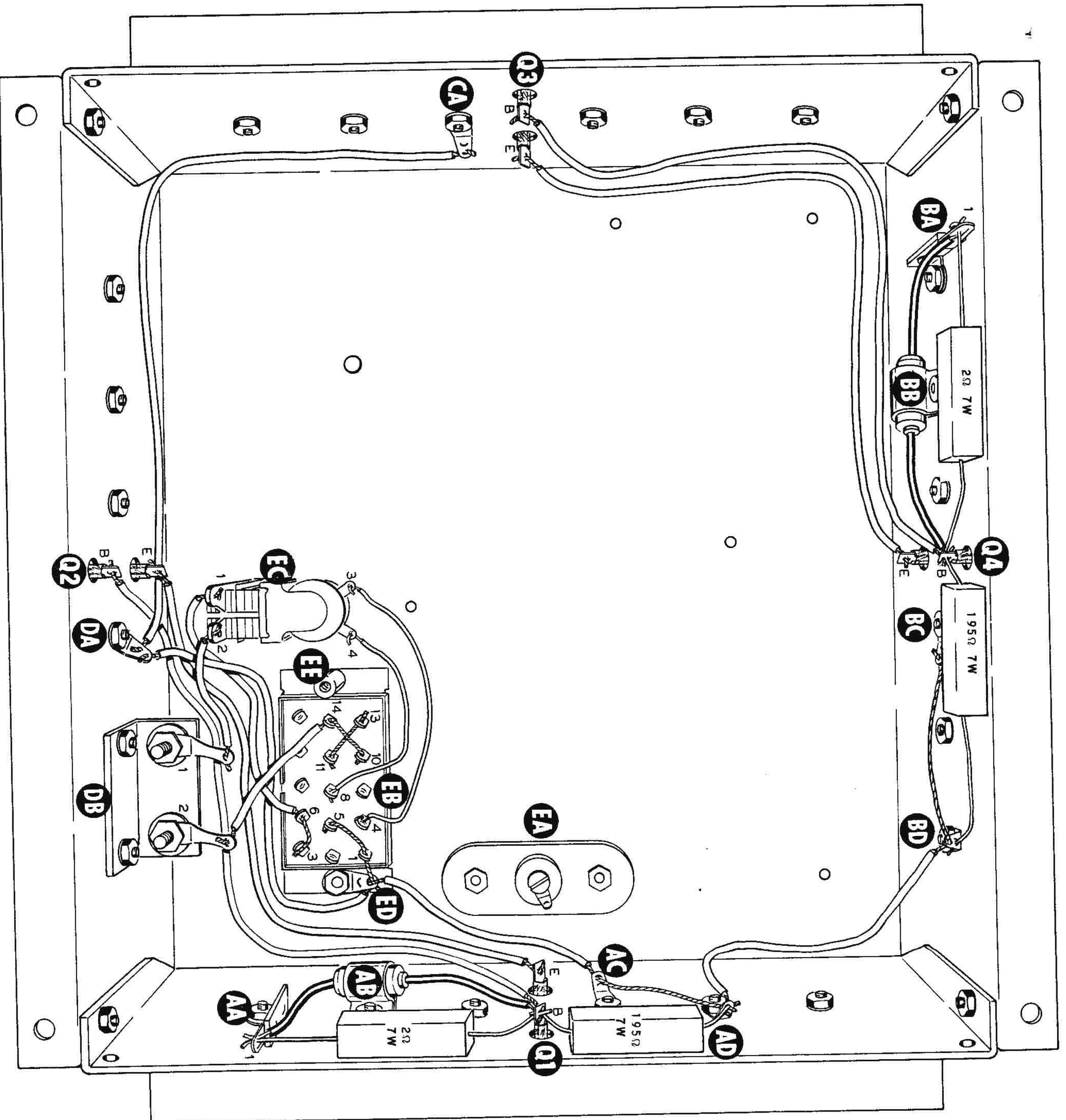
A white line-art illustration on a dark, textured background. It depicts a man and a woman working together on a project. The man, on the left, is standing and looking down at a large, open manual or schematic. The woman, on the right, is sitting and looking up at him. They are surrounded by various electronic components and tools, including a large rectangular unit with a dial, a small bowl, and several loose components. The overall style is that of a vintage technical manual cover.

# HEATHKIT<sup>®</sup>

## ASSEMBLY MANUAL

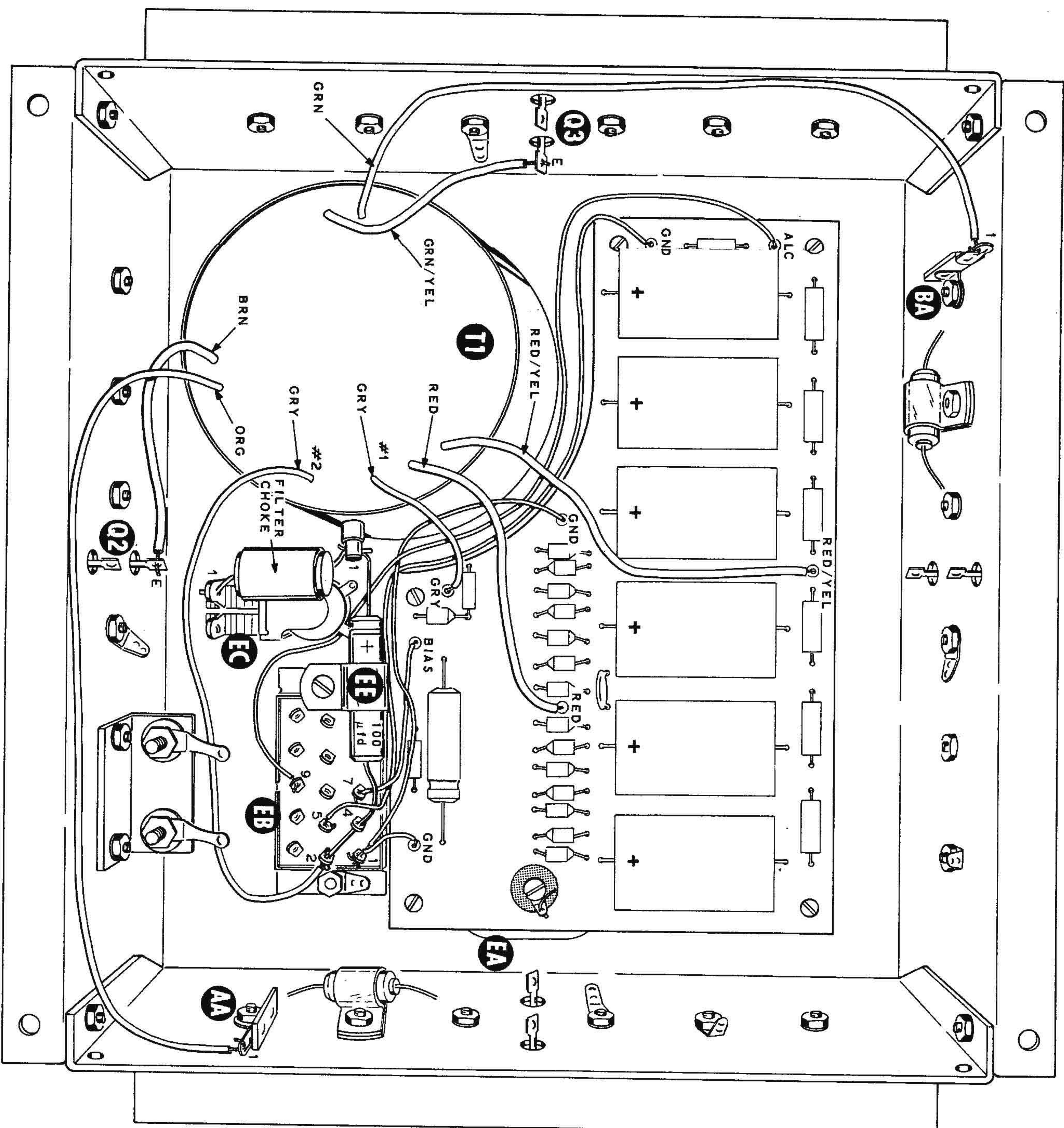






PICTORIAL 6







Assembly  
and  
Operation  
of the



TRANSISTORIZED  
MOBILE  
POWER SUPPLY

MODEL HP-14

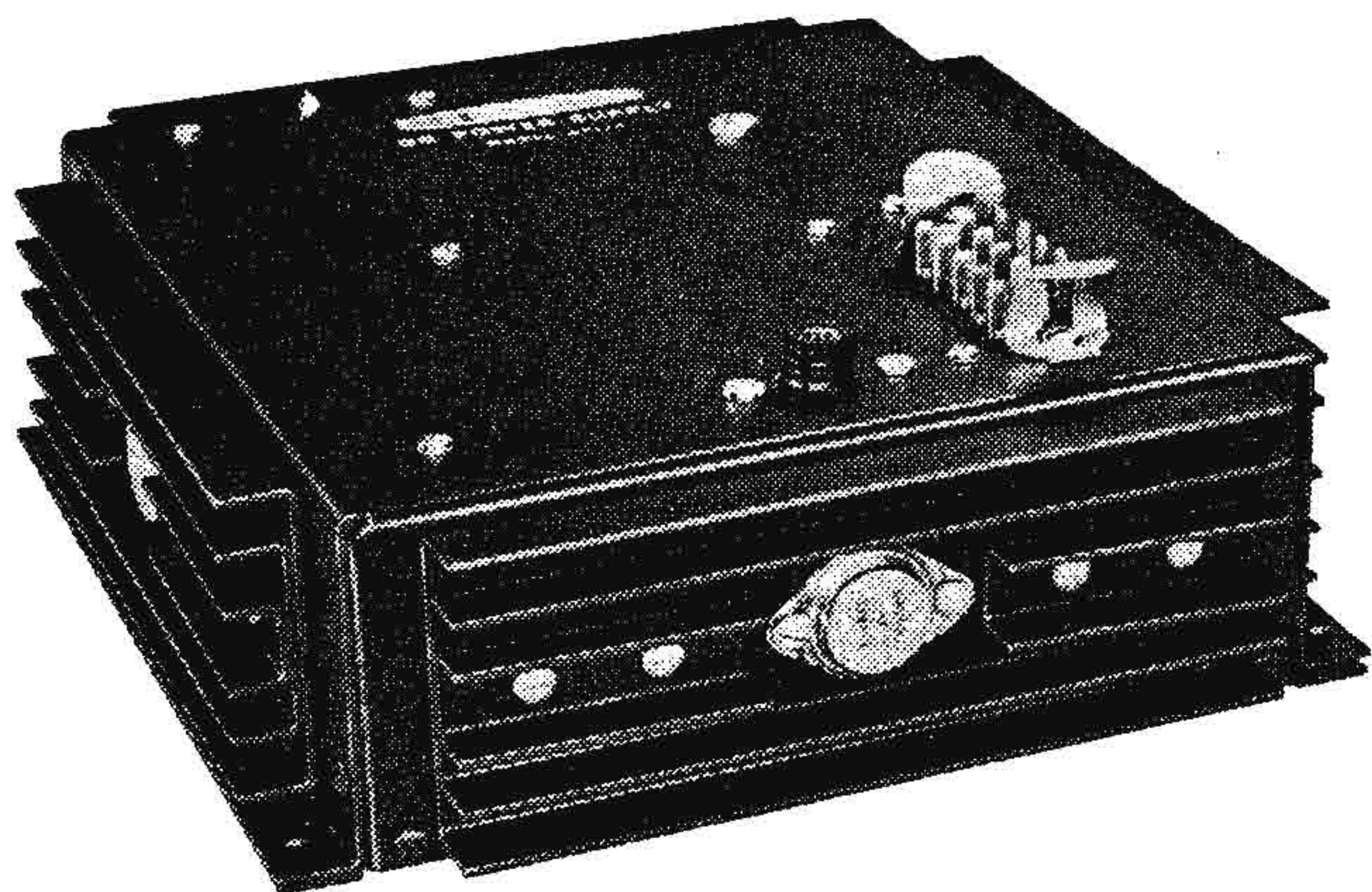


TABLE OF CONTENTS

Introduction. . . . .	2
Construction Notes. . . . .	3
Parts List. . . . .	4
Proper Soldering Techniques. . . . .	6
Circuit Board Wiring And Soldering. . . . .	7
Step-By-Step Procedure. . . . .	9
Step-By-Step Assembly -	
Circuit Board Wiring. . . . .	10
Chassis Parts Mounting. . . . .	11
Chassis Bottom Parts Mounting And	
Initial Wiring. . . . .	15
Final Chassis Wiring. . . . .	18
Final Assembly. . . . .	20
Power Connector Wiring. . . . .	20
Installation. . . . .	24
Operation. . . . .	26
In Case Of Difficulty. . . . .	26
Troubleshooting Chart . . . . .	27
Service Information -	
Service. . . . .	28
Replacements. . . . .	29
Shipping Instructions. . . . .	29
Warranty. . . . .	30
Specifications. . . . .	31
Circuit Description. . . . .	32
Circuit Board X-Ray View. . . . .	34
Chassis Photograph. . . . .	35
Schematic. . (fold-out from page). . . . .	35



## INTRODUCTION

The Heathkit Model HP-14 Transistorized Mobile Power Supply is designed to furnish all operating voltages for the Heathkit Model HA-14 mobile SSB Linear Amplifier. The Power Supply provides a high voltage of 2300 volts DC and a bias voltage of -120 volts DC. It also switches the filament voltage for the Linear Amplifier. The Power Supply can be used with other mobile amplifiers that are 1 KW PEP voice modulated SSB. It cannot be used with continuous, steady current flow linear amplifiers such as for AM or CW.

The Circuit features relay control of all primary power and automatic reset circuit breaker protection of the DC input voltage to the Power Supply. An automatic reset load delay type of circuit breaker is used for positive protection of the Power Supply and linear amplifier in case of an overload or short circuit.

An epoxy encapsulated toroid type power transformer, designed for maximum efficiency, is used in the Power Supply. This transformer, in addition to the four heavy-duty power transistors, provides a high frequency switching rate along with high power output, and instant starting. The four transistors are cooled with four specially designed heat sink fins.

Efficient long-life silicon rectifiers and heavy-duty filter capacitors provide trouble-free rectification and filtering. A heavy-duty circuit board is used to provide easy and quick assembly.

NOTE: It is recommended that this Power Supply be used in an alternator-equipped automobile. The alternator should have a rating of at least 35 amperes and the battery should be rated at 50 ampere hours or more.



## CONSTRUCTION NOTES

This manual is supplied to assist you in every way to complete your kit with the least possible chance for error. The arrangement shown is the result of extensive experimentation and trial. If followed carefully, the result will be highly stable and dependable performance. We suggest that you retain the manual in your files for future reference, both in the use of the equipment and for its maintenance.

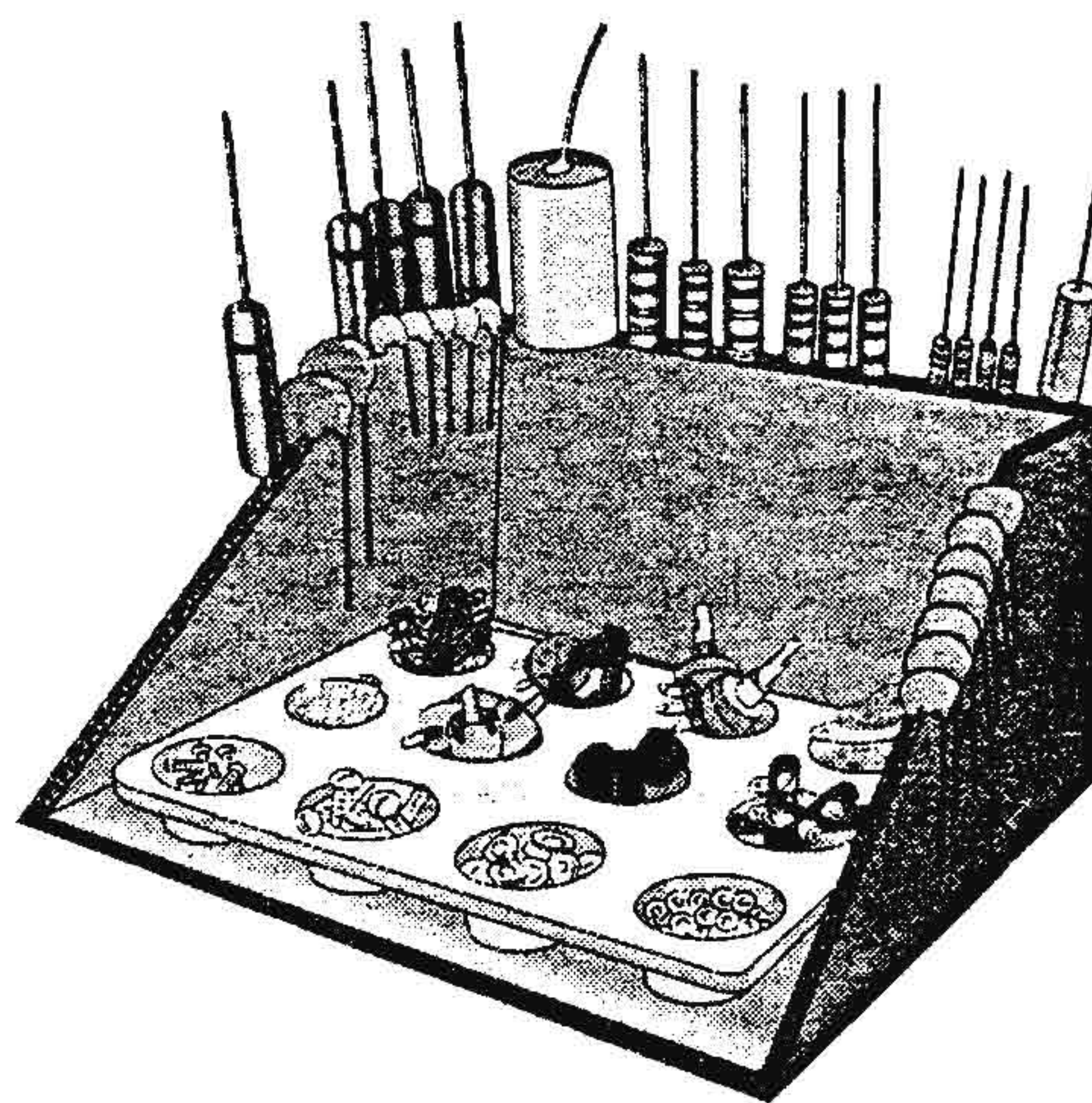
**UNPACK THE KIT CAREFULLY AND CHECK EACH PART AGAINST THE PARTS LIST.** In so doing, you will become acquainted with the parts. Refer to the information on the inside covers of the manual to help you identify the components. If some shortage or parts damage is found in checking the Parts List, please read the Replacements section and supply the information called for therein.

Resistors generally have a tolerance rating of 10% unless otherwise stated in the Parts List. Tolerances on capacitors are generally even greater. Limits of +100% and -20% are common for electrolytic capacitors.

We suggest that you do the following before work is started:

1. Lay out all parts so that they are readily available.
2. Provide yourself with good quality tools. Basic tool requirements consist of a screwdriver with a 1/4" blade; a small screwdriver with a 1/8" blade; long-nose pliers; wire cutters, preferably separate diagonal cutters; a penknife or a tool for stripping insulation from wires; and a soldering iron (or gun). A set of nut drivers, while not necessary, will aid extensively in construction of the kit.

Most kit builders find it helpful to separate the various parts into convenient categories. Muffin tins or molded egg cartons make convenient trays for small parts. Resistors and capacitors may be placed with their lead ends inserted in the edge of a piece of corrugated cardboard until they are needed. Values can be written on the cardboard next to each component. The illustration shows one method that may be used.





## PARTS LIST

The numbers in parentheses in the Parts List are keyed to the numbers on the Parts Pictorial to aid in parts identification.

PART No.	PARTS Per Kit	DESCRIPTION
----------	---------------	-------------

### RESISTORS

(1) 1-3	1	100 $\Omega$ 1/2 watt (brown-black-brown)
1-109	1	12 K $\Omega$ 1/2 watt (brown-red-orange)
1-26	1	100 K $\Omega$ 1/2 watt (brown-black-yellow)
(2) 1A-30	6	220 K $\Omega$ 1 watt (red-red-yellow)
(3) 3G-1	2	195 $\Omega$ 7 watt wire-wound
3G-26	2	2 $\Omega$ 7 watt wire-wound

### CAPACITORS

(4) 21-37	1	470 $\mu$ f disc
(5) 25-147	1	10 $\mu$ f electrolytic
25-145	2	25 $\mu$ f electrolytic
25-146	1	100 $\mu$ f electrolytic
(6) 25-33	6	20 $\mu$ f electrolytic

### HARDWARE

(7) 250-83	4	#10 x 1/2" sheet metal screw
(8) 250-162	24	6-32 x 1/2" screw
(9) 250-89	5	6-32 x 3/8" screw
(10) 250-155	4	#6 x 3/8" black sheet metal screw
(11) 250-116	4	6-32 x 1/4" screw (black)
(12) 250-3	4	4-40 x 3/16" screw
(13) 250-49	12	3-48 x 1/4" screw
(14) 252-5	2	10-32 nut
(15) 252-3	31	6-32 nut
(16) 253-3	2	#10 fiber flat washer
(17) 253-7	2	#10 fiber shoulder washer
(18) 254-3	1	#10 lockwasher
(19) 254-1	37	#6 lockwasher
(20) 254-9	4	#4 lockwasher
(21) 254-7	12	#3 lockwasher
(22) 259-23	2	5/16" solder lug
(23) 259-5	2	#10 solder lug
(24) 259-15	1	#8 solder lug
(25) 259-1	7	#6 solder lug
(26) 255-11	1	1" spacer
(27) 255-35	6	11/16" phenolic spacer

PART No.	PARTS Per Kit	DESCRIPTION
----------	---------------	-------------

### DIODES-WIRE-SLEEVING-TRANSISTORS-FUSE

(28) 57-27	15	Silicon diode
344-50	1	Black hookup wire
344-29	1	Blue stranded hookup wire
344-43	1	High voltage wire
347-27	1	2-wire cable
347-18	1	8-wire cable
346-1	1	Black sleeving
346-2	1	Clear sleeving
(29) 417-60	4	Power transistor
421-13	1	1/2 ampere fuse

### SHEET METAL

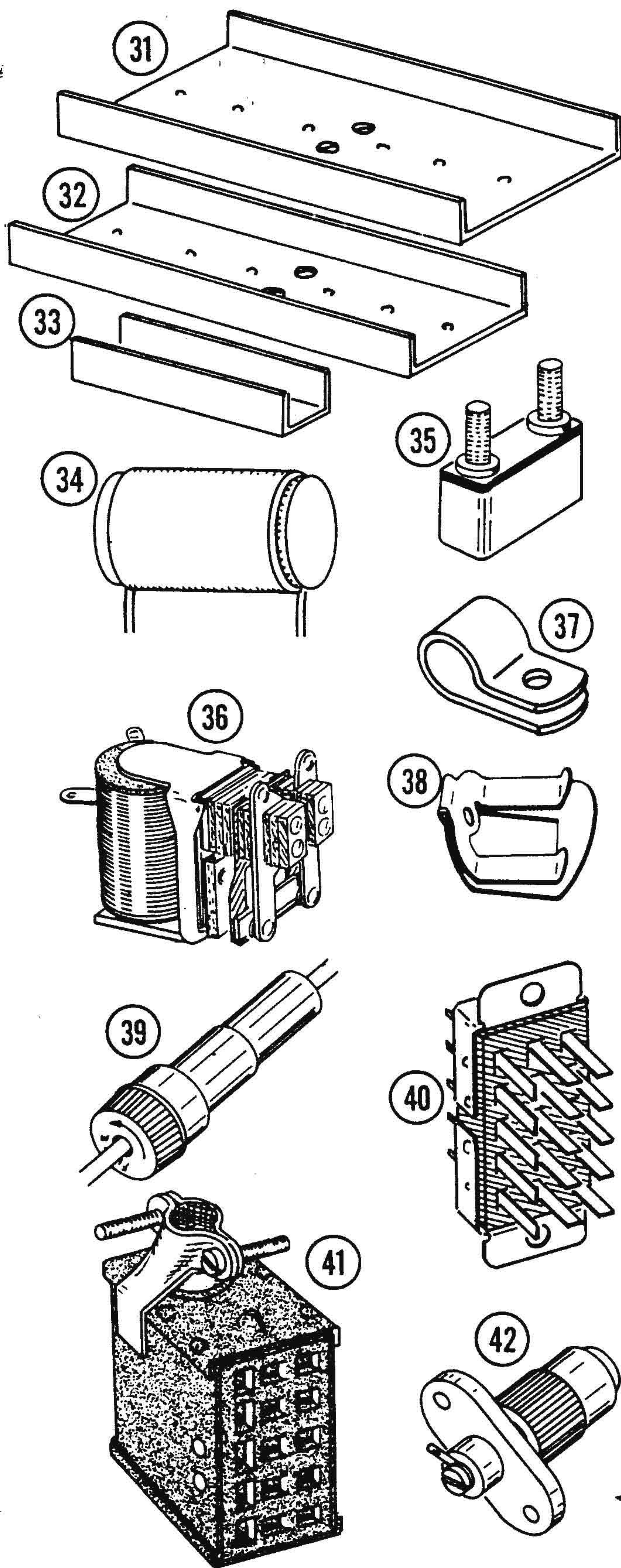
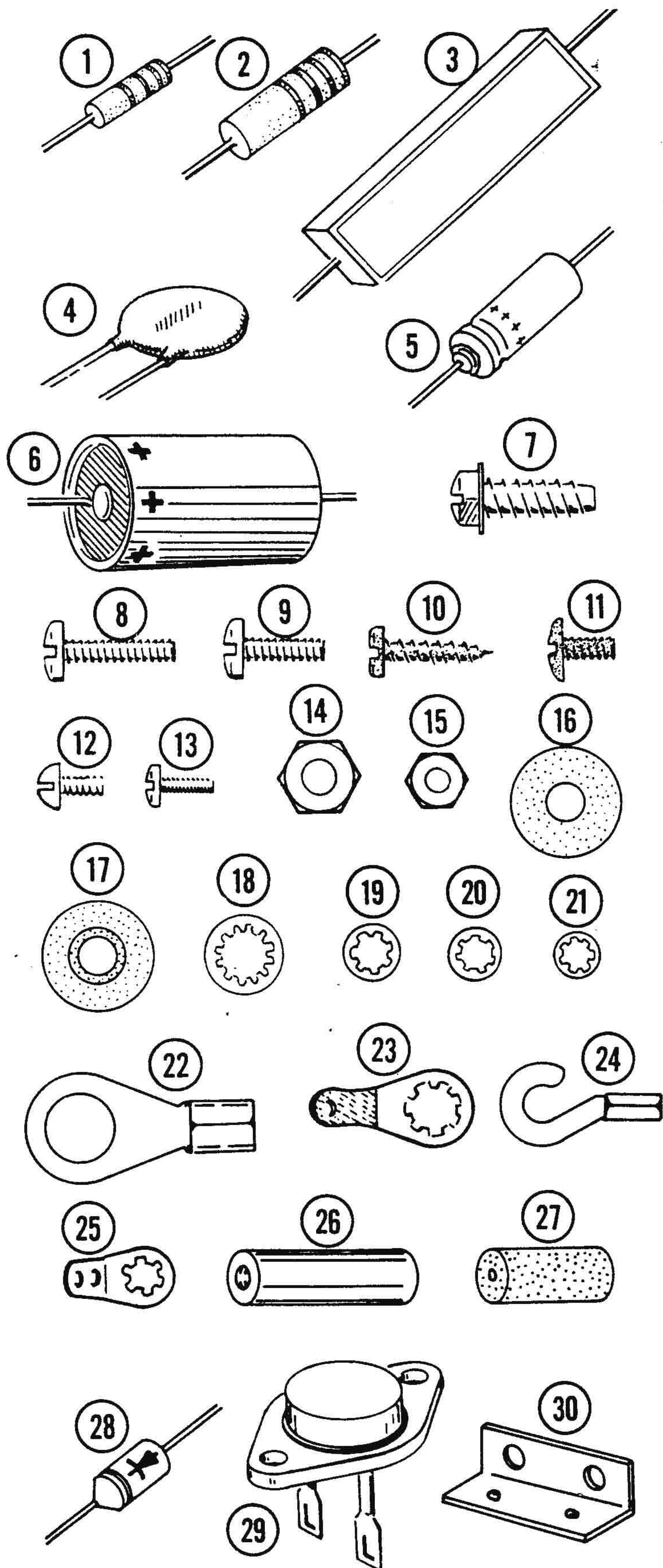
200-M431P135	1	Chassis
(30) 204-M646	1	Circuit breaker mounting bracket
205-M468F	1	Bottom plate
(31) 215-M11F	4	Bottom heat sink
(32) 215-M12F	4	Middle heat sink
(33) 215-M13F	8	Top heat sink

### MISCELLANEOUS

85-104P136	1	Circuit board
(34) 45-59	1	Filter choke
54-160	1	Power transformer
(35) 65-16	1	Circuit breaker
(36) 69-36	1	Relay
(37) 207-18	3	3/8" plastic clamp
(38) 260-32	2	Clip lock
(39) 423-6	1	Fuseholder
431-26	2	1-lug terminal strip
(40) 432-34	1	Male power plug
(41) 432-35	1	Female power socket
(42) 432-52	1	High voltage connector
490-5	1	Nut starter
331-6	1	Solder
595-726	1	Manual



# PARTS PICTORIAL





## PROPER SOLDERING TECHNIQUES

Only a small percentage of customers find it necessary to return equipment for factory service. By far the largest portion of malfunctions in this equipment are due to poor or improper soldering.

If terminals are bright and clean and free of wax, frayed insulation and other foreign substances, no difficulty will be experienced in soldering. Correctly soldered connections are essential if the performance engineered into a kit is to be fully realized. If you are a beginner with no experience in soldering, a half hour's practice with some odd lengths of wire may be a worthwhile investment.

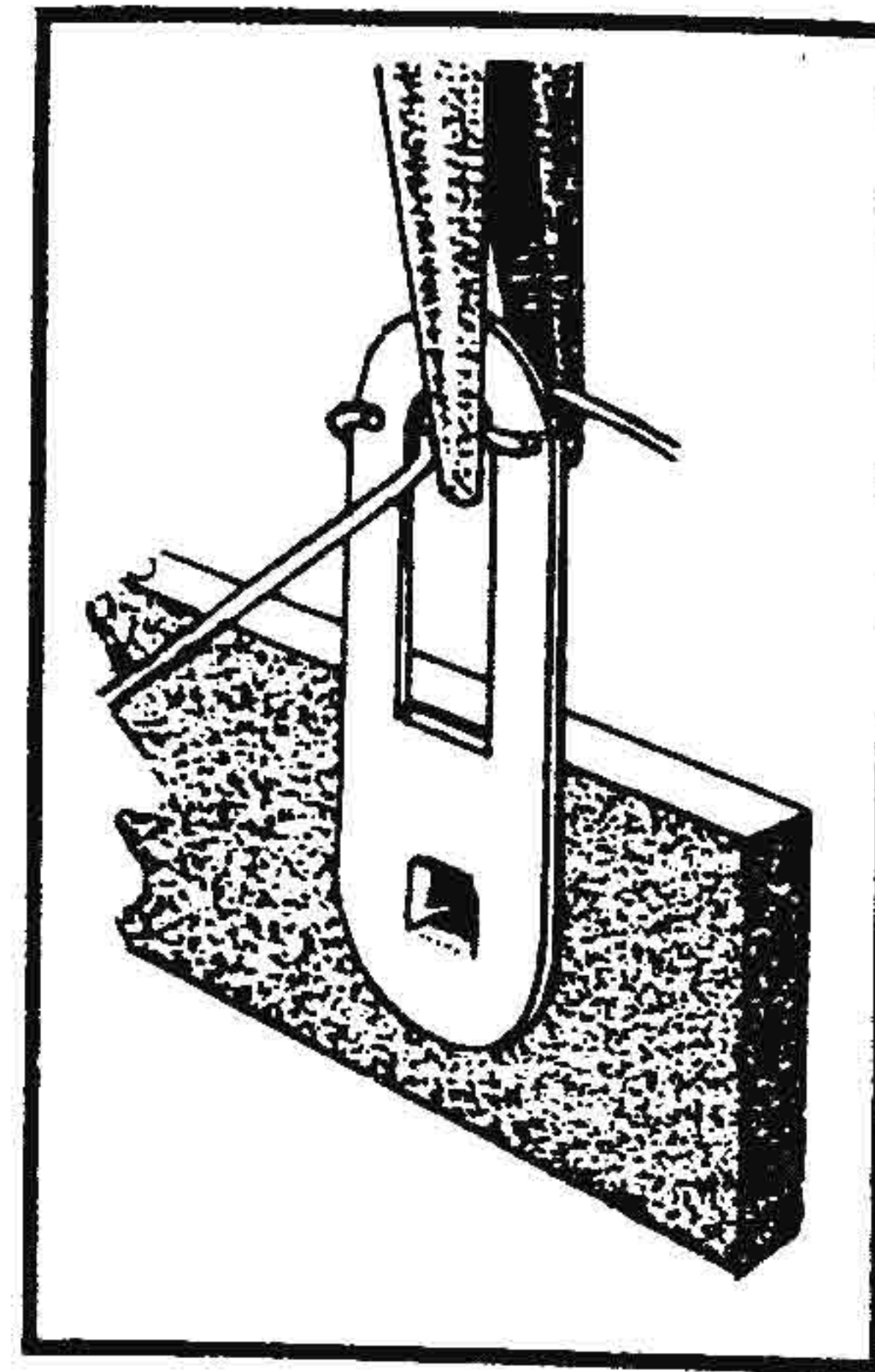
For most wiring, a 25 to 100 watt iron or its equivalent in a soldering gun is very satisfactory. A lower wattage iron than this may not heat the connection enough to flow the solder smoothly. Keep the iron tip clean by wiping it from time to time with a cloth.

### CHASSIS WIRING AND SOLDERING

1. Unless otherwise indicated, all wire used is the type with colored insulation (hookup wire). In preparing a length of hookup wire, 1/4" of insulation should be removed from each end unless directed otherwise in the assembly step.
2. To avoid breaking internal connections when stripping insulation from the leads of transformers or similar components, care should be taken not to pull directly on the lead. Instead, hold the lead with pliers while it is being stripped.
3. Leads on resistors, capacitors, and similar components are generally much longer than need be to make the required connections. In these cases, the leads should be cut to proper length before the part is installed. In general, the leads should be just long enough to reach their terminating points.

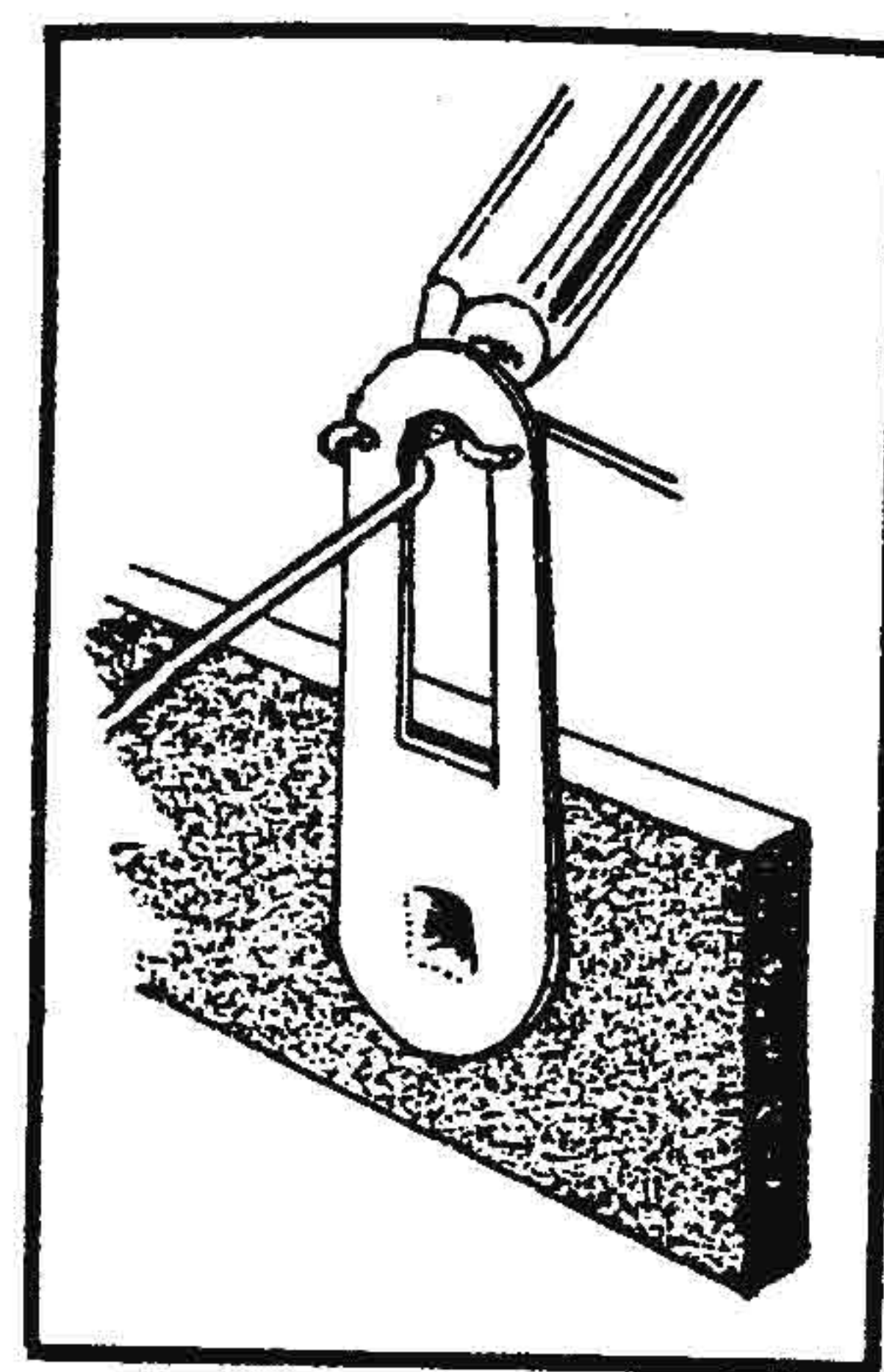
4. Wherever there is a possibility of bare leads shorting to other parts or to the chassis, the leads should be covered with insulating sleeving. Where the use of sleeving is specifically intended, the phrase "use sleeving" is included in the associated assembly step. In any case where there is the possibility of an unintentional short circuit, sleeving should be used. Extra sleeving is provided for this purpose.

5. Crimp or bend the lead (or leads) around the terminal to form a good joint without relying on solder for physical strength. If the lead is too large to allow bending or if the step states that it is not to be crimped, position it so that a good solder connection can still be made.

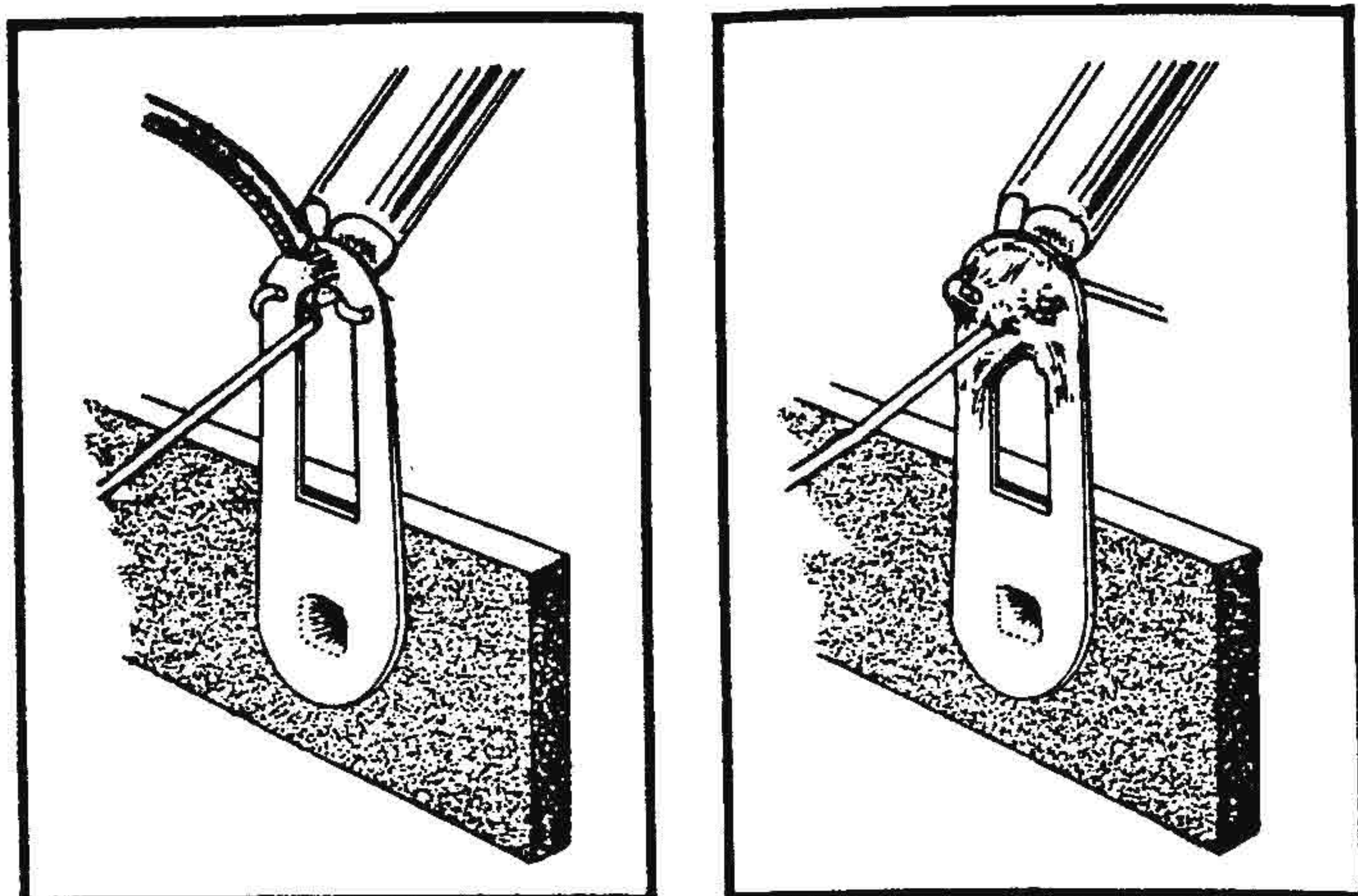


6. Position the work, if possible, so that gravity will help to keep the solder where you want it.

7. Place a flat side of the soldering iron tip against the joint to be soldered until it is heated sufficiently to melt the solder.







8. Then place the solder against the connection and it will immediately flow over the joint; use only enough solder to thoroughly wet the junction. It is usually not necessary to fill the entire hole in the terminal with solder.
9. Remove the solder and then the iron from the completed joint. Use care not to move the leads until the solder is solidified.

A poor or cold solder joint will usually look crystalline and have a grainy texture, or the solder will stand up in a blob and will not have adhered to the joint. Such joints should be reheated until the solder flows smoothly. In some cases, it may be necessary to add a little more solder to achieve a smooth, bright appearance.

ROSIN CORE SOLDER HAS BEEN SUPPLIED WITH THIS KIT. THIS TYPE OF SOLDER MUST BE USED FOR ALL SOLDERING IN THIS KIT. ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE EQUIPMENT IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. IF ADDITIONAL SOLDER IS NEEDED, BE SURE TO PURCHASE ROSIN CORE (60:40 or 50:50 TIN-LEAD CONTENT) RADIO TYPE SOLDER.

## CIRCUIT BOARD WIRING AND SOLDERING

Before attempting any work on the circuit board, read the following instructions carefully and study the Figures. It is only necessary to observe the following basic precautions to insure proper operation of the unit the first time it is turned on.

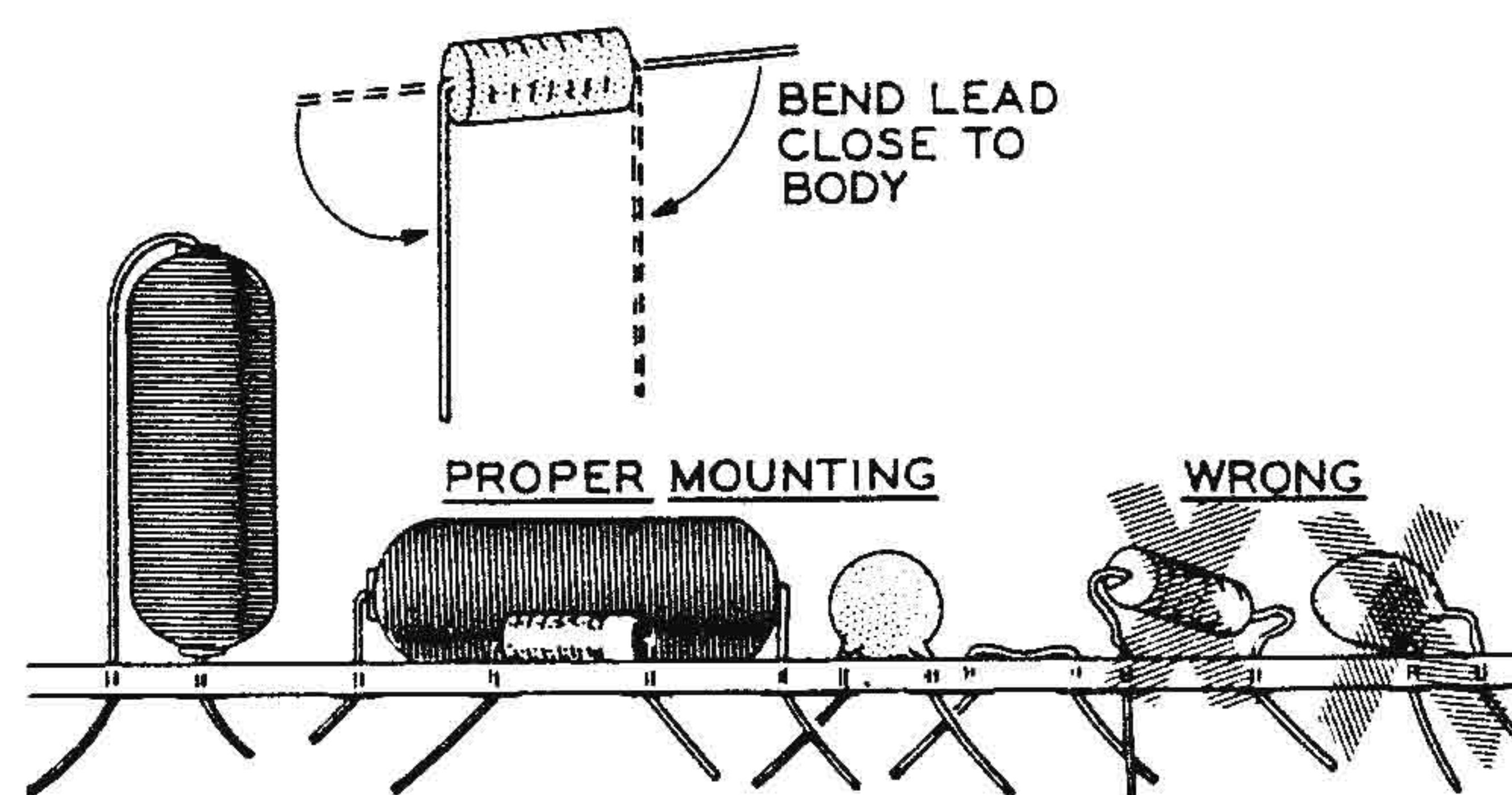
Proper mounting of components on the board is essential for good performance. A good general rule to follow is that all components on the board should be mounted tightly to the board, unless instructions state otherwise. All leads should be kept as short as possible to minimize the effects of stray capacity in the wiring. Proper and improper methods of mounting are illustrated in the accompanying Figures.

**NOTE:** Exercise care not to damage resistors or capacitors when bending the leads as shown.

Tubular capacitors and resistors will fit properly if the leads are bent as shown. Disc capacitors will generally fit in place with no lead preparation other than determining that the leads are straight. Components with lugs normally require no preparation unless the lugs

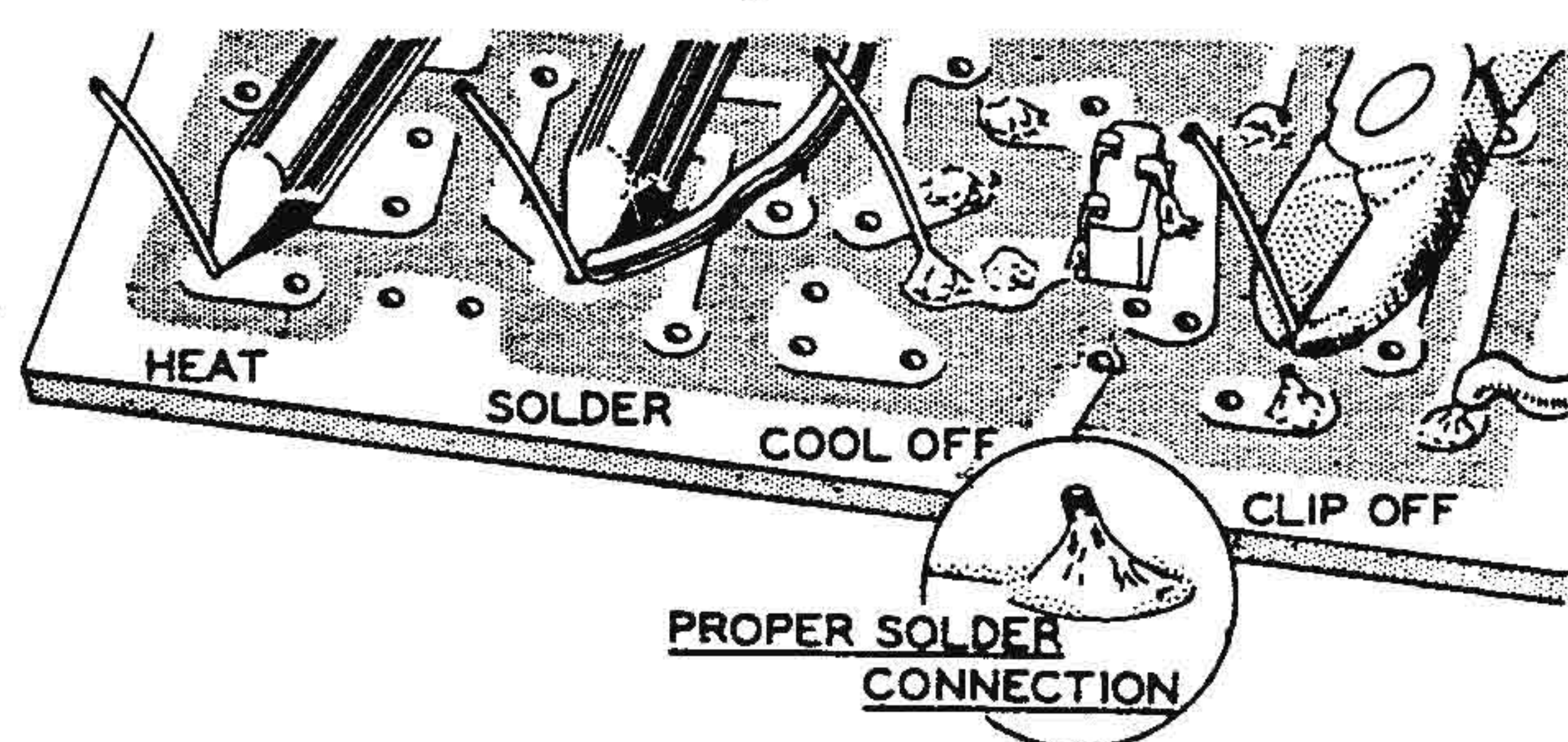
appear to be bent, in which case they can be straightened with pliers.

Parts should be inserted as instructed, and the leads bent outward, as illustrated, to lock them in place. After the part is in position, cut the leads off about 1/4" from the board. When a group of parts have been installed on a circuit board, solder each lead to the foil pattern and clip off the excess wire.



SPREAD LEADS OF EACH COMPONENT TO KEEP THEM FROM FALLING OUT WHEN THE BOARD IS TURNED OVER



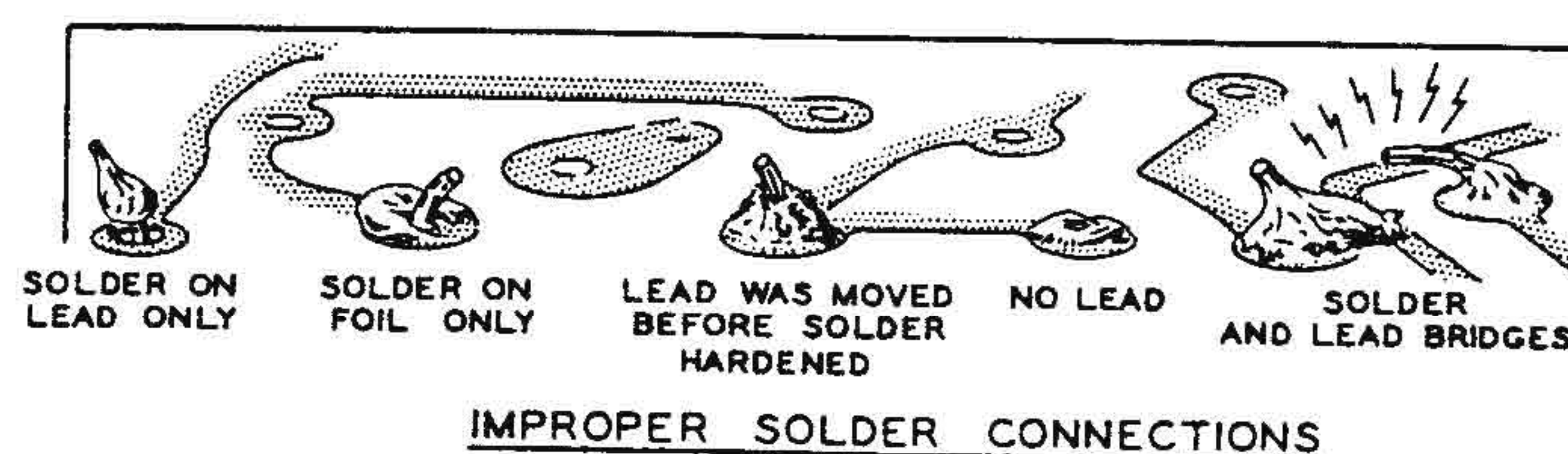


The actual technique of soldering leads to a circuit board is quite simple. Position the tip of the soldering iron so that it firmly contacts both the circuit board foil and the wire or lug to be soldered, as shown. The iron should be held so that solder is not likely to flow to adjacent foil conductors or connections. The solder should immediately be placed between the iron and the joint to be soldered. Remove the length of solder as soon as its end begins to melt and flow onto the lead and foil. Hold the tip of the iron in place only until the solder begins to flow outward over the foil; then remove the iron quickly.

Avoid overheating the connection. A soldering pencil or small iron (approximately 25 watts)

is ideal for use in circuit board work. If only a high wattage iron or soldering gun is available, precautions must be taken to avoid circuit board damage due to overheating and excess solder.

The use of excessive amounts of solder will increase the possibility of bridging between foil conductors or plugging holes which are to be left open for wires which may be added later on. If solder is accidentally bridged across insulating areas between conductors, it can be cleaned off by heating the connection carefully and quickly wiping or brushing the solder away with a soft cloth or clean brush. Holes which become plugged can be cleared by heating the area immediately over the hole while gently pushing the lead of a resistor through the hole from the opposite side, and withdrawing the lead before the solder rehardens. Do not force the lead through; too much pressure before the solder has time to soften may separate the foil from the board.





## STEP-BY-STEP PROCEDURE

The following instructions are presented in a logical step-by-step sequence to enable you to complete your kit with the least possible confusion. Be sure to read each step all the way through before beginning the specified operation. Also read several steps ahead of the actual step being performed. This will familiarize you with the relationship of the subsequent operations. When the step is completed, check it off in the space provided. This is particularly important as it may prevent errors or omissions, especially if your work is interrupted. Some kit builders have also found it helpful to mark each wire and part in colored pencil on the Pictorial as it is added.

### ILLUSTRATIONS

The fold-out diagrams in this manual may be removed and attached to the wall above your working area; but because they are an integral part of the instructions, they should be returned to the manual after the kit is completed.

In general, the illustrations in this manual correspond to the actual configuration of the kit; however, in some instances the illustrations may be slightly distorted to facilitate clearly showing all of the parts.

### SOLDERING

The abbreviation "NS" indicates that a connection should not be soldered yet as other wires will be added. When the last wire is installed, the terminal should be soldered and the abbreviation "S" is used to indicate this. Note that a number will appear after each solder instruction. This number indicates the number of leads that are supposed to be connected to the terminal in point before it is soldered. For example, if the instruction reads, "Connect a wire to lug 1 (S-2)," it will be understood that there will be two wires connected to the terminal at the time it is soldered. (In cases where a wire passes through a terminal or lug and then connects to another point, it will count as two wires, one entering and one leaving the terminal.)



# STEP-BY-STEP ASSEMBLY

## CIRCUIT BOARD WIRING

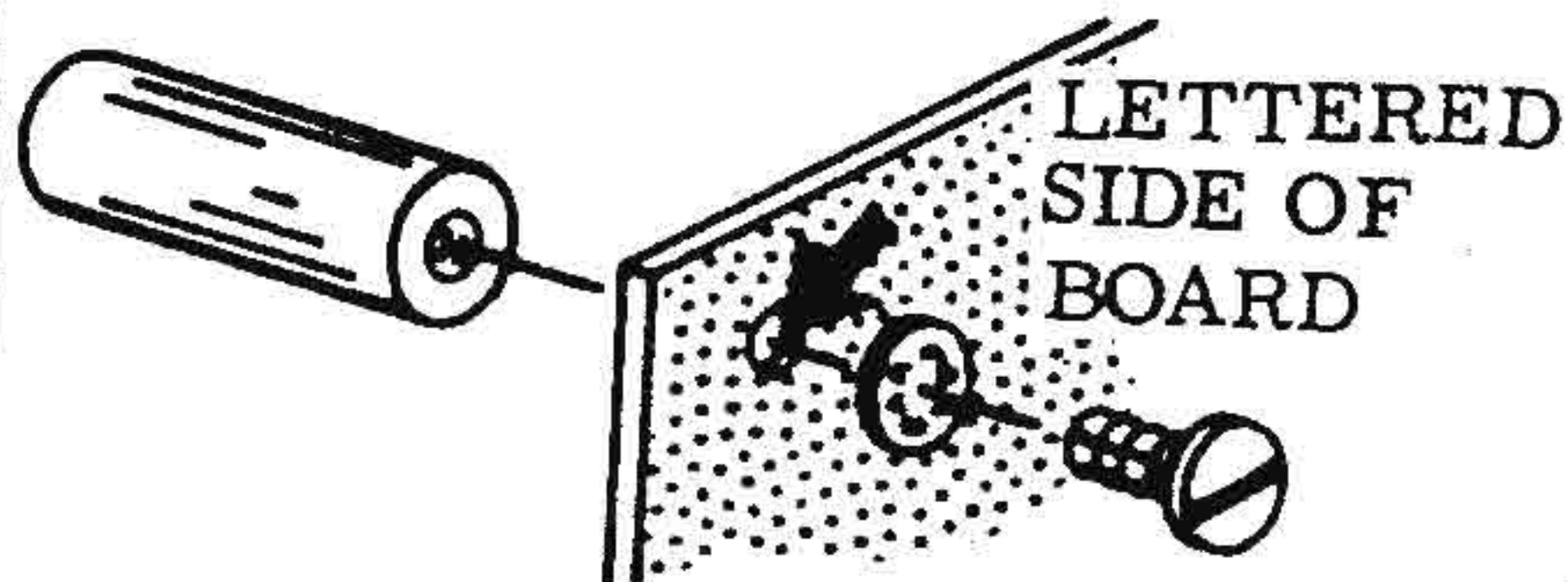
- ( ) Refer to Pictorial 1 and perform the steps around it. NOTE: After installing six or seven components, solder each lead to the foil side of the board. After soldering, cut off the excess lead lengths close to the foil unless otherwise instructed.

### START



- ( ) Locate the circuit board (#85-104P136) and position it as shown with the lettered side up.

- ( ) Mount a 11/16" phenolic spacer on the circuit board at the six locations marked by arrows. Use 3-48 x 1/4" screws and #3 lockwashers. Do not overtighten or the threads in the spacer will strip.

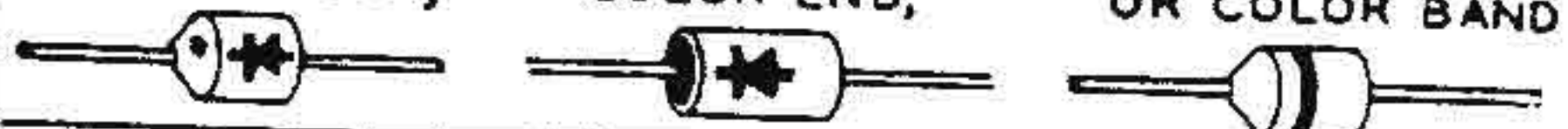


- ( ) 100  $\Omega$  (brown-black-brown). NOTE: A diode lead will also be placed in hole 2 later.

- ( ) One end of a 2-1/4" black hookup wire.

- ( ) 15 silicon diodes. Position the cathode (K) end of the diode over the shaded area on the circuit board. Space the diodes so the hole lettered RED on the circuit board is not blocked. Do not cut off the indicated diode lead.

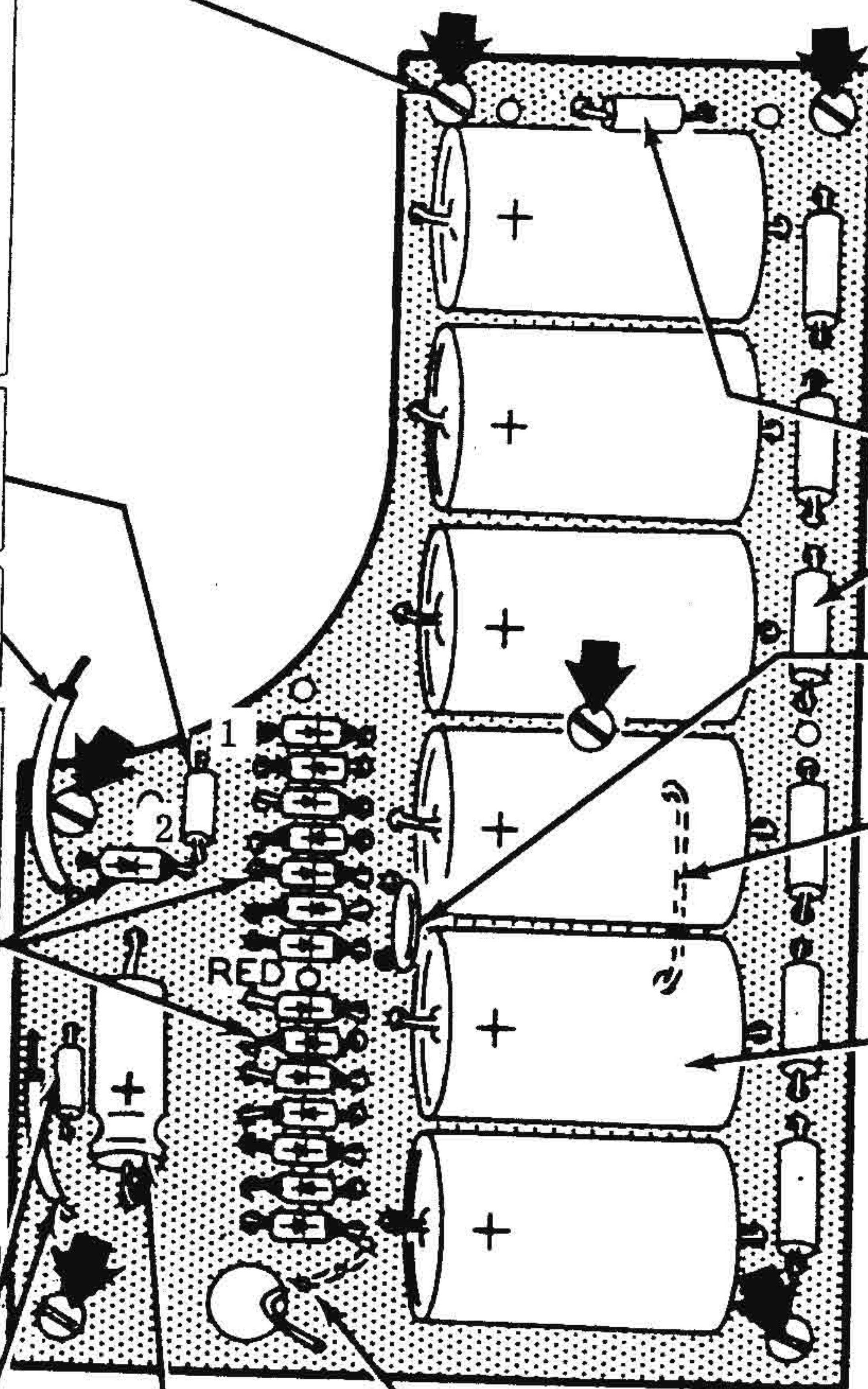
NOTE: PLACE SILICON DIODES WITH THE CATHODE END AS DIRECTED. THE CATHODE END MAY BE IDENTIFIED BY A COLOR DOT, COLOR END, OR COLOR BAND



- ( ) 100 K $\Omega$  (brown-black-yellow).

- ( ) One end of a 1-1/4" black hookup wire.

- ( ) 10  $\mu$ f electrolytic capacitor. Position the positive (+) end as marked on the circuit board.



Do not cut off this lead, but bend it over and place it through hole HV as shown.

### CONTINUE



- ( ) 12 K $\Omega$  (brown-red-orange).

- ( ) Six 220 K $\Omega$  (red-red-yellow) 1 watt.

- ( ) 470  $\mu$ f disc capacitor.

- ( ) 1-1/2" jumper wire. Use a 1-1/2" length of hookup wire with 1/4" of insulation removed from each end.

- ( ) Six 20  $\mu$ f electrolytic capacitors. Position the positive (+) end of the capacitors as marked on the circuit board.

Be sure to solder all leads to the foil and cut off all excess lead lengths except the one diode lead marked. Be sure there are no solder bridges between components or foil.

### FINISH

Proceed to the following steps.

PICTORIAL 1



## CHASSIS PARTS MOUNTING

NOTE: Pictorials 2, 3, 4, and 5 concern the mounting of the transistors and heat sink fins to the chassis. The sides of the chassis have been called out with letters A through D. The small drawing at the bottom of each Pictorial shows which side is being worked on and how the chassis was positioned for the Pictorial drawing.

### Chassis Side A

Refer to Pictorial 2 for the following steps.

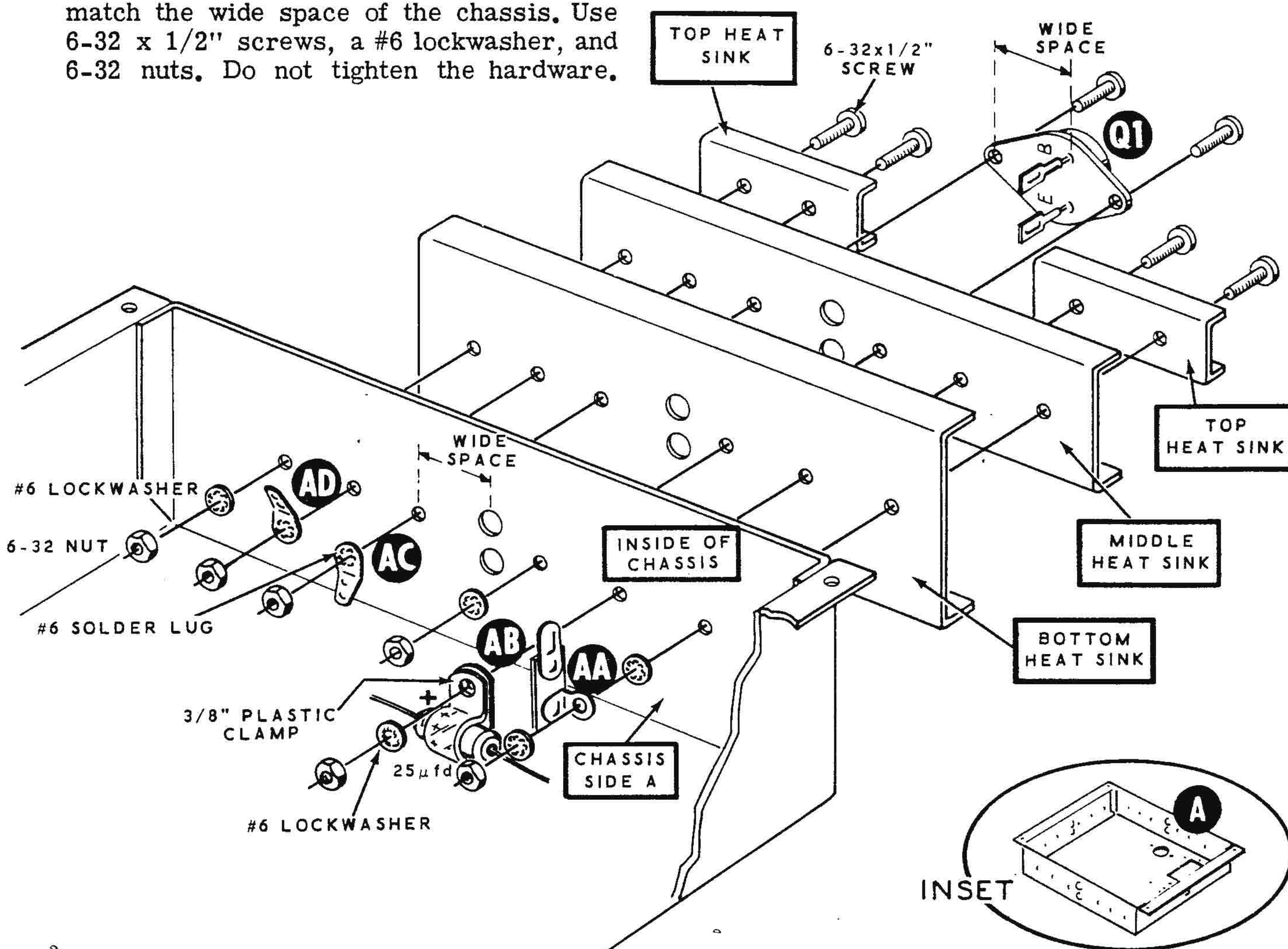
- ( ) Position the chassis as shown in the inset drawing on Pictorial 2.
- ( ) Mount transistor Q1 and a bottom and middle heat sink on the chassis, with a #6 solder lug inside the chassis at AC. Position the wide space of the heat sinks and transistor to match the wide space of the chassis. Use 6-32 x 1/2" screws, a #6 lockwasher, and 6-32 nuts. Do not tighten the hardware.

- ( ) Mount a top heat sink, with a #6 solder lug inside the chassis at AD. Use 6-32 x 1/2" screws, a #6 lockwasher, and 6-32 nuts. Do not tighten the hardware.

- ( ) Place a 25  $\mu$ fd electrolytic capacitor in a 3/8" plastic clamp. Position the capacitor so the positive (+) end is near transistor Q1 when the clamp is positioned as shown in Pictorial 2.

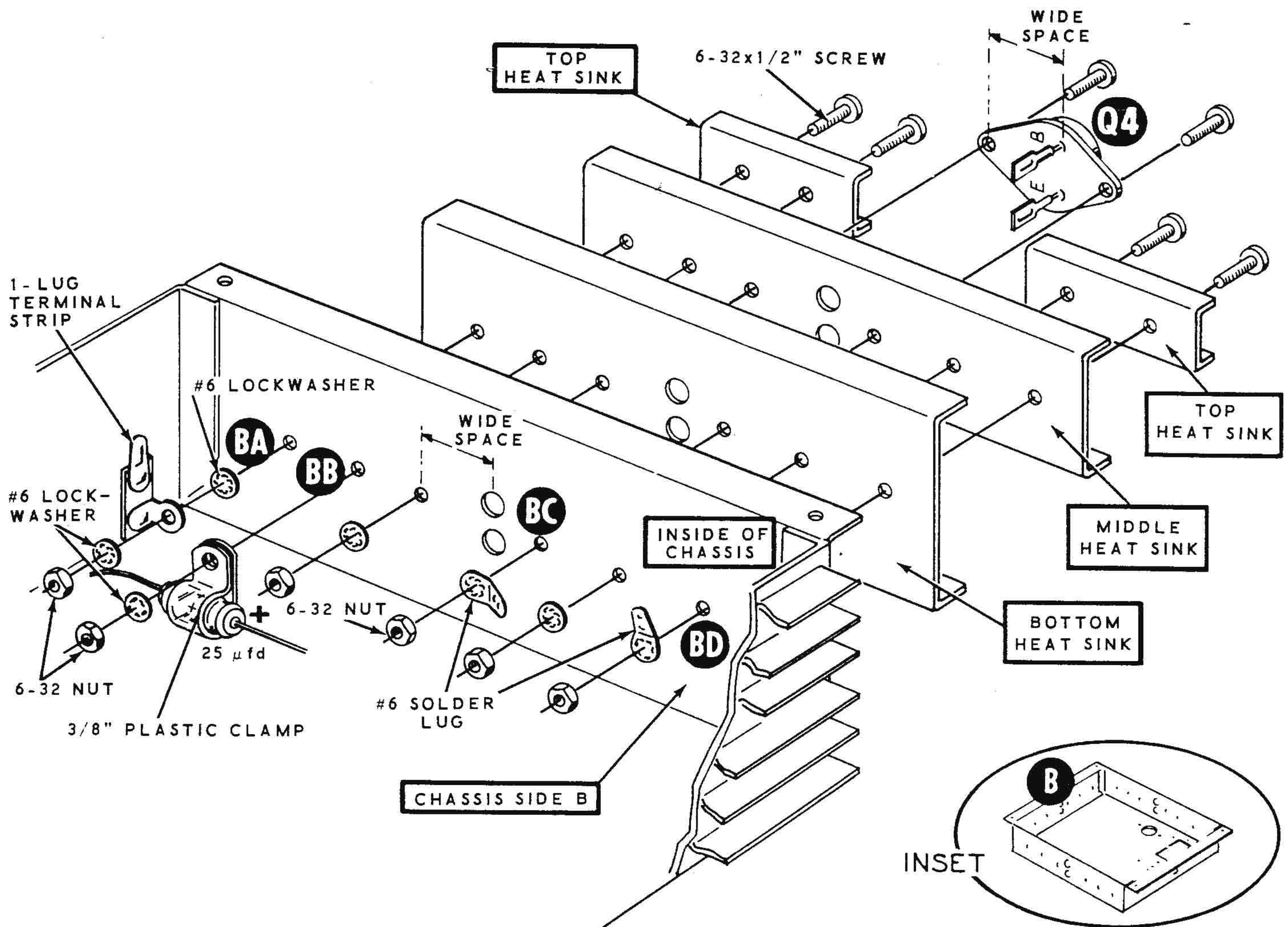
- ( ) Mount a top heat sink, with the plastic clamp and capacitor at AB and a 1-lug terminal strip at AA inside the chassis. Use 6-32 x 1/2" screws, #6 lockwashers, and 6-32 nuts as shown.

- ( ) Now tighten the hardware in side A of the chassis.



PICTORIAL 2





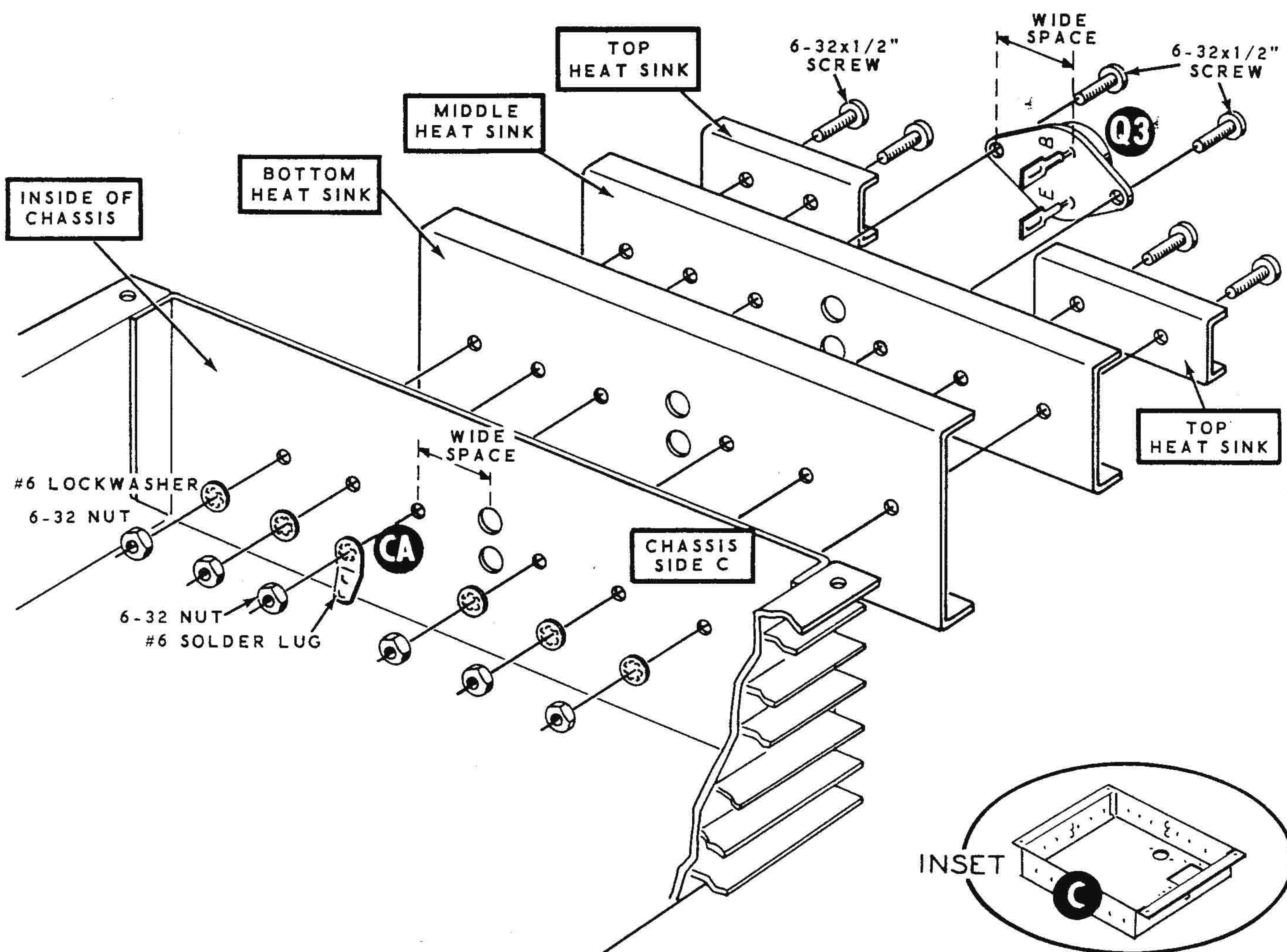
PICTORIAL 3

## Chassis Side B

Refer to Pictorial 3 for the following steps.

- ( ) Mount transistor Q4 and a bottom and middle heat sink on the chassis, with a #6 solder lug inside the chassis at BC. Position the wide space of the heat sinks and transistor to match the wide space of the chassis. Use 6-32 x 1/2" screws, a #6 lockwasher, and 6-32 nuts. Do not tighten the hardware.
- ( ) Mount a top heat sink, with a #6 solder lug inside the chassis at BD. Use 6-32 x 1/2" screws, a #6 lockwasher, and 6-32 nuts. Do not tighten the hardware.
- ( ) Place a 25  $\mu$ fd electrolytic capacitor in a 3/8" plastic clamp. Position the capacitor so the positive (+) end is near transistor Q4 when the clamp is positioned as shown in Pictorial 3.
- ( ) Mount a top heat sink, with the plastic clamp and capacitor at BB and a 1-lug terminal strip at BA inside the chassis. Use 6-32 x 1/2" screws, #6 lockwashers, and 6-32 nuts.
- ( ) Now tighten the hardware in side B of the chassis.





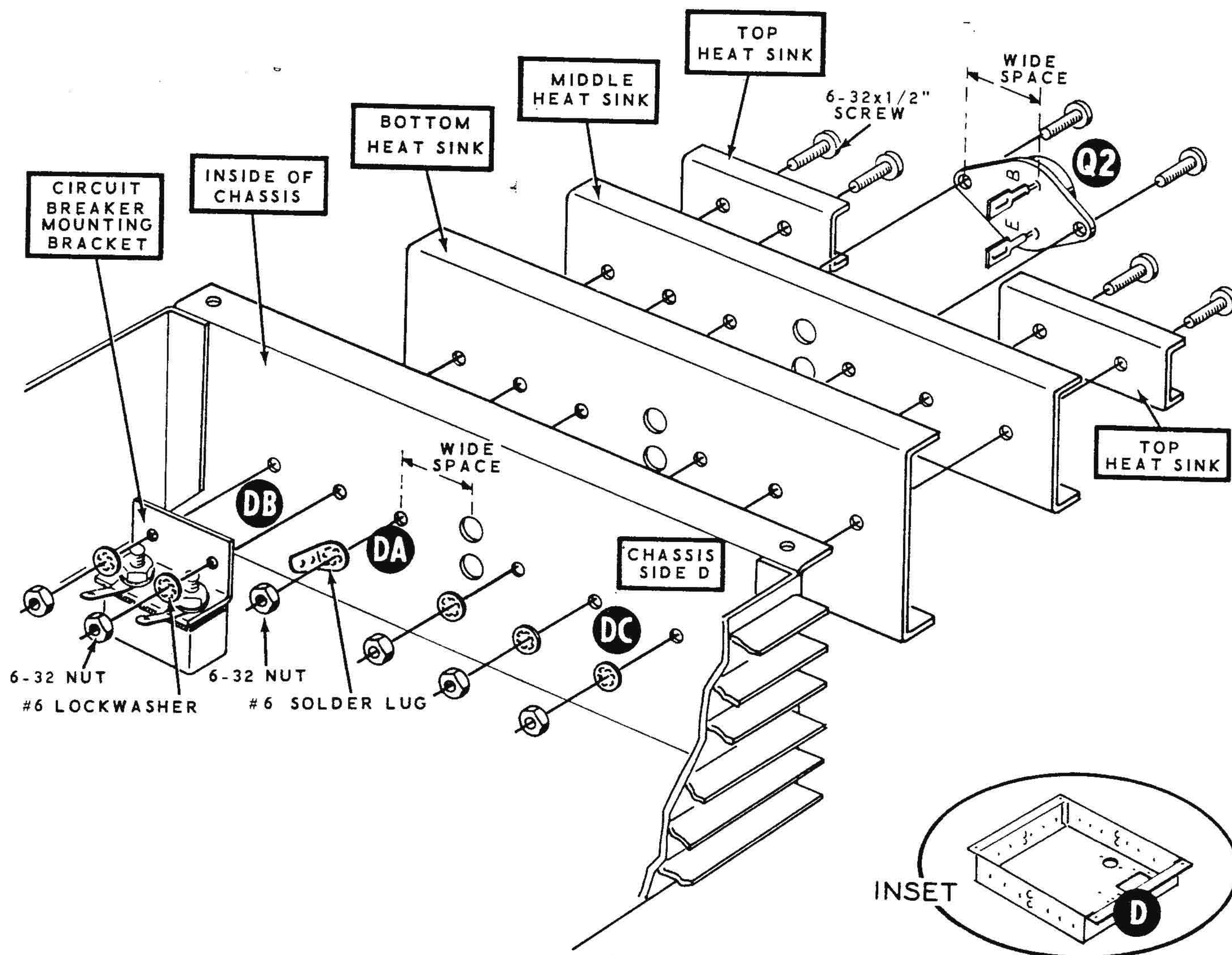
PICTORIAL 4

### Chassis Side C

Refer to Pictorial 4 for the following steps.

- ( ) Mount transistor Q3 and a bottom and middle heat sink on the chassis, with a #6 solder lug inside the chassis at CA. Position the wide space of the heat sinks and transistor to match the wide space of the chassis. Use 6-32 x 1/2" screws, a #6 lockwasher, and 6-32 nuts. Do not tighten the hardware.
- ( ) Mount a top heat sink on each side of the transistor. Use 6-32 x 1/2" screws, #6 lockwashers, and 6-32 nuts.
- ( ) Now tighten the hardware in side C of the chassis.





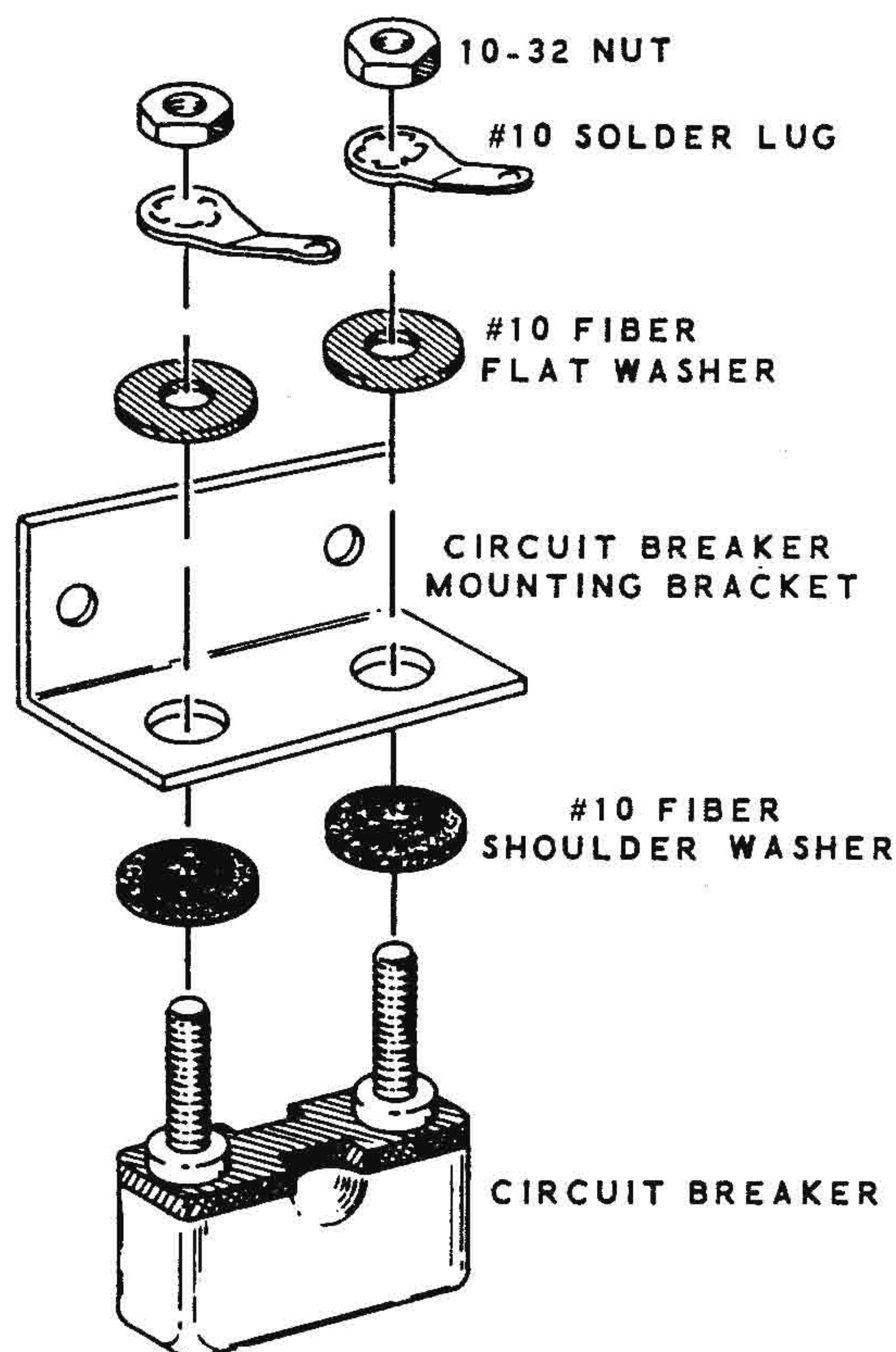
PICTORIAL 5

**Chassis Side D**

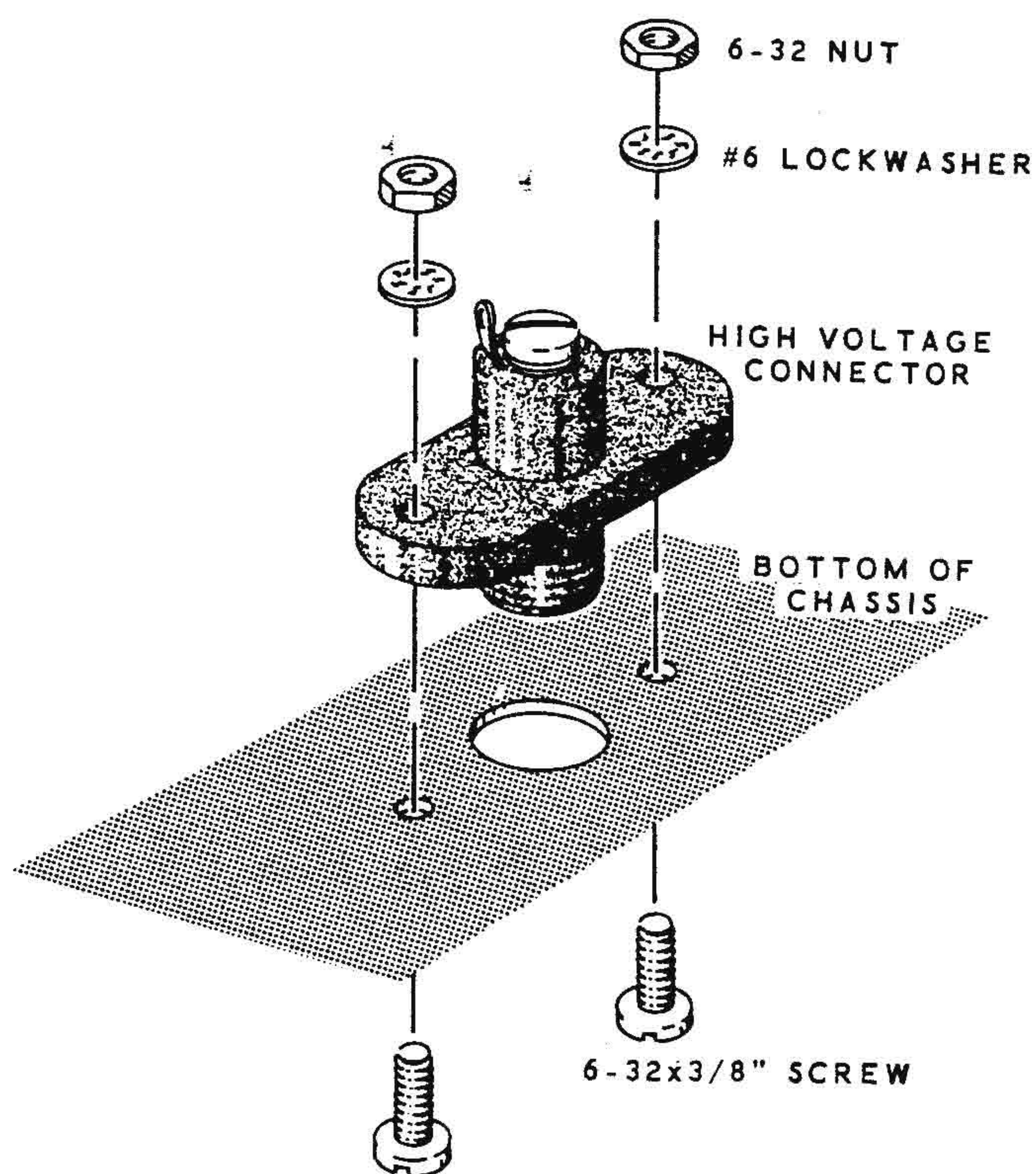
Refer to Pictorial 5 for the following steps.

- ( ) Mount transistor Q2 and a bottom and middle heat sink on the chassis, with a #6 solder lug inside the chassis at DA. Position the wide space of the heat sinks and transistor to match the wide space of the chassis. Use 6-32 x 1/2" screws, a #6 lockwasher, and 6-32 nuts. Do not tighten the hardware.
- ( ) Mount a top heat sink at DC on chassis side D. Use 6-32 x 1/2" screws, #6 lockwashers, and 6-32 nuts. Do not tighten the hardware.
- ( ) Refer to Detail 5A and mount the circuit breaker to the circuit breaker mounting bracket. Use #10 fiber shoulder washers, #10 fiber flat washers, #10 solder lugs, and 10-32 nuts.
- ( ) Mount the remaining top heat sink, with the circuit breaker mounting bracket at DB inside the chassis. Use 6-32 x 1/2" screws, #6 lockwashers, and 6-32 nuts.
- ( ) Now tighten the hardware in side D of the chassis.





Detail 5A

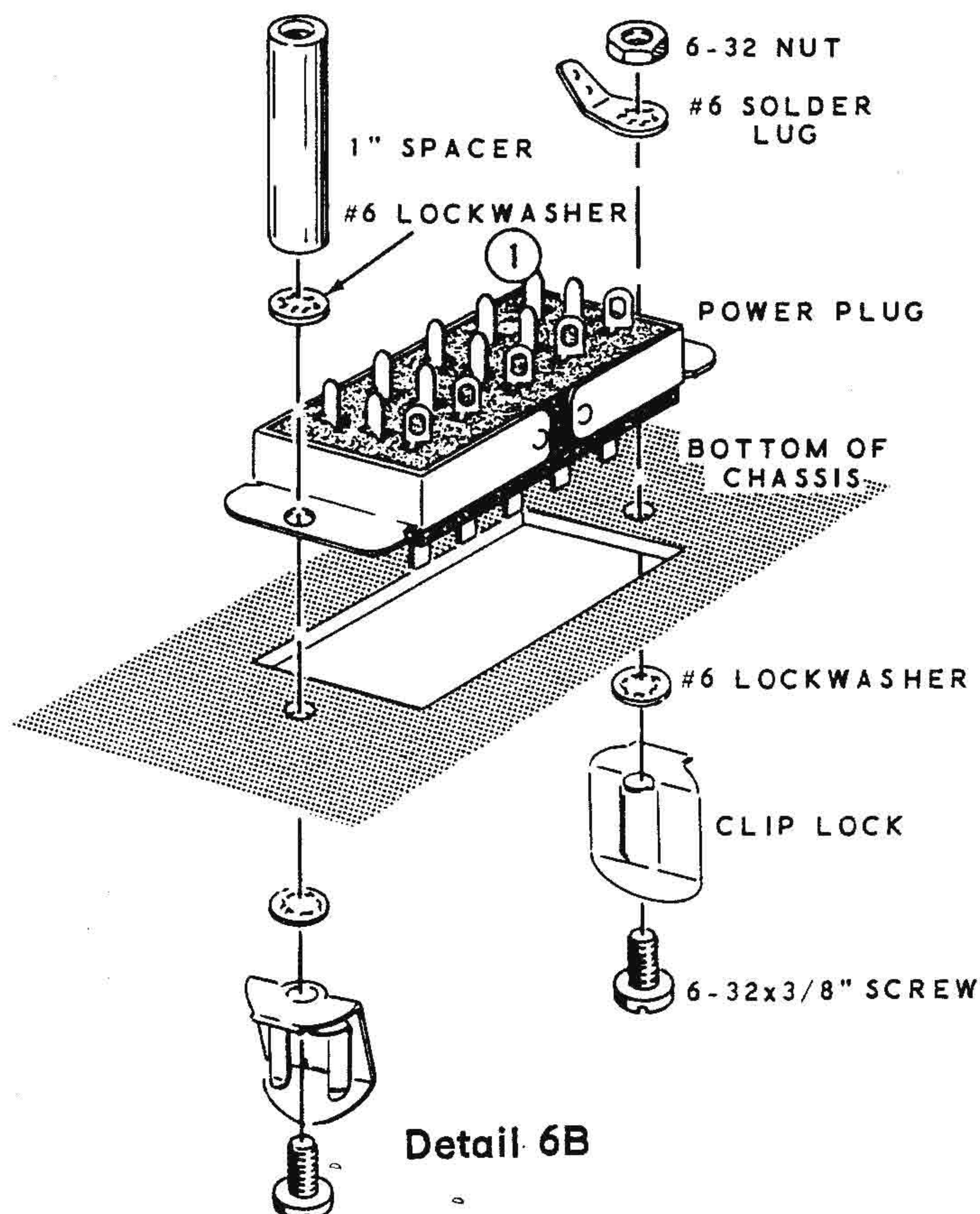


Detail 6A

## CHASSIS BOTTOM PARTS MOUNTING AND INITIAL WIRING

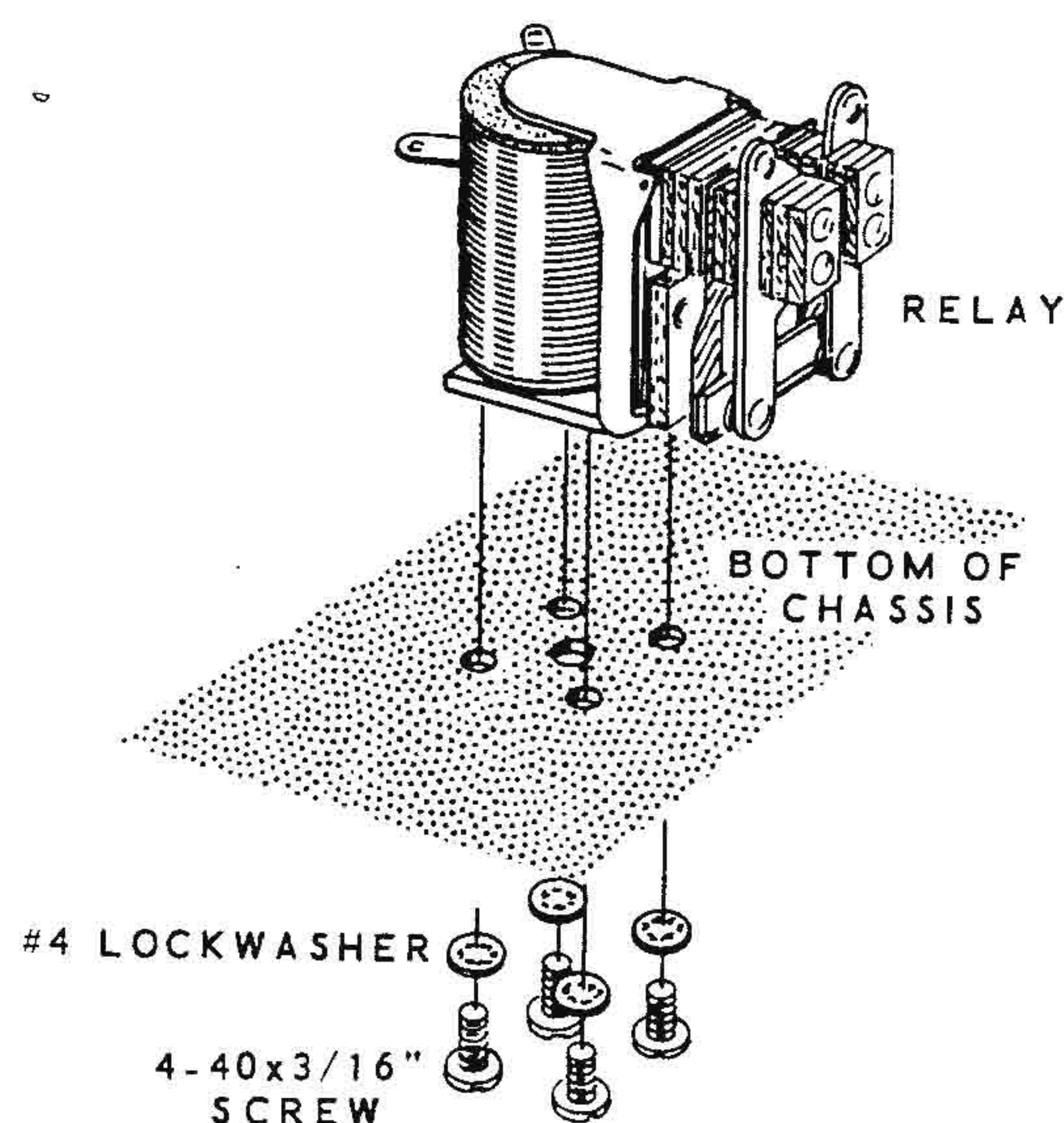
Refer to Pictorial 6 (fold-out from Page 17) for the following steps.

- ( ) Install a 6-32 x 1/4" black screw, #6 lockwasher, and a 6-32 nut at each corner of the chassis as shown.
- ( ) Locate the high voltage connector and remove the top cap. Set the cap aside to be used later.
- ( ) Refer to Detail 6A and mount the high voltage connector at EA. Use 6-32 x 3/8" screws, #6 lockwashers, and 6-32 nuts. Bend the solder lug up at a 90 degree angle as shown in Pictorial 6.
- ( ) Referring to Detail 6B, mount the male power plug and two clip locks at EB, with a #6 solder lug at ED and a 1" spacer at EE inside the chassis. Position lug 1 of the socket as shown in Pictorial 6. Use 6-32 x 3/8" screws, a #6 lockwasher, and a 6-32 nut.



Detail 6B





Detail 6C

- ( ) Referring to Detail 6C, mount the relay at EC with four 4-40 x 3/16" screws and four #4 lockwashers. Position the relay lugs as shown in Pictorial 6.
- ( ) Place a 3/8" length of clear plastic sleeving over each lug of transistors Q1, Q2, Q3, and Q4.

NOTE: Prepare the wire ends by removing 1/4" of insulation from each end unless otherwise instructed. Melt a small amount of solder on the exposed wire ends to hold the small strands together.

- ( ) Connect a 7" blue wire from lug E of transistor Q1 (S-1) to lug E of transistor Q2 (NS).
- ( ) Connect a 7-1/2" blue wire from lug B of transistor Q1 (NS) to lug B of transistor Q2 (S-1).
- ( ) Remove 1-1/2" of insulation from one end of a 4-1/4" blue wire. Melt a small amount of solder on the 1-1/2" bare wire to hold the small strands together.
- ( ) Place the 1-1/2" prepared end of the 4-1/4" wire through solder lug AC (S-2) to solder lug AD (NS). Connect the other end of this wire to solder lug ED (NS).
- ( ) Place a 1" length of sleeving over the positive (+) lead of the capacitor mounted in plastic clamp AB. Connect this lead to lug B of transistor Q1 (NS). Place a 1-1/4" length of sleeving over the other lead and connect this lead to lug 1 of terminal strip AA (NS).
- ( ) Connect a 2  $\Omega$  7 watt wire-wound resistor from lug 1 of terminal strip AA (NS) to lug B of transistor Q1 (NS).
- ( ) Connect a 195  $\Omega$  7 watt wire-wound resistor from lug B of transistor Q1 (S-4) to solder lug AD (NS).
- ( ) Remove 1-3/4" of insulation from one end of a 6" blue wire. Place the 1-3/4" prepared wire end through solder lug BD (NS) to solder lug BC (S-1). Connect the other end of this wire to solder lug AD (S-3).



- ( ) Connect an 8-1/2" blue wire from lug E of transistor Q4 (S-1) to lug E of transistor Q3 (NS).
- ( ) Connect a 9" blue wire from lug B of transistor Q4 (NS) to lug B of transistor Q3 (S-1).
- ( ) Connect a 195  $\Omega$  7 watt wire-wound resistor from solder lug BD (S-3) to lug B of transistor Q4 (NS).
- ( ) Place a 1-1/4" length of sleeving on the positive (+) lead of the 25  $\mu$ fd electrolytic capacitor mounted in plastic clamp BB. Connect this lead to lug B of transistor Q4 (NS). Place a 1-1/4" length of sleeving on the other capacitor lead and connect this lead to lug 1 of terminal strip BA (NS).
- ( ) Connect a 2  $\Omega$  7 watt wire-wound resistor from lug 1 of terminal strip BA (NS) to lug B of transistor Q4 (S-4).
- ( ) Connect an 8" blue wire from solder lug CA (S-1) to solder lug DA (NS).
- ( ) Remove 1-1/4" of insulation from one end of a 5-1/2" blue wire. Place the 1-1/4" prepared end of this wire through solder lug ED (S-3), through lug 1 (NS) to lug 5 (NS) of power plug EB. Connect the other end of this wire to solder lug DA (S-2).
- ( ) Remove 1/2" of insulation from one end of a 4" blue wire. Place the 1/2" prepared end of this wire through lug 6 (S-2) to lug 3 (S-1) of power plug EB. Connect the other end of this wire to lug 1 of relay EC (NS).
- ( ) Connect a 2" blue wire from lug 2 of relay EC (S-1) to lug 1 of circuit breaker DB (S-1).
- ( ) Remove 3/4" of insulation from one end of a 2" blue wire. Place the 3/4" prepared end of this wire through lug 14 (S-2) to lug 10 (S-1) of power plug EB. Connect the other end of this wire to lug 2 of circuit breaker DB (S-1).
- ( ) Remove 1/2" of insulation from the remaining length of blue wire. Place the 1/2" prepared end of the wire through lug 13 (S-1) to lug 11 (S-1) of power plug EB. Now cut the wire off flush with lug 13 of EB. Solder the wires connected between lugs 13 and 11 and 14 and 10 together where they cross.
- ( ) Connect a 3" black hookup wire from lug 8 of power plug EB (S-1) to lug 4 of relay EC (S-1).
- ( ) Connect a 3-3/4" black hookup wire from lug 4 of power plug EB (NS) to lug 3 of relay EC (S-1).



## FINAL CHASSIS WIRING

Refer to Pictorial 7 for the following steps.

- ( ) Cut the power transformer leads to the following lengths. Measure the leads from the point at which they leave the transformer.

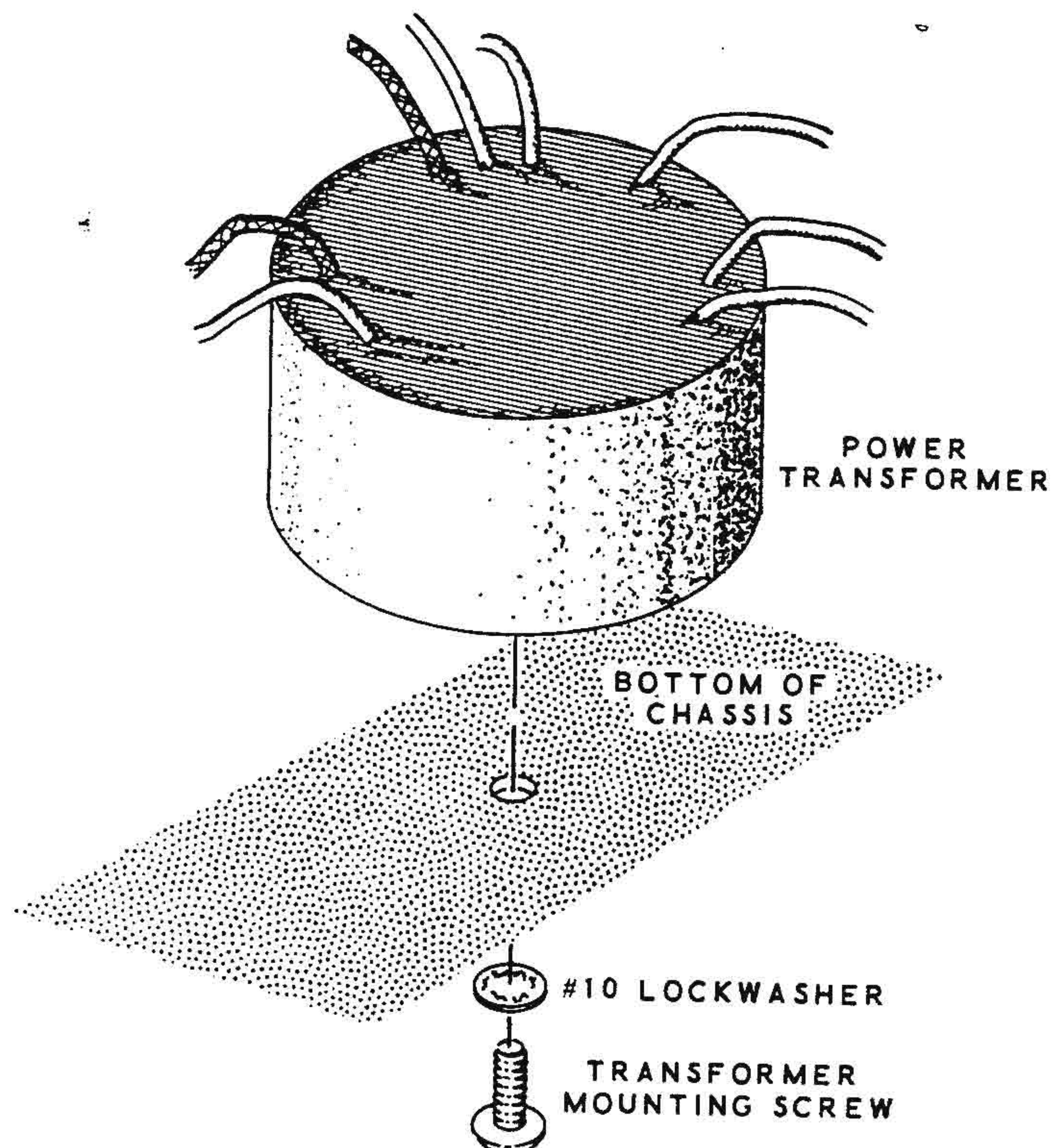
<u>COLOR</u>	<u>LENGTH</u>
Green	5-3/4"
Green-yellow	3-1/4"
Red-yellow	6-1/4"
Red	4"
Gray #1	3-1/2"
Gray #2	6-1/2"
Orange	6"
Brown	2-3/4"

- ( ) Remove 1/4" of insulation from the end of each transformer lead. Melt a small amount of solder on the exposed ends to hold the small strands together.

- ( ) Refer to Detail 7A and mount the power transformer at T1. Position the lug on the side of the transformer as shown in Pictorial 7. Use the 10-32 x 3/8" screw supplied with the transformer and a #10 lockwasher. Be sure that no wires are pinched under the transformer.

Connect the wires extending from the transformer as follows:

- ( ) Green-yellow to lug E of transistor Q3 (S-2).
- ( ) Green to lug 1 of terminal strip BA (S-3).
- ( ) Gray #2 to lug 2 (NS) of power plug EB.
- ( ) Brown to lug E of transistor Q2 (S-2).
- ( ) Orange to lug 1 of terminal strip AA (S-3).



Detail 7A

- ( ) Connect one end of a 10-1/4" black wire to lug 9 of power plug EB (S-1). Route this wire as shown. Leave the other end free as it will be connected later.
- ( ) Connect one end of an 8" black wire to lug 5 of power plug EB (S-2). Leave the other end free as it will be connected later.
- ( ) Connect one end of a 5" black wire to lug 1 of power plug EB (NS). Leave the other end free as it will be connected later.
- ( ) Position the circuit board in the chassis on edge so that both the lettered side and the foil side are accessible.
- ( ) Connect the free end of the wire extending from lug 9 of power plug EB to hole ALC on the circuit board (S-1).

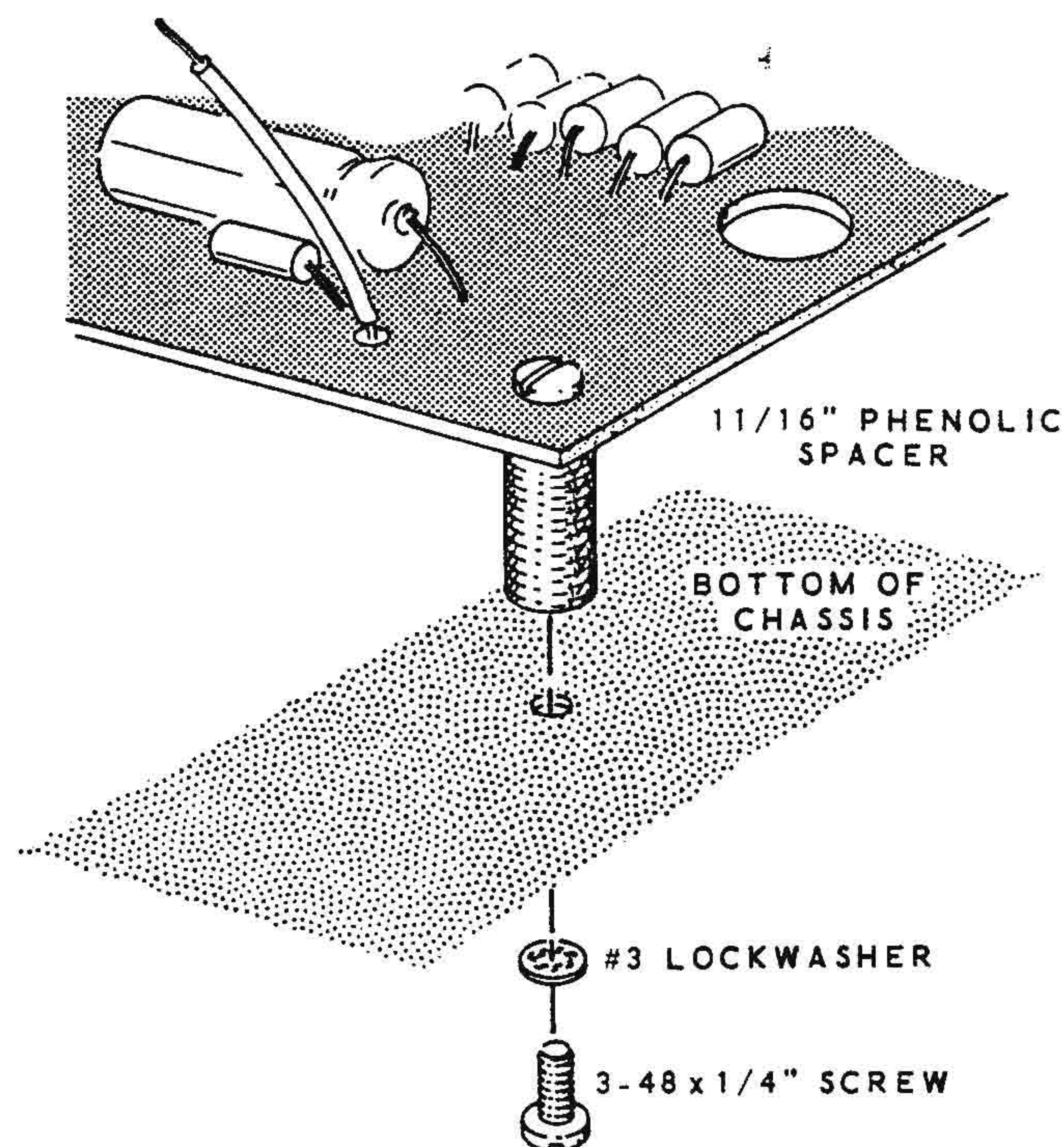


- ( ) Connect the free end of the wire extending from lug 5 of power plug EB to hole GND near the 12 K $\Omega$  resistor on the circuit board (S-1).
- ( ) Connect the free end of the wire extending from lug 1 of power plug EB to hole GND near the silicon diodes (S-1).

Connect the wires extending from the transformer as follows:

- ( ) Red-yellow to hole RED/YEL on the circuit board (S-1). Route this wire between the 20  $\mu$ fd electrolytic capacitors and down against the circuit board.
- ( ) Red to hole RED on the circuit board (S-1).
- ( ) Gray to hole GRY on the circuit board (S-1).

- ( ) Refer to Detail 7B and mount the circuit board to the chassis with 3-48 x 1/4" screws and #3 lockwashers.
- ( ) Connect the free end of the wire extending from hole GND on the circuit board, to lug 1 of power plug EB (S-4).
- ( ) Connect the free end of the wire extending from hole BIAS on the circuit board, to lug 7 of power plug EB (S-1).
- ( ) Connect the free end of the wire extending through the circuit board near high voltage connector EA, to the solder lug on EA (S-1).
- ( ) Place a 100  $\mu$ fd electrolytic capacitor in a 3/8" plastic clamp. Position the capacitor so the positive (+) end is near the power transformer when the clamp is positioned at EE as shown in Pictorial 7.

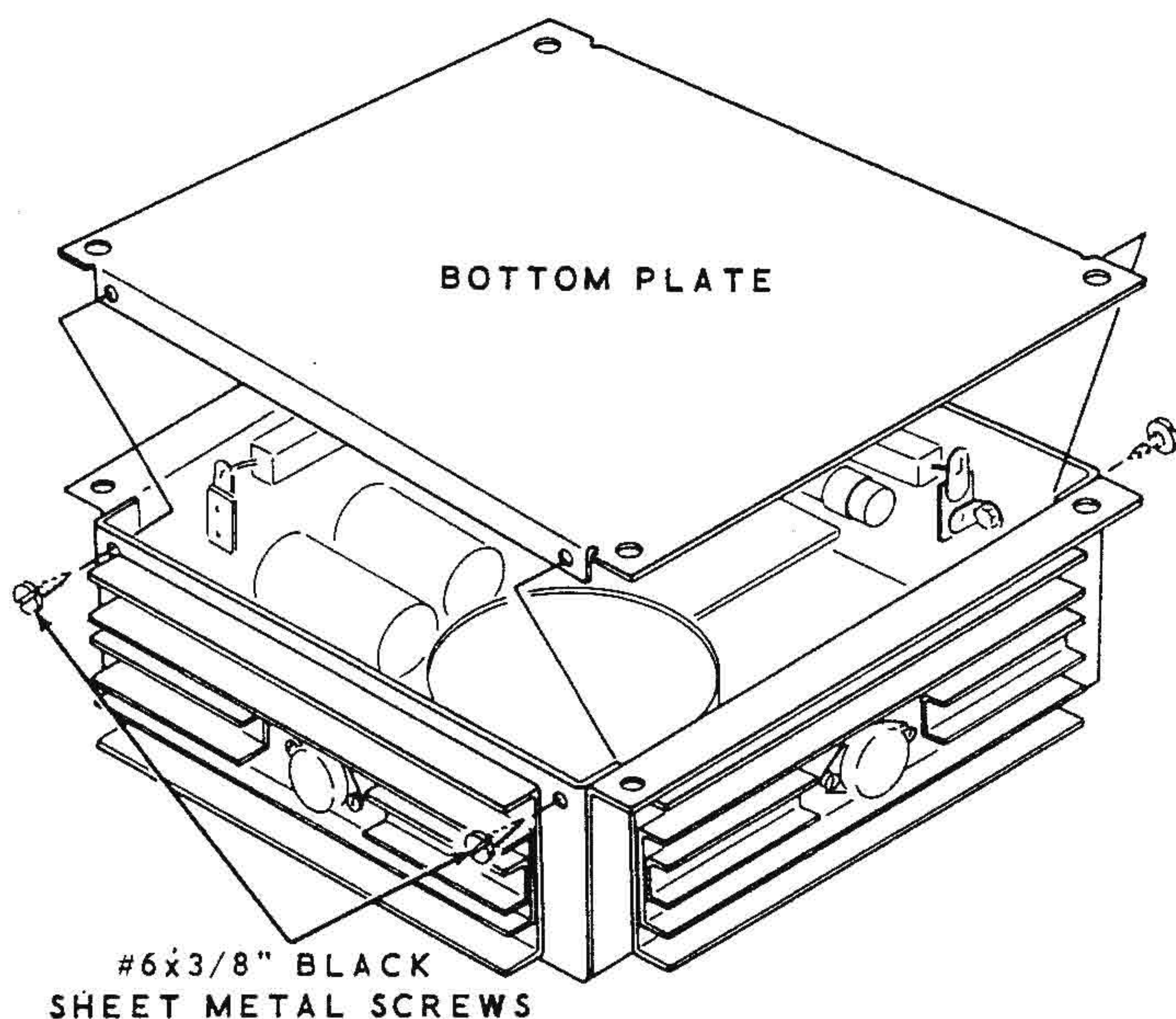


Detail 7B

- ( ) Mount the prepared plastic clamp and capacitor on spacer EE with a 6-32 x 3/8" screw.
- ( ) Connect the positive (+) lead of the mounted 100  $\mu$ fd electrolytic capacitor, to lug 1 of power transformer T1 (NS). Place the other lead of this capacitor through lug 4 (S-3) to lug 2 (S-2) of power plug EB. Solder together the leads between lugs 1 and 5, and between lugs 4 and 2 of EB where they cross.
- ( ) Connect the filter choke from lug 1 of power transformer T1 (S-2) to lug 1 of relay EC (S-2). Position the choke so it does not touch the top of the relay.

This completes the wiring of the HP-14 Power Supply. Check all solder connections to be sure they are properly soldered. Remove all wire clippings and solder splashes from the chassis.





PICTORIAL 8

## FINAL ASSEMBLY

- ( ) Refer to Pictorial 8 and install the bottom plate on the chassis. Use four #6 x 3/8" sheet metal screws.

NOTE: The blue and white identification label shows the Model Number and Production Series Number of your kit. Refer to these numbers in any communications with the Heath Company; this assures you that you will receive the most complete and up-to-date information in return.

- ( ) Install the identification label in the following manner:

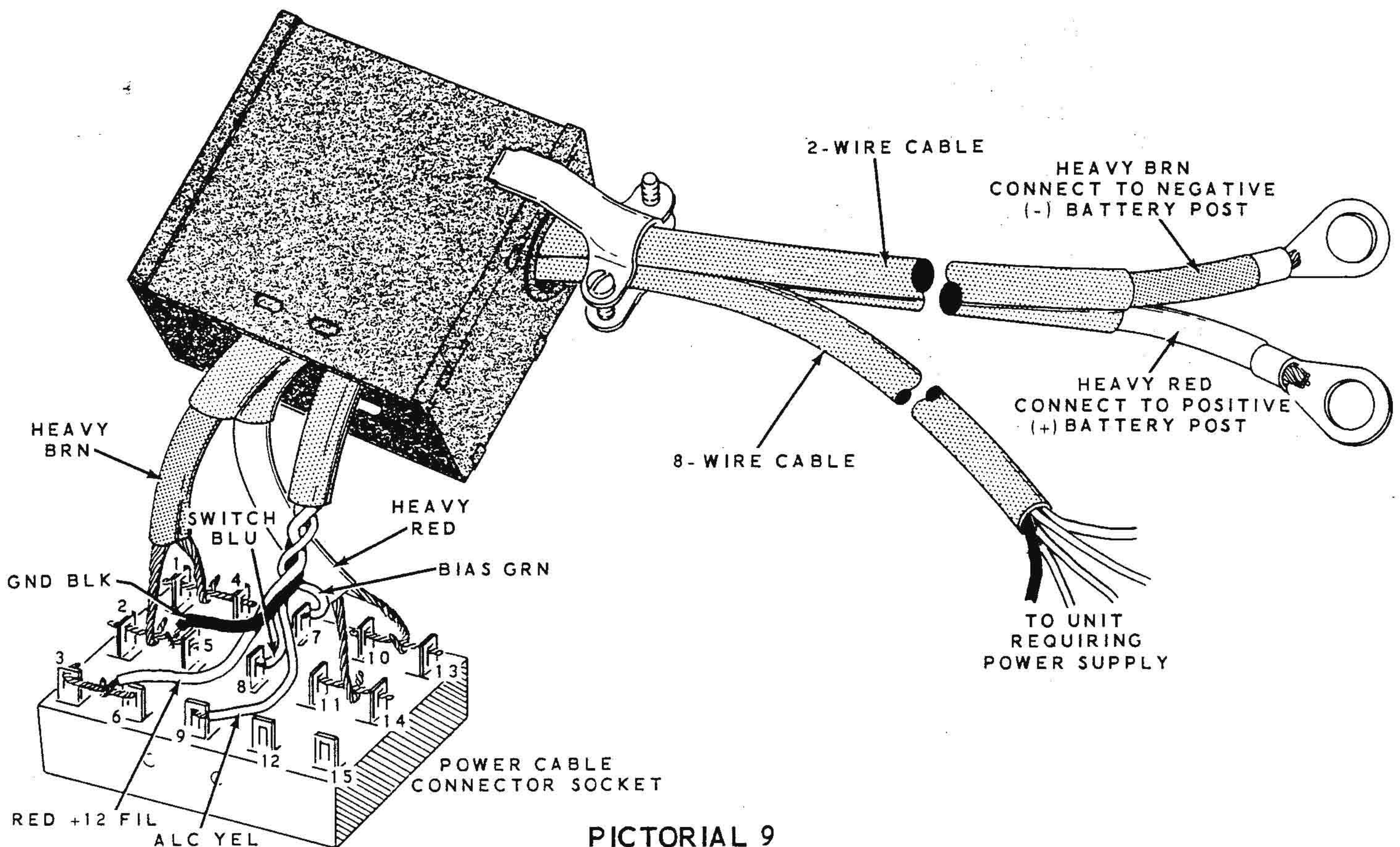
1. Select a location for the label where it can easily be seen when needed, but will not show when the unit is in operation. This location might be on the rear panel or the top of the chassis, or on the rear or bottom of the cabinet.
2. Carefully peel away the backing paper. Then press the label into position.

## POWER CONNECTOR WIRING

Refer to Pictorial 9 for the following steps.

- ( ) Remove the cable clamp from the power socket cover.
- ( ) Place one end of the 2-wire cable and one end of the 8-wire cable through the hole on the side of the socket cover, until the cables stick out the bottom of the cover as shown.
- ( ) Position the female power connector socket as shown.
- ( ) Remove 4" of insulation from one end of the remaining blue wire. Twist the strands together tightly and melt a small amount of solder on the exposed wire to hold the small strands together. This wire will be used to wire the power socket in the following five steps.
- ( ) Place the prepared wire end through lug 1 (S-1) to lug 4 (S-1). Clip off the excess wire at lug 1.
- ( ) Place the prepared wire end through lug 2 (S-1) to lug 5 (S-1). Clip off the excess wire at lug 2.
- ( ) Place the prepared wire end through lug 3 (S-1) to lug 6 (S-1). Cut off the excess wire at lug 3.
- ( ) Place the prepared wire end through lug 13 (S-1) to lug 10 (S-1). Clip off the excess wire at lug 13.
- ( ) Place the prepared wire end through lug 14 (S-1) to lug 11 (S-1). Clip off the excess wire at lug 14.



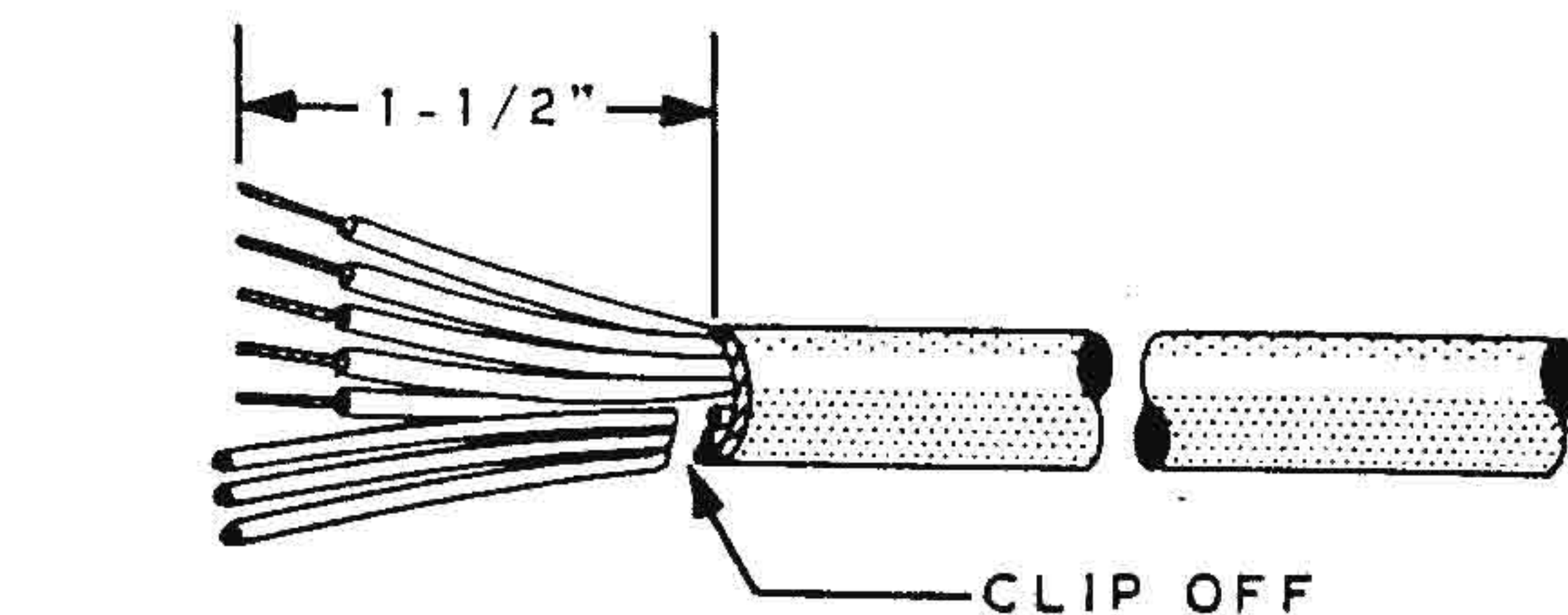


PICTORIAL 9

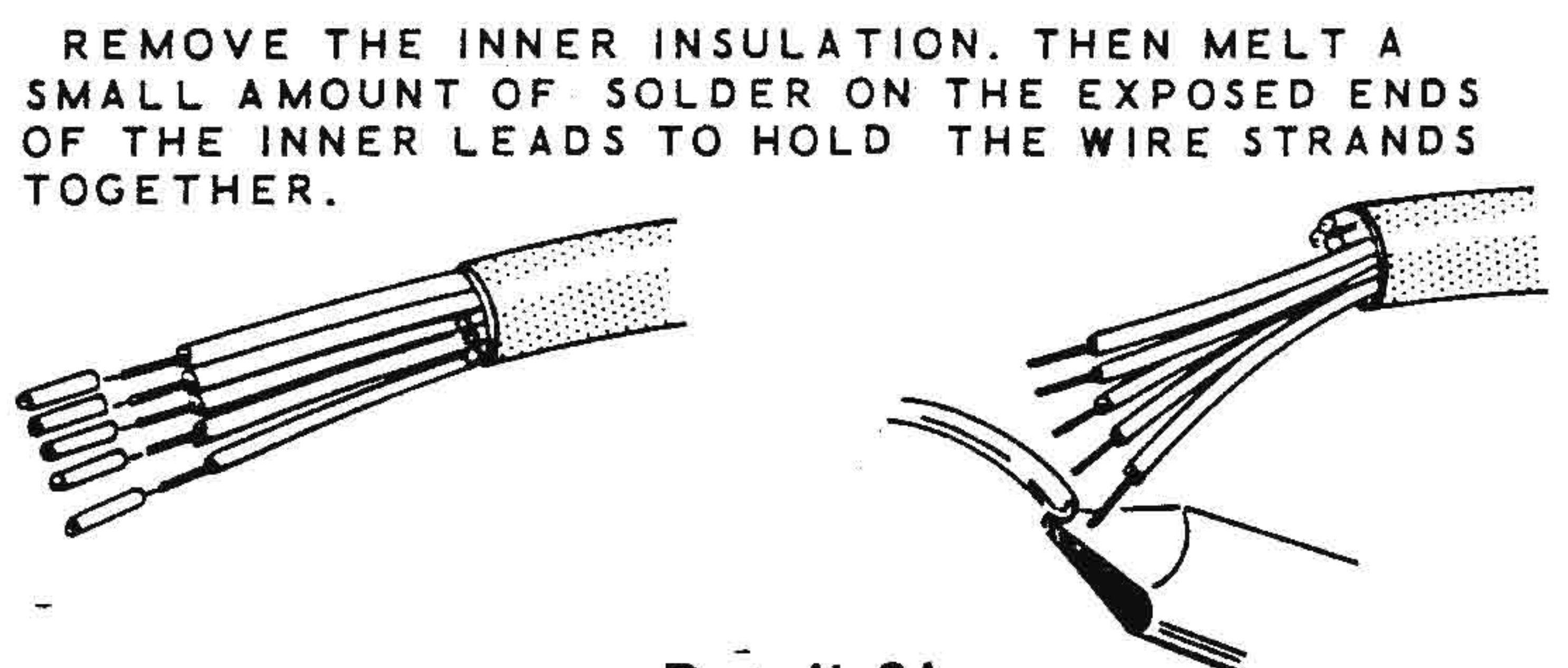
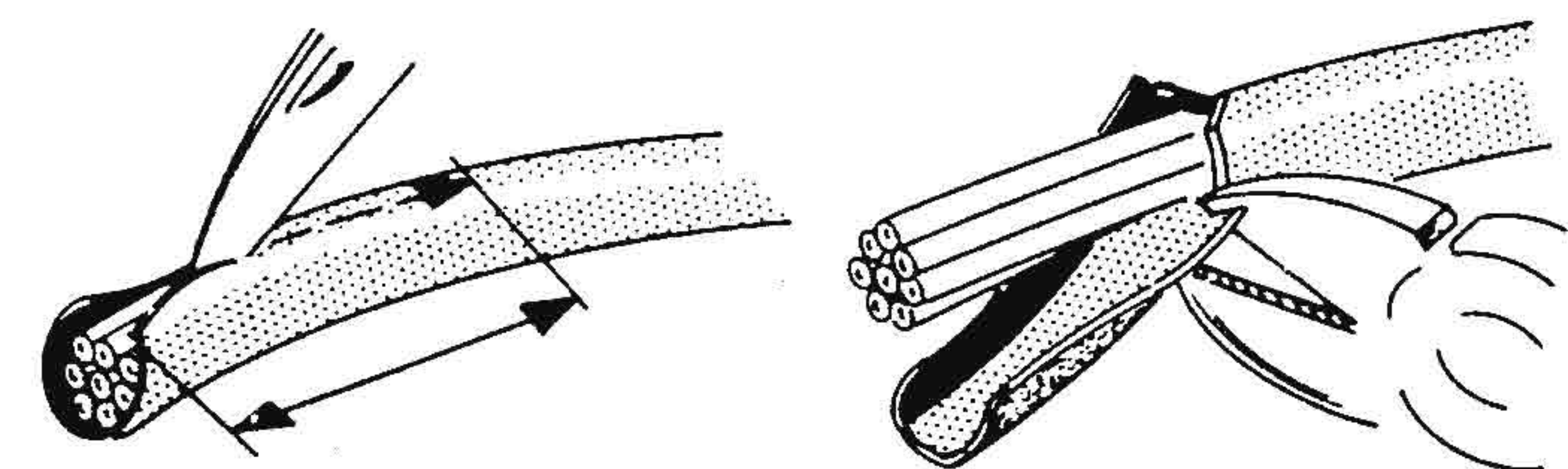
- ( ) Referring to Detail 9A, remove 1-1/2" of the outer insulation from one end of the 8-wire cable. Cut off the white, orange, and brown wires, as they are not used. Then remove 1/4" of insulation from the end of each remaining wire. Melt a small amount of solder on the exposed wire ends to hold the small strands together.

Connect the wires at the prepared end of the 8-wire cable to the power socket as follows:

- ( ) Red to the center of the wire connected between lugs 3 and 6 (S-1).
- ( ) Yellow to lug 9 (S-1).
- ( ) Blue to lug 8 (S-1).
- ( ) Green to lug 7 (S-1).
- ( ) Black to the center of the wire connected between lugs 2 and 5 (S-1).

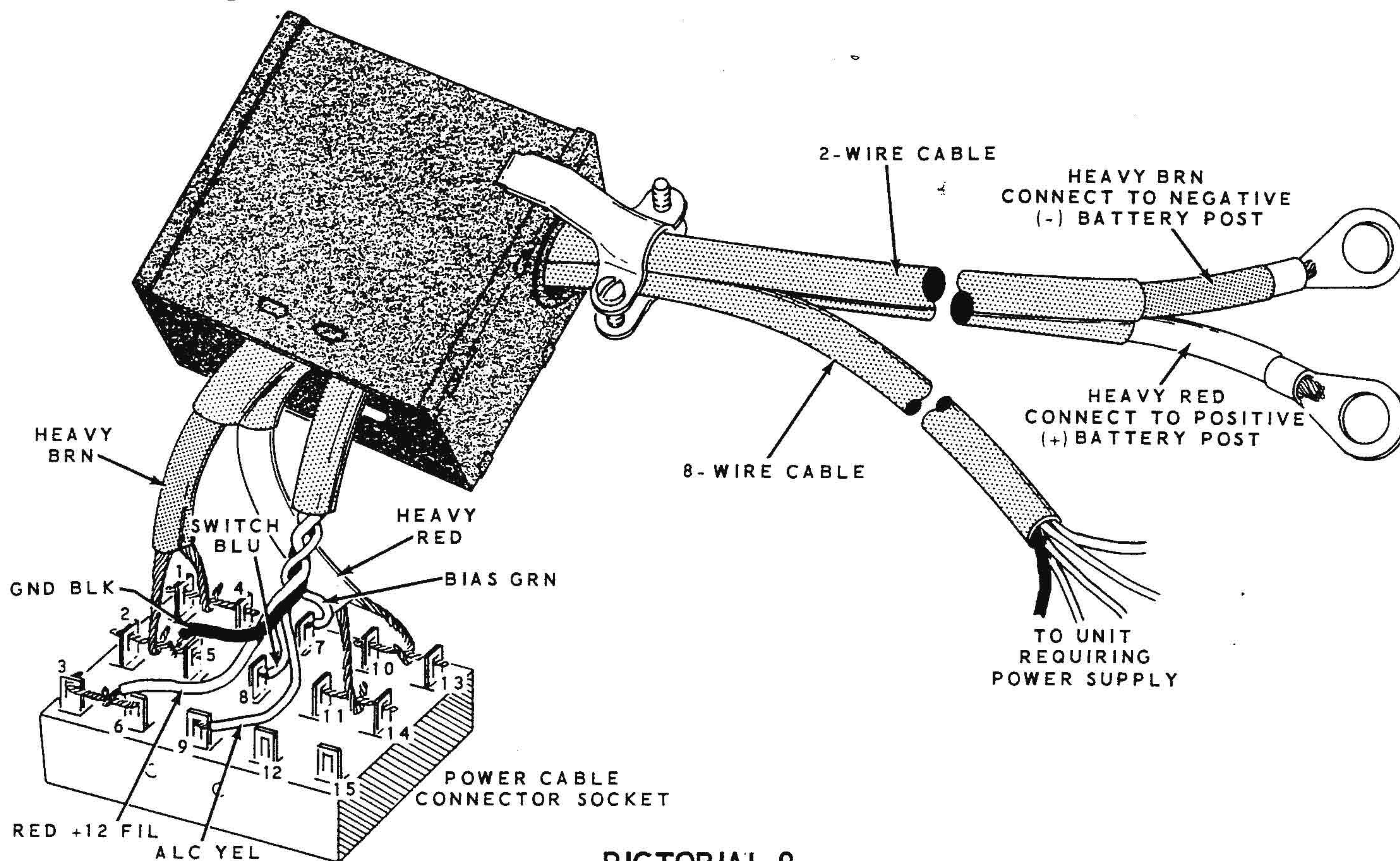


TAKING CARE NOT TO CUT THE INNER LEADS REMOVE THE OUTER INSULATION OF THE CABLE.



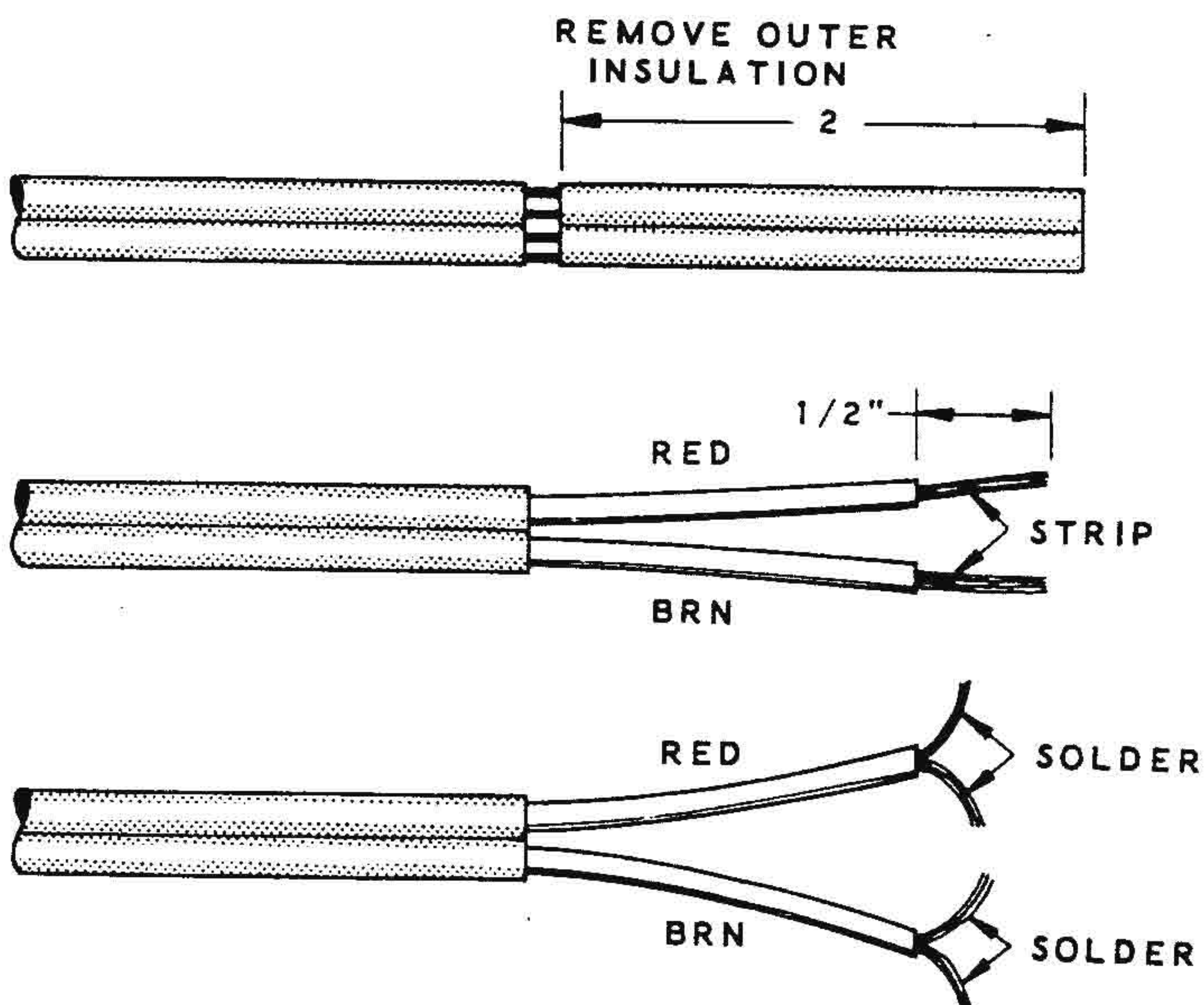
Detail 9A





PICTORIAL 9  
(Repeat)

- ( ) Referring to Detail 9B, remove 2" of outer insulation from one end of the 2-wire cable. Then remove 1/2" of insulation from the end of each wire. Separate the end of each wire into two halves as shown. Melt a small amount of solder on each group of wire strands to hold them together.

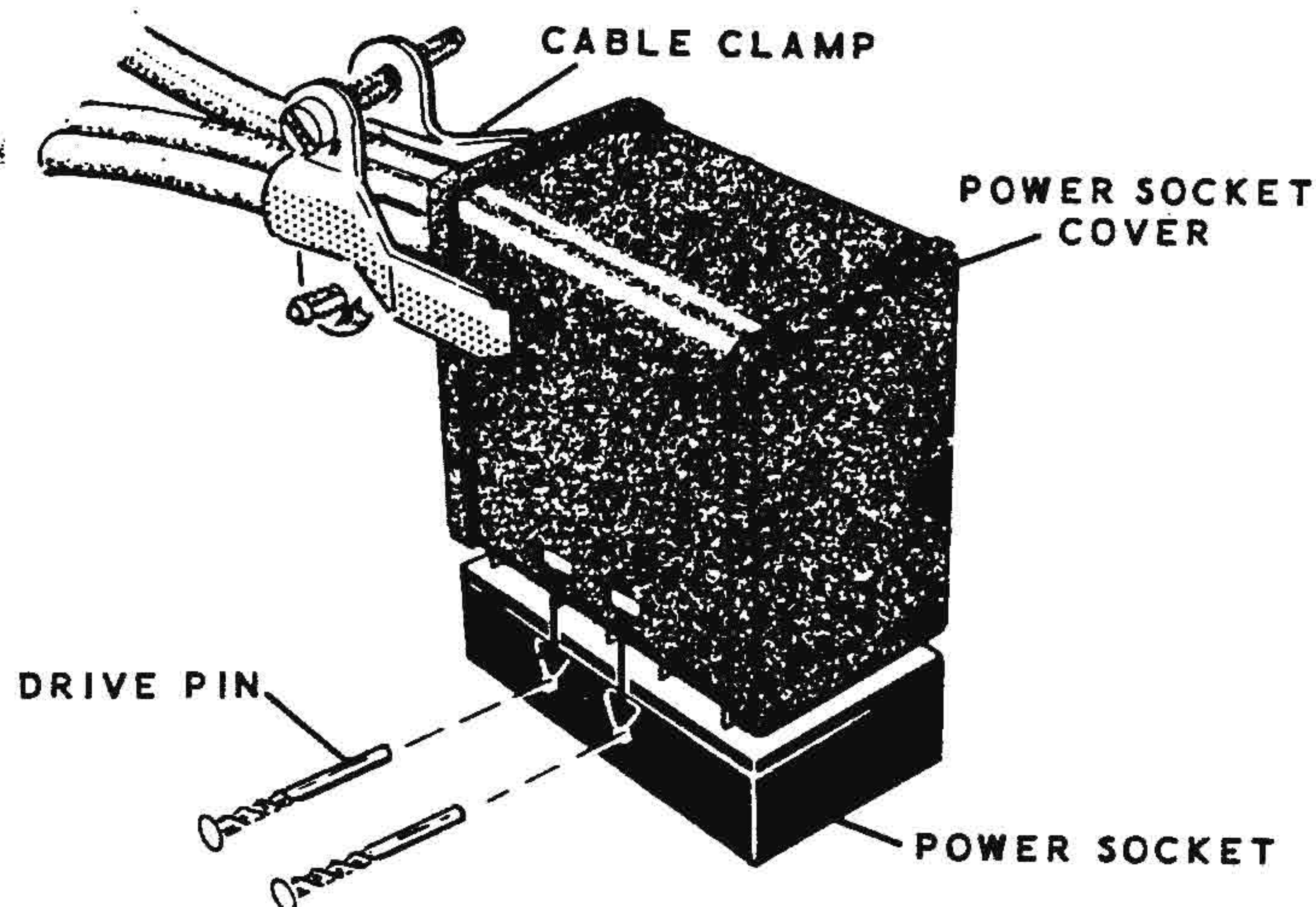


Detail 9B

- ( ) Connect one group of red wire strands to the center of the wire connected between lugs 11 and 14 of the power socket (S-1).
- ( ) Connect the other group of red wire strands to the center of the wire connected between lugs 10 and 13 of the power socket (S-1).
- ( ) Connect one group of brown wire strands to the center of the wire connected between lugs 1 and 4 of the power socket (S-1).
- ( ) Connect the other group of brown wire strands to the center of the wire connected between lugs 2 and 5 of the power socket (S-1).

NOTE: The power socket cover can be positioned on the power socket so the cables will come out either side. Before completing the following steps, decide which side the wires should come out of for your installation.



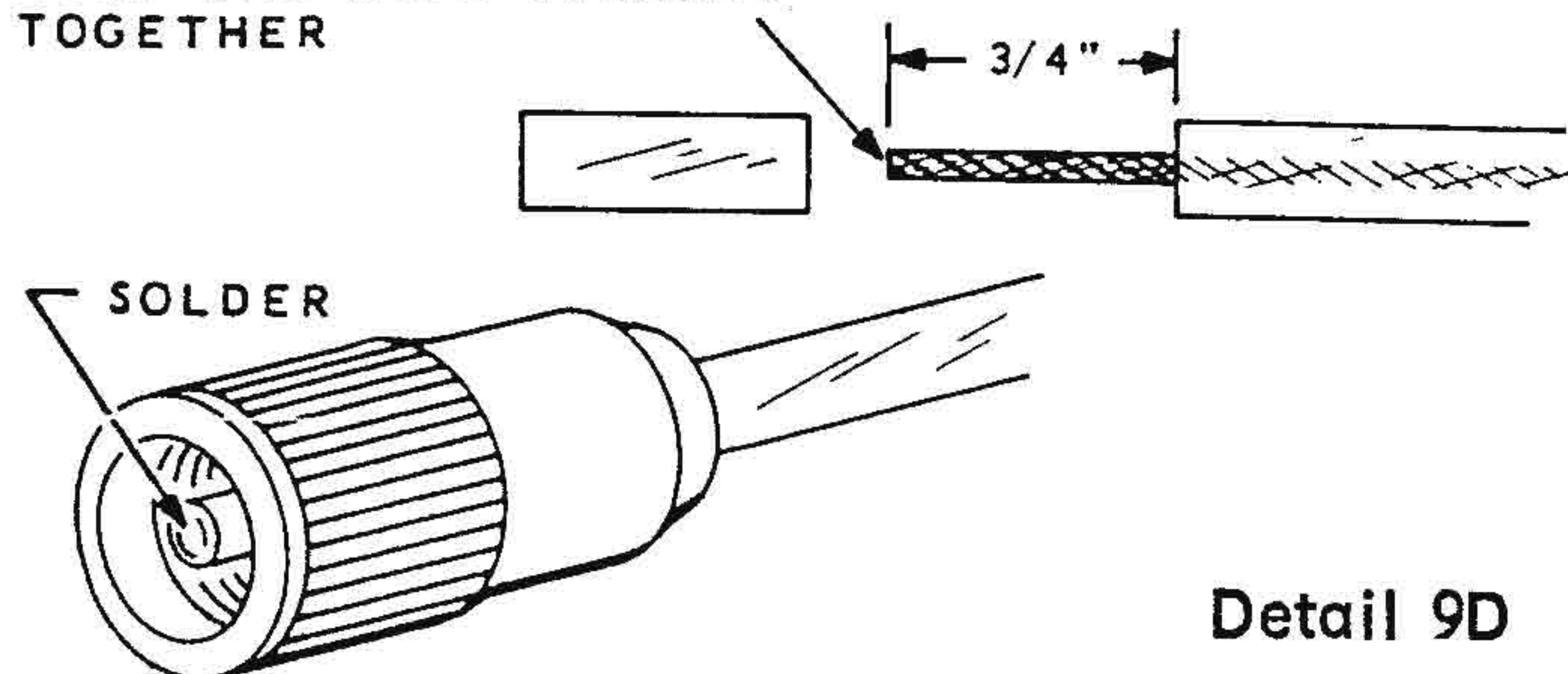


Detail 9C

Refer to Detail 9C for the following steps.

- ( ) Push the power socket cover over the power socket. Line up the small holes in the power socket cover with the power socket.

MELT A SMALL AMOUNT OF SOLDER ON BARED END TO HOLD THE WIRE STRANDS TOGETHER



Detail 9D

- ( ) Insert the two drive pins in the holes and lightly tap them into place.
- ( ) Install the cable clamp in the slots in the power socket cover and tighten the screws in the clamp to secure the cables.
- ( ) Refer to Detail 9D and install the high voltage connector cap on the high voltage wire.

## RESISTANCE CHECKS

Measure the resistance from the pins on the power plug to chassis ground. The following readings were taken with an 11 megohm input VTVM. If any of the following resistance read-

ings are not within  $\pm 10\%$  of the value shown, refer to the In Case Of Difficulty section on Page 26.

POWER PLUG PIN NUMBER	RESISTANCE MEASURED
1	0 $\Omega$
2	0 $\Omega$
3	.5 $\Omega$ (If less, reverse test leads and recheck)
4	0 $\Omega$
5	0 $\Omega$
6	.5 $\Omega$
7	30 K $\Omega$ at least. (If less, reverse test leads and recheck)
8	2 $\Omega$

POWER PLUG PIN NUMBER	RESISTANCE MEASURED
9	12 K $\Omega$
10	0 $\Omega$
11	0 $\Omega$
12	INF (NC)
13	0 $\Omega$
14	0 $\Omega$
15	INF (NC)
HV	1 Megohm (If less, reverse test leads and recheck)



## INSTALLATION

**WARNING:** Before installing this Power Supply in your automobile, measure the alternator output voltage. The voltage output of the charging system **MUST NOT EXCEED 14.5 VOLTS**. If necessary, have the automobile voltage regulator adjusted for a maximum of 14.5 volts DC output.

### MOUNTING CONSIDERATIONS

For best results the Power Supply should be mounted under the hood. Several possible mounting locations are shown in Figure 1. Choose the mounting location in your automobile that will provide maximum ventilation and protection from water spray.

The Power Supply should be located near the battery so the shortest possible cable from the Power Supply to the battery can be used.

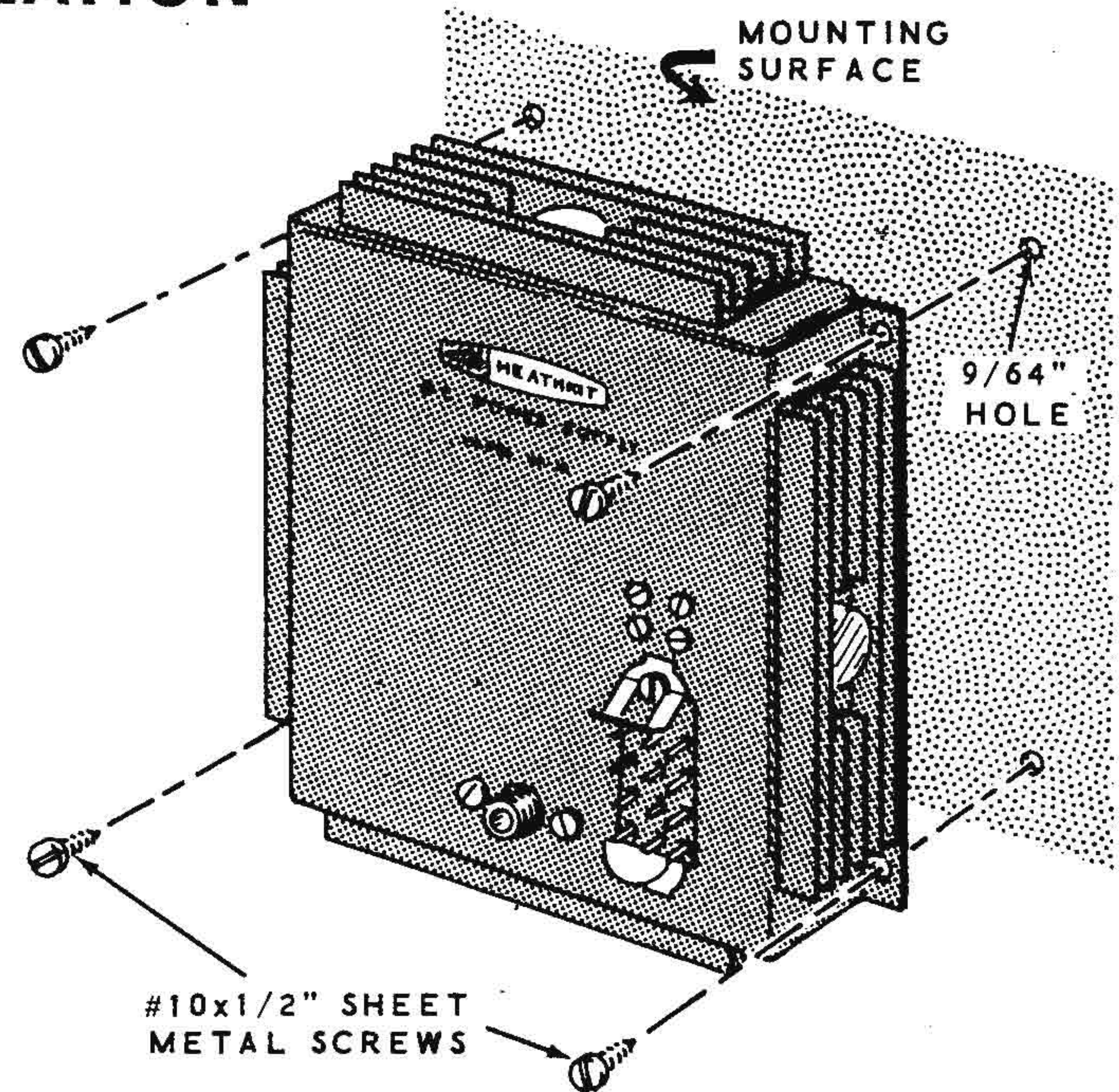


Figure 2

( ) When the mounting position has been decided on, use the Power Supply as a template and mark the four hole locations on the mounting surface. Drill a 9/64" hole at each of these four points.

( ) Referring to Figure 2, mount the Power Supply at the prepared location. Start all four #10 x 1/2" sheet metal screws into the mounting surface, and then tighten securely.

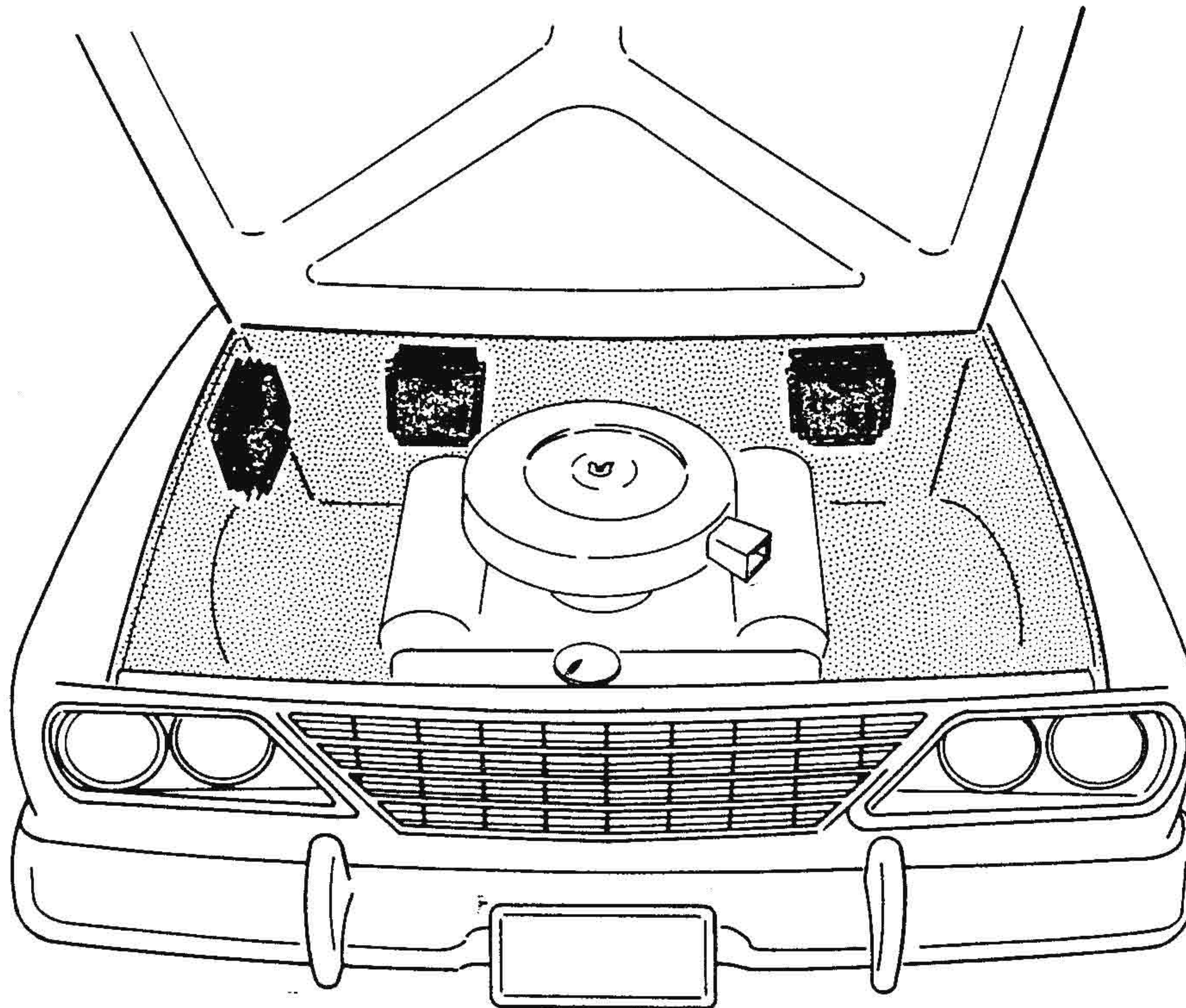


Figure 1



- ( ) Attach the power socket to the power plug, making sure the socket is pushed all the way onto the plug.

## BATTERY CONNECTIONS

NOTE: If the automobile battery cables terminate in spring connectors rather than bolt-on clamps, it will be necessary for you to purchase the bolt-on type clamp locally. This type of clamp, shown in Figure 3, is available at most auto supply stores.

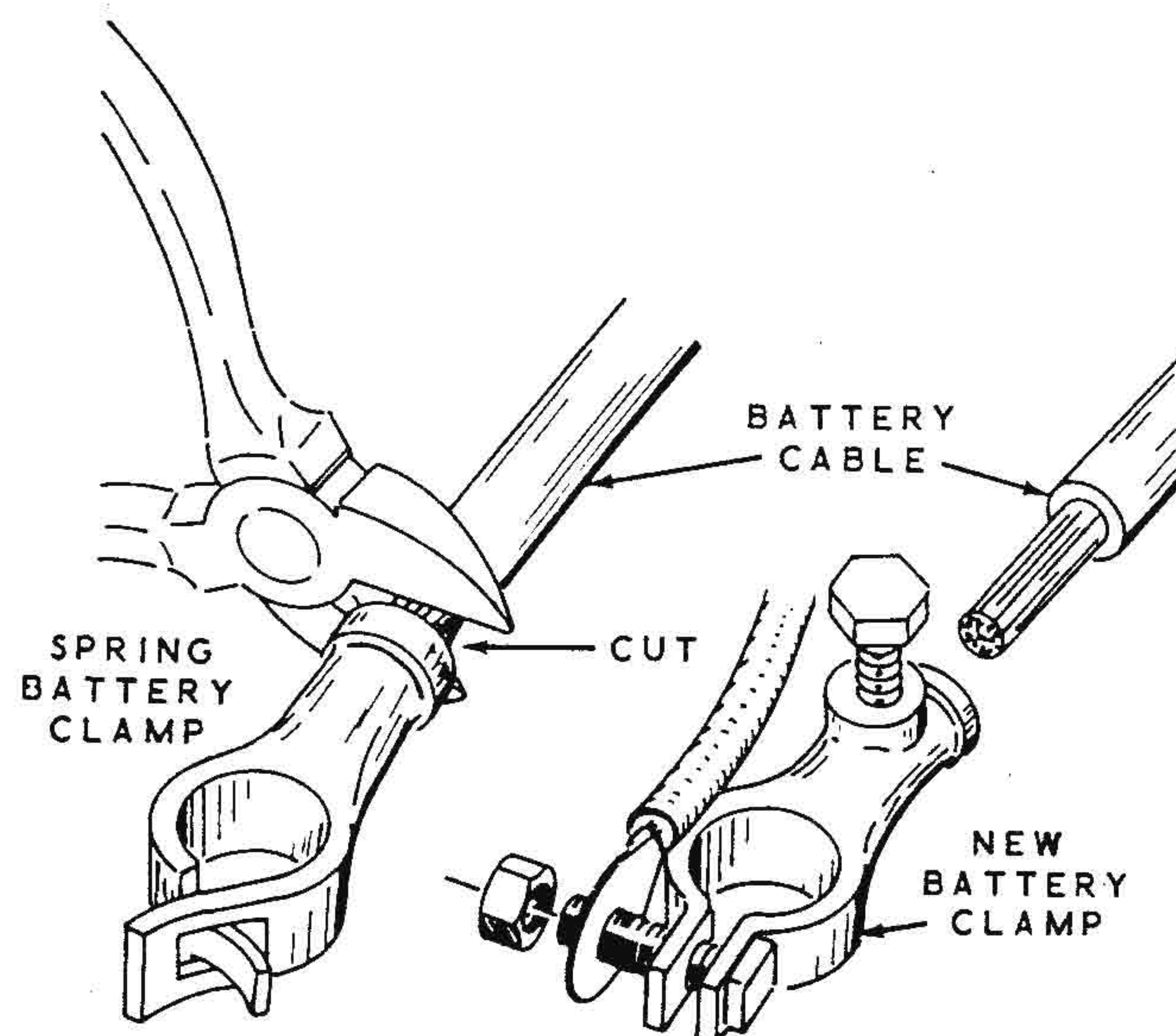


Figure 3

- ( ) Route the 2-wire cable to the battery. Make sure the cable clears all moving parts and it is not near the exhaust manifold. Allow sufficient cable length so the wires can be connected to the battery terminals, then cut off the excess cable.
- ( ) Slit the 2-wire cable, allowing enough brown and red wire length to easily reach the battery terminals. Remove the outer insulation and then strip 1/4" of insulation from the ends of the brown and red wires.
- ( ) Attach and solder the 5/16" solder lugs to the wire ends.
- ( ) Loosen and remove the nut of the negative (-) battery cable clamp. Then slip the solder lug of the brown wire over the bolt and replace the nut. Tighten securely.
- ( ) Loosen and remove the nut of the positive (+) battery cable clamp. Then slip the solder lug of the red wire over the bolt and replace the nut. Tighten securely.
- ( ) The in-line fuseholder is wired to the free end of the 8-wire cable. The wiring of this end of the cable is covered in the HA-14 Linear Amplifier Manual. Figure 4 shows how the switching circuit of the Power Supply is wired to the Linear Amplifier and through the fuseholder to the ignition switch.

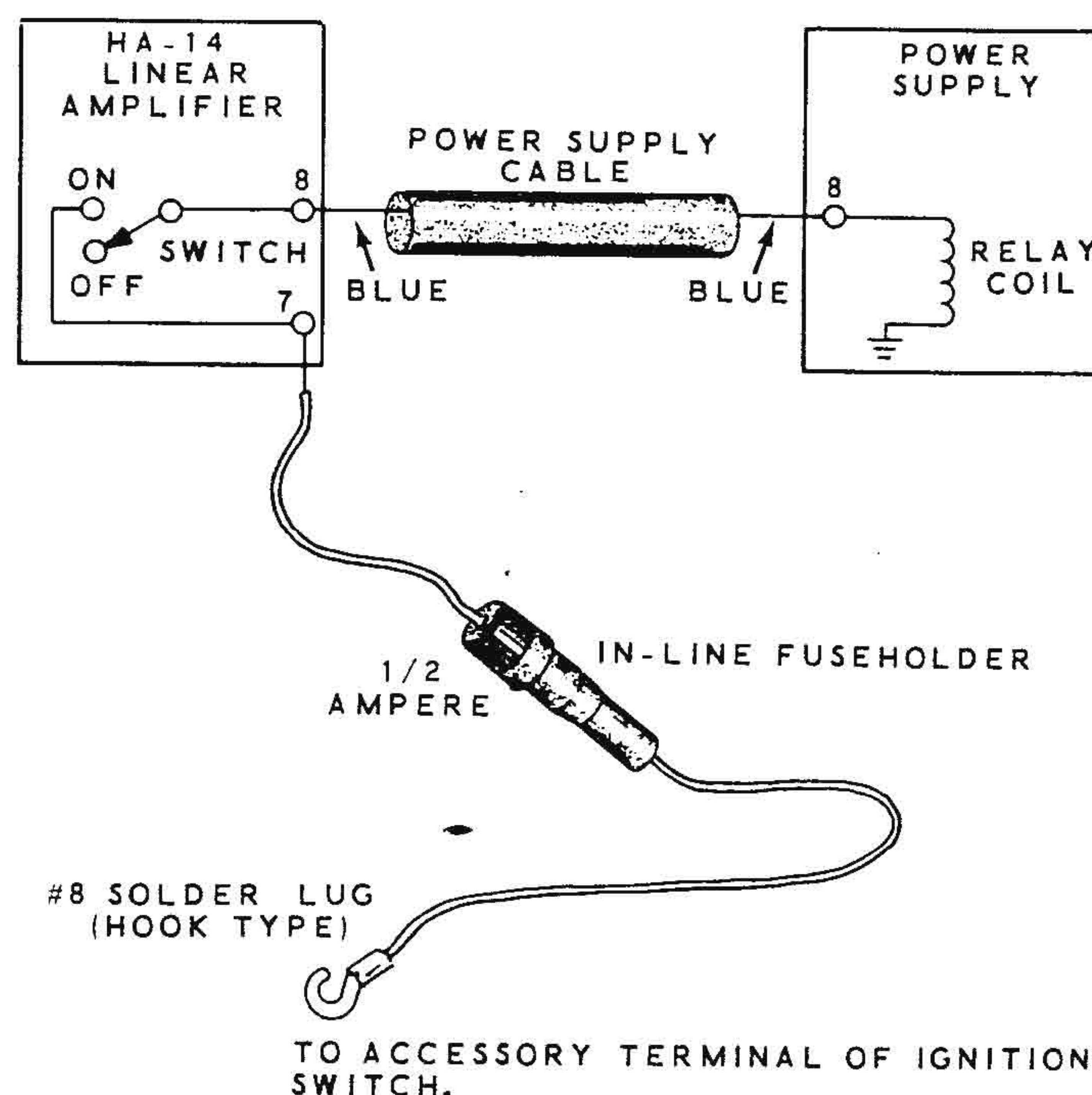


Figure 4



## OPERATION

The Power Supply is controlled by the ON-OFF switch in the Linear Amplifier. This switch is connected in series with the ignition switch through the in-line fuseholder. This prevents leaving the Power Supply and Linear Amplifier on while the automobile is not in use. NOTE: The Power Supply will normally produce a 1500 cps audible sound.

If an overload or short circuit appears, the Power Supply will stop oscillating and if the overload or short is sustained, the 40 ampere circuit breaker will open. If the Power Supply stops oscillating because of a brief overload, it will start as soon as the current drain returns to normal. This condition is usually caused by the linear amplifier being overdriven, causing "flat-topping." Flat-topping causes a high

average current to be drawn from the Power Supply, causing the Power supply to stop. Once the power supply stops, the antenna relay in the linear amplifier opens and removes the load from the power supply. This allows the power supply to restart. Continual flat-topping will cause the power supply to stop and start with voice modulation. The exciter output must be reduced to correct this condition. Exciters with ALC circuits will have less tendency to cause flat-topping. If the overload or short causes the circuit breaker to open it will be necessary to turn all power off for a few seconds while the thermal strip in the circuit breaker cools and resets the breaker. When the circuit breaker opens, the pilot lamps in the Linear Amplifier will go out. If the Power Supply stops because of an overload of short duration, the pilot lamps will remain lit.

## IN CASE OF DIFFICULTY

1. Recheck the wiring. Trace each lead in colored 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 consistently overlooked by the constructor.
2. It is interesting to note that about 90% of the kits that are returned for repair, do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the Proper Soldering Techniques section of this manual.
3. Check the values of the parts. Be sure that the proper part has been wired into the circuit, as shown in the pictorial diagrams and as called out in the wiring instructions.
4. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring.
5. If, after careful checks, the trouble is still not located and a voltmeter is available, check voltage readings against those shown on the Schematic Diagram. NOTE: All voltage readings were taken with an 11 megohm input vacuum tube voltmeter. Voltages may vary  $\pm 10\%$ .



6. A review of the Circuit Description will prove helpful in indicating where to look for trouble. A logical method of troubleshooting will provide the best results. Check first to see that the Power Supply is connected properly to other equipment, and to the battery and relay switching sources. Re-check the wiring at each end of the Power Supply cable. Since the relay is the on-off switch for the complete system, check its operation. Also check the circuit breaker. Repeated opening of the circuit breaker

indicates an overload or short in the circuit supplied through the circuit breaker.

To locate a difficulty in the Power Supply, proceed to check through the transistor circuits, the transformer, and each of the three secondary rectifier-filter circuits. Also, refer to the Troubleshooting Chart. Chassis photograph and an X-Ray view of the circuit board clearly show the location of the resistors, capacitors, and transistors by their schematic designation. These can be found on Pages 34 and 35.

## TROUBLESHOOTING CHART

DIFFICULTY	POSSIBLE CAUSE
Power Supply does not start. Filaments and pilot lamps in Linear Amplifier do not light.	<ol style="list-style-type: none"> <li>1. Circuit breaker open.</li> <li>2. Faulty relay.</li> <li>3. Incorrect wiring of relay.</li> <li>4. Incorrect wiring of power cable.</li> <li>5. No voltage to relay from fuse line.</li> <li>6. Blown fuse.</li> </ol>
Filaments and pilot lamps in Linear Amplifier light but Power Supply will not start.	<ol style="list-style-type: none"> <li>1. Short in high voltage wiring.</li> <li>2. Short in bias supply wiring.</li> <li>3. Defective transistor.</li> <li>4. Defective diode.</li> </ol>
Power supply stops and Linear Amplifier pilot lamps and filaments go out after transmitting for a few minutes. Turning the Power Supply off for a few seconds and then turning it back on causes it to restart.	<ol style="list-style-type: none"> <li>1. Excessive current being drawn due to overdriving the linear. (Reduce microphone gain.)</li> <li>2. Faulty circuit breaker.</li> </ol>
Power Supply stops momentarily and the antenna relay in the Linear Amplifier opens when transmitting. Pilot lamps and filaments in linear stay lit.	<ol style="list-style-type: none"> <li>1. Overdriving linear due to excessive modulation or long tones such as a whistle or constant voice tone. (Reduce microphone gain.)</li> <li>2. Corroded battery terminals causing a high resistance connection.</li> </ol>



## SERVICE INFORMATION

### SERVICE

If, after applying the information in this manual and your best efforts, you are still unable to obtain proper performance, it is suggested that you take advantage of the technical facilities which the Heath Company makes available to its customers.

The Technical Consultation Department is maintained for your benefit. This service is available to you at no charge. Its primary purpose is to provide assistance for those who encounter difficulty in the construction, operation or maintenance of HEATHKIT equipment. It is not intended, and is not equipped to function as a general source of technical information involving kit modifications nor anything other than the normal and specified performance of HEATHKIT equipment.

Although the Technical Consultants are familiar with all details of this kit, the effectiveness of their advice will depend entirely upon the amount and the accuracy of the information furnished by you. In a sense, YOU MUST QUALIFY for GOOD technical advice by helping the consultants to help you. Please use this outline:

1. Before writing, fully investigate each of the hints and suggestions listed in this manual under In Case Of Difficulty. Possibly it will not be necessary to write.
2. When writing, clearly describe the nature of the trouble and mention all associated equipment. Specifically report operating procedures, switch positions, connections to other units, and anything else that might help to isolate the cause of trouble.
3. Report fully on the results obtained when testing the unit initially and when following the suggestions under In Case Of Difficulty. Be as specific as possible and include voltage readings if test equipment is available.
4. Identify the kit Model Number and Series Number, and date of purchase, if available. Also mention the date of the kit assembly manual. (Date at bottom of Page 1.)

5. Print or type your name and address, preferably in two places on the letter.

With the preceding information, the consultant will know exactly what kit you have, what you would like it to do for you and the difficulty you wish to correct. The date of purchase tells him whether or not engineering changes have been made since it was shipped to you. He will know what you have done in an effort to locate the cause of trouble and, thereby, avoid repetitious suggestions. In short, he will devote full time to the problem at hand, and through his familiarity with the kit, plus your accurate report, he will be able to give you a complete and helpful answer. If replacement parts are required, they will be shipped to you, subject to the terms of the Warranty.

The Factory Service facilities are also available to you, in case you are not familiar enough with electronics to provide our consultants with sufficient information on which to base a diagnosis of your difficulty, or in the event that you prefer to have the difficulty corrected in this manner. You may return the completed equipment to the Heath Company for inspection and necessary repairs and adjustments. You will be charged a minimal service fee, plus the price of any additional parts or material required. However, if the completed kit is returned within the Warranty period, parts charges will be governed by the terms of the Warranty. State the date of purchase, if possible.

Local Service by Authorized HEATHKIT Service Centers is also available in some areas and often will be your fastest, most efficient method of obtaining service. HEATHKIT Service Centers will honor the regular 90 day HEATHKIT Parts Warranty on all kits, whether purchased through a dealer or directly from the Heath Company; however, it will be necessary that you verify the purchase date of your kit.

Under the conditions specified in the Warranty, replacement parts are supplied without charge;



however, if the Service Center assists you in locating a defective part (or parts) in your kit, or installs a replacement part for you, you may be charged for this service.

HEATHKIT equipment purchased locally and returned to Heath Company for service must be accompanied by your copy of the dated sales receipt from your authorized HEATHKIT dealer in order to be eligible for parts replacement under the terms of the Warranty.

THIS SERVICE POLICY APPLIES ONLY TO COMPLETED EQUIPMENT CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Equipment that has been modified in design will not be accepted for repair. If there is evidence of acid core solder or paste fluxes, the equipment will be returned NOT repaired.

For information regarding modification of HEATHKIT equipment for special applications, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at most electronic equipment stores. Although the Heath Company sincerely welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for special purposes. Therefore, such modifications must be made at the discretion of the kit builder, using information available from sources other than the Heath Company.

## REPLACEMENTS

Material supplied with HEATHKIT products has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally, improper operation can be traced to a faulty component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information.

A. Thoroughly identify the part in question by using the part number and description found in the manual Parts List.

B. Identify the kit Model Number and Series Number.

C. Mention date of purchase.

D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. PLEASE DO NOT RETURN THE ORIGINAL COMPONENT UNTIL SPECIFICALLY REQUESTED TO DO SO. Do not dismantle the component in question as this will void the guarantee. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

## SHIPPING INSTRUCTIONS

In the event that your instrument must be returned for service, these instructions should be carefully followed.

Wrap the equipment in heavy paper, exercising care to prevent damage. Place the wrapped equipment in a stout carton of such size that at least three inches of shredded paper, excelsior, or other resilient packing material can be placed between all sides of the wrapped equipment and the carton. Close and seal the carton with gummed paper tape, or alternately, tie securely with stout cord. Clearly print the address on the carton as follows:

To: HEATH COMPANY  
Benton Harbor, Michigan 49023

ATTACH A LETTER TO THE OUTSIDE OF THE CARTON BEARING YOUR NAME, COMPLETE ADDRESS, DATE OF PURCHASE, AND A BRIEF DESCRIPTION OF THE DIFFICULTY ENCOUNTERED. Also, include your name and return address on the outside of the carton. Preferably affix one or more "Fragile" or "Handle With Care" labels to the carton, or otherwise so mark with a crayon of bright color. Ship by insured parcel post or prepaid express; note that a carrier cannot be held responsible for damage in transit if, in HIS OPINION, the article is inadequately packed for shipment.



## WARRANTY

Heath Company warrants that all Heathkit parts shall be free of all defects in materials and workmanship under normal use and service, and in fulfillment of such warranty Heath Company will, for a period of three months from the date of shipment, replace any part upon verification that it is defective.

The foregoing warranty shall apply only to the original buyer, and is and shall be in lieu of all other warranties, whether express or implied and of all other obligations or liabilities on the part of Heath Company and in no event shall Heath Company be liable for any anticipated profits, consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase, assembly or operation of Heathkits or components thereof. No replacement shall be made of parts damaged by the buyer in the course of handling or assembling Heathkit equipment.

The foregoing warranty is completely void if corrosive solder or fluxes have been used in wiring the equipment. Heath Company will not replace or repair any equipment in which corrosive solder or fluxes have been used.

This warranty applies only to Heath equipment sold and shipped within the continental United States including APO and FPO shipments. Warranty replacement for Heathkit equipment outside the United States is on an f.o.b. factory basis. Contact the Heathkit authorized distributor in your country or write: Heath Company, International Division, Benton Harbor, Michigan, U.S.A.

**HEATH COMPANY**



## SPECIFICATIONS

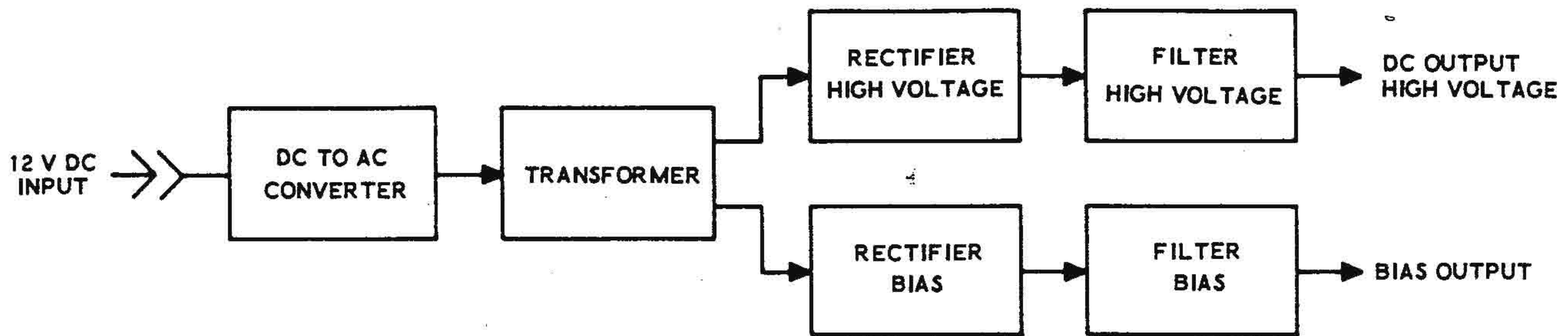
Input Voltage. . . . .	12 to 14.5 volts DC (negative ground).
Input Current. . . . .	25 amperes average, 50 amperes peak (depends on input drive power to companion linear amplifier and voice characteristics).
Allowable Ambient Temperature. . . . .	-10 degrees Fahrenheit to 122 degrees Fahrenheit.
High Voltage Output. . . . .	2300 volts DC at no load, 2000 volts DC at 500 ma peak (approximately 170 ma average).
Bias Voltage. . . . .	-130 V DC no load, -110 V DC at 60 ma.
Duty Cycle. . . . .	SSB: 50% (normal voice modulation).
Switching Frequency. . . . .	1500 cps (approximately).
Dimensions. . . . .	8-3/8" wide x 7-3/4" long x 2-5/8" deep.
Net Weight. . . . .	8 lbs.

NOTE: An input voltage of 13.0 volts DC was used in determining electrical specifications.

All prices are subject to change without notice. The Heath Company reserves the right to discontinue instruments and to change specifications at

any time without incurring any obligation to incorporate new features in instruments previously sold.





BLOCK DIAGRAM

## CIRCUIT DESCRIPTION

While reading the following circuit description, refer to the Schematic Diagram (fold-out from Page 35), Block Diagram, and the partial schematic diagram in the text.

### PRIMARY CIRCUIT

The 12 volt battery potential available at the power connector is applied through the 40 ampere circuit breaker to the relay contacts. When the relay is energized, the 12 volt battery voltage is applied to the linear amplifier filaments and also applied through filter choke L1 to the center tap of the primary winding of power transformer T1.

To produce the high DC voltage required to operate the linear amplifier, the battery voltage must be changed to an AC voltage in order to obtain the necessary transformer voltage step-up action. The AC voltage is produced by the switching action of the heavy-duty transistors and the efficient toroid-type power transformer.

The basic converter circuit is shown in Figure 5. Transistors Q1 and Q2 are connected in parallel as are transistors Q3 and Q4. The two parallel combinations are necessary to handle the large amount of peak current. Since these transistors are connected in two parallel combinations, each combination operates as one transistor. Each parallel set has been shown as a single transistor in Figure 5 for simplification.

Figure 5 indicates the relative phase and amplitude of the primary and secondary voltages. When power is first applied to the primary circuit, an imbalance exists between the two transistor circuits. This imbalance is due primarily to slight

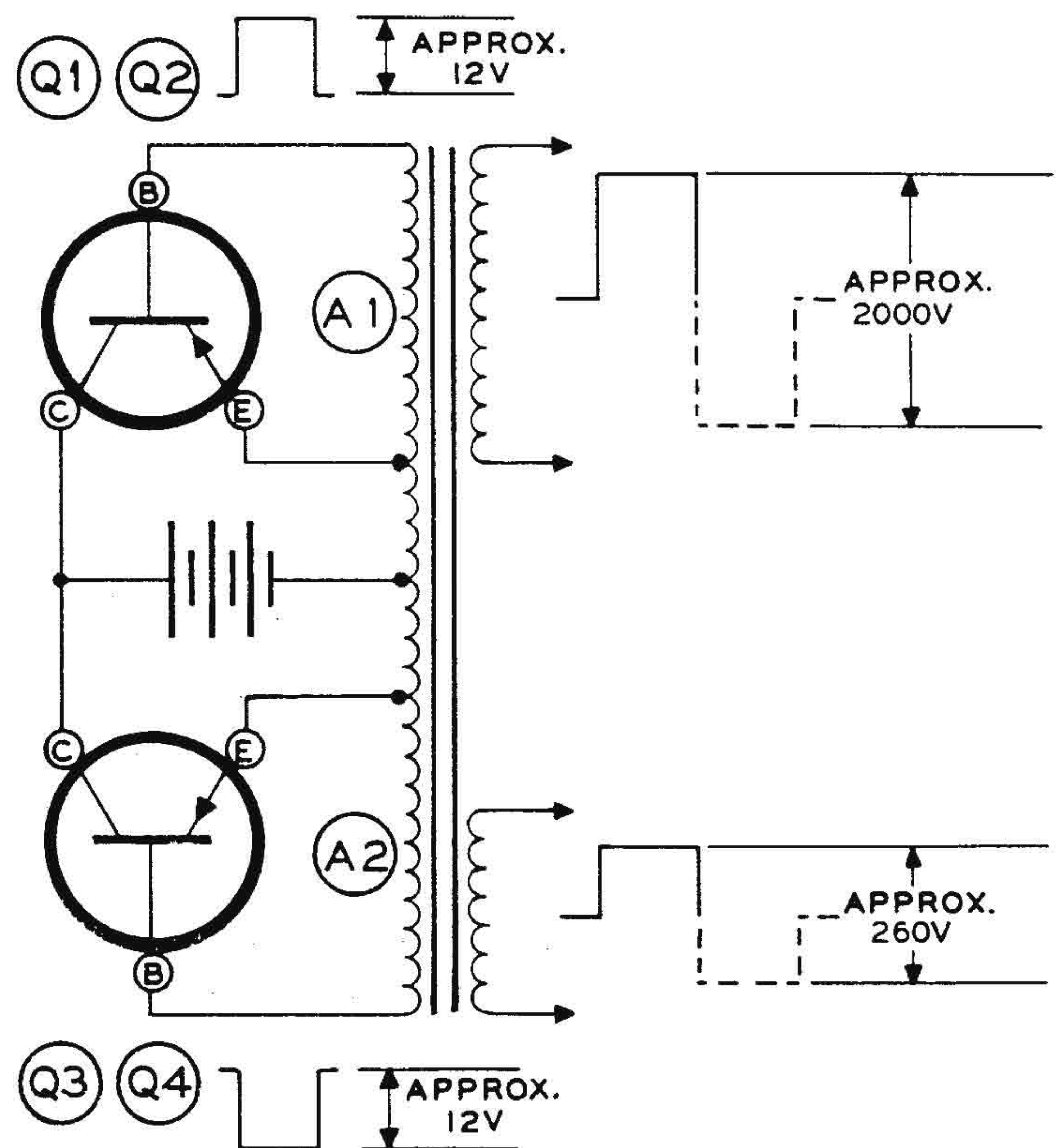


Figure 5

differences in transistor and transformer winding characteristics. The imbalance causes one transistor set to momentarily take control and apply battery voltage across one section of the transformer primary winding, either section A1 or A2, depending upon which transistor set is in initial control.



The polarity of the base feedback voltage, with respect to the transformer primary, is such that it drives the "initial control" transistor set into very heavy conduction. When this occurs, the collector current is several amperes, depending upon the load on the power supply output. Degeneration causes the other transistor set to be cut off completely.

This condition of high current flow will continue until the transformer core reaches saturation. When core saturation occurs, the rate of change of flux approaches zero. The circuit is then unable to maintain the large driving current in the base circuit of the conducting transistor set, resulting in a decrease in collector current. This decrease in collector current causes a further decrease of base drive. Circuit feedback is such that continued reduction of base drive causes the conducting transistor set to stop conducting (switch off) and the other transistor set to begin conducting (switch on).

Since the primary circuitry is symmetrical, the operation of the second transistor set is identical to that of the initial control transistor set. The conditions are duplicated causing resaturation of the transformer core. This rapid change in core saturation induces an alternating square wave voltage in the transformer secondary winding. The amplitude of the alternating square wave voltage is in proportion to the turns ratio between the primary and secondary of the transformer. The cycle will continue to repeat itself and produce the necessary high AC voltage in the transformer secondary windings.

The transistor switching frequency is determined by a number of factors including transistor circuit values, and transformer and transistor characteristics. The transistors operate at a nominal switching frequency of 1500 cycles per second. This frequency represents a good compromise of efficiency, filtering, and operating temperatures. At higher frequencies, the time required for the transistors to switch on and off is a large portion of the operating cycle. This results in a low efficiency. At lower frequencies, larger value filter capacitors would be required and a much larger transformer would be needed.

The transformer used in the power supply is a very efficient toroid-type, designed to operate at a frequency of approximately 1500 cycles per second. The transformer will run relatively warm even under no load. This condition is normal for a transformer operated near or in a saturated condition.

Transistors must operate at relatively low temperatures. High temperature operation will greatly increase leakage currents and sharply reduce efficiency and reliability. Transistors used in this type of switching application operate at high current during one-half of each cycle. The transistor heat which occurs is effectively dissipated by radiation from the heat sink assemblies which are cooled by air circulating around the heat sink fins.

## SECONDARY CIRCUIT

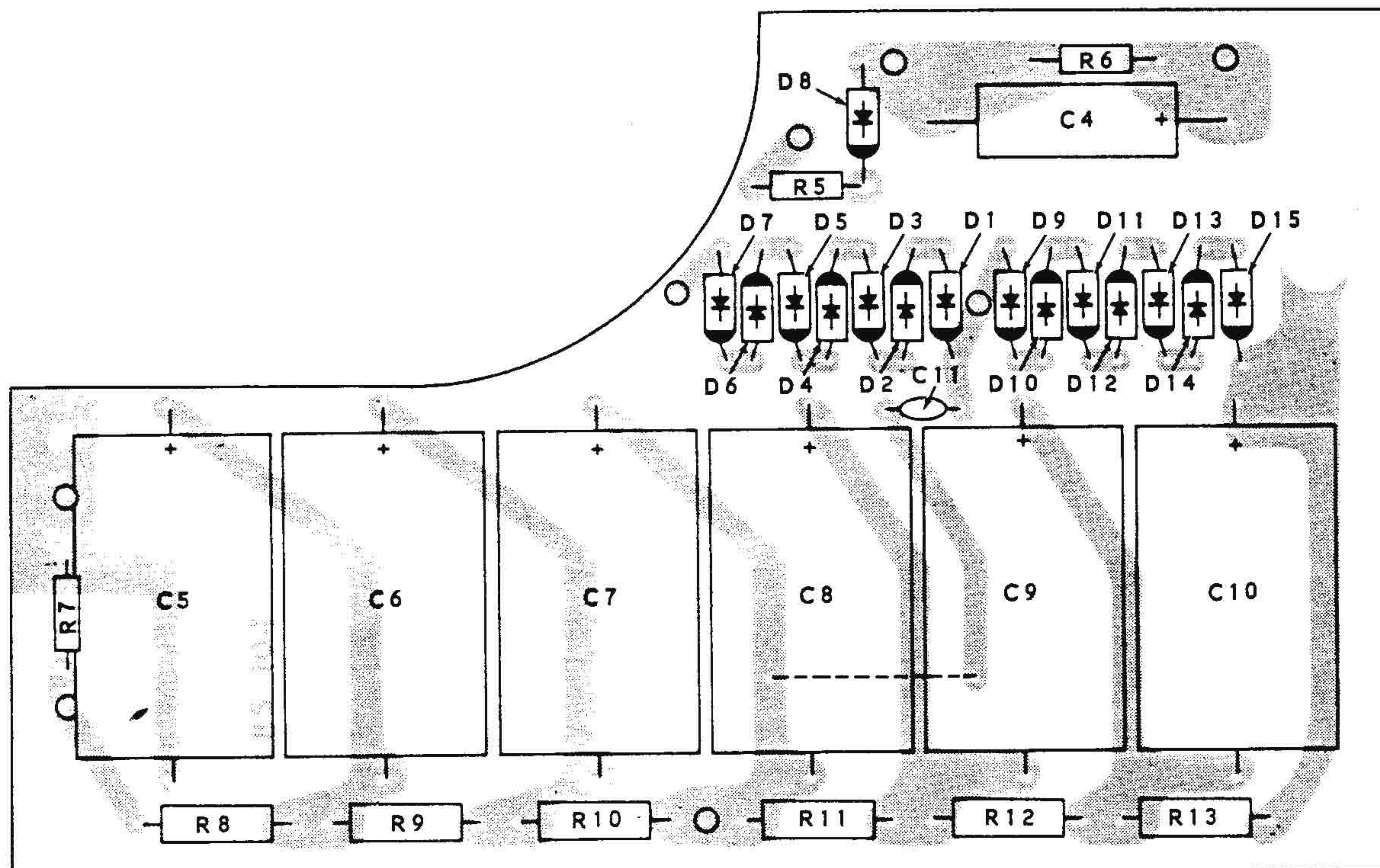
The high voltage DC section uses a full-wave voltage doubler circuit consisting of diodes D1 through D7, D9 through D15, and capacitors C5 through C10. A voltage doubler circuit produces a DC output of approximately twice the peak value of the alternating voltage available at the secondary winding of the transformer. Diodes D1 through D7 rectify one-half cycle of the alternating voltage, and diodes D9 through D15 rectify the other half cycle. On alternate half cycles, capacitors C5 through C7 and capacitors C8 through C10 charge to the approximate values of the AC voltage appearing across the transformer secondary winding. The polarity is such that the DC voltages developed across these two sets of series capacitors add together. This "doubled" DC voltage appears between ground and the junction of D15, C10, and R13. Resistor R7 is in series with the bleeder resistor and provides an ALC threshold voltage of approximately 6 volts for the linear amplifier.

Buffer capacitor C11 absorbs transient voltage surges that occur in the secondary winding as a result of the transistor switching action in the primary circuit.

The bias voltage section uses diode D8 as a half-wave rectifier. Resistor R6, and capacitor C4 filter the -130 volts DC for cut-off bias of the Linear Amplifier. The bias voltage also operates the antenna change-over relay in the amplifier.

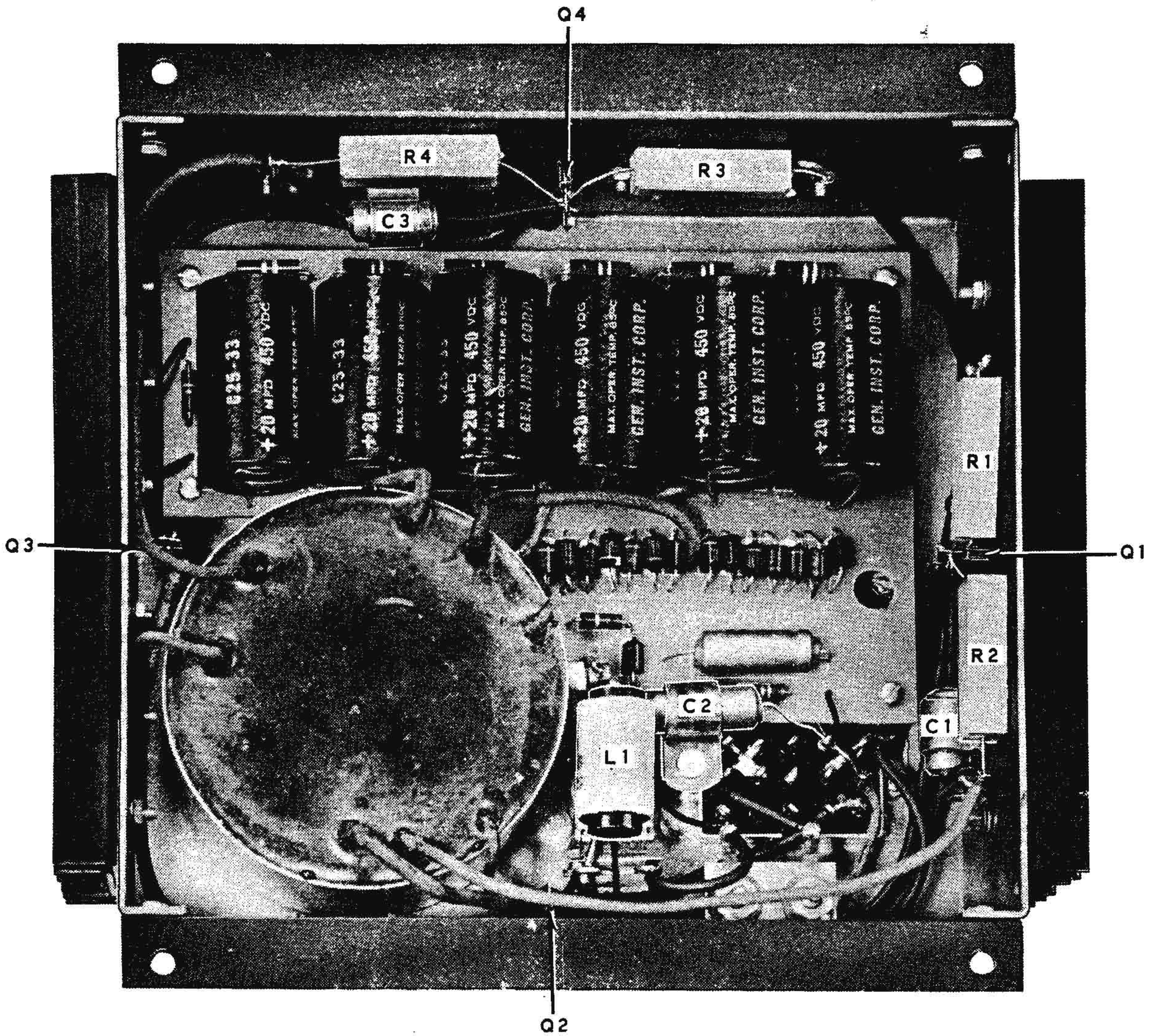


## CIRCUIT BOARD X-RAY VIEW

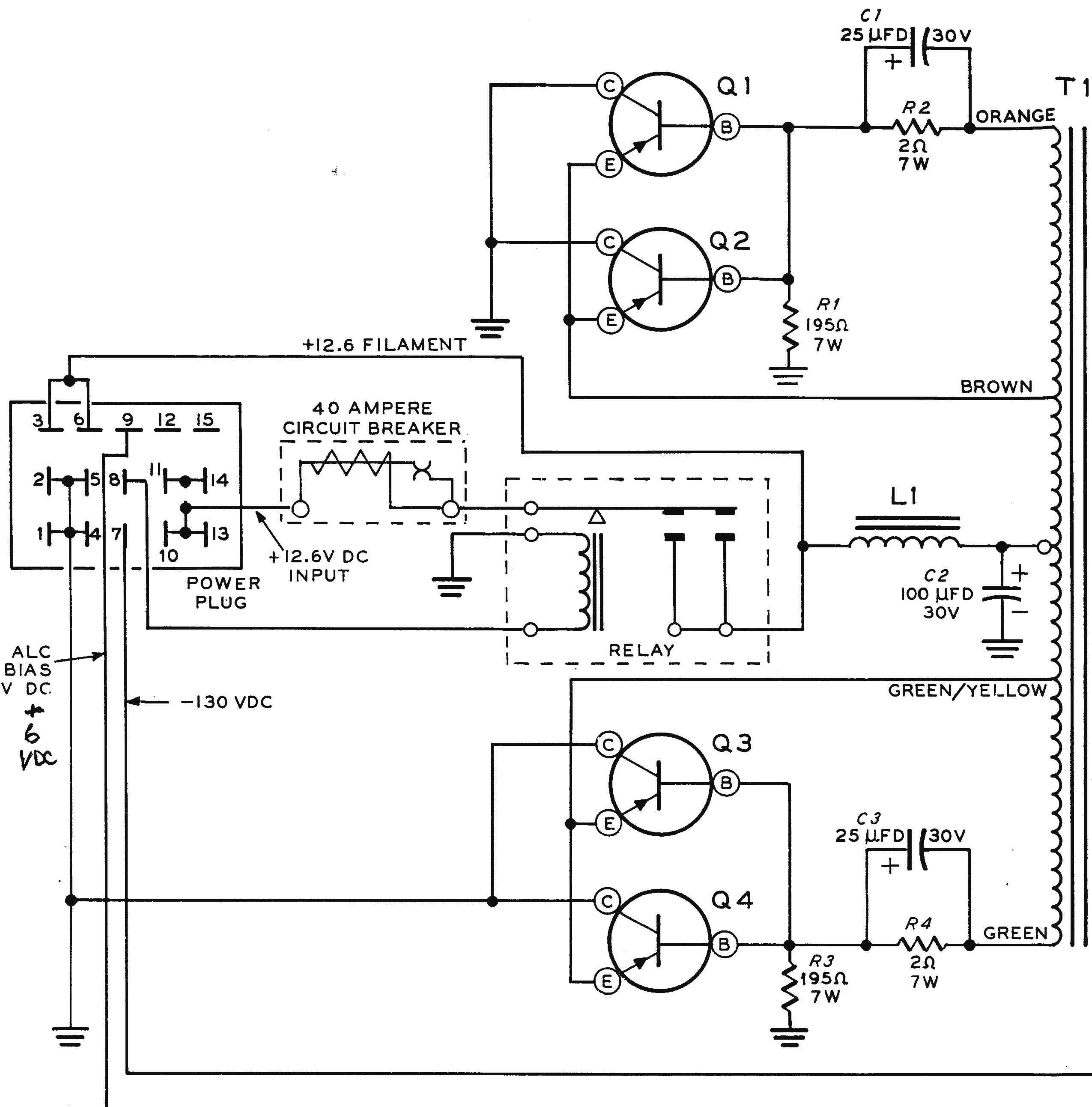




# CHASSIS PHOTOGRAPH



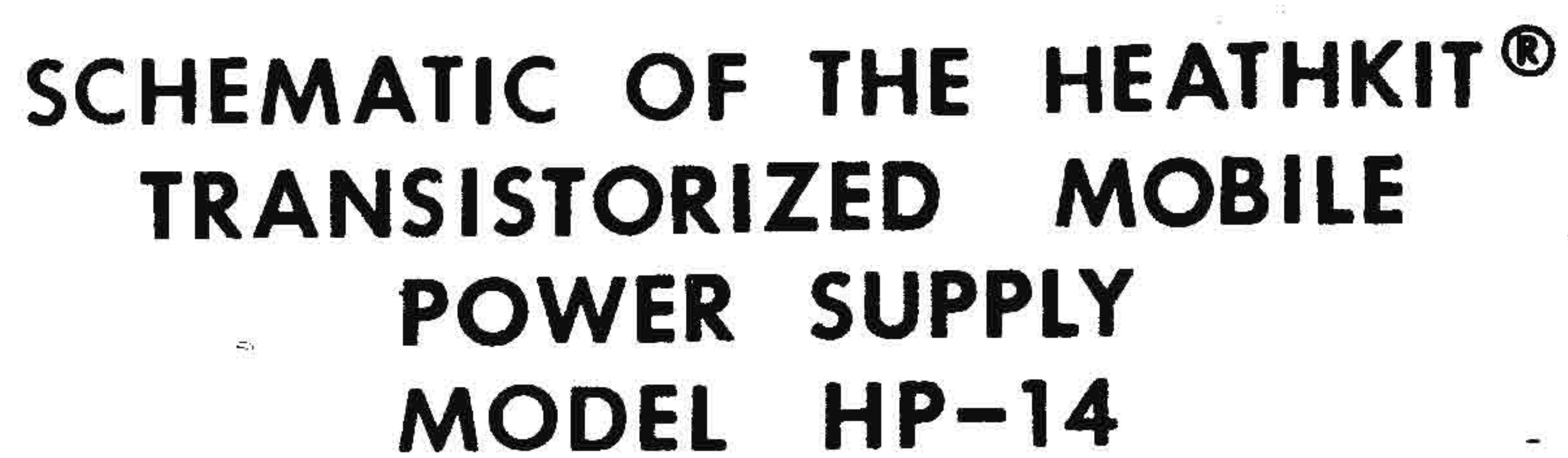




# NOTES:

ALL RESISTANCES IN OHMS ( K = 1000 ).  
 ALL VOLTAGES MEASURED FROM INDICATED POINT TO CHASSIS GROUND.  
 ○ INDICATES VOLTAGE READING.  
 POWER PLUG SHOWN FROM INSIDE CHASSIS.  
 TRANSISTORS SHOULD BE ORDERED FROM HEATH COMPANY BY PART NUMBER.




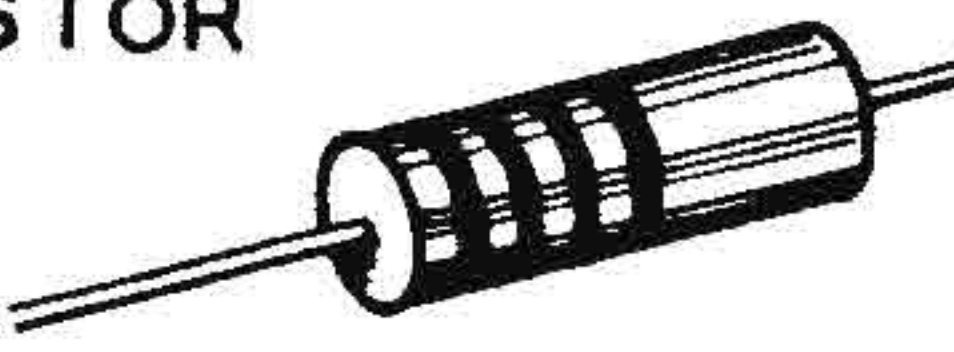

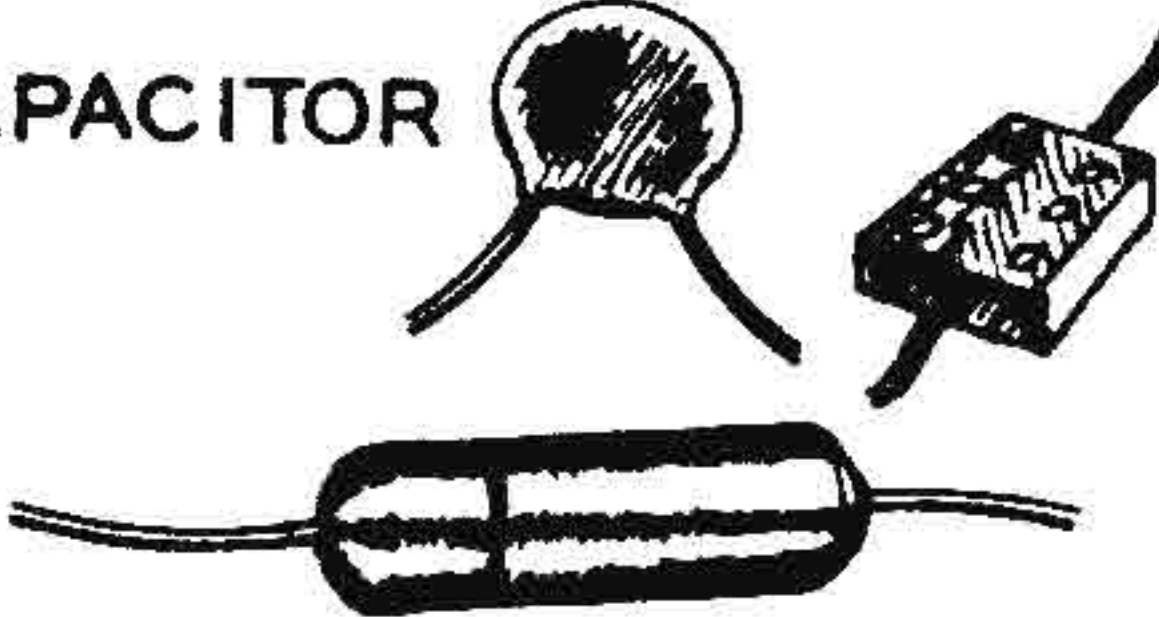
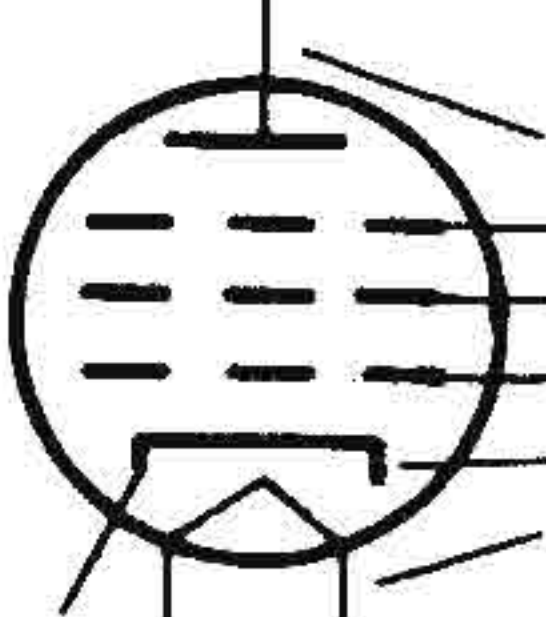

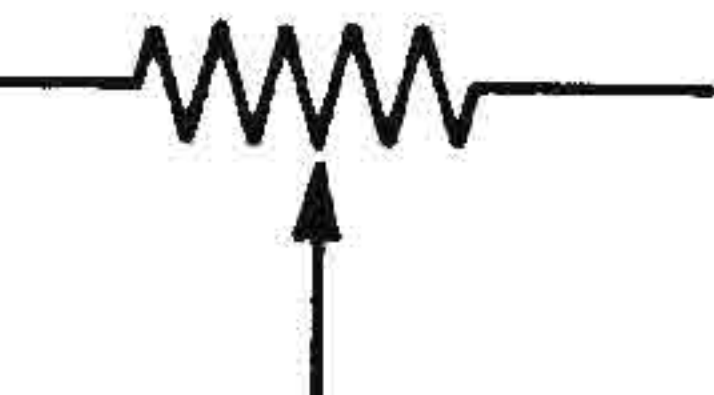
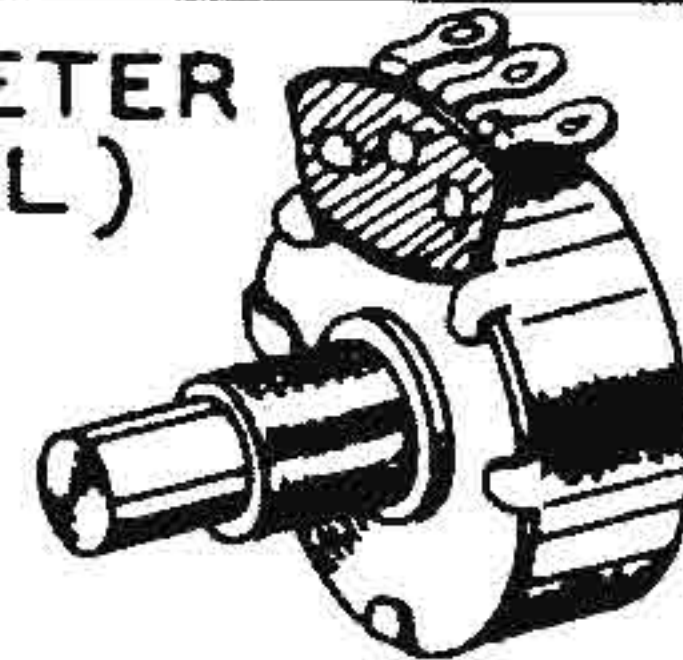
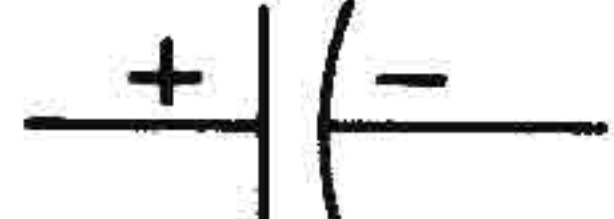
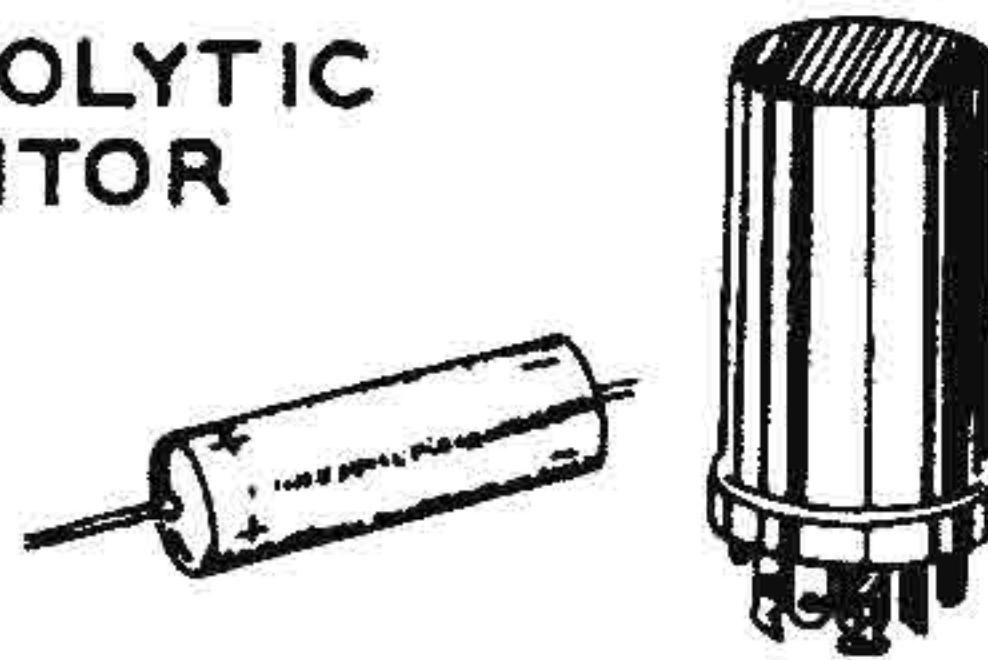
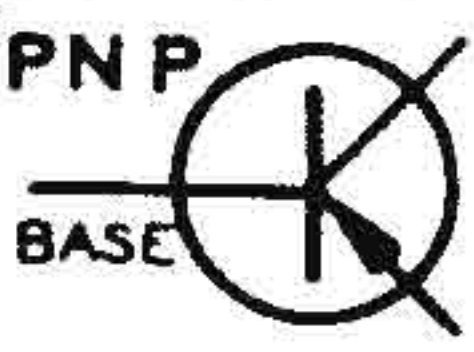

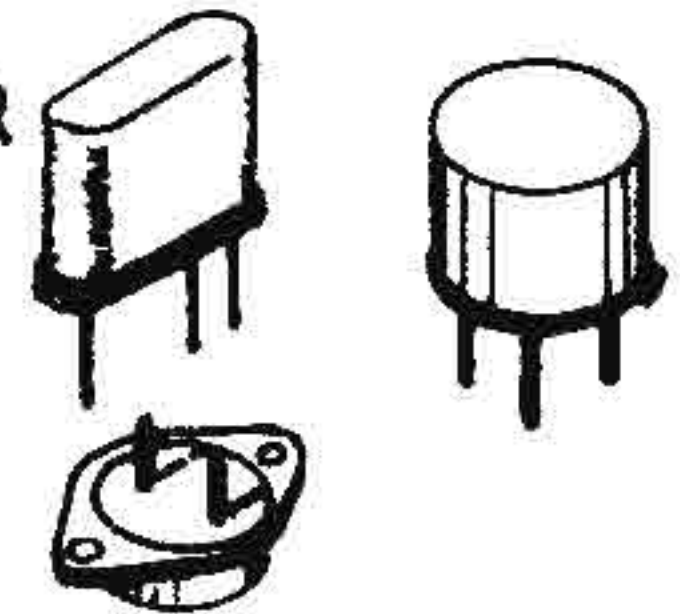
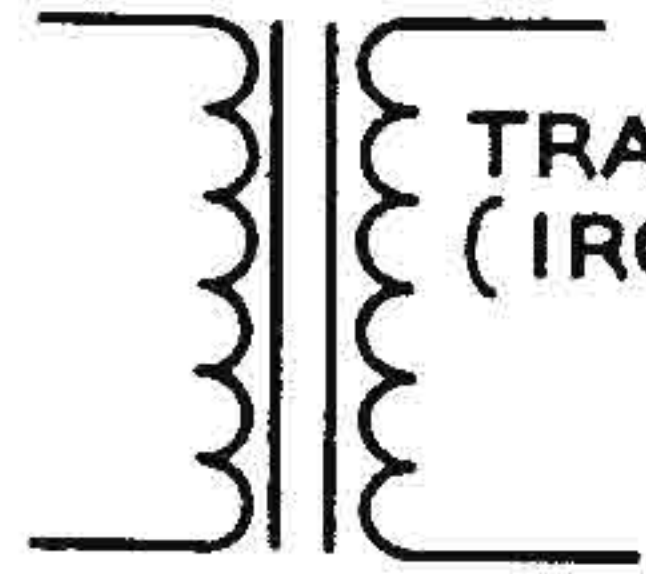
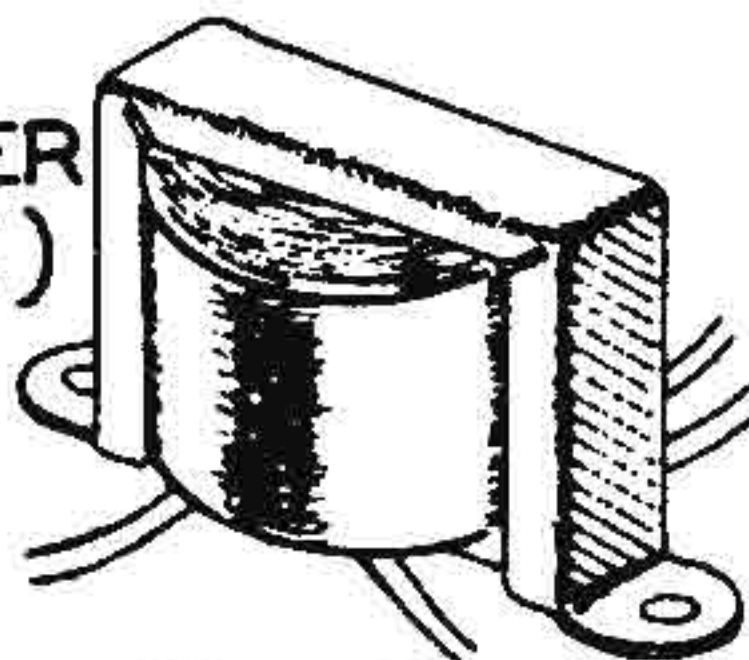

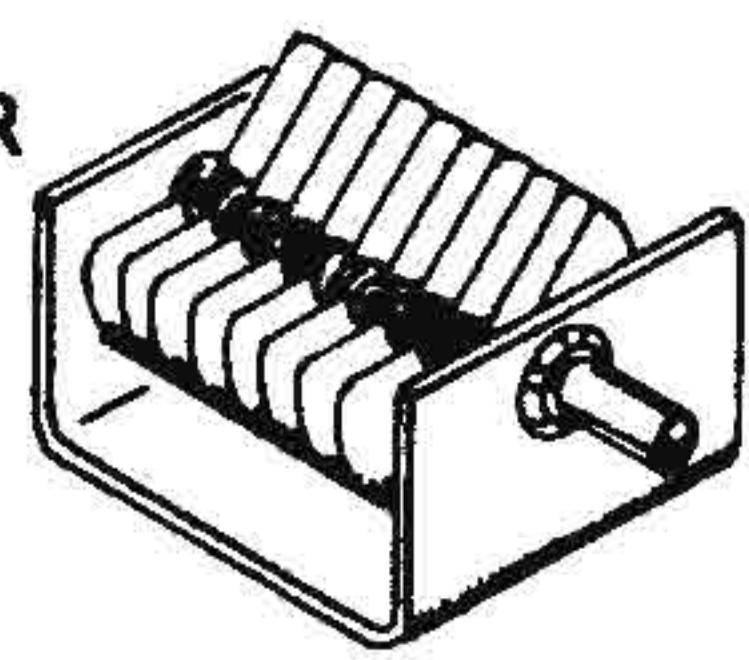
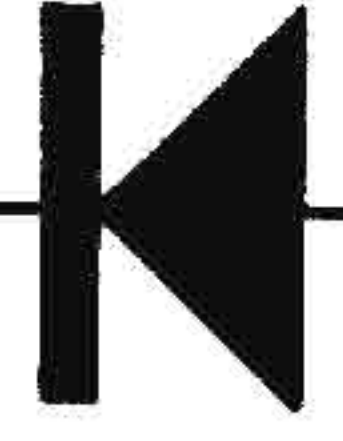
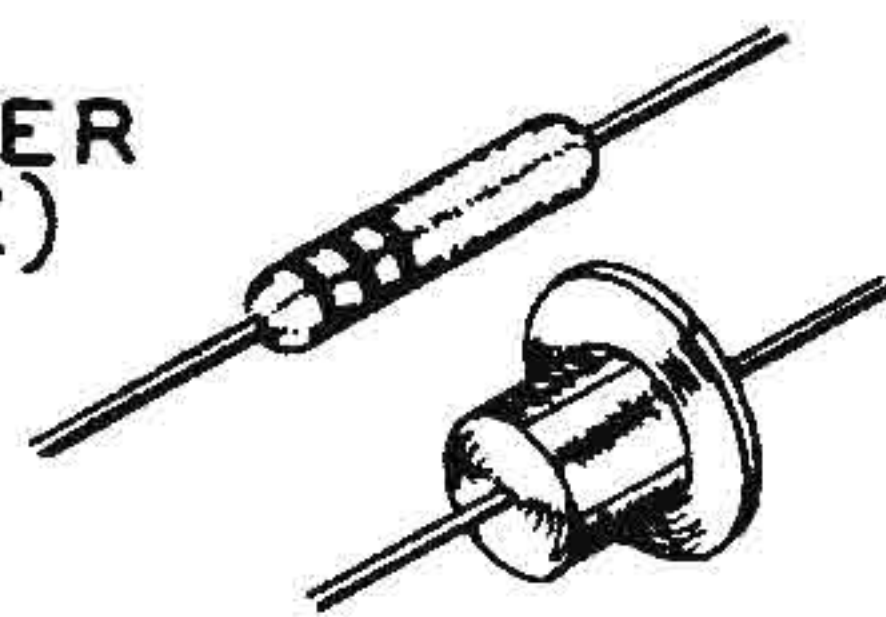
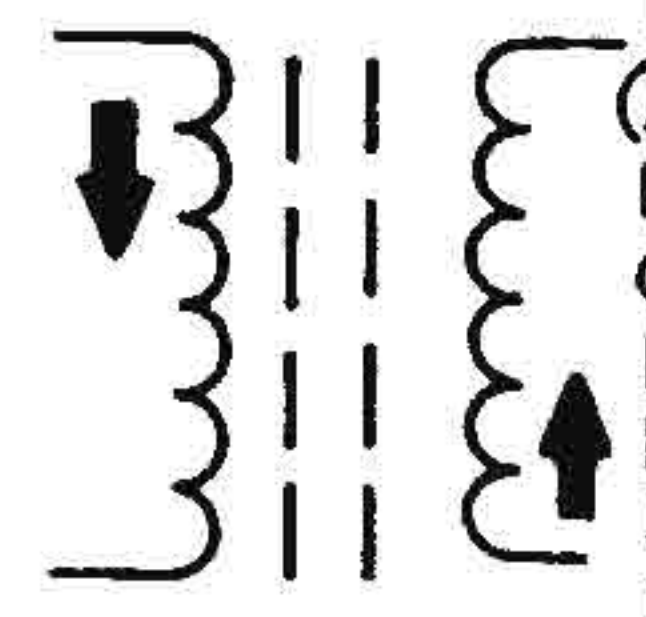
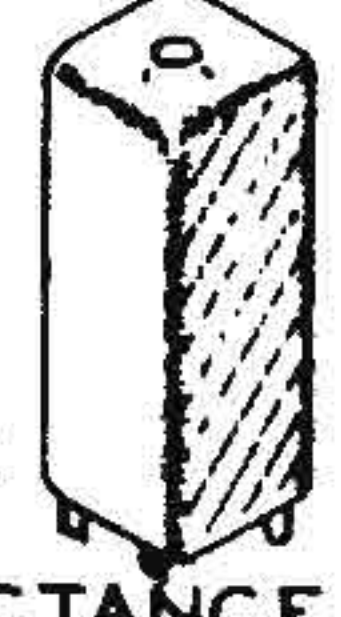

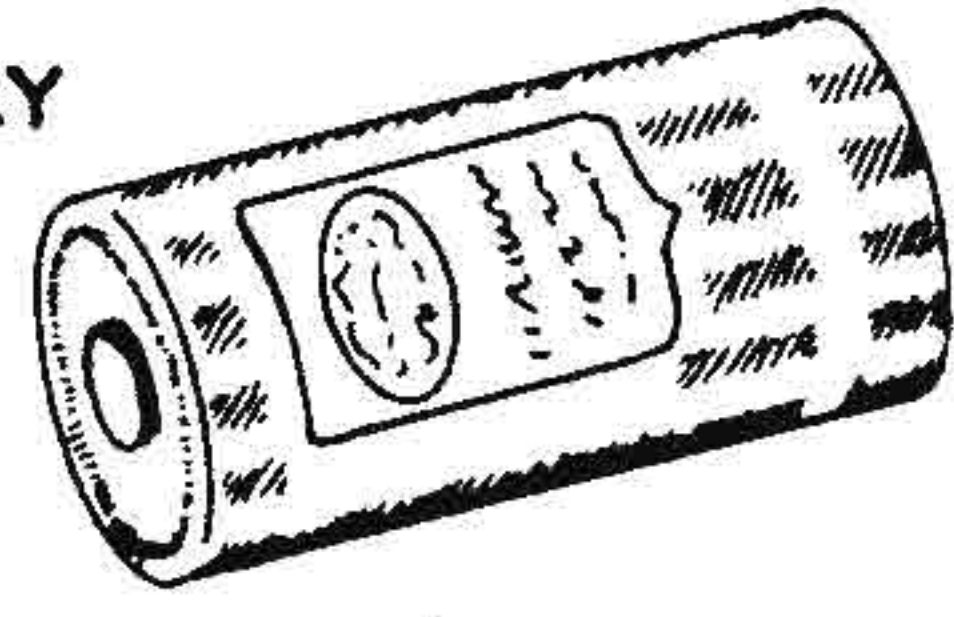
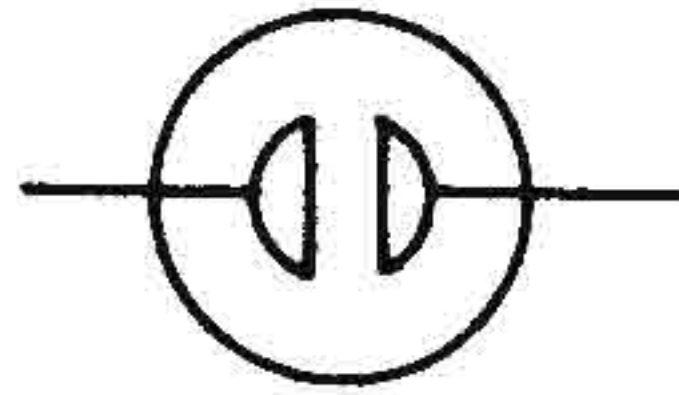
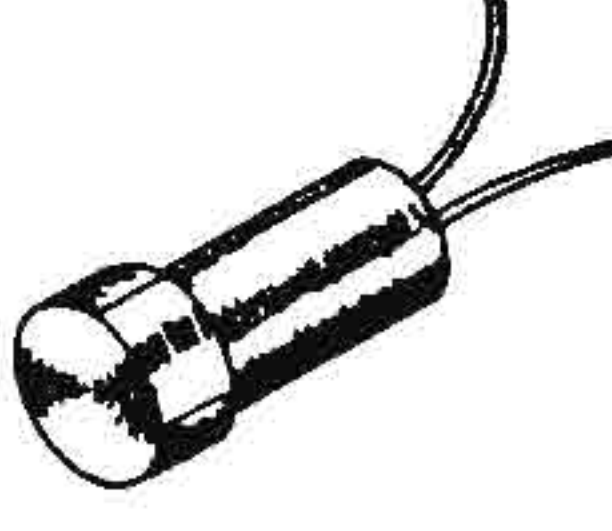
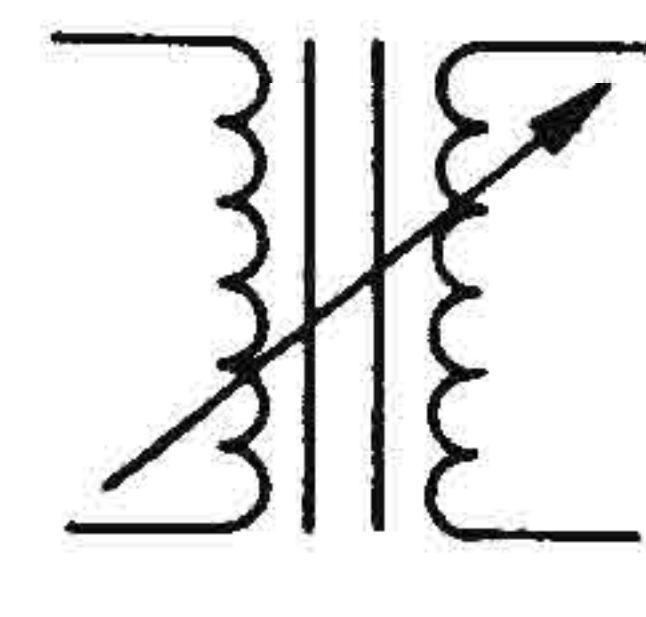

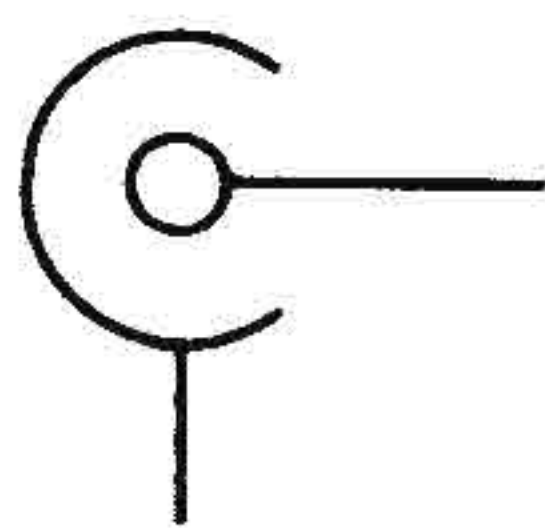
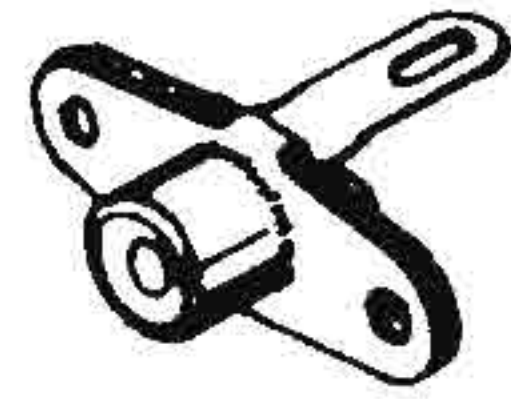
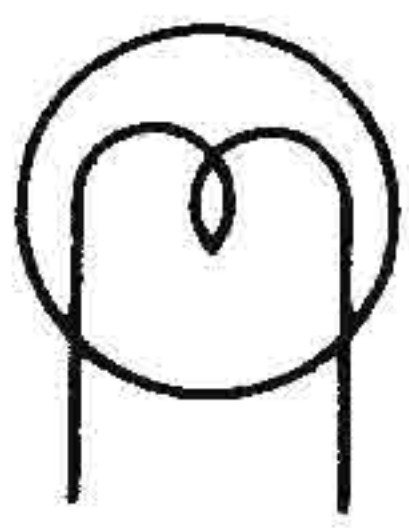
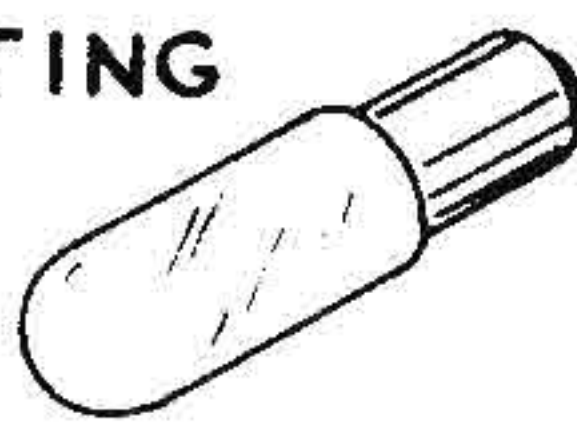
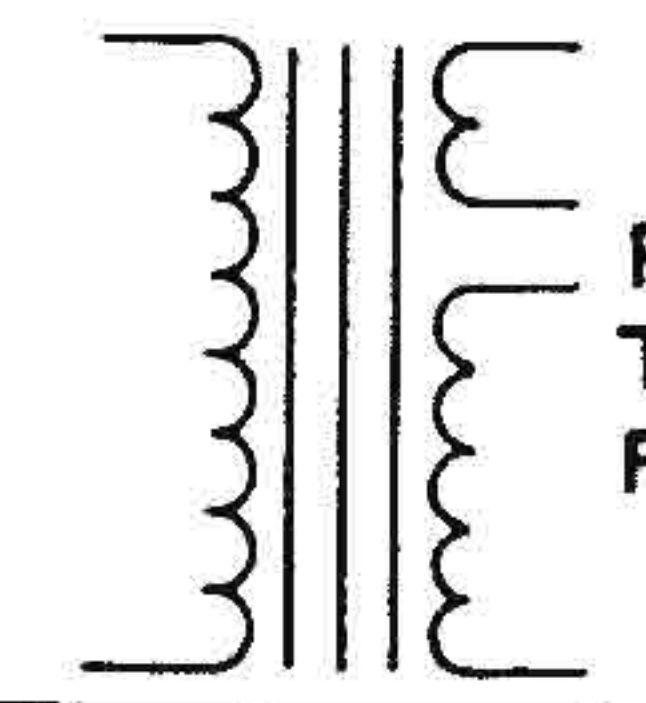
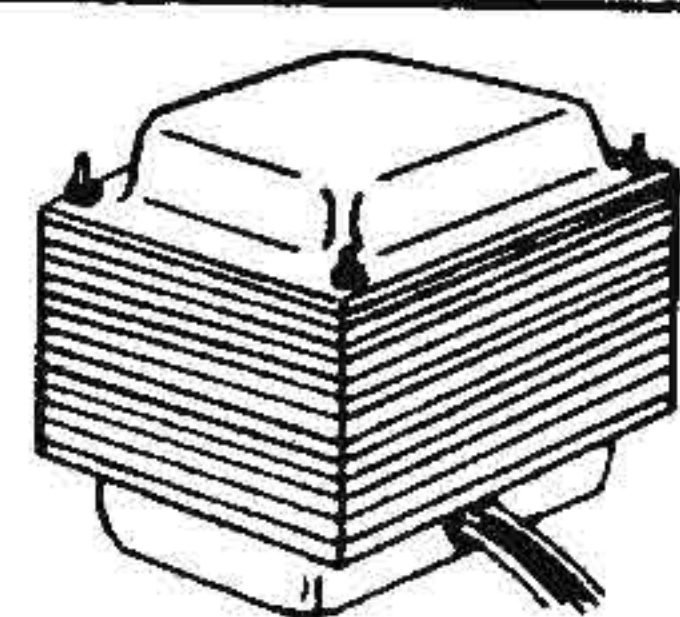

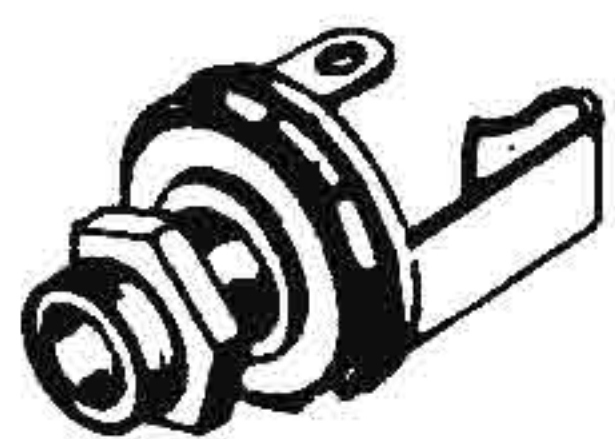
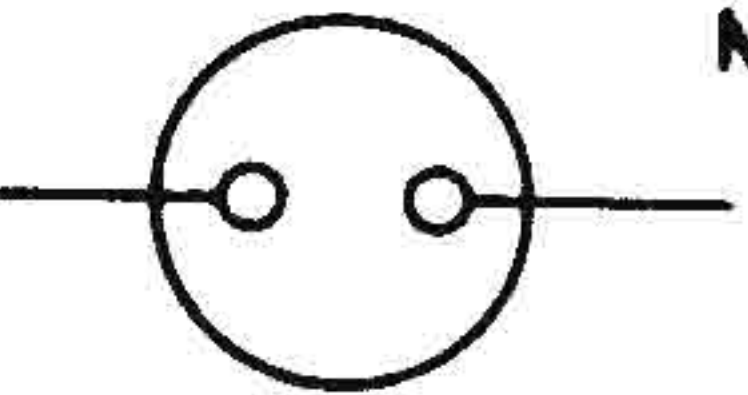
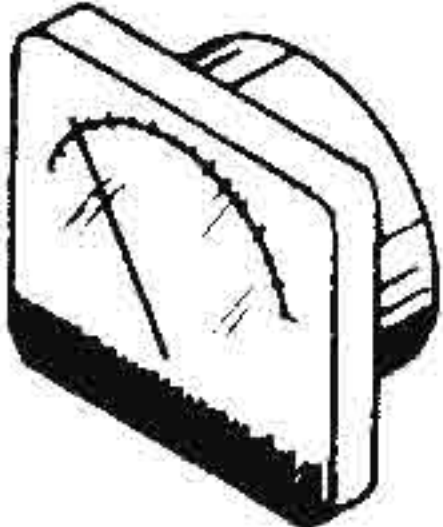

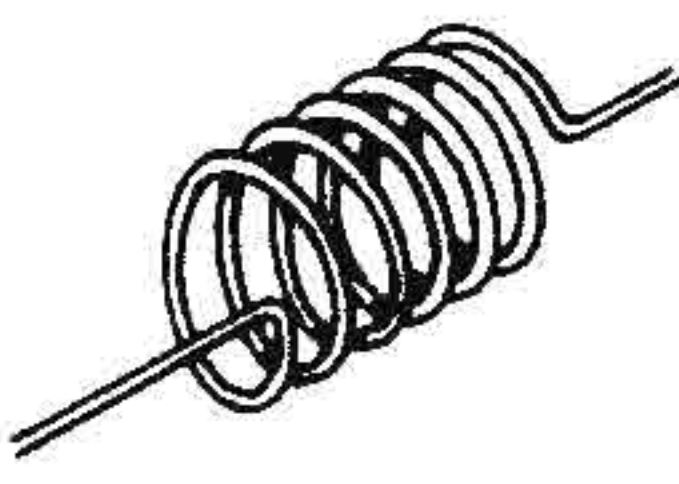
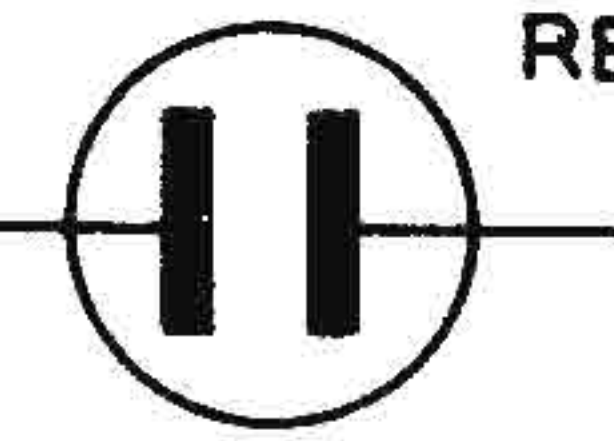
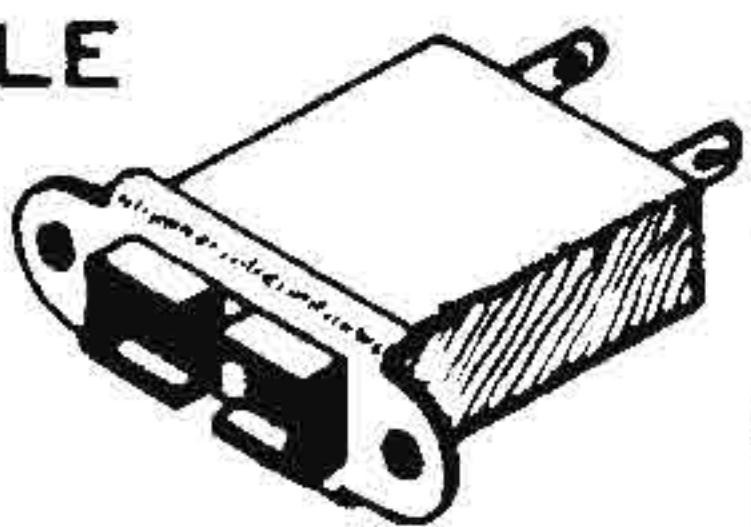


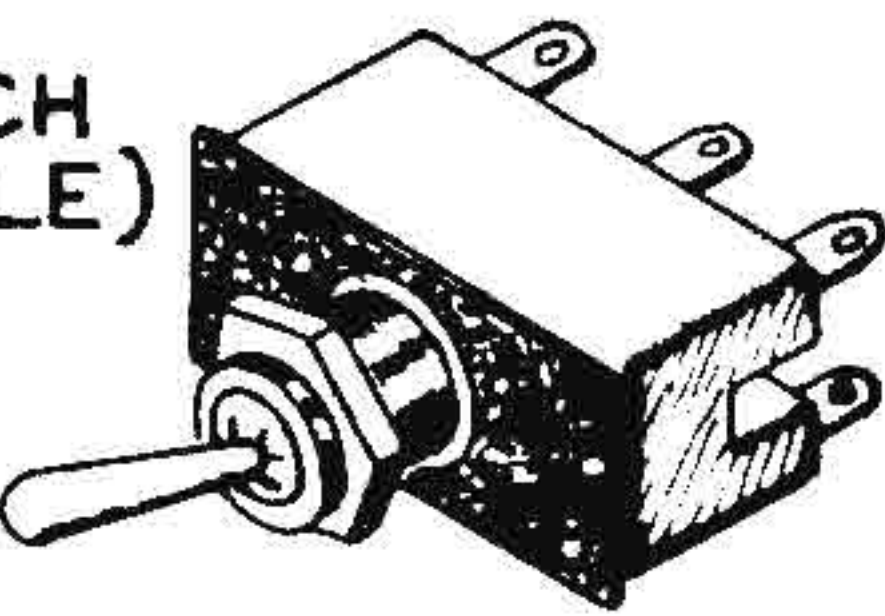
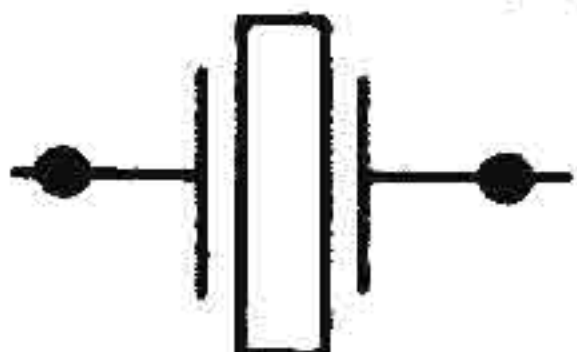

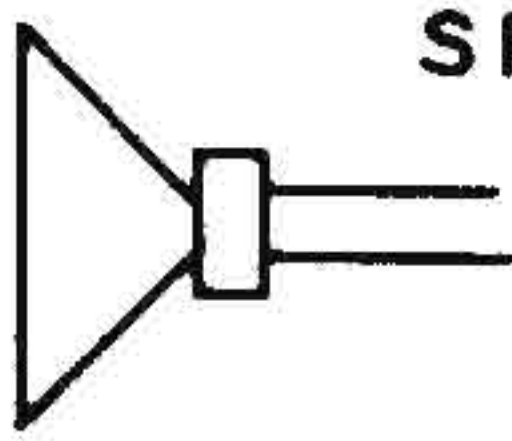
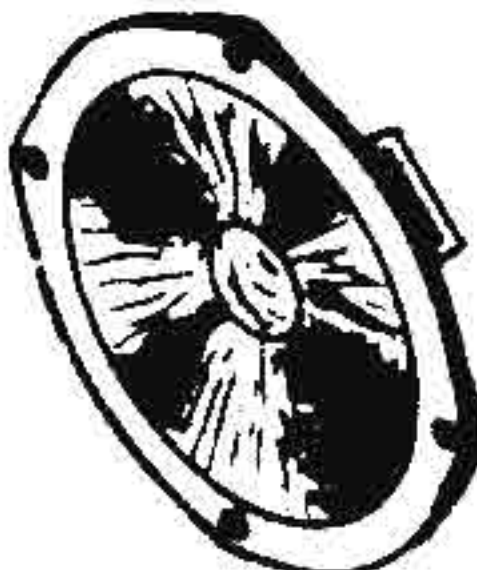


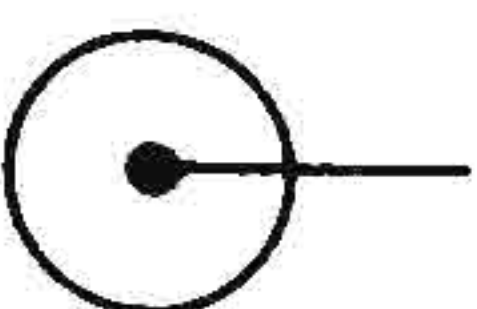
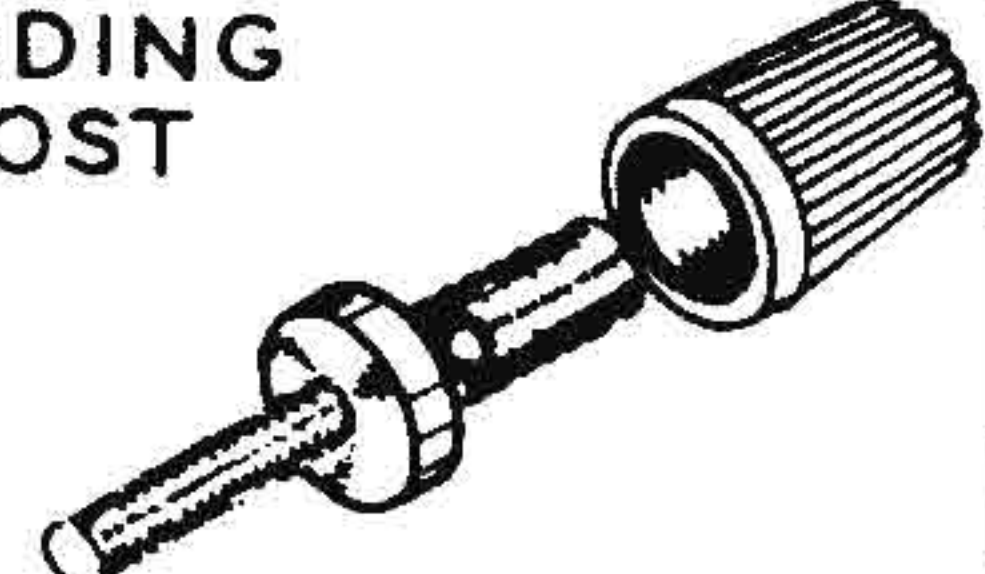
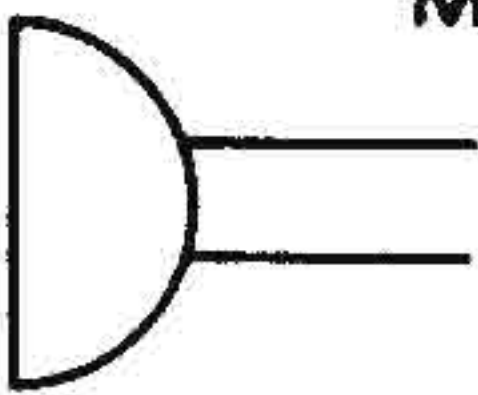
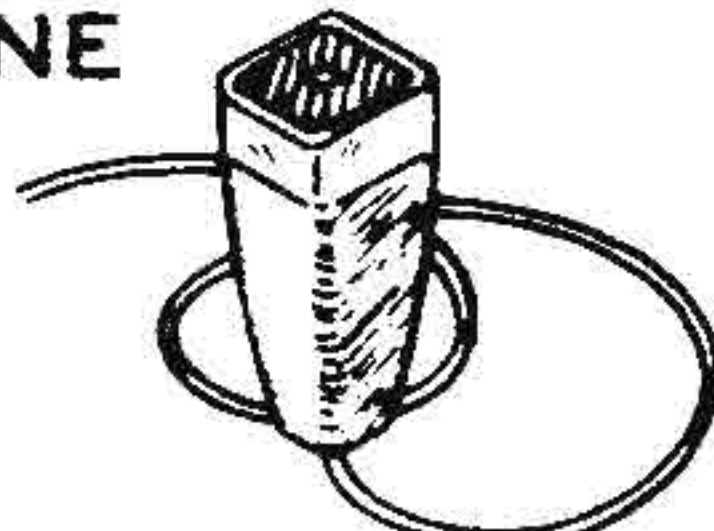

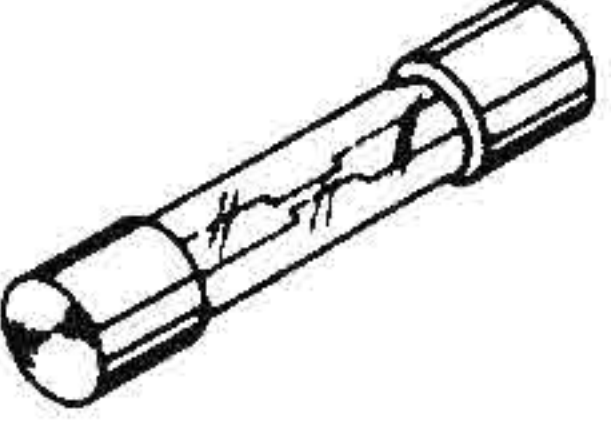
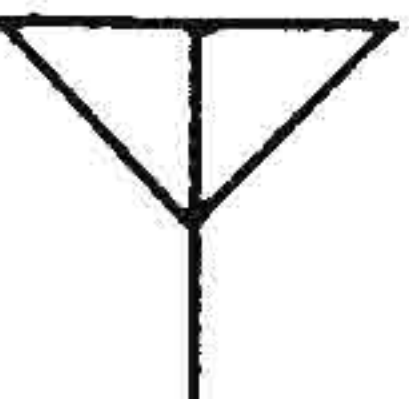
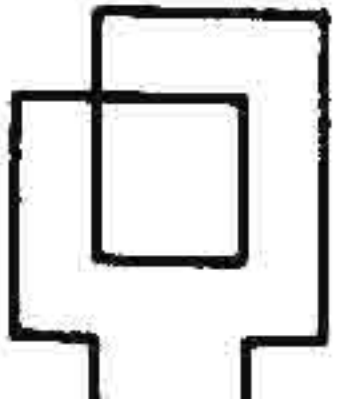



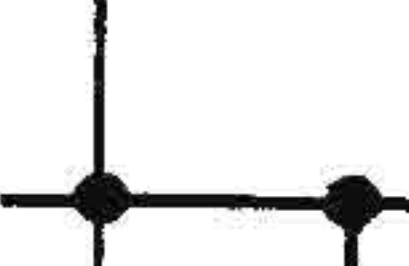





## TYPICAL COMPONENT TYPES

This chart is a guide to commonly used types of electronic components. The symbols and related illustrations

should prove helpful in identifying most parts and reading the schematic diagrams.

<b>RESISTOR</b>  	<b>CAPACITOR</b>  	 <b>TUBE</b>  <p>PLATE SUPPRESSOR SCREEN GRID CATHODE FILAMENT</p>
<b>POTENTIOMETER (CONTROL)</b>  	<b>ELECTROLYTIC CAPACITOR</b>  	<b>TRANSISTOR</b>   <p>PNP BASE COLLECTOR EMITTER NPN BASE EMITTER COLLECTOR</p> 
<b>TRANSFORMER (IRON CORE)</b>  	<b>VARIABLE CAPACITOR</b>  	<b>RECTIFIER (DIODE)</b>  
<b>TRANSFORMER (ADJUSTABLE POWDERED IRON CORE) ARROW INDICATES DIRECTION OF CORE MOVEMENT TO INCREASE INDUCTANCE</b>  	<b>BATTERY</b>  	 <b>NEON BULB</b> 
<b>TRANSFORMER (ADJUSTABLE CORE)</b>  	<b>PHONO JACK</b>  	 <b>ILLUMINATING BULB</b> 
<b>POWER TRANSFORMER</b>  	 <b>PHONE JACK</b> 	 <b>METER</b> 
<b>INDUCTOR (COIL)</b>  	 <b>RECEPTACLE</b> 	  <b>SWITCH (TOGGLE)</b> 
 <b>PIEZOELECTRIC CRYSTAL</b> 	 <b>SPEAKER</b> 	 <b>SWITCH (ROTARY)</b> 
 <b>BINDING POST</b> 	 <b>MICROPHONE</b> 	 <b>FUSE</b> 
 <b>ANTENNA</b> <b>GENERAL</b>  <b>LOOP</b>	 <b>EARTH GROUND</b>  <b>CHASSIS GROUND</b>	<b>CONDUCTORS</b>  <b>NOT CONNECTED</b>  <b>CONNECTED</b>  <b>SHIELDED</b>



## **CAUTION**

**USE EXTREME CARE DURING THE INITIAL TESTING AND ALL SUBSEQUENT OPERATION OF THIS POWER SUPPLY. WHILE THE HP-14 IS DESIGNED FOR MAXIMUM SAFETY, NEVER LOSE RESPECT FOR THE HIGH VOLTAGE THAT IS PRESENT. PROTECT YOURSELF ALWAYS AGAINST LETHAL OR SEVERE ELECTRIC SHOCK.**

**HEATH COMPANY**



# HEATH COMPANY

BENTON HARBOR, MICHIGAN

**THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM**