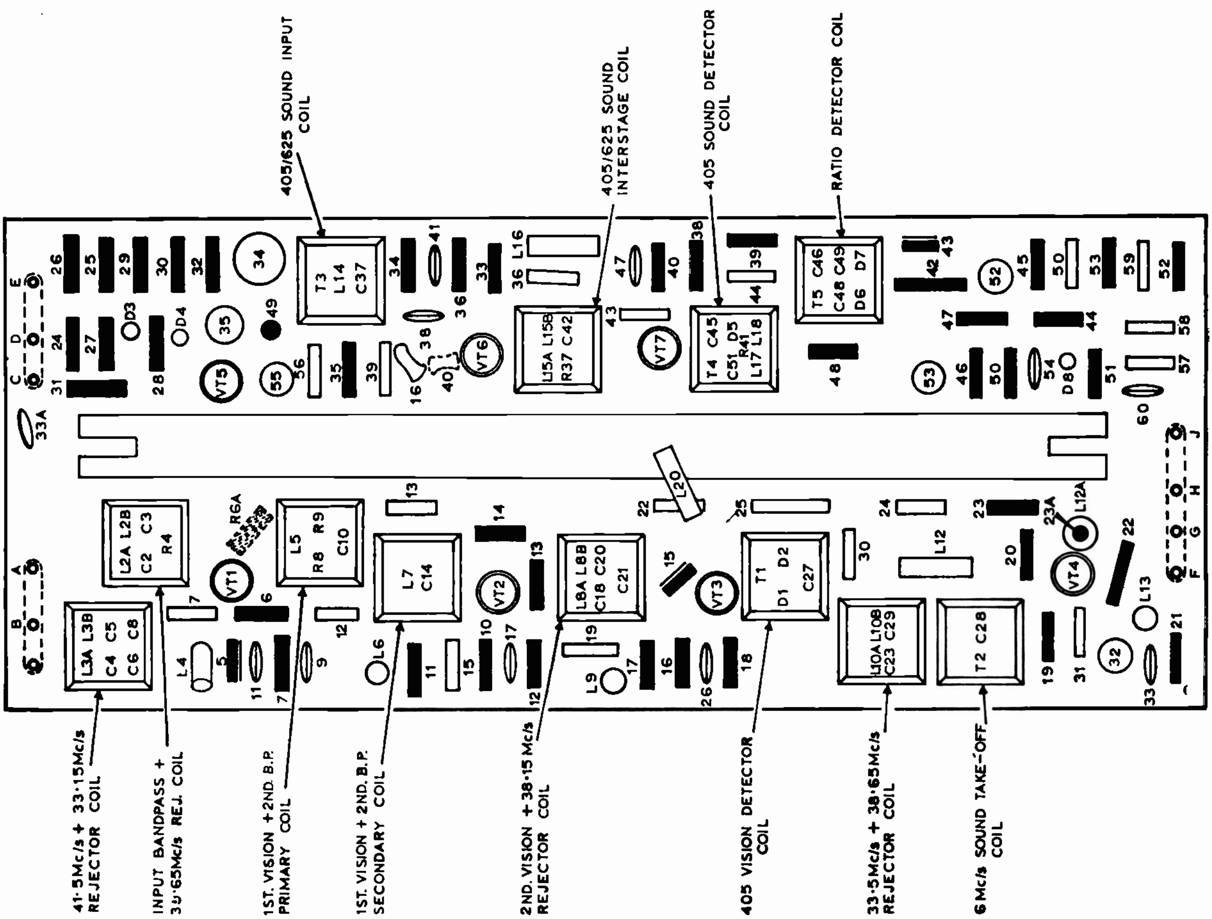


Fig. 2: Component layout on the i.f. deck.

hours whilst the latter channel may be received for perhaps only a short time; changing to a higher channel may restore signals for a short period after the tuner is reset to channel 23. A replacement oscillator transistor will nearly always clear up this irritating fault.

VT3 and VT4 rarely give trouble. VT3 is used on both standards but VT4 is used on v.h.f. only as oscillator.

The tuning spindle carries double the number of gang capacitors, thick for v.h.f. and thin for u.h.f. It is an unfortunate fact that eager little (?) hands can easily cause one or more of the vanes to foul so that the signals are shorted at that point. A good light and a pair of short-sighted eyes will reveal the gangs that are clear through their rotation and those that foul.

The IF Strip

There are five i.f. amplifier transistors in the i.f. strip plus a video phase splitter (VT4) and an a.g.c. transistor (VT5). If trouble is experienced on this unit note the function and position of each transistor then check the switch contacts, the voltages, the pre-set controls and the transistors.

405 sound is handled by VT1, VT2, VT6 and VT7.

405 vision is handled by VT1, VT2, VT3 and VT4.

625 sound is handled by VT1, VT2, VT3, VT6 and VT7.

625 vision is handled by VT1, VT2, VT3 and VT4.

Thus if the 625 vision is weak or absent but the sound is good check VT4 onward to the PFL200.

If there is little or no sound or vision on 625 switch to 405 and if there is then sound but no vision check VT3, D1 etc.

If there are no sound or vision signals on 405 check the a.g.c. circuit, VT1, VT2 and inject an i.f. signal at A to verify that the fault is in the i.f. strip and not in the tuner.

To check that the a.g.c. circuit is functioning note the following voltages (with no signal input, the present contrast control R75 set for maximum gain and 405 selected): VT5 collector 17.5V, base 16.74V, emitter 17.6V; with R75 turned to minimum gain these should become 3.15V, 17.3V and 17.75V respectively. Note that these readings are negative with respect to chassis.

The Video Stage

V13 (PFL200) is used as the video amplifier and sync separator. A poor picture or a picture which

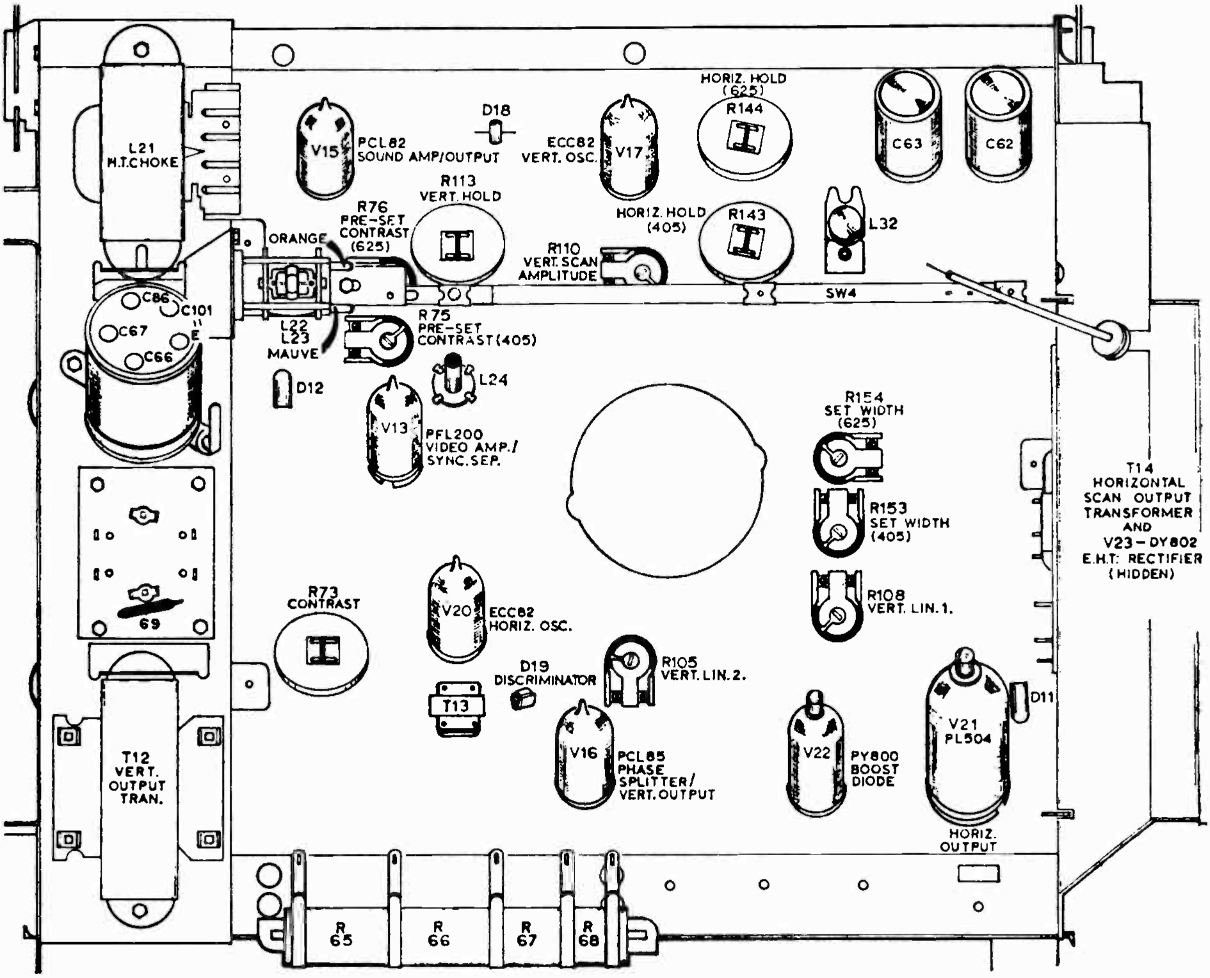


Fig. 3: Rear chassis view.

is difficult to lock should direct attention to this valve although it does not generally speaking give a lot of touble. A point to watch out for is when this trouble is experienced and the contrast control R73 and screen feed resistor R72 both overheat. This is due to the video anode load resistor R74 (3.3kΩ) becoming open-circuit. When this happens the contrast control can be damaged and all three items may have to be replaced. If the picture is quite good but the sync is poor check R120 (33kΩ) which is rather small: use a 1W type for the replacement.

The Line Output Stage

The line output stage can be expected to give a little trouble but not a lot. The PL504 lasts quite well as does the PY800 (except for the occasional sparking which will necessitate replacement). Resistors R155 and R156 (both 3.9MΩ) will certainly change value however, causing lack of width which worsens as the resistors age. They are on the right-hand side, coloured orange, white, green, and are easy to replace. The resistors R157 and R158 (330kΩ on early chassis, 470kΩ on later ones) feed the tube first anode and the height control. They do not often change value but R109 in series with the height control does: we will talk about this later.

We are often asked to supply the type number of the width circuit v.d.r. as this is not given on a lot of circuits. The one used in these models is the Mullard type E298ED/A265 which is a piece of information you will probably not have to use.

Capacitor Troubles

There are three capacitors which can cause trouble in the line output stage. The first is the boost reservoir capacitor C118 (0.1μF, 1kV) which can short causing non-operation of the line output stage: removing the top cap of the PY800 will bring the timebase to life if this capacitor has shorted (or if there is a short between the windings of the line output transformer, but don't let's think of that!). The other two are the S-correction capacitors C122 and C123. Both are in series with the scan coils on 625 lines but only C123 is in circuit on 405 lines. A degree of horizontal displacement with vertical lines down the left side is characteristic of a shorted S-correction capacitor.

CONTINUED WITH CIRCUIT DIAGRAM NEXT MONTH

UHF AERIAL preamplifier

HALVOR MOORSHEAD

IDEALLY an aerial amplifier should not be used: if the signal is weak a more elaborate aerial array should be employed. This ideal is not always practical however as there are limits to aerial size and height. But before resorting to the use of a preamplifier the more conventional methods of improving the signal should be tried. These include using a higher gain aerial, increasing the aerial height above ground level and using the shortest possible run of feeder cable.

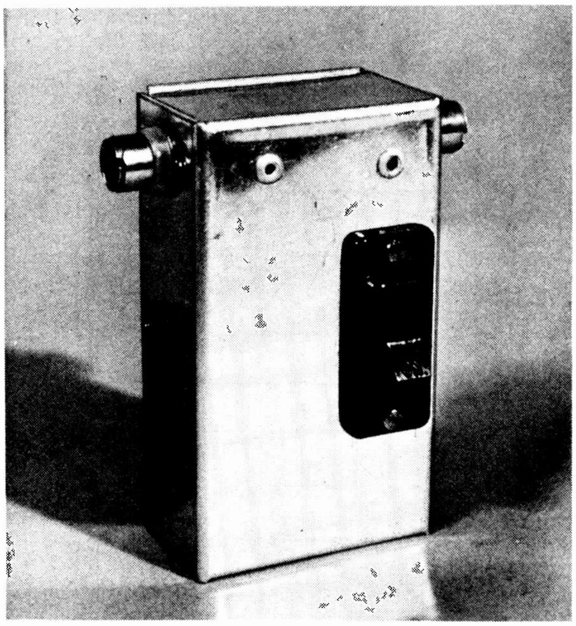
Use of Aerial Amplifiers

TV aerial preamplifiers are used for several quite different purposes. The obvious one is where signal strength is weak, providing a poor picture even with a decent aerial array. A preamplifier is also useful where the signal may be just strong enough but an unavoidably long length of coaxial cable attenuates it—100ft. of low-loss coaxial cable at the top end of Band V attenuates the signal by about 8dB (or to only 40% of the original signal strength).

In many parts of the country two or more ITV stations can be received, giving additional programmes for several hours each day. The overlap areas at u.h.f. are not however all that large. Nevertheless additional stations can be received at many locations using a good aerial in conjunction with an amplifier.

Yet another use is for DX work: recent indications are that u.h.f. signals travel very much better over long paths under the right conditions than was previously thought. The author has received stations in Belgium, Holland, West Germany and France on several occasions and reception is greatly improved by using a preamplifier in conjunction with a decent array.

Using the amplifier described here the author (living in suburban London) receives excellent colour signals from Anglia TV (Sudbury ch.41, 43 miles away) and Southern (Dover ch.66, 62 miles away). Both stations are received using correctly aligned 18-element aerials but with an unavoidable 100ft. length of feeder. Without the preamplifier reception is variable to say the least; Dover has never been received in colour without it. With the preamplifier reception is slightly variable but excellent, virtually noise-free pictures can be received 95 per cent of the time from Dover and 99 per cent of the time from Sudbury.



The amplifier is housed in an aluminium box which is available from H. L. Smith Ltd.

Circuit Description

The complete circuit is shown in Fig. 1(a). Although it is very simple the layout is particularly important because of the high frequencies involved. The AF239 transistor is connected as a common-base amplifier with the input signal applied to its emitter through the d.c. blocking capacitor C1. R1, R2 and R3 provide the correct bias voltages for the emitter and base, the collector being at chassis potential (negative). It is necessary to decouple the positive supply and the base and this is done by the 1,000pF feedthrough capacitors C2 and C3. The collector is connected to the tuned circuit consisting of VC1 and L1 with the output taken from a tapping half way along the coil. The screen of the transistor must be connected directly to the chassis. The current drain is very low at something less than 1mA and a PP3 battery will give very long service as useful gain is still achieved when the battery voltage is as low as 5.5V.

The use of the specified transistor is deliberate: several types were tried in several types of circuit and although the AF239 is not one of the latest it seemed very much the best and is cheap, selling usually for less than 40p. It has good gain and a low noise figure.

The coil consists of a single piece of wire bent

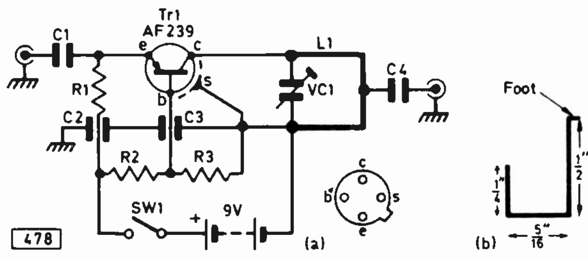
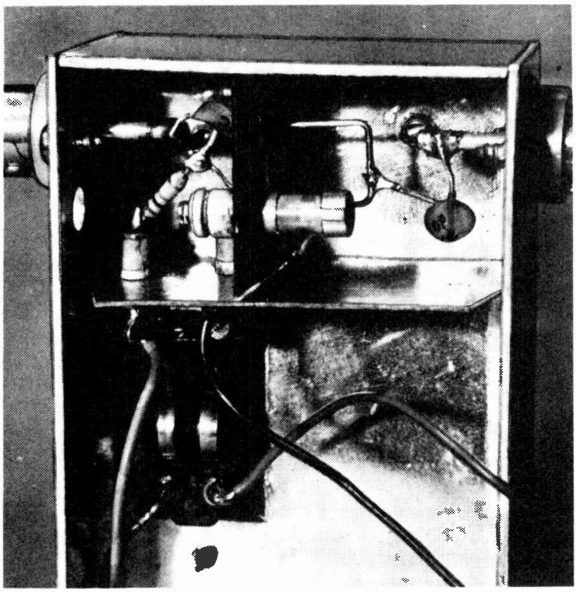


Fig. 1: Circuit (a) and coil details (b).



Internal view of the u.h.f. preamplifier.

to the shape shown in Fig. 1(b). The type of wire used is that employed for the inner conductor of low-loss coaxial cable. The small foot at one end is purely to provide a firm soldering point to the chassis ; it serves no electronic function.

Selectivity

High selectivity is of course not required in an amplifier of this type and the tuning peak is fairly broad—at least broad enough to cover the stations in a transmitter group, in other words about 100MHz. This broad peak is achieved by deliberately mismatching the output, tapping the coil in the centre rather than towards the earthy end. As a rule of thumb the impedance of a tuned circuit can be taken as 10kΩ: a centre tap should match 2.5kΩ therefore for perfect matching. The coaxial output and receiver input look like 80Ω however. This mismatch broadens the response by lowering the Q. By tuning VC1 the broad peak can be sited anywhere in the u.h.f. bands.

Gain

Figure 2 shows curves for gain against channel number. Even with the tuning set for maximum gain at the lowest frequencies there is still unity gain at the highest frequencies while with the tuning set for maximum gain at the high frequency end there is still useful gain at the lower end: as with most preamplifiers there is some falling off in gain at the top end.

The gain axis of the graph is not calibrated because it is not easy to measure the gain of an amplifier at these frequencies without sophisticated equipment. The gain readings taken during development were measured by connecting a voltmeter (on the 5V or 10V range) to the receiver's a.g.c. line. The higher the signal applied to the set the greater the a.g.c. voltage but the relationship is not linear. The measurements do however show relative gain.

Comparative Performance

The performance of the preamplifier was compared with that of three commercially available models: it was found to compare very favourably. One of the commercial models (using a modern transistor) was in many conditions unstable although a tap sometimes cured this! Using the same transistor as used in this commercial unit the author experienced similar problems. Even when working properly the a.g.c. voltage produced by this com-

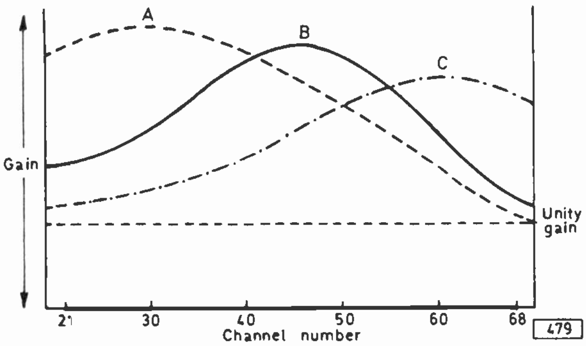


Fig. 2: Frequency/gain characteristics.

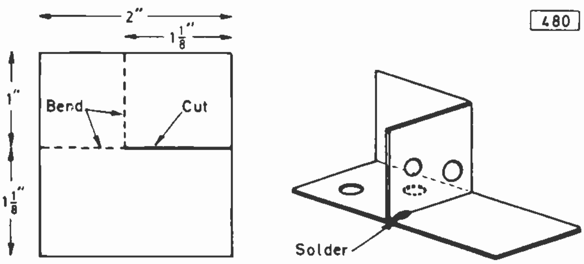


Fig. 3: Subchassis details.

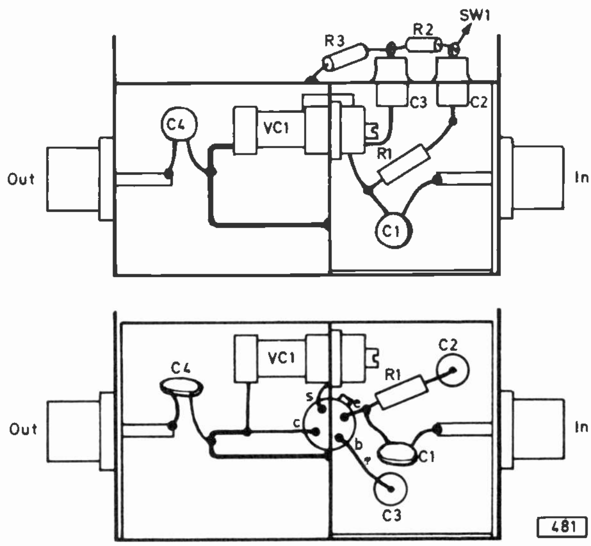


Fig. 4: Constructional details.

mercial preamplifier never matched that of the present unit.

Another commercial model performed much better. This could be tuned over the whole band but the response was far too sharp. Weak signals are available in the author's area on ch.50 and ch.51 and when using this unit it was necessary to adjust the tuning over even this narrow range. This preamplifier was unsuitable for receiving a complete channel group since if it was set for maximum gain on the middle channel of the group there was actually attenuation on the other two stations!

The stability of the present design is excellent. Six units have been built with no problems and have been tried out on a variety of aerials and receivers. The stability is so good that three have been connected in series with good results and no instability noted—a very severe test.

It would not be honest to quote a definite gain figure in dB but it is probably in the order of 12-14dB. The a.g.c. voltage with a weak station was increased from 1V to 4.5V and an excellent picture obtained. This relationship is not linear however as previously noted.

Construction

Unless you are absolutely sure about layout techniques at u.h.f. it is essential to follow the constructional details (Figs. 3 and 4) carefully. The circuit is built into a small aluminium box but most components are mounted on a small tinplate subchassis. The gauge of this is not critical but 20 or 22 s.w.g. is the easiest to work. The subchassis is cut out and bent as shown in Fig. 3: several holes are required in this and are best drilled before the chassis is bent. One circular hole is drilled to take the transistor, the subchassis providing a screen between the input (emitter) and the output (collector) circuits. Such a screen is essential at these frequencies. The other holes are for the trimmer and the feedthrough capacitors. The exact positions of these holes are not all that critical and so dimensions are not given. The general positions—which can be seen from the drawings and the photographs—should however be followed. Two views of the component layout are shown in Fig. 4.

Components List

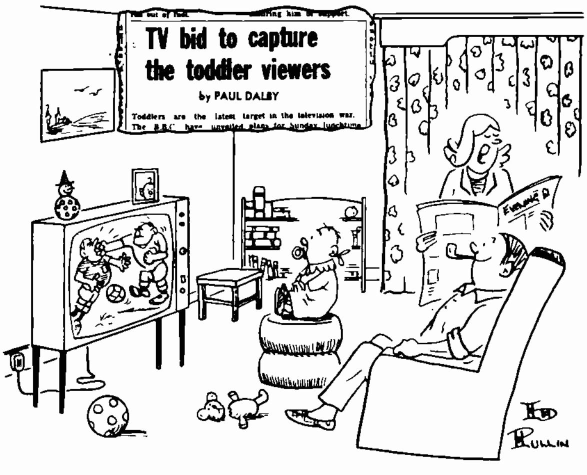
Tr1	AF239
VC1	2-20pF tubular trimmer (Henry's Radio type U4)
C1	10pF ceramic disc
C2	1000pF feedthrough
C3	1000pF feedthrough
C4	10pF ceramic disc
R1	1kΩ
R2	15kΩ
R3	56kΩ

Resistors ⅛ or ¼W 5%

L1	See text and Fig. 1(b)
SW1	On-off switch

Miscellaneous: PP3 battery; 2 coaxial sockets; tinplate for subchassis; battery clip.

Chassis: 4 x 2⅛ x 1¼in. available from H. L. Smith Ltd., 287 Edgware Road, London, W.2.



"They must be joking!"

Once the subchassis is made and bent the components can be fitted to it. The short end of the coil is soldered directly to the collector of the transistor, the short length of collector lead adding to the inductance of the coil. The specified trimmer has a small tag which is soldered to the coil as shown. With the components fitted to the subchassis the assembly can be mounted inside the main chassis. The prototypes were pop-riveted but could just as well have been bolted. Coaxial sockets are fitted to the opposite sides of the chassis, the feed to the receiver being via a length of coaxial cable with plugs at both ends. This coaxial lead should be at least a foot long—a shorter length may lead to instability though this did not occur on any of the prototypes.

The trimmer is tuned through a small hole drilled adjacent to the input socket and sited so as to line up with VC1.

Any type of on-off switch can of course be used: its position will depend on the type chosen.

As we have emphasised the unit is very stable. If instability should occur it will probably be found that it can be cured by wiring a resistor directly across the output socket. This is not an ideal solution but it does work and was adopted on some early prototypes which used an entirely different layout. The value of the resistor should be as high as possible—as long at it eliminates the trouble: it may lie between 82Ω and 1kΩ.

Positioning

The preamplifier can be mounted on the back of the set. It is best however to site it as near the aerial as possible. In the author's case with the 100ft. feeder the improvement obtained is vastly better when the preamplifier is inserted 20ft. from the aerial (at the point where the coaxial feeder first becomes accessible) than when it is mounted at the back of the set.

Although the preamplifier is intended for use with low-level signals it has shown no signs of overloading on strong local stations. No improvement is seen however as the extra gain is cancelled by the set's a.g.c. ■

COLOUR RECEIVER CIRCUITS

GORDON J. KING

LINE OUTPUT STAGES

In spite of the trend towards all-transistor TV chassis valves have not been completely ousted and quite a few hybrid models with valve timebases are still being made. In the field timebase the well-known triode-pentode multivibrator/output stage is still used while in the line timebase the flywheel-controlled PCF802 sinewave line oscillator driving a stabilised output pentode with the usual boost diode remains popular.

The circuit of the valve line output stage used in the recent 17in. Decca Model CS1730 is shown in Fig. 1. The drive waveform—from a PCF802 sinewave oscillator via *RC* shaping networks—is of the usual squarewave form at an amplitude of 150V peak-to-peak. The d.c. circuit is from h.t. through the conducting PY500 boost diode and the primary of the line output transformer to the anode of the PL509 line output valve. The screen grid resistor R1 controls the total dissipation of the PL509 while the valve is biased partly by the voltage developed across its cathode resistor R2 but mainly by the negative potential at its grid generated as a result of rectification of line pulses by the voltage-dependent resistor VDR in the stabilising circuit.

Beam Limiting

In common with some other receivers the increasing voltage across the cathode resistor R2 with increasing beam current (i.e. as the PL509 is called upon to deliver more power with rising e.h.t. load) is used to reduce the beam current automatically to a safe predetermined value. This sometimes operates by adjusting the tube biasing directly, or via the Y channel (by adjusting the gain of the Y channel and hence the video drive), or by adjusting the gain of the i.f. channel by way of the a.g.c. system. The last mentioned method is adopted in this Decca chassis.

Horizontal Shift

A d.c. potential is applied to the line scan coils for horizontal picture shift purposes. The d.c. is provided by diode D1 which rectifies the line signal developed across the corresponding secondary winding on the transformer. The diode load is effectively the 100Ω preset P2 while the reservoir is the 250μF electrolytic C2. Smoothed d.c. thus flows from chassis through the transformer winding to point A, through the line scan coils and the width inductor and back to chassis via the wiper on the 100Ω preset. Adjustment of the preset regulates the current and results in horizontal movement of the whole raster on the screen. If the shift is insufficient in one direction the current direction can be reversed by changing over the line shift sense flying lead.

From the line signal point of view the two halves of the scanning coils are in parallel, with a line balance inductor between them at one end. This inductor adjusts the symmetry between the two halves of the coils. Lack of symmetry here makes it impossible to converge horizontal red and green lines (with the blue beam switched off) accurately: the result is that the lines cross over somewhere along their length. It will be recalled that a similar control is used with the field scan coils and corrects crossover along red and green vertical lines. The crossover effect is in both cases a result of lack of symmetry between the two halves of the coils.

Width and Linearity Control

The basic line signal path is via A, the scan coils/balance inductor, the linearity coil, the S-correction/d.c. isolating capacitor C1 and the convergence circuit to earth. The linearity control works on the "saturated inductor" principle, the impedance afforded by the inductor to the scan current decreasing as the magnetic saturation of the core is increased. The saturation is regulated by a small adjustable magnet. Thus as the scan waveform rises to the saturation point set by the magnet the impedance offered to the changing current decreases and it is this which tailors the current in the scan coils for least non-linearity of line scan.

From first principles a linear horizontal scan is produced by the linear build up of current in the scan coils. In a pure inductance such a linear build up would be achieved by applying a squarewave input but since the coils also possess resistance the drive waveform must have a sawtooth component as well. The drive waveform is shaped to help compensate for the resistive component while the linearity correcting devices provide the final tailoring which can be astonishingly accurate in practice.

The width control varies the impedance in series with the scan coils: as the inductance is increased the current in the coils is reduced.

Line Stabilising

As with all sets using voltage multiplication—a doubler circuit in this case—to derive the e.h.t. voltage fifth harmonic tuning is employed. This improves the e.h.t. regulation by flattening the tip of the e.h.t. pulse applied to the doubler. The flatter top means that e.h.t. energy is available for a longer time during the flyback period and it is this which enhances the regulation.

The VDR in Fig. 1 is fed with line pulses via C5 and produces from these a negative potential of value

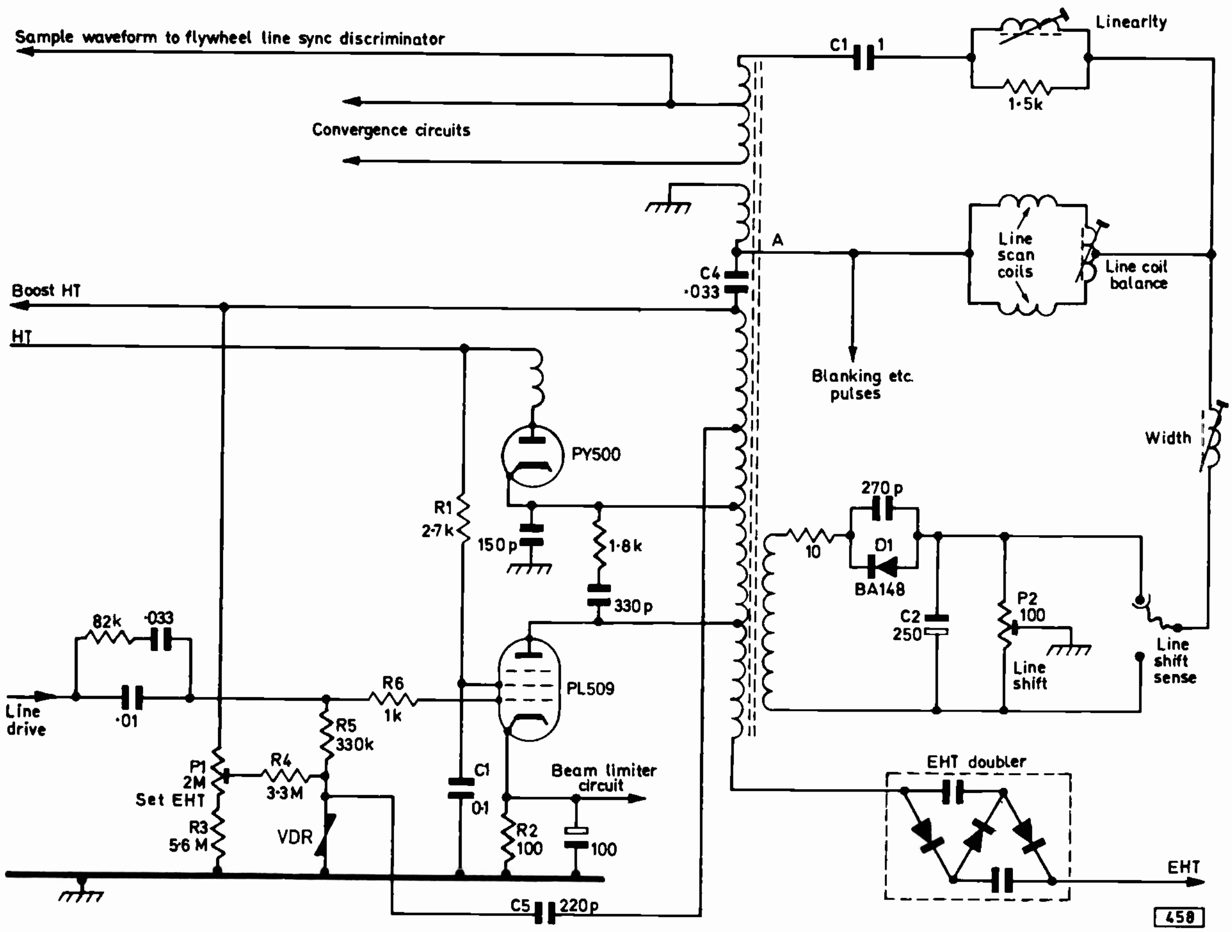


Fig. 1: Valve line output circuit used in the Decca 17in. Model CS1730.

depending on the pulse amplitude. This potential is used as the bias which sets the PL509 line output valve's operating point. The network P1, R3 and R4 is returned to the boost supply: thus by adjusting P1 the bias applied to the valve's control grid can be regulated. This preset is used for setting the e.h.t. potential. The system also provides stabilisation since the bias varies with the pulse amplitude: as the pulse amplitude decreases with load increase more line power is turned on as a result of the negative bias falling to compensate.

The e.h.t. doubler is fed with 10kV pulses and produces an output d.c. of the order of 20kV for the final anode of the 17in. tube used in this model. Larger tubes require up to 25kV and this is now generally provided by a tripler fed with pulses of about 8·4kV.

Pincushion raster correction has not been found necessary with the small tube used in this model.

Transistor Line Output Circuit

The basic action of a transistor line output stage is described elsewhere in this issue (see *TV E.H.T. Systems*). As a practical example the circuit used in the Thorn/BRC 8000 chassis is shown in Fig. 2.

As the output transistor is an npn type it requires a positive supply at its collector. This is supplied via R1 and L1 from a stabilised 180V source. The primary of the output transformer consists of windings A and B and since the h.t. side of L1 is connected through C1 to the top of winding A while the bottom of winding B is connected to Tr1 collector the transformer is shunt fed: from the signal point of view it is connected directly in the collector lead of Tr1 but with the advantage that the primary windings do not carry d.c. Instead the d.c. is fed via L1 which has a high impedance at the line frequency: the required low-impedance coupling is provided by C1.

Winding C in parallel with windings A-B couples the e.h.t. overwind D which feeds flyback pulses of suitable amplitude to the e.h.t. rectifier D1. This produces by half-wave rectification an e.h.t. supply of some 22kV. Diode D2 provides the first anode supply for the tube and the focus supply is tapped from its output via P1.

Winding E feeds rectifier D3 which produces the horizontal shift potential. The arrangement is similar to that shown in Fig. 1.

The low-impedance convergence system is connected in series with the scan coils via winding F, the 0·68μF S-correction capacitor and the linearity inductor. We will be looking at this earth return path in a later instalment.

When Tr1 is switched off at the end of the line

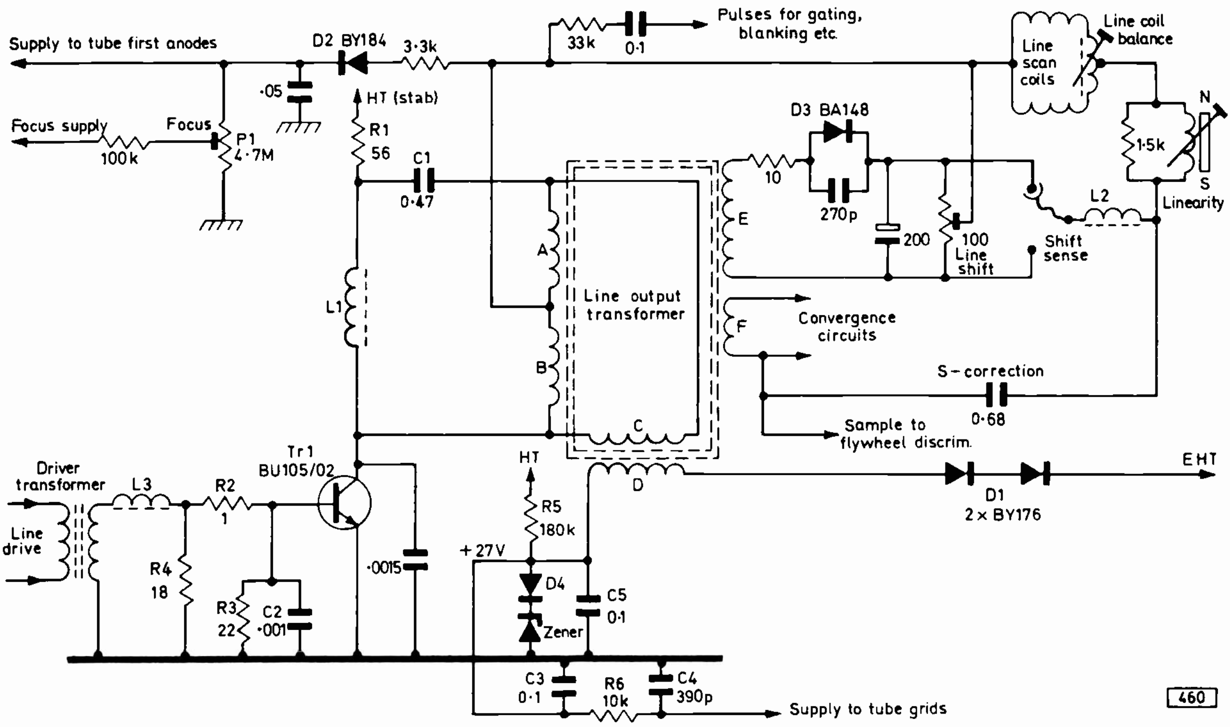


Fig. 2: Transistor line output circuit used in the BRC 8000 chassis (17in. tube).

scan the low-impedance path required in the base circuit is provided by R2/R3/R4 and C2. The maximum base current in Tr1 is limited by R2 while the series choke L3 provides a finite time delay so that the charge energy stored at the collector junction can be smoothly removed. R3 prevents ringing and protects the output transistor against base breakdown in the event of a fault condition which permanently or intermittently disconnects the secondary of the driver transformer.

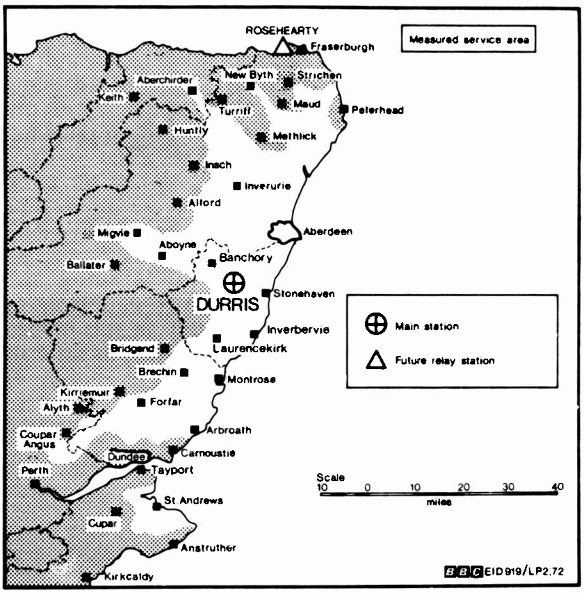
Efficiency Diode Action

When the circuit tries to swing negatively following the positive e.h.t. pulse at Tr1 collector the collector-base diode of Tr1 conducts to provide the efficiency diode action: by clamping the earthy side of the circuit to chassis the current decay in the coils provides the initial part of the forward scan. As with all half-wave e.h.t. systems third harmonic tuning is employed: for e.h.t. regulation reliance is placed on operating the line output stage from a well stabilised supply rail.

Beam Limiter

The low-potential side of the e.h.t. overwinding D is returned to chassis through D4 and the zener diode in series with it. These diodes are biased from the stabilised 180V line through R5 and pass 1mA of current: this results in the junction of R5/R6 delivering +27V to the three grids of the picture tube, giving correct biasing. If the c.r.t. beam current exceeds approximately 1mA the diodes cease to conduct and the voltage at the junction R5/R6 falls, back-biasing the tube guns and reducing the beam current. The potential is filtered by C3/R6/C4 and since C3 retains a charge for a short period after the set is switched off the e.h.t. reservoir charge is fully dissipated before a stationary spot has time to appear on the screen.

To be continued . . .



*Approximate service area of the **Durris** u.h.f. transmitter. Channels: BBC-1 22; ITV 25; BBC-2 28; fourth 32. Maximum vision e.r.p. 500kW, polarisation horizontal, receiving aerial group A. Map courtesy BBC.*

LONG-DISTANCE TELEVISION

ROGER BUNNEY

WITH the approach of early Autumn we usually look forward to improved tropospheric conditions but unfortunately this year September has been rather quiet. There have been slight lifts in conditions, with two slow-moving high-pressure systems which produced mediocre reception from the closer West German u.h.f. transmitters, but certainly nothing to shout about! One unusual reception which was experienced by several enthusiasts was of the Brocken ch.E34 DFF (East German) transmitter on the 5th. This gave high-level signals all day whilst little else was about—an instance I presume of tropospheric ducting. The signals were such that they allowed our colour expert Graham Deaves of Norwich to resolve the SECAM colour in the transmissions, the first time to our knowledge that this has been achieved in the UK.

The Aurora reported briefly last month occurred on the evening of August 5th. Strangely there have been no reports of signal reception. I feel sure that in view of the reports of this Aurora there must be someone who saw something: we anxiously await news! A letter from Cyprus indicates that the Solar activity at this time produced signals via F2/TE from Gwelo, Rhodesia ch.E2 and unidentified Spanish and Arabic transmitters.

For my part this month has seen me visiting our old colleague Ian Beckett at Buckingham and catching up on the latest television activities there. Ian has just installed a new Band IV u.h.f. array, a Fuba XC391B. This impressive array consists of 22 director assemblies (not unlike J Beam's Multibeam director assembly only twice the size!), dipole with integral wideband amplifier, and a large reflector screen. Even under the poorest conditions I witnessed it extract Dunkirk ch.E39 ORTF-2 (French 2nd Chain) from the ether. Something of a mystery was the reception over several days of an unknown ch.E39 negative-going video signal from the Belgian direction. Has anyone seen this one? J Beam at Northampton kindly allowed us a visit to their factory where we saw both the domestic aerials (Multibeams, Parabeams) and specialised systems being constructed. Due to all this travelling the log shows a rather long gap in the middle: I feel I haven't missed too much though!

1/9/72	BRT (Belgium) ch.E2 (trops).
2/9/72	ch.E2, 4: unidentified SpE signals of Olympics.
3/9/72	RTP (Portugal) ch.E2; unidentified programme ch.E2—both SpE.
4/9/72	TVE (Spain) ch.E2—SpE.
5/9/72	SR (Sweden) ch.E2 (MS); BRT E2 (trops).
7/9/72	CST (Czechoslovakia) ch.R1 (MS); BRT E2 (trops).
8/9/72	ORF (Austria) E2a—MS.
9/9/72	BRT E2—trops.
11, 12/9/72	DFF (East Germany) E4—MS.
14/9/72	DFF E4 (MS); BRT E2 (trops).
16/9/72	BRT E2—trops.
22, 23/9/72	BRT E2—trops.
25/9/72	CST R1; WG (West Germany) E2—both MS.
26/9/72	CST R1 (MS); BRT E2 (trops).
29/9/72	CST R1; WG E2; DFF E4—all MS; BRT E2 (trops).
30/9/72	TVP (Poland) R1; WG E2; DFF E4; RAI (Italy) IB, *ID*—all MS.

I am still unfortunately at the temporary location although I hope by this time next month to be installed at the new house—builders permitting! Consequently for the past month I have been operating with the wideband dipole only, with the addition on the 22nd of a J Beam wideband Band III array type ABM8. This enabled me to note improved tropospherics from the 23rd, with various ORTF (French) transmitters. Since MS (meteor shower) seemed so active towards the end of the month I ran two receivers on the 30th between 0800-0940 BST. One receiver remained on Band I while the other was tuned to ch.E5/R6. After several short bursts of information I was rewarded at 0924 with an identifiable flash (approximately 2 seconds!) of the RAI (Italy) test card on ch.ID. Quick reference to the EBU transmitter listings revealed a number of possible high-powered stations and we eventually decided that Monte Serra ch.ID was the most likely one (270kW, located south west of Florence). This is the first time I have received RAI in Band III and ended the month with an exciting flourish. Incidently the aerial was some 18ft. high, feeding into two amplifiers—the first with a single BF180 and the second with two AF139s. It does show that quite exotic reception is possible with minimum equipment.

News

Italy: Mt. Cammarata ch.IA increase in e.r.p. to 35kW from 30kW; Mt. Caccia ch.IA to 34kW from 30kW; Mt. Nerone ch.IA to 34kW from 30kW; Mt. Faito ch.IB decrease in e.r.p. to 40 kW from 53kW. These figures represent vision e.r.p.: in addition all sound e.r.p.s are now 10% of the vision carrier (were 25%).

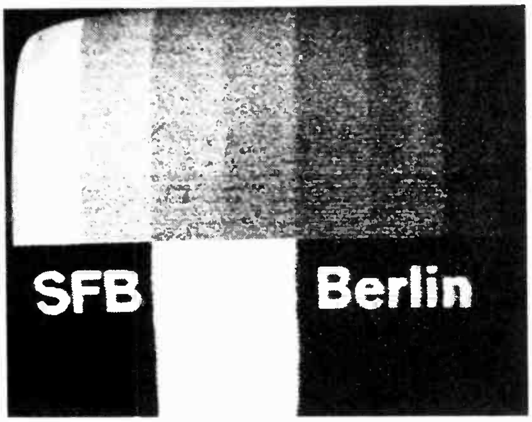
Sweden: Storuman ch.E33 1000kW horizontal (approximately 150 miles North of Sundsvall).

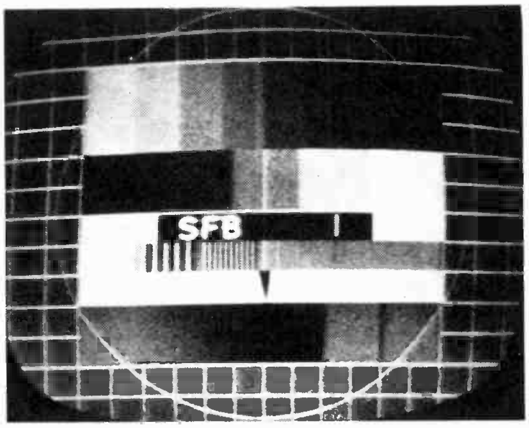
Turkey: We note that the Turkish Radio and Television Service (TRT) has opened several more transmitters (unfortunately in Band III). For some time certain high-powered Band I transmitters have been listed as "projected" and we await possible openings within the next year or so. The Istanbul University television transmitter on ch.E4 (Istanbul Teknik Universitesi) has increased e.r.p. to 500kW—it's a step in the right direction!

East Germany: A North German TV programme guide

Clock received on ch.R1 by Rym Muntjewerff.

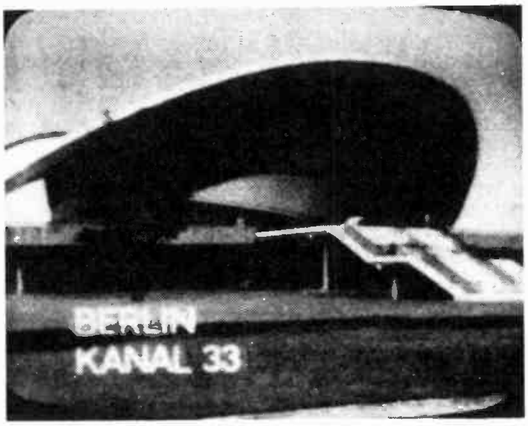
DATA PANEL 17—2nd series



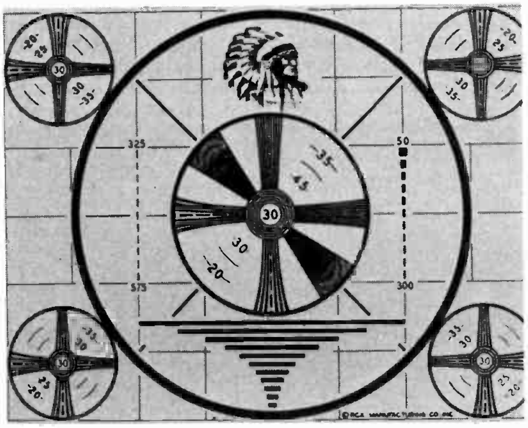


Sender Freies Berlin SFB-1 test pattern left, test card right.

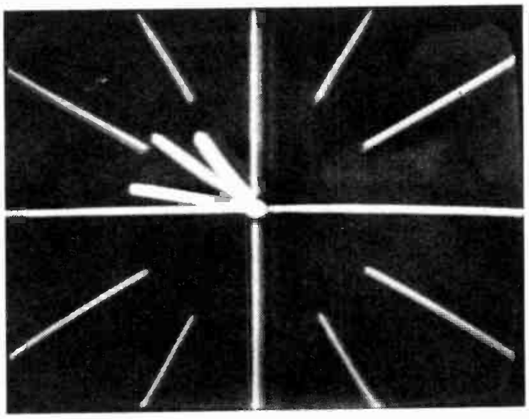
SFB-3 test card.



SFB identification slide.



Standard pattern: RCA Indian head test card.



ORF-1 Austria clock.

Photographs courtesy Europese Testbeeldjagers, Rym Muntjewerff and Peter van der Kramer.

lists a new 1st chain transmitter at Blesberg ch.E35. This is not as yet officially listed.

Exotics: In October we gave details of reception in Holland by Rym Muntjewerff of a mystery clock which was some three hours ahead of CET/BST (+4 hours GMT). We are pleased to feature this month a photograph of this remarkable signal. on ch.R1 from the USSR.

Norway: Official information from NRK via Europese Testbeeldjagers. We have noted previously NRK's use of test card F. This is regularly transmitted by the service for five minutes before the start of programmes (1745-1750CET). It is used to take advantage of the flesh tones within the circle—a colour lacking from the various electronically generated patterns.

Data Panels

As we expected some of the West German test patterns have been changed recently. Rather than list corrections immediately we have decided to await communication from our friends' overseas advising us of the exact situation following the latest and probably last West German Data Panel. A slight correction to the October Panel however: reverse the captions on the lower two test patterns which seemingly moved after writing the column! Now to conclude our run down on the West German programme companies.

Sender Freies Berlin-SFB: The 1st network uses either the circular electronic card (less regularly now) or the ZDF/SWF electronic card with identification as shown. The 3rd network shares the same cards and networks with RB and NDR. The studio centre is at West Berlin.

Saarlandischer Rundfunk: Studio centre at Saarbrucken.

Suddeutscher Rundfunk: Studio centre at Stuttgart.

Unfortunately we have received no information whatsoever on the latter two companies. If anyone can provide test card data or information we would be most grateful.

Standard Pattern: We include this month the RCA Indian head test card. This is used extensively in the United States: in the European area its use is mainly confined to Egypt, Aramco TV in Saudi Arabia and various AFRTS bases.

Italian Colour

RAI Television is at present conducting tests in colour, alternating between PAL and SECAM. These test transmissions commenced with the Olympics, the aim being to establish the best system to use. It seems however that the result is already being forecast. It is expected that the SECAM system will be adopted since according to a recently published document if Italy adopts the SECAM system there will be certain trading advantages with France—an alliance within the Common Market which would create an "industrial equilibrium in the electronics field" and the construction at Rome of a Mediterranean Centre for programme research and production.

From our Correspondents

Graham Deaves wishes to conduct research into colour TV propagation via any mode and over any distance: if anyone can help please write in to the column and we will forward the letters to him.

In the September issue we mentioned Reg Roper's use of a new type of u.h.f. array which by all accounts performs exceedingly well. Detailed information has now come to hand and will be included elsewhere in the magazine as soon as possible. Our thanks to Reg for his information.

Victor T. Budas, a licensed radio amateur (GM3VTB), comments on the strange results of Sporadic E propagation. Victor at Glasgow and a friend David Thomson at Larkhall some 12 miles distant simultaneously monitored both E and R channels during the recently passed SpE season: using the 80 metre Amateur Band for talk-back communication several points were soon realised. Even with only the short distance between them operation on the same channel would produce entirely different results at the two locations. At one location TVP ch.R1 might be present while at the other location MT (Hungary) ch.R1 would be received; such a situation would occasionally reverse. At times there was similar reception at both locations but this was the exception. It all shows how unpredictable if not selective SpE propagation is. We have noted signal variation on aerials spaced as close as 60 ft. If anyone can report further on this interesting phenomenon please write in.

After a long interval we have heard again from A. Papaeftychiou who tells us of TE/F2 reception at the beginning of August (see above). He also mentions that a new high-power Greek transmitter of the EIRT Network is being received at good strengths on the north coast of Cyprus and on high ground looking over the sea towards Rhodes. Experiments in the Nicosia area some 20 miles inland were however rather inconclusive. A further problem exists with co-channel interference from Damascus!! The Greek transmitter is Kerkyra ch.E9 10kW. Unfortunately both transmitters are vertically polarised.

Beginners' Corner

In answer to popular request we will be starting next month a brief series within the column to assist newcomers with information and advice, including how to get started, equipment, requirements, etc.

Eurovision

Whilst the main concern of this column is the reception of foreign TV transmissions it is nevertheless of interest to note the international links between the various national broadcasting organisations. In Western Europe the Eurovision organisation is the co-ordinating link. The basic structure was initially aired at the first EBU (European Broadcasting Union) Assembly at Torquay in February 1950. At this meeting the idea of an international television programme exchange was discussed and during that same year—while the EBU was formulating the machinery for such a project—the BBC organised the first European television programme from another country, a live transmission from Calais (August 27th 1950). Further exchanges took place between England and France in July 1952. The 1953 Coronation was viewed in various European countries and the experience gained with links and relays was put to use in the summer of 1954 with the Lille Experiment in which eight countries participated in the exchange of live transmissions including the World Football Championships in Switzerland. Lille was the co-ordinating centre for this experiment, and it was in this year that the name Eurovision was adopted together with the distinctive star-burst caption. With the extension of television services in Europe a steadily increasing number of exchanges took place. In 1958 and 1959 news exchanges started; since 1961 these have been on a regular basis. The year 1958 also saw exchanges with the Eastern European equivalent—Intervision—organised by the O.I.R.T.

Since 1961 the expansion of the European networks has continued and various North African countries are now included. In July 1962 the Telstar Satellite made possible the first trans-Atlantic TV exchange and satellites now form a considerable portion of exchange traffic with countries all over the World.

Various transmission standards are in use in Europe but all co-operating Eurovision/Intervision members exchange material using a common 625-line standard with converters to return to a particular standard for the appropriate country. The EBU has a permanent network of leased vision and sound lines connecting the main TV centres in each country. The main Eurovision technical operations centre is within the dome of the Palais de Justice, Brussels, Belgium, with legal and administration offices at Geneva.

YOUR PROBLEMS SOLVED

★ **Requests for advice in dealing with servicing problems must be accompanied by a 10p postal order (made out to IPC Magazines Ltd.), the query coupon from page 91 and a stamped, addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets or answer queries over the telephone.**

SOBELL 1000

When first switched on the line whistle can be heard but just as the e.h.t. rectifier warms up it goes and there is no e.h.t. Instead of a blank screen there is sometimes a vertical line about 6in. high by ½in. wide at the centre of the screen but this disappears when the brightness control is turned up. If the set is switched off for about 10 seconds and then switched on again it works perfectly for the rest of the evening. The line timebase valves have all been either replaced or checked and found to be OK.—T. Fields (Sale).

Your symptom suggests intermittent system switch contacts. Check this and then if necessary take voltage readings around the PCF802 line oscillator stage to try to isolate the source of the fault condition.

HMV 2610

The field lock on 405 is perfect but on 625 lines it is erratic—it might lock for five-ten minutes and then start moving around. It stabilises without adjustment but then starts off again. The field timebase and sync separator valves have been replaced.—H. Pemberthy (Slough).

All resistors in the video amplifier stage (V5, PCL84) should be checked, particularly those which appear discoloured. The bias stabilising resistor R24 (47kΩ) is the usual cause of the trouble. Note that it is in series with R23 and R28 across the h.t. line and chassis. The anode load resistor R29 (4kΩ) may also have changed value.

SOBELL 1019

The brightness of the picture keeps varying from dark to light, the area affected moving all over the picture. There is also loss of field lock. The PFL200 video/sync valve has been replaced, also the 200μF main smoothing electrolytics.—K. Evans (Bargoed).

The trouble seems to be either inadequate smoothing (check the electrolytics smoothing the HT3 and 4 lines) or a heater-cathode leak in one of the valves (possibly the PCL85). We also suggest you check the l.f. attenuator capacitor C102 (0.22μF) in the video feed to the c.r.t. cathode.

STELLA ST1912

There is a line sync problem with this set: at high illumination levels the picture slips to the left. The two ECC82 valves in the line timebase and the PFL200 video/sync valve have been replaced. This has produced some improvement but not a complete cure.—T. J. Ryder (Wimbledon).

The trouble is probably due to change of value of R2144 (27kΩ) the anode load resistor connected to pin 6 of the first ECC82 (V2003): this triode section shapes the sync pulses for application to the other triode section of the valve which acts as flywheel comparator.

EKCO T330

The problem is that the contrast and brightness keep varying. They can be adjusted easily enough but sometimes they change within a minute or so and keep on varying. At other times they settle down and remain all right for anything up to a whole evening.—T. Chapter (Ryde).

This trouble could be due to one of any number of things such as poor contact at one or more valve bases, faulty a.g.c., a defective capacitor, a dry-joint and so on. Check the seating in their holders of each of the valves on the left-hand side and the connections to the bases. If this does not reveal the cause of the trouble you will have to take voltage readings to find out where the variation occurs.

PYE 13U

The picture cannot be resolved on 405 lines and can only be resolved on 625 lines when the line hold control is at one end of its travel—there is tearing even then, especially on white objects. The two PCL84 valves (triode sections sync separator and line oscillator respectively) have been replaced, also the PY800 efficiency diode.—H. Chalmers (Birkenhead).

As there is no flywheel sync and the line output valve also serves as part of the line oscillator we suggest you check this valve (PL36) and also the coupling capacitor C87 (0.01μF) wich may be leaky.

BUSH CTV184S

The picture overscans by about 1¾in. all round and is also dull. Suspecting that the oversize raster was due to low e.h.t. I replaced the tripler unit but this did not provide any improvement. The width tapping on the line output transformer was then set to minimum but the picture is still oversize. The first anode presets have been adjusted, increasing the brightness but leaving the overscanning as before.—G. J. Pennyweather (Bury).

We are fairly sure you will find the 560Ω resistor 6R6 in the line output stage either open-circuit or otherwise damaged (this resistor is part of the network used to "balance" the two output transistors). It is usually damaged as a result of one of the associated capacitors 6C5 or 6C6 (both 4,700pF) being faulty: both should be replaced. If necessary use Radiospares 0.005μF buffer capacitors as replacements. The fault could be due to one of the line output transistors but this is less likely.

FERGUSON 3807

When the set has thoroughly warmed up, say after an hour, the picture breaks up forming seven or eight horizontal black narrow bands with what appears to be cramped up bands of picture between when channels are changed. By turning the brilliance control right up and then back to its normal setting the picture can be obtained again. The trouble also occurs if the set is switched on again after having been off for about an hour. The sound is not affected. —S. Glinson (Stoke).

The trouble appears to be in the line output stage and we suspect that the line output valve grid is floating as a result of a resistor going high-resistance. Check the resistors between the control grid and the v.d.r. (Z3), also the v.d.r. itself, when subjected to heat rise. Poor soldering to the panel could be the cause.

ULTRA 1780

There is field collapse (narrow line across screen) on this set and we are having difficulty putting this right. The field timebase valve (30PL13), coupler to the output section, cathode electrolytic, triode anode load resistor and height control have all been replaced but the fault persists. The 30PL13 runs hot after a while.—L. Gaynor (Poole).

First check the linearity feedback capacitor C104 for leakage. Then check the field charging capacitor C103 for leakage. If the voltage at the height control is low check the boost rail decoupling capacitor C66 and the focus potentiometer P6. It would be as well to check the value of the cathode resistor R125 (270Ω).

BUSH TV115

We are having difficulty clearing a case of critical line hold with one of these sets. The picture cannot be locked on 405 lines: hold is almost obtained with the hold control in mid-position but the picture then pulls away to the right and the line timebase appears to run at half speed. A picture is obtained on 625 lines, but with critical line hold. The line oscillator and sync separator valves have been replaced and the flywheel sync diodes checked and found to be in order. The voltages in the line oscillator stage are all normal.—H. Gatehouse (Bristol).

A reference pulse is fed back from the line output transformer to the flywheel sync discriminator circuit via a 150kΩ resistor (R60, up in the corner to the right of the diode) and an 0.005μF capacitor (C71, under the tube on the strip to the left of the line output section). Check these two components: the resistor may have gone high-resistance or the capacitor leaky. The voltage rating of the capacitor must be 1kV.

SOBELL ST196DST

Whenever a caption appears at the bottom of the screen a loud buzz which drowns the rest of the sound occurs.—S. Rosianski (Bedford).

The most common cause of this trouble is the electrolytic C51 which decouples the video amplifier (PCL84) screen grid and the supply to the EH90 sound detector—it is connected to pin 9 of the PCL84. On 625 it may be necessary to tune the detector coil L23 ; on 405 it is sometimes necessary to adjust the sound take-off transformer T5.

REGENTONE 191

The horizontal linearity on this set is poor: when a test card is displayed the left- and right-hand squares are cramped while the centre circle is elliptical. The line output and boost diode valves have been replaced, also the S-correction capacitor C62. There is plenty of width.—H. Owenshaw (Pately Bridge).

The first course of action is to check the setting of the linearity sleeve which is situated under the scan coils. This must have its gap to one side and must not be pushed too far in to start with. Reduce the width by adjusting the tap setting on R60, then adjust the sleeve on the tube neck for best linearity, finally expanding the width to scan correctly. If the linearity is still poor check C57 which is connected across the width control resistor R60, the continuity of L29 which is connected across the S-correction capacitor and forms part of the S-correction tuning, and the value of the line oscillator anode load resistor R52 (470kΩ).

GEC BT456DST

There are four white lines about ¼in. wide on the left-hand side of the picture while half the picture on the right-hand side is darker than the rest. Also the picture is grainy although the signal strength is good here and the tuner valves have been replaced. —S. Robson (Southampton).

The vertical white lines on the left-hand side of the picture could be caused by a faulty line output valve screen grid decoupler—C138 (0.1μF)—or ringing due to a defective line output transformer though this is not common with this series. The shading could be due to inadequate smoothing, the mains filter capacitor C149 (0.1μF) or one of the capacitors in the c.r.t. grid circuit. The grainy picture could be the result of a break in the aerial input circuit or possibly increase in value of R139 (2.7MΩ) which is connected to the slider of the contrast control.

MURPHY V783

As the brightness is increased the picture breaks up—it does not balloon as with low e.h.t. When the brightness is decreased a stable picture is obtained but it is too dark and lacking in quality. The line timebase valves have all been replaced, also the line output transformer as it sounded as if it had an internal arc. The tube has also been tested.—R. G. Hassel (Edmonton).

The most frequent cause of this trouble is the line output valve screen feed resistors—there are three of them on this set, R43 and R44 (both 1.5kΩ) on 405 and R41 (4.7kΩ) on 625. These resistors tend to change value with age and use.

BUSH TV181S

The trouble is occasional loss of line hold. The receiver works all right for weeks on end—except for a slight gap or sometimes a light strip at the extreme right of the screen—but when the hold is lost the oscillator coil core has to be adjusted every few minutes. The EF184 line oscillator valve and the line output stage valves have been changed without improving the situation.—G. Barkhurst (Godalming).

The trouble is either in the flywheel discriminator circuit or the oscillator feedback circuit. Check the discriminator diodes 3D6 and 3D7 first—type U14557/2 but separate ones can be used if preferred provided they are a matched pair. If the diodes are not at fault check the associated components. Then if necessary check the capacitors in the oscillator feedback circuit—3C36 (0.01μF) across the screen grid resistor of the EF184 and 3C34 (470pF) in series with the oscillator coil.

MASTERADIO TE7T

The height decreased until the picture occupied a strip about 2in. high across the centre of the screen. This was some three years ago and the set has not been in use since. Although it is old it gave a good picture until the fault developed and being a well built chassis I am thinking of trying to put the fault right. As the set has not been in use I do not expect any deterioration to have taken place.—T. Ryle (Worthing).

We do not agree that the set would not have deteriorated while out of use for three years. Normally disuse for this length of time would result in paper capacitors absorbing sufficient dampness to make leakage develop. This usually shows up in the field timebase, giving the symptoms of lack of height, bottom compression and so on. Which leads us to your fault. The likely cause of this is that the supply to the field output transformer is much below the correct 275V. The set is unusual in employing a 12BH7 double triode as the field oscillator and output valve, with the supply to the output triode taken from the boost line via a 4.7kΩ 1W resistor decoupled by a 16μF 450V electrolytic. Check both these components and the 50μF electrolytic decoupling the cathode (pin 8). Then if necessary turn attention to the blocking oscillator section of the 12BH7 where the 47kΩ resistor in series with the height control and the 8μF (200V) field charging electrolytic should be checked.

MURPHY V430

There is a perfect picture and good sound on v.h.f. radio. The TV sound does not come on however until the set has warmed up for 10 minutes or more. —R. Chaplefield (Reading).

The problem is instability in the sound i.f. strip. This is of the double superhet type and uses the two 6C12 valves. Try bridging a known good capacitor across each of the decouplers in turn.

FERRANTI T1123

I am having considerable difficulty clearing a severe short on this set. The power supply circuits seem to be OK and all likely electrolytics have been checked.—M. Joseph (Oldham).

We suspect that the PCL84 has an internal short. Check by removing it. If this is the case its screen feed resistor R26 (5.6kΩ) will probably be charred, its bias resistor R28 (220Ω) damaged and, if the set has been in use on 405 lines, the vision detector diode V7 (inside the coil can next to the PCL84) will have suffered. This diagnosis is based on our experience with this range of sets (Pye 11U, Ekco T418 series).

GEC 2018

The line hold on 405 lines on this set is very critical. The PCF802 line oscillator valve and all the capacitors in this stage have been replaced and adjustment of the oscillator coil does not improve the condition.—R. Udell (Hitchin).

You have changed all likely components in the line oscillator stage so we suggest that attention is turned to the flywheel sync circuit. Check the phase detector diodes MR1/2, their load resistors R113 and R115 (each 330kΩ) and the sync pulse couplers C160 and C162 (both 470pF). Also check C163 ($0.002\mu F$) which integrates the reference pulse waveform fed back to the discriminator circuit.

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TELEVISION DECEMBER 1972

TEST CASE

120

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

? *A single-standard receiver came in with the complaint of low gain. Workshop tests showed this to be the case since with the workshop aerial signal which is adequate for other receivers applied the picture was weak at full contrast yet free from grain. The sound volume was also below normal.*

Signal inputs below the workshop level were applied via an aerial attenuator and it was only on a very low-level signal that picture grain became troublesome; increasing the signal level with pre-amplification failed to improve the results significantly.

The valves were tested and found to be up to standard and no particular fault could be found in the tuner. It was eventually decided to test the tuner by substitution, however, since a replacement for the particular model was at hand. The results were just the same: a clean picture apparently lacking gain and low sound output. Ultimately the trouble was located and the previous tests indicated that quite a lot of time was wasted in incorrect diagnosis. What should a symptom of this nature have indicated to the service technician? See next month's TELEVISION *for the answer and for a further item in the Test Case series.*

SOLUTION TO TEST CASE 119

Page 43 (last month)

The power supply for the i.c. intercarrier sound channel used in the GEC Model 2047 is obtained from the line output stage. With this knowledge the service technician would have been able to reconcile the lack of e.h.t. voltage and the sound fault. Eventually it was found that the line output stage was at fault, "blocking" and hence removing the supply for the intercarrier sound i.c.

It will be recalled that some form of operation resulted from connection of the test meter on its 100V range between the control grid of the line output valve and chassis. This indicated that the blocking effect was due to a very high resistance or open-circuit control grid circuit. There is a 10MΩ resistor in the grid circuit and by replacing this component normal working was resumed. Resistors of such high value in grid circuits often cause a bit of trouble and should come under early scrutiny; that in question is particularly vulnerable.

A test meter can often be employed for determining resistor continuity but its sensitivity should be fairly high (say 20,000Ω/V) and it should be set to a range consistent with the voltage in the circuit being tested. On the 100V range a 20kΩ/V meter would of course exhibit a value of 2MΩ across its leads.

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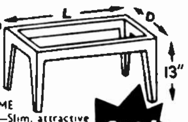

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