SECTION 5
CALIBRATION PROCEDURE

The instrument should not require frequent recalibration, but occasional adjustments will be necessary when tubes and other components are changed. Also, a periodic calibration is desirable from the standpoint of preventative maintenance.

Apparent troubles occuring in the instrument are often actually the result of improper calibration of one or more circuits. Consequently this section of the manual should be used in conjunction with the Maintenance section during troubleshooting work.

In the instructions that follow, the steps are arranged in the proper sequence for a complete calibration of the instrument. Each numbered step contains the information required to make one adjustment or a series of related adjustments.

In each calibration step only the required information is given. Controls are assumed to be set at the positions they were in during the previous step unless specific instructions are given to change their settings. All jumpers are disconnected at the end of each step unless instructions are given to the contrary.

It will be necessary for you to refer to the calibration steps immediately preceding the adjustment you wish to make to determine the proper settings for the controls not mentioned in that step. Due to the interaction between adjustments in the horizontal and vertical amplifiers, single adjustments in these circuits usually cannot be made. When amplifier adjustments are required, the entire amplifier should be calibrated. In addition, if either the 150 volt supply or the high voltage power supply is adjusted, the entire instrument must be calibrated.

If you find that a circuit is out of calibration, but you are not aware of which particular adjustment will correct the difficulty, it is usually best to calibrate the entire circuit.

Equipment Required

The following equipment or its equivalent is necessary for a complete calibration of the Type 570 Oscilloscope.

1. DC voltmeter (sensitivity of at least 5000 ohms per volt) with corrected readings within 1% for 100, 150, 300 and 400 volts and within 3% of 1700 volts. Be sure your meter is accurate; few portable test meters have the required accuracy, particularly after a period of use.

2. Accurate rms-reading ac voltmeter, 0-150 volts (0-250 or 0-300 volts for 210- to 250-volt operation).

3. Variable autotransformer, having a rating of at least 500 watts.

4. Oscilloscope, Tektronix Type 503 or 504. If a Type 503 or 504 Oscilloscope is not available, it will be necessary to substitute an oscilloscope with the following specifications: (1) calibrated vertical deflection factors from .01 to 10 volts per division and (2) bandpass of dc to 500 kilocycles.

5. Jumpers, 6 inch with banana plugs.

6. Socket adapter plate, miniature 9 pin.

7. 6U8 vacuum tube.

8. Alignment tool. See figure 5-1.

Fig. 5-1. Tool required for calibrating the Type 570 Oscilloscope.

9. 1% resistors making up the values of 495k-1w, 197k-1w, 100k-1w, 50k-1w, 20k-1w, 10k-1w, 5k-2w, 2k-5w and 1k-5w.

10. Ohmmeter with 0-1k, 0-10k and 0-100k scales.

Preliminary

Preset the front-panel controls of the Type 570 as follows:

FOCUS	counterclockwise
INTENSITY	counterclockwise
ASTIGMATISM	counterclockwise
RANGE DC VOLTS	140
INDICATION	+DC
STEPS/FAMILY	midrange
STEPS/SEC	120 counterclockwise
START ADJUST	midrange
VOLTS/STEP	1
PLATE-SCREEN-GRID	PLATE
MA/DIV	1
PLATE-GRID	PLATE
VOLTS/DIV	1
POSITIONING (VERTICAL and HORIZONTAL)	midrange
PEAK VOLTS	100
SERIES LOAD	10k
HEATER	6.3
HEATER VARIABLE	counterclockwise
+DC	100
+DC VARIABLE	clockwise
-DC	counterclockwise
POWER-MAIN	OFF
POWER-TEST	ON
TEST POSITION	OFF

Before applying power to the instrument the resistances of the power supplies should be checked. The typical resistances of the supplies may be found in the chart below.

Also check the -150 27k rest panel connector for 27k between the test panel connector and the -150 volt supply.

Connect the power cord and the ac voltmeter to the output of the autotransformer. Turn the POWER-MAIN to the ON position and adjust the autotransformer for an output of 117 volts (or 234 volts). Allow the instrument to warm up for several minutes before proceeding with the calibration adjustments. During calibration, periodically check the input voltage to the instrument and adjust the autotransformer as necessary to maintain the voltage at 117 or 234 volts except when the power supply regulation is being checked.

NOMINAL RESISTANCES OF POWER SUPPLIES

POWER SUPPLY	APPROX. RESISTANCE TO GROUND
-150v	10k
+100v	20k
+300v	30k
+400v	30k
FLOATING POWER SUPPLY	
+400v	100k or higher
-300v	100k or higher

CAUTION

Do not reset the -150 ADJ Control unless you are planning to perform a complete calibration of the instrument.

1. Low-Voltage Power Supplies

Connect the dc voltmeter between the +DC connector on the test panel and ground. Set the -150 ADJ for exactly a reading of +100 volts on the voltmeter. Now connect the voltmeter to the -150 volt test point. If the -150 volt reading is not within 2% of -150 then R536 must be paralleled by R537, a selected value.

R537 is selected so that when the -150 ADJ is set for exactly a reading of +100 volts, the 150 volt supply will be within 2% of being -150 volts.

Check to see that the +100 and +300 volt regulated power supplies are within 2% of the proper voltage. Under no condition is the -150 ADJ to be reset after the adjustment described above.

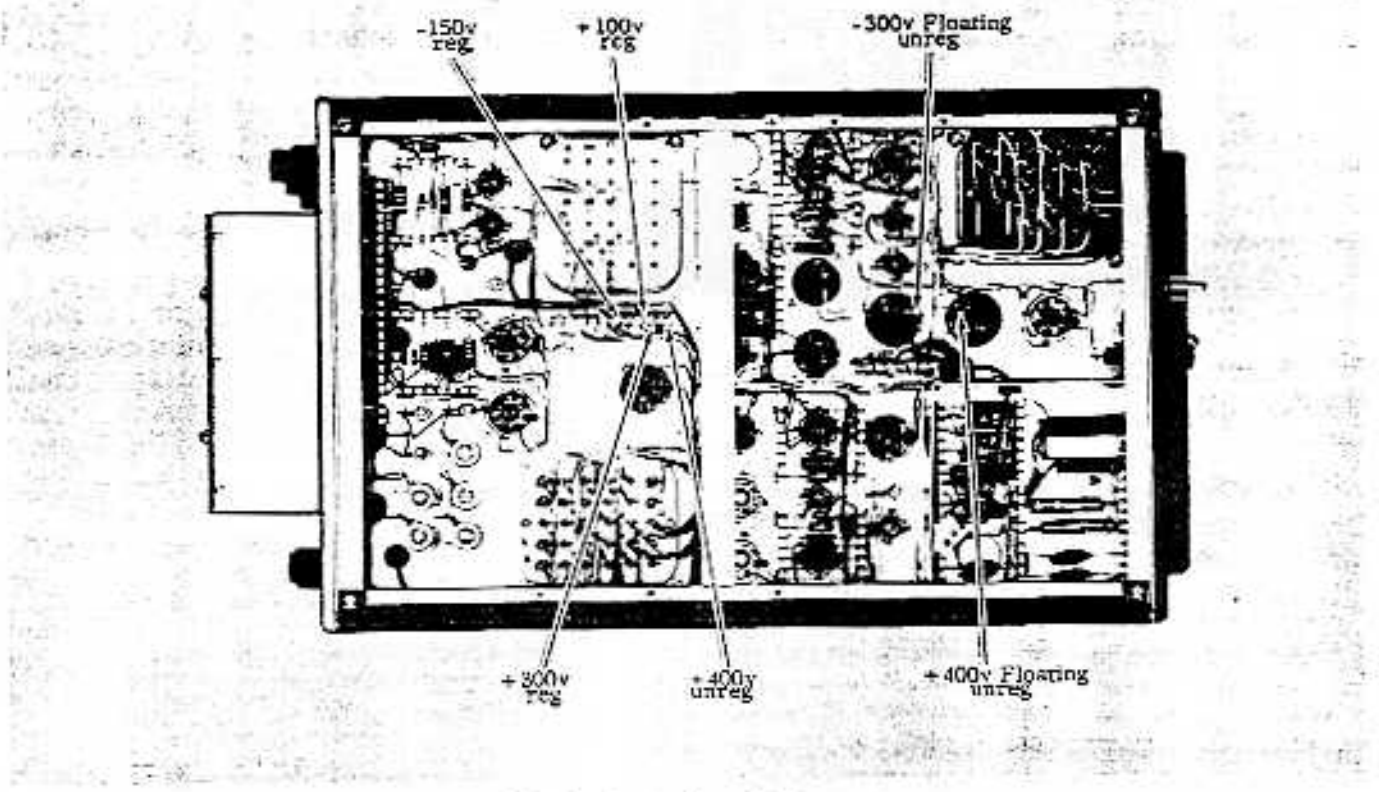

Fig. 5-2. Low-Voltage Power Supply test points.

Now check the +400 volt unregulated supply of the Power Supply and the +400 and -300 volt unregulated supplies of the Floating Power Supply. The unregulated supplies should be within 5% of the proper voltage.

Vary the output of the autotransformer between 105 and 125 volts (or between 210 and 250 volts) to check the regulation of the low voltage power supplies. The power supplies must regulate within 2% (regulated) or 5% (unregulated) of their correct voltages.

TYPICAL RIPPLE AMPLITUDES	
POWER SUPPLY	TYPICAL RIPPLE
-150v	5mv + 50% at 105 and 125v
+100v	5mv + 50% at 105 and 125v
+300v	30mv + 50% at 105 and 125v
+400v	4.5v + 50% at 105 and 125v
FLOATING POWER SUPPLY	
+400v	.5v + 50% at 105 and 125v
-300v	.5v + 50% at 105 and 125v

Using the test oscilloscope, check the ripple voltage at the output of each power supply when the autotransformer is adjusted for 117 volts. Swing the autotransformer output voltage from 105 volts to 125 volts while observing the amount of ripple. It should remain about the same amplitude from low line to high line voltage. Return the line voltage to 117 volts.

2. H V Adjustment

While the Type 570 Oscilloscope is still in a position for access to the underside, the HV will be set. Connect the voltmeter to the high-voltage test point shown in figure 5-3. Adjust the H V ADJ until a reading of -1700 volts is obtained.

The high-voltage regulation is checked by observing the voltage reading while changing the line voltage from 105 to 125 volts. If the reading shows a drop or rise then the high-voltage supply is not regulating properly. Improper regulation will probably be cured by changing V605.

3. Checking +DC Circuit range and Meter accuracy

Connect the accurate voltmeter between the

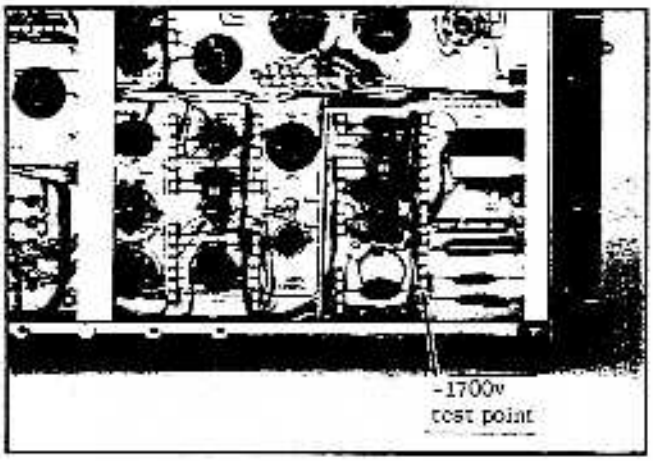

Fig. 5-3. High Voltage test points.

+DC connector on the test panel and ground. Set the +DC Control and the RANGE DC VOLTS Control as called out in the table below.

Using the +DC VARIABLE Control, set the voltage of the +DC connector on the test panel to the value called out in the table. The voltage is set to the proper value by using the accurate voltmeter connected to the +DC connector on the test panel. After the voltage is set then the reading of the meter mounted on the Type 570 is compared to that of the accurate voltmeter. The meter mounted on the Type 570 should not be off the proper reading by more than 2% in any of its ranges.

METER ACCURACY CHECK		
Voltage at +DC Connector (test panel)	+DC Control	RANGE DC VOLTS Control
300v	300	700
300v	300	350
200v	200	350
100v	100	350
100v	100	140
70v	100	140
70v	100	70
35	50	70
35	50	35
14	20	35
14	20	14
7	20	14
7	20	7

NOTE

If the +DC VARIABLE will not reduce the output of the +DC connector to 7 volts then change V540B. By changing this tube it is usually possible to obtain a 7 volt output or less.

4. —DC Control Check

Connect the accurate voltmeter between ground and the -DC connector on the test panel. Turn the -DC Control clockwise and make sure that the voltage output of the -DC connector goes from 0 to -100 volts.

5. Grid A, Grid B and —150 27 k Connector check

Connect the voltmeter between the GRID A connector and ground, the voltmeter should read approximately -108 volts. Now move the TEST POSITION switch to GRID B. The voltmeter should still read -108 volts.

Remove the voltmeter lead from the GRID A connector and connect it to the GRID B connector on the test panel. Move the TEST POSITION switch to the OFF position, the voltmeter will now read approximately -108 volts. Now move the TEST POSITION switch to GRID A position, the voltmeter will once again show the approximate -108 volt reading.

After checking the GRID A and GRID B connectors on the test panel, move the voltmeter lead from the GRID B connector and connect it to the -150 27k connector on the test panel. The voltmeter should read -150 volts from this connector.

6. CRT Alignment

Set the INTENSITY Control to a usable level. Adjust the FOCUS and ASTIGMATISM Controls for a focused spot. Now switch the VOLTS/DIV Control to 10. This will result in a horizontal line across the face of the crt. With the VERTICAL POSITIONING Control, position the line under one of the horizontal graticule lines.

Crt adjustment SN 101-5199

If the trace and graticule line do not coincide over the length of the graticule, loosen

the crt base clamp and rotate the tube with the alignment ring. When the trace and the graticule line are in coincidence, push the tube forward so that it rests snugly against the graticule. Then tighten the crt base clamp. Recheck the alignment after tightening the clamp to be sure it didn't move while the clamp was being tightened.

CRT adjustment SN 5200-up

Loosen the clamp at the base of the crt and push the crt against the graticule, then tighten the clamp. Now with the red knob, near the bottom of the clamp, rotate the crt until the trace runs parallel to the horizontal lines of the graticule.

7. Adjusting PHASE A and B and setting CRT GEOM ADJ Control

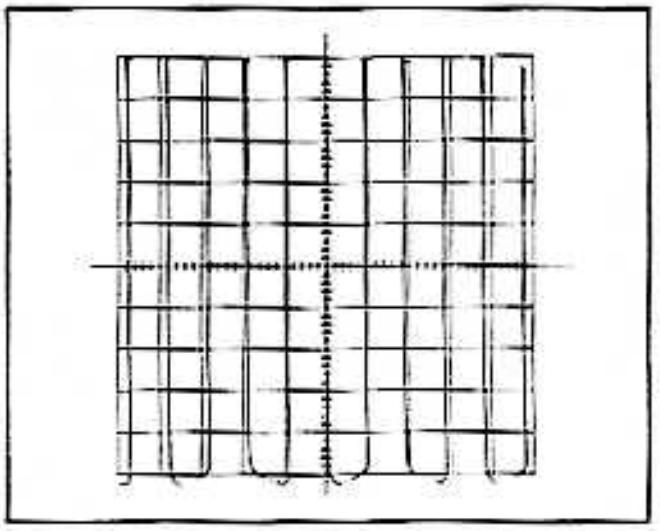

Fig. 5-4. The waveform obtained in the 240 position of the STEPS/SEC Control, which is used to adjust the CRT GEOM ADJ Control.

Set the PLATE-GRID Control to GRID, the VOLTS/DIV Control to 1 and connect a jumper from the P connector on the test panel to ground. Adjust the STEPS/FAMILY Control for 10 vertical lines. Adjust the PHASE A Control for the flatest bottom on the waveform. Now turn the STEPS/SEC Control to the 120 clockwise position and adjust the PHASE B Control for the flatest top on the waveform. Turn the STEPS/SEC Control to the 240 position and check for alternate switching, see figure 5-4.

Using the display obtained in the 240 position of the STEPS/SEC Control, adjust the CRT GEOM ADJ Control for minimum curvature of the vertical lines at the sides of the crt.

Disconnect the jumpers.

8. Checking Vertical Tube Balance

When the VERTICAL POSITIONING Control is in its midrange position the dots should be between the second and fourth division line as measured from the bottom full graticule line. If the dots do not lie in this area then V280 and V281 should be changed until the near balanced condition is obtained.

9. VERT GAIN Adjustment and Checking MA/DIV Switch

Turn the PLATE-SCREEN-GRID Control to SCREEN, the RANGE DC VOLTS Control to 140 and the INDICATION Control to +DC. On instruments below serial number 5122 turn the MA/DIV Control to .02 while on instruments above serial number 5121 the control is set to .1.

While observing the meter, set the +DC Controls for exactly 140 volts, then switch the INDICATION Control to HTR. Now position the dots to the bottom full graticule line. Switch the INDICATION Control to +DC and adjust the VERT GAIN Control for a deflection of 10 divisions.

Switch back and forth between the +DC and HTR positions of the INDICATION Control to remove interaction in the adjustment. Be sure that the dots are on the bottom graticule line each time you switch after setting the +DC position.

To check the ±3% accuracy of the MA/DIV Control, set the +DC Controls to obtain 100 volts. Be sure to set the INDICATION Control to the HTR position after setting the +DC voltage.

Turn the MA/DIV Control to 50 and position the dots to the bottom full graticule line. Connect the 1k-5w resistor between the +DC connector and ground. The dots will have moved up two divisions. Switch the MA/DIV switch to 20 and check to see that the dots are 5 divisions from the originally set point (the VERTICAL POSITIONING Control is not reset after it is set as above). See the table below for the other settings of the MA/DIV Control.

MA/DIV Accuracy Check

MA/DIV Setting	Resistor Value	Deflection obtained from Bottom Graticule Line
10	1k-5w	10 divisions
5	2k-5w	10 divisions
2	5k-2w	10 divisions
1	10k-1w	10 divisions
.5	20k-1w	10 divisions
.2	50k-1w	10 divisions
.1	100k-1w	10 divisions
.05	197k-1w	10 divisions
.02	495k-1w	10 divisions

Remove all connectors.

10. Adjusting VOLTS/DIV BAL (located under instrument)

Turn the PLATE-GRID Control to PLATE and connect the P and K connectors on the test panel together. Now rotate the VOLTS/DIV Control and at the same time adjust the VOLTS/-DIV Control for no horizontal movement of the spot on the crt. Disconnect the jumper between the P and K connectors on the test panel.

11. Setting VOLTS/STEP ZERO ADJ.

Turn the PLATE-GRID Control to GRID, the VOLTS/DIV Control to .1 and the START ADJUST Control full counterclockwise. With a jumper ground pin 8 of V115. While pressing the ZERO BIAS button position the spot under the center vertical graticule line with the HORIZONTAL POSITIONING Control. Release the ZERO BIAS button and return the spot under the center vertical graticule line with the VOLTS/STEP ZERO ADJ Control. Disconnect the jumper between ground and pin 8 of V115.

12. Setting the Knob Position of the START ADJUST (SN 5200-up)

Press the ZERO BIAS button in and set the spot under a convenient reference line on the graticule. Release the ZERO BIAS button and position the start of the dots under the same reference line using the START ADJUST to do the positioning.

The dot on the knob of the START ADJUST should now be pointing at the 0 in the front panel.

If your instrument is below serial number 5002 and you would like to know the start position then do the above procedure and mark the zero on your front panel in pencil or ink.

13. HOR GAIN Adjustment

Turn the PLATE-GRID Control to PLATE, the VOLTS/DIV Control to 10, the MA/DIV Control to 50 and the SERIES LOAD Control to 1M. Adjust the +DC Controls for 100 volts out of the +DC connector on the test panel as explained earlier in this procedure.

Connect a jumper between the P connector on the test panel and ground. Line up the spot under the far left-hand graticule line. Now connect the jumper between the P connector and the +DC connector on the test panel. Adjust the HOR GAIN Control until the spot is under the far right-hand graticule line. Reconnect the jumper to ground and then to +DC several times to remove interaction. Remove the jumper from the test panel.

14. Setting VOLTS/STEP ADJ

Reset the PLATE-GRID Control to GRID, the VOLTS/DIV Control to .1 and the VOLTS/-STEP Control to .1. Adjust the VOLTS/STEP ADJ until there is one dot per graticule division.

15. Adjusting Volts/Div Cal (R227)

Reset the VOLTS/DIV Control to 10 and the VOLTS/STEP Control to 10. Adjust R227 (see Fig 5-8.) for one dot per graticule division.

If R227 does not have enough range of adjustment, to set the crt display for one dot per graticule division, then R228 may be paralleled by a selected resistor R226.

NOTE

Steps 13, 14 and 15 interact, therefore they should be repeated several times.

After the interaction has been eliminated the VOLTS/STEP and the VOLTS/DIV Controls should be checked against each other for a one dot per graticule division display when the switches are set the same value, i.e., 5 and 5.

16. MIN NO CURVES Adjustment, and Maximum Number of Curves and SINGLE FAMILY Button Check

Turn the STEPS/FAMILY Control full counterclockwise and adjust the MIN NO CURVES

for 5 dots. Now turn the STEPS/FAMILY Control clockwise and check to see that at least 13 dots can be seen before you enter the area for the SINGLE FAMILY button.

After checking for at least 13 dots continue to rotate the STEPS/FAMILY Control clockwise into the Single Family area. Push the SINGLE FAMILY button and obtain one sweep each time it is pushed. Rotate the STEPS/FAMILY Control counterclockwise until a constant display of dots is once again displayed.

17. Checking HEATER Control and Adjusting AC Volts Adj. (R350)

Connect an accurate ac voltmeter between the two HTR connectors on the test panel. Adjust the HEATER VARIABLE until a reading of 6.3 volts is obtained on the voltmeter. Now turn the INDICATION Control to HTR and while observing the 0-140 volts scale, on the meter of the Type 370, adjust R350 for a meter reading of 100% (100 volt position). Disconnect the ac voltmeter from the HTR connectors on the test panel.

HEATER Setting	VOLTS/DIV Control	Divisions of Deflection
1.25	.2	8.8
1.4	.2	9.9
2.0	.5	5.6
2.35	.5	6.6
2.5	.5	7.0
3.15	.5	8.9
4.2	1	5.9
4.7	1	6.6
5.0	1	7.0
6.3	1	8.9
7.5	2	5.3
12.6	2	8.9
18.9	5	5.3
25	5	7.0
35	5	9.9
50	10	7.0
117	20	8.3

Remove the jumpers from the test panel.

With a jumper connect the P connector on the test panel to ground, and turn the PLATE-GRID Control to PLATE and the VOLTS/DIV Control to 1. Position the spot under the far left hand graticule line. Now change the jumper from ground to the "hot" HTR connector on the test panel. A horizontal deflection of 8.9 divisions should be obtained.

When checking through the ranges of the HEATER Control, be sure to maintain the heater voltage at 100% as read on the meter of the Type 370. If the voltage is other than 100% it maybe adjusted to 100% with the HEATER VARIABLE Control. The accuracy of the HEATER Control should be within ±5% in all positions.

18. Checking PEAK VOLTS Control

Reset the VOLTS/DIV Control to .5, the PLATE-GRID Control to PLATE and the SERIES LOAD to 300. Check each of the positions of the PEAK VOLTS Control for the proper deflection (±5%) as in the table below.

VOLTS/DIV Control	PEAK VOLTS Control	Divisions of Deflection
.5	5	10
1	10	10
2	20	10
5	50	10
10	100	10
20	200	10
50	300	6
50	500	10

19. Checking SERIES LOAD Resistor Values

Turn off the POWER-MAIN of the Type 370. Connect an accurate ohmmeter between pin 3 of V315 and the P connector on the test panel. Set the SERIES LOAD Control to each position and read the value on the ohmmeter. The values should be within ±5% of the front panel value.

20. Adjusting Plate Sweep (C311) and Plate Trans (C315) Current Balance Capacitors

Reset the following controls:

MA/DIV	.02
VOLTS/DIV	50
PLATE-SCREEN-GRID	PLATE
PLATE-GRID	PLATE
POWER-MAIN	ON
PEAK VOLTS	500
SERIES LOAD	1M

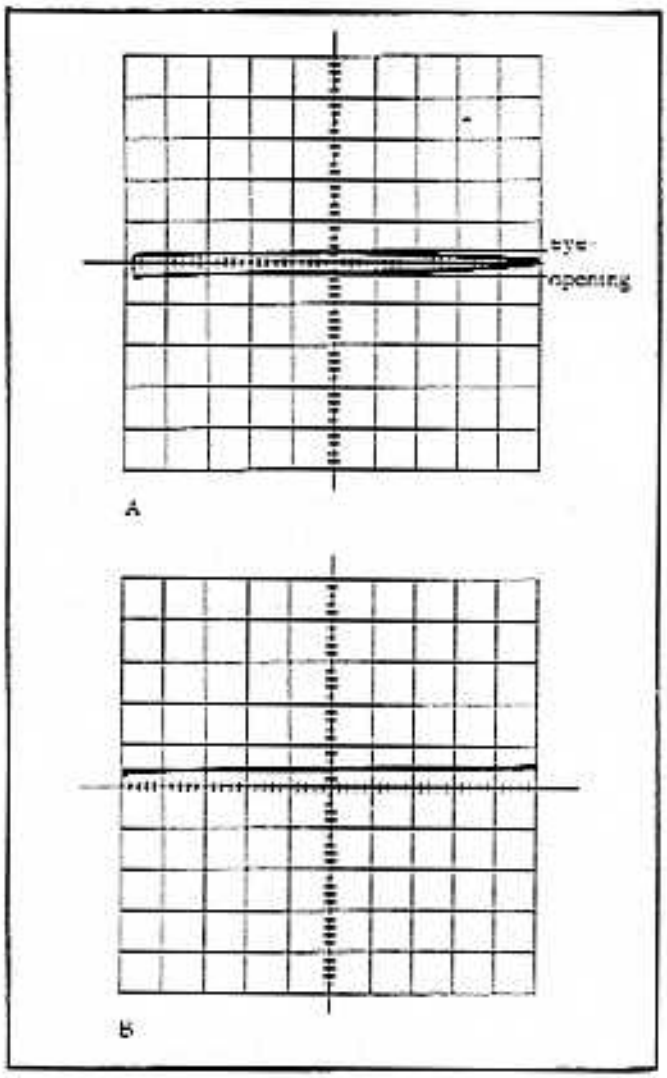

Fig. 3-5. A. The display seen before the Current Balancing capacitor(s) are adjusted and connected properly. B. The display with properly connected and adjusted current balancing capacitor(s).

Allow the instrument to warm up for about 5 minutes. Now observe the eye-opening of the loop on the crt. If the loop is a straight line then no further adjustment is necessary. If the loop has an eye-opening then one of the following configurations, which brings the loop the closes to a straight line, should be used. The variable capacitors must be adjusted for the smallest eye-opening each time a new configuration is used.

CAUTION

Damage to the instrument may result if an end of C315 and C316 are tied to the same transformer terminal.

T310 Current Balance Capacitor Connections

Configuration	C315	C316
1	Not connected	Connected between terminals 5 and 8
2	Not connected	Connected between terminals 7 and 8
3	Not connected	Not connected
4	Connected to terminal 5	Not connected
5	Connected to terminal 7	Not connected
6	Connected to 5	Connected between terminals 7 and 8
7	Connected to 7	Connected between terminals 5 and 8

21. Adjusting GRID (C502) and SCREEN (C509) Current Balance Capacitors

Turn the PLATE-SCREEN-GRID Control to GRID. C502 is connected and adjusted to give the least eye-opening in the loop.

C502 Connections

Configuration	Connection
1	No connection
2	Lead connected to terminal 14 of T501
3	Lead connected to terminal 16 of T501

Now set the PLATE-SCREEN-GRID Control to SCREEN. Connect and adjust C509 to give the least eye opening.

C509 Connections

Configuration	Connection
1	No connection
2	Lead connected to terminal 7 of T501
3	Lead connected to terminal 9 of T501

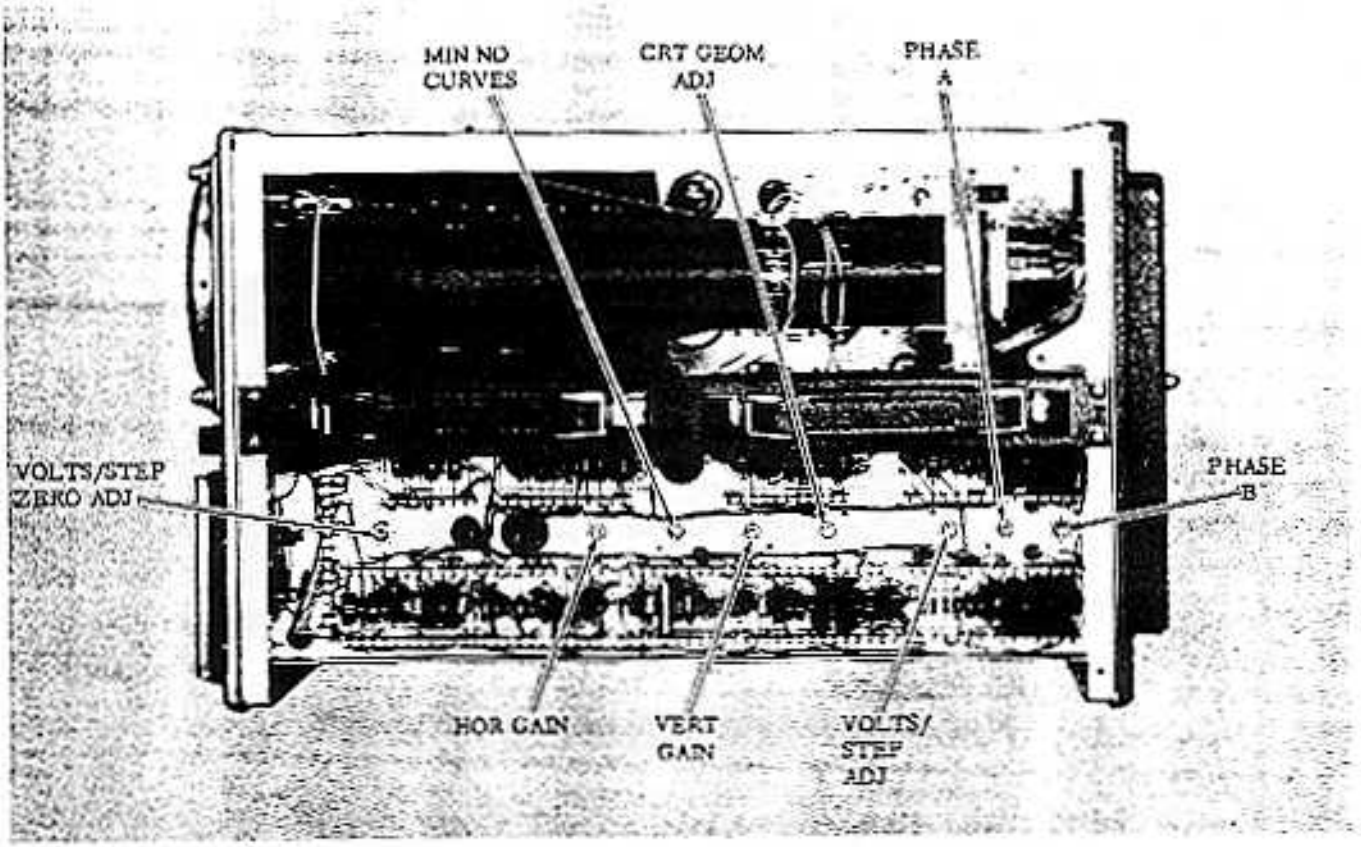

Fig. 1-6. Top view of Type 570 above serial number 5001.

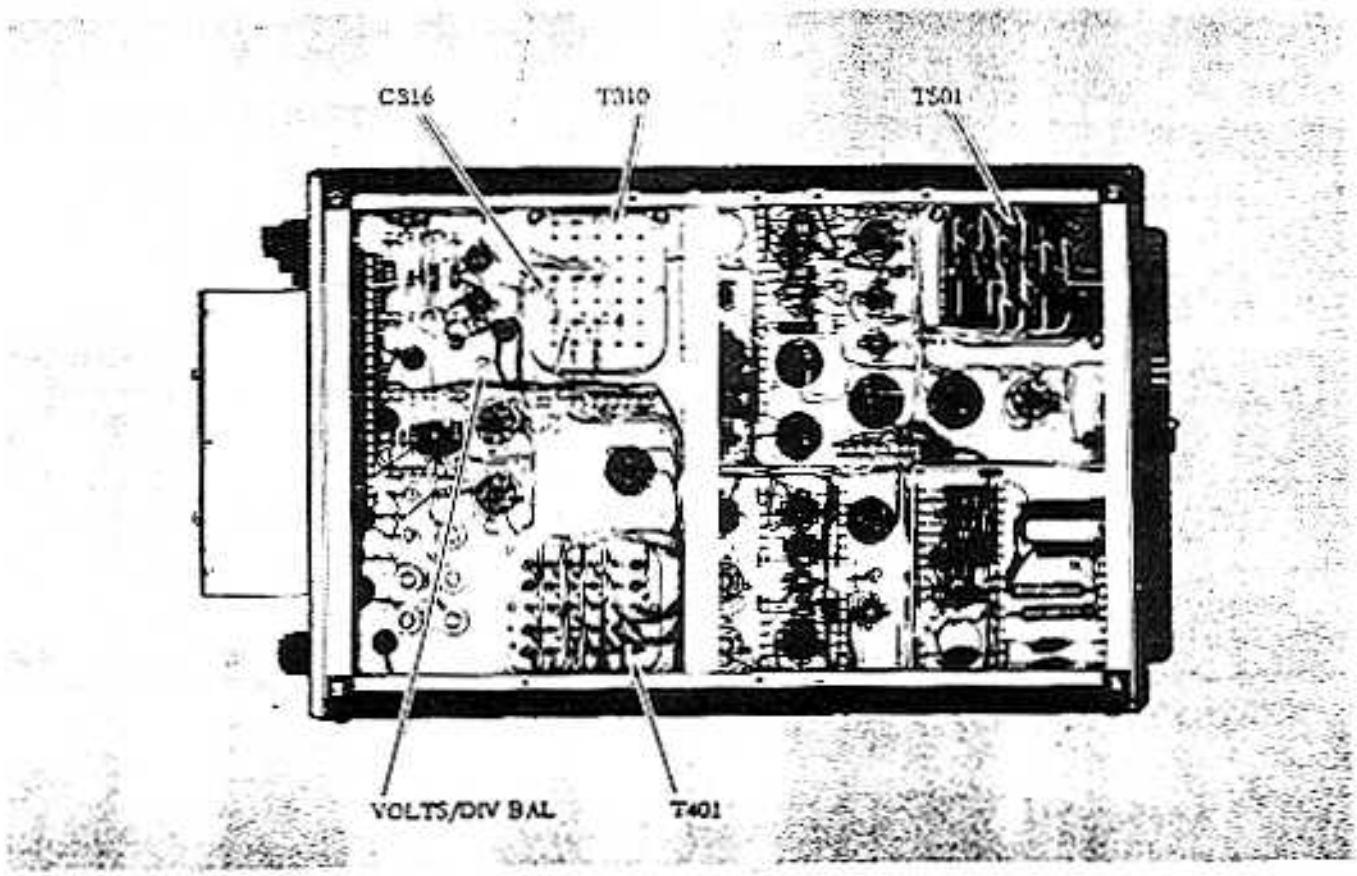

Fig. 1-7. Bottom view of Type 570.

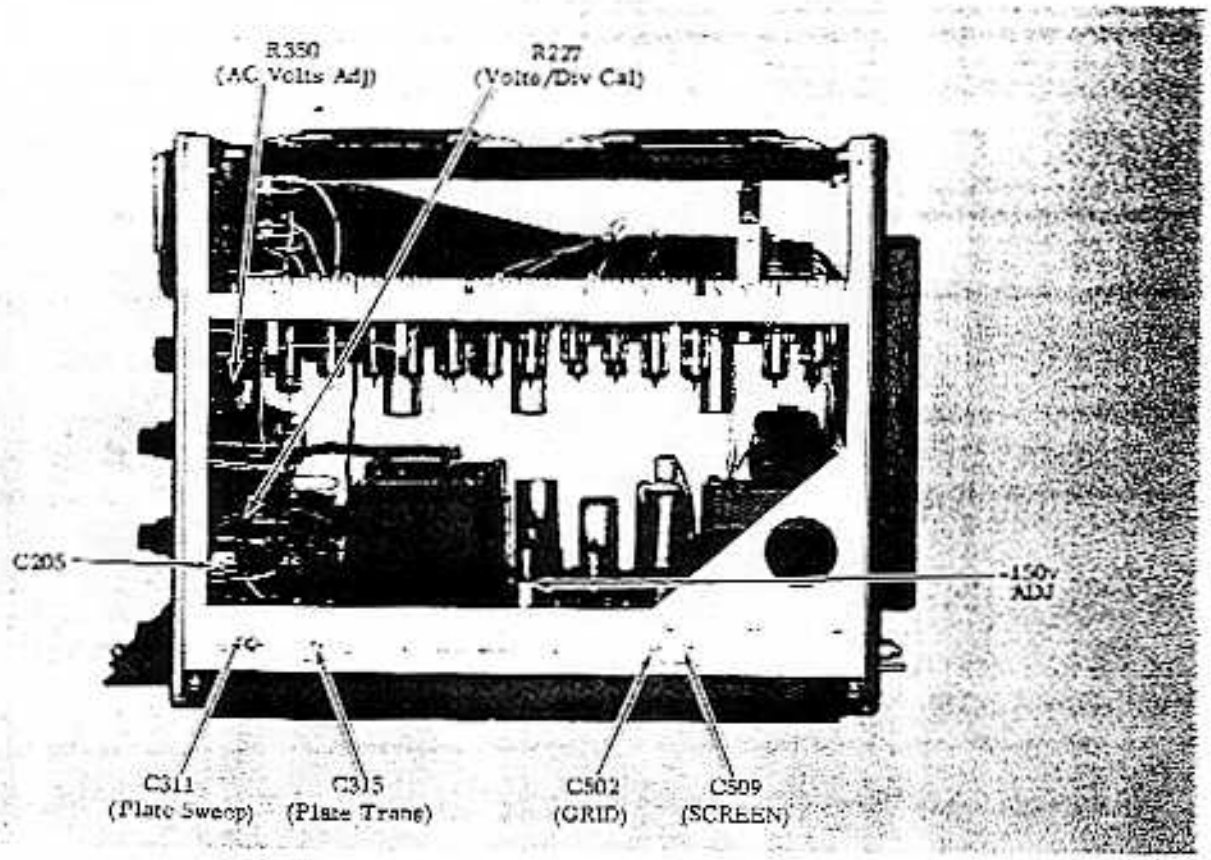

Fig. 5-6. Right side view of Type 570.

22. Adjusting C205

Turn the POWER-TEST switch off and install the nine-pin-miniature socket adapter into the test panel. Connect the patch cords as follows.

6U8 Triode Connections

Pin No.	Connect to	Tube element
1	P	Plate
4	HTR	Heater
5	HTR	Heater
8	K	Cathode
9	GRID A	Grid

Install a Type 6U8 in the socket adapter and turn the POWER-TEST switch ON after the proper heater voltage has been set. Adjust the following controls of the Type 570 to obtain a normal set of plate current versus plate voltage triode curves.

PLATE-SCREEN GRID	PLATE
PLATE-GRID	PLATE
MA/DIV	1
VOLTS/DIV	20
VOLTS/STEP	.5
START ADJUST	0
STEPS/SEC	120 clockwise
STEPS/FAMILY	approximately 5 steps
TEST POSITION	GRID A
HEATER	6.3
HEATER VARIABLE	adjust for 100%
PEAK VOLTS	100
SERIES LOAD	5k

Now adjust C205 to obtain optimum retrace (a single line).