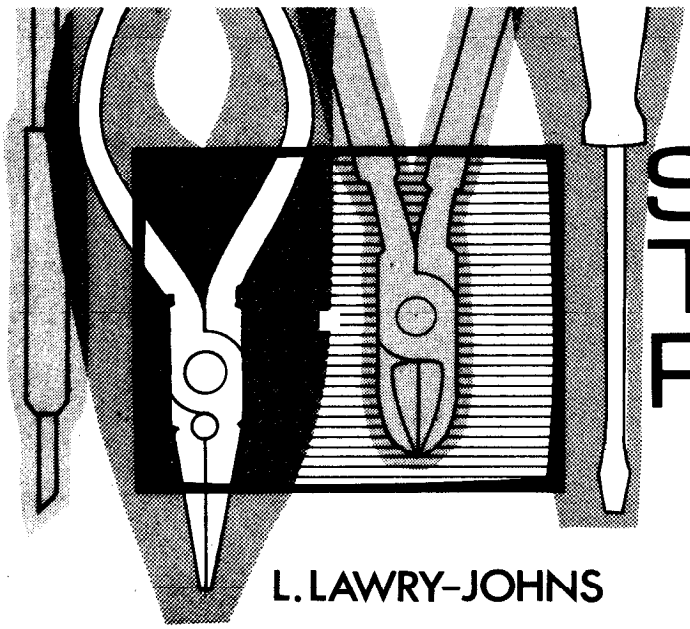


SERVICING TELEVISION RECEIVERS

THE PHILIPS K70 COLOUR CHASSIS

L. LAWRY-JOHNS

A LARGE number of these Swedish built sets were released on the market about five or six years ago, both through wholesalers and through rental outlets. A goodly number are now on the second-hand market or otherwise out of the hands of the original suppliers. There are many readers therefore who need or will need such information as we can put together in as readable a form as we can manage.

Description

The cabinet is rather bulky, housing a 26in. 90° tube. It sits on a frame and if the original fixings are still in use an Allen key is required to release the bolts. You may well find however that these have been omitted at some time in a set's career – very often the set can be lifted off without the necessity to seek the bolt holes. The front presentation is quite pleasant, with a push on/off switch at the top and six rotary controls beneath. These are volume and tone, brightness and contrast, and saturation and hue. The tone and the hue controls have a definite centre position to "feel" the preferred position.

The six press-button tuner at the bottom covers v.h.f. and u.h.f., but only the latter is of use in the UK of course. Thus all six will probably be found set to receive u.h.f. There are likewise two aerial sockets at the top rear, but only one need concern the user.

There are two loudspeakers and the quality of reproduction is very good (until the PCL86 audio output valve starts its pranks that is).

The Innards

The rear cover is secured by two sliders (secured by screws) at the top: it hinges down to free the bottom clips.

The first time one removes the rear cover and looks at the interior one's initial reaction is to put the cover back on and forget the whole thing – or remember an appointment elsewhere and promise to return at a later date. Such cowardly impluses must be controlled of course if you own the set, and you then have to take time to see where most things relevant to the fault are situated. There is a plastic plug at the top right and a plastic latch at the bottom right (marked). With the plug withdrawn and the latch swung to the right the chassis can be swung open to reveal the front of the panel, the bottom centre power supply panel and the right side group of line output valves. Most receivers use a PL509, a PL504 and a PY500 in this group but it is quite common to find a label on the right side with PL509 boldly proclaimed. This means that there are two PL509 valves and no PL504. More on this later.

Profusion of Presets

A thing which strikes a close observer is the profusion of preset controls. Wherever the eye settles there is another preset to tempt the hopeful fiddler. Over a period of time many engineers develop an instinct for spotting the right preset almost every time, even on a strange chassis. It doesn't work on this one. The service information must be at hand at all times before any adjustment is attempted – except perhaps for convergence.

Convergence

The convergence panel is on the left side, concealed by a wood strip secured at the top by a single screw. If only a single adjustment is needed it can often be done without sliding out the panel (box is perhaps a better word) as the knobs are clearly marked both in sequence and function. For more exact setting up the panel must be withdrawn and stood on top of the cabinet. All adjustments are made, including static convergence, following the numbered sequence. There are no static magnets on the tube assembly.

There are six background (first anode or "G2") controls. The three to the left of the tube are the initial or coarse adjustments, those on the extreme left side are the fine ones for getting the grey-scale just right without dismantling the rear cover.

Valve Functions

There is a goodly number of valves and although their functions are in the main obvious there is a joker in the pack. One looks up to the top left and sees the extreme left PCL86 which is obviously the audio output valve. To the right of this are the three PCF200 colour-difference amplifiers and clamps, following conventional practice in hybrid chassis, with the PL802 luminance amplifier farther towards the centre.

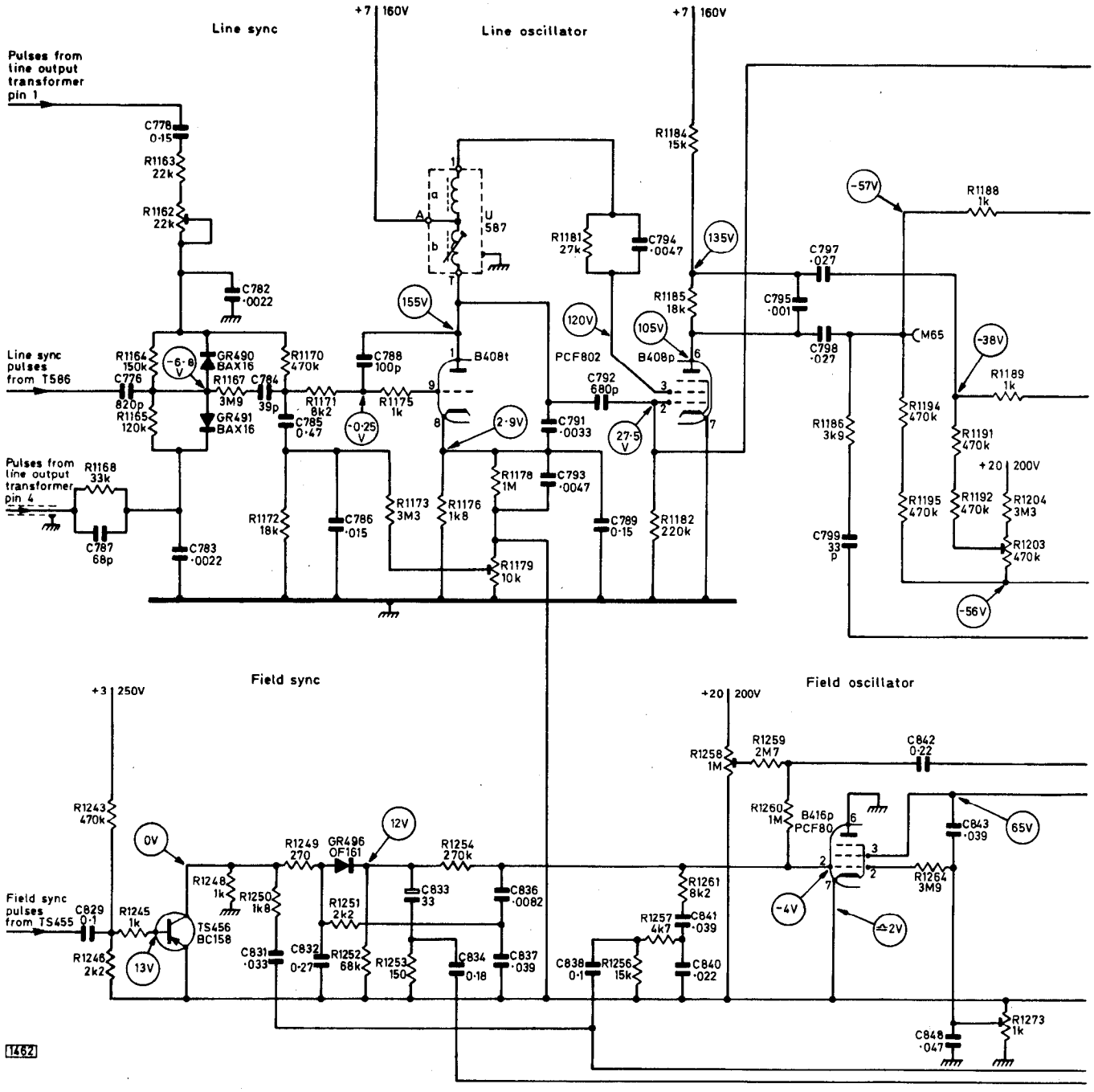


Fig. 1: Circuit diagram of the timebases. There are slight modifications, including the use of a

The top centre panel houses the PL508 field output and the PCF80 part field oscillator: this is the joker. The triode section of the PCF80 plays no part in the field timebase operation, but if the contrast is falling off try replacing this valve instead of panicing when the PL802 is found not to be at fault and you feel that the next step must be to start making transistor voltage checks. The contrast control sets the triode's grid voltage, its cathode voltage in turn setting the level at which transistors in the luminance and the chrominance channels operate. So there's one subtle one for you and the reason why when it's necessary to adjust the field hold control there is often an accompanying loss of contrast.

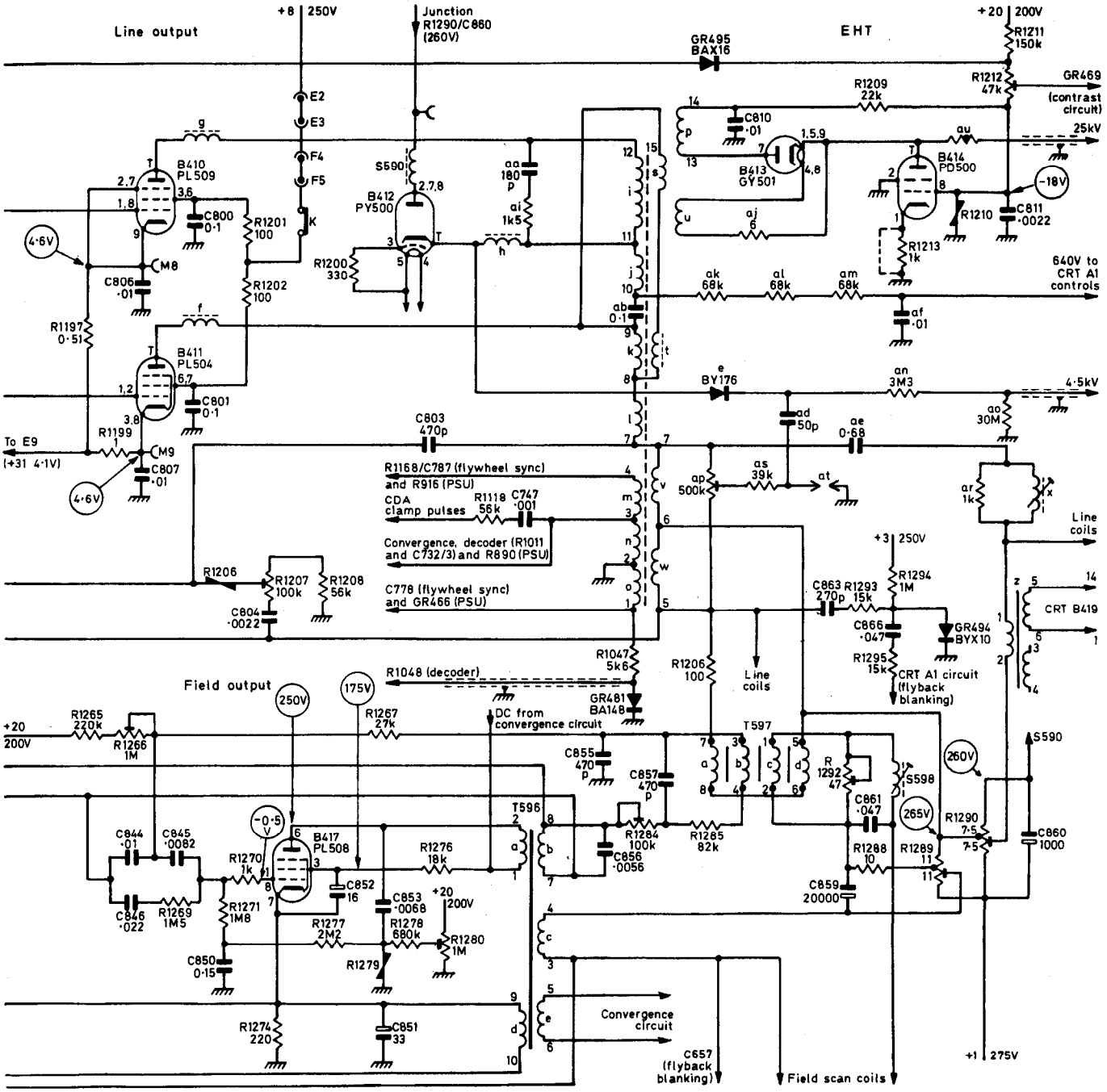
Line Timebase

The line oscillator is a conventional PCF802 on the lower right side and there is no mystery here except for the purpose of each preset on the panel. It's easy for example to mistake the line drive for the beam limiter, while nearby is the balance control which has nothing to do with the flywheel line sync as might at first be imagined but adjusts the balance between the PL509 line output and the PL504 (later PL509 too) current stabiliser valves. This control should be set for zero voltage between the two cathodes. There is a flywheel line sync balance control as well, but this is R1162 mounted at the left upper side of the same panel.

One might also expect to find the line sync transistors (TS452 line sync separator and TS453 pulse amplifier) somewhere near, but they are up at the top left (roughly under the PCL86) along with the sync buffer transistor TS426 and the noise-canceller TS451. There is a trouble spot here which we will outline later.

Power Supplies

Still on the bottom centre panel however, the line



second PL509 in place of the PL504, in the line output stage. These will be shown next month.

oscillator components are along the top but the bottom is taken up with power supply resistors and smoothing capacitors.

A thing which may strike the close observer when looking at this area is the number of very small resistors in the power supply lines. In fact these act more like fuses and should not be replaced with larger types because in the event of a short the load would be reflected farther back in the supply with consequently more extensive damage and confusion as to the source of the fault. If one of the small resistors is found "looking poorly" one immediately knows at least in which circuit the fault lies. This is more important than it might at first appear to be, since some of the supply lines are drawn from the line output transformer.

It should be appreciated that there is no mains transformer and therefore all the supply lines are dropped either from the mains or derived from windings on the line output transformer (including the tube heaters). The valve heaters are in a series chain which follows the GR460 bridge of rectifiers (as opposed to the parallel h.t. rectifiers GR461/GR462). If this sounds a bit murky, look at the power unit diagram and read what comes later.

Circuit Protection

But for the moment we want to return to the subject of the small safety resistors. Let us say that R901 is found damaged. This is a 33Ω ¼W type. It's in the "+2" (27.0V) supply line to the field timebase. In the event of a short in the field circuit – the output stage that is – the resultant heavy current flow will burn up this small resistor instead of opening the thermal cut-out (R897). If the 33Ω resistor was a larger type the cut-out would open and leave considerable doubt as to where the fault was.

Note also R916 which again is an ¼W type but has a value of 100Ω. This is in series with a BA148 diode which supplies (+20, 200V) the field oscillator. The current demand is very low, hence the use of a BA148, and the

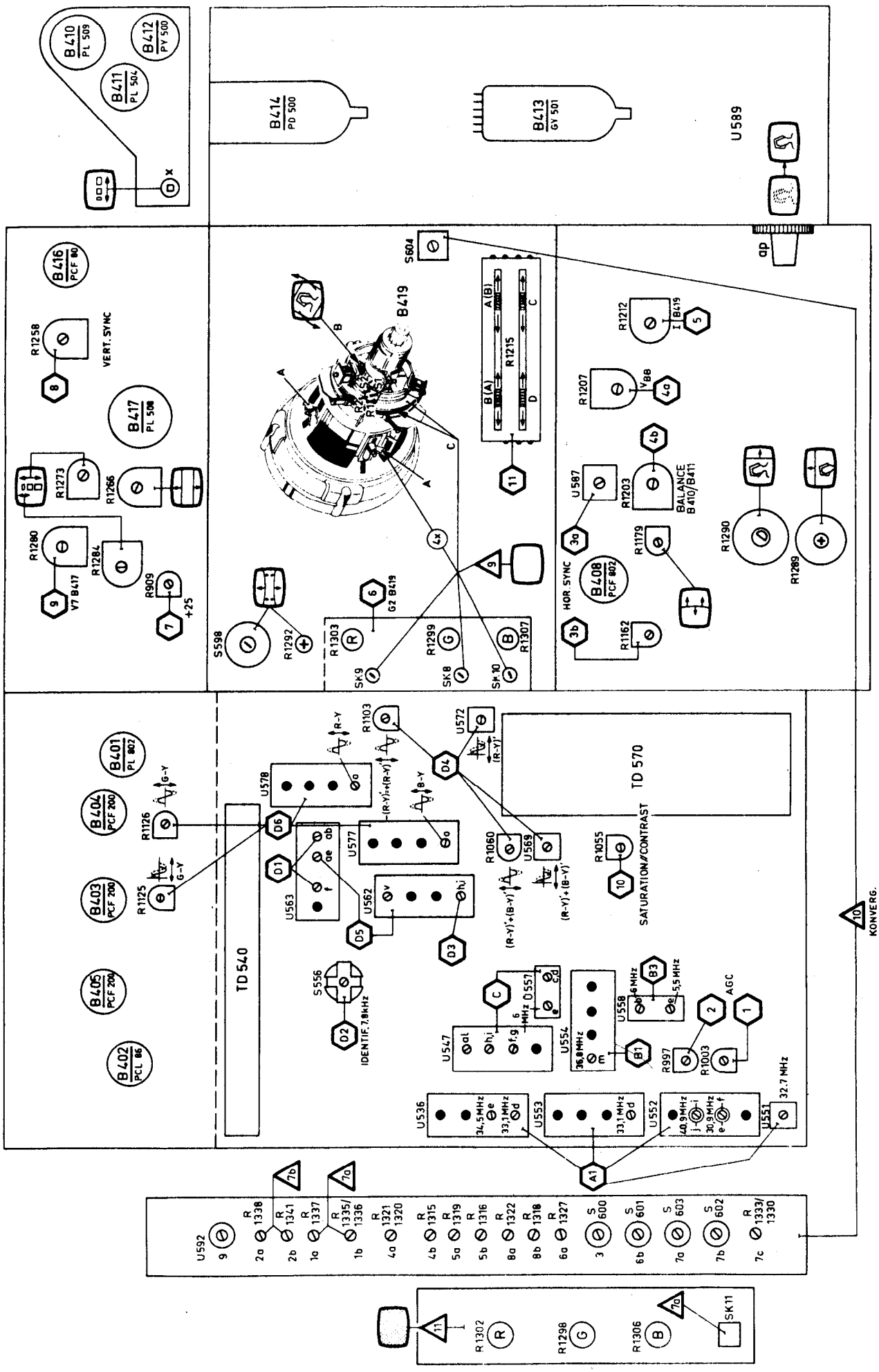


Fig. 2: Chassis layout. The signal circuits are below left with the colour-difference, luminance and sound output circuits above. At bottom centre is the board carrying line oscillator and the power supply resistors and smoothing capacitors. The field timebase is on the centre top panel while the line output compartment is at the right.

source of the supply is a winding on the line output transformer (windings N and M or 2 to 4).

Obviously a severe short across this line would overload the line output stage and indeed the writer has heard the "whine" of protest from the line output transformer just before R916 gives up the ghost and burns to a cinder. What causes this to happen? Several things, but usually the diode itself shorts as the result of local heat.

So this is the purpose of the small resistors: to act as fuse links as well as surge limiters. Although the chassis is full of somewhat unusual features we do not propose to go into lengthy explanations of all these as by and large the main part of the receiver is reliable and requires little attention. There are some parts which regularly give trouble however, presenting the repairer with quite a headache if he is not forewarned.

Power Supply Faults

Most of the troubles occur in the power supply and in fact these cause the least doubt. Most often the first sign of trouble is that the set fails to work at all. Investigation may show that either the supply fuse in the mains plug has failed (if it's a 5A type) or that one of the 3·15A fuses on the power panel (perhaps both) has blown. In fact there are three fuse holders on the panel, the centre one being unused.

In this event the first items to check are the four diodes which form the bridge (hence our earlier reference to a bridge of rectifiers rather than a bridge rectifier). Quite often these may not all be of the specified type (BY127), and may be of the square variety with a slope at one end to indicate polarity. Whatever type is found, check their back-to-front resistance: one will almost certainly be found to be short-circuit. Remember that these four diodes lead a pretty hard life, passing the heater as well as the h.t. current.

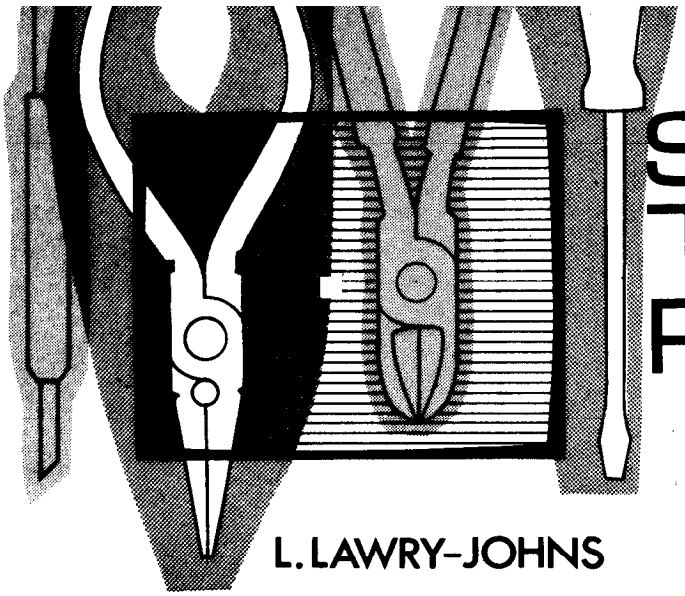
Heater Chain

In view of this one may find that replacement of the faulty diode and the blown fuse may still leave the set not working due to a more obscure trouble which initially put the "last straw on the camel's back". When the set is switched on take note of the valve heaters, particularly in the line output cage. It is sometimes the case that these will light up brightly whilst all the other heaters do not light up at all. This can be caused by a shorted heater decoupling capacitor (little brown discs from heater pins to chassis) and two of these can be seen sticking out from the PY500 valve base. On two occasions we have found one to be blackened to denote that the heater current is flowing through the PL504, the PL509, the PY500 and the capacitor only, the other valves remaining unsupplied. There could be other causes such as a heater-cathode short in another valve, but this hasn't happened to us on this chassis so far. So far . . .

EHT Compartment

Before leaving the subject of valve heaters, don't forget that the PD500 shunt stabiliser is in the top of the enclosed e.h.t. compartment and that the heater of this valve is also in the series chain. And whilst we are about it we must mention that the cover of the e.h.t. compartment operates the switch which is in series with the h.t. supply to the screen grids of the PL504 and the PL509 (or both PL509s if two are used). This is to cut off the e.h.t. when the cover is removed, thus preventing X-ray radiation from the GY501 and PD500 valves.

CONTINUED NEXT MONTH



SERVICING TELEVISION RECEIVERS

PHILIPS K70 CHASSIS

continued

L. LAWRY-JOHNS

HT Supply Faults

The next most common fault is rather more awkward. It will be seen that the h.t. supply is drawn from a pair of BY127 diodes situated at the lower rear (rather than on the same panel as the fuses and bridge rectifiers). There are two surge resistors below the diodes, R891 and R892. These have a value of 4·7Ω, are wirewound and in rectangular white housings.

The sequence of events is (I believe) as follows. One wirewound resistor becomes open-circuit as wirewounds are apt to do, and this shuts off the supply to one BY127. The other manfully struggles on, bearing the load until it registers its objection by burning up. This damages the panel which may also ignite to add further heat before the diode shatters and shuts off the current and (hopefully) the minor blaze goes out of its own accord, leaving a nice old mess to clear up. Now one may think that a small cut away job and the fitting of new diodes and a surge limiter together with the replacement of any other damaged components would be the sum total of the work involved, but this is rarely so.

If the thermal cut out R897 is open, proceed with caution and check for h.t. shorts. Even if none are found, fireworks may still occur as the line timebase warms up after R897 has been resoldered and the set switched on. The fireworks may come from R916. The trouble is that the BA148 previously referred to has been subjected to heat and it doesn't like it. Since it's not supplied from the h.t. line the short will not show up unless you check across the diode or from the +20 line.

Burn ups

There are several variations on this theme of burn ups on the lower panel and we once found the beam limiter preset control R1212 burnt out together for some reason with R1209 (we never did find out why but suspect a short between tracks which had burned away thus destroying the evidence). Again we found R916 cooked up due to the BA148 shorting and we had to put this down to local heat. The moral of this is to check the BA148 for shorts whenever there has been excessive heat in the vicinity.

Weak Sync

A common occurrence is gradually weakening sync pulses until a point is reached where the line is pulling one way or the other with no positive hold, the field being lockable but only just. A word of caution here though. If the field sync is solid but the line cannot be locked, try another PCF802. If however the field sync is weak as well as the line it saves an awful lot of trouble if a couple of resistors are checked before chasing the sync pulses back along the line.

The suspect resistors are R1145 and R1147. These are situated on the upper left side and are connected from the +3 (250V) line to the collector of TS451. Their values are 47kΩ and 39kΩ respectively but they tend to change value (going high), giving wrong voltage readings all around the area of the sync transistors. When these resistors have been replaced one voltage may be found at variance with the service information. This is the collector voltage of TS453. It's given as 13V on the circuit but we haven't been able to record this figure and about half is more likely to be found.

Dark Picture

A dark picture is normally due to a low-emission PL802 luminance output valve. In the unlikely event of a new valve not curing the condition, check the tube base voltages to ensure that the cathodes, grids and first anodes are about right, then follow the trail provided by these readings. Give or take a few volts, the cathodes should be at about 200V, the grids at about 88V and the first anodes at about 350V depending upon the settings of the background controls.

Luminance Output Stage

If the cathode voltages are high, the PL802 is probably not passing normal current and if the valve is not at fault its cathode and grid components should be checked, including the black-level clamp transistor TS429. This transistor is normally cut off, being turned on by the line frequency clamp pulses. Note that there is an error on the official circuit – where the slider of the brightness control is shown connected to chassis – and also on the printed board layout where GR473 is identified as GR493 . . . Lack of brightness could be centred around TS429 and the components in the PL802's cathode and grid circuits – say due to TS429 being leaky or short-circuit, thus increasing the valve's cathode voltage. We say could because so far as we are concerned this part of the circuit has behaved itself.

Panel Decomposition

What hasn't behaved itself is the panel around the base of the PL802. This decomposes, with resulting shorts

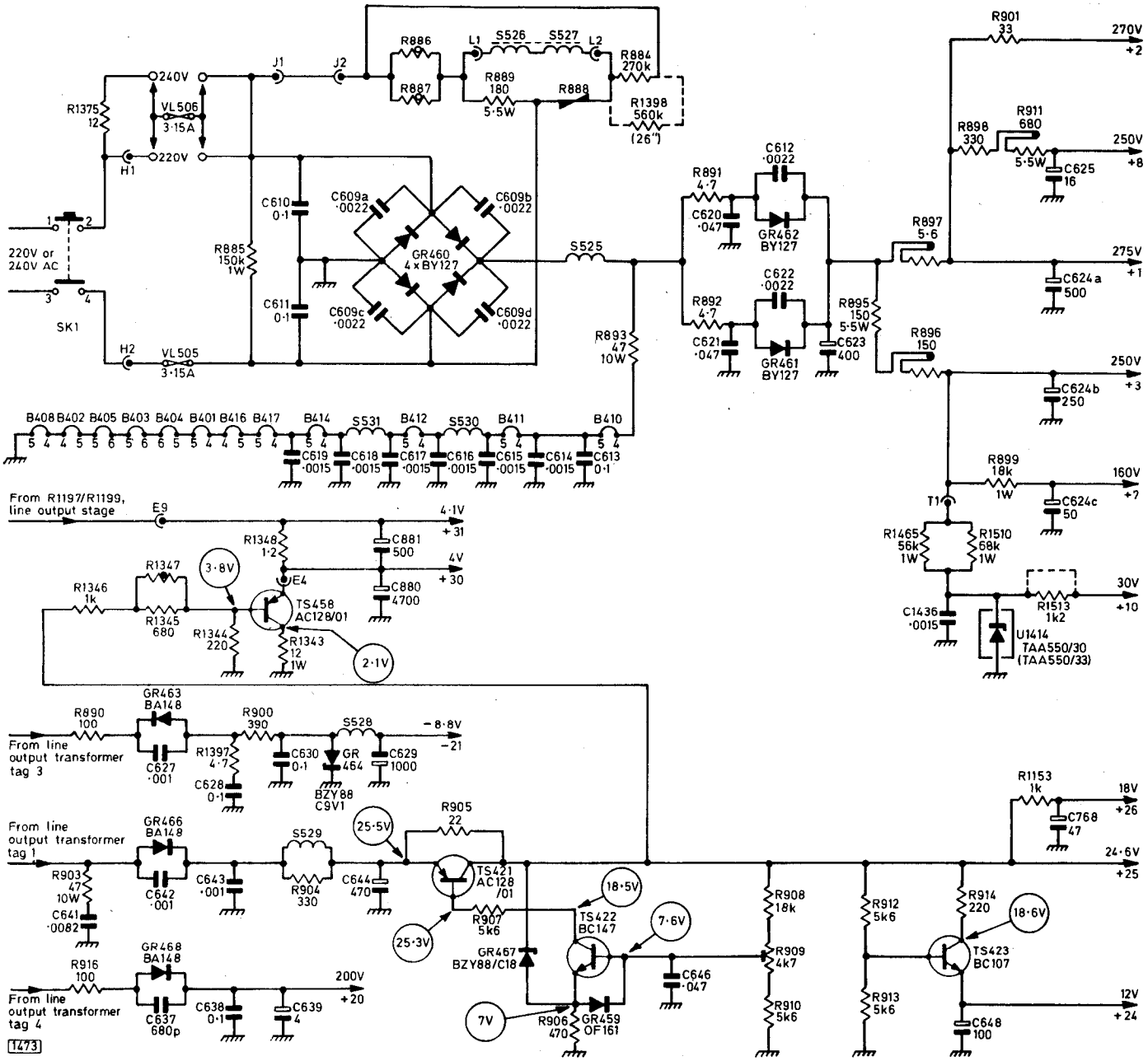


Fig. 3: The power supply circuits. Some of the feeds come from the line output stage.

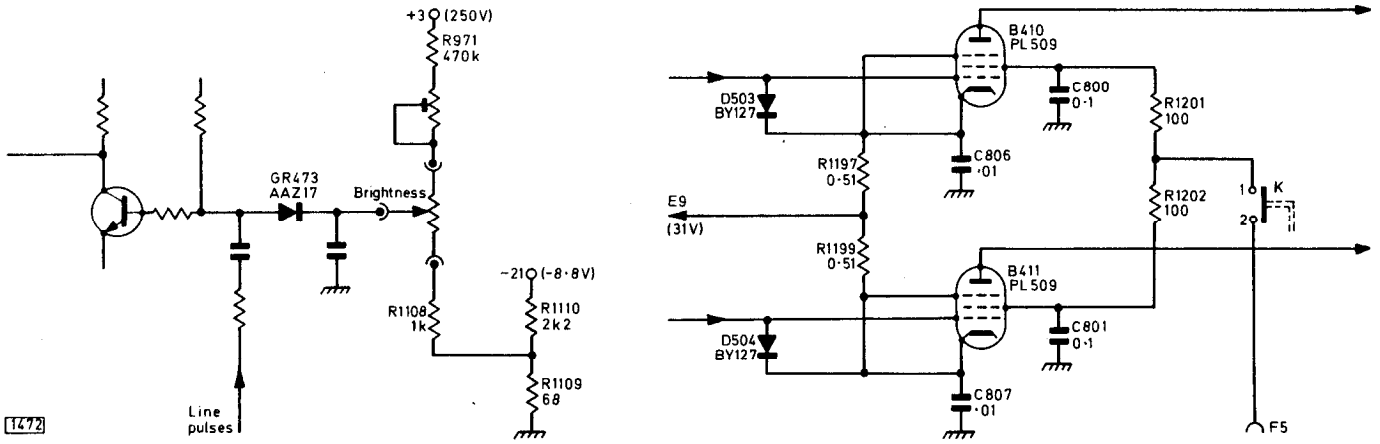


Fig. 4: Modifications to the brightness control circuit (left) and to the line output circuit (right).

between tracks causing various conditions including a burn out of the heater track so that the initial symptom is no heaters glowing. Once again a judicious cutting away job with little bridges to complete the circuits is called for.

Colour Problems

Fortunately the decoder is pretty well trouble free so that the majority of colour problems are not serious and are

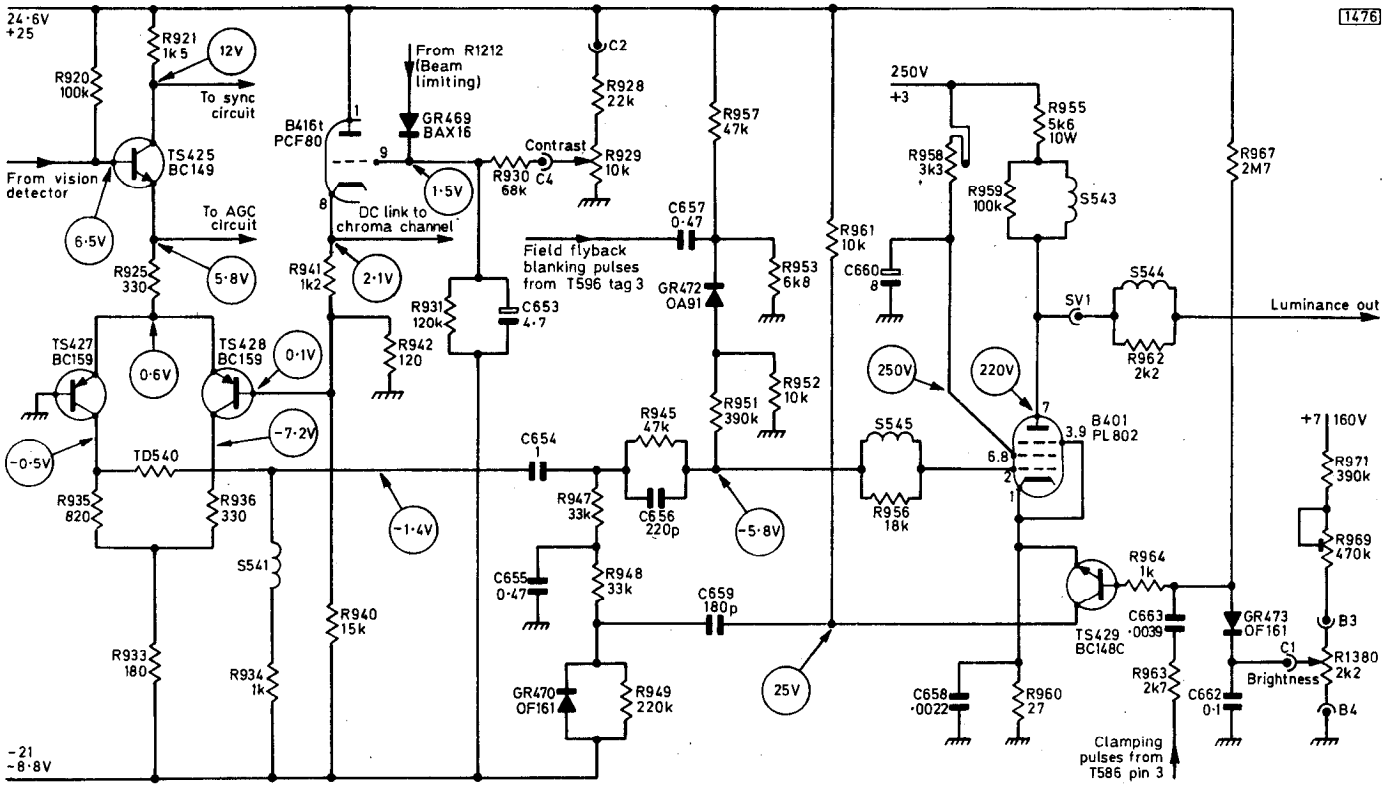


Fig. 5: The luminance channel.

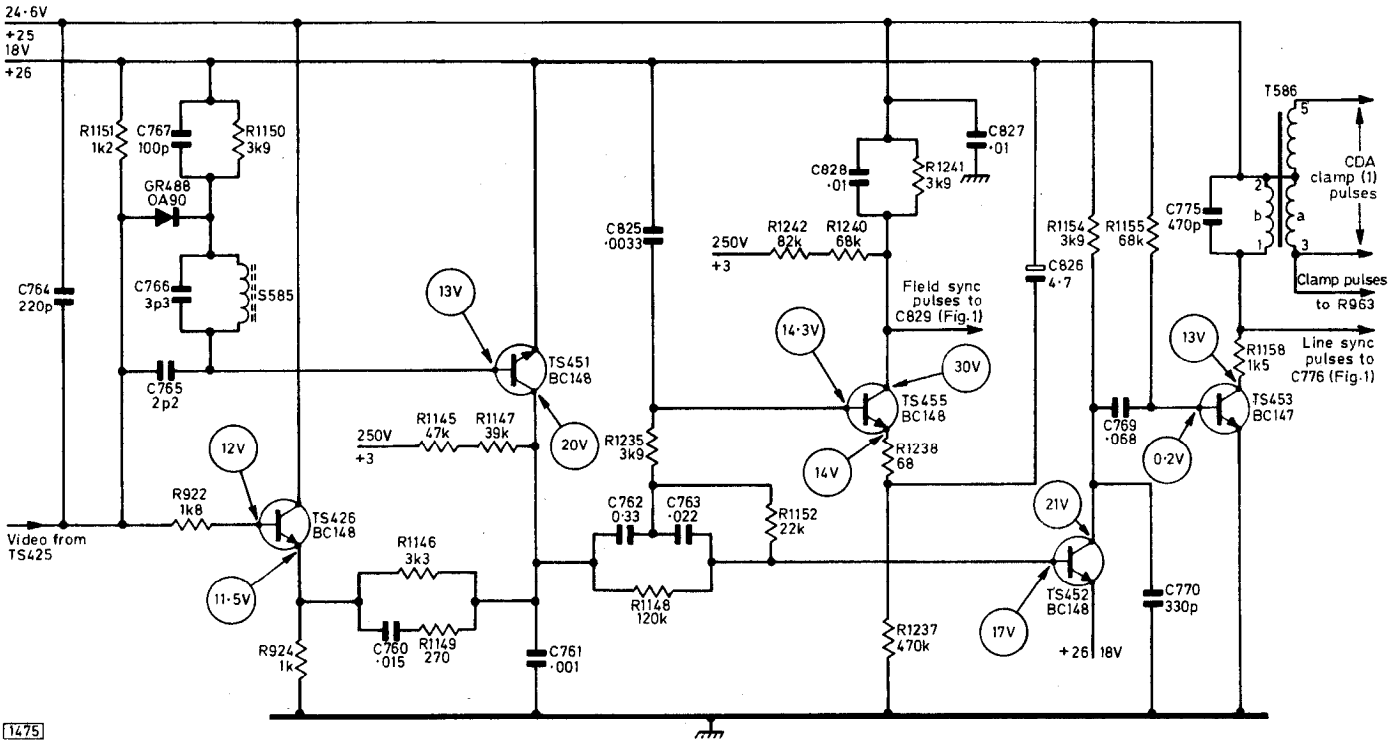


Fig. 6: The line and field sync pulse separator circuitry.

centred around either the colour-difference amplifiers or the c.r.t. first anode voltages. There are three colour-difference PCF200 valves, and the slow ascendancy of one primary colour over the other two is normally due to that particular valve losing emission.

Quite often however the tube grids are all even at 80-90V and in this event attention should be directed to the first anodes – c.r.t. pins 4, 5 and 13. The line flyback pulse coupling capacitor C866 has been found responsible for low pin 13 (blue gun) voltage when the complaint is that the picture is "yellow". Checking back to the preset R1307 it may be found that the voltage at the slider is quite high, thus directing suspicion to the 1MΩ resistors R1310 and 1311 which in fact are rarely at fault. Don't forget though that on the lower left side there's a switch (SK11, blue button) which is accessible to the user and that this removes the boost feed to the blue preset controls (for red-green convergence), leaving only some 250V available from the +3 h.t. line. Guess whose face was red on one occasion . . . , and on another when someone had pushed in the top colour killer switch (SK3, black button). All in all however incorrect first anode voltages should not cause a lot of

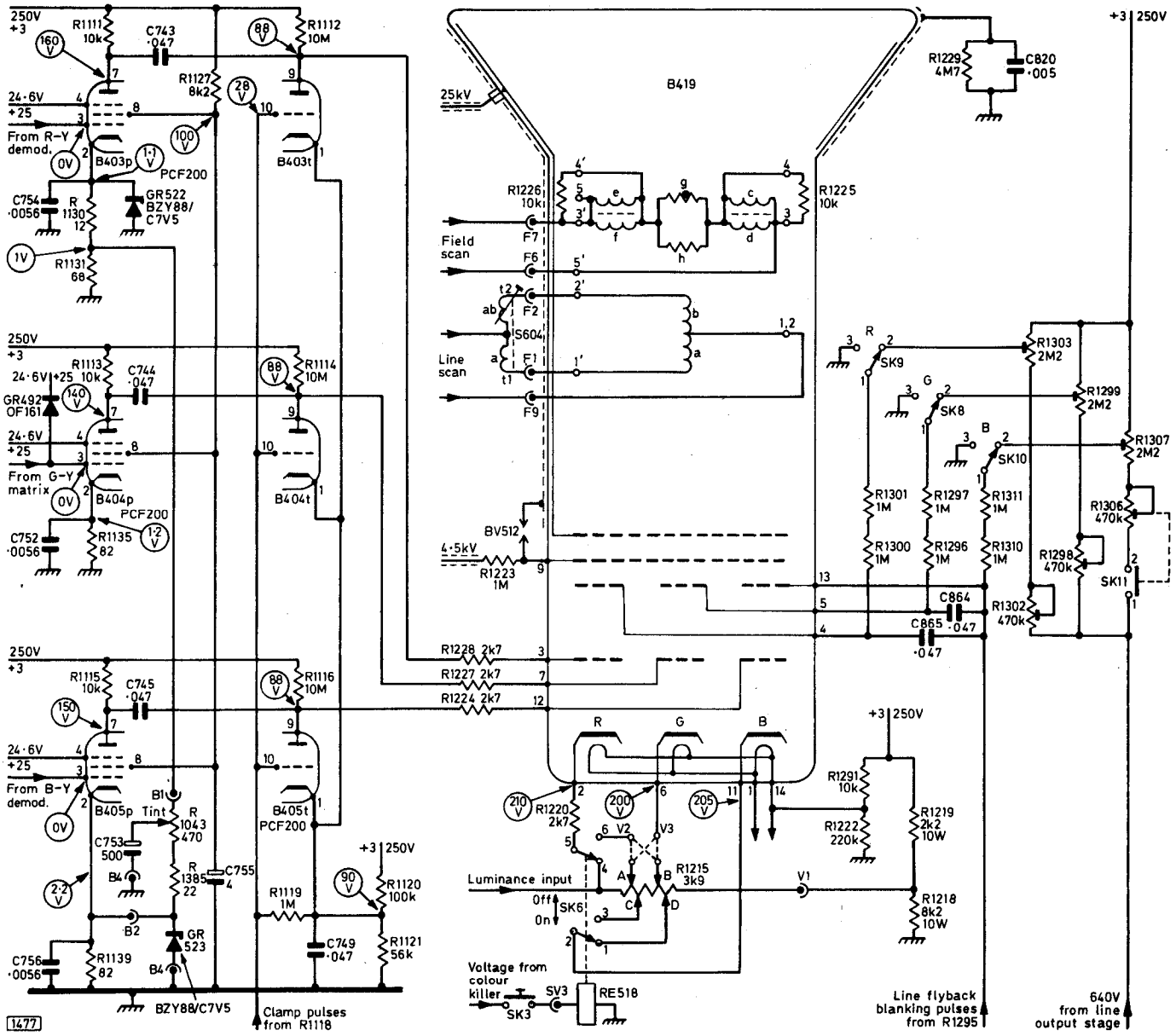


Fig. 7: The colour-difference amplifier and c.r.t. circuitry.

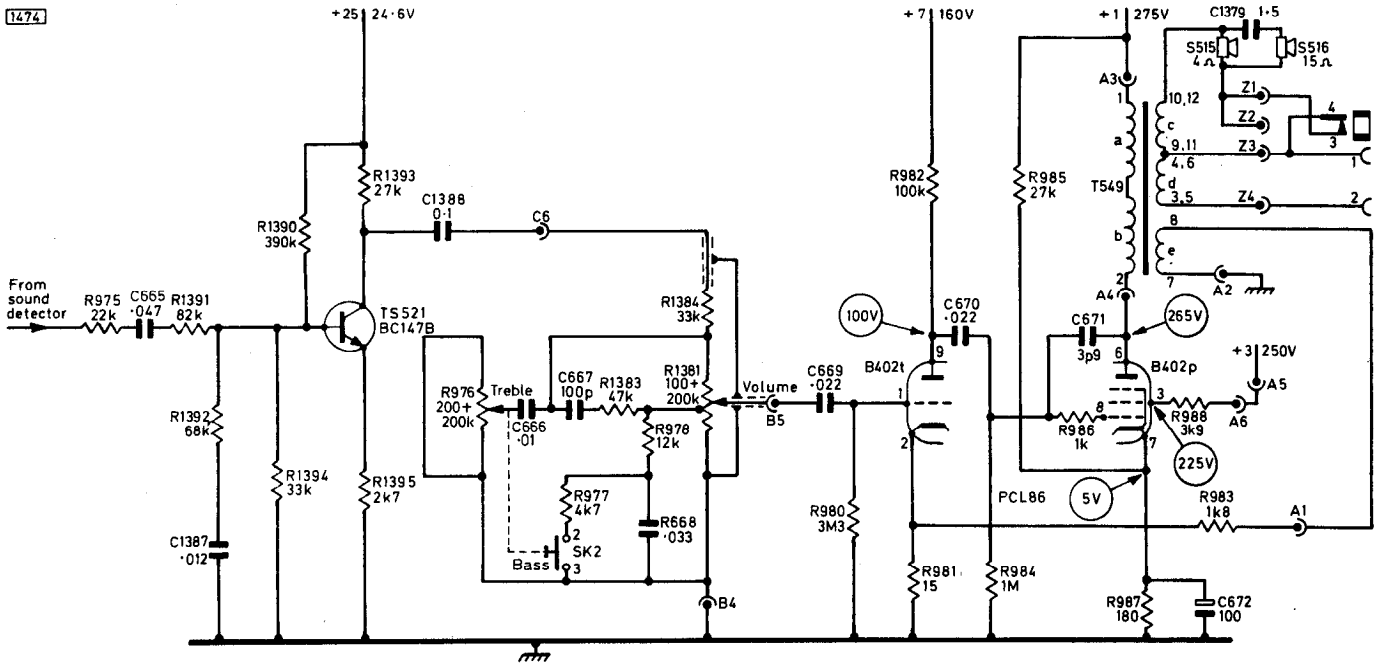


Fig. 8: The audio channel.

heartache if a logical approach is adopted, working from the tube base back.

There are rare occasions when the first anodes are o.k. but the grid voltage(s) stay stubbornly wrong even when a new PCF200 has been fitted in the relevant stage. Here one must appreciate that the grids are clamped to the triode anodes, and that the 10MΩ resistors can go high or the coupling capacitors can leak. If necessary check the value of R1120 which should be 100kΩ – this affects all three clamps when it changes value.

No Picture

In cases of no raster, switch on and wait for the line timebase to warm up, carefully listening for the "rustle" as the e.h.t. charges the tube envelope. If this rustle is heard there is most certainly e.h.t. present and the cause of no screen illumination should be looked for elsewhere (check the tube base pins as previously described).

If there is no audible sign of an e.h.t. build up, bring your trusty neon near the PL509 etc. If it lights up, the line output stage is functioning and an e.h.t. probe should be applied under the tube cap to see how near to 25kV the voltage is.

If there is little or no e.h.t., remove the screening around the right side compartment and accept the fact that removal of the cover allows the top right switch to spring out switching off the line output stage (cuts off the screen grid supplies).

If there is no e.h.t., the switch can be operated by hand without risk of X-ray radiation. Either the GY501 e.h.t. rectifier or the PD500 stabiliser triode is likely to be faulty. The GY501 can sometimes die without fuss so that a replacement is all that is required. But it is often the case that this and the PD500 die anything but quietly and leave little doubt as to where the trouble lies, often with the demise of the beam limiter control R1212 (previously mentioned) as well.

The PD500 is held by a frame secured by three screws at the top (slacken and lift, first removing the two screws securing the little coil can above which prevents complete lifting of the PD500 assembly). With the PD500 out, there are two screws holding down the GY501 holder. Check the sockets and clips for corrosion.

We haven't found a defective line output transformer yet (having said that we'll probably have a run of them) but this is only our own experience – that most of the line output stage troubles concern the PY500, PL509 and PL504 (or a second PL509, whichever version is met) valves. These cause the no e.h.t. condition, lack of width, poor focus and dreadful convergence (remember, no magnets for static convergence).

We have also not yet had a burn up in the focus network, but no doubt this pleasure is to come when the BY176 focus rectifier and/or its 50pF reservoir capacitor decide to short. The spark gap ("at" on the circuit) may save the resistor and control etc. but this is in doubt. Deterioration of the series 3·3MΩ or shunt 30MΩ resistors will cause variation of focus, but so far they have been remarkably good.

Fault Summary

Sound troubles have been confined to defective PCL86 audio output valves. No tuner troubles to date, but one must expect at least to have to replace an r.f. amplifier transistor sooner or later if the picture becomes grainy with "difficult" colour.

The AC128/01 voltage regulators (TS421 and TS458) have behaved themselves but it is as well to study the lines controlled by them so as to anticipate the effect of a failure since the +25 line is the main transistor supply source.

The signal sections and the decoder have not presented us with any problems, though at one time we primed ourselves to meet such situations by studying the circuitry and dreaming up all sorts of permutations of "if this" and "if that" only to find such fault symptoms on other sets but not on this one.

Faults will be encountered time and time again on these models, but will almost always be in the power supply lines and the valved circuits.

We haven't said much about the field timebase. Such problems as we have met have concerned the PL508 or the PCF80, also the polystyrene capacitor C836 which can collapse the field or cause rolling depending upon whether it shorts out or just sits there doing nothing. At the top centre, it's the only silver one around.

Front Controls

Trouble may also be experienced with the front controls. These have a plug of carbon inserted in the centre rotor to wipe the carbon track. If turned too violently (it wasn't me mum) the plug may part company with the rotor and the control is then ineffective. The control panel is secured by two screws and doesn't present much of a problem if the right replacements are to hand.

Modifications

An 8·2kΩ resistor (R1312) has been added between pin 2 of the c.r.t. and the V1 end of R1215, modifying the blue/green adjustment.

R1209 in the e.h.t. circuit was changed to a safety resistor (part number 4822 111) to give improved protection against c.r.t. flashover.

R906 in the l.t. stabiliser circuit was changed to 680Ω to give improved stabilisation.

The following modifications were introduced to decrease brightness fluctuations due to mains voltage variations. The earthy end of the brightness control is taken via R1108 to the junction of R1110/R1109 (see Fig. 4), these resistors having been added. R1110 is taken to the −21 supply. R900 in the −21 supply changed to 330Ω. In the top end of the brightness control network R971 was changed to 470kΩ and taken to the 250V h.t. rail (+3) instead of the 160V h.t. rail (+7). GR473 was changed to type AAZ17.

To reduce the dissipation in the PL509 line output valve (B410) the other pentode in the stage (B411) was changed from a PL504 to a PL509 (see Fig. 4). The positions of the B410 and B411 heaters in the heater chain were transposed and R893 (47Ω) was removed. BY127 diodes were added as shown between the control grids and cathodes of the two valves. R1199 was changed to 0·51Ω. In the line oscillator circuit R1181 was increased to 47kΩ and a 220kΩ resistor (R1180) was added between pins 3 and 8 of the PCF802.

R899 in the +7 (160V) supply was changed from 18kΩ to 1·8kΩ.

A. Denham comments on the K70: The main bugbear has always been the power supply, and the chassis is noted for destroying the BY127s and their surge limiters, along with lots of spidery print and circuit board – and a few capacitors just for luck! All these bits are on the vertical power supply board, above the smoothing cans. These latter have a nasty habit of leaking white goo all over the best

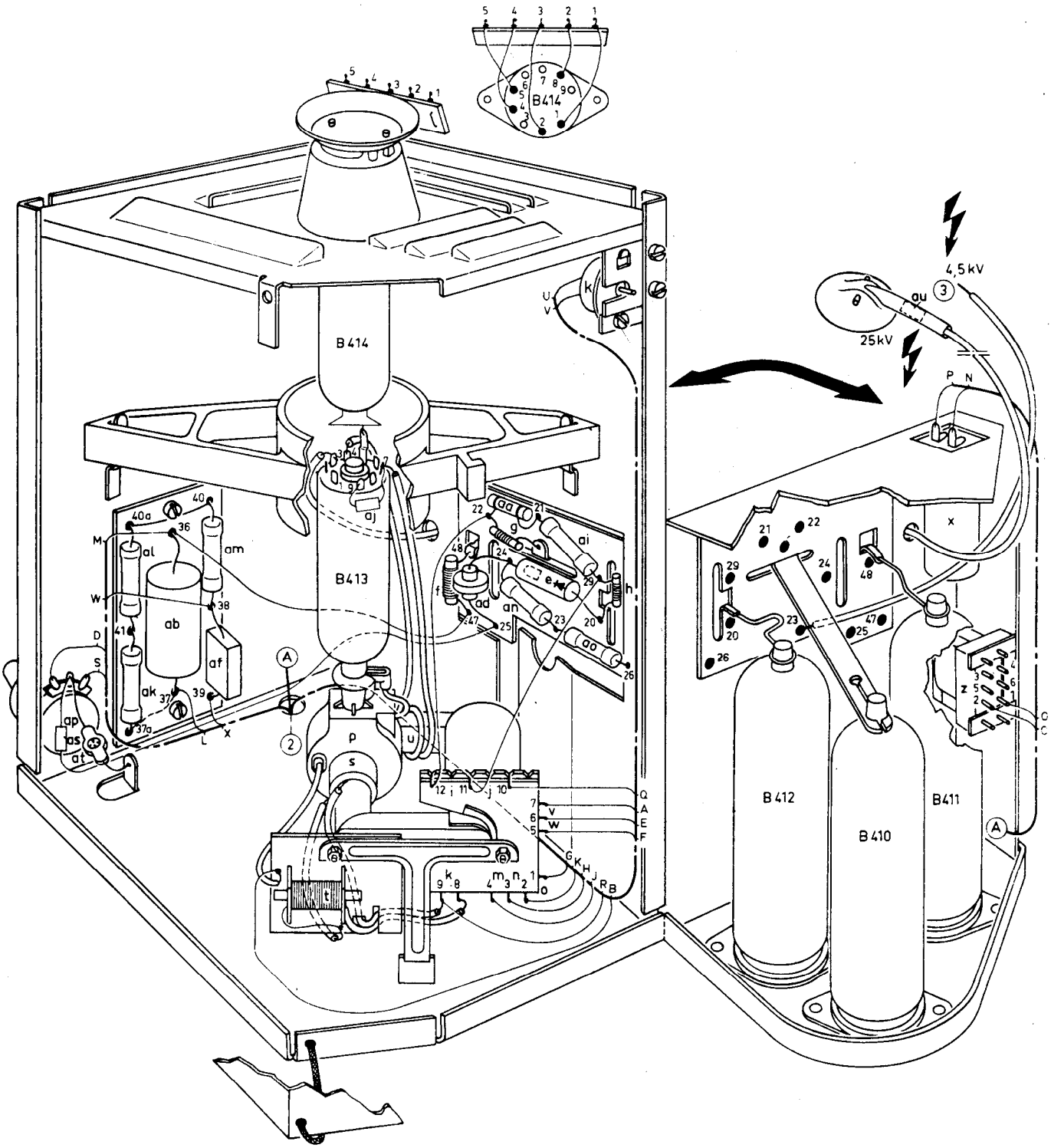


Fig. 9: Layout of the line output/e.h.t. compartment.

carpet incidentally.

The service manual is a must when tackling the chassis, and for normal valve life in the line output stage I strongly advise that the boost voltage setting (R1207, adjust for 550V between pin 10 of the line output transformer – test point M10 – and the junction S590/C860), the output valve balance setting (R1203, see previously) and the beam limiter setting (R1212, remove the jumper lead across R1213 then with a plain white raster – brightness and contrast controls at maximum – adjust for 0·1V across R1213: the reading with the brightness and contrast controls turned to minimum should be 1·3V ±0·1V) should all be strictly followed.

To all prospective c.r.t. changers who have been struggling for two or three hours to remove said object through the rear – forget it, the c.r.t. comes out through the front. I once surprised someone where I worked by replacing a c.r.t. in under twenty minutes (it takes about two hours the other way). The c.r.t. heater is fed from a winding on the line output transformer: on one occasion the symptoms of a very sick tube turned out to be due to a small capacitor in the PD500 e.h.t. stabiliser circuit – so tread warily!

When these sets were first introduced we had several cases of the 30MΩ resistor in the focus circuit giving up, causing poor focus.

One other trouble we have had is several cases of the line shift potentiometer going open-circuit.