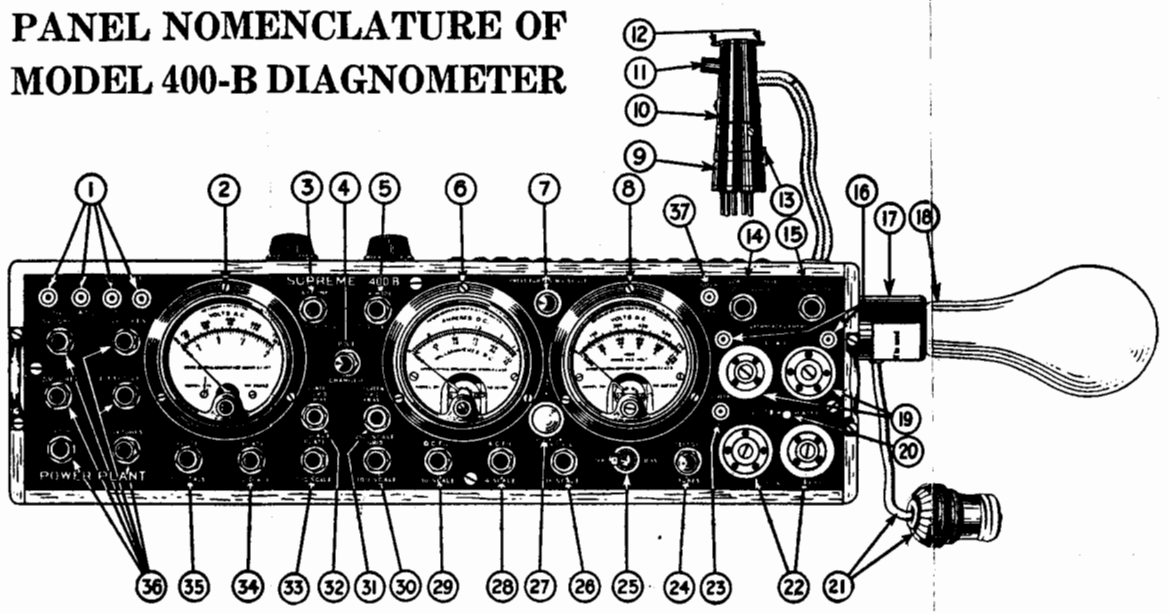
# PANEL NOMENCLATURE OF MODEL 400-B DIAGNOMETER




*(The numbers shown in front of each paragraph refer to the corresponding numbers of the above drawing)*

1 Oscillator Coil Pin Jacks marked B. P. G. F.

2 A.C. Voltmeter, 4 scales, 750-150-16-4-0.

3 A. C. Line Jack, for connecting 150-volt scale of A. C. Voltmeter (2) across A. C. Supply Line (21).

4 Pole Changer Push Button Switch for reversing connections to the D. C. Voltmeter (8) when the needle backs off scale during D. C. filament (29) or cathode (5) analysis.

5 Cathode Bias Jack, for indicating cathode biases on the 100-volt scale of the D. C. Voltmeter (8) when analyzing from UY sockets with the "UX-Heater" switch (20) in the "Heater" position.

6 D. C. Milliammeter, the 125-Mil. scale of which is in the common plate circuit of the 4 sockets (19) and (22). The 2½-Ampere scale is available externally only.

7 Milliammeter switch for opening a shunt for the 25-milampere scale range (6).



8 D. C. Voltmeter, 4 scales, 750/250/100/10/0.

9 Analyzer Adapter for UY Sockets.

10 Universal Analyzer Plug. This plug should be removed from any radio tube socket before connecting the Diagnometer to the A. C. Supply Line (21).

11 Control Grid contact lug on the Analyzer Plug (10).

12 Top Heater Tube Filament contacts on the Analyzer Plug (10).

13 Adapter Release on the Analyzer Plug (10).

14 This Jack is used for rejuvenating 5-volt Tubes of the Thoriated Filament type on Diagnometers which have serial numbers composed of figures only or ending with "N" or "N1." On Diagnometers of later series, this jack is used for space charge voltage readings on the D.C. Voltmeter (8) of pentode tubes.

15 This Jack is used for rejuvenating 3-volt tubes of the Thoriated Filament type on Diagnometers which have serial numbers composed of figures only or ending with "N" or "N1". On Diagnometers of later series, this Jack is used only for applying potentials to a type '80 rectifier for the high resistence continuity tests outlined on Pages 115b—115d.



16 Overhead (top) Heater tube Filament Pin Jacks.

17 Polarized series socket Adapter for 100-watt Mazda Protective Lamp.

18 100-Watt Mazda Lamp.

19 Load Sockets used when analyzing from radio tube sockets.

20 "UX-Heater" switch. To be left in "Heater" position when analyzing from radio sockets which utilize tubes having independent cathodes. For all other tube socket analysis, leave the switch in the "UX" position.

**(Continued on reverse side).**

21 A. C. power supply cord and plug. To be detached when analyzer plug (10) is to be inserted in any radio tube socket.

22 "Tube Testing Sockets" used when the Diagnometer employs any tube while connected to an A. C. power supply system.

23 Screen grid jack for connecting to the control grid contact on top of any screen grid tube placed in any Diagnometer tube socket.

24 Switch to be depressed when testing screen grid tubes and the second plate of full wave rectifying tubes placed in either Tube Testing Socket (22).

25 Switch for applying either of two grid potentials to the grid of any tube placed in a Tube Testing Socket (22).

26 A. C. Filament jack for connecting 16-volt scale of A. C. Voltmeter (2) across the filament contacts of the Analyzer Plug (10).

27 Push button switch for shunting "G" and "F" of the oscillator coil pin jacks (1) to "stop oscillation" of any amplifier tube used in a Tube Testing Socket (22).

28 A. C. Filament Jack for connecting the 4-volt scale of the A. C. Voltmeter (2) across the filament contacts of the Analyzer Plug (10).

29 D. C. Filament Jack for connecting the 10-volt scale of the D. C. Voltmeter (8) across the filament contacts of the Analyzer Plug (10).

30 Grid jack for connecting the 100-volt scale of the D. C. Voltmeter (8) across the grid and cathode* contacts of the Analyzer plug (10) for indicating negative grid bias.

31 Screen Grid Jack for connecting the D. C. Voltmeter (8) across the grid and cathode contacts of the analyzer plug for indicating positive screen grid bias.

32 Control Grid Jack for connecting the 10-volt scale of the D. C. Voltmeter (8) across the control grid contact lug (11) and the cathode* contact of the analyzer plug (10) for indicating negative control grid bias.

33 Plate Jack for connecting the 100-volt scale of the D. C. Voltmeter (8) across the plate and cathode* contacts of the analyzer plug (10) for indicating positive plate potentials below 100 volts.

34 Plate Jack for connecting the 250-volt scale of the D. C. Voltmeter (8) across the plate and cathode* contacts of the Analyzer Plug (10), for indicating positive plate potentials between 100 and 250 volts.



35 Plate Jack for connecting the 750-volt scale of the D. C. Voltmeter (8) across the plate and cathode* contacts of the Analyzer Plug (10), for indicating positive plate potentials between 250 and 750 volts.

36 Power Plant Jacks for applying a filament potential which corresponds to the filament rating of any tube placed in either of the Tube Testing Sockets (22) when the DIAGNOMETER is connected with the Supply Cord (21) to an A. C. Supply System.

37 Space Charge (pentode) pin jack on "N2" or later series for connection, with a suitable connector, to the space charge (pentode) contact of r. f. pentode tubes, or to the pin plug terminal of the No. 6022 pentode adapter. This pin jack is internally connected to a space charge (pentode) contact on the lower half of the analyzer plug (10).

*The "Cathode" is the usual designation of the electron—emitting element of a vacuum tube. The cathode may consist of an independent element heated by a filament, or a filament may perform the functions of a cathode where no separate cathode element is employed.

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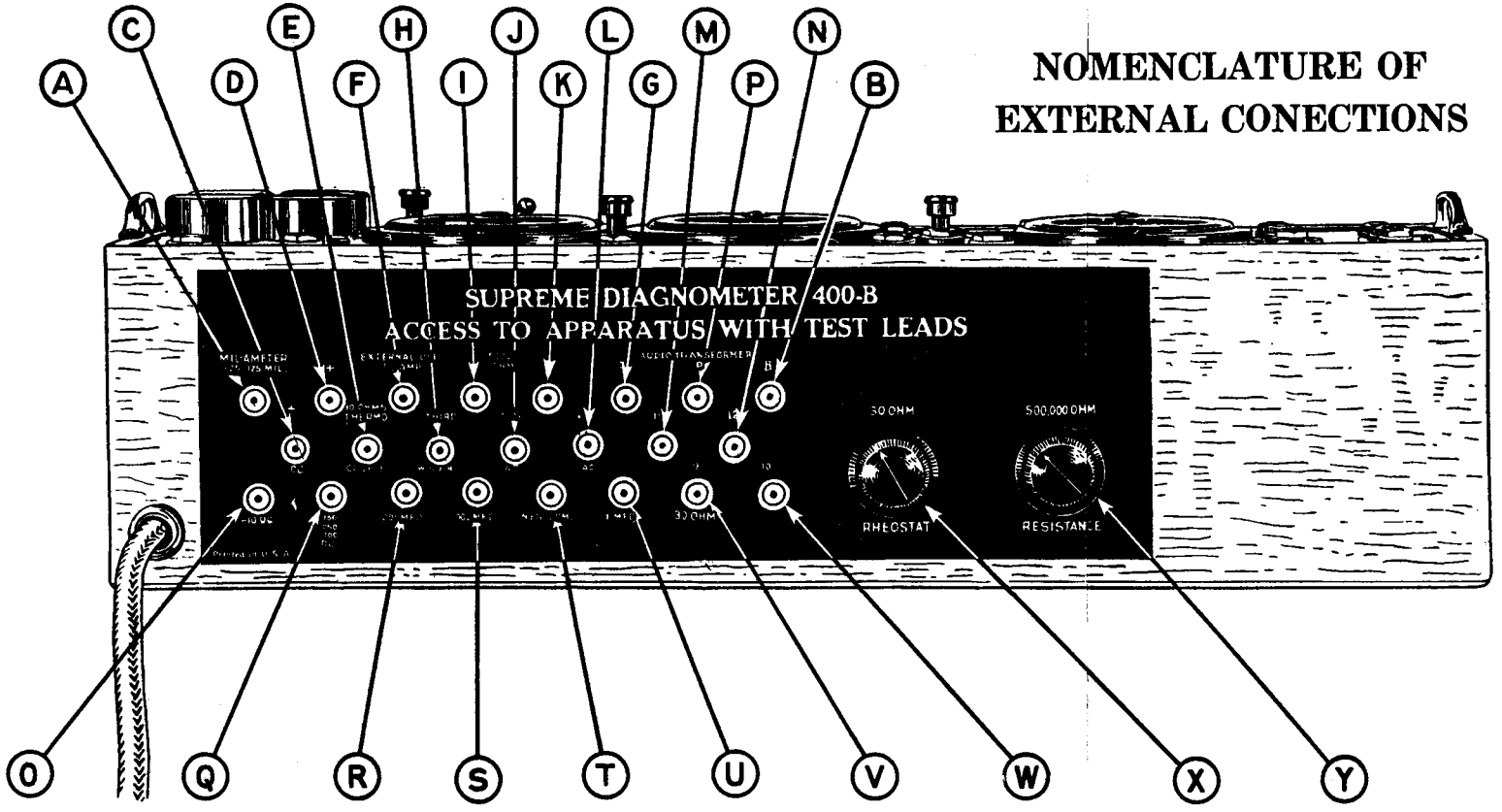
# NOMENCLATURE OF EXTERNAL CONECTIONS




*(The letters of the alphabet in parentheses shown in front of each paragraph refer to the corresponding encircled letters of the above drawing)*

(A) Connects to negative side of 125-mil. scale of D.C. Milliammeter (6). Positive side connects to (D). 25-mil. scale available by depressing Milliammeter switch (7).

(B) Connects to one side of primary circuit of audio transformer. Other side of primary connects to (P).

(C) Common positive connections for all scales of D.C. Voltmeter (8). Negative connections available at (O) and (Q) when a corresponding Jack (29), (33), (34) or (35) is closed.



(D) Common positive connections to D.C. Milliammeter (6). Negative 125-scale available at (A) without closing any switch or jack. Negative 25-mil. connection completed at (A) by depressing Milliammeter switch (7). Negative connection to 2½-ampere scale of D.C. Milliammeter (6) completed at (F) without closing any switch or jack.

(E) One side of 30-ohm rheostat (X) and thermocouple heater unit of D.C. Voltmeter (8). Other side of 30-ohm rheostat available at (V). Rheostat should not be used as a filament control with a battery hook-up of the DIAGNOMETER.



(F) Negative connection to 2½-ampere scale of D.C. Ammeter (6). Positive connection completed at (D) without closing any switch or jack.

(G) One side of secondary winding of audio transformer which is completed at (T).

(H) One side of third (low impedance secondary)

(Continued on reverse side).

winding of audio transformer. The other side is completed at (E).

(I) One side of 500,000-ohm variable resistor (Y). The other side is completed at (K), the resistor being independent of all other circuits.

(J) One side of 750-volt scale range of A.C. Voltmeter (2). The other side is completed at (L) without closing any panel switch or jack.

(K) One side of 500,000-ohm variable resistor. The other side is available at (I).

(L) Common connection for all scales of A.C. Voltmeter (2). The other side of the 4 and 16-volt scale ranges is available at (U) when a corresponding panel jack (28) or (26) is closed. The other side of the 150-volt scale range is available at (D) when the A.C. Line panel jack (3) is closed. The other side of the 750-volt scale range is available at (J) without closing any panel switch or jack.

(M) One side of thermo-couple heater unit. The other side is available at (E).

(N) To be connected to (C) for closing thermo-couple heater unit to 1-mil. movement of D.C. Voltmeter (8).

(O) Connects to negative side of 10-scale of D.C. Voltmeter when panel jack (29) is closed for completing the positive meter connection to (C).

(P) One side of audio transformer primary. The other side terminates at (B).

(Q) Connects to negative side of 100, 250 and 750-volt scale ranges of D.C. Voltmeter (8) when a corresponding panel jack (33), (34) or (35) is closed for completing the positive meter connection to (C).

(R) One side of 0.001Mfd. fixed condenser. The other side connects to (T).

(S) One side of 0.002 Mfd. fixed condenser. The other side connects to (T).

(T) Common connection of each condenser terminating at (R), (S) and (U); also connects to filament end of audio transformer secondary.

(U) One side of 1.mfd. fixed condenser. The other side connects to (T).

(V) One side of 30-ohm Rheostat (X). The other side connects to (E).

(W) Connects directly to (V).

(X) Control knob of 30-ohm Rheostat avaiable at (E) and (V).





(Y) Control knob of 500,000-ohm variable resistor available at (I) and (K).

## D. C. VOLTMETER TERMINALS

10-volt scale: (C) and (O) with panel jack (29) closed.

100-volt scale: (C) and (Q) with panel jack (33) closed.

250-volt scale: (C) and (Q) with panel jack (34) closed.

750-volt scale: (C) and (Q) with panel jack (35) closed.

250 MA., A.C. scale: Uncalibrated current squared range available at (E) and (M) with jumper between (C) and (N).

## D.C. AMMETER—MILLIAMMETER TERMINALS

2½-ampere scale (D) and (F).
125-milliamperes (D) and (A).
25-milliamperes (D) and (A) with milliammeter switch (7) depressed.

## A. C. VOLTMETER TERMINALS

4-volt scale: (L) and (U) with panel jack (28) closed.

16-volt scale: (L) and (U) with panel jack (26) closed.

150-volt scale: (L) and (D) with panel jack (3) closed.

750-volt scale: (L) and (J) without closing any jack.

## AUDIO TRANSFORMER TERMINALS

Primary Circuit: (P) and (B).
Secondary Circuit: (G) and (T).

This audio transformer (3½:1 Ratio) is used as a coupling device for output meter synchronizing. It may also be used for paralleling or bridging a defective audio transformer of a radio to prove a transformer defect.

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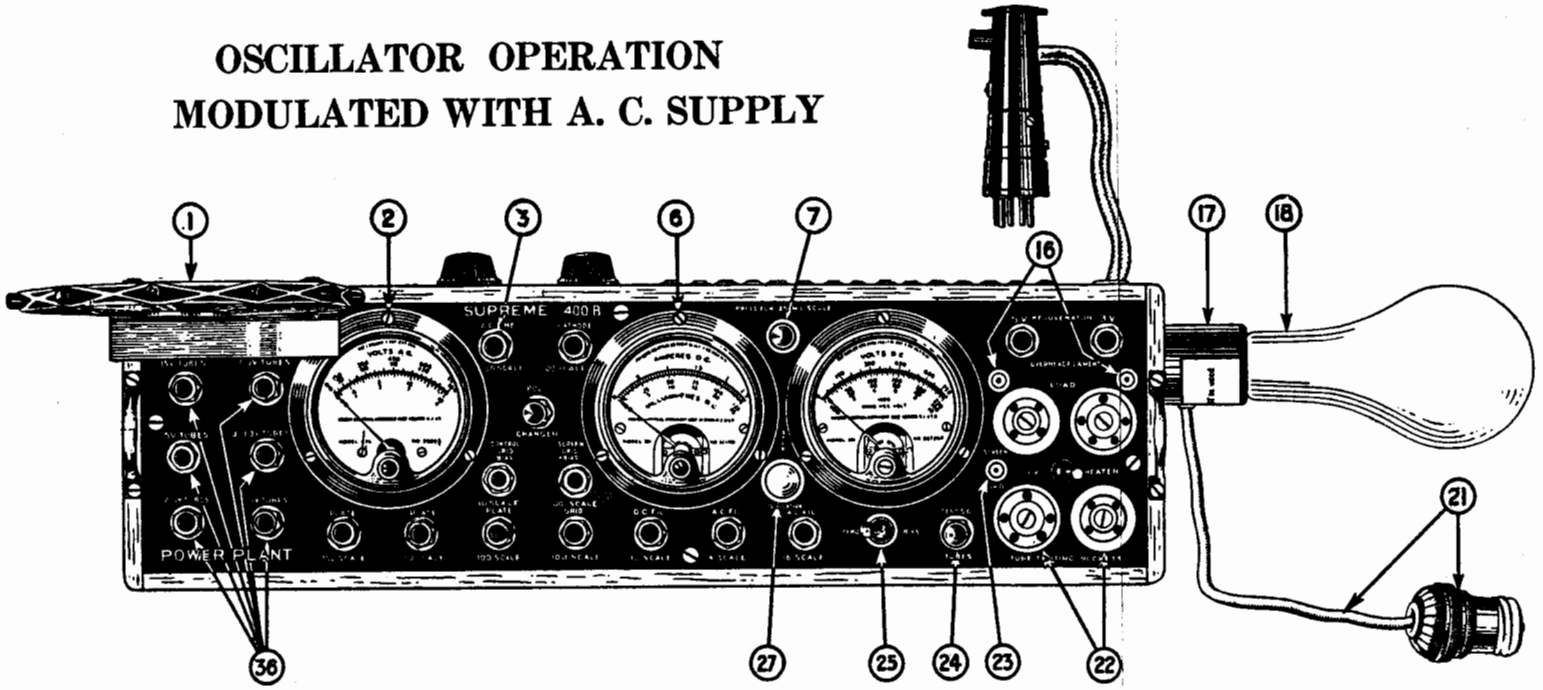
# OSCILLATOR OPERATION
# MODULATED WITH A. C. SUPPLY




*(The Roman numerals shown in front of each paragraph indicate the progressive procedure in performing the described operations)*

i Remove any jumpers or test leads which may have been left connected to the instrument, open all jack switches on the panel, and clear the Analyzer Plug (10) from contact with any electrical conductors which may be grounded or connected to the common A.C. supply system.

ii Insert the polarized series socket adapter (17), without the 100-watt Mazda lamp (18), in the receptacle on the end of the tray.

iii Connect the supply plug (21) to a convenient A.C. Supply Outlet.

iv Close the A.C. Line Jack (3). If the A.C. Voltmeter (2) shows a reading, the series-socket Adapter (17) is shunted and the deficiency must be corrected before proceeding with any test.



v If the A.C. Voltmeter (2) shows no reading, place the 100-watt Mazda lamp (18) in the series socket Adapter (17). The A.C. supply voltage should then be indicated on the A.C. Voltmeter (2). No device other than the prescribed 100-watt Mazda lamp (18) should ever be used in the series socket adapter (17). A lower resistance would endanger the milliammeter.

vi Insert the Oscillator Coil with its label to the front, in the prescribed position (1).

vii Place an amplifier tube of any type, except a screen grid or top heater, in one of the tube Testing Sockets (22).

viii Remove the Jack Plunger from the "A.C. Line" Jack (3) and insert it in the Power Plant Jack (36) the voltage marking of which corresponds to the filament rating of the tube which has been placed in the "Tube Testing Socket" (22).



ix If the tube is generating oscillations, modulated r.f. signals should now be radiated at about five different frequencies within the broadcast band. These signals may be "tuned in" with any operative radio for synchronizing, neutralizing, or other purposes.

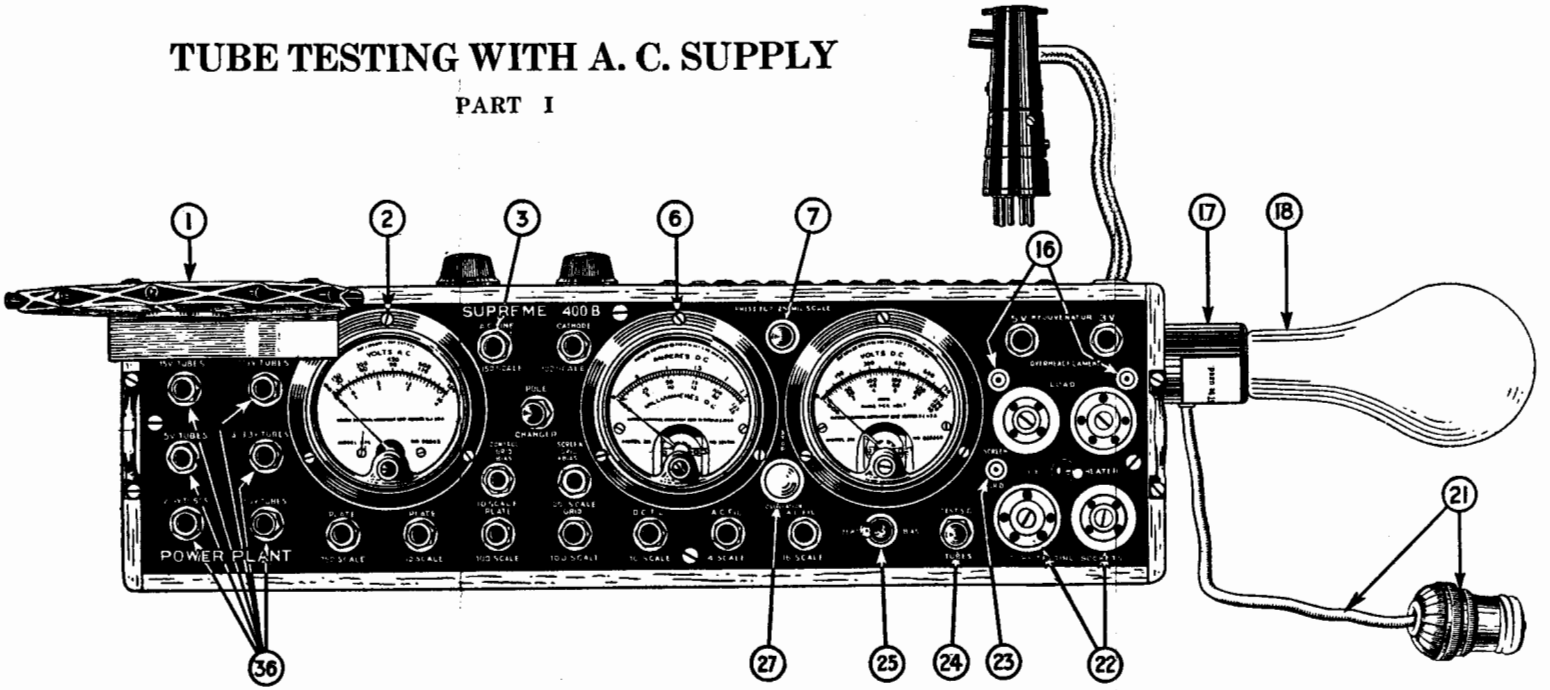
x The harmonic frequencies may be changed somewhat by changing the position of the "Zero-Bias" toggle switch (25).

xi If it is desired to increase the pickup strength of the signals, the oscillator coil intermediate winding, which terminates at two pin jacks on

(Continued on reverse side).

# TUBE TESTING WITH A. C. SUPPLY

## PART I




*(The Roman numerals shown in front of each paragraph indicate the progressive procedure in performing the described operations)*

### TUBE TESTING (EXCEPT SCREEN GRID, RECTIFIER, AND TOP HEATER TUBES) WITH A. C. SUPPLY

i Remove any jumpers or test leads which may have been left connected to the instrument, open all jack switches on the panel, and clear the Analyzer Plug (10) from contact with any electrical conductors which may be grounded or connected to the common A.C. supply system.

ii Insert the polarized series socket adapter (17), with a 100-watt Mazda lamp (18) in the receptacle on the end of the instrument tray. If any device other than a 100-watt Mazda lamp (18) should ever be used in the series socket adapter (17), the Milliammeter (6) might be harmed or show incorrect readings.

iii Connect the supply plug (21) to a convenient A.C. supply outlet.



iv Close the A.C. Line Jack (3) and observe the supply voltage on the 150-scale of the A.C. Voltmeter (2).

v Insert the Oscillator Coil, with its label to the front, in the pin jacks (1) marked "B.P. G.F." on the panel.

vi The tube to be tested should be placed in one of the Tube Testing Sockets (22).

vii Throw the biasing toggle switch (25) to its "Zero" position.

viii Close the Power Plant Jack (36) the voltage marking of which corresponds to the filament rating of the tube.

ix As the tube attains its operating temperature, the plate current of the tube, as modified by the r. f. pulsations induced by the oscillatory circuit, will be indicated on the 125-scale of the D.C. Milliammeter (6). If the plate current reading (6) is less than 25 milliamperes, the millammeter push button switch (7) may



be depressed for a more discernible reading on the 25-mil. scale.

x Depress the "Stop Oscillation" button (27) for observing the plate current reading of the tube in a non-oscillating condition.

xi With the "Stop Oscillation" button (27) depressed, throw the biasing toggle switch (25) to its "Bias" position. The resulting change in plate current (6) is an indication of the amplifying merits of the tube under test, the greater the *change* for any type tube the better the tube.

xii Release the "Stop Oscillation" button (27) and observe the plate current reading (6) of the tube, as modfied by the r. f. pulsations induced by the oscillatory circuit, with the "Zero Bias" toggle switch (25) in its "Bias" position. A comparison of this reading on different good tubes of the same type affords an

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excellent means for matching tubes for the tuned stages of a radio.

xiii The four plate current readings obtained may be compared with the Tube Testing Tables, page 15, which indicate average relationships in tube characteristics.

## SCREEN GRID TUBE TESTING WITH A.C. SUPPLY

i Remove any jumpers or test leads which may have been left connected to the instrument, open all jack switches on the panel, and clear the Analyzer Plug (10) from contact with any electrical conductor which may be grounded or connected to the common A.C. supply system.

ii Insert the polarized series socket adapter (17) with a 100-watt Mazda lamp (18), in the receptacle on the end of the instrument tray. If any device other than a 100-watt Mazda lamp (18) should ever be used in the series socket adapter (17), the Milliammeter (6) might be harmed or show incorrect readings.

iii Connect the supply plug (21) to a convenient A. C. supply outlet.

iv Close the A. C. Line Jack (3) and observe the supply voltage on the 150-scale of the A. C. Voltmeter (2).

v Insert the Oscillator Coil, with its label to the front, in the pin jacks (1) marked "B.P.G.F." on the panel.

vi The tube to be tested should be placed in one of the Tube Testing Sockets (22), with its top control grid contact connected with a short clip-pin plug lead to the "Screen Grid" (23) panel pin jack.

vii Throw the biasing toggle switch (25) to its "Zero" position.

viii Close the Power Plant Jack (36) the voltage marking of which corresponds to the filament rating of the tube.

ix After the tube attains its operating temperature, depress the "Test S.G. Tubes" push button switch (24). The plate current of the tube, as modified by the r. f. pulsations induced by the oscillatory circuit, will then be indicated on the 125-mil. scale of the D.C. Milliameter (6). If the plate current reading (6) is less than 25-milliamperes, the Milliammeter push button switch (7) may be depressed for a more discernible reading on the 25-mil. scale.





x Depress the "Stop Oscillation" button (27) for observing the plate current reading of the tube in a non-oscillating condition.

xi With the "Stop Oscillation" button (27) depressed, throw the biasing toggle switch (25) to its "Bias" position. The resulting *change* in plate current (6) is an indication of the amplifying merits of the tube under test, the greater the *change* for any type of tube the better the tube.

xii Release the "Stop Osclation" button (27) and observe the plate current reading (6) of the tube, as modified by the r. f. pulsations induced by the oscillatory circuit, with the "Zero-Bias" toggle switch (25) in its "Bias" position. A comparison of this reading on dfferent good tubes of the same type affords an excellent means for matching tubes for the tuned stages of a radio.

xiii The four plate current readings obtained may be compared with the Tube Testing Tables. page 15, which indicate average relationships in tube characteristics.

## PENTODE TUBES

The above procedure applies to tests of r. f. space charge (pentode) tubes on instruments provided with the "SP CH-GRID" pin jack (37) between the "5-v" or "Space Charge-100-scale" jack (14) and the D.C .Voltmeter (8) by connecting this pin jack to the space charge (pentode) contact of the tube under test.

Power Pentode Tubes are tested with Adapter No. 6021.

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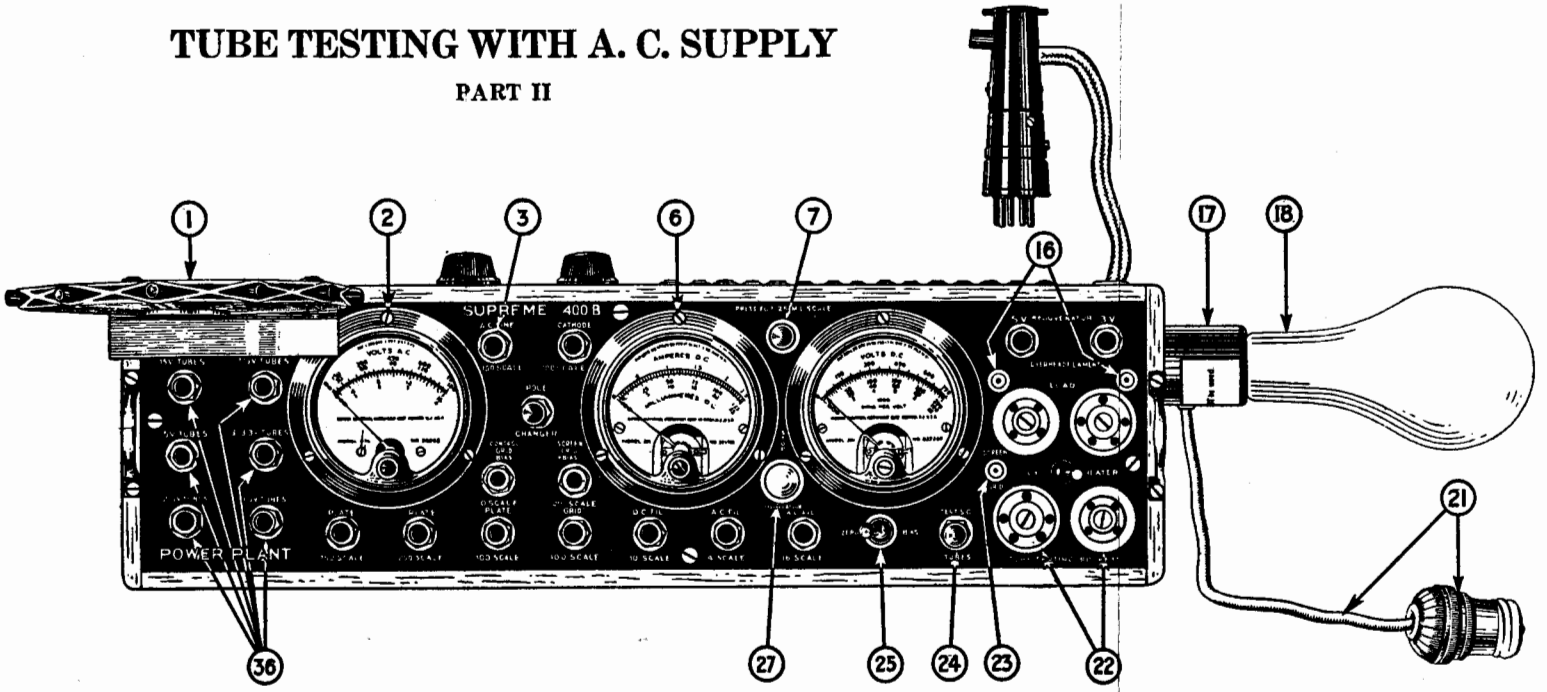
# TUBE TESTING WITH A. C. SUPPLY

## PART II




*(The Roman numerals shown in front of each paragraph indicate the progressive procedure in performing the described operations)*

### RECTIFIER (THERMIONIC) TUBES

i Remove any jumpers or test leads which may been left connected to the instrument, open all jack switches, and clear the analyzer plug (10) from contact with any electrical conductor which may be grounded or connected to the common A. C. supply system.

ii Insert the polarized series socket adapter (17), with a 100-Watt Mazda lamp (18), in the receptacle on the end of the instrument tray. If any device other than a 100-watt Mazda lamp (18) should ever be used in the series socket adapter (17), the Milliammeter (6) might be harmed or show inaccurate readings.

iii Connect supply plug (21) to a convenient A.C. supply outlet.



iv Close the A. C. Line Jack (3) and observe the supply voltage on the 150-scale of the A. C. voltmeter (2).

v Insert the Oscillator Coil, with its label to the front, in the pin jacks (1) marked "B.P.G.F." on the panel.

vi The tube to be tested should be placed in the UX Tube Testing Socket (22).

vii Close the Power Plant Jack (36) the voltage marking of which corresponds to the filament rating of the tube.

viii The current of one plate will be indicated on the 125-mil. scale of the D. C. Milliammeter (6).

ix When testing a full-wave rectifier tube, depress the "Test S. G. Tubes" push button switch (24) for obtaining the plate current reading of the other plate.



x The plate current readings obtained may be compared with the Tube Testing Tables, page 15, which indicate the average relationships in tube characteristics.

### OVERHEAD (TOP) HEATER TUBES

i Remove any jumpers or test leads which may have been left connected to the instrument, open all jack switches on the panel, and clear Analyzer Plug (10) from contact with any electrical conductor which may be grounded or connected to the common A. C. supply system.

ii Insert the polarized series socket adapter (17) with a 100-watt Mazda lamp (18), in the re-

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ceptacle on the end of the instrument tray. If any device other than a 100-watt Mazda lamp (18) should ever be used in the series socket adapter (17), the Milliammeter (6), might be harmed or show incorrect readings.

iii Connect the Supply Plug (21) to a convenient A. C. supply outlet.

iv Close the A. C. Line Jack (3) and observe the supply voltage on the 150-scale of the A. C. Voltmeter (2).

v Insert the Oscillator Coil, with its label to the front, in the pin jacks (1) marked "B.P.G.F." on the panel.

vi The tube to be tested should be placed in the UX Tube Testing Socket (22) with its overhead (top) heater contacts connected with short clip-pin plug leads to the "Overhead Filament" (16) panel pin jacks.

vii Throw the biasing toggle switch (25) to its "Zero" position.

viii Close the "3-3.3 V Tubes" Power Plant Jack (36).

ix As the tube attains its operating temperature, the plate current of the tube, as modified by the r. f. pulsations induced by the oscillatory circuit, will then be indicated on the 25 mil-scale of the D.C. Milliammeter (6). If the plate current reading (6) is less than 25 milliamperes, the Milliammeter push button switch (7) may be depressed for a more discernible reading on the 25-mil. scale (6).

x Depress the "Stop Oscillation" button (27) for observing the plate current reading of the tube in a non-oscillating condition.

xi With the "Stop Oscillation" button (27) depressed, throw the biasing toggle switch (25) to its "Bias" position. The resulting change in plate current (6) is an indication of the amplifying merits of the tube under test, the greater the *change* for any type of tube the better the tube.





xii Release the "Stop Oscillation" button (27) and observe the plate current reading (6) of the tube, as modified by the r. f. pulsations induced by the oscillatory circuit, with the "Zero-Bias" toggle switch (25) in its "Bias" position. A comparison of this reading on different good tubes of the same type affords an excellent means for matching tubes for the tuned stages of a radio.

xiii The four plate current readings obtained may be compared with the Tube Testing Tables, page 15, which indicate average relationships in tube characteristics.

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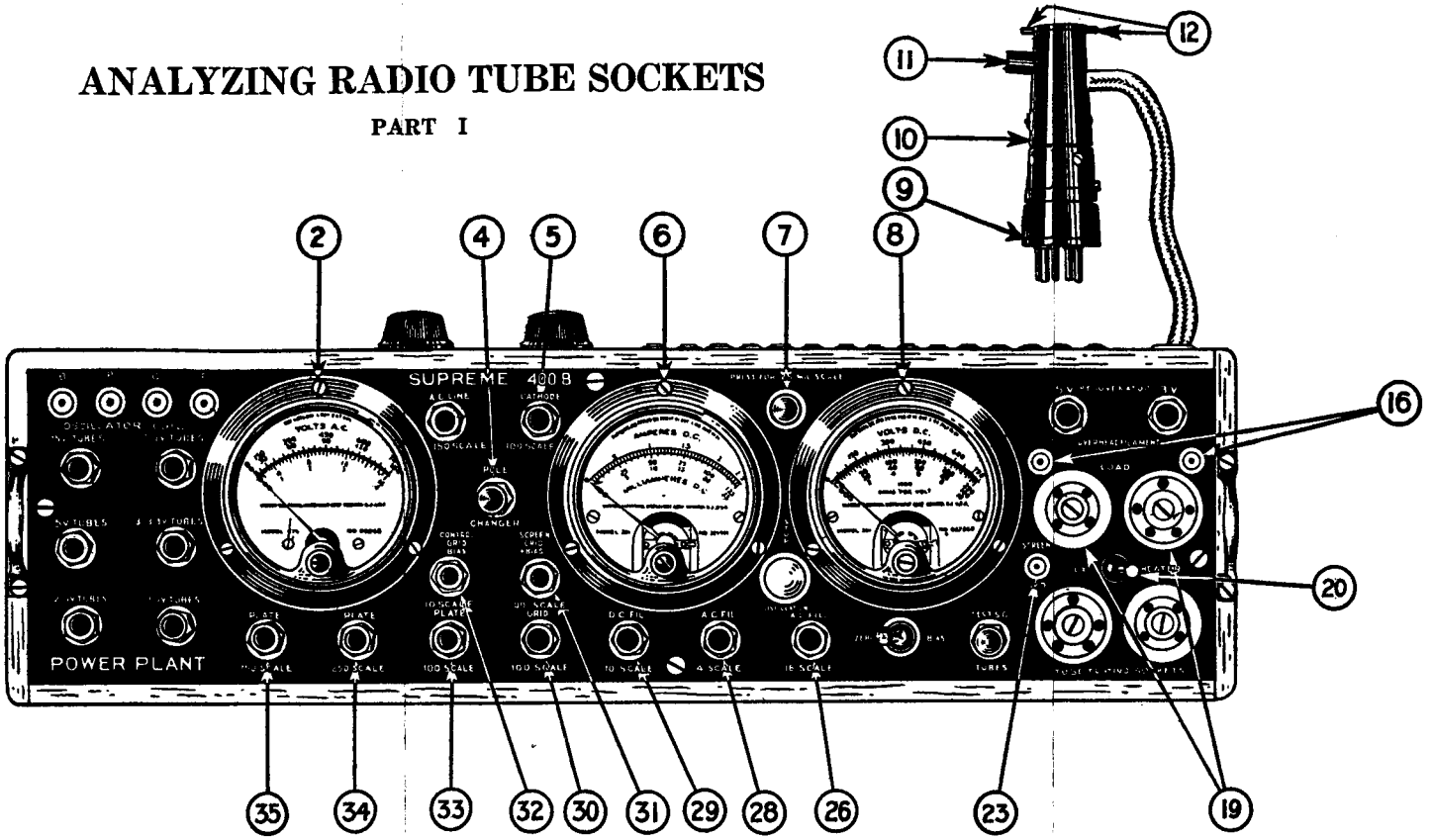
# ANALYZING RADIO TUBE SOCKETS

## PART I




*(The Roman numerals shown in front of each paragraph indicate the progressive procedure in performing the described operations)*

### TRIODE TUBES, UX AND UY SOCKETS

i Remove the Oscillator Coil from the Oscillator Coil pin jacks (1), and remove all jack plungers and connecting leads from the Diagnometer.

ii With the radio to be analyzed turned "Off," remove a tube from the radio and place the tube in the "Load Socket" (19), which will accommodate the tube without an adapter.

iii Throw the "UX-Heater" switch (20) to the "UX" position for UX tubes and to the "Heater" position for UY tubes.

iv Insert the Analyzer Plug (10), using the adapter (9) if required, into the radio tube socket.

v Turn the radio "On" and adjust the volume and tuning controls to whatever positions may be recommended by the radio manufacturer for analyzing. The plate current load of the tube will be indicated on the 125-mil. scale of the D.C. Milliammeter (6) during the analysis If the reading is less than 25 milliamperes, the "Press for 25-mil. scale" Milliammeter push button switch (7) may be depressed for a more exact reading on the 25-scale of the meter. If the tube is good, a normal reading on the D.C. Milliammeter (6) generally indicates continuity of all radio circuits terminating at the socket being analyzed.

vi If it is desired to continue the analysis on the same socket, insert the jack plunger in the A.C. Filament Jack (26) or (28) the scale marking of which least exceeds the filament rating of the tube. The filament voltage should then be indicated on the A.C. Voltmeter (2) scale which corresponds to the closed jack (26) or (28).

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vii Insert the Jack Plunger in the Plate Jack (33), (34) or (35) the scale marking of which least exceeds the plate potential specified for the radio tube socket. The applied plate potential should then be indicated on the D.C. Voltmeter (8) scale which corresponds to the scale marking of the closed jack (33), (34), or (35).

viii The negative grid potential should be indicated on the 100-scale of the D.C. Voltmeter (8) when the Jack Plunger is placed in the Grid Jack (30. If the grid of the radio tube socket being analyzed is resistance-coupled to the preceding stage, a more accurate reading of the applied grid potential will be indicated by connecting a test lead between the grid contact of the unoccupied "Load Socket" (19) and the "Grid Return" which is usually the grounded chassis of the radio.

ix A negative cathode bias applied to a UY radio tube socket under analysis should be indicated directly on the 100-scale of the D.C. Voltmeter (8) when the Jack Plunger is placed in the cathode jack (5). If the D.C. Voltmeter (8) needle backs off scale, depressing the pole changer push button switch (4) affords a direct reading of positive cathode biasing.

## SCREEN GRID TUBE SOCKET ANALYSIS

i Remove the Oscillator Coil from the Oscillator Coil Pin Jacks (1) and remove all Jack Plungers and connecting leads from the Diagnometer.

ii With the radio analyzer turned "off" remove a tube from the radio and place the tube in the "Load Socket" (19) which will accommodate the tube without an adapter.

iii Connect the top control grid contact of the tube with a short clip-pin plug lead to the "Screen Grid" pin jack (23) on the panel.

iv Throw the "UX-Heater" switch (20) to the "UX" position for UX tubes and to the "Heater" position for UY tubes.

v Insert the Analyzer Plug (10), using the Adapter (9) if required, into the radio tube socket.

vi Connect the control grid contact lug (11) of the Analyzer Plug (10) to the control grid clip of the radio tube socket.

vii Turn the radio "On" and adjust the volume





and tuning controls to whatever positions may be recommended by the radio manufacturer for analyzing. The plate current load of the tube will be indicated on the 125-mil. scale of the D.C. Milliammeter (6) during the analysis. If the reading is less than 25 milliamperes, the "Press for 25-mil. scale" Milliammeter push button switch (7) may be depressed for a more exact reading on the 25-scale of the meter. If the tube is good, a normal reading on the D.C. Milliammeter (6) generally indicates continuity of all radio circuits terminating at the socket being analyzed.

viii If it is desired to continue the analysis on the same socket, insert the plunger in the A.C. Filament Jack (26) or (28) the scale marking of which least exceeds the filament rating of the tube. The filament voltage should then be indicated on the A.C. Voltmeter (2) scale which corresponds to the closed jack (26) or (28). If the filament of the radio tube socket is supplied with a direct current potential, the D.C. Filament Jack (29) should be used instead of an A.C. Filament Jack (26) or (28) for indicating the D.C. filament potential on the 10-scale of the D.C. Voltmeter (8).

ix Insert the Jack Plunger in the Plate Jack (33) (34) or (35) the scale marking of which least exceeds the plate potential specified for the radio tube socket. The applied plate potential should then be indicated on the D.C. Voltmeter (8) scale which corresponds to the scale marking of the closed jack (33), (34) or (35).

x The negative control grid bias should be indicated on the 10-scale of the D.C. Voltmeter (8) when the Jack Plunger is placed in the Control Grid Jack (32).

xi The positive screen grid bias should be indicated on the D.C. Voltmeter (8) when the Jack Plunger is placed in the Screen Grid Jack (31).

xii A negative cathode bias applied to a UY radio tube socket under analysis should be indicated directly on the 100-scale of the D.C. Voltmeter (8) when the Jack Plunger is placed in the Cathode Jack (5). If the D.C. Voltmeter (8) needle backs off scale, depressing the pole changer push button switch (4) affords a direct reading of positive cathode biasing.

## PENTODE CIRCUITS

The above procedure applies to the analysis of





r. f. space charge (pentode) circuits with Diagnometers provided with the "SP CH-GRID" pin jack (37) between the "5-v" or "Space Charge-100 scale" jack (14) and the D.C. Voltmeter (8) by connecting this pin jack to the space charge (pentode) contact of tube under test. The space charge lug located near the base of the Analyzer Plug (10) should be connected to the space charge contact of the radio tube socket being analyzed.

Power Pentode analyses require the use of Pentode Pin Plug Adapter No. 6022 for the UY Load Socket with the pin plug inserted into the "SP CH" pin jack (37) and Pentode Space Lead Adapter No. 6023 attached to the Analyzer Plug (10), with the "UX-Heater" switch in the "UX" position.

Printed in U. S. A. July 1931

vii Insert the Jack Plunger in the Plate Jack (33), (34) or (35) the scale marking of which least exceeds the plate potential specified for the radio tube socket. The applied plate potential should then be indicated on the D.C. Voltmeter (8) scale which corresponds to the scale marking of the closed jack (33), (34), or (35).

viii The negative grid potential should be indicated on the 100-scale of the D.C. Voltmeter (8) when the Jack Plunger is placed in the Grid Jack (30. If the grid of the radio tube socket being analyzed is resistance-coupled to the preceding stage, a more accurate reading of the applied grid potential will be indicated by connecting a test lead between the grid contact of the unoccupied "Load Socket" (19) and the "Grid Return" which is usually the grounded chassis of the radio.

ix A negative cathode bias applied to a UY radio tube socket under analysis should be indicated directly on the 100-scale of the D.C. Voltmeter (8) when the Jack Plunger is placed in the cathode jack (5). If the D.C. Voltmeter (8) needle backs off scale, depressing the pole changer push button switch (4) affords a direct reading of positive cathode biasing.

## SCREEN GRID TUBE SOCKET ANALYSIS

i Remove the Oscillator Coil from the Oscillator Coil Pin Jacks (1) and remove all Jack Plungers and connecting leads from the Diagnometer.

ii With the radio analyzer turned "off" remove a tube from the radio and place the tube in the "Load Socket" (19) which will accommodate the tube without an adapter.

iii Connect the top control grid contact of the tube with a short clip-pin plug lead to the "Screen Grid" pin jack (23) on the panel.

iv Throw the "UX-Heater" switch (20) to the "UX" position for UX tubes and to the "Heater" position for UY tubes.

v Insert the Analyzer Plug (10), using the Adapter (9) if required, into the radio tube socket.

vi Connect the control grid contact lug (11) of the Analyzer Plug (10) to the control grid clip of the radio tube socket.

vii Turn the radio "On" and adjust the volume





and tuning controls to whatever positions may be recommended by the radio manufacturer for analyzing. The plate current load of the tube will be indicated on the 125-mil. scale of the D.C. Milliammeter (6) during the analysis. If the reading is less than 25 milliamperes, the "Press for 25-mil. scale" Milliammeter push button switch (7) may be depressed for a more exact reading on the 25-scale of the meter. If the tube is good, a normal reading on the D.C. Milliammeter (6) generally indicates continuity of all radio circuits terminating at the socket being analyzed.

viii If it is desired to continue the analysis on the same socket, insert the plunger in the A.C. Filament Jack (26) or (28) the scale marking of which least exceeds the filament rating of the tube. The filament voltage should then be indicated on the A.C. Voltmeter (2) scale which corresponds to the closed jack (26) or (28). If the filament of the radio tube socket is supplied with a direct current potential, the D.C. Filament Jack (29) should be used instead of an A.C. Filament Jack (26) or (28) for indicating the D.C. filament potential on the 10-scale of the D.C. Voltmeter (8).

ix Insert the Jack Plunger in the Plate Jack (33) (34) or (35) the scale marking of which least exceeds the plate potential specified for the radio tube socket. The applied plate potential should then be indicated on the D.C. Voltmeter (8) scale which corresponds to the scale marking of the closed jack (33), (34) or (35).

x The negative control grid bias should be indicated on the 10-scale of the D.C. Voltmeter (8) when the Jack Plunger is placed in the Control Grid Jack (32).

xi The positive screen grid bias should be indicated on the D.C. Voltmeter (8) when the Jack Plunger is placed in the Screen Grid Jack (31).

xii A negative cathode bias applied to a UY radio tube socket under analysis should be indicated directly on the 100-scale of the D.C. Voltmeter (8) when the Jack Plunger is placed in the Cathode Jack (5). If the D.C. Voltmeter (8) needle backs off scale, depressing the pole changer push button switch (4) affords a direct reading of positive cathode biasing.

## PENTODE CIRCUITS

The above procedure applies to the analysis of





r. f. space charge (pentode) circuits with Diagnometers provided with the "SP CH-GRID" pin jack (37) between the "5-v" or "Space Charge-100 scale" jack (14) and the D.C. Voltmeter (8) by connecting this pin jack to the space charge (pentode) contact of tube under test. The space charge lug located near the base of the Analyzer Plug (10) should be connected to the space charge contact of the radio tube socket being analyzed.

Power Pentode analyses require the use of Pentode Pin Plug Adapter No. 6022 for the UY Load Socket with the pin plug inserted into the "SP CH" pin jack (37) and Pentode Space Lead Adapter No. 6023 attached to the Analyzer Plug (10), with the "UX-Heater" switch in the "UX" position.

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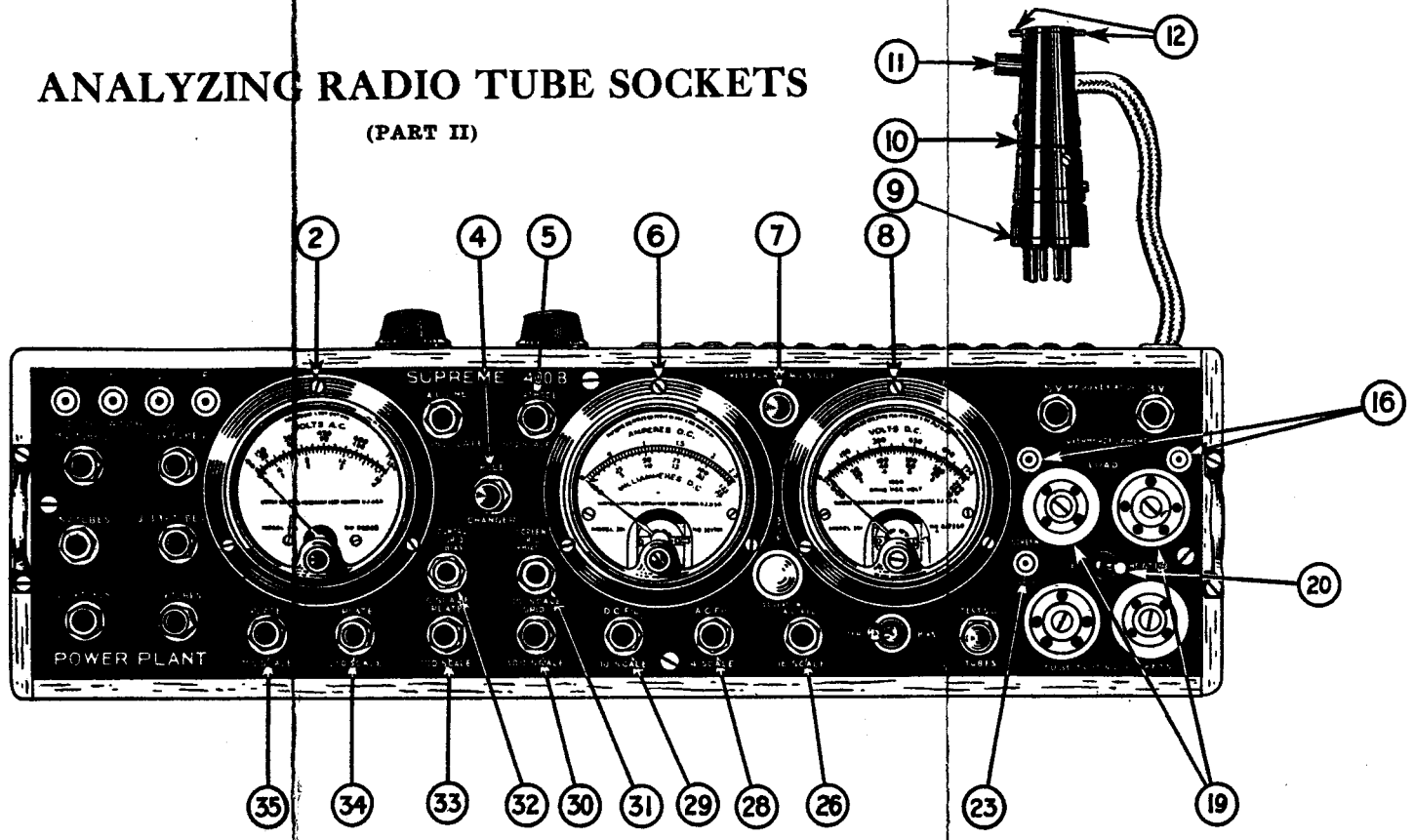
# ANALYZING RADIO TUBE SOCKETS

**(PART II)**




*(The Roman numerals shown in front of each paragraph indicate the progressive procedure in performing the described operations)*

## TRIODE TUBES, UX AND UY
## D. C. FILAMENT

i Remove the Oscillator Coil from the Oscillator Coil pin jacks (1) and remove all Jack plungers and connecting leads from the Diagnometer.

ii With the radio to be analyzed turned "Off," remove a tube from the radio and place the tube in the "Load Socket" (19) which will accommodate the tube without an adapter.

iii Throw the "UX-Heater" switch (20) to the "UX" position. Insert the Analyzer Plug (10), using the adapter (9) if required, into the radio tube socket.

iv Insert the Jack Plunger in the D.C. Filament Jack (29).

v Turn the radio "On." If the D. C. Voltmeter (8) needle backs off scale, depress the pole changer push button switch (4) while adjusting the radio filament controls, if any, for an indication on the 10-scale of the D.C. Voltmeter (8) of the rated filament voltage of the tube. The plate current load of the tube will be indicated on the 125-mil. scale of the D.C. Milliammeter (6) during the analysis. If the reading is less than 25 milliamperes, the "Press for 25-mil. Scale" milliammeter switch (7) may be depressed for a more exact reading on the 25-mil. scale of the meter. If the tube is good, a normal reading on the D.C. Milliammeter (6) will generally indicate continuity of all radio circuits terminating at the socket being analyzed.

vi If it is desired to continue the analysis on the

*(Continued on reverse side)*

same socket, insert the Jack plunger in a Plate Jack (33), (34) or (35) the scale marking of which least exceeds the plate potential specified for the radio tube socket. The applied plate potential should then be indicated on the D.C. Voltmeter (8) scale which corresponds to the scale marking of the closed jack (33), (34) or (35).

vii Insert the Jack Plunger in the Grid Jack (30) for observing the negative grid potential which will be the lower of two separate readings indicated on the 100-scale of the D.C. Voltmeter (8), the two readings corresponding to the two positions of the Pole Changer Switch (4). The reading of the lower value will not include the filament voltage.

## TOP HEATER TUBE SOCKET ANALYSIS

i Remove the Oscillator Coil from the Oscillator Coil Pin Jacks (1) and remove all Jack Plungers and connecting leads from the Diagnometer.

ii With the radio to be analyzed turned "Off," remove a tube from the radio and place the tube in the UX "Load Socket" (19).

iii Connect the top heater contacts of the tube with short clip-pin plug leads to the "Overhead Filament" pin jacks (16) on the panel.

iv Throw the "UX-Heater" switch (20) to the "Heater" position.

v Insert the Analyzer Plug (10), without the adapter (9), into the radio tube socket.

vi Connect the Top Heater Tube Filament Contacts (12) of the Analyzer Plug (10) to the "trolly" filament contacts of the radio tube socket.

vii Turn the radio "On" and adjust the volume and tuning controls to whatever positions may be recommended by the radio manufacturer for analyzing. The plate current load of the tube will be indicated on the 125-mil. scale of the D.C. Milliammeter (6) during the analysis. If the reading is less than 25 milliamperes, the "Press for 25-mil. Scale" milliammeter push button switch (7) may be depressed for a more exact reading on the 25-scale of the meter. If the tube is good, a normal reading on the D.C. Milliammeter (6) generally indicates continuity of all radio circuits terminating at the socket being analyzed.





viii If it is desired to continue the analysis on the same socket, insert the Jack Plunger in the A.C. Filament Jack (26) or (28) the scale marking of which least exceeds the filament rating of the tube. The filament voltage should then be indicated on the A.C. Voltmeter (2) scale which corresponds to the closed jack (26) or (28).

ix Insert the Jack Plunger in the Plate Jack (33), (34) or (35) the scale marking of which least exceeds the plate potential specified for the radio tube socket. The applied plate potential should then be indicated on the D.C. Voltmeter (8) scale which corresponds to the scale marking of the closed Jack (33), (34) or (35).

x The negative grid potential should be indicated on the 100-scale of the D.C. Voltmeter (8) when the Jack Plunger is placed in the Grid Jack (30). If the grid of the radio tube socket being analyzed is resistance-coupled to the preceding stage, a more accurate reading of the applied grid potential will be indicated by connecting a test lead between the grid contact of the unoccupied "Load Socket" (19) and the "grid return" which is usually the grounded chassis of the radio.

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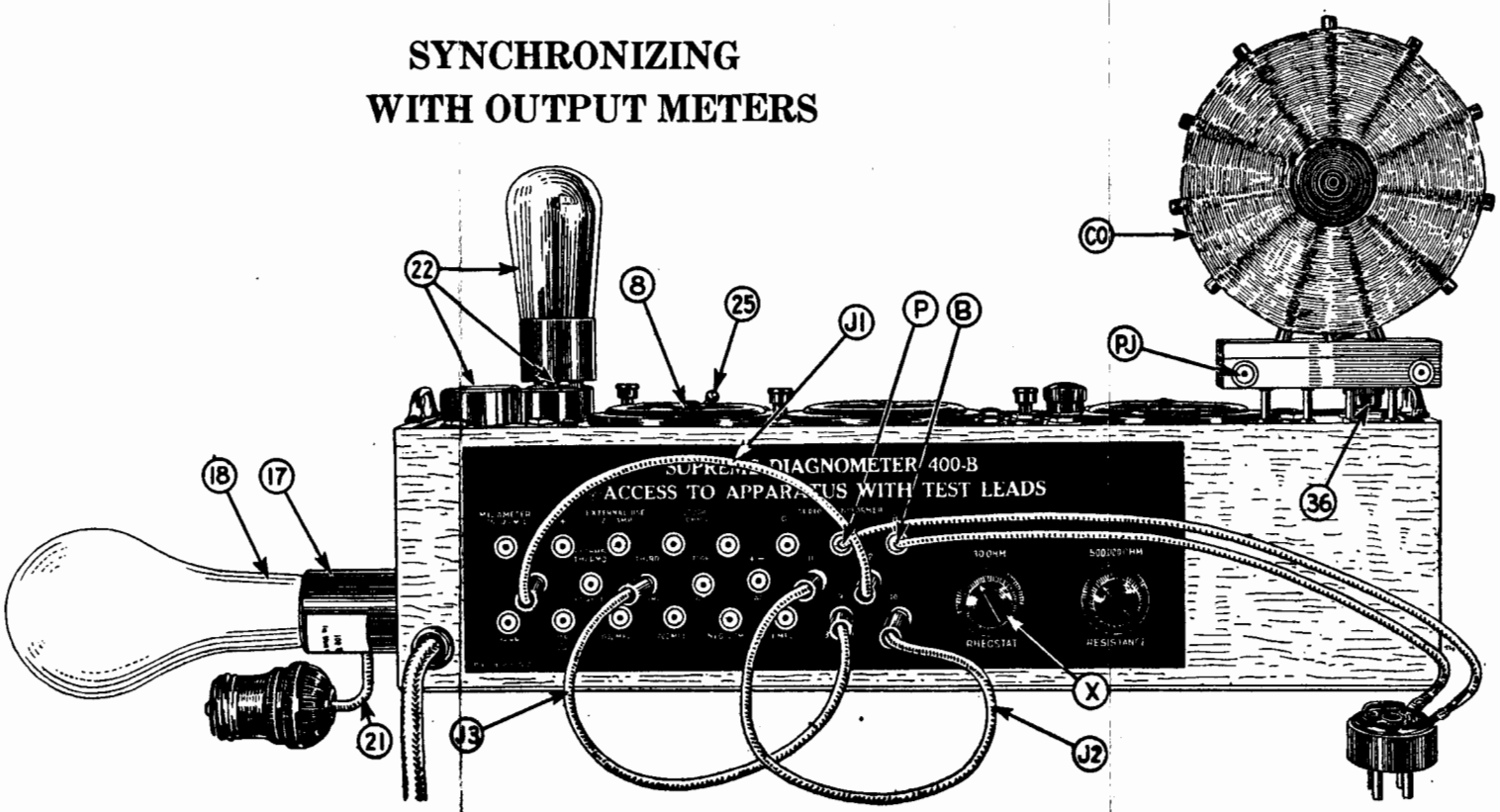
# SYNCHRONIZING WITH OUTPUT METERS




*(The Roman numerals shown in front of each paragraph indicate the progressive procedure in performing the described operations)*

## THERMO-COUPLE OUTPUT METER SYNCHRONIZING

**(Letters in Parentheses refer to the drawing on Page 108)**

i Put the Modulated Oscillator in operation in the manner outlined on page 109.

ii Set the 30-ohm Rheostat Control (X) in its approximate center position.

iii Connect Jumpers (JI), (J2), and (J3) to the Pin Jacks as indicated.



iv Connect the Synchronizing (plate-break) adapter terminals to the (P) and (B) Pin Jacks, on the back of the instrument tray.*

v Remove a tube from the last audio stage of the radio and insert the tube in the adapter. Place the adapter in the vacant audio tube socket.

vi Rotate the tuning knob of the radio while adjusting the 30-ohm Rheostat for the desired needle deflection which will occur on the D.C. Voltmeter (8) as each harmonic of the modulated Oscillator is "tuned in" on the radio. A maximum needle deflection indicates resonance of the radio with the modulated oscillator.

When using the Synchronizing (plate-break) adapter in push-pull stages, the needle deflection of the meter may be increased on some radios when the push-pull socket not occupied by the adapter is left vacant during the synchronizing operations.



*When synchronizing radios designed for magnetic speakers, the loudspeaker terminals of the radio may be connected to the (P) and (B) Pin Jacks, instead of using the Synchronizing (plate-break) adapter.

(Continued on reverse side).

vii Adjust the coupling between the Diagnometer and the radio for the desired signal strength.

viii Adjust each tuning condenser for a maximum reading on a signal between 1000 and 1500 kilocycles, or between whatever other frequency limit specified by the manufacturer of the radio.

## THERMO-COUPLE OUTPUT METER MEASUREMENTS

By omiting Paragraphs i, vi, vii and viii, above this hook-up may be used for comparing the gain of any two audio amplifiers in the following manner:

ix Remove the aerial and ground leads from the radio under test.

x Remove the detector tube of the radio.

xi With suitable test leads, apply an audio-frequency signal to the plate and cathode contacts of the vacant detector socket. For these comparisons, the ordinary 110-volt 60-cycle power supply may be used for supplying the audio signal potential.

xii The same tests may be accomplished with the A.C. Voltmeter by similar modifications of the following procedures:

## LOW IMPEDANCE OUTPUT A.C. VOLTMETER SYNCHRONIZING

i Put the Modulated Oscillator in operation in the manner outlined on Page 109.

ii Connect the "plus-or-minus A.C." (L) and the "1mfd." (U) external pin jacks of the Diagnometer to the voice coil terminals of the radio.

iii Close the 4-volt A.C. Filament Jack (28).

iv Throw the "UX-Heater" toggle switch (20) to the "Heater" position.

v Rotate the tuning control of the radio. A decided A.C. Voltmeter (2) deflection will occur as each harmonic of the Modulated Oscillator is "tuned in" on the radio. A maximum needle deflection indicates resonance of the radio with the modulated oscillator.

vi Adjust the coupling between the Diagnometer and the radio for the desired signal strength

vii Adjust each tuning condenser for a maximum reading on a signal between 1000 and 1500 kilocycles, or between whatever other frequency limits specified by the manufacturer of the radio.





## HIGH IMPEDANCE OUTPUT A.C. VOLTMETER SYNCHRONIZING

i Put the Modulated Oscillator in operation in the manner outlined on page 109.

ii Connect a jumper between the "Third Winding " (H) and "plus-or-minus A.C." (L) exter-pin jacks.

iii Connect a jumper between the "30-ohm" (E) and "1 mfd." (U) external pin jacks.

iv Throw the "UX-Heater" toggle switch (20) to the "Heater" position.

v Close the 4-volt A.C. Filament Jack (28).

vi Connect the Synchronizing (plate-break) Adapter terminals to the (P) and (B) Pin Jacks on the back side of the instrument tray.*

vii Remove a tube from the last audio stage of the radio and insert the tube in the Adapter. Place the Adapter in the vacant audio tube socket.

viii Rotate the tuning knob of the radio while adjusting the 30-ohm rheostat for the desired needle deflection which will occur on the A.C. Voltmeter (2) as each harmonic of the modulated Oscillator is "tuned in" on the radio. A maximum needle deflection indicates resonance of the radio with the modulated oscillator. When using the Synchronizing Adapter in push-pull stages, the needle deflection of the meter may be increased on some radios when the push-pull socket not occupied by the adapter is left vacant during the synchronizing operations.

ix Adjust the coupling between the Diagnometer and the radio for the desired signal strength.

x Adjust each tuning condenser for a maximum reading on a signal between 1000 and 1500 kilocycles, or between whatever other frequency limits specified by the manufacturer of the radio.

*When synchronizing radios designed for magnetic speakers, the loudspeaker terminals of the radio may be connected to the (P) and (B) external Pin Jacks, instead of using the Synchronizing Adapter.

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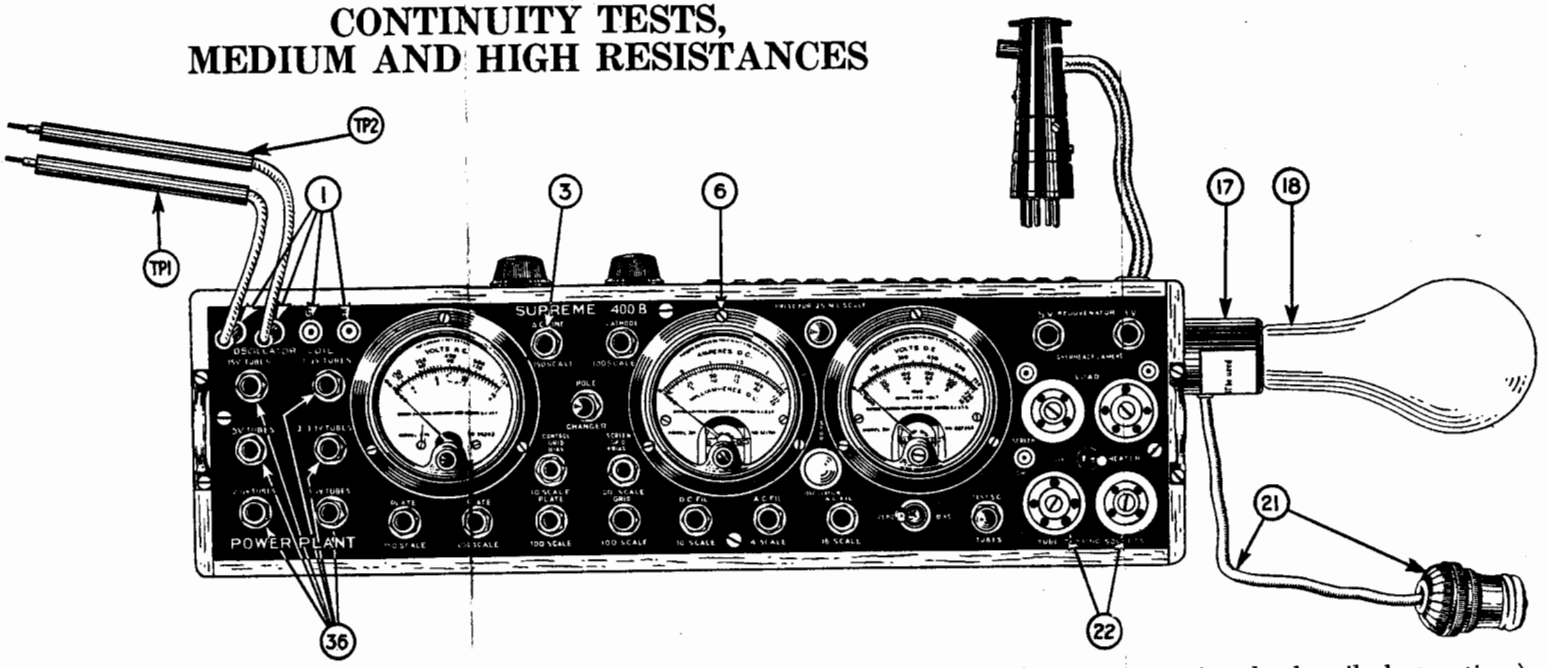
# CONTINUITY TESTS, MEDIUM AND HIGH RESISTANCES




*(The Roman numerals shown in front of each paragraph indicate the progressive procedure in performing the described operations)*

## MEDIUM RESISTANCES

i Remove any jumpers or test leads which may have been left connected to the instrument, open all jack switches on the panel, and clear the Analyzer Plug (10) from contact with any electrical conductor which may be grounded or connected to the common A.C. supply system.

ii Insert the polarized series socket adapter (17), with a 100-watt Mazda lamp (18), in the receptacle on the end of the instrument tray. If any device other than a 100-watt Mazda lamp (18) should ever be used in the series socket adapter (17), the Milliammeter (6) might be harmed or show incorrect readings.

iii Connect the supply plug (21) to a convenient A.C. supply outlet.

iv Close the A.C. Line Jack (3) and observe the supply voltage on the 150-scale of the A.C. Voltmeter (2).



v Insert test probes (TPI) and (TP2) in the two left side ("B" and "P") Oscillator Coil pin jacks (1).

v Place a thermionic rectifier tube, such as the '81 of '80 type, in the UX Tube Testing Socket (22).

vii Close a Power Plant Jack (36), the voltage marking of which corresponds to the filament voltage rating of the tube used.

viii Closing the circuit with the free ends of the test leads will cause the plate current of the tube to be shown on the Milliammeter, indicating continuity of the SUPREME DIAGNOMETER plate circuit with the external circuit under test *This test should not be undertaken on a grounded radio or other grounded apparatus. This precaution is necessary for meter protection where the protective lamp (18) may be in the grounded side of the A. C. supply system.*

ix This hook-up may be used for measuring medium resistances in the manner outlined on pages 35 and 36. When applied to Diagnometers having a letter "N" in the serial number, 200 ohms should be subtracted from the values indicated by the chart.



## HIGH RESISTANCES

For determining continuity through high ohmic resistances in either reactive (inductive and capacitive) or non-reactive circuits, and for the testing of condensers in the manner outlined on pages 34 and 35, but without the use of any battery, the following procedure is recommended:

i Remove any jumpers or test leads which may have been left connected to the instrument, open all jack switches on the panel, and clear the Analyzing Plug (10) from contact with any electrical conductors which may be grounded or connected to the common A.C. supply system.

ii Insert the polarized series scoket adapter (17),

with a 100-watt Mazda lamp (18), in the receptacle on the end of the instrument tray. If any device other than a 100-watt Mazda lamp (18) should ever be used in the series socket adapter (17), the Milliammeter (6) might be harmed.

iii Connect the supply plug (21) to a convenient A.C. supply outlet.

iv Place an '80 tube in the "UX" Tube Testing socket (22).

v When using a Diagnometer having a serial number composed of figures only, or ending with "N" or "N1," insert the grooved rejuvenator plunger to the halfway "aging" position in the "3v." Rejuvenator Jack (15). This will apply a filament potential of about 3.3 volts to the '80 tube. When using a Diagnometer of later series, insert a plain jack plunger in the "High Res.-Continuity" jack (15) for applying a 5-volt filament potential to the type '80 tube.

vi Insert a Jack Plunger in the "A.C. Line Jack" (3). The supply voltage should then be indicated on the A.C. Voltmeter (2).

vii Insert a second Jack Plunger in the "Control Grid-Bias" Jack (32).

viii Connect a jumper between the "Screen Grid" (23) pin jack on the panel and one of the 500,000-ohm pin jacks (I) on the back of the instrument tray.

ix Connect a jumper between the "B" and "P" Oscillator Coil Pin Jacks (1) on the panel.

x Connect a test probe to the unoccupied 500,000 ohm Pin Jack (K) on the back of the instrument tray.

xi Connect a test probe to the common A.C. Pin Jack (L) on the back of instrument tray.

xii While touching the free ends of the test probes together, adjust the 500,000-ohm control knob (Y), located on the back of the instrument tray, for a full-scale needle defection on the D.C. Voltmeter (8). The variable resistance has the effect of increasing the internal resistance of the 10-scale of the D.C. Voltmeter to a value of about 50,000-ohms for accommodating the applied rectified effective potential of about 50 volts.

xiii *This test should not be undertaken on a grounded circuit* The common A.C. pin jack (L) on the back of the instrument tray is connected to one side of the primary winding of





the power transformer during this test, and grounding the test probe connected to this pin jack would probably short circuit the A.C. supply system in localities where one side of the A.C. supply system is grounded.

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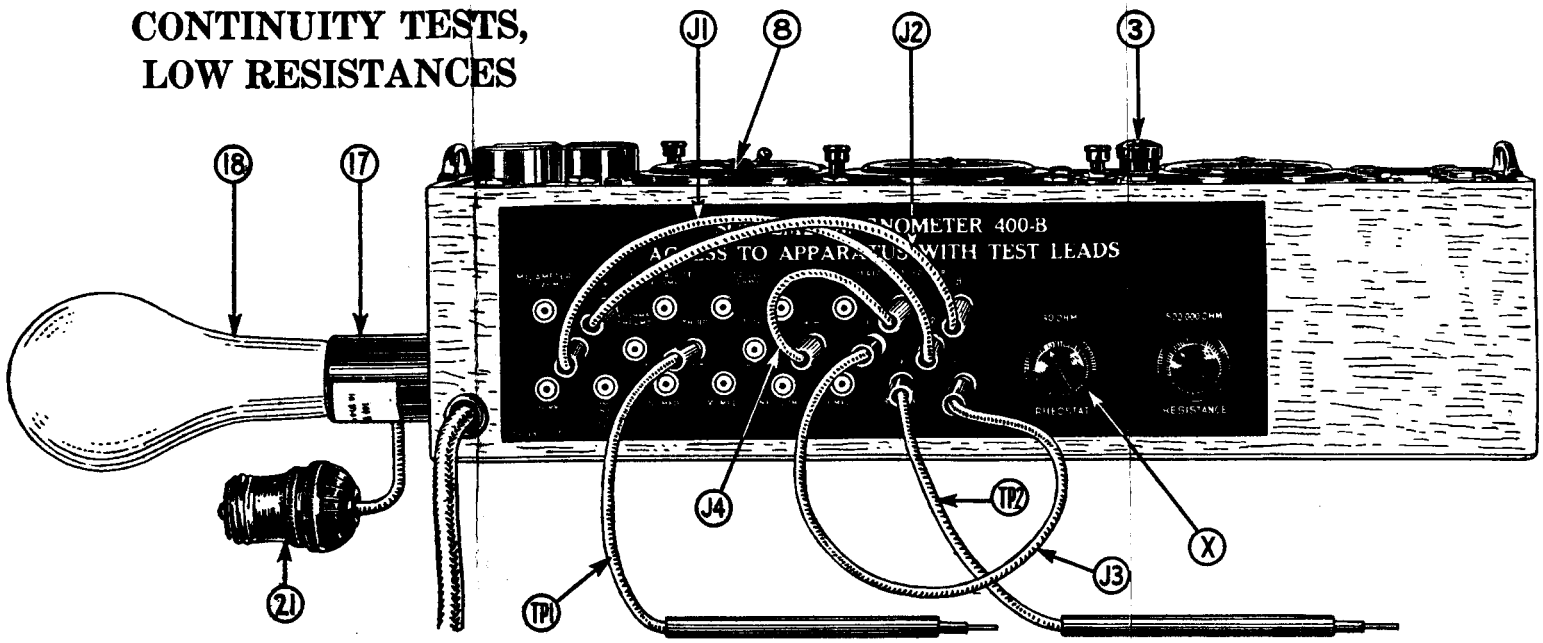
# CONTINUITY TESTS, LOW RESISTANCES




*(The Roman numerals shown in front of each paragraph indicate the progressive procedure in performing the described operations)*

i Remove any jumpers or test leads which may have been left connected to the instrument, open all Jack Switches on the panel, and clear the Analyzer Plug (10) from contact with any electrical conductors which may be grounded or connected to the common A.C. supply system.

ii Insert the polarized series socket adapter (17), with a 100-watt Mazda lamp (18), in the receptacle on the end of the instrument tray. If any device other than a 100-watt Mazda lamp (18) should ever be used in the series socket adapter (17), the Milliammeter (6) might be harmed.

iii Connect the Supply Plug (21) to a convenient A.C. supply outlet.

iv Connect Jumpers (J1), (J2), (J3) and (J4) to the pin jacks as indicated.

v Insert the Jack Plunger in the A.C. Line Jack (3).

vi Connect Test Probes (TP1) and (TP2) to the Pin Jacks as indicated.

vii With test probes touched together, adjust 30-ohm Rheostat Control Knob (X) for full-scale reading on the D.C. Voltmeter (8).

The approximate uncalibrated range of the meter in this resistance test is from 0.1 to 25-ohms, depending on the A.C. supply voltage. It is very useful in locating defective soldered joints, shorted variable condenser plates without disconnecting r. f. coils, and for checking the center tap of filament resistors or for indicating other low resistance values.

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