Servicing the ITT CVC1 and CVC2 Chassis

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AT the start of colour TV in the UK in 1967 most setmakers immediately brought out dual-standard colour receivers. They were ponderous and temperamental machines, and in many cases are best forgotten! ITT was the last major setmaker to introduce a colour receiver, and their first models were unique in the UK in boasting a hand-wired chassis and the largest electrolytic capacitor the author has ever seen. These remarkable sets were not made in great numbers and are comparatively rare outside the circle of independent retailers. The earlier CVC1 chassis was a dual-standard one and is even thinner on the ground than the later single-standard version, the CVC2. It is the purpose of this article to summarise some common idiosyncracies of the CVC2, covering also the CVC1 which is very similar except for the "extras" required for dual-standard operation. The list is not claimed to be complete, but you'll find most of the common faults.

Before preparing the article we studied the careers of a couple of dozen CK402s which had been out on rental for a period of about five years. One of the main features to emerge was that they are very light on c.r.t.s. Most colour sets of this vintage contain very tired c.r.t.s, but very few CVC2s have been found to need a replacement tube to date. There doesn't seem to be any particular reason for this. Any ideas?

First a brief note about the circuitry. Most of this follows the usual lines adopted in hybrid colour chassis. Colour-difference tube drive is used, but unusually a BD119 transistor is used as the luminance output device. There are one or two unexpected features in the decoder however. First, colour-killing takes place in the emitter circuits of the B–Y and R–Y preamplifier transistors. Secondly an automatic grey-scale shift circuit operates via these preamplifiers: this gives a slightly different grey-scale on colour and monochrome. Thirdly a bridge rectifier driven by anti-phase outputs from the ident amplifier is used as the PAL switch, and in conjunction with a transformer with a centre-tapped primary winding inverts the R–Y chrominance signal on alternate lines. Finally the reference oscillator feeds two subcarrier amplifiers, one driving the R–Y demodulator and the other, via a 90° phase shift coil, the B–Y demodulator. The feedback signal to the burst detector comes from the B–Y subcarrier amplifier. One consequence of this arrangement is that demise of the B–Y subcarrier amplifier transistor will shut down the burst detector and thus remove the colour.

Hand-Wiring Problems

The question of dry-joints will appear like a refrain throughout this article, and justifies explanation. Apart from normal dry-joints and shorts between adjacent tags, these chassis suffer from corrosion problems on earth joints. Wherever a wire is soldered to chassis earth it is wrapped round a "finger" formed from the steel chassis. This is fine initially, but after a period of time corrosion sets in and the earth connection becomes intermittent. "Off-earth" faults are difficult to diagnose at the best of times, but when combined with intermittency many fruitless hours can be spent tracing the source of the trouble. Whenever intermittent problems are encountered a healthy tug at the earthing wire will often move it on its tag: a beefy soldering iron and plenty of flux-cord solder will then put matters to rights. Another problem inherent in hand-wiring is the risk of burning the insulating covering of a passing wire where it is in contact with a hot solder-tag during the soldering process. This can lead to frustrating intermittent problems.

Tuners

The CVC1 is fitted with conventional rotary tuners after the style of the contemporary monochrome models. These are comparatively trouble-free. The CVC2 has a four-channel push-button tuner, with a small printed panel on the main chassis to make up for the gain lost by removal of the v.h.f. tuner. The CVC2's tuner is notorious for poor resetability, and slight readjustment of the tuning on changing channels is usually necessary. Although the trouble is mechanical, the lack of a.f.c. aggravates the problem. The tuner may be one of two types, as used in later ITT monochrome receivers. The type with the "wheel and spring" selector mechanism is the more reliable from the reset point of view. If ever a set was a worthy candidate for conversion to varicap tuning this is it! (See *Television* October 1972.)

IF, AGC and Luminance Stages

The i.f. strip is often responsible for low-gain, instability and various intermittent problems. The a.g.c. department should be eliminated first, by overriding its potential (across Ck75, see Fig. 1) with a low-impedance bias box. The vast majority of i.f. problems stem from faulty transistors and poor jointing. Transistor failures are usually easily tracked down with a d.c. voltmeter.

Txk10 and Txk11 are suspect for a.g.c. faults, with Txk10 favourite. Txk12 is concerned only with the tuner a.g.c.

The luminance output transistor Txf1 (BD119) carries the world on its shoulders in this chassis, but is remarkably reliable provided it is firmly in contact with its heatsink.

Brightness Faults

Brightness faults are not uncommon, and usually stem from the beam limiter transistors on the line timebase chassis. These are Txh1 (BC116) and Txh2 (BC118) – see Fig. 2. Varying brightness can often be traced to leakage in the $12{\cdot}5\mu F$ luminance coupling capacitor Ck77 – uncontrollable brightness is the fault should it go short-circuit. Another cause of brightness troubles is the line output valve's cathode decoupling capacitor Ch29 ($200\mu F$) – the cathode voltage is used as the basis of the beam limiter action. A brightness fault that's difficult to diagnose is when R24 ($470k\Omega$) which returns the c.r.t. first anode preset controls to chassis goes open-circuit or high resistance. The first anode voltages rise and the increased beam current brings the beam limiter circuit into operation.

The result is negative voltages around the beam limiter transistor Txh2, at the base and emitter of the d.c. restorer transistor Txk13 and at the base of the luminance output transistor Txf1. The potential divider network in the collector circuit of the luminance output transistor – from the 290V rail to chassis – prevents the collector voltage rising to the full h.t. potential but leaves a bright screen with flyback lines. A possibility in case of brightness variations is the two 50μF electrolytics Cp2 and Cp3 which smooth the –20V rail. A glance at Figs. 2 and 6 will show why.

Sound Circuits

Apart from the bogey of dry-joints etc the sound department gives little trouble. Occasionally the capacitors which tune the intercarrier sound transformers have been found open-circuit. These are Ck17, Ck18 and Ck21, and are polystyrene types. When the PCL86 audio valve is replaced the earthing and value of its cathode resistor Rf5 (120Ω) should be checked.

The Decoder

No colour or intermittent colour are amongst the most common failings of the CVC2. The decoder is easily detachable for replacement but exchange decoders are hard to come by and the return of the entire decoder to ITT for repair necessarily involves some delay. Earthing and wiring problems are rife in the decoder and should be the first thing to look for. Our old friends the polystyrene capacitors come high on the list of suspects, Cd62 (0·03μF), Cd57 (0·0022μF) and Cd59 (0·22μF) in the ident stage and the

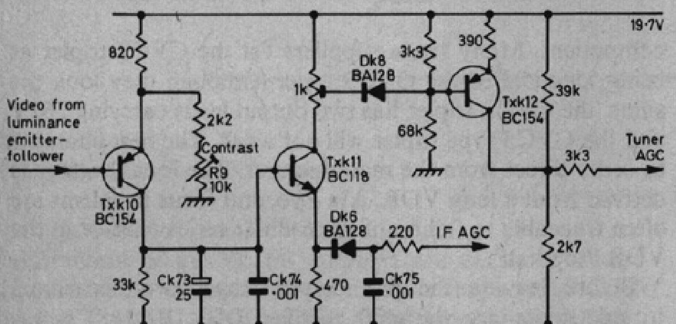

Fig. 1: The a.g.c. circuit.

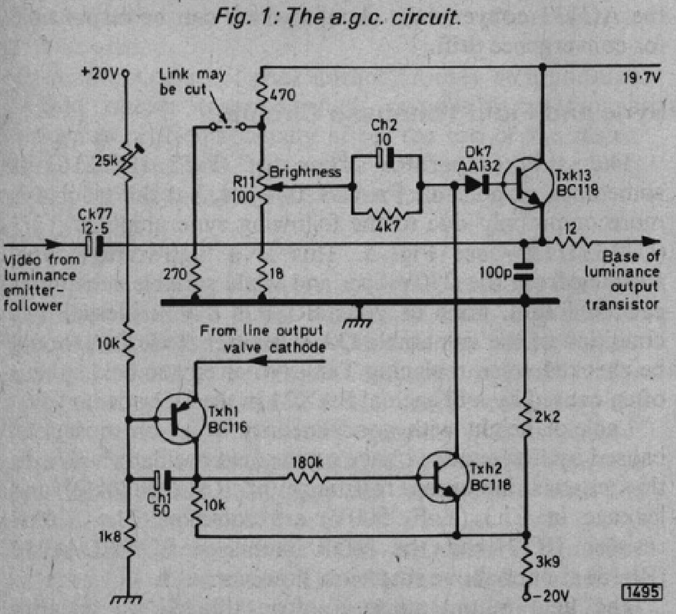

Fig. 2: The beam limiter and brightness/d.c. restorer circuit.

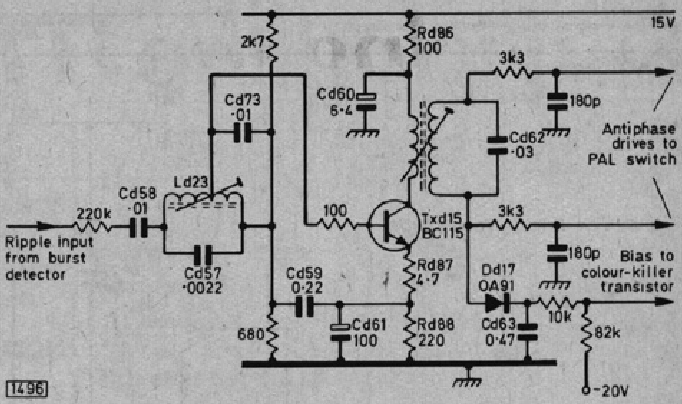

Fig. 3: The ident amplifier and colour-killer circuits.

colour-killer reservoir capacitor Cd63 (0·47μF) being particularly troublesome (see Fig. 3). In fact all polystyrene capacitors in the decoder should be treated with suspicion. Where the colour-killer is erratic due to low ident signal (at least 6V d.c. is necessary at the cathode of the colour-killer rectifier Dd17) Rd87 (4·7Ω) may be bypassed. This modification, we hastily add, is quite unofficial.

Erratic performance of the burst department is often curable by the replacement of the can containing Ld21 and Ld22 – the phase detector can. When working in the burst phase detector area it should be borne in mind that the subcarrier reference feed comes via Txd7, the B–Y subcarrier amplifier/demodulator driver. Thus failure of this transistor will delete the ident and activate the colour-killer.

The reference oscillator transistor Txd16 (BC118) and its crystal can be responsible for intermittent colour while the 8·2V zener diode Dd19 in this circuit can cause erratic colour sync.

The collector circuits of the burst gate pulse generator (Txd12), the gated burst amplifier (Txd14) and the ident amplifier (Txd15) transistors incorporate *RC* decoupling networks in which the capacitive element is an electrolytic. The capacitors are Cd44 (50μF), Cd45 (2μF) and Cd60 (6·4μF) respectively. They tend to go open-circuit or to dry up, reducing the efficiency of the relevant stage(s).

Turning to the chroma channel, the transistors Txd1-3 can fail, the electrode voltages betraying the culprit. Several deep and mysterious cases of intermittent or no chroma have been tracked down to the colour control plug and socket on the front panel coming adrift! A strange kind of chroma instability, with multicoloured patterning, sometimes results from the failure of Ld2, the primary winding in the second chroma can.

Absence of either the R–Y or the B–Y outputs from the decoder chassis is usually caused by failure of one of the BC118 subcarrier amplifier transistors in the demodulator circuits. The chokes Ld16 and Ld17 via which the demodulated chroma signals pass out of the decoder to the colour-difference output stages are prone to dry-joints, leading to similar symptoms.

An unexpected no colour situation arises when the screen grid voltages on the three PCL84 colour-difference amplifiers disappear due to failure of the common feed resistor Rf17 (12kΩ). The auto grey-scale shift circuit is tied to the operation of the colour-killer. Thus where the auto-shift circuit operates but no colour is present, Rf17 is the first suspect. Fading of one or more colour-difference signals when the set is thoroughly warm calls for replacement of the appropriate PCL84, while drifting grey-scale or colour shading should lead to investigation of the 0·001μF coupling capacitor and the 10MΩ resistor in the appropriate clamp stage. When investigating wrong colours

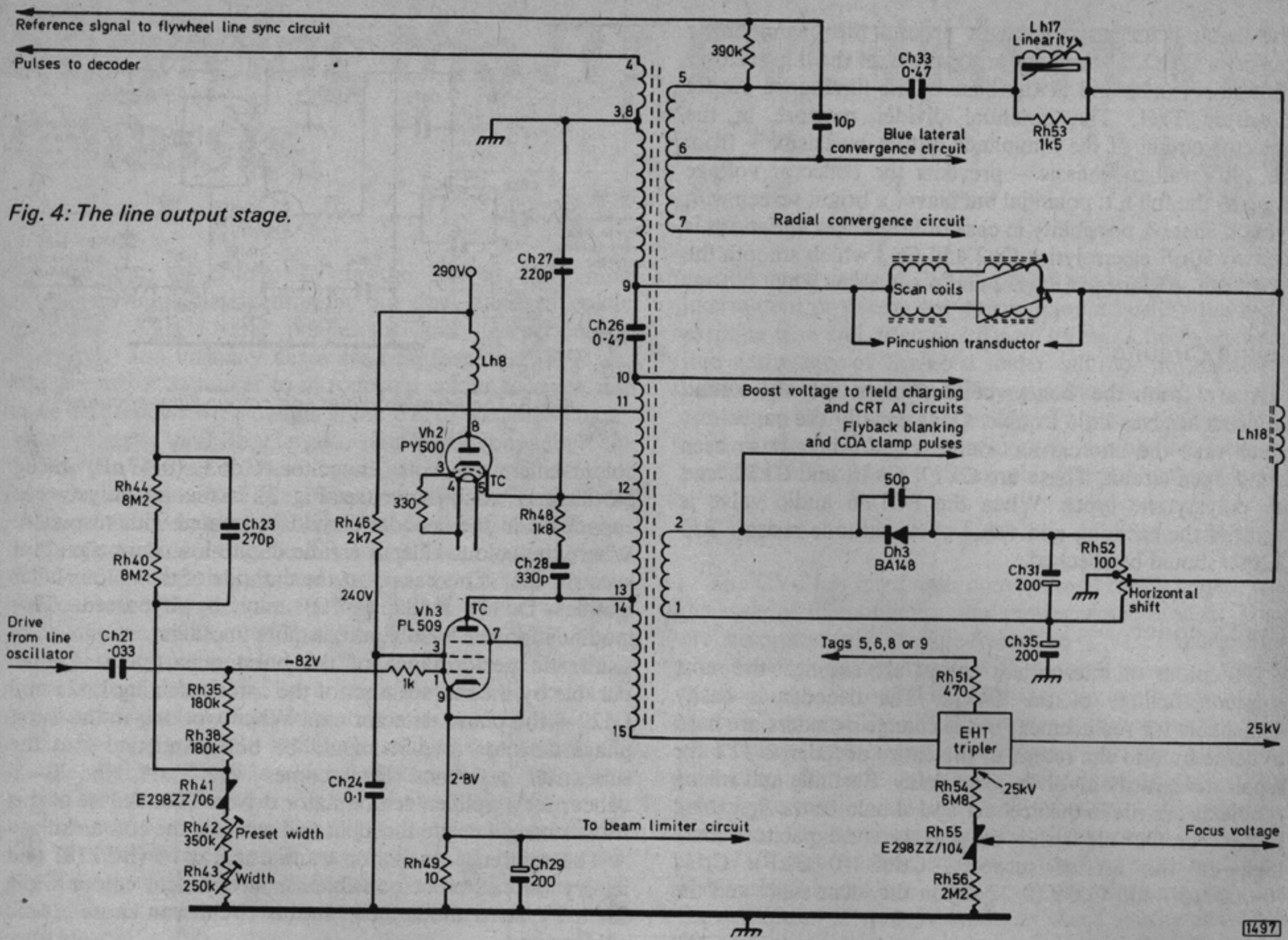

Fig. 4: The line output stage.

note that G–Y matrixing is carried out in the anode circuits of the PCL84 R–Y and B–Y output pentodes.

Line Timebase

The PCF802 line oscillator circuit is similar to that used in the VC51-VC53 monochrome chassis and will need no introduction to the service technician. Reluctance to strike up from cold is commonly due to the feedback coupling capacitor Ch18 which is an 800pF (guess!) polystyrene type. Line frequency troubles follow reduction in the value of the triode cathode bias resistor Rh26 (47kΩ to HT) as they have done for so many years in ITT's wired monochrome sets. The diodes and capacitors in the flywheel sync discriminator stage can be responsible for a particularly horrible type of line twitch, but here again joints and earthing should be checked first. A "watery" twitch (he talks gibberish, this man!) on the line is often caused by corrosion in the line oscillator coil Lh6/7.

Having sorted out the line oscillator we can follow the line drive pulses to the line output stage (see Fig. 4). Several horrors await us here. The two 8·2MΩ resistors Rh40 and Rh44 in the width circuit predictably go high, resulting in low width. On the same panel is the 220pF ceramic capacitor Ch27 whose function is to tune the line output transformer and whose habit is to go dead short. The PY500 then glows until the 1·6A h.t. fuse Fp4 blows.

On the secondary side of the line output transformer the main offender is the 1·5kΩ line linearity coil damping resistor Rh53. This burns and goes open, resulting in heavy striations down the left of the picture. A 5W replacement is much better. The e.h.t. tripler is quite reliable, but when replacement is necessary it's important to obtain the correct component. Many trade suppliers list the CVC2 tripler as being identical to the CVC5 type. Although they look the same, the CVC2 tripler has two output leads carrying 25kV and the CVC5 type tripler will not work. The best course is to order direct from the manufacturer. The focus voltage is derived from a long VDR, à la Pye, and focus problems are often traceable to failure of the 6·8MΩ series resistor in the VDR "top hat".

Before leaving the line output stage, two occasional trouble spots are the shift rectifier Dh3 (BA148) which sometimes shorts to the detriment of its reservoir Ch31, and the AC131 convergence clamps which can be responsible for convergence drift.

Sync and Field Timebase Circuits

The sync separator transistor Txf2 (BC116) is sometimes responsible for lack of sync, but the trouble is more commonly due to the following sync amplifier Txf3 (U14551/1) – see Fig. 5. This is a high-voltage type, working from the 290V line, and while suitable substitutes can be found, none of your BC107s if you please! The condition of the vulnerable OA91 emitter diode Df1 should be checked when replacing Txf3. No or erratic field sync is often caused by a bronchial BAX21 in the Df2 position.

Lack of height with good linearity is, as on most sets, caused by low anode voltage on the field oscillator valve. In this chassis increased resistance of Rh12 (820kΩ) and leakage in Ch3 (1μF, 500V) are common. The 330kΩ resistor Rf57 and the VDR stabiliser E298ED/A258 (Rh15) are not above suspicion, however.

The field output stage is often afflicted by linearity problems, cramping at the bottom being the most common.

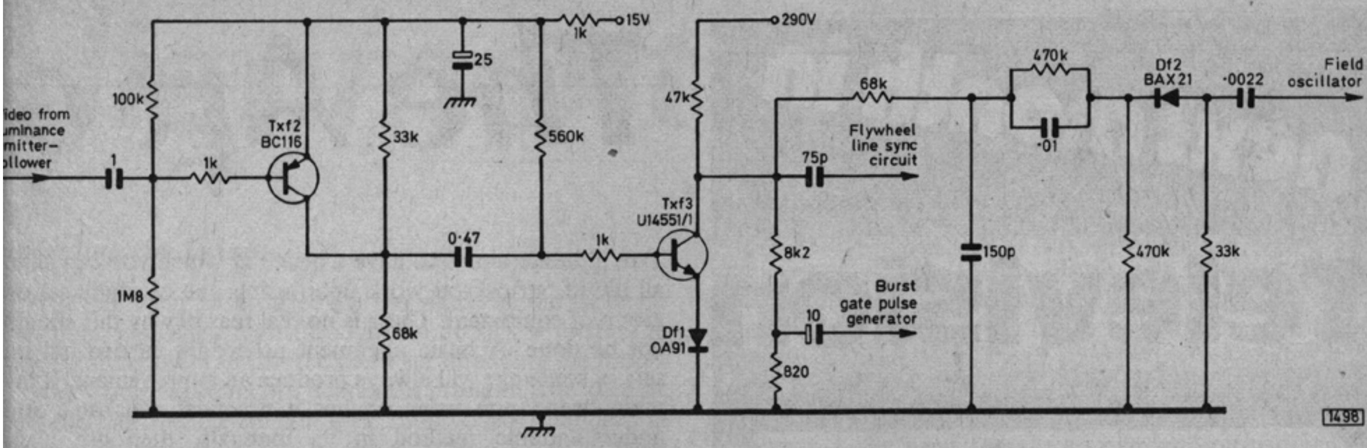

Fig. 5: The two-transistor sync separator circuit. Note that the burst gating pulses are derived from the sync pulses.

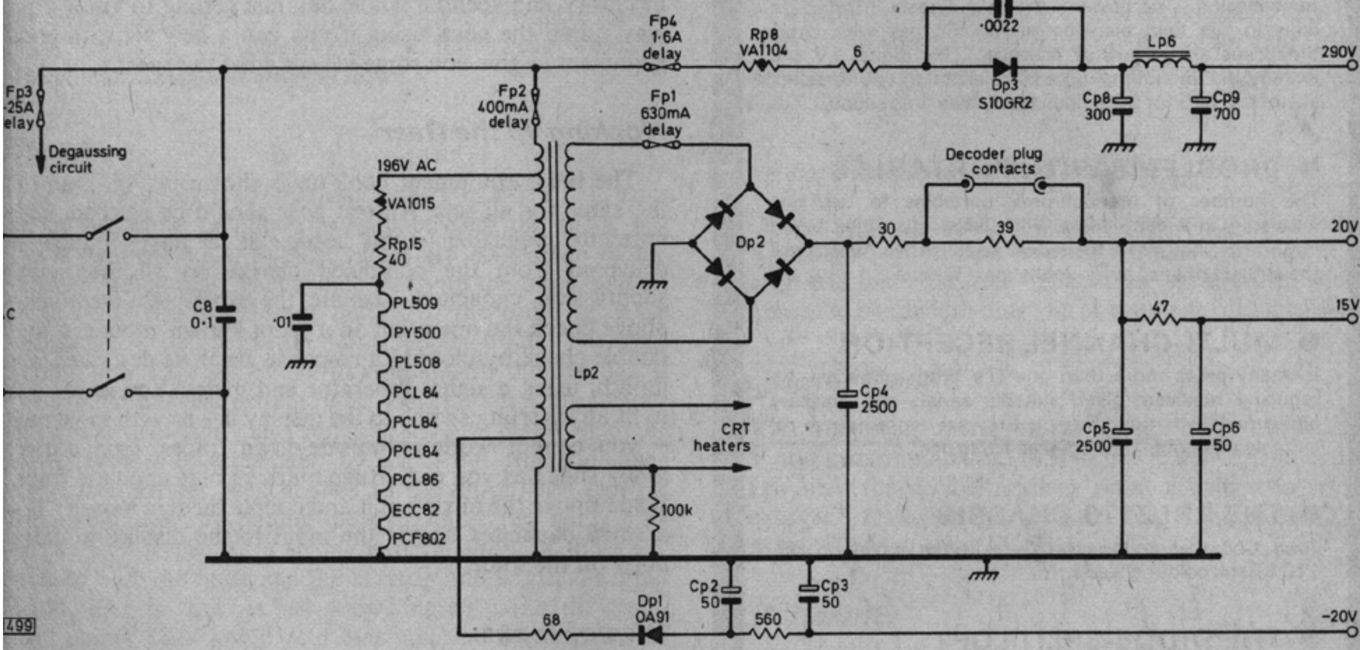

Fig. 6: The power supply circuitry.

Replacement of the PL508 output valve does not always cure this, and any of the electrolytic capacitors Cf37 (4000μF), Ch5, (100μF), Cf38 (32μF) or Cf40 (400μF) may be responsible. If the value of the cathode bias resistor Rf64 (470Ω) has changed, a 5W replacement is recommended.

In stubborn cases of poor linearity it may be found that the field output transformer is responsible. Although transformer problems usually affect the top of the raster, bottom cramping and foldover have more than once been traced to the field output transformer in the CVC2.

Power Supply

The power supply is the last section to be dealt with but is certainly not least in the number of faults it produces! The mains filter capacitor C8 can go short-circuit, sometimes welding the switch contacts together before blowing the plug fuse. Lack of h.t. can be caused by the VA1104 thermistor Rp8 parting company with its lead-out wires. The h.t. rectifier Dp3 (S10GR2) commonly shorts to blow the 1·6A h.t. fuse, and can be replaced with the humbler-sounding BY127.

A strange situation arises when the reservoir capacitor Cp8 goes low capacitance. The efficiency of the following filter Lp6 and Cp9 results in complete absence of hum effects on the picture and sound, but because the average voltage at the cathode of the h.t. rectifier is lower than the peak mains the h.t. voltage falls to give a low-width effect. A great deal of time can be spent in the line output department before the simple expedient of checking the h.t. voltage leads the harassed technician back to the power unit. The vast can containing the smoothing block is not commonly available, and has to be ordered from the makers.

The l.t. rectifier bridge Dp2 sometimes goes leaky, blowing the 630mA l.t. supply fuse. Dp2 can also go high resistance, with the result that the 15V and 20V l.t. lines drop and the receiver's performance is affected – there can be intermittent colour, brightness troubles and so on. Four 1N4001 diodes in a bridge configuration make a more reliable replacement.

Finally a fault that often throws suspicion on the power unit but in fact lies elsewhere, mysterious blowing of the 1·6A h.t. fuse for no apparent reason. The replacement fuse may last for hours or days, only to fail again with a sharp crack. If you are lucky a fireworks effect will be seen under the chassis amidships, and the trouble will be found to be insulation breakdown of the tagstrip associated with the wirewound resistors feeding the colour-difference amplifiers. Ideally the tagstrip should be replaced, but a "get you home" trick is to cut away the afflicted portion of Paxolin. ■