Servicing the Tandberg CTV1 Chassis

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THE subject of this article, the Tandberg CTV1 chassis, is the predecessor to the company's current range of 110° solid-state colour TV receivers. In contrast to the latter it employs a 90° deflection c.r.t. and a hybrid chassis. At first glance it looks similar to many other hybrid designs, but on close scrutiny some unusual and interesting features are to be found. Correctly set up, the chassis is capable of producing excellent pictures. It helped Tandberg to establish a reputation as manufacturers of quality TV receivers.

Line Output Stage

The set is designed around a straightforward PL509/PY500A line output stage (see Fig. 1) with a tripler e.h.t. supply, but the protection of this stage is unusual and interesting. The protection device consists of two springs arranged vertically between the two line output stage valves and joined at the top by a low melting point alloy, thus forming a temperature sensitive switch which opens when either or both valves overheat, isolating the h.t. supply to the line output stage. To make the switch more sensitive to the overheating of the valves the springs have a matt black finish in order to absorb the infra-red radiation from tortured anodes more effectively. A short length of the special alloy in wire form is thoughtfully supplied with each receiver, twisted around a tag close to the bottom of the switch. Very early receivers had a fuse in place of the thermal switch.

Line Oscillator

In this hybrid receiver there is nothing quite so hybrid as the line oscillator, which uses a BC157 and an ECH84 (see Fig. 2). The BC157 is the oscillator stage, with the heptode section of the ECH84 as a reactance stage and the triode section as a voltage amplifier to give sufficient voltage swing to drive the PL509. Some earlier receivers do not have the transistor oscillator stage however, the triode section of the valve being both oscillator and driver. This is a point to watch as only one version is shown in the service information.

Field Timebase

The field timebase circuitry (see Fig. 3) is completely solid-state, using a silicon controlled switch as the field oscillator and a single transistor amplifier with linearity feedback, followed by two transistors connected as a Darlington pair to drive the rather unusual output stage. This uses a single transistor biased in class A and choke-coupled to the scan coils. The choke is in fact an autotransformer with a step up winding providing pulses which after suitable shaping are fed to the c.r.t. cathodes for field flyback blanking.

Power Supplies

Unlike many current designs in which the various l.t. rails required are conveniently derived from the line output stage, all the power supply rails are mains derived (see Fig. 4). The result is that the l.t. supplies are fairly complicated. The mains transformer has two l.t. windings, apart from the 6·3V winding for the c.r.t. heaters, and these feed two bridge rectifiers followed by regulator circuits. One gives a regulated +22V rail and an unregulated +29V rail, the other regulated − 18V and +6V rails (set R422 for −18V).

The h.t. supply is straightforward, consisting of a half-wave rectifier with a choke filter.

Tuners

There are separate u.h.f. and v.h.f. tuners mounted at the back of the chassis. The latter is for continental 625-line transmissions on Bands I and III, but is useful in this country for operation on v.h.f. relay systems. The set is also unusual in having a solenoid operated mechanical band-switch for Band I/Band III in contrast to the usual switching diodes.

The IF Strip

The i.f. strip is built into a plug-in, screened module and among the five active devices three are dual-gate MOSFETS, no doubt used because of the advantages of low cross modulation and the easy design of the a.g.c. circuitry. There are three separate video detectors in the i.f. module. One (D1) is for the luminance and chrominance, another (D51) detects the 6MHz sound intercarrier beat, while the third (D220) detects the video signal for the noise-blanking, a.g.c., and sync. separator stages. This detector is fed from a point before the second 33·5MHz trap in order to produce the wide bandwidth video signal necessary for effective noise blanking.

Access

Access to the main chassis at first sight looks to be a problem – apart from the plug-in modules – but the whole

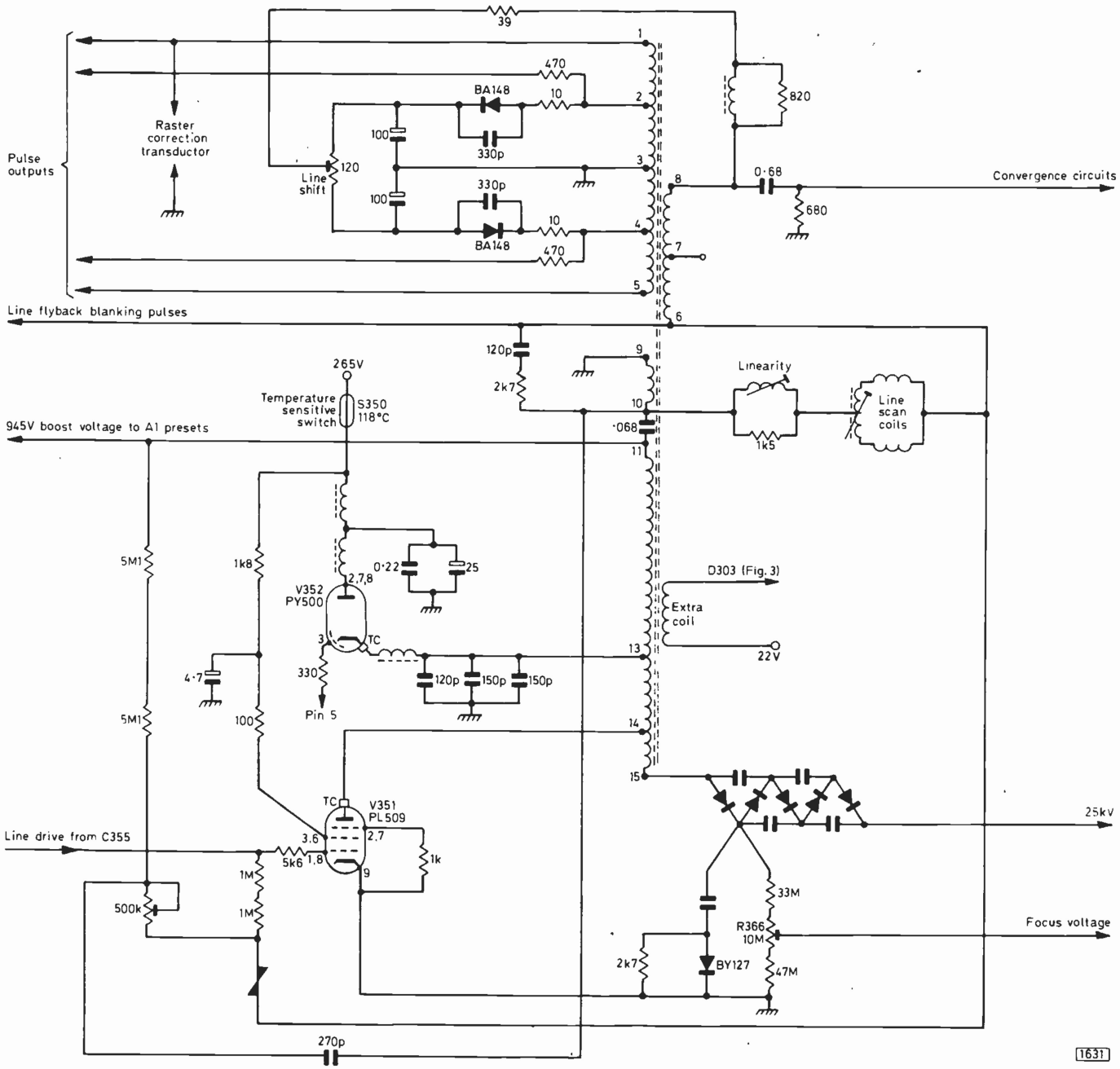

Fig. 1: Circuit of the line output stage. EW raster correction is carried out in the line oscillator circuit.

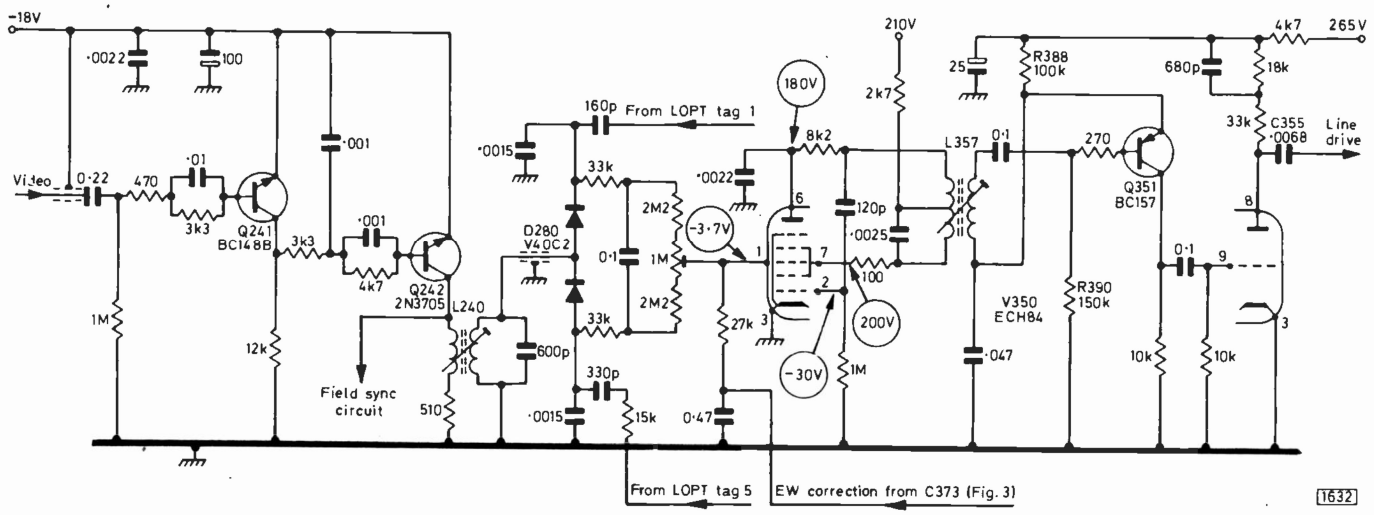

Fig. 2: The sync separator and line generator circuits. In some sets the ECH84 acts as oscillator and reactance valve, with Q351 omitted.

chassis is mounted on rails and can be slid backwards for service after two springs have been released. Access to the underside of the chassis is obtained by releasing the same two springs and pulling the chassis back farther and lifting it – it's hinged at the front – until the top of the line output chassis engages a hook at the top of the cabinet, holding it at a convenient 45°. When new, the sets were fitted with a peg on each side of the chassis secured by screws holding the chassis to the rails. This was a transit precaution. If the chassis is reluctant to slide backwards however these may still be in place.

The control panel, which also carries the audio amplifier and output stages, can be taken out as a unit by moving out of the way the three clips which hold it in place.

Stock Faults

These receivers seem to be inherently reliable but are let down by a number of stock faults which are soon recognised, making for easy servicing but doing nothing for customer satisfaction.

LT Troubles

The l.t. power supplies seem to be one of these "weak links" on the chassis. The usual trouble is that the l.t. supply goes on and off intermittently, sometimes for only a few seconds in an hour. This is usually due to a faulty 2N5296 regulator output transistor, but the BC147s which drive them are not always without blame, so it's a good policy to change both the BC147s and the 2N5296 when a fault like this occurs.

It's easy to identify which of the two l.t. regulators is causing trouble. Failure of either gives the no sound or vision symptoms whilst failure of the 22V regulator gives field collapse as well. So if the symptoms are no sound or picture with a blank raster transistors Q404, Q405 and Q406 are suspect, but if no sound or picture with field collapse go for Q401, Q402 and Q403.

Field Collapse

Field collapse by itself, again at times intermittent, is usually the 2N5496 field output transistor Q305 or occasionally the field oscillator Q301, a BR101. If the correct replacement for the field output transistor is not to hand a 2N3055 can be fitted in an emergency since the heatsink and printed board are drilled to take its TO3 case as well as the 2N5496.

Line Timebase Faults

The usual indication of trouble in the line output stage is the opening of the temperature sensitive switch between the two valves. Replacement of the valves and resetting the switch with the alloy provided is usually a permanent cure. On some occasions the switch seems to open for no good reason, probably due to higher than normal ambient temperature, high mains voltage etc., as the melting point of the alloy is only 118°C. The temptation to reset the switch with ordinary solder (with a melting point of 220°C) should be resisted: this would not melt until the worst possible fault conditions occurred, and could be the cause of severe damage or even a fire.

Other possible causes of no e.h.t. are the tripler – easily diagnosed by disconnection – or a line oscillator which is reluctant to start. If the condition is not cured by a new ECH84 valve and the circuit is of the later type with a transistor oscillator the cause of the trouble may well be R388 or R390 being high in value.

In my own experience at least this chassis seems to suffer more than the average from arcing around the interconnecting leads from the line output stage valves to the line output transformer, and the connections from the line output transformer to the printed circuit board. In the odd case this has even damaged the line output board beyond repair.

The moral of this is that when changing line output stage valves or working on the line output stage one should check that any leads carrying line power run clear of each other and of nearby components, and also watch out for dry-joints and loose connections. By doing this you may save the customer the cost of a new line output panel.

Focus trouble is nearly always the 10MΩ control, but in some cases the spark gap goes leaky in spite of the fact that a high quality glass encapsulated unit is used. When replacing the gap install it with some clearance between it and the c.r.t. base panel in order to prevent leakage due to dirt trapped between the two.

Intermittent Sound

A common and annoying fault which seems to occur sooner or later on most TV sets using this chassis is intermittent sound. In a few cases this is because the sound output transistor Q74, a 2N3055, is faulty, but in the majority of cases the source of this trouble is dry-joints on the emitter and base pins of this transistor and on its securing screws which also serve as the collector connections. The cure is to resolder the joints with a generous dose of solder, taking care that there is no strain on the soldered joints.

Tuning Troubles

Troubles with the tuner seem to be similar to those experienced in other TV receivers with varicap tuners – noisy switch contacts, tuning potentiometers and the like. Remedies are cleaning plus a dash of contact lubricant or replacement, depending on the severity of the case. After several years the most commonly used buttons refuse to work or become intermittent, operating only if the button is held in as far as possible. The cause is wear on the part of the push button which operates the bandswitch – this is located on the top of the push button assembly – and a quick cure is to slacken the screw holding the switch and to move the switch to take up the wear, finally retightening the screw. A more permanent cure where the receiver is used on u.h.f. only is to rewire the switch so that the u.h.f. tuner is permanently in operation.

IF Unit

The i.f. strip is a reliable unit. Since it's a plug-in module it can easily be returned to the manufacturer for service should the thought of working with MOSFETS prove daunting.

Colour Circuits

The decoder and the RGB drive circuits have proved trouble free, with nothing of the nature of a stock fault. It's

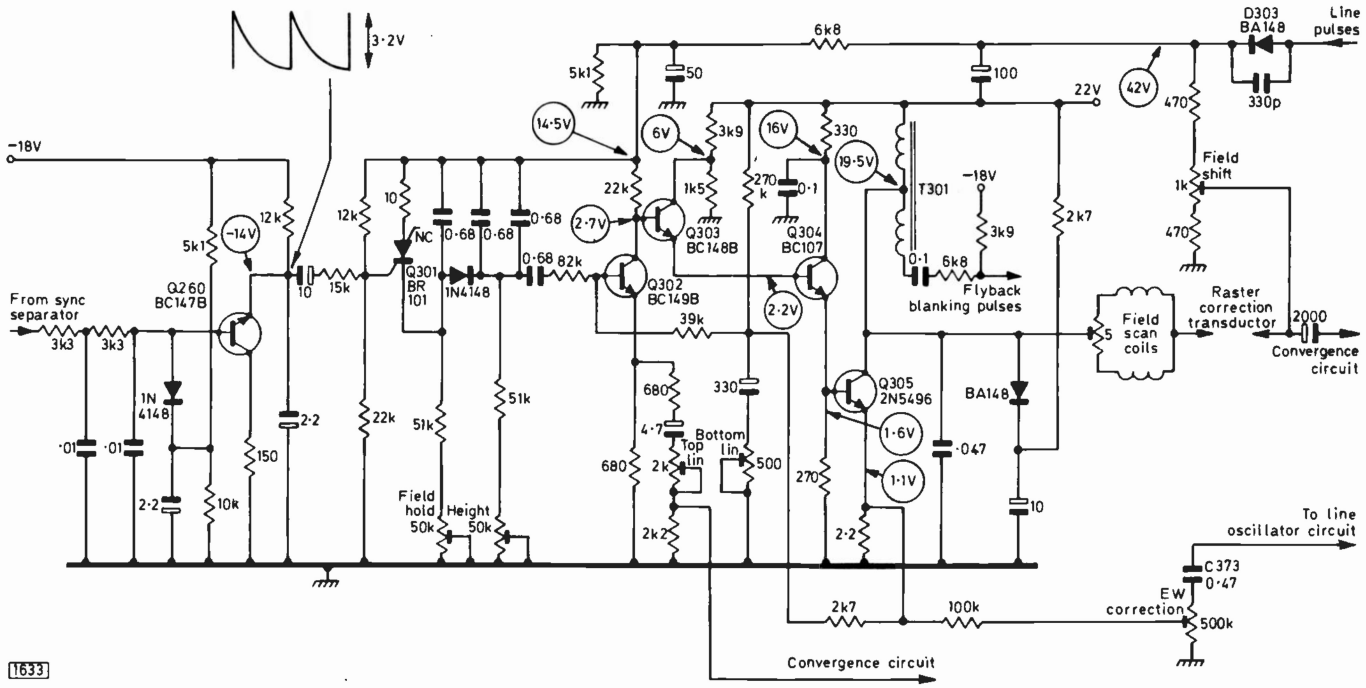

Fig. 3: Field timebase circuit.

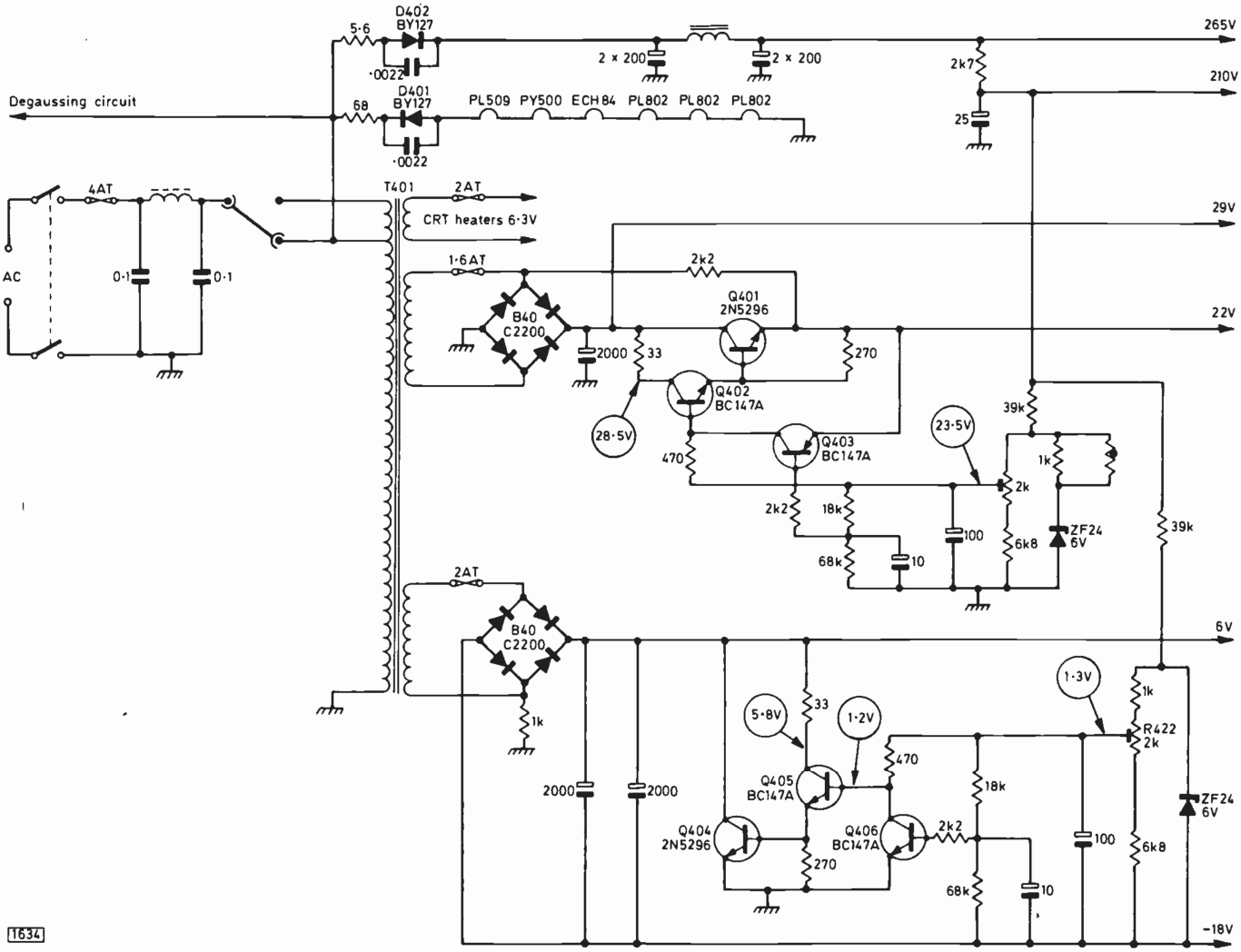

Fig. 4: Power supply circuits.

worth noting however that the three PL802 RGB output valves drive the c.r.t. grids, not the cathodes. A.C. coupling is used, with single diode clamps – the clamp voltage is set by the brightness control. The c.r.t. cathodes are used for beam limiting and field flyback blanking – line flyback blanking is carried out in the c.r.t. first anode circuit. ■