ASSEMBLING AND USING YOUR

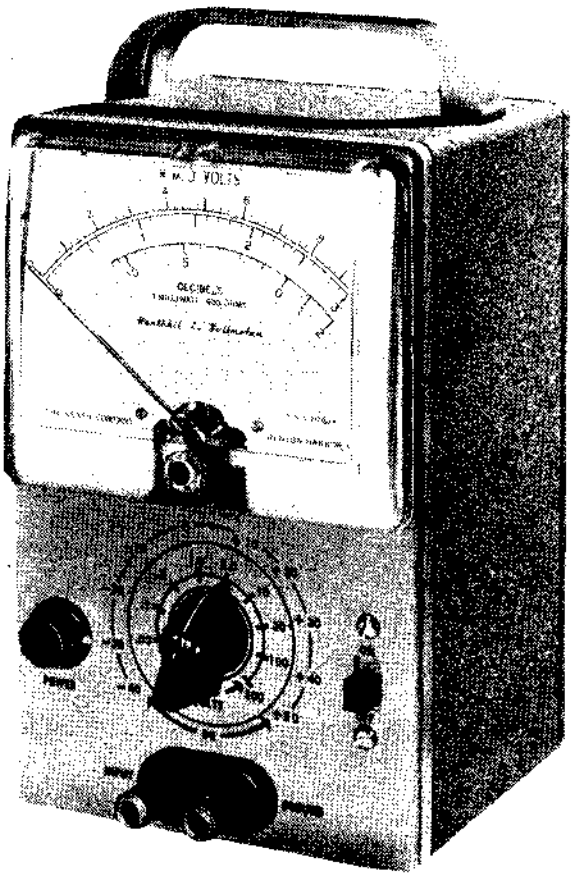
Heathkit

A. C. Voltmeter
Model AV-1

THE HEATH COMPANY
BENTON HARBOR, MICH.

PRICE $1.00

HEATHKIT
MODEL AV-1
A. C. VOLTMETER

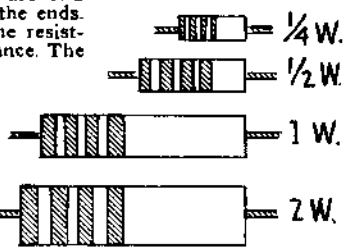


Technical Specifications

Power Requirement:	105-125V AC, 50-60 cycles, 10 Watts
Tube Complement:	1 - 6AU6 1 - 6AT6
Input Impedance:	1 Megohm at 1 KC
Ranges:	.01, .03, .1, .3, 1, 3, 10, 30, 100, 300 V RMS
Decibels:	Total range -52 to +52 db, scale -12 to +2 db. (1 MW - 600 ohm) ten switch selected ranges from -40 to +50 db.
Physical Specifications:	7-3/8" high x 4-11/16" wide x 4-1/8" deep
Net Weight $3\frac{1}{2}$ lbs.	Shipping Weight 5 lbs.

USEFUL INFORMATION FOR KIT BUILDERS

Resistors are identified by a color code used in several bands around the resistors. There are two general types of resistors. One, the uninsulated type, has the connecting wires bound around the ends. The other, the insulated type, has the wire connected internally and coming out the ends. The resistance code uses three bands or colors, while a fourth, usually silver or gold, indicates the tolerance. The colors are arranged so that the first two indicate the first two figures of the resistance, while the third indicates the number of digits (zeros or multiplier) which follow the first two figures On uninsulated resistors, the body is the first figure, the end color the second figure, and the dot the number of digits. On insulated resistors, the band nearest the end is the first figure, the next band is the second figure and the third band the number of digits.



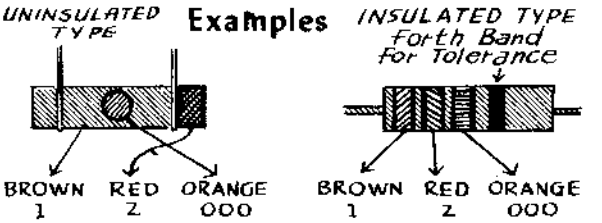
WATTAGE SIZES

WATTAGE. Resistors are rated as to wattage (power dissipation) according to size. The chart shows approximate sizes which vary with manufacturers. To determine wattage size necessary multiply current through resistor in amperes by voltage drop across resistors in volts. Example — A plate loading resistor for a tube drawing 10 milliamperes (.01 Amperes) has a voltage on one side of 300 volts and on the other side 200 volts, giving a drop of 100 volts. Therefore 100 volts × .01A. = 1 Watt.

A higher wattage resistor can always be substituted for smaller size.

Uninsulated Insulated Color	Body Color First Ring First Figure	End Color Second Ring Second Figure	Dot Color Third Ring Number of Digits
Black	0	0	None
Brown	1	1	0
Red	2	2	00
Orange	3	3	,000
Yellow	4	4	0,000
Green	5	5	00,000
Blue	6	6	000,000
Violet	7	7	0,000,000
Grey	8	8	00,000,000
White	9	9	000,000,000

Examples



Some Popular Sizes of Resistors

RESISTANCE IN OHMS	BODY OR FIRST BAND	END OR SECOND BAND	DOT OR THIRD BAND
50	Green	Black	Black
250	Red	Green	Brown
1500	Brown	Green	Red
30,000	Orange	Black	Orange
220,000	Red	Red	Yellow
1 Megohm	Brown	Black	Green

The fourth ring or other end may be silver (10% tolerance) or gold (5% tolerance) or it may be omitted entirely which indicates 20% tolerance.

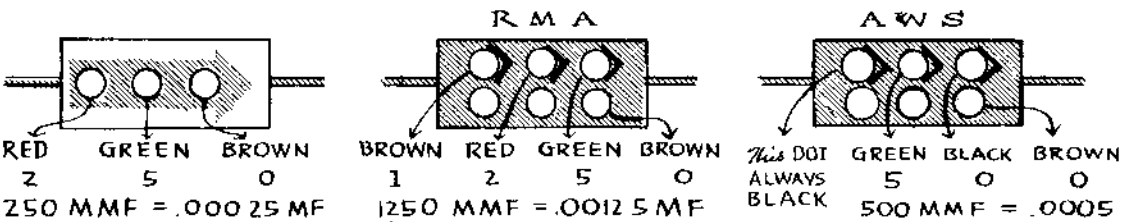
Condenser Code

Condensers use the same code as resistors and are read in micromicrofarads.

If there is one row of dots, they are read in direction of arrow or if manufacturer's name appears in the same direction as name. If two rows of dots appear, it can either be of two different codes: The RMA or the AWS (American War Standard). In the RMA, the top row of dots are the first three figures (carried to three figures), the bottom row are left to right the voltage rating, tolerance, and decimal multiplier.

In the AWS code, the top row of dots are the first three figures while the bottom row are, left to right, characteristic, tolerance, and decimal multiplier.

Examples



Some Commonly Used Sizes of Condensers

MMF.	MF.	FIRST DOT	SECOND DOT	THIRD DOT
10	.00001	Brown	Black	Black
50	.00005	Green	Black	Black
100	.0001	Brown	Black	Brown
250	.00025	Red	Green	Brown
500	.0005	Green	Black	Brown
1000	.001	Brown	Black	Red
3000	.003	Orange	Black	Red
10,000	.01	Brown	Black	Orange

The tolerance rating corresponds to the color code, i.e., red — 2%, green — 5%, etc.

The voltage rating corresponds to the code multiplied by 100. Example: Orange dot — 300 volt rating; Blue — 600 volt rating.

Nov. 20, 1951

ASSEMBLY AND USE OF THE HEATHKIT
MODEL AV-1
A. C. VOLTMETER

PRELIMINARY NOTES AND INSTRUCTIONS:

Your Heathkit A.C. voltmeter is an excellent instrument and care used in its construction will be well repaid. Construction is open and easily accomplished, but it should not be rushed, as poor workmanship can easily result in poor operation.

UNPACK THE KIT CAREFULLY AND CHECK EACH PART AGAINST THE PARTS LIST.

In so doing, you will become acquainted with the parts. If a shortage is found, attach the inspection slip to your claim, and notify us promptly. Screws, nuts, and washers are counted mechanically, and if a few are missing, please secure them locally. Use the charts on the inside covers of this manual to identify the parts.

Read the manual completely through before starting actual construction; in this way, you will become familiar with the general procedure used. The model AV-I is a more advanced type kit. Its construction should not be undertaken by those inexperienced in the construction and operation of laboratory equipment. Because this kit is not intended for the novice, the very detailed "step-by-step construction" found in most Heathkit manuals has been omitted. In its place there has been added a section entitled "Notes on Construction." This more generalized construction procedure will be less tedious and much more interesting for the more experienced builder. When actually assembling, read each article completely through so that no suggestion will be missed.

Read the note on soldering on the inside of the back cover. Make a good mechanical joint of each connection with clean metal to clean metal. Use only good quality rosin core radio type solder. Pastes and acids are difficult to remove and minute amounts left combine with moisture from the air forming a corrosive product. Weeks or months later corrosion may result in untimely failure.

NOTE: ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE INSTRUMENTS IN WHICH ACID CORE SOLDER OR PASTES HAVE BEEN USED. (When in doubt about solder, it is recommended that a new roll plainly marked "Rosin Core Radio Solder" be purchased.)

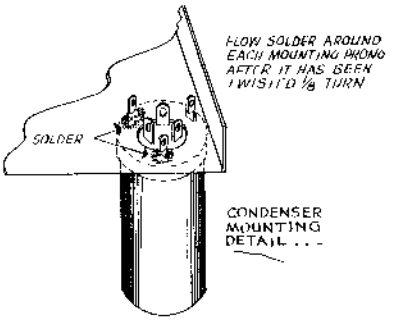
Small changes in parts may be made by the Heath Company. Any part supplied will work just as well as the part for which it was substituted. By reading the color code on resistors for instance, it will he readily understood that a value of 5100 ohms is a substitute for the specified 4700 ohms, provided the specified value is not supplied. Such changes will only be made if the specified parts are unobtainable at the time, and are made to insure a minimum delay in filling your order.

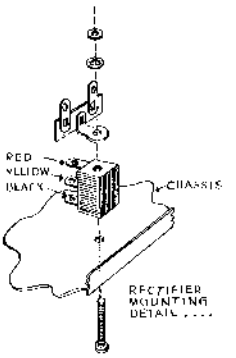
Resistors and controls have a tolerance rating of plus or minus 20% unless otherwise stated. Therefore, a 100K ohm resistor may test between 80K and 120K ohms. The letter K stands for 1,000 and M for 1,000,000. Thus a resistor marked 90K is 90,000 ohms etc. Some manufacturers use M for 1,000. Consulting the parts list will clarify any parts in question. Frequently condensers show even greater variations such as minus 50% to plus 100%. This Heathkit is designed to accommodate such variations.

Notes on Construction

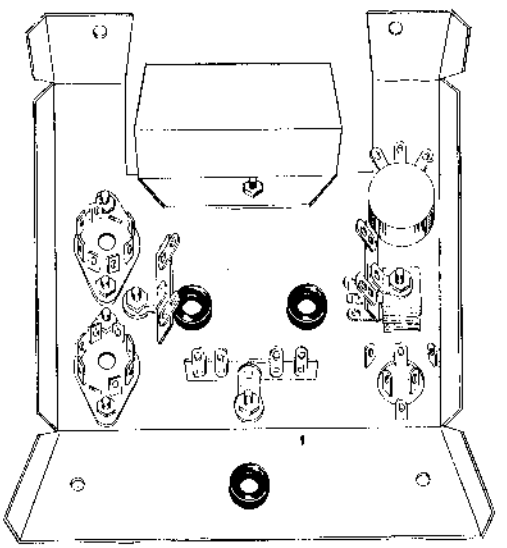
Many tests were run to determine the best chassis layout before the final instrument was approved. We therefore strongly recommend that the photoprint and pictorials be followed exactly when building the kit. Any deviations from the actual model may produce unwarranted inaccuracies in the completed instrument.

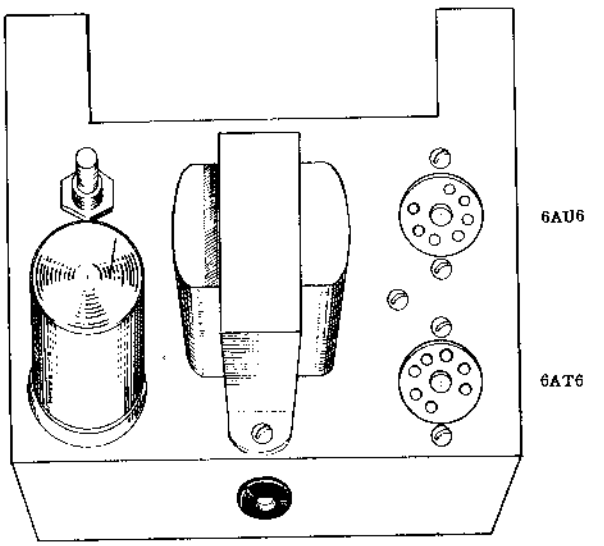
To begin construction, mount the tube sockets, control, large metal condenser, rubber grommets, the two lug terminal strips, and selenium rectifier on the chassis. Refer to pictorial for exact position of each part and especially note the detailed mounting of the rectifier and large condenser. Use Lockwashers where needed.





Next mount the transformer, adding the meter shield and 4 lug terminal strip under the proper nuts before tightening down the transformer. Follow the pictorial for the location of these parts and to get the correct transformer leads through each hole.



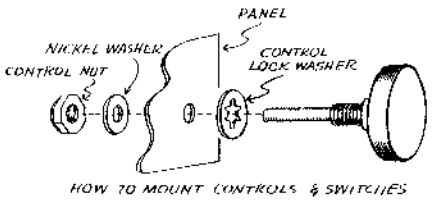


Wiring of the chassis may now be completed according to the pictorial wiring diagram. Leave all leads which go from chassis to panel sufficiently long. Utilizing the chassis wiring photoprint will help in getting the parts in their exact places. Many parts are supplied by the manufacturer with leads far too long for a compact instrument such as this. These leads should be cut to proper length as the parts are wired into place. Not only will this produce a neater looking instrument, but in highly sensitive circuits, long leads may cause erratic operation. Proper polarity must be observed on such items as electrolytic condensers, selenium rectifiers, and crystal diodes.

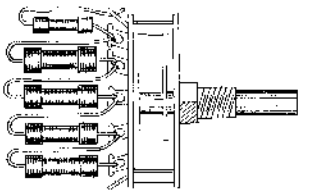
Having completed the chassis wiring, the next step is the mounting of the precision resistors on the range selector switch. Follow the switch detail very carefully.

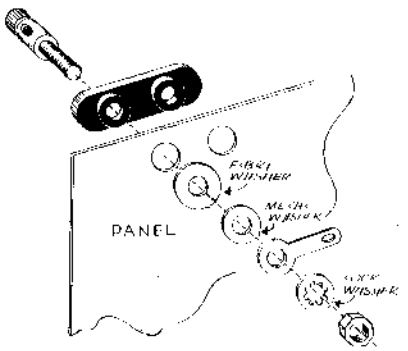
The completed switch may now be mounted on the panel along with the other parts except the meter. Note panel pictorial and details. Here again use lockwashers and panel washers where needed.

Now the meter and panel can be attached to the chassis. Slide the meter through the panel. Next, place the chassis in position with the chassis mounting flanges over the two lower meter mounting studs. Tighten down with lockwashers and nuts supplied with the meter.

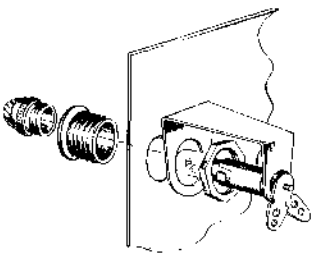


HOW TO MOUNT CONTROLS & SWITCHES


MOUNT RESISTORS AS SHOWN



TERMINAL ASSEMBLY DETAIL


PILOT LIGHT ASSEMBLY

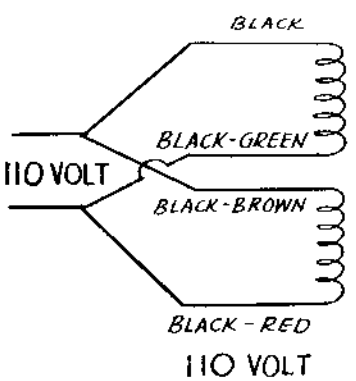
The remaining wires should now be cut to length and soldered in place. This completes the wiring.

A careful check of all wiring and solder connections is now in order. Tracing each lead on the pictorial in colored pencil as it is checked may prevent overlooking some wiring.

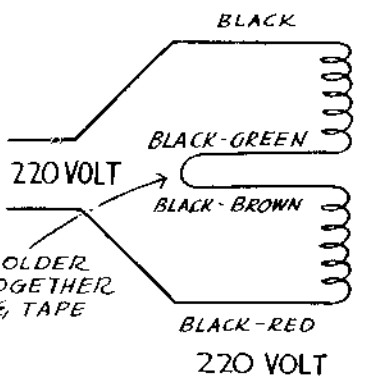
IMPORTANT WARNING

Miniature tubes can be easily damaged when plugging them into their sockets. This is especially true if small quantities of solder have been allowed to lodge in the socket pin holes. Therefore, use extreme care when installing these tubes. WE DO NOT GUARANTEE OR REPLACE MINIATURE TUBES BROKEN DURING INSTALLATION.

After the wiring has been checked, the tubes can be placed in their respective sockets and the instrument is ready for testing and calibration.



110 VOLT



220 VOLT

WIRING OF EXPORT TYPE 110/220 VOLT POWER TRANSFORMERS

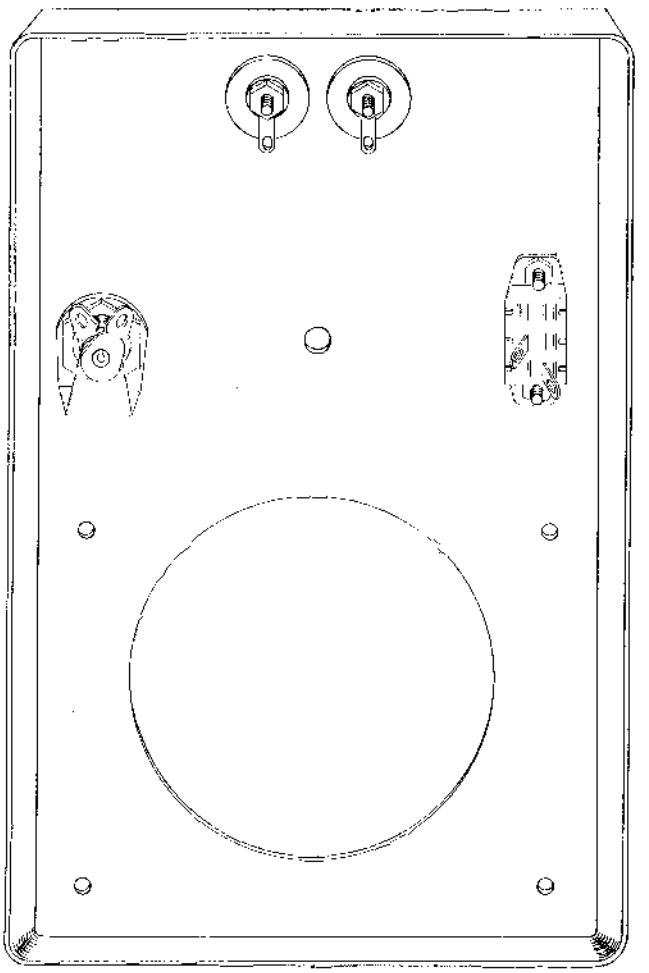
These transformers have a dual primary for use on either 110 Volts or 220 Volts. Wire as shown.

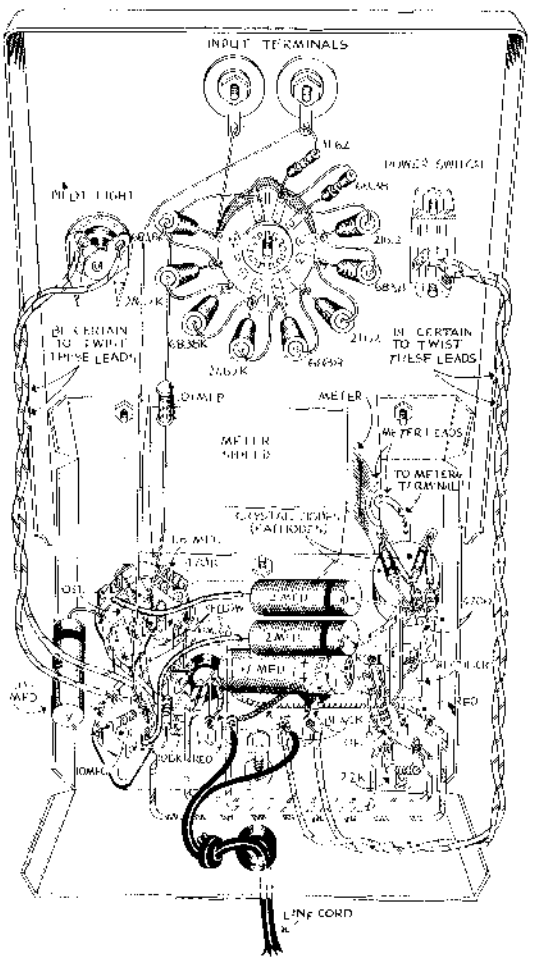
TEST AND CALIBRATION

With the instrument turned off, make sure the mechanical zero of the meter is correct. If not, adjust as follows: Place instrument in normal operating position. (i.e. such as it would be, if set on a level surface when mounted in its cabinet.) Turn the black plastic screw on the meter face with a screwdriver, while gently tapping the meter face with one finger, until the pointer coincides with the zero line on the left side of the scale.

Plug into a 117 volt 50/60 cycle AC outlet. SERIOUS DAMAGE will result if an attempt is made to operate this instrument on DC.

Upon turning on the switch, the pointer should move about slightly. Allow the unit a minute or so to warm up. With the meter range switch set to the 300 volt range, connect the input terminals to the 117V AC line. Adjust the calibration control until the meter reads 117V on the 300V range. Power companies maintain line voltages within approximately 5%. This is sufficiently accurate for most uses.





If any difficulty is experienced when attempting to calibrate the instrument, the power should be disconnected and the steps outlined under "In Case of Difficulty" should be followed.

When a standard AC voltmeter is available, a more accurate calibration may be made. If possible, make adjustments nearer full scale, such as 90V on the 100V range or 250V on the 300V range.

After calibration, install the instrument in the cabinet with two sheet metal screws through the back panel and into the chassis. This completes the instrument.
NOTE: When comparing this instrument with another instrument, consider that the instruments may deviate in opposite directions. Thus two instruments, botb accurate to 2%, may show a difference in reading of 4%. Critical comparison should be made only against an accurate laboratory standard AC voltmeter.

In Case of Difficulty

1. Recheck the wiring. Most cases of trouble result from wrong or reversed connections. (Often having a friend check the wiring will reveal a mistake consistently overlooked.)
2. Check the tubes.
3. If the pointer does not move, check calibration control. If this control is turned to one extreme, the meter will not indicate when a voltage is applied to the input terminals.
4. If the pointer swings to full scale on all ranges, the instrument may be oscillating. Redress of wiring should correct this.
5. Check continuity through the test leads.
6. Compare operating voltages with the table below. If a wide deviation is found, the transformer and filter circuits should be rechecked. Test for possible component failure.
7. If the meter reads downscale, the crystal diodes have been reversed. Correct by interchanging the meter connections or reversing the diodes.

Voltage Comparison Chart

Measurements shown in the chart were made with an 11 megohm input VTVM. Each voltage reading was made with respect to the chassis.

PIN	6AU6	6AT6	RECTIFIER LUG COLOR	RECTIFIER VOLTAGE
1	0 to - 1 V DC	0 to - 1 V DC	Black	0
2	0	0	Brown	140 to 165V DC
3	0	5 to 6 V AC	Red	280 to 320V DC
4	5 to 6 V AC	0		
5	90 to 120 V DC	0		
6	30 to 50 V DC	0		
7	0	110 to 135 V DC		

Using the Instrument

Reading Voltages

The Model AV-1 has 10 separate voltage ranges allowing measurements up to 300 volts RMS. Frequency response is $\pm$ 1 db from 10 CPS to 50 KC.

The markings on the range switch refer to Full Scale readings.

When the instrument is set to the lower ranges the meter will show a residual indication. This is caused by the extreme sensitivity of the circuit. To check for zero indication, the input terminals should be shorted together. This residual indication has no effect on the accuracy of these ranges when readings are made across low impedance circuits.

Residual indication can be reduced by connecting the grounded input terminal to a good outside ground. Also some reduction may be noted by setting the range switch to the lowest range and reversing the line plug in it's receptacle, noting which way gives the lower residual indication.

The meter scale is marked 0-3 and 0-10 for voltage measurements. When making measurements on the .03, .3, 3, 30 or 300 volt ranges, read the 0-3 meter scale and adjust the decimal for the correct voltage.

Example—
Using the .03 range, the meter reads (2.). For correct voltage, move the decimal two places to the left, (.02) volts.

When making measurements on the .01, .1, 1, 10, or 100 volt ranges, read the 0-10 meter range and adjust the decimal for the correct voltage.

Example—
Using the .1 volt range the meter reads (6.4). For correct voltage move the decimal two places to the left, or (.064) volts.

Due to the high sensitivity of the instrument, the input terminals should not be touched when the meter is set for the lower ranges. Stray electric fields, picked up by the human body will deflect the pointer beyond full scale. Repeated banging may bend the pointer.

Although the pointer may bend by overloading, the electronic circuit is self limiting. Because of this self limiting the maximum current through the meter movement under extreme overload conditions is yet within the safety factor of the meter coil windings. Although the meter may not burn out from severe overloading, other circuit components can be damaged by prolonged overloads.

Using the Decibel Scale

Because the human ear does not respond to the volume of sound in proportion to the signal strength, a unit of measure called the "Bel" was adopted. The "Bel" is more nearly equivalent to human ratios. Normally the reading is given in 1/10 of a "Bel" or "decibel."

Different signal levels are adopted by various manufacturers as standard or "0" decibels. The trend within the last few years has been toward the use of 1 milliwatt into a 600 ohm load as "0" db. This reference has been given a special designation of "dbm." This Heathkit is calibrated to read in "dbm" when connected across a 600 ohm load.

When using the AV-1 for db measurements, adjust the range switch until there is a reading on the decibel scale. The meter reading is then either added to or subtracted from the range indication.

Example—
Range +20 db, meter indicates -5 db, actual value is +15 db.
Range -10 db, meter indicates -4 db, actual value is -14 db.

As the decibel is a power ratio or voltage ratio, it may be used as such without specifying the reference level. Thus for instance, a fidelity curve may be run on an amplifier by feeding in a signal of variable frequency but constant amplitude. At a reference frequency of say 400 cycles, make an initial reading on the AC voltmeter, connected to the output. Note, a suitable load, such as a speaker should be connected to the amplifier during the test. As the input frequency is varied, amplitude held constant, the output level variation may be noted directly in db above and below the specified reference level.

When making comparative measurements, the circuit impedances must be considered. Such is the case when measuring overall gain through an amplifier. If the input impedance is the same as the output impedance, the db gain can be measured directly with the AV-1. In the case where the input and output impedance differ, it is necessary to correct each reading mathematically to a common reference level.

Complex Wave Forms

This instrument, like most AC voltmeters, is calibrated to read the Root Mean Square (RMS) value of a pure sine wave. This is 70.7% of the peak voltage.

As characteristic of most rectifier type instruments, the meter deflection is proportional to the average value of the input wave form. Thus when measuring odd shaped waves (square, saw-tooth, pulse) the meter reading must be given special interpretation. Special reading on this subject will be found in the bibliography.

Circuit Description

The basic circuit consists of two stages of amplification feeding a modified bridge circuit. The meter-bridge circuit returns to the cathode of the voltage amplifier to provide negative feedback.

The AC voltage to be measured is applied across a one megohm voltage divider. This voltage divider provides ten separate meter ranges. The precision resistors used here make it possible for one calibration to serve all ten ranges. Part of the voltage developed across the divider is applied to the grid of the first amplifier stage.

The first stage of amplification uses a hi-gain pentode as a voltage amplifier. The next stage utilizes a hi-mu triode as a current amplifier to feed the meter circuit. Within the modified bridge circuit, the two crystal diodes rectify the output current, providing a unidirectional current flow through the meter movement.

For calibration purposes the meter is placed in parallel with a portion of the calibration control connected to the DC terminals of the bridge. This one calibrating resistance serves for all meter ranges. Once adjusted, the meter deflection is proportional to the voltage across the input terminals.

The feedback loop provides the necessary stability and frequency response. This uses the bridge current to develop negative feedback in the cathode circuit of the voltage amplifier. Extra shielding is provided around the meter to prevent unwanted feedback from the meter to the input circuit.

The power supply is transformer operated. It utilizes a dual selenium rectifier in a half-wave voltage doubler circuit. Two sections of resistance-capacitance filtering are used to provide an adequate hi-voltage supply.

Accuracy

The accuracy of the meter movement is within 2% of full scale. The precision resistors used in the voltage divider are held to within 1%. Some slight error may be introduced by the circuit itself. Final accuracy of the instrument should be within 5% of full scale at the calibrating frequency.

The frequency response of the instrument is $\pm$ 1 db from 10 CPS to 50 KC.

In actual practice, inaccuracies do not usually fall in the same direction, consequently some tend to cancel out others. Therefore, it should be expected that the accuracy of the AV-1 will fall well within 5% of full scale.

Bibliography

Added information on the construction and use of A.C. Voltmeters will be found in many radio magazines. Particular reference is made to:

Vacuum Tube Voltmeters, 2nd Edition . . . . . by J. F. Rider

An Electronic A.C. Voltmeter. . . . . by L. Fleming
Radio & Television News, Feb. 1951

A Vacuum Tube Voltmeter for Audio Frequencies . . . . . by H. C. Likel
Electronics, December 1940

Vacuum Tube Voltmeter Using Feedback . . . . . by S. Ballantine
Electronics, September 1938

Use of Decibels

Practical Sound Engineering. . . . . by H. M. Tremaine
Radio & Television News, May 1951

Service

If continued operation difficulties of the completed instrument are experienced, may we remind you that the Heath Company has provided a technical consultation service. Every effort will be made to assist you through correspondence. We emphasize that in all correspondence this instrument should be referred to as the Model AV-1 A.C. Voltmeter.

The facilities of the Heath Company Service Department are also available. Your instrument may be returned for inspection, repair, and calibration for a service charge of $3.00 plus the cost of any additional material that may be required. This service policy applies only to completed instruments constructed in accordance with the instructions as stated in the manual. Instruments that are not completed or instruments that are modified will not be accepted for repair. Instruments showing evidence of acid core solder or paste fluxes will be returned not repaired.

The Heath Company is willing to offer its utmost cooperation to assist you in obtaining proper operation of your instrument. The repair service is available until one year from the date of purchase.

NOTE: Before returning this unit, be sure all parts are securely mounted. Attach a tag to the instrument giving name, address and trouble experienced. Pack in a rugged container, preferably wood, using at least three inches of shredded newspaper or excelsior on all sides. Do not ship in original carton only as this carton is not considered adequate for safe shipment of the completed instrument. Ship by prepaid express, if possible. Return shipment will be made by express collect. Note that a carrier cannot be held liable for damage in transit if packing, in his opinion, is insufficient.

Prices are subject to change without notice. The Heath Company reserves the right to change the design without incurring liability for equipment previously supplied.

Warranty

The Heath Company limits its warranty on any parts supplied with any Heathkit (except tubes, meters, and rectifiers, where the original manufacturer's guarantee only applies) to the replacement within three (3) months of said part which, when returned with prior permission, postpaid, was, in the judgment of the Heath Company, defective at the time of sale.

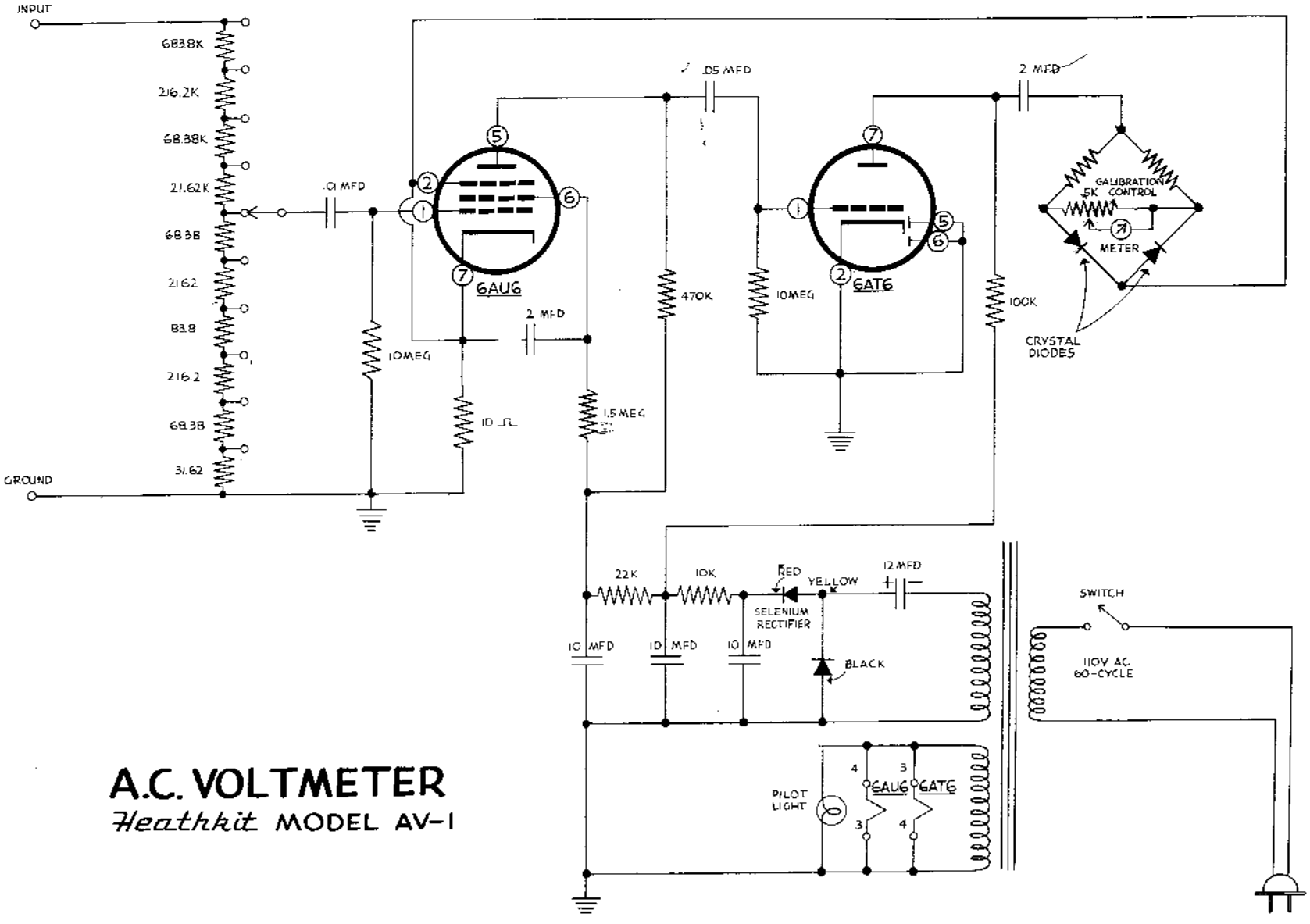
The assembler is urged to follow the instructions exactly as provided. The Heath Company assumes no responsibility nor liability for any damages or injuries sustained in the assembly of the device or in the operation of the completed instrument.

HEATH COMPANY
Benton Harbor, Michigan

AV-1 PARTS LIST

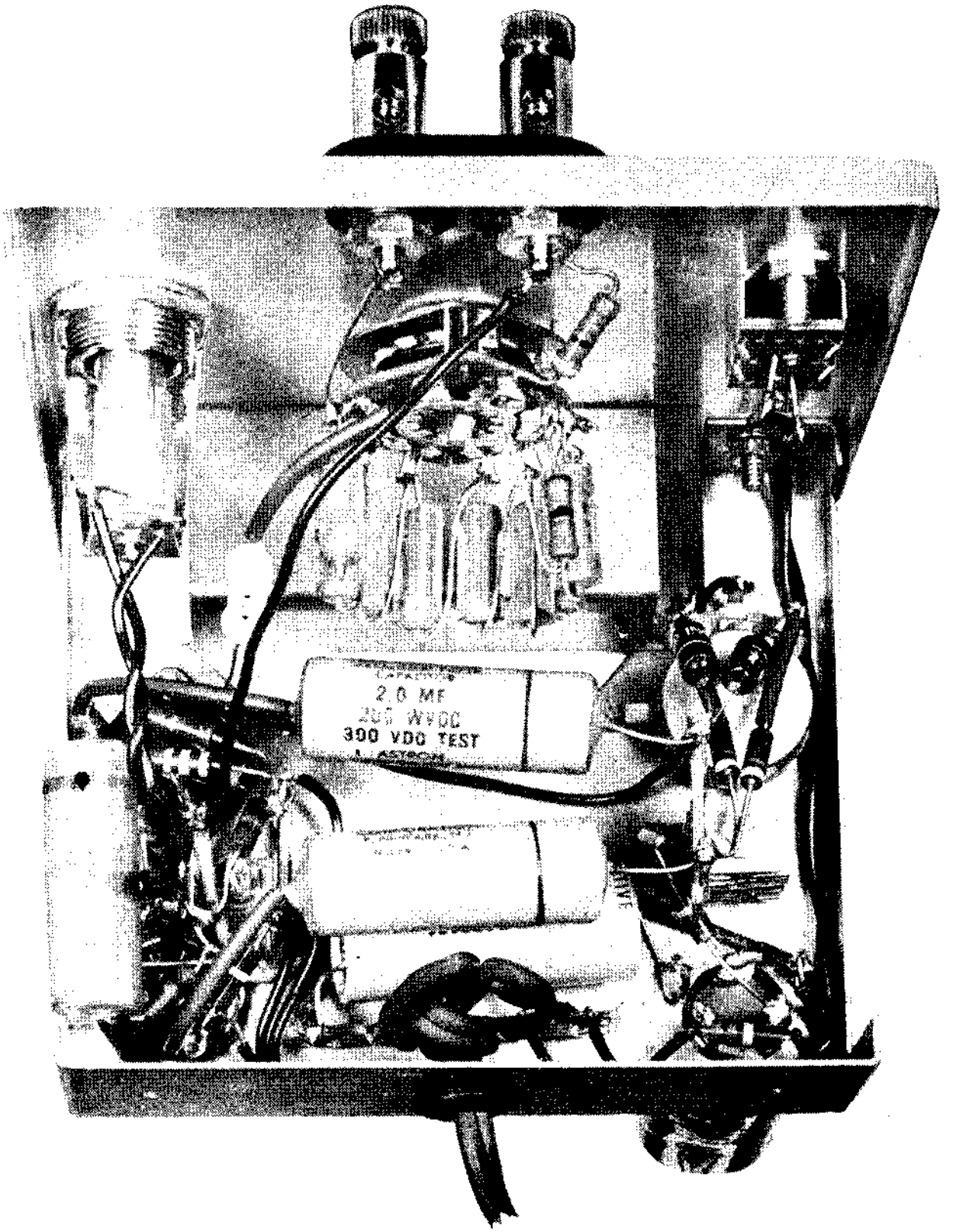
Part No.	Parts Per Kit	Description
Resistors		
2-22	1	31.62 Ohm Precision
2-23	1	68.38 Ohm Precision
2-25	1	216.2 Ohm Precision
2-28	1	683.8 Ohm Precision
2-31	1	2162 Ohm Precision
2-33	1	6838 Ohm Precision
2-39	1	21.62 K Ohm Precision
2-40	1	68.38 K Ohm Precision
2-42	1	216.2 K Ohm Precision
2-45	1	683.8 K Ohm Precision
1-41	1	10 Ohm
1-16	2	4.7 K Ohm
1-20	1	10 K Ohm
1-22	1	22 K Ohm
1-26	1	100 K Ohm
1-33	1	470 K Ohm
1-36	1	1.5 Megohm
1-40	2	10 Megohm
Condensers		
21-16	1	.01 MFD Ceramic
23-10	1	.05 MFD Tubular
23-17	2	2 MFD Tubular
25-5	1	12 MFD-150V El.
25-13	1	10-10-10 MFD 350V El.
Control Switches		
10-19	1	5K Control
63-11	1	10 Pos. Switch
60-1	1	SPST Slide Switch
Sockets-Terminal Strips-Grommet-Feet-Knob		
434-15	2	Miniature Sockets
431-2	2	2-lug Terminal Strips
431-5	1	4-lug Terminal Strip
73-1	3	3/8" Rubber Grommet
261-1	4	Rubber Feet
462-1	1	Pointer Knob
Wire		
89-1	1	Line Cord
344-1	1	Roll Hookup Wire
346-1	1	Length Spaghetti

Part No.	Parts Per Kit	Description
Tubes-Transformer-Rectifiers-Meter		
411-11	1	6AU6
411-10	1	6AT6
54-2	1	Power Transformer
57-4	1	Rectifier
56-1	2	Crystal Diodes
407-8	1	Meter
Binding Post Assembly		
75-1	1	Insulator
427-1	2	Bases
250-20	2	Thumbscrews
252-5	2	10-32 Nuts
254-3	2	#10 Lockwashers
253-6	2	#10 Fibre Washers
253-8	2	#10 Nickel Washers
259-3	2	#10 Solder Lugs
Pilot Light Assembly		
412-1	1	#47 Lamp
252-12	1	Nut
455-1	1	Bushing
413-1	1	Jewel
434-22	1	Socket
Hardware		
250-2	4	3-48 Screws
252-1	4	3-48 Nuts
250-9	5	6-32 x 3/8 Screws
250-13	1	6-32 x 1 Screw
252-3	6	6-32 Nuts
254-1	6	#6 Lockwashers
250-8	2	#6 Sheet Metal Screws
250-19	2	10-24 Handle Screws
252-7	2	Control Nuts
254-4	2	Control Lockwashers
253-10	1	Control Nickel Washer
Sheet Metal Parts		
200-M18	1	Chassis
203-19	1	Panel
203-4	1	Rear Cover
90-2	1	Case
206-M2	1	Shield
211-1	1	Handle



A.C. VOLTMETER

Heathkit MODEL AV-1


2.0 MF
300 VDC TEST

R M A Color Code on Transformers

I.F. TRANSFORMERS

Blue — Plate Lead
Red — B + Lead
Green — Grid
Black — Ground or AVC

If center tapped other grid is green and black striped.

AUDIO TRANSFORMERS

Blue — Plate Lead
Red — B + Lead
Brown — Other Plate on Push Pull
Green — Grid Lead
Black — Ground Lead
Yellow — Other Grid on Push Pull

POWER TRANSFORMERS PRIMARY — BLACK

High Voltage Plate — Red
Center Tap Red and Yellow Striped

Rectifier Filament — Yellow
Center Tap Yellow and Blue

Filament No. 1 — Green
Center Tap Green and Yellow

Filament No. 2 — Brown
Center Tap — Brown and Yellow

Filament No. 3 — Slate
Center Tap — Slate and Yellow

Soldering

The most important thing in good soldering is to heat the joint and allow the solder to flow into it. The solder should melt from contact with the joint rather than with the iron. Never use pastes or acids in radio work.

Use only rosin core solder. Never depend on the solder to hold a joint.. Always make a firm connection with the wire before applying solder. To tin a soldering iron (soldering cannot be done with the bare copper) file the surface lightly while the iron is hot and then quickly apply a generous amount of rosin core solder while the filed surface is still bright. Wipe off excess solder with a cloth.

Tin all four sides of the tip in this manner.

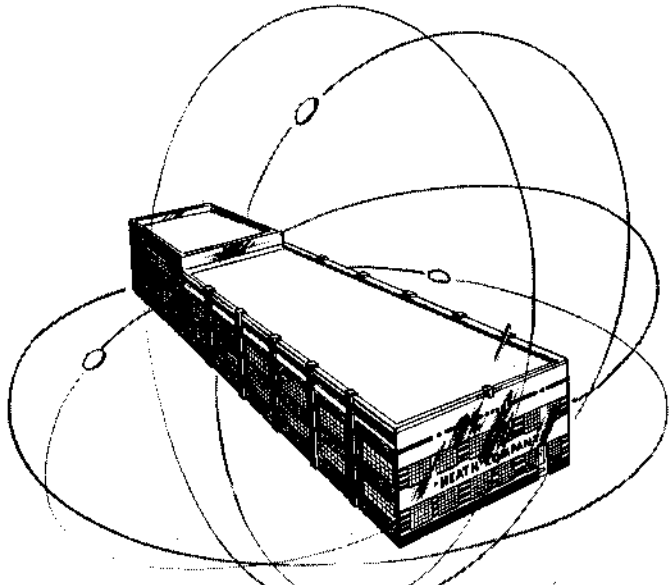
The terminals must be clean, and preferably tinned. On some terminals that are hard to solder to (nickel plated f.i.) it is desirable to pre-tin the surface before installation or connection. Clean (scrape or sandpaper) the surface, heat with iron and apply rosin core solder liberally. Wipe off or shake off excess solder.

Recommended Tools

A good electric soldering iron (100 watt with small tip)
Long or needle nose pliers 6".
Diagonal or side cutting pliers (5" or 6").
An assortment of screw drivers flat and Phillips type.
File. Round and flat types.
Purchase quality tools and you will enjoy and use them many years.
American Beauty soldering irons, Plomb, and Williams pliers are recommended.

Symbols Used in Radio Circuits

ANTENNA OR AERIAL	VARIABLE CONDENSER	QUARTZ CRYSTAL
CHASSIS OR GROUND	ELECTROLYTIC CONDENSER SHOWING POLARITY	CONNECTION OF TWO WIRES
AIR CORE COIL	SWITCH	NO CONNECTION
AIR CORE TRANSFORMER OR COIL	ROTARY SWITCH	FUSE
R.F. CHOKE	SPEAKER	PHONE PLUG
FILTER OR IRON CORE CHOKE . . .	METER	K = 1000
IRON CORE TRANSFORMER	PILOT LIGHT	M = 1,000,000
FIXED RESISTOR	PHONE JACK	OHM.
VARIABLE RESISTOR OR POTENTIOMETER	SUPPRESSOR, PLATE, SCREEN, GRID, VACUUM TUBE, CATHODE, FILAMENT	MF = MICROFARAD
FIXED CONDENSER		MMF = MICRO MICROFARAD



THE HEATH COMPANY

BENTON HARBOR, MICH.