

# **HICKOK**

INSTRUCTION MANUAL

for

**MODEL 123R**

**CARDMATIC TUBE TESTER**

Manual No. 2490-601

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## CARDMATIC TUBE TESTER MODEL 123 R

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## SECTION II

### OPERATING INSTRUCTIONS

#### PRELIMINARY

- a) The Model 123R must be connected to a proper source of power as outlined under the Installation Section.
- b) Depress the red "ON" switch located in the upper right corner of the front panel. (Generally, the tube tester should be left on throughout the day, assuring instant operation when desired.) The instrument is now in a standby condition and prepared to perform testing operations as may be called for by the card system.

#### TUBE TESTING

The green indicator lamp should be on before starting tube testing.

- a) Select the card for the tube type to be tested.
- b) Insert tube into socket indicated on card.

- c) Insert card in slot of card switch; push card until switch engages and black knob comes up.
- d) Allow 10 to 15 seconds warmup for tube under test.
- e) Observe short lamps under hood below meter. If any bulbs glow, tube is shorted. Replace tube.

#### NOTE

Disregard any bulb glow that occurs after No. 2 button has been released.

During any test, if the needle shows in the RED area of the meter, replace the tube; if the needle shows in the GREEN area the tube is O. K.

- f) Observe needle position on meter scale 1.
- g) Push button 2 and read scale 2.
- h) Push button 3 and read scale 3.



## SECTION III MAINTENANCE

### GENERAL

The Model 123R is checked and calibrated at the factory prior to shipment. However, it should be checked with its own test cards during installation and at appropriate intervals thereafter to assure proper operation.

Special test cards are furnished for use by maintenance men or other authorized personnel in checking the tester. These cards are contained in an envelope inside the back cover of this Instruction Manual.

Test card checkout procedure is as follows:

Turn tester on; allow 15 to 20 minutes warmup.

- a) Insert card No. 1 in switch. Short lamps No. 1 and No. 5 should glow. Press No. 2 button. Meter should read half scale. If reading is other than half scale, adjust potentiometer No. 1. (See figure No. 2 for proper location of controls.)
- b) Insert card No. 2. Short lamp No. 1 should glow. Press No. 2 button. Meter should read half scale. If other reading is obtained, adjust potentiometer No. 2.
- c) Insert card No. 3. Short lamp No. 1 should glow.

Press No. 2 button. Adjust potentiometer No. 3 to obtain half scale reading on meter.

- d) Insert card No. 4 (150 V supply). Short lamp No. 1 should glow. Press No. 2 button and adjust potentiometer No. 4 to obtain half scale reading on the meter.
- e) ADJUSTMENT NO. 5 IS SET AND SEALED AT THE FACTORY. NO. 5 CARD IS NOT FURNISHED.
- f) Insert card No. 6. Press push button No. 2. The meter should indicate zero. If reading is off zero, adjust potentiometer No. 6 for correct indication.
- g) Insert card No. 7. Press push button No. 2. The meter should indicate zero. Adjust potentiometer No. 7 for correct indication.
- h) Adjustments No. 8, No. 9 and No. 10 are set and sealed at the factory.

If any of the above checks are not normal and cannot be adjusted properly, follow the Troubleshooting Procedure. Should trouble still persist, contact the factory, giving the nature of the trouble. Instructions will then be given for either correcting the trouble or returning the equipment.

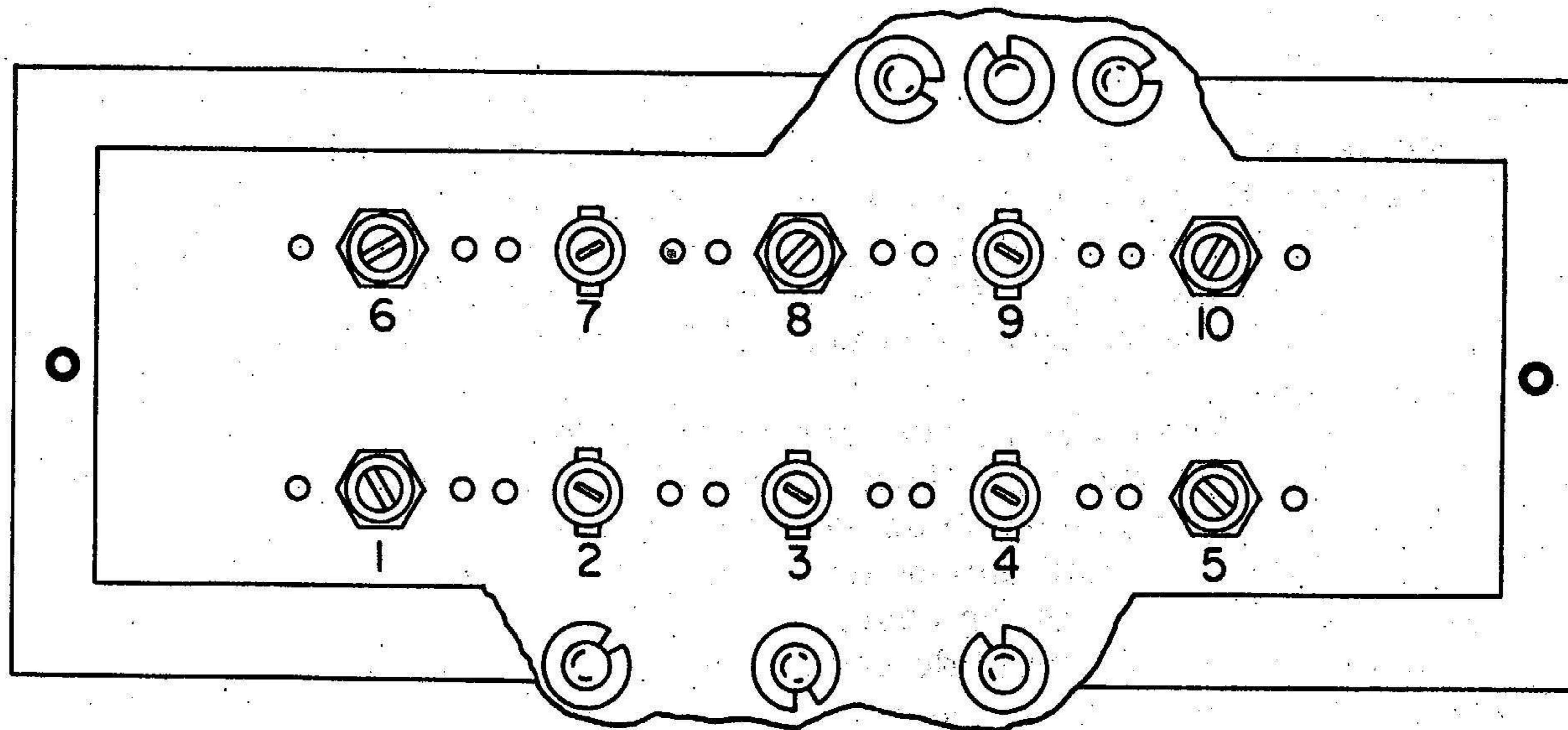


Figure 2. Side Panel Removed, Showing Calibration Controls



## TROUBLESHOOTING PROCEDURE

SYMPTOM	REMEDY
Test 1 will not adjust properly.	Replace 6X4 and 0A2 tubes.
Test 2 or 3 or 4 cannot be adjusted for mid-scale reading.	Replace 6DQ6A, 6AU8 and 5U4GB. Be sure the plate cap is connected to 6DQ6A and the cap lead is not touching either the body of the 6DQ6A or the 5U4GB.
Test 6 or 7 cannot be adjusted. <i>G.M. Bridge</i>	Check 1/4 amp fuse (see Service Note No. 4). Replace if necessary. If trouble persists, replace 1N1695 crystals, Hickok Part No. 3870-90. (See Service Note No. 5).
No filament voltage to tubes under test.	Tighten or replace the 100 watt light bulb.
Card does not actuate the card switch when fully inserted.	<p>First, check that the tester is turned on and card is being inserted properly, with printed side up.</p> <p>If trouble persists, TURN TESTER OFF. Move the card slowly back and forth in switch through last 1/4 inch of travel. An audible light "CLICK" of the micro-switch should be heard.</p> <p>If NO "CLICK" is heard, readjust the microswitch as follows:</p> <ol style="list-style-type: none"> <li>a) Pull the line plug from the 115V AC power source.</li> <li>b) Remove the Phillips head screws on each side of the card switch cover.</li> <li>c) Lift the back of the cover, slide toward the front to clear the card guide and lift off.</li> </ol> <p>NOTE: The black reject knob must be down for cover to slide under the card guide.</p> <ol style="list-style-type: none"> <li>d) Loosen slightly the two screws which secure the microswitch to its bracket at the top of the card switch. Carefully position the microswitch until the card actuates it as indicated by the "CLICK".</li> <li>e) Tighten the mounting screws.</li> <li>f) Recheck the action with a card.</li> <li>g) Plug tester into power source and turn on.</li> <li>h) Check that card now properly actuates switch.</li> </ol> <p>NOTE: LINE VOLTAGE IS PRESENT ACROSS THE MICROSWITCH CONNECTIONS.</p> <ol style="list-style-type: none"> <li>i) Be sure that the card releases easily when the reject knob is pushed. If it does not, the microswitch has been set in too close. Readjust slightly as described above until proper operation is achieved.</li> <li>j) Replace card switch cover.</li> <li>k) Be sure to pull line plug when making these mechanical adjustments as noted above.</li> </ol>
Card will not come out of switch when rejected.	<p>Actuate switch with card and push reject knob again.</p> <p>If card still does not release, proceed as follows:</p> <ol style="list-style-type: none"> <li>a) Pull the line plug from the 115V AC power source. Remove the Phillips head screws on each side of the card switch cover.</li> <li>b) Lift the back of the cover, slide toward the front to clear the card guide and lift off.</li> </ol> <p>NOTE: The black reject knob must be down for cover to slide under the card guide.</p> <ol style="list-style-type: none"> <li>c) Inspect the tops of the contact pins as seen through the holes. One of these pins has moved up above its normal position through a hole in the card.</li> <li>d) Using a small screw driver or other suitable tool, carefully push the pin down until it clears the card.</li> </ol> <p>The card should now slide easily out of the switch.</p> <p>Plug tester into power source and turn ON.</p> <p>Reactivate the switch several times with the same card.</p> <p>The card should be free to slide out each time the reject button is pushed.</p> <p>When operation is normal, replace card switch cover.</p>



## SERVICE NOTES

### NOTE 1. POTENTIOMETER CALIBRATIONS

#### POTENTIOMETERS NO. 5 AND NO. 10

Potentiometers No. 5 and No. 10 control the signal amplitude and signal voltage. To adjust proceed as follows:

- Connect the instrument to the line through a variac set to 115 volts. Turn instrument on.
- Insert 6L6 card in switch.
- Connect a high impedance, sensitive AC voltmeter from pin 5 to pin 8 on any convenient one of the tube test sockets. See figure No. 3.

NOTE: This must be a high impedance AC voltmeter capable of ACCURATE measurement of 0.22 volt. HICKOK Model DMS-3200 Main Frame with a Model DP-130 AC Voltmeter Plug-In or equivalent is recommended.

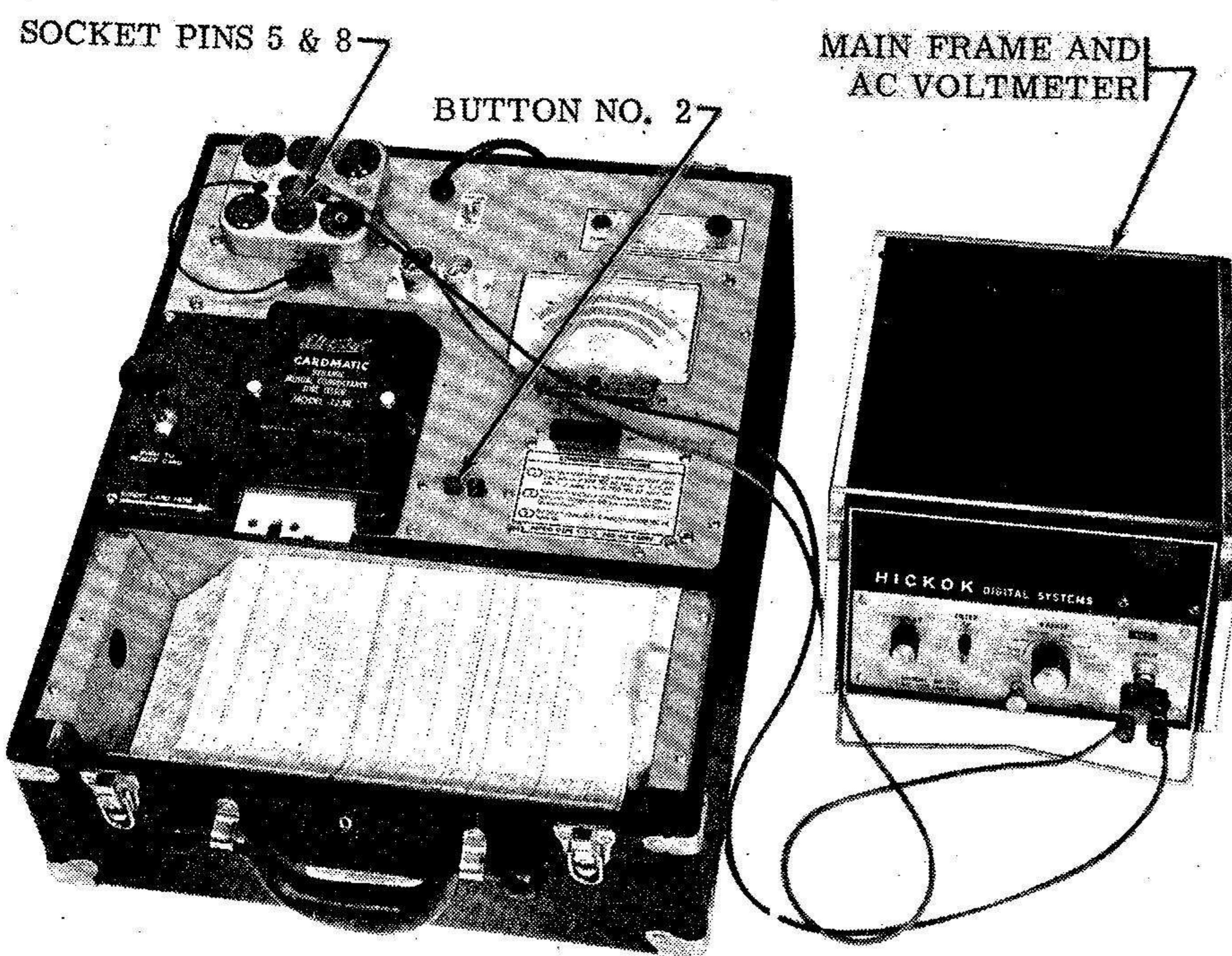


Figure 3. Test Setup for Signal Amplitude and Voltage Calibrations

- Check voltage regulation as follows: While holding down button No. 2, vary the line voltage from 105 to 125 volts. Note the reading indicated on the voltmeter. The signal voltage at 105 and 125 should be the same. The signal voltage at 115 should not vary more than 1% from the 105 and 125 readings.

If the circuit is not regulating in this manner, adjust potentiometer No. 10 and rock the line voltage until the desired regulation is indicated on the voltmeter. The exact value of the signal voltage during this regulation adjustment is not critical.

- After the signal regulation is properly adjusted, the exact signal level of 0.22 volts rms is set by adjusting potentiometer No. 5.

#### POTENTIOMETER NO. 8

This control adjusts the cutout level of the high sensitivity coil of the overload relay. It is adjusted as follows:

- Insert test card No. 4 in card switch. Place a short circuit from pin 3 to pin 6 on any convenient tube test socket. See figure No. 4. Adjust potentiometer No. 8 until the overload relay kicks out when button No. 2 is pushed.
- When adjustment is complete remove short circuit.

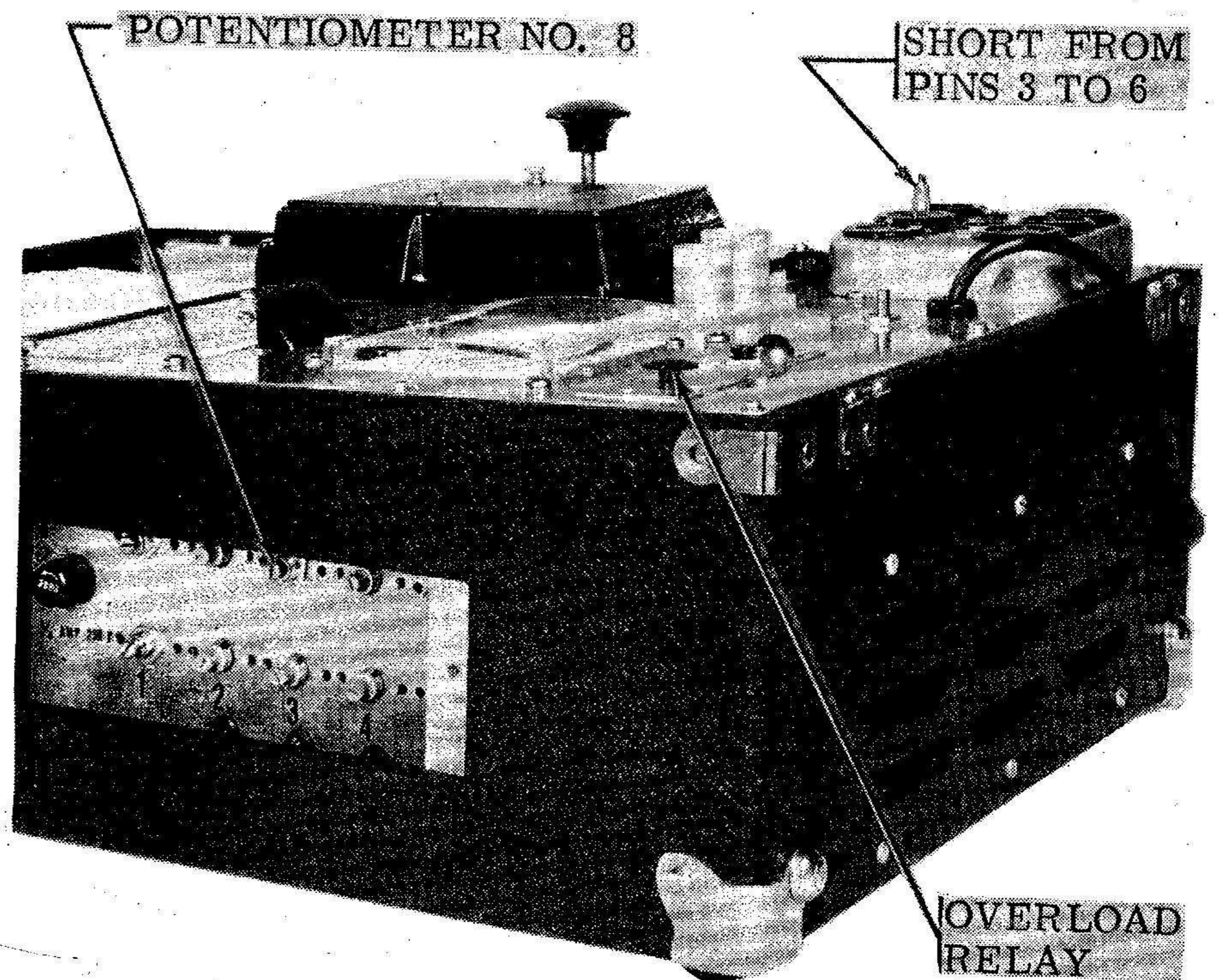


Figure 4. Test Setup for Potentiometer No. 8

#### POTENTIOMETER NO. 9

This control adjusts short test sensitivity. The procedure is as follows:

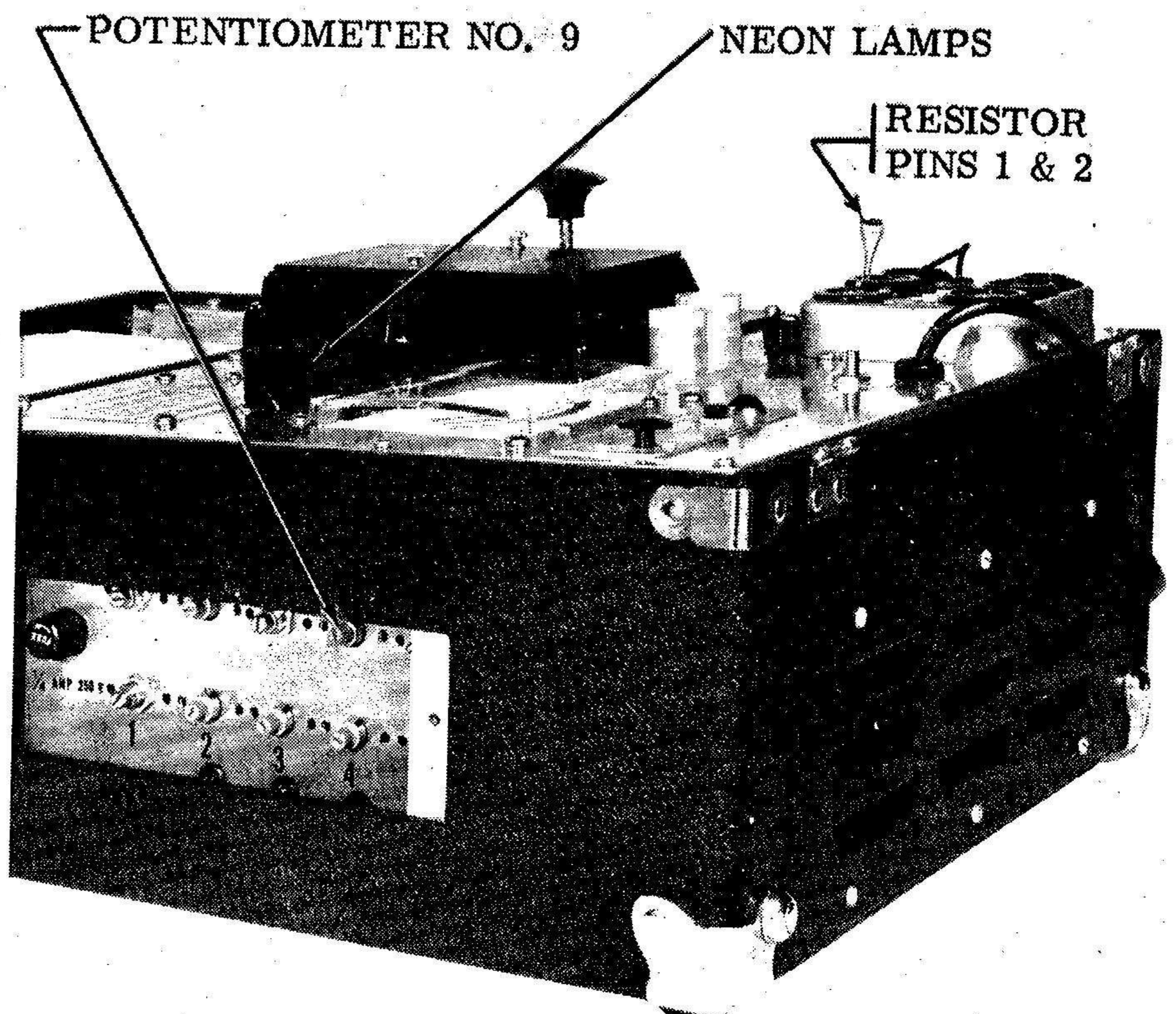


Figure 5. Test Setup for Adjusting Short Test Sensitivity



- a) Turn tester on.
- b) Insert 12BY7 card in card switch.
- c) Connect a 10 megohm resistor from pin 1 to pin 2 on any convenient tube test socket. See figure No. 5.
- d) Adjust potentiometer No. 9 until neon short lamps 1 through 4 just flicker on and off. Lamp 5 will not flicker.
- e) Connect a 20 megohm resistor in place of the 10 megohm used above. All lamps should be completely out. If glow is observed repeat the last two steps.

#### NOTE 2. CHECKING B+ VOLTAGES

The regulated B+ voltages are normally checked on the instrument by use of test cards No. 2 (50 volt supply), No. 3 (100 volt supply) and No. 4 (150 volt supply).

If one or more of these tests does not give a mid-scale reading on the panel voltmeter and the associated potentiometer cannot be adjusted, the source of trouble may be isolated as follows: See figure 6.

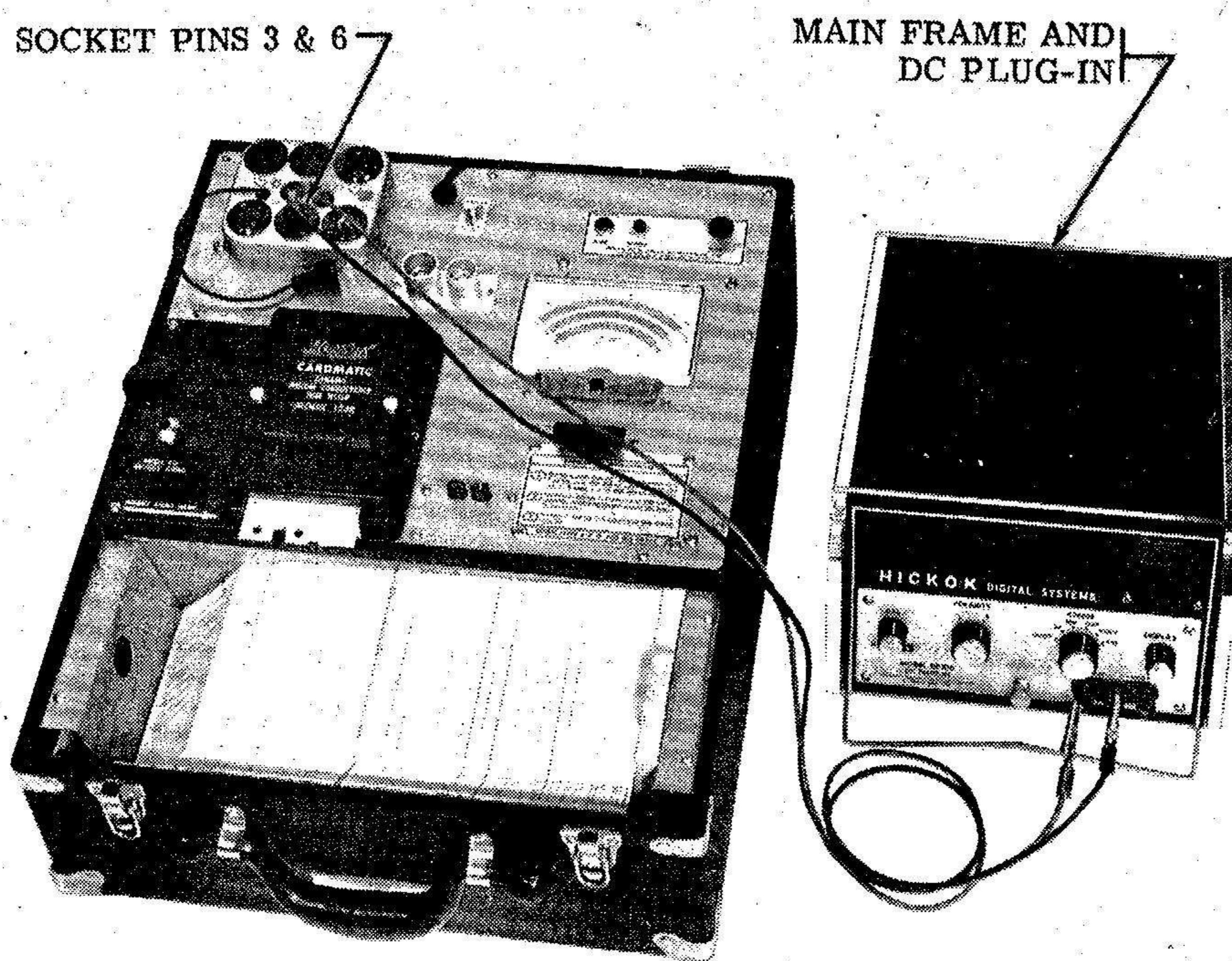


Figure 6. Checking B+ Voltages with External Voltmeter

- a) Connect an external voltmeter from pin 3 to pin 6 on one of the tube test sockets (any one of the test sockets may be used according to convenience).
- b) If the external voltmeter agrees with the panel meter that the power supply cannot be adjusted, then the trouble lies in the power supply itself. Check power supply tubes and appropriate power supply socket voltages. See Service Note 6.
- c) If the external meter shows the power supply to be properly adjusted while the panel meter shows an appreciable error, then the trouble lies in the meter or shunting system.
- d) Use shunt resistor test cards to check metering system. See Service Note 8.

#### NOTE 3. TOLERANCES ON TESTS 6 AND 7

Test cards 6 and 7 are used to zero balance the Gm bridge circuit at high current levels and low current levels, respectively. These controls require occasional checking and adjustment to assure maximum accuracy in Gm readings. However, a certain amount of drift from zero is permissible without introducing appreciable errors.

During these calibration tests the meter has a high sensitivity. On test No. 7 a drift of 10 meter divisions from zero is equivalent to 50 micromhos. This would represent only a 1% error on a typical 5000 micromho tube reading.

If very accurate readings are desired on the low Gm tubes (500 to 1000 Gm) it would be advisable to check the zero balance calibration just before the tests are made. However, in general testing this procedure is not necessary.

In actual practice it is usually best to adjust these controls in reverse order. In other words, check and adjust potentiometer 7 first, then adjust potentiometer 6.

#### NOTE 4. FUSE PROTECTION FOR GM BRIDGE

A 1/4 amp fuse is mounted in a fuse holder mounted next to potentiometer 6. See figure 4. This fuse should be checked first in case of difficulty on test cards 6 and 7. If defective, replace with type 3AG, 1/4 amp fuse. DO NOT USE "SLO-BLO" type fuse.

#### NOTE 5. REPLACING 1N1695 DIODES

If it becomes necessary to replace the 1N1695 diodes mounted on the printed wiring board the following points should be kept in mind:

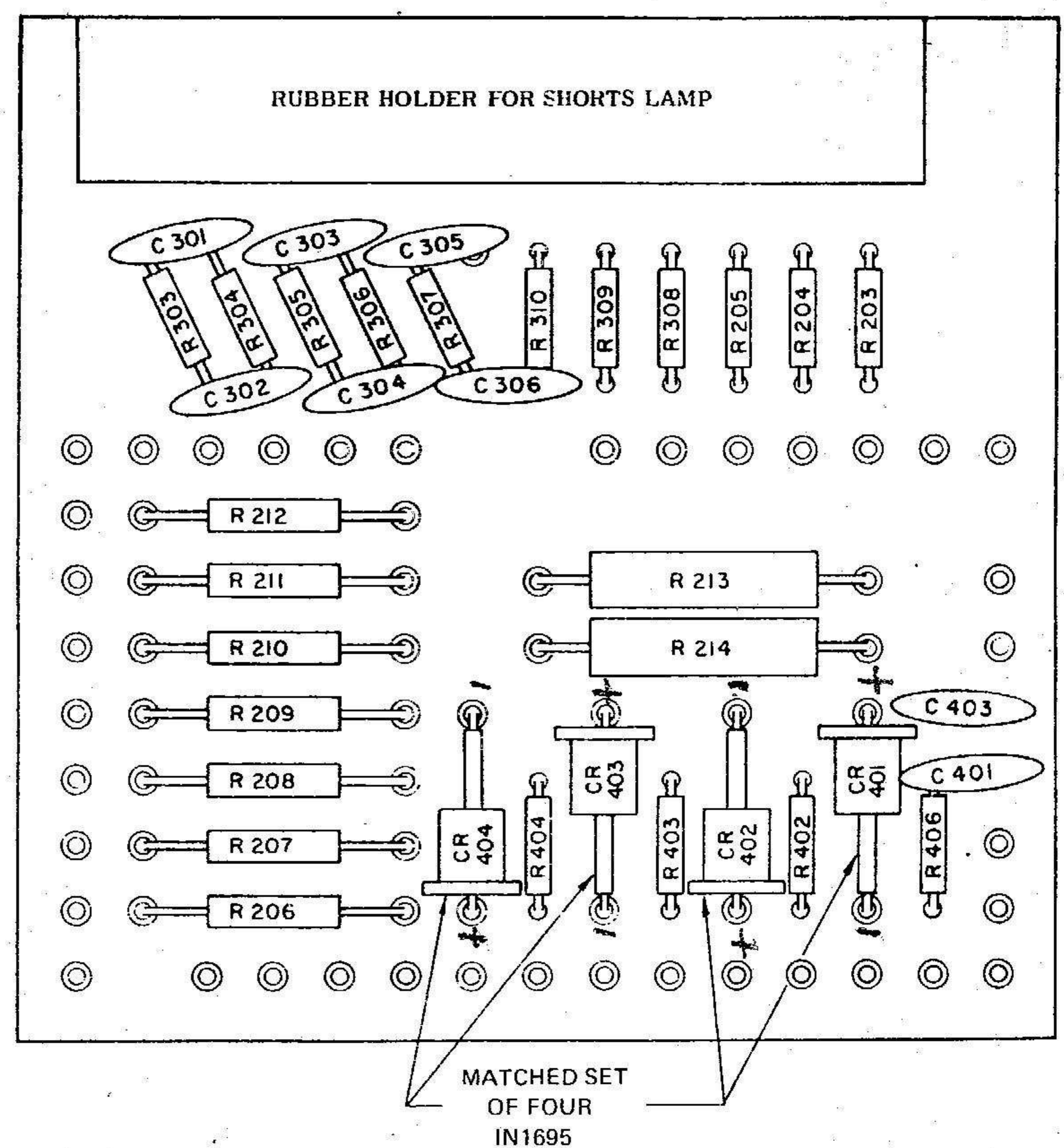


Figure 7. Printed Wiring Board



Tube	Test Card	1	2	3	4	5	6	7	8	9
OA2	2	0	- 145	NC	NC	NC	NC	- 145		
	3	0	- 145	NC	NC	NC	NC	- 145		
	4	0	- 145	NC	NC	NC	NC	- 145		
6X4	2	215 AC	NC	HTR	HTR	50	215AC	101		
	3	215 AC	NC	HTR	HTR	50	215AC	101		
	4	215 AC	NC	HTR	HTR	52 * 50	215AC	103 101*		
6AU8	2	0	-1.05	145	HTR	HTR	0	-4.2	*-4.4	180 185 69 76 *
	3	0	-1.05	145	HTR	HTR	0	-2.1	*-2.5	145 *150 35 43*
	4	0	-1.05 *-1.03	145	HTR	HTR	0	-5.5	*-6.0	210 *195 100 140*
6DQ6	2	-1.05	HTR	-34 *27	345 *340	-170 *-135	NC	HTR	52	
	3	-1.05	HTR	+35 *43	345 *335	+ 35 *+ 44	NC	HTR	102	
	4	-1.05 *-1.25	HTR	+102 *140	345 *275	+102 *+140	NC	HTR	150	
5U4	2	NC	FIL	59	250AC	0	250AC	365AC *360	FIL	
	3	NC	FIL	59	250AC	0	250AC	362AC *352	FIL	
	4	NC	FIL	59 *57	250AC *245	0	250AC *245	360AC *290	FIL	

\* Button 2 pressed

Figure 8. Nominal Socket Voltages During Tests 2, 3 and 4

- The four crystals supplied in the original equipment are matched units. Replacements should also be matched units. These are available under Hickok part No. 3870-90.
- When replacement is made the crystals must be physically mounted in the same manner as the ones that are removed. This arrangement is shown on the Printed Wiring Board component layout. Figure 7.
- Care should be taken not to overheat the crystal during the soldering operation. It is suggested that the lead wire be held with pliers between the crystal body and the point being soldered. **THIS IS VERY IMPORTANT.**

**NOTE 6. POWER SUPPLY-TUBE SOCKET VOLTAGE CHART**

The above chart (figure 8) indicates the nominal voltages present on the pins of the power supply tubes during checks with test cards 2, 3 and 4. These volt-

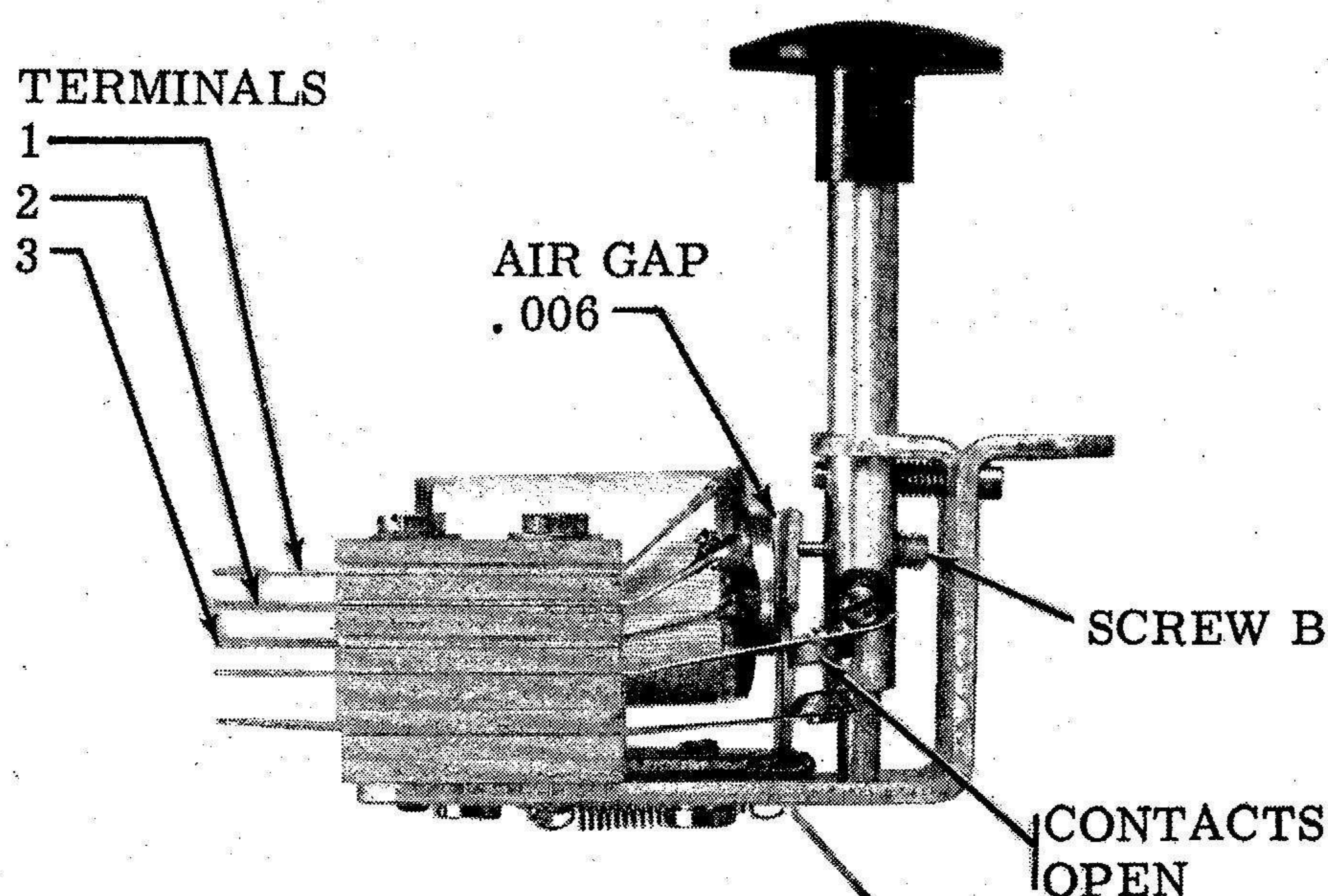


Figure 9. Relay in "Up" Position - Contacts Open

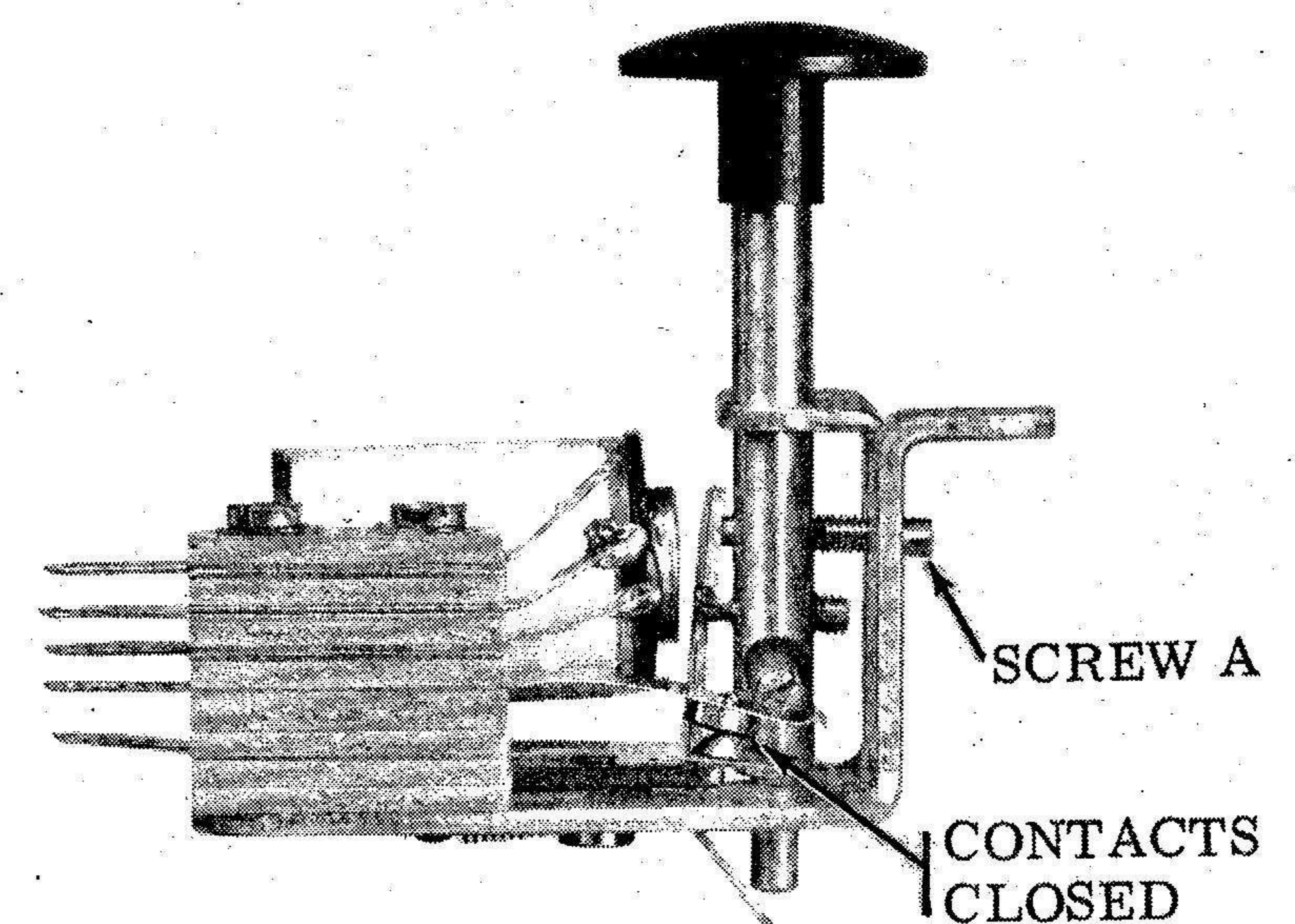


Figure 10. Relay Down - Contacts Closed

- If either winding is open a new relay may be obtained from the factory, Hickok Part No. 18400-6.

The mechanical and electrical adjustments described below are intended to be performed without



removing the relay from the instrument. The procedure is substantially the same to check a relay outside the equipment, if desired.

## 2. Mechanical Adjustment.

- With the relay up, check that the air gap is set to .006 inches by use of proper feeler gages. See figure 9. Air gap can be reset by adjusting lower screw "B". The glyptal sealing the adjusting screw should be softened with thinner before re-setting. The screw should be resealed with glyptal after adjustment.
- With the relay in the down (engaged) position, check that the end of the lower screw "B" is in line with the inside edge of the armature. Any required adjustment is accomplished with the upper screw "A". Soften glyptal with thinner before adjustment and reseal with glyptal after adjustment as before. See figure 10.

## 3. Electrical Adjustment.

- Connect a temporary short circuit between the two terminals as indicated in figure 11.

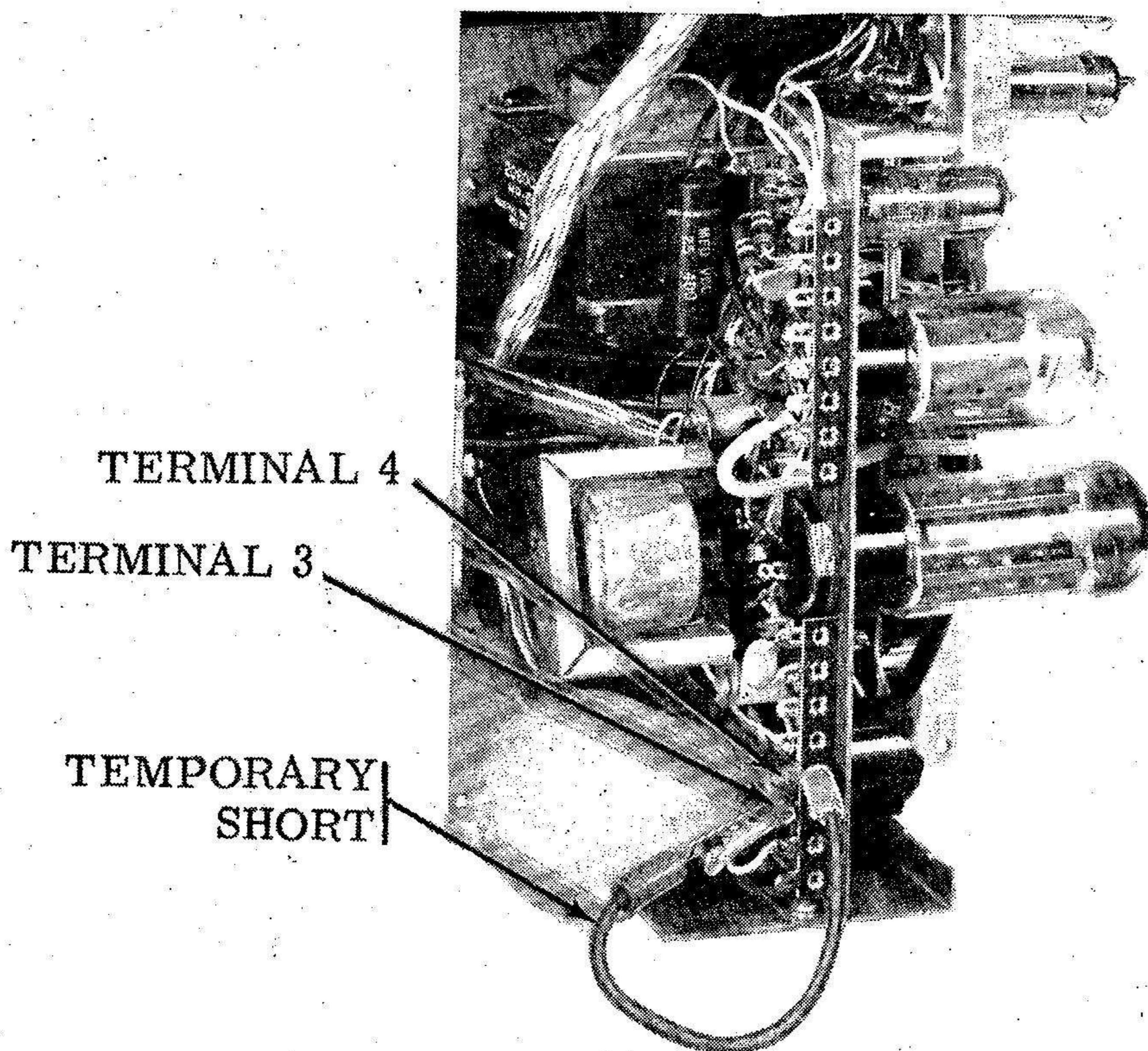


Figure 11. Section of Chassis of Model 123R

- Connect the line cord in series with a 0-5 amp AC ammeter to a variable source of low voltage AC. See figure 12. This source can be a variable transformer in the primary of a step down transformer. A filament transformer is suitable for this purpose.

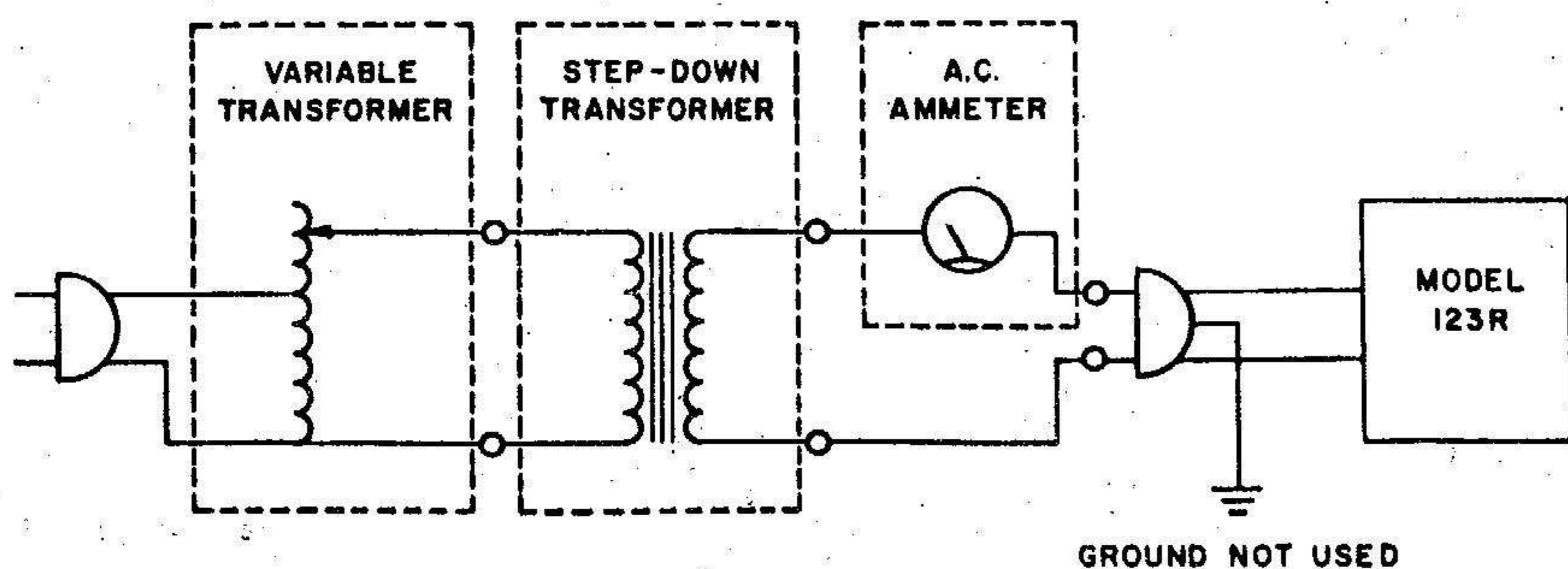


Figure 12. Schematic of Test Hook-up

- Slowly increase the current to the tube tester by raising the output voltage from the variable AC source. The overload relay should "kick out" between 3.0 and 3.2 amps AC.
- If the relay kicks out below 3.0 amps AC, increase the tension on the spring by turning lug "C", figure 13. Recheck and readjust spring tension until relay kicks out within proper limits.

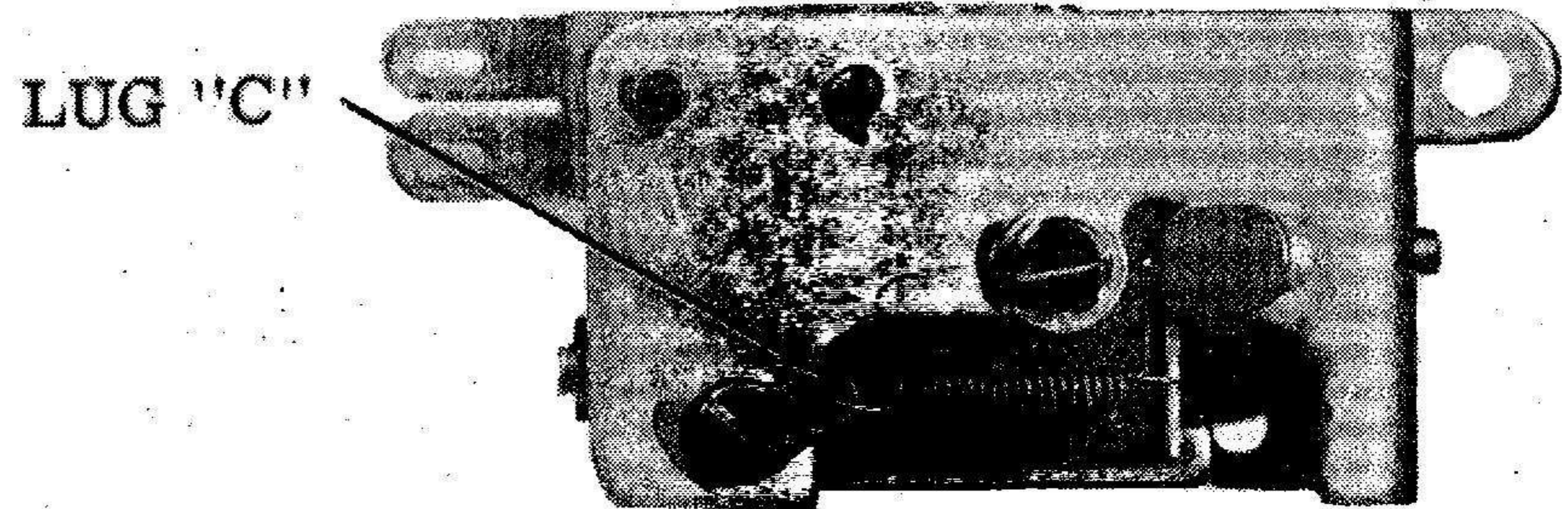


Figure 13. Overload Relay Adjustment

- If the relay kicks out above 3.2 amps AC, decrease tension on the spring by turning the lug until desired setting is reached.
- Be sure to lock spring adjustment with glyptal after resetting.

## NOTE 8. METER SHUNT TEST

Eight special meter shunt test cards are enclosed with this manual. These cards are intended to facilitate the location of possible defective meter shunt resistors. Each card checks one meter shunt resistor. The normal readings while pushing button 2 should be approximately mid-scale on the meter. If the shunt resistor is open or shorted, the meter will read toward zero or almost full scale and that resistor should be replaced. Latest model instruments have a 0-100 scale on the meter dial. A meter reading between 45 and 55 with any of these cards is satisfactory. The shunt resistor test cards are identified as A, B, C, D, E, F, G and H. Replacement shunt resistors may be obtained from the factory under the following code numbers which are listed in their proper relationship to their test card.

Test Card	* Ref. Desig.	Resistor Value	Replacement Resistor Code No.
A	R207	1280 ohms $\pm 1\%$	18537-72
B	R208	640 ohms $\pm 1\%$	18537-71
C	R209	320 ohms $\pm 1\%$	18537-70
D	R210	160 ohms $\pm 1\%$	18537-31
E	R211	80 ohms $\pm 1\%$	18537-69
F	R212	40 ohms $\pm 1\%$	18537-68
G	R213	20 ohms $\pm 1\%$	18673-207
H	R214	10 ohms $\pm 1\%$	18673-205

\* Located as shown in figure 5.

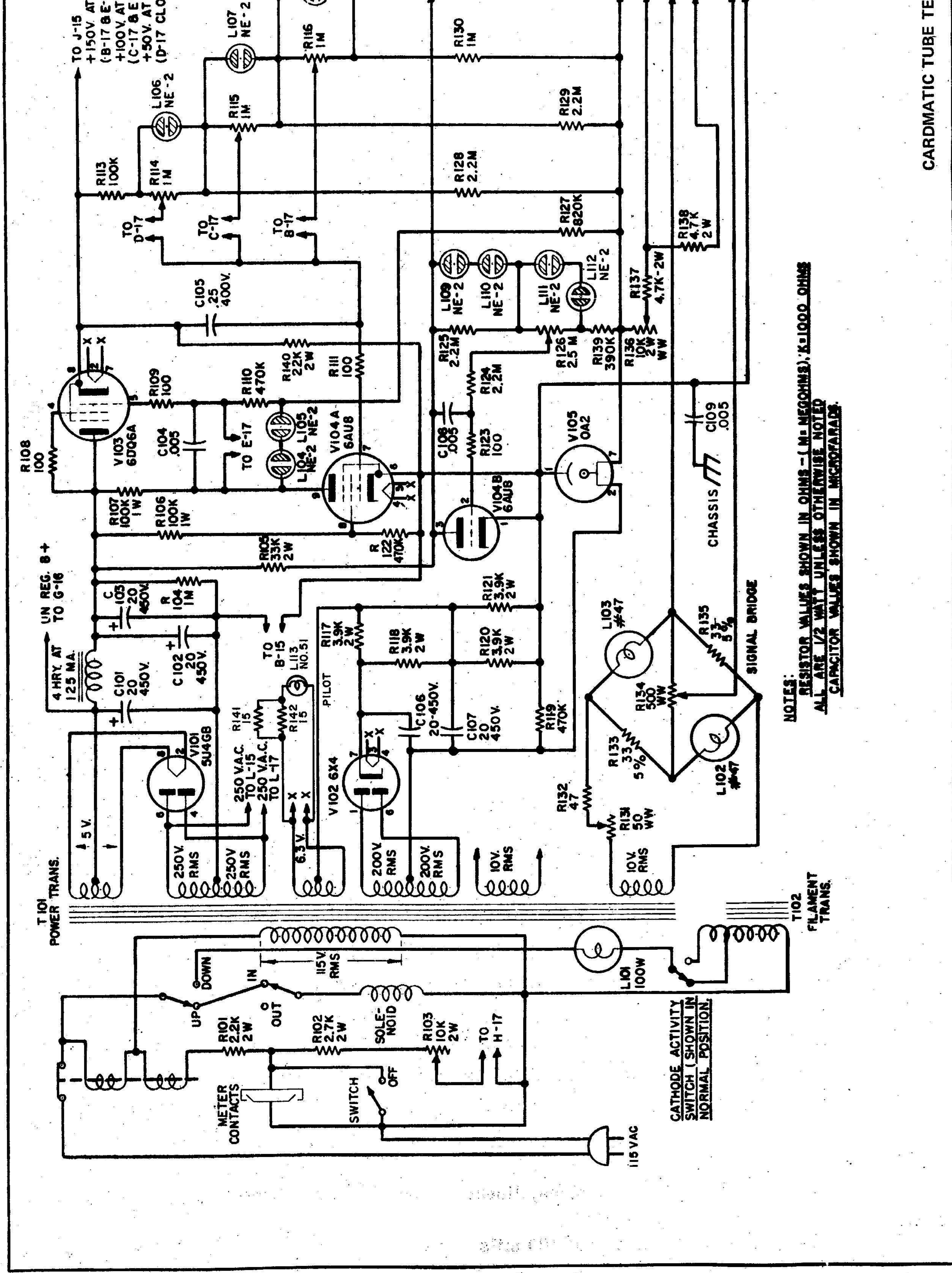


## REPLACEMENT PARTS LIST

Reference designations have been assigned to identify all parts used in the Model 123R. In ordering parts, refer to the current parts price list for this instrument. Prices are subject to change without notice, and the minimum billing charge is \$3.50.

REF. DESIG.	DESCRIPTION	HICKOK PART NO.
C101 thru C103	CAPACITOR: electrolytic, 20-20-20-20 $\mu$ F, 450V, 1-3/8" x 3", supplied with insulating sleeve	3085-77
C104	CAPACITOR: ceramic, .005 $\mu$ F, disc type, Centralab type DA-048-001A (-0 + 100%), Centralab Distributor Part No. DD501	3110-7
C105	CAPACITOR: plastic, tubular, 0.25 $\mu$ F, 400V, Astron Blue Point or General Instrument IMP	3105-218
C106, C107	CAPACITOR: electrolytic, 20-20 $\mu$ F, 450V, 1" x 3", supplied with insulating sleeve	3085-78
C108, C109	Same as C104	
C201	CAPACITOR: paper, 4 $\mu$ F, 600V, Astron, supplied in 2 lug can, or Cornell Dubilier CP41-B1FF405K1 type TNAD-6040	3105-226
C202	CAPACITOR: electrolytic, 1000 $\mu$ F, 40V, 1-3/8" x 3", supplied with insulating sleeve	3085-79
C301 thru C306, C401	Same as C104	
C402	CAPACITOR: electrolytic, 1000 $\mu$ F, 6V, 1" x 3", supplied with insulating sleeve	3085-80
C403	Same as C104	
CR401 thru CR404	CRYSTAL: (matched set of 4) 1N1695	3870-90
L102, L103	LAMP: GE #47, 6-8V, .15 amp, aged	12270-63
L113	LAMP: GE #51, pilot	12270-22
L301 thru L305	LAMP: matched set of 5 NE2 neon	12272-1
R103	POTENTIOMETER: 10,000 ohms, 2 watt, wire wound, Chicago Telephone type 252	16925-244
R114 thru R116	POTENTIOMETER: 1 megohm, $\pm 20\%$ , 1/2 watt carbon, linear taper, Centralab Model 2, snap-in type	16925-290
R131	POTENTIOMETER: 50 ohms, 2 watt, wire wound, Chicago Telephone type 252	16925-289
R134	POTENTIOMETER: 500 ohms, 2 watt, wire wound, Chicago Telephone type 252	16925-287
R136	Same as R103	
R207	RESISTOR: deposited carbon, 1280 ohms, $\pm 1\%$ , 1/2 watt	18537-72
R208	RESISTOR: deposited carbon, 640 ohms, $\pm 1\%$ , 1/2 watt	18537-71
R209	RESISTOR: deposited carbon, 320 ohms, $\pm 1\%$ , 1/2 watt	18537-70
R210	RESISTOR: deposited carbon, 160 ohms, $\pm 1\%$ , 1/2 watt	18537-31
R211	RESISTOR: deposited carbon, 80 ohms, $\pm 1\%$ , 1/2 watt	18537-69
R212	RESISTOR: deposited carbon, 40 ohms, $\pm 1\%$ , 1/2 watt	18537-68
R213	RESISTOR: deposited carbon, 20 ohms, $\pm 1\%$ , 1 watt	18673-207
R214	RESISTOR: deposited carbon, 10 ohms, $\pm 1\%$ , 1 watt	18673-205
R401	POTENTIOMETER: 2 ohms, 2 watt, wire wound, Chicago Telephone type 252	16925-288
R405	POTENTIOMETER: 1000 ohms, linear, taper, 1/2 watt, Centralab Model 2, snap-in type	16925-222
	CHOKE: power, 4 henrys at 100 mils	3250-72





CARDMATIC TUBE TESTER - MODEL 123R

NOTES:  
 RESISTOR VALUES SHOWN IN OHMS - (M = MEGOHMS), K = 1000 OHMS  
 ALL ARE 1/2 WATT UNLESS OTHERWISE NOTED  
 CAPACITOR VALUES SHOWN IN MICROFARADS

*dup 888-0-12-2+0-8805-5A*