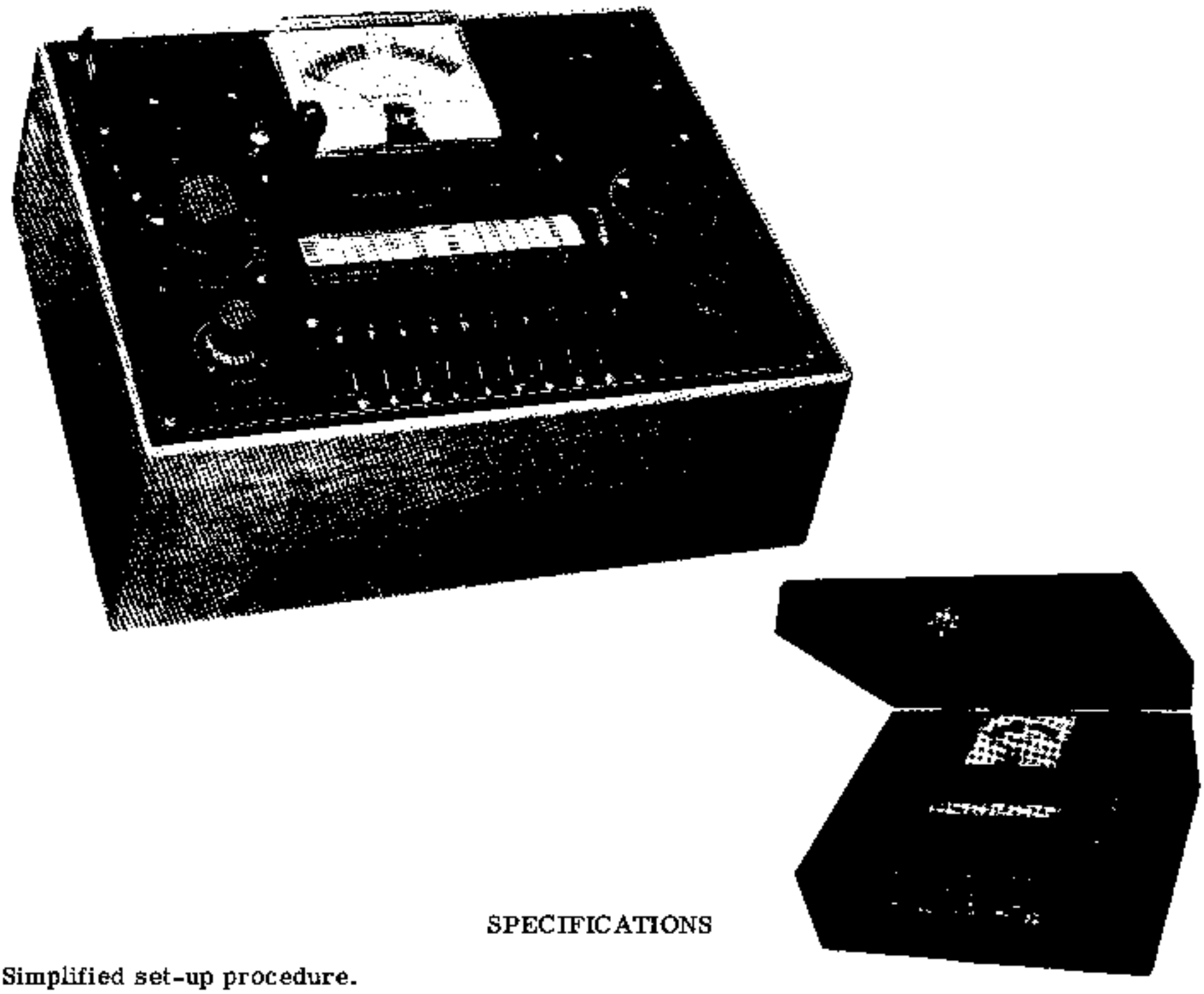
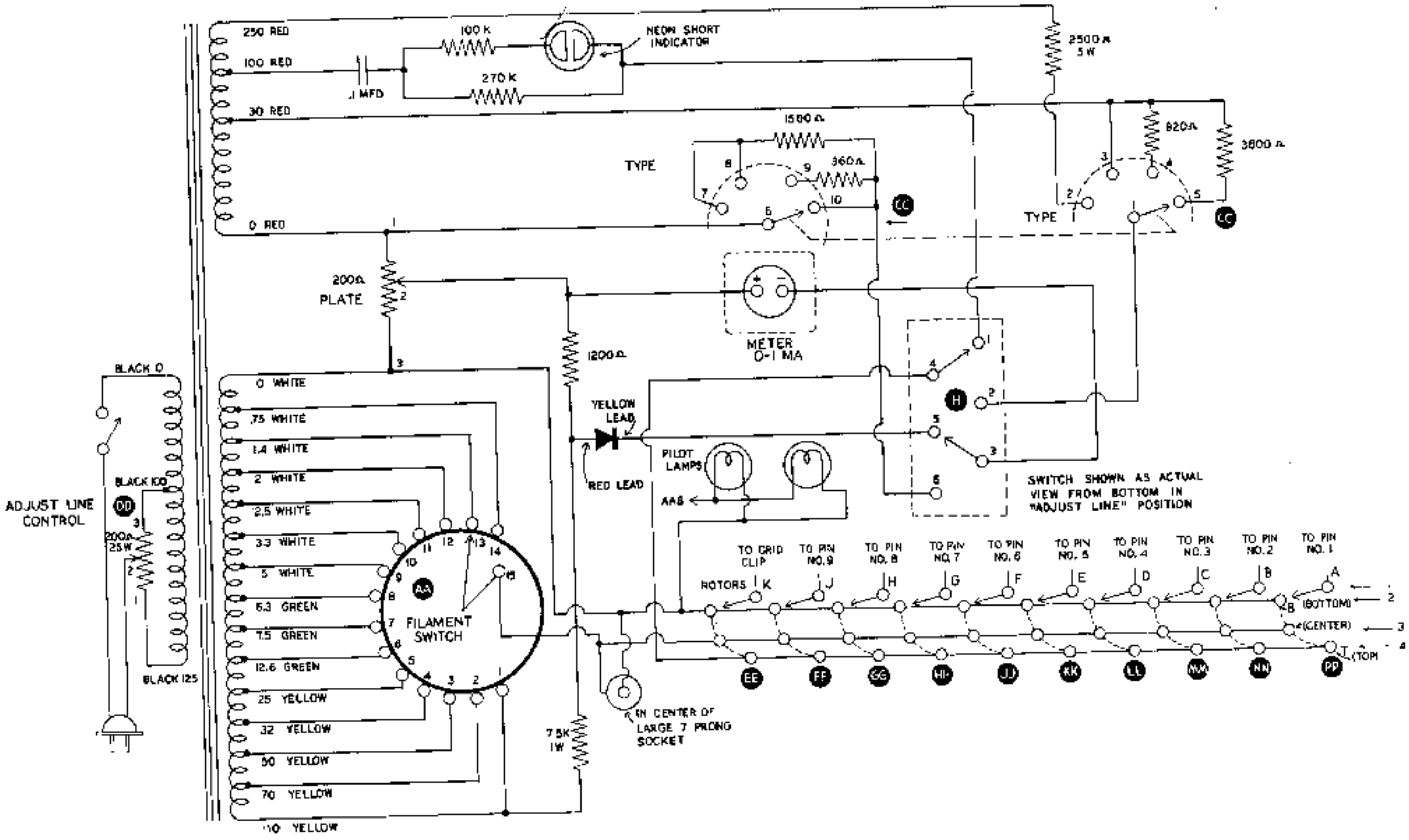
ASSEMBLY AND OPERATION OF THE HEATHKIT TUBE CHECKER

MODEL TC-2



SPECIFICATIONS

Simplified set-up procedure.
Rapid switch selection of individual tube elements.
Any combination of base pin connections.
Check for quality, emission, shorted elements, open elements, and filament continuity.
Checks 4, 5, 6, and 7 pin large, regular and miniature, octal, loctal, Hytron, 9 pin miniature and pilot lamps.
Individual tests on multiple element tubes.
Blank panel socket for obsolescence protection.
Compensation for line voltage variation.
New smooth rolling illuminated roll chart.
Easy to read GOOD-BAD meter scale.
Fourteen Filament voltages - .75 to 117 volts
Element Test Voltages.....0-250 volts
Dimensions.....14" wide x 11" deep x 4 1/4" high
Power Requirements..... 105-125 volts 50/60 cycles AC



SCHEMATIC
HEATHKIT TUBE CHECKER
Model TC-2

INSTRUMENT DESCRIPTION

The Heathkit model TC-2 Tube Checker was expressly designed for checking tubes encountered in everyday radio and TV service work. It is capable of providing an overall quality test, will indicate shorted elements, open elements and filament continuity. It will check 4, 5, 6, and 7 pin, large, regular and miniature, octal, loctal, Hytron, 9 pin miniature series tubes and pilot lamps. Separate tests for the oscillator section of converter tubes have been provided. A blank socket is arranged on the panel to facilitate modification for checking newly added tube types as protection against obsolescence.

The roll chart contains all necessary data for the checking of currently used tubes. Because of the constantly growing list of tubes, it was decided to eliminate tubes classified as seldom-used, or obsolete, in an effort to hold down the physical length of the roll chart. The information for various settings of the tubes in this particulat classification is supplied on a separate sheet. The Heath Company periodically revises the roll chart in order to provide the latest test information. Announcement of new chart availability is usually made in Heathkit Flyer advertising and replacement charts can be obtained for a nominal charge of fifty cents ($0.50).

One secondary winding of the power transformer is tapped for fourteen different filament voltages which range from .75 volts up to 110 volts. Such an arrangement assures placing the proper filament voltages on the hundreds of tubes listed on the chart and the filament switch makes proper connections.

The other secondary winding has voltage taps of 30 volts, 100 volts and 250 volts, and the various tests use these different voltages. Three basic circuits are set up as the tube is checked and these operate in the following manner.

The first basic circuit is used when making the quality and open checks. In these tests, 30 volts AC are placed across the tube between filament and plate and the tube under test conducts as a half-wave rectifier. The filament and cathode are connected together as are the plate and the grids. The PLATE adjust control adjusts the sensitivity of the BAD-GOOD meter, which is in the circuit at this time. The roll chart gives the setting for PLATE adjust control and a good tube with the sensitivity of the meter properly set will have sufficient cathode emission to swing the meter needle to the GOOD position. If the tube emission is too low, the conducting current of the tube will not be high enough to bring the needle into the GOOD section, rather into the ? or BAD section. Thus the cathode emission is checked.

Basically, the open check works as follows. The plate and all grids connected together will receive a certain amount of electrons from the cathode. The meter reading with this flow is noted. Then, to test each element individually for opens, each of the grids is in turn disconnected and if the element is not open, the current through the meter drops and the reading is less than originally noted. If an element is open, it is recognized because the meter reading does not drop when this element is checked. For tubes with quite a number of grids, the operation is somewhat more complex, but the same theory applies in general. For gas tubes, (OZ4, etc.) the 250 volt tap rather than the 30 volt tap is used. The circuitry remains unchanged.

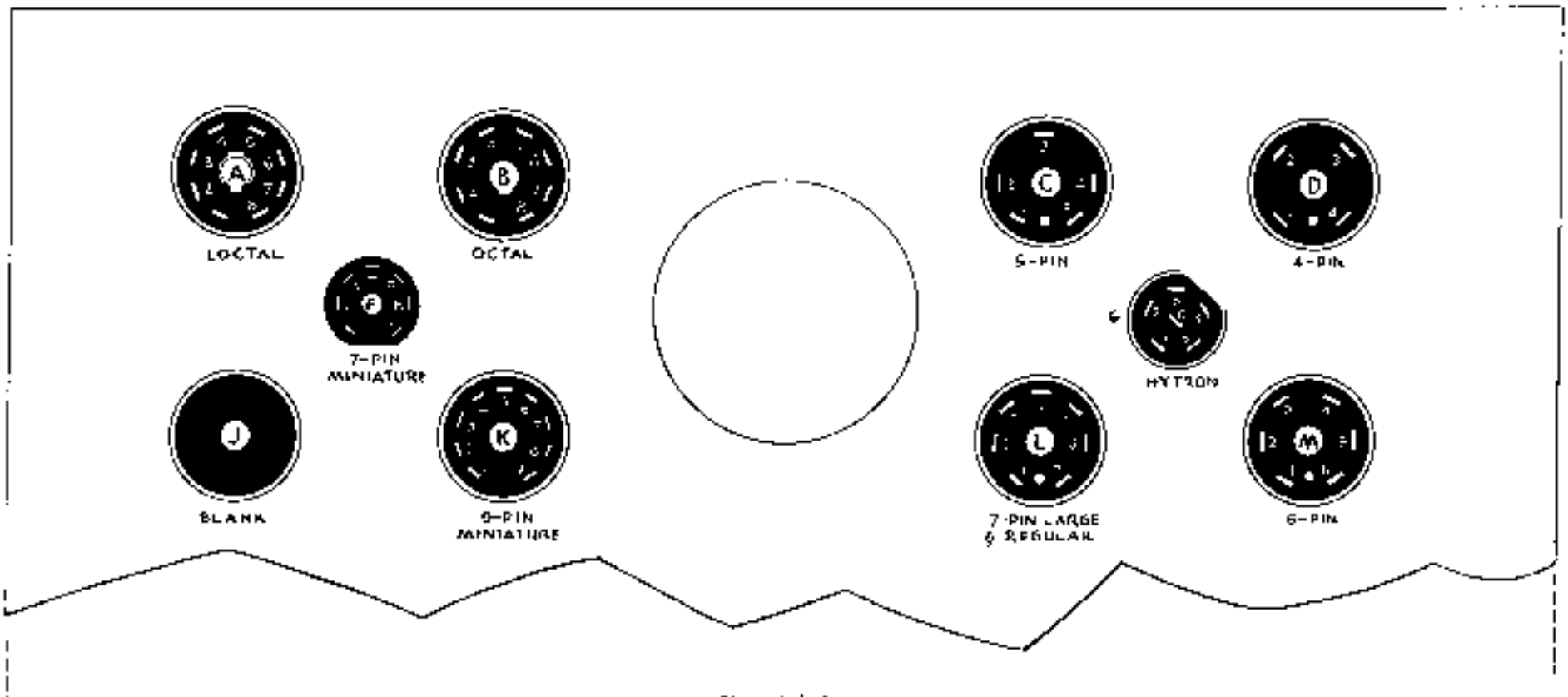
The second basic circuit is used in short and filament continuity test. The 100 volt tap is connected to the neon bulb short indicator and associated network, and is in series with the plate of the tube being tested. The meter is not now in the circuit and the checks are indicated by the neon bulb. Putting the switches in the positions as indicated on the roll chart, connect the various tube elements in such a manner that a shorted element will cause considerable increased current flow through the resistor in parallel with the neon bulb. The voltage drop then produced reaches the operating voltage of the neon bulb, and it glows brightly indicating a short. For the filament tap continuity test, the filament setting is reduced to .75 volts and with continuity the neon bulb will glow.

The third basic circuit is in the SET LINE position. The SET LINE control in the primary of the power transformer, varies the voltage across the primary thereby in turn the secondary voltage. The meter with the voltage divider network and the rectifier now in the circuit will indicate the proper secondary voltage when the needle is set on the SET LINE marking. The purpose of the SET LINE is to assure proper voltages on the tube under test, rather than have false indication as a result of high or low power line voltages.

NOTE: In some sections of the country where AC line supply voltages are somewhat higher than the average, it may be necessary to further compensate for increased voltage by installing a resistor in series with one leg of the transformer primary winding. The exact resistance value required can best be determined experimentally, but it will generally fall between 50 and 100 ohms. Due to the power requirements of the Tube Checker it would be advisable that the resistor have a rating of at least 20 watts and should preferably be of the wire-wound type.

MECHANICAL ASSEMBLY

Study Pictorial 1 very carefully, and note the placement of various parts. This pictorial shows the aluminum panel as viewed from the rear. Throughout this manual, a system of alphabetical



Pictorial 1
Panel Viewed from Rear

designation will be used for each part, and each terminal connection of the part will be assigned a number. Therefore, the first tube socket in the upper left corner, which is a loctal socket, is designated as A, and the eight pins will be identified as A1, A2, A3, etc. Actually marking the panel openings will prove helpful. This same procedure will be used throughout instrument construction. Please note also that some parts such as the lever switches, have been assigned a dual alphabetical designation, such as EE, FF, GG, etc.

This completes instrument construction and the knobs can now be installed on the panel controls. Install the large pointer knobs on the filament switch and the plate control. Index the filament switch knob so that in maximum counterclockwise position it indexes at the .75 volt position, and in maximum clockwise position it indexes at the 100-115 volt position. Install the plate control knob so that at its maximum counterclockwise position it indexes at zero, and in maximum clockwise position it indexes at 100. The SET LINE and TYPE knobs should also be installed in a similar manner. The lever switch buttons should now be installed on the lever switches. Inspection of the switch buttons will show that they must be correctly positioned before being pushed down on the switch arms. Two additional buttons have been supplied with your kit to be used as spares. Retain them for possible future use.

PRELIMINARY TESTS

Plug the line cord into a 117 volt AC 50 to 60 cycle supply source. Never use 25 cycle or DC supply voltage, as the power transformer will suffer severe damage. Turn the panel switch to its ON position. The roll chart panel lamps should immediately light, and the meter pointer will deflect to mid-scale. With the use of the SET LINE control, it should be possible to adjust the meter pointer to the meter line test position. It is normal for the range of adjustment to be on the high side of the meter, rather than toward the low end. This is understandable in view of the fact that when heavy current drain tubes, such as rectifiers drawing 2 and 3 amperes on the filament, are being tested, the reading will drop somewhat and it will be necessary for the SET LINE control to be readjusted to the line test position.

If the neon short lamp lights up during any of these preliminary tests, turn the Tube Checker off immediately and systematically trouble-shoot the circuit for possible cause of difficulty. The short test should not indicate any glow during the preliminary test procedure if the instrument is correctly wired. Should difficulty be encountered, a voltage check of the power transformer would be helpful. Use an AC voltmeter and refer to the schematic for the proper voltages that would normally be obtained at the various windings.

If preliminary tests indicate that the Tube Checker is functioning, the action of the checker can be further tested by making actual tests on a variety of tubes that may be available.

CABINET INSTALLATION

The Tube Checker can now be installed in the cabinet or carrying case. When the panel is in place, you will note that there has been a slight space provided between the cabinet wall and the edge of the panel to accomodate any small variations that may occur. After properly centering the panel, small holes should be drilled in the wood corner supports, so that the panel mounting screws can be installed. If a drill is not available, a starting hole can usually be made with a small, sharp screwdriver or a small awl.

USING THE HEATHKIT TC-2 TUBE CHECKER

The Heathkit Tube Checker will provide a number of varied tests and these are outlined in the steps below. The following steps should always be used as a guide in setting up tube testing procedure.

(1) With power cord connected, move roll chart to listing of the tube to be tested, and turn SET LINE control until meter pointer is at LINE TEST point.

(2) Set the TYPE switch to the number shown on the chart.

(3) Set the FILAMENT selector to the voltage shown.

(4) Set the PLATE control according to chart information.

(5) Set LEVER switches to TOP and BOTTOM positions as shown in top and bottom columns in chart.

(6) Insert tube and re-set the SET LINE control if necessary.

(7) Check tube for short by moving levers shown in light type through the two positions returning to the positions shown on chart. A shorted tube is indicated by a steady glow of the neon bulb. Disregard neon bulb flashing as lever switches are moved. It is possible that some serious short circuits, such as plate to filament, will momentarily overload the power transformer. This condition will be indicated by complete dim out of the panel lamps. Do not allow the Tube Checker to operate under this extreme condition for any length of time. Make the test as quickly as possible in order to obtain the desired information.

(8) Check tube for quality test by moving the test slide switch to TEST position after allowing sufficient time for the tube to reach operating temperature. If the meter pointer falls in the GREEN scale, the quality of the tube is GOOD.

TO TEST FOR OPEN ELEMENTS, PROCEED AS FOLLOWS:

(1) Holding slide switch in TEST position, move each lever in the TOP position (only those in light type) to the BOTTOM position and return. Satisfactory tube elements (those properly connected to their pins) are indicated by a change in meter reading. The grid element usually shows a large change, while a screen or plate show only a slight change.

NOTE: If the meter indication in the quality test (step 8) is off scale, reduce the meter reading to an on-scale reading by turning the PLATE control, then proceed with the open element test.

TO CHECK FILAMENTS, FILAMENT TAPS, INTERNAL CONNECTIONS FOR CONTINUITY:

Set FILAMENT selector switch to .75. Move each lever shown in dark type through each of its other two positions. Always move only one lever at a time. Satisfactory filaments, taps and internal connections will be shown by a bright glow of the SHORT test indicator.

MULTIPLE TUBE TYPES:

Tubes which contain several sets of elements are indicated on the chart by a bracket set of listings, one for each test to be made on the tube. The tester is set up according to the tests in each line and checked through all of the tests as outlined above.

PILOT LIGHTS:

Check pilot lights by setting the FILAMENT selector switch to the proper voltage and inserting the pilot light in the socket found in the center of the seven pin socket. This is a universal contact-type pilot light test socket and does not require that the lamp be permanently inserted. It is merely necessary to hold the pilot lamp so that the side wall of the base and the center pin of the lamp make contact with the corresponding points in the lamp socket.

NEW TUBES:

The Heath Company periodically revises the Tube Checker roll chart in order to keep abreast of new tube releases. However, because of the great quantity of new tubes being released by manufacturers, a customer will occasionally desire to check a new tube before the test data appears on the roll chart. The instructions below will tell exactly how to set up the instrument for obtaining temporary settings so that these new tubes may be checked provided manufacturer's data is available.

(a) Note manufacturer's data carefully concerning the base diagram of the pin connections and filament voltage.

(b) Set the Tube Checker TYPE switch as follows:

Type 1 - for low cathode current tubes (below 4 ma) usually diode type tubes.

Type 2 - for cathode current tubes between 3 ma and 15 ma. These are usually filament type tubes with the exception of diodes.
Type 3 - for cathode current type tubes greater than 8 ma. These are usually indirectly heated cathode types with the exception of diodes.
Type 4 - for gas control tubes, gaseous rectifiers, and eye or target tubes.

(c) Set filament voltage to values specified by manufacturer.

(d) Set all levers to the center position.

(e) Determine the first filament connection from the tube base diagram and leave its connection lever in the center position. Its connection lever can be found as follows: Lever A corresponds to pin 1. Lever B to pin 2. Lever C to pin 3, etc.

(f) Determine the second filament connection from the tube base diagram and set its connection lever to the B (bottom) position.

(g) Determine from base diagram if tube has a filament tap, and if so, set connection lever corresponding to tap to the B (bottom) position. Also determine from base diagram if tube has panel lamp.

(h) If the tube has more than one section (duo diodes, duo triodes, etc.) make a separate test for each section. For the section being tested follow instructions below. For the section not being tested, move all corresponding connection levers to the B (bottom) position. If tube has only one section, follow instructions below.

(i) Move the connection lever corresponding to the cathode to the B (bottom) position.

(j) Move all other elements of the section being tested (screens, supressors, grids, plate, etc.) to the T, top position.

(k) Plug tube into correct socket.

(l) Plug instrument into 105-125 volt, 50-60 cycle outlet and turn power on.

(m) Adjust SET LINE control so that the meter indicates line test.

(n) Hold the adjust line short-test switch in the test position and adjust plate voltage control to bring the pointer to the middle of the good scale. (If possible, make this adjustment for at least three new tubes and select the average setting.)

(o) List all these settings in the manual.

(p) If the tube is of the multi-section type check the remaining sections in the manner outlined above and list the settings in the manual.

SPECIAL SOCKET:

The Heath Company can supply a special acorn socket which can be installed in the blank socket panel position. The acorn socket is available from the Heath Company for a nominal charge of $0.75, including installation and wiring instructions. It will be necessary to enlarge the blank socket panel opening slightly by using a file, and to drill two mounting holes for the acorn socket. In testing tubes of more than one top contact, a small grid clip lead can be made with a phone tip on the other end which can be inserted in a vacant socket contact and connected into the tester with the proper lever switch.