SERVICING television receivers

L. LAWRY-JOHNS

HYBRID PYE COLOUR CHASSIS

FROM the original Pye 691 dual-standard chassis which was marketed under several brand names including Invicta, Ekco, Dynatron and Ferranti, there has evolved a series of improved designs culminating in the last of the Pye group's hybrid colour chassis designated the 697. This uses a vertical printed board in place of the large metal screened box which contained the line output stage valves and transformer in the earlier versions. Between the first and last basic designs there was an intermediate version which dispensed with the GY501 e.h.t. rectifier and PD500 e.h.t. stabiliser triode used in the earlier models, employing an e.h.t. multiplier tray instead but retaining the large screened line output section with its wired components.

Only the earliest models (Pye CT70, Ekco CT102 etc.) were of the dual-standard variety, all others being for u.h.f. reception only and thus presenting a far less complicated tuner, i.f. strip and convergence set up. This certainly makes life a lot easier, but there is one disadvantage. It is quite often the case that some of the convergence controls and associated components give trouble. The duplicate set for 405-line operation were very rarely used and can be brought into operation by disconnecting the system switch and leaving the convergence section in the 405-line position, thus obtaining a nice new set of controls etc. except of course for those common to both systems (well you can't have it all can you?). Apart from faulty controls the items to check in the event of stubborn convergence problems include the AC128 clamp transistors and the reversible electrolytics on the panel.

Before going farther we had better warn that there were quite a number of changes during the long production run of these chassis and one consequence of this is that many of the component reference numbers used in the various versions differ. This is particularly the case in the line timebase. The component reference numbers used in this article relate to the original dual-standard chassis unless otherwise indicated.

Sync Faults

A common fault with these sets is weak sync. The BC107 sync separator transistor VT6 sits on the i.f. panel and is operated from an h.t. rail obtained via a resistor (R389) on the luminance/colour-difference amplifier panel. Its base is biased by a potential divider and it is the upper resistor here, R33 4·7MΩ, that is nearly always responsible for this trouble. We got caught once when the resistor was all right and the transistor seemed to read correctly, but it turned out to be the BC107 in the end. The fault has also been traced to the BC107's base-emitter junction protection diode D3 (OA47) being defective. This is connected in series with the emitter of the BC107.

Loss of sync along with loss of colour occurs when the 3·9kΩ wirewound resistor R389 on the right side of the luminance/colour-difference panel goes open-circuit. This resistor feeds the screen grids of the three PCL84 colour-difference output valves and as we have seen also provides the h.t. for the sync separator circuit. In later models fitted with a varicap tuner it was changed to 3·3kΩ and can spring open for no apparent cause, thereby causing loss of signals since the tuning voltage is derived from this line.

No EHT

There is a tendency for insulation deterioration to occur in older models, both under the line output section and at the top front. Cut away the affected section and rewire as necessary: this does not call for description and in any case the condition will vary from set to set.

A common cause of no e.h.t. is an open-circuit line output valve screen grid feed resistor (R232, 2·7kΩ). You may find that this component is intact electrically but that it has parted company with the panel to which it should be wired. As switching is no longer necessary it can be wired directly from L43 to the PL509 base, leaving the associated decoupling capacitor C231 in its original position.

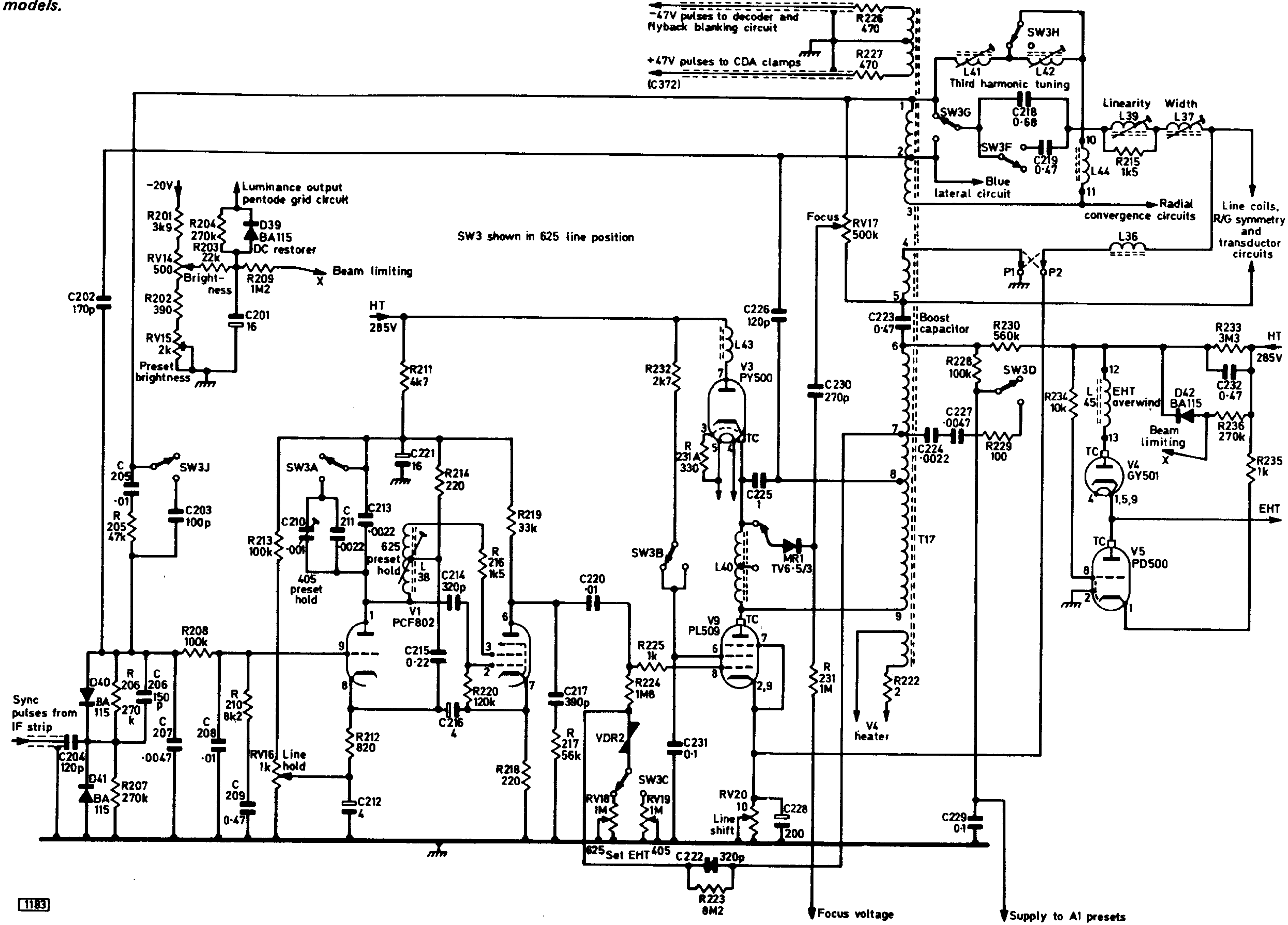
In later versions which use an e.h.t. multiplier tray failure of this component is a common cause of no e.h.t. —or lack of width. If it is necessary to replace the tray C226 should also be checked. This is the first capacitor of the multiplier chain but is mounted externally. If defective it could have caused the failure of the original tray and will mean that the new one has a short life.

The line output stage can be killed or less seriously overloaded if C229 which smooths the feed from the boost rail to the c.r.t. first anode potentiometers is defective. If this is found to be the case the associated resistor R228 should also be checked.

A clean-up job is often necessary at the base of the GY501 e.h.t. rectifier and the top cap of the PD500 shunt stabiliser—it's a good idea to replace both these valves at the same time to avoid almost certain recall later. This also holds good for the PL509 line output valve and the PY500 efficiency diode—they also seem to affect each other. Another lesson we have learnt is to look at the top caps of these valves before refitting: a goodly number are not properly soldered.

When the customer complains of smoke it is a fairly

Fig. 1: Circuit of the line timebase used in earlier (dual-standard) models.



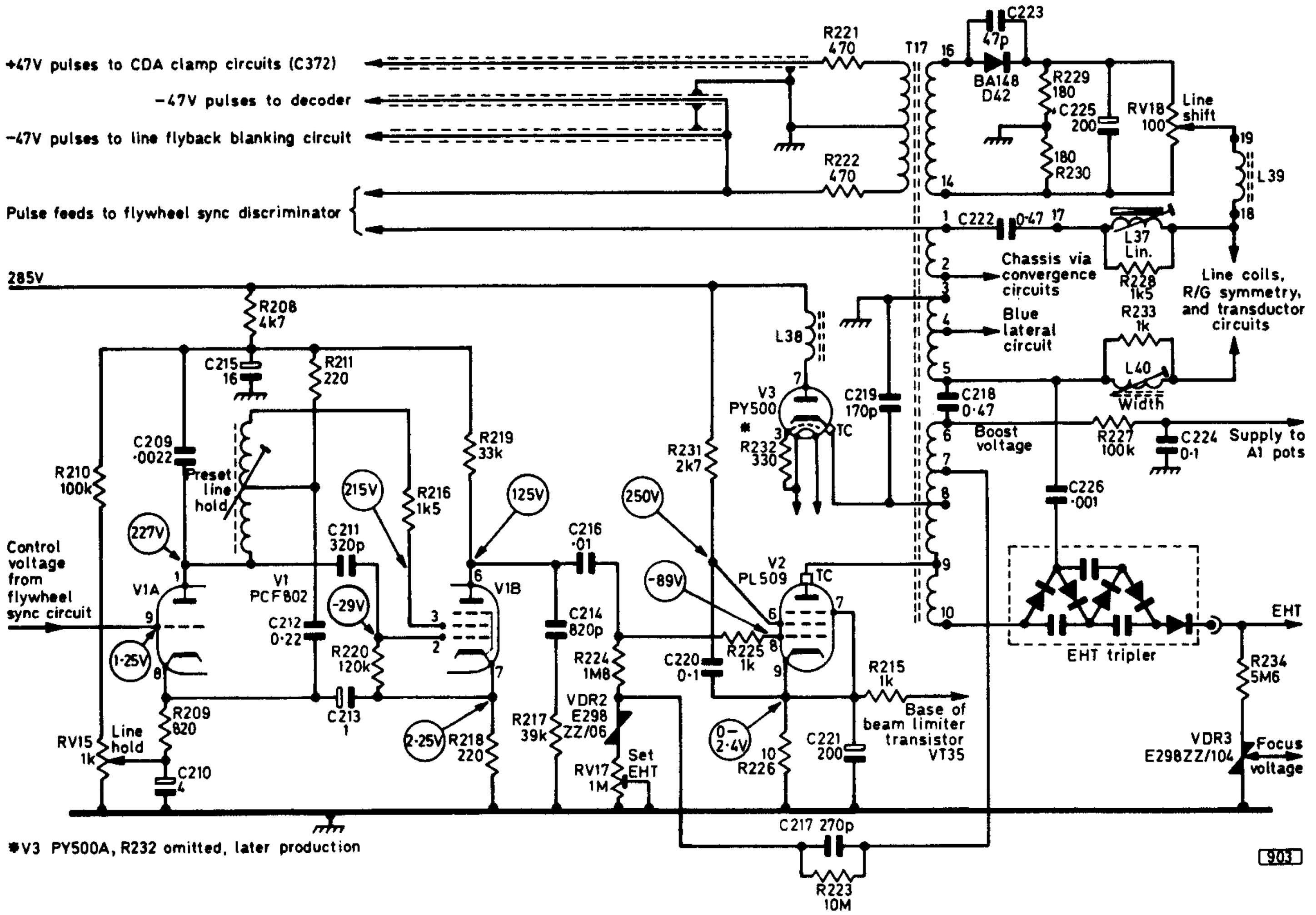


Fig. 2: Line oscillator and output stages used in single-standard chassis. In later production C219 is 180pF and is connected between tags 8 and 1 of T17; RV18 is centre-tapped and R229, R230 are omitted.

safe bet that the line output transformer will be found in some state of distress and in need of replacement. The design of the transformer has been changed through the different versions however and it is now more reliable. In those single-standard chassis which retain the metal housing we have in several cases found the transformer all right but the transformer tuning disc ceramic capacitor (C219, 170pF pulse) completely blackened and split in two. Removal of the rear plate leaves the capacitor in view at the top left side of the transformer where it is easily replaced.

In other cases the lead feeding the e.h.t. tray is connected to the transformer solder blob at an angle, resulting in discharge to the windings. The consequent damage may make it necessary to replace the transformer. This is not always the case however: sometimes the insulation can be repaired and the cable presented directly to the soldering blob (not at an angle) thus saving the cost of a new transformer. This particular point applies mainly to later sets with the printed panel. The complaint of smoke from these later sets need not indicate component failure at all: we have often gone along well armed with a replacement transformer and the usual items only to find that the trouble is due to conduction across the panel at the top, adjacent to the input fuse. The action required here is to scrape away the tracks affected and fit wire connections in place of them.

When a new line output transformer has been fitted there can be some odd side effects which arise as a result of removing and replacing the right side unit, particularly when this is of the later type with edge connectors along the top and down the left side. One can take great care to dismantle the various bits and pieces, fit the new transformer and put everything back in the right order but still be faced with all sorts of troubles when the set is switched on. These may range from loss of signals to the strangest looking convergence you've ever seen. The thing is not to panic (just run for your life!). Edge connectors are all very well provided they connect. Then again the connectors may well connect but the wires inside may not have been soldered in the first place. They just sit there working happily until they are disturbed, after which they look innocent enough but following removal and replacement of the panel just do not connect. Check each one: it saves a lot of time in the end.

Lack of Width

When the complaint is lack of width, perhaps coupled with a long wait for the picture to appear, the first items to check are the PL509 and PY500 valves. In most cases this will clear up the trouble and probably make the picture better than it has been for some time (that's what the customer usually says). There are times however when valve replacement is not the answer. It then pays to check the high-value resistor R223 (8·2M Ω or 10M Ω, or it may be two resistors totalling roughly this value) which provides a d.c. path between the boost

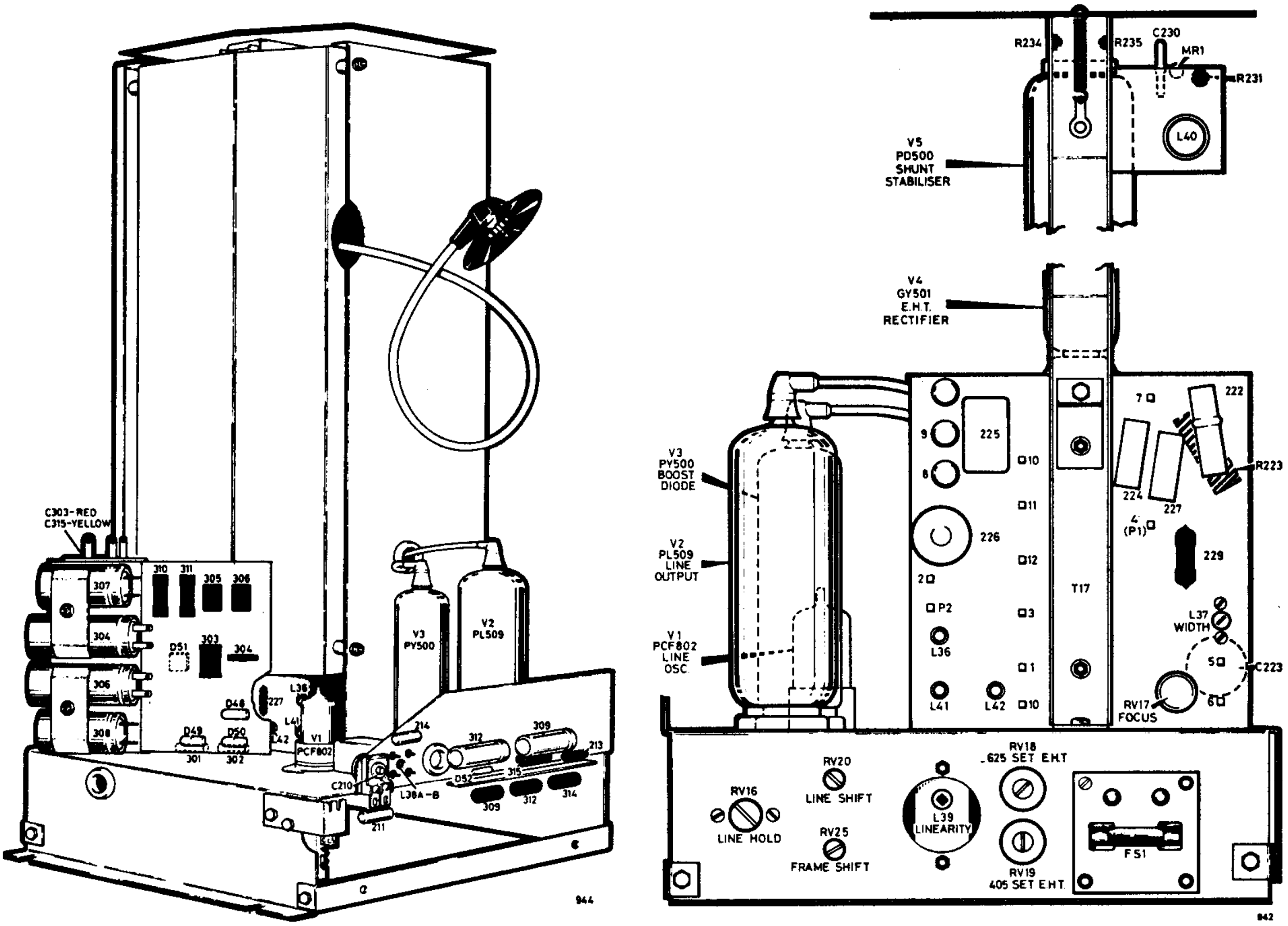


Fig. 3: The line output assembly used in dual-standard sets.

line and the set e.h.t. controls. This can go high-resistance. The associated pulse feedback capacitor C222 can also play games, and either component can be responsible for fluctuating width. The voltage-dependent resistor (VDR2) rarely gives trouble. The set e.h.t. control(s) can suffer from poor contact however, and it is vitally important not to have any hanky-panky here. Replace the control concerned and probably save the cost of a new line output transformer.

Boost Capacitor

It should be noted that one end of the boost reservoir capacitor C223 (0·47µF) is from the d.c. point of view returned to chassis. When it goes short-circuit therefore an intolerable load is presented to the PY500. No mystery here.

Striations

There is also no mystery about the appearance of striations (vertical rulings) down the left-hand side. R215 (1·5kΩ) wired across the line linearity control tends to go high-resistance thus removing the damping from the coil.

In single-standard models a variable control RV41 is connected across the parallel-connected pincushion distortion correction transductor windings to provide N/S amplitude adjustment. This quite often burns out to give the symptom of light horizontal striations across the top of the screen.

Line Oscillator

Line oscillator troubles can usually be sorted out by replacing the PCF802 or making a general check on the associated capacitors including the feedback coupling capacitor C214 which is a less obvious suspect than the cathode coupling electrolytic C216. When C216 is defective it can produce a fault condition whose cause is not so obvious, a bright vertical band down the centre of the screen. Other components which can give trouble in this area are the 16µF h.t. smoothing electrolytic C221 which can cause line hold variations, and the associated 4·7kΩ h.t. feed resistor R211 which when it goes open-circuit kills the line oscillator and results in an overheated PL509 and PY500.

Focus Troubles

Focus troubles in the dual-standard chassis should direct attention to the control (RV17), C230 which is connected to its slider and the focus rectifier MR1 which can be damaged if C230 is leaky.

If in later versions the focus is far out but the raster is of full width the v.d.r. focus unit is likely to be suffering from poor slider contact, a broken spring or cracked rod element—the rod tends to fracture at the centre.

CONTINUED NEXT MONTH

SERVICING television receivers

L. LAWRY-JOHNS

PYE HYBRID COLOUR CHASSIS —cont.

Weak Line Sync

In the event of weak line hold first try a new PCF802 line oscillator valve, then check the flywheel line sync discriminator diodes D40, D41 (type BA155 in later versions). Check C221 as mentioned last month. Another thing to check if necessary is the resistor (R205 47kΩ in Fig. 1) in the high-voltage reference pulse feedback path to the discriminator.

In the line timebase circuits shown last month the single-standard flywheel sync discriminator circuit was not included since it is basically the same as the dual-standard version. Note however that the feedback capacitor in the low-voltage reference pulse feedback path to the discriminator is 0·0022μF (not 170pF as in the case of the dual-standard circuit shown in Fig. 1). In later chassis the flywheel sync filter resistor (R208 in Fig. 1) is 68kΩ. Also in later dual-standard and in all single-standard chassis the anti-hunt network components in the filter circuit (R210 and C209 in Fig. 1) are 3·3kΩ and 1μF: it is worth making this change in earlier chassis if the picture is bent over at the top.

The Field Timebase

The field timebase does not give much trouble but when a fault does occur confusion can arise due to misleading symptoms. For example, absence of say the 20V positive supply line does not mean that the field will collapse completely. Quite a sizeable band of scan (albeit distorted) will remain. This is due to the 20V negative line (or vice versa) still being present and operating the timebase after a fashion while shifted up or down due to the shift control being connected across the same positive and negative supply lines (via R323 and R324).

Now let us consider a couple of particular cases. Both concern new sets which had been out for only a

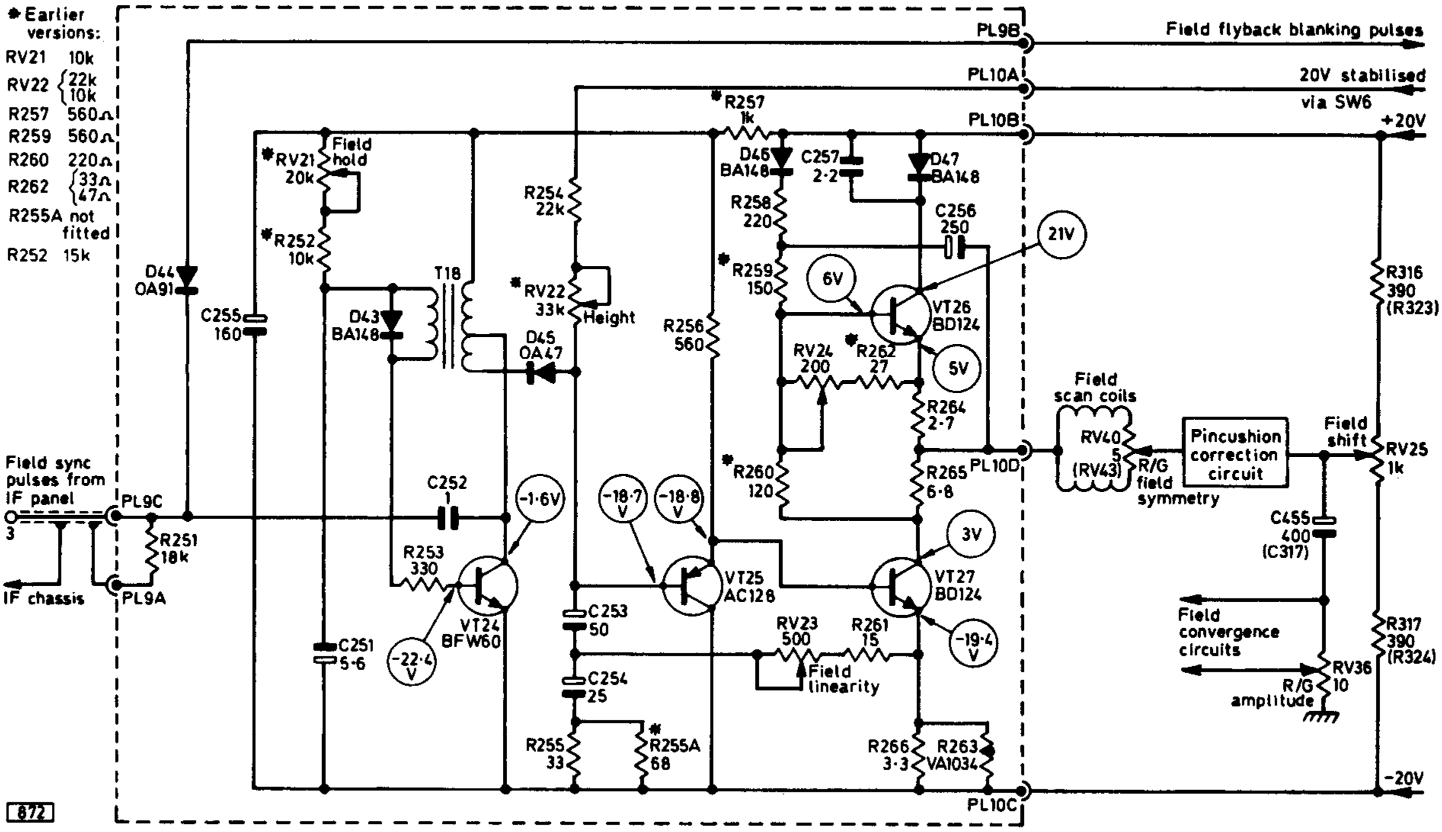


Fig. 4: The field timebase circuit, showing modifications. In the dual-standard version a coil (L49) was incorporated in series with the field shift control slider. Component reference numbers in brackets apply to the dual-standard chassis. For layout see page 261, April 1974.

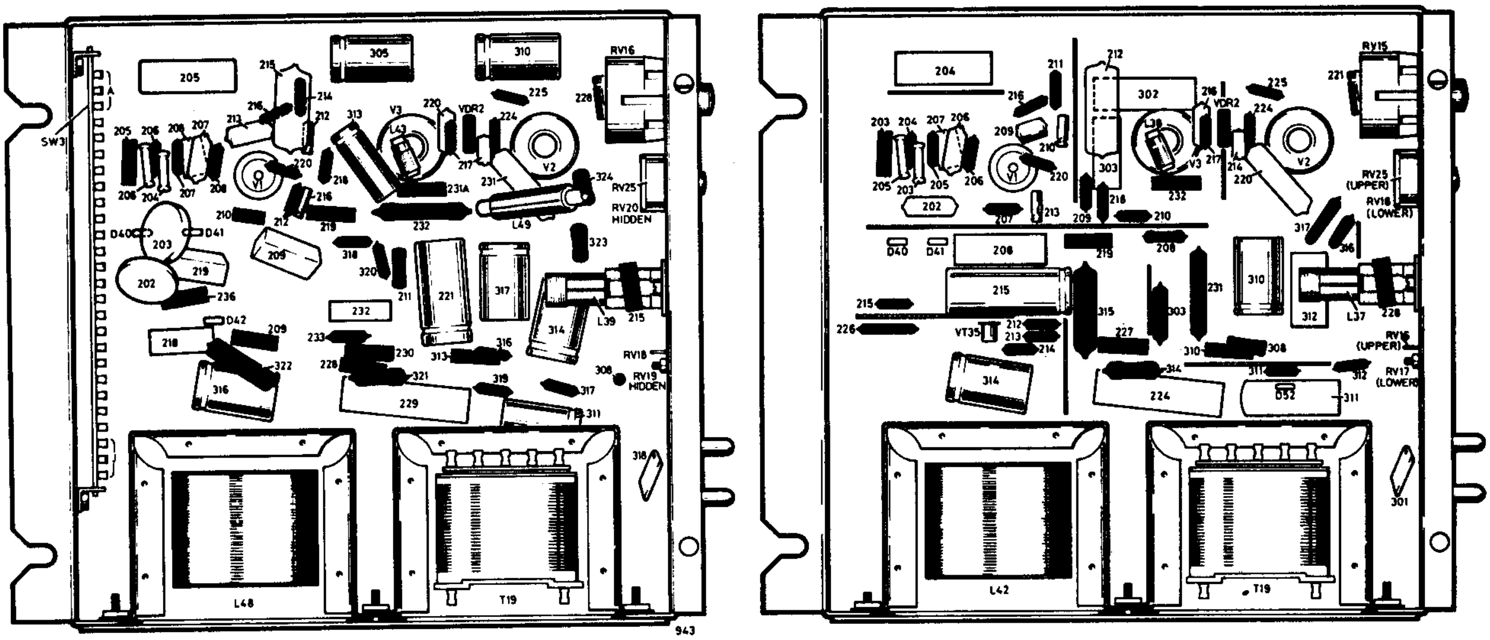


Fig. 5: Underchassis views of the earlier line timebase/power supply unit, dual-standard version left, single-standard version right. Most of the components in the single-standard version were later mounted on two printed boards.

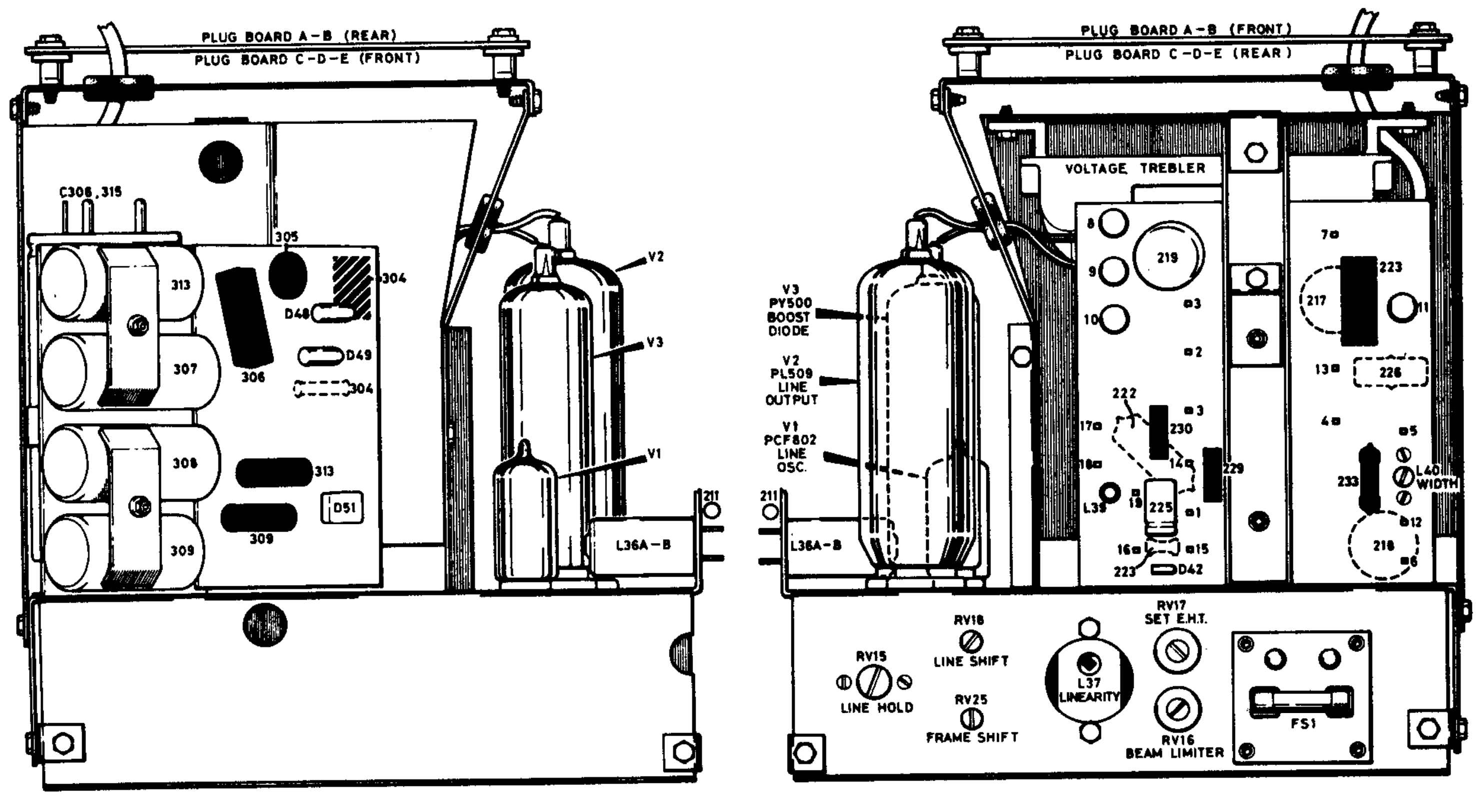


Fig. 6: Views of the line timebase/power supply assembly used in earlier single-standard chassis. These retained the screened compartment but used an e.h.t. tripler in place of the GY501 and PD500 in the dual-standard chassis.

couple of weeks at the most. Both were up-to-date 697 versions, with the right side vertical printed panel.

The first set had a band of about four inches of scan across the lower half of the screen folded up. A meter check on the output transistors showed that they were sharing only 20V and that the 20V positive line was absent, so we said "Ah, must be the bloody edge connector". Having spent some time sorting out which contact was involved we then found the supply absent there as well. The dropper resistor down below was intact so we tediously followed the track up the panel until the voltage was suddenly lost. There visible only when scraped was the finest of cracks. After constructing a suitable bridge the scan opened up to its full glory as it remains to this day. The fact that the line output stage collapses for a split second about once a week (only) is another story which cannot yet be related.

Set number two appeared to function well enough but after it had been in use for a week or so the owner complained of an annoying slight height fluctuation—not enough to switch the set off and go to bed but enough to irritate. We arrived on the scene complete with a replacement field timebase panel just in case the going got rough only to find that the 20V supply to the

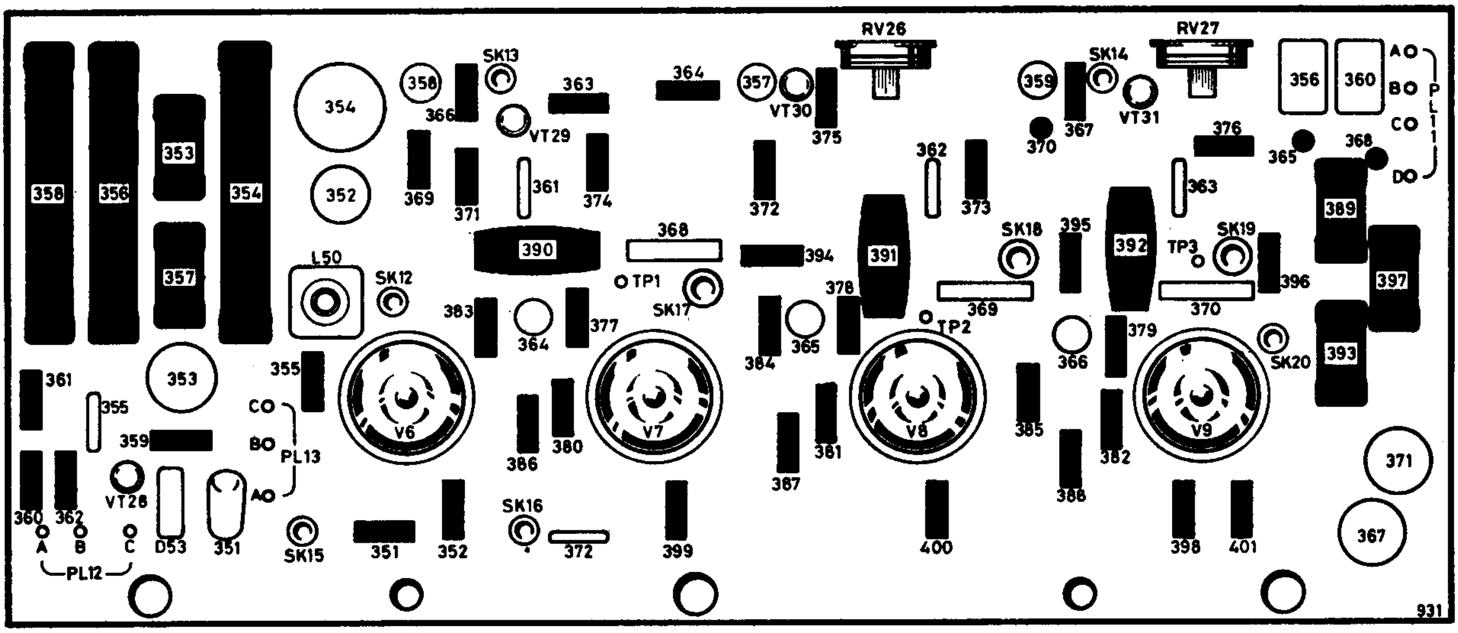


Fig. 7: Layout of the CDA (colour-difference amplifier) panel. The physical shapes of some of the components differ in later versions.

height control was fluctuating. "Bloody zener" we wrongly diagnosed. In fact it turned out to be the 250μF electrolytic (C312) across the zener. It was well nigh open-circuit. When one ponders on this, the zener did do a pretty good job in keeping the voltage as steady as it was.

So there we are: the field timebase panel is more reliable than its power supply. What about the time when one of the output transistors went open-circuit, that wasn't the supply was it? No, but that was a long time ago, about the time when the 160μF smoothing capacitor C255 shorted and collapsed the field. So it doesn't matter what you say, there always seems to be something to jog your memory and prove you wrong. Field hold troubles can be caused by C255 drying up.

The CDA Panel

The luminance output stage and the colour-difference amplifiers are on the left side board: the valves seem to glow brighter than they should. The one with the single heater is the PL802 luminance output valve which can be looked upon as the video amplifier in a monochrome set. It leads a rather arduous life, what with

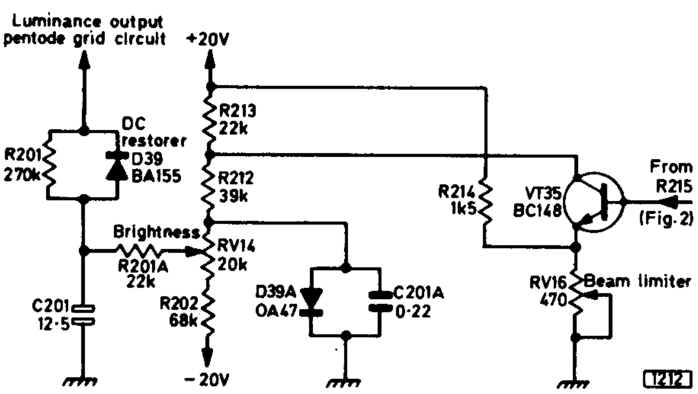


Fig. 8: Beam limiter circuit used in single-standard chassis. In earlier versions D39 was type BA115, R202 82kΩ, R212 and R213 47kΩ with D39A/C201A omitted.

the large signal swings, the brightness control operating on its control grid and its cathode bouncing up and down with the blanking pulses. It's not a life that I would like. When the brightness falls and the control is fully up therefore, spare a thought for the PL802 which may well be failing in emission causing the c.r.t. cathodes to rise in respect of the clamped grids.

With a 285V supply line the anode voltage of the PL802 (pin 7) should be about 215V with about 1·25V on its cathode (pin 9) and 205V on its screen grid (pin 8). If the valve is not at fault and the screen grid voltage is low check the 4μF capacitor (C353) which decouples it. If the screen grid voltage is high check the PL802's cathode components which include VT28 and D53.

If the voltages around the PL802 are correct it is likely that all is not well with the colour-difference output clamps. These consist of the triode sections of the colour-difference amplifiers (V7, V8 and V9), the three PCL84 valves. The cathodes of these three triodes are strapped and held at a constant voltage of something like 105V by the potential divider R393, R397. Obviously these may change value. Say R393 goes high-resistance. The voltages at the anodes will then fall as will the voltages at the c.r.t. grids and in consequence the brightness of the picture will be reduced. The reverse will happen of course if R397 goes high-resistance. The triode cathodes will then rise together with the anode voltages and the c.r.t. grid voltages to produce a brighter picture.

Wrong Colours

All this is fairly obvious. When on the other hand only one clamp varies, the colour of the picture will change. If for example the picture takes on a magenta hue it is likely that the c.r.t. green grid voltage is low and that R395 has gone high-resistance. If the green PCL84 loses emission on the other hand its anode voltage will rise producing excessive green.

We have often been called in because of pretty awful colours to find that one of the PCL84 valves has an excessively bright single heater, one of its heaters having failed leaving the other to receive the full wack.

The rule then is to get the voltages right, starting

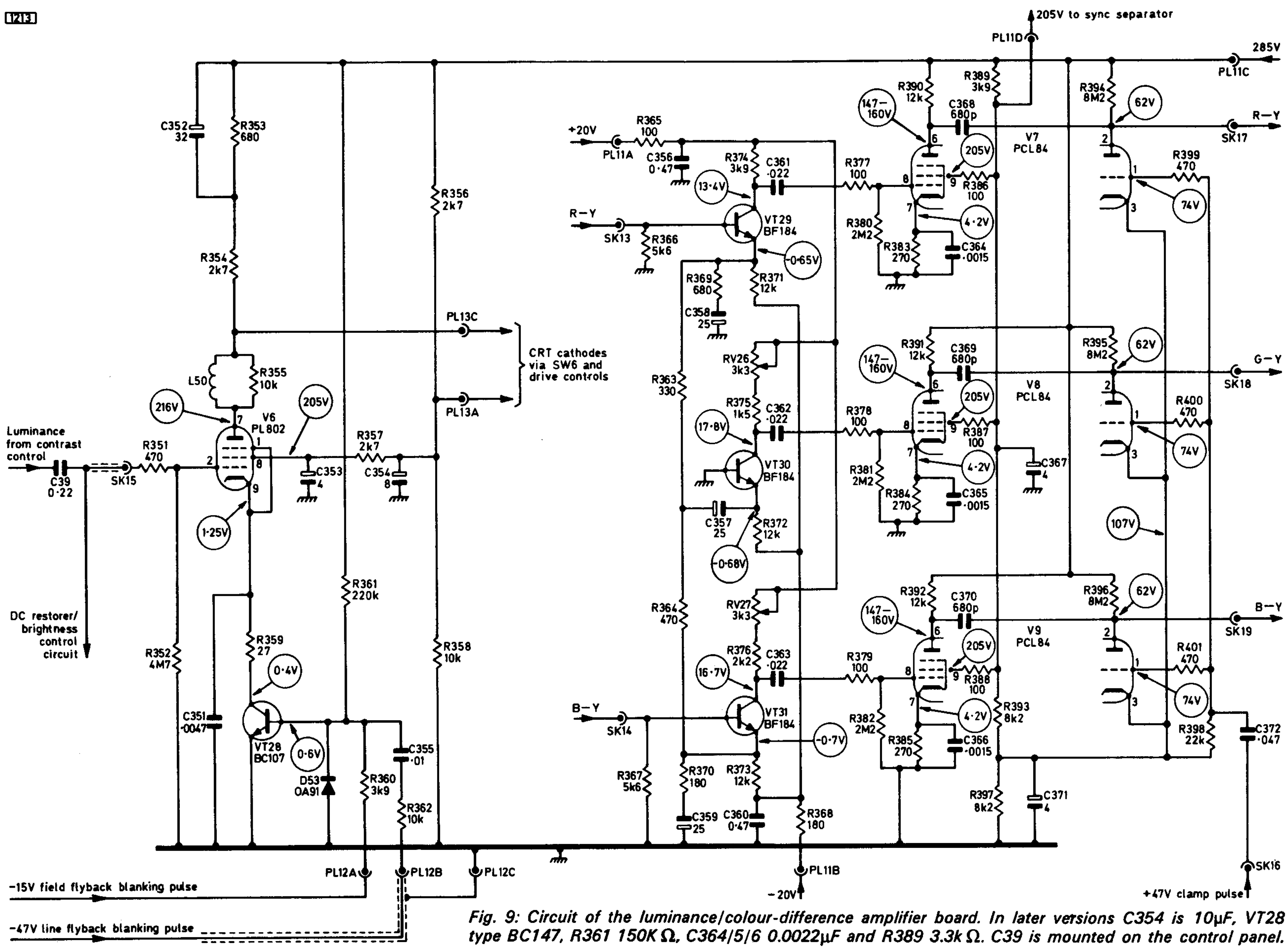


Fig. 9: Circuit of the luminance/colour-difference amplifier board. In later versions C354 is 10μF, VT28 type BC147, R361 150KΩ, C364/5/6 0.0022μF and R389 3.3kΩ. C39 is mounted on the control panel.

from the c.r.t. grids and first anodes and working back to the PCL84 anodes and screen grids: in nine cases out of ten the cause of the trouble will become apparent as an incorrect voltage is found.

Mention of the c.r.t. first anodes draws attention to the presets RV40–RV42 and their 1·5MΩ series resistors R469–R471.

Note that there will be no clamping action if R227 (line output section) goes open-circuit and the result will be weak colours.

IF and Decoder Panels

Believe it or not we have had only two faults (both more than once of course) on the i.f. panel. The first involves replacing the 4·7MΩ resistor to the base of the sync separator: this has already been mentioned. The other and more difficult one is to find the cause of loss of volume, the audio module not being at fault.

By coincidence when this one first turned up we had been spending some time on a Marconiphone Model 4816 portable (Thorn 1590 chassis) which had a similar complaint. We located the cause of the trouble in the Marconiphone set first. The cure consisted of removing the 6MHz quadrature coil can and replacing the small capacitor across the coil. Thus armed we approached the i.f. panel of the colour set (a later version, Invicta Model 7053). This also has an intercarrier sound i.c. and a similar quadrature coil and sure enough the 1,500pF tuning capacitor across the coil was open-circuit.

So all in all we can no more criticise the i.f. panel than we can the decoder, which has proved very reliable indeed.

CONCLUDED NEXT MONTH

SERVICING television receivers

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PYE HYBRID COLOUR CHASSIS —cont.

Audio Module

The original models used an audio module (LP1162) while the latest use an SN76013N-07 integrated circuit.

The module has three transistors hiding in kennels and one out on its own. The kennels (heatsinks sounds just as bad) house an AC128 driver and an AC128 and AC176 as an output pair. The lid of the unit screws on to the top of the kennels with rather irritatingly small PK screws which seem to defy a wide variety of screwdrivers—even those which should fit merely mangle the screw head. Once the cover is off it doesn't take long to replace the faulty AC128s and possibly the AC176, together with the emitter resistors which have a value of about 2·2 Ω.

When dealing with these items or the i.c. the essential aid is some solder wick (impregnated braiding) or a solder sucker in order to clear away the solder and facilitate the removal of the chip, transistor or other component.

Tuner Unit

The tuner unit fitted in earlier models was of the usual mechanical variety found in monochrome sets of the period. These have been the subject of many paragraphs in previous articles in this and other servicing features. Our remarks therefore will be confined to the varicap tuner used in later models and its attendant circuitry. This tuner is by now quite well known, consisting of three transistors etc. in association with four diodes which vary their capacitance according to the voltage applied to them as bias. A control voltage of 0·3V to 28V is sufficient to tune over the whole band of channels from 21 to 68. Whilst the tuner itself can be responsible for tuning drift in most cases the stabilising i.c. D5 (TAA550) is the cause of the trouble. As the a.f.c. is disconnected by merely pushing in the button, this can be quickly cleared of suspicion. If the a.f.c. is at fault check the soldering around the discriminator transformer T5. Make sure that the actual coil leads are soldered to the posts (inside the can). The two diodes do not seem to give trouble but we have been told that the associated capacitors can.

Some Odd Ones . . .

Recently we unpacked a new 26in. model for a pre-delivery check on the bench and on switching on noted that the valves heated, the tube didn't. There was a hum and a ping as the thermal cut-out opened and after a little checking we found a short to chassis across C313 (the 20V positive line smoother). Disconnecting the edge connector did not remove the short so we naturally took it that C313 was short-circuit. It wasn't. Looking closer at the edge of the panel, at the 20V take off point, we found that a lead protruded through and was long enough to have been bent down and soldered to the next contact down! It seemed that this had been done during production, had never been checked and had had the final inspection blue and white card attached, duly signed by two inspectors (well there were a couple of wiggly lines in the spaces where the signatures would normally be put).

We got to thinking then, surely the thing had been converged. Therefore the wire must have been soldered down after this stage of the proceedings. If so, at what stage was that?

Anyway we unsoldered the wire and cut if off short (as it should have been in the first place) and repaired the cut-out which is fitted on the transformer between the tags. The set then behaved itself, and the convergence wasn't far out. We then thought a bit more.

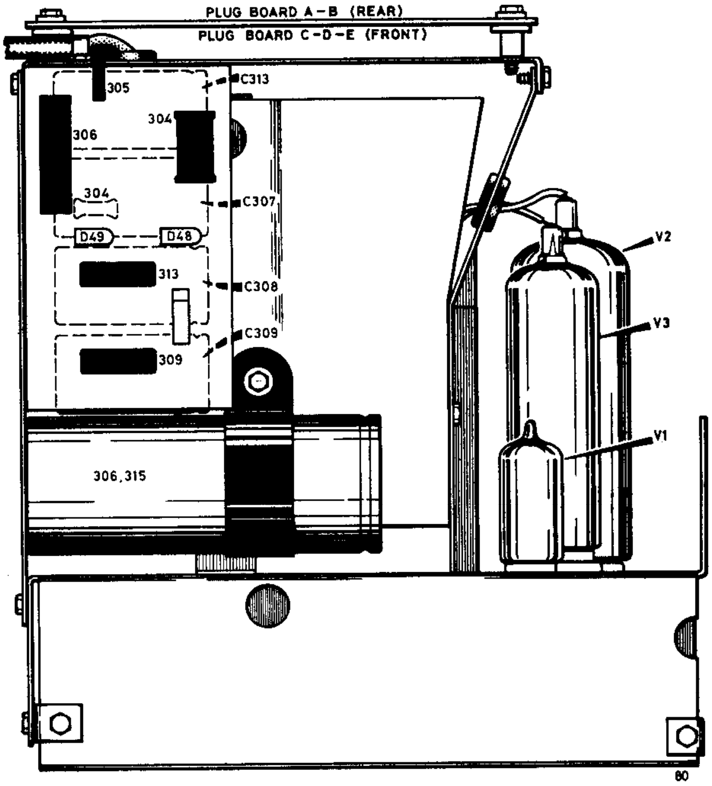

Fig. 10: The line timebase/power supply assembly used in later 691 and in the 693 chassis.

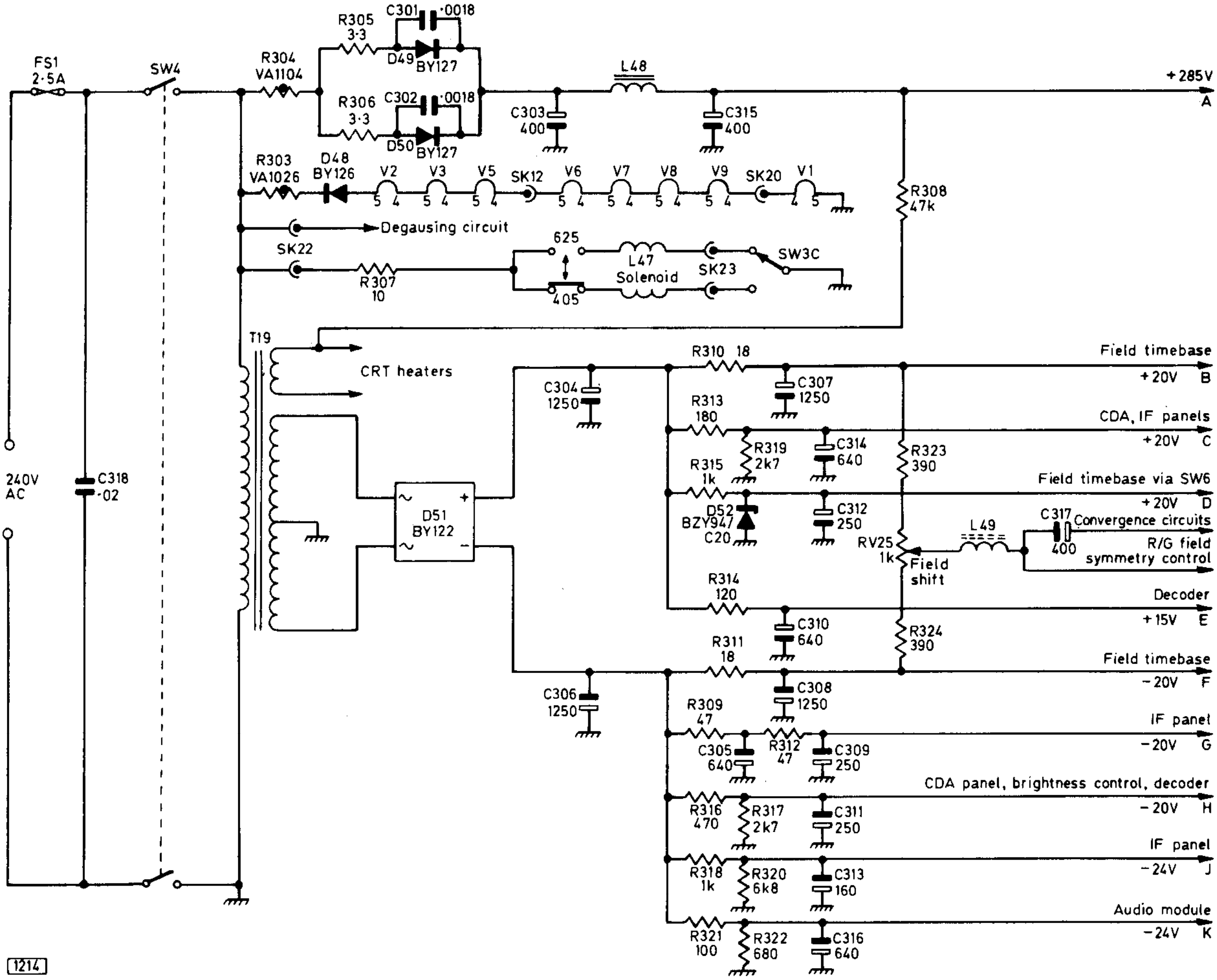

Fig. 11: The power supply circuitry used in the dual-standard 691 chassis.

The box the set came in looked as if it had been resealed. So perhaps we had not been the first to receive it and other eager little hands could have done the deed after dispatch from the factory. Further enquiries

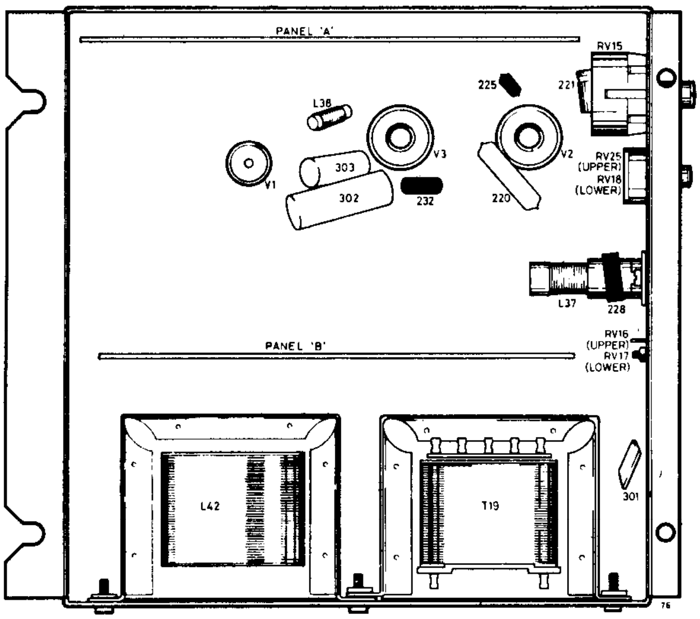

Fig. 12: Underchassis view of the line timebase/power supply assembly used in later 691 and in the 693 chassis.

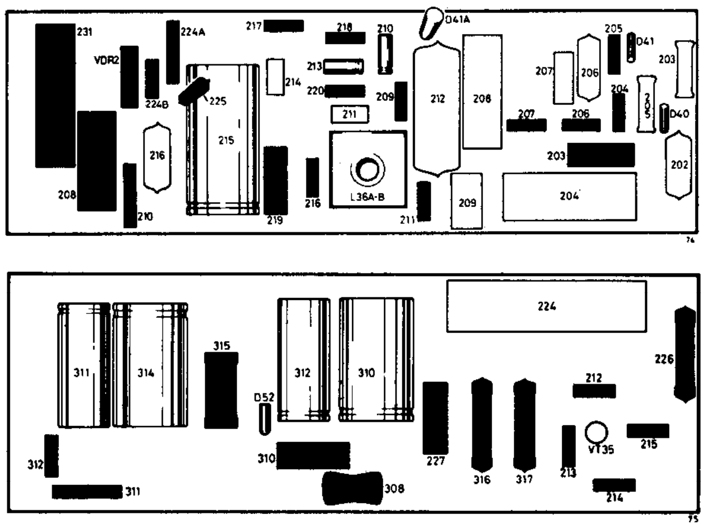

Fig. 13: The printed boards, line oscillator panel A top and smoothing panel B below, mounted beneath the line timebase/power supply assembly used in later 691 and in the 693 chassis.

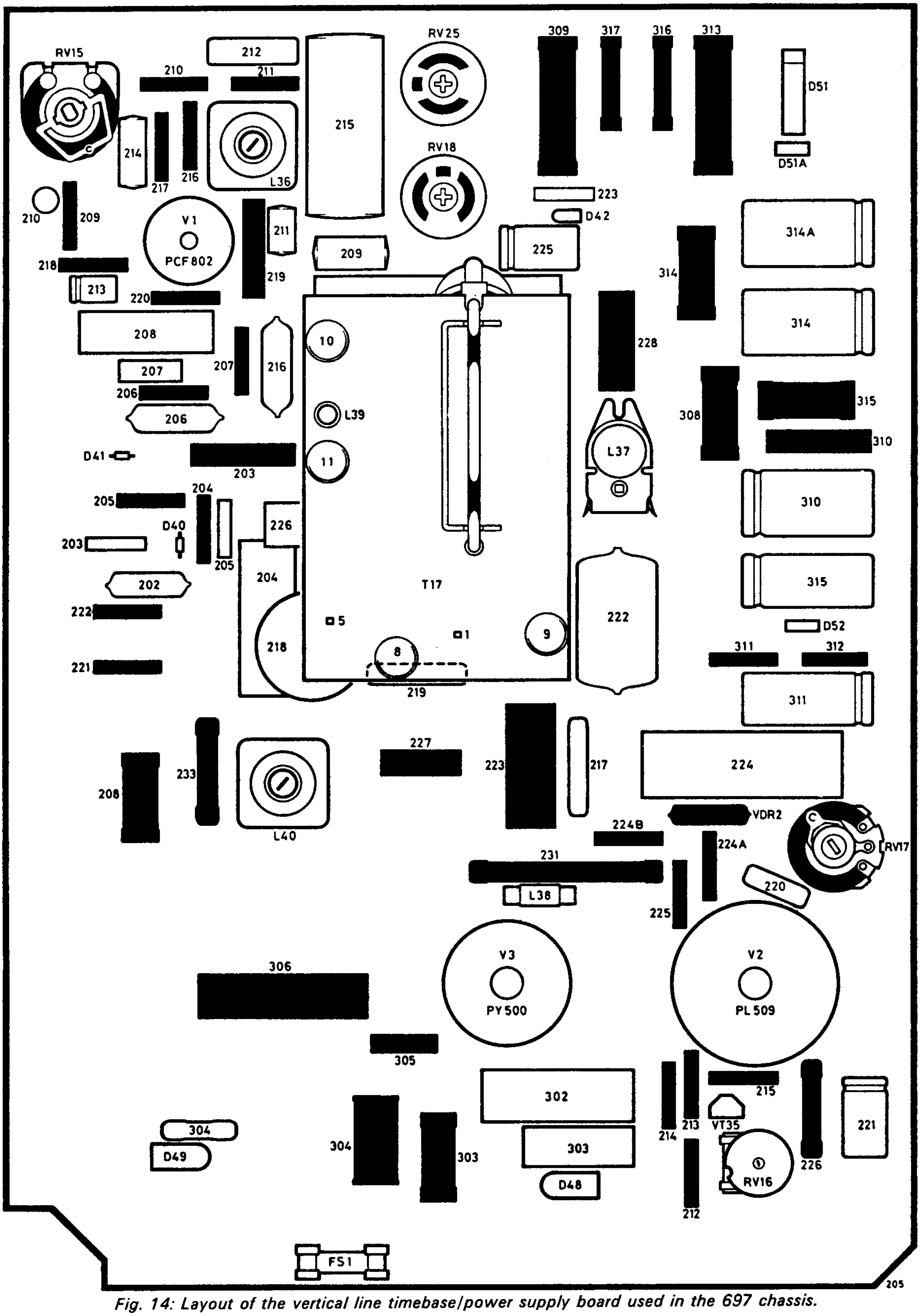

Fig. 14: Layout of the vertical line timebase/power supply board used in the 697 chassis.

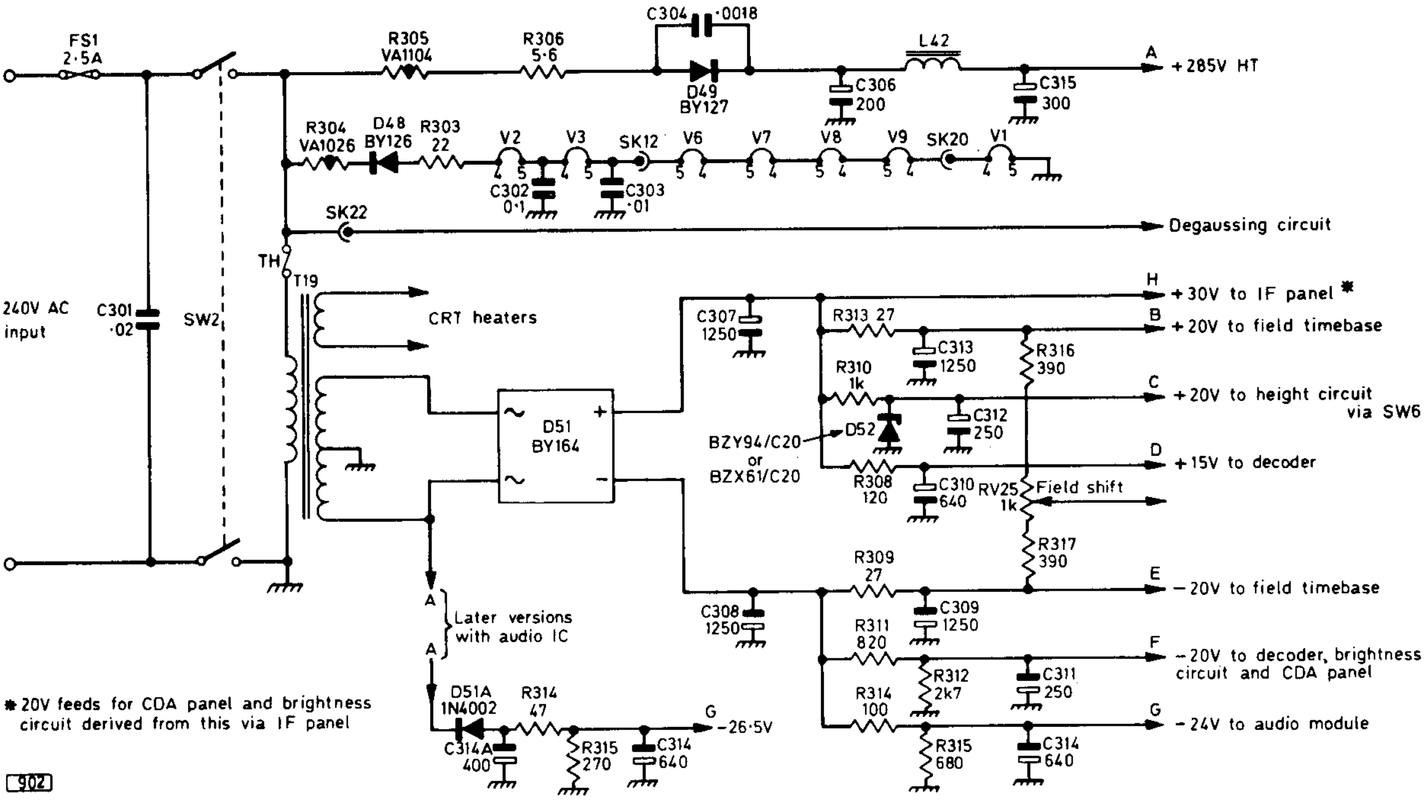

Fig. 15: Power supply circuitry used in single-standard chassis. In later versions C301 is 0·2μF, thermal fuse TH is added as shown, R306 is 3·3Ω, R303 and D48 are transposed and the heater chain is as follows: V2, V3, SK20, V9, V8, V7, V6, SK12, V1, chassis. Note different "G" supply circuit used with audio i.c.

suggested that we were not the first dealer to receive the set. We won't go into the ifs and buts as it was a long drawn out affair. The upshot is that we still do not know who did the deed and at what stage.

Bridge Rectifiers

Whilst on the subject of l.t. shorts incidentally we have had numerous sets of various types—monochrome and colour television receivers, radios and unit audios—in for service with varying symptoms of poor smoothing and excessive current demand, seemingly due to leaky or open-circuit electrolytics: the fault has been found to be due to the bridge rectifier itself however. We mention this because it could well happen in the models under discussion.

Convergence

The original models are often difficult to converge, particularly at the sides and mainly with the blue dynamic controls. Whilst it is well nigh impossible to obtain perfect registration all over the screen and a waste of time trying to achieve this (looking close up) it should nevertheless be possible to achieve good convergence when looked at from a reasonable viewing distance.

Where this cannot be done first note the action of the controls. If this is jerky the control itself is at fault. If the control has a smooth action however but will not give the desired affect the associated capacitors and the AC128 transistors—which are wired as diodes—should be checked. If tapping the panel produces convergence changes check for dry soldered joints around the control pegs and the resistors etc. Nothing is more annoying than to achieve beautiful convergence and then find that after putting the panel back on or swinging it down—as the case may be—horrible errors that necessitate finding the faulty joint and possibly doing the whole lot again are produced.

Note for Beginners

If the colours do not appear to be right don't try to set up the drive and c.r.t. first anode controls on a colour picture. Turn down the front colour control, or detune slightly to lose the colour, then set up the controls to obtain a good black, grey and white (cloudy white) picture—the drive controls for the whites and light greys, the first anode presets (mounted on the convergence board) for the darker greys. If you don't know where the drive controls are don't try to do the job at all.

Get it right in black and white, then mount the colour on top.

Power Supply Notes

The 285V h.t. supply and the supply for the valve heaters are derived from the mains via diodes in the usual way. The supply for the tube heaters and the l.t. supplies are derived from a transformer.

The l.t. supply comes from a bridge rectifier. Thus although the chassis is the negative return for the h.t. supply, as is usual in most large-screen monochrome sets, the chassis is approximately midway from an l.t. point of view, there being both positive and negative (with respect to chasses) supply lines.

In Conclusion

On the subject of poor line sync we have noted several reports, though we have not experienced this

—turn back to page 358

SERVICING TV RECEIVERS

—continued from page 373

problem ourselves, of the fault "line shake" due to C211 and C212 (single-standard chassis component reference numbers) in the line oscillator circuit. It is recommended that these should be replaced using the best polystyrene or polyester types available.

Finally we have noticed that failure of C226 (0·001μF) in the e.h.t. multiplier circuit is becoming more common, resulting in the first stick in the e.h.t. tray burning out. The 2·5A mains input fuse blows since the PY500 efficiency diode will have been virtually a short-circuit across the h.t. line. So if there is a nasty smell fit a new capacitor, e.h.t. tray and mains fuse, and check the PY500.

NEXT MONTH: PHILIPS G6 CHASSIS