

# Heathkit® Manual

*for the*

## **AC POWER SUPPLY**

**Model HP-1144A**

595-2198-01

**HEATH COMPANY**  
BENTON HARBOR, MICHIGAN 49022

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## TABLE OF CONTENTS

INTRODUCTION .....	2	IN CASE OF DIFFICULTY .....	28
ASSEMBLY NOTES .....	3	Troubleshooting Chart .....	29
PARTS LIST .....	6	SPECIFICATIONS .....	30
STEP-BY-STEP ASSEMBLY		CIRCUIT DESCRIPTION .....	30
Circuit Board Assembly .....	8	CIRCUIT BOARD X-RAY VIEW .....	31
Chassis Assembly .....	13	SEMICONDUCTOR IDENTIFICATION CHART .	32
Chassis Wiring .....	15	SCHEMATIC .....	Illustration Booklet, Page 5
TEST AND ADJUSTMENTS .....	25	WARRANTY .....	Inside front cover
FINAL ASSEMBLY .....	26	CUSTOMER SERVICE .....	Inside rear cover
OPERATION .....	28		

## INTRODUCTION

The Heathkit Model HP-1144A AC Power Supply provides well-regulated, low voltage, DC power from an AC power source. You can wire it to operate from either a 120-volt AC or 240-volt AC 50/60 Hz power line and maintain regulation within 2%.

This AC Power Supply was primarily designed to provide +13.8 VDC for the Heathkit, Model SB-104

SSB Transceiver. A cable and socket provide output power and a series connection for the remote on-off switch on the Transceiver.

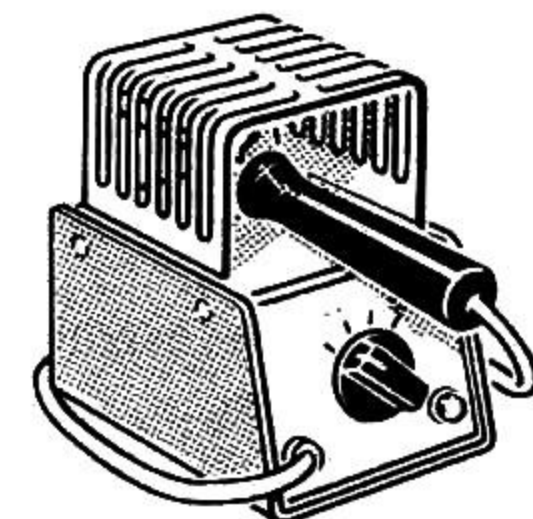
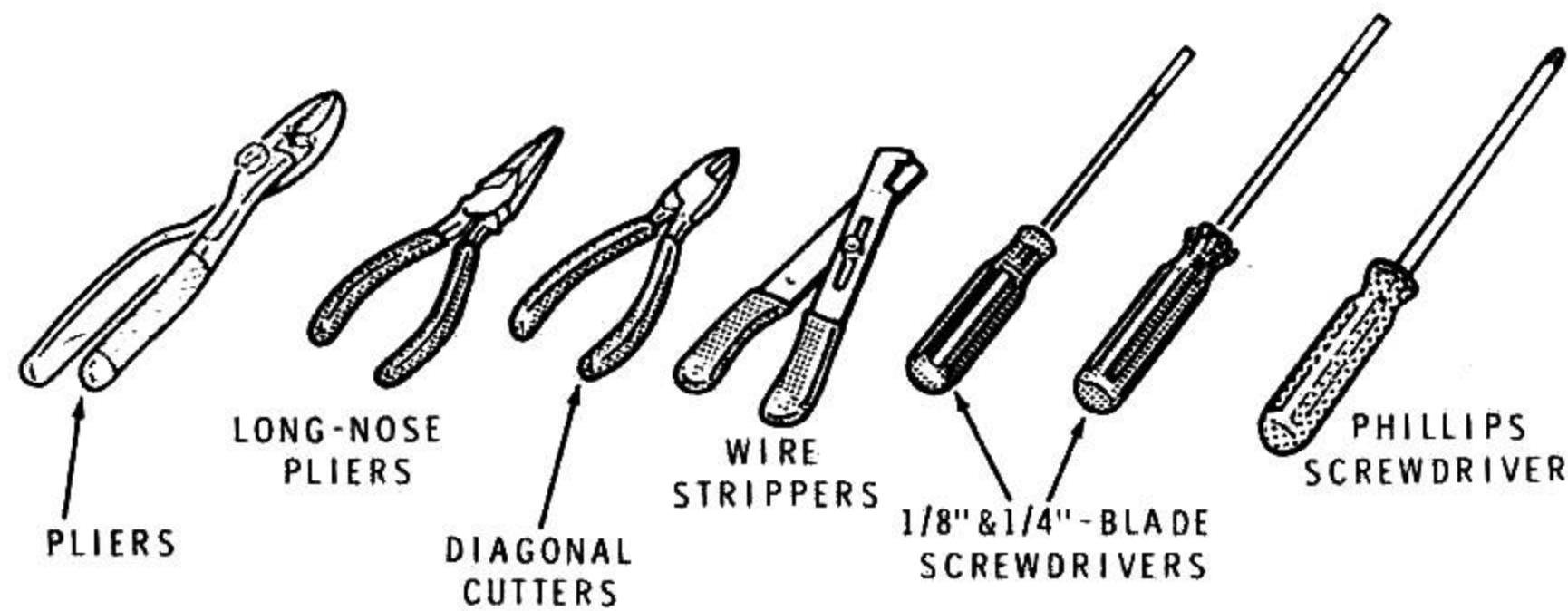
The attractive, rugged construction and reliable performance of this Power Supply will provide many years of dependable service.



## ASSEMBLY NOTES

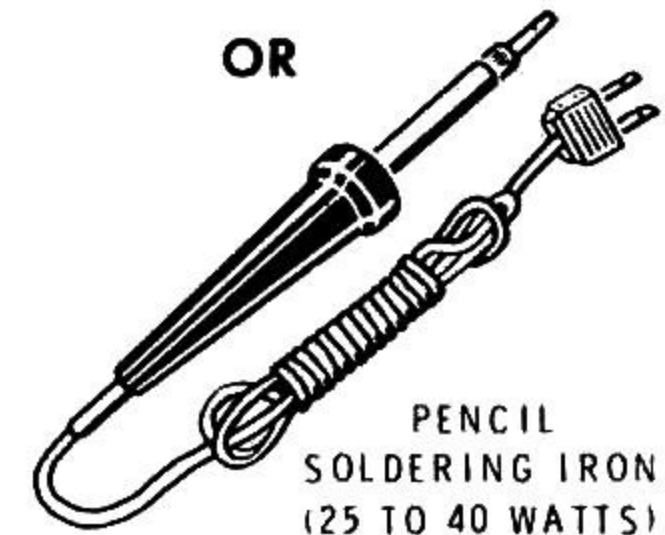
### TOOLS

You will need these tools to assemble your kit.



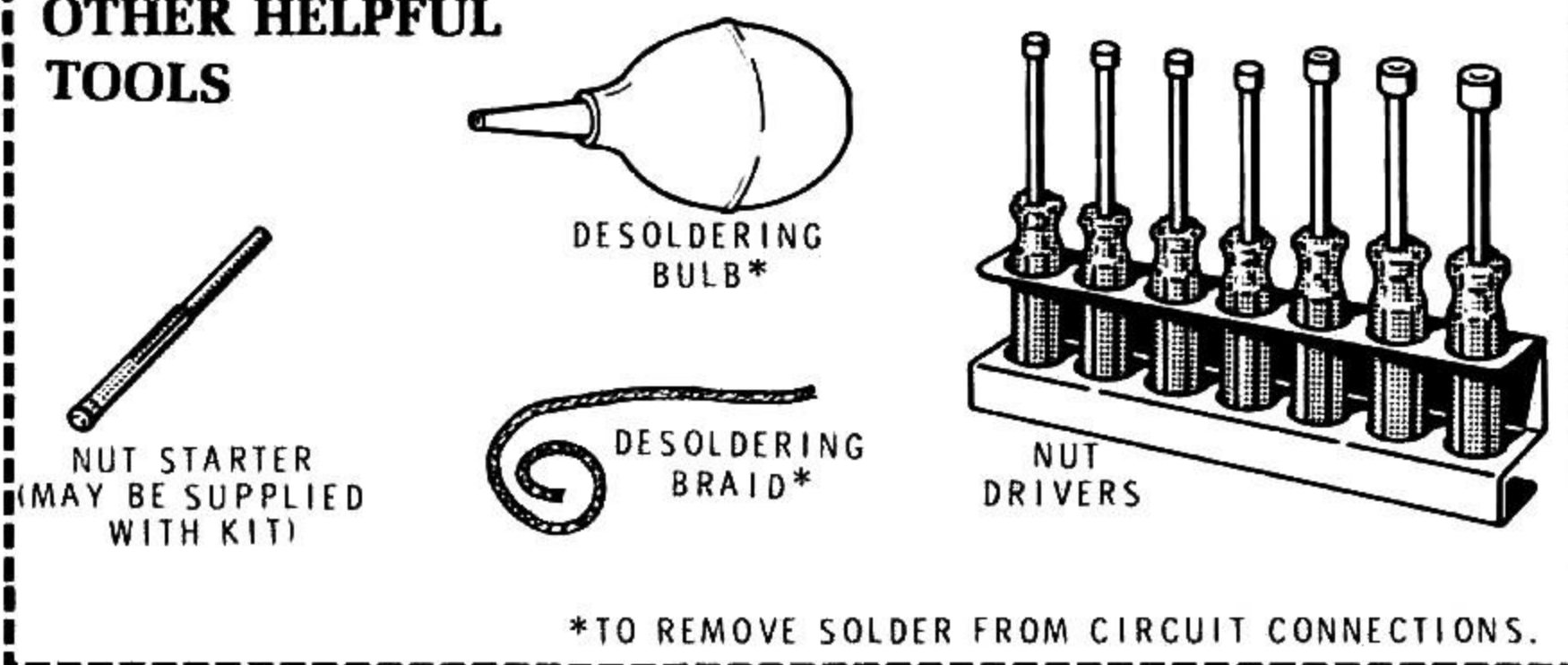
HEATHKIT  
SOLDERING  
IRON

OR



PENCIL  
SOLDERING IRON  
(25 TO 40 WATTS)

### OTHER HELPFUL TOOLS



\*TO REMOVE SOLDER FROM CIRCUIT CONNECTIONS.

### ASSEMBLY

1. Follow the instructions carefully. Read the entire step before you perform each operation.
2. The illustrations in the Manual are called Pictorials and Details. Pictorials show the overall operation for a group of assembly steps; Details generally illustrate a single step. When you are directed to refer to a certain Pictorial "for the following steps," continue using that Pictorial until you are referred to another Pictorial for another group of steps.
3. Most kits use a separate "Illustration Booklet" that contains illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. Keep the "Illustration Booklet" with the Assembly Manual. The illustrations in it are arranged in Pictorial number sequence.
4. Position all parts as shown in the Pictorials.
5. Solder a part or a group of parts only when you are instructed to do so.

6. Each circuit part in an electronic kit has its own component number (R2, C4, etc.). Use these numbers when you want to identify the same part in the various sections of the Manual. These numbers, which are especially useful if a part has to be replaced, appear:
- In the Parts List,
  - At the beginning of each step where a component is installed,
  - In some illustrations,
  - In the Schematic,
  - In the section at the rear of the Manual.
7. When you are instructed to cut something to a particular length, use the scales (rulers) provided at the bottom of the Manual pages.

**SAFETY WARNING: Avoid eye injury when you cut off excess lead lengths. Hold the leads so they cannot fly toward your eyes.**

## SOLDERING

Soldering is one of the most important operations you will perform while assembling your kit. A good solder connection will form an electrical connection between two parts, such as a component lead and a circuit board foil. A bad solder connection could prevent an otherwise well-assembled kit from operating properly.

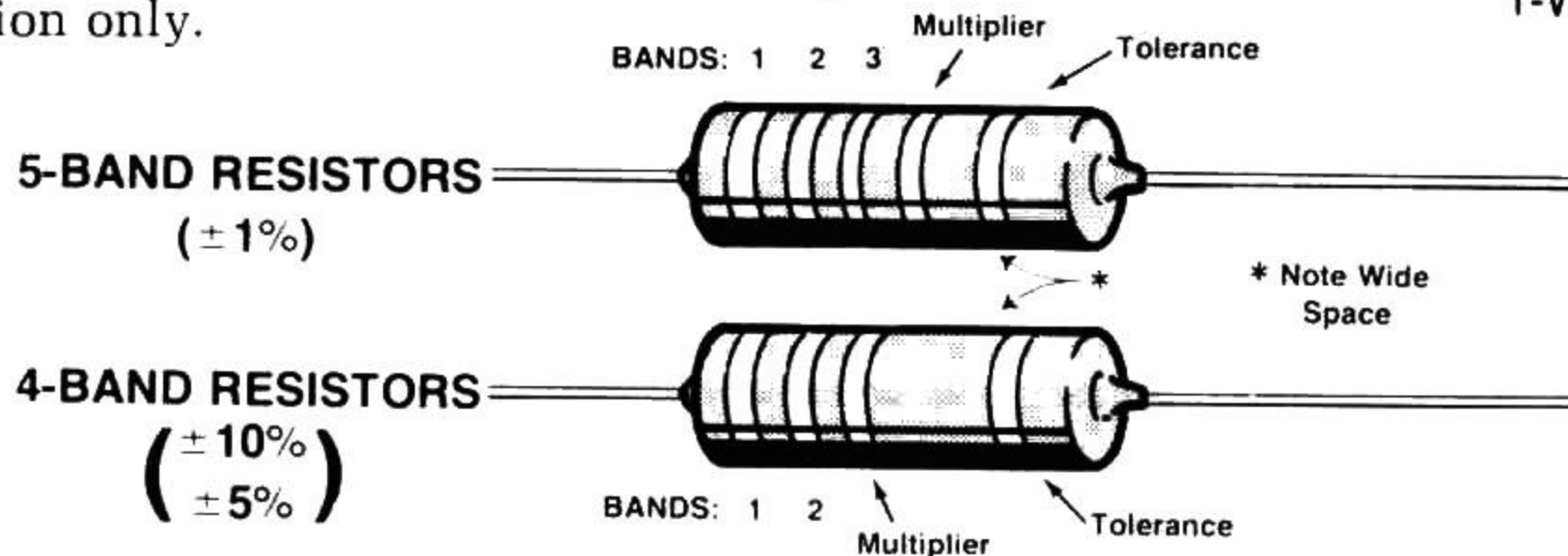
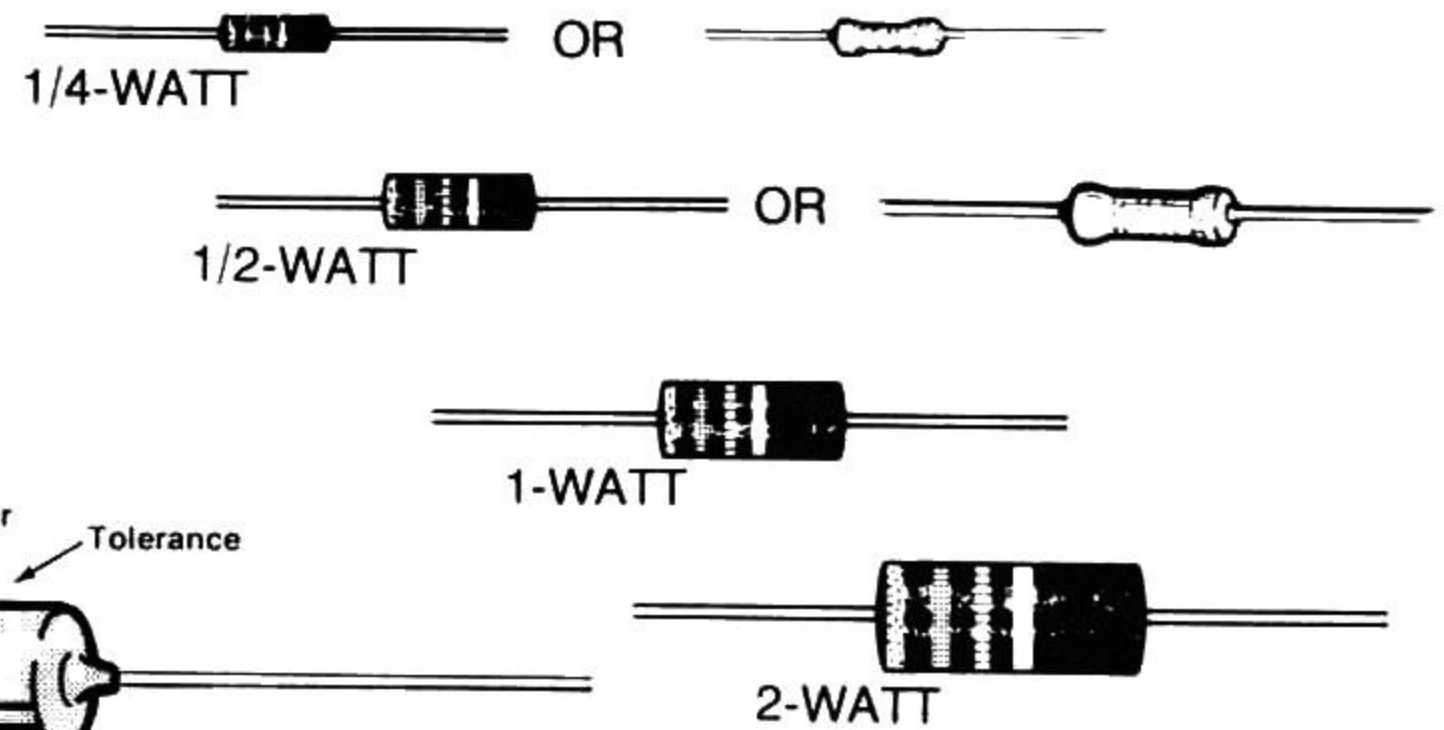
It is easy to make a good solder connection if you follow a few simple rules:

1. Use the right type of soldering iron. A 25 to 40-watt pencil soldering iron with a 1/8" or 3/16" chisel or pyramid tip works best.
2. Keep the soldering iron tip clean. Wipe it often on a wet sponge or cloth; then apply solder to the tip to give the entire tip a wet look. This process is called tinning, and it will protect the tip and enable you to make good connections. When solder tends to "ball" or does not stick to the tip, the tip needs to be cleaned and retinned.



**PARTS**

**Resistors** will be called out by their resistance value in  $\Omega$  (ohms),  $k\Omega$  (kilohms), or  $M\Omega$  (megohms). Certain types of resistors will have the value printed on the body, while others will be identified by a color code. The colors of the bands and the value will be given in the steps, therefore the following color code is given for information only.



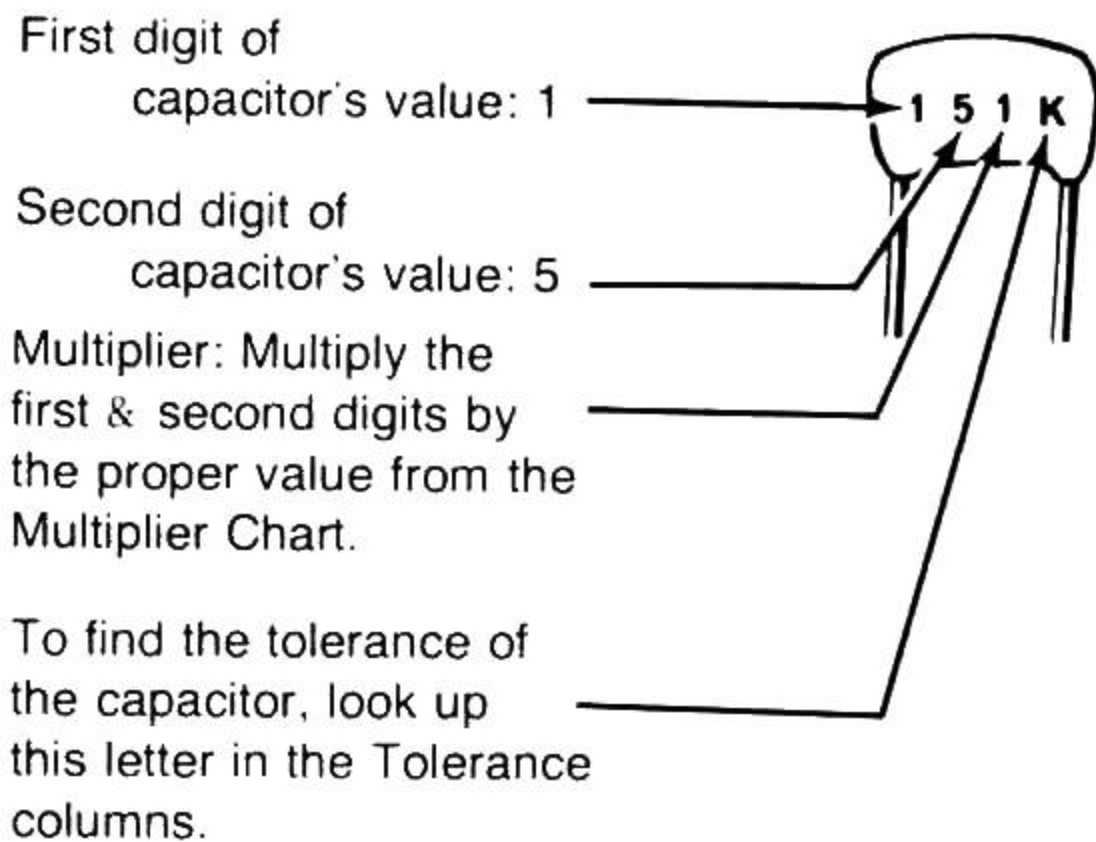
Band 1 1st Digit		Band 2 2nd Digit		Band 3 (if used) 3rd Digit		Multiplier		Resistance Tolerance	
Color	Digit	Color	Digit	Color	Digit	Color	Multiplier	Color	Tolerance
Black	0	Black	0	Black	0	Black	1	Silver	$\pm 10\%$
Brown	1	Brown	1	Brown	1	Brown	10	Gold	$\pm 5\%$
Red	2	Red	2	Red	2	Red	100	Brown	$\pm 1\%$
Orange	3	Orange	3	Orange	3	Orange	1,000		
Yellow	4	Yellow	4	Yellow	4	Yellow	10,000		
Green	5	Green	5	Green	5	Green	100,000		
Blue	6	Blue	6	Blue	6	Blue	1,000,000		
Violet	7	Violet	7	Violet	7	Silver	0.01		
Gray	8	Gray	8	Gray	8	Gold	0.1		
White	9	White	9	White	9				

**Capacitors** will be called out by their capacitance value in  $\mu F$  (microfarads) or pF (picofarads) and type: ceramic, Mylar\*, electrolytic, etc. Some capacitors may have their value printed in the following manner:

**EXAMPLES:**

$151K = 15 \times 10 = 150 \text{ pF}$   
 $759 = 75 \times 0.1 = 7.5 \text{ pF}$

**NOTE:** The letter "R" may be used at times to signify a decimal point: as in:  $2R2 = 2.2 \text{ (pF or } \mu F)$ .



MULTIPLIER		TOLERANCE OF CAPACITOR		
FOR THE NUMBER:	MULTIPLY BY:	10 pF OR LESS	LETTER	OVER 10 pF
0	1	$\pm 0.1 \text{ pF}$	B	
1	10	$\pm 0.25 \text{ pF}$	C	
2	100	$\pm 0.5 \text{ pF}$	D	
3	1000	$\pm 1.0 \text{ pF}$	F	$\pm 1\%$
4	10,000	$\pm 2.0 \text{ pF}$	G	$\pm 2\%$
5	100,000		H	$\pm 3\%$
			J	$\pm 5\%$
8	0.01		K	$\pm 10\%$
9	0.1		M	$\pm 20\%$

\*DuPont Registered Trademark



## PARTS LIST

Check each part against the following list. The parts may vary slightly from the illustration. Keep any part that is individually packaged with a part number on it in its package after you identify it until you actually use it. Some parts are marked with a "171-" packaging number. These numbers are used for packaging only and do not appear in the Manual "Parts List." Save all packaging material until you locate all the parts.

To order a replacement part, use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of this Manual. For prices, refer to the separate "Heath Parts Price List." NOTE: Never use a "171-" packaging number if you must order replacement parts; use only the part numbers listed below.

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
<b>RESISTORS</b>				
A1	6-6819-12	1	68.1 $\Omega$ , 1%, 1/4-watt (blue-gray-brown-gold-brown).	R5
A1	6-5110-12	1	511 $\Omega$ , 1%, 1/4-watt (green-brown-brown-black-brown)	R3
A1	6-9090-12	1	909 $\Omega$ , 1%, 1/4-watt (white-black-white-black-brown)	R6
A1	6-102-12	2	1000 $\Omega$ , 5%, 1/4-watt (brown-black-red-gold)	R8, R10
A1	6-103-12	1	10 k $\Omega$ , 5%, 1/4-watt (brown-black-orange-gold)	R9
A2	6-220	2	22 $\Omega$ , 5%, 1/2-watt (red-red-black-gold)	R7, R11
A3	1-22-1	1	1500 $\Omega$ (brown-green-red)	R13
A4	1-30-2	1	270 $\Omega$ , 10%, 2-watt (red-violet-brown-silver)	R12
A5	3-11-5	8	.33 $\Omega$ , 5%, 5-watt wire-wound	R1*, R2*
A6	10-383	1	10 k $\Omega$ control	R4
<b>CAPACITORS</b>				
B1	21-195	1	.1 $\mu$ F ceramic	C3
B2	25-257	1	10 $\mu$ F electrolytic	C4
B3	25-199	1	500 $\mu$ F electrolytic	C10
B3	25-241	1	1200 $\mu$ F electrolytic	C6
B4	25-263	2	10,000 $\mu$ F electrolytic	C1, C2
B5	27-47	4	.1 $\mu$ F Mylar	C5, C7, C8, C9

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
<b>DIODES</b>				
C1	56-56	1	1N4149	D3
C1	56-620	1	15 V zener	D4
C1	57-65	2	1N4002	D1, D2
C2	57-86	1	NL576A SCR	Q4
C3	57-88	1	MDA990 bridge rectifier	BR1

### TRANSISTORS — INTEGRATED CIRCUIT (IC)

NOTE: Transistors and IC's are marked for identification in one of the following four ways:

1. Part number.
2. Type number. (For IC's this refers only to the numbers. Disregard any letters before or after the number.)
3. Part number and type number.
4. Part number with a type number other than the one listed.

D1	417-823	1	MPU131 transistor	Q5
D2	417-215	1	2N3055 transistor	Q3
D2	417-254	2	MJ802 transistor	Q1, Q2
D3	442-626	1	78MGT4 IC	U1

\*Resistors R1 and R2 are each made up of four resistors in parallel.



KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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### HARDWARE

Hardware may be packed in more than one envelope. Open all hardware envelopes before you check the hardware.

E1	250-89	16	6-32 × 3/8" screw	
E2	250-434	2	6-32 × 3/8" flat head screw	
E3	250-475	12	#6 × 3/8" sheet metal screw	
E4	250-1199	4	#6 × 5/8" sheet metal screw	
E5	250-206	7	6-32 × 11/16" screw	
E6	250-253	8	1/4"-20 × 7/8" bolt	
E7	252-3	13	6-32 nut	
E8	252-57	13	1/4-20 nut	
E9	252-183	1	1/4"-28 nut	
F1	253-89	1	D-washer	
F2	253-31	8	1/4" flat washer	
F3	254-1	21	#6 lockwasher	
F4	254-14	16	1/4" lockwasher	
F5	255-83	4	11/16" spacer	
F6	259-20	1	Connector pin	
F7	259-1	1	#6 solder lug	
F8	259-23	1	Large solder lug	

### CHASSIS PARTS

G1	90-1108-1	1	Cover	
G2	200-678-2	1	Chassis	
G3	207-2	2	Capacitor mounting clamp	
G4	215-76	1	Heat sink	

### WIRE — SLEEVING — CABLE

89-23	1	Line cord
340-11	6'	Bare wire
344-31	3'	Brown wire
346-4	4-1/2'	Black sleeving
346-7	1-1/2"	Clear sleeving
347-40	4'	Cable

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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### GROMMET — INSULATOR

H1	73-23	1	Rubber grommet	
H2	75-44	2	Transistor insulator (between cardboard)	
H3	75-71	1	Strain relief	

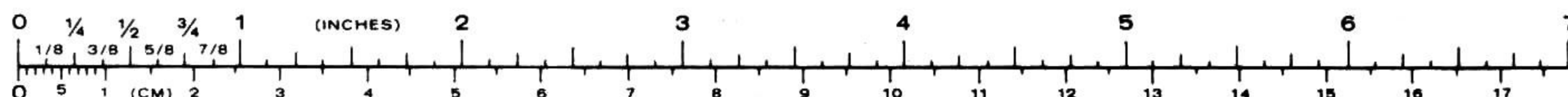
### FUSEHOLDER — TERMINAL STRIPS

H4	423-1	2	Fuseholder	
H5	431-42	1	5-lug terminal strip	
H6	431-67	1	20-lug terminal strip	

### MISCELLANEOUS

	54-848	1	Power transformer	
	85-1928-2	1	Circuit board	
J1	207-18	1	Cable clamp	
J2	261-34	4	Foot	
	352-31	1	Thermal compound*	
	391-34	1	Blue and white label	
	421-9	1	7-ampere slow-blow fuse	F1
	421-18	2	20-ampere regular fuse	F2
J3	434-118	1	11-pin socket	
J4	434-189	2	Transistor socket	
J5	440-8	1	Socket cap	
J6	490-5	1	Nut starter	
	597-260	1	Parts Order Form	
		1	Assembly Manual (See front cover for part number.)	
			Solder	

\*Dow Corning thermal heat sink compound contains Zinc Oxides, SiO<sub>2</sub>, and slight traces of CO<sub>2</sub>.



## STEP-BY-STEP ASSEMBLY

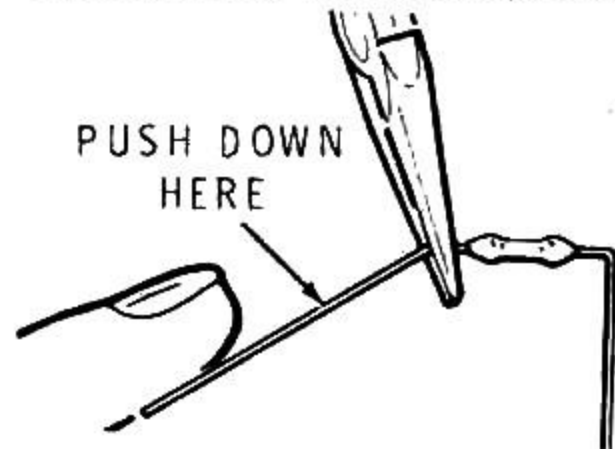
## CIRCUIT BOARD ASSEMBLY

## START

In the following steps, you will be given detailed instructions on how to install and solder the first part on the circuit board. Read and perform each step carefully. Then use the same procedure whenever you install parts on a circuit board.

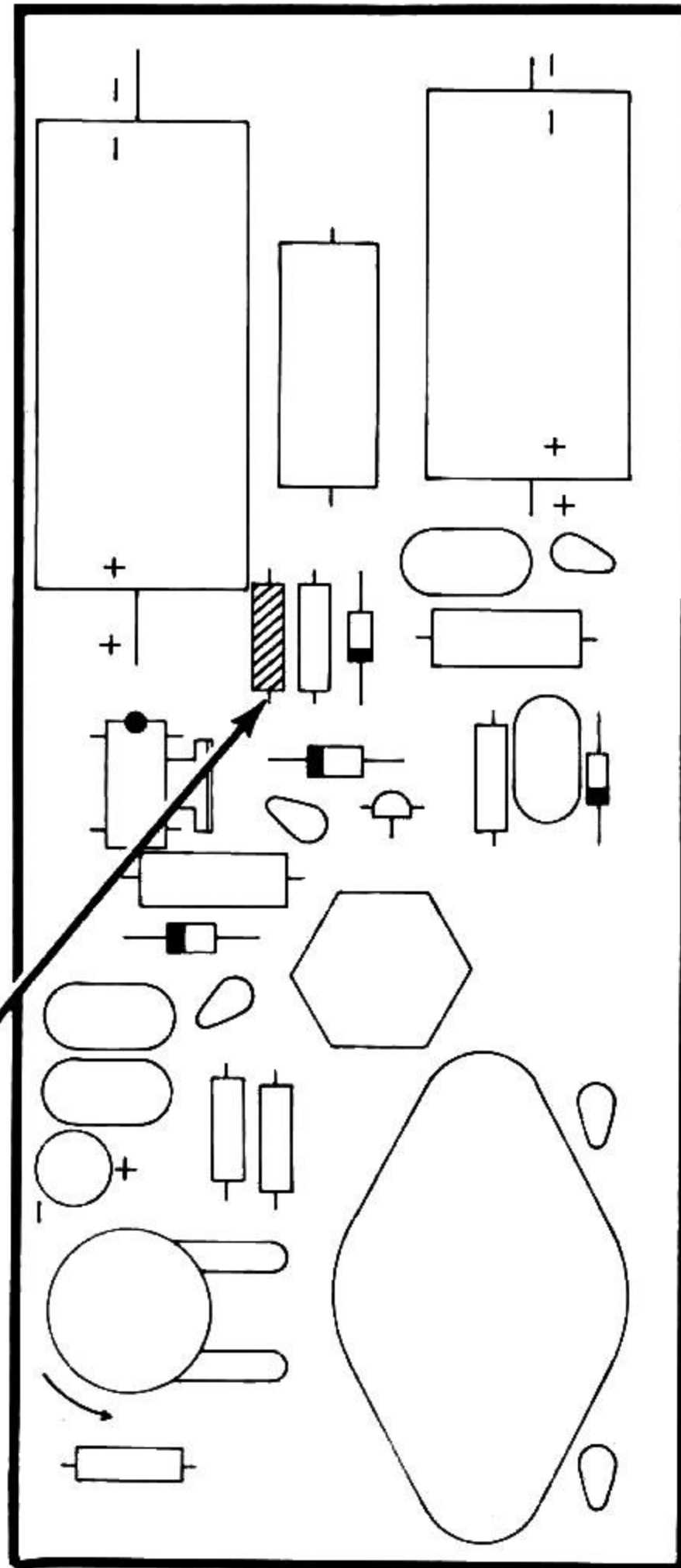
( ) Position the circuit board as shown with the printed side (not the foil side) up.

( ) Locate a 1000  $\Omega$ , 5%, 1/4-watt (brown-black-red-gold) resistor and bend the leads straight down with long-nose pliers to fit the hole spacing on the circuit board.



( ) Push the leads through the holes at the indicated location on the circuit board. The end with color bands may be positioned either way.

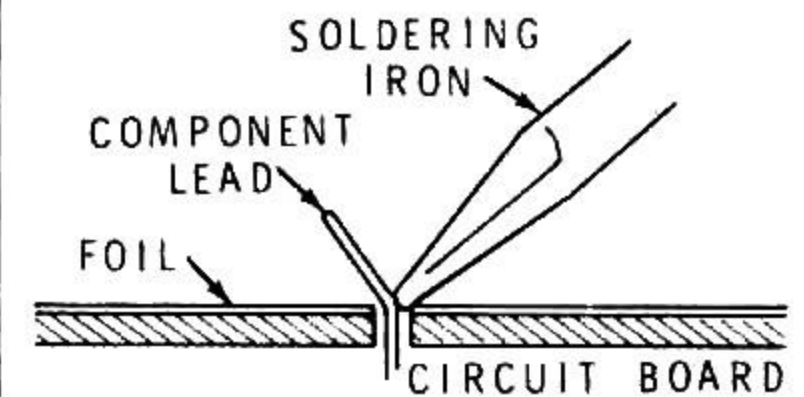
( ) Press the resistor against the circuit board. Then bend the leads outward slightly to hold the resistor in place.



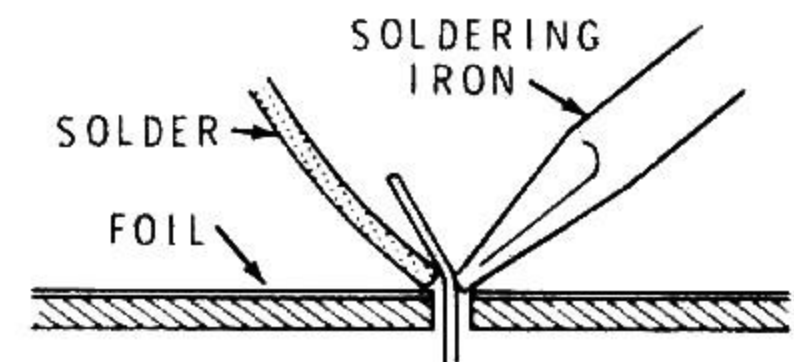
## CONTINUE

( ) Solder the resistor leads to the circuit board as follows:

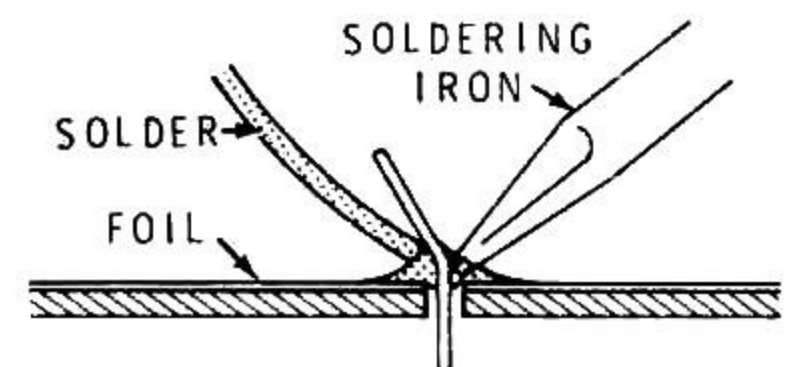
1. Push the soldering iron tip against both the lead and the circuit board foil. Heat **both** for two or three seconds.



2. Then apply solder to the other side of the connection. **IMPORTANT:** Let the heated lead and the circuit board foil melt the solder.



3. As the solder begins to melt, allow it to flow around the connection. Then remove the solder and the iron and let the connection cool.



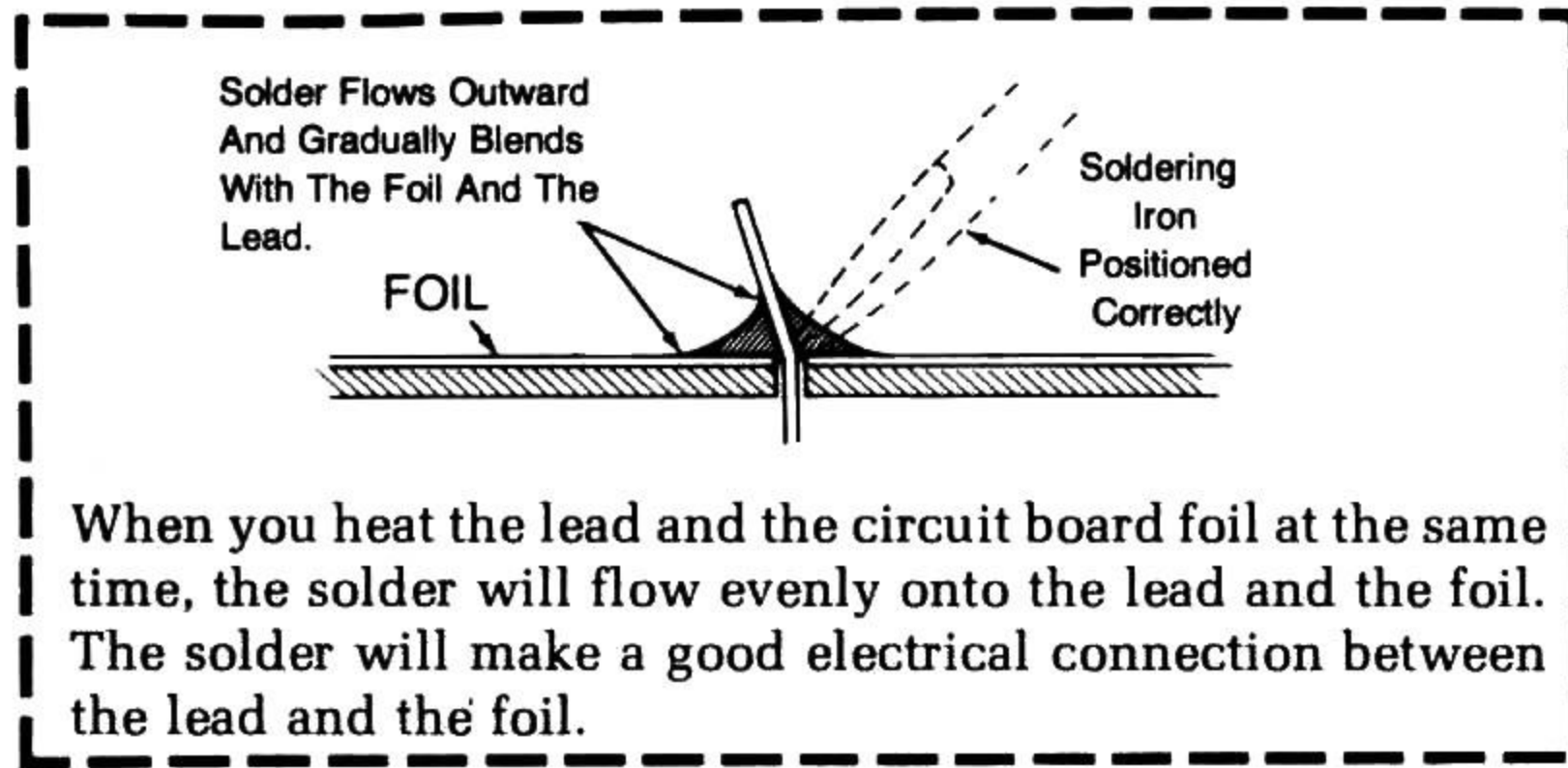
( ) Cut off the excess lead lengths close to the connection. **WARNING:** Clip the leads so the ends will not fly toward your eyes.

( ) Check each connection. Compare it to the illustrations on Page 9. After you have checked the solder connections, proceed with the assembly on Page 10. Use the same soldering procedure for each connection.

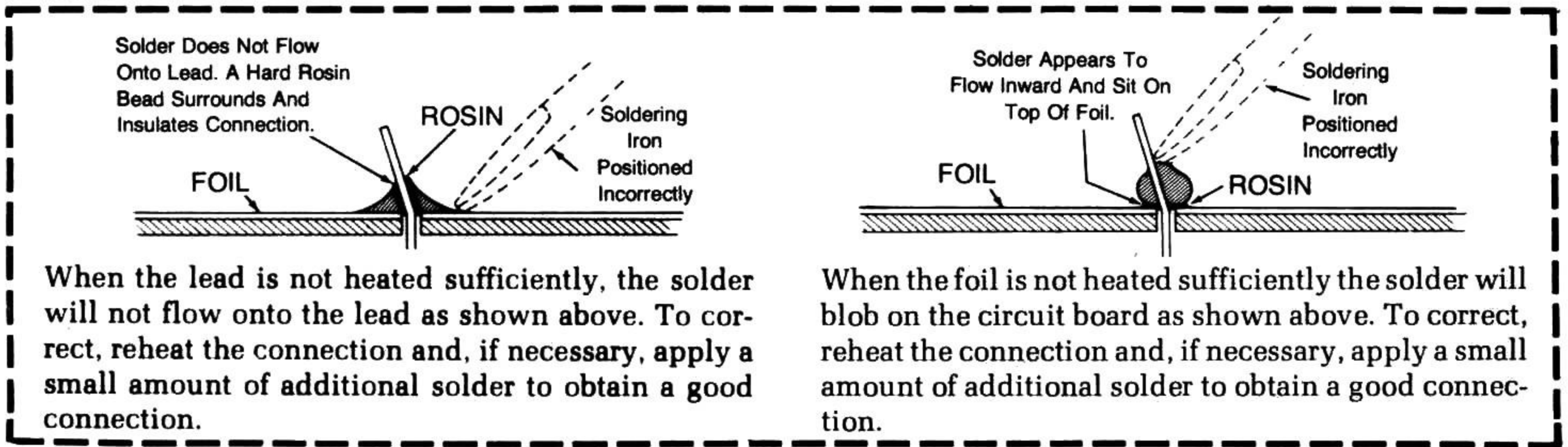
PICTORIAL 1-1



### A GOOD SOLDER CONNECTION



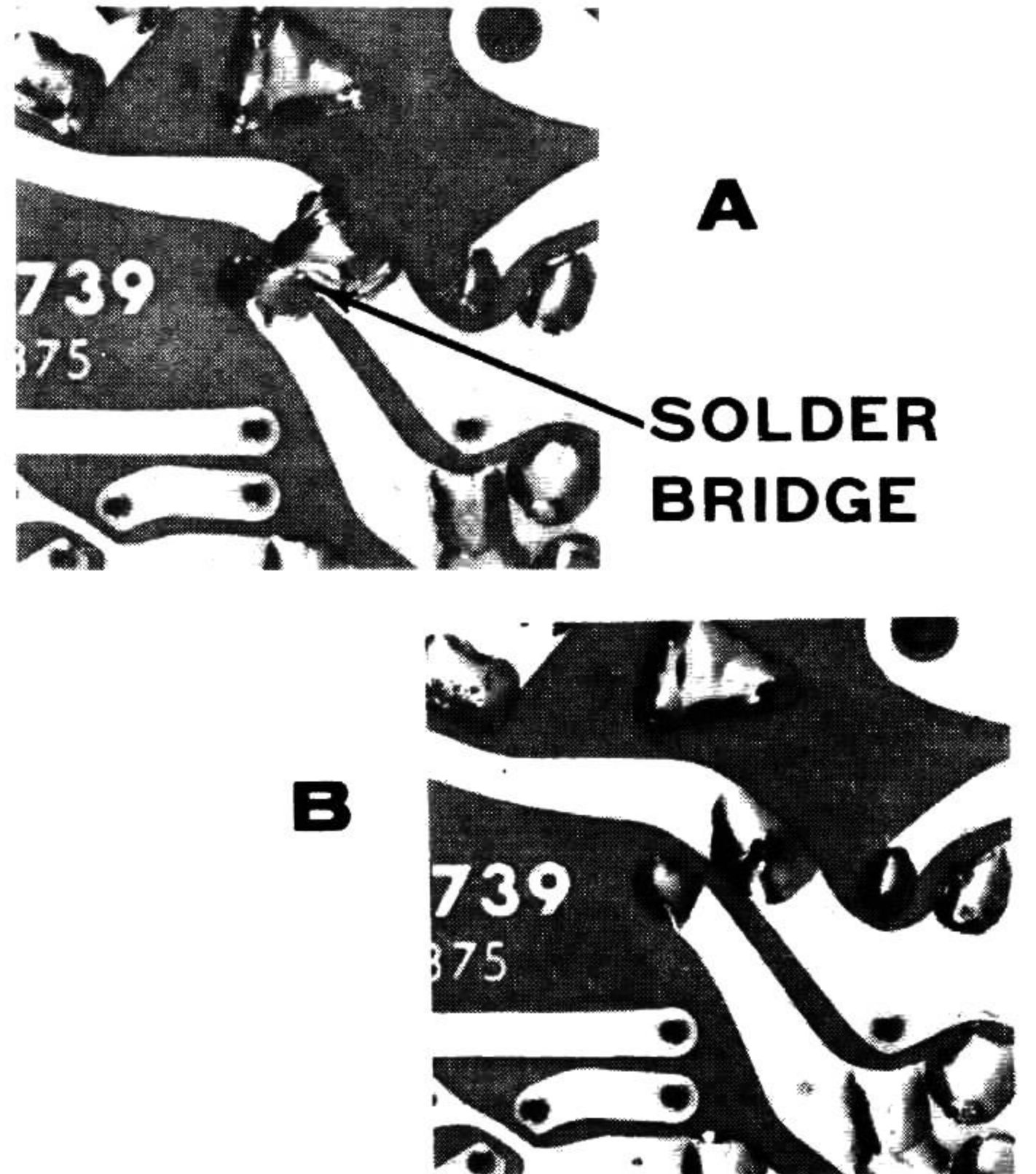
### POOR SOLDER CONNECTIONS



### SOLDER BRIDGES

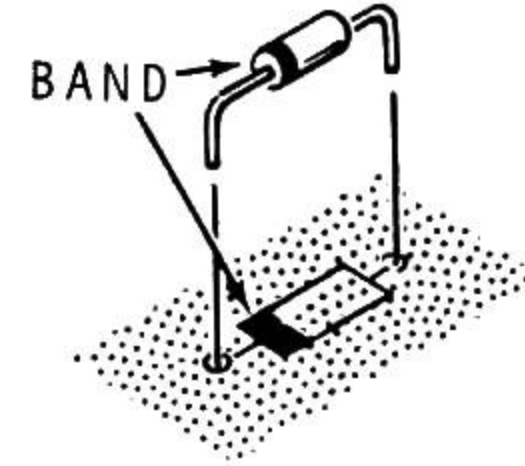
A solder bridge between two adjacent foils is shown in photograph A. Photograph B shows how the connection should appear. A solder bridge may occur if you accidentally touch an adjacent previously soldered connection, if you use too much solder, or if you "drag" the soldering iron across other foils as you remove it from the connection. A good rule to follow is: always take a good look at the foil area around each lead before you solder it. Then, when you solder the connection, make sure the solder remains in this area and does not bridge to another foil. This is especially important when the foils are small and close together. NOTE: It is alright for solder to bridge two connections on the same foil.

Use only enough solder to make a good connection, and lift the soldering iron straight up from the circuit board. If a solder bridge should develop, turn the circuit board foil-side-down and heat the solder between connections. The excess solder will run onto the tip of the soldering iron, and this will remove the solder bridge. NOTE: The foil side of most circuit boards has a coating on it called "solder resist." This is a protective insulation to help prevent solder bridges.



**CONTINUE**

NOTE: When you install a diode, always position the banded end as shown on the circuit board.



( ) D4: 15 V zener diode (#56-620).

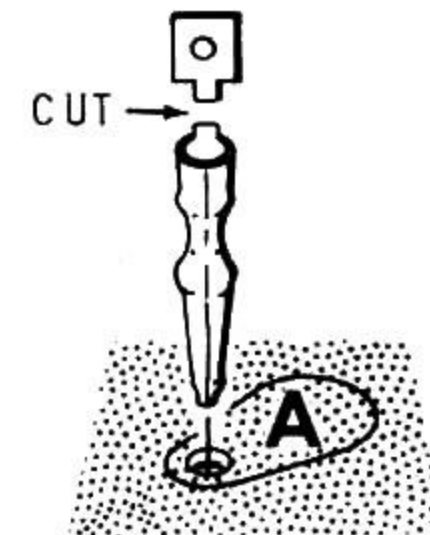
( ) D3: 1N4149 diode (#56-56).

( ) D2: 1N4002 diode (#57-65).

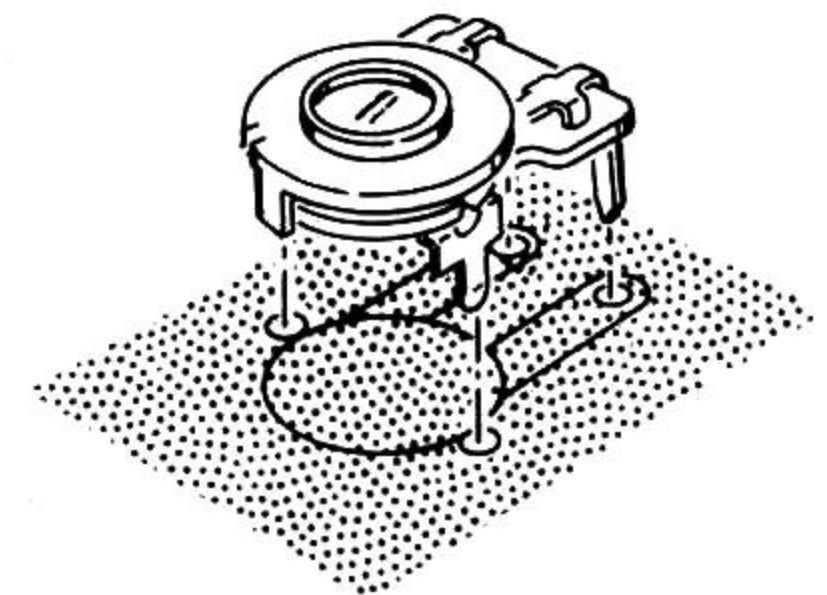
( ) D1: 1N4002 diode (#57-65).

( ) Solder the leads to the foil and cut off the excess lead lengths.

( ) Install a connector pin in hole A. Solder it to the foil. Cut off and discard the upper tab.



( ) R4: 10 k $\Omega$  control (#10-383). Solder the lugs to the foil.


**START**

( ) R9: 10 k $\Omega$ , 5%, 1/4-watt (brown-black-orange-gold).

( ) R8: This resistor was installed on Page 8.

( ) R11: 22  $\Omega$ , 5%, 1/2-watt (red-red-black-gold).

( ) R10: 1000  $\Omega$ , 5%, 1/4-watt (brown-black-red-gold).

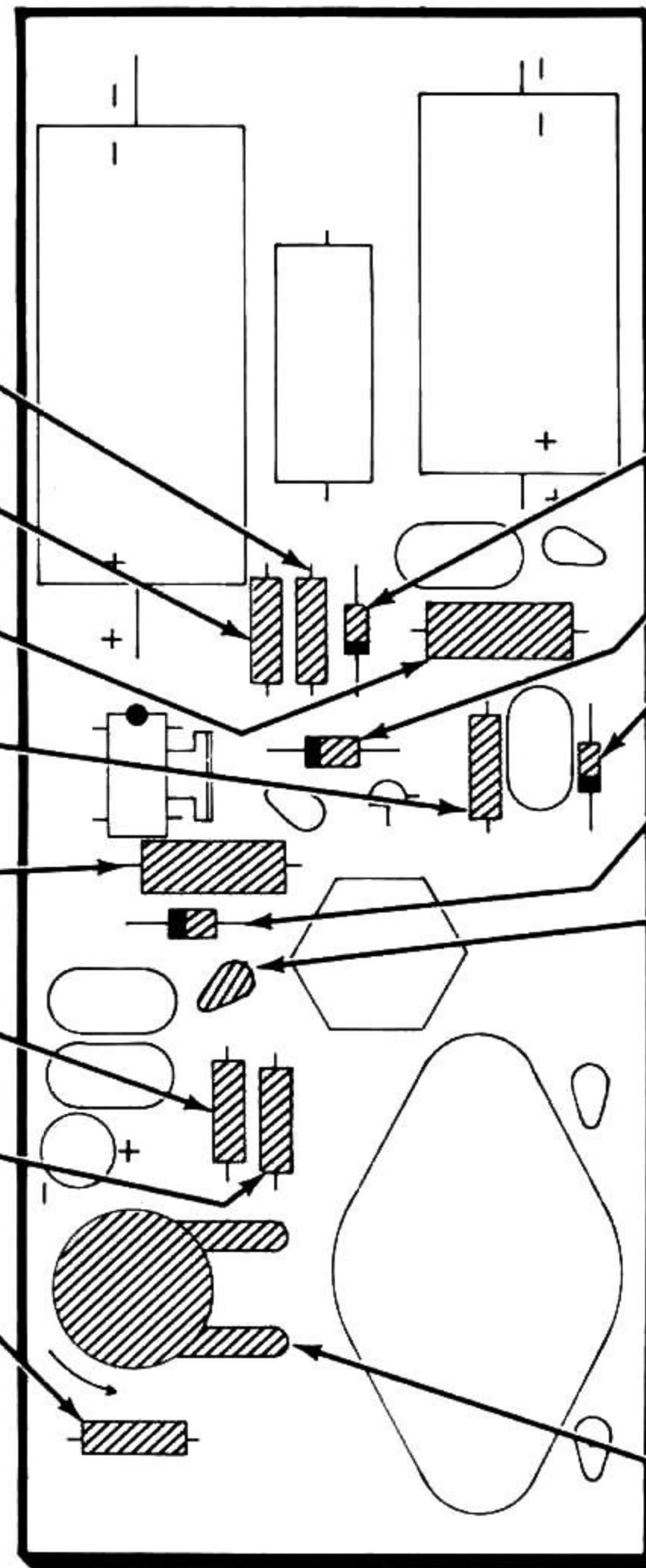
( ) R7: 22  $\Omega$ , 5%, 1/2-watt (red-red-black-gold).

( ) R6: 909  $\Omega$ , 1%, 1/4-watt (white-black-white-black-brown).

( ) R5: 68.1  $\Omega$ , 1%, 1/4-watt (blue-gray-brown-gold-brown).

( ) R3: 511  $\Omega$ , 1%, 1/4-watt (green-brown-brown-black-brown).

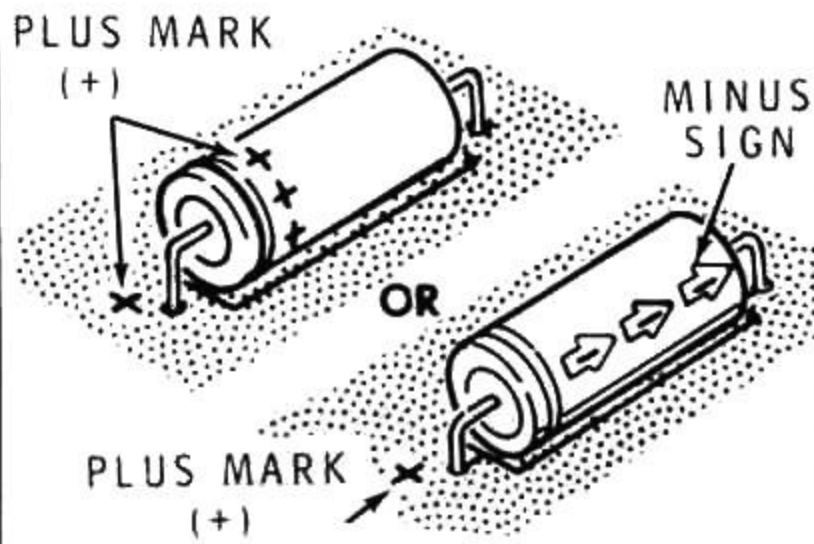
( ) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 1-2

**START**

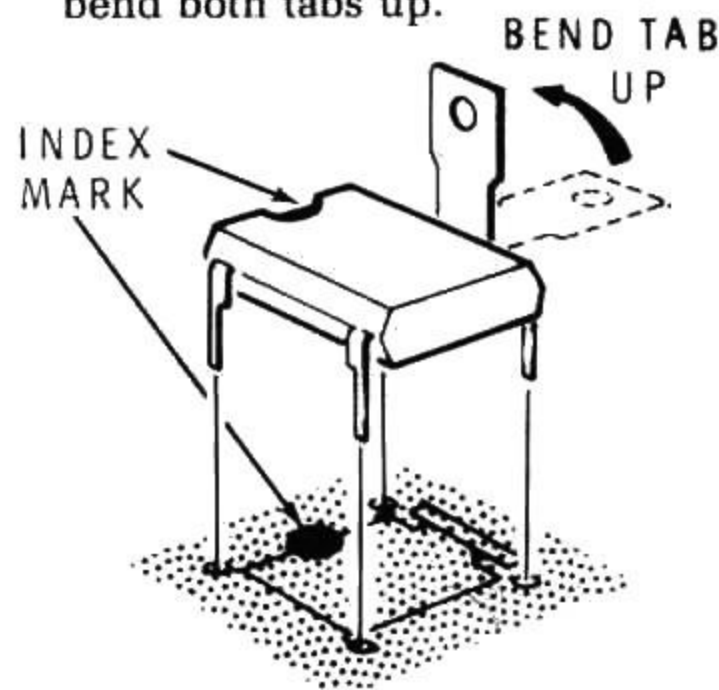
NOTE: When you install an electrolytic capacitor, be sure to position the plus (+) or minus (-) marked end as shown on the circuit board.



( ) C6: 1200  $\mu$ F electrolytic.

( ) R12: 270  $\Omega$ , 10%, 2-watt (red-violet-brown-silver).

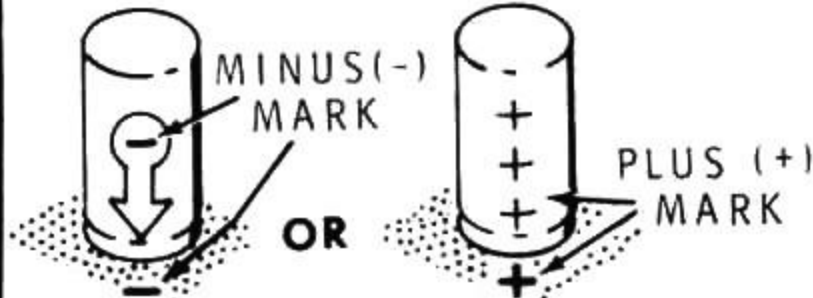
( ) U1: 78MGT4 IC (#442-626). Be sure to line up the index mark on the IC with the mark on the circuit board. The IC may have two metal tabs instead of one. If so, bend both tabs up.



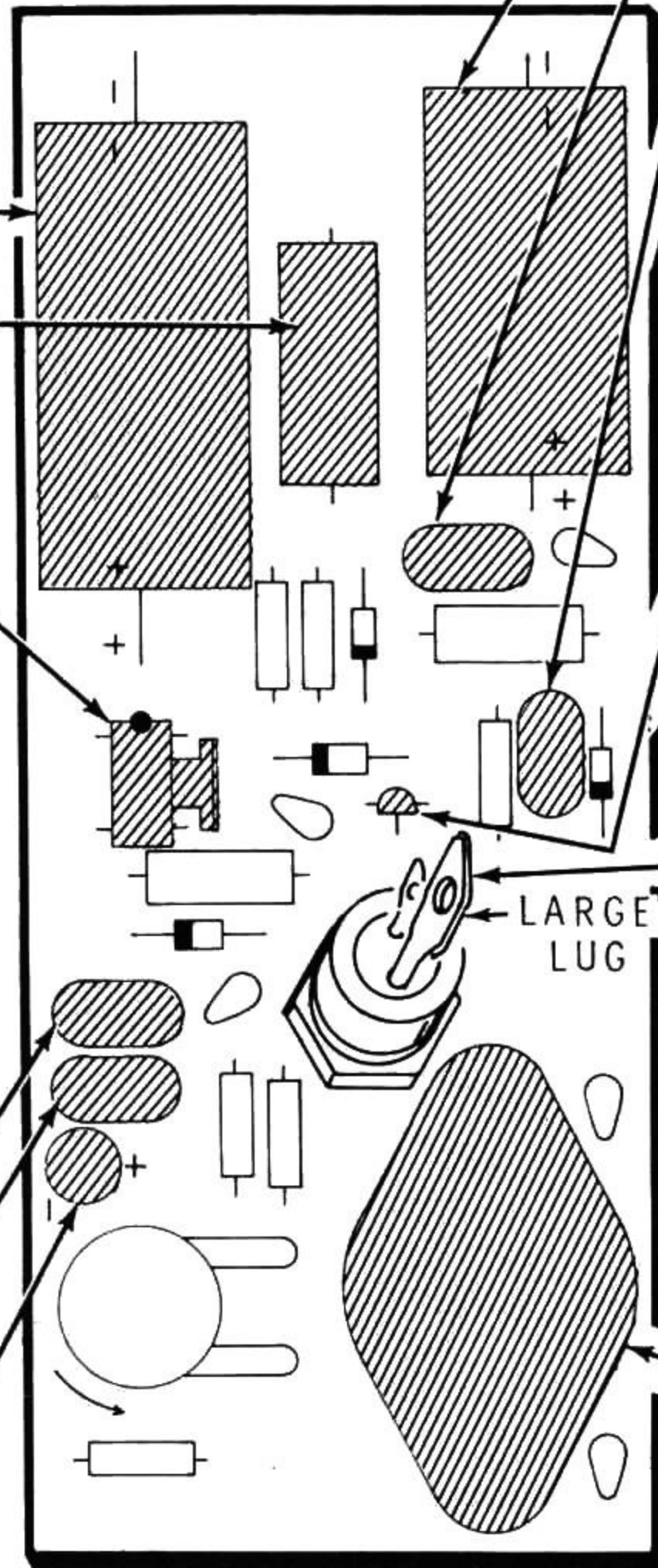
( ) C8: .1  $\mu$ F Mylar.

( ) C5: .1  $\mu$ F Mylar.

( ) C4: 10  $\mu$ F electrolytic. Be sure to position the plus (+) or minus (-) marked side of the capacitor as shown on the circuit board.



( ) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 1-3

**CONTINUE**

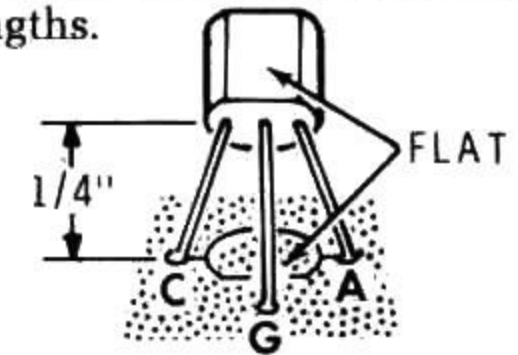
( ) C10: 500  $\mu$ F electrolytic.

( ) C9: .1  $\mu$ F Mylar.

( ) C7: .1  $\mu$ F Mylar.

( ) Solder the leads to the foil and cut off the excess lead lengths.

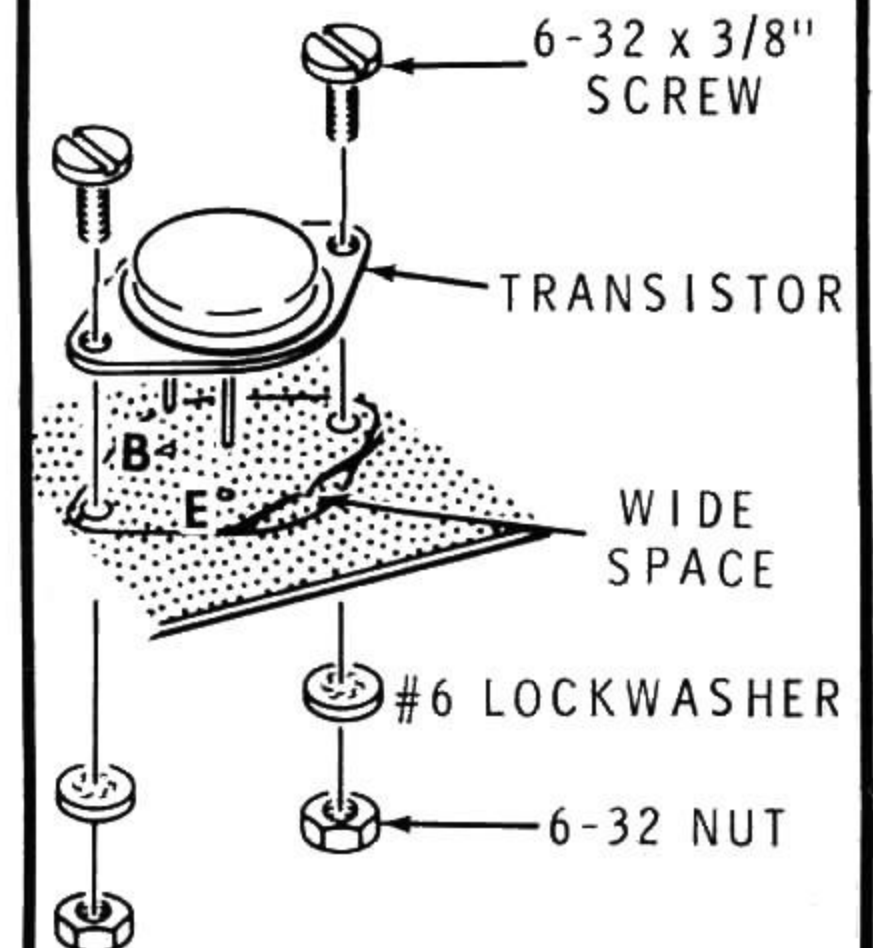
( ) Q5: MPU131 transistor (#417-823). Position the transistor with its flat over the outline of the flat on the circuit board. Then insert the C, G, and A leads into their correct holes. Solder the leads to the foil and cut off the excess lead lengths.



( ) Q4: NL576A SCR (#57-86). Be sure to position the large lug as shown.



( ) Q3: 2N3055 transistor (#417-215) Note the spacing between the leads and the mounting holes. Solder the leads to the foil and cut off the excess lead lengths.





**START** ↘

**NOTE:** When wiring this kit, you will be instructed to prepare the lengths of wire ahead of time. To prepare a wire as in the next step, cut it to the indicated length and remove 3/8" of insulation from each end. At each wire end, twist the small wires together and melt solder on them. The wires are listed in the order in which they will be used.

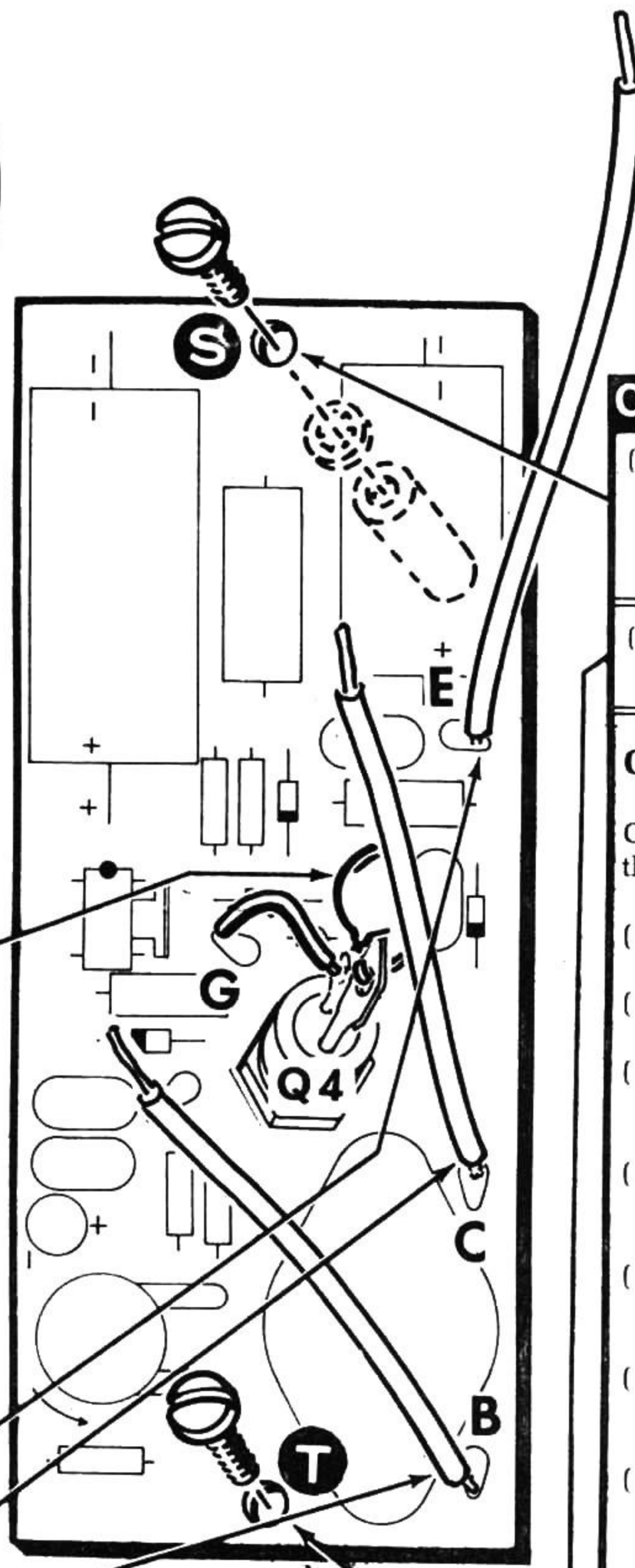
( ) C11: Refer to the inset drawing at the top of this Page and connect one lead of a .1μF ceramic capacitor to the large lug of SCR, Q4. Route the other lead through the small lug to hole G on the circuit board. Use 1" of sleeving on the lead. Solder the small lug and hole G. Cut off the excess lead lengths.

( ) Prepare the following lengths of brown wire: 2", 5-1/2", 3-1/2", and 3-1/2". Solder these wires as you connect them in the following steps.

( ) 5-1/2" wire at E.

( ) 3-1/2" wire at C.

( ) 3-1/2" wire at B.



PICTORIAL 1-4

**CONTINUE** ↘

( ) Mount a 6-32 × 11/16" spacer to the circuit board (foil side) at S with a 6-32 × 3/8" screw and a #6 lockwasher.

( ) In a similar manner, mount a 6-32 × 11/16" spacer at T.

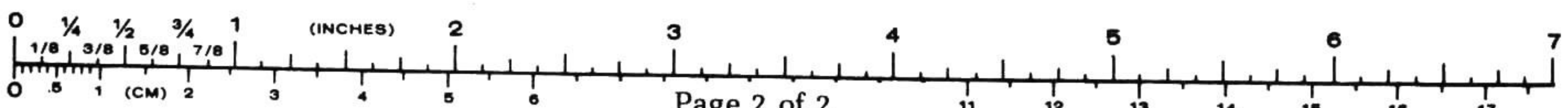
**CIRCUIT BOARD CHECKOUT**

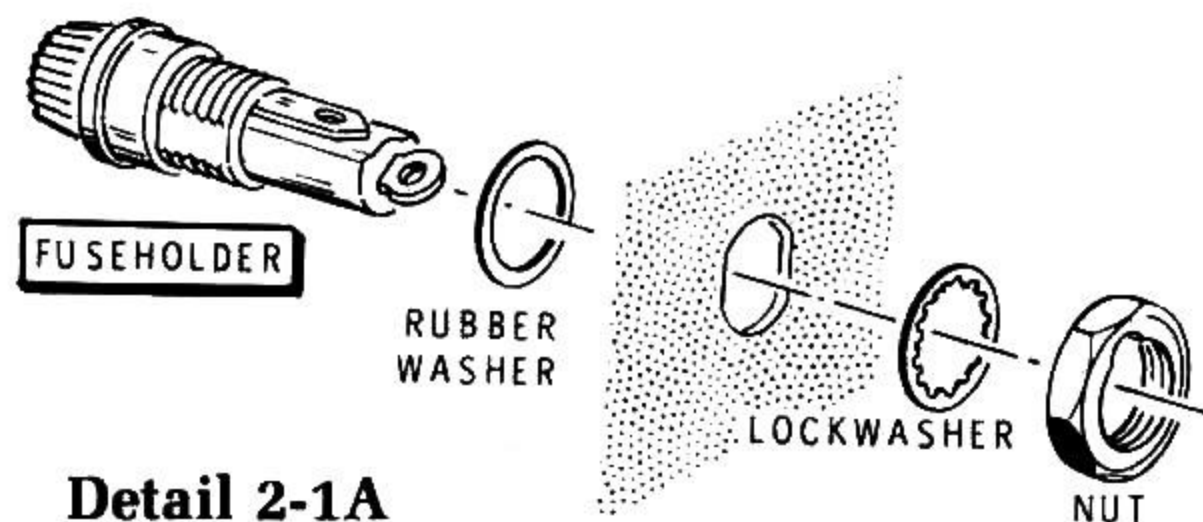
Carefully inspect the circuit board for the following conditions.

- ( ) Unsoldered connections.
- ( ) Poor solder connections.
- ( ) Solder bridges between foil patterns.
- ( ) Protruding leads which could touch together.
- ( ) Integrated circuit for the proper type and installation.
- ( ) Transistor for the proper type and installation.
- ( ) Electrolytic capacitors for the correct position of the positive (+) or negative end.
- ( ) Diode for the correct position of the banded end.

The circuit board wire connections will be made later. Temporarily set the circuit board aside.

**FINISH**





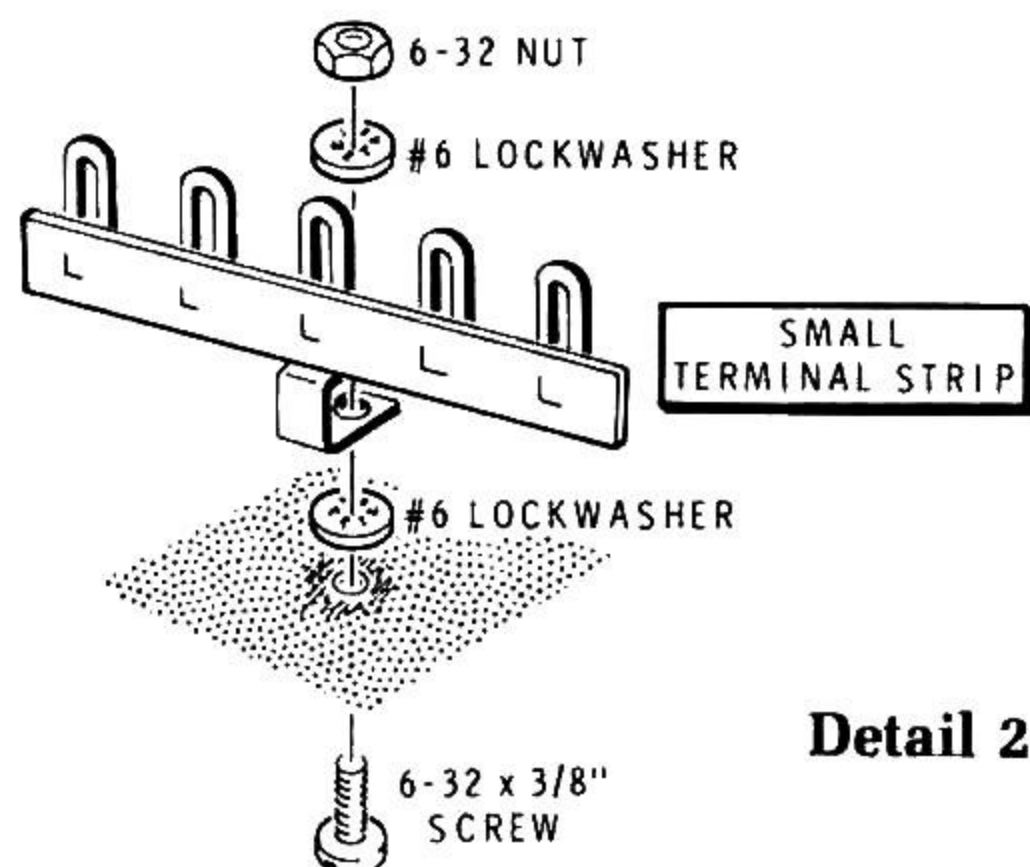
Detail 2-1A

## CHASSIS ASSEMBLY

Refer to Pictorial 2-1 (Illustration Booklet, Page 2) for the following steps.

- ( ) Carefully peel the protective paper from the plastic feet and press a foot onto the chassis bottom at each corner. Do not cover the holes.
- ( ) Use sandpaper or some instrument and scrape or sand the paint from the chassis around holes J, G, and E. It is very important that good electrical connections be made to the chassis at these points.
- ( ) Install a grommet at hole A.
- ( ) Refer to Detail 2-1A and mount a fuseholder at F1 with the hardware supplied with the fuseholder. Be sure to position the lug as shown.
- ( ) In a similar manner, mount a fuseholder at F2.

NOTE: When hardware is used, the steps will give the size and type only. For example, "Use 6-32 x 3/8" hardware" means to use a 6-32 x 3/8" screw, one or more #6 lockwashers, and a 6-32 nut. Refer to the Detail for the proper installation of the hardware. Use the nut starter to pick up and start 6-32 nuts on screws.



Detail 2-1B

- ( ) Refer to Detail 2-1B and install a terminal strip at B with 6-32 x 3/8" hardware.

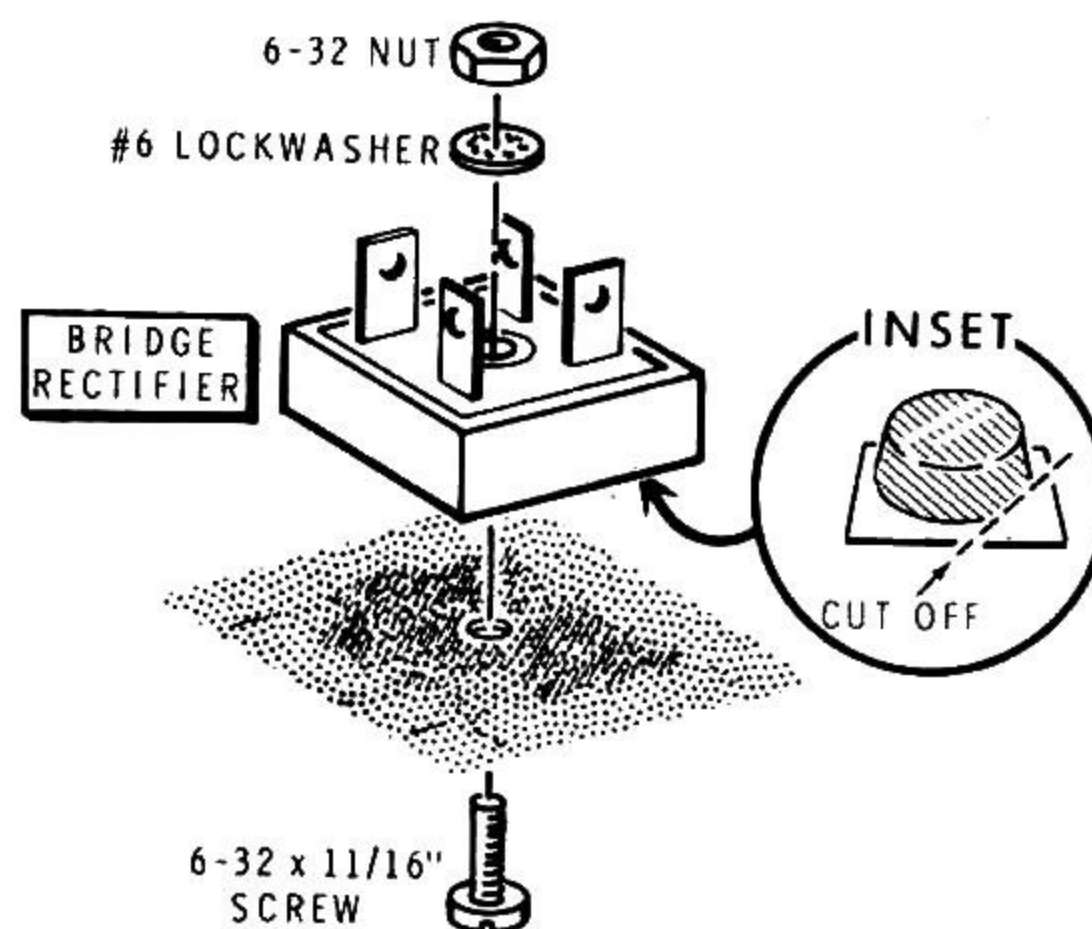
### WARNING:

The thermal compound used in the following step (and later) can be injurious to both your eyes and your clothes. Handle it with utmost care.

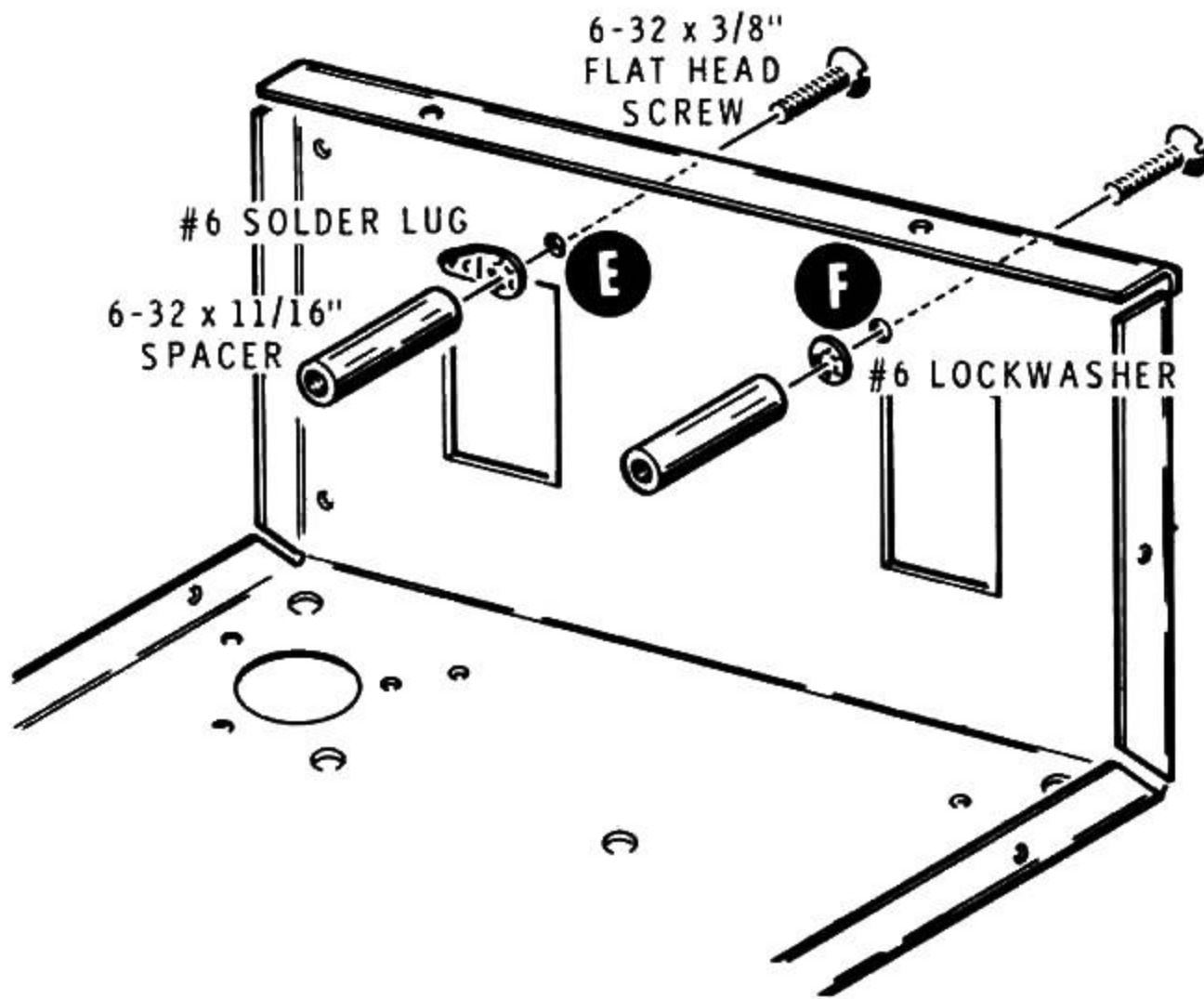
**KEEP THE COMPOUND AWAY FROM YOUR EYES.** Wash your hands **immediately** after you use the compound. Should you get any in your eyes, wash your eyes with water at once and see a doctor as soon as possible.

**KEEP THE COMPOUND OFF YOUR CLOTHES.** If you get the compound on your clothes it may leave a permanent white stain.

- ( ) BR1: Refer to the inset drawing in Detail 2-1C and open the thermal grease pod. Spread a thin layer of the thermal grease on the large flat side of the MDA990 bridge rectifier (#57-88). Save the remaining thermal grease for use later.
- ( ) Refer to Detail 2-1C and install the bridge rectifier at BR1 with 6-32 x 11/16" hardware. Position the plus (+) marked lug as shown in Pictorial 2-1. NOTE: Your bridge rectifier may look slightly different.

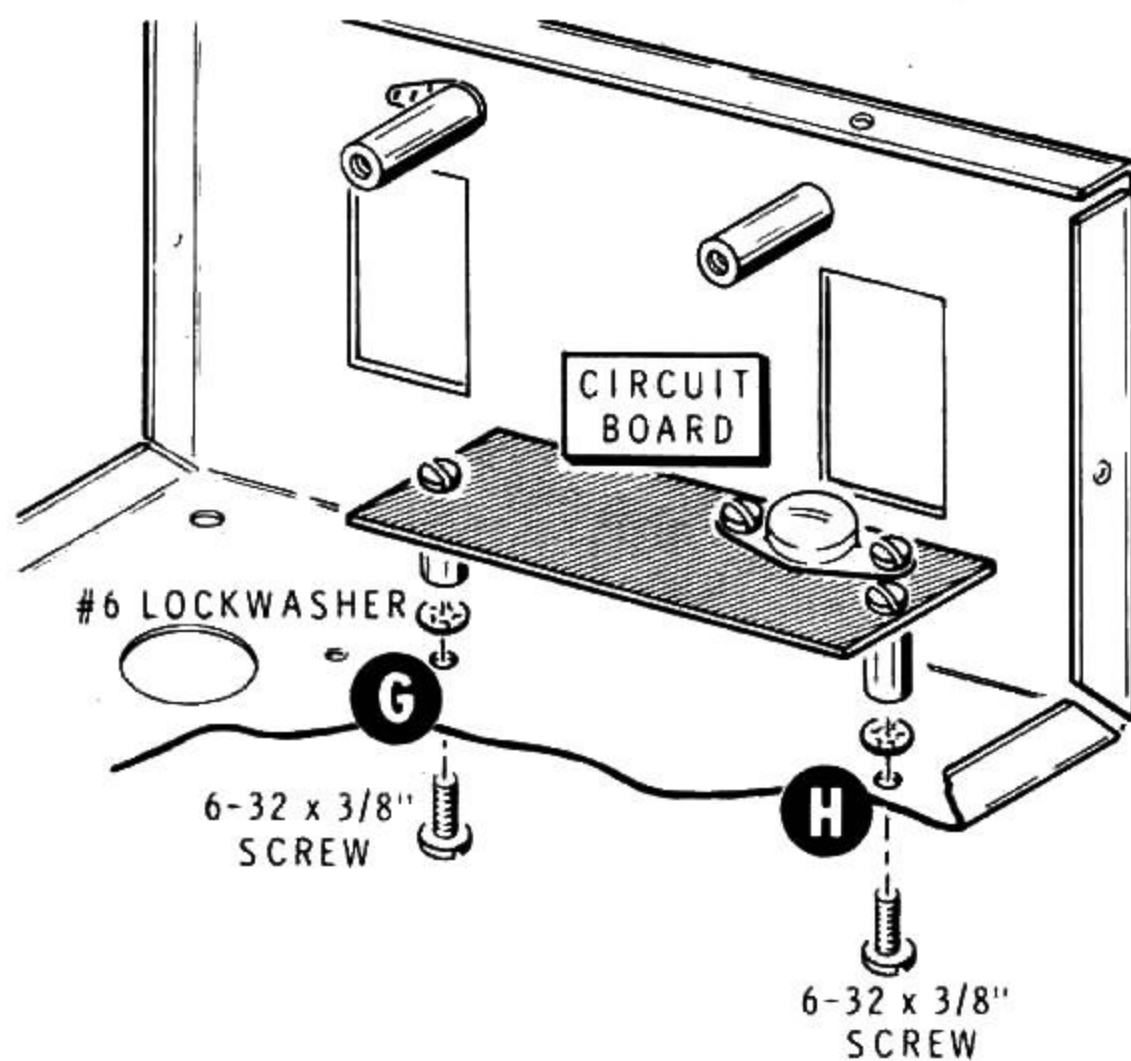


Detail 2-1C

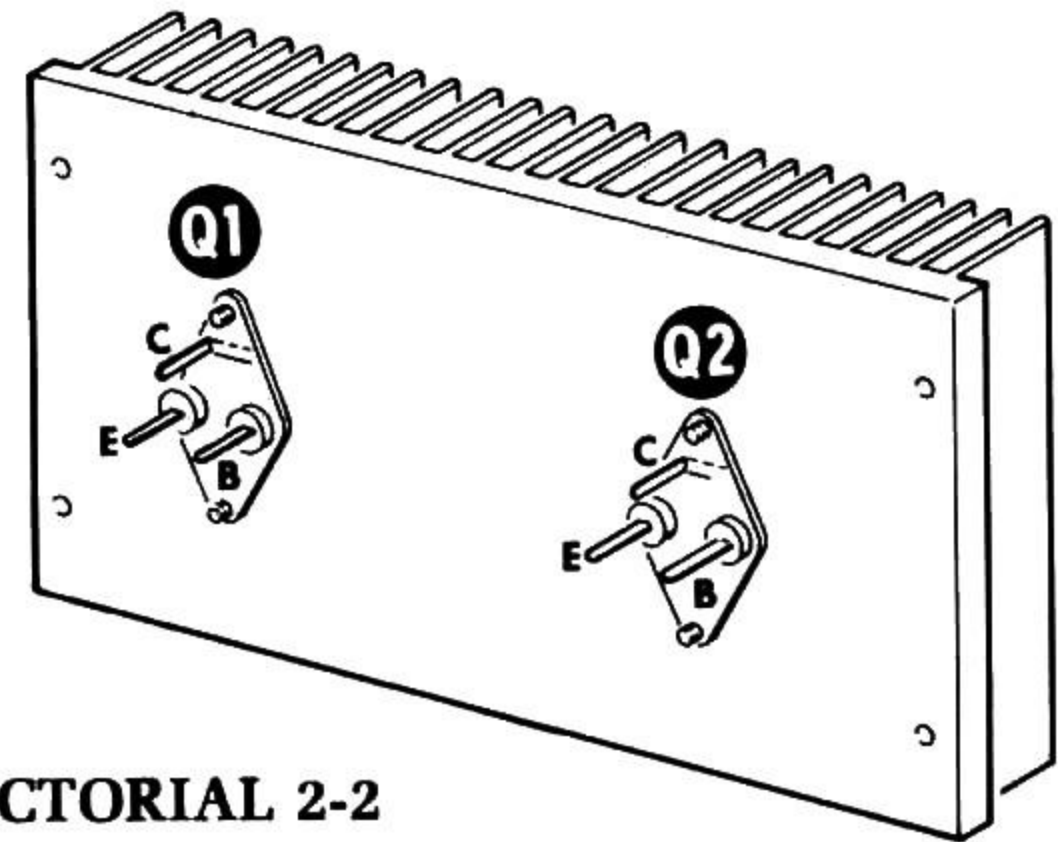


**Detail 2-1D**

- ( ) Refer to Detail 2-1D and mount a 6-32 × 11/16" spacer at E with a 6-32 × 3/8" flat head screw and a #6 solder lug.
- ( ) In a similar manner, mount a 6-32 × 11/16" spacer at F.
- ( ) Refer to Detail 2-1E and mount the circuit board at G and H with 6-32 × 3/8" hardware.



**Detail 2-1E**



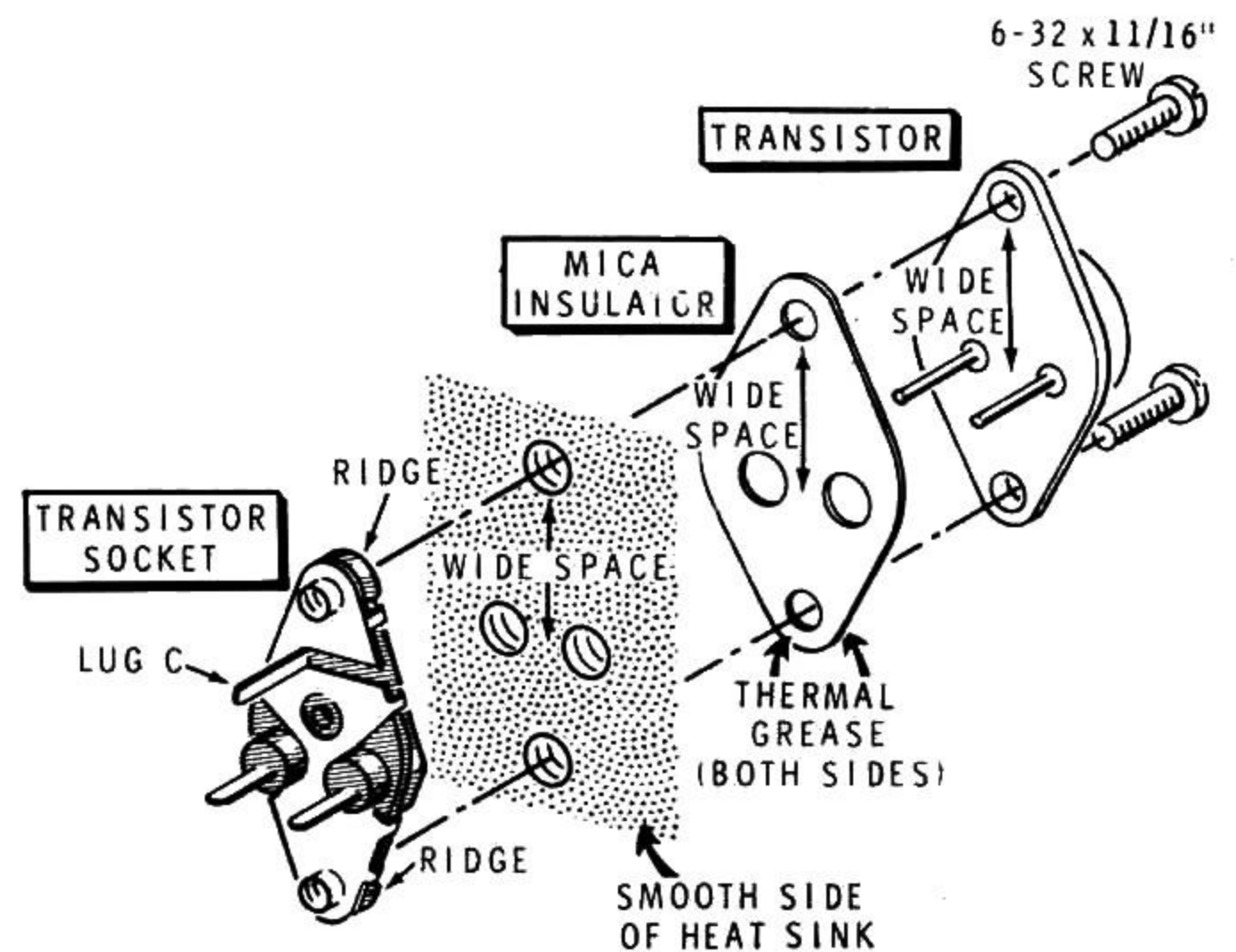
**PICTORIAL 2-2**

Refer to Pictorial 2-2 in the following steps.

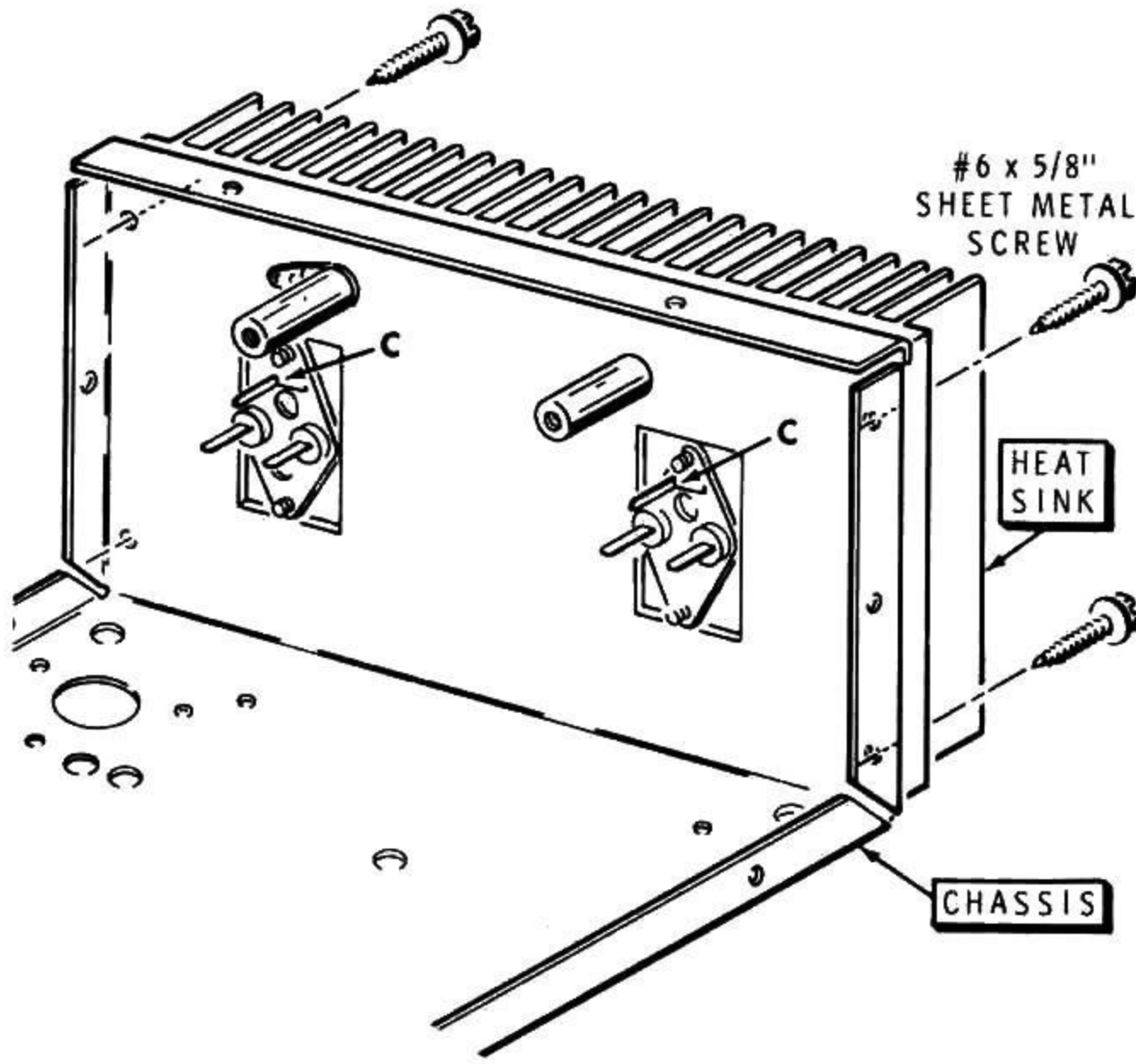
- ( ) Locate two mica insulators and apply thermal compound to both sides of each insulator. Place one insulator on each MJ802 transistor (#417-254).

**NOTE:** As you mount each of the following transistors, line up the wide space on the transistor, mica insulator, heat sink, and transistor socket. Be sure the transistor socket ridges seat properly in the mounting holes when you tighten the screws.

- ( ) Q1: Refer to Detail 2-2A and install an MJ802 transistor (#417-254), mica insulator, and transistor socket on the heat sink at Q1 with two 6-32 × 11/16" screws.
- ( ) Q2: In a similar manner, mount an MJ802 transistor (#417-254) at Q2.



**Detail 2-2A**



**Detail 2-3A**

Refer to Pictorial 2-3 (Illustration Booklet, Page 2) for the following steps.

- ( ) Refer to Detail 2-3A and mount the heat sink on the rear of the chassis panel with four #6 × 5/8" sheet metal screws. Position the heat sink so the C lugs are up as shown.
- ( ) C9: Connect a .1 μF ceramic capacitor between transistor socket Q1, lug C (NS) and solder lug E (S-1).

Prepare the following wire and sleeving.

WIRE	SLEEVING
( ) 5-1/2"	4-1/4"
( ) 6-1/4"	5"
( ) 3-3/4"	
( ) 3-1/4"	1"
( ) 4"	1-1/4"

**CHASSIS WIRING**

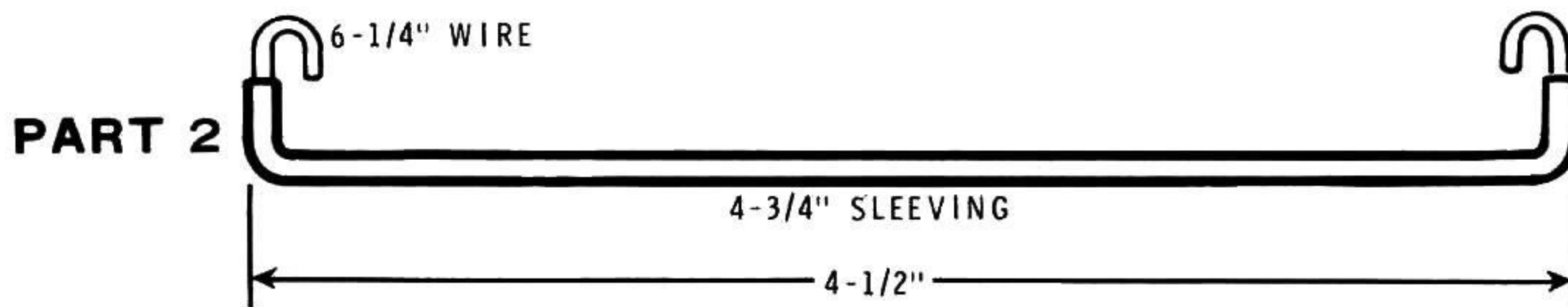
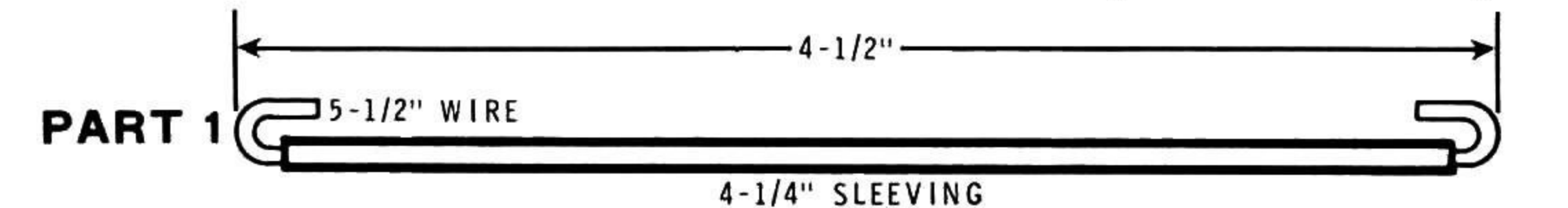
NOTE: To prepare bare wire in the following steps, cut the bare wire and sleeving to the indicated lengths; then place the sleeving on the wire. The wires will be used in the order they are listed.

NOTE: As you install each wire, form the wire to the respective outline given in Detail 2-3B. Be careful not to damage the connecting lugs.

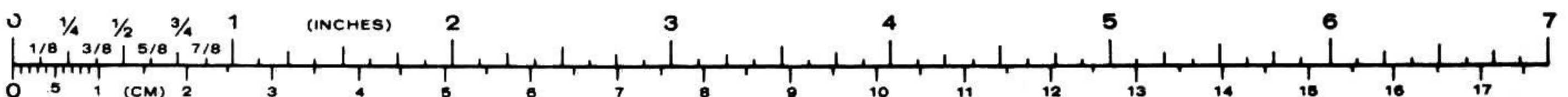
- ( ) Refer to part 1 and form the 5-1/2" wire as shown.

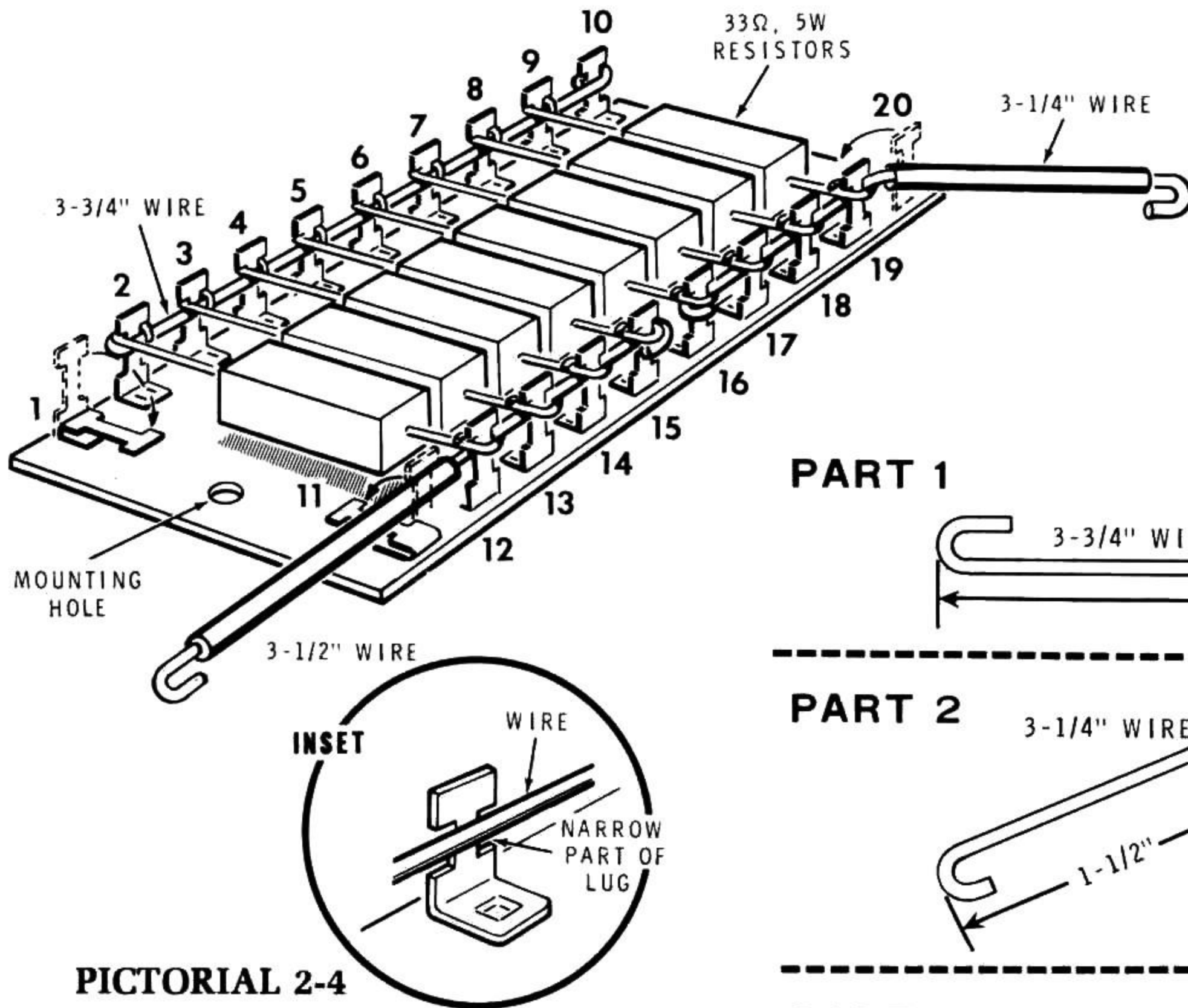
NOTE: In the following steps, (NS) means not to solder because other wires will be added later. "S-" with a number, such as (S-3), means to solder the connection. The number following "S" tells how many wires are at the connection. Use special care when you solder these connections. Apply enough heat and solder so that each wire is properly soldered.

- ( ) Connect this wire between Q1 lug C (S-2) and Q2 lug C (NS).
- ( ) Refer to part 2 and form the 6-1/4" wire as shown.
- ( ) Connect this wire between Q1 lug B (S-1) and Q2 lug B (NS). Be careful you do not solder the transistor pins to the socket lugs.



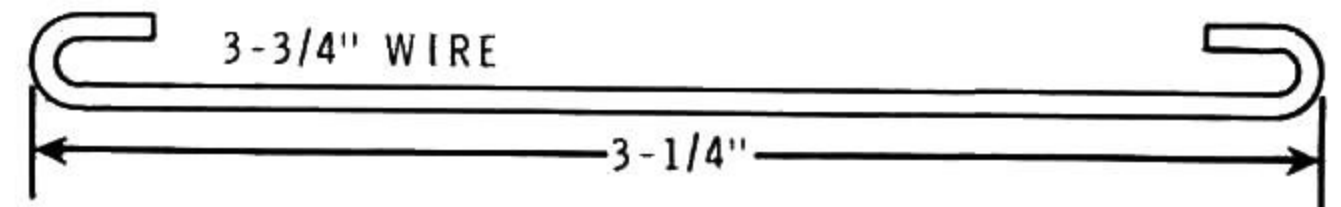
**Detail 2-3B**



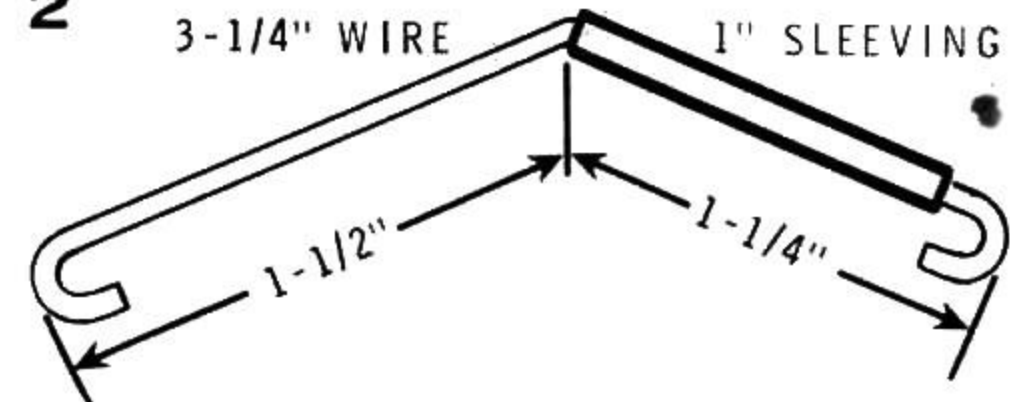


PICTORIAL 2-4

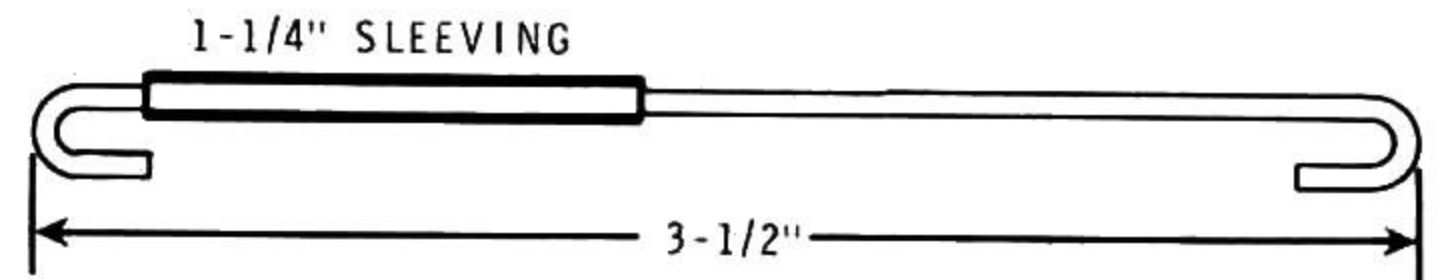
PART 1



PART 2



PART 3



Detail 2-4A

Refer to Pictorial 2-4 in the following steps.

- ( ) Locate the terminal board and bend over lugs 1, 11, and 20. Either end of the board can be the lug 1 end.
- ( ) Refer to Part 1 of Detail 2-4A and form the 3-3/4" wire as shown.

NOTE: When you solder a bare wire to the terminal board, be sure to connect the wire to the narrow part of the lug as shown in the inset drawing. Do not lay the wire down against the terminal board.

- ( ) Crimp the 3-3/4" bare wire to lugs 2 and 10. Place the wire on the inside of the lugs. Solder lugs 2 and 10 only.
- ( ) Refer to Part 2 of Detail 2-4A and form the 3-1/4" wire as shown.
- ( ) Crimp this wire to lug 16 as shown. Solder lugs 16 and 19 only.
- ( ) Refer to Part 3 and form the 4" wire as shown.

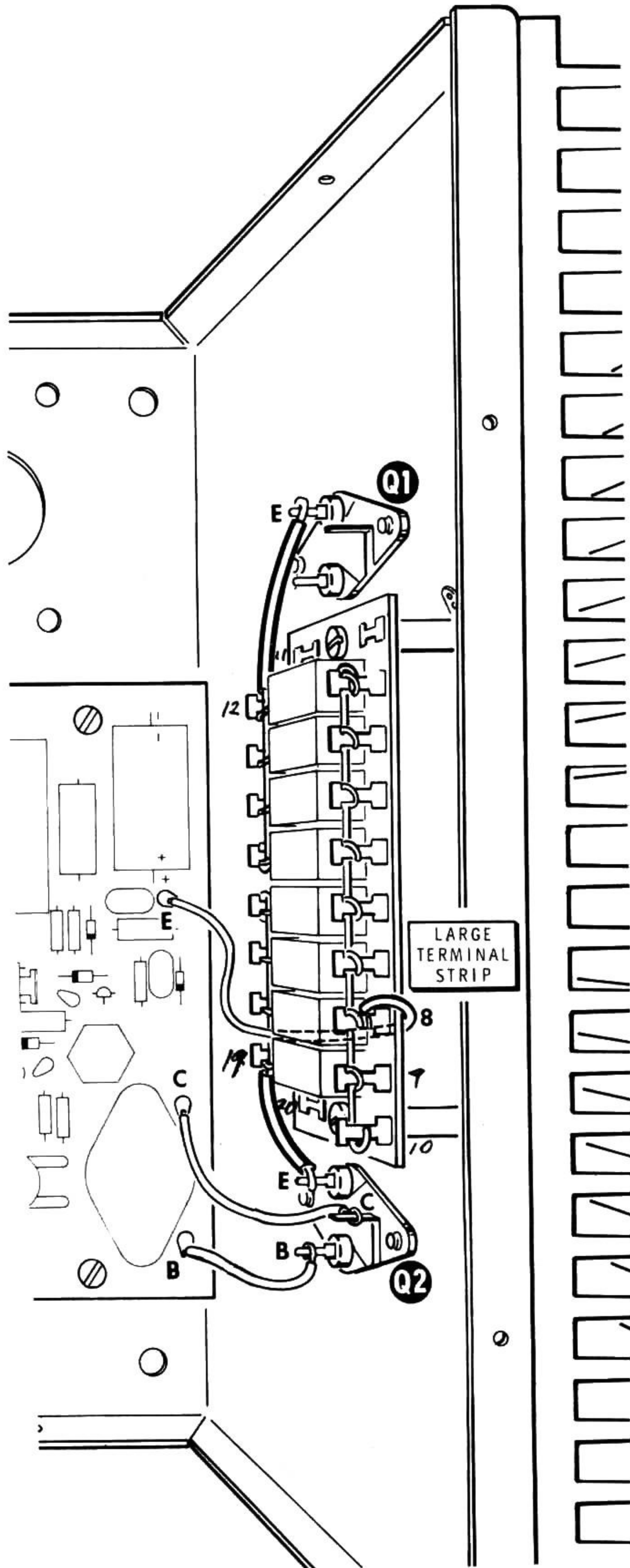
- ( ) Crimp this wire to lug 15 as shown. Solder lugs 12 and 15 only.

NOTE: Resistors R1 and R2 (which will be constructed on the terminal board) are each made up of four .33  $\Omega$ , 5-watt, wire-wound resistors.

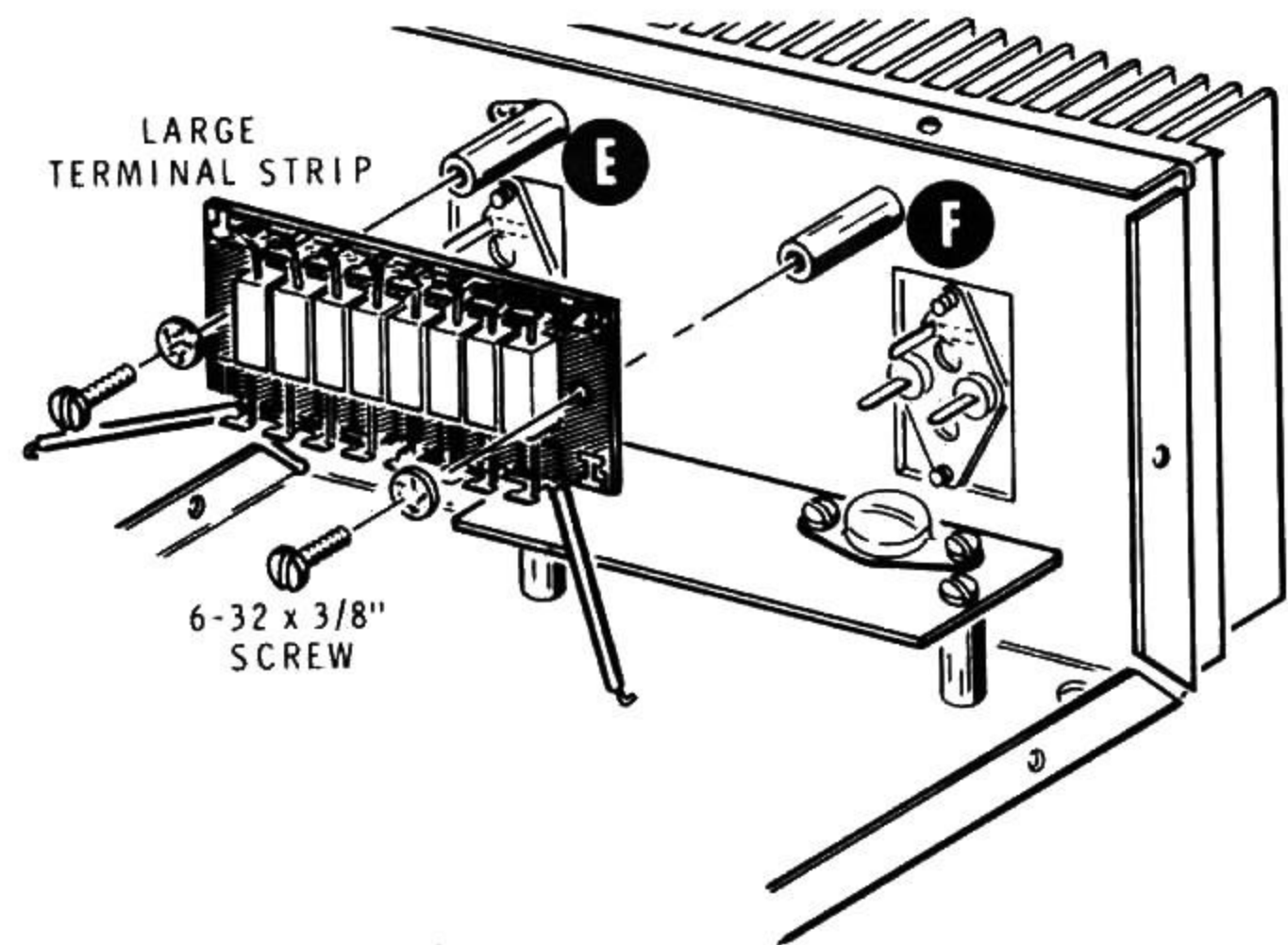
- ( ) Solder a .33  $\Omega$ , 5-watt resistor between lugs 2 and 12. Wrap the resistor lead around the terminal board lug and the bare wire. Do not permit the resistor to lay against the board.
- ( ) In the same manner, solder seven more .33  $\Omega$ , 5-watt resistors to the terminal board.
- ( ) Check the bare wires connected to lugs 15 and 16 on the terminal board. These two lugs should not touch.







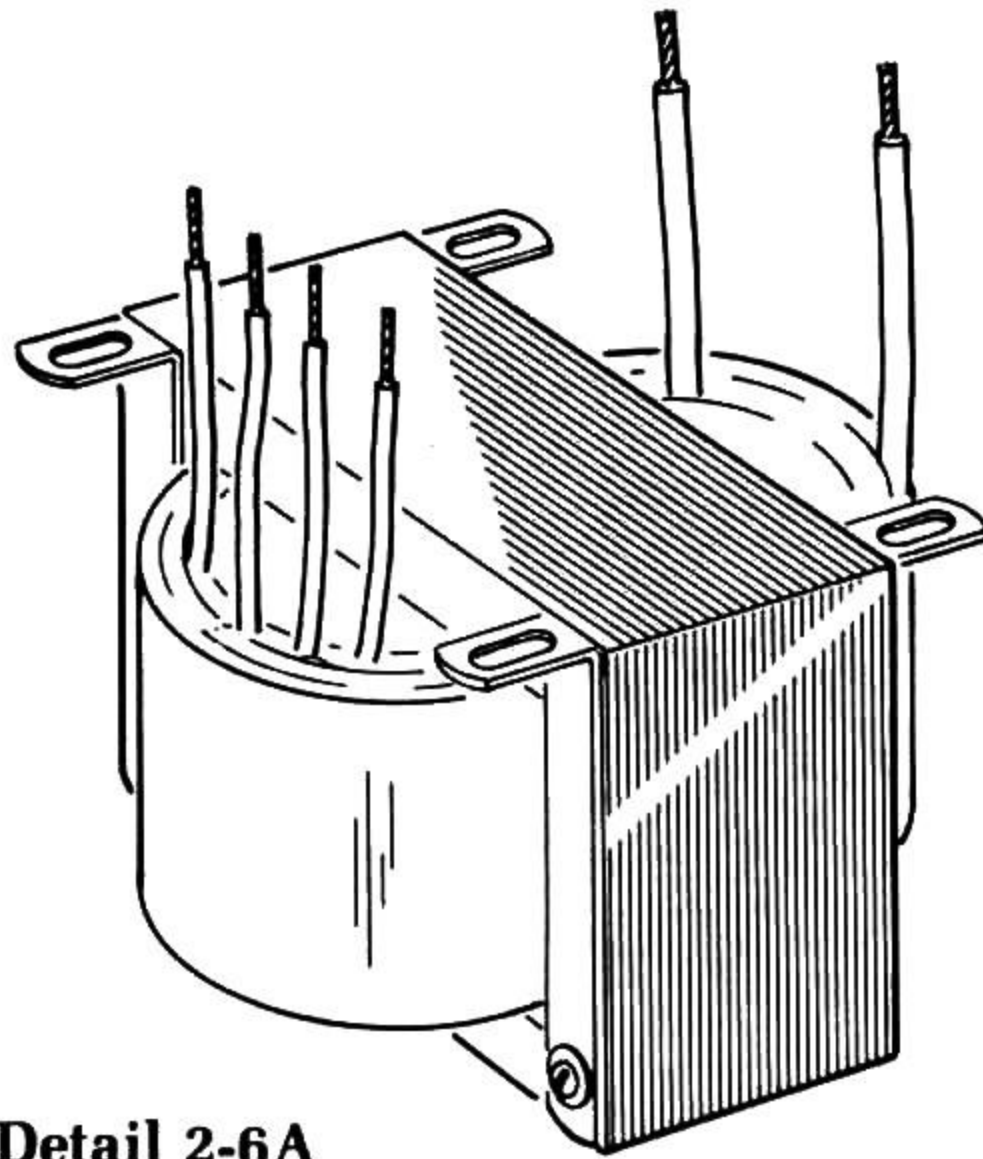
PICTORIAL 2-5



Detail 2-5A

Refer to Pictorial 2-5 for the following steps.

- ( ) Hold the terminal board up to spacers E and F. Carefully form the two wires coming from the terminal board so they fit over Q1 and Q2 lugs E. Be careful that you do not break the terminal board lugs.
- ( ) Position the wire coming from hole E on the circuit board behind the terminal board. Then refer to Detail 2-5A and mount the terminal board to spacers E and F with 6-32  $\times$  3/8" screws and #6 lockwashers.
- ( ) Connect the wire coming from lug 12 of the terminal board to Q1 lug E (S-1).
- ( ) Connect the wire coming from lug 19 to Q2 lug E (S-1).
- ( ) Connect the wire coming from circuit board hole B to Q2 lug B (S-2).
- ( ) Connect the wire coming from circuit board hole C to Q2 lug C (NS).
- ( ) Solder the wire coming from circuit board hole E to terminal board lug 8. Note that other wires have already been soldered to this lug.



Detail 2-6A

Refer to Pictorial 2-6 (Illustration Booklet, Page 3) for the following steps.

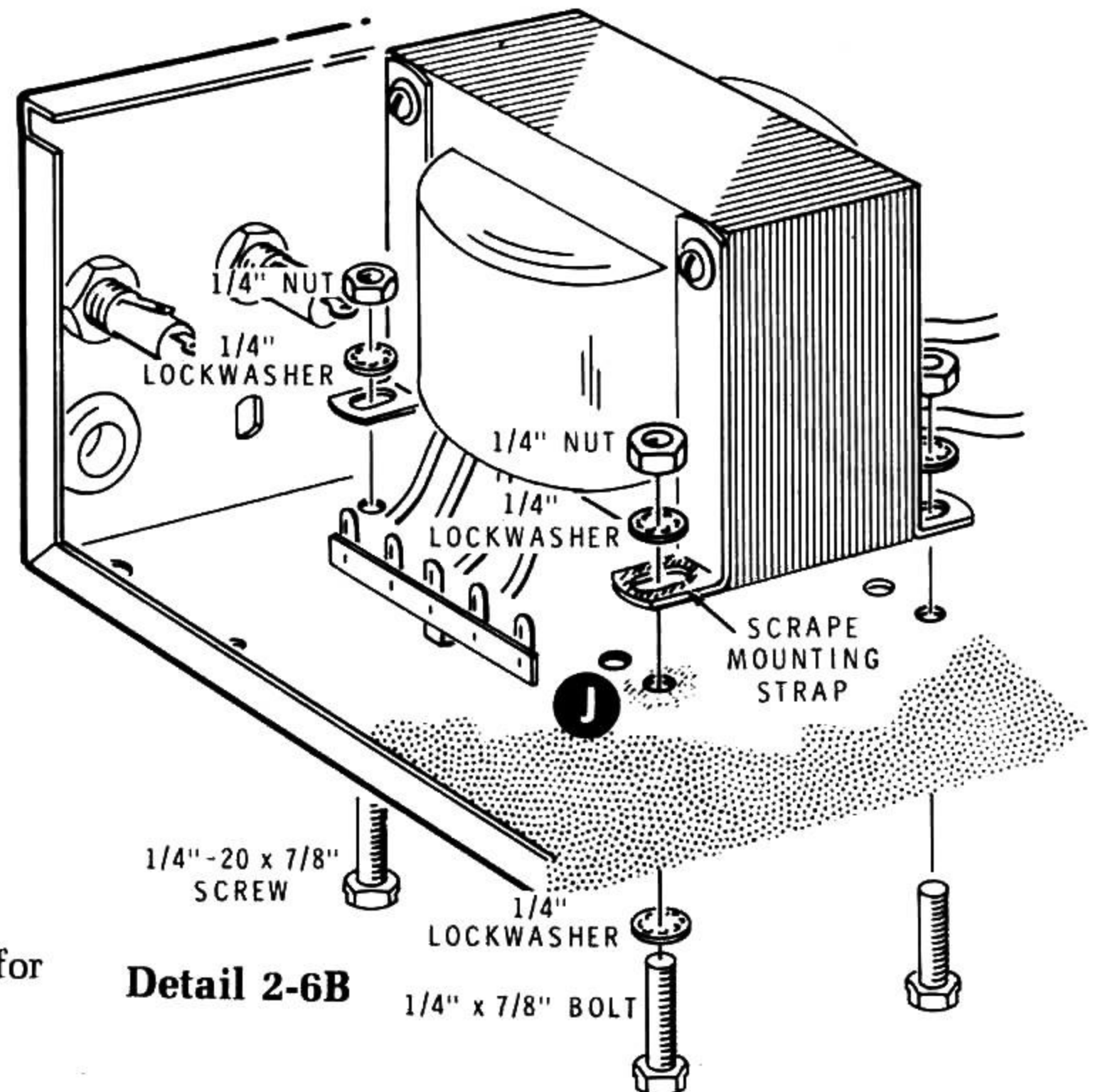
- ( ) Slide an 11" length of sleeving over a 12" bare wire. Then connect this wire between fuseholder F2 lug 2 (S-1) and BR1 lug 1 (NS). Do not position this wire down against the chassis where it passes along the rear panel. Route the wire as shown.
- ( ) Refer to Detail 2-6A and straighten the transformer leads as shown.
- ( ) Refer to Detail 2-6B and scrape the top and bottom areas of the indicated transformer mounting strap.

NOTE: In the next step, make sure that the bare wire along the rear panel does not become pinched under the power transformer.

- ( ) Mount the transformer with 1/4" x 7/8" hardware; position the transformer and leads as shown. Note the extra lockwasher at hole J and disregard the two unused holes.

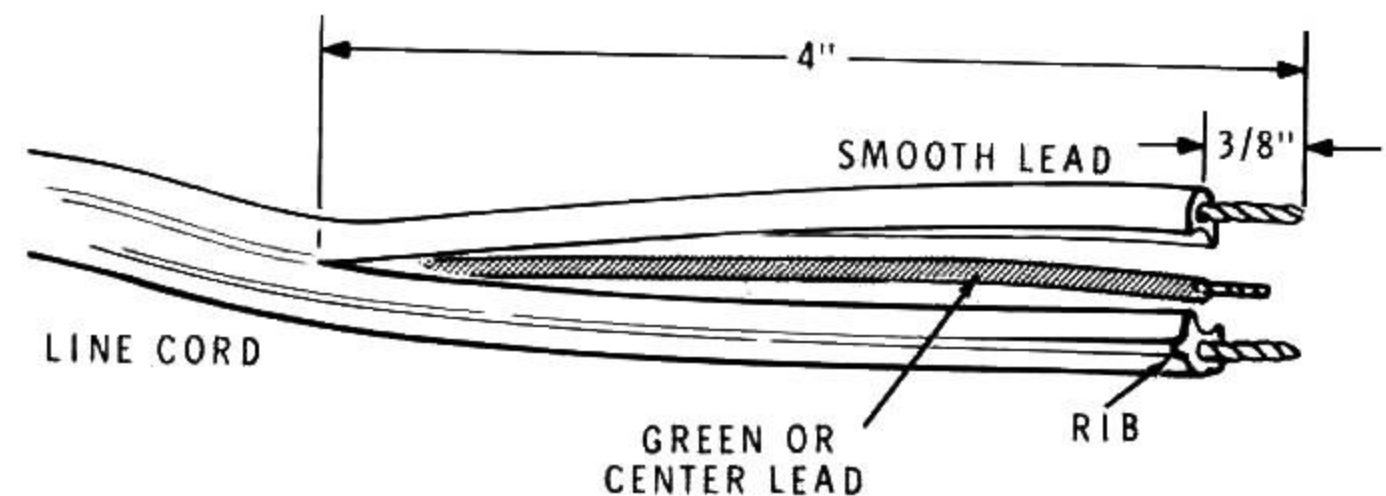
NOTE: Refer to inset drawing #1 and make mechanically secure connections as you wire the transformer and line cord in the following steps.

- ( ) Connect the black-red transformer lead to lug 5 of terminal strip B (NS).
- ( ) Connect the black-yellow transformer lead to lug 4 of terminal strip B (NS).



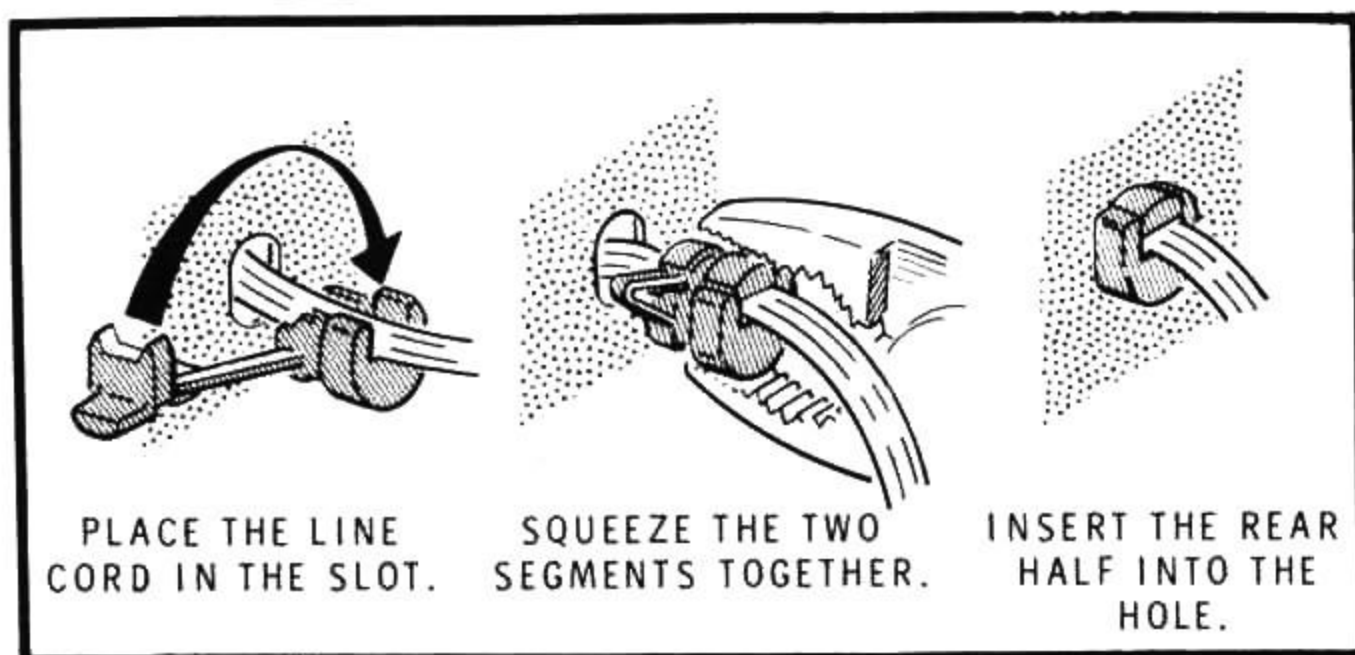
Detail 2-6B

- ( ) Connect the black-green transformer lead to lug 2 of terminal strip B (NS).
- ( ) Connect the black transformer lead to lug 1 of terminal strip B (NS).



Detail 2-6C

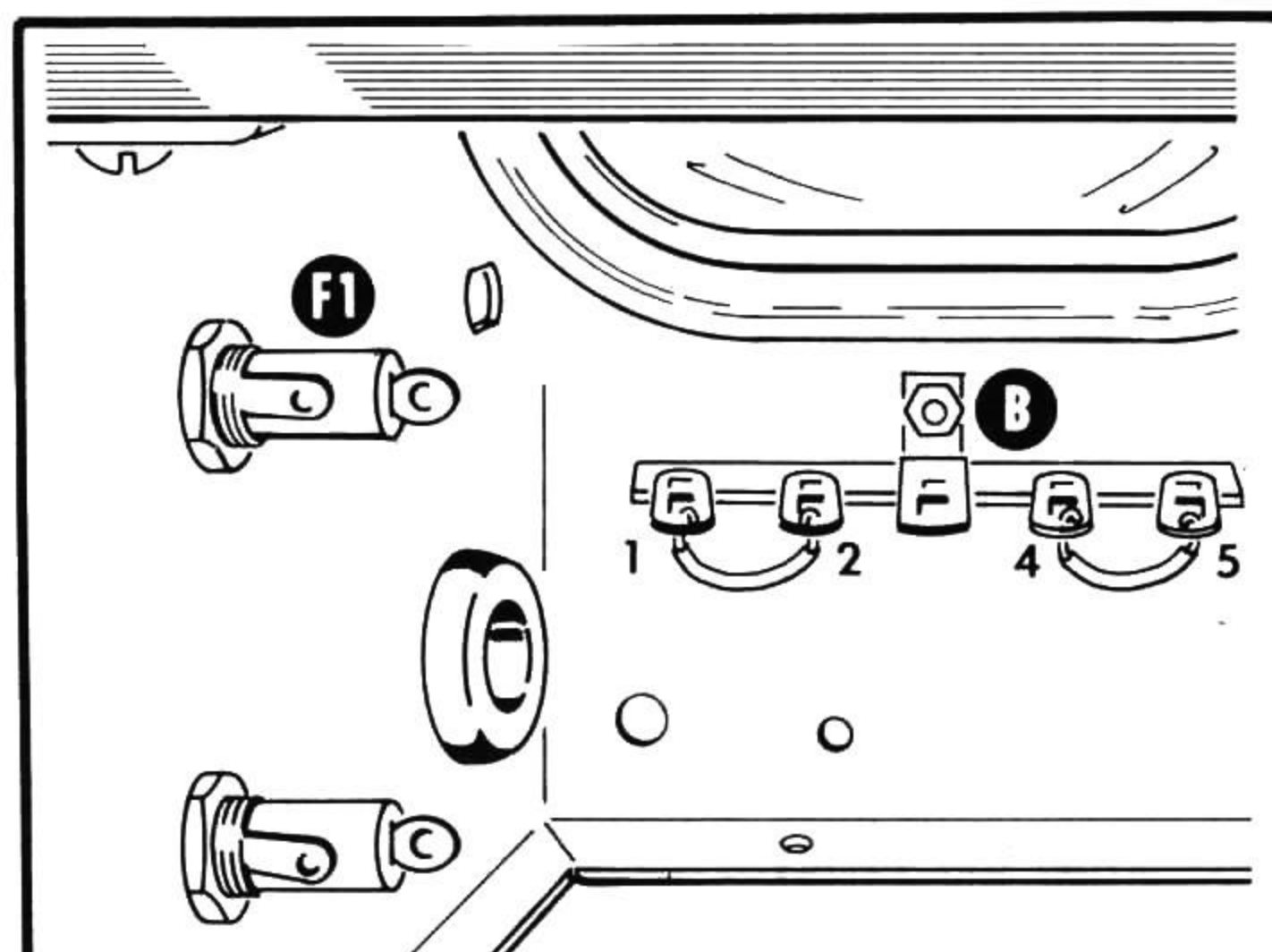
- ( ) Refer to Detail 2-6C and separate the wires at the free end of the line cord for 4". Prepare the wire ends as shown. Note that there is a smooth lead and a ribbed lead as shown in inset drawing #2.
- ( ) Insert the prepared end of the line cord through hole L and connect the smooth lead to fuseholder F1 lug 2 (S-1). Make a mechanically secure connection.
- ( ) Securely connect the ribbed lead to terminal strip B lug 1 (NS).
- ( ) Securely connect the green or center lead to terminal strip B lug 3 (S-1).



Detail 2-6D

- ( ) Refer to Detail 2-6D and install a strain relief on the line cord at hole L.

NOTE: Two different sets of wiring instructions are given in the following steps. One set is for 120-VAC line voltage (most often used in the United States), and the other is for 240-VAC line voltage. Use only the instructions that agree with the line voltage in your area. The 7-ampere fuse supplied with this kit is for 120-VAC use only.

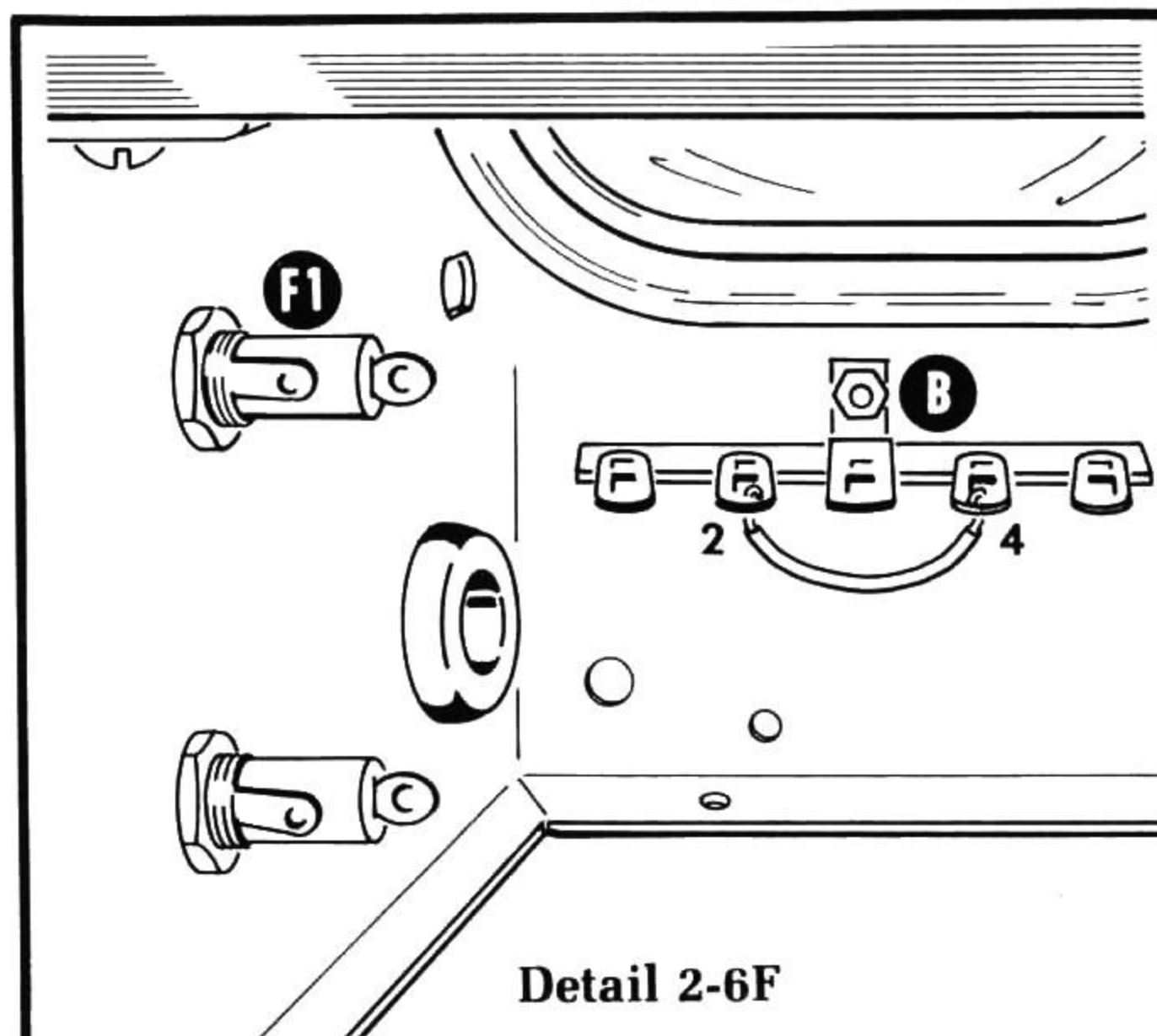


Detail 2-6E

### For 120 VAC Only

Refer to Detail 2-6E for the following steps.

- ( ) Prepare two 2" lengths of brown wire.
- ( ) Connect a 2" wire between lugs 1 (S-3) and 2 (S-2) of terminal strip B.
- ( ) Connect the other 2" wire between lugs 4 (S-2) and 5 (NS) of terminal strip B.
- ( ) F1: Turn the fuseholder cap counterclockwise and install a 7-ampere fuse.



Detail 2-6F

### For 240 VAC Only

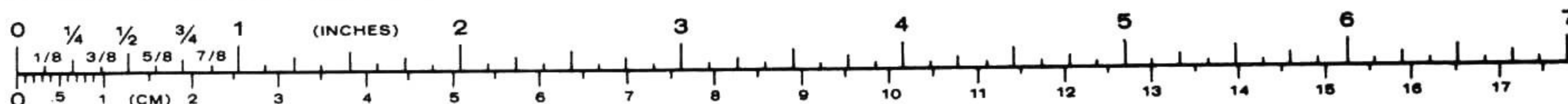
Refer to Detail 2-6F for the following steps.

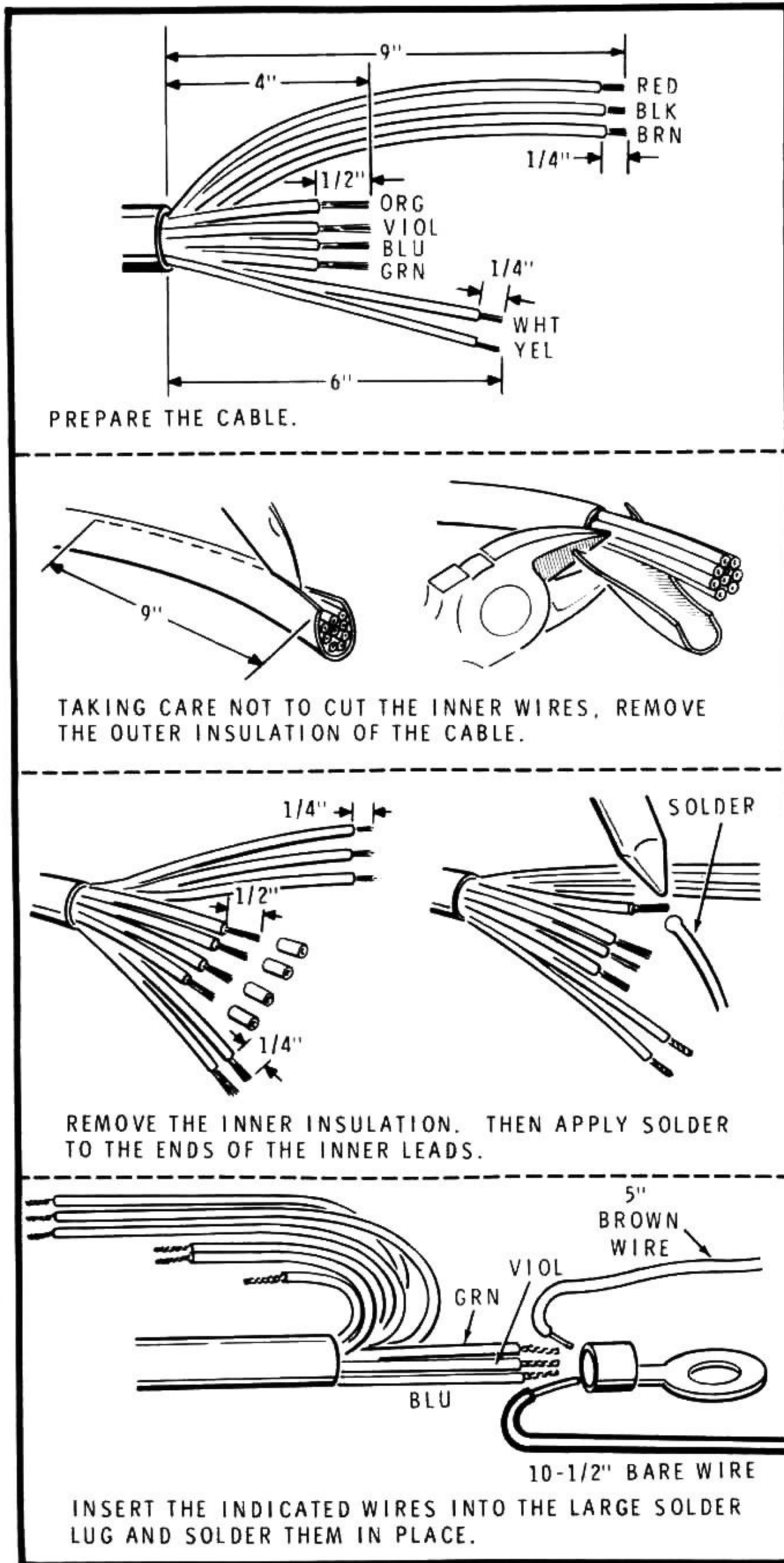
- ( ) Prepare a 2" length of brown wire and connect it between lugs 2 (S-2) and 4 (S-2) of terminal strip B.
- ( ) Solder the wires connected to lug 1 (S-2) of terminal strip B.
- ( ) F1: Turn the fuseholder cap counterclockwise and install a 4-ampere fuse (not supplied).

NOTE: The plug on the power cord in this kit is for standard 120-VAC outlets. For 240-VAC operation in the U.S.A., cut off the plug and replace it with a permanent plug that matches your 240-VAC receptacle. Be sure your power connection conforms with section 210-21 (b) of the National Electric Code, which reads in part:

"Receptacles connected to circuits having different voltages, frequencies, or types of current (AC or DC) on the same premises shall be of such design that attachment plugs used on such circuits are not interchangeable."

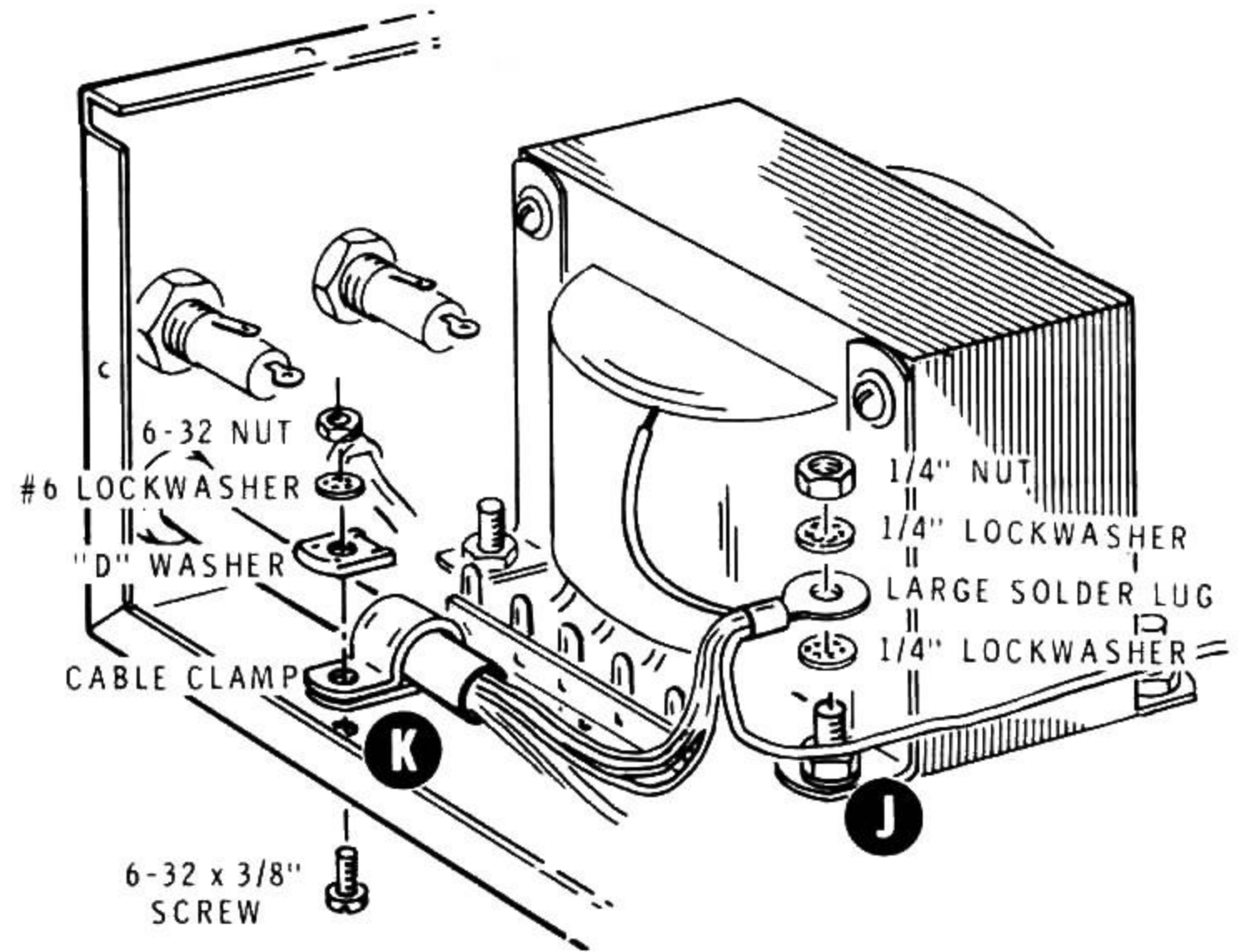
When you install a new plug, make sure you connect it according to your local electrical code. Keep in mind that the green, or center, line cord wire is connected to the power supply chassis.





**Detail 2-6G**

- ( ) Insert one end of the cable through grommet A.
- ( ) Refer to Detail 2-6G and prepare the cable as shown.
- ( ) Cut a 10-1/2" length of bare wire. Place a 9-3/4" length of sleeving on this wire.
- ( ) Prepare a 5" brown wire.



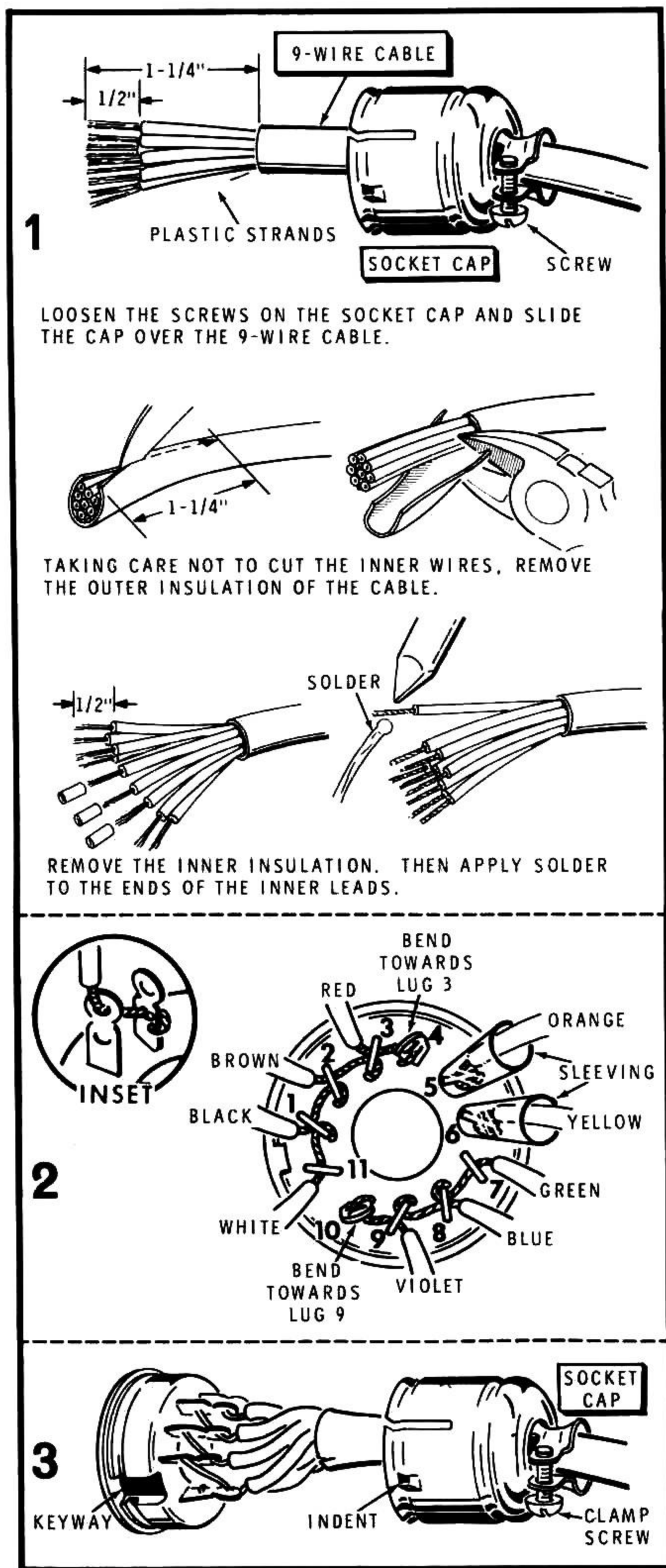
**Detail 2-6H**

- ( ) Insert the green, blue, and violet cable wires, the 5" brown wire and the 10-1/2" bare wire into the large solder lug and solder them to the lug.
- ( ) Refer to Detail 2-6H and mount the large solder lug at J with a 1/4" nut and two 1/4" lockwashers. Route the 10-1/2" bare wire as shown.
- ( ) Mount a cable clamp at K on the cable with 6-32 x 3/8" hardware and a D-washer as shown.
- ( ) Crimp the other end of the 10-1/2" bare wire to BR1 lug 3 (NS).
- ( ) Solder the free end of the 5" brown wire to the large lug of SCR Q4.

Connect the wires coming from the cable as follows:

- ( ) White wire to circuit board connector pin A (S-1).
- ( ) Yellow wire to fuseholder F1 lug 1 (S-1).
- ( ) Orange wire to terminal strip B lug 5 (S-3). (This would be S-2 if you wired your Power Supply for 240 VAC.).
- ( ) Solder the red, black, and brown wires to lug 10 on the terminal board.





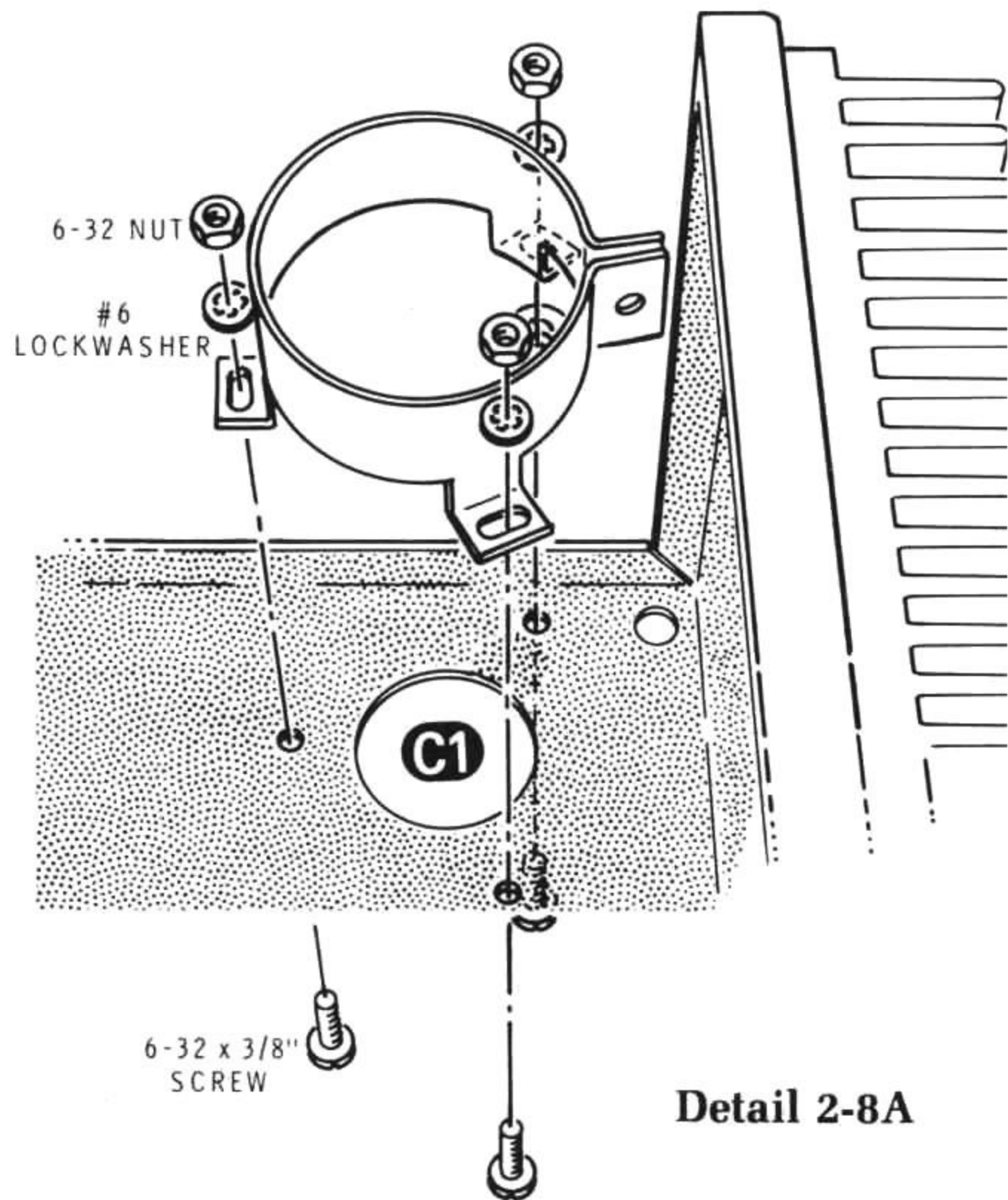
PICTORIAL 2-7

Refer to Pictorial 2-7 for the following steps.

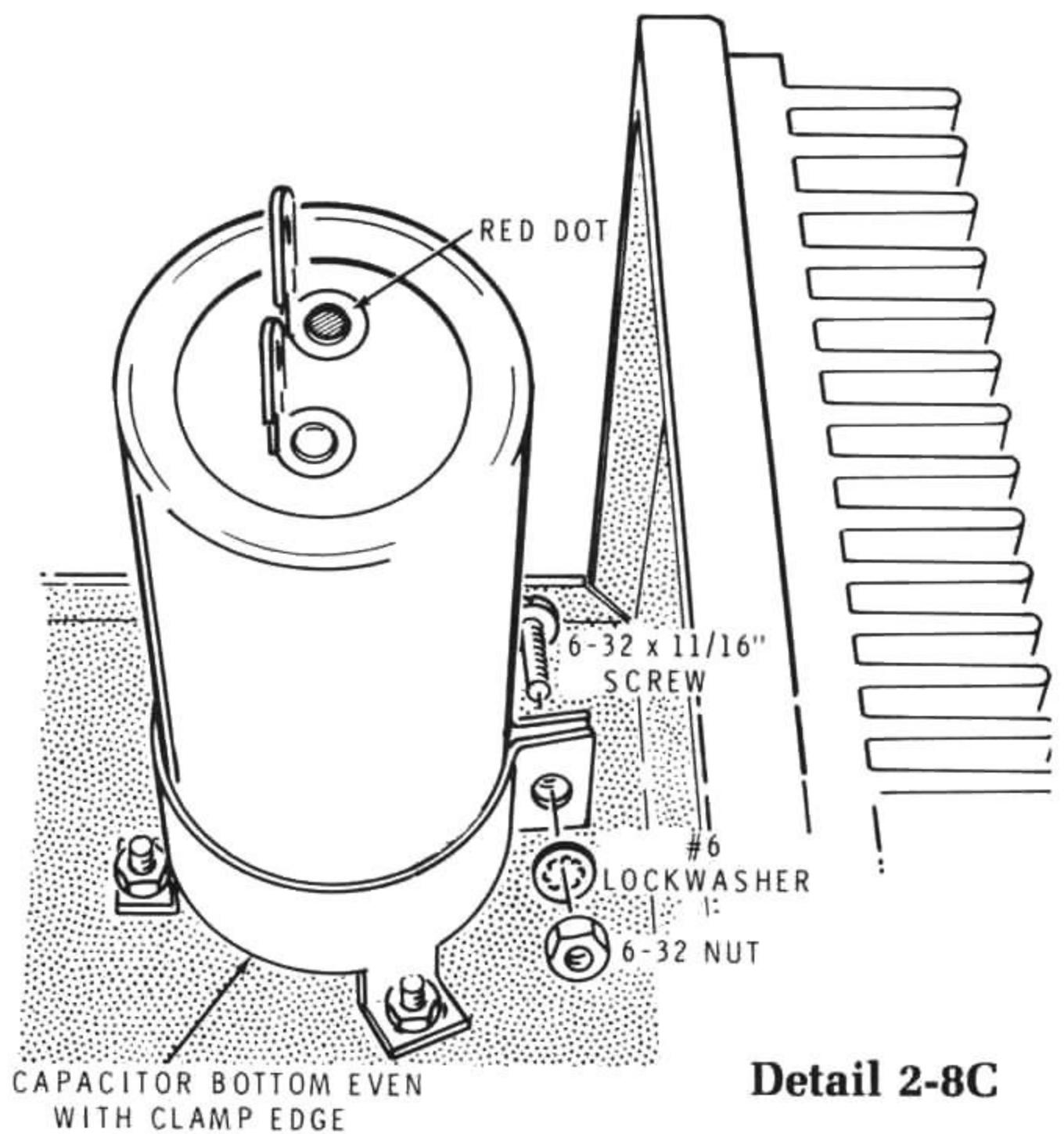
- ( ) Refer to Part 1 and prepare the free end of the cable. Cut off the small black plastic strands.
- ( ) Slide the socket cap over the cable.
- ( ) Locate the clear sleeving and cut it in half. Place these lengths on the orange and yellow wires.
- ( ) Refer to Part 2 of Pictorial 2-7 and the inset and connect the wires to the socket lugs as shown. Solder the wires at each lug.
- ( ) Slide the lengths of insulation down over the connections at lugs 5 and 6.
- ( ) Refer to Part 3 of Pictorial 2-7, line up the socket cap indent with the socket keyway, and press the cap onto the socket. Then tighten the clamp screws.

Refer to Pictorial 2-8 (Illustration Booklet, Page 4) for the following steps.

- ( ) Position the chassis as shown.
- ( ) Connect one transformer white lead to bridge rectifier BR1 lug 2 (S-1). Wrap the lead on the lug.
- ( ) Connect the other transformer white lead to bridge rectifier BR1 lug 4 (S-1). Wrap the lead on the lug.



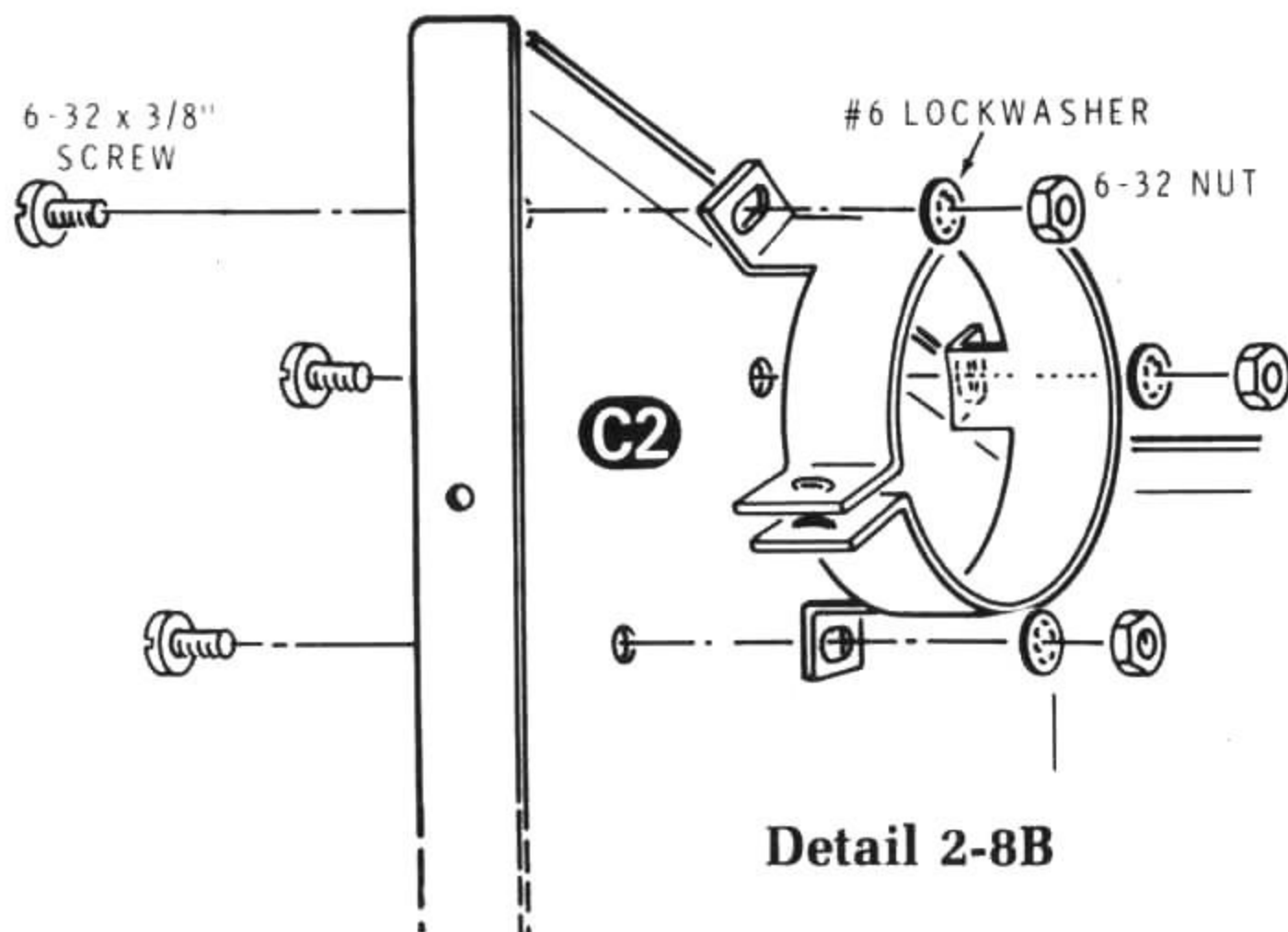
**Detail 2-8A**



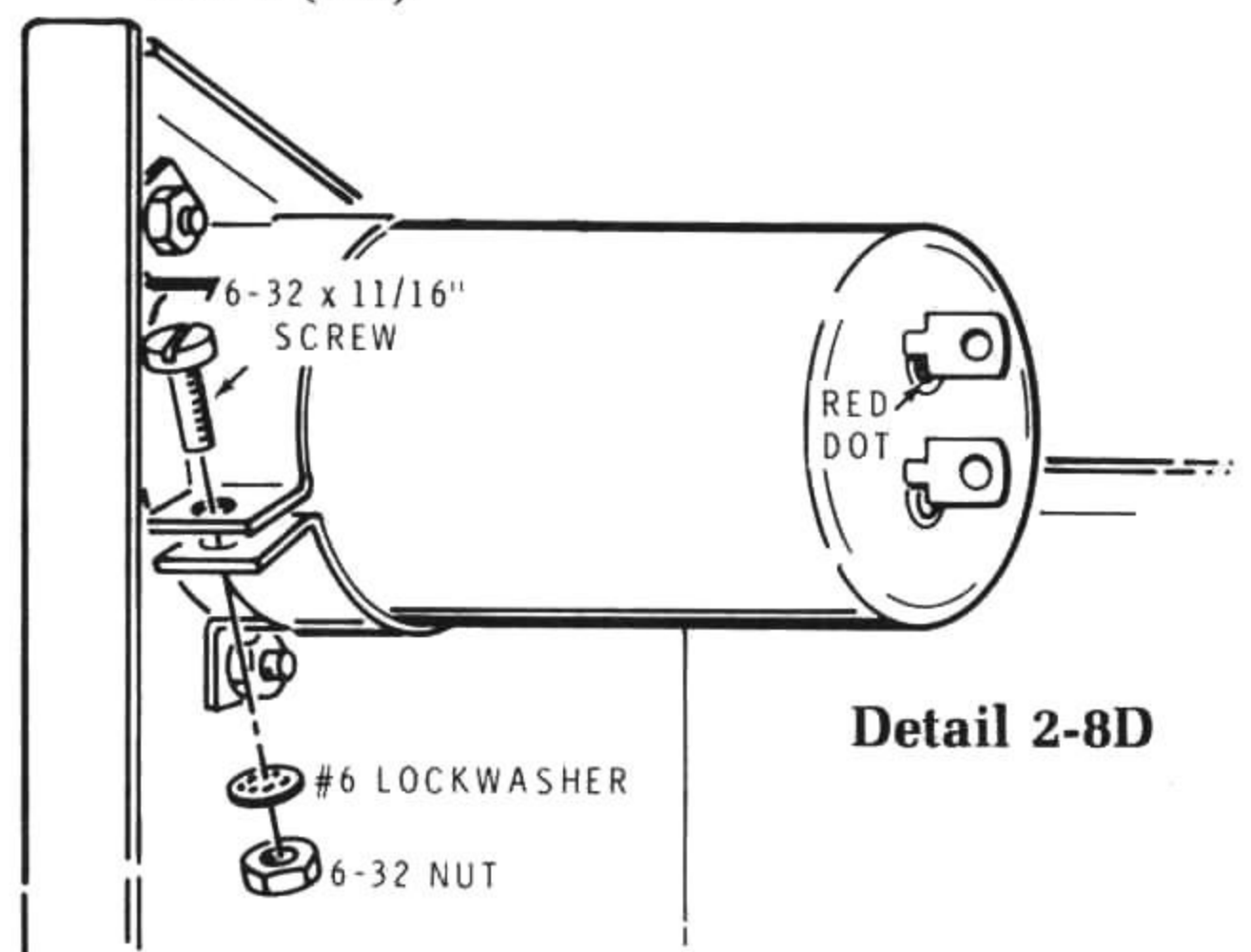
**Detail 2-8C**

NOTE: In the following steps, do not tighten the clamp hardware until the steps indicate.

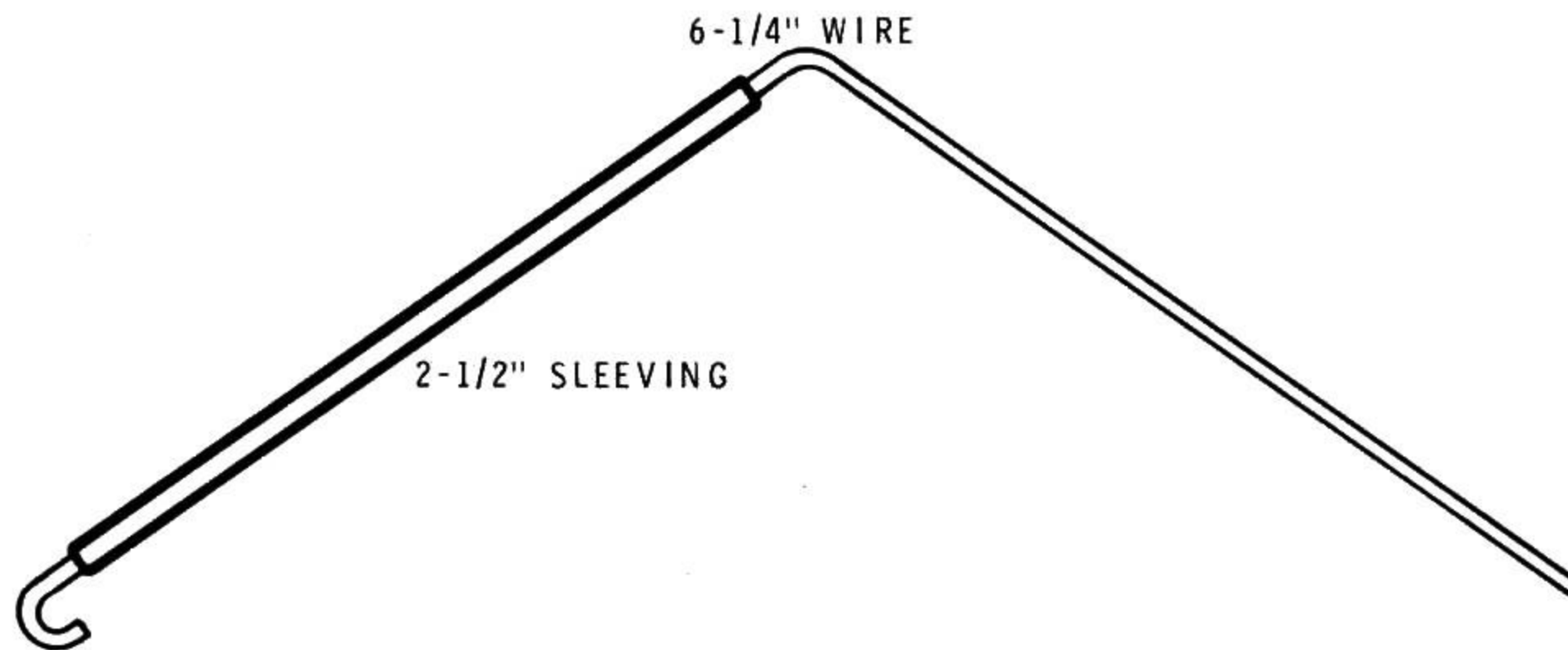
- ( ) Install 6-32 × 11/16" hardware in each clamp.
- ( ) Refer to Detail 2-8A and mount a clamp at C1 in the position shown. Use 6-32 × 3/8" hardware.
- ( ) Refer to Detail 2-8B and mount a clamp at C2 with 6-32 × 3/8" hardware.
- ( ) C1: Refer to Detail 2-8C and install a 10,000 μF electrolytic capacitor in the clamp at C1. Position the capacitor bottom even with the clamp edge and the red dot to the chassis side edge as shown. Tighten the clamp screw; then tighten the clamp mounting screws.
- ( ) C2: Refer to Detail 2-8D and install a 10,000 μF electrolytic capacitor in the clamp at C2. Position the red dot as shown and press the capacitor bottom tight against the chassis. Tighten the clamp screw; then tighten the clamp mounting screws.
- ( ) R13: Connect a 1500 Ω (brown-green-red), 1-watt resistor between capacitor C1 lugs 1 (NS) and 2 (NS).



**Detail 2-8B**



**Detail 2-8D**

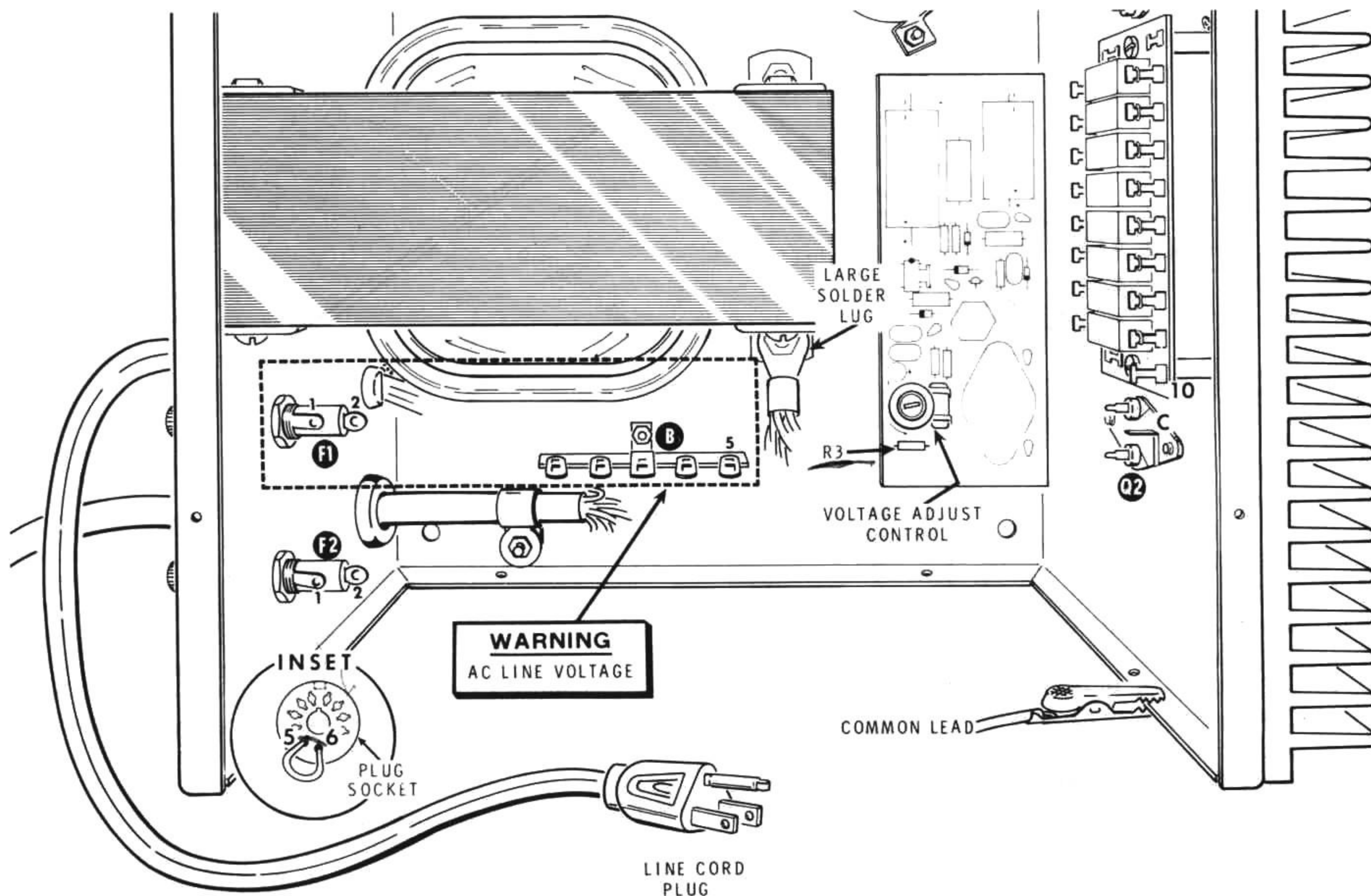


Detail 2-8E

- ( ) Cut two 6-1/4" bare wires. Place a 2-1/2" length of sleeving over each wire.
- ( ) Refer to Detail 2-8E and form these wires as shown.
- ( ) Route the bare part of one of these wires up through capacitor C2 lug 2. Then slide a second 2-1/4" length of sleeving over the bare wire.
- ( ) Connect the lower part of this wire to BR1 lug 3 (S-2) and the upper part to capacitor C1 lug 2 (S-1).
- ( ) In the same manner, route the bare part of the other wire up through capacitor C2 lug 1. Then slide a 2-1/4" length of sleeving over the bare wire.
- ( ) Connect the lower part of this wire to BR1 lug 1 (S-2) and the upper part to capacitor C1 lug 1 (S-1).
- ( ) Solder capacitor C2, lugs 1 and 2.
- ( ) Slide a 7-1/2" length of sleeving over an 8-1/2" bare wire. Use this wire in the next step.
- ( ) Connect an 8-1/2" bare wire between fuseholder F2 lug 1 (S-1) and Q4 lug C. (S-3).

This completes the initial assembly of your AC Power Supply. Carefully inspect all the connections for loose wires or unsoldered connections. Remove any solder splashes. Then proceed to "Test and Adjustments."





PICTORIAL 3-1

## TEST AND ADJUSTMENTS

### PRIMARY WIRING TESTS

#### Resistance Measurements

Refer to Pictorial 3-1 for the following steps.

NOTE: Do not connect the line cord to an AC outlet until you are instructed to.

A wiring error in the primary wiring circuit of your Power Supply could cause you to receive a severe electrical shock or cause damage to the unit. Therefore, if you have an ohmmeter or can obtain one, make the following resistance measurements.

NOTE: If you do not obtain the indicated results in the following steps, check for wiring errors on the 5-lug terminal strip, the fuseholders, or the circuit board.

- ( ) Connect the negative ohmmeter lead to the center lug (green lead) of the 5-lug terminal strip. Leave this lead at this location until you are instructed to move it.
- ( ) Touch the positive ohmmeter lead to first one and then the other flat line cord prong. The meter should read infinite both times.





- ( ) Touch the positive ohmmeter lead to the round line cord prong. The meter should read 0.
- ( ) Connect the negative ohmmeter lead to one flat line cord prong and the positive lead to the other flat prong. The meter should read infinite.
- ( ) Refer to the inset drawing on Pictorial, 3-1 and use the remaining length of bare wire to short pins 5 and 6 in the power cable socket. The ohmmeter should now read between 1 and 6 ohms.
- ( ) Remove the bare wire from between pins 5 and 6 in the power cable socket.
- ( ) Set the VOLTAGE ADJUST control on the circuit board fully clockwise.
- ( ) Connect the negative ohmmeter lead to the chassis as shown.
- ( ) Touch the positive ohmmeter lead to lug C of transistor Q2. The meter should read at or near infinity. Allow time for the meter needle to stop moving.
- ( ) Touch the positive meter lead to fuseholder F2 lug 2. The meter should read at or near infinity.
- ( ) Touch the positive meter lead to lug 10 on the large terminal strip. The meter should read approximately 300 ohms.
- ( ) Remove both ohmmeter leads.
- ( ) Install a 20-ampere regular fuse in the 20 AMP fuseholder.
- ( ) Temporarily solder this wire between fuseholder F1 lug 1 and terminal strip B lug 5.
- ( ) Adjust the VOM to measure DC voltages in the 15-volt range.
- ( ) Connect the positive lead of the VOM to lug 10 on the large terminal strip.

**CAUTION:** When the line cord is connected to an AC outlet, AC voltage will be present at several places on the chassis, as shown in Pictorial 3-1. Be careful you do not contact this voltage because an electrical shock will result.

- ( ) Plug the line cord into a proper AC outlet. The output should measure between 10 and 15 volts DC.
- ( ) Turn the VOLTAGE ADJUST control on the circuit board until the meter indicates +13.8 volts DC. Be careful that you do not exceed this voltage or the fuse may blow.

**NOTE:** In the next step, hold the wire by the insulation and do not touch any other parts of the Power Supply.

- ( ) Touch a piece of wire to the two leads of resistor R3. Fuse F2 (20 AMP fuse) should blow. This shows that the crowbar circuit in your Power Supply is operating properly.
- ( ) Replace the 20-ampere fuse with the extra fuse supplied.
- ( ) UNPLUG THE LINE CORD.
- ( ) Remove the temporary wire from between fuseholder F1 lug 1 and terminal strip B lug 5.

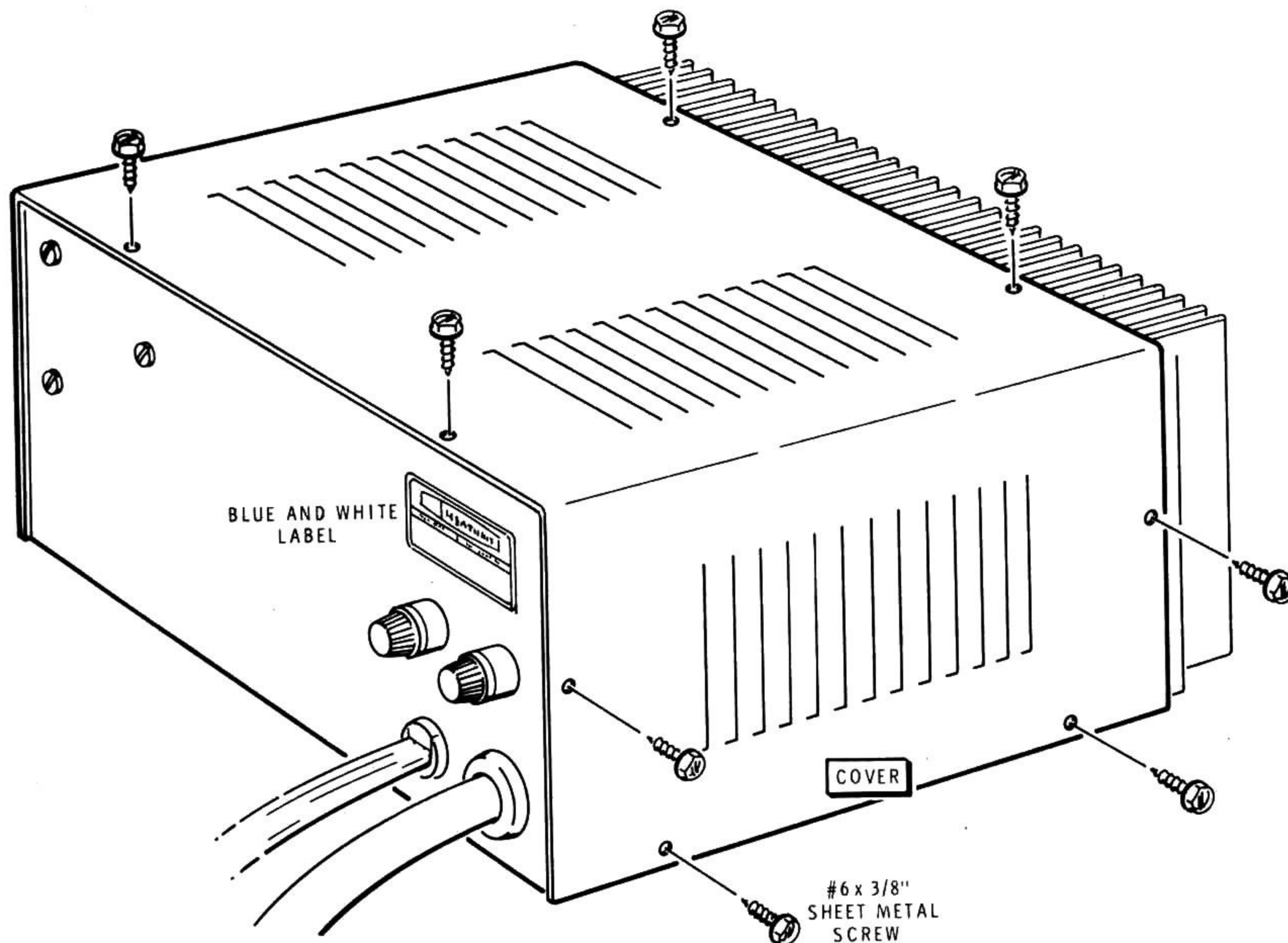
### Voltage Adjustment

- ( ) Prepare a 5" brown wire.

This completes the "Test and Adjustment" section of the Manual. Proceed to "Final Assembly."



## FINAL ASSEMBLY



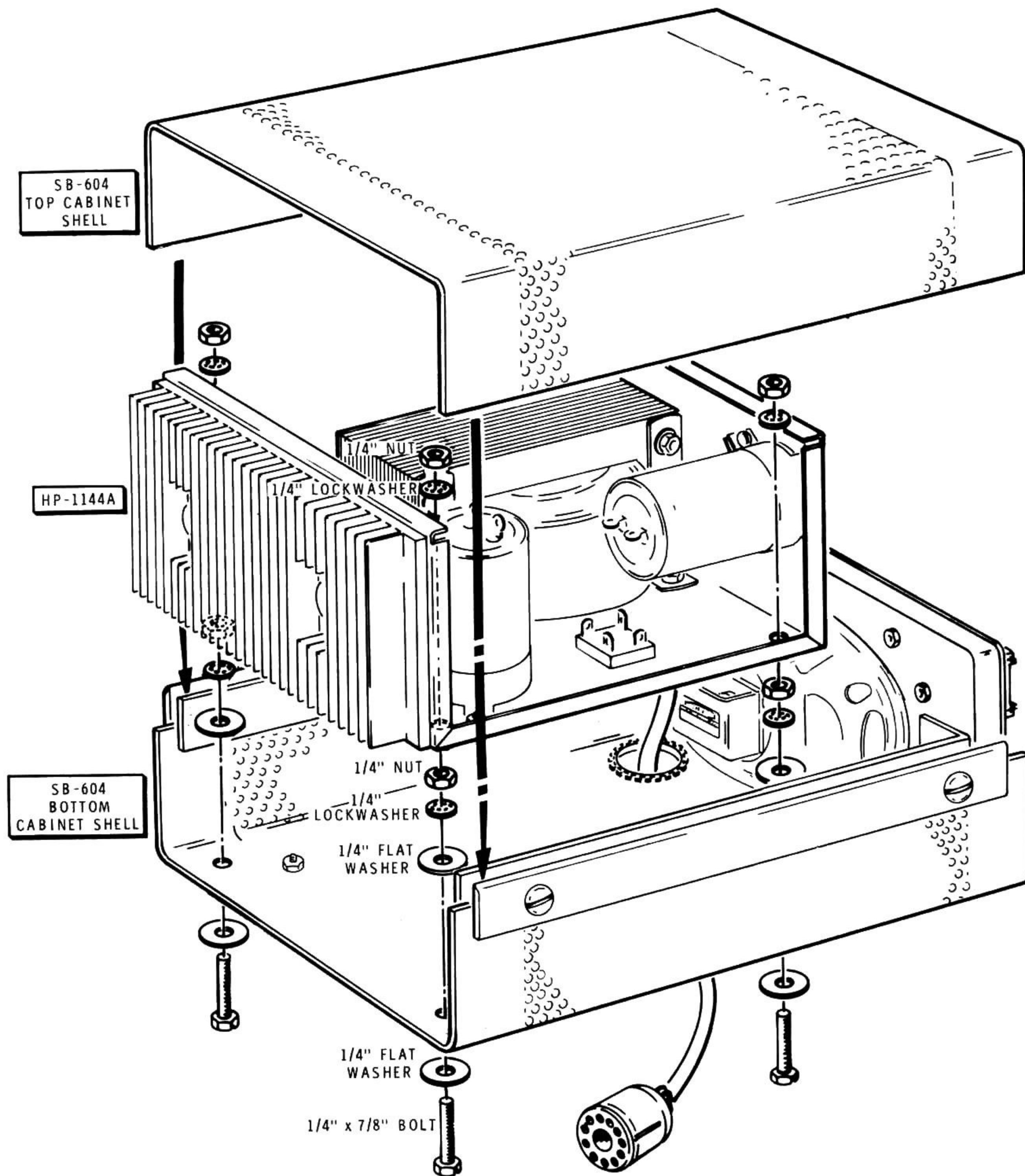
**PICTORIAL 3-2**

This Power Supply is complete with its own cover, or you can mount it in the SB-604 speaker cabinet. Since the Power Supply cover reduces air circulation, which results in less efficient cooling, we recommend that you use only one of the next two steps.

- ( ) Refer to Pictorial 3-2 and mount the Power Supply cover with twelve #6 × 3/8" sheet metal screws as shown.
- ( ) Refer to Pictorial 3-3 and mount the Power Supply in the SB-604 speaker cabinet with four 1/4" × 7/8" bolts as shown.

- ( ) Carefully peel away the backing paper from the blue and white identification label. Then press the label on the rear of the chassis. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.

This completes the assembly of your AC Power Supply.



PICTORIAL 3-3

## OPERATION

The output voltage of the AC Power Supply is adjustable to 13.8 VDC, which is needed for correct operation of your transceiver. Just connect the power cable

to your transceiver and the line cord to the proper AC line. The Power Supply will be switched remotely by your transceiver.

## IN CASE OF DIFFICULTY

**CAUTION:** When the line cord is connected to an AC outlet, AC voltage will be present at several places on the chassis. Be careful you do not contact this voltage or an electrical shock can result.

**NOTE:** Refer to the "X-Ray View" (Page 31) for the physical location of parts on the circuit board.

1. Recheck the wiring. Trace each lead in color pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something you have consistently overlooked.
2. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, you can eliminate many troubles by carefully inspecting the connections to make sure they are soldered as described on Pages 8 and 9. Reheat any doubtful connections. Be sure all the wires are soldered at places where several wires are connected.
3. Be sure the transistors and the integrated circuit are in the proper locations (correct part number and type number). Be sure that each transistor lead is in the right hole and has a good solder connection. Check the integrated circuit for proper positioning and for good contact at each pin connection.
4. Check capacitor values carefully. Be sure the proper part is wired into the circuit at each capacitor location. Check each electrolytic capacitor to be use the lead near the positive (+) marking is at the correct position.
5. Check each resistor value carefully.
6. Be sure the correct diode is installed and that the banded end is positioned correctly.
7. Check all component leads connected to the circuit board.
8. Make sure bare wires do not touch the chassis or other lugs and make sure all wires are properly soldered.



## Troubleshooting Chart

PROBLEM	PROBABLE CAUSE
No output voltage.	<ol style="list-style-type: none"> <li>1. F1.</li> <li>2. F2.</li> </ol>
Primary fuse F1 blows.	<ol style="list-style-type: none"> <li>1. Bridge rectifier BR1.</li> <li>2. Capacitor C1, C2.</li> </ol>
Output fuse F2 blows.	<ol style="list-style-type: none"> <li>1. Excessive loading (keydown).</li> <li>2. Output shorted.</li> <li>3. Q1, Q2.</li> <li>4. U1.</li> <li>5. Output voltage set too high.</li> </ol>
Unable to obtain +13.8 VDC with Voltage Adjust control.	<ol style="list-style-type: none"> <li>1. U1.</li> <li>2. Q3.</li> <li>3. R7.</li> <li>4. D1.</li> </ol>
Voltage drops significantly when transmitting.	<ol style="list-style-type: none"> <li>1. U1.</li> <li>2. Q1, Q2, Q3.</li> </ol>

In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of the Manual. Your Warranty is located inside the front cover.

## SPECIFICATIONS

Output Voltage .....	13.8 VDC regulated (adjustable).
Maximum Output Current .....	20 amperes intermittent. 8 amperes continuous.
Power Requirements .....	110 to 130 VAC, 6 amperes; or 220 to 260 VAC, 3 amperes; 50/60 Hz maximum.
Over Voltage Protection .....	Crow bar circuit will blow 20 ampere fuse if the output exceeds 15.5 volts.
Regulation .....	Less than 2% from no load to 20 amperes.
Ripple .....	Less than 1% at 20 amperes.
Fuses .....	7-amp, 3 AG, slow-blow primary. 20-amp, 3 AG, output.
Dimensions .....	5-1/2" high × 9-1/4" wide × 10-1/4" deep. (13.97 cm H × 23.49 cm W × 26.03 cm D).
Net Weight .....	23 lbs. (10.4 kg).

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The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

## CIRCUIT DESCRIPTION

The line voltage is coupled through fuse F1 and the power switch in your transceiver to the power transformer. The power transformer steps the voltage down from 120 VAC (or 240 VAC) to approximately 14 volts AC. This voltage is then rectified by bridge rectifier BR1 and filtered by capacitors C1 and C2 to provide a DC voltage. This voltage is then coupled through fuse F2 to the regulator circuit.

Transistors Q1, Q2, and Q3 form a Darlington-type regulation circuit that provides high gain. Q1 and Q2 are in parallel in a series regulation circuit. The output voltage from this circuit is controlled by the base bias to Q3, which is provided by integrated circuit U1.

U1 has a zener reference diode built into it. This integrated circuit samples the output voltage which is coupled back through resistors R6, R5, R3, and R4, and compares it to the internal reference voltage. Then U1 automatically adjusts the bias voltage to Q3 so the output voltage will remain fixed. The sensing voltage is taken from the load end of the power cable so any voltage that is lost due to cable length is accounted for.

The output voltage is adjusted by control R4. Increasing or decreasing this sampling voltage to U1 will result in a corresponding decrease or increase at the output. Resistors R3, R5, and R6 establish the narrow adjustable range of control R4. Capacitor C8 provides RF filtering.



Capacitor C6 provides a DC voltage of sufficient amplitude to permit U1 to regulate properly. Diode D1 allows capacitor C6 to charge but prevents it from discharging. In this way, only the small load of U1 is placed on C6. Resistor R7 prevents excess current flow through D1 when the Power Supply is in operation.

When the output voltage exceeds a safe level, zener diode D4 starts to conduct, causing a 0.4 volt drop across R11. This turns unijunction transistor Q5 on,

which allows current to flow through Q5 and diode D3 to SCR Q4. This turns Q4 on, which shorts the collector of Q3 to ground, blowing fuse F2. Resistor R8 prevents SCR Q4 from accidentally triggering. Capacitor C7 provides an RF bypass to prevent accidental triggering of Q5.

Resistors R1 and R2 balance the current between regulator transistors Q1 and Q2. Resistor R12 is a bleeder resistor, while capacitors C9 and C10 provide transient protection for the Power Supply.

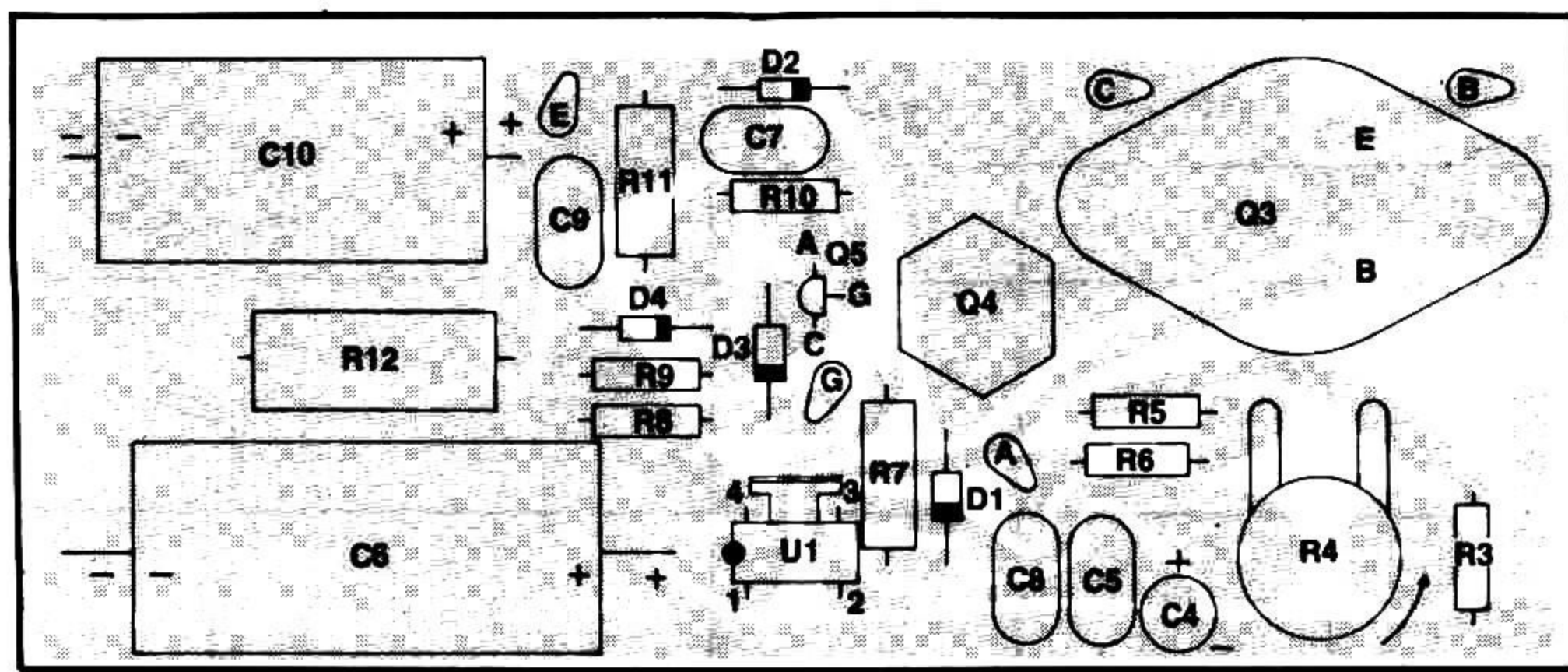
## CIRCUIT BOARD X-RAY VIEW

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

A. Find the circuit component number (R5, C3, etc.) on the X-Ray View.

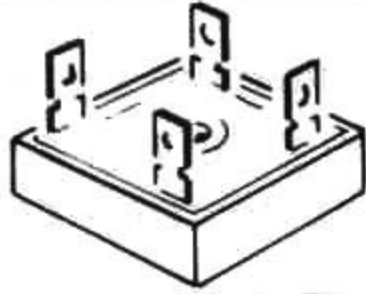



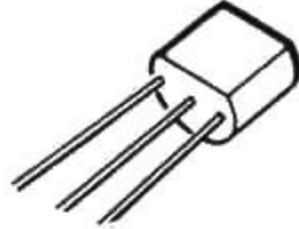
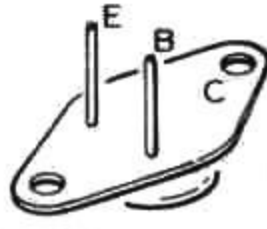


B. Locate this same number in the "Circuit Component Number" column of the "Parts List" in the front of this Manual.

C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.



(VIEWED FROM THE COMPONENT SIDE)

## SEMICONDUCTOR IDENTIFICATION CHART

COMPONENT NUMBERS	HEATH PART NUMBER	REPLACED BY	DESCRIPTION
BR1	57-88	MDA990-2	BRIDGE RECTIFIER 
D1, D2	57-65	1N4002	DIODE NOTE: HEATH PART NUMBERS ARE STAMPED ON MOST DIODES. 
D3	56-56	1N4149	DIODE 
D4	56-620		15V ZENER DIODE 
Q5	417-823	MPU131	TRANSISTOR 
Q1, Q2	417-254	MJ802	TRANSISTOR 
Q3	417-215	2N3055	
U1	442-626	MFC6030 78MGT4	INTEGRATED CIRCUIT 
Q4	57-86	NL576A	SCR 



## IMPORTANT NOTICE

Please make the following changes in your Manual before you begin to assemble your kit.

Page 6 — Left column, under Capacitors.

Change: B1 21-195 1 .1  $\mu$ F ceramic C3

To: B1 21-195 2 .1  $\mu$ F ceramic C3, C11

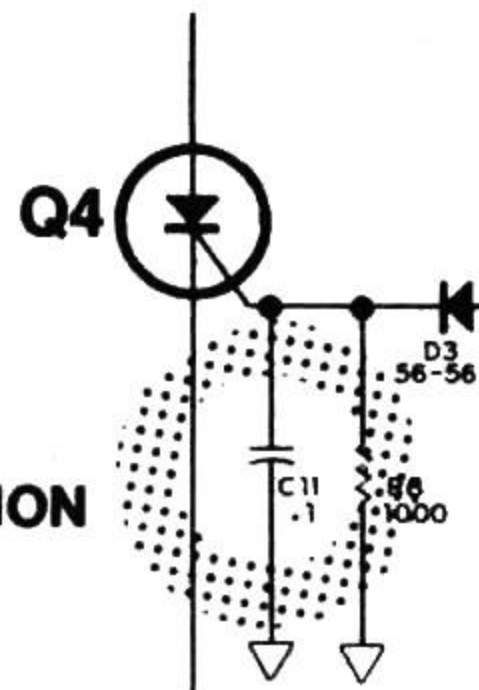
Page 12 — Remove Page 12 from this Notice and tape it over Page 12 in your Manual.

Schematic Diagram — Refer to the Schematic Correction in this Notice and make the indicated correction on your schematic.

Thank you,

HEATH COMPANY

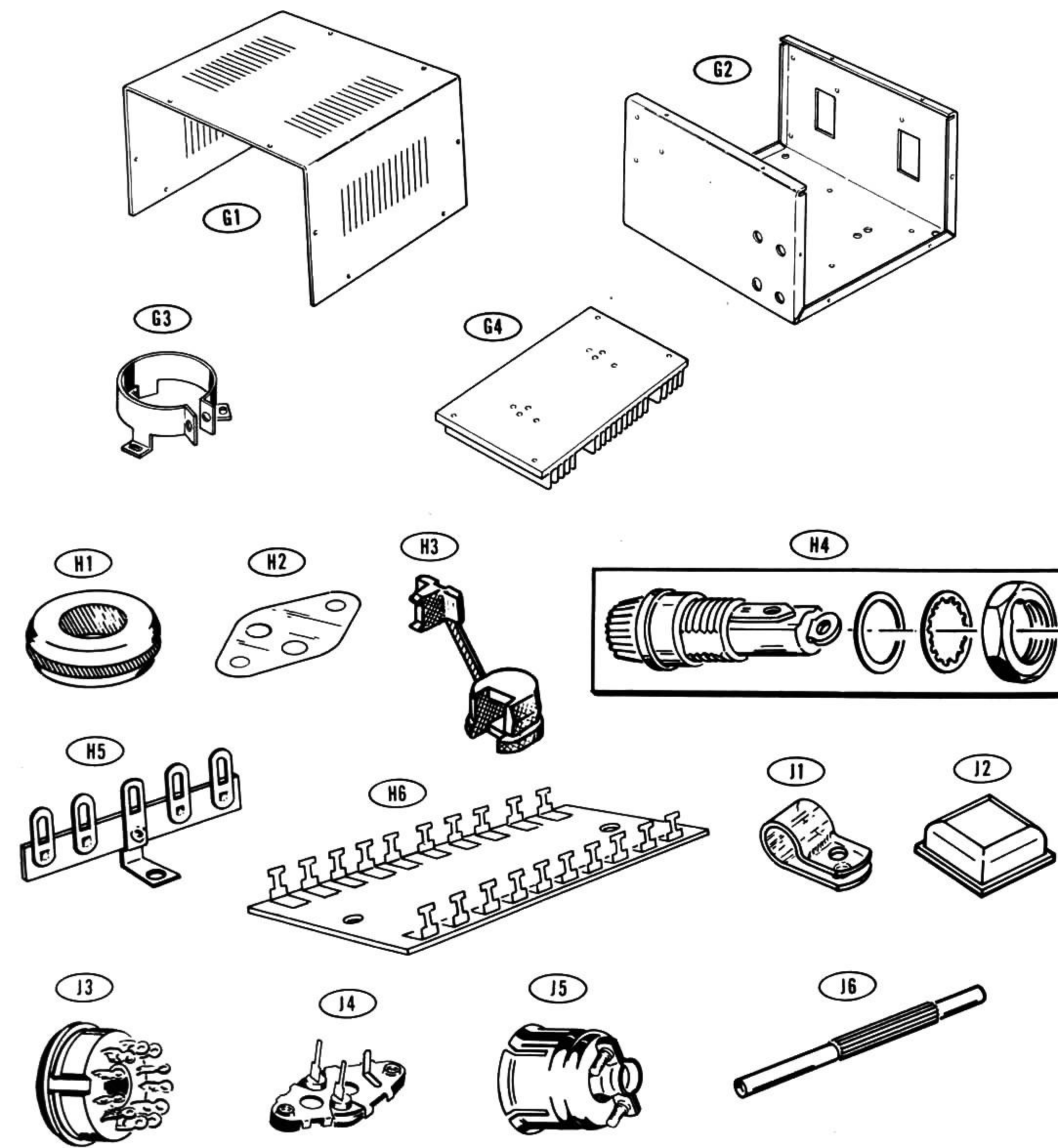
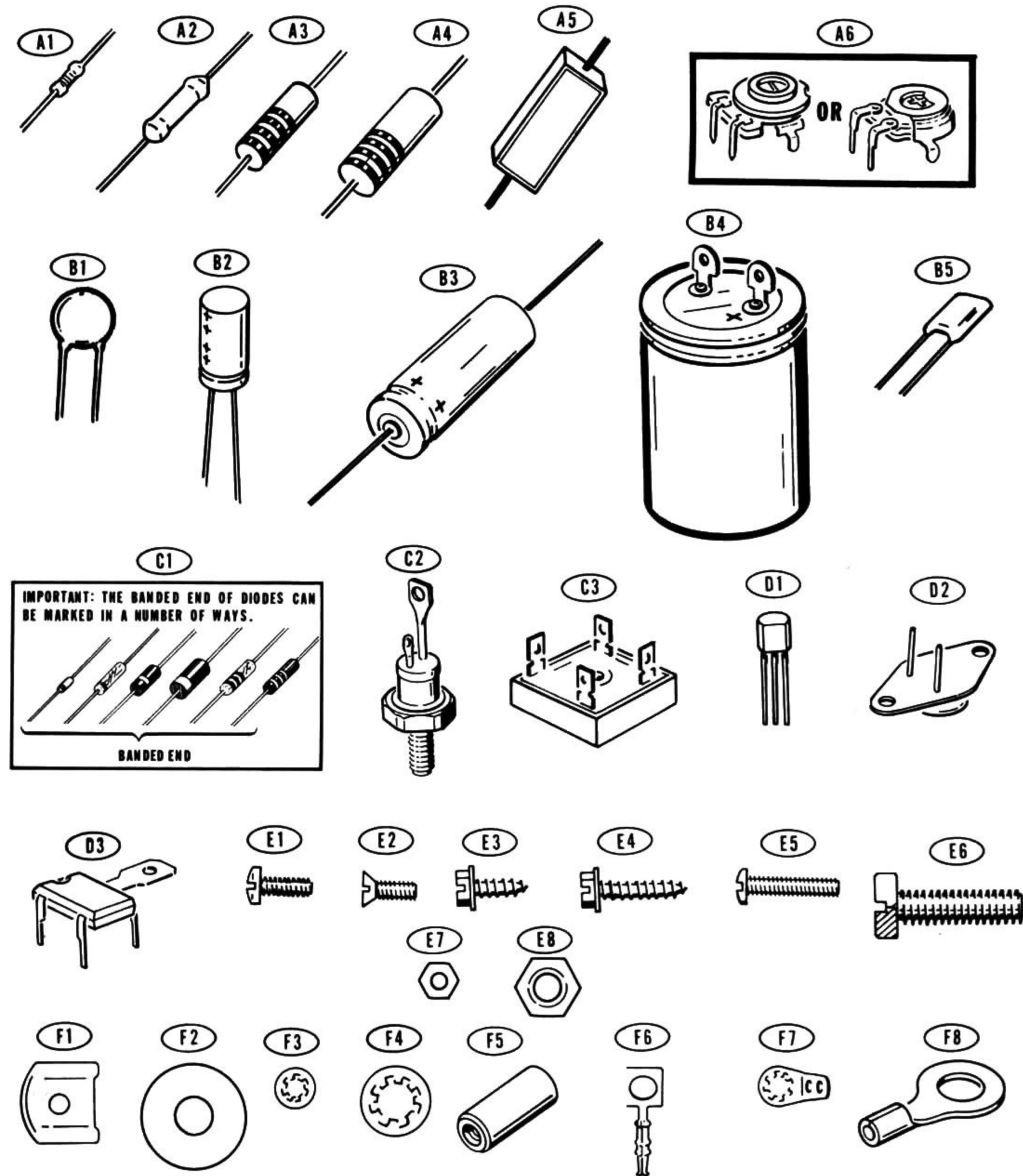
**SCHEMATIC CORRECTION**



# ILLUSTRATION BOOKLET

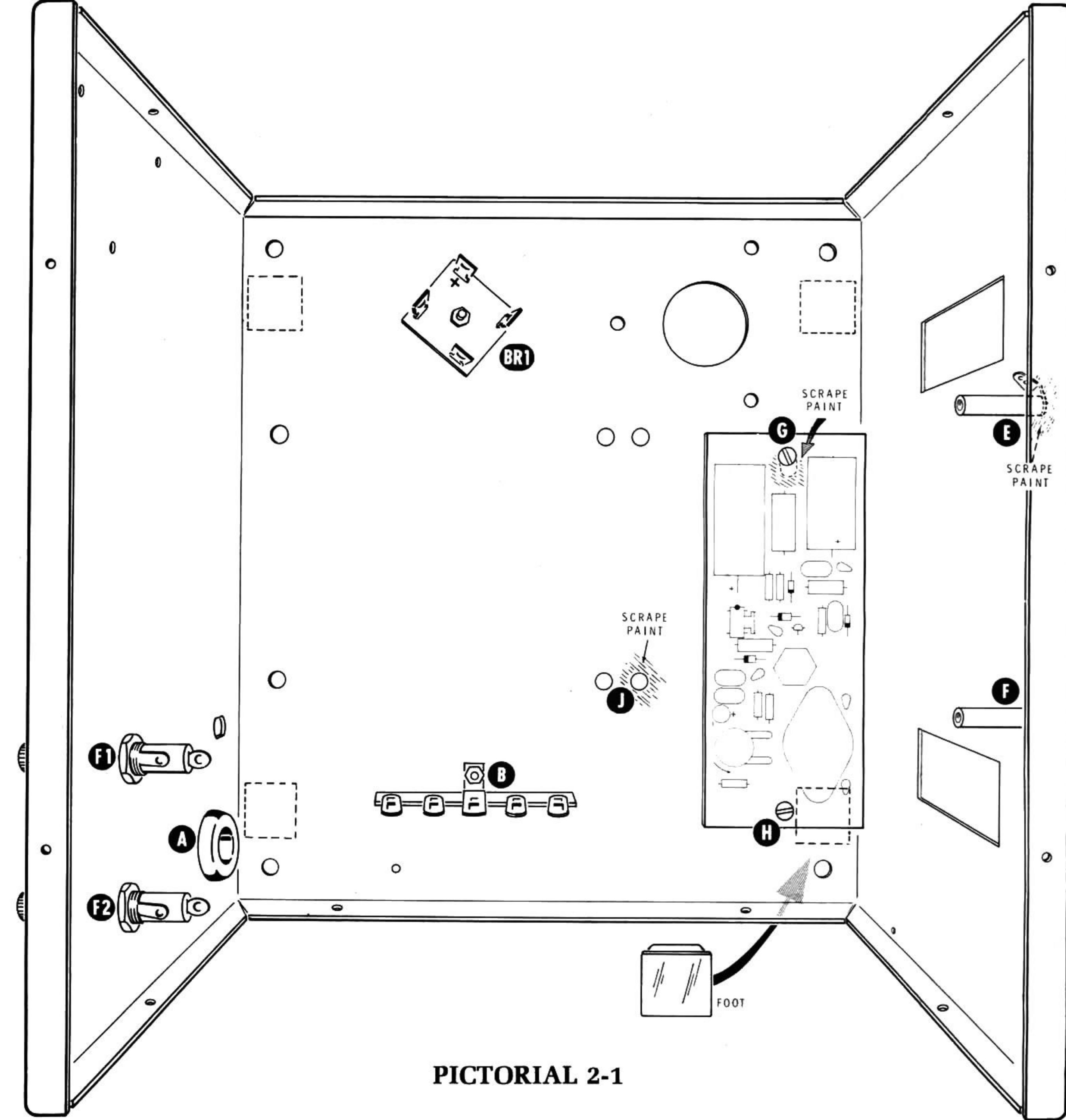
Part of 595-2198-01

## PARTS PICTORIAL

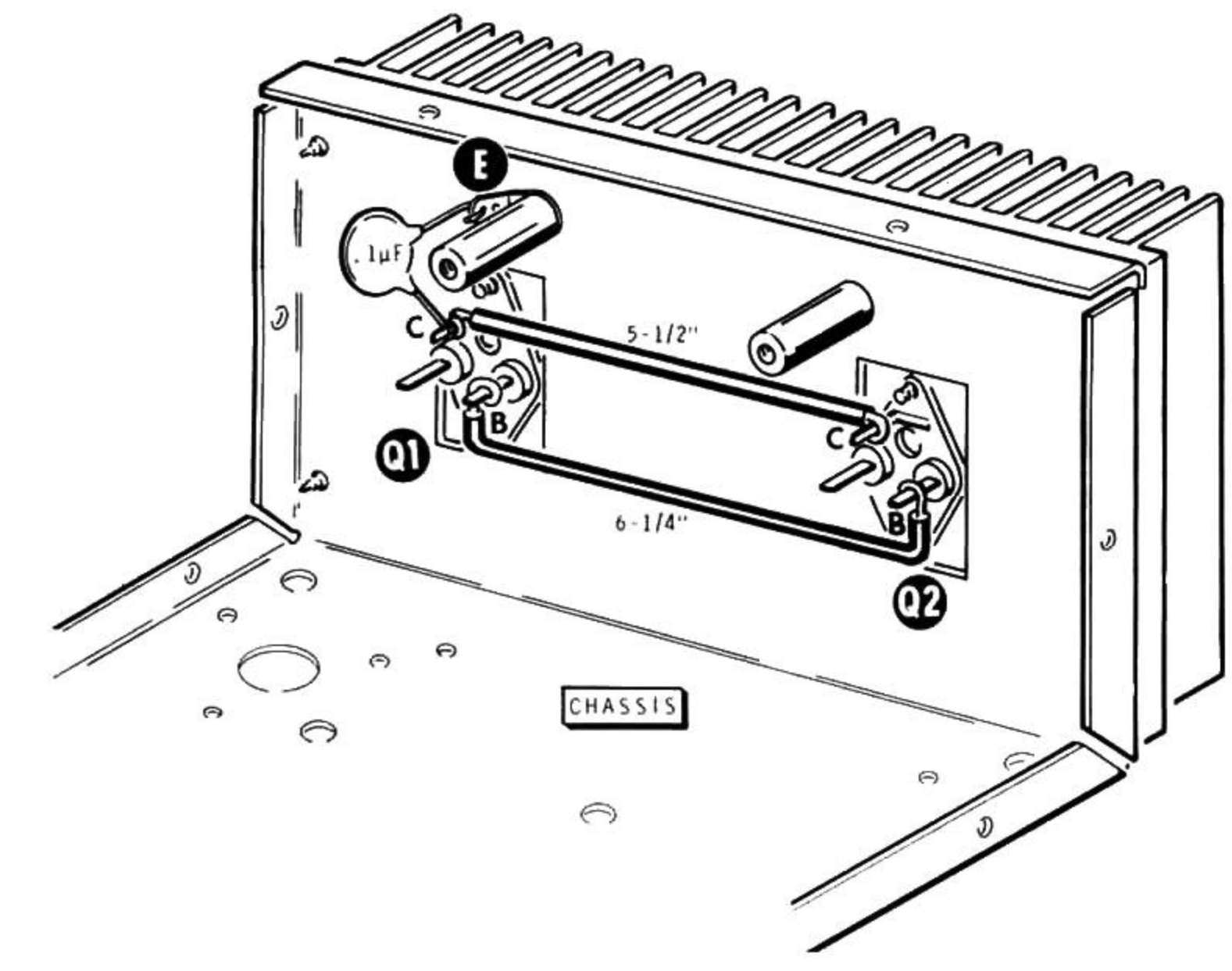


Model HP-1144A

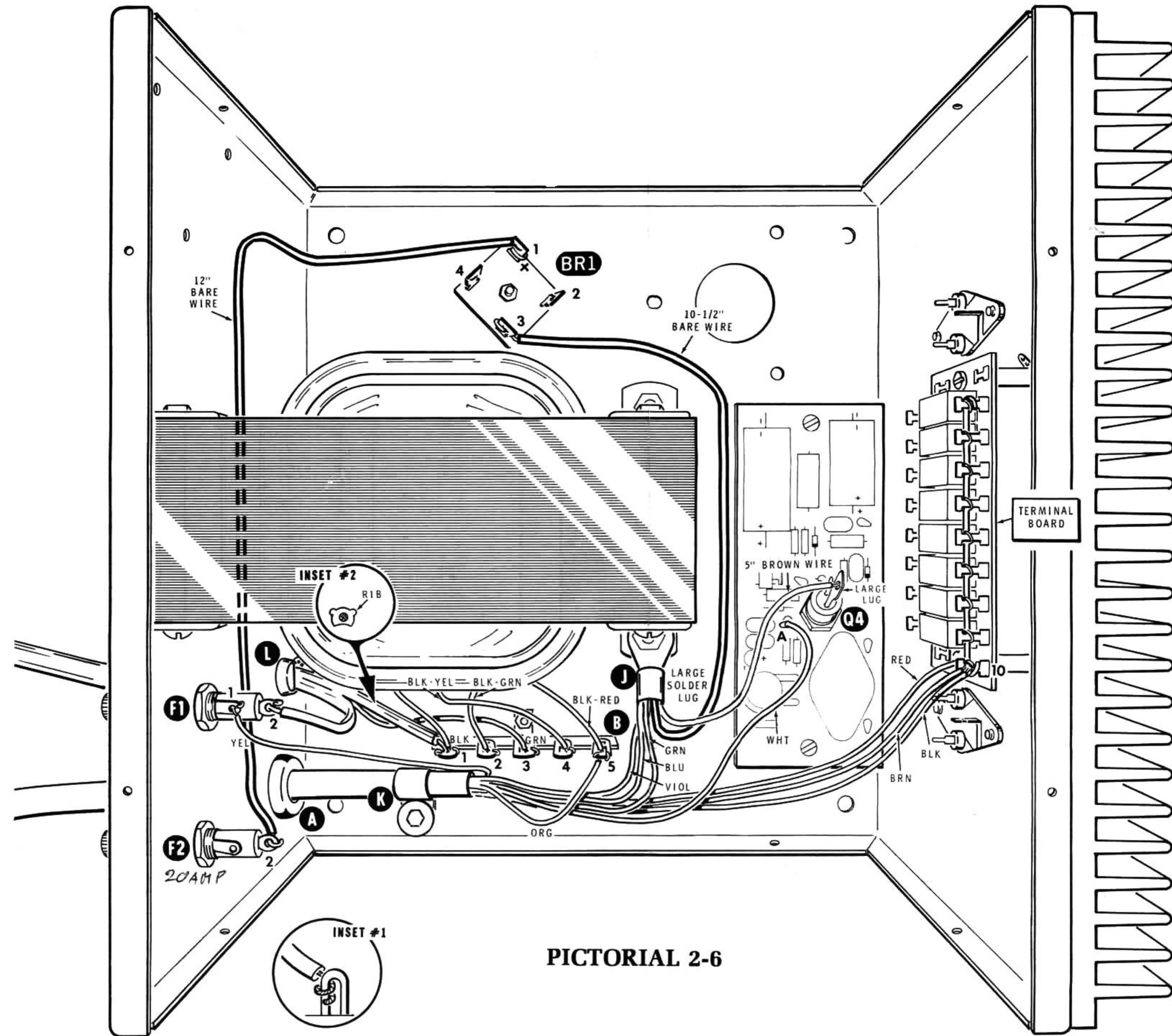
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PICTORIAL 2-1



PICTORIAL 2-3



PICTORIAL 2-6





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