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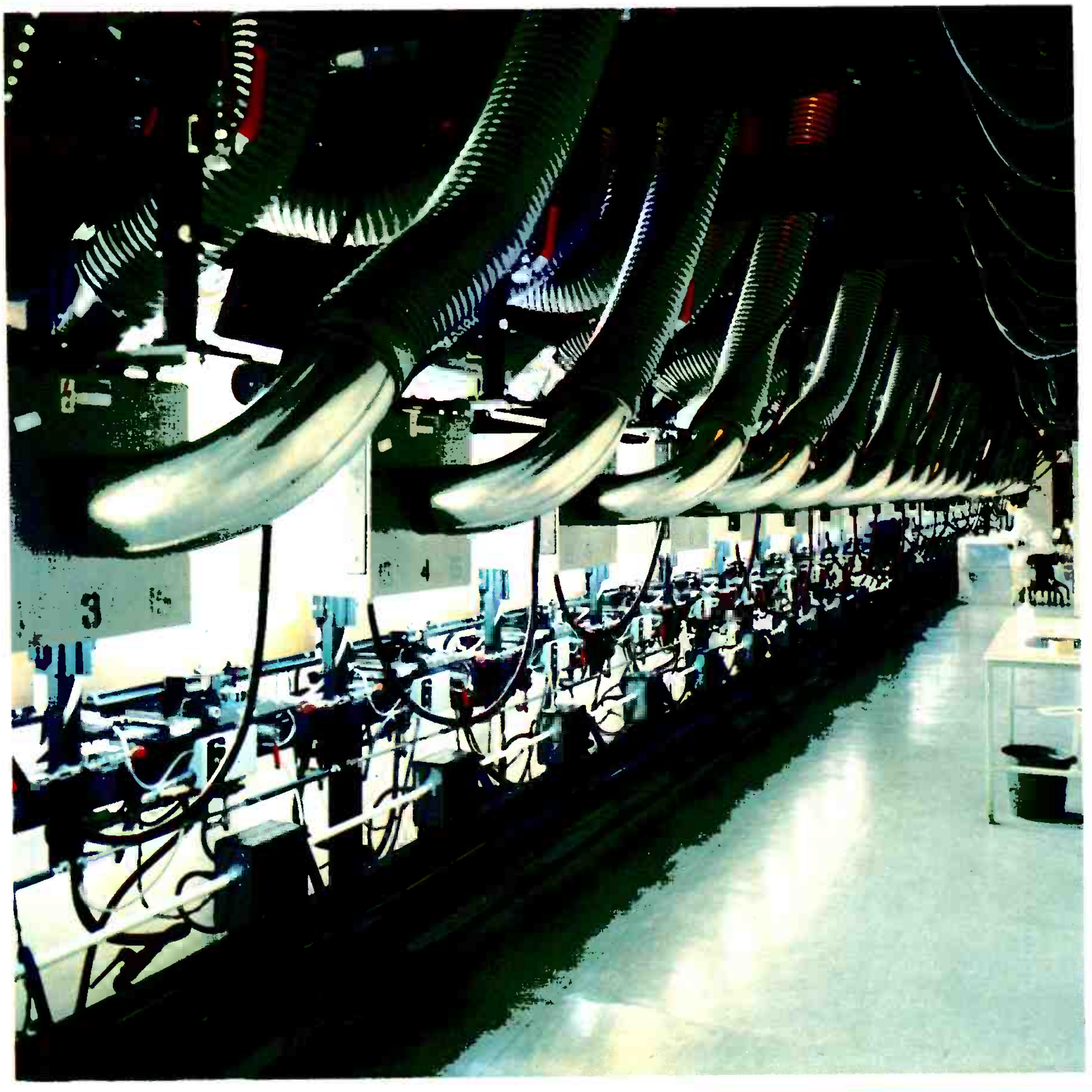

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TELEVISION

November 1982

Vol. 33, No. 1
Issue 385

CORRESPONDENCE
All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", King's Reach Tower, Stamford Street, London SE1 9LS. Editorial correspondence should be addressed to "Television", IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF.

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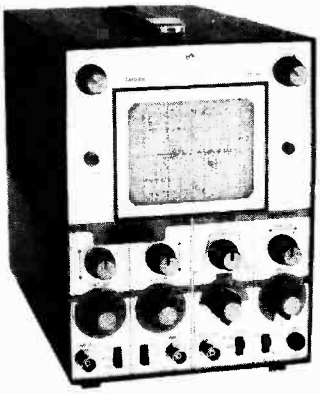

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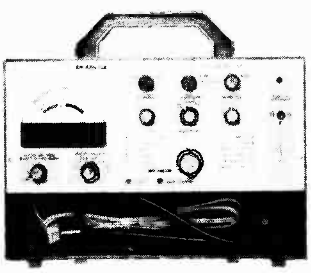

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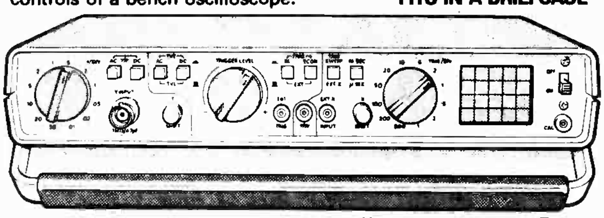

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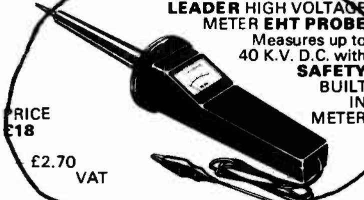

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Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
AN240	3.84	MS1513L	2.80	TA7193P	5.67	TBA673	2.45	TDA2530	2.70
AN214Q	3.91	MS1515L	3.28	TA7204P	3.77	TBA700	2.12	TDA2532	2.45
AN7150	3.97	SAS560S	1.80	TA7205AP	3.72	TBA720A	2.45	TDA2524	2.25
CA555	46	SAS570S	1.80	TA7222	1.80	TBA720Q	2.12	TDA2540	3.84
CA741	25	SAS580	2.90	TA7310P	2.78	TBA750	2.05	TDA2541	2.65
CA748	45	SAS590	2.90	TA7609P	4.39	TBA800	99	TDA2560	2.15
CA3065	1.80	SL901B	4.45	TAA300	58	TBA810AS	1.35	TDA2581	2.25
LA4031P	3.21	SL917B	6.25	TAA310	2.83	TBA820	1.70	TDA2590	3.25
LC7130	5.93	SL1310	1.80	TAA320	2.00	TBA890	3.94	TDA2591	2.95
LC7120	5.87	SL1327Q	1.20	TAA350A	60	TBA920(Q)	1.80	TDA2593	2.95
LC7137	5.50	SL76544	2.05	TAA550	28	TBA950(2X)	2.40	TDA2600	3.25
LM1303N	2.63	SN76003N	1.75	TAA570	1.80	TBA970	4.09	TDA2611A	1.95
HA1151	3.89	=SN76013N		TAA630	3.15	TBA990	1.49	TDA2640	2.60
MC1307	1.00	SN76013ND	1.65	TAA621-AX1	3.00	TBA1441	2.75	TDA2680	3.15
MC1310P	1.60	SN76023N	1.65	TAA840/S1	1.96	TCA160	1.20	TDA2690	1.35
MC1327	1.70	SN76110N	89	TAA700B	1.70	TCA760	2.30	TDA3560	6.00
MC1351P	1.50	SN76115N	2.27	TAA700	1.70	TCA270SQ	1.25	TDA3561	6.00
MC1330P	90	SN76131N	1.30	TAA661B	1.20	TCA800	2.15	TDA3950	2.50
MC1349	1.20	SN76226(DN)	1.55	TBA120A	70	TCA940	1.65	TDA3960	2.95
MC1350	96	SN76227N	1.18	TBA120S	70	TDA440	2.20	UPC566H	2.95
MC1352	1.00	SN76532N	1.50	TBA120SA	70	TDA1002	1.95	UPC575C2	3.40
MC1358P	1.50	SN76533N	1.38	TBA120AS	70	TDA1003A	5.50	UPC1025H	2.95
MC1495L	3.00	SN76033N	1.65	TBA120B	1.30	TDA1004A	2.95	UPC1182H	2.95
MC14011BCP	42	SN76544N	1.35	TBA120SB	1.30	TDA1006A	2.50	UPC1156H	4.26
MC14049UB	43	SN76650N	1.05	TBA120U	1.00	TDA1035	4.70	UPC1350C	4.15
ML231/ETTR6016	2.20	SN76660N	80	TBA395	2.20	TDA1044	4.37	UPC1185H	3.86
ML232	2.20	SN76666N	80	TBA396	80	TDA1170	1.99		
ML236	5.35	SW153	2.74	TBA440N (TBA1441)	2.75	TDA1190	2.60		
ML237	1.95	TA7050P	95	TBA440P	2.50	TDA1200	2.95		
ML238	4.20	TA7051P	95	TBA480(Q)	1.20	TDA1270	3.95		
ML239	2.50	TA7074P	1.00	TBA510	3.00	TDA1327	1.70		
ML920	4.12	TA7108P	3.43	TBA520Q	1.20	TDA1352B	1.60		
ML922	3.29	TA7120P	2.43	TBA530(Q)	1.28	TDA1412	1.20		
ML926	2.18	TA7130P	1.93	TBA540	1.49	TDA2002	2.50		
ML928	2.18	TA7141P	95	TBA550(Q)	1.58	TDA2140	5.95		
MRF475	2.50	TA7193P	5.67	TBA560Q	1.59	TDA2190	4.70		
MRF477	10.00	TA7171P	1.85	TBA570	1.00	TDA2020	4.66		
MSN5807	7.87	TA7172P	1.85	TBA690	1.50	TDA2030	2.80		
PLL02AG	9.89	TA7173P	1.85	TBA641BX1	3.50	TDA2521	4.17		
		TA7176P	2.50			TDA2522	2.40		
						TDA2523	2.20		

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Type	Price	Type	Price
7805	78	7905	98
7806	78	7906	98
7808	78	7908	98
7812	78	7912	98
7815	78	7915	98
7818	78	7918	98
7824	78	7924	98
78L05	68	79L05	72
78L08	68	79L12	72
78L12	68	79L15	72
78L24	68	79L24	72

T.T.L. 74LS SERIES

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
74LS00	19	74LS37	19	74LS92	35	74LS160	60	74LS251	54
74LS02	19	74LS38	20	74LS93	35	74LS161	60	74LS253	1.00
74LS03	19	74LS40	20	74LS107	46	74LS162	85	74LS257	53
74LS04	20	74LS42	36	74LS109	27	74LS163	60	74LS258	67
74LS05	19	74LS47	80	74LS112	27	74LS164	65	74LS259	74
74LS08	19	74LS48	80	74LS113	27	74LS165	65	74LS273	80
74LS09	19	74LS49	80	74LS114	27	74LS174	57	74LS283	50
74LS10	19	74LS51	19	74LS123	52	74LS175	47	74LS293	70
74LS11	19	74LS54	19	74LS125	46	74LS191	66	74LS352	1.54
74LS13	37	74LS55	19	74LS126	46	74LS192	65	74LS353	1.10
74LS14	46	74LS73	28	74LS132	46	74LS193	66	74LS365	36
74LS15	19	74LS74	26	74LS138	48	74LS194A	69	74LS366	36
74LS20	19	74LS75	46	74LS139	48	74LS197	80	74LS367	36
74LS21	19	74LS76	22	74LS151	44	74LS240	80	74LS368	36
74LS22	19	74LS78	22	74LS153	44	74LS241	80	74LS373	99
74LS26	19	74LS83A	60	74LS155	44	74LS242	76	74LS374	99
74LS27	19	74LS86	26	74LS156	44	74LS243	76	74LS393	80
74LS30	19	74LS85	62	74LS157	44	74LS244	80	74LS670	1.20
74LS32	20	74LS90	35	74LS158	44	74LS245	1.18		

'4000 B' SERIES CMOS

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
4001B	21	4027B	39	4069B	22	4511B	76	4539B	77
4002B	21	4028B	64	4070B	22	4512B	72	4541B	96
4008B	72	4029B	90	4071B	22	4513B	1.68	4543B	1.12
4011B	21	4032B	1.04	4072B	22	4514B	1.88	4551B	96
4012B	21	4035B	80	4073B	22	4515B	1.88	4553B	2.40
4013B	30	4038B	99	4075B	22	4516B	76	4554B	1.20
4014B	74	4040B	72	4076B	80	4518B	76	4556B	48
4015B	76	4042B	58	4077B	22	4519B	64	4560B	1.76
4016B	31	4043B	71	4078B	22	4520B	76	4561B	74
4017B	66	4044B	71	4081B	22	4521B	1.68	4566B	1.20
4018B	72	4046B	96	4093B	43	4522B	88	4580B	3.60
4020B	76	4047B	70	4094B	1.56	4526B	88	4581B	1.84
4021B	70	4049UB	32	4099B	1.20	4527B	1.20	4582B	80
4022B	70	4050B	32	4160B	72	4528B	88	4583B	1.00
4023B	21	4051B	72	4161B	72	4529B	1.04	4584B	40
4024B	50	4052B	72	4162B	72	4530B	62	4585B	88
4025B	21	4053B	72	4163B	72	4531B	72	4597B	1.84
		4060B	96	4502B	72	4532B	1.00	4598B	2.40
		4066B	43	4505B	1.88	4536B	2.64	4599B	2.00
		4068B	22	4510B	76	4538B	1.04		

SEMICONDUCTORS

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
AC107	35	BC107A	20	BC178	26	BC549	8	BD410	55	BF224	18
AC126	22	BC107B	20	BC182	9	BC550	7	BD434	55	BF225	20
AC127	22	BC108	20	BC182LB	10	BC557	8	BD437	86	BF241	15
AC128	20	BC108A	20	BC183LB	10	BC558	9	BD438	94	BF256LC	28
AC128K	32	BC108B	20	BC184L/B/C	10	BCX34	27	BD507	52	BF256	28
AC141K	34	BC108C	20	BC204	10	BCY72	13	BD508	55	BF257	28
AC142K	30	BC109	20	BC208	13	BD115	32	BD509	56	BF258	25
AC176	25	BC109B	20	BC209	10	BD116A	65	BD510	60	BF259	24
AC176K	32	BC109C	20	BC212	9	BD124P	60	BD517	60	BF262	84
AC186	41	BC114	12	BC212L	9	BD131	33	BD520	75	BF263	50
AC187	26	BC115	17	BC213	9	BD132	35	BD526	62	BF271	24
AC187K	28	BC116A	12	BC213B	10	BD133	40	BD696A	1.49	BF273	12
AC188	25	BC117	20	BC213L	9	BD135	26	BD707	95	BF274	24
AC188K	37	BC118	24	BC214	9	BD136	27	BDX32	1.50	BF310	30
AD143	82	BC119	36	BC214L	10	BD137	26	BF115	35	BF311	30
AD149	79	BC139	26	BC237B	12	BD138	23	BF117	36	BF336	36
AD161	42	BC140	32	BC238A/B/C	8	BD139	28	BF125	26	BF337	30
AD161/2	1.15	BC141	26	BC251A	12	BD140	31	BF127	26	BF338	34
AD162	42	BC142	21	BC252A	12	BD144	1.20	BF154	12	BF355	37
AF106	49	BC143	24	BC252B	12	BD159	65	BF158	18	BF362	37
AF114	89	BC147	9	BC261A	18	BD160	1.30	BF160	27	BF363	33
AF118	62	BC148	9	BC261B	15	BD166	52	BF167	24	BF371	30
AF121	56	BC149	10	BC262A	15	BD179	52	BF173	22	BF457	35
AF124	34	BC157	11	BC262B	15	BD182	72	BF177	35	BF458	28
AF125	35	BC158	10	BC300	33	BD183	75	BF178	26	BF459	35
AF126	34	BC159	10	BC301	28	BD201	85	BF179	28	BFR39	27
AF127	32	BC160	25	BC303	28	BD202	80	BF180	36	BFR90	1.74
AF139	42	BC161	28	BC307	10	BD203	80	BF181	36	BFT42	28
AF178	1.54	BC170B	15	BC308A/B	17	BD204	84	BF182	30	BFT43	28
AF239	45	BC171	9	BC327	11	BD222	46	BF183	29	BFW10	60
AF279	97	BC171A	10	BC328	9	BD223	56	BF184	30	BFX29	30
AL102	2.00	BC171B	10	BC337	11	BD225	47	BF185	30	BFX84	27
AU106	2.50	BC172	9	BC338	9	BD232	45	BF194/394	11	BFX85	28
AU107	2.00	BC172B	10	BC461	30	BD233	35	BF195	11	BFX86	30
AU110	2.00	BC172C	10	BC547	10	BD234	37	BF196	10	BFX88	25
AU113	1.40	BC173C	12	BC548	10	BD235	33	BF197	11	BFY50	20
BC107	20	BC174A/B	10			BD236	40	BF198	18	BFY51	22
		BC177	27			BD237	33	BF199	15	BFY52	20
						BD238	35	BF200	30	BFY90	75

Type	Price	Type	Price	Type	Price
BR100	17	MJE340	40	2N2904	51
BR101	30	MJ3000	1.98	2N2905	28
BR103	59	DT112	1.91	2N3054	60
BRC4443	80	DT121	1.91	2N3055	60
BRX46	40	SW150	3.90	2N3702	11
BRY39	30	SW153A	2.74	2N3703	10
BRY56	57	BU105/02	1.58	2N3705	10
BT100/02	92	OC71	27	2N3706	10
BT101	1.20	OC79	20	2N3708	17
BT102/500R	1.20	R2008B	1.80	2N2904	30
BT106	1.00	R2010B	1.80	2N5294	48
BT107	1.69	R2265	1.40	2N5296	48
BT108	1.69	R2322	58	2N5298	69
BT116	1.21	R2323	67	2SB337	1.86
BT119	3.66	R2461	1.50	2N5496	53
BT120	3.66	R2540	2.80	2N6107	75
BT151/800R	1.20	RCA16334	90	2N6109	81
BU104	2.00	RCA16335	80	2SA715	1.98
BU105	1.25	TIP29C	43	2SC495	1.10
BU108	1.80	TIP30A	47	2SC496	1.31
BU124	1.30	TIP30C	43	2SC643A	1.50
BU126	1.49	TIP31C	55	2SC1096	1.72
BU204	1.50	TIP32C	42	2SC1172Y	2.20
BU205	1.34	TIP33B	75	2SC1173Y	1.69
BU206	1.80	TIP41C	46	2SC1306	2.73
BU208	1.60	TIP42C	47	2SC1307	3.00
BU208A	1.65	TIP47	70	2SC1449	1.67
BU208/02	2.10	TIP120	65	2SC1520	68
BU326A	1.42	TIP2955	90	2SC1678	2.67
BU407	1.25	TIP3055	63	2SC1909	2.90
BU500	1.95	TIS91	21	2SC1953	1.44
BU526	2.46	TV106/02	1.55	2SC2028	1.82
BU807	2.94	2N696	21	2SC2029	2.60
BUW81A	3.84	2N918	82	2SC2078	2.90
E1222	28			2SC2091	1.34
				2SC2166	2.73

I.C. SOCKETS

DIL to DIL

8 way	22
14 way	29
16 way	32
18 way	32
20 way	32
22 way	34
24 way	36

DIL to QUIL

14 way	32
16 way	34
18 way	37

QUIL to QUIL

14 way	32
16 way	36

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NOW OUR SUN HAS GONE TO BED THE WINTER MONTHS JUST LOOM AHEAD BUT ITS THANKS TO ALL YOU CHEERY MEN WHO SENT US SUNSHINE BACK AGAIN AND ASKED WHEN PHOTO WOULD APPEAR – WELL WE'RE PRINTING IT WITH CHRISTMAS CHEER WE HOPE THAT SHEILA AND THE LASSES WILL HELP YOU MEND THOSE AWKWARD CHASSIS!

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Channel Four and all that

The traditional fourth push-button on the TV tuner is at last going to serve its original purpose. Channel 4 starts operation any day now, and we wish it a bright future. An additional choice of programming can't be a bad thing – let's hope it won't be just more of the same with a bit of difference. The initial programme details don't exactly raise one's hopes unfortunately. To start off with a panel game of all things! After all the effort that went into establishing the new network, one had hoped for something a bit more enterprising. Another hope is that we don't get a fourth dose of sport to coincide with sport on the other three channels, something which incredibly seems to happen all too frequently at present. What is it about our programme controllers that makes them give such emphasis to sport? Music programmes get cut and films postponed, but it never works the other way round. Sport is of course easy TV: just point the camera in the appropriate direction and hire a commentator to waffle away without actually saying anything. Maybe we might get a panel game as an alternative on such occasions!

The new channel is not exactly helping the ITV companies at present. Scottish Television has just reported increased advertising revenue for the half year, up 22·5 per cent, but after meeting increased costs profit has fallen. A substantial proportion of these increased costs consists of the company's Channel 4 commitment. This could be a temporary phenomenon, since the Channel 4 subscriptions are being levied before the advertising revenue starts to come in, but the industry seems to be a bit worried about that advertising revenue. Prospective advertisers on the other hand naturally want to see what sort of programmes will be forthcoming and what sort of viewer response the new channel is going to get before committing themselves. It seems that at the time of writing there have been no firm advertisement bookings in some of the smaller regions.

The advertising/ITV industry is naturally a bit uptight at present. To start a major new venture in the middle of a severe recession doesn't help exactly. Whilst advertisers were being turned away when Channel 4 was originally being planned, there's now ITV space to sell. Channel 4's start-up budget is £104 million, of which £49 is being provided by the fifteen ITV contractors whilst the rest is being borrowed from the IBA. The idea of course is for the ITV companies to recover their subscriptions by selling advertising space in their regions, but interest so far has been decidedly lacking.

This could lead to an almighty row if there's no improvement. It has been suggested that advertising revenue may fund less than half of Channel 4's next year costs, which could wipe out the ITV companies' profits for the year. If that happens and the viewing figures are poor, there'll be mounting pressure for a change in the system.

Why worry about the problems of the ITV contractors? Well, they do draw attention to the fact that TV has to be paid for, something that seems to get overlooked in all this talk about 30 channel cable TV and so on. It's all very well to get enthusiastic about the multiplicity of channels available in places like Brussels, but many of those channels are simply being pinched. Unpaid for use of the BBC and ITV channels, also French and German channels, is common in the Low Countries, just as parts of Canada receive US stations and so on. Satellite TV will further complicate matters. There's little that can or need be done about this, but it's important that those who want to offer multichannel TV via cable don't obscure the fact that someone somewhere along the line has to pay for these channels. In one way or another that someone ends up being the viewer! It's true that with ITV the viewer pays indirectly, when he purchases the advertised goods, but the point that stands out is that in the present economic climate and with Channel 4 and breakfast TV seeking revenue from advertisers there'll be little if anything left over to fund extra cable channels.

It would be wise to wait and see how Channel 4 develops over the next couple of years before making a firm decision on extra cable channels. The money to pay for them has to come from somewhere – the programmes too (what a prospect: thirty pictures of indistinct horses walking around in circles before they do their bit of running around in circles!). The awful possibility is that cable could become the Concorde of the TV industry. Then and not least there are the technical problems of what technology to adopt. We could all too well end up with the same sort of mess the telephone network has got itself into. The idea might be to get in first and claim world leadership, but if the technology isn't right the rest of the world won't be interested. Telephone equipment was once a major export industry: the UK's share of this market has declined substantially over the last decade however, largely as a result of not being able to offer the type of equipment wanted.

COVER PHOTO

Our front cover photograph this month shows the shadowmask production line at Mullard's Simonstown plant. Rolled sheet steel goes in at one end, and after a series of precision photo-etching processes finished shadowmasks arrive at the other end. Our thanks to Mullard Ltd. for providing the photograph.

Servicing Thyristor Line Timebases

Ted Barrett

LARGELY due to advances in colour c.r.t. scan coil design, the thyristor line output stage has become obsolete. It's a very good system to use where the line scan coils require large peak currents with only a moderate flyback voltage – an intrinsic characteristic of toroidally wound deflection coils. Many sets fitted with 110°, narrow-neck delta-gun tubes used a thyristor line output stage – for example those in the Grundig and Saba ranges and the Finlux Peacock. The circuit continued to find favour in earlier chassis designed for use with in-line gun tubes, examples being found in the Grundig and Körting ranges – also the Rediffusion Mk. III chassis. Deflection currents of up to 13A peak-to-peak are commonly encountered with 110° tubes, with a flyback voltage of only some 600V peak-to-peak. The total energy requirement is of the order of 6mJ, which is 50 per cent higher than modern 110° tubes of the 30AX and S4 variety with their saddle-wound line scan coils.

Circuit Operation

The basic thyristor line output stage arrangement used in all these chassis is shown in Fig. 1 – it was originally devised by RCA. The part to the right of the tuning capacitance acts in exactly the same manner as a transistor line output stage, with the scan thyristor Th2 replacing the transistor. The thyristor is switched on about half way through the forward scan, the efficiency diode D2 providing the initial part of the line scan (left-hand side of the screen). The scan coils and line output transformer (used to generate the e.h.t. plus various other supply lines and pulse waveforms as required) are a.c. coupled, via the scan-correction capacitor C5 and C6 respectively.

The problem with a thyristor is that it can be turned on at its gate but not off. To switch a thyristor off, the current flowing through it must be reduced below a value known as the hold-on current. This is the main function of the components on the left-hand side – the line generator, the flyback thyristor with its parallel diode and the commutating coil. During the forward scan, the tuning capacitors are charged from the h.t. line via the input and commutating coils. The line generator produces a pulse to trigger the flyback thyristor Th1 – this occurs just before the actual flyback. When Th1 switches on, the junction of the input coil and the commutating coil is momentarily connected to chassis. The tuning capacitance and the commutating coil then resonate, producing a pulse which draws current via the scan thyristor. Since this current flow is in the opposite direction to the scan current flow, the two cancel and the current flowing via the scan thyristor falls below the hold-on current. Th2 is thus switched off, and the scan coils resonate with the tuning capacitance to provide the flyback action.

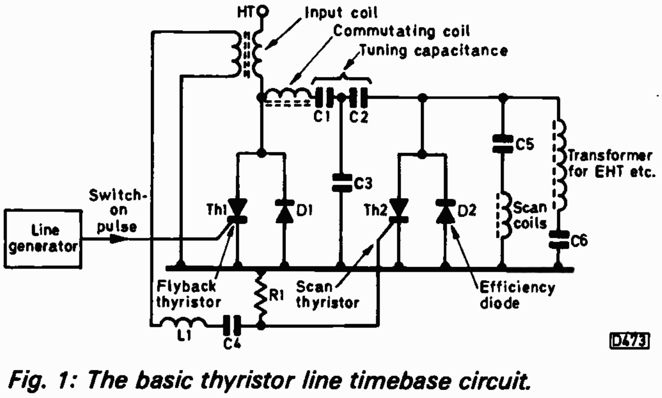

Fig. 1: The basic thyristor line timebase circuit.

So much for the basic action. A secondary winding coupled to the input coil produces a pulse to switch the scan thyristor on, in conjunction with the shaping/delay network L1, C4, R1. The tuning capacitors are usually arranged in the T formation shown to reduce the values required and the voltages developed across them. In practical circuits the input and commutating coils are usually combined in a single unit which for obvious reasons is generally known as the combi coil. The main point not so far mentioned is stabilisation. There are two approaches to this. In earlier circuits a transductor was included in parallel with the input coil to vary the impedance in series with the tuning capacitance. This was driven by a transistor which was in turn controlled by feedback from the line output transformer. A more efficient technique is used in later circuits, with a current dumping thyristor in series with the input coil.

Practical Circuit

As a typical example of the earlier type of circuit, Fig. 2 shows the thyristor line output stage used in the Grundig 5010/5011/6010/6011 series. Td1 is the regulating transductor which is driven by Tr506. Ty511 is the flyback thyristor (commutating thyristor might be a better name), Ty518 the scan thyristor, Di518 the efficiency diode and C516/7/8 the tuning capacitance. The scan coils are coupled via C537, while C532 provides coupling between the primary winding of the line output transformer and chassis. A transductor (Td2) is used for EW raster correction. The combi coil also feeds l.t. rectifiers from its secondary windings.

Component Problems

The only problem with this type of circuit is the large amount of energy that shuttles back and forth at line frequency. This places a heavy stress on certain components. Circuit losses produce quite high temperatures, which are concentrated at certain points, in particular the combi coil. This leads to deterioration of the soldered joints around the coil, a common cause of failure. This can have a cumulative effect, a high-resistance joint increasing the local heating until the joint becomes well and truly dry – a classic symptom with some Grundig sets. The wound components themselves can be a source of trouble, due to losses – particularly the combi coil and the regulating transductor. Later chassis are less prone to this sort of thing, partly because of the use of later generation, higher efficiency yokes but mainly due to more generous

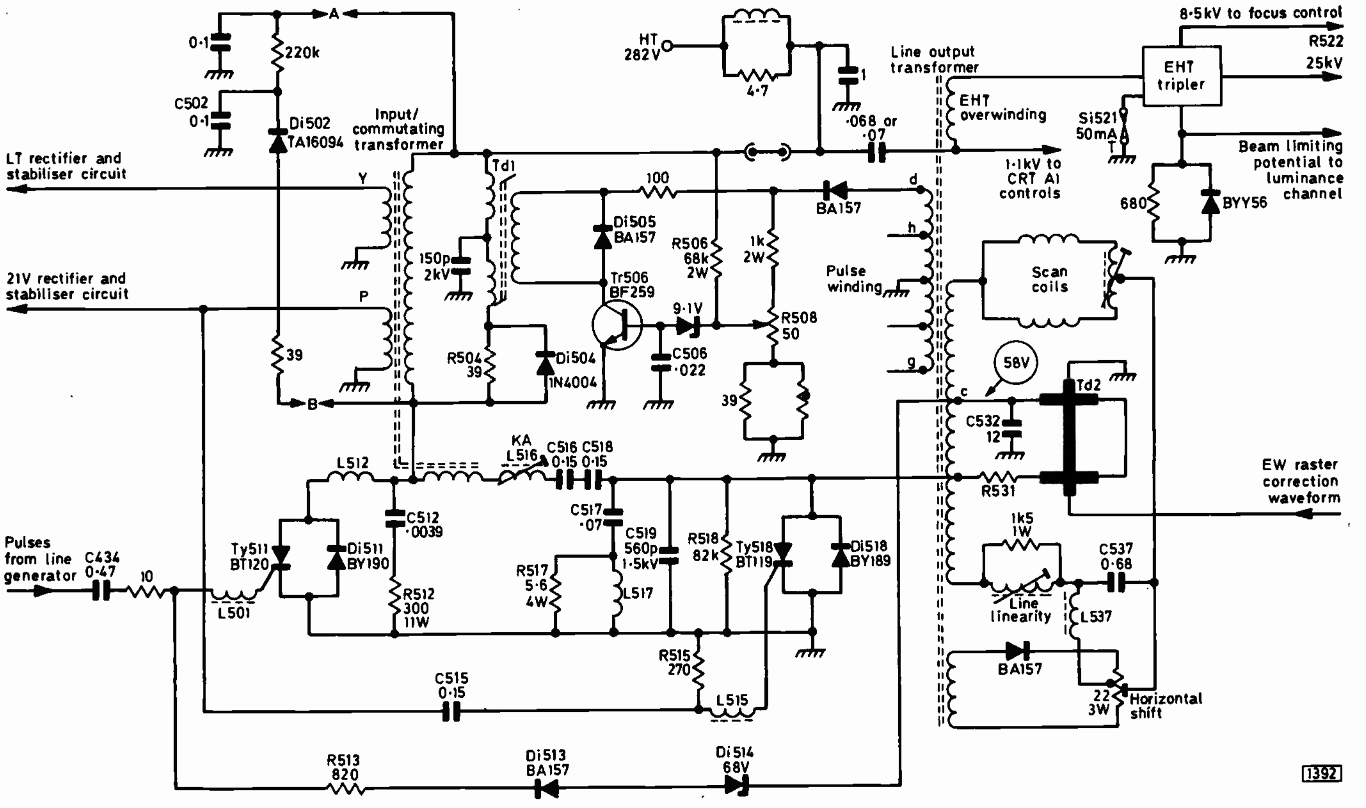

Fig. 2: Practical thyristor line output stage circuit used in the Grundig Models 5011 and 6011 (there were minor variations in the earlier 5010/6010). The over-voltage circuit R513/Di513/Di514 is used in later models – if the voltage at tag c on the line output transformer exceeds 68V, zener diode Di514 conducts, triggering Ty511 so that the overload cutout operates. The clamp circuit connected between points A and B was incorporated in earlier models to protect Ty511.

and better design of the wound components.

The ideal dielectric for use in the tuning capacitors is polypropylene (either metalised or film). It's a truly wonderful dielectric – very stable, with very small losses, and capable of operation at high frequencies and elevated temperatures. It's also nowadays reasonably inexpensive. Unfortunately many earlier chassis of this type used polyester capacitors, and it's no surprise that they were inclined to give up. When replacing the tuning capacitors in a thyristor line output stage it's essential to use polypropylene types – a good range of axial components with values ranging from 0·001μF to 0·47μF is available from RS Components, enabling even non-standard values to be made up from an appropriate combination. Using polypropylene capacitors in place of polyester ones will not only ensure capacitor reliability but will also lower the stress on other components by reducing the circuit losses (and hence power consumption).

The thyristors are also liable to fail, as are their parallel diodes. Earlier devices were less reliable than their successors. Since all thyristor line output stages operate in the same way and under similar conditions, the use of later types of thyristors and diodes in earlier circuits is a matter of mechanical rather than electrical considerations. One important point should be noted: the scan thyristor is a faster device and often has a higher voltage rating than the flyback thyristor. The simplest course is to keep in stock some of the later scan thyristors that incorporate an efficiency diode – suitable types are the RCA S3900SF and the Telefunken TD3-800H. The Telefunken device is in a TO66 package (and can be obtained quite cheaply) while the RCA type is in a TO220 package. Either type can be used in the scan or flyback positions and can also be used as a replacement for the regulating thyristor used in later designs instead of a transductor. Whenever replacing a thyristor in the line output stage it's good practice to replace the parallel diode at the same time. Using one of the above recommended devices will do this automatically, since the thyristor and its parallel diode share the same encapsulation – always remember to remove the old diode when this is a separate device however, as some can exhibit high-voltage leakage/breakdown which is not evident from a quite check with the Avo.

Apart from the wound components (including the line output transformer), the thyristors and their parallel diodes and the tuning capacitors several other components are prone to failure. These include the tripler, scan/flyback rectifier diodes used to provide various supply lines, surge limiting resistors, the scan coil coupling/scan correction capacitor (replace with a metalised polypropylene type) and regulator components such as the thyristor in later types and the transductor driver transistor in earlier circuits.

Basic Fault Conditions

All chassis that use a thyristor line timebase incorporate a trip of some sort. The type varies from chassis to chassis. Early Grundig sets have a mechanical cutout; the Saba H chassis uses a thyristor and solenoid to open the mains on/off switch; a common arrangement consists of a thyristor in series with the h.t. line and a control transistor which shorts the thyristor's gate and cathode in the event of excessive current demand (this gives audible tripping at about 2Hz). Some sets incorporate both excess current and over-voltage trips, but most have just the former. There are two basic fault conditions: when the excess current trip is activated and the set goes dead, or no e.h.t. with the trip not activated.

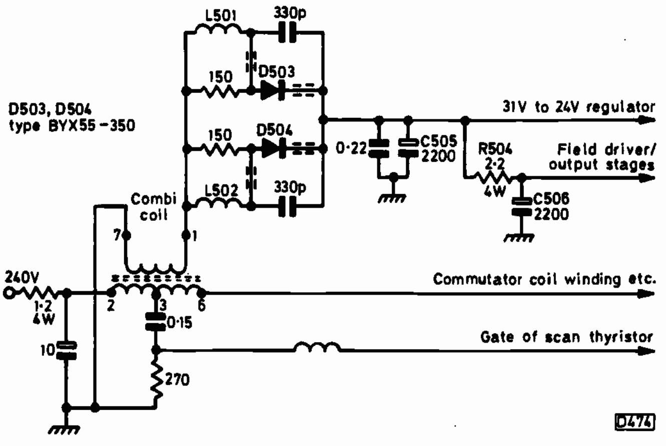

Fig. 3: Components connected to the input and rectifier windings on the combi coil in the Finlux Peacock. The commutator winding is connected between pins 5 and 8.

The first condition is usually due to a line timebase fault, the most common being a short-circuit flyback thyristor or its parallel diode. A straightforward resistance check will sort this out. If this is not the case, short-circuit the scan thyristor by soldering a wire link between its anode and cathode. This will prevent any drive to the scan coils and the line output transformer. If the tripping stops, the fault could be due to the tripler, the line output transformer, a rectifier diode fed from a winding on the latter or a short in a circuit supplied by a scan rectifier diode. If the trip continues to operate and the flyback thyristor/diode is not the culprit, the most likely causes are incorrect drive to this thyristor – if possible check with a scope against the waveform given in the manual – or a rectifier diode fed from the combi coil. As an example of the latter, Fig. 3 shows the arrangement used in the Finlux Peacock: the electronic trip will operate if either D503 or D504 goes short-circuit, a fairly common fault on these sets. The diodes can also go open-circuit/high resistance to give the no sound with field collapse symptom, but that's another story (our apologies for referring to the diodes as D603/4 in the September 1981 issue, page 583).

When the set is dead, h.t. is present and the trip is not activated, suspect the following: the scan thyristor, the efficiency diode, the line output transformer, the scan-correction capacitor, or lack of drive to the scan thyristor.

Dry-joints can be the cause of any of these basic fault conditions, depending on the actual circuit and where the dry-joint has occurred.

Other Symptoms

Hairline cracks in the ferrite core of a wound component can give rise to strange symptoms since this upsets the delicate balance of the tuning arrangements. There will usually be excessive current which will probably cause the trip to operate. Alternatively the fault may be incorrect line frequency which cannot be set by the line hold control. This fault can also give rise to excessive e.h.t., which can in turn produce a chain reaction of destruction, e.g. the tripler is a common victim as are the two line output stage thyristors.

Excessive e.h.t. leading to instant destruction of these components may also be due to open-circuit line scan coils or the connections to them. A quick resistance check done on the board itself will eliminate both the coils and the leads/connectors.

Excessive e.h.t. with foldover in the centre of the screen and cooking in the tube's first anode supply network occurs in the Grundig 5010 series when L515 in the scan thyristor's trigger circuit (see Fig. 2) goes short-circuit. The reason for this situation is that the thyristor is triggered on early. Another common fault in these sets is failure of Di504/R504 – failure of one seems to affect the other, so both should be replaced. The usual symptom is fuzzy verticals and a sawtooth effect on diagonals. The trip may operate, possibly after period of operation. These components set up the transductor's operating bias.

Linearity problems are usually caused by the regulator circuit, which can also be responsible for line "hunting". In the event of lack of width in the earlier type of circuit, check for dry-joints in the regulator circuit and suspect the control transistor.

Foldover on the left-hand side of the screen can be caused by an open-circuit flyback diode. Foldover at the centre of the screen with greatly reduced width is the symptom when the efficiency diode goes open-circuit – the trip may or may not operate.

Unusual interference patterns on the screen, best viewed with the contrast control turned to minimum and the brightness control advanced until a distinctly visible but not over bright white raster is obtained, can be due to the tripler if there's curved patterning on the extreme left-hand side of the screen, the regulator clamp diode (Di505 in Fig. 2) if there's curved interference just to the left of centre, or the flyback thyristor drive circuit if there's a single vertical line of patterning about four fifths of the way to the right of the screen.

Footnote

The aim of this article has been to provide a general guide to servicing rather than to list faults common to particular models. Much useful information on individual chassis with thyristor line output stages has appeared in previous issues of *Television* – refer to the following as required:

Asa 6000 series: May 1981.
Grundig 5010/5011/6010/6011 etc.: November 1976.
Körting 5507/55636 20in. PIL tube model: March 1979.
Saba H chassis: March 1978.
Zanussi BR1026: March/April 1980.

A final footnote on the Finlux Peacock, since little information has been published on this. It's not unusual to find field collapse due to R504 (see Fig. 3) having gone open-circuit. Replacement may restore normal results but it's as well to check the voltage developed across this resistor. 2-2·5V is normal but anything above this should be investigated – in particular replace the biasing diode(s) (three 1N4148s in early sets, a single STV3 in later ones) in the field driver stage, using two 1N4001 diodes in series.

In early sets there's a 10Ω resistor with a shorting link in series with these diodes, in later sets two 39Ω resistors are fitted in parallel. Fit a single 39Ω or 47Ω resistor in this position to avoid the possibility of a crossover line at the centre. In the event of slight bottom foldover check for 31V across C505. If this voltage is low, one or both of the rectifiers D503/4 could have a high forward resistance, one of the associated coils L501/2 could be dry-jointed, the printed circuit board could be cracked if a faulty BYX55 has been replaced heavy-handedly, or C505/6 could be open-circuit.

VCR Clinic

Reports from Derek Snelling, Richard Roscoe and Mike Sarre

Ferguson 3V29/30

The problem of the Ferguson 3V29/30 machines drifting off tune during the first couple of weeks was mentioned in this column last April. It's apparently due to the tuning potentiometers burning in: the recommendation is to run the machines for 24 hours prior to installation. If you have to keep retuning the set, fit the additional circuit shown in Fig. 1.

Ferguson have also had a problem with tape damage due to the insertion of slack tapes (mainly rented ones) in the machine. A modification kit, part number 00X6-419, has been introduced to alleviate this. It consists of a plastic collar and a plastic cap for the pinch roller. The collar is placed over the tension pole, positioning it farther back in the rest position and thus making it difficult for the slack tape to go to the wrong side of it. The cap makes a slack tape slide off the top of the roller on insertion instead of getting caught and damaged. **D.S.**

Hitachi VT8000 Series

Several points are worth noting in connection with the Hitachi VT8000 series.

First, a hum bar on record with the VT8500 and VT8700 – this can sometimes be seen on playthrough, i.e. in the E-E mode. The cure is to fit a low-voltage (a Mylar type is suggested) 0·1μF capacitor across C760 on the tuner PCB and to cut the pink lead (chassis connection) between the tuner board and the tuning preset board.

Secondly, tape damage after rewind. The problem is caused by the fact that the supply spool brake comes on fractionally before the take-up spool brake, or the latter slips slightly, when the machine stops after rewind. This results in a loop of tape which gets trapped in the cassette flap when the cassette is removed. There are two modifications for this, one mechanical and the other electrical. The former consists of filing a piece off one brake arm (see Fig. 2) to ensure that after rewind this brake comes on fractionally before the other one to prevent tape slack. The latter modification consists of fitting a small panel called the tape board next to the main board beneath the set, wiring this to the microprocessor as indicated (see Fig. 3). When the tape reaches the end on rewind, the rewind end sensor sends a signal to the microprocessor: this is detected by the tape board which instructs the machine to continue to rewind for a fraction of a second to remove any slack. It also does this when the machine is first switched on.

This is a very neat solution, but requires the rewind end sensor to detect the end of the tape: with machines such as the VT8500 and VT8700 that are fitted with the tape index system, if this is switched on during rewind the tape stops when the next index pulse occurs, so the modification circuit does not operate. With these machines it's advisable to do both modifications therefore.

This final point is not so much a modification as a problem arising from a production change. The fault is rather puzzling: a squeaking/rubbing noise comes from the tape transport system, the sound is warbled and the picture wavy. This usually happens only with certain tapes, and any alteration to the tape tension when the fault is present will affect it. We finally tracked down the cause of the fault with help from Hitachi. It's due to the audio/control head resonating, a bit like a wine glass when rubbed with a damp finger. Apparently the head material was changed to improve the sound output and this problem showed up. All the faulty heads we've come across so far (we've changed eleven) have had the number 671 stamped on them, so this may be the batch that causes the problem. Certainly all the machines concerned were sold during March/April this year, though the fault didn't show up till a couple of months later. The replacement heads supplied by Hitachi are of a slightly different construction again, and don't exhibit the fault. **D.S.**

Mitsubishi HS310B

A Mitsubishi HS310B would thread up normally but the spools wouldn't go round. On inspection we found that the pinch roller solenoid was failing to pull the pinch roller against the capstan: when it was pulled in manually,

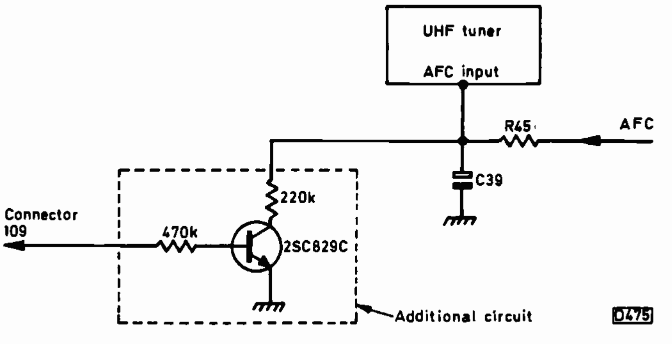

Fig. 1: Tuning modification, Ferguson 3V29/30.

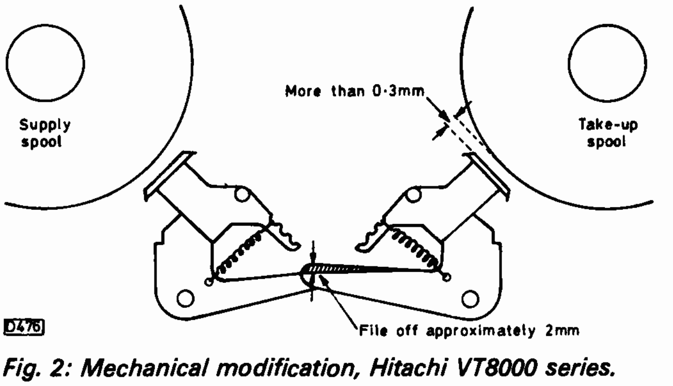

Fig. 2: Mechanical modification, Hitachi VT8000 series.

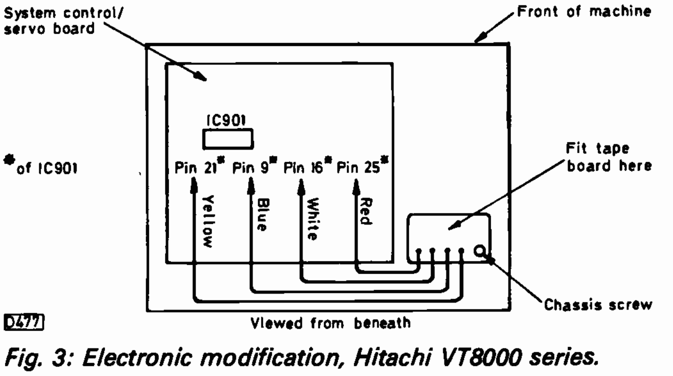

Fig. 3: Electronic modification, Hitachi VT8000 series.

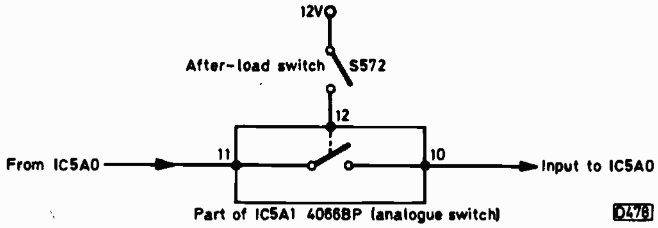

Fig. 4: After-load switch arrangement, Mitsubishi HS310B.

the machine would run normally until the pinch roller once more disengaged, so the servos and motors were all clearly o.k.

The main control chip is IC5A0, the output from pin 36 of this driving the pinch roller solenoid. We established that this output was not present, but having read in past issues how reliable these 40-pin brutes are we didn't immediately reach for the soldering iron. Much poring over the circuit diagram (why isn't it compulsory to include a good circuit description in all manuals?) revealed that one of the control inputs to IC5A0 comes via an analogue switch which is part of IC5A1. This switch is in turn controlled by the after-load switch S572 (see Fig. 4). The latter closes once the tape has threaded up completely, putting 12V on the control pin (12) of the analogue switch which then closes, telling the control chip to operate the pinch roller solenoid.

We found that S572 was o.k. and was putting the 12V on to pin 12 of the i.c. switch after the tape had threaded. The 12V also appeared at both switch terminals however. Replacing IC5A1 cured the trouble – and 14 pins are a lot easier to cope with than 40! **R.R.**

Sanyo VTC5600P

Fault: Playback speed varies and line slip.

As with all servo faults, the first step is to check all the input and reference signals. This usually pinpoints the cause of the problem very quickly. In this case we found that the 50Hz reference pulse was missing at S403, pin 8, on servo board 1. On tracing back to servo board 2, there were no pulses at pins 9/10 of i.c. Q1315, but on switching to record the pulses were o.k. We then started to trace back on the playback side to try to find the elusive pulses. There was nothing at Q1316, and Q1312 was just putting out noise. This led us to the oscillator section of i.c. Q1322, which should have been oscillating at 31·25kHz. The circuit seemed quite lively, and changing the crystal cured the problem. **M.S.**

JVC HR7700

Fault: Wow and flutter on playback sound with own recording. Prerecorded tapes play back o.k.

Yet another servo fault. Of all the machines that come into our workshop we find that about 50 per cent have mechanical faults, 30 per cent servo faults and 20 per cent all other types of fault. So it's important to know about servos!

We started with the servo 1 board. With the scope at the capstan sampling point (TP8) in the record mode there was no pulse on the rising slope of the trapezoid waveform. Moving back to TP7, there was still no pulse. TP7 is at pin 14 of IC12, this pin being linked to the tracking circuit. We checked the voltages around the associated transistor (X11) and found zero volts at its

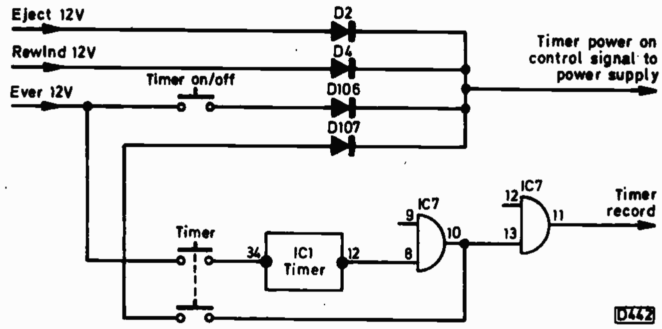

Fig. 5: Part of the Sony C7's timer control circuit.

collector instead of 11·7V – it was open-circuit. Replacing this pnp transistor restored correct operation. **M.S.**

Sony C7

Fault: Timer mode will not set (when pressing the timer button the red LED illuminates but the green LED stays on and all functions continue to work as normal).

This one involved us in delving into the timer control logic circuitry. Fig. 5 shows the bit involved. Diodes D2/4 and D106/7 form OR gates, sending timer "power on" signals to the power supply. We found that there was 12V at each side of D107, as a result of which there was a continuous "power on" signal. This voltage was getting through the timer switch from the AND gate IC7 (output pin 10). Now pin 8 of this gate was low and pin 9 high, so the output should have been low. Replacing IC7 cured the problem. **M.S.**

Sanyo VTC5300P

Fault: Varying speed playback of own tapes.

After replacing a noisy capstan motor (which is no mean task) we discovered that this machine played back its own tapes with speed variations – the playback was correct with a prerecorded tape. It seemed therefore that the control pulses were not being recorded correctly. We checked for the 50Hz pulse at a convenient point on the servo panel at the left-hand side. No signal was present. This led us back to the system control panel beneath the machine, then to the video 2 circuit. We eventually found that the signal at TP1239 (collector of transistor Q1239) contained a lot of "mush" which was swamping the reference pulses on record. Replacing this transistor – which showed no signs of being defective when tested – produced a nice, clean reference pulse to the servo panel and cured the fault. **M.S.**

Ferguson 3V29

Fault: Head drum rotating at 45 r.p.m. (perhaps it thought it was a record player!).

The engineer who had been looking into this one shot off on holiday, leaving me to pick up the pieces. He'd

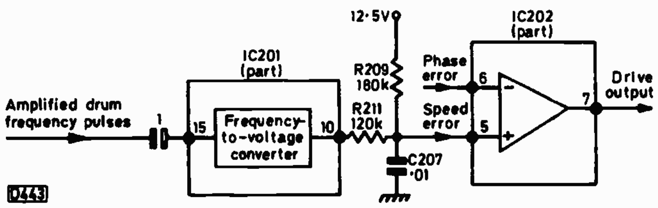

Fig. 6: Part of the Ferguson 3V29's drum servo circuit.

tried replacing the two i.c.s (IC201 and IC202) in the motor drive amplifier circuit, so I decided to start from scratch. As a first step I checked the drum motor stop circuit, i.e. the input to transistor Q202 etc. Everything was o.k. here. The drive output at pin 7 of IC202 was then found to be low (see Fig. 6). The output comes from an operational amplifier within the i.c., the inputs being pins 5 and 6, both of which should be at about 6·2V. Pin 5 was in fact at 0·4V. The l.t. voltage was correct at the supply side of R209 while the voltage at pin 10 of IC201 was 4·25V instead of 2·9V. This proved that the servo system was working correctly (a high voltage is required from the control frequency-to-voltage converter when the drum speed is low and vice versa). With higher voltages at each end of R209/R211 than at pin 5 of IC202 it had to be either the i.c. or the filter capacitor C207. It turned out that C207 was leaky. **M.S.**

Philips N1700

Fault: Chews tape for no apparent reason.

Here's a simple fault that took a long time to deal with due to its intermittent nature. What was happening was that after half to one and a half hours the friction motor (tape take up on play and record) developed a null spot and would stop, causing the tape to spill into the machine and get fouled up. Replacing the motor cured the problem. **M.S.**

Teletopics

LATEST TX9s

The latest version of the Thorn TX9 chassis contains one major change and one minor one. The major change is the use of a chopper power supply on the new main panel, type PC1044. It's of the Siemens self-oscillating type, with a TDA4600 control i.c. – the same arrangment as used in the Decca/Tatung 120/130 series chassis (see description in the January 1982 *Television*) but here providing 18V and 115V outputs. The new main panel can be substituted for the earlier ones (PC1001 and PC1040) but for battery operation must be used in conjunction with add-on battery converter type TA126 which has been specifically designed for use with the PC1044. A quick way of identifying the new panel is the changed position of the mains fuse FS1, which is now positioned behind the tuner (towards the tube) as viewed from the rear of the receiver. The new power supply results in reduced weight, a lower component count and simplified operation.

The minor change is the use of an SL1432 i.c. to drive the SAW filter on the new i.f. panel type PC1531. The SL1432 has an a.g.c. input (pin 7), dispensing with the need for an r.f. a.g.c. control (RV36). The new a.g.c. arrangement gives improved performance in the presence of strong adjacent channel interference.

Whilst on the subject of TV chassis, there's a new one from Philips, the CTX. This is initially being used in Models CT2006 and CT2016 (14 and 16in. respectively). The circuitry is arranged on a single main panel instead of the mother-daughter-board system used in previous Philips chassis. The sets are produced in the Philips' Singapore plant, though it's understood that a 20in. version will go into production in the UK. More details will be given when we've had an opportunity to examine the circuit.

VIDEO PROSECUTIONS

Can a prerecorded video cassette be an obscene publication? A recent case brought by the Director of Public Prosecutions against a north London video software distributor at Willesden magistrates court has produced a decision. All 590 copies of two horror tapes entitled *Death Trap* and *Driller Killer* were seized, the maximum action that could be taken under section 3 of the Obscene Publications Act. The decision to prosecute under section 3 was described as "exceptional", the prosecution being brought before the magistrates as a test case. Dealers are warned that future prosecutions will be brought under section 2 of the Act: this can involve a substantial fine or prison sentence.

TVROs AVAILABLE

In case you've not yet come across these initials, TVRO stands for television receive only, a term that's come to be used for satellite TV receiving terminals. Although there's not all that much by way of signals so far, TVROs are beginning to come on the market. March Microwave Ltd. of 112 South Street, Braintree, Essex (telephone 0376 44277) have available a terminal for reception in the 12GHz broadcast band. The terminal is known as the Satcom 1200 and the price of a complete system is around £3,000 – the price varies according to specification. Gallium arsenide f.e.t.s are used in the head unit, which has a low-noise amplifier and down converter. The unit has a stable, low-drift performance across a minimum bandwidth of 500MHz. This is complemented by an indoor unit which can provide outputs for standard domestic TV receivers or for a cable distribution network. The system has been designed to be compact and affordable for business, educational, cable and home TV use.

South West Aerial Systems have introduced a satellite receiver system for use in the 4GHz band. This comprises a dish aerial, head unit and indoor unit which can provide outputs on ch. E3, ch. E36 or at video/audio. The inclusive cost of the system is around £1,700. An advertisement appears elsewhere in this issue.

SONY COMMITTED TO HIGH-DEFINITION TV

Speaking at the recent International Broadcasting Convention at Brighton, Sony's deputy president Masahiko Morizono said that the company had made "a firm commitment" to manufacture of the Japanese 1,125-line high-definition TV system (see report in the September issue, page 596) though the production time scale has not yet been decided. Prototype cameras, VTRs, display systems and fibre-optic links were all on display at the Convention. Pilot movie production using the system has already been undertaken in the USA, but its use for TV purposes will have to await a decision on standards for future satellite use.

ELECTRONIC HOBBIES FAIR

The Electronic Hobbies Fair, sponsored by "Everyday Electronics", "Practical Electronics" and "Practical Wireless", is being held on November 18th-21st at Alexandra Palace, N. London (nearest tube station Wood Green). The aim is to provide the biggest and best ever event for the electronic hobbies enthusiast.

TUBE REBUILDING

TSR Vacuonics Ltd. have opened a new factory at St. Andrews, Fife for the rebuilding of Sony TV tubes. Mullard have announced the end of delta-gun colour tube rebuilding at their Simonstown plant, due to falling demand. In-line gun tubes will continue to be rebuilt and a stock of delta-gun tubes sufficient to meet demand well into the future is being held.

GEC-McMICHAEL

GEC (Radio and Television) Ltd., the GEC marketing arm for consumer electronic products, has been merged with another GEC subsidiary McMichael. The managing director of the newly formed GEC-McMichael will be McMichael's managing director David Wright. Old timers will recall that McMichael was once a leading brand in the radio and television field – their earliest products were radio kits which were first marketed in 1920. The company was bought by Sobell in the mid-fifties, the joint company subsequently becoming part of GEC. McMichael has remained as a separate entity however, concentrating in recent years on defence electronics. The intention is to take advantage of the growing opportunities in the television field by introducing new products developed by McMichael's research organisation. Such products will include satellite terminals and an up-market modular TV system which was shown in prototype form at the recent International Broadcasting Convention.

RADIO AND TELEVISION SERVICING

The latest of the annual *Radio and Television Servicing* books, covering 1981-2 models, has been published by Macdonald Educational, Holywell House, Worship Street, London EC2A 2EN at £19·50. As usual, there's a wealth of servicing data on the latest TV sets and other consumer electronic products.

V2000 PORTABLES

Further details of the new portable VCRs using the V2000 system have now been released by Philips and Grundig. The Philips VR2220 weighs 4·6kg (exclusive of battery and cassette) and measures 274 × 219 × 117mm: it uses standard V2000 cassettes and provides a recording time of an hour per charge of its lead-acid, slot-in battery. It's partnered by the VR2120 tuner/timer/mains adaptor/charger unit and the VK4020 camera. The recorder itself is expected to retail at around £550, with the tuner/timer at £250 and the camera at £500. Features include automatic assembly editing to give clean cuts between shots and audio dubbing to enable an additional sound track to be recorded.

The Grundig machine, Model VP200, is rather different, using a mini cassette which gives an hour's recording time per side and fits into an adaptor for use with a standard machine. The dimensions of the VP200 are 185 × 214 × 70mm and the weight 2·1kg – the cassette measures 108 × 72 × 21mm. The machine has been shown at W. German exhibitions but no decision on a UK launch date has been made.

On the disc front, Philips have reduced by £50 the suggested prices for LaserVision players – the new prices are £399 for the standard version and £449 for the version with remote control. In addition, a gift package of three video disc albums claimed to be worth £50 gives a total saving of £100.

WILLOW VALE'S TRADE SHOW

Willow Vale Electronics Ltd. are holding a trade show on Wednesday, January 26th at the Caversham Bridge Hotel, Reading, from 11.30 a.m. to 8.30 p.m. Admission is by invitation obtainable on request by telephoning 0734 884444.

TRANSMITTER OPENINGS AND CHANNEL 4

Antiference have produced a useful two-colour broadsheet giving facts and guidance on Channel 4 TV reception. It includes a comprehensive u.h.f. transmitter list with the opening dates (where known) of the various Ch. 4 transmitters, and highlights the opportunities the new service will give to "aerial people" and those in the TV trade. Copies can be obtained from Antiference Ltd., Aylesbury – telephone 0296 82511.

A new 22-page edition (dated August 1982) of the IBA's Pocket Guide to ITV, Channel Four and ILR stations is now available. This includes the latest information on Ch. 4 transmitter openings, also current and future ILR services and closing dates (where known) for Band III transmitters.

The following relay transmitters are now in operation:
Cathcart, Glasgow TV4 ch. 53, BBC-1 ch. 57, Scottish Television ch. 60, BBC-2 ch. 63.
Cushendall, Antrim BBC-1 ch. 40, Ulster Television ch. 43, BBC-2 ch. 46, TV4 ch. 50.
Cushendun, Antrim BBC-1 ch. 22, TV4 ch. 25, BBC-2 ch. 28, Ulster Television ch. 32.
Dunure, Strathclyde BBC-1 ch. 40, Scottish Television ch. 43, BBC-2 ch. 46, TV4 (future) ch. 50.
Glenariff, Antrim TV4 ch. 54, BBC-1 ch. 58, Ulster Television ch. 61, BBC-2 ch. 64.
Ipswich, Suffolk BBC-1 ch. 22, Anglia Television ch. 25, BBC-2 ch. 28, TV4 ch. 32.
Largs, Strathclyde BBC-1 ch. 39, Scottish Television ch. 42, BBC-2 ch. 45, TV4 (future) ch. 49. Polarisation *horizontal.*
Orton, Cumbria BBC-1 ch. 41, Border Television ch. 43, BBC-2 ch. 46, TV4 ch. 50.
Rye, Sussex Television South ch. 41, BBC-2 ch. 44, TV4 ch. 47, BBC-1 ch. 58.
Tillicoultry, Alloa TV4 ch. 53, BBC-1 ch. 57, Scottish Television ch. 60, BBC-2 ch. 63.
Wootton Courtenay, Somerset BBC-1 ch. 22, HTV West ch. 25, BBC-2 ch. 28, TV4 ch. 32.

The above transmissions are vertically polarised unless otherwise stated.

THE COST OF CABLING

A report ("TV and Video Technology in the UK") from the Economist Intelligence Unit includes some interesting estimates on the cost of installing cable systems in the UK. The cost of providing a fibre-optic cable network covering 50 per cent of households would be of the order of £5 to £20 billion – or between £500 and £1,500 per household. A coaxial cable network would work out at around £2 to £4 billion to cover 50 per cent of households. When the cost of providing the services is added to this, it would appear that prospective users will find themselves faced with substantial charges. It's interesting to note that whilst the spread of cable networks in the USA has been rapid their profit performance has been patchy.

SERVICE BRIEFS

The following information has been received from Philips:
TX chassis: Whilst the volume control can be responsible for uncontrollable volume the TBA120AS intercarrier sound i.c. is more likely to be the cause.
G11 chassis: The type BYX55-600 diode used in one of the EW diode modulator positions (D3132) and as the 37V rectifier (D3138) is no longer supplied as a replacement part. Diode type BYV95C is now being supplied as a substitute: it should be mounted 12mm (½in.) off the panel, well clear of surrounding components.
VR2022 VCR: A number of early production machines were fitted with a head servo panel whose print pattern differed from later production – the positive and negative 175V supplies were interchanged at socket N2. When replacing this panel (U202) the 175V supply connections should be checked and if necessary the cableform leads changed over.

Hey Constable!

Les Lawry-Johns

WE were snoozing peacefully at 04·15 the other morning. Our dreams were then interrupted by this earsplitting crash of broken glass. A horrible noise, difficult to describe and a bit frightening. "That bloody cat" I moaned.

"It's not the cat, it's the shop window" H.B. bawled, reacting quicker than me.

Rush down the stairs and switch on window lights. Just reaching the front door when I realise I'm stark naked (hot night). H.B. now at bottom of stairs with towel wrapped round her. Grab it – quicker than you could unveil a statue of Venus – and wrap it round lower regions. Open shop door and peep outside. No one to be seen. Whoever had smashed the window hadn't hung around for long and was nowhere in sight. Look at main window. Large hole on left side and scene of utter devastation inside. Large double housebrick lying amidst pile of broken glass and shattered display stands. It appeared that a portable TV set was missing.

"What did they get" asked H.B., now decently done up in her dressing gown.

"The daft buggers have only taken a monochrome portable. Hardly worth the effort" I said, checking to see that the remote control colour portable and the other more important items were still there.

H.B. went to phone the police whilst I dressed and got out the car to take a quick tour round, looking for any likely suspects on foot. Not a soul of course, so back to the shop to find that the police had arrived and were taking notes.

Getting the Facts

"Thirty eight, twenty four, thirty eight" Honey Bunch volunteered. That got me a bit as I couldn't quite see what her vital statistics had to do with it.

"They grabbed a portable TV, not my wife" I told the young officer.

"We have to have all the facts sir. Er, how old was the set?"

"How old! It'd only just been born, that's how old it was."

"Oh I see. It was new then?"

"It was new till that bloody brick hit it. I don't suppose it looks all that new right now. I've the make, model and serial number if that helps."

"Ah yes. Of course. Now how old are you sir?"

"Ninety four. What's that got to do with it?"

"Must keep a complete record sir. Now, do you keep a dog?"

"Yes, but he's not all that brave. Hides away if there's a loud noise. Only thing that upsets him is when someone stands on his mat. He bites them."

"Which mat is that sir?"

"The one you're standing on. I'll call him so that you can take a look."

"Please don't bother. Well, that's about all. If you find out who did it, let us know." And off he went.

Left alone we cleared out the window, swept up the debris and tidied up generally, waiting to get in touch with the glaziers who, bless them, had a new window fitted by mid-day.

Italian Interlude

My friend Geoff sold a TV set to an Italian family that lived nearby. They saw it working and paid the money, then popped it into the car and took it home. That same afternoon the lady returned waving her arms in the air. "Set no gooda. No goodatall. You owe me twelve pounds fifty. I take it now."

Well. Why twelve fifty? The set had cost a lot more than that. When the lady stopped bawling, Geoff ventured to ask.

"Becauser the set no go I kick electric fire. Now he no go. Cost twelve pound fifty to repair. Hur?"

"You kicked the fire, you pay for it. We'll pop round and fix the set for nothing, all right?" bargained Geoff.

Eddy looked up from the workbench and Geoff nodded to him. Eddy takes over. Soothing Eddy. Smarmy sod. Had the woman eating out of his hand in half a minute. Whipped her round to her house, retuned the set from London to Bluebell Hill in thirty seconds and stayed for two hours. No more mention of the fire. I could do with a bloke like that. On second thoughts, perhaps not.

A Couple of Deccas

I'm not well acquainted with the Decca colour portable (70 series chassis), so when Len brought his in for me to look at I was a bit wary. He's one of our local characters, an electrician by trade. So I guessed he'd already been having some sort of a go at it. I normally only see him in the local when we (me and the dog) pop in for a quick one after our walk. This is early on in the evening, about six thirty, but by that time Len is usually sloshed. It was fairly early in the morning when Len arrived, sober (I think).

"It used to go when I hit it. Now it doesn't. There's obviously a dry-joint" diagnosed Len.

"What did you do to it?" I asked carefully.

"Well, as the picture went off but the sound would stay on till I hit it to bring the picture back, I thought the trouble must be in the tuner."

"Well I never. Brilliant. What did you do next?"

"Took the tuner out. When I put it back there wasn't any sound either."

The chassis swings up. So we did this and took a look at the tuner. It plugs into the panel, and it's possible to plug it in wrong. Not easy mind you, but Len had managed it.

So we took it out and had another go, finally refitting the clip to hold it in position. We now had sound but no raster, due to the line output stage not working. Slight pressure on the line output transistor subpanel restored normal operation, and inspection revealed that the panel could move independently of the transistor which was soldered to it. Resolder the base and emitter legs to the panel and there we are.

"Wife will be pleased" said Len. "She goes to bed early and this keeps her company."

"You don't get home till late then?" I said by way of conversation.

"Most often don't get home at all" said Len. "Usually sort of fall asleep in funny places."

So Len wandered off, leaving me to reflect on the odd lives some people live. I couldn't ponder long because this young chap brought another colour portable in. Just had to be a Decca 70.

"It sort of went off" he explained. "Mum said if you hummed and harred about doing it, take no notice, just leave it for you to play with."

"I'll play with her if she talks like that" I threatened.

"That's what mum said you'd say. Mum's name is Joyce."

"I see. Yes well leave it for a couple of hours and I'll see what I can do. Give your mum my regards."

Fancy Joyce talking to her son like that. Let's see. How old would he be now? Well, must try to help the lad. Nice looking boy that.

So we looked at the Decca and didn't have to look far. The focus lead from the tripler was welded to a 27Ω wirewound which didn't look too happy with the wedding. It was just a matter of re-insulating the focus lead, dressing it away from any warm parts and replacing the 27Ω resistor, hoping that no other damage had been done. Fortunately nothing else had been affected, and a nice picture was produced.

Another Constabulary Visit

In comes this good looking fellow. Introduces himself as Don Clark, Inspector (technical) with the county police.

"Calling about the smash and grab?" I asked.

"Heavens no. Don't deal with that sort of thing. Technical, electronics and all that stuff. You must come and see our headquarters. Think you'd find some of the things we've got interesting."

"I'd like that" I said, wondering what might happen if I paid a visit to the police headquarters.

"Just passing by and thought I'd pop in to say how much I enjoy reading that magazine of yours. That chap Chas E. Miller kills me. Really does."

"He and his friend Ike Hodge kill me too" I said. "Pop in again next time you're passing Don."

Focus on Portables

1: IF and AGC Circuits

George Wilding

MONOCHROME portables from many countries have been imported into the UK over the past decade, and there is great diversity in the circuitry they employ. To start with, the tuner units: though the varicap type is now the norm – there are still some current models that use mechanical tuners – quite a variety of different types of mechanical tuners are to be found in earlier models. Many use a diode mixer for example, while the simple tuner unit used in the Sony TV144UK dispensed with an r.f. amplifier stage, incorporating just a diode mixer and a transistor oscillator. This was followed by a two-stage, wideband i.f. preamplifier.

The i.f. circuitry employed is also diverse. You may find a couple of chips preceded by a bandpass filter, a single chip preceded by a SAWF and its driver, a discrete component i.f. strip or, as previously mentioned, a transistor i.f. strip preceded by a preamplifier. Whilst the conventional diode is the usual type of vision detector employed in discrete component i.f. strips, it's not uncommon to find that a transistor is used for this purpose.

Interstage Coupling

Where discrete component circuitry is employed, many different collector load/interstage coupling arrangements are to be found. Coupling involves providing a good match between the comparatively high output impedance of one stage and the much lower input impedance of the following stage. Tuned transformers employing a suitable step-down ratio will meet this requirement, but tuned coils with impedance matching by means of a couple of capacitors or even just one capacitor are equally popular. Alternatively the coil may be tapped.

Fig. 1 shows the basic idea of capacitive impedance matching: the coil is tuned by C1 and C2 in series, the ratio of C2 to C1 determining the degree of coupling to the following stage – the larger the value of C2, and thus the lower its reactance at the signal frequency, the more closely the tapping point approaches the live end of the coil. By the latter we mean the collector end, since the other end is decoupled by C3. Because of the latter condition, identical results would be obtained by connecting the capacitors between the collector of the transistor and chassis.

When only one capacitor is used to couple the signal to the following transistor, the latter's input capacitance may act as the second capacitor in the coupling/matching arrangement. Transformers and coils are commonly damped with a resistor to broaden the bandwidth – on occasion you may even find that *RC* coupling is used.

Neutralisation

Whatever is done earlier in a discrete component i.f. strip, the final stage is usually transformer coupled to the detector. Neutralisation is also commonly employed in the final i.f. stage. The reason for this is that the types of transistor used in the final i.f. stage tend to have a larger feedback capacitance, whilst as the signal is at maximum

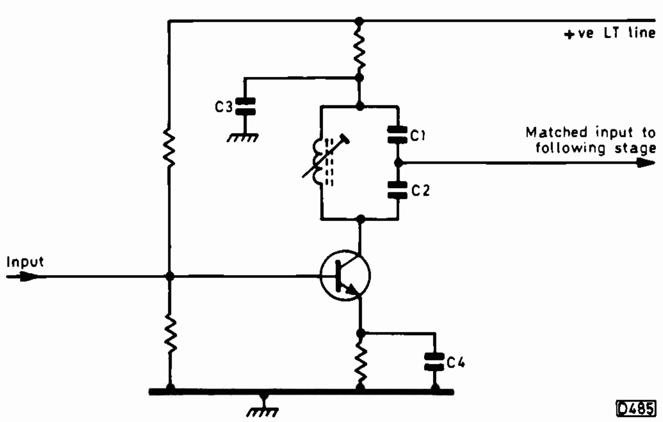

Fig. 1: Capacitive impedance matching between stages.

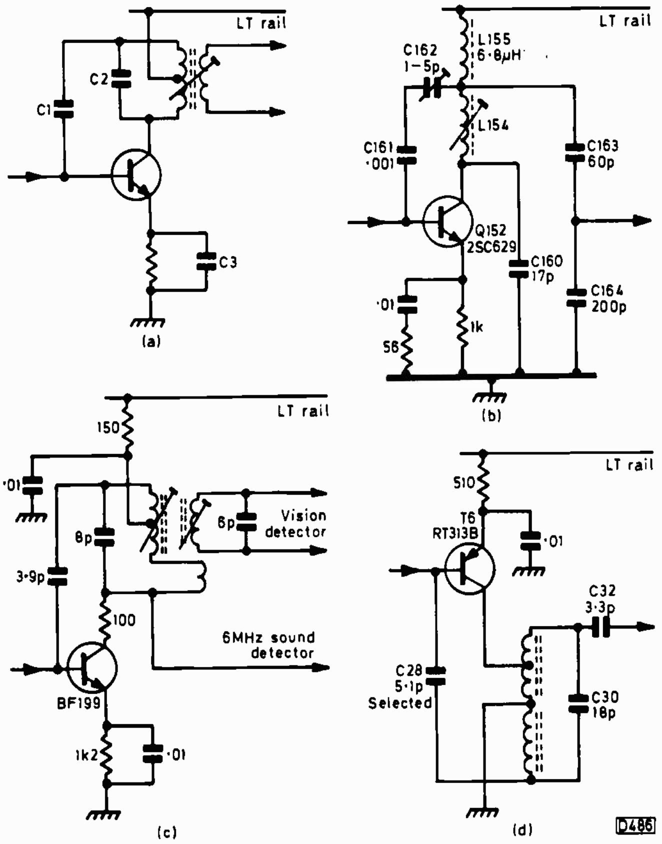

Fig. 2: Basic principle of neutralisation (a) plus some contrasting examples of neutralising and impedance matching arrangements (b-d).

amplitude the effect of any feedback will be much greater.

The simplest way of providing neutralisation is shown in Fig. 2(a). Here the l.t. supply is applied to an almost central tapping point on the i.f. transformer's primary winding, so that signals of opposite polarity will appear at each end. We can therefore connect a small capacitor (C1) whose value is equal to the transistor's collector-base feedback capacitance from the top of the coil to the base so that the two feedback signals cancel out (neutralise each other) at the base of the transistor. If the tapping point on the coil is not central, we will still get opposite polarity effects but the value of the capacitor will have to be changed to compensate for the signal amplitude disparity at the two ends of the winding.

Fig. 2(b) shows the coupling/neutralising circuit used in the second i.f. preamplifier stage in the Sony TV720UK. The two series connected coils L155 and L154 are tuned by C160 and by C163/4 which also provide capacitive matching to the following stage in the manner previously described. Since the junction of L154/5 is live from the signal point of view, a neutralising signal can also be tapped off at this point. It's applied to the transistor's base via the trimmer C162 (neutralising adjustment) and the d.c. blocking capacitor C161.

The example shown in Fig. 2(c) is the arrangement used in the final i.f. stage in the Philips T8E chassis. This may at first sight look a bit unusual, but is in fact the basic circuit. The extra winding provides tight coupling to the vision detector circuit, the 8pF capacitor tunes the primary inductance, the 3·9pF capacitor provides neutralisation while the 100Ω resistor is included to prevent spurious oscillation.

As a further contrast, Fig. 2(d) shows the final i.f. stage used in the Rigonda Fiesta. It's unusual in that whilst the earlier i.f. stages in the set use npn transistors a pnp type is used in this last stage. So the collector is returned to chassis, with C28 providing neutralisation, C30 tuning and C32 matched output coupling to the detector circuit. Note the precise value of C28.

Bandpass Filtering

Whether discrete component or i.c. circuitry is used, the bandpass forming circuitry is usually lumped together and placed between the tuner and the i.f. strip – as in other types of TV receiver. Such circuits rarely give trouble, a dry-jointed connection being the most likely fault.

AGC Arrangements

Since portables may have to work under extreme reception conditions, the a.g.c. system must have a wide range. Where i.c. circuitry is employed there are hardly any discrete a.g.c. components other than those that provide an adjustable delay to the tuner, a gating pulse feed, and maybe an inverter stage if it's necessary to invert the sense of the a.g.c. potential applied to the tuner.

Several different a.g.c. arrangements are to be found with discrete component i.f. circuitry. The starting point is generally the load resistor of a video emitter-follower used to drive the video output stage. Fig. 3 shows a couple of typical examples.

The first example, Fig. 3(a), is used in the Philips TX chassis. Under no signal conditions, C350 charges to 1·4V via R353. This positive voltage at the base of the a.g.c. amplifier transistor TS351 drives it to saturation, its collector voltage then being 0·8V. The voltage developed at the junction of the potential divider R355/6 is filtered and used as the base bias for the first i.f. amplifier transistor TS217. The amplitude of the sync pulses, which are negative-going at the cathode of D350, provide the measure of signal strength. D350 acts as a peak detector, conducting on the sync pulse tips to produce a negative-going a.g.c. voltage at the base of TS351. The a.g.c. voltage applied to the base of TS217 is thus positive-going, reducing the gain of this transistor with increased signal strength through forward a.g.c. action.

TS217 also acts as a d.c. amplifier for the a.g.c. system, providing a positive-going a.g.c. voltage (with increased signal strength) at its emitter to bias the base of the second i.f. amplifier transistor and a negative-going voltage at the slider of R216 in its collector circuit. This latter voltage is amplified and inverted by TS366 and applied to the r.f. amplifier stage in the tuner.

The circuit used in the Sanyo 12T234, shown in Fig. 3(b), also produces a positive-going a.g.c. voltage as signal strength rises. Transistor Q151 acts as a peak detector, gate and amplifier. Negative-going sync pulses are fed to its base, while a 25V peak-to-peak line flyback pulse is fed to its collector to provide the gating action. This has the advantage that the transistor conducts only when a sync pulse is present at its base. At this point, the pulse coupling capacitor C156 acquires a charge proportional to signal strength. This charge is fed via D154 to the a.g.c. reservoir capacitor C154, and then via 3·3kΩ resistors to the bases of the first two i.f. amplifier transistors.

The potential divider R155/6 provides a minimum low-signal bias for the i.f. transistors. R157/8 provide the same action for the tuner a.g.c. D153 is held cut off until the a.g.c. voltage at its anode exceeds the voltage at its

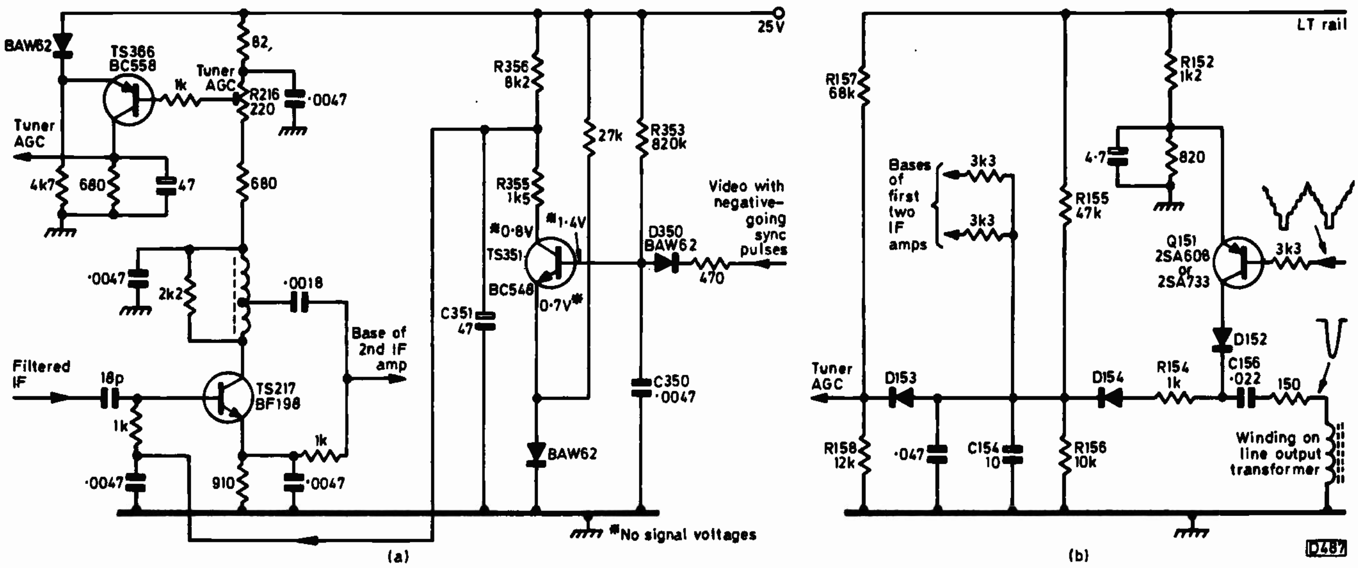

Fig. 3: Representative a.g.c. circuits used in monochrome portables.

cathode set by the potential divider action of R157/8: D153 thus delays the application of a.g.c. to the tuner until the signal strength rises to a predetermined level.

Fault Conditions

Faults in a.g.c. circuits are not common, and when they do occur are mainly due to defective transistors, diodes or electrolytic filter/reservoir capacitors – in that order of probability – giving rise to a variety of symptoms.

Should the a.g.c. amplifier transistor (TS351) in the Philips circuit fail to pass current for any reason the result will be complete loss of sound and vision signals since in this type of circuit one or more of the i.f./r.f. amplifier transistors will be driven into saturation. In the circuit shown in Fig. 3(a), with TS351 non-operative R355 will no longer be returned to chassis and will thus fail to provide a potential divider action with R356. So the base bias applied to the controlled transistors will rise dramatically and all three transistors will be saturated.

The opposite situation will arise if Q151 in the Sanyo circuit – Fig. 3(b) – becomes non-conductive. There will then be no a.g.c. action, resulting in excessive contrast, vision-on-sound, sound-on-vision and possibly loss of sync. A collector-emitter short-circuit in Q151 will result in low sensitivity on the other hand, since the current flowing via R156, D154, R154, D152, Q151 and R152 will increase the a.g.c. bias developed across R156.

Open- or short-circuit diodes in a.g.c. circuits can cause similar problems, while leakage in an electrolytic capacitor can alter the bias applied to the controlled stages. Partially dried up electrolytics can also cause buzz on sound, since the field as well as the line sync pulses must be filtered out.

When confronted with loss of signals or excessive contrast, it pays to start by making voltage checks in the a.g.c. circuit – in most models the a.g.c. circuit is more prone to failure than the i.f. stages are. An npn transistor with excessive forward bias will have a lower than normal collector voltage: if it's driven into saturation, the voltages at the base, emitter and collector will be nearly the same, though a careful measurement will reveal that the base voltage is slightly higher than the other two.

The most common fault in the i.f. strip itself (discrete component type) is a defective transistor, which should be revealed by voltage checks. A less common though not infrequent cause of signal loss, sometimes intermittent, is leakage in an emitter decoupling capacitor.

Correction

Our apologies to S. Simon and to readers for an error that occurred in the Routine TV Receiver Tests article in the August issue (ITT CVC5-CVC9 series hybrid colour chassis). This was due to a misunderstanding on our part and a misreading of the circuit diagram. The correction to note is that when the 20V l.t. supply fails there will be no sound and no raster in *all* versions of these chassis.

A simplified circuit of the RGB driver/output stage configuration used in later versions of the chassis (CVC8 and CVC9) is shown in Fig. 1. Noting the presence of the 82kΩ resistor between the output transistor's base circuit and the h.t. line, we had supposed that absence of the 20V supply would have left the output transistor biased into conduction, with a low voltage at the c.r.t. cathode. The key to what actually happens lies in the driver stage however. With its base returned to chassis and its emitter linked to the h.t. line via the 82kΩ resistor, the driver transistor will switch on and short-circuit the base of the output transistor which will in consequence be cut off. So, as in the earlier CVC5 and CVC5/8 chassis which use a different RGB driver/output circuit, the result will be a blank raster with high voltages at the c.r.t. cathodes.

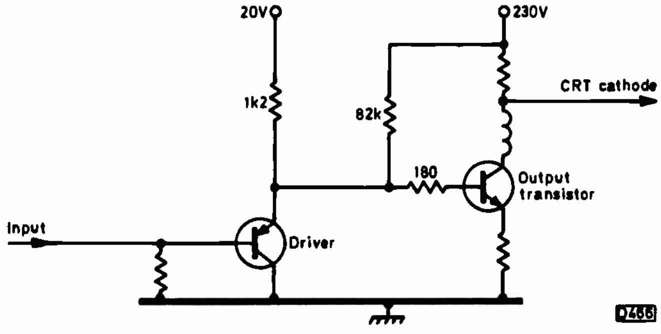

Fig. 1: Video circuit used in later ITT hybrid colour sets.

Fault Report

Mick Dutton

Decca 30 Series

We've had several interesting faults on sets fitted with the Decca 30 series hybrid colour chassis recently.

The problem with the first was sound but no raster. We switched on and found that there was a nice, healthy e.h.t. rustle, so over to the tube base to check voltages. The first anodes were very low at only 300V or so, and on checking back to the timebase board we found that there was a very large voltage drop across R475 (220kΩ) which feeds the first anode presets from the boost supply. The obvious assumption was that it had gone high in value. This was not the case, but as it was running quite warm there was clearly an excessive load in the first anode circuit. Everything measured o.k. on a resistance check, so we removed the three leads to the first anode connections on the tube base. This produced a nice 800V at the sliders of the first anode presets, and the problem turned out to be due to leakage in the spark gap associated with the red first anode pin – there was no measurable leakage when checked with an Avo, but replacing it restored normal results.

The second set had neither sound nor picture: the valve heaters were alight, but fuse F2 (500mA A/S) in the l.t. rectifier circuit had blown. We replaced this and switched on. Heaters alight, plenty of spark at the top cap of the PL509, but no signals. After a minute or so the fuse failed again. Replace fuse, check diodes etc. in the power supply, then switch on. The 25V output was very low at just 1·5V, but returned to normal when the i.f. panel was unplugged. The culprit turned out to be the small disc ceramic l.t. line decoupler C38 (0·01μF) which measured short-circuit.

The next set had a slight hum bar – on the picture, not the sound. The power supply looked in good condition, and the l.t. reservoir/smoothing electrolytics C604/6 checked o.k. We then noticed that if the brightness was advanced the fault became more prominent. A peculiarity of this chassis is the preset brightness control which is connected between the 25V line and a negative −38V line. It turned out that the reservoir capacitor for this latter supply (C605, 22μF) had gone open-circuit.

The final set led us a dance over a good few days. The initial complaint was of intermittent lines in the background of the picture. We'd replaced the tripler not long before, and had noticed that the aerial signal was rather poor. When we called this time a new aerial had been installed and there were signs of overloading which we cured by fitting a 12dB attenuator. A few days later we were called back for the same problem, but as we could find no signs of it we took the set back to the workshop for a soak test. The set spent several days on the bench without the fault putting in an appearance, so back it went to the customer.

The next call came a week later, and this time we saw the lines – it looked like aerial overloading. A check with another set cleared the aerial installation however, and we came to the conclusion that it was a tuner fault. We didn't have one with us, but as I was putting the back on I noticed a smell of e.h.t. arcing from the left-hand side. Close inspection in the dark revealed tracking from the envelope of the PL509 to the surrounding metalwork. A new valve stopped this and finally cured the background lines problem.

Lack of Brightness

The problem with a 24in. monochrome Decca set (Model MS2401) was lack of brightness – the customer said that the picture had got darker gradually over a period of several weeks until now it was only just visible on highlights. Tube base voltage checks revealed that the first anode supply was low at 350V instead of 660V. The resistors in the feed were o.k., as was the decoupler C92, but when we disconnected the focus control to measure its value we found that it had fallen from 2MΩ to only 280kΩ. A new slider potentiometer restored the picture to normal.

Rank A823 Chassis

Field collapse is a fairly common fault on the Rank A823 chassis, the usual cause being dry-joints on the NS pincushion phase coil or the pincushion amplitude control. These components were o.k. on this occasion however, as was the field output stage. We then remembered that the field scan coupling capacitor 7C5 (400μF) is mounted on the convergence panel: it proved to be open-circuit.

Folded Picture

A GEC monochrome portable (Model M1201) produced a picture which was folded down the centre. The voltages in the line output stage all seemed low, but we couldn't fault any of the smaller components. A new line output transformer was then ordered and fitted, but the fault remained. We eventually traced it to the line driver transformer whose secondary winding was high-resistance. On examining its pin connections a large amount of flux was found where the wires were soldered: cleaning off and resoldering finally cleared the problem.

Telefunken 709 Chassis

The problem with an elderly Telefunken hybrid colour set (709 chassis) was field collapse, and on checking the voltages in the field output stage we discovered that the output transformer's primary winding had gone open-circuit. Luckily we had a scrap chassis handy, so we transplanted the field output transformer from this. After a bit of setting up the receiver produced a very acceptable picture.

Rank T20 Chassis

Sets fitted with the Rank T20 chassis seem to suffer more than their fair share of faults. We've had three different line driver transformer faults for example. First there was the case of the dead set, due to dry-joints where the transformer is soldered to the panel; secondly a dead set due to the wire from the transformer winding never having been soldered to its leg (I've had that one twice); and finally the set that used to blow up BU208 line output transistors once in a while – we put this down to breakdown between the transformer's primary and secondary windings.

We also had a set with a very strange field fault. The complaint was of intermittent foldover at the bottom, with teletext lines at the top of the picture – the problem seemed to appear only on bright scenes. On making voltage checks in the field timebase everything was found to be about right but a little unstable. To cut a very long story short, 4D4 which is part of the biasing network for the second driver transistor 4VT5 had never been fitted!

Thorn 8800 Chassis

No sync and lack of luminance information was the fault on a Thorn 8800 chassis – the colour was present as normal. The two main suspects were IC1 (TCA270) and IC3 (SN76226DN-07) but replacing these made no difference. Time to check waveforms. The level of the output at pin 9 of IC1 was low at some 0·5V peak-to-peak instead of 2·7V, while the output from the following filter was almost non-existent. The signal is coupled from this point to pin 6 of IC3 by the tantalum capacitor C153 (1·5μF) which was found to be almost dead short.

Telefunken 711 Chassis

A set fitted with the Telefunken 711 chassis came in with the complaint of no raster and smoke coming from the back. The smoke was found to have been coming from the safety resistor R550 (68Ω) which supplies the line driver stage. We replaced this and checked the transistor (T561, type MJE340) which was all right. As there were no obvious short-circuits we switched on. Up came the sound but there was no rustle of e.h.t. and after a few seconds R550 became very warm – the voltage at the collector of T561 was only 10V instead of about 150V.

We decided to check the waveform at the base of T561 and found that this was absent. Neither was there any output waveform at pin 2 of the TBA950-2 line oscillator i.c. A few voltage measurements here revealed that there was no 12V supply to pin 2 – in fact there was no U3 (12V) supply from the 12V series regulator in the power supply section. The cause was the driver transistor T402 (BC307) which was open-circuit base-to-emitter.

Thorn 1615 Chassis

A case of no tuning with a Thorn monochrome set (1615 chassis) was simply due to R5 (24kΩ) being open-circuit, thus removing the supply to the TAA550 stabiliser.

Grundig 1510

The problem with a Grundig 1510 colour portable was that it would go dead after a period of use. We checked for the usual dry-joints in the thyristor line output stage but everything looked o.k. So we left a meter connected to the "A" h.t. rail – 255V to the line output stage – and found that when the fault occurred the voltage dropped to zero. The fault was due to the electronic cut-out thyristor going open-circuit intermittently.

Telefunken 712 Chassis

The complaint with a 20AX Telefunken set (712 chassis) was a dark picture with bars of interference. The first anode voltages were low at only 200V, and on tracing back we found only 250V on the input side of the first anode presets. The problem turned out to be due to a dry-joint on the first anode supply smoothing capacitor C579 (0·068μF).

Purity Problem

The problem with a Thorn set fitted with the 8500 chassis was that the purity would vary. The degaussing circuit was checked and found to be working correctly, so we came to the conclusion that the tube was at fault. A new one was fitted and set up, and the set returned to the customer. Two days later it was back with the same fault!

We reset the purity, and this time disconnected the degaussing circuit: after a few hours the purity had again moved out. As we had another of these sets in the workshop we decided to try swapping over the degaussing shields. The fault in the first set was now cured but was present in the second set. Removing the affected shield and demagnetising it by hand with a degaussing coil solved the problem. The metalwork must somehow have become permanently magnetised.

Philips G11 Chassis

Two sets fitted with the Philips G11 chassis have been our way recently. The problem with the first was intermittent no sound – the sound would go off after about half an hour, and the customer said a tap on the cabinet would get it back. We hooked up a meter and found that there was no 38V supply to the sound output stage on the i.f. panel when the fault was present. As so often with this chassis, the fault was due to a dry-joint, this time at pin 3A1 on the line timebase panel.

The problem with the second set was that the picture had suddenly gone very dark, with the sound normal. A few checks at the tube base revealed that the first anode voltages were normal, so we suspected a fault in the RGB output stages or their biasing. The voltages around the output transistors seemed reasonable however, so we moved back to the U6200 luminance/chrominance control module where we found that the supply voltage at pin 15 was only 4V instead of 11·8V. This voltage comes from the 12V regulator on the i.f. panel, and although its input was correct at 17V it was giving only 4V output. A new i.c. cleared the fault.

Grundig 2200

A Grundig 2200 came to us with the complaint of general convergence errors which could not be corrected by means of the dynamic correction controls. The problem was caused by cracked print inside the convergence assembly on the tube neck: we were able to strip the unit down and make repairs with some thin wire.

Indesit Monochrome Set

The customer complained that his 24in. Indesit solid-state monochrome set would go dead when it got warm. We took it into the workshop, connected it up and switched on. Half an hour later it went off. There was h.t. at the smoothing capacitor but no other sign of life. A close examination revealed white deposits around the base of this electrolytic, and on fitting a replacement normal operation was restored.

In these sets the negative side of C901/2/3 is returned to chassis via C921, which should have 2·6V across it. In this case the 2·6V was missing due to the reduced capacitance of the main smoothing pack.

Philips G8 Chassis

I've had several cases recently of field foldover in sets fitted with the Philips G8 chassis. The problem has been traced to cracked print between the pincushion correction transductor and R4483, thus effectively disconnecting the field windings on the transductor from the circuit.

Another problem that seems to be getting quite common on the G8 chassis is R1372 (390kΩ) going high in value. This is the feedback resistor in the mains thyristor control circuit, and the result is intermittent picture jitter due to the over-voltage circuit operating. You get the same problem with the Pye 725 etc. chassis when R897 (470kΩ or 390kΩ) goes high in value.

The Spirit of '51

Chas E. Miller

WHEN TV was in its infancy in 1951 a booklet entitled "Trouble-free Television" was published. I came across a copy recently in a pile of second-hand service sheets – and what a fascinating insight it gives into the world of television in those far off post-war days. Even to one who lived through this period, the attitudes of the time now seem almost beyond belief.

Take the front cover to start with – it features a photograph of a group of ultra-short-wave haired tots gazing entranced at an Ekco console model which is displaying a picture of the dreaded Andy-Pandy disappearing backwards into his own hamper. A better scene setter for what is to follow would be hard to imagine. In the opening chapter the author declares: "By its appeal to both eye and ear and stimulation of the intellectual senses, Television (his capital T) is the most satisfying medium for home entertainment yet devised . . . Television comes to us as a virile, intimate and refreshing solace of our leisure." Well! After a write up like that, it's not surprising that "purchasers will be well advised . . . to place their orders as soon as possible. Otherwise, because of the scarcity of certain non-ferrous metals and the rearmament demand for Radar, they may have to wait months for delivery, thus missing programmes of great appeal." They don't write sales talk like that any more – my heart bleeds for those unfortunates who missed the television premier of "Wallaby Jim of the Islands" due to the Cold War, not to mention umpteen editions of "Whirligig".

What to Expect

Having assumed that his readers would immediately rush out and buy sets, our author goes on to tell them what to expect and do. "Installation completed, the first evening programme will be some occasion. The peak period normally commences at eight o'clock. It's then that the BBC steps out high, wide and plentiful with television broadcasts rated the world's best by all except a few disgruntled viewers." And we wouldn't trust them, would we? On he goes with "the viewers are greeted with charming smiles by an announcer who outlines the programme for their entertainment. Feminine members of the audience will be keenly interested in the dresses for the lady announcers, provided by the BBC and chosen for their photographic properties." The dresses, lady announcers or both? "At last we are away and can sit back for an enjoyable hour or two" – unless there's a breakdown "followed by a few words of apology and 'in the meantime we will play a few records'."

" 'Thank goodness it isn't our tube' exclaims the viewer with relief, and waits for the reassuring statement 'I am glad to say that we are now able to go ahead with the programme'." Some things haven't changed all that much after all. Certainly the programme schedules of those far off days affected service engineers in a way that continues. The "high, wide and plentiful" programmes began at eight o'clock – and normally finished not later than ten o'clock! What constitutes "plentiful" is clearly a debatable point. There was the demonstration film and fifteen minute showings of test card C from ten till noon, with "very old films, often repeated" (something else common to the present) from three till four and Children's Hour from five to six. There were no test transmissions between these hours, so when delivery of a set was not possible during those sporadic day time hours the engineer had no choice but to turn out at eight o'clock at night.

We certainly made a rod for our own backs! For years after all day programmes became commonplace we were still expected to work all the hours God sends – someone phoned me at ten past eleven only the other evening and seemed surprised that I wasn't madly interested in his troubles. But if nothing else the scarcity of programmes did give the illusion that each was an event in its own right. This was aided by the elaborate tuning-in procedure that had to be carried out before the evening's viewing commenced. Younger readers may find it hard to believe that people did adhere to the long-winded process described in "Trouble-free Television", but I can assure them that it was the norm for many years.

The Switch-on Procedure

"Switch on ten minutes before the hour. Only click on if combined with Brightness." That last rather puzzling comment meant that if the on/off switch was ganged with the brightness control it should be rotated just far enough to operate only the switch. If the switch was ganged with the volume control, "give it about half a turn after a minute or so. In this case the other control . . . should have been turned right off to fade out the picture before switching off."

One then waited until the signature tune – "a phantasy of National airs" – warns that "it's time to begin operations." The brightness control had to be turned up slowly until a test card became apparent. The contrast and brightness were then balanced in order to achieve sharp distinctions between the steps of the displayed grey scale. After a while the card was faded out, together with the music, to be replaced with a picture of the BBC's coat of arms. After "a minute or two of silence there is another record, the 'Television March' by Eric Coates, accompanied by the relief map of England featuring aerial masts from which radiate rings of light representing the transmitting waves." And "that is all there is to bringing the receiver into operation."

The ten-minute warm up was advisable because sets needed that amount of time to reach their normal working temperature. Sets employing electromagnetic focusing were especially affected, and if one corrected the fuzziness too soon the chances were that one would be up and down to the control all evening. Added to the set's own hazards was what the author described as "that post-war disease of 'load-shedding'." When the power stations were in danger of being overloaded, the engineers used Ohm's Law to cut back on demand. They simply reduced the consumer's voltage by say ten per cent, automatically reducing the current consumption by the same amount. On occasion the load-shedding would reduce the voltage to under 200V, which had a severe effect on sets innocent of any h.t. regulation. Although not the primary reason, this problem certainly helped to make it desirable to have a large number of sub-controls which were usually available through a small sliding or hinged door at the front or side of the cabinet. It was by no means unusual to find eight or more "user presets".

Programmes of the Time

The latter half of the book was mainly concerned with the programme matter of the time, and one receives the impression that the author was beginning to repent his earlier fulsome praise. "Less satisfying is the inevitable repeat of Sunday's drama or opera on Thursdays. If that happens to be a cultural type, or of a kind preceded by a warning that it is unsuitable for children, for many families that will mean two nights when it will not be thought worth while switching on . . . In the first few months of 1950, there was an outburst of indignation at the unsuitability of the dramatic productions on Sundays, leading to a better balance subsequently . . . It is feared that the more cultured emphasize their tastes and create a false impression that the performances they prefer are what the mass desire, the lowbrows remaining in silent, if angry, obscurity." So much for the disgruntled few!

"Friday's programmes have been generally of the popular type . . . Monday's are often the dullest . . . There are numerous (variety) shows, generally one on Saturdays, but except for the more spectacular items . . . they often fall flat." A photograph of an item being presented in one well-liked programme reveals that the ever reliable stand by, the viewer's phone in, was even then in use. But ". . . there is too much emphasis on politics for the people of a country that is not politically conscious."

The Final Word

So there you are. If it all sounds too familiar, comfort yourselves with the thought that the technical merit of most inventions far outweighs the use to which they are put – for example aerosol paint cans in toilet blocks and fish and chips wrapped in colour supplements. Let the author of "Trouble-free Television" have the (almost) last word: "Were the BBC to aim at a round the clock service with television (it) would inevitably decline to a mediocre level." No doubt he would have included ITV had it been around then. But at least we now have full colour mediocrity . . . "Trouble-free Television" was written by A. C. Armstrong and published by G. T. Foulis and Co., Ltd.

next month in

TELEVISION

● SOME RECENT CHASSIS
Fault reports relate mainly to older sets – the latest generation of TV chassis don't have "stock faults" in the way that older ones did. Nevertheless if you deal with the more recent sets in sufficient numbers you acquire a certain amount of fault know-how. John Bourne on the Thorn TX9 chassis and the Hitachi NP8CQ.

● VINTAGE TV – EMI
From the latest to the oldest! The HMV 905 dates from 1938 and John Narborough has recently been renovating one. Interesting to see how sets were designed in those days – and it says more than something for the technology that they can still be got going.

● MILLER'S MISCELLANY
From the sets of yesteryear to the workshops of the time. Chas E. Miller describes some work places that will make you either laugh or cry. Also some recent servicing problems and a visit to the Radio Rentals' renovating plant at Bristol.

● TEST AND FAULT REPORTS
Eugene Trundle on the Manor Supplies Mk. V pattern generator and a report from John Coombes on various TV receiver faults.

● VCRs FOR SECAM
One of the advantages of the SECAM colour system is the ease with which the signal can be recorded on tape. Things are more complex in practice since French and Middle Eastern SECAM machines don't operate in the same way. David Matthewson reports.

● ROUTINE TV RECEIVER TESTS
S. Simon on the Pye 725 and related solid-state colour chassis.

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A Simple 4GHz Satellite Receiver

Roger Bunney

SIMPLICITY was the aim with the 4GHz receiver to be described. It consists of two basic elements – the "plumbing" and the electronics. The former (see Fig. 1) consists of a horn which is placed at the focal point of the parabolic dish to collect the signal and direct it to a pick-up probe. The probe in turn provides the input for the electronics (see Fig. 2), which consist of a frequency changer (mixer plus local oscillator), a three-stage i.f. amplifier and a voltage stabiliser which provides 15V and 12V outputs. So we have an input to the mixer at 4GHz and an output at 70MHz.

Improved signal-to-noise ratio and image rejection would be obtained by incorporating one or two stages of low noise amplification at the input and using double conversion, but the idea has been to show how things can be done simply in order to encourage experimentation. More sophisticated arrangements are being worked on and will be featured in future articles. Satellite TV transmissions use f.m. for the video of course, but images of fair quality can be resolved by feeding the 70MHz signal to a standard a.m. receiver. Again, more advanced circuits will be given in due course.

The feedhorn is based on a design by Steve Birkill published in the February 1979 issue of the US publication CATJ – credit must be given to Steve for his pioneering work in this field. Sources of dish aerials have been mentioned in previous Long-distance Television columns, and if you don't fancy making a feedhorn a complete unit with SMA output socket can be obtained from Harrison Brothers (22 Milton Road, Westcliffe-on-Sea, Essex). Once the horn has been mounted, the electronics built and tested and the dish aligned with the satellite, signals should be resolved. Locating the satellite may take some effort in practice, but since the EIRP of the Gorizont channel 1 transmissions is high, signal acquisition should be easy once you are nearly "on beam". The 3·675GHz Gorizont satellite is at some 197° from North at an elevation of 30° in the southern UK.

Production of the feedhorn is tricky. A heavy-duty soldering iron (say 240W) is advisable, and if you've a friend who's skilled at metalworking get him to help! The waveguide section of the feedhorn consists of a seven inch length (may be longer) of 54mm outside diameter copper water pipe which can be obtained from a scrap yard. The end adjacent to the probe is closed with a circular cap of thick brass. The reflector at the input end is also made of brass – $\frac{1}{16}$ in. double sided PCB could be used, but there will be no forward slant and an outer ring $\frac{7}{8}$ in. high should be fitted. The quarter-wave probe is fitted within the waveguide, $1\frac{1}{8}$ in. from the rear end. In my prototype this was spun from brass, with a tapered connection end to the electronics section giving a push-fit through the Teflon insulator. The reflector shapes the pick-up characteristics to encompass the appropriate dish capture area, and will obviously vary with the focal length – the dimensions given provide a good compromise for typical practical dishes with focal points around 26-32 in. (focal/diameter ratios from 0·35 to 0·5). From comments made during discussions with Harrison Brothers copper seems to be essential for the waveguide – don't use aluminium! The accompanying photographs show the overall construction. An SMA socket could be fitted instead of the Teflon insulator, giving direct coupling to a commercial low noise amplifier unit.

An industry has grown up almost overnight in the USA to cater for the rapidly increasing interest in satellite TV reception in the 4GHz band. As a result, much simplified electronic packages for the purpose have come on the market. Two such items are used in the present design. First a double balanced mixer, Varil type DBM1600,

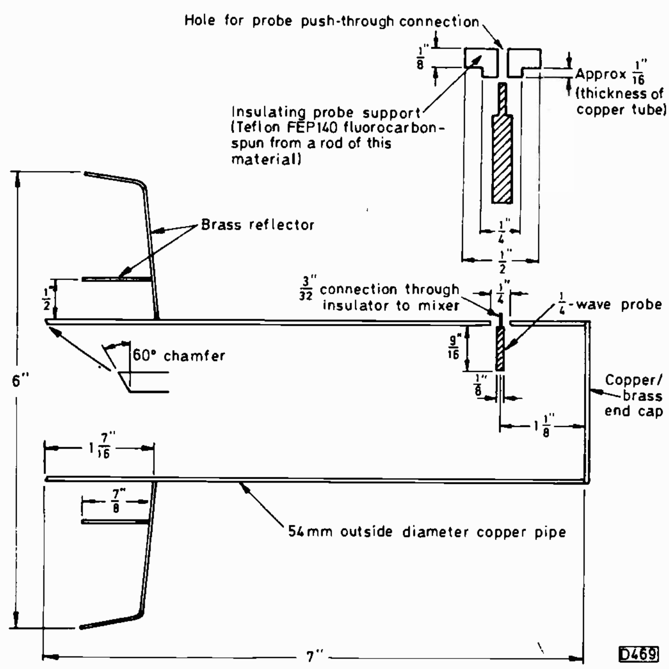


Fig. 1: Construction of the feedhorn.

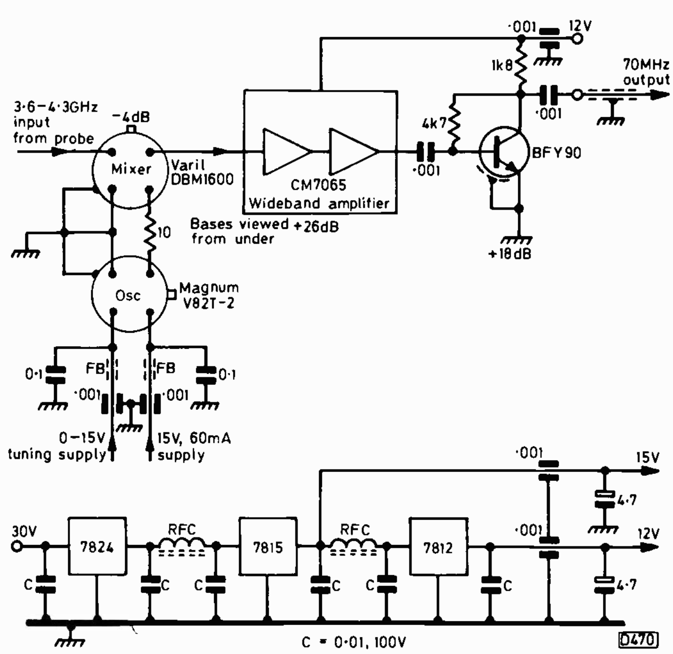


Fig. 2: The electronics. Electrolytics 35V tantalum.

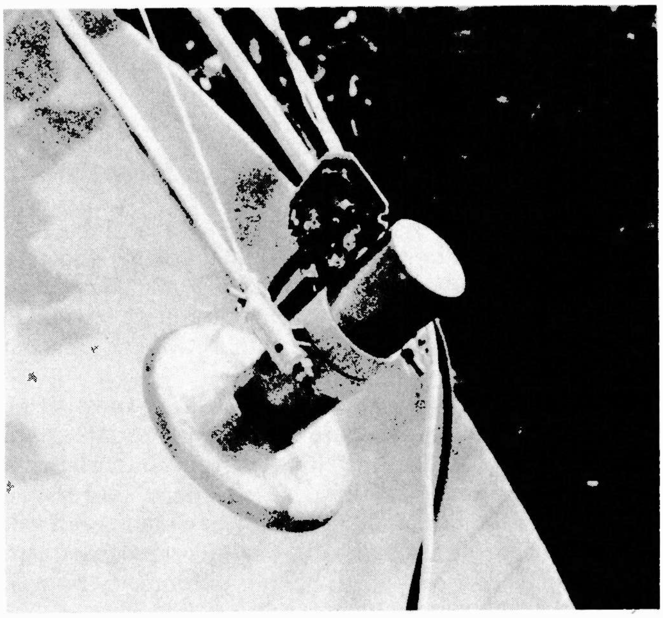
which is housed in a TO8 package. Inside there are four diodes in a ring formation plus input and output transformers. One merely connects the 4GHz input to one pin, the local oscillator input to another, earths the third and takes the output from the fourth. The conversion loss is low at some 4dB. The mixer is complemented by a varicap tuned oscillator, Magnum type V82T-2, which is also housed in a TO8 package. Applying a tuning voltage of 0-15V to one pin enables the whole band (3·6-4·3GHz) to be converted down in conjunction with a suitable mixer – to 70MHz in this case. One pin is earthed, another provides the output, and the remaining one requires 15V at 60mA. This is high, but the output provided is 10-15mW. With careful mounting of these two TO8 packages a very compact microwave downconverter is obtained. Since there is no amplification prior to the mixer, it's essential to mount this very close to the signal probe's output pin.

The mixer is followed by a Labgear type CM7065 two-stage amplifier which provides a gain of 26dB. The CM7065 is a wideband (40-86MHz) amplifier with a noise figure of 1·8dB. I removed the case and changed the position of the middle screen (adjusting the lower third through 45°) and the output connection screening (still the cable clamp but moved farther away). The space left adjacent to the original input clamp (removed) was used to mount the two TO8 packages, the green varnish being scraped from the PCB and two holes drilled and filed to enable the TO8s to be fitted flush. Conductive epoxy resin (RS) was carefully applied to ensure complete earthing. The CM7065 was also modified to accept a separate supply instead of being powered via the output cable. Further gain of some 18dB was obtained by adding a BFY90 transistor amplifier stage, giving an overall i.f. gain of 44dB. The BFY90 stage was fitted adjacent to the output clamp connection, with appropriate modification to the connections at this point. Output is via the cable clamp as normal, modified to remove the 12V through powering facility.

As can be seen from the photographs, the resultant head downconverter board sits upright atop the circular waveguide. Brass strips are soldered to the guide and to the PCB to provide support. A standard double-sided PCB is mounted adjacently to house the three stabilisers. These receive a 30V input and provide stabilised 15V and 12V outputs. There is also a 0-15V feed to tune the oscillator and an earth return.

In Steve's original feedhorn, the method of adjusting for left- or right-hand circular polarisation, or vertical/horizontal polarisation, was to twist an integral sleeve with two protruding screw threads within the waveguide. Assuming that one is looking into the guide, towards the vertical signal probe at the rear, threads at ten past eight (45°) give right-hand circular polarisation while the opposite (ten to four) gives left-hand polarisation. With the screws across the middle (horizontal) you get vertical polarisation. For horizontal polarisation the probe must be rotated so that it is horizontal, with the screws at six o'clock. Steve subsequently suggested an easier arrangement – a PTFE slab some 1cm thick and 4cm long is inserted so that it fits just inside the open end of the tube. This is adjusted to the same positions as noted above and gives the same results. Right-hand circular polarisation is required for reception of Gorizont's channel 1.

This isn't a project for the complete beginner – though I knew nothing about microwaves at the start and mine worked! Also, the TO8 devices are not cheap. PTFE and



Feedhorn with downconverter mounted atop.

Front view of the feedhorn.

Teflon can be obtained from Insoll Materials Ltd., 39 Wilbury Way, Hitchin, Herts SG4 0TW. Note that Teflon is a registered trade name of Du Pont (Geneva). Hugh Cocks (Bre Cottage, Cripps Corner, Staplecross, Robertsbridge, E. Sussex TN32 5RY) can supply the TO8 devices, while CM7065 amplifiers can be obtained from South West Aerial Systems (10 Old Boundary Road, Shaftesbury, Dorset). The copper tube is of the standard seamless water pipe type – you may get an offcut from a large builder (this piping is not used for domestic work but for factory etc. installations). I obtained a two foot length for £2 (scrap weight value) from a scrap metal yard. Please include a stamped, addressed envelope with any enquiries sent to the above mentioned suppliers.

The friend who made the feedhorn supplied the brass work. I found him by first contacting a local artist and asking him whether he knew of any local metal workers involved in arts and craft work! The feedhorn can be held by a clamp made from small size Marley drainpipe fittings – a circular bracket gives a safe, tight fit around the 54mm waveguide. Two lengths of half inch outside diameter alloy tubing were used to suspend the feedhorn in front of the dish.

It has been suggested that whereas the 12GHz band will be the DBS band, the 4GHz band will be the haunt of the TV-DXer! There's a lot about, Gorizont being merely the start.

VCR Servicing

Part 13 **Mike Phelan**

THIS month we'll look at some of the problems associated with the mechanical side of the VHS machine. We've already discussed things like faulty motors, so let's take a detailed look at the actual tape path through the machine (see Fig. 55).

It must be stressed at the outset that most of the adjustments require the use of the appropriate manufacturer's jigs. Also, and this is very important, no adjustments are necessary unless parts have been renewed or the machine has already been tampered with. The tape path is very critical: to enable prerecorded tapes to be played there must be no differences between machines of the same type.

We'll start off at the left-hand side of Fig. 55, where the tape leaves the cassette. When the play key is depressed, the two loading arms carrying the entry/exit guide rollers and slant poles leave their resting places and carry the tape out, wrapping it around the head drum. The back tension lever is then released, so that the pole contacts the tape, the attached brake band wrapping around the supply reel. This maintains a constant tape tension around the head irrespective of variations in cassette size etc. If the tape tension increases, the pole moves to the right and slackens the brake band: if the tension decreases, the pole penetrates the tape farther, increasing the tension on the brake band.

There are two adjustments here, one for the position of the anchor at the fixed end of the band and one for the spring tension. The alignment kit is necessary for carrying these out, but fortunately most trouble is not due to misadjustment. As a rough check, with the machine in the playback mode a line drawn from the front right-hand corner to the static guide by the erase head should pass through the back tension pole. Excessive back tension will result in the chroma being displaced to the left of the luminance, with premature head and tape wear. Insufficient back tension produces a rather noisy picture because the head-to-tape contact is impaired. The main cause of this is that the brake band and reel disc need cleaning – with alcohol. Another problem is that the brake band sometimes snaps. To get to all these parts it's necessary to remove the cassette housing (four screws). The band can be cleaned if the screw and bush attaching it to the arm are removed. Do not take out the screw at the other end.

Next in line come the static guide, which should never be moved, and the erase head. If the tape is not running centrally in the guide, i.e. there's curving at the top or bottom edge (see Fig. 56) with the paint seal unbroken, suspect that the back tension pole is not vertical – correct by gentle bending.

The two slant poles and guide rollers we'll leave till later. The other static guide should also never be moved, but the audio/control head has three screws for adjustment. Assuming that the head's been replaced, the procedure is as follows. First mount the head at approximately the correct height, vertically. With the machine in playback, use a small mirror to look at the ferrite inserts in the head. Adjust all three screws until these project equally above and below the tape edge. Some heads have white inserts to facilitate this. Adjust the back screw to make the head vertical in the fore-and-aft direction. Then repeat the procedure.

Next put in the alignment tape with the 6kHz audio track. With a scope at TP19 (top of the audio-servo board), tighten *all three screws* a quarter turn and note whether the audio monitored on the scope increases. Ignore any increase obtained after moving one or two screws. If there is an increase, repeat this procedure: if there isn't, try slackening all three screws. The head is now at the correct height. We must next adjust the azimuth for best h.f. response. This is done by adjusting the side screws (say one eighth of a turn) in equal and opposite amounts, still with the scope at TP19. The only thing that remains is to adjust the back screw until the tape is running centrally in the static guide. Repeat the height and azimuth adjustments.

If the tape runs upwards or downwards after a few minutes the pinch wheel isn't vertical. Check by pushing it towards the capstan to see whether the gap is parallel. Correct by bending the arm on which the pinch wheel is mounted. If the tape runs over the top shoulder of the static guide the audio will be intermittent: if it runs over the bottom shoulder the lower edge will be wrinkled where it passes the control head, causing intermittent loss of the control pulses and side-to-side movement of the picture – if this is bad enough there'll be no off-stape control pulses and no servo action. The oil fence on the capstan will produce the same effect if it's not pushed right down. If the audio/control head is much too low, the h.f. bias on record will erase the top edge of all the video tracks – giving a well defined noise bar at the bottom of the picture, disappearing three seconds before the end of the recording.

It's worth considering what happens if the audio/control head is moved laterally in the direction of tape travel. As far as the machine's own recordings are concerned, nothing will happen, but with a prerecorded tape the phasing of the off-tape control pulses will shift (the pulses have a fixed relationship with the tracks, defined in the VHS standard). This has the same effect as adjusting the tracking control. In manufacture, the baseplate on which the head is mounted is set so that the alignment tape plays back with the tracking control in the *centre*: the preset tracking is then adjusted on the machine's own recordings. Note that we said centre, not click, position – the tracking in the click position depends on the setting of the preset control.

The position of the audio/control head's baseplate must never be moved. When you consider how close together the control pulses are on the tape you will appreciate how critical this adjustment is. The total movement spans several pulses, so at first glance you might think that there are several "correct" positions for the head. Not so however as there's only one correct position where the audio and the picture are synchronised – this is noticeable on lip movements on a prerecorded tape if incorrect.

Loading Mechanism

We'll return now to the loading mechanism, where most faults occur. If either slant pole or guide roller is for any reason not in the correct position, the angle of the tape path around the head drum will not be correct. This may not affect the recordings made on a particular machine, but it won't play back prerecorded tapes cor-

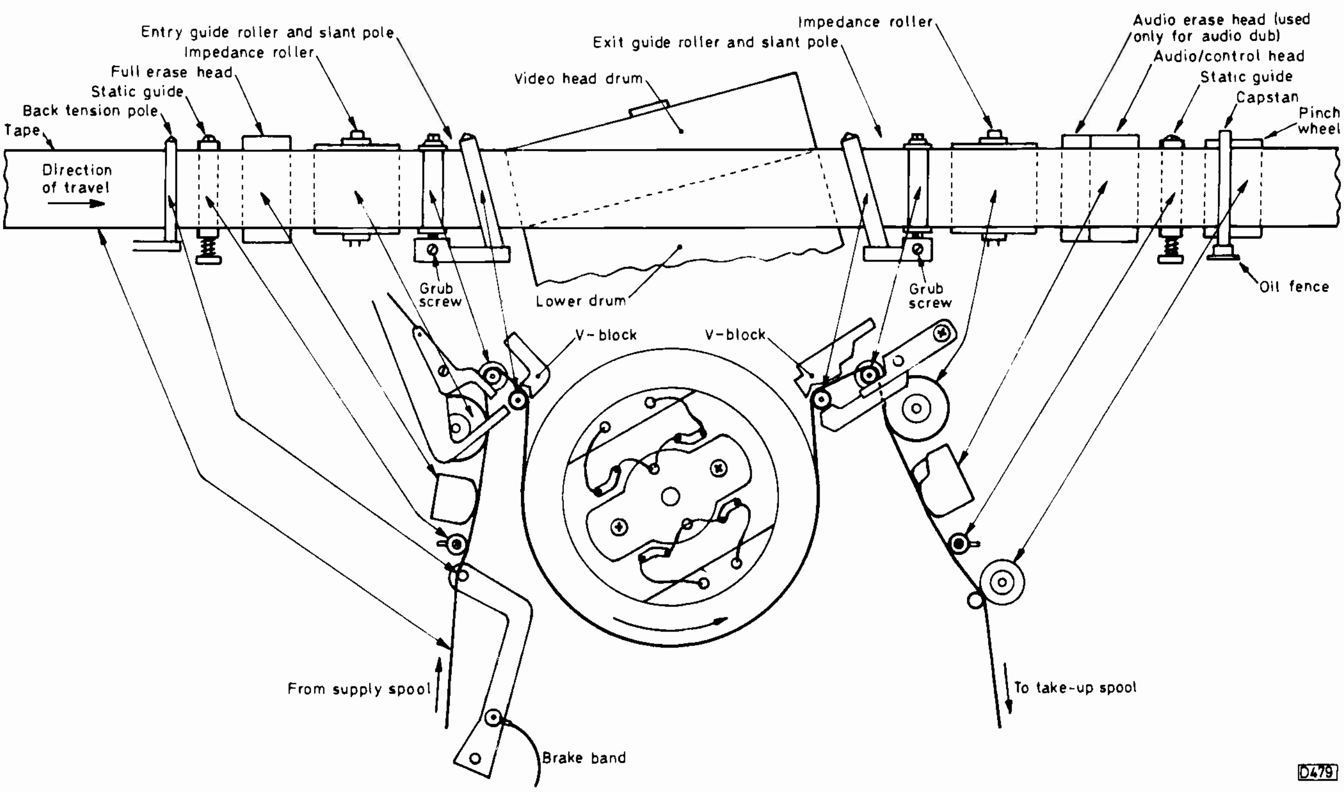


Fig. 55: The tape path in the JVC VHS machine.

rectly. We assume therefore in the following notes that an alignment tape or at worst a tape made on a known good machine is being used. Faults of this nature cause noise bars at the top or bottom of the picture, depending on whether the entry or exit guide is responsible. Observe each in turn as the machine laces up. The slant pole should go positively home in the V block and should not spring back.

Most problems here are due to one screw coming loose, but there can be much puzzlement if you are not aware of this. If one or other arm doesn't seem to locate, put the machine in stop and see if the two loading arms can be moved relative to each other (see Fig. 57). The cassette housing has to be removed of course. If there's any play it will be necessary to remove the cabinet base and swing out the Y-C board. Then remove the drum flywheel and belt. Take off the copper earthing bush and the three screws holding the brush and pickup head. Tighten the screw shown (Fig. 58).

If you're unlucky, the end of the link will have worn and will have to be replaced together with the loading arm. This means that the lower drum assembly will have to be lifted out. Make a careful note of the positions of all the washers and screws, as putting the wrong length screw anywhere can cause problems. Do not be tempted to adjust the slotted links.

Reassemble, cleaning the copper earthing bush and the small spring brush. This earths any static produced by head-to-tape friction, and if dirt is present here there'll be horizontal flashes all over the picture. When replacing the cassette housing, make sure that the flag on the release bar and the flat spring go between the keyboard frame and the eject lever, otherwise the eject will not work.

Noise Bars

If you have problems with noise bars at the top or bottom of the picture, the waveform at TP7 on the pre-rec board will tell you a lot (see Fig. 59). It's occasionally necessary to adjust the guide rollers because the grub screws haven't been fully tightened, but don't do this for fun. Assuming that both rollers have moved (unlikely), proceed as follows. Tighten both grub screws only finger tight (with the cassette carriage out). To play a tape with the carriage out, tape down the cassette switch or bend the spring up slightly so that the cassette operates the switch. Put the cassette in, operating the flap manually. Place a weight on top of the cassette or use the spring bar available from Thorn/JVC. Note that too much extrane-

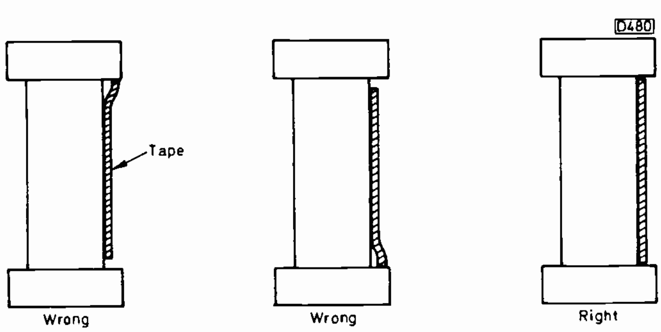
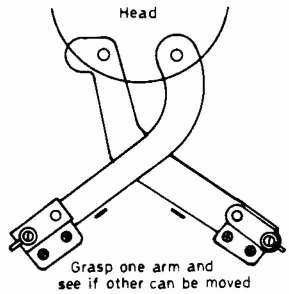


Fig. 56: Static guide operation.



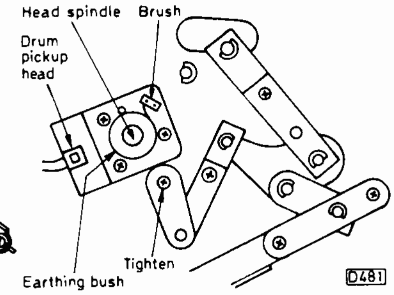


Fig. 57: (left): Loading arm check.
Fig. 58: (right): Loading arm driving mechanism.

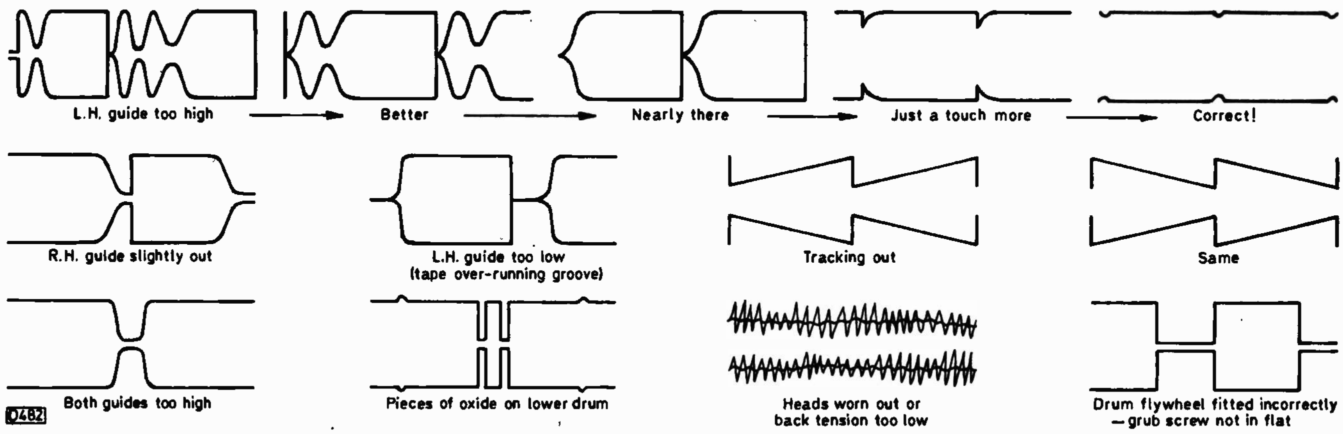


Fig. 59: Signal envelopes (f.m.) at TP7 on the pre-rec board.

ous light falling on the machine will cause the photo sensor to operate.

If the guide rollers are suspect, don't put a good tape in yet – use any old tape, even a damaged one. The first thing to do is to adjust the guide rollers approximately. Unscrew each one about two turns, then screw in, looking closely at the tape as it enters or leaves the lower drum groove at the end of same. As the roller is lowered, the tape meets the bottom of the groove then suddenly wrinkles as it overruns the groove. Back off until the wrinkles disappear, and repeat with the other roller. Check the rest of the tape path, then substitute the alignment tape and connect the scope to TP7. Look at the waveforms shown in Fig. 59. Adjust the tracking for maximum f.m., then the guide rollers no more than one turn each to get rid of noise bars. The dips in the f.m. envelope tend to be much the same whether the tape is too low or too high, but by getting the tape at the bottom of the groove to start with you'll probably have to *unscrew* the guides slightly to get the correct waveform. The preliminary visual adjustment is important because if both guides are too high by an equal amount the writing angle will be correct but there will not be a full 180° wrap and part of the f.m. will be missing. This is usually audible, as the heads collide with the bottom of the tape.

Adjusting the tracking reduces the amplitude of the f.m. envelope and makes it taper. Try to keep it parallel and at maximum. A perfect shape is sometimes unobtainable, but the lowest parts should be at least 60 per cent of the highest.

When you've achieved what you think is the correct adjustment, tighten the grub screws and recheck.

The foregoing assumes that there are no faults in the machine and that the servo adjustments are o.k. Obviously if you get a machine that's been well and truly twiddled it's necessary to go through everything several times – you can't adjust the servos if the guide rollers are so far out that the picture rolls continuously.

Take-up Clutch

A word on the take-up clutch. This little fellow causes more than his fair share of trouble. The usual story is that everything is o.k. until near the end of a three hour tape. The machine then stops and the tape is found to be rather chewed. The reason for this is that the clutch slips excessively after a period of use, but the Hall sensor doesn't operate until the take-up spool has stopped for several seconds. The slipping clutch makes the spool go round in fits and starts, and a loop of tape builds up between it and the capstan. There's no cure other than to renew the clutch.

Some Quickies

To close with, a few "quickies" in list form.

Screeching on fast rewind: Oil the counter pulley.

Squeaks on record and playback: Replace the take-up spool tyre.

Record key won't depress: Function plate notch closed up due to someone jumping on the record key with a pre-recorded tape in.

Machine goes to stop at end of lacing up: Notch in play key worn.

Video Books

As interest in video continues to grow, so the number of books on the subject increases. Two fairly substantial volumes have been published by Newnes in recent months. The first, Ru van Wezel's Video Handbook (edited by Gordon J. King), tries to be too many things and unfortunately doesn't quite succeed in any of them. It has its problems, being a revised English edition of a work originally published in Dutch and written in the mid-seventies. The intended audience is the technician and enthusiast, though at almost 400 pages and with a price tag of £19·95 you'd need to have more than a passing interest. The information ranges from basic standards to constructional details of cameras and mixers, and is readably and interestingly presented. There are omissions however – no mention of the Betamax system for example, nor of single-tube colour cameras. Newnes are understood to be working on a second, revised edition, which will hopefully make the book what it deserves to be.

The second book, Gordon White's Video Techniques (£9·95), is a different matter. It's up-to-date and comprehensive, though lacking the practical information and sections on programme making provided in the Video Handbook. If you want the latest information on satellite or digital TV, chroma key, tape duplication, tape editing etc., this is the book for you. It's not without the occasional error – it would be nice to be able to store a single frame of colour TV in a 16k RAM – but on the whole is accurate and readable. In short, it would be a worthwhile addition to the bookshelf of anyone who wants a readable review of current technology and operating systems.

D.K.M.

Routine TV Receiver Tests: Pye Hybrid Colour Receivers

S. Simon

To most regular readers this article will probably be the least necessary in the present series, in view of the amount of information previously published in the magazine on the Pye hybrid colour chassis. I've found however that there are a surprising number of well experienced engineers, working mainly in the rental field, who've never come across one of these "old faithfuls". So for them and for newer readers, the present offering.

There were three basic versions of the chassis, with other variants including remote control. The first was the dual-standard version which had a very large line output stage compartment on the right-hand side housing the PD500 e.h.t. stabiliser and GZ501 e.h.t. rectifier in a configuration that was commonly used in the initial generation of colour receivers. We will not dwell on these very early sets, but instead concentrate on the second generation single-standard chassis – the 691, 693 and 697.

Identifying whether the set uses the earlier 691/693 chassis or the later 697 chassis is simply a matter of glancing at the right side line timebase section. If there's a square metal box containing the line output transformer and tripler its the earlier version. If there is a single, vertical panel showing you its print side, its a 697. The 693 differs from the 691 in having a varicap tuner.

Initial Handling

First a word of caution. The supply from the mains is not taken directly to the on/off switch. Instead it's taken to the one and only fuse (2·5A anti-surge – don't exceed this rating) whence it's conducted via wires and edge connectors (691, 693) or print and edge connectors (697) to the on/off switch. This means that there are areas which are live whether the set is switched on or not – the warning mainly concerns the 697 chassis, where the fuse and print are at the top of the main panel in a more accessible position. If this fuse is found severely blown or with its glass shattered, it's possible that the associated print has also suffered and rewiring may be necessary.

The cause of a shattered fuse in the 697 chassis will probably be the mains filter capacitor (C301), which in this chassis is associated with the on/off switch and will probably be of the blue-white variety rated at 600V. This is the d.c. rating, the a.c. rating being 300V. Too low – use a 1kV d.c. type as the replacement. If the capacitor is not at fault, check the BY127 h.t. rectifier diode which is up on the top left of the vertical panel as viewed from the rear. Whilst a short-circuit diode would shatter the fuse, it would be unlikely to disturb the print unless the fuse rating has been varied. We have often found a piece of 15A (or so) fuse wire across the holder, the set owner apparently reasoning (?) that if the fuse's rating is increased it won't blow!

Thus the place to start looking for the mains is not at the on/off switch but at the fuseholder, which should be covered by a red plastic hood. This may or may not be present. It's quite common, mainly on the 691 series, for the edge connectors to give trouble. B2 and B3 link the a.c. supply to the switch, B1 and B4 being the return from it. Where they are worn away or intermittent, remove the relevant leads and solder them directly to what is left of the copper strip.

No Results

In the event of the fuse being blown but not shattered, the first step should be to take a resistance reading between the PY500A efficiency diode's top cap (cathode) and chassis. If the reading is low, remove the top cap to see whether the low reading remains at the valve or at the cap (or the PL509 line output valve's top cap). If the short is in the valve (heater-cathode short), replace the PY500A and keep your hand on the off switch since the PL509 may also have suffered. Indeed its heater may be open-circuit, which will stop any heater current flowing at all.

If the short is not in the PY500A there are two main possibilities. First the 0·47μF, 1kV boost capacitor (C218) which is mounted on the line output transformer. If this has gone short-circuit your reading will be zero ohms. Secondly there's the tube's first anode supply circuit. The first anodes are fed from the line output transformer (boost rail) via a filter consisting of a 100kΩ resistor (R227) and an 0·1μF, 1kV decoupling capacitor (C224). One might think that even had the capacitor gone short-circuit the presence of the 100kΩ resistor would prevent a low resistance reading being obtained – if, that is, it retained its value of 100kΩ. But it's a 1W resistor alas, and when it finds that it has 1kV suddenly across it the poor old thing burns up (the customer's complaint is "the picture went off and there was a smell of burning, then it all went off"). So it ends up as a virtual short. To check on this is an easy matter with the 697 chassis (vertical panel) – you just locate the position of the resistor (about a third of the way down from the top, in the centre), shine a light on it and enquire as to its health. If the colours (brown, black, yellow) are clearly visible, the resistor feels all right and the 0·47μF boost capacitor on the line output transformer (also clearly visible) can be unhooked at one end for a quick test.

There's another possibility, the 180pF (or 170pF), 8kV disc capacitor (harmonic tuning) on the transformer. This could be short-circuit – less likely but a real possibility nonetheless.

When one is dealing with the earlier versions access is a little more difficult since the 0·47μF boost capacitor is mounted on the right side (lower) of the screened section, which necessitates removal of the whole unit (two screws on the rear flange), whilst the 100kΩ resistor is underneath with the 0·1μF decoupling capacitor leading off to the rear. Some models have a trap door under the unit.

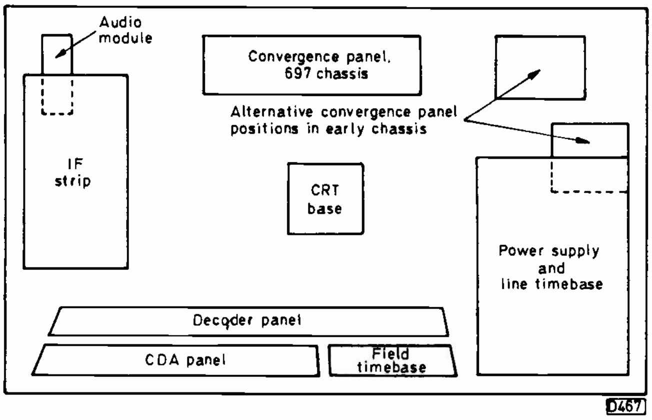


Fig. 1: Panel layout, viewed from the rear.

This makes access easy, but in most versions the whole unit must be removed – no real effort however once the cableform ties have been released and the earthing clips removed. There are two earth clips on the left-hand side and the focus unit earth on the right.

If the fuse has failed and there are no low resistance readings from the top caps of the line output stage valves to chassis, the next step is to check the l.t. bridge rectifier. This is easy on the 697, not quite so easy on earlier chassis. The BY164 bridge rectifier lives down at the bottom right-hand side of the main panel of the former, but is on a subpanel at the front of the screened section in the latter, again necessitating removal of the complete unit.

The usual fault is a short between either the positive or negative pin and one of the a.c. input pins. The BY164 is mounted vertically in the 697 chassis, so that there's a recognisable row of four contacts down in the bottom, right-hand corner. It's a matter of moments to make readings between them, on the low ohms range – the centre two will read low resistance because this is the a.c. input from the mains transformer. The effect of a direct short from either end to the centre can be nasty as this may not immediately blow the fuse. As a result, the transformer will run very hot until the fuse blows, leading to shorted turns in this rather hefty item and ending with a simple fault becoming an expensive repair. The problem is avoided in the 697 chassis by incorporating a thermal fuse in the transformer's primary winding. This can be removed and repaired without too much trouble.

Thus if the tube's heaters are not glowing but the mains fuse is intact, the fault could well be that the transformer is open-circuit with a sprung thermal cutout: this should lead to a check on the bridge rectifier for shorts before any other action is taken.

The 697 also employs an extra l.t. rectifier diode to provide the supply for the audio output i.c.

Line Oscillator

The PCF802 line oscillator valve is situated in a very awkward position in the 697 chassis – this is the one big problem when working on this chassis. It's not too great a snag for those familiar with the chassis, but one is inclined to swear a bit the first time. The valve itself is not often the cause of line hold troubles. The usual cause is the pulse feedback/integrating resistor R203 (47kΩ, 2W) which tends to change value. The problem is that when it goes low in value it can deal a death blow to the flywheel sync discriminator diodes D40/41 before it actually disintegrates. This means that the unit must be removed, also the line output transformer cover, and the panel hinged down for access. Removing the tripler unit's front securing screw simplifies matters.

If the flywheel sync discriminator diodes are in order, R203 has probably gone high in value. A replacement must be rated at 2W or more for reliable operation.

The other item that can cause quite a lot of trouble, which may not be immediately obvious, is the 100kΩ resistor R210. It's connected between the h.t. supply to the line oscillator stage and the line hold control. If this resistor changes value – which it does – the first effect will be to change the line hold control setting required. As its value falls further however the effect becomes more insidious, because the line oscillator stage's h.t. voltage is reduced. The effect of this is to reduce the line drive to the PL509 line output valve, which overheats and produces the lack of width symptom. A new PL509 may apparently restore normal conditions, but the new valve will overheat and speedily fail. A similar problem arises when the h.t. decoupling electrolytic C215 (16μF) fails – normally only the black ones give trouble.

Lack of width should initially lead to a check on the h.t. voltage – for about 290V at C315 – followed by checks on the line output stage valves (PL509 and PY500A) and a check for changed value resistors in the width circuit (R223 1·8MΩ and R224 10MΩ).

Video Troubles

The next most likely trouble spot on these chassis is the CDA (colour-difference amplifier) panel. This houses the PL802 luminance output pentode and the three PCL84 colour-difference output/clamp valves. In early models the valve bases were of the flush type: unfortunately the heat conducted on to the panel leads to rapid deterioration of the panel material, resulting in cracks and dry-joints. The various effects produced are too numerous to list. Examples are no h.t. supply to one of the valve bases, varying colours, intermittent loss of picture etc. It's prudent to examine the underside of the panel closely and take whatever action is necessary to overcome cracks and solder deterioration.

Apart from the PL802 losing emission to cause lack of brightness, or running into grid current to cause excessive brightness, there are several fault conditions that can be confusing. These occur on later panels with stand-off valve bases as well as the earlier panels.

One very common "stock fault" is when the carbon resistor R353 (680Ω) becomes open-circuit. Since it's in series with the luminance output pentode's anode load resistor, you might think that the result would be no luminance information at all. In fact the result is a smeary picture, lacking in detail. The reason for this is that there is another route via which h.t. reaches the anode of the luminance output valve – via the screen grid feed resistor R356 (2·7kΩ) and the two high-light presets RV44/5. The effective anode load is thus substantially increased, accounting for the very poor definition.

The next common fault is loss of h.t. to one of the CDA pentode anodes, due to one of the three anode load resistors R390/1/2 going open-circuit. Since the following clamp triodes are not affected, the grey scale remains good (colour off): with the colour restored, one of the primary colours is missing. The PCL84 next to the PL802 is the red one, the centre one is for green and the one on the right-hand side is for blue. The relevant 12kΩ load resistors are fairly easy to find – behind the valves – and a quick check with a meter will show which one has h.t. at one end but not the other.

Hopelessly wrong voltages on the CDA panel, e.g. negative readings at the tube grids instead of the normal 100V (approximately), should lead one to check the condition of the main electrolytic h.t. reservoir/smoothing can C306/C315 (200 plus 300μF) which will probably be found to have a bulge sticking out between the tags. This is a common cause of the "no raster" condition, with the relevant tube voltages nowhere near what they should be.

Before leaving the CDA panel we should also point out that models using varicap tuning (press buttons not push) obtain the tuning voltage via an h.t. feed resistor on the right-hand side of the panel. The resistor is R389 (3·9kΩ): it also supplies the three PCL84 pentode screen grids. If there is no h.t. on the tuner panel, i.e. the resistors here remain cold, check the right-hand side of the CDA panel where R389 is probably open-circuit. The value of the resistor was changed to 2·7kΩ in later models.

The importance of the spring clips that secure the rear of the CDA panel to the main frame must also be mentioned. They provide essential earthing, and although the clips may be making mechanical contact the electrical contact may not be good. The effect of this is to shade the grey scale from green on one side to blue on the other. An extra earth wire soldered to the panel and screwed to the main frame to ensure good bonding is often a good idea.

Field Timebase

The field timebase is housed on a small panel just to the left of the line timebase/power supply unit. It has its fair share of troubles, but not too many. The original panels had a pair of BD124 output transistors of the SO55 configuration. These were changed to TO220 types, often retaining the BD124 number, with modified mounting. The output transistors are driven by an AC128 or AC188 transistor which should be mounted under the panel for cooler operation. The height control is connected to the base of the driver transistor, and is fed via a 22kΩ resistor (R254) from a separate, zener diode stabilised 20V line (input at PL10A). There are three l.t. supply lines to the field timebase, which sits between positive and negative 20V rails (PL10B and PL10C respectively).

The most comon cause of field collapse on the 697 chassis is to be found on the main board where, towards the top centre, the supply tracks have to run past an area that's subject to considerable heat from the power resistors. Close inspection will reveal the discoloured solder and the fine hair cracks radiating from it. Jumper leads should be used to complete the circuits affected.

Loss of the supply to the height control will not result in complete loss of field scan, only to severe loss of height. The cause of this is usually leakage through the l.t. smoothing electrolytic C312 (250μF) or the stabilising zener diode D52. These items are mounted on the main board, approximately half way up the right-hand side. Note that you should not expect to find a positive voltage at the height control: the positive 20V supply will be found only at the other end of the series resistor (R254) next to the control.

General Notes

Poor sync is usually due to the sync separator's base bias resistor R33 (4·7MΩ) on the i.f. panel (left-hand side) increasing in value. It's on the lower right of the panel.

The decoder panel is very reliable. Loss of colour should direct attention to the supply points – orange 15V positive, pink 20V negative.

A weak point in models fitted wth the 697 chassis is the front control panel (brightness, contrast etc.) which was hand wired in earlier versions. A tendency for heavy handedness will result in the controls being loosened on the panel – the contact may become intermittent or completely lost.

The relationship between the brightness control and the beam limiter should be understood. The PL802's grid bias is obtained from the brightness control which is slung – with various series resistors – across the positive and negative 20V lines. The beam limiting action is carried out by a transistor which acts as a shunt on the positive side. When it conducts, the negative bias to the grid of the PL802 is increased, producing a darker picture. It's base is biased from the cathode of the line output valve. A reversible electrolytic (C201, 12·5μF) smooths the voltage tapped from the slider of the brightness control: it sometimes leaks, giving the impression that the beam limiter circuit is malfunctioning.

No article on the Pye hybrids would be complete without mention of the pincushion amplitude control RV41 (50Ω) on the convergence panel. This item is under-rated and changes value, the result being bright white lines across the top of the screen. A fixed 12Ω resistor can be fitted instead.

The advice given in this article will enable the vast majority of common faults encountered on these Pye hybrid colour sets to be dealt with quickly, which is the aim of the present series of articles. For a more detailed discussion of various possible faults, see the article by Andy Denham in the September 1977 issue and the follow-up letter from Mike Phelan in the November 1977 issue.

GRAY CODING

Attentive readers may have noticed that we got confused a while back over a thing called the Gray code, a variant on the binary system. If like us you're not familiar with this digital coding system the comparison is as follows:

Binary	*Gray*
0000	0000
0001	0001
0010	0011
0011	0010
0100	0110
0101	0111
0110	0101
0111	0100
1000	1100
1001	1101
1010	1111
1011	1110
1100	1010
1101	1011
1110	1001
1111	1000

Why dream up something different? Well, if you look at the Gray code you'll see that only one of the four digits changes each time instead of one or more. This reduces the possibility of voltage spikes giving rise to false data, and is thus an advantage for video analogue-to-digital conversion.

Inside the Philips VR2020

Part 6

Brian Dempster

THIS final instalment on the basic machine deals with the system control arrangements. An introduction to some of the techniques used was provided by the article on microcomputer control of VCRs in the previous issue.

The job of systems control panel U20 is as follows: (1) to scan the keyboard for operator requests; (2) to carry out any such requests; (3) to monitor the machine's operation for any potentially damaging conditions and to bring about appropriate safety procedures; (4) to update the time of day clock; (5) to accept and store instructions for timed recordings and to carry out such instructions; (6) to perform the search tuning and channel store duties.

Microcomputer Control

The heart of the control system is an 8049 microcomputer i.c. Extra programme memory and input/output line expansion are provided by an 8355 i.c., with additional output expansion provided by an 8243 i.c. Two 5101 RAM chips are used to store the tuning information and timed recording requests (total capacity 256 bytes) – these are supported by a 3·6V nickel-cadmium battery to ensure data retention for up to three months with no mains voltage applied. Fig. 37 shows a simplified block diagram of the system.

The 8355 input/output expander i.c. has an eight bit bus port, two eight bit input/output ports and 2k bytes of programme memory (ROM). It can be instructed to connect the bus port to either input/output port for data movement in either direction. It can also be instructed to put the contents of a particular "address" in its memory on to the data bus. The control lines tell the device which of these types of instruction to carry out.

The 8049 microcomputer i.c. communicates with the rest of the control system mainly via its bus port, which is used for feeding in information on the machine's operating conditions and requests from the keyboard, and to feed out data to update the displays and, via the output expander, to control the operation of the machine. The bus also addresses the external memories in the 8355 and two 5101 i.c.s, i.e. makes it possible for the microcomputer to obtain the information held in these i.c.s' memories. The control lines from the 8049 activate the external device to which information is to be sent, or from which information is requested, at any time.

The address/data bus has four "high order" bits, giving the bus a total of twelve lines: the four high order bits are driven by the lowest four bits coming via the 8049 i.c. The high order bits are used for the ROM's upper addresses and to communicate, via port 2 of the 8243 i.c., with the rest of the machine to issue instructions.

The timing of the microcomputer's operations is controlled by an internal 6MHz clock – there's a 6MHz crystal, which is external of course.

Port 1 of the microcomputer i.c. controls the tuning during the search tuning process and transmits a signal for camera remote control on the lower four bits. The upper four bits are used to accept a wind tacho pulse (for tape counter updating), a crystal derived 50Hz signal (to update the time of day display), a camera remote control signal and to send out a signal associated with the time of day updating.

Operation of the System

Let's see how the control system operates from application of the mains supply to the machine onwards. Removing the mains supply drives pin 1 of the microcomputer i.c. low. The microcomputer then carries out a "data dumping" sequence, i.e. it stores in the RAM information on the machine's condition (mode, tape counter reading, etc.). The RAM holds this information after removal of the mains supply since it's powered by the battery. When the mains supply is restored, the microcomputer's reset pin 4 is driven high. At the same time the 8355 input/output expander/ROM i.c.'s reset pin goes low. This starts the control programme at the correct point, the microcomputer ascertaining the machine's previous condition. It then puts the machine into the mode in which it was previously operating, restores the displays and flashes the clock (to indicate that there's been a mains failure). The state of the battery is checked, and if its output is found to be low a memory clear sequence is carried out, completely wiping the memory in case corrupted data is present. Once the previous mode of operation has been reinstated, the microcomputer starts on the main programme, scanning the keyboard and checking the feedback signals.

Keyboard scanning techniques were described last month. The process feeds a binary word to the microcomputer which then places the required address on the data/address bus to gain access to the relevant part of the programme in the 8355's ROM – the control lines are set to the levels necessary for this. Instructions are then fed to the microcomputer via the bus, and may call for machine condition checks to be made before any further action is taken. The computer analyses the resultant reports, in accordance with the programme, and issues the appropriate commands via the bus. Safety operations such as unthread, switch off etc. are brought about under the control of the programme as conditions dictate.

Output Latching

The output ports of the 8355 and 8243 i.c.s have latches which maintain the outputs so that the data needs to be fed to these devices for only a very short time. The next "write" command to an output port overwrites any information already present there. Since these expanders are MOS devices the output currents are limited:buffer transistors are used for some of the outputs therefore.

Tuning Arrangements

The basic idea of search tuning is to produce a ramp voltage of about 0-30V to tune through Bands IV and V until a transmission is found. Fine tuning is then brought about and if the channel is required the user stores the tuning voltage value. By allocating a two digit number to each channel/tuning voltage value (up to a total of 25) the

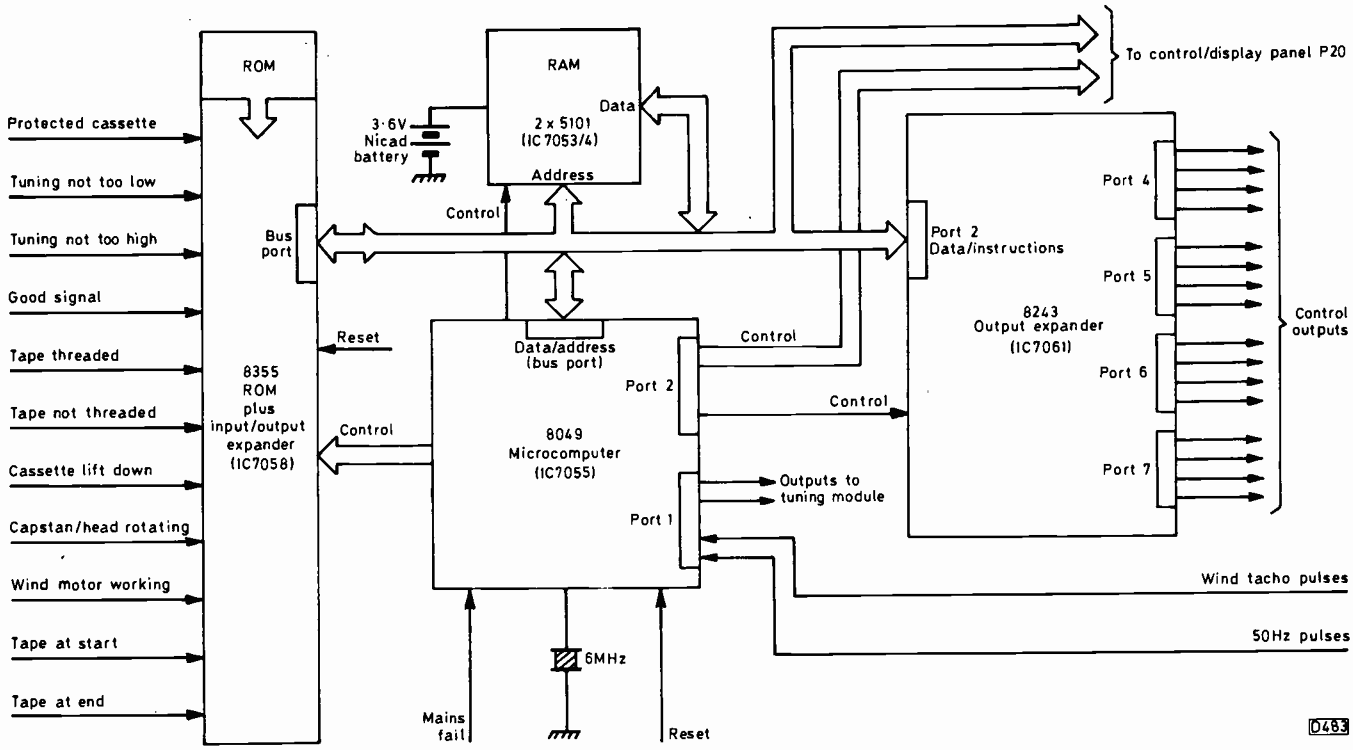


Fig. 37: Block diagram of the machine's control system. The heart of this is the 8049 microcomputer control i.c. Extra programme memory is provided by the ROM in the 8355 i.c., the two RAM's providing changeable memory storage.

stored channels can be recalled at will.

A representation of the tuning system is shown in Fig. 38. When a stored channel is selected by the user, digital output signals appear at pins 29 and 30 of the microcomputer. These are fed to tuning panel U60 via a latch i.c. The tuning signals consist of squarewaves whose mark-space ratio, and thus average or mean value, indicates the stored channel. The amplitude of the squarewave is set by the microcomputer's supply line voltage (5V) of course. These outputs are inverted by amplifiers fed from a stabilised 31V supply to produce an output which is suitable, after integration, for tuning a varicap tuner. An active filter is included between the integrating network (C1 and the associated feed resistors) and the output, which is developed across C2, to the tuner.

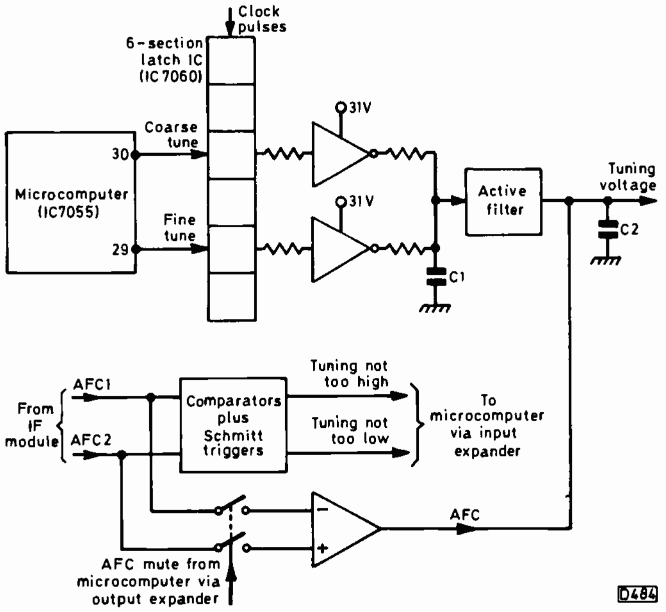


Fig. 38: The tuning system.

The coarse tune output from the microcomputer defines the tuning to an accuracy of six bits. The fine tune output from pin 29 is passed via a circuit whose values are such that it contributes only 1/64th of the final tuning voltage, i.e. it provides fine tuning after a station has been located. The a.f.c. is muted by the microcomputer during the initial tuning operation.

During the search operation, binary words for successive tuning voltages are progressively clocked into the latch. When a signal is detected, a high to low transition occurs at pin 39 of the microcomputer – the a.f.c. signals, via the comparator/Schmitt trigger, provide the indication that a signal is present. After tuning, the picture mute signal (from the sync panel) is removed and the received channel is displayed on the monitor.

Updating

50Hz pulses derived from the 4·43MHz oscillator on the sync panel are fed into the microcomputer at port 1, counted and used to update the time of day. The current time is entered by pressing the set clock button on the front panel to blank the clock display, then setting the time via the keyboard. The wind tacho pulses fed in at this port are counted and used to update the tape counter: the microcomputer knows whether to increase or decrease the counter reading by checking the machine's condition (wind, rewind etc.).

Programme Interrupts

Functions such as search tuning, time of day and tape counter updates take place during an "interrupt". This enables the programme to be broken into (at the end of a cycle). Using an interrupt ensures that critical timing functions do not have to wait for other sequences to finish.

Letters

TUSSLE WITH A TX9

We had our first tussle with a Thorn TX9 chassis the other day. The h.t. regulator thyristor CSR1 had gone short-circuit and taken with it half the mains rectifier bridge, D67, D77, D82, zener diode D83 and transistor TR66. These items were replaced, but with the full applied mains voltage the over-voltage trip operated. By adjusting the set h.t. control RV185 to minimum the set would operate, but all voltages were a little on the high side and the picture bounced continually. Going round with a scope, the culprit was found to be the thyristor's surge protection capacitor C142 – it was leaking as the thyristor fired. One for the notebook!
K. Fry,
Shaw, Nr. Swindon, Wilts.

TUNING PROBLEM

During the past two weeks we've serviced two solid-state GEC colour sets (2110 series) with identical faults, the symptoms being flashing tuner neons and inability to pre-select required channels.The usual cure is to replace the complete set of neons – this normally restores the tuning system to working order. The fault remained after doing this however – also after replacing the touch tuning chip.

On closer inspection we noticed that the plug and socket connecting the tuner to the main board was heavily tarnished, and after cleaning both the plug and socket the fault was cured. It's the first time we've encountered this problem. Could the tarnished condition of the mated plug and socket form a rectifying junction at these low currents?
R. M. Guerin,
Torteval, Guernsey.
Editorial comment: We suspect that the trouble was due to a defective circuit connection, e.g. a high-resistance earth path, rather than rectifying action.

PYE PUZZLER

We've had the following fault on Pye/Philips monochrome portables fitted with the TX chassis on several occasions in recent months. Each time the symptoms have been the same, either constant or intermittent, namely a smoothing fault – buzz on sound and an unstable picture.

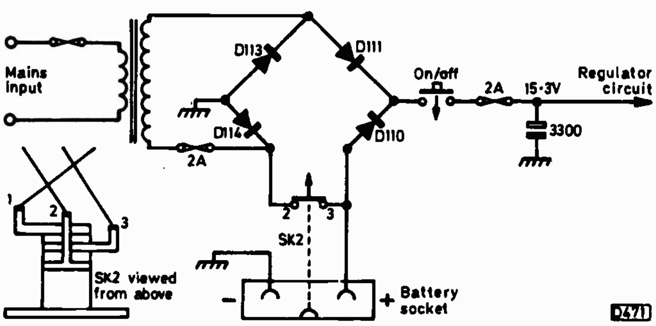


Fig. 1: The mains/battery input/switching arrangement used in the Philips/Pye TX chassis (simplified circuit).

The input to the series regulator transistor was low at around 12·5V instead of 15·3V as stated in the manual, and on inspection diode D114 in the bridge rectifier was found to be running far warmer than the other three. Replacing the diodes failed to cure the trouble, so checks were made around them for any resistance or leakage. A reading of a few ohms was found between the cathode of D114 and the anode of D110: the only suspect item here is the switched mains/battery socket (see Fig. 1), and on placing a wire across tags 2-3 on the socket the fault disappeared, with all four diodes running at the same temperature. A replacement switched socket clears the fault completely. If you inspect the old socket you'll find the switched connections slightly oxidised.
T. L. Bingham,
Glebe Park, Lincoln.

LINE OSCILLATOR COIL PROBLEM

The problem I had with an ITT monochrome set fitted with the VC200 chassis was very similar to that described by George Wilding in the September issue, i.e. loss of line sync. Replacing the PCF802 valve and capacitors C124-7 made no difference, so I tried adjustment of the line oscillator coil L56. This had seized solid however, and any pressure on it only made matters worse. A new coil was obtained and fitted, but after a week the set came back with the same trouble. Once again I attempted to adjust the coil, and found that even in this brief time it had started to jam. The core was eventually freed, with a lot of care and some contact lubricant. Since there is no separate line hold potentiometer in these sets, I recommend that anyone fitting a new line oscillator coil ensures that it's well lubricated so that future adjustment is possible.
J. Norman,
Burgess Hill, Sussex.

THORN 9000 CHASSIS

We've had exactly the same symptoms described in the September Service Bureau with the Thorn 9000 chassis – the picture split by horizontal lines, a high-pitched whistle and the set cutting out on changing channels. The fault was due to the 87·9V supply reservoir capacitor being open-circuit – this is the h.t. supply to the line output transformer. When the fault is present the voltage at the collector of the chopper transistor VT701 increases by 30-50V, fluctuating, which might account for the intermittent tripping.
G. Lewis,
Hartlepool, Cleveland.

HEAD WEAR

I read with interest Derek Snelling's mention of head wear on Toshiba VCRs (VCR Clinic, August). We experienced something similar recently in our workshop on a Toshiba V8600. The customer's complaint was of poor rewind on most tapes. Having checked the torque on both reels (correct) and ensured that the tape guides were not bent we scratched our heads, a little baffled until we noticed that the surface of the video head drum was of a very dull appearance. Cleaning fluid had no effect, so a replacement was tried – with complete success.

This particular customer had used tape head cleaners on this machine and on his previous V5470, which required new heads after only ten months' use. I always advise our customers not to use any form of head cleaner at all.

David F. Pentin,
Melling, Merseyside.

(See also reference to the tape tension arm setting in last month's VCR Clinic – editor.)

SORTING OUT EW FAULTS

I read with interest the notes on EW faults in the article on the Philips G11 chassis in your September issue. It can be a bit of a problem when you find that the width and EW shaping controls have no effect. I now use a simple method to determine whether the fault lies in the EW amplifier/drive circuit or the diode modulator. The procedure works with most such circuits, e.g. the G11, Decca 100, Rank T20/22 etc.

A typical arrangement (Rank T20/22 chassis) is shown in Fig. 2. The amplifier and driver stages are all d.c. coupled, with the width preset varying, via one or more of the preceding stages, the conduction of the driver transistor. The driver's output is applied to the diode modulator circuit: the greater the conduction of the driver transistor, the greater the width. This latter fact is the key to diagnosis.

The two basic faults are: (1) lack of width with bowed sides and (2) excessive width with bowed sides. Let's take lack of width first. If we short across the emitter and collector of the driver transistor (4VT18 in Fig. 2) we get the condition equivalent to maximum conduction of the transistor. One of two things will happen: (a) the width will not be affected; (b) the width will increase so that the raster fills the screen. If the result is (a), we know that the fault lies after the driver stage, i.e. in the diode modulator or an associated component. If the result is (b), the fault is prior to the diode modulator, i.e. in the driver transistor itself or a preceding stage.

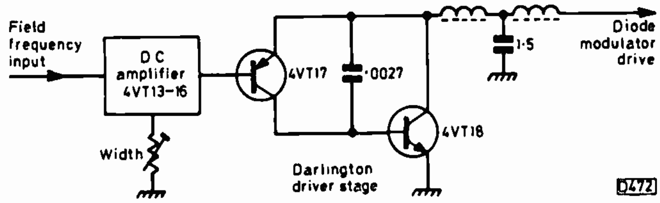


Fig. 2: Typical diode modulator drive arrangement, in this case as used in the Rank T20/22 chassis. The driver transistors 4VT17 and 4VT18 receive their power supply from the diode modulator, the components in 4VT18's collector circuit filtering out the line frequency components.

With excessive width, we can turn the driver transistor off by shorting together its base and emitter. Again either of two things will happen: (a) the width remains excessive; (b) the width reduces. If the width remains excessive the fault lies in the driver transistor or the EW modulator. If the width is reduced, the fault is prior to the driver transistor.

The idea then is to use the driver transistor as the mid-point in the whole system, employing very simple checks to see whether the fault lies before or after this stage. I find this an invaluable aid to diagnosis. Note that the driver transistor may be an npn or a pnp device – the procedure remains the same however.

Jim Rainey,
Bangor, Northern Ireland.

Long-distance Television

Roger Bunney

THERE was a slow decline in Sporadic E activity during August, particularly from the middle of the month. Some exotic signals were received by the more vigilant – reception from Arabic sources occurred on at least three occasions, and signals from Italian free stations were seen during the early morning hours of the 15th. Tropospheric reception improved somewhat during the month.

It was too late to include some news from Ryn Muntjewerff in the last column – of a selective tropospheric opening on July 29th when ten low-power Norwegian relays were received in Holland on channels between E24-44. The highest power relay station received was on ch. E44, with 1·7kW e.r.p. Fortunately most of the relays were transmitting the PM5544 test pattern prior to the start of programmes, with the pattern carrying the identification of the relevant main transmitter. Oslo was being transmitted on ch. E44, Hovdefjell on chs. E25, 28, 36 and 40, and Lyngdal on ch. E22 (the other four relays were either on programme or used a pattern without identification).

So to the general log for August, as follows:

4/8/82 RAI (Italy) ch. IA, B; RTP (Portugal) E2, 3; RTVE (Spain) E2-4; MTV (Hungary) R1, 2; CST (Czechoslovakia) R2; JTV (Jordan) ch. E3 at 1635.
5/8/82 RAI IA, B; RTVE E2-4; RTP E3; MTV R1; CST R2; TSS (USSR) R1; TVP (Poland) R1.
6/8/82 ORF (Austria) E2a, 3; Switzerland E2, 3; MTV R1, 2; JRT (Yugoslavia) E4; RTP E3; RTVE E2-4; TF1 (France) F2, 4; Switzerland E2, 3; RAI IA; SWF (W. Germany) E2; DFF (E. Germany) E4; CST R1; JTV Amman ch. E3 at 1045-1115 BST – a good day!
7/8/82 RTVE E2-4; RAI IA; JRT E3, 4; MTV R1, 2; CST R1; TSS R1, 2; DR (Denmark) E3, 4.
8/8/82 RTVE E2-4; RAI IA, B; TVP R1; JRT E3; TSS R1-3; NRK (Norway) E2.
9/8/82 RTVE E2-4; RAI IA, B; NRK E2, 3; SR (Sweden) E3; CST R1; JRT E3; Switzerland E2; W. Germany E2.
10/8/82 TSS R1, 2; TVP R1, 2; MTV R1; CST R1; RAI IA; RTVE E2-4.
11/8/82 TVR (Rumania) R2, 3; TSS R1, 2; TVP R1, 2; CST R1, 2; DFF E4; ORF E2a-4; W. Germany E2; RAI IA, B; RTVE E2-4 (with experimental teletext).
12/8/82 RTVE E2-4; RTP E3; MTV R1, 2; DFF E4; CST R2; TVP R2; TSS R2; SR E3, 4.
13/8/82 RTVE E2-4; TVP R1, 2; TSS R2; NRK E2.
14/8/82 TSS R1, 2; NRK E2; RTVE E2.
15/8/82 ORF E2a-4 (with Austrian Grand Prix); JRT E3, 4; RAI IA, MTV R1, 2; RTVE E2-4; TVR R2; TSS R1, 2; NRK E2; TF1 F4; Arabic signal on ch. E3 at 1735; also a very early morning opening – see later.
16/8/82 SR E2; RTVE E2.
17/8/82 RTVE E2-4; RTP E2, 3; RAI IA; JRT E3; TVP R1, 2; CST R1.
18/8/82 TSS R1, 2; CST R1, 2; TVP R1, 2.
19/8/82 TSS R1, 2; TVP R2; CST R1; MTV R1; RAI IA.
21/8/82 TSS R1, 2; DR E3, 4; NRK E2; JRT E3, 4; RAI IA; RTVE E2-4.
22/8/82 RTVE E2, 3; improved tropospheric reception with W. German u.h.f. signals received in eastern UK.
23/8/82 JRT E3.
25/8/82 RAI IA, B; RTVE E4.
26/8/82 RTVE E3; MTV R1; SR E2; RAI IA, B.
27/8/82 JRT E3, 4.
29/8/82 TSS R1, 2.

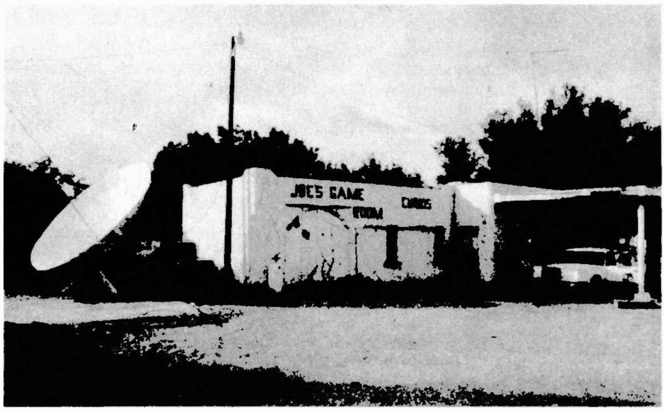
During early September there was a slow moving high pressure system which produced improved tropospheric conditions with reception mainly on an easterly path. Here at Romsey the signals reached as high as W. German u.h.f. outlets and E. Germany ch. E6 (3rd-4th September).

Cyril Willis received Gwelo, Zimbabwe ch. E2 via TE (transequatorial skip) on August 4th, 9th and 15th. The high solar activity mentioned last month, producing an Aurora on July 14th, produced further activity on August 7-8th following the Sun's rotation. In the early hours (0300) of August 15th Cyril Willis noted Band I activity with several Italian f.m. stations both in and above Band I, including one with a programme in English. NCT came up on ch. E3 (not ch. IA as their logo suggests) at 0345, with a further unidentified signal on ch. E4. Ray Davies (Norwich) was contacted and confirmed the presence of these signals.

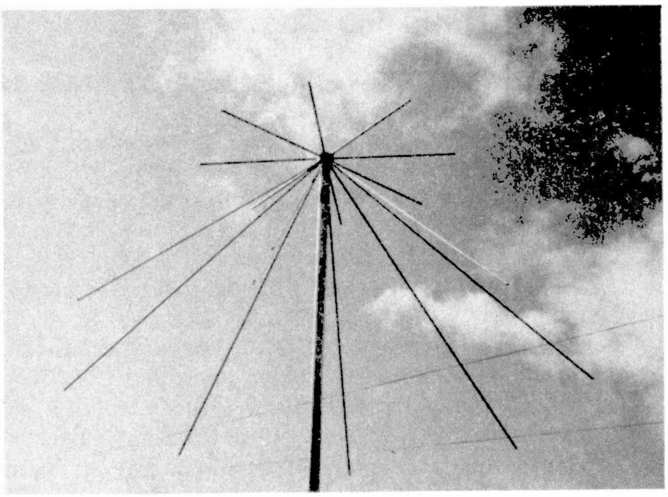
During an Italian SpE opening Hugh Cocks received a ch. A2 system M (525 lines) signal of (one assumes) US forces origin. The prevailing skip conditions suggest that there's a US base using ch. A2 (despite denial by the AFRTS of this channel being used in Europe) in southern Italy or north Africa. The "typically American" programming was in English. Can anyone assist with identification?

Garry Smith suggests that certain IBA transmitters are staying on air to prevent relays that receive their signals RBR (taken off-air, converted to another channel and retransmitted) processing other incident signals of a perhaps dubious nature. A sighting by Arthur Milliken during July tends to confirm this.

Here at Romsey problems have arisen with the 4GHz dish. The focus seems to be incorrect and to date no signals from the Gorizont satellite have been received. Fortunately the feedhorn and head electronics (see else-



Satellite TV terminal installed at Joe's Gas Station, Nickel Creek, Texas. Photograph from John Tellick.



The Revco Electronics discone aerial.

where) have been tested and found to be working by using Hugh Cocks' 6ft. dish. A reasonable quality display was obtained.

My thanks to the following who contributed to the log this month: Paul Barton (Harrogate), Hugh Cocks (E. Sussex), Cyril Willis (Ely), Arthur Milliken (Wigan), Brian Renforth (Chippenham), Iain Menzies (Aberdeen) and Ryn Muntjewerff (Holland).

News Items

France: In connection with re-engineering work for the new fourth channel, most of the main 819-line v.h.f. transmitters should be off-air by the second week of September. David Moller has sent the following list of channel four openings: first half of 1983 Lille, Metz, Mulhouse, Nancy, Strasbourg, Caen, Cherbourg, Le Havre, Rouen, Brest, Le Mans, Nantes, Rennes, Vannes, Lyon, Saint-Etienne; second half of 1983 most other regions including Hyeres, Marseilles, Menton, Nice, Saint-Raphael, Toulon, Ajaccio, Bastia, Corte, Grenoble and Toulouse.
India: The government has decided to start the phased introduction of colour TV. Test transmissions have been carried out in Delhi.
Guyana: France has received a major contract for establishing a colour TV service, with studios at Georgetown and eight 2kW transmitters there and elsewhere in the coastal/mining areas. The opening is expected late next year.

The Discone Aerial

The discone aerial is a wideband system with a ten to one frequency range and omnidirectional characteristics. It's widely used for monitoring purposes, particularly with scanners (e.g. aircraft band use etc.) and has a predominantly vertically polarised pickup pattern with unity gain. For the enthusiast who's interested in a search aerial with general v.h.f./u.h.f. coverage, it's an ideal choice. The details shown in Fig. 1 were sent in by Derick Browne (Hove). Though the aerial is simple in principle, in practice it's rather difficult to construct.

Until recently two types have been available, a three-paired element system of relatively poor constructional standard selling at about £13, and a more up-market version, intended for the professional communications user, retailing at upwards of £45-£50. Revco Electronics (Poundwell St., Modbury, Devon PL21 0RQ) have now

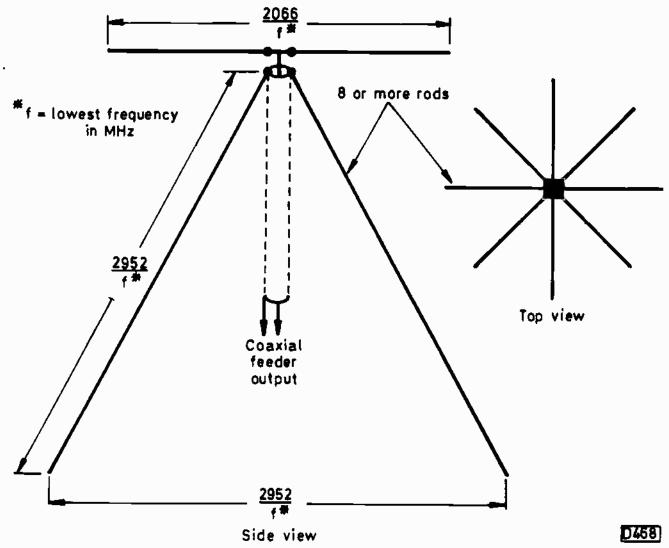


Fig. 1: Discone aerial data.

introduced a discone aerial with eight pairs of elements (i.e. eight hanging downwards and eight shorter horizontal elements on top) at below £25. Examination and use shows that this is a very efficient system, made to a high constructional standard. Connection is via 50Ω coaxial cable to a PL259 socket beneath the large element mounting hub. A small tool is provided to ensure tight, secure fitting of the elements. The "Revcone" covers 50-500MHz and is highly recommended. Our thanks to Revco Electronics for supplying a sample (see photo on previous page).

From our Correspondents . . .

The main talking point continues to be satellite TV reception, though the cost is unfortunately prohibitive for most of us at present – come back ATS-6, all is forgiven! Chris Wilson (see article in the September issue) is working on improvements to his 11·6GHz system, including the use of an NEC 72089 gallium arsenide f.e.t. r.f. amplifier and a much higher first i.f. (700MHz). A Cassegrain feed system is now in use, giving improved pictures, and the new i.f. amplifier will use two BFR91 transistors in a stripline arrangement. Whilst on holiday in E. Europe recently Chris obtained a copy of an aerial magazine called *Sdelovact Technika.* It shows a receiving system in western USSR for the 714MHz Ekran (Stat-T) signals (satellite at 99°E). There's a total of 32 stacked Yagis, each with approximately 23 elements!

L. Bruzzichesi (Malawi) has constructed a 714MHz system for Ekran reception, using a five metre dish plus head amplifier feeding a PLL f.m. detector. He watched the World Cup in colour from Spain, listening to the live commentary from Rome via a shortwave radio. Interesting to note that the picture had a half second delay with respect to the sound. The first transmission (0600-0900GMT) had a higher power than the second (following a four minute break at 0900). The video quality was such that the broadcast "could have come from next door"! A 4GHz system is under construction – signals from the Saudi Arabian Intelsat downlink at 24·5°W are already being received using a two-stage low-noise amplifier, Birkill feedhorn and a Gillespie single-conversion receiver.

John Tellick (at present working in New York) has sent us a shot of a garage in the Guadalupe Mountain Range, Texas whose owner, tired of fringe-quality TV signals, invested $6,000 in a satellite terminal. He now gets 18 channels noise free! John's cable system at his N.Y. flat provides 28 channels.

On the subject of multi-channel cable systems, David Moller (Eastbourne) recently spent five days on holiday in Belgium. The local TV shop there was on cable and could receive sixteen channels, all signals being converted to system B/G PAL. There were three French, one Luxembourg, three German, four Belgian, three UK and two Dutch channels.

A DXer in Nicosia, Cyprus, who started operations as long ago as 1964, reports regular reception from most neighbouring Arabic stations and Greece ch. E9. He comments that SpE results are good, thanks in part to no local Band I signals. Summertime locals include Israel chs. E8, 10, 11 and 24, JTV chs. E3, 6 and Syria ch. E9. The September/October period always brings signals from Gwelo (ZTV) ch. E2 and Nigeria (NTA) chs. E2 and 3.

Gareth Foster reports on a visit to Hong Kong, Canton, Peking, Penang and Singapore. In China colour sets for hotels cost around £7-800, with monochrome portables (made locally or in Japan) being available from £150. Many aerials point to Hong Kong – even approaching Canton, some 80 miles away, there are aerials swaying on high bamboo masts pointed at HK, though such reception is officially discouraged. Dual-standard colour sets (systems D/I) are on sale in Hong Kong. The Fuba XC391 aerial is available there at £35, but an enterprising company sells a copy of the XC343 under the "Fuber" brand name at £5. The number of missing elements to be seen suggests that these Fuber aerials are not too strongly made! HK and Malaysia both use the PM5544 pattern. Malaysia's version has the identification RTM at the top with a six-figure digital clock at the right-hand centre and WARNA 1 (or 2) at the bottom – Warna is Malayan for colour.

DX-TV Receiving System

The DX-TV receiving system I described earlier this year (see articles in the February/March/April issues) has proved most successful, used with ET021 tuners. A prototype of an additional unit which converts the French system L signals to the UK system I is now working and will be described in a subsequent issue.

Correction

A slight (but important) amendment is required to my article on wideband u.h.f. aerials in the August 1982 issue. Stacked bowtie arrays were described as having a wide vertical beamwidth. This is incorrect. What I intended to say was that the system has a wide signal capture area vertically, i.e. what one bowtie misses another may get, enabling signals that vary in strength with height to be received. The system has a very narrow vertical beamwidth: signals that arrive at right angles to the reflector screen are accepted, but signals (or interference) that arrive at angles above or below the aerial structure are severely attenuated. The basic principle of this is as follows. Signals arriving from the forward direction and at right angles to the reflector appear at the output in phase. Signals arriving from above, below or from the sides produce out-of-phase outputs from the dipoles and thus cancel when added.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·00 postal order (made out to IPC Magazines Ltd.), the query coupon from page 44 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

RANK A823 CHASSIS

There are two faults on this set. First the sound disappears once, twice or maybe three times an evening. If the set is left untouched the sound may come back in anything up to an hour. Otherwise the sound can be brought back by advancing the volume control to almost maximum, then turning it down again. The second fault is that the picture sometimes moves two inches to the left on changing channels, and in this state all the colours are out of position. It can be rectified by changing channels once or twice.

The sound fault is probably due to the germanium output transistors (AC176 and AC128) which should be replaced. The sideways displacement is not uncommon on this chassis and is known as "false line lock". Slight, careful adjustment of the flywheel line sync discriminator transformer 5T1 (bottom of the scan output panel, on the right-hand side) should cure this.

SONY KV1810UB Mk. II

The height increases intermittently by varying amounts of up to about 25 per cent, especially during the first half hour after switching on. The height control can be adjusted to correct the scan, but there seems to be some non-linearity at the top. With the control set correctly, one of the teletext lines appears at the top. Reducing the height removes the line. Another problem is that the white balance can be set correctly for only one brightness level. If this is done at low brightness, increasing the setting of the picture control produces a green tint overall. With equal voltages at the three cathodes the picture becomes red. This seems to be the tube, since interchanging the drives has no effect.

The height and linearity variations may be due to the 2SC867 field output transistors Q503/4 or the 2SC1124 driver transistor Q502, but before investigating these replace thermistor Th501 (TH1500) in the field bias network – these little thermistors are notorious. Also check the setting and condition of the bias control VR505. The grey-scale problem is almost certainly due to a worn tube. We've found that Trinitron tubes don't wear too well, but the situation can often be improved by careful manipulation of the drive *and* background controls.

RANK T22 CHASSIS

A line frequency whistle starts after the set has been on for about an hour if the ambient temperature is about 70°F. The picture is not affected, but the strength of the whistle varies with picture content. After a further hour the whistle stops.

Whistling is a common affliction with modern sets. The usual offender in this chassis is the line linearity coil 5L4. Check by using an insulated tool to put pressure on the coil when the whistle is present. If this proves the point, a replacement coil should clear the fault.

DECCA 30 SERIES CHASSIS

The blue line tilt potentiometer VR500 burnt out and after a few hours the same thing happened to a known good replacement. R502 in series with the blue line parabola potentiometer also runs very hot. Good but rather degraded convergence can be obtained, but I'm reluctant to leave the set running in view of the overheating.

Most of the available energy in this section of the circuit is bypassed by the 10Ω resistor R504. Check it for being high in value, open-circuit or dry-jointed. Also check diode D412. Then replace VR500 and R502.

THORN 8800 CHASSIS

Line shake is present on BBC-1 only. BBC-1 transmissions are available from two transmitters in this area, and the fault is present whichever is tried – but not on BBC-2 or ITV. The shake is worse at switch on. Disconnecting the a.g.c. link does not affect the fault, though careful adjustment of the vision/a.f.c. detector coils L112/L111 seems to affect but does not cure the trouble.

We've not had the fault with this chassis and suggest that if possible you try the set at a different location to eliminate the aerial system from suspicion. If the fault proves to be in the set, check the setting of the a.g.c. crossover control R127, the 12V zener W102 which stabilises the supply to the TCA270SQ vision detector i.c., and then try *slight* adjustment of the vision detector coil L112. If these steps fail to cure the fault, suspect the tuner unit.

SPLICING VIDEO TAPES

Where can splicing tape that doesn't bleed adhesive over the heads and is sufficiently flexible be obtained? – many splicing tapes are much too stiff. I've seen it said that a straight splice should be made, but am unsure whether it should be perpendicular or diagonal. Also, would an overlap joint be better, arranged so that the overlap trails the heads?

The tape should be spliced at right angles to its edge with a perfect butt joint – otherwise another pile-up will occur. Splice on the back (non-oxide) side and restrict the number of splices to one per tape. Half inch Bib splicing tape is suitable – most of the larger video dealers stock it. Bib also have a complete kit.

GRUNDIG 5011

There's a quarter-inch wide rope-like line down the right-hand side of the screen, about two inches from the edge. It disappears briefly if the brightness control is turned down then up again.

There are some official modifications for this, as follows: fit a choke (similar to L501) between Di637/C637 in the 14·3V supply to the line driver stage; place a link across L501 in the line drive coupling to the gate of the flyback thyristor; change C432 in the line driver transistor's base circuit from 0·001μF to 0·0068μF.

TEST CASE

239

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.

If we were to make a list of the simplest faults to deal with in a colour set, lack of one of the primary colours would come near the top – especially in the case of a seven year old hybrid set with which we are very familiar. A quick whip round with the AVO, a new transistor or whatever, and a tweak of the grey-scale pots is par for the course with a fault like this. How could we get into such a muddle that it took us a couple of hours to sort out the fault?

The set was an ITT hybrid one fitted with the CVC9 chassis, and the absent colour was blue. Yellow test card, yellow pictures. The first step in a case like this is to measure the voltages at the electrodes of the tube's blue gun. We found 430V at the first anode (pin 13) and 44V at the grid (pin 12), i.e. what one would expect under normal conditions. We next, as expected, found an excessively high voltage at the cathode (pin 11) – some 245V. Normally about 150V is present here, and it seemed that the blue output transistor T33d was cut off, in turn cutting off the tube's blue gun. These transistors often develop an open-circuit base-emitter junction, so in went a new BF337. The old one was cold when removed, which we took as confirmation of our diagnosis.

With the new transistor installed, power was applied. Up came the picture, as yellow and jaundiced as before and still with 245V at pin 11 of the c.r.t. We had almost made up our minds that the d.c. coupled driver transistor T32d was short-circuit, but instead of picking up the soldering iron we picked up the meter leads to compare the voltages in the blue output stage with those in the neighbouring green output stage. The relevant circuit is shown in Fig. 1 – T33d is the blue output transistor and T32d the blue emitter-follower driver transistor. The voltage at the base of T33d was found to be low – 5·7V compared to 7V at the base of the green output transistor. T33d's emitter voltage was 5V, which seemed fair enough, but the voltage at the emitter of T32d was 7·5V. So the coupling resistor R246d, which was of the correct value at 180Ω, had 1·8V across it, suggesting that a whopping 10mA was flowing via the output transistor's base. It seemed that the new BF337 was faulty, but a resistance check proved otherwise. T32d was o.k. as well. The output stage load resistor R248d was of the correct value, and swapping over the blue and green c.r.t. drive leads brought us a blue raster.

What had we overlooked? If you are as puzzled as we were, it might help to know that when the culprit was eventually brought to light suspicion fell on the owner's wife, children and cat! We'll tell you why next month.

ANSWER TO TEST CASE 238
— page 659 last month —

Last month's cliff-hanger concerned a solid-state GEC colour set – one of the C2110 series. If you recall, we were in trouble with an intermittent case of loss of field sync, and were rather confused by the presence of a sawtooth waveform all round the field sync amplifier transistor TR451 when the fault was present. The sawtooth was present at the positive plate of the newly fitted emitter decoupling electrolytic C452, and we soon discovered that it was also present at the negative plate – and that's the earth line for the field timebase panel.

We were using the metal chassis frame as the earth connection for the scope, the connection between the two "earths" being PL28-1. This was dry-jointed, as a result of which some of the field scan current was developing a sawtooth voltage on the field timebase panel's earth print. This had the effect of cancelling the field sync pulse, whose source on the line oscillator/sync panel was firmly grounded. A run over the print connections of PL28, especially pin 1, cured the trouble.

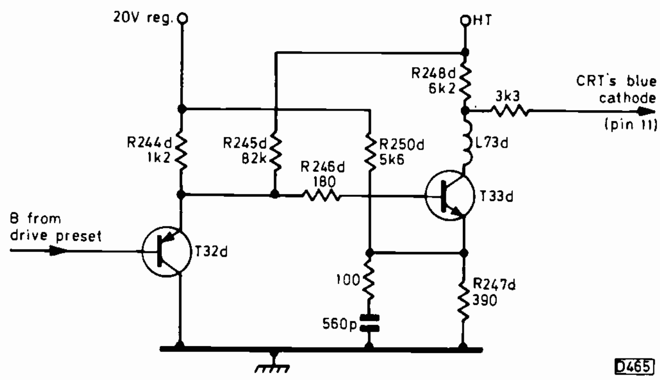


Fig. 1: Blue driver and output stage circuits used in the ITT CVC9 chassis. R245d is included to provide h.t. tracking. R250d provides output stage bias stabilisation. The peaking coil L73d and the partial decoupling of R247d improve the h.f. response.

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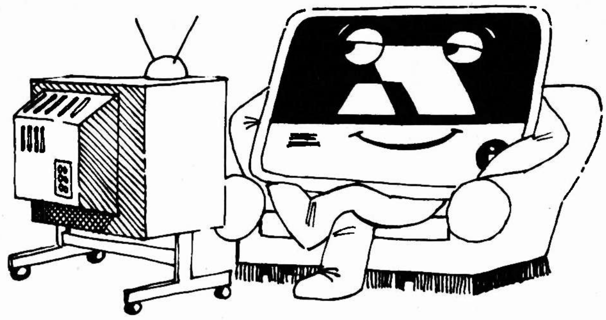

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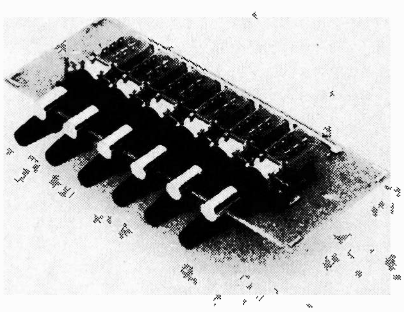

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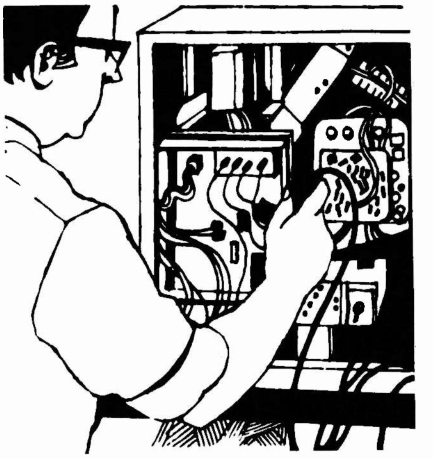

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