

# OPERATING INSTRUCTIONS

APPROVED

FOR



## RADIO TEST EQUIPMENT



MODEL 530



THE HICKOK ELECTRICAL INSTRUMENT COMPANY  
CLEVELAND, OHIO U. S. A.

THE INSTRUMENT PACKED HEREWITH IS:

PACKER'S CHECK

1 MODEL 530 DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER	✓
1 MODEL 510X DYNAMIC MUTUAL CONDUCTANCE COMBINATION TUBE TESTER AND ANALYZER.	

ACCESSORIES INCLUDED WITH THE 530 TESTER ARE:

1 - TAG "IMPORTANT" INFORMATION	
1 - BOOKLET INSTRUCTIONS FOR 530	✓

SERIAL NO. 562254

SIGNED: P. J.

ACCESSORIES INCLUDED WITH THE 510X TESTER ARE:

1 - TAG "IMPORTANT" INFORMATION	
1 - BOOKLET INSTRUCTIONS FOR 510X	
1 - BOOK OF TUBE SETTINGS	
1 - PAIR FLEXIBLE LEADS WITH PINS AND PRODS	
1 - CONDENSER CABLE WITH PLUG, PIN TIP & ALLIGATOR CLIP	

SERIAL NO. \_\_\_\_\_

SIGNED: \_\_\_\_\_

IMPORTANT

READ INSTRUCTIONS THOROUGHLY BEFORE ATTEMPTING TO OPERATE TESTER

There are two rectifier tubes, an 83 and a \*5W4, necessary to operate this tester. They are not included and we want you to know what they are. The price of the tester is based upon not furnishing them. Also, to avoid breakage in shipment. See following pages for details.

NOTE: Pages 1 to 10 inclusive, together with Dwg. 289W1, 325W apply to 530 tester. Pages 1 to 16 inclusive together with Dwg. 289W1, 325W, 310W2 apply to 510X testers.

\* A type 5Y3gt can be substituted for the 5W4 tube.

CIRCUITS USED IN THIS TESTER ARE COVERED BY PATENTS  
ALL INFRINGEMENTS WILL BE PROSECUTED.

INSTRUCTIONS FOR OPERATION OF MODELS 530 - 510X  
STANDARD LABORATORY TYPE DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER.  
WITH VOLTS, OHMS, CAPACITY, MILLIAMPERES, DECIBELS & INDUCTANCE  
MEASUREMENT.

Read these instructions through before attempting to operate tester.

1. There are two rectifier tubes, an 83 and a \*5W4, necessary to operate this tester. They are not included and we want you to know what they are. The price of the tester is based upon not furnishing them. Also, to avoid breakage in shipment. See paragraph 3 below.
2. Use on 60 cycles 110-125 volt circuit. 25 or 50 cycles supplied on special order at extra cost.
3. To install the No. 83 and No. 5W4 tubes proceed as follows:
  - (a) Remove Control Panel from Cabinet.
  - (b) Insert a new 5W4 tube in the 8 pin socket on sub-panel inside the tester.
  - (c) Insert a new 83 tube in the 4 pin socket on sub-panel.
  - (d) Turn on power. If meter vibrates and fuse lamp lights up brilliantly a defective No. 83 tube is indicated. This is caused by an excess of mercury within the glass bulb. Select an 83 tube that will not flash.
  - (e) Replace screws in panel and instrument is ready for use.
4. FUNCTIONS OF THE VARIOUS CONTROLS:
  - (a) The selectors "A" and "B" control the socket contacts. Plate, Grid, Cathode, etc., are led to any combination of socket contacts as required. These switches are fully wired but only slightly more than one-third of the available combinations are used with tubes announced. The master switch (see page 10) must be set on TUBE TEST when instrument is used as a tube tester.
  - (b) The Center switch in the top row controls the filament voltage. The 530 and 510X testers are now equipped to test tubes with filament voltages up to 117 volts.
  - (c) The potentiometer "L" controls the sensitivity of the meter. When set at 60 (Gm) the scale is read in micromhos from 0-3000. When set at 70 the micromho scale reads 0-6000. When set at 76 the micromho scale reads 0-15,000. The other settings for the left potentiometer as given in the chart after each type of tube are used when it is required that a good tube read in the green sector of the scale. This Red-Green scale is the so-called English Reading Scale. This scale is used when testing tubes for customers who know nothing about micromhos. As an example, a number 24 tube, when the left potentiometer is set at 60, should read 1000 micromhos, but when the left potentiometer is moved to 42, as given in the chart under "L" settings, the meter should read in the green sector. In either case, the reading is dynamic mutual conductance. These "L" settings for the various types of tubes are chosen so that a power tube will be rejected when it is down 25%, and an amplifier tube when it is down 20% below standard, (Manufacturers' Specifications). This dual scale feature is found only in HICKOK instruments.
  - (d) The potentiometer "R" controls the "C" bias on the tube. Different tubes are operated at different values of "C" bias. A change in "C" bias causes a change in mutual conductance. The "R" setting as given in the chart are correct for each type of tube and are the same whether using the micromho or English Reading scales.

\* A type 5Y3GT can be substituted for the 5W4 tube.

(e) The Short Test-Tube Test Switch enables checks for shorts to be made before making the regular tube test. Turn the switch through the positions 1-2-3-4-5 while watching the neon short lamp. If the lamp burns continuously in anyone of these positions the tube contains a "SHORT". An instantaneous flash as the switch is moved from one position to another is to be disregarded. That is caused by the charging of a condenser in the circuit. Intermittent shorts can be detected by tapping the tube with the finger. If tube is found to be free from shorts turn switch to Tube Test position for regular tube test. See "NOISE TEST".

(f) The Short Lamp is a 1/4 watt, 110 volt, candelabra base neon signal lamp made by The General Electric Company. This lamp will last indefinitely unless broken.

(g) The Fuse Lamp is a standard No. 81, single contact auto bulb. This can be procured from any auto dealer or gasoline station attendant. This fuse lamp is in the primary circuit of the transformer.

(h) Line Adjustment. This control is a rheostat in primary circuit of the transformer. Set Master Switch at bottom of panel on TUBE TEST. Press Line Test button and adjust knob until pointer of meter is exactly over the mark "LINE TEST" on the dial. Make this adjustment while the tube being tested is in the socket.

(i) The ON-OFF switch is for turning power on or off.

(j) There are two push buttons marked "RECTIFIER TEST". The one marked "ST'D" (standard) is for all standard filament or heater type rectifier tubes. The button marked OZ4 is used when testing the gaseous rectifiers OZ3 and OZ4 made by Raytheon. Rectifier tubes should read in the green sector if satisfactory. Separate tests are made for each plate.

(k) In the center of the panel are two push buttons marked "GAS TEST" and "AMPL. TEST". The button "AMPL. TEST" is used when testing all tubes having mutual conductance that is, all amplifier tubes. This includes all kinds of amplifier tubes and power tubes, but is not to be used when testing Rectifier or Diode tubes. On the chart under "NOTATIONS" will be noted the injunction "Press Rect. Button" or "Press Diode Button" after certain tubes. Where no specific instruction is given, the AMPL. Button is to be used. Some tubes contain both an amplifying and a rectifying element or amplifying and diode elements. These tubes, such as the 6B6 and 12A7 are listed for each element that is being tested.

(l) GAS TEST: A tube can be checked for gas content as follows:

Set the "L" Potentiometer on 60 (Gm) and hold down button marked "GAS NO. 1". Adjust "R" Potentiometer until meter reads 100 micromhos. Hold down "GAS NO.1" and press "GAS NO. 2". If the meter hand moves more than ONE of the small divisions the tube contains too much gas.

Some tubes such as the 45 and 71A cannot be brought down to 100 micromhos by turning the "R" knob. In that case, turn "R" to 82 and test for gas.

Some tubes develop gas after being heated for a period of time. If a tube is suspected, allow it to heat for a few minutes.

(m) The Line Test Button has been described under Par. 4 (h).

(n) Diode Test. The Diode Test Button is to be pressed when testing a diode element of a tube. This places a low voltage on the element as recommended by tube manufacturers. DO NOT Press AMPL. OR RECT. buttons when testing a diode element as the high voltage applied will paralyze the diode element.

5. As an example, suppose we are testing the 6B6 tube which contains an amplifying element and two diode elements.

(a) First, of course, we check for shorts.

(b) Assuming tube contains no shorts, we check next the amplifying element. Consulting the chart we find the following settings for the amplifying section: A, 7---B, 5---Fil., 6.3---L, 32---R, 10. As this is the amplifier section we press AMPL. BUTTON. The pointer rises in the green sector say slightly above the G in Good. We now wish to know the actual micromhos of this tube. We turn the "L" knob to 60 (GM) and note that the meter reads 800 micromhos. As this agrees with the value given in the chart we know that the tube is normal as to the amplifier section. We next check No. 1 diode, from the chart we note that the settings are A, 10---B, 5---Fil. 6.3---L, 0---R, 0. We note that chart states Press Diode Button. If the pointer of the meter rises above the mark designated "Diodes OK" the No. 1 diode element is OK. No. 2 element is tested in the same manner, merely change "B" from 5 to 2.

#### DYNAMIC MUTUAL CONDUCTANCE

- WHAT IT IS -

WHY IT IS THE ONLY EXACT TEST.

6. Conductance is the opposite of resistance. The greater the conductance of a tube, the easier it is for electrons to flow thru it. Mutual means "pertaining to both of two things." The two things considered when measuring "mutual conductance" are the grid and the plate of the tube. The plate will pass current but its value will depend on the grid voltage as well as plate voltage. Therefore, the conductance of the tube depends on both the plate and the grid voltages. It is MUTUAL CONDUCTANCE. Dynamic pertains to motion. In measuring "Dynamic Mutual Conductance" the tube must be working. To simply take an emission reading is meaningless, because the tube is not working. Likewise, to take a reading, then shift the grid and take another reading is simply finding the difference between two static readings. That is not "Dynamic Mutual Conductance". In the 510X and 530 tube testers there is applied to the grid, in addition to its regular direct current "C" bias, an alternating signal voltage which modulates the plate current. The meter measures the amount of modulation or dynamic mutual conductance.

Due to the success of the "HICKOK" line of Dynamic Mutual Conductance Tube Testers, some of our competitors are attempting to mislead the public by calling their product "Dynamic Mutual Conductance" testers. Do not be fooled - unless the tester reads in actual micromho it is not a dynamic mutual conductance tester.

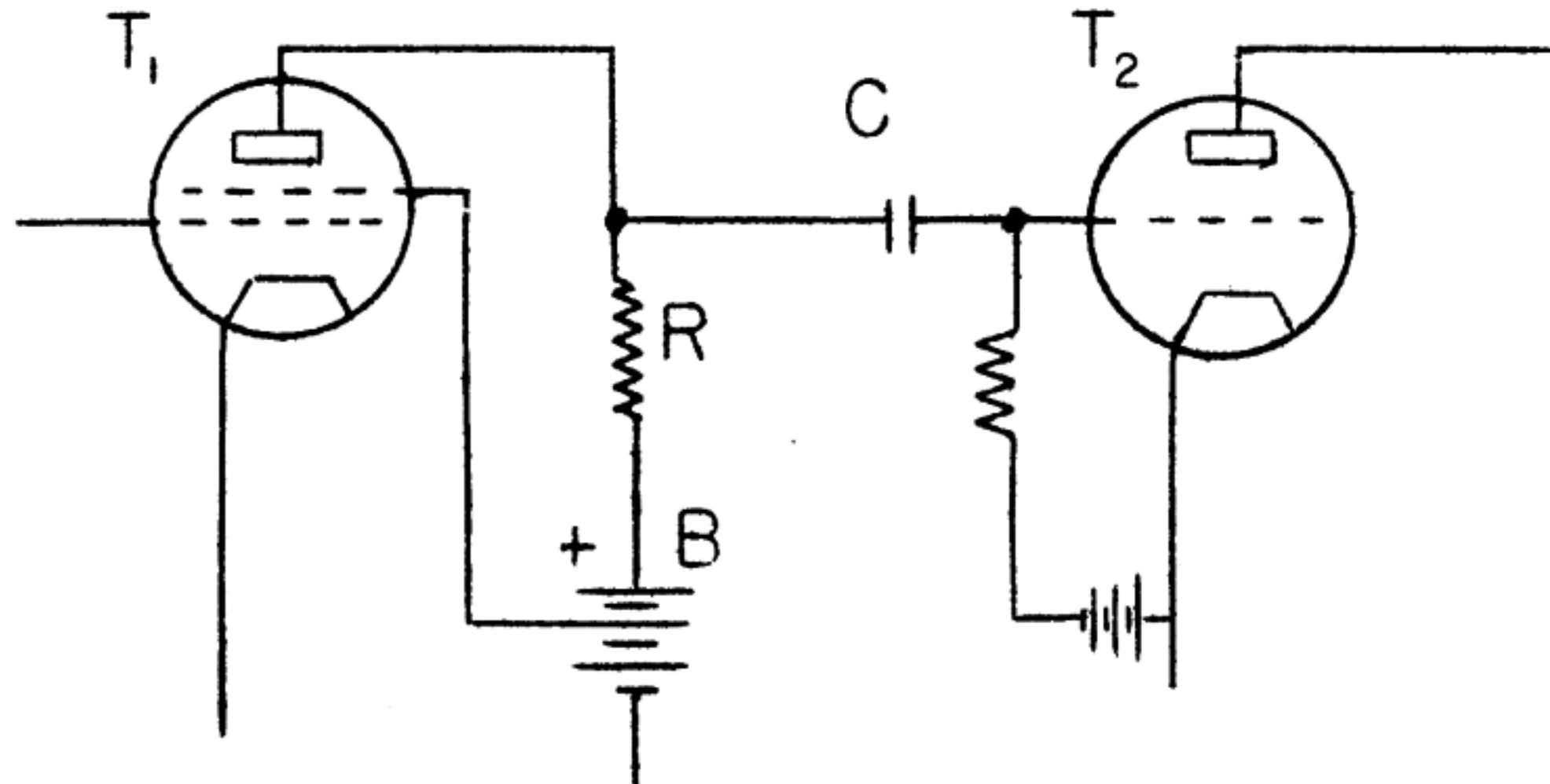
The three principal characteristics of a vacuum tube are amplification factor, plate resistance and mutual conductance. To measure the amplification factor or plate resistance alone will not give a measure of the value of the tubes as an amplifier, but mutual conductance is tied in such a way with amplification factor and plate resistance that mutual conductance is the quotient of amplification factor divided by plate resistance. In the form of an equation it will look like this:

$$G_m = \frac{\mu}{r_p}$$

WHERE: G<sub>m</sub> is mutual conductance  
 μ is amplification factor  
 r<sub>p</sub> is plate resistance.

is thus seen that when we measure mutual conductance we automatically measure both the other two characteristics. So mutual conductance is a 3 in 1 measurement. That is why it is considered of first importance by tube engineers and manufacturers.

The following simple illustrations will make clear the value of the mutual-conductance test, and the fallacy of the emission test.



The above figure represents a conventional stage of resistance coupling. The gain for this stage is the product of the resistance,  $R$ , multiplied by the Mutual Conductance in mhos of the tube  $T_1$ . Suppose  $R$  is 100,000 ohms and the mutual conductance of  $T_1$  is 750 micromhos, then:

$100,000 \times .00075 = 75$ , which is the gain. If the mutual conductance were 700 micromhos, the gain would be 70, etc. There is no correlation between emission and gain.

Likewise, in an r.f. transformer coupled stage the voltage amplification or voltage gain is expressed:

$$\text{Gain} = \frac{r_p \times R_p}{r_p + R_p} \quad \text{Multiplied by the mutual conductance of } T_1$$

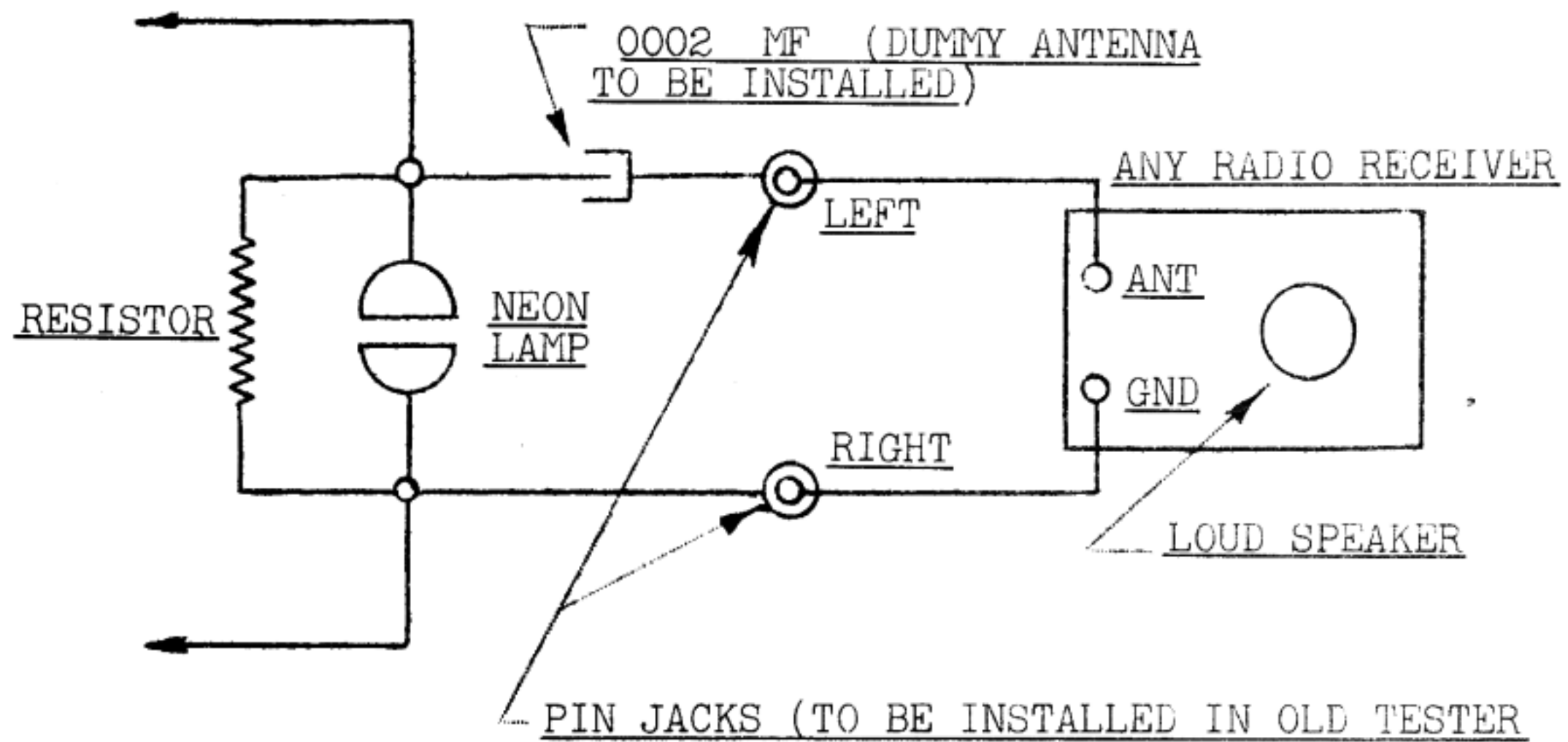
WHERE:  $r_p$  is the plate resistance of  $T_1$  and  $R_p$  is the load resistance.

### NOISE TEST

That you may demonstrate in a very convincing way the effects of a noisy tube in a radio receiver, we have incorporated in the circuit of the 510X and 530 a simple but effective noise test.

The following diagram which explains its operation also shows you how this test may, in a few minutes time, be installed in any of our previous models of tube testers which have the neon short test.

In the 510X and 530 testers, the pin jack to the LEFT is to be connected to ANT. post of radio receiver.



#### HOW THE NOISE TEST OPERATES.

As the Short Test switch on the tube tester is rotated through the points 1-2-3-4-5, tap the tube under test with the fingers. Any loose or jangling elements will cause loud crashes of static in the loud speaker. Sixty cycle hum cannot get through the R.F. stages of the radio receiver.

LOCATING SHORTED ELEMENTS: In the following table, X under any selector switch position indicates that Neon Lamp burns in that position.

SELECTOR SWITCH POSITION

KIND OF SHORT	1	2	3	4	5
FIL. - CATHODE				X	X
FIL. - GRID			X	X	X
FIL. - PLATE	X	X	X		
FIL. - SCREEN		X	X	X	X
CATHODE - GRID			X		
GRID - PLATE	X	X		X	X
GRID - SCREEN		X			
PLATE - SCREEN	X			X	X
CAP. - FIL.	X	X	X	X	
CAP. - GRID	X	X			X
CAP. - CATHODE	X	X	X		X
CAP. - SCREEN	X				X
CAP. - PLATE				X	
SHELL - FIL.	X				
SHELL - PLATE		X	X		
SHELL - GRID	X		X	X	X
SHELL - SCREEN	X	X	X	X	X
SHELL - CATHODE	X			X	X
SHELL - CAP.		X	X	X	

## BALLAST TUBES

INSTRUCTIONS FOR TESTING "BALLAST TUBES" ON THE 530 AND 510X TESTERS.

In the following chart of settings, an "X" under any "Short Switch" position indicates that neon lamp will light in that position with Selectors A and B set as shown following the tube type number.

Certain ballast tubes having complicated internal connections, such as the K36H, have three selector settings for complete test.

Noisy ballast tubes are detected by using the Noise Test, same as for other tubes. Tap tube with fingers while making test.

NOTE: ALWAYS SET FILAMENT SWITCH ON "BLST" POSITION. SHORT TEST SWITCH IS NOT TURNED TO TUBE TEST POSITION.

## BALLAST TUBES

TUBE TYPE	SELECTOR		SHORT SWITCH POSITION				
	A	B	1	2	3	4	5
1A1-1B1-1C1-1E1-1F1-1G1-1J1- 1K1-1L1-1N1-1P1-1Q1-1R1G-1S1G- 1T1G-1U1G-1V1-1Y1-1Z1-2	1	1	X	X	X	X	
2UR224 - - - - -	3	1	X	X	X	X	X
2LR212 - - - - -	(2 3	12 2	X X	X X	X X	X X	X X
3 - - - - -	1	1	X	X	X	X	
03G - - - - -	1	1				X	X
4-5 - - - - -	1	1	X	X	X	X	
6-133 - - - - -	1	1				X	X
6-6AA - - - - -	1	1	X	X	X	X	
7-8-9 - - - - -	1	1	X	X	X	X	
10A-10AG - - - - -	1	1				X	X
10AB - - - - -	1	1	X	X	X	X	
K17B - M17C - BM17C - - - - -	3	1	X	X	X	X	X
M17HG - M17H - - - - -	(4 5 7	4 1 12	X X X	X X X	X X X		X X X
K23B-K23C-KX23B-KX30C - - - - -	3	1	X	X	X	X	X
M30H - - - - -	(4 5 7	4 1 12	X X X	X X X	X X X		X X X
30A - K30A - - - - -	1	1				X	X
K30D - - - - -	(3 3	1 12	X X	X X	X X	X X	X X
33A-33AG - - - - -	1	1				X	X
K34B - - - - -	3	1	X	X	X	X	X
36A - - - - -	1	1				X	X



## BALLAST TUBES (CONT.)

TUBE TYPE	SELECTOR		SHORT SWITCH POSITION				
	A	B	1	2	3	4	5
K36B-BK36B-L36B-M36C-BM-36C-L36C-KX36C - - - - -	3	1	X	X	X	X	X
KX36A - - - - -	1	1	X	X	X	X	
36D-L36D - - - - -	(3 3)	1 12	X X	X X	X X	X X	X X
L36DJ - - - - -	(4 7 8)	2 5 12	X X X	X X X	X X X	X X X	X X X
K36H-M36H-M36HG - - - - -	(4 5 7)	4 1 12	X X X	X X X	X X X	X X X	X X X
L40S1 - L40S2 - - - - -	(2 3 4)	1 12 4	X X X	X X X	X X X	X X X	X X X
L36DJ - - - - -	(4 7 8)	2 5 12	X X X	X X X	X X X	X X X	X X X
K36H-M36H-M36HG - - - - -	(4 5 7)	4 1 12	X X X	X X X	X X X	X X X	X X X
L40S1 - L40S2 - - - - -	(2 3 4)	1 12 4	X X X	X X X	X X X	X X X	X X X
42A - - - - -	1	1				X	X
42A1 - - - - -	1	1				X	
42A2 - 42B2 - - - - -	7	1	X	X	X	X	X
K42B-L42B-M42B-KX42B-LX42B } L42BX-K42C-L42C-M42C }	3	1	X	X	X	X	X
BK42D-K42D-L42D - - - - -	(3 3)	1 12	X X	X X	X X	X X	X X
LX42D - L42DX - - - - -	(1 1)	2 7	X X	X X	X X	X X	X X
K42E - L42E - - - - -	3	1	X	X	X	X	X
L42F - - - - -	1	2	X	X	X		X
42HA-K42HJ-M42H-M42HG - - - - -	(4 5 7)	4 1 12	X X X	X X X	X X X	X X X	X X X
KX42C - - - - -	3	1	X	X	X	X	X
L42S1 - - - - -	(2 3 4)	1 12 4	X X X	X X X	X X X	X X X	X X X
49A - 49AJ - K49AJ - - - - -	1	1				X	X
KX49A - - - - -	3	1	X	X	X	X	X
49A1 - - - - -	1	1				X	
49A2 - 49B2 - - - - -	7	1	X	X	X	X	X
K49B - L49B - M49B - BM49B - } K49C - L49C - M49C - BM49C - } BK49C - K49E - L49E - }	3	1	X	X	X	X	X

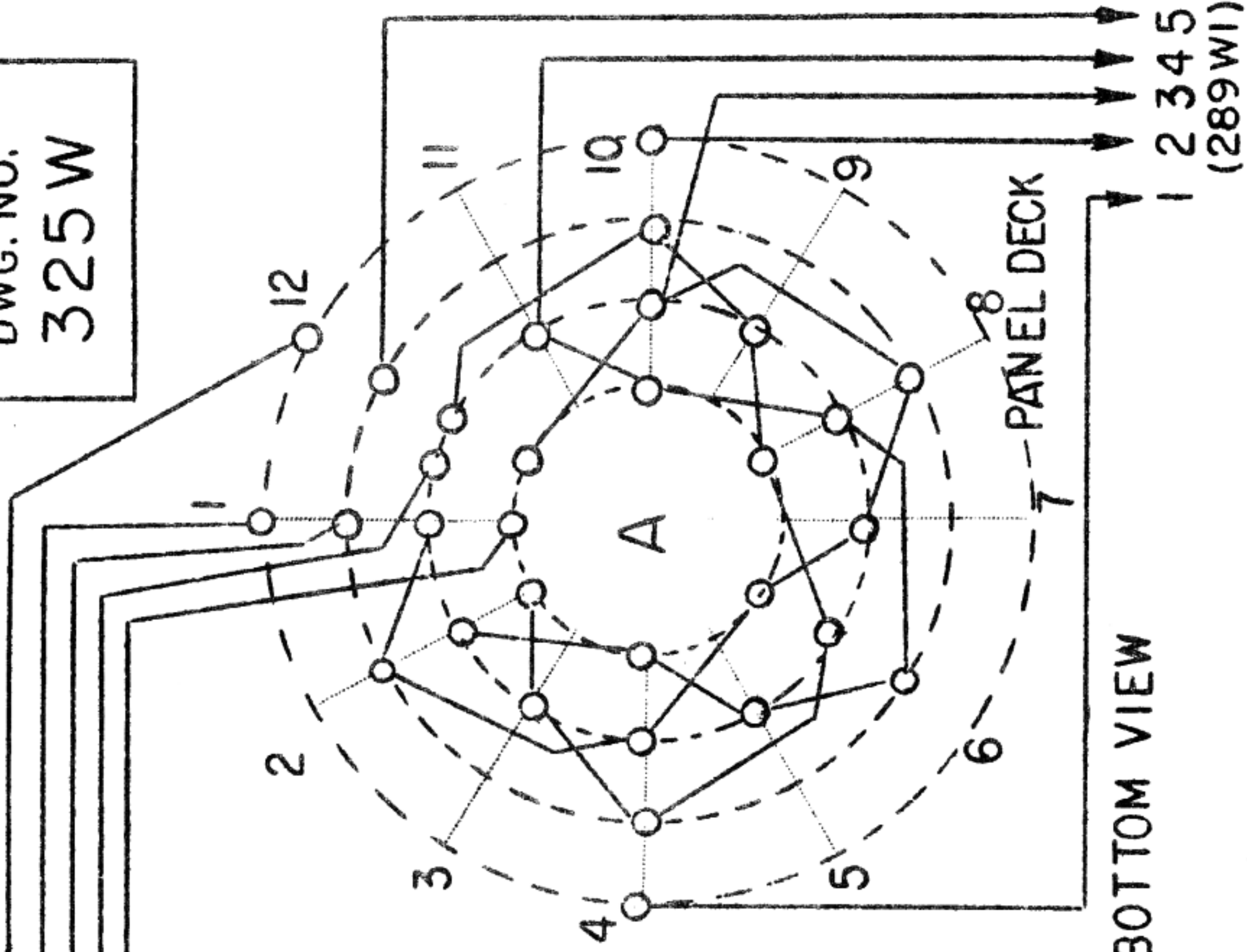
## BALLAST TUBES (CONT.)

TUBE TYPE	SELECTOR		SHORT SWITCH POSITION				
	A	B	1	2	3	4	5
K49D - BK49D - L49D - - - - -	{3 3	1 12	X X	X X	X X	X X	X X
L49F - - - - -	1	2	X	X	X		X
M49H - M49HG - - - - -	{4 5 7	4 1 12	X X X	X X X	X X X		X X X
KZ49B - KZ49C - - - - -	1	1	XX	X	X	X	X
K49BJ - L49BJ - - - - -	{7 8	1 12	X X	X X	X X	X X	X X
L49S2 - - - - -	{2 3 4	1 12 4	X X X	X X X	X X X	X X X	X X X
49AJ - K49AJ - - - - -	1	1	X	X	X	X	X
KX49B - LX 49B - LX49C - - - - -	3	1	X	X	X	X	X
L49DJ - - - - -	{4 7 8	2 5 12	X X X	X X X	X X X	X X X	X X X
L49S3 - - - - -	{2 3 4	1 12 4	X X X	X X X	X X X	X X X	X X X
50A2 - - - - -	3	1	X	X	X	X	X
50A2MG - 50B2 - - - - -	1	1	X	X	X	X	X
50X3 - - - - -	1	1	X	X	X	X	
K52H - M52H - - - - -	{4 5 7	4 1 12	X X X	X X X	X X X		X X X
K54B - - - - -	3	1	X	X	X	X	X
55A - K55A - - - - -	1	1				X	X
55A1 - - - - -	1	1				X	
KX55A - - - - -	1	1	X	X	X	X	
55B-K55B-M55B-BM55B-L55BG-LX55B-	3	1	X	X	X	X	X
55A2 - 55B2 - - - - -	7	1	X	X	X	X	X
K55C - L55C - KX55C - - - - -	3	1	X	X	X	X	X
K55CP - - - - -	{4 1 1	12 11 9	X X X	X X X	X X X	X X X	X X X
K55D - L55D - - - - -	{3 1	1 12	X X	X X	X X	X X	X X
L55E - M55E - - - - -	3	1	X	X	X	X	X
L55F - M55F - BL55F - - - - -	1	2	X	X	X		X
K55H - M55H - M55HG - - - - -	{4 5 7	4 1 12	X X X	X X X	X X X		X X X
L55S1 - L55S2 - - - - -	{2 3 4	1 12 4	X X X	X X X	X X X	X X X	X X X
60R30G - - - - -	3	1	X	X	X	X	X
64.23 - - - - -	1	1				X	
67A - - - - -	1	1				X	

## BALLAST TUBES (CONT.)

TUBE TYPE	SELECTOR		SHORT SWITCH POSITION				
	A	B	1	2	3	4	5
K67B - L67B - - - - -	3	1	X	X	X	X	X
L73B-K74B-L74B-CX74C - - - - -	3	1	X	X	X	X	X
80A - - - - -	1	1				X	X
K79B - K80B - M80B - K80C - } KX80B - L80B -	3	1	X	X	X	X	X
K80F, - - - - -	1	2	X	X	X		X
KX87B - LX87B - L90B - - - - -	3	1	X	X	X	X	X
K90F - M90F - K92F - M92F - - -	1	2	X	X	X		X
92A - - - - -	1	1				X	X
L92B - 95K2 - - - - -	3	1	X	X	X	X	X
L99D - - - - -	{3 3	1 12	X X	X X	X X	X X	X X
100R8 - - - - -	33	1	X	X	X	X	X
120R - - - - -	1	1	X	X	X	X	
140L44 - 140R44 - - - - -	{1 1	2 7	X X	X X	X X	X X	X X
165L4 - 165L8 - 165R4 - 165R8 -	3	1	X	X	X	X	X
165 R - - - - -	1	1	X	X	X	X	
165L44 - 165R44 - - - - -	{1 1	2 7	X X	X X	X X	X X	X X
185L4 - 185L8 - 185R4 - 185R8	3	1	X	X	X	X	X
185R - - - - -	1	1	X	X	X	X	
185L44 - 185R44 - - - - -	{1 1	2 7	X X	X X	X X	X X	X X
200R - 250R - - - - -	1	1	X	X	X	X	
250R8 - 290L4 - - - - -	3	1	X	X	X	X	X
300R4 - 320R4 - - - - -	3	1	X	X	X	X	X
340 - - - - -	1	1	X	X	X	X	
808 - 1 - - - - -	{7 8	1 12	X X	X X	X X	X X	X X
E14980 - W43357 - W45788 - 3613	3	1	X	X	X	X	X
3334-3334A - - - - -	{3 3	1 12	X X	X X	X X	X X	X X
8593 - 8598 - 8601 - 8664 - -	3	1	X	X	X	X	X
3ER248 - - - - -	{4 7 8	2 5 12	X X X	X X X	X X X	X X X	X X X
3CR241 - - - - -	{3 3	1 12	X X	X X	X X	X X	X X

DWG. NO.  
325 W



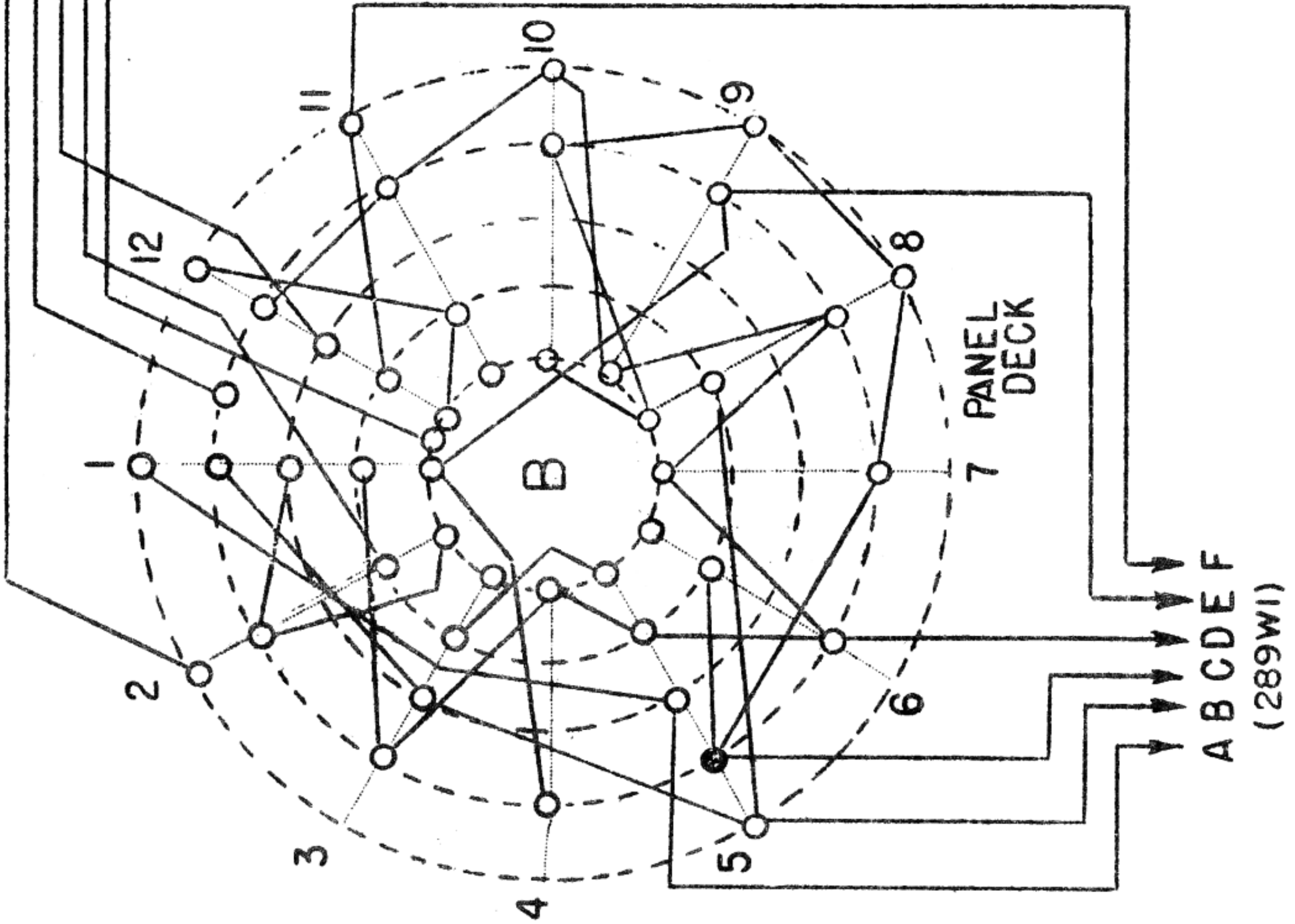
BOTTOM VIEW

# PERMUTATOR SWITCH

MODEL 530-510X

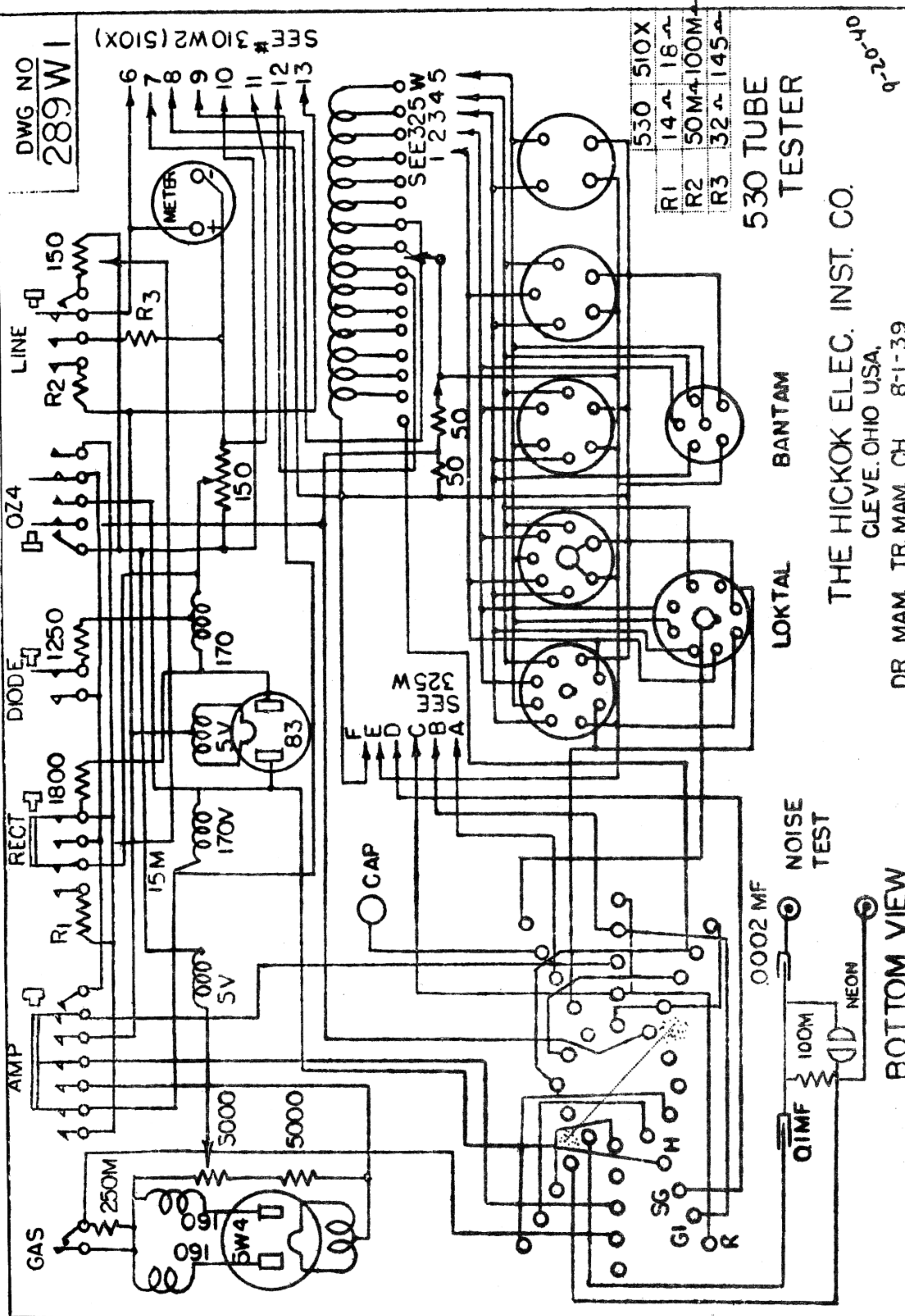
THE HICKOK ELECT. INST. CO.

CLEVE. OHIO U.S.A.



DWG NO  
289W1

SEE # 310W2 (SIOX)



R1	530	510X
R2	14~	18~
R3	50M~	100M~
	32~	145~

530 TUBE  
TESTER

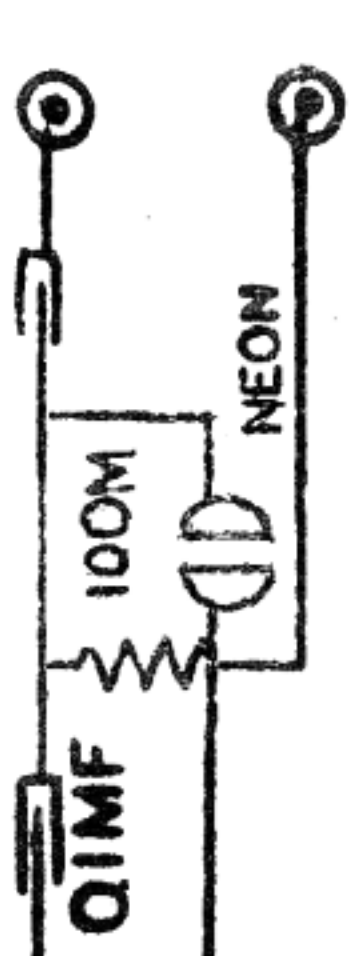
LOKAL BANTAM

THE HICKOK ELEC. INST. CO.

CLEVE. OHIO USA,

DR MAM TR. MAM CH. 8-1-39

NOISE  
TEST



BOTTOM VIEW

9-20-40

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