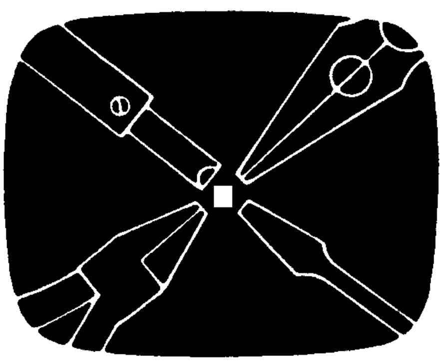


SERVICING television receivers

L. LAWRY-JOHNS

TCE 1590/1591 CHASSIS

THE Thorn 1590 chassis is used in a series of 12in. mains-battery portable models with a circular aerial and an earphone socket among the features. Models include the Ferguson 3816, Marconiphone 4816 and Ultra 6816. A variation in a larger cabinet with a 14in. tube and different controls is the 1591 chassis used in the Ultra Model 6818 and also the Alba Model T14. A fair number of modifications have been made during production, mainly to the field timebase and the audio circuits.

These are nice little sets. They are generally quite reliable and given a reasonable signal input are capable of displaying a good, well defined picture. They do not have the gain of some other portables but give good results in most areas and bearing in mind their very reasonable price (less than most) represent good value.

Designed to receive u.h.f. signals only on 625 lines, the simple four-button tuner is the same as that used in larger screen models of the same vintage, i.e. the push-bar type where the bar rotates the tuning gang tensioned by a spring which resists the inward movement of the selected button spindle. The advantage of this mechanical system is its simplicity, the disadvantages being outlined later.

Apart from the four buttons the only other control on the front of the 12in. models is volume-on/off. This is not as simple as it looks as it has to do a bit of battery as well as mains switching. With the switch in the off position the tube cathode is returned to chassis to discharge the e.h.t. quickly and thus avoid a lingering spot. The larger model (1591 chassis) uses a somewhat different arrangement with a separate on/off button at the bottom and edge-type volume and brightness controls which peep through the top.

Access

1590: Cabinet removal involves pulling off the front volume control knob, laying the cabinet face down, removing the two bottom front screws and the two rear cabinet screws and feeding through the mains cable as you lift the shell off. This allows most parts to be got at without further dismantling but there are times when the panel has to be lifted out to expose the front end and in this event the front centre screw and the two side screws (securing the panel to the supporting struts) have to be removed. This is where an eye must be kept on the leads which are mainly of the wrap round variety except those to the VT21 voltage regulator transistor—these can part company with the pins but being in sleeving appear to be connected until the sleeving is pulled back.

1591: Lay face down, remove the two side screws and the top two and lift off. In fact it is not necessary to lay the set face down in order to clear the shell but it does seem to come off easier this way. The chassis can be swung up by removing the two screws securing the side angle struts.

When reassembling the 1590 do not forget to check that the insulators are fitted under the front end (the idea is to prevent the cabinet screws penetrating through to the printed board).

Power Supplies

These sets can be operated from the standard a.c. mains or from a 12V battery: d.c. mains cannot be used.

On battery operation correct polarity must be observed: reversing the supply will result in fuse F2 blowing. The battery supply lead has one wire marked with a red sleeve to indicate the positive connection. Diode W6 is connected from the fuse to chassis. This diode normally does nothing: should the supply be reversed however it conducts and fuse F2 fails thus protecting the rest of the circuit.

When used on mains the supply is taken via a 250mA fuse (F1) to the primary winding of the step-down transformer T1. The secondary winding is centre-tapped to chassis and supplies about 15V to the full-wave rectifiers W7 and W8. The rectified output of about 16V is fed to the battery supply socket switching and then to the 2.5A fuse F2 where it fills up the reservoir capacitor C85 and feeds the audio output stage direct while the rest of the set is fed via the regulator (VT21/VT22) which maintains the supply line at a little under 12V when correctly set up.

The series regulator transistor VT21 is an AD149 type fitted on a separate heatsink above the main panel since it normally runs quite warm. The voltage sensing transistor VT22 should not run warm. If it does check the setting of R104 and the value of R103 and R106. The voltage at VT22 base should be 5V. VT22 can become defective and completely upset the voltage regulation. In the event of the regulation being impaired check these points and zener diode W17 (D32) which we found to be at fault on one occasion.

Intermittent Supply Fault

Before leaving the subject of the power supply we

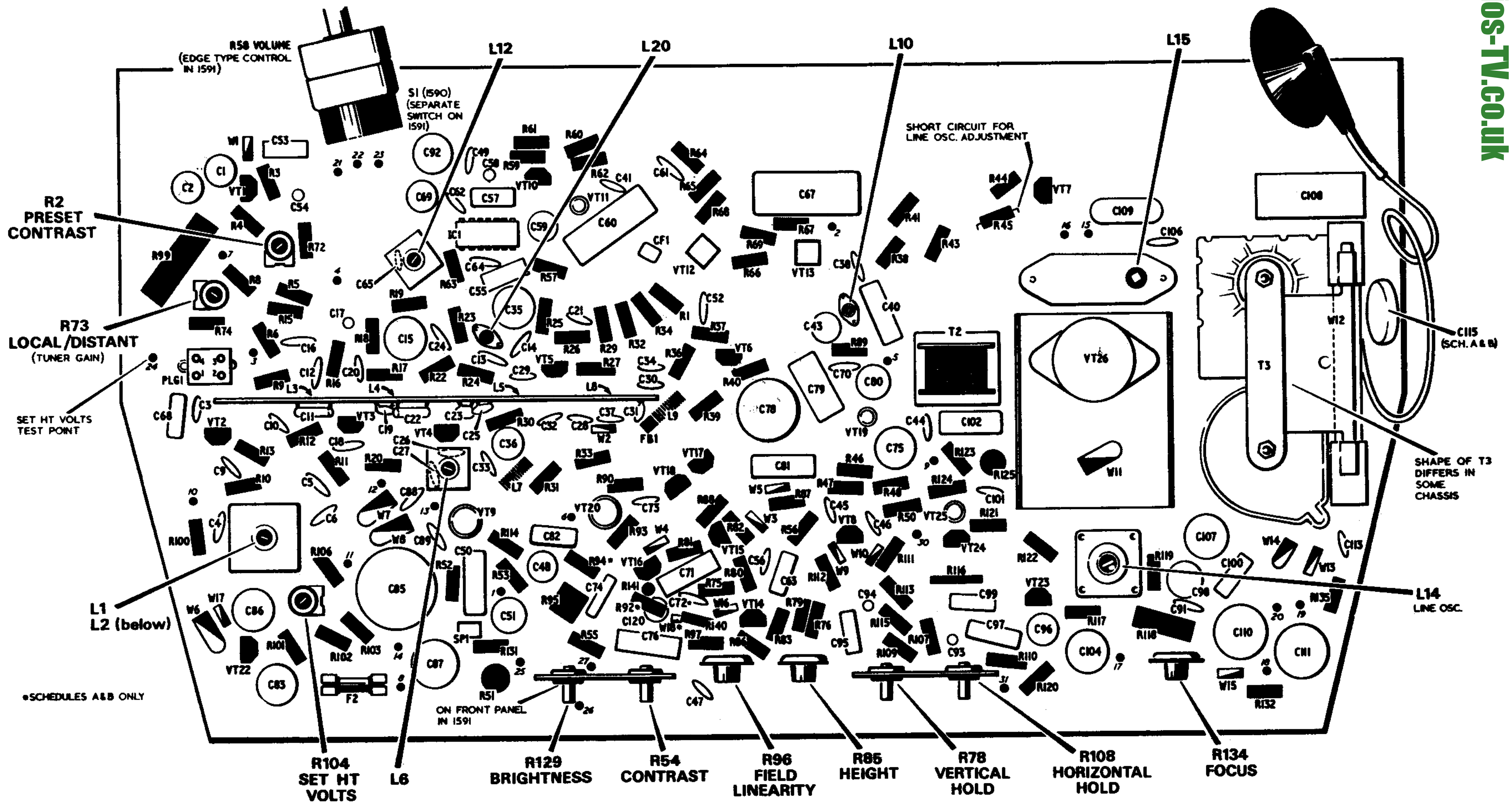


Fig. 1: Layout of the printed panel.

Service Notes: The c.r.t. has a 20mm neck with all-glass base. Take care when handling to avoid breaking the sealed-off tubing which projects through the centre of the base. Tube types: CME1220 (12in.), CME1420 (14in.). Correct line hold setting is when the picture is centred and free from foldover. R73 is normally set fully clockwise (maximum gain): back off if cross-modulation is experienced in strong signal areas. R104 is set for exactly 11.6V between tag 24 (HT1) and chassis. To tune the line oscillator short-circuit VT7 collector to chassis—the picture will then float—and adjust R108 for 4V at its slider. Then adjust L14 for a floating but resolved picture. Remove the shorting link. If necessary centre the picture with the shift magnets.

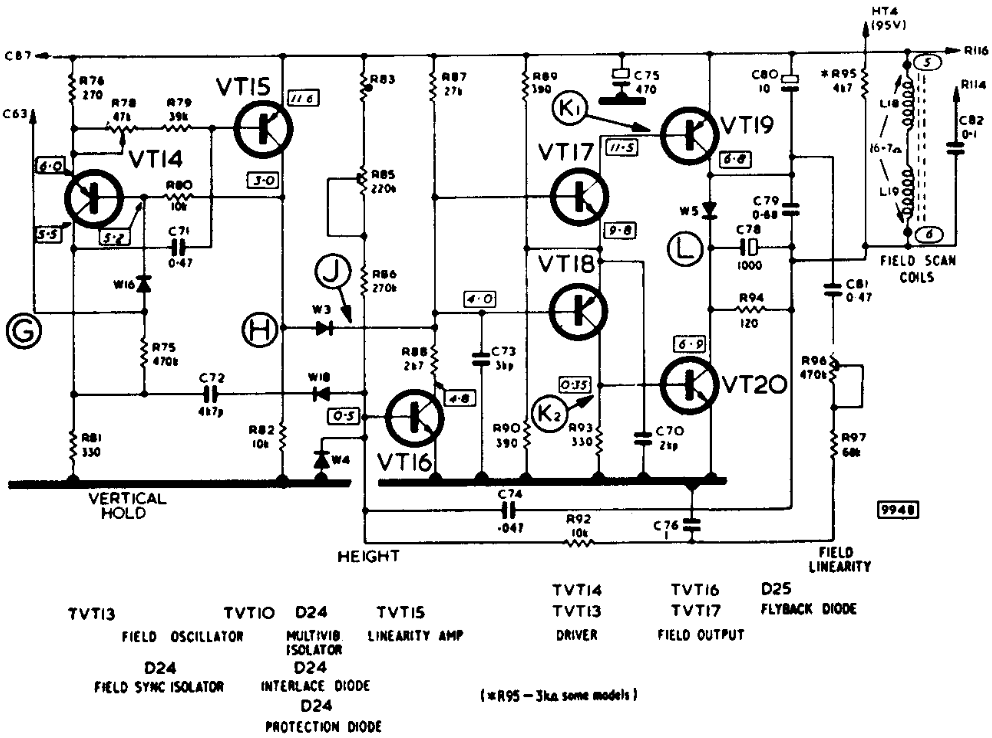


Fig. 2 (left): The field timebase circuit used in Schedule A and B versions of these chassis. The same basic circuit (the complete circuit diagram will be given next month) is used in later versions but with a considerable number of component modifications. R95 provides field d.c. shift, C79 provides field flyback tuning in conjunction with the scan coils, C73 damps the input to VT17/VT18.

would mention an intermittent fault condition which we encountered very recently. An Ultra 6818 was brought to us with the complaint that although it had been taken back to the original suppliers several times the same fault recurred following a short period of use after its return from them. The owner stated that the set would function for a certain period (which varied) quite well when suddenly the picture would distort and the sound would go "gurgly". We removed the cabinet shell and had an exploratory tap around with the set working. "That's it" shouted the owner as we gently tapped the main electrolytic C85.

We examined the print for dry-joints without finding anything wrong and concluded therefore that the capacitor's leadout tags were at fault. These were concealed by the panel and the base insulating washer of course. We removed the solder from the joints with desoldering braid (the sucker pump being less in favour of late) and lifted out the offender. A hammer and a disused screwdriver blade were employed on the leadout tags to improve the contact with the rivets and the capacitor was replaced in the set. No amount of tapping or rocking would subsequently disturb the well defined test card being displayed or the lively Spanish style music issuing from the small loudspeaker.

Breathing modestly on our finger nails and polishing them on our coat lapel we reassembled the shell and bid a cheerful farewell to the happy owner who promptly tripped ass over tip over our collie who had carefully laid immediately behind him. Ben (the collie) lost his haughty demeanour (which he had adopted ever since he saw an old "Lassie" film one Saturday morning) and fled yelping, leaving tuffs of fur all over the place. We put the set back on the bench but it was quite unruffled by the incident. "Just part of the test routine" we murmured brushing hairs off the poor fellow's coat."

A Case of Bent Verticals

In another recent case bent verticals could not be cured by checks on the smoothing capacitors or the line timebase. A new BC147 regulator control transistor completely cleared the trouble.

The Tuner Unit

As previously mentioned the tuner unit is a standard Thorn type, using an AF239 or equivalent r.f. transistor and an AF139 oscillator-mixer. Being simple in operation it does not give much trouble apart from one or two common failings.

The most obvious is a mechanical one which is easily remedied. When the channels received are at the low end (say 20 to 40) of the band the bar is pushed well back to the rear, thus stretching the return spring and exerting maximum strain on the bar which tends to pull out of its slots. Although it may pull out on only one side the tuning is completely lost. Sometimes the bar may be found hanging from the spring or even laying in the bottom of the cabinet. When it has been slotted back into position (the right way round) and soldered (and the tops of the slots closed) the spring may be stretched slightly to relieve the strain if the upper channels are not used. Stretching the spring is not such a good idea on a portable however since it may be used in several different areas, say London during the week and around Dover at the weekend, representing the two ends of the tuning range.

The necessity to retune the buttons frequently is often due to poor contact inside the tuner between the spindle leaf springs and the body of the tuner. The procedure required is to remove the several springs with a large soldering iron, clean thoroughly and replace. Squirting quantities of cleaning fluid on the inside of the tuner is no solution to the problem and in some circumstances can damage the tuner.

The usual remarks concerning faulty transistors apply of course. Weak and grainy reception in a situation where reception is normally good should direct attention first to the aerial and the feeder connections and then to the tuner, checking vane

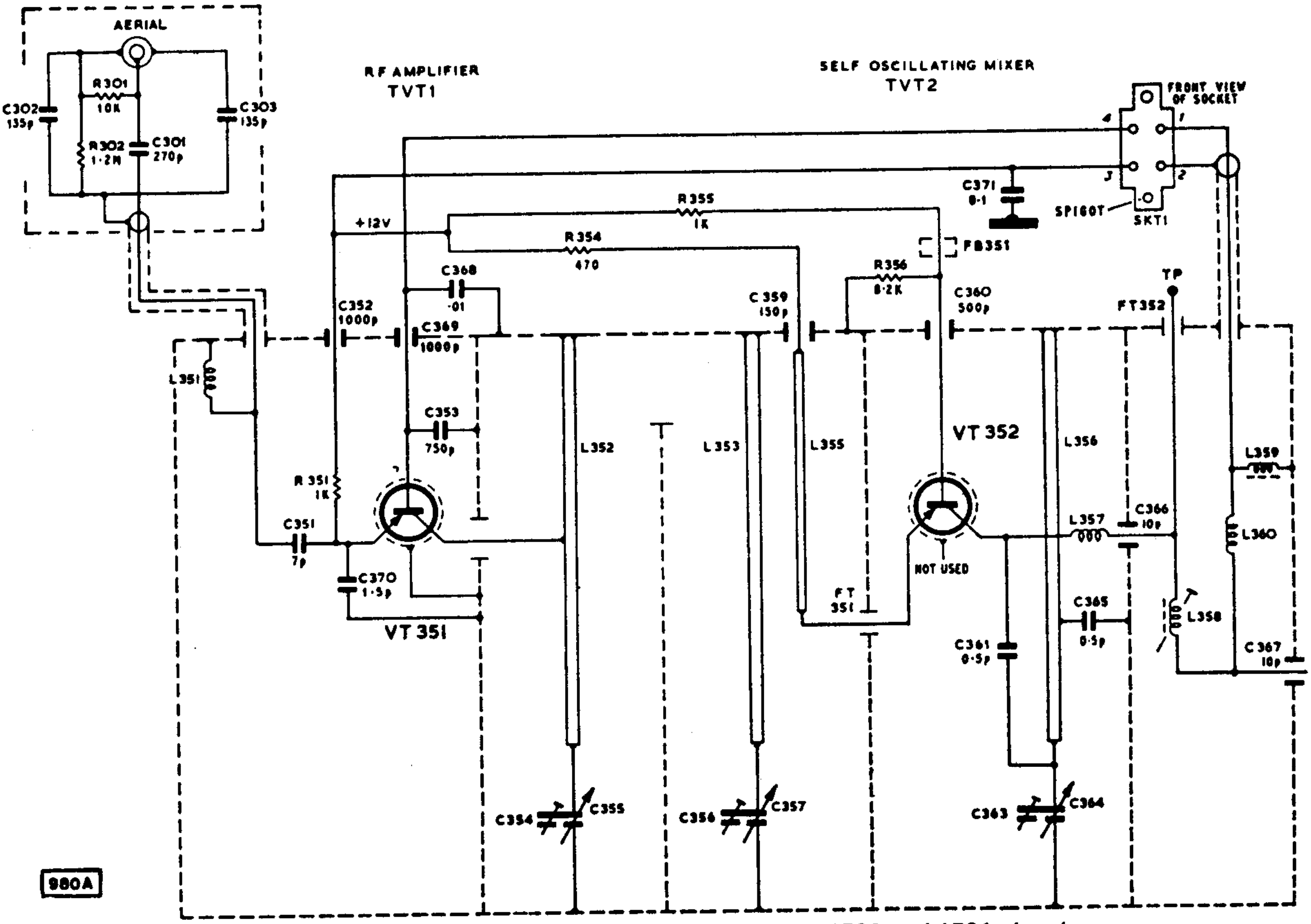


Fig. 3: Circuit of u.h.f. tuner type T21-200 used in the 1590 and 1591 chassis.

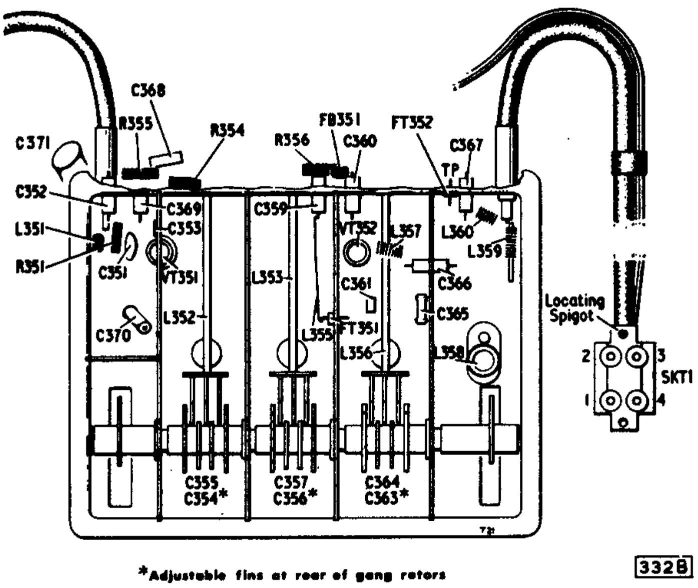


Fig. 4: Tuner unit component layout

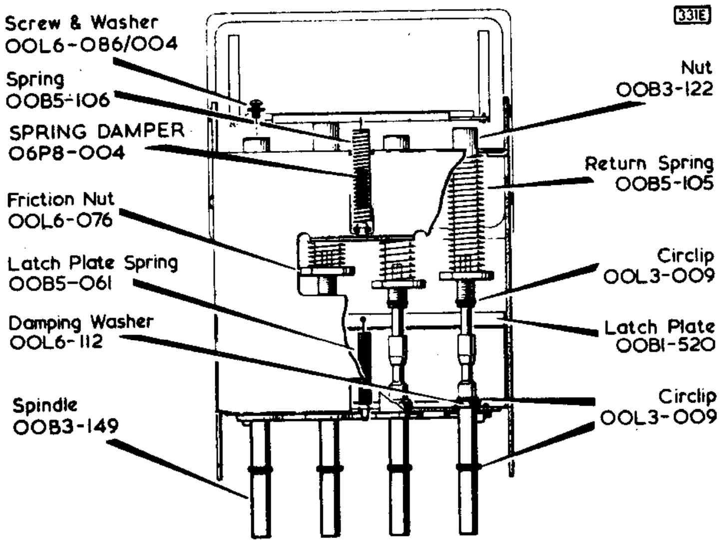


Fig. 5: Tuner push-button mechanism.

clearance etc. Check the base voltage of the r.f. amplifier at pin 4 of the socket and at capacitor C368 on the tuner where 9V should be recorded if the local-distant control is set to maximum. Variation of this control (R73) should affect the voltage across the emitter resistor of the r.f. amplifier transistor VT351. This resistor (R351, 1kΩ) should record the current passed by VT351. 12V at its supply end and the same at the VT351 emitter end indicates that there is no current passing and with 9V or lower at VT351 base offers a good case for suspecting the transistor which should then be checked by the usual back-to-front resistance tests with an ohmmeter. Replacement is not difficult in this type of tuner, using a small iron and the right type of tweezers. An AF239 can be used as a replacement for the Thorn TVT1.

CONTINUED—WITH FULL CIRCUIT—NEXT MONTH

SERVICING television receivers

L. LAWRY-JOHNS

TCE 1590/1591 CHASSIS—cont.

Mixer Transistor

The irritating habit of the oscillator-mixer transistor VT352 (Thorn TVT2 or AF139) is its reluctance to oscillate at low frequencies. Thus a selected button may tune in perfectly as it is unscrewed to say channel 26 but when it is turned clockwise to tune down to channel 23 the programme may start to come in and then suddenly cut off as the correct tuning point is reached. Alternatively it may tune in for a time and then cut off. "Just when it was getting interesting. I could have thrown the bloody teapot at it. If it does it again I'll chuck it out of the * * * * * * * window". Before trying a new transistor check the oscillator section tuning vanes to ensure that they are not fouling with the stator at this point. Fitting a replacement transistor is easier in this position as the screening lead is unused and is cut off short.

Audio Circuits

The main trouble spot on the printed panel is neither the signal stages nor the timebases. Due perhaps to the use of an unregulated supply for the audio output stage it is the transistors here that seem to fail. Our main circuit shows the original design–later models can vary to a marked extent and one should not be surprised to find an additional transistor in the R66 position with a variable resistor to regulate the base current of the output pair. The transistors may also be completely different from those shown and these are not interchangeable therefore. The types fitted must be adhered to.

The normal complaint is that fuse F2 fails: examination may show that resistors R68 and R69 are discoloured. If the circuit uses a Thorn OP2A (AC128) driver and OP7 output pair (matched pair with equivalents VT12 AC176K, VT13 AC128K) the writer's experience has led him to observe the following rule: if in doubt change the 128. If the output pair have damaged their emitter resistors therefore change them as a pair and also change the AC128 driver which may well have caused the trouble in the first place even if it reads right.

Faulty Capacitors

Faulty transistors are not the only things which can cause trouble here however. The electrolytic capacitors used can become defective in three ways. First they can dry up or otherwise become open-circuit resulting in very weak or no sound. Secondly they can short thus completely upsetting the operating conditions of the transistors. Completely wrong voltage readings on the output pair for example are often due to C58 shorting, thus taking the base of VT10 well down to cut off which in turn cuts off VT11 and so on. The third defect is fairly heavy leakage so that the capacitor behaves more like

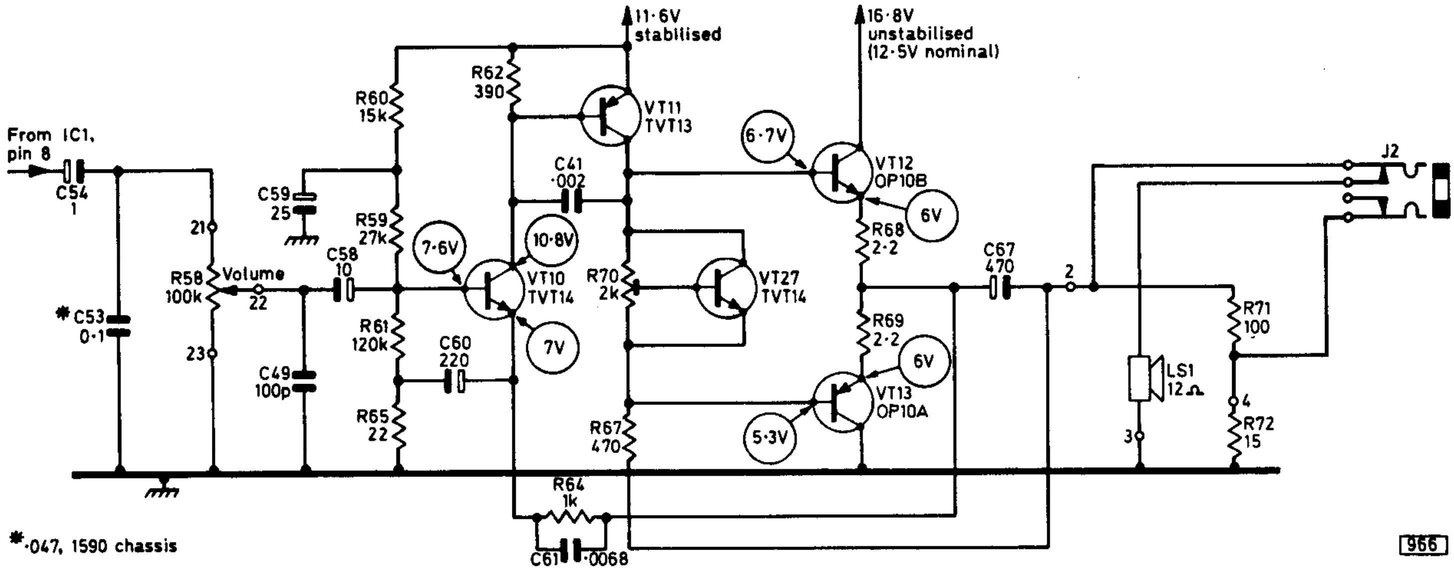


Fig. 6: Audio circuit used in later versions of the chassis.

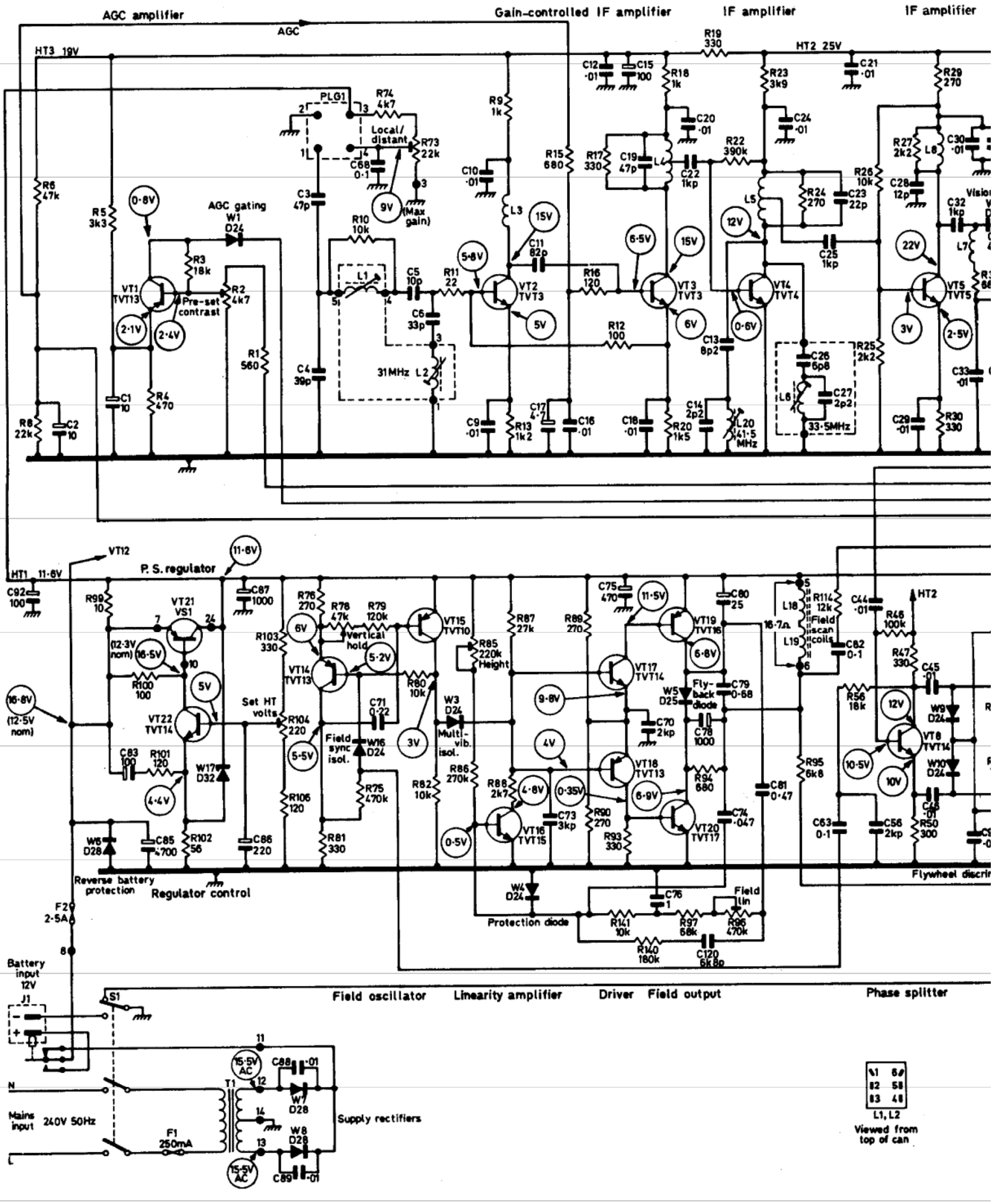
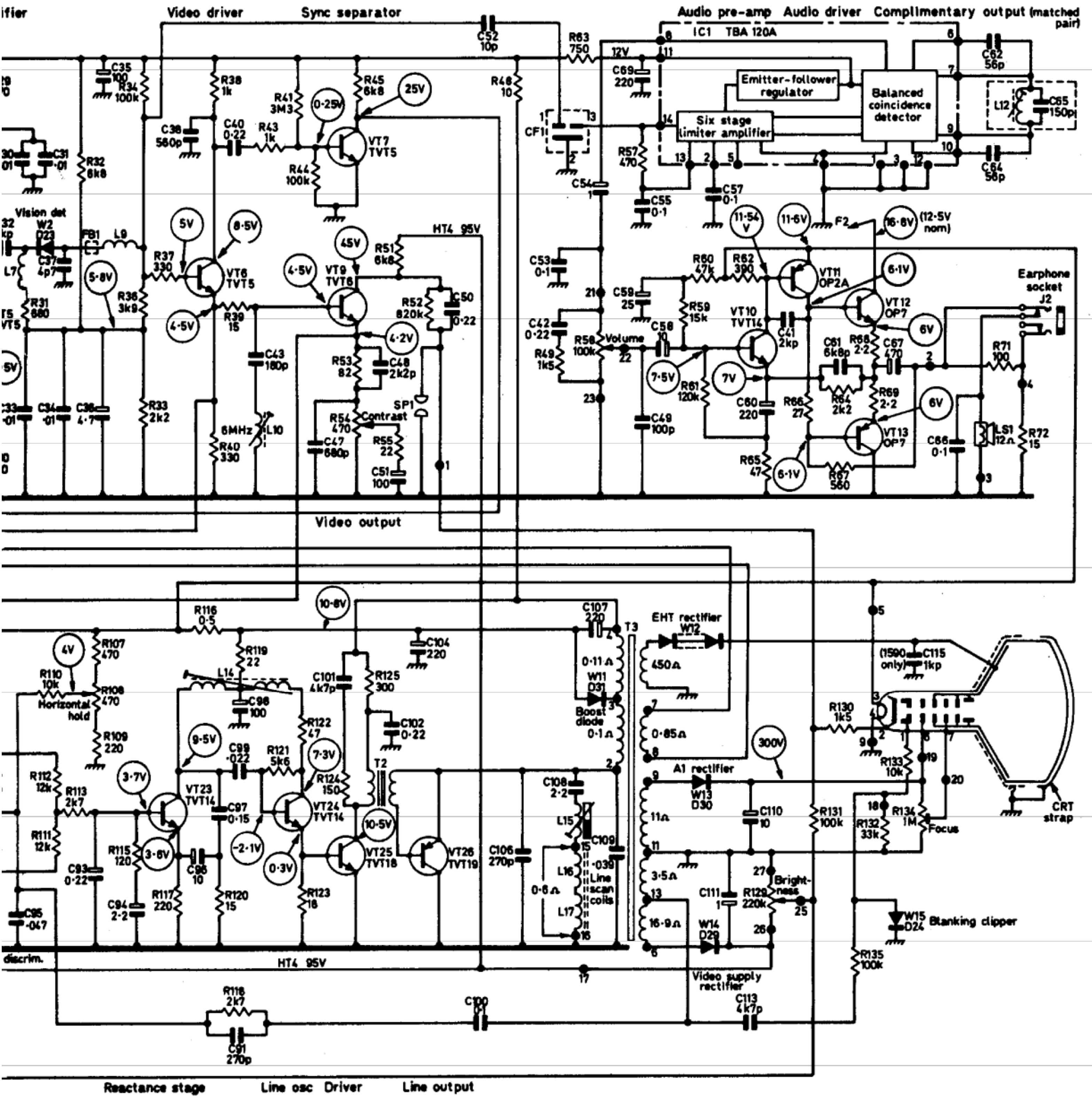
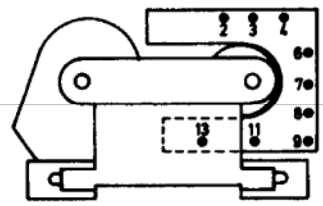
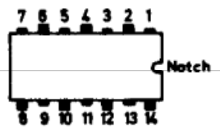


Fig. 7: Circuit diagram of the TCE/BRC 1591 chassis, schedule C. The 1590 chassis differs as follows: F





Top view of line output transformer showing pin connections



Top view of IC1 showing pin connections

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s: R131 150k Ω; C106 3,900pF; C115 fitted; C42 and R49 omitted. See also modifications on page 507.

a resistor, again upsetting the bias conditions to produce weak and croaky sound with the voltages deviating from those specified.

It doesn't take long to remove a suspect capacitor and check it on a meter where the circuit values are such as to preclude testing in situ. If a capacitor is suspected of being open-circuit it is easy to slap another across it as a quick check. Leakage will necessitate removal. Do not omit to check C54 which is the coupler from the i.c. to the volume control.

Intercarrier Sound IC

The intercarrier sound i.c. is something you can't do much about other than replace it if it is suspect. The only tuning is the quad coil (L12) whose core setting is fairly critical in order to get clear sound free of buzz. The tuning is otherwise set by the ceramic filter CF1.

The IF Strip

Fault finding in the i.f. strip becomes much easier once the positions of the four transistors have been established and also which parts of the print are the emitter, base and collector connections. Check these against the voltages given and the faulty stage can usually be located in a very short time. Low emitter voltage is not always an indication that a particular transistor is defective however. The gain of VT3 is controlled by the a.g.c. amplifier while its emitter voltage controls VT2 base (via R12). So get VT3 base voltage right first, and check the electrolytics C17, C2 and C1. Leakage through any of these will upset the whole system.

VT4 has no emitter resistor: its base is biased by R22 whose value is something which should be checked. The stage is working correctly when there is a voltage drop of some 12V across R23.

VT5 is the hard worker, having to handle fairly large signal voltages. This is the transistor which is most likely to fail. Its base voltage is held at 3V by R25 and R26 and this should produce about 2.5V at the emitter if the transistor is in order. Replacement type BF197 can also be used in the VT6 and VT7 positions.

Video and Sync Circuits

From the detector diode W2 (OA91) the demodulated signals pass to the video driver VT6 which should have 5V on its base. If this voltage is low check C36 which could well be leaky: this is far more likely than R32 or R33 changing value.

The sync separator VT7 is fed from the collector of VT6 whilst the video output transistor (VT9) is driven from VT6 emitter (the feed to the gated a.g.c. stage VT1 is also taken from VT6 emitter). There should be 4.5V across R40.

The video output transistor is a high-voltage type fed from a 95V line which is obtained from the line output stage via W14 (reservoir C111). The voltage drop across R51 should result in about 45V at VT9 collector. This voltage is dependent upon the signal and upon the correct working of the driver stage, also of course on VT9 itself.

The sync separator VT7 is followed by a phase splitter stage (VT8). Field sync pulses are obtained from its collector, antiphase line sync pulses from its emitter and collector.

Field Timebase

Neither the field nor the line timebase has given us much trouble to date (he said with his fingers, legs and eyes crossed).

In the field timebase VT14 and VT15 form a multivibrator which produces a pulse output (positive going) at VT15 collector: this drives VT17 and VT19 hard on and cuts off VT18 and VT20 to give the flyback action. The scan is produced by C74 driving VT16. As the voltage across R87 increases VT18 and VT20 are driven on while VT17 and VT19 are driven towards cut off. The voltages throughout are interdependent which makes fault tracing difficult. The writer prefers to start with a quick check on the back-to-front resistance of each transistor in turn, bearing in mind the direct coupling which prevents a high resistance reading being obtained when the test leads are reversed and which transistors are pnp and which are npn types. Readers who are unfamiliar with transistors in field timebases should read Harold Peters lovely article in the April 1974 issue —the present circuit is somewhat different to the one described there however.

Line Timebase

Antiphase line sync pulses are fed to the discriminator diodes W9/W10 which also receive a reference pulse from the line output transformer fed back via C100 and integrated by R118/C95 and a d.c. control voltage from the hold control R108. The discriminator feeds the reactance stage VT23 which controls the sinewave line oscillator VT24. Line hold troubles are normally caused by the discriminator diodes becoming unbalanced (compare the back-to-front ratio of each) or by one of the electrolytic capacitors drying up or becoming leaky. C96 is the primary suspect, more often becoming open-circuit so that another capacitor bridged across it will prove the point.

A driver stage follows the oscillator and is coupled to the output transistor by transformer T2. The output transistor itself rarely seems to fail in this chassis (others may have had different experience, we can only speak for ourselves). We cannot comment upon the fault symptoms caused by this therefore. We have had to replace the boost diode W11 however. This must be a fast-acting diode of the type specified, Thorn D31 or two BYX70 in parallel. Any other combination is likely to overheat. An XK3017 can be used however if this type is available, as can an F203. Ordinary silicon diodes are quite unsuitable.

Supplies from the Line Output Stage

Windings on the line output transformer feed rectifiers which provide the video h.t. line, the c.r.t. first anode and focus supplies and of course the e.h.t. The video h.t. and c.r.t. first anode voltages are decoupled by electrolytics, C110 (10μF) being the first anode smoother and C111 (1μF) the video h.t. smoother. A short in either capacitor will damp oscillations and render the line output stage inoperative.

Alternative Semiconductor Devices

If the Thorn specified semiconductor types cannot be obtained the following Mullard equivalents may be used.

VT8, 10, 17, 22, 23, 24	BC147	VT11	AC128
VT1, 14, 18	BC157	VT12	AC176K
VT4	BF194	VT13	AC128K
VT2, 3	BF196	VT21	AD149
VT5, 6, 7	BF197	W6, 7, 8	BY126
VT9	BF336	W13	BA148F

In the case of VT11, VT12, VT13, VT22 and VT25 see Fig. 6 and the modifications below however.

Modifications

As previously mentioned later versions incorporate a redesigned audio circuit using silicon driver and output transistors. The circuit is shown in Fig. 6. An extra transistor (VT27) stabilises the output stage quiescent current against temperature changes. Preset R70 is for initial adjustment of the quiescent current—it should be necessary to reset this only after replacing VT10, VT11, VT12, VT13 or VT27. The procedure is as follows: connect a meter in series with VT12 collector, turn R70 fully anticlockwise (viewed from rear of chassis), switch on, turn volume control to minimum, then slowly advance R70 for a meter reading of 4mA. With the modified output stage it is not necessary to used a matched pair of output transistors. These can be replaced individually therefore.

The field timebase circuit used in earlier production (schedule A and B) differed considerably—see Fig. 2 (last month).

In addition there have been a number of minor component modifications as follows:

C38 reduced to 390pF to eliminate cogging under certain video conditions.

C66 removed to improve the audio quality.

C80 reduced to 10μF to improve field linearity.

C111 reduced to 1μF to improve spot suppression at switch off (was 33μF in the 1590 chassis).

C116 (1,000pF, 350V) added across boost diode W11 to eliminate line tearing under weak signal conditions.

C117 (0·1μF) added across C111 to eliminate striations due to the inductance of C111.

C118 (0·01μF) r.f. bypass capacitor added from VT21 base to chassis to overcome instability on battery operation.

R3 removed and R6 reduced to 33kΩ to improve the a.g.c. action.

R10 may be 10kΩ or 18kΩ as necessary to provide the correct i.f. response.

R32 increased to 8·2kΩ, R38 to 1·2kΩ and R40 to 470Ω to improve the video performance.

R48 changed to a fusible type for increased safety and reliability.

R102 increased to 68Ω to improve the regulator operation.

VT22 changed to type TVT21 (increased rating) to improve reliability.

VT25 reclassified type TVT21 to include type BC337.