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Television

AUGUST 1976

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Television

SERVICING
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VOL. 26
NO. 10
ISSUE 310
AUGUST
1976

this month

OUR NEXT ISSUE DATED SEPTEMBER 1976 WILL BE PUBLISHED ON AUGUST 16

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CORRESPONDENCE

All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", Kings Reach Tower, Stamford Street, London SE1 9LS. All other correspondence should be addressed to the Editor, "Television", Fleetway House, Farringdon Street, London EC4A 4AD.

BINDERS AND INDEXES

Binders (£2.10) and Indexes (45p) can be supplied by the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF. Prices include postage and VAT.

BACK NUMBERS

We regret that we are unable to supply back numbers of *Television*. Readers are recommended to enquire at a public library to see copies. Requests for specific back numbers of *Television* can be published in the CQ Column of *Practical Wireless* by writing to the Editor, "Practical Wireless", Fleetway House, Farringdon Street, London EC4A 4AD.

QUERIES

We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them. All correspondents expecting a reply should enclose a stamped addressed envelope.

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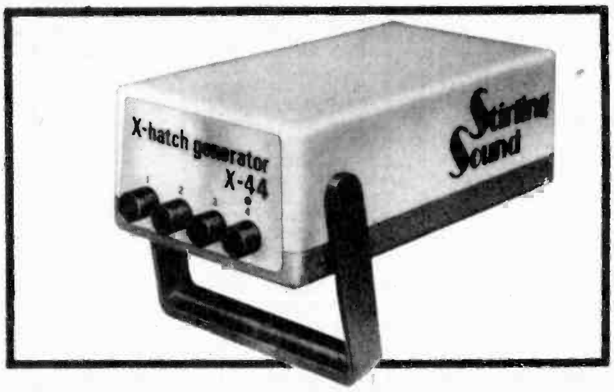

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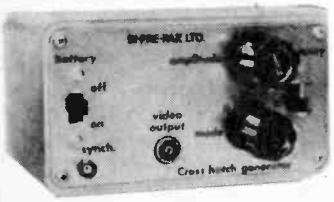

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BD133	0.35
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BF158	0.18
BF159	0.18
BF160	0.17
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BF164	0.18
BF167	0.20
BF173	0.20
BF177	0.24
BF178	0.30
BF179	0.28
BF180	0.30
BF181	0.28
BF182	0.34
BF183	0.30
BF184	0.22
BF185	0.22
BF186	0.30
BF194	0.11
BF195	0.11
BF196	0.12
BF197	0.12
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BF200	0.28
BF216	0.12

Type	Price (£)
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BF222	0.12
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BF258	0.40
BF259	0.47
BF260	0.23
BF262	0.30
BF263	0.23
BF271	0.15
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BFX85	0.25
BFX88	0.24
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THE WAY FORWARD

At this time of year, writing in early June, it is possible to assess the way things are going in our industry: HEDA is over, the budget with its welcome reduction in VAT is well behind us, while the economic statistics for the first quarter of the year have now been published. What sort of picture emerges?

One gets the impression that export-led growth, or at least an export-led clamber out of the depths of the recession, is the order of the day. Some figures. During the first quarter, exports of the UK electronics industry as a whole exceeded imports by £10·08 millions. Not a staggering amount perhaps, but nevertheless a rather different situation to that during the last few years. Exports of consumer electronics goods exceeded imports by £940,000 in the first quarter. Compare this with the situation at the height of the 1973 boom when, in the final quarter, there was a deficit of over £60 million! Focus more closely on the Colour TV section of the market and an even more cheering position is seen, with exports during the first quarter well over twice imports. The figures are worth careful note: exports £12·35 million, imports £5·02 million, giving a favourable trade balance of £7·33 million.

The industry, helped no doubt by the depressed value of the pound, is clearly doing well in overseas markets. Meanwhile, the home market has still to show any sign of a revival. Colour set deliveries during the first quarter were 35% down on the first quarter of 1975, though monochrome set deliveries were 15% up. So it seems that the signs of increased production – several setmakers have announced returns to full-time working and staff recruitment – are due mainly to growth in exports. Decca, Rank, Thorn, Pye and GEC have all reported success with their export models, but the value of the multinationals rather comes into question. Theoretically, if they can produce more cheaply in their UK plants they should be concentrating on increased UK production. But in practice they seem to move more slowly than our domestic firms. This is not to say that foreign owned companies are not playing a part in the UK's export success. In fact there are at least two interesting examples to the contrary. When Tandberg started production in the UK their aim was to assure for themselves continuing success in the UK market, which had become an important part of their operations. Now however plans are going ahead for expansion of their Haddington, near Edinburgh, colour TV plant and for exports from it to Scandinavia. A similar situation exists at Sony's Bridgend, South Wales colour TV plant, which is already exporting colour sets to the continent. And it's not only the TV setmakers who are finding exports a way to recovery (the ex-works turnover of the UK radio and TV industry fell from £337 million in 1974 to £292 million in 1975, despite inflation): aerial and component manufacturers are also doing well.

One only hopes that these efforts won't evaporate when the next peak in the home market comes. Successful exporters have all found that meeting delivery dates is one of the most vital ingredients of their success. But when boom conditions in the home market return it's often all too easy for the forceful dealer down the road to get priority over those unknown agents in far off places: he can after all make a right pest of himself on the local 'phone! The answer is a more gradual development of the home market than we have had in the past, as BREMA have in fact been impressing upon the government. No more sudden and substantial alterations to credit conditions and VAT rates, please!

But what of the future? While the TV industry seems at present to be poised for healthy growth, anxious glances are nevertheless being cast in the direction of Japan, whose massive TV industry is now the world's largest. There is indeed something ominous in the way that Japanese TV set prices in the UK have risen so little in recent times despite substantial increases in Japanese wages and the devaluation of the pound. Another ominous point is the UK's growing dependence on the Japanese colour c.r.t. industry. There is now just one home producer, Mullard, and however successful they are no setmaker will want to be wholly dependent on one supplier for by far the most expensive component in his sets. By failing to bail out Thorn's colour tube operations, we have thus guaranteed a continuing and costly import market for the foreseeable future.

teletopics

HEDA/SOUND & VISION '76

Commercially, the Home Electronics and Domestic Appliances trade exhibition held at the National Exhibition Centre, Birmingham seems to have been a success, though some firms seem to be hankering after a return to the traditional London hotel shows. Technically, this seems to be something of a stand-still year, or rather one of gradual development. Setmakers are increasingly going over to in-line gun colour tubes, but there were few completely new chassis on show. Decca showed their new 100 chassis which uses the Mullard 20AX tube, but this is not in full production so far. Rank have introduced 22 and 26in. models using their Z718 chassis in the Murphy range. Certain German setmakers feature infra-red (not ultrasonic) remote control systems, Grundig's self-seeking tuning arrangement being of particular interest. Something new from Saba was a set fitted with an f.e.t. tuner unit featuring in addition a pin diode attenuator: this is said to give interference-free reception even under difficult conditions.

It's certainly useful for those in the trade to be able to see the various ranges under one roof. Whether the public is interested in seeing row upon row of not very dissimilar products is another matter, especially at a location such as Birmingham which is not exactly a tourist centre. The following public exhibition, Sound and Vision '76, seems at any rate to have been something of a flop, with less than half the expected number of visitors attending.

TELETEXT LATEST

Labgear have announced a teletext adaptor for use with existing TV sets – the decoded signals are fed into the receiver's aerial socket. The adaptor, Model CM7026, is expected to be available early next year at a price in the region of £200-250. The adaptor uses the Texas Instruments Tifax decoder package. At HEDA, sets incorporating Tifax decoders were being demonstrated by ITT, Thorn, Decca and Pye. Mullard had on show a complete range of components for a "low-price l.s.i. decoder". The first generation Mullard l.s.i. teletext decoder consists of a module containing about a dozen i.c.s, including seven 1k bit memory i.c.s to store the 960 characters of a teletext page.

The BBC has now started a second teletext service, with different information, on BBC-2, and the BBC's Board of Governors has approved a continuing financial provision to maintain and expand its teletext services.

Apart from the well-known twinkling teletext lines at the top of the screen, a teletext shadow effect – a patch of white at the top of the screen – has been reported on some models and Philips have introduced a modification for their G8 chassis to overcome it. This consists of adding a resistor of 390Ω value (select in the range 330-470Ω for optimum results) in series with the base field flyback blanking transistor (T4488) on the timebase panel. This increases the width of the blanking pulse.

VIDEODISCS NEARER?

Full details have now been released of the agreement, mentioned in passing last month, between Plessey and RCA on the RCA Selectavision videodisc system. Plessey has signed a seven-year licence agreement with RCA whereby Plessey's Consumer Electronics subsidiary Garrard will manufacture and market Selectavision videodisc players. Garrard have announced that they expect to have a prototype player completed by the end of the year.

It now looks as if the RCA system could be the first major breakthrough in terms of an acceptable, moderately priced videodisc system for the domestic market. The 12in. vinyl records are similar in appearance to standard LP discs and are little more expensive. The player is relatively simple, with the stylus directly tracking the disc. The two-sided records give thirty minutes' playing time per side. The output from the player is fed into the TV set's aerial socket.

BATC CONVENTION

The next British Amateur Television Club convention is to be held in Parkinson Court at the University of Leeds from 10 a.m. to 5.30 p.m. on Saturday September 18th. Admission is free and anyone interested in amateur television is welcome. There will be displays and demonstrations of members' equipment, both slow-scan and 625-line. There will also be trade stands and a bring and buy stall. For further details write to: A. R. Watson, Somerby View, Bigby, Barnetby, South Humberside.

TRANSMITTER OPENINGS

The following transmitters are now in service:

Addingham (West Yorkshire) BBC-1 channel 40, ITV (Yorkshire Television) channel 43, BBC-2 channel 46. Receiving aerial group B.

Blair Atholl (Tayside) BBC-1 (Scotland) channel 40, ITV (Grampian Television) channel 43, BBC-2 channel 46. Receiving aerial group B.

Chepping Wycombe (Bucks) ITV (Thames Television and

London Weekend Television) channel 41, BBC-2 channel 44, BBC-1 channel 51. Receiving aerial group B.

Gunnislake (Cornwall) BBC-1 channel 40, ITV (Westward Television) channel 43, BBC-2 channel 46. Receiving aerial group B.

Killearn (Stirling) ITV (Scottish Television) channel 59, BBC-2 channel 62, BBC-1 (Scotland) channel 65. Receiving aerial group C/D.

Leamington Spa (Warwickshire) BBC-1 channel 56, BBC-2 channel 62, ITV (ATV) channel 66. Receiving aerial group C/D.

Tavistock (Devon) BBC-1 channel 57, ITV (Westward Television) channel 60, BBC-2 channel 63. Receiving aerial group C/D.

Torosay/Craignure (Island of Mull) BBC-1 (Scotland) channel 22, ITV (Scottish Television) channel 25, BBC-2 channel 28. Receiving aerial group A.

All these transmissions are vertically polarised.

NEW MULLARD UHF TUNER

Mullard have introduced a new u.h.f. tuner, type U321, which makes use of some of the latest developments in semiconductor technology in order to overcome the ever increasing problems caused by congestion in the u.h.f. bands. The use of a BF480 large-signal r.f. transistor and a BA280 Schottky diode mixer gives a good noise figure with greatly improved signal handling – particularly cross modulation. The a.g.c. is applied to a pin diode network which attenuates the signal instead of altering the biasing of the controlled stage. There is also a v.h.f. version and a u.h.f. version intended for continental use. The supply voltage is 12V; tuning voltage range (channels 21-69) 1-28V; power gain typically 23dB; typical noise factor 7dB; image rejection about 53dB; and a.g.c. control range roughly 26dB.

SPECTRA NOW PART OF GRANADA

Spectra TV Rentals, founded in 1969 and 80% owned since 1973 by GEC, has been bought for £9·4 millions by Granada TV Rentals. It is understood that Granada and GEC have entered into an agreement for the future supply of TV sets. Spectra has some 260,000 colour and 73,000 monochrome sets out on rent.

SONY'S UK SETS

Sony's Bridgend, South Wales colour TV plant, opened in December 1974, is now producing at the rate of 165 sets a day. All Sony 18 and 20in. colour sets sold in the UK are now produced there and sets are also being exported to Europe. Sony monochrome and small-screen colour sets are still imported.

GEC SERVICE DEPARTMENT

The service and spares department of GEC (Radio and Television) Ltd. has now been moved from Wembley to the Hirwaun Industrial Estate, Aberdare, Glamorgan CF44 9UY. Delays are likely if correspondence is sent to the previous address.

PICTURE JITTER

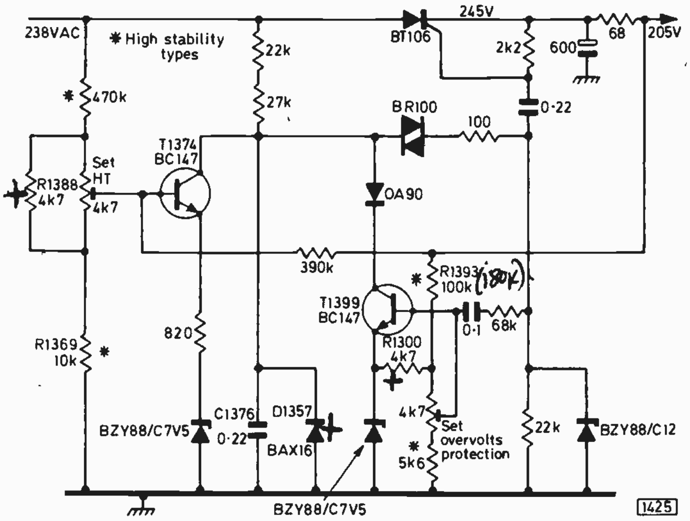

Fig. 1: Latest version of the regulated h.t. supply circuit used in the Philips G8 chassis. Modifications (see text) have recently been introduced to overcome picture jitter. R1388 has been added recently and R1369 changed to 10kΩ to improve the long-term h.t. stability.

Picture jitter is one of the most tricky problems to deal with in solid-state chassis using thyristor regulated h.t. lines. Various changes introduced by Rank on their A823-series chassis have been reported in the magazine in past issues. Recently Philips have introduced minor modifications to their G8 chassis to overcome the problem. These are the addition of a 4·7kΩ resistor (R1300) between the junction of R1393/R1396 and the emitter of transistor T1399, change of the value of the upper resistor (R1393) in this transistor's base bias network from 180kΩ to 100kΩ, and the addition of a BAX16 diode (D1357) in parallel with the charging capacitor in the diac (BR100) firing circuit. These alterations are shown in Fig. 1, which also incorporates previous changes.

SAW FILTERS FROM PLESSEY

Plessey Semiconductors have introduced a range of surface acoustic wave filters for use in colour television receivers. They are the SW150, SW170 and SW200, which are tailored to UK, European and US specifications respectively. The function of these devices is to act as an i.f. bandpass filter between the tuner and the i.f. strip. Their phase characteristics make them particularly suitable for use where teletext decoding is involved. Because of their small size, direct signal breakthrough can be a problem unless care is taken over circuit layout – for optimum adjacent channel performance a 70dB rejection over a distance of half an inch is required. The basic principle of a SAW filter is shown in Fig. 2. The input transducer converts the electrical input signal into an acoustic wave which travels across the surface of the piezoelectric substrate, being converted back into an electrical signal by the output transducer. It's the design of the transducers that provides the filter characteristics. The insertion loss and temperature coefficient are low, the devices are compact and of low cost, and require no adjustment of course.

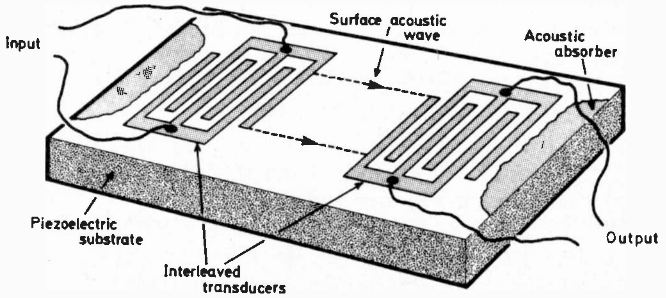

Fig. 2: Principle of the surface acoustic wave filter.

LONG-DISTANCE TELEVISION

ROGER BUNNEY

MAY 1976 was certainly an active month for long-distance television reception. The Sporadic E season started for me on May 8th, with good reception from Scandinavia. Since then there have been signals from many areas on most days. No particular direction seems to predominate, but signals from distances of over 1,000 miles seem to be lacking. ORF (Austria) has provided really strong signals at times, with the channel E2a Jauerling transmitter reaching a measured 2·5mV signal. Other signals seen here have included RAI (Italy) with extensive use of the PM5544 test pattern interspersed with colour test films, and the Yugoslavian RTV Ljubljana PM5544 pattern with a digital clock inserted. JRT BGRD (Belgrade) also uses the PM5544 pattern with digital clock, making identification of weak signals very difficult at times.

Personally, the main item this month was reception of the ATS-6 satellite, using a home-made dish array – but more of that later! The following log gives the basic details of reception here, but with extended programme hours on so many networks identification of sources is becoming much more difficult than a few years ago.

Month's Log

1/5/76 DFF (East Germany) channels E3, 4; WG (West Germany) E2; TVP (Poland) R1 – all MS (Meteor Shower). Much of the early morning period consisted of Moscow Mayday parades – carried of course over the Eastern European networks.
3/5/76 DFF E4; DR (Denmark) E3; JRT (Yugoslavia) E4; RAI (Italy) IB – all MS; CST (Czechoslovakia) R1 – SpE.
4/5/76 DFF E4; RAI IB – both MS; JRT E4; SR (Sweden) E2 – both SpE.
5/5/76 DFF E3, 4; TVP R1, 2; JRT E3; MT (Hungary) R1; ORF (Austria) E2a; WG E2, 4; RTVE (Spain) E2, 4 – all MS.
6/5/76 DFF E4; CST R1; TVP R1; ORF E2a – all MS.
8/5/76 NRK (Norway) E2 twice; E3 twice, E4; RAI IB – all SpE (the first opening of the season here at Romsey).
9/5/76 TSS (USSR) R1; ORF E2a; TVP R1; CST R1 – all MS; TVP R1, 2; TSS R1 – all SpE. This SpE opening lasted all afternoon and into the early evening, but due to the vast number of programmes identification of most signals was difficult.
10/5/76 DFF E3, 4; DR E3; ORF E2a – all MS.
11/5/76 DFF E4 – MS; MT R1 – SpE.
12/5/76 DFF E4; TVP R1; CST R1 – all MS; TSS R1 twice; TVP R1, 2 – all SpE. Note that the ch. R2 TVP signal was from a low-power 2nd chain outlet!
13/5/76 DFF E3, 4 – MS; TSS R1 twice; CST R1, 2; MT R1, 2; JRT E3, 4; RAI IA, IB; Switzerland E2 (very short skip here) plus many unidentified signals – all SpE.
16/5/76 DFF E4 – MS; TVP R1, 2 – SpE.
18/5/76 DFF E4; TVP R1, 2 – MS; RAI IA; JRT E3; TSS R2; CST R1; many unidentified signals – all SpE.
19/5/76 RAI IA, IB; JRT E3, 4; RTVE E2, 3; ORF E2a, 4; TVP R1; WG E2; many unidentified signals – all SpE.
20/5/76 RTVE E2, 3; There was an unusual programme featuring dancing men on ch. E2 from a southerly direction at 1955 – all SpE.
21/5/76 CST R1; TVP R1 – both MS; RAI IA, IB – both SpE.
22/5/76 TSS R1 twice; CST R1; TVP R1, 2; MT R1; RAI IA, IB twice; RTVE E2, 3, 4; ORF E2a, 4; RTP (Portugal) E3; JRT E4; Albania IC; many unidentified signals including R3, 4 – all SpE. This was the best opening here so far this year.
23/5/76 TSS R1; CST R1, 2; MT R1; JRT E3; unidentified signals on R1, 2 – all SpE.
24/5/76 TVP R1, 2; MT R1; RTVE E2; RTP E2; RAI IA; unidentified signals up to R4 – all SpE.
I logged this as a good opening, with the band jammed at 1745.

It will be seen that stations to the east through to the south west are predominating reception this season, with a lack of Scandinavian signals. I gather from those more active than I that the more distant Scandinavian and Finnish stations were frequently received during the first week of May but subsequently faded out.

On May 9th at least three enthusiasts logged an Arabic station on ch.E3. The signal was noted at various strengths between 1650-1830 and was seen with various programmes during this period including news. Clive Athowe (Norwich) was able to receive sound and vision clearly, confirming the Arabic language. Clive suspects that the signal originated at Port Said since the field pulse carried no VITS coding and was smaller than JTV (Jordan) logged last year. Just prior to the Arabic reception TVR (Rumania) had been noted on ch.R2, thus confirming double-hop reception conditions. I'm sure other enthusiasts will have received many new stations and look forward to hearing about their reception.

New EBU Listings

West Germany: Kiel chs. 35, 55. Increased mast height, now 219 metres (previously 74 metres).
Azores: Cume ch. E4, 180W horizontal. This station could be a possible during suitable SpE conditions despite the low power. RTP provides the programmes.

News Items

Hungary: We understand that the Hungarian second chain (MT-2) will be restricted to the existing two transmitters in order to give priority to the extension of the first chain coverage to the whole country. It is anticipated that within the next few years there will be 95% MT-1 coverage and 50% MT-2 coverage.

India: It seems that an Indian satellite may be launched in the late 1970s to continue the space broadcasts. A new transmitter at Hyderabad will be opened in spring 1977 to continue educational broadcasts – hopefully covering almost half the existing SITE area.

West Germany: AEG-Telefunken are installing a 12GHz TV transmitter in West Berlin so that the West German Post Office can conduct propagation tests to investigate the future of direct TV broadcasting from satellites. The power is given at 100W but with an anticipated increase later this year.

Greece: The Greek TV Service ERT is to commission an experimental radio link with RIK (Cyprus), via relay transmitters at Rhodes and Paphos, to enable Cyprus to take Eurovision programmes. Previously an experimental link had provided programmes of medium quality via direct off-air pick up on the island from Greek TV: after processing the signals were sent out over the Cyprus transmitters.

Balloons: Following previous reports in this column on transmissions from moored balloons, it seems that there are two balloon projects in the Middle East. In Iran, a balloon transmitter is covering the Baluchistan area (South East Iran) while another to the south west transmits over the Persian Gulf region. Each has two TV and two f.m. transmitters. Unfortunately no frequencies are mentioned.

Satellites: The WTFDA reports that Japan is to launch a TV satellite from Tanegashima, Japan in February 1979. It will transmit in colour with f.m. video. The General Electric Company is building another satellite for Toshiba, to be launched in February/March 1977 from the Kennedy Space Centre. It's intended for experimental TV broadcasts. Known as ECS, the satellite will be stationed 145° (±·5°) east.

Cuba: The USSR is to assist Television Nacional, Havana in establishing the first colour service on the island. Talks were concluded in March this year.

Sporadic E

For an in-depth study of the causes and characteristics of Sporadic E I recommend the article "28MHz Sporadic E" published by the Radio Society of Great Britain in the May 1976 issue of *Radio Communication.*

Satellite Reception from ATS-6

The number of enthusiasts who have successfully resolved pictures from the ATS-6 satellite at present providing educational programmes for the Indian subcontinent slowly grows. Clive Athowe has now resolved

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EF80	56p	PCF200	£1.13	PL508	£1.17	30FL1	97p
EF183	72p	PCF801	68p	PL509	£2.00	30FL2	97p
EF184	72p	PCF802	83p	PL802	£2.00	30L15	£1.00
EH90	79p	PCF805	£1.22	PY81	45p	30L17	98p
EY51	72p	PCF808	£1.13	PY800	54p	30P12	95p
EY86/7	56p	PCH200	£1.17	PY801	54p	30PL1	£1.35
GY501	£1.35	PCL82	59p	PY500	£1.12	30PL13	£1.10
PC86	£1.10	PCL83	68p	PY500A	£1.12	30PL14	£1.62
PC88	£1.10	PCL84	72p	U25	80p	30PL15	£1.35
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		PCL805	95p				

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ECC83	34p	GY501	80p	PD500	£2.25	UF89	42p	30PL13	75p
ECC85	40p	GZ30	45p	PFL200	73p	UL41	72p	30PL14	85p
ECC88	47p	PC86	63p	PL36	62p	UL84	44p	30PL15	85p
ECH42	72p	PC88	63p	PL81	50p	UY85	35p	30P4MR	90p
ECH81	36p	PC97	40p	PL81A	54p	U25	72p		
ECH83	82p	PC900	49p	PL82	38p	U26	65p		
ECH84	52p	PCC84	40p	PL83	46p	U191	70p		
ECL80	52p	PCC85	44p	PL84	46p	6/30L2	70p		
ECL82	47p	PCC88	62p	PL500	75p	6BW7	68p		
ECL83	68p	PCC89	50p	PL504	75p	6F23	70p		
ECL86	42p	PCC189	53p	PL508	83p	6F28	68p		
EF80	30p	PCF80	40p	PL509	£1.80	6V6	47p		
EF85	37p	PCF82	50p	PL519	£2.80	10F1	68p		
EF86	52p	PCF86	58p	PL802	£2.00	20L1	80p		
EF89	33p	PCF200	95p	PY33	52p	20P4	85p		
EF183	37p	PCF801	50p	PY81/3	41p	30C1	40p		
EF184	37p	PCF802	55p	PY88	41p	30C15	78p		
EH90	56p	PCF805	£1.21	PY800	41p	30C17	78p		
EL34	83p	PCF806	54p	PY801	41p	30C18	£1.21		
EL41	58p	PCF808	£1.12	PY500	£1.00	30F5	75p		
EL84	35p	PCH200	77p	PY500A	£1.00	30FL1	97p		
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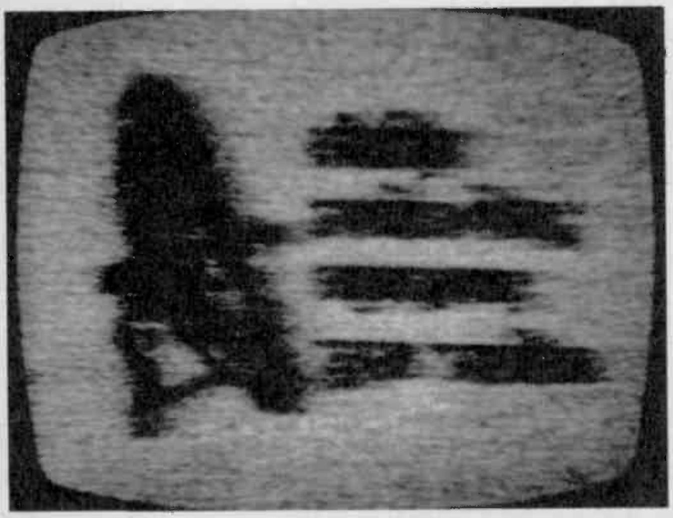
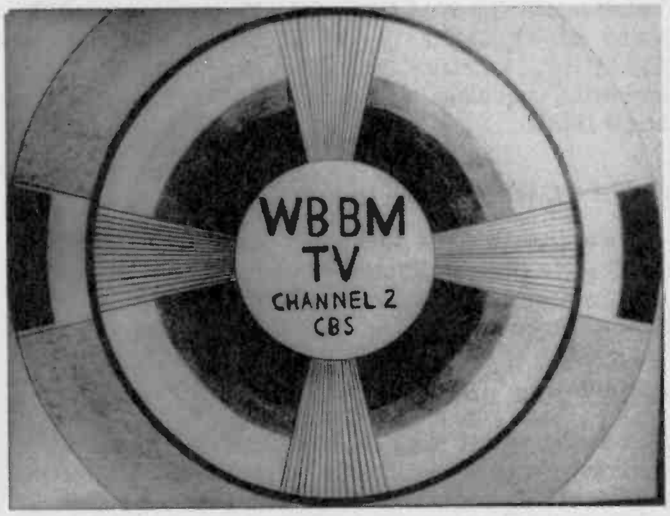
New Delhi news announcer, received by Steve Birkill from the ATS-6 satellite.

Caption received by Steve Birkill from ATS-6, showing the satellite itself.



Caption received by Roger Bunney from the ATS-6 satellite – signal locked with inverted vision.



The WBBM-TV test card: Chicago channel A2. Photo courtesy Keith Hamer.

signals using a home-constructed dish with a dipole and disc reflector. The only enthusiasts to have resolved the 860 MHz signals using conventional Yagis (i.e. domestic group C/D types) have been Hugh Cocks with a Jaybeam Multibeam and Charles Hopkinson with an Antiference XG21C/D. Steve Birkill continues to improve his reception as the accompanying photographs show.

At long last I have myself managed to receive pictures from ATS-6 – thanks in part to an enforced absence from work due to mumps! During this period I was able to construct a crude dish assembly from an old sun lounger frame some 6¼ x 5¼ feet. A simple dipole and reflector were mounted facing back into the dish, feeding into a Wolsey wideband u.h.f. "Supa Nova" amplifier. The dish was fixed to a step ladder and after considerable effort signals were received – in a direction some degrees to the south of the expected 135°. The focal point of my dish is much closer than others – some 18 in. compared to Ian Beckett's 27 in. Unfortunately the phase-lock loop receiver didn't work as well as anticipated, similar results being obtained on the normal DX receiver fed via an ELC2000S tuner.

The signal obtained is a most unusual one – due to the use of an a.m. detector to demodulate the f.m. vision. It's possible to lock a fair signal, but with reversed video (i.e. a negative picture). Tuning to the h.f. side reverses the polarity to the normal video and maintains locked syncs – though with a considerable increase in noise. Jaybeam have kindly provided a group C/D Parabeam aerial which I've now modified, using the reflector, slot dipole and one director as the signal pick-up device for the dish. This gave a considerable increase in signal strength, unfortunately somewhat negated by a belt of trees coming into leaf. The ATS-6 signal tends to vary in strength depending on the weather. It's best on a clear, cloudless day, with lower strength on an overcast and wet day. The photograph of my reception – locked in the inverted video form! – hardly compares with Steve's quality but is at least recognisable.

Gains of Parabolic Dishes

David Roche has kindly sent us a gain/dish diameter chart processed on a computer. As will be seen (Table 1). the higher the frequency the greater the efficiency for a given dish diameter. A further increase in gain can of course be obtained by using a more efficient pickup assembly, for example a slot dipole instead of a conventional dipole. The gains shown are for a plane polarised system; a lower gain would be obtained using a cross-polarised system.

From Our Correspondents . . .

Help is wanted by F. Zaccario of Gothic Cottage, 1 Little Lane, Retford, Notts. He wants to buy a TV-DX receiver covering both v.h.f. and u.h.f. If anyone can assist please write to Mr. Zaccario.

LONG-DISTANCE TELEVISION

Anthony Mann (Perth, Australia) has reported spectacular F2/TE activity in March, resulting in signal reception from the Western USSR (Lithuania/Estonia) at 38MHz. March 26 was the most active day this year: between 1500-2000 local time he noted the band jammed with Asian/Japanese signals, with the m.u.f. (maximum usable frequency) at 40MHz, dropping to 30MHz at 1800. The m.u.f. towards the north west then began to increase, bringing in W. USSR with distances of around 8,000 miles. Unfortunately the m.u.f didn't rise sufficiently for the ch. B1 sound at 41.50MHz or the French ch.F2 sound at 41.25MHz. A major magnetic storm destroyed the improving conditions, and on March 27th the m.u.f. was below 18MHz.

Fanned Dipole

We've received an interesting letter from Bill Holt (Leeds). He's using a fanned wideband dipole for Band 1 and we hope to include more information shortly. From Bill's reception the dipole seems to work very well.

Legal Point

A recent report suggests that the UK Post Office is considering the prosecution of anyone who receives the ATS-6 satellite transmissions, on the grounds that a special licence is necessary for such reception. To the best of my knowledge the usual domestic TV licence covers the user for the reception of the various long-distance signals which DXers receive throughout the year. Certainly I will not be ceasing experimentation with the reception of the ATS-6 satellite until transmissions cease this August. I would appreciate hearing from anyone who is approached by official bodies.

Satellite Reception – Summary

Technically, the ATS-6 satellite TV experiment at 860MHz has been successful, so successful that a number of UK enthusiasts and various organisations have been able to receive the video signals using both receivers with the correct f.m. demodulators and also normal domestic a.m. video receivers. The experiment ceases on August 1st, when the educational TV role will be taken over by terrestial transmitters. The ATS-6 satellite will shortly after be moved to a position to give experimental transmissions to South America – at much higher frequencies.

From the information now available it is possible to make some assessment of the future role of direct TV transmissions and the basic reception techniques required, though the date of any further transmissions is quite impossible to predict. For covering large land areas – such as India – it is likely that u.h.f. will be used, with a transmitter aerial having a forward beamwidth at the –3dB points of perhaps 10° maximum. In more densely populated areas such as Europe a much more restricted beamwidth will be required – ranging between 0·5° and 1° depending on the size of the country involved. For the UK a transmitting aperture in the region of 1° would be necessary. For the USSR and Europe satellite transmissions in the 11·7-12·5GHz band (Band VI) are planned, with wideband f.m. video modulation – deviation 16MHz peak-to-peak with a channel bandwidth of 24MHz. F.M. is preferable for the vision signal since a much lower transmission power is required for a given video/noise figure: it also provides a greater protection ratio from possible sources of interference such as other satellite transmissions.

Since such satellites will be in synchronous equatorial orbit at some 24,000 miles, receiving aerials will have to be inclined at an angle and will have to have directional characteristics giving sufficient protection against other satellite transmissions. The type of aerial likely to be favoured will be either a parabolic dish with a diameter approaching one metre and a gain of perhaps 39dB, or an etched copper laminate system of stacked dipoles. The latter would have lower gain due to losses in the material, even with a receiving aperture in excess of one metre.

Conversion down from 12GHz must be done near the aerial to avoid prohibitive feeder losses. Both single and double conversion receivers have been suggested, in the latter case with the 12GHz signal converted to u.h.f. at the aerial and a second conversion in the receiver. Remodulation of the video output, feeding back into the receiver at either v.h.f. or u.h.f. with a.m. video, has been put forward.

The EBU is currently assessing the results from the ATS-6 direct satellite TV experiment. Previously, terrestial 12GHz experiments have been carried out in West Germany. The first results showed that in the presence of heavy rain and cloud the signal is subject to severe attenuation. Mullard Research Laboratories have also been experimenting with s.h.f. reception techniques for some time.

Table 1: Gains for Parabolic Aerials of Various Sizes

Channel	*Frequency (MHz)*	*Diameter in Feet*									
		1	2	3	4	5	6	7	8	9	10
63	806	5·9	12	15·5	18	19·9	21·5	22·8	24	25	25·9
64	814	6	12	15·6	18·1	20	21·6	22·9	24·1	25·1	26
65	822	6·1	12·1	15·6	18·1	20·1	21·7	23	24·2	25·2	26·1
66	830	6·2	12·2	15·7	18·2	20·2	21·8	23·1	24·3	25·3	26·2
67	838	6·3	12·3	15·8	18·3	20·3	21·8	23·2	24·3	25·4	26·3
68	846	6·4	12·4	15·9	18·4	20·3	21·9	23·3	24·4	25·4	26·4
69	854	6·4	12·5	16	18·5	20·4	22	23·3	24·5	25·5	26·4

SYCLOPS REVISITED

Barry F. PAMPLIN

This time last year we described the operation of the novel line output stage/ switch-mode power supply circuit used in the Thorn 9000 chassis. In his return visit Barry F. Pamplin describes his experiences in dealing with the fault conditions that arise in practice.

WE first looked at the Syclops circuit – which combines the line output stage and the switch-mode regulated power supply – in the Thorn 9000 chassis last summer (August 1975). At that time there was little or no field experience available to assess the reliability of the circuit nor much idea of the sort of troubles that were going to brighten our winter days.

Well, those winter days are now just a memory and we know what sort of a menu of faults Syclops had waiting for us. The first course was dry-joints, followed by a substantial entrée of diode troubles. But enough of this rhetoric and down to business! Considering the novelty of the circuitry involved there has, in the author's experience, been rather less trouble than was anticipated. This article deals with faults in the Syclops section of the set: other faults will be dealt with in a following article.

Modifications

Before dealing with actual fault conditions it should be mentioned that since the details published last year Thorn have introduced a modification to the way in which the 24V supply for the signal circuits is obtained. In the original arrangement the 30V rail developed by W708 for the audio stages was fed via a regulator (VT703) to power the signal circuits. This arrangement has been altered by omitting the regulator and feeding the signal circuits from the 24.5V field timebase supply at fuse F4. This modification is important from a servicing point of view since it affects the symptoms produced for example by failure of F4. The present circuit is shown in Fig. 1.

Tripping or dead?

One of the troubles with any auto-resetting circuit is that if the reset rate is very fast the net result is nothing in terms of what can be seen and heard. Thus lesson number one is to be able to distinguish a really "dead" set from one which is very much alive and tripping. The way to do this is to check the potential at pin 7 of socket 16 on the line and power board. Use a meter set to 10 or 30V f.s.d. A fast flicker on the meter is good evidence that the corpse isn't as dead as it would have you believe, so that you must approach it on the basis of "tripping" rather than "dead".

Mains fuse failure

Having dealt with that diversion we can now say that a truly "dead" set either doesn't have a supply at all (check when the last electricity bill was paid) or has an open-circuit mains fuse F1. One of the joys of the 9000 chassis is finding F1, working out how on earth you get to it, and cussing aloud when it keeps on blowing when you switch on. Somewhere in the Thorn empire there must be a special department studying fusible link inaccessibility – it works very efficiently. The siting of F1 on the 9000 chassis is second only to the siting of F2 in the 1590 series of portable monochrome sets.

To date we have traced the following components as the cause of repeated F1 failure. A short-circuit mains rectifier W701 (this is the first of many troublesome diodes you will be hearing about), a collector-emitter short in the Syclops transistor VT701 (more about this one later), that old hardy annual the mains filter capacitor, which is in the left-hand corner of the line output/power supply panel PC752, and the thermistor X701 in the degaussing circuit going low-resistance.

Xmas Eve Fault

We all have our favourite tales about Xmas Eve faults. The current one in the author's workshop concerns a 9000 chassis which when it didn't work was decidedly dead but the smallest of taps almost anywhere on PC752 brought it to life.

All the indications were of a dry-joint, but we could not find it. Every joint was resoldered. Every bit of enamelled copper wire emerging from a winding into a pin was tugged. Finally we decided it might be inside the Syclops transistor itself and we changed it. Guess what? Despite the external

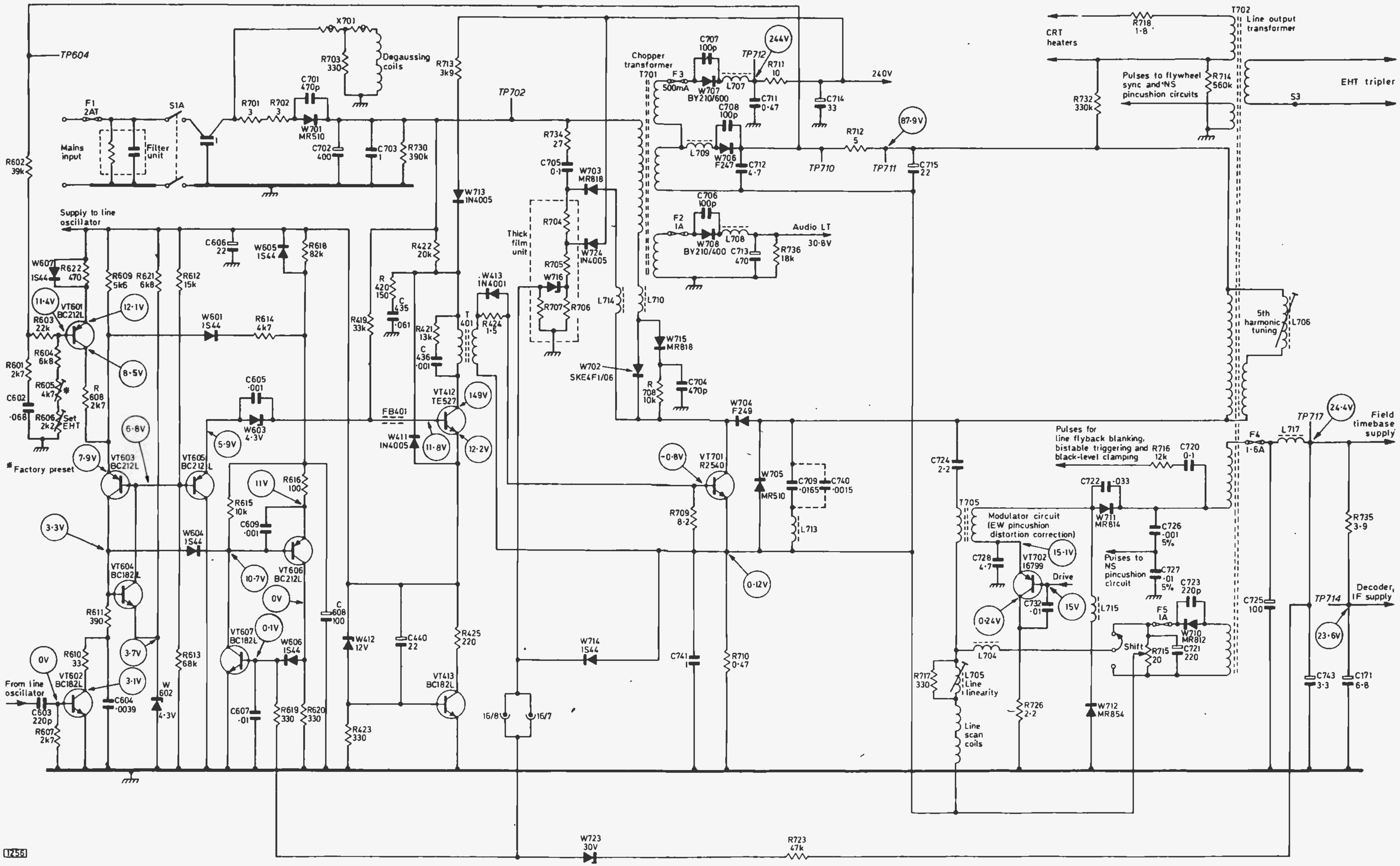


Fig. 1: Current Syclops circuit, incorporating production modifications. Components with reference numbers starting with 7 are mounted on the Syclops board (PC752). C436/R421 and C435/R420 are transposed on the board. Early models used a different thick film unit (type OVB AB), with W724 omitted: the early type must not be fitted where W724 is present or there will be continuous tripping. The later thick film unit bears the identifications OVB B AB or OVP-B. In earlier models the 24V signal panel supply was obtained from a regulator fed from the 30V line.

appearance of being a simple "soldered in" job we found that it was really a plug in system and that the springs in the socket were so lacking in tension that any contact between the socket and the base lead of the transistor was merely accidental. Worse still – the base and emitter connections to the transistor had been "cranked" with a pair of pliers on the production line, so it was clear that the trouble was known at that stage! Since that memorable day we have met many more examples of faulty base-emitter connections to VT701, causing not only intermittent operation but also corona effects on the screen with no visible indication as to the source.

The saga of the seven ten

One of the hazards in designing any novel circuitry is the problem of foreseeing what will happen in all of the many combinations of possible fault conditions. The problem of the seven ten involves considering what happens if VT701 develops a collector-emitter short and R710, carrying the resulting fault current until the mains fuse relieves it of its misery, decides to go open-circuit.

Briefly, some 320 odd volts, developed across the main reservoir capacitor C702, will find itself unimpeded by VT701 and unable to get to chassis via R710. It sets off on a path of destruction via W714 to the base of VT607 and thereafter via diverse paths to chassis.

If you don't want these awful things to happen to any of your 9000 sets take a look at R710. If it's of the open spiral type of construction replace it with a 7W unit (obtainable f.o.c. from Thorn).

Dealing with tripping

The key to quick diagnosis of tripping faults lies in the careful observation of any secondary symptoms. Symptoms which have particular significance are the speed of tripping, the presence of hum on the sound, any indications of excessive e.h.t., and factors which affect the tendency to trip.

We will deal first with the set which is starting and tripping at high speed without any obvious side effects. The problem here is knowing where to start, and it will be helpful to set out in detail the procedure we have evolved by trial and error. It has no inherent justification except that it has proved in practice to be the shortest route to finding the fault.

(1) Unplug the input lead to the e.h.t. tripler. If this stops the tripping suspect the tripler – also check R724 and R725 for overheating (see Fig. 2).
(2) Replace the thick-film overvoltage unit (R704 etc.) on PC752.
(3) If the tripping persists check the following components for leaks: C708 (if faulty replace with 2kV working unit), W706, W705, W602, W703, W723 and VT602.
(4) If all these components are o.k. check by substitution VT411 and LR1 in the line oscillator circuit (the 1.8kΩ section can change value).

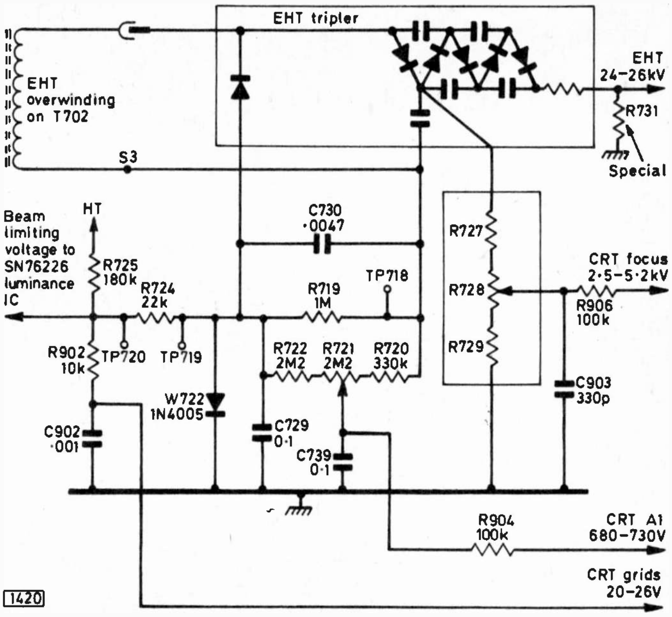


Fig. 2: The e.h.t. tripler and beam limiter circuits. C730 charges to 1kV to provide the c.r.t. first anode supply. The c.r.t. beam current returns to chassis via W722, which is forward biased from the h.t. line via R725 and R724. If the beam current is excessive, W722 cuts off and the voltage at the junction R724/R725/R902 swings negatively. This negative potential is fed to the c.r.t. grids via R902 and to pin 2 of the SN76226 luminance i.c. via a 1MΩ resistor to reduce the drive applied to the RGB output stages, thus reducing the beam current to a safe level. C903 later omitted.

We turn now to those faults in which the Syclops circuit is tripping but other symptoms are apparent. First, the situation where the cause of the tripping is clearly excessive e.h.t. – as evidenced by crack overs from the c.r.t. final anode connection. A common cause of this condition is an ineffective efficiency diode W705. This may be due either to a defect in the diode itself or, more likely, a dry-joint where it's soldered to the board. Another possibility is a short in diode W704 which couples the line output transformer to the Syclops transistor.

In all cases where the circuit has been generating abnormally high e.h.t. it is wise after clearing the fault to check that R720 has not changed its value and that the circuit board under the c.r.t. first anode control R721 has not been arcing over (see Fig. 2).

Tripping accompanied by a pronounced hum from the speaker is an easily recognised symptom. Check for cracks in the print connecting the main reservoir capacitor C702 into circuit.

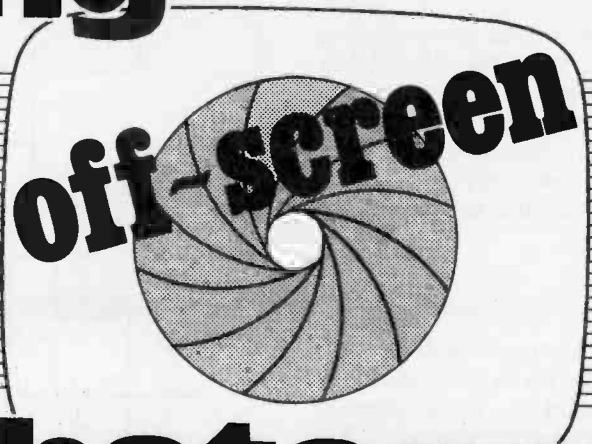
If "solid" tripping presents problems it can be imagined that intermittent tripping is worse! Tripping on channel change is not uncommon and is usually due to either a defective thick-film overvoltage unit or incorrect setting of the e.h.t. Other reported causes of intermittent tripping are W714 leaky and dry-joints on the overwinding on T702 and the shift coil L704.

Dry-joints

Whether the author's experience is typical or not is difficult to ascertain. It seems to him however that the incidence of dry-joint troubles on the 9000 boards, especially boards PC752 and PC756, is much higher than is normal with Thorn assemblies. The problems perhaps appear worse since the dry-joints give rise to a variety of symptoms which at first sight suggest quite different troubles.

Reference has already been made to tripping caused by joint troubles around W705 and C702. A prolific source of dry-joints is the line output transformer T702. In addition to tripping, dry-joints here have been found to cause excessive brightness with very high c.r.t. first anode voltages, and complete lack of raster due to a break in the c.r.t. heater supply. ■

taking off-screen photographs



Alan DAMPER

THERE are several reasons for wanting to take off-screen photographs from a television receiver. One may wish to record some particular personality or event, or maybe a fault symptom. Probably most off-screen photography is undertaken by those interested in long-distance television reception however. Whatever the main interest in long-distance television is – whether purely technical, or an urge to receive as many stations as possible – what is ultimately required is a good record of reception. The written log is essential of course, but the interest is increased if a visual record can also be made. Good results can be obtained using even the simplest camera.

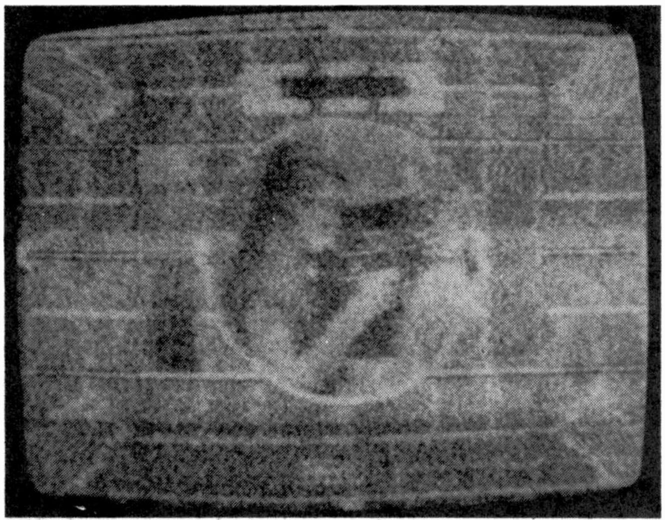
Each complete picture on the TV screen consists of two interlaced fields. Each of these consists of $312\frac{1}{2}$ lines and lasts 1/50 second. It takes 1/25 second therefore to complete one frame of a 625-line picture having a field frequency of 50Hz. To record this image on film, the camera shutter should remain open for at least 1/25 second. Most cameras have a shutter setting of 1/30 second, whilst those with fixed shutter speeds are set at around this value. Using this speed can cause some annoying results. Because the shutter is open for a period rather shorter than that required to complete a full interlaced picture scan, some areas of the screen will appear brighter than others in the photograph. This effect is not serious but is nevertheless undesirable.

Exposure

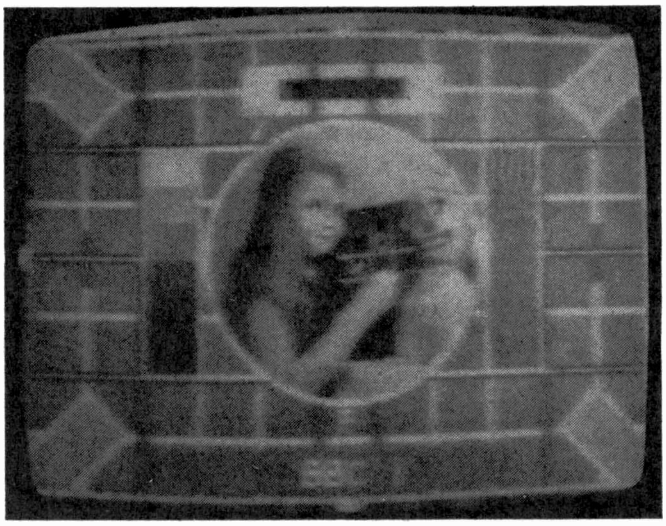
Experiments show that the basic exposure required for 125 ASA film (Ilford FP4 etc.) is 1/30 second at an aperature setting of f 5.6. If the shutter can be set at a slower speed, the aperture can be readjusted accordingly. Photographic exposures are based on a factor of two: if we want to halve the aperture the camera must be set to the next f stop *above* the last, i.e. 1/30 second at f 5.6 is equivalent to 1/15 second at f 8. The range of f stops usually found on cameras is: 2; 2.8; 4; 5.6; 8; 11; 16; 22. The higher the number, the less light is permitted to reach

Test card F taken with 2 seconds exposure time at f22 with a x4 neutral density filter.
All photos taken with 125 ASA film.

Exposure time for this photograph was $\frac{1}{30}$ of a second at f5.6. Note brightness variation due to an incomplete frame being recorded.



For low signal conditions, this is the result of photographing exactly what the camera sees. This was taken at 1/30 of a second at f5.6.



By extending the exposure time to 1 second, the instantaneous effect of noise is greatly reduced. In order to avoid over exposure the f-stop was set at f16 and a x4 neutral density filter used.

the film. Not all cameras have all these values, and some cameras – such as instamatics – use pictorial symbols such as clouds. As a rough guide, the lightly overcast symbol is around f 8 whilst bright sunshine is f 16.

For normal off-screen photography use a shutter speed of 1/15 second and expose at f 8 with 125 ASA film. This will give an accurate record of the image received. With instamatics try f 5.6 (dark clouds). For box cameras the aperture is usually fixed at around f 11 while the shutter speed is around 1/25 second. Because of this a faster film – around 400 ASA (Ilford HP4) – should be used.

Coping with weak signals

We have just recommended a shutter speed of 1/15 second: certainly if anything on the screen is moving this is the longest exposure possible without serious blurring. The most useful pictures for the DXer however are those in which the station can be identified – test cards and captions for example. As these remain stationary, longer exposures can be given. This is very useful since the technique can be used very effectively to remove the noise from a weak signal and to reveal details not visible during reception.

In theory noise is of a completely random nature and is different on each frame. Because of this it will cancel itself out if enough frames are "added" together. An exposure of one second will integrate 25 full frames and will remove a large amount of the noise.

Now an exposure of one second will allow 16 times (to the nearest multiple of two) the required amount of light to fall on the film. To compensate for this the aperture must be reduced by the same factor. As each f stop has a factor of two, the aperture must be reduced by four stops, resulting in a higher f number being used. So a photograph taken with a shutter speed of one second will require an aperture setting of f 32. Cameras with aperture settings of f 32 are rare to say the least. There are two ways of overcoming this problem.

Alternatives

First, the film used can be changed to one with a slower emulsion, thus needing more light (lower f number). A suitable film is Ilford Pan F which is rated at 50 ASA. With this film the basic exposure should be around 1/15 second at f 5.6, giving a setting of f 22 at a shutter speed of one second.

Alternatively, neutral density filters can be fitted over the lens. A filter of this type having a "filter factor" of × 2 will automatically halve the light falling on the lens, thus allowing one second exposures at f 22 with 125 ASA film.

For cameras with a maximum aperture number of f 16 both these methods can be used at the same time or a filter with a factor of × 4 can be used on its own.

In practice, exposures of greater than one second are not really necessary. Interesting results can be obtained by experimenting with longer exposures however.

Problems

There are two problems that can affect the image obtained when longer exposures are used. The first is reduced contrast because of the noise. With negative vision modulation the noise appears as black dots. As these are most prominent on white areas the effect is of reducing the brightness of the highlights, resulting in loss of contrast. To overcome this a higher contrast film is useful – Pan F is suitable. The second problem is that the signal received will usually be extremely noisy, and even with locked sync (which is essential) there will be some line and field jitter. This reduces the sharpness of the image as the accompanying photographs show. For this reason exposures of greater than one second will rarely yield more detail, while the chances of sync slip during the exposure are increased.

Summing up

To sum up, for normal shots of pictures "as received" a medium-speed film is suitable (Ilford FP4 or other 125 ASA film) with an exposure of 1/15 second at f 8. For longer exposures a slower film such as Ilford Pan F is better, with exposures around one second at f 22 or the equivalent using filters.

For good results a tripod is essential. At 1/15 second however a hand-held shot will be reasonable.

When setting up the camera make sure that the top and bottom of the screen will not be cut off. This will happen if an attempt is made to fill the sides of the frame – which is rather elongated with 35mm. cameras.

If the photographs are taken in a darkened room – as they should be to avoid reflections – the resulting pictures will have an almost black surround and consequently only the screen will be visible. ■

servicing

The TELEFUNKEN 711 CHASSIS

PART 2

P. C. MURCHISON

LAST month we covered the power supply section of the chassis. This time we shall take a look at the front end and the signal circuits.

Tuners

Earlier sets came fitted with a multiband v.h.f./u.h.f. tuner unit. This had a balanced feeder (300Ω) aerial input circuit which often led to mismatching, causing loss of gain and ghosting problems. Fortunately there are not many sets around with this type of tuner, later ones being fitted with a tuner designed specially for the UK market. This has an unbalanced 75Ω aerial input circuit of course, and operates on u.h.f. only. Basically, the tuner consists of an r.f. amplifier stage and a mixer/oscillator stage, followed by an i.f. amplifier. Varicap diodes are used for frequency selection, the tuning voltage being obtained from the "programme storage" unit. A simplified circuit of the latter is shown in Fig. 2.

Channel Selection

There are eight sensor contacts on the touch-sensitive switch contact board, seven for ordinary channel selection and the eighth for use with a videotape recorder – when this selection is made 12V is applied to pin 8 of the TBA950 sync separator/line generator i.c. in order to alter the time-constant of the flywheel sync phase comparator circuit during the replay of a videotape recording.

The programme storage function is carried out by two integrated circuits, types SAS560 and SAS570. These are almost identical internally, the only difference being that the SAS560 has an additional internal transistor (T14, see Fig. 1) which ensures that the set is always tuned to channel selection number one when it's initially switched on.

Internal Circuitry

The internal circuitry of one of the four switching stages (E1-E4 in Fig. 2) is shown in Fig. 1, for i.c. type SAS560. When the base of T1 is earthed via the high-value resistor chain and the sensor contacts it switches on and in turn switches T2 on. T5 which had previously been conducting because of the bias via its base resistors R2, R3 and diode D3 turns off suddenly when T2's collector voltage drops to around half a volt. T5's collector voltage rises to a value set by the zener diode D4, switching T6 on. As a result, a voltage of about 4·5V is developed across R1124, which is the common emitter resistor for all the switching stages.

T6 enables T8 and T11 to switch on, in turn switching on transistor T9 to select the tuning voltage and T13 to illuminate the appropriate channel indication lamp.

Transistor T8 also supplies T7 with base voltage, via zener diode D10 and R8. After the finger is removed from the sensor plate T6 switches off but T7 remains on, taking over and holding the stage in the operating state. When, as a result of a further channel selection, the voltage across R1124 rises to 4·5V T7 will switch off, removing the hold action of the initial channel selection, and the newly switched on stage will take over.

When the set is first switched on there is no voltage across the common emitter resistor R1124 and the base of T14 is negative with respect to its emitter. T14 conducts therefore, turning off T5 to give selection of channel 1 via the action just described.

External Circuitry

The complete external circuit of one of the two programme selection i.c.s is shown in Fig. 2. S1-S4 are the sensor contact plates which must be bridged with a finger to initiate programme change. High-value resistors are

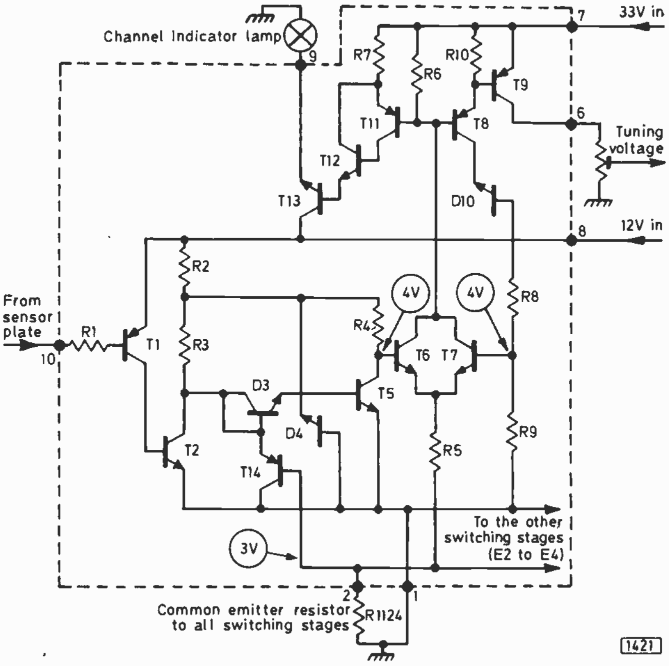


Fig. 1: Internal circuitry of one of the switching stages (E1) in the SAS560 i.c. The E1 stage incorporates the additional transistor T14 to ensure that the set automatically tunes to "channel 1" when initially switched on.

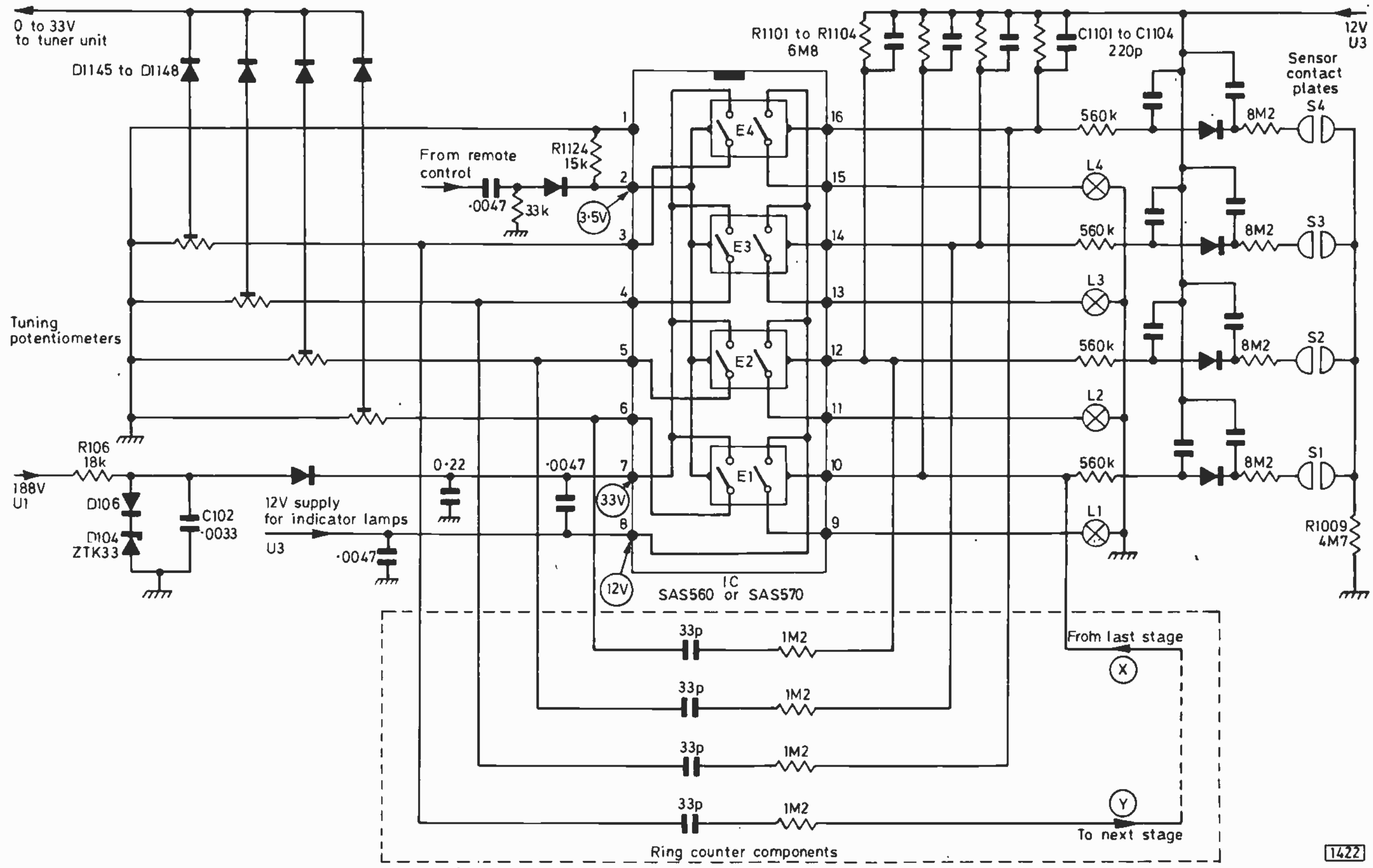


Fig. 2: Circuitry of the touch-sensitive tuning selection unit, showing in simplified form the i.c. which provides the switching action. Only one of the two i.c.s used in the unit is shown: two are used in order to provide choice of eight channel selections.

connected in series with the sensor plates to safeguard against high current flow in the sensing circuit. Diodes D1145-D1148 connected in series with the sliders of the tuning potentiometers minimise the risk of interaction between the potentiometers. As can be seen, the electronic switches E1-E4 switch both the tuning voltage to the tuning potentiometers and the 12V required to light the appropriate channel indicator lamp.

R1101-R1104 and C1101-C1104 are present to make the unit insensitive to interference pulses. Isolating diodes are present in the sense input circuits to prevent interaction here.

Remote Control

Programmes can be remotely selected by plugging a remote control unit into the rear of the set. This control unit has a channel change switch which supplies a 12V positive pulse to pin 2 of the i.c. every time the switch is operated. For this control unit to work with the storage circuit the two i.c.s are connected as a ring counter, the output from the first stage being connected to the input of the next stage via a capacitor-resistor network (33pF plus 1·2MΩ) and so on until a complete ring counter circuit is formed. Every time a positive pulse is applied to pin 2 of the i.c. the channel will change upwards one place, the channels changing in sequence until number eight is reached when after a further pulse the selection returns to channel 1.

Drift

Unfortunately there is no a.f.c. applied to the Telefunken tuner. This inevitably leads to a common problem, tuning drift. The tuning voltage stabiliser diode D104 (ZTK33) is often a very small glass type which seems to have a very poor temperature coefficient. The result is that as the temperature in the set rises so the tuning voltage changes, putting the set off tune. Diode D106 does not seem to provide sufficient compensation for this temperature drift. The common type TAA550 stabiliser is far more stable, consisting of several zener diodes in series, and is a much more satisfactory replacement.

Another problem is when the "contacts" of the electronic switches in either i.c. vary in resistance, again causing tuning drift. The answer in this case is to replace the i.c.

Channel Change Faults

Erratic channel changing, or sticking on one channel, is usually caused by one of the i.c.s (the SAS560 in the case of channels 1-4 and the SAS570 in the case of channels 5-8). The appropriate i.c. must be replaced. The SAS560 often sticks permanently on channel 1, presumably due to failure of the internal transistor T14. The diodes and 560kΩ resistors in series with the sensor plates often go open-circuit, causing failure to select the relevant channel. It's a fairly easy job to check these components and replace as necessary.

Snowstorm

The tuners have an earthed brading to bond them to the main chassis of the set. This is often left off by service engineers, causing a "snowstorm" on the screen. It's always advisable to check that this brading is well soldered, using a high-wattage soldering iron.

IF Strip

The i.f. signal from the tuner leaves at pin one and then

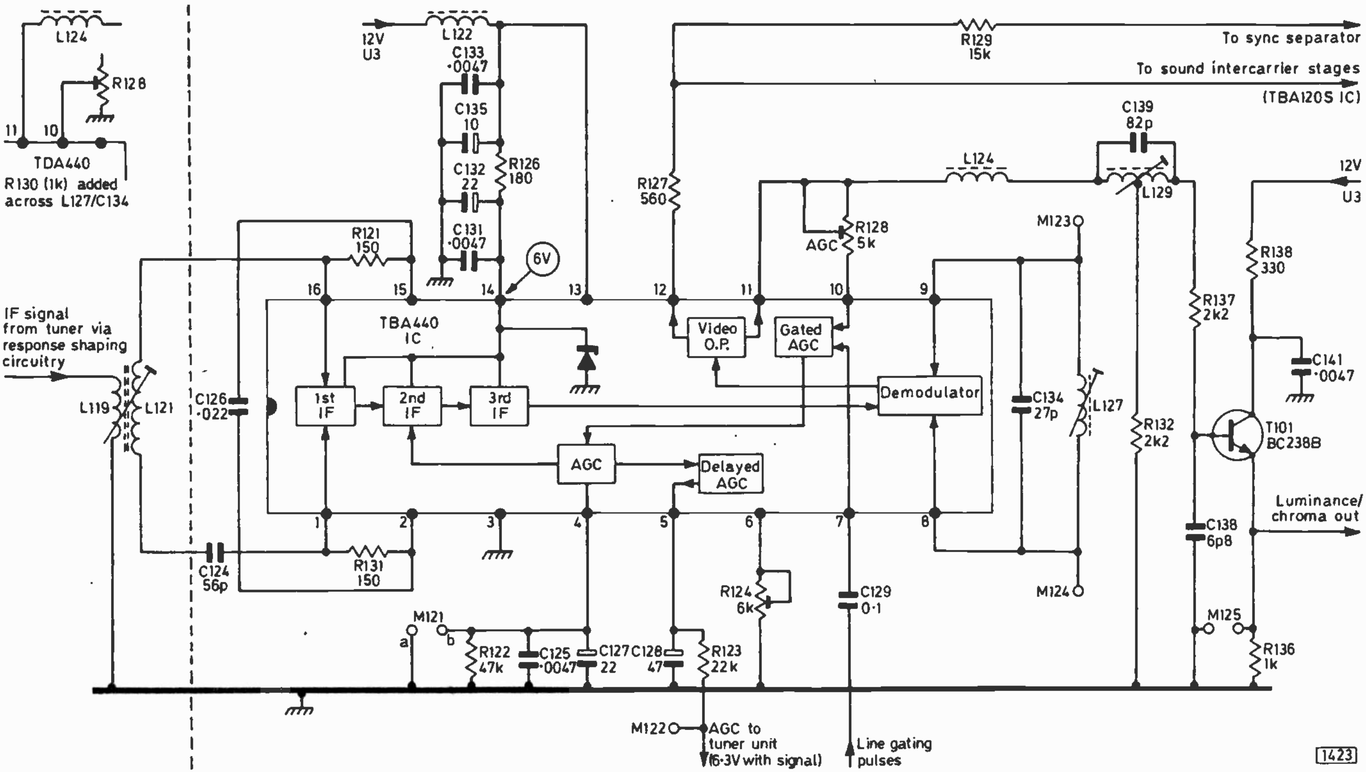


Fig. 3: Block diagram of the i.f. integrated circuit, also showing the external components.

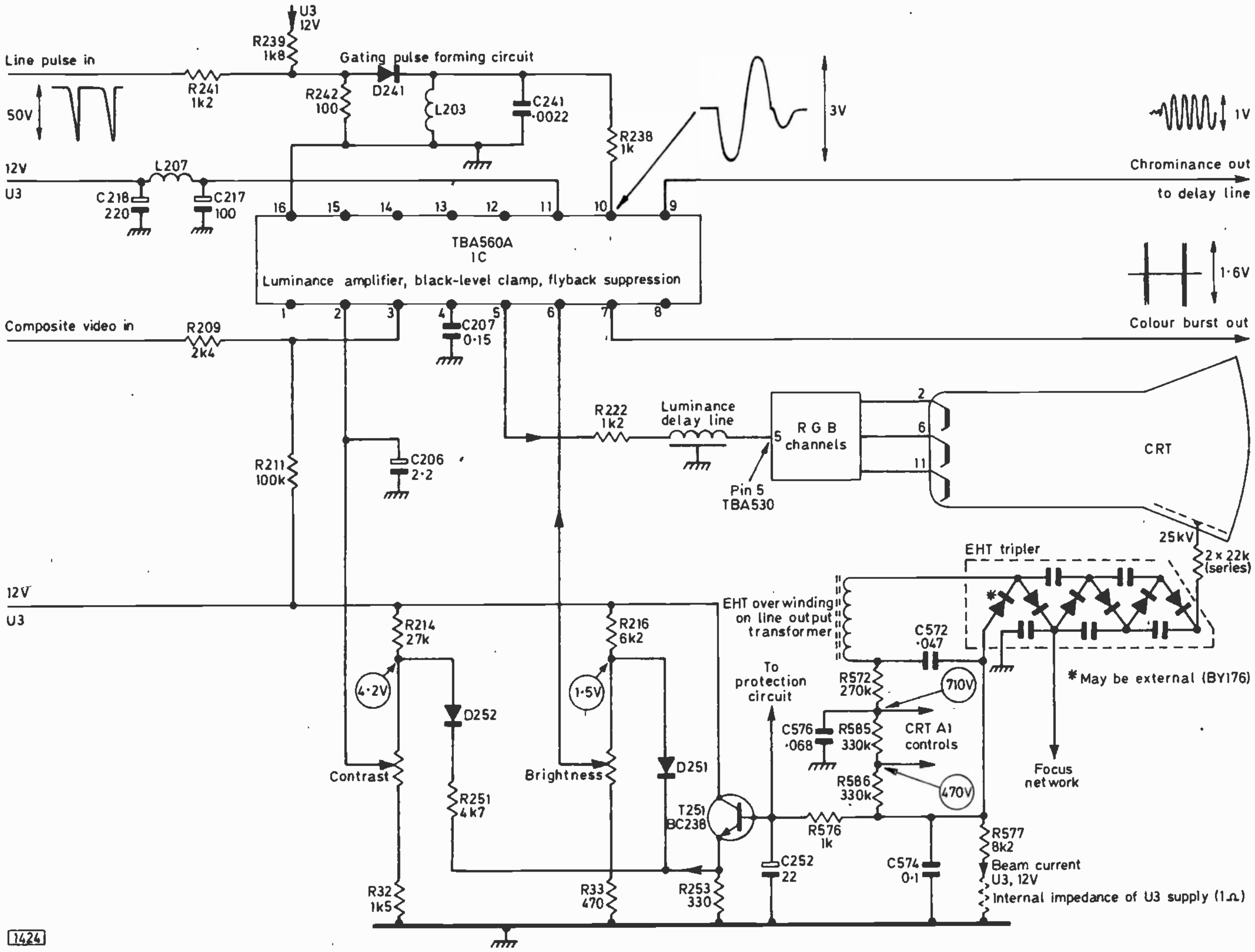


Fig. 4: Simplified diagram of the circuitry around the TBA560A luminance i.c., also showing the e.h.t. and the beam limiting arrangements. The gate pulse forming circuit is shown at the top: the overswing pulse produced when L203 rings is used to gate the bursts and operate the clamp circuit in the i.c.

goes via the i.f. bandpass shaping network to either a TBA440 or a TDA440 i.f. i.c. – in the later 711A chassis there is a separate transistor i.f. preamplifier stage. The TBA440/TDA440 contains three stages of i.f. amplification, a synchronous vision detector and a video preamplifier giving a positive-going video output at pin 12 and a negative-going video output at pin 11. It also contains a gated a.g.c. circuit which controls the first two i.f. stages in the i.c. and provides a delayed a.g.c. output at pin 5 for the tuner unit.

The positive-going video output at pin 12 feeds both the sync separator and the intercarrier sound channel (TBA120S) while the negative-going video output feeds the luminance and chrominance channels in the TBA560A i.c. via the emitter-follower transistor T101 (see Fig. 3).

The i.f. strip has proved reliable in operation, the only failure experienced being occasional breakdown of the i.c. itself. This gives the symptom of a blank raster. A check at the a.g.c. test point M122 in these circumstances will usually reveal zero a.g.c. to the tuner instead of 6V, confirming failure of the i.c.

AGC

Setting up the a.g.c. circuit is very simple. A standard colour-bar signal is applied to the aerial socket and all controls are set for a normal picture. With an oscilloscope connected between test point M125 and chassis, R128 is adjusted for a staircase signal of 2·9V peak-to-peak. Once this procedure has been carried out optimum results will be obtained under all input signal conditions.

Luminance Channel

Luminance amplification is carried out in the multipurpose TBA560A i.c. The signal is fed in at pin 3, at low impedance, after which it undergoes black-level clamping and flyback blanking before emerging at pin 5. Control of both the brilliance and contrast is effected simply by varying the d.c. voltages on pins 6 and 2 (see Fig. 4), these user controls being on the front panel of the receiver.

Beam Limiting

The contrast and brilliance controls are also tied in with the beam limiting circuit, to prevent the beam current reaching the point at which defocusing occurs. The beam limiter circuit is fairly simple in operation but is quite effective and entirely automatic – there is no preset control to set up as in most other types of circuit.

The beam current flows via the c.r.t., the tripler, R577 (see Fig. 4) and the low-impedance of the U3 12V power supply to chassis. In consequence a voltage dependent on the beam current is established across R577. Maximum voltage (negative-going) is developed across this resistor when the beam current is around 1·2mA, the rated maximum beam current for the c.r.t.

The voltage across R577 is applied to the base of T251 via a smoothing network (R576/C252). At zero beam current there will be no voltage drop across R577. In consequence the base of T251 will be at 12V and its emitter will be at 11·5V. Diodes D252 and D251 have 4·2V and 1·5V respectively at their anodes and are thus both cut-off. As the beam current rises so the voltage across R577 increases and the base of T251 moves negatively, its emitter voltage falling in sympathy. At a beam current of around 850μA the emitter voltage will have fallen sufficiently for D252 to conduct. The voltage at the top end of the contrast control will then fall to that at the emitter of T251. The voltage at pin 2 of the TBA560A will also fall, automatically turning down the contrast and thus decreasing the gain of the luminance amplifier in the i.c.

When the c.r.t. beam current reaches about 1·1mA diode D251 also conducts and a similar process takes place, the voltage at pin 6 of the i.c. falling to turn down the brightness. With these two control operations the beam current cannot rise above 1·2mA.

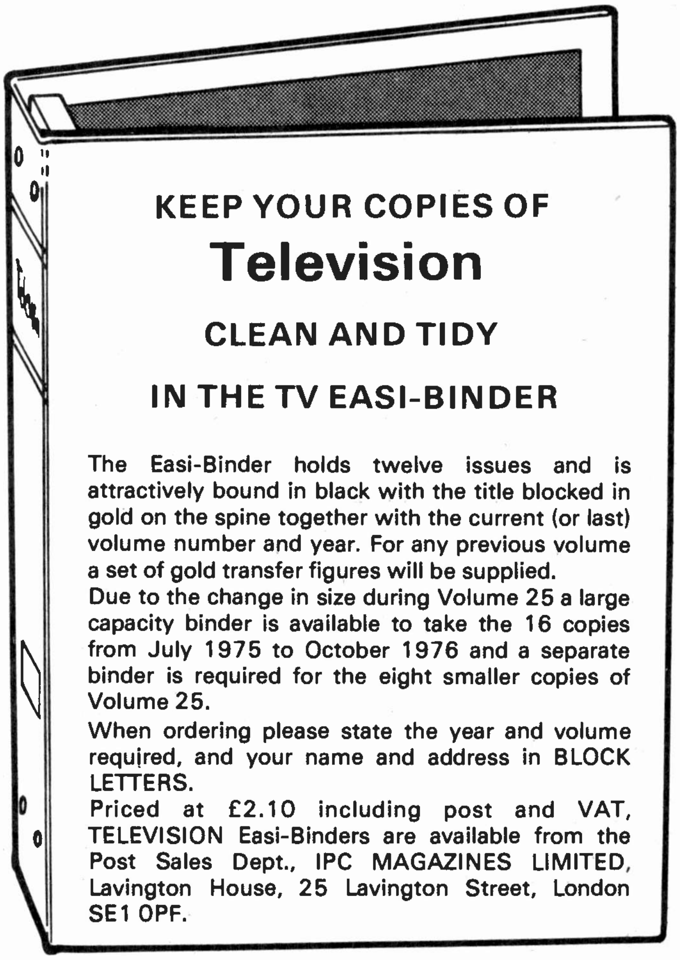
Faults

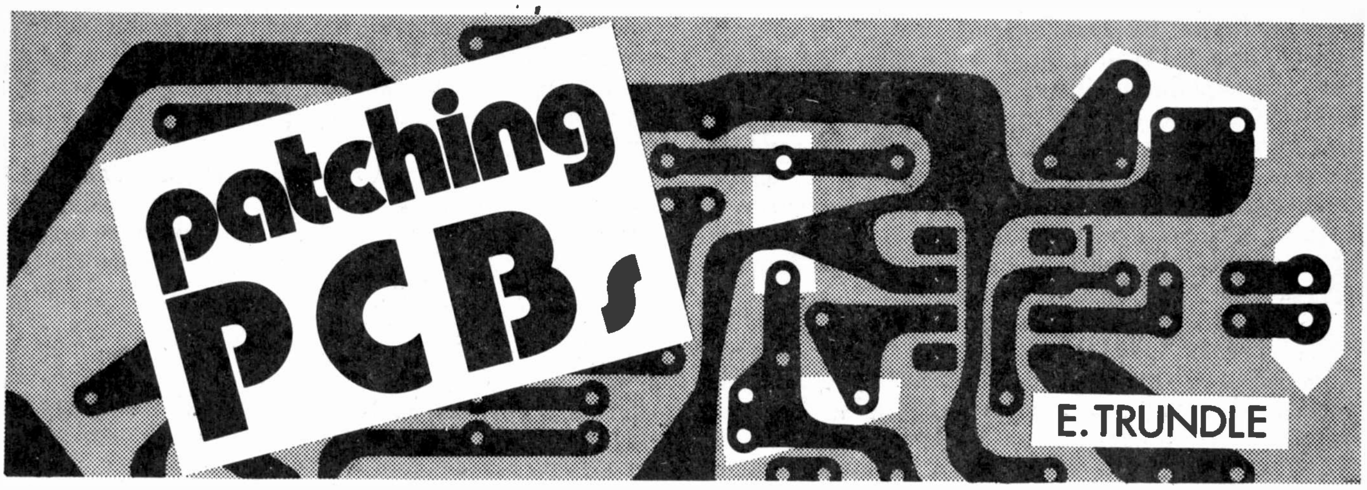
The only rather nasty fault encountered in this stage is when there is complete loss of video, with an excessively bright white raster and of course the excess beam current causing the protection circuit described last month to come into operation. This is caused by a tiny inductor (L203) in the gating pulse forming circuit going open-circuit and upsetting the operation of the entire i.c. It must be replaced by the genuine Telefunken replacement part – nothing similar will do!

The voltage to feed the c.r.t. first anode preset controls is obtained from the e.h.t. overwinding on the line output transformer, as Fig. 4 shows. R586 can go open-circuit with the result that the first anode voltage rises to about 1kV, giving an overbright raster with bowed flyback lines.

To Follow

Next month we shall be considering mainly the rather unusual field timebase circuit used in this chassis.





patching PCBs

E. TRUNDLE

DESPITE the ramifications of BS415 and BEAB, a holed printed-circuit board due to excessive heat is by no means unheard of – even in sets of recent manufacture. Where most of the circuitry is mounted on one large panel, as in virtually all monochrome receivers and many colour sets, panel replacement is not economically possible. The patching method of repair to be described here is of particular application to these larger boards, but can also be successfully and economically used on the smaller "module" type printed panels.

The usual method of repair where a hole has been burnt in the panel is the "wire brigade" approach, linking the severed ends of the print tracks with tinned copper wire. Even with small holes this does very little for the appearance of the printed board, while if the hole is big enough to embrace component mounting tags or leads the components concerned have to be left suspended in a cats-cradle of wires. This amounts to bodgery of the first order, and renders further repair or replacement of components in the same area very difficult. It is not claimed that the method to be described is quicker than the "Forth Bridge" technique, but with practice a neat and workmanlike result can be achieved, with the added advantage that components in the area affected can be easily replaced should this become necessary on a later occasion.

Preparing the panel

The first step is to remove the charred components along with any others in the immediate area, so as to clear the panel up to at least 12·5mm (0·5 in) around the burn hole. Smoke and soot deposits should be scrubbed with methylated spirits using a small paint brush and an old toothbrush, followed by a final rinse with clean meths. This process will usually show that the damage is not as severe as first appearances suggested.

Using a sharp penknife or similar tool, the burn hole should next be enlarged by scraping and hacking until all the charred material has been removed. Some board materials are more difficult than others in this respect, fibreglass panels tending to go stringy or fluffy while SRBP panels often have a pocket of carbonised material extending some distance from the burn hole. When the hole has been sufficiently enlarged to present a clean face around its periphery, the edges should be smoothed and squared with a small file so that any radiused edges or corners are removed, leaving us with a straight-sided, irregularly shaped hole. At this point, all the debris should be removed by blowing the chassis with an air-line, or by similar means.

Making the patch

It is important that the patch is a reasonably good fit in the hole. A pattern is made by pressing a piece of writing paper against the hole on the print side, so that it is pierced by the spikes of any component wires in the area. A pad of foam rubber or similar material is then used to support the paper from behind, while the shape of the burn hole is traced on the paper with a sharp pencil inserted through the hole. This pattern is then cut out and used for cutting and shaping a piece of paxolin or SRBP. Bear in mind that the pattern will be slightly smaller than the patch required, due to the thickness of the pencil. Suitable patching material is available from electrical wholesalers.

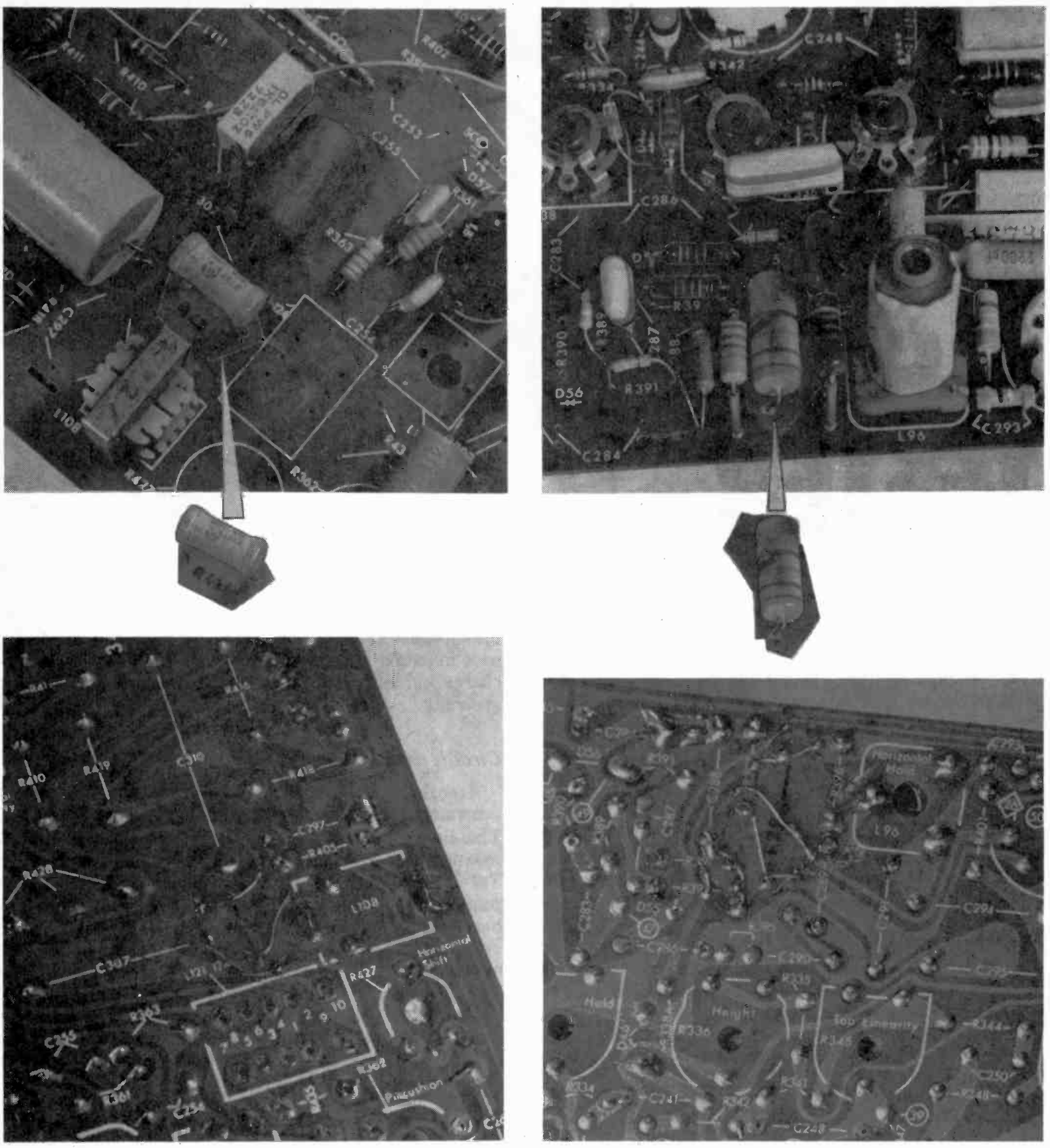
At this stage the print layout in the service manual should be consulted so that the necessary holes can be drilled in the patch. If the manual is not available, or does not give a drawing of the print pattern, an identical receiver will show the hole positions and print routing. Failing this, a study of the circuit diagram will have to suffice. The holes are best drilled by hand, the tiny drill required being very vulnerable to breakage in an electric drill. An effective if unorthodox drilling method used by the author is to rotate a small watchmakers' screwdriver in the fingers – this bores a small hole very rapidly.

The edges of the hole and patch should then be smeared with epoxy resin adhesive and the two parts supported in place. The butt joint thus formed is surprisingly strong. With a little heat applied (the bench light is useful here) and the new quick-setting epoxy resins, ten minutes will see the joint set and the work ready for the next stage.

Dressing the panel

The severed ends of the print tracks which crossed the patch area are now cleaned of lacquer and tinned. To avoid lifting the delicate print, this process must be done carefully using a small well-tinned soldering iron. The original print pattern can then be reproduced on the surface of the patch using 22 s.w.g. tinned copper wire. Where a component leg makes connection through the patch, form the tinned copper wire into a complete 360° loop under the hole – of sufficient diameter to take the lead-out wire or tag. Such loops can easily be made by wrapping the wire around one jaw of a small pair of pointed pliers. Each length of wire should be shaped and looped before fitting, to reduce the risk of tearing the existing print tracks.

Where, as is usually the case, the original damage was done by an overheating resistor its replacement should be



Two examples of repaired printed-circuit panels, showing both the front and back of the board in each case. Very much neater and stronger than merely suspending the components in a network of wire links.

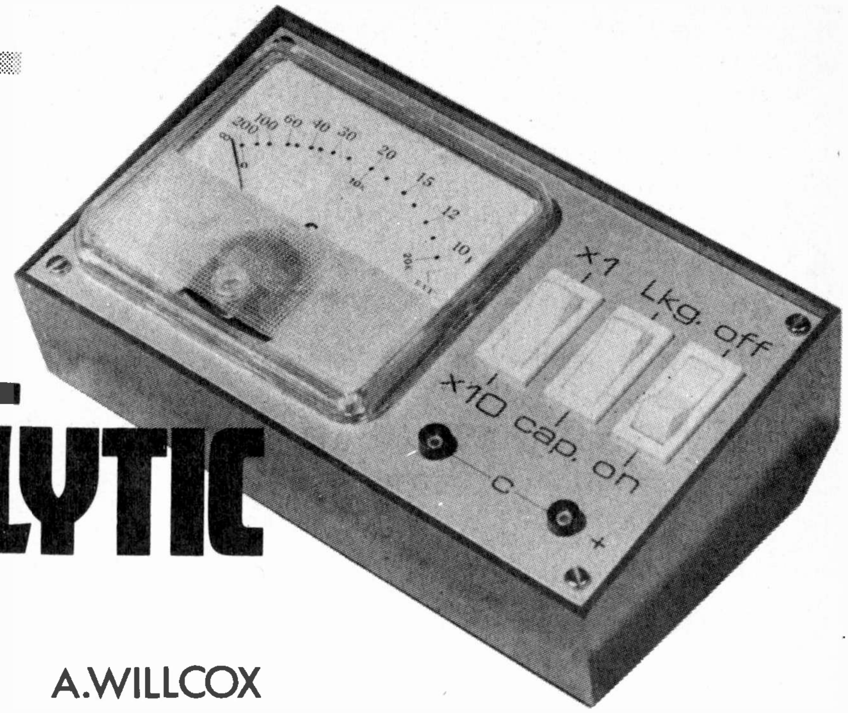
mounted on longer legs. In the case of an older set where the panel has become charred around a hot valveholder it is prudent to fit a "stand-off" type of valveholder. These are available, in the B9A size, from RS Components.

Many manufacturers print the component numbers on one or both sides of the panel and the patch can be similarly marked with a fibre or felt-tipped pen. Possible variations on the patch theme are the use of perforated board to avoid hole drilling (this also lends itself to the use of pins for component mounting and wire routing), and the use of a tank cutter or similar tool to make a circular hole and a matching patch – this latter technique is particularly applicable to valveholder transplants.

Finishing

A professional finish is bestowed by a final squirt of clear protective lacquer by you-know-who (no, dear readers, I haven't got shares in RS Components!). With the "loop" method of connecting component leads, subsequent component replacement is as simple as on conventional print – providing desoldering braid is used. This is available from several sources!

As with most things in our trade the process takes longer to describe than to do. As the photographs show however, the results are certainly worth the effort and time, even in these days of £5-an-hour bench technicians – pardon? ■



ELECTROLYTIC TESTER

A.WILLCOX

THE capacitance meter featured in the May issue measured values up to 10μF by charging the unknown capacitor to a fixed voltage, then discharging it into the meter circuit. The average current thus measured is directly proportional to the capacitance. The instrument described here measures values from 10μF to around 4,000μF, but in this case the unknown capacitor (Cx) is supplied with a constant charging current and the voltage attained after a fixed time is measured.

Reference to Fig. 2 will show that this voltage is inversely proportional to the value of the capacitor. When the capacitor is supplied with a constant charging current the voltage across it rises in a linear fashion described by the equation V = It/C, where t = time. The more familiar exponential rise associated with the charging of a capacitor occurs because the effective resistance of the capacitor varies from zero initially, to infinity when fully charged. The effect of this is to reduce the charge current continuously throughout the period. If, however, the capacitor is charged through a circuit whose resistance is allowed to reduce as the capacitor's effective resistance increases, the total resistance in circuit may remain the same, resulting in a steady charge current. Such a circuit is the constant current generator.

Circuit description

Transistor Tr1 in Fig. 1 forms a constant current generator, supplying charge current to Cx via D4 and VR1. The diodes D1 and D2 are silicon types and so have a forward voltage drop each of 0·6V, thus fixing the base of Tr1 at 1·2V (R5 can be considered as connected to the positive supply rail via pin 3 at this stage). Now the base/emitter junction of Tr1 forms another silicon diode, again with a volts drop of 0·6V, and so the emitter is at 1·2 − 0·6 = 0·6V. From this the emitter current is, by Ohm's law, Ie = 0·6/VR1 (R6 is shorted out by S2 when measuring capacitance). Now the emitter current is also, in the main, the collector current, and so the charge current for Cx is set by the value of VR1. The collector current is fixed at

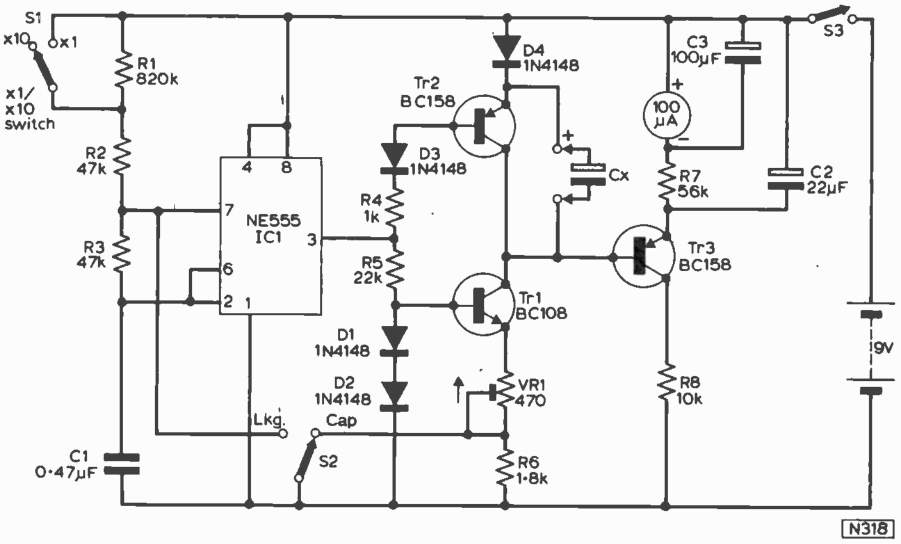


Fig 1: Circuit diagram of the electrolytic capacitor tester.

2mA in this case, and within limits this value holds regardless of any change in the collector load (state of charge in *Cx*). This is another way of saying that the collector current of a transistor is relatively unaffected by changes in the collector voltage. If *Cx* is allowed to charge for 0·03s at 2mA the voltage across it after this time is given by inserting these values into the equation stated above, that is:

$$V = It/C = \frac{2 \times 3 \times 10^{-5}}{C}$$

or 60/C if the value of *Cx* is given in microfarads. So when *Cx* = 10μF, V reaches 6V; 20μF gives 3V, 40μF reaches 1·5V, and so on.

The peak reading voltmeter comprising Tr3 and associated components responds to this voltage, and to provide a continuous indication *Cx* is periodically charged and discharged at a rate set by the timer i.c.

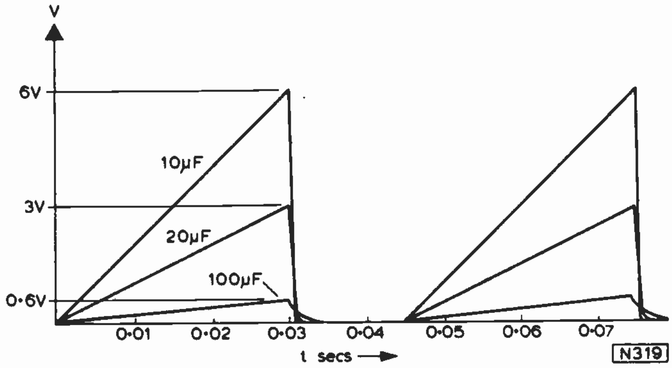


Fig. 2: The maximum voltage reached by Cx is inversely proportional to its capacitance.

Astable

The timer i.c. is connected to operate in the astable mode, with the output at pin 3 switching continually between the supply rails at a rate set by R1, R2, R3 and C1. When the output at pin 3 is positive, bias is supplied to the constant current generator Tr1, and so *Cx* charges. When S1 is closed this charging continues for 0·03s, whereupon pin 3 connects to the negative supply line, turning off Tr1 and forward biasing Tr2 through R4. Tr2 remains conducting, discharging *Cx* in the process, until pin 3 again goes positive. So it is seen that Tr1 and Tr2 turn alternately on and off, causing *Cx* to charge and discharge continually. When S1 is closed *Cx* charges at 2mA for 0·03s, and when S1 is open (×10) *Cx* charges at the same current, only this time for 0·3s.

Turning now to Fig. 2, here it is seen that if *Cx* is 10μF it will reach 6 volts in 0·03s, whereas if it were 100μF it would attain only one tenth of this value, i.e. 0·6V. If we have a voltmeter with a sensitivity of 6V f.s.d. arranged so as to measure the peak charge on *Cx*, then for it to indicate capacity, f.s.d. should be marked 10μF, ½ f.s.d. marked 20μF, 1/10 f.s.d. marked 100μF, and so on. If, however, the charge time were increased to 0·3 and *Cx* were 100μF, then it too would charge up to 6V; f.s.d. would then correspond to 100μF, with 1/10 f.s.d. then indicating 1000μF. The ×10 switch functions in this way by increasing the charge time by a factor of ten.

Voltmeter

The meter movement combined with the series resistor R7 forms a voltmeter with an f.s.d. of 6V. Now were it not for the presence of C2, Tr3 would function as an emitter follower presenting the voltmeter with a faithful reproduction of the waveform across *Cx*. In practice, however, when *Cx* discharges, the presence of C2 modifies the situation by holding this voltage at its maximum value, so causing Tr3 to be reverse biased during the discharge periods. The result is that Tr3 only conducts briefly on peaks in order to replenish the charge that C2 loses through R7. The time constant C2.R7 is relatively long, and so the voltage applied to the voltmeter is very nearly equal to the peak voltage reached by *Cx*. The diode D4 adds 0·6V to the voltage measured across *Cx* by the voltmeter in order to overcome the *V*be of Tr3; otherwise *Cx* would have to charge to at least 0·6V before the voltmeter would start to indicate. A resistor could be used here instead of a diode because the current is constant, but D4 is also used in conjunction with D3 to raise the voltage required to turn on Tr2. This is necessary because when the output of the i.c. is positive, pin 3 only comes within a volt or so of the supply voltage, and this would be sufficient to turn on Tr2 whilst charge current is being supplied to *Cx*. The discharge time allowed for *Cx* is set by the time constant R3.C1, and is the same for both positions of the range switch S1. This time is just sufficient to discharge a 4000μF capacitor, and sets the limit on the largest value that can be measured with accuracy.

Leakage test

When S2 is in the Lkg. position the operation of the i.c. ceases, owing to pin 7 being earthed. Pin 3 is held in the positive state and so Tr1 is on continuously. R6 is now in circuit, reducing the current through Tr1 to about 0·3mA. Now if *Cx* has a leakage of 20kΩ the voltage developed across it due to this current will be 6V, and the meter will read f.s.d. If *Cx* has a leakage of 10kΩ, only 3V will be developed and the meter will indicate half full scale. Used in this way the meter forms a linear-scale ohmmeter. Note that the capacitance value does not affect this reading because, whatever the capacitance, as long as the leakage is negligible it should charge to over 6V as the current is now continuous. This leakage facility is included for, on a capacity check, a leaky capacitor will just read high, and may mistakenly be accepted as satisfactory.

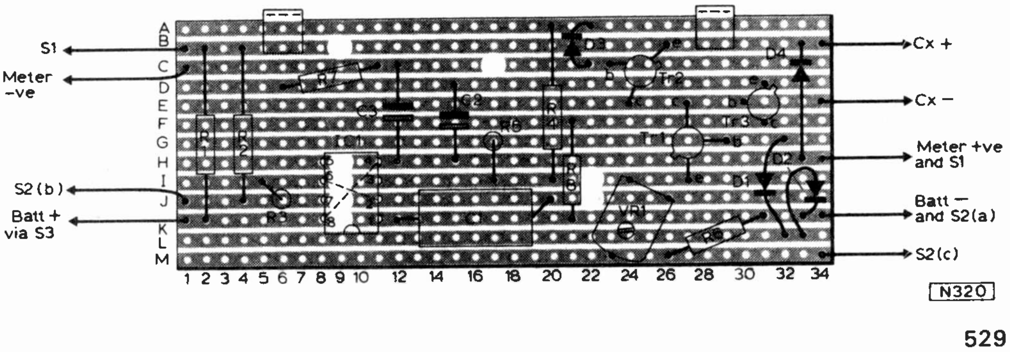


Fig 3: Component board layout. Links under IC1 are on track side of board. Mounting feet are glued to component side of board. Track breaks are at B9, C17, H9, I9, I22, J9, J22 and K9.

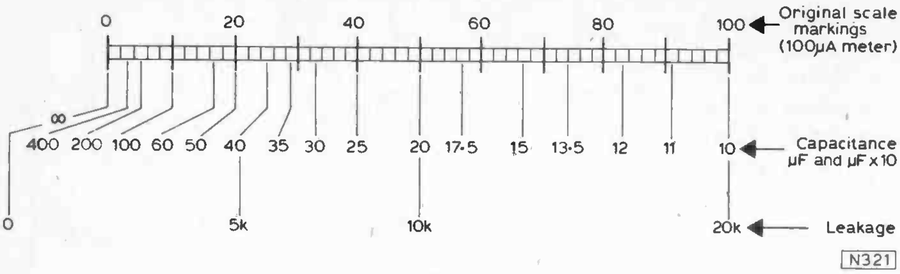


Fig 4: Calibration of the meter scale. For use as a linear scale ohmmeter, the Leakage scale should be fully calibrated.

★ Components list

Resistors:

R1	820kΩ	2%	R6	1·8kΩ	5%
R2, R3	47kΩ	2%	R7	56kΩ	2%
R4	1kΩ	5%	R8	10kΩ	5%
R5	22kΩ	5%	VR1	470Ω	min. preset

Capacitors:

C1	0·47μF polycarbonate
C2	22μF tantalum
C3	100μF tantalum

Semiconductors:

Tr1	BC108 or similar silicon npn
Tr2 Tr3	BC158 or similar silicon pnp
D1-D4	1N4148 or similar silicon
IC1	555 timer (NE555V, MC1445P, LM555CN, etc.)

Miscellaneous:
S1, S3 s.p.s.t. rocker switches; S2 s.p.d.t. rocker switch; Instrument case Type 21; (Switches and case from R.S. Components) Meter, 100μA 86×78mm (SEW MR65P, Laskys); Stripboard 87×35mm (3·45×1·4 in), 2·54mm (0·1 in) pitch; 2mm plugs and sockets; PP3 battery.

Components

The values given for R7, C2 and C3 are chosen to suit a meter with a sensitivity of 100μA, but a 50μA movement may be used instead, in which case another 56kΩ resistor should be wired in series with R7, while C2 and C3 may be halved in value. These capacitors should preferably be tantalum types. For good stability and close tolerance, coupled with small size, C1 should be a polycarbonate type capacitor. R1, R2, R3 and R7 should be of 2% tolerance, but none of the remaining components are critical.

Meter scale

If it is intended to make use of the instrument as a linear scale ohmmeter in addition to its role as a capacity meter, then it is as well to leave the original meter scale intact to serve for this purpose. Additional markings can be made to the scale as shown in Fig. 4 to indicate capacitance. On the prototype, only an indication of acceptable leakage was required and so the existing scale markings were dispensed with to give a less cluttered appearance. In any event the scale-plate is best removed carefully before marking – 'Letraset' is easy to use and gives neat results. If the scale is first covered with white plastic sheet (Fablon etc.) the original scale will show through just sufficiently to identify the points to be marked.

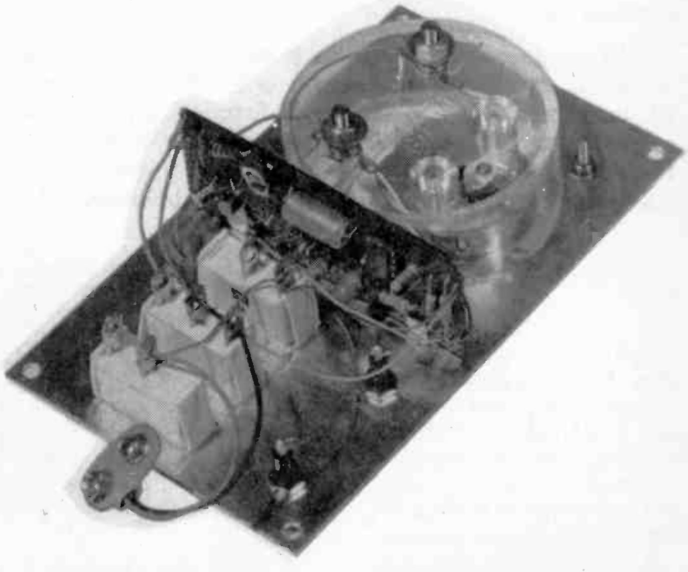
When the instrument is switched on with no capacitance connected to the test sockets the meter pointer will go beyond full scale deflection, but when the battery is due for replacement it will fail to reach this position. A shorting link should now be connected across the test sockets, and the mechanical set zero on the meter adjusted to give zero as marked on the dial. This action offsets the small deflection which occurs due to the fact that D4 overcompensates slightly for the Vbe of Tr3.

Calibration

If the tolerance of the timing components is guaranteed, all that is necessary to complete calibration is to adjust VR1 to give 2mA through the test terminals. This is most easily achieved by connecting a 1kΩ 2% resistor to the test sockets and adjusting VR1 until the meter reads 30μF with S2 in the 'Cap' position (2mA × 1kΩ = 2V = 1/3 f.s.d. = 30μF). If the tolerance of the timing components is in doubt, it may be better to set VR1 using a 10μF or a 100μF tantalum capacitor as a standard. Tantalum capacitors are usually pretty close to their marked value, or in any case much closer than the average electrolytic that is likely to be tested in practice.

As mentioned above, when S2 is in the 'Lkg' position the instrument forms a linear scale ohmmeter, and if it is desired to make general use of it in this form then the original scale should be retained. Also, R6 must be replaced with a 2·2kΩ preset adjusted to set the ohmmeter using a close tolerance resistor as a standard.

Although this instrument is designed to complement the meter described in the May issue, and reads values from 10μF up, smaller capacitances than this can of course be measured by simply placing them in parallel with a 10μF standard which may be kept for this purpose. ■



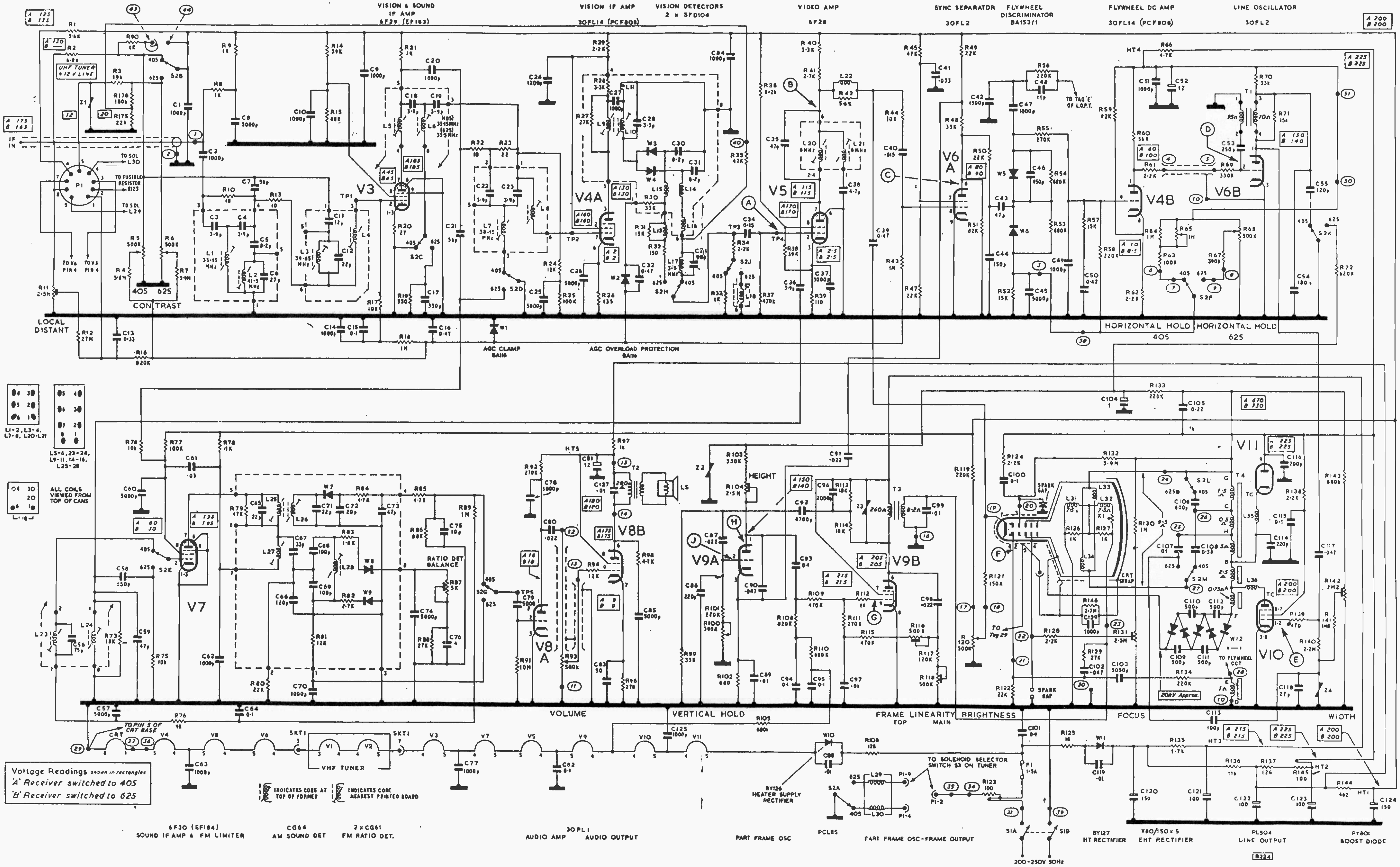


Fig. 1: Circuit diagram of the Thorn 1400 dual-standard chassis – schedule E version incorporating production modifications.

junction of which R35 is returned. In earlier models R35 was returned to the junction of R3, Z1. This modification divorces the detector from the 12V u.h.f. tuner supply. Finally, make sure that R74 and R75 are both 10kΩ. Then adjust L27 and R87 for optimum results.

Line Output Stage Faults

This chassis has its fair share of stock faults the majority of which affect the line timebase.

The e.h.t. for the tube is derived from the line output transformer via a tripler (or doubler on small screen sets) unit which clips to the side of the transformer. Whilst a fault in this unit usually proclaims itself in no uncertain manner there are times when it neither smokes nor smells but still stops the line output stage working. So when one is faced with a no picture condition which is due to lack of e.h.t. it is prudent first to disconnect the tripler from the transformer and see whether this restores some life to the line output stage.

If it does one may find that the tripler is warm and a new one is called for, preferably of the closed in variety. A nice solid block tripler is less likely to break down than the open type. The only advantage (which is dubious anyway) of the latter is that it can be opened up so that the pencil rectifiers can be replaced separately. Other tripler faults are picture ballooning or sizzling at high brightness levels (see later).

Assuming that the tripler is not at fault, lack of e.h.t. is usually due to valve or component failure, very rarely to the line output transformer which has a very good record. Where one has to be replaced it is usually due to hamfistedness when soldering (or unsoldering) connections to its tags which will come away if pulled when hot.

The item most often at fault is the 220pF high-voltage harmonic tuning capacitor C114 which is soldered to the transformer and which shorts the PY800 boost diode to chassis at the drop of a hat. Needless to say, the PY800 doesn't like this and is likely to blow itself before failure of the fuse can put an end to its misery. Later versions have a thermal cut-out (R145) in the supply line (HT2) and where this is present it will be found sprung open, the fuse remaining intact and the rest of the set continuing to function. So the drill is, if the cut-out is open on later models or the fuse blown on earlier ones check the resistance reading from the PY800 top cap to chassis and if a short is found check the capacitor – which may proclaim its guilt by looking a little off colour.

These remarks apply to several Thorn chassis, both earlier and later, and it is essential to use the proper type of capacitor for replacement. The tubular type of high-voltage ceramic capacitor is not suitable and will have a short life. The round disc type must be fitted for reliable operation. Cut the old one out with wire cutters (do not unsolder), then fit the new one with a couple of nice quick blobs of solder after twisting its wires round the relevant tags. This is to avoid sustained heat on the pegs and damage to the transformer.

C114 can also cause lack of width – before it finally goes short-circuit.

Still on the subject of no e.h.t., but where there is no short across the PY800 (PY801), overheating is usually caused by the PL500 (PL504) passing too much current. If this valve is red hot when the h.t. is reconnected (if it has been disconnected by the thermal cut out that is) there can be several causes. The usual one is failure of line drive from the oscillator stage. Whilst the 30FL1 (30FL2) line oscillator valve is the most frequent offender, it is by no means the only one.

If there is no voltage at pin one – there should be around 145V – check the value of R70 – assuming that there is h.t. on the other side of this resistor. It can go high. There are times when it's of correct value and C54 or C55 may be found shorted. If not it could well be that the stage is simply not oscillating. This could be due to several factors, from C53 back to the d.c. amplifier stage V4B and the discriminator diodes W5/W6. The source of the trouble in this case depends on which voltages are right and which are wrong.

If there is no voltage at pin 1 of the 30FL1 and also no voltage at the other end of R70 the HT4 smoothing resistor R66 is suspect, also C52 which may be leaky.

If the PL504 is not cherry red but only dully red (not really a Marxist, just a left-wing socialist perhaps) it is probably being driven from the oscillator but damped in the output stage. The PY800 is often overlooked in this connection but in fact is often responsible. If the valves are not at fault it becomes necessary to disconnect a few items, the tripler of course (which should have been removed first), the scan coils, and C113 checked. Remove the top cap of the PY800 and if the stage comes to life suspect the boost capacitor C105 which will be shorting to the h.t. line. Check the value of R133 (220kΩ): if this is low and discoloured check R72 which may have "gone to ground", or C104 may be shorted.

If the PL504 is quite cool it could well be that its screen grid feed resistor R138 is open-circuit. This could well be due to C115 shorting but is not often the case. An open-circuit C115 may give rise to striations.

A frequent complaint is that while there is a picture the width is insufficient and the picture expands and contracts. The PL504 and the PY800 could be responsible but are often not. A general check on the width stabilising circuitry is called for. Start with the width control itself, R142. Check it for correct value and smooth action. Then check the value of R143 which can lose as well as gain value. If it falls in value it can mess up the width control while if it increases in value the width control is ineffective. If these are in order check R141 and R140, both of which can go high.

These are not rare faults, they happen regularly and often and must be expected. The v.d.r. Z4 is very rarely at fault and should not be suspected even after it has suffered at the hands of a shorted C113. For those interested, it is a type E298ZZ/05.

If C113 has to be replaced it is prudent to check C107 (assuming the set is used on 625) which can also short to spoil the scanning waveform. The result is compression on the left side with a white line down the edge.

C108 and C106 can be responsible for no picture on 405 lines.

Line Tear and Sync Problems

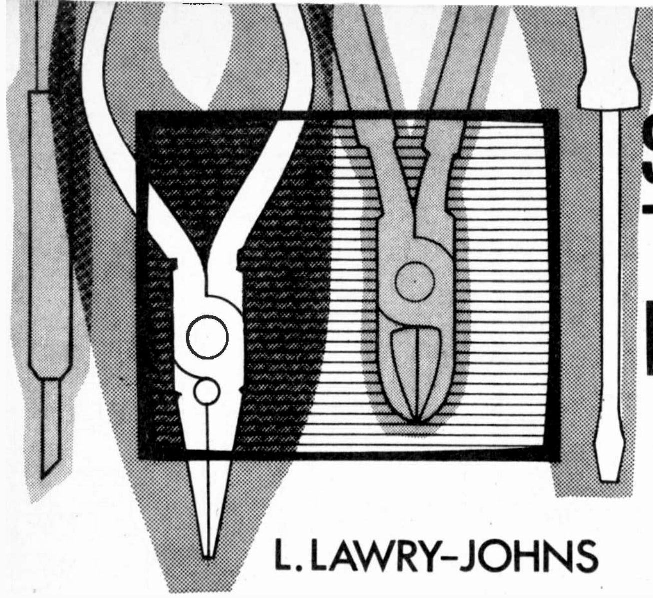
Intermittent horizontal displacement of lines which is not affected by the brightness of the picture directs suspicion to C54 (180pF) which can become leaky to give rise to these symptoms. If the brightness does have an effect however, i.e. the condition gets worse as the picture gets brighter (tube draws more current) then the tripler is at fault with one of the pencil rectifier sticks breaking down. When the tray is removed from the transformer a sniff is enough to confirm the diagnosis, the smell being enough to penetrate the most insensitive of noses. A similar effect can arise if the outer coating of the tube is not effectively earthed to chassis, but this is very rarely the case.

If the line hold takes a time to sort itself out when the set is first switched on but settles down after a period to give no more trouble, suspect a lazy 30FL1 line oscillator valve. The valve can also play about after a period to give loss of line hold – or it may fail completely to cause picture collapse to the centre with consequent line output stage overheating.

Variation of line hold need not be due to this valve however and one or two other points may need to be checked before the real cause is tracked down. Among the causes found have been the 30FL14, R59, R60, R62, R66, R69, C50 and the discriminator diodes W5 and W6. Weak sync can be due to these components (the 30FL1 is also the sync separator) plus the resistors associated with pins 6 and 7 of this valve (check R45 and R48). If necessary go back to the video stage where R38 may have decreased in value thus increasing the video cathode bias and upsetting the sync pulses.

In difficult cases of no line sync do not omit to check the reference pulse feed from the line output transformer (tag E) via R56/C48 and C42/C47 to W5. A short in the screened lead between R61 and R69 is another possibility.

Wavy verticals should direct attention to the main smoothing block, then C52.



SERVICING TELEVISION RECEIVERS

THORN 1400 CHASSIS

L. LAWRY-JOHNS

IT'S getting on for seven years since we first covered the Thorn 1400 series. Since then the circuit has been changed quite a bit and lots of different fault conditions have shown up. In all there have been some fifty models with tube sizes from 16in. to 24in. and cabinet presentations from semi-portables to large wooden cabinets with or without legs. We will not list the models since there is little chance of confusion: they are all dual-standard sets with a single vertical swing out panel.

The v.h.f. tuner is a conventional turret type but the u.h.f. tuner can be either a continuously tuneable type with a dial numbered 21 to 65 or a four pushbutton unit (more than one type of these may be found).

There is no chance of confusing these sets with the later 1500 series since the latter has no v.h.f. tuner and no system switching, while the earlier 950 chassis used a horizontally mounted board rather than a vertical one.

Tube Condition

Now we usually start straight off with a discourse on the more common faults. Since we are dealing with a more elderly group of models however it would perhaps be better first to discuss the things which will determine whether a repair is going to be a worthwhile proposition. Doubtless many of these sets encountered will already have had a new tube fitted but even so this could be failing, particularly if the original make has been fitted as a replacement. As to the symptoms of a low emission tube, suffice it to say that if turning up the brilliance or contrast results in the whites turning pearly it is time to start thinking. Tapping the tube neck may liven things up for a while but not for long. A c.r.t. rejuvenator may also pulse up a new lease of life, but there is no substitute for a new tube from a long term point of view.

Open-Circuit Grid

There is another common tube fault which is mainly confined to the original make and which can happen at any time and quite suddenly. This is when its control grid becomes open-circuit internally. The result in no control of brightness, the screen merely being faintly illuminated with faint flyback lines displayed for the benefit of the close peerer. Again, it may be possible to apply a high pulse voltage between the grid and cathode in an attempt to weld the break, but this is not really the answer. One has to face up to the question as to whether the set warrants a new tube or not.

Panel Burn Up

The next big question mark is not caused by the failure of any particular item but by a burn up of the board around the right side of the system switch. This can be messy, and may wreck the system switch as well as damaging the panel. The obvious answer here is to do away with the switch and wire the contacts in whatever mode they normally work. Whilst this is usually 625, there are situations where the 1400 or other dual-standard receivers are retained purely for their 405-line capability. This type of repair requires little technical know-how but quite a bit of patience in cutting away the affected area, making good the tracks (not necessarily in the same place) and joining up the contacts in whichever switch position is required. There is of course no need for the solenoid, the switch or the switch contacts, wiring etc.: once this lot is removed the board takes on a more streamlined and neat appearance – except for the holes in the panel made by the original burn up.

Buzz on 625

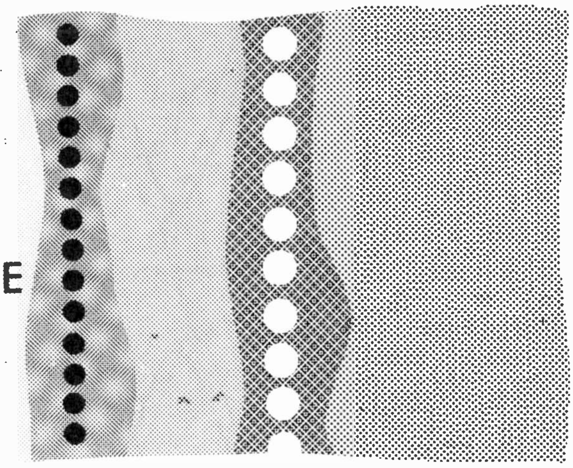
The most common complaint with this chassis has always been vision buzz on sound when used on the 625-line standard. The first thing to do is to make sure that it is vision buzz (varies with picture content) and not buzz induced from the scan coils. This latter complaint is constant until the panel is swung open, when it stops as the sound ratio detector moves away from the coils. Generally this condition will not be met since most sets will have been fitted with the double screening can over the L27-28 etc. coil assembly (if one wonders why a second cover should have been fitted over the original, this is the reason: the original screen didn't screen enough!).

Now to get down to the annoying vision buzz. Generally no amount of tuning the coil cores (mainly L27-28) or setting the rejector potentiometer R87 will completely remove the buzz and one is left with the task of going through the whole of the vision i.f. alignment procedure or looking for an alternative. There is an alternative, and this consists of making some very small alterations to the circuitry.

The first job is easy and simply consists of changing the video stage screen grid feed resistor from 3kΩ to 8.2kΩ or thereabouts. The resistor is R36, connected to pin 8 of the 6F28. The next is a little more involved and requires the addition of two small resistors, one of 22kΩ, the other 180kΩ (both ½W). These are shown in our circuit diagram (Fig. 1, schedule E receivers) as R175 and R176 to the

CHROMA LOCK DECODING

E. J. HOARE



DURING the early days of colour television there was much discussion about the merits of various techniques for decoding the PAL transmissions. Many laboratories carried out experiments and design studies, mainly on Simple PAL and Delay Line PAL decoders. Simple PAL was cheaper, because it did not need a delay line, but it turned out to be rather less robust in the presence of signal distortions and circuit alignment errors, and it was difficult to avoid the generation of small phase errors which caused blinds on the picture. These could be predicted theoretically, and were confirmed in practice.

Delay lines were relatively expensive in those days but they made it possible to achieve complete separation of the U and V components of the chrominance signal. This resulted in the cancellation of most phase errors and made the decoder much easier to design and manufacture. It was hardly surprising therefore that delay line PAL became the standard decoding technique and came to be used almost universally – particularly since it employed a number of well known circuit techniques such as the a.p.c. loop for subcarrier regeneration, which is analogous to the flywheel sync circuit used with line oscillators. The main exceptions to the use of delay line PAL decoding were to be found in certain imported sets, some of which used NTSC decoding techniques in order to avoid patent difficulties with the newly introduced PAL system. At the present time however virtually all receivers use delay line PAL and the results are very good.

In some of the early engineering papers and textbooks there is the occasional reference to New PAL or New/New PAL, and also to chroma locked oscillators. These terms refer to a decoding technique which is an intriguing refinement of the present standard method. Very little is heard about it at present, and readers of *Television* may readily be forgiven their slight fall from grace if they have to admit that their knowledge of the subject is incomplete!

The key feature of chroma lock decoding is the manner in which the local reference subcarrier is regenerated in the receiver. In ordinary delay line PAL decoding a very stable crystal controlled oscillator is used and is phase corrected during the line flyback blanking interval by comparing its phase with that of the transmitted burst signal. Any phase difference produces a d.c. error voltage which is used to pull the oscillator into its correct phase via the action of an a.p.c. loop. This is fine up to a point, but it means that any phase distortion of the chrominance signal during the active picture period is not "seen" by the a.p.c. loop, and the decoder cannot adjust itself to such changed phase conditions.

In a chroma lock decoder however the phase of the local reference oscillator is controlled throughout the picture period by the chrominance signal itself. Thus any phase change in the chrominance signal, caused by distortion in the transmission path, is immediately compensated by a corresponding phase change in the reference carrier generated by the local oscillator in the decoder. This phase compensation may not be too important if signal reception is good, but the advantages are obvious under conditions of severe multipath reception or in difficult fringe areas.

Before describing the principles of chroma lock decoding it may be as well to summarise briefly the form of the transmitted chrominance signal, and the reasons for needing a local reference subcarrier with accurately controlled phase. It will then be easier to appreciate the issues involved in chroma lock operation.

The Chrominance Signal

The simple three-tube colour TV camera gives gamma corrected output voltages corresponding to the red, green and blue content of the scene being televised. If these are combined in the well known ratio 0.3R + 0.59G + 0.11B a luminance signal (Y) is obtained which when modulated on to the vision i.f. carrier will produce a normal black-and-white picture on a monochrome receiver.

To produce a colour picture all that is necessary is to add the chrominance information. This takes the form of the three-colour difference signals, R – Y, G – Y and B – Y. In the receiver, after decoding has taken place, these three signals are added to the luminance signal as follows: $(R-Y)+Y=R$, $(G-Y)+Y=G$ and $(B-Y)+Y=B$. Thus signals corresponding to the three camera outputs are reproduced in the receiver to drive the three cathodes of the colour display tube.

The colour-difference signals should be regarded as modifying the effect of the luminance signal which is applied to all three guns of the display tube. If no colour-difference signals are present, the luminance signal produces a black-and-white picture. The colour-difference signals may be either positive or negative, increasing or reducing the effect of the luminance drive to the three guns and thus changing the ratio of the red, green, and blue light outputs in order to produce the required colour. For example, a positive R – Y colour-difference signal will turn on the red gun more to produce a pink or red light output. If a negative B – Y signal is added the blue light output will be reduced and the colour will change towards yellow.

In practice it is necessary to transmit only the R – Y and B – Y information because G – Y can be derived from the other two signals by a resistive matrix circuit in the receiver. At the transmission end of the chain the R – Y and B – Y

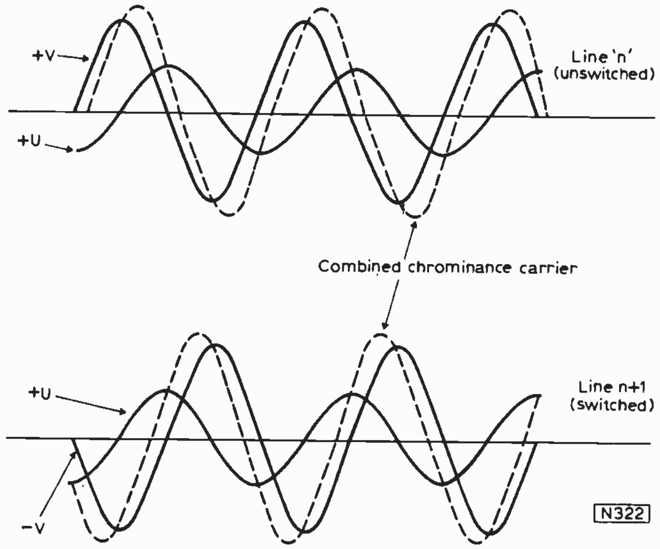


Fig. 1: The chrominance carrier for a purple hue, on successive lines, derived from the U and V signals.

signals are first reduced in amplitude to avoid overloading the transmitter and to reduce interference with the luminance signal. The two "weighted" colour-difference signals are known as V and U respectively.

Next the V signal is *amplitude* modulated on to a carrier at 4.43361875MHz and this carrier is inverted, i.e. phase reversed, on alternate lines of the picture. This is the well known PAL switching process. The U signal is also amplitude modulated on to a carrier, and this has precisely the same frequency as the V carrier but has a constant phase difference of 90 degrees. The U carrier is not switched and so maintains a constant phase.

Modulation

The process of modulation takes place in a balanced modulator circuit whose output consists of a carrier having sidebands centred on the frequency given above. After adding the two sets of modulation, U and V, we get a signal which contains both *amplitude* and *phase* modulation to convey the two items of information – the V and U signals (see Fig. 1). This combined chrominance carrier is then modulated on to the vision carrier which carries the luminance signal as well. The vision carrier therefore comprises a full bandwidth luminance signal from 0-5.5MHz and also a restricted bandwidth chrominance centred on a carrier at 4.43MHz.

In the receiver the vision carrier can be demodulated using any of the usual circuits. If this is followed by the appropriate selectivity there will be two video outputs: one is the luminance signal, with the chrominance carrier at 4.43MHz removed by a narrow notch filter; the other is the chrominance carrier itself, separated out by means of a bandpass circuit having a bandwidth of about ± 1.0MHz. From now on it is this latter carrier with which we are concerned.

Delay Line PAL Decoding

The basic purpose of the decoder, whether ordinary delay line PAL or chroma lock, is to separate and detect as accurately as possible the U and V components of the chrominance signal. Fig. 2 shows the principles of a delay line PAL decoder in simple block schematic form. It consists of three main parts. The delay line and matrix circuit separate the amplitude modulated combined chrominance carrier. The local reference oscillator generates carriers in ± V phase for the V demodulator, and + U phase for the U demodulator. Finally the demodulators convert the U and V carriers into U and V video colour-difference signals. By suitable choice of gain, the U and V signals can then be converted into B − Y and R − Y and mixed in the correct proportions to give G − Y. It is interesting to note that nearly all the circuitry in a decoder is present for but one purpose: to feed the appropriate inputs to the two demodulators. Rather ironically, these themselves are often very simple circuits.

In order to complete our survey of the background on which chroma lock is based it is important to be clear about two basic points. First, the delay line and matrix (adding and subtracting) circuits operate on the combined chrominance signal to produce two outputs: one an amplitude modulated carrier in ± V phase and the other an amplitude modulated carrier ± U phase. Fig. 3 shows how this comes about. The second point is that these two carriers, although amplitude modulated, cannot be detected by ordinary diode detection because a simple diode "envelope" detector cannot produce an output which is either positive- or negative-going – as the colour-difference signals are. See Fig. 4: the same output would be obtained whatever the carrier's phase. It is essential to have reference carriers which can inspect both the phase and amplitude of the U and V signal carriers in order to identify whether they are carrying information of positive or negative polarity. It is the purpose of chroma lock decoders to generate these reference carriers in a more accurate and economical way than in an ordinary delay line PAL decoder.

The Basis of Chroma Locking

The idea behind the technique of chroma lock is to use the U and V chrominance carriers themselves to lock the output of a simple oscillator in the correct phase for feeding to the demodulators. In the upper half of the block schematic diagram shown in Fig. 2 we have a delay line and matrix circuit which gives outputs consisting of pure U and V *chrominance* carriers. The U and V *reference* carriers need to be in precisely the same phases as these two signals in order to achieve the greatest possible accuracy in decoding. So why not feed these two chrominance carriers through limiters (to amplify them and remove the amplitude modulation) and then use them as reference carriers for demodulation?

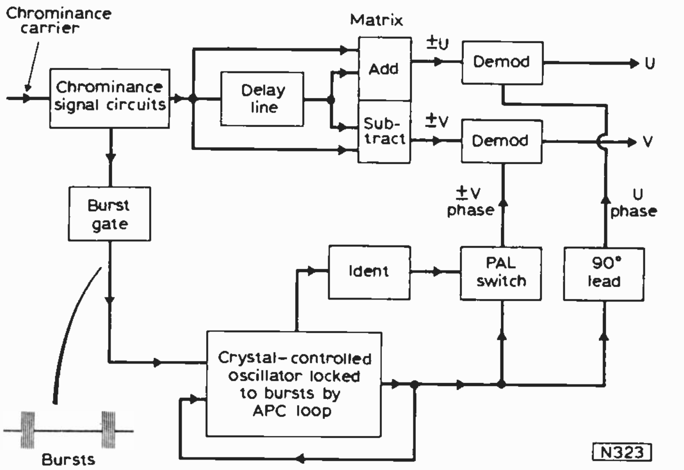


Fig. 2: Block diagram of an ordinary delay line PAL decoder.

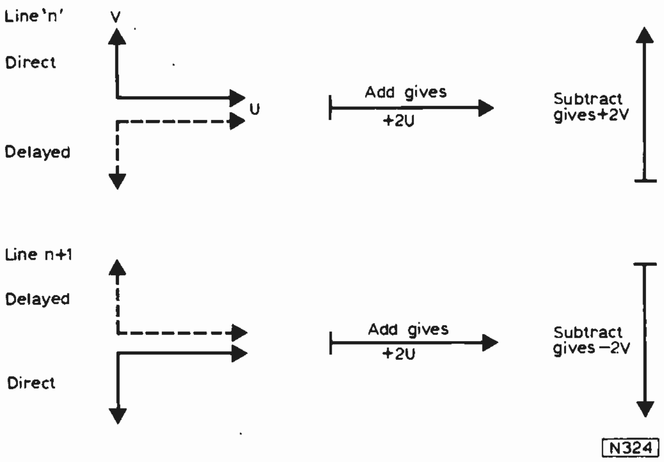


Fig. 3: The delay line/matrix operations on two successive lines.

Unfortunately this is too simple an approach to the problem. Both chrominance carriers may be in either positive or negative phase, and in any case the V reference carrier has to be switched on alternate lines in sympathy with the V signal switching at the transmitter. These difficulties can nevertheless be overcome. Suppose the U carrier is doubled in frequency. A phase difference of 180 degrees between + U and − U is doubled also, becoming 360 degrees. This removes any ambiguity. Fig. 5 illustrates the point a little more clearly.

Now consider the V signal. In addition to the basic R − Y colour-difference signal polarity consideration this may be either plus or minus depending upon whether it is a switched or an unswitched PAL line. So we have two ambiguities. It will have a phase difference of 90 degrees to the U signal carrier however. If it is frequency doubled, this phase difference becomes 180 degrees. Invert the doubled carrier and a ± V signal will have the same phase as a ± U signal.

Using the cheap and simple form of frequency doubling shown in Fig. 5 this is perhaps not quite as clear as the theory suggests – because the waveforms are not pure sinewaves. In terms of locking a local reference oscillator however the point is still valid. It becomes still more so if the inverted, frequency doubled V carrier is added to the doubled U. See Fig. 5 again and note the phase coincidences marked in the waveforms. It will be seen that the combined, doubled carriers when added together are in U phase.

Now we come to a snag. This carrier in U phase is just as likely to lock an oscillator in − U phase as in + U phase. It all depends upon the instantaneous phase of the oscillator at the instant during any line of the picture when the frequency-doubled chrominance-derived carrier comes along. It should be noted that some lines of a picture may contain no chrominance information at all, i.e. a black-and-white region. Clearly some means must be found to ensure that the oscillator is in approximately the correct phase before the new reference carrier is applied to it. The answer, of course, lies in the burst signal.

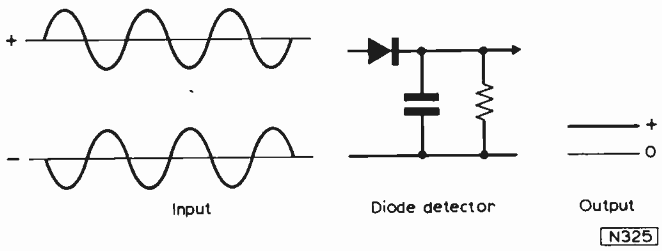


Fig. 4: A simple diode detector will give the same positive voltage output from the two carriers shown on the left.

The transmitted burst signal consists of ten cycles of a sinewave carrier having exactly the same frequency as the chrominance carrier itself. The *phase* of the burst sinewave changes from line to line in order to indicate whether a switched or an unswitched PAL line is being transmitted. The burst occurs during the line flyback blanking interval – it's on the back porch following the line sync pulse. As a reminder, see Fig. 6.

The basic principle of operation of chroma lock decoding is now almost established. There is plenty of detail to fill in however and more to say to provide scope for speculation and, hopefully, some experimentation by readers.

The burst is transmitted on every line, and if we have a very stable oscillator this can be phase synchronised by the burst once every line, during the line flyback blanking interval. The phase of the synchronised oscillator will be at ±45 degrees to the −U phase – see Fig. 6 again. Provided the oscillator really is stable, it will then run for the whole of

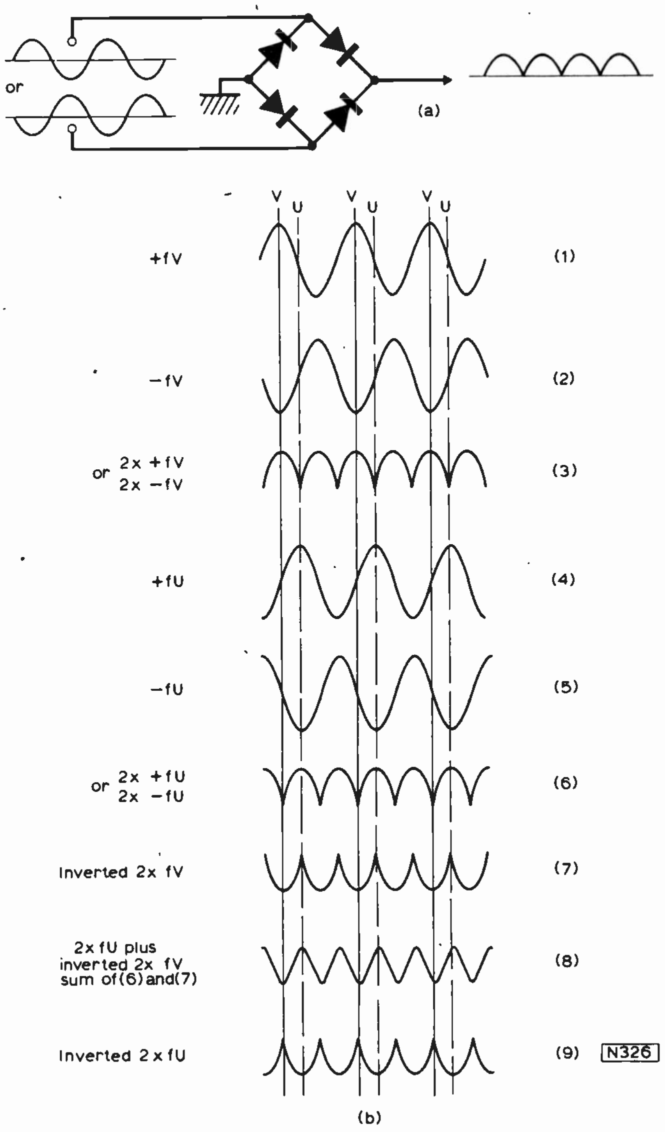


Fig. 5: (a) Frequency doubling by means of a full-wave rectifier circuit. (b) Chroma lock decoding waveforms. Note the phases of the frequency doubled and if necessary inverted U and V signals, enabling them to be used for correct phase locking of the U and V reference oscillators.

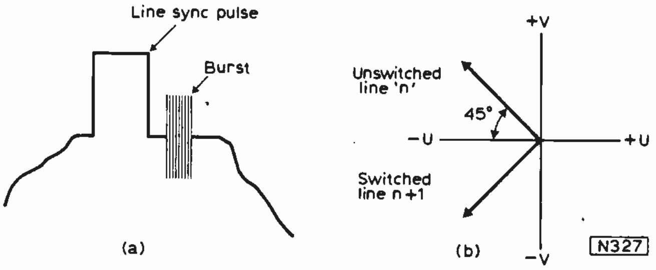


Fig. 6: The burst consists of ten cycles of subcarrier transmitted during the line sync pulse back porch. The phase of the burst alters ±45° about the −U phase on alternate lines to indicate whether or not the line contains switched V signal.

the following line scan period at approximately this phase angle. If anywhere during the line a U or V chrominance signal is transmitted – preferably both together – a frequency-doubled carrier will be obtained which can be used to relock the oscillator into correct −U phase. This −U phase is not the nominally correct phase as given by the burst signal, but the *actual* phase of the combined chrominance subcarrier itself – whatever phase distortions it may have suffered either in the transmission path or in the decoder itself.

To establish the position so far, Fig. 7(a) shows a simple block diagram of the chrominance signal path and the synchronised reference oscillator in −U phase. The reference carrier can easily be inverted to give +U phase if this inversion cannot be carried out conveniently in the U demodulator.

The next step to consider is the simplest way of generating a switched V reference carrier. Fig. 5 shows that if the U carrier is frequency doubled and inverted, the positive peaks are in V phase. So this carrier can be used to lock a separate oscillator running in V phase, and this too can be partially synchronised (to the nearest 45 degrees) during the line flyback blanking interval by the burst signal. See Fig. 7(b).

To summarise then, providing either or both the U or V chrominance carriers are present during any line or part of a line, a reference carrier will be generated in U phase. The burst, present at the end of every line, will correct the phase of the reference oscillator to the nearest 45 degrees. The presence of the chrominance carrier(s) will then pull the oscillator into correct phase lock. If no chrominance information is present, the oscillator will have a phase error (of about 45 degrees). This is of no importance however because no decoding action is necessary if no chrominance information is being transmitted!

The V reference carrier is obtained – see Fig. 7(b) – from a separate oscillator partially locked by the swinging burst and finally locked by the inverted, doubled, U reference carrier.

A Complete Chroma Lock Decoder

A chroma locked decoder can be designed in several ways, but Fig. 8 shows a fairly complete block diagram of the type we have been discussing. In the interests of clarity it is assumed to be in discrete component form. It may look a bit complicated at first glance, but when you consider the saving of the complete a.p.c. loop plus the ident and PAL switch circuits it's in fact no more complex than the equivalent ordinary delay line PAL decoder (see Fig. 9). Bear in mind also that diode frequency-doubling circuits and simple differential amplifier limiters are simple circuits that need no adjustment. Their operation is completely automatic. The only real difficulty concerns the performance of the oscillator. This is a serious problem which we shall discuss in detail later.

Referring to Fig. 8, the input to the decoder is the chrominance signal carrier which has been separated from the composite video signal obtained from the vision detector. A simple bandpass circuit centred on 4.43MHz with a bandwidth of ± 1.0MHz is usually adequate, but the bandpass characteristic should include a deep notch filter tuned to 6.0MHz to reject the sound carrier. This prevents a spurious coloured pattern at 6.0 – 4.43 = 1.57MHz being superimposed on the picture.

The combined chrominance carrier is amplified in a gain-controlled stage, the output having a constant amplitude burst signal. Thus the chrominance carrier, although varying in amplitude depending upon the saturation of the picture, is always correct relative to the amplitude of the luminance signal.

Considering the signal path first, it will be seen that this is the same as in an ordinary delay line PAL decoder. The amplitude of the chrominance signal is adjusted by means of a customer saturation control. It then passes to a second amplifier where the burst signal is gated out – this prevents a pedestal waveform, which might upset a subsequent clamping action, appearing on the decoded output.

The signal next requires power amplification in a driver stage to feed the low input impedance of the chrominance

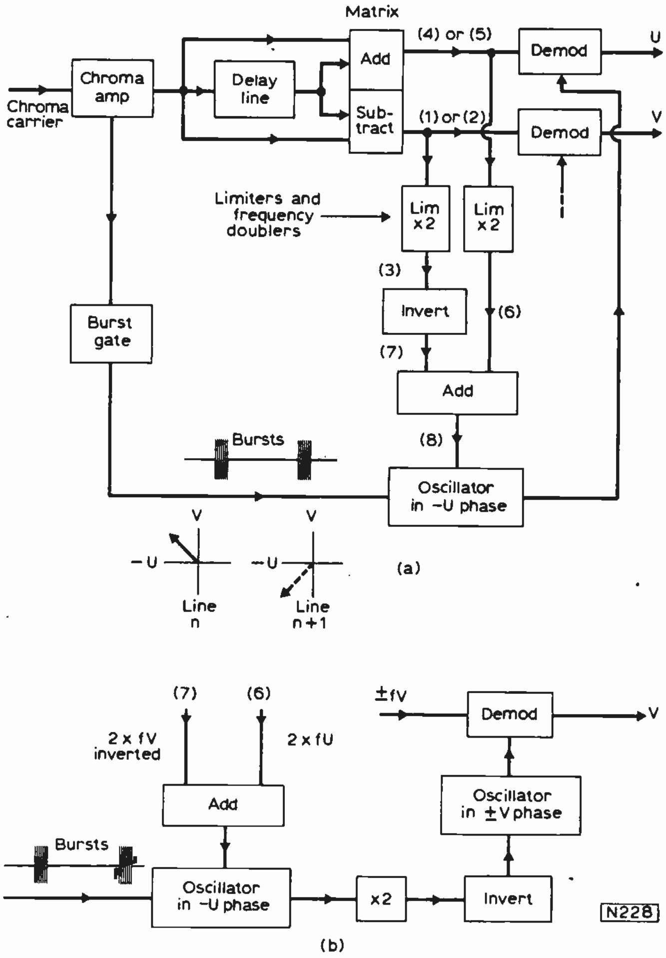


Fig. 7: Simplified block diagram of a basic chroma lock decoder. (a) Generating a reference carrier in U phase. (b) Obtaining a V reference carrier in ±V phase. For clarity, the a.c.c., blanking, saturation control and colour-killer have been omitted. Numbers (1)-(8) refer to the waveforms shown in Fig. 5.

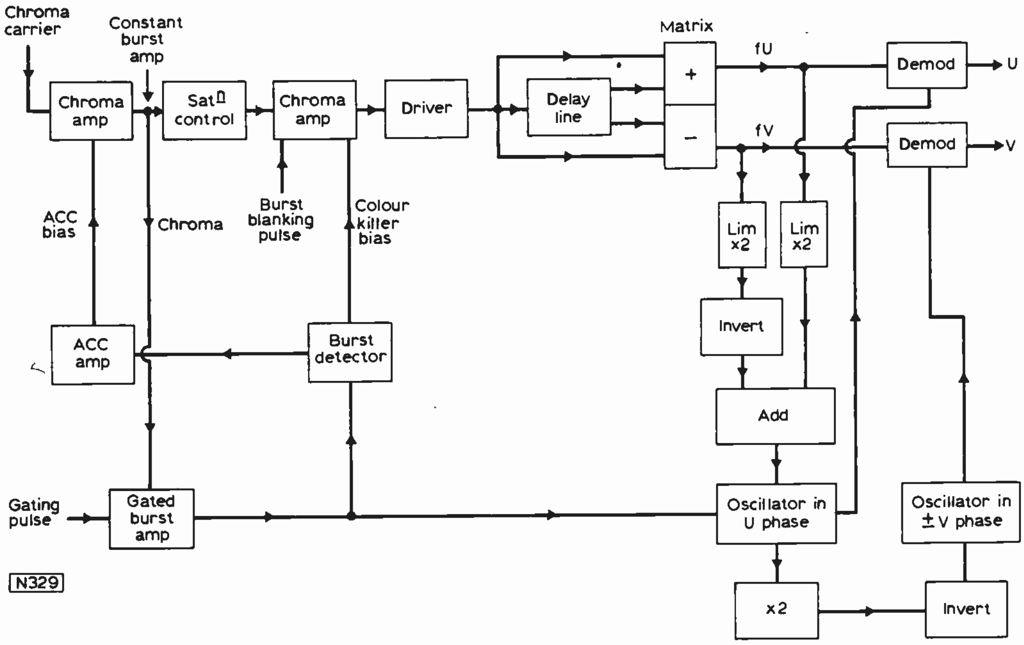


Fig. 8: A complete chroma lock decoder.

delay line. The output of the line, together with a direct path signal of identical phase and amplitude, is fed to the adding and subtracting matrix. The output of the adder consists of the pure U signal carrier and that of the subtractor a pure V signal carrier. Both these signals are supplied to their respective demodulators. They also pass through limiters and frequency doublers to an adder circuit in the manner already described and illustrated in Fig. 5.

Turning to the auxiliary circuits, the signal from the first chroma amplifier is also fed to a gated burst amplifier. This is turned on by a burst gating pulse *only* during the short interval when the burst is present. It's turned off for the rest of the line scan period. Thus the output is pure burst and nothing else. This burst can be detected by a simple diode circuit to give a d.c. output. Part of this is amplified in an a.c.c. (automatic chroma control) stage to control the gain of the first chrominance amplifier. A second output is used to activate the chrominance signal channel when the burst is present, i.e. when a colour transmission is being received. On monochrome transmissions no enabling bias is present and so the signal channel is closed, preventing spurious coloured noise appearing on the picture.

We now come to the chroma lock circuits. The output from the gated burst amplifier is also applied to the U reference oscillator. During the burst interval this oscillator is pulled into phase lock with the burst, and runs in approximately this phase throughout the following line scan period. If a chrominance signal is transmitted at any instant during the line either a frequency-doubled U or V signal carrier, or both added together, will also be applied to the U reference oscillator which will be quickly pulled into correct phase lock, i.e. U carrier phase. This signal is applied to the U demodulator. Normal demodulation takes place, but with the added advantage that the reference carrier phase will be exactly matched to that of the U signal.

Similarly the V reference oscillator will be approximately synchronised by the burst signal, whether in positive or negative burst phase, and finally synchronised correctly by the frequency-doubled carrier obtained from the U reference oscillator. Thus the reference carriers fed to the two demodulators have been correctly phase locked by the chrominance signal instead of by means of a crystal controlled oscillator and an a.p.c. feedback loop.

For comparison an ordinary delay line PAL decoder is shown in block diagram form in Fig. 9. It will be familiar to most readers so little needs to be said about it, particularly as the whole of the signal path and some of the burst processing circuits are the same as those used in a chroma lock decoder. The important difference is that the U and V reference carriers required for the demodulators are

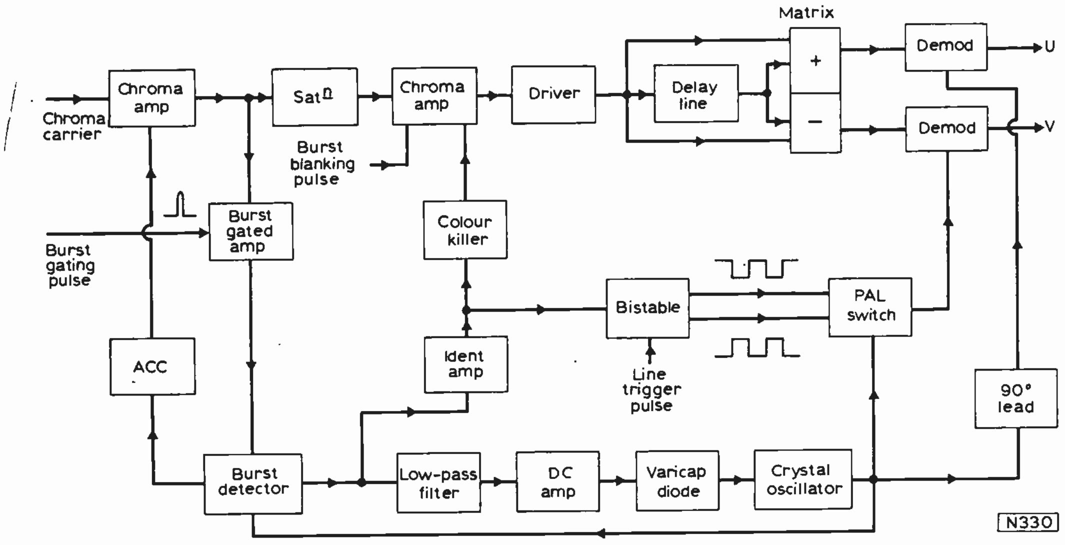


Fig. 9: Normal delay line PAL decoder.

generated by a crystal controlled oscillator. The phase of the oscillator output is compared with that of the burst signal, any phase difference generating an error voltage which acts upon the oscillator to pull it into phase lock. This involves a large feedback loop with a long time-constant. The oscillator locks to the average phase of the bursts, but there must be a small phase error in order for the control loop to work effectively. Under noisy signal conditions this phase error increases. In practice the system works very well, but chroma lock can work even better.

Advantages of Chroma Locking

The main advantage of chroma locking is the fact that the phases of the two reference carriers required for demodulation are locked to the phases of the chrominance carriers themselves instead of to the burst signal. This may seem paradoxical since the burst phase is supposed to have an accurately controlled relationship to that of the chrominance signal carriers. This is so at the transmitter, but it does not always hold all the way down the transmission path and in the decoder circuits.

One of the two main problems is differential phase distortion. This means that the extent of a phase error introduced into a chrominance signal, including the burst, varies with the amplitude of the signal. Thus a large chrominance carrier may have a larger phase error than that introduced into the relatively small burst. An equal error in both would be of no consquence, but a phase error difference is very undesirable. If the reference oscillator is phase locked by the burst and its output is used to demodulate a chrominance carrier having a different phase angle the decoding is not completely accurate. Although PAL decoding is very robust, any error is clearly undesirable.

One of the most common causes of differential phase distortion is the application of a signal – such as the composite video signal shown in Fig. 10 – to a simple transistor amplifier. The collector current of the transistor varies in sympathy with the instantaneous amplitude of the input. However a change of collector current causes a change of input impedance – reactive as well as resistive. Thus unless great care is taken in the design of the input circuit the phase of the chrominance carrier will vary depending upon the amplitude of the luminance signal. In the waveform shown in Fig. 10 the carrier phase error will change from step to step along the luminance staircase.

Another cause of phase distortion is crosstalk in the decoder. Chrominance or reference carriers in one circuit may get coupled into an adjacent circuit. The result is still a sinewave, but it will have a different phase. Should this occur after the burst has been gated out for feeding to the a.p.c. loop, the phase relationship between the burst and the chrominance signal will no longer be correct.

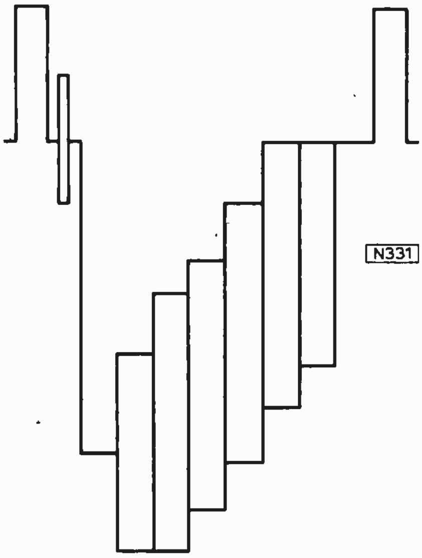


Fig. 10: The composite video signal – for a colour-bar display.

This kind of crosstalk can arise in a variety of different ways, and it is often very difficult to eliminate it in practical decoder designs. In many cases all that can be done is to reduce it to an acceptable level.

The oscillators in a good chroma lock decoder are able to respond very quickly to changes in chrominance signal phase, and so no significant decoding errors are caused.

With the important exception of the oscillators themselves, the circuits used in chroma lock decoders are simple and cheap. Frequency doublers need only a bridge network of four ordinary diodes, while limiters are easily constructed from differential amplifiers using standard types of transistors. The same types can also be used for the burst gating, a.c.c. stages and so on. No crystal is used in the oscillator circuits, and this represents an important cost saving. There is also a useful reduction in the number of coils used. A less important point, though still helpful, is that chroma lock decoders are very easy to align. The rather critical adjustments to the oscillator phase shift networks and the burst detector and a.p.c. loop circuits of an ordinary PAL decoder are replaced in a chroma lock decoder by just two oscillator frequency adjustments. These can be set to a zero beat condition using the picture as a display device.

From the point of view of the amateur constructor there is no doubt that chroma locking has a strong novelty factor which must appeal. It should be pointed out however that the design of any kind of decoder is not a task to be undertaken lightly unless adequate time, equipment, and experience are available.

The Locked Oscillators

The Achilles' heel of chroma locking, and probably the reason why the technique has been little used in commercial decoders, concerns the oscillators. In the first place these have to be very stable. For example if an oscillator is locked into the approximately correct phase by the burst signal and no chrominance information is transmitted until near the end of the line scan, the phase of the oscillator in the type of chroma lock decoder described must not change by more than about 30 degrees.

Now a line consists of about 283 cycles of chrominance carrier frequency. Suppose that the chrominance information begins only near the end of the scan, say on the right-hand side of the picture about 200 cycles after the phase locking by the burst. The frequency of the oscillator must not change by more than the ratio of one part in $(360 \times 200)/30$ = one part in 2400. Furthermore this stability must be maintained for a period of years, i.e. until the next service call is needed for some other reason.

Now it is not a very difficult matter to design an oscillator having this sort of stability provided a high Q tuned circuit is used – together with careful temperature compensation. If the oscillator is to be responsive to phase changes of the chrominance signal however, and in particular if the V oscillator is to be phase reversed on every line by the burst signal, it is not possible to use a high Q tuned circuit. Such an oscillator would be too stable to be able to respond quickly enough – primarily because of the relatively large amount of energy stored in the tuned circuit. This energy has to be increased or decreased very quickly in order to achieve the desired phase change in the time available.

If the tuned circuit is fairly heavily damped to give a low Q value the oscillator will be able to respond quickly but its long term stability will be impaired. Until recently there did not seem to be any very clear answer to this problem. The outlook is now brighter however. Quite simple *RC* oscillators have been designed using integrated circuits and having quite remarkable stability. It may well be that modern techniques will make chroma locking a viable commercial proposition for domestic television receivers.

Alternative Chroma Lock Decoders

The chroma lock decoder shown in Fig. 8 is a simple one with a strong similarity to ordinary delay line PAL. It has one basic defect however. The burst signal can synchronise the U and V reference oscillators during the line flyback blanking interval only to the nearest 45 degrees. When chrominance information comes along the separated, frequency-doubled U and V chrominance carriers have to change the phase of the reference carriers by about 45 degrees to achieve correct phase lock. This may take a few cycles, and during that time decoding errors will occur. A smudgy outline may be visible at the beginning of the coloured part of the picture.

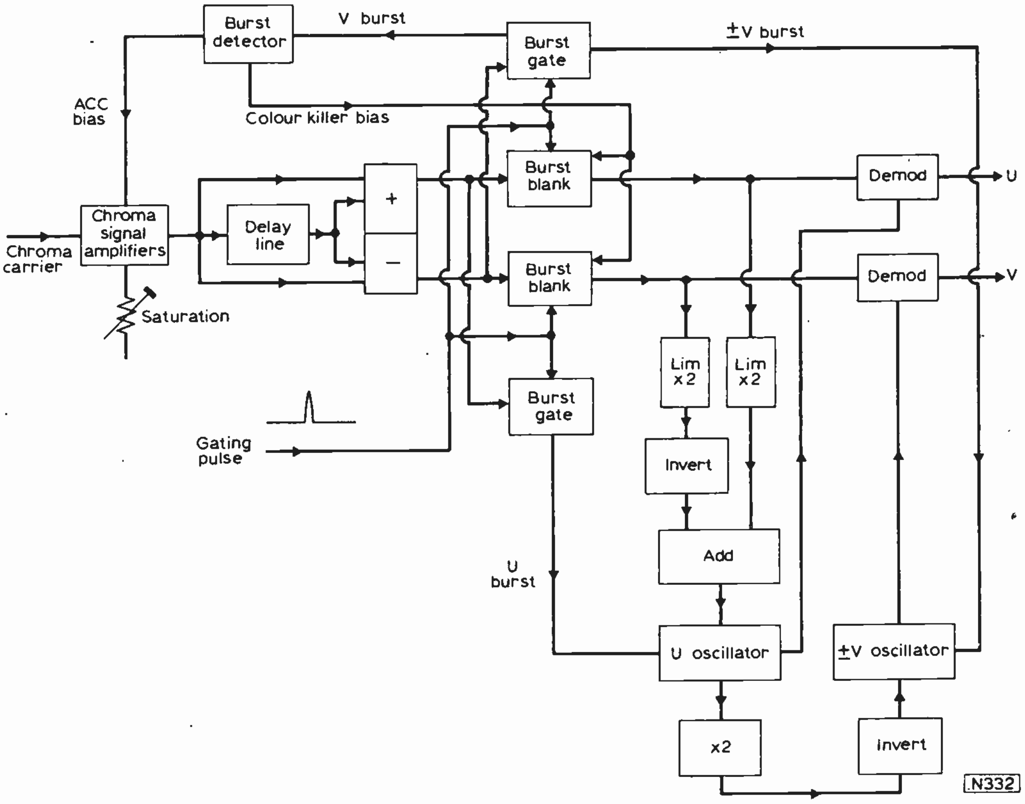
More serious however is that if the oscillators drift by more than about 30 degrees in the wrong direction – away from their correct phase – the doubled chrominance carriers will not be able to pull them into their correct phase at all. This difficulty would be much reduced if the bursts could be used to synchronise the U and V reference oscillators in correct U and V phase. Two advantages would accrue. First, accurate phase locking of the reference carriers by the frequency doubled chrominance carriers would involve only a small phase change. Thus visible decoding errors at the beginning of the coloured part of the picture would hardly occur. Secondly, the reference oscillators could drift away from their correct phase by a much larger angle, say 60-80 degrees, before a point was reached where they could not be pulled into correct lock by the chrominance carriers. So we need burst in ±V phase on alternate lines, and –U phase on every line. This would result in the oscillator stability requirement being relaxed from one part in about 2,400 to one part in 1,000: a very useful improvement.

The sharp eyed reader will have spotted the answer already. The output of the delay line and matrix adder consists of pure U chrominance carrier. Provided there has been no burst blanking it will also contain burst in U phase. The process by which the U and V components of the combined chrominance carrier are separated in the matrix acts just as effectively on the burst signal as it does on the chrominance information. Thus the output of the subtractor consists of pure ±V chrominance carrier together with ±V burst. These two burst outputs clearly provide the possibility of locking the two U and V reference oscillators approximately into their correct phase, ready for final locking by the frequency-doubled chrominance carriers. We can now devise a new and better form of chroma lock decoder.

Fig. 11 shows the block diagram of this more sophisticated and basically sound arrangement. In essence it is very similar to the one shown in Fig. 8, but the need to extract the two separate components of the burst signal in –U and in ±V phase requires duplication of the burst gating and blanking functions. Slightly more complicated perhaps, but having an obvious advantage in the way that the two oscillators are locked directly in U and V phase by the burst signals rather than at a phase angle of 45 degrees to the correct axes.

Note that there is one significant defect in the arrangement shown in Fig. 11. If the saturation control is turned down, the amplitude of the chroma signal to the processing circuits is reduced. The limiting circuits will of course take care of this in the phase locking circuits, and the output to the oscillators will not be affected. The burst is transmitted at a fairly low amplitude however, and under

Fig. 11: A more practical form of chroma lock decoder.



fringe conditions the input to the limiters may be too small to drive them as effectively as signal components corresponding to localised high-saturation areas of the picture. It is possible therefore that the U oscillator will not be correctly locked during the line flyback blanking interval, and when a larger chroma signal component comes along the oscillator may be locked in the wrong phase.

A better arrangement would be to have a saturation control in each channel just before the two demodulators. The phase locking circuits would then receive the full burst amplitude regardless of the saturation setting of the picture. This technique is a bit tricky however. It means having accurately matched and ganged potentiometers in the gain control circuits, and the latter are likely to introduce a certain amount of signal compression. This causes a reduction of saturation at the higher levels and some hue distortion. In practice it is probably better to stick to the simpler approach unless integrated circuits are used – these can incorporate sophisticated techniques which are uneconomic in discrete component form. For instance, multistage limiters can be used: these have a very high performance under noisy signal conditions.

So far we have been discussing chroma lock decoders which have one master oscillator in U phase, locked by either, or both, chrominance signal carriers. The V reference carrier is derived from a slave oscillator which is phase locked by the frequency-doubled U reference carrier. If good limiting action can be achieved however, i.e. good discrimination between a low-level U or V signal carrier and electrical noise, then another decoder configuration is possible. This is shown in Fig. 12.

No special performance advantages can be claimed for this circuit, but its symmetry and the fact that each circuit block is duplicated may appeal for both aesthetic and practical reasons. There is also a certain element of simplicity about it. Each channel has its own oscillator which is phase locked by the appropriate burst during the line flyback blanking interval and by its own frequency-doubled signal carrier during the picture period.

It's worth noting a point concerning colour-killer circuits. The circuit which is disabled must always be *after* the point where the bursts are separated from the rest of the signal, i.e. the burst detector must always be able to sample the incoming signal in order to establish whether the bursts are there – or not. Otherwise it cannot ascertain whether a colour or a monochrome programme is being transmitted. A comparison of Figs. 8 and 9 on the one hand and Figs. 11 and 12 on the other will clarify this point.

An Experimental Decoder

The decoder shown in Fig. 12 gives rise to an interesting possibility for experimentation. Why not take an ordinary delay line PAL decoder and turn, say, the U signal into chroma lock form? Anyone who has the experience and facilities to build limiter, frequency doubling, burst gating and low *Q* oscillator circuits (none of them very difficult) could make up a reference carrier strip similar to that shown in Fig. 12. The existing reference carrier feed to the U demodulator could be disconnected and replaced by the new one, the burst blanking being temporarily disconnected. When this was working satisfactorily a burst blanking stage could be added using the gating pulse from the original decoder. This strip could then be duplicated to replace the V reference carrier feed. The whole a.p.c. loop, ident, bistable and switching circuits would become redundant. One of the new reference carriers could be used to drive the original burst detector: this would keep the a.c.c. circuit operating normally. The colour killer could be temporarily disabled, and if desired the appropriate bias could be fed to the two burst blanking stages. The circuit would then be a true chroma lock decoder almost identical to Fig. 12.

Chroma Lock Past and Future

In view of the intriguing and ingenious nature of the chroma lock technique, and the fact that it was devised during the early days of the PAL system, it may seem surprising that so little has been heard of it. There are probably three main reasons for this. Consideration of these also provides an illustration of the workings of normal commercial engineering.

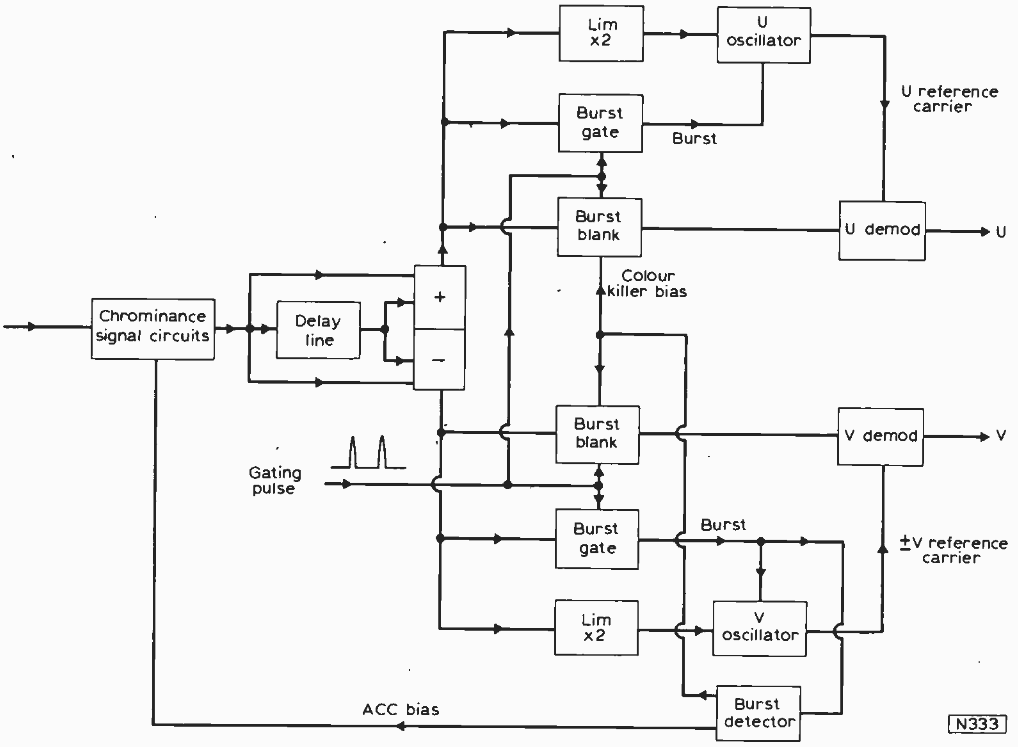


Fig. 12: One of several other possible chroma lock configurations.

In the first place the requirements of very long term oscillator stability were a daunting challenge to the circuit design engineer. By the very nature of things it was difficult for him to have complete confidence that his decoder would be reliable in the sense of having long term stability over a period of several years. Without this confidence, his commercial colleagues would justly feel that they were being asked to take an undue risk in adopting the technique – particularly as the cost savings, though significant, were not a compelling factor.

The second fact, reinforcing the first, was that ordinary delay line PAL gives a very good performance and a high level of confidence in its long term behaviour. The advantages of chroma locking would show up only under very difficult reception conditions, and these represent but a small proportion of the potential market. The choice of safety first was understandable and correct.

The final nail in the coffin was provided by the advent of decoder integrated circuits. For commercial reasons, again quite correctly, these were designed to marry up with existing discrete component circuits. As more i.c.s were developed these too were arranged to marry up with the earlier ones, thus providing an evolutionary progress in design rather than a sudden break with established practice. This is not only good engineering procedure, it is also the kind of situation that inevitably develops in a competitive market. No i.c. manufacturer can afford to go it alone: he must fit his products to the market place, and this usually involves linking them into an established pattern of existing components while trying to go one better either in price or performance. To adopt a different decoding technique would involve the risk of not selling any i.c.s at all. There are only a few possible customers – the setmakers.

Chroma lock has been experimented with by a number of laboratories however. It has also been used by some Australian enthusiasts. Before colour programmes were officially transmitted in Australia a lengthy period of test transmissions took place. To put experimenters off, the burst signal was suppressed. Ordinary decoding techniques were useless therefore, but chroma lock overcame the problem. The trick was to press a switch in the oscillator circuit until correct phase locking occurred by normal chance selection; lock then took over and maintained this correct phase.

An area where chroma locking makes a useful contribution is in the field of broadcasting. If a PAL signal suffers differential phase distortion during transmission, via an imperfect local cable link for example, it can be correctly decoded by the chroma lock technique and then recoded. Thus any phase errors are removed. Some sophisticated techniques exist whereby the signal does not even have to be decoded. Such devices are known as error correctors and can also incorporate compensation for differential amplitude distortion. Another application is in transcoders which convert PAL to SECAM or PAL to NTSC.

Finally

As a final comment there is still the distinct possibilty that chroma lock decoding will prove to be well suited to the application of advanced integrated circuit techniques. Furthermore if videotape and disc recording really catch on in the domestic market, and the mechanical imperfections of such equipment result in major phase changes of the chrominance signal during the line scan, the use of an improved decoding technique even less susceptible to phase errors than ordinary delay line PAL may make a very useful contribution to colour television engineering. ■

SERVICING THE DECCA

'BRADFORD' CHASSIS SERIES 10 & 30

PART 3. by R.W. THOMSON

FAILURES in the power supply sections of radio and TV sets are usually fairly easy to locate and rectify, blown electrolytics and burnt resistors being all too obvious. Sometimes however faults which give misleading symptoms can arise. An example occurs in the smaller screen models in this series, the CS1730 and CS1830, when a dried out electrolytic h.t. reservoir capacitor (C602) causes the h.t. voltage to drop just far enough to limit the width and height of the picture – without any trace of hum being evident. The larger screen models give a more positive indication of low h.t.

Hum

Sources of hum can usually be readily diagnosed if it is remembered that hum on the h.t. line will be apparent on sound and on the raster but will seldom affect the vision. On the other hand hum on the l.t. supplies will nearly always result in hum bars with little or no colour content, and may or may not appear as hum on the sound sections. Note the negative supply in the c.r.t.'s grid circuit – the preset brightness control VR601 is strung between positive and negative rails. The negative supply is provided by D603 and smoothed by C605 which can be responsible for a hum bar on the picture. Another hum possibility is a cathode-heater leak in one of the valves, the culprit usually being easily identified by the appearance of the raster. Our accident prone friend the PCL82 in the sound section can almost certainly be relied upon to destroy its cathode biasing components as well as itself when this happens!

Loss of capacitance in a reservoir capacitor – that's the one nearest the rectifier – always causes low voltages but doesn't always result in hum, whereas an open-circuit or low-capacitance smoother, such as C601 on the h.t. line or C604 on the l.t. line, creates so much ripple on the d.c. supply as to be just too obvious. Where there are separate reservoir and smoothing capacitors, as in the l.t. supply, it is good practice in the writer's view to replace both together – except in the case of failure in a fairly new set where old age isn't the cause of the defect.

Common Power Supply Faults

The more common power supply faults are as follows:

No sound or raster, R603 open-circuit: Check whether the h.t. rectifier D600 is short-circuit. The correct replacement resistor should be fitted since it offers a great deal of protection, fusing a lot faster than the thermal overload trip (10 chassis) or the anti-surge mains fuse (30 chassis).

Mains fuse blown: Check the mains filter capacitor C607 and D600 for being short-circuit.

No sound or raster, fuse o.k., heaters out: Check for an open-circuit heater, a break in the heater line at the PCL82 base, plug/socket connections.

No sound or raster, heaters, R603, and fuse o.k., small screen models: Check whether the h.t. smoothing resistor R606 (100Ω, replaces L600 fitted in the larger sets) or D600 is open-circuit.

No sound or raster, heaters, R603 and fuse o.k., large-screen models: Check D600 for being open-circuit.

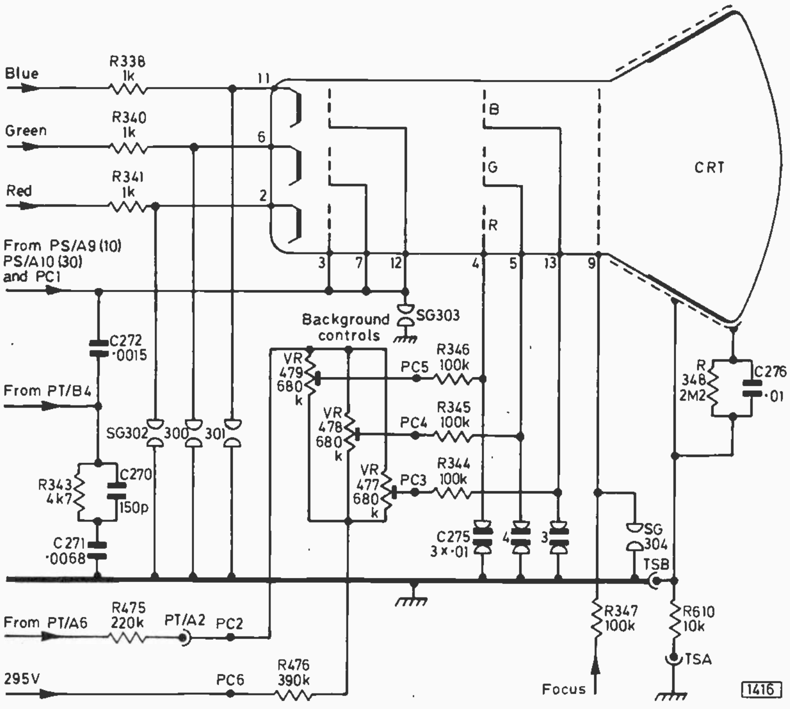


Fig. 1 (left): C.R.T. circuit, 10 series chassis. In the 30 series chassis R610 is omitted, C276 is 0·004μF, VR477-9 are 1MΩ with C409 (0·01μF) shunting R476 and the background controls. C272/R343/C270/C271 are omitted (line flyback blanking is carried out in IC2), the c.r.t. grid bias from R600 and the field flyback blanking pulses from PC1 being fed to pins 3/7/12 via a 10kΩ resistor (R339).

Fig. 2 (right): The power supply circuit used in the 10 series chassis. The circuit used in the 30 chassis is similar, the main differences being as follows. The thermal cutout is replaced by a 2A anti-surge fuse (F3) in the live a.c. lead and a 500mA fuse (F2) from tag F on T600 to chassis; D601, D602 and D603 are type 1N4002, D601 and D602 being protected by parallel 0·01μF capacitors; C604 is 2,500μF and C605 22μF; R606 in the heater line is omitted; R611 is omitted and VR601 is connected directly between C604 and C605 (i.e. there is no R612); the plug and socket connections differ. In the 17 and 18in. models R606 (100Ω) replaces L600. C605 is 47μF in Model CS1830.

No sound or vision, raster present: Check R602 for being open-circuit.
Hum on sound and raster, vision o.k.: Check the h.t. electrolytic can C601/C602.
Hum on vision, raster and sound: Check the l.t. supply electrolytics C604 and C606. Check whether one of the l.t. supply rectifiers D601 and D602 is open-circuit.
Frequent overload cutout tripping (10 chassis) not accompanied by overheating in any other component: Cutout itself faulty, or shorted turns on the mains transformer T600. The latter is uncommon but not unknown.

Power Panel

Some components mounted on the power panel can cause troubles associated with other sections of the set. In particular as mentioned in Part 1 some of the sound components – the PCL82 etc. – are mounted on this board. Attention is again drawn to the damage that can occur in unmodified 10 series receivers, particularly around the PCL82 valve base.

Brightness Faults

Lack of brightness is another fault that can be traced to this part of the set. As mentioned above, the c.r.t.'s bias comes basically from the preset control VR601 which is across the positive l.t. supply from R602/C604 and the negative supply provided by D603 and C605. A change in the value of any of these components, or a faulty slider or track on VR601, will radically change the brightness level. Note that on the 10 chassis there is an h.t. tap via R611 to VR601, but since this resistor carries little current and is not subjected to pulse voltages it seldom gives trouble. What can be more confusing is a screen either too dark or too bright with VR601 having no effect. This is due to the c.r.t. grid spark gap SG303 being leaky or short-circuit.

Quite a common cause of lack of brightness is when R475 increases in value. This resistor provides the feed from the boost rail to the c.r.t. first anode preset controls. As it changes value it eventually leaves the first anode voltages at less than the bare minimum of 450V. In the 10 chassis the other cause of brightness troubles is the brightness/RGB clamp circuit which we dealt with in Part 2.

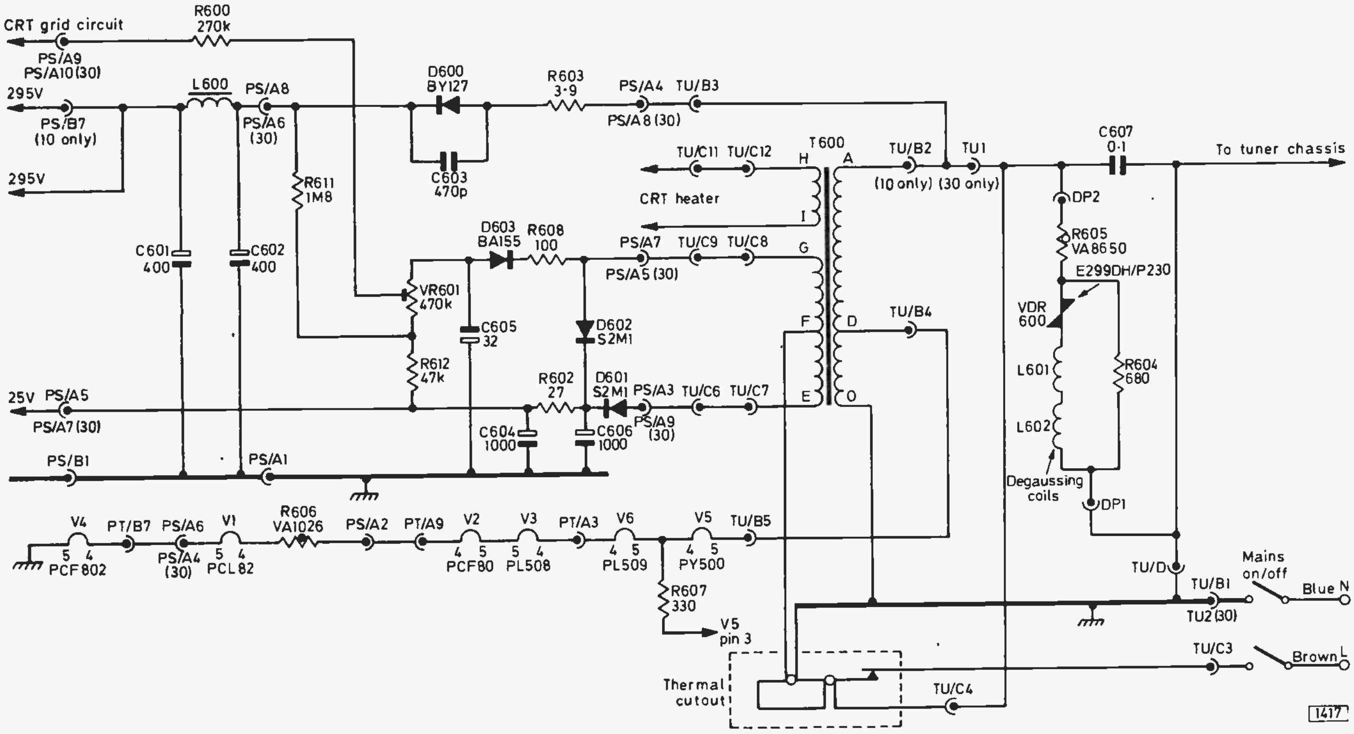
Focus Faults

Loss of focus in the larger-screen sets can usually be traced to R468 which goes high and reduces the focus control voltage range. On the odd occasion R470 can go high, but if it does one has a sure indication that this is the case since the focus voltage goes so far up the scale that the spark gap SG304 has a continuous arc through it – in fact it will melt away if permitted to run like this for long. Replacement of these resistors is a bit fiddly as they are enclosed in the small focus control tube. I prefer to wire them with longer leads, using proper e.h.t. sleeving over the resistors themselves and leaving them outside the box. One watt resistors stand up much better than the original ½W types fitted, and if you carry out this up-rating there is no alternative but to fit them externally – but do insulate them very carefully. This can be done neatly and safely with a little care. No medals are awarded to those who prepare multikilovolt belts up the arm of a future serviceman – who may be you!

Intermittent loss of focus occurs if the lid of the focus control box is not clamped in place properly. It is good practice to clean the v.d.r. with a small piece of sandpaper, roughening off the glaze that forms under the wiper of the focus control. Some people refer to the v.d.r. itself as the focus control: this is incorrect and misleading, the whole gubbins being the focus control. The stick is of necessity a v.d.r. since the voltage source is pulsing and with poor regulation. SG304 can also be responsible for intermittent focus troubles – due to dust.

Convergence

Convergence troubles are sometimes due to failure of the dynamic convergence controls. It is best to use metal-clad controls as replacements as the plastic ones originally fitted



perhaps fault in I.C.
is [illegible] @ fixed potential?

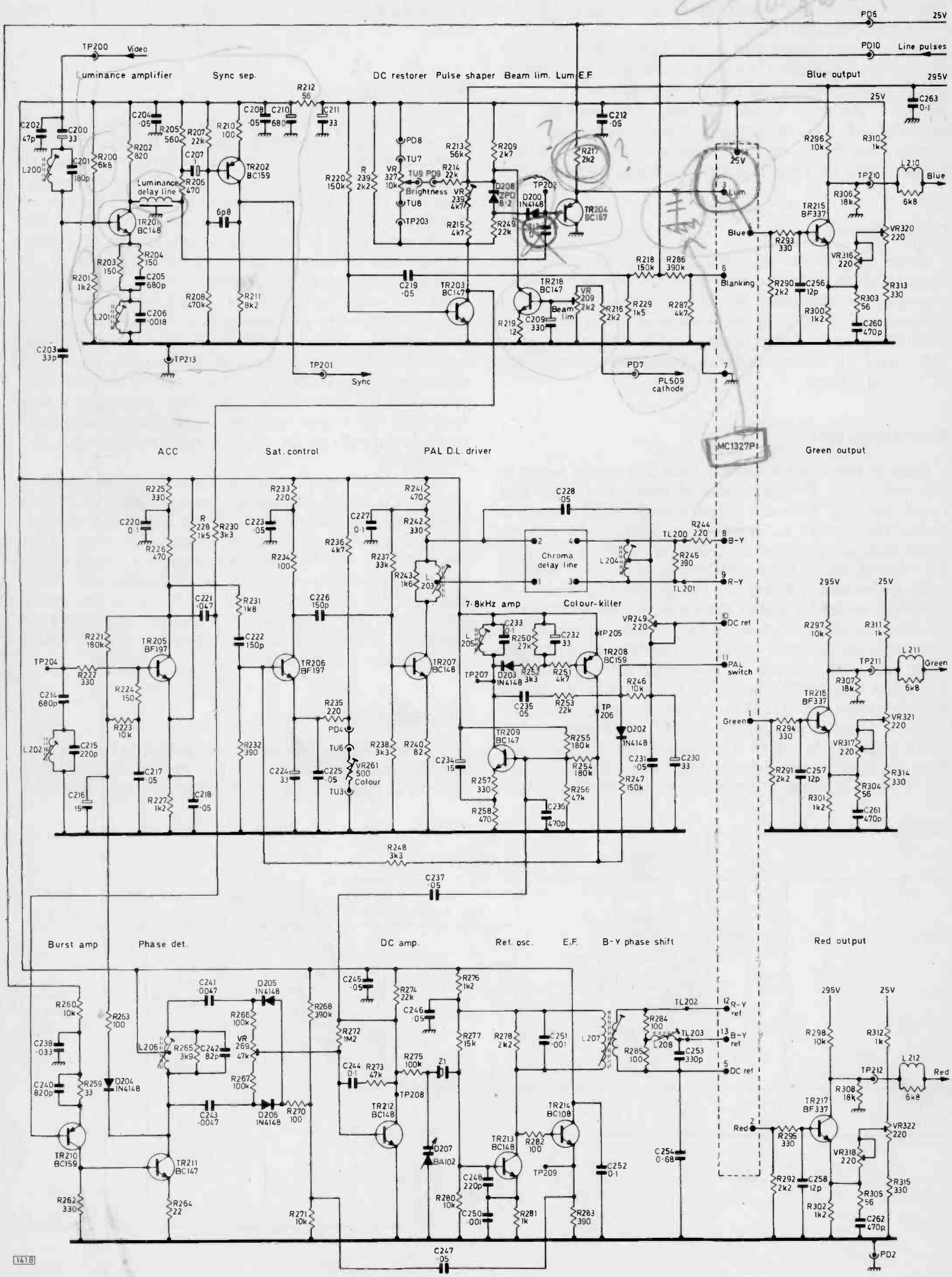


Fig. 3: Circuit of the decoder used in the 30 series chassis.

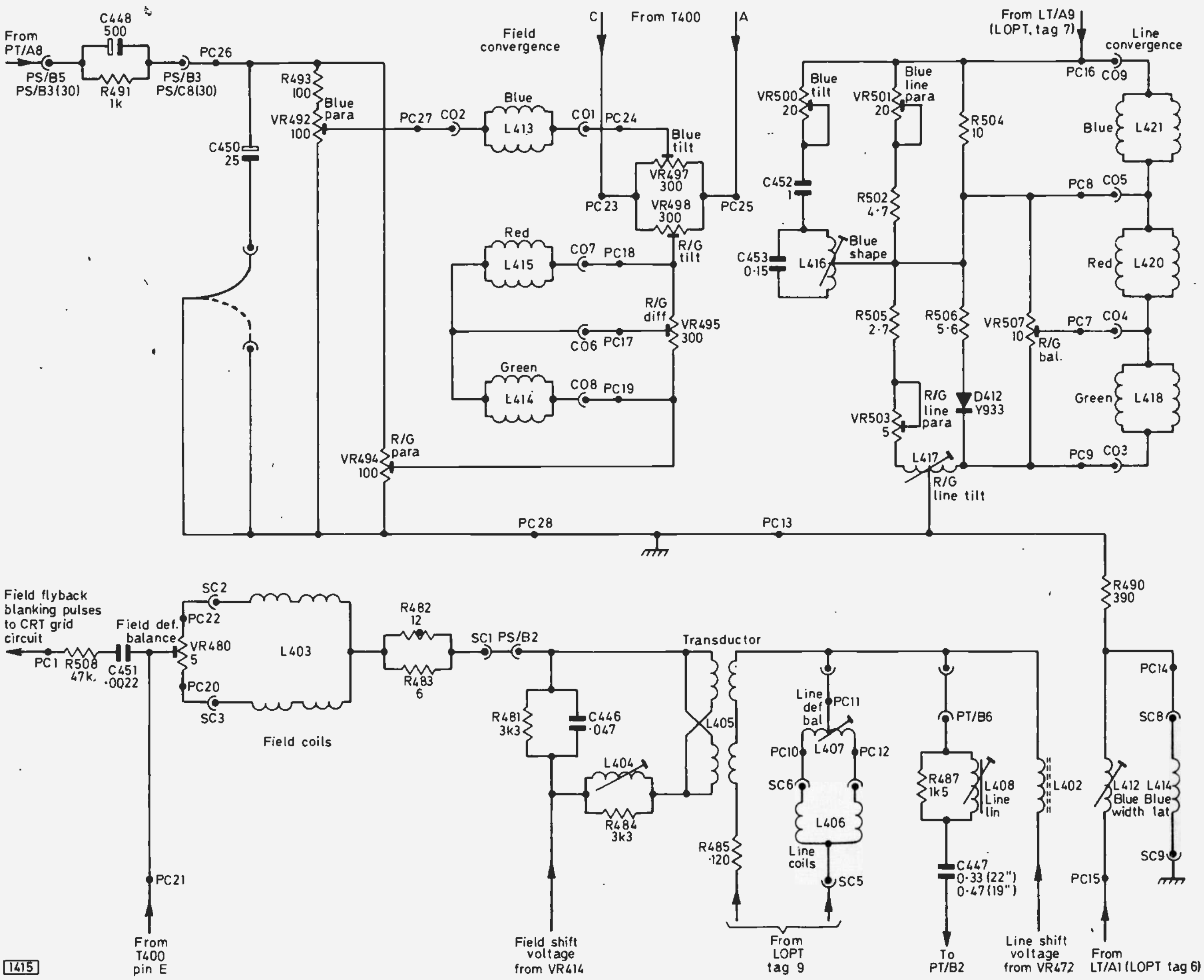


Fig. 4: The convergence circuitry, 10 series chassis. In the 30 series R493 and R508 are omitted, L412 is a tapped coil with the second section replacing R490, R484 is omitted and R481 is changed to 10Ω and is connected across the parallel windings on the transductor. The S-correction capacitor C447 is 1μF in the 17in. model. The small-screen (17, 18 and 19in.) models do not incorporate pincushion distortion correction, transductor L405 and its associated components L404, C446, R481, R484 and R485 being omitted.

seem to be heavily over-run at some settings.

A special word of warning should be given about the convergence wiring. It is possible for the harness to the convergence board to lie dangerously close to the line output transformer. The result can be damage to the convergence circuits if the high pulse voltages appearing at the transformer connections get at the harness insulation. It pays to check the position of the wiring whenever the convergence board has been moved up to its adjustment position or returned to its normal position.

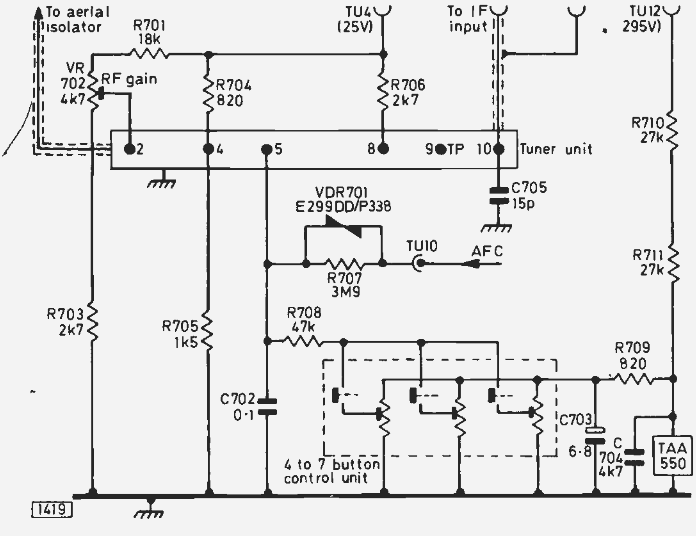


Fig. 5: Circuitry associated with the varicap tuner used in many 30 series models.

There are no great problems with the convergence procedure or with picture centring – though attention is again drawn to the field shift control VR414 which can cause intermittent height fluctuations. R491 can also give trouble as we saw last month. The 25μF electrolytic C450 in the field convergence circuit can go short-circuit, introducing vertical R/G errors and making R492 and R494 ineffective.

Some 17in. c.r.t.s can call for convergence control settings that lead to overheating. This can generally be helped by adding a 6·8Ω 3W resistor between tags 8 and 9 at the edge of the convergence board, i.e. across VR507.

Miscellaneous Faults

Like any other piece of electronic equipment, the Decca Bradford chassis can on occasions produce weird and

VOLTAGE TABLE

The following voltages were measured under normal conditions with a colour picture displayed, using an Avo Model 8 (20kΩ/V).

Transistor	*Ve*	*Vb*	*Vc*
TR3	1·65	2·25	16·5
TR4	5·4	6	12
TR5	12	12·6	21·5
TR6	4·7	5·3	19·5
TR7	4	4·6	10·4
TR8	4·6	—	23
TR9	24	23	2·5
TR10	0	0·6	11
10 Decoder			
TR201	2·15	2·75	12·8
TR202	12·8	12·2	20
TR203/4/5	1·8	2·5	13·8
TR206	20	21	1·9
TR207/TR217/TR225	1·4	1·9	20
TR208/TR218/TR226	0·8	1·4	120
TR210	9·6	10·2	19
TR211	0	−0·1	15·5
TR212	1·2-1·64	1·9	18·5-20
TR213	6·9	7·5	15·7
TR214	20	19·4	19·9
TR215	3·4	3·7	20
TR216	9·4	10	20
TR220	14·3	15·5	0·16
TR221	0·08	0·16	20
TR222	0	0·5	11
TR223	5	5·1	13·25
TR224	12·6	13·25	20
30 Decoder			
TR201	2·3	2·9	12·7
TR202	19·5	19·6	2
TR203	0	−1·5	22
TR204	18·2	10	0
TR205	9·7	10·3	17·6
TR206	1·4	2·1	19·2
TR207	0·65	1·25	12·5
TR208	19·6	19	19·5
TR209	4·8	5	19·6
TR210	19·8	21·7	0·15
TR211	0·09	0·15	19·5
TR212	0	0·5	10
TR213	4·9	5·2	13·2
TR214	12·5	13·1	19·6
TR215/6/7	8·1	8·4	125
TR218	0	0·5	36

Valve	*Va*	*Vsg*	*Vk*
V1T (10)	80	—	1·2
V1P (10)	190	200	16·3
V1T (30)	110	—	1·4
V1P (30)	295	240	21
V2T	93	—	0
V2P	90	96	0
V3	280	260	24
V4T	245	—	3·5
V4P	140	235	2
V6	—	250	—

Pin	*IC1*	*IC2*
1	6	8·1
2	5·65	8·1
3	4·6	18·2
4	2·2	8·4
5	2·3	6·6
6	2·3	−0·5
7	0	0
8	0·03	3·7
9	—	3·7
10	—	3·7
11	4·6	3·7
12	—	6·6
13	4·6	6·6
14	12·5	24·6

C601 295V; C602 308V; C604 24·6V; C605 −40V; C606 31·5V.

wonderful causes of failure. Some of these are avoidable since they arise due to carelessness by servicemen.

Two outstanding examples which come to mind are failure of the valves to heat after valve replacement – particularly where the PCL82 or PL508 is concerned – and damage to the convergence board wiring due to lack of clearance between the harness and the line output transformer (see above). The latter fault can be avoided by tying the harnesses back out of the way as is done by the manufacturers in later models. The former trouble can be avoided only by taking care when changing valves. Both the PCL82 and PL508 valve bases have to endure a fair amount of heat, which makes the surrounding material brittle and introduces the danger of cracks – with the resulting intermittent faults one associates with hair-line breaks in the tracks. The PL508 often unsweats the base connections from the panel, resulting in either no field scan or the mind-boggling type of intermittent fault one learns to live with in time!

Shorting of the boost diode and line output valve top cap leads to chassis is quite often found, especially if they've come off and been resoldered. If this happens, don't just trim the end and resolder. Cut a new length of wire just a bit longer than the original, dressing the wiring away from the valve and the screening cans to avoid the considerable heat in this part of the set (once again, in the case of excessive overheating here remember to check R453 which can go low and R450 which can go high). Refitting the cap to the original lead merely brings it closer both to the valve and the earth screens, increasing the local heating and the danger of flashovers.

In later 25kV sets an insulation ring is added at the underside of the boost diode valve base in order to give improved protection against flashovers – and spasmodic fuse failure. The part number is 850070. C.R.T. flashovers can result in a sizeable pulse appearing at the earthy end of the tripler. This can get into the timebase and the decoder circuits, causing failure of components such as the flywheel sync discriminator diodes D402/D403, the horizontal shift rectifier D404, the pulse shaper transistor TR211/TR203, and the MC1327 i.c. To provide protection a 1-2kV 0·75pF sparkgap (Centralab type GC00075-1201) was added between tags 8 and 9 on the line output transformer.

We've given quite a list of faults and their causes, but it is unlikely that more than one or two will ever arise in a particular set. The faults mentioned have been found randomly in a large number of sets over a period of more than five years, and the percentage of receiver failures compares very favourably with other makes handled by the writer. All sets have their particular bugs, and I hope I've covered most if not all those in the Bradford chassis. Some other set designs I've dealt with would require an article twice the length of the present series in order to cover the faults to which they are prone.

Service Notebook

G.R.WILDING

Floating Picture

A fairly common fault with sets fitted with the Pye group's hybrid colour chassis (691-697 chassis) is a line and field locked picture which floats sideways across the screen in one direction or the other. The cause of the trouble is in the flywheel sync discriminator circuit of course, and in nearly all cases is due to the 47kΩ pulse feedback resistor R203 (see Fig. 1) being high resistance or burnt out.

The action of the circuit is as follows. R203 in series with C204 feed a high-amplitude negative-going reference pulse to the circuit from a winding on the line output transformer. To optimise the phasing, i.e. sharpen the edge of the resultant waveform, a similar polarity but smaller amplitude pulse from a separate winding on the transformer is fed to the circuit via C202. The negative-going sync pulses are applied to the junction of the discriminator diodes D40/D41 via C203, whose small value minimises interference from noise pulses and the field pulse train. R203 acts with C206 to integrate the main reference pulse, a 25V peak-to-peak sawtooth being developed across C206. The output obtained from the following filter components, which set the circuit's pull-in range, depends on the phase relationship between the sawtooth waveform and the sync pulses. C205 shunted across D40 minimises circuit unbalance during absence of the sync pulses when changing channels etc. The action here is not always fully appreciated. The trouble arises since D40 will tend to conduct on the positive tips of the sawtooth, producing a charge on C203. This alters the circuit's output voltage, shifting the oscillator's frequency. Adding C205 produces a charge which cancels that developed by C203.

Due to the high amplitude of the main reference pulses – –700V peak-to-peak at the line output transformer take-off point – a considerable current is passed by R203. As a result it will often be found damaged, of changed value or completely burnt out after some years service – giving the floating picture effect described.

In many cases one or both of the discriminator diodes will be found short-circuit. This was the case with an Ekco Model CT103 receiver which was brought into the workshop recently. After changing both diodes and R203 line lock was restored but performed in an unusual manner following each channel change: the picture would at first be displaced well over to one side of the screen and would then move across to be almost as far out on the other side, subsequently making repeated shifts of decreasing extent until the picture finally settled down midway. Clearly there were other component defects and it was found that both the diode load resistors R204 and R205 had gone high resistance. On replacing these the drawn out hunting action ceased.

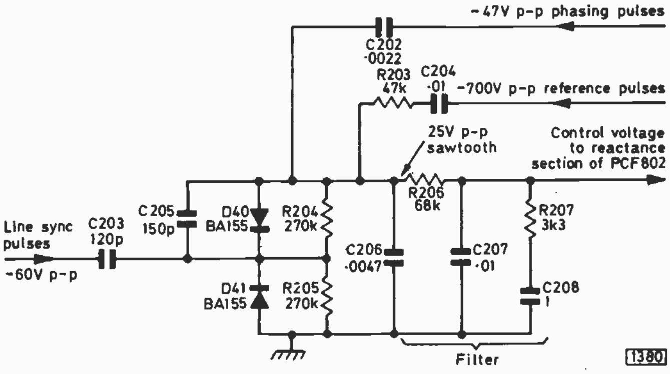


Fig. 1: Flywheel line sync discriminator circuit used in the Pye group hybrid colour chassis (691-7).

Failure of a discriminator circuit to control a sinewave line oscillator results in the floating picture symptom rather than loss of sync since even in the absence of sync pulses this type of oscillator has an inherent tendency to remain on frequency.

No EHT

Twice recently we have come across ITT colour sets fitted with the CVC5 series chassis exhibiting the "sound, no raster" symptom but accompanied by a slight smell of burning. The cause in both cases was a defective tripler producing negligible e.h.t., its internal short burning up the nearby 470Ω resistor R426 which forms part of the tripler earth return path – via tags 1, 4, 5 or 9 of the line output transformer.

Weak Field Sync

Good line sync but weak field sync was the problem with a Bush Model TV181S monochrome receiver (A774 chassis). It wasn't improved by fitting a new PCL805 field timebase valve, while the next suspect, the interlace diode 3D5 via which the field sync pulses are applied to the field timebase, was found to be perfect. Good line sync, particularly where as in this chassis a sinewave line oscillator is used, does not however mean that the sync separator is operating perfectly. In this chassis a BC117 transistor is used as the sync separator. Its collector voltage read about 95V, just within ten per cent of the correct figure of 87V. Since a sync separator, whether valve or transistor, is cut off most of the time however any failure to completely saturate when the sync pulse arrives can produce only a small variation in the anode or collector voltage. Normally with a transistor sync separator one finds a base bias network, but in this case there is a direct feed from the collector of the BF178 video output transistor. The obvious course was to try a new BC117, and on doing so really firm field lock was obtained with the collector voltage very close to the correct figure.

Oversized, Low Brightness Picture

A 12in. Ferguson mains/battery Model 3816 (Thorn 1590 chassis) had an oversized picture of low brightness level, while a severe hum bar near the centre of the screen resulted in the picture wavering about and made it impossible to get

Service Notebook

2

firm timebase locking. The oversized picture immediately suggested that the e.h.t. was low, probably due to low l.t. rail voltage as a result of a dried up reservoir electrolytic. On removing the set's plastic cabinet and switching on however we found that the AD149 series regulator transistor was running cold. Apart from the audio output stage supply, which is taken directly from the reservoir capacitor, the entire receiver current was passing via the AD149's parallel 10Ω resistor. The result of course was an excessive voltage drop, low l.t. rail voltage and the symptoms noted (the hum bar was present because the rail voltage was varying during the field scan).

Now a variety of faults could be responsible for the AD149 failing to conduct. Going on probabilities however the transistor itself was likely to be defective. Since the values of the adjacent resistors in the circuit are low, it's impossible to make reliable checks on a regulator transistor without isolating it. On disconnecting the AD149 and making ohmmeter checks from each electrode to each other one in both directions we discovered that the base-emitter junction was open-circuit. After checking for possible defects elsewhere in the circuit we fitted a replacement, set the "set h.t. volts" preset control for minimum output, connected the voltmeter across the l.t. rail, switched on and slowly increased the setting to obtain the precise specified l.t. rail voltage of 11·6V. In all portables it is extremely important to ensure that the stabilised l.t. rail voltage is correct: otherwise, apart from inhibiting the action of the stabiliser circuit, the results can be excessive e.h.t. which strains the line output transformer and transistor and the e.h.t. rectifier – also an overrun c.r.t. heater (since this is generally fed from the l.t. rail) which will shorten the tube's life.

Smoke and Burning

When smoke and the smell of burning carbon resistors come from a TV chassis the first move naturally is to locate the components concerned and then find and remove the short-circuit responsible for the excessive current flow. The cause of the trouble need not necessarily be a short-circuit however, particularly in complicated colour TV circuitry. It could well be that a low-resistance path in parallel with the burning resistors has gone open-circuit.

OPTOCOUPLED AUDIO EXTRACTOR

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The transformer used in the prototype and specified in the components list had a secondary rated at 12-0-12V at 50mA, whereas the circuit diagram implied that a 15-0-15V component had been used.

Because of the poor regulation normally inherent with this type of miniature transformer, the r.m.s. output of the 12V winding when supplying a load of only about 2mA is near to the 15V quoted on the circuit diagram. In any case, VR2 should be adjusted for a voltage of $\frac{1}{2}V_B$ across R2, as described in the text.

The printed board can be obtained from WKF Electronics, Welbeck Street, Whitwell, Worksop, Notts S80 4TW at 62p plus 10p post and packing (price includes VAT).

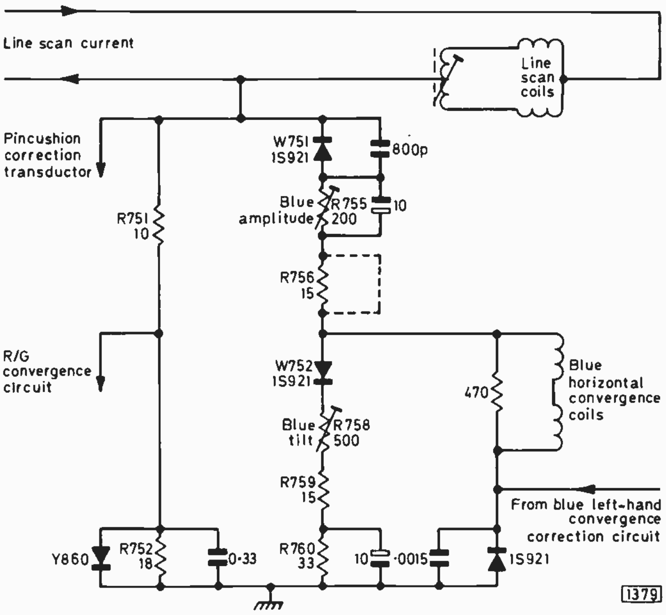


Fig. 2: Part of the blue horizontal convergence circuit in the Thorn 3500 chassis. Where there are parallel resistive paths, open-circuit components can cause burn ups.

The owner of a colour set fitted with the Thorn 3500 chassis 'phoned to say that while watching the set the picture suddenly degraded and smoke then started to rise from between the top of the tube and the cabinet – before he hastily switched off. On inspection, no damage was evident. But on next removing the plastic cover over the various preset convergence controls we found three resistors and two miniature diodes badly burnt, while the blue tilt and amplitude controls were somewhat blackened. Our first move was to remove all these components, clean up the discoloured convergence panel and check the adjacent capacitors which proved to be o.k. On studying the circuit – the section concerned is shown in Fig. 2 – we discovered that as expected the damaged components – W751 through to R760 – are connected in series and that there is a parallel low-resistance path, formed by the two wire-wound resistors R751 and R752. R751 was found to have gone open-circuit, with the result that excessive line scan current had passed via the damaged components. After making the necessary component replacements and doing some slight reconvergence a first class picture was obtained.

Had R752 gone open-circuit, the components in the R/G section of the convergence circuit would also have been damaged.

Field Collapse

The trouble with a Rediffusion monochrome set was complete field collapse which fitting a new PCL805 field timebase valve failed to cure. Wobbling the valve in its holder – to make and break the pentode anode current – didn't produce any movement of the horizontal white line, so clearly the fault was not failure to oscillate but negligible or zero anode current in the output pentode section of the valve. Likely causes were an open-circuit screen grid feed resistor or cathode bias resistor, though in practice when the latter goes open-circuit the parallel low-voltage decoupling electrolytic capacitor generally breaks down to give at least some anode current. Open-circuit scan coils or a short-circuit across the field output transformer were other, less likely possibilities. An open-circuit field output transformer primary winding would have resulted in grossly excessive screen grid current – often enough to make the screen grid winding visibly red.

In this set the panel carrying the field timebase circuit is secured to the bottom of the cabinet. Since there isn't an inspection panel, to check for an open-circuit screen grid feed resistor we removed the valve and applied the meter to pin 7 of the holder. Full rail voltage was found to be present, so assuming that the holder itself was o.k. the trouble was likely to be an open-circuit cathode bias resistor. This component turned out to be intact however, the cause of the trouble being traced to a break in the printed wiring between this component and the valve-holder. A normal raster was restored on soldering across the printed circuit crack.

EHT Troubles

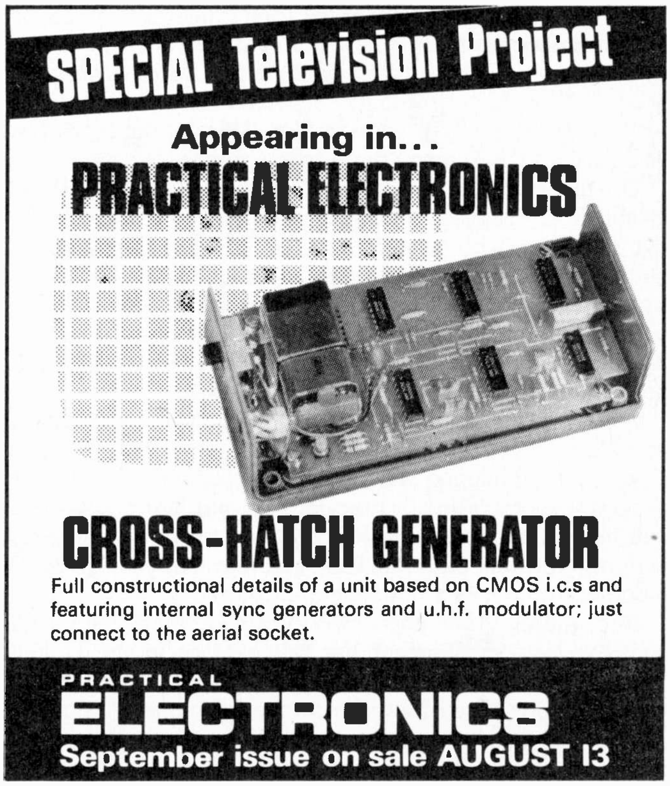
The raster on a Thorn colour set fitted with the 3000 chassis had vanished suddenly, though the overload cutout had not come into operation. On removing the back we could see no signs of any damaged or overheated components so as all the fuses were intact we switched on again. For a second or two a sort of squeal came from either the line output or e.h.t. transformer, but no e.h.t. materialised. We disconnected the tripler from the e.h.t. transformer and found that it had a resistance to chassis of only a few kilohms. It had clearly broken down, but on next checking the pulse output socket on the transformer we found that only a very small arc could be obtained. Inspection then showed that the casing of this transformer was cracked and opening up – usually a sure indication of breakdown.

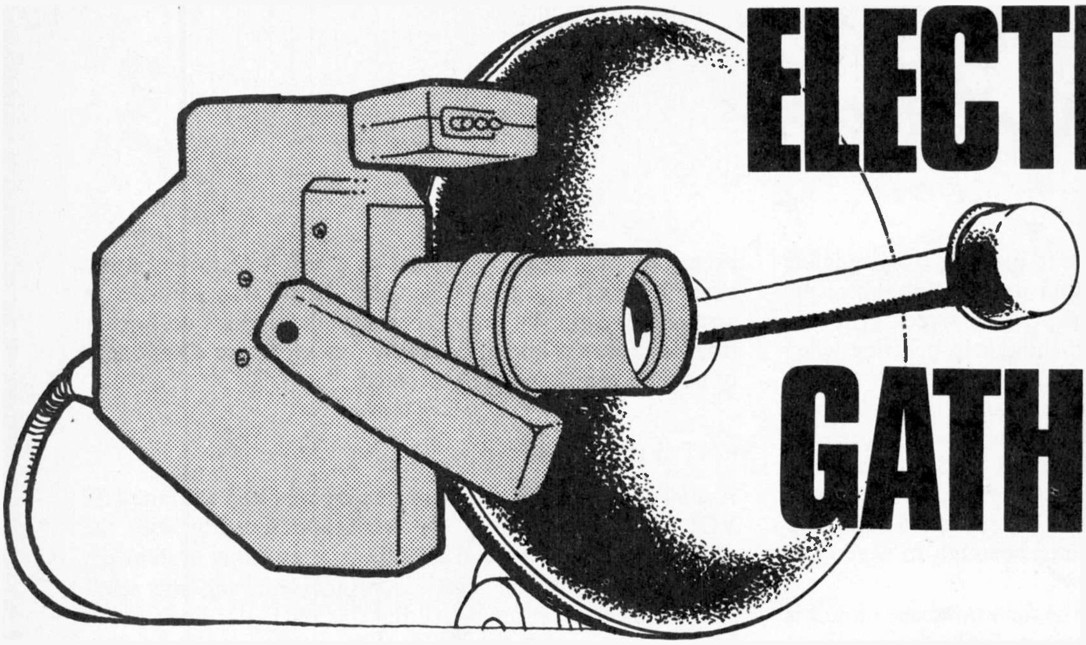
After replacing the transformer and tripler the picture reappeared, and on making some further adjustments, including the vital set e.h.t. control, very good results were obtained. The set e.h.t. control is in the power supply and determines the h.t. – which should be within the range 58–65V – applied to the line, field and audio circuits, and thus the e.h.t. Its setting should always be checked when servicing sets fitted with the 3000/3500 chassis, especially if the tripler or any components on the power supply panel have broken down. Incorrect adjustment can result in the chopper output rising to 70V or more, with proportional and possibly damaging effects on all components associated with the line and e.h.t. outputs.

We were recently called to service one of these sets which was giving occasional "loud cracking noises". As anticipated, the cause was e.h.t. spark overs, due solely to the fact that the set e.h.t. control was fully advanced, resulting in a chopper output voltage of 72V. The grossly excessive e.h.t. being produced as a result of this was the cause of the flashovers. When the control was adjusted in accordance with the manufacturer's instructions no further trouble occurred and undoubtedly an expensive component or panel breakdown was prevented.

EHT but No Raster

A dual-standard KB monochrome model fitted with the ITT VC1 chassis came into the workshop recently with the complaint "sound normal but no raster on either system". It was noticed however that on rapidly rotating the v.h.f. channel selector, momentary but narrow raster lines would be produced across the screen. This proved that e.h.t. was present, so the fault was clearly due to incorrect c.r.t. operating voltages – either the cathode was too high, the grid too low or the first anode voltage low or zero. The first move therefore was to short the grid and cathode pins with a screwdriver blade to remove all bias. This should have produced a full brilliance raster. The screen stayed unlit however so the trouble was the first anode voltage which turned out to be only 125V instead of the correct figure of 410V. As usual, the voltage is obtained from the boost rail via a fairly high value resistor (470kΩ) decoupled by an $0{\cdot}05\mu$F capacitor. Usually it's the decoupling capacitor which causes this fault by leaking or going short-circuit, but an ohmmeter check showed that the capacitor was blameless in this respect. The resistor had clearly gone high value, and on connecting a replacement across it a bright but narrow raster appeared. The replacement was fitted and the lack of width found to be simply the result of the two line hold controls being incorrectly set. On plugging in an aerial and resetting them full width was obtained.





ELECTRONIC NEWS GATHERING

Pat HAWKER

A SUBSTANTIAL stone has recently been thrown into the pool of American television and the ripples are already reaching Europe. The stone carries the legend "electronic news gathering" (ENG) or alternatively "electronic journalism", and accounts for a significant proportion of current American equipment purchases. As a means of providing more, better or cheaper news coverage it is seen by some as opening new windows on the world; by others, concerned with film, it is being more coldly and reluctantly welcomed – though few now doubt that ENG is here to stay.

The starting point is that electronic equipment – including lightweight colour cameras and videocassette recorders – has now reached the stage where it can be used by news teams as an alternative to the 16mm film traditionally used for this purpose.

Advantages

It offers several advantages. First "live" coverage or instant replay so that the newsman can be sure that he has what he wants without waiting for a film to be processed. Secondly the picture quality is potentially as good as or better than hurriedly processed film. Thirdly, the tapes can be erased and used many times over – film is for ever.

On the other hand a film camera is extremely reliable, mechanically rugged, readily transported and can be used by one man with a minimum of advance preparation. Until very recently "live" TV coverage using electronic techniques required a large OB vehicle, considerable preparation and extremely high equipment costs. It was a case of "have camera will travel" or "have electronics will need a fleet of lorries".

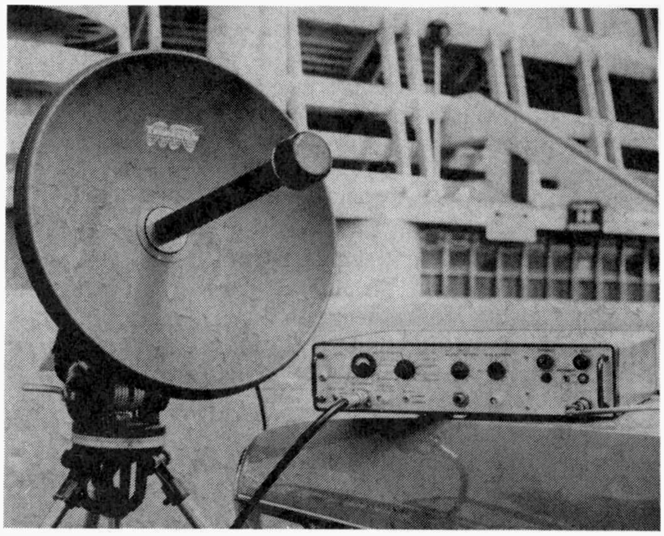
A few years ago a new look began to be taken at providing more compact OB units. In 1973 Thames Television developed an airborne production unit for programmes recorded in Europe; ITN put into operation a unit based on an extended Range Rover for news, complete with microwave link facilities and the Ampex VR3000 recorder, using it as a vehicle-mounted unit.

But during the past two years a new and still controversial development has taken place in the United States. This is the use of more truly "portable" equipment which can be operated away from the vehicle with much the same freedom of movement as the film camera gives. And if the full economic advantages of re-usable tape over one-time film are to be achieved, then the operation needs to become "all-electronic" so that the film processing unit can be closed down.

Disadvantages

Critics of electronic-news point out that the "portability" of electronic cameras, recorders and microwave links has, at least until now, been of a different order to that of the film camera. An electronic newsman not only looks like a loaded up Father Christmas – he's also decked out with as many "goodies" as a Christmas tree: heavy back-packs, restricting multiconnecting cables, shoulder-carried camera heads, battery belts, recorders which can just about be carried suspended from a harness. Other problems are that cable plugs and sockets are easily damaged; batteries react against relatively heavy loads and hard use; two-man sharing of loads may help move the equipment but result in umbilical cords and add to manpower; impromptu microwave links may suffer interference or from multipath problems or show an unwillingness to batter their way through city skyscrapers and tower blocks.

Although an unanticipated number of maintenance problems were met by the pioneers of electronic news, it's



A portable microwave system for ENG manufactured by Terracom.

nevertheless being increasingly used by all three major American television networks – CBS, NBC and ABC – and by a small but increasing number of independent stations. The Ikegami HL33 and HL35, Fernseh KCN, and Philips PCP90 cameras are being used, with the RCA TK76 and the Thomson-CSF "Microcam" expected shortly.

At the recent Chicago convention of the National Association of Broadcasters a number of new ENG cameras were introduced, with the trend towards the elimination of the back-pack or ground-rested electronics-pack. The new Ikegami HL77, Hitachi SK80 and NEC MNC-61 are examples of integral one-piece cameras. The "Microcam" and TK76 make use of large-scale integration to reduce the size and weight. The "Microcam" has a camera head, including lens, weighing only 8lb; a shoulder-slung electronics hip pack of just 3lb; and with a consumption of 22W can operate from a battery belt of as little as 2lb.

VTRs

The standard videotape recorders for ENG (except where vehicle mounted) are U-matic recorders such as the Sony VO-3800 which provides 20 minutes of colour recording on a single $\frac{3}{4}$in. tape cassette and weighs 30lb. JVC have a similar format CR4400U machine weighing 24.5lb, and some Akai machines are also in use.

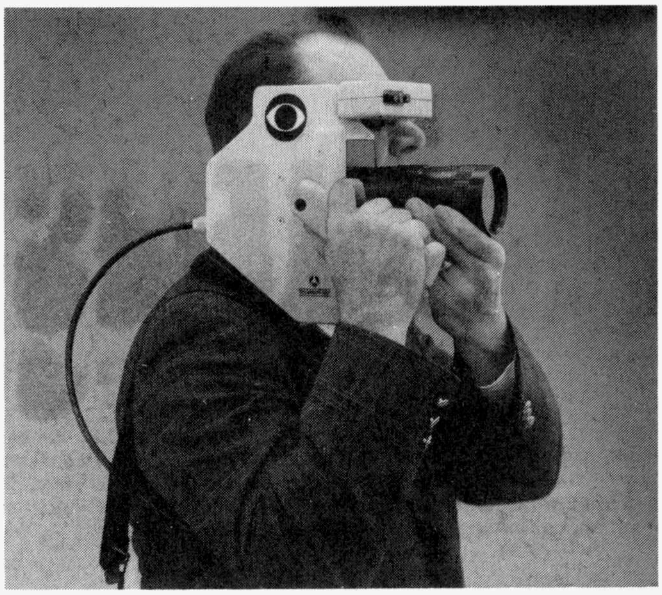
Two years' experience has shown that a television news team of just two or three people can cover a series of events or interviews around a city, either taping the material or sending it to the studios via a microwave link (usually at 2GHz). In practice tape is being used in preference to microwaves except for "live" coverage. This is partly because of interference and multipath problems, and partly because it is easy and pleasant for the news team to drop back to the studios for a quick coffee.

The system certainly works. The quality of ENG material is generally up to the standard of 16mm film that has been force-processed at high speed. Some American broadcasters have even begun using their ENG equipment rather than film for full length 30 minute and one hour documentaries.

Even ENG enthusiasts admit that there are headaches – though some are firmly convinced that news film is on its way out. ENG has had severe reliability problems, with equipment out of commission for a higher percentage of time than had been anticipated, and requires more maintenance (for example very frequent cleaning of v.t.r. heads) than had been expected. There have also been management problems in reaching agreement with unions over staffing levels. Then the economic advantages of ENG look less certain if instead of wiping and re-using the tapes they are stored away for possible later use.

CBS have been operating "all ENG" at St. Louis for over two years; they are busy converting CBS Chicago where two ENG minicam vehicles are in use and two more nearing completion; CBS Los Angeles will be all ENG by 1977; CBS Philadelphia is part ENG; but New York is proving a difficult city for ENG because of microwave problems. NBC claim that in Chicago their news coverage has been increased by 57% and in New York by 42% through using ENG. They will have over 20 new ENG colour cameras in use this year. In California NBC have a helicopter devoted to ENG operations, and they will soon have more than a dozen ENG tape editing rooms in use. ABC are making considerable use of ENG in Washington DC.

Sony have just introduced a new portable recorder, type BVU100, and the compact 1in. Bosch Fernseh BCN series has been licensed to other firms.



The Thomson-CSF "Microcam" colour camera. With lens and viewfinder, it weighs only 8lbs, and the shoulder-slung electronics pack only 3lbs.

Some Americans are calling for a $\frac{1}{2}$in. tape in cassette format. Some are providing time-code editing in the field to save time back at the news centre. Some broadcast from Sony VO-2850 editing-type machines. Others transfer the edited stories to 2in. quadruplex machines, including the large ACR25 cartridge machines, for insertion into the newscasts. There is enormous variety in the way in which different stations are tackling ENG.

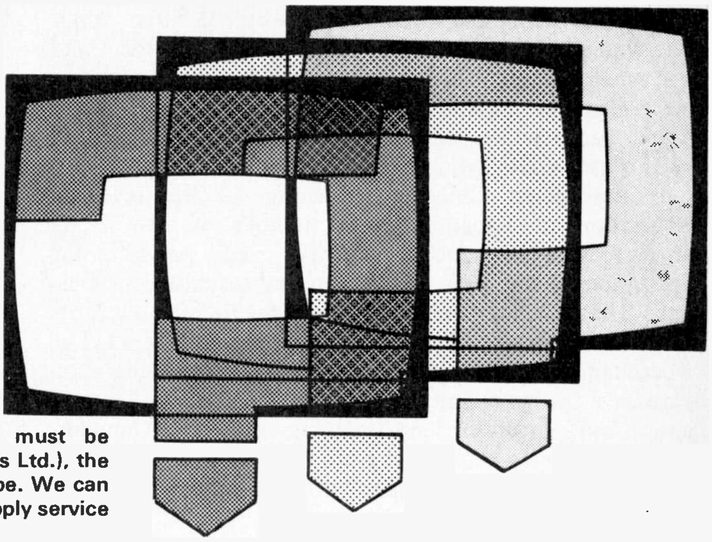
For "live" coverage, quickly set up microwave links are essential. Rapid progress is being made in this area – though the broadcasters are pushing for still further improvements. Transmissions from vehicles are usually circularly polarised, a number of dishes being permanently installed at the receiving base with remote switching facilities for changing direction or polarisation. "Quad polarisation" is being advocated – this implies the ability to select either right-hand or left-hand circular polarisation, or vertical or horizontal linear polarisation. When a circularly polarised signal is reflected from a building it automatically reverses polarisation. Links are established to base at 2 or 7GHz, and light-weight short range 13GHz equipments are available to link an ENG team with its vehicle.

Prospects

For the future there is speculation on the feasibility of integrated camera/recorders, possibly using disc techniques. The main aim is to reduce interconnections and setting-up times so that ENG can compete with film in getting into action fast when the unexpected happens. Film is not standing still however, but is fighting back with improved film stocks and in one advertisement stresses "no back-pack, no separate recorder, no timebase corrector – a 'street-ready' system under $10,000". Once an American station begins to use ENG however it becomes more and more anxious to close down its film operations to avoid the expense of running both systems.

At the moment the tide is flowing for ENG, but with rather more hesitation than just a year ago. Film men call for "balanced" film and electronics, stressing that each can cover some news events better than the other. ■

Your PROBLEMS solved



Requests for advice in dealing with servicing problems must be accompanied by a 50p postal order (made out to IPC Magazines Ltd.), the query coupon from page 557 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.

MARCONIPHONE 4717

The fault with this set is colour patterns at the top and bottom left-hand corners. The colouring is blue-green at the top left and red-blue at the bottom left. Adjusting the purity magnets with a red raster will not clear the patterns – nor will adjustments with blue and green rasters. Adjusting the convergence does not produce any improvement. Shifting the yoke with a red raster displayed produces the normal impure raster but does not alter the corner colouring. Degaussing has made no improvement and I now suspect the c.r.t.

If you have tried all combinations of purity magnet and deflection coil positions and there are no magnetic fields around the set it would seem that the c.r.t. is responsible. In such cases we have found that strategically placed miniature bar magnets (RS Components type) on the degaussing shield often improves matters. (Thorn 3500 chassis.)

SONY TV9-306UB

The problem is striations – light and dark vertical bars approximately $\frac{3}{4}$in. wide – right across the screen, slightly darker on the left-hand side. These are prominent after switching on, then gradually decrease in prominence until after about two hours they are just noticeable (if you look for them) but do not interfere with viewing – they are clearly evident when there is no signal however.

We suggest you first check C816 (0·05μF, 500V) which decouples the c.r.t. first anode. If this does not resolve the fault, check D805 which clamps the line flyback blanking pulse to chassis. Finally, the line output stage tuning could be upset due to a faulty output transformer or one of the capacitors C810-C813.

BUSH CTV1222

After five months the fault "sound but no raster" developed. There was burning in the line output stage, and to cure the fault the engineer replaced 6R9. Six months later the engineer again called due to burning in the line output stage, and again replaced 6R9. On neither visit was the e.h.t. tray replaced. Recently I was called in and found that a 2W resistor had been fitted in the 6R9 position and was badly burnt – so badly that its colours were beyond recognition. The smoking still occurs with the focus and e.h.t. leads disconnected, so I suspect a faulty e.h.t. tray though I am not sure what the purpose of 6R9 is. Could a higher wattage type have been fitted to avoid replacing the tray?

The official wattage rating for 6R9 is $\frac{1}{2}$W. It is connected in series with the e.h.t. tripler's earth return path, so there is almost certainly leakage in the tripler. It would do no harm to fit a 1W replacement resistor – and a new e.h.t. tray of course. (RRI A823AV chassis.)

EKCO T520

The sound on this set is not as loud as it should be. The PCL82 audio amplifier/output valve has been changed and its associated resistors and capacitors checked but the problem remains.

Inject a test signal at the volume control. If the resultant audio output signal is up to standard the weakness is earlier and you will have to go through the i.f. stages to find where the loss is occurring. If the audio output is not up to standard and the PCL82 and its associated components are in order suspect shorted turns in the output transformer. This is a more common condition than was once the case and is one which should not be overlooked. (Pye 368 chassis.)

FERGUSON 3711

If the temperature is low the picture appears in black and white when the set is switched on and colour appears only after about an hour. The fault seems to be due to temperature since it occurs only when the weather is cold. It happened previously while the set was under guarantee and a replacement panel then restored correct operation.

This type of fault could be due to one of a large number of components in the decoder section, and without voltage readings etc. it is difficult to be specific. The first action to take is to over-ride the colour-killer when the fault is present. This is done by connecting an 82kΩ resistor from the rear end of R339 (junction R339/C323/C324) to chassis. If this action results in unlocked colour, suspect the d.c. amplifier transistor VT303 (BC183LB) which controls the reference oscillator, its anode load resistor R319 (56kΩ), or a wandering crystal. After servicing in this part of the receiver the presets R309, R312 and R315 should be readjusted as specified in the manual. If over-riding the colour-killer does not produce any colour suspect a fault in the chrominance stages VT110, VT309 and VT310, the pulse polarity splitter stage VT308, or a stalled oscillator (VT304). (Thorn 3500 chassis.)

MURPHY CV2214

Two horizontal grey bands of colour, separated by about two thirds of the screen height, drift slowly up the screen. The bands are about 1½in. deep and the fault lasts for one to two hours. The l.t. bridge rectifier and the electrolytics in the l.t. supply circuit have been replaced.

There is also an 18V zener diode in the l.t. supply to the decoder. We suggest you check this, then the 11V regulator transistor on the decoder panel and its emitter decoupling capacitor 3C16 (47μF). An oscilloscope would be invaluable in tracing this ripple, which could even be present on the h.t. line due to failure or poor earthing of the h.t. electrolytics. Make sure that the decoder panel is properly earthed. (RRI A823AV chassis.)

PHILIPS G24T301

There is a horrible noise from the speaker when the set is switched on from cold. It can be reduced by turning down the volume control. The fault clears once the set has warmed up, but while present it's accompanied by a picture with very low contrast. It takes about ten minutes for the picture to reach the correct contrast.

Incidentally, I had one of these sets that kept burning out line output transformers. The trouble ceased after fitting a new i.f./line timebase panel. As a matter of interest I put a hacksaw through the old panel, and found that around the high-value width circuit resistors (R2166/7) the panel was badly burnt on the inside, though there was no external indication of this. Obviously the trouble was due to the panel conducting.

Thanks for telling us about the board trouble. A point to note! Your new problem sounds to us like some form of i.f. instability. We suggest you check the two electrolytics C2075 and C2074 in the a.g.c. circuit, and C2035 which smooths the supply to the first two i.f. stages and the a.g.c. amplifier, preferably by substitution. Small decouplers like C2041 and C2033 which decouple the collector supplies to the second and first i.f. amplifier stages respectively are also possible culprits. The use of freezer and light heat from a hair-dryer might help reveal the component responsible. (Philips 300 chassis.)

DECCA CS2214

There are about six white lines approximately an inch apart down the left-hand side of the screen. They don't show up on a dark background, only on a light background. I notice that R487 has cracked in half.

R487 damps the line linearity coil. Since it is open-circuit the coil is ringing and thus producing the striations on the screen. Replacing the resistor (1·5kΩ, 2W) will cure the fault. (Decca Series 10 chassis.)

ITT ARISTOCRAT SV048

I had to keep retuning the picture, until finally I could get a picture but no sound or by further adjustment sound but no picture – just occasionally picture and sound for a time. The tuning is now quite dead however, with just a raster present. The raster is narrow, about two inches short on either side, with the width control having no effect. The top cap sparks are very weak – about 1/16 of an inch. On touching or getting near C95 I get a loud sound consisting of a jumble of foreign stations! Whilst trying to adjust the line oscillator coil with a metal screwdriver it seemed as if something shorted and the raster collapsed. The focus was also a bit out, with correct focusing only at the edges of the picture.

The lack of width and poor focus are tied up with the absence of signals since the small-signal transistors are supplied by a rectifier fed from the line output transformer. All these faults should clear up when the high-value resistor feeding d.c. to the width circuit is replaced – it may consist of two resistors in series (4·7MΩ and 5·6MΩ, 1W or 2W). First however the line oscillator must be repaired. It is likely that you have damaged the coil: check it for continuity. C95 feeds the signal to the intercarrier sound channel: your probe here was acting as an aerial via which radio signals were getting into the sound circuits. (ITT VC200 chassis.)

PHILIPS G22K533

On switching the set on the picture is not full height – there is a black band at the bottom of the screen accompanied by about half an inch of foldover at the bottom of the picture. The bottom of the screen gradually fills, but the foldover remains. This process takes about five minutes but is getting longer.

This trouble can be caused by deterioration of the BD124 field output transistors which are the first suspects. Make sure that the 45V supply to the field timebase is up to standard – it's provided by rectifiers fed from a winding on the line output transformer, with C5537 (800μF) the reservoir. The two diodes in the field output stage, D4458 and D4467, could also be faulty. (Philips G8 chassis.)

VERTICAL WHITE LINE

The trouble is that when the set is switched to ITV there is a bright white line about an inch or so wide vertically down the screen. It's more like a shaft of light, and does not completely obliterate the picture.

What you are seeing is the line blanking interval of another transmission, visible because of the transmitted offset. The cause is cross-modulation by co- or adjacent-channel interference. Check the aerial: it may be of the wrong type, or incorrectly aligned or polarised.

SONY KV1810UB

Although the hue control is set in the fully clockwise position the picture is still slightly biased towards purple. Is there a preset control that can be used to centre the user hue control?

There is no preset control to centre the effect of the user hue control, which works by differential adjustment of the amplitudes of the U and V signals. If there is a decoding error, it will be necessary to realign the decoder. It is much more likely however that the grey-scale is wrong. Remove the colour and adjust the red, green and blue background controls (VR152/4/6) for a neutral grey.

PHILIPS G22K520

The trouble with this set is hooking – the first half inch or so at the top of the picture is leaning to the left, at an angle of about 30°.

We suggest you check the four electrolytics in the sinewave line oscillator circuit – C4498 (4μF), C4520 (16μF), C4518 (50μF) and C4496 (40μF). If necessary check C2170 (10μF) which is connected to pin 1 of the TAA700 video/a.g.c./sync i.c. (Philips G8 chassis.)

GRUNDIG 5010

Correct grey-scale tracking cannot be obtained. When the set is first switched on the picture is vivid green – whether on a monochrome or colour signal. This excessive green subsides after a few minutes but one is always conscious of a green cast in the background. The convergence is perfect, and so is the picture – except for the green cast. When the c.r.t. first anode controls are turned to minimum the green gun will not cut off at normal brightness and contrast levels, leaving a green picture. What adjustments should be made to clear the trouble?

The problem is probably due to a fault rather than maladjustment. First ensure that pin 5 of the c.r.t. (green gun first anode) can be varied between approximately 470V and 740V by adjusting the preset control: if not check the control and its associated *RC* network. Then verify that the green cathode drive preset R684 is in order. If so, concentrate on the G – Y output stage, starting with measurement of the voltage at the c.r.t. green gun grid pin 7 (should be about 30V). The first suspects here are the G – Y clamp diode Di585 and its 3·3MΩ shunt resistor R585. It is possible that the c.r.t. is faulty.

BEOVISION 1600

The picture on this monochrome set is excellent, but the sound very distorted. Checks around the sound output stage haven't revealed anything amiss.

The most likely cause of the trouble is a faulty loudspeaker. But beware! The unit fitted has an impedance of 800Ω. An ordinary loudspeaker will quickly ruin the audio output transistors.

ITT FT100

Sound and picture reception are good but the focus appears to shimmer. On close examination the picture constantly moves in and out of focus. I find this very disturbing though most people don't seem to notice it.

A copper deposit can build up on the focus v.d.r. Clean off with emery cloth. Check the associated resistors and the focus potential feed resistor on the c.r.t. base panel. A further possibility is corona discharge across the focus spark gaps on the c.r.t. base panel. File both gaps a little wider. (ITT CVC7 chassis.)

COSSOR CT1973A

The sound comes on almost immediately after the set has been switched on but there is a long delay before the picture appears. It's clear, but then starts to shrink at the top and bottom – the width remains o.k. Altering the setting of the height control makes no difference. The height can be temporarily regained by advancing the contrast and brilliance controls, but the picture then explodes and disappears. I've changed the field timebase valves without success.

The long delay in the picture appearing is probably due to the fact that the PL36 line output valve is in need of replacement. The fact that the picture size varies as the c.r.t. beam current increases means that the e.h.t. regulation is poor. So change the EY86 e.h.t. rectifier. To get the height right check the 1·2MΩ resistor (R438) in series with the height control – you'll undoubtedly find it has increased in value. (Philips 152A series.)

KB SV048

The picture rolls and the field hold is weak. A new PCL805 field timebase valve has been tried without success, so I assume the trouble is in the sync separator stage where the voltages don't seem right. Before changing the BF117 sync separator transistor are there any other checks that should be made?

Since the voltages in the sync separator stage are wrong the trouble is almost certainly in this stage and the transistor itself is the most common offender. Its 1·5MΩ base bias resistor R133 should be checked however in case it has gone high-resistance, while the series connected base feed components R131 (150Ω) and C114 (0·47μF) can be quickly checked by bridging. Field hold troubles on this chassis can also be due to the field sync pulse coupling capacitor C70 (0·0047μF) being leaky. (ITT VC200 chassis.)

MARCONIPHONE 4801

The trouble started when R79 on the mains dropper burnt out. I replaced the complete unit, also the HT6 smoothing resistor R78 and the video driver VT8, but there is still no picture and very low sound.

When R79 goes open-circuit the HT6 line rises substantially. In addition to VT8, the final i.f. amplifier VT7 is likely to be damaged, giving the symptoms you are experiencing. If replacement of VT7 doesn't effect a cure, check the emitter voltages of the first two i.f. transistors since the decouplers here can go short-circuit, and check the a.g.c. circuit. (Thorn 1500 chassis.)

PHILIPS G24T306-02

A sync fault has recently developed in this set. At high contrast levels the picture tends to pull to the left in the lower half of the picture while at the same time the field hold flicks. The fault is especially bad on adverts with light backgrounds. The previous probables you have published in past issues – e.g. the d.c. restorer diode, video preamplifier transistor, PFL200 video output valve and the electrolytics in this stage, and the sync separator's screen grid feed resistor – have all been tried without success.

The anode of the sync separator section of the PFL200 is connected to a potential divider across the h.t. line. It's quite likely that the upper resistor, i.e. the stage's load resistor R2138, has increased in value. Check this – it should be 100kΩ (voltage on pin 4 should be 46V). (Philips 300 chassis.)

FERGUSON 3703

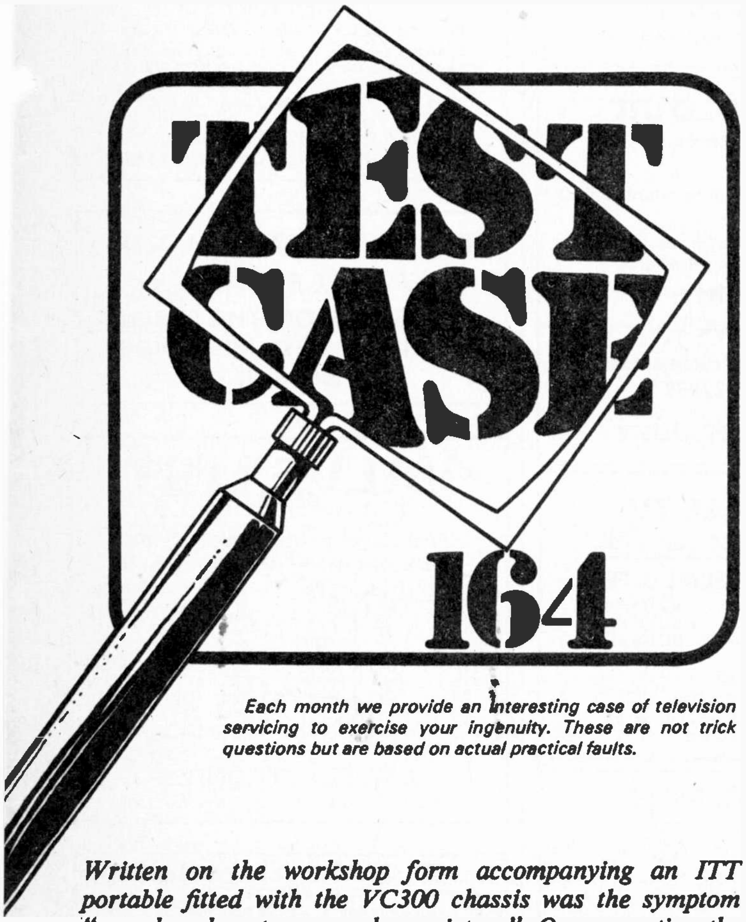
The picture content is good but is marred by horizontal lines which vary in coarseness. They are not affected by picture content. The lines disappear when the colour control is turned down to give a monochrome picture. Similarly they are not present on monochrome transmissions.

Look at the colour bars at the top of the test card, reducing the height if necessary to do so. If alternate lines of the red bar are black, check the two OA47 diodes W309/W310 in the PAL switch circuit – they are mounted at the front of the decoder board and could be leaky. Failing this it is necessary to have available the full equipment required to carry out decoder alignment, during which the fault should be cured. (Thorn 3000 chassis.)

KB KV125

The line and field sync on this set are poor – both hold controls have to be continually adjusted. It's also necessary to readjust whenever the channel is changed.

A PCF80 is used as the sync separator. You will probably find that its screen grid feed resistor R63 (330kΩ), connected to pin 3, has increased in value. Also check its anode load resistor R66 (220kΩ) which is connected to pin 6. (ITT VC52 chassis.)



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.

Written on the workshop form accompanying an ITT portable fitted with the VC300 chassis was the symptom "sound and raster normal, no picture". On connecting the workshop aerial, sound on all channels was in fact present. But the display consisted of a blank raster which remained virtually unaffected by operation of the brightness or contrast control.

The chassis uses an integrated circuit as the vision detector and video preamplifier; it also provides the 6MHz intercarrier sound signal. Since the sound was all right it was concluded that the i.c. was operational and that the trouble must be between the i.c. and the tube gun.

Consequently tests were first carried out around the video output stage, which employs a BF257 transistor. Using a high-resistance d.c. voltmeter it was found that the base voltage was pretty-well normal. This voltage is supplied by a conventional potential divider network. To prove the conductivity of the transistor the technician then made a measurement between its emitter and chassis, obtaining a reading of the order of 3.2V. This was assumed to be the voltage across the emitter resistor due to the output transistor's current flowing through it, so further measurements in this area were abandoned.

Attention was returned to the i.c., and as the voltages on its pins appeared to be normal it was thought that the video preamplifier section was defunct. The i.c. was replaced but, sadly, the fault remained – there was no change in the conditions whatever. Where was the technician's reasoning in error, and what should he have investigated before replacing the i.c.? See next month's Television *for the solution and for a further item in the Test Case series.*

SOLUTION TO TEST CASE 163
Page 499 (last month)

If the technician investigating the colour-only symptom on the Pye set with the 713 chassis had had an oscilloscope at hand he would have soon discovered that the Y (or luminance) signal was missing from pin 5 of the TBA530 matrix i.c. This signal comes from the Y output stage of the TBA560 i.c., on which the contrast control works. The Y signal goes into the TBA560 at pin 3, after passing through the luminance delay line, a low-pass filter and an electrolytic coupling capacitor.

Lack of Y signal prevented primary-colour matrixing in the TBA530 i.c. so that the tube guns were being driven by only the colour-difference signals. As these were controllable by the colour control while (as quickly discovered by the second technician) the contrast control had virtually no effect on the display the second technician immediately directed his attention to the Y channel. The symptoms pointed to Y channel discontinuity *prior* to the TBA560, and the fault turned out to be a dry-joint on the Y delay line connection to the printed circuit board. Failure of the Y channel *after* the TBA560 produces different symptoms (the screen becomes black because the d.c. conditions in the TBA530 i.c. are altered).

Test Case 162: In the answer to this item we omitted to mention the cause of the incorrect decoder reference oscillator frequency. The crystal can be responsible but more often the trouble is due to one of the capacitors in the circuit – in this case it was C322 (50pF) which is in series with the varicap diode. Although its value had fallen significantly, there was still sufficient feedback for oscillation to be maintained, though at slightly incorrect frequency. After replacing C322 and peaking the oscillator output coil the set operated as well as new.

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TELEVISION AUG. 1976

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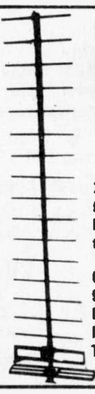

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