SERVICE BULLETIN

160 AMPERE MIG - STICK WELDER

This Service Bulletin provides technical information about the 160 Ampere Mig - Stick Welder which will aid in the maintenance and repair of the equipment. For operation information and parts list, consult the Operating Manual supplied with the equipment.

1. Description of Circuits: (Refer to Schematic Diagram)
The equipment consists of five major circuits:
   1. Primary Circuit
   2. Control Circuit
   3. Secondary (welding) circuit
   4. Wire Feed Motor Circuit
   5. Spot - Weld Control Circuit

1.1 Primary Circuit
The primary circuit consists of the input cord, switch, fan motor and transformer primary. On machines with all input voltage less than 250 volts the input cord has an attachment cap on the end.

On machine with any input voltage over 250 volts, no attachment cap is provided. The input cord goes to the on - off switch. A special switch is used for input voltage over 250 volts. The transformer primary is connected to the load side of the on - off switch.

The transformer primary is usually reconnectable for two input voltages. This reconnection is made by changing the transformer leads at the on - off switch. In case of difficulty a check should be made to assure that the proper primary voltage connection has been made. The transformer primary winding is part of the upper coil of the transformer.

The fan motor is part of the primary circuit and is always supplied for 230 volts. On 230/460 and 575 volt models, the fan motor is supplied from an isolated 230 volt winding on the transformer. On 208/230 and 220/380 volt models, the fan motor is connected to the 230 or 220 volt tap of the main primary winding.

1.2 Control Circuit
The control circuit is supplied with 24 volts from an isolated winding which is part of the upper coil of the transformer. One lead of this light winding comes from the rear of the coil and goes to the junction of a thermostat lead and a lead from the 5 point terminal block. The other end of this winding comes out of the front of the coil and goes to blade 1 of the Process Selector.

NOTE - Blade numbers on the process selector refer to the stationary blades counting from the front of the welder.

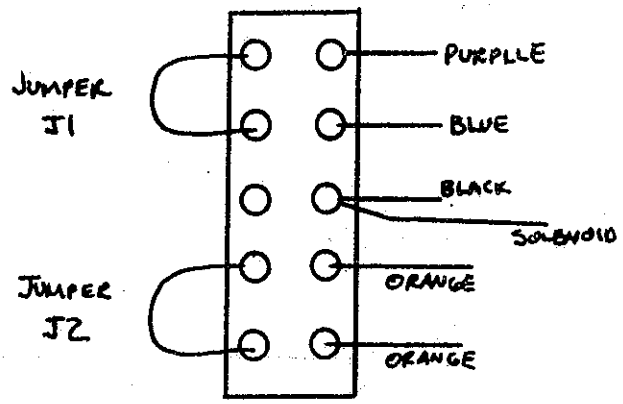
A thermostat connected in series with the contactor is in bedded in the upper coil of the transformer and provides protection against over heating.

Without the spot panel, the control circuit functions in the following way.

When the process selector is in either of the two Dip - Transfer positions, blades 2 and 3 are connected together. This means that the solenoid valve and the contactor are energized simultaneously by the gun - trigger.

When the Process Selector is in one of the three Stick - Electrode positions, blades 1 and 2 are connected together, but blade 3 is isolated. This energizes the contactor without the use of the gun trigger, but disconnects the solenoid valve.

Jumper J1 must be installed on the five point terminal block to complete the control circuit if the optional spot weld control is not used.



1.3 SECONDARY (WELDING) CIRCUIT

The secondary (welding) circuit is supplied by transformer windings located in both the upper and lower coils of the transformer. The transformer design provides for control of the transformer leakage reactance by the mechanical positioning of the iron shunts between the upper and lower coils. As the shunts are moved into the main transformer core by the lead screw, the leakage reactance increases reducing the transformer output. The increased leakage rectance also results in a small reduction in open circuit voltage.

The method of controlling transformer output described in the previous paragraph is commonly used in welders designed for stick electrode welding only, but is not normally used in welders designed for Gas Metal Arc Welding. It is used in this equipment to obtain excellent gas metal arc welding characterestics with a transformer that can also be used for stick electrode welding. The welding voltage control is obtained in this welder by selecting either the high or low voltage range and by varying the slope of the output characterestic within each range.

Part of the secondary winding is located in the upper transformer coil and is magnetically closely coupled to the primary winding. The remainder of the secondary winding is located in the lower transformer coil and is magnetically loosely coupled to the primary. The coupling is varied by changing the position of the iron shunts with the crank.

The Process Selector selects the proper number of secondary turns for each type of welding and this results in the following open circuit voltages.

Process Selector setting	Open Circuit Volts Output Indicator Maximum	Output Indicator Minimum
Dip Transfer Low	23 V.	22 V.
Dip Transfer High	35 V.	33 V.
Stick Electrode DCRP	71 V.	64 V.
Stick Electrode DCSP	71 V.	64 V.
Stick Electrode AC	71 V.	71 V.

The output of the transformer passes through the slope selector' to the welder contactor. The welder contactor has all contacts paralleled by a flat copper jumper which also serves as a heat sink to keep the contacts cool. From the contactor the transformer output goes to the rectifier and back to the polarity control blades of the Process Selector. The polarity control section of the Process Selector consists of blades 6,7,8,11,12,13,14,15, and 16. This section makes the connections which gives proper polarity at the work and electrode terminals. It also disconnects the stick electrode terminal when dip - transfer is being used and disconnects the dip transfer lead when stick electrode is being used.

The AC input to the main rectifier (SRI) is connected at all times when the contactor is closed regardless of the type of welding

being done. A resistor capacitor (R4 - C2) surge suppressor is connected across the rectifier input and high frequency protection capacitors are connected across each diode. A bleeder resistor is incorporated in the high frequency protection capacitor assembly. The output of the main rectifier is filtered by the inductor (L1) in series with the output. When the Process Selector is set in either of the two Dip - Transfer positions, a bank of 5 capacitors (C3) and a bleeder resistor (R5) is connected across the output of the main rectifier ahead of the inductor. This capacitor bank improves the welding characterestics when using dip transfer The direct current output as filtered then goes to the polarity control section of the Process Selector for connection to the output terminals.

1.4 WIRE FEED MOTOR CIRCUIT

The wire feed motor circuit is energized by a portion of the secondary windings of the transformer. The AC voltage input into the wire feed motor circuit is approximately 6 volts less than the AC voltage input to the welding circuit. This reduced voltage was selected to give the proper range of wire feed motor speeds to match the welding circuit output. The connection points of the input to the wire feed motor circuit are blade 10 on the Process Selector and a small wire coming from a crossover junction between the upper and lower coils at the rear of the transformer. This small lead goes to the rear auxiliary switch on the contactor.

The power is applied to the wire feed motor circuit through the main and auxiliary contacts of the contactor and through blades 9 and 10 of the Process Selector. The normally open auxiliary switch is required to prevent a voltage feeding through the motor circuit from appearing at the output when the contactor is open.

The fuse in the wire feed motor circuit is selected to protect the wire feed motor from over load. The maximum rated current input to the motor is 10 amperes.

The motor speed is controlled by the rheostat (R2) and resistor (R3) connected in a voltage divider circuit.

The normally closed auxiliary contacts on the front side of the contactor provide dynamic braking on the wire feed motor when the contactor opens.

Jumper J2 must be installed on the five point terminal block to complete the wire feed motor circuit of the optional spot weld control is not used.

1.5 SPOT - WELD CONTROL CIRCUIT

When the optional Spot - Weld Control is installed, Jumpers J1 and J2 are removed. The contactor and solenoid valve are now energized through the normally open contacts of the relay K1 and the wire feed motor is energized through a set of normally closed contacts of the time delay relay TDI.

The sequence of operation of the Spot - Weld Control is as follows:

A. Operation of the gun trigger supplies 24 volts to Spot Weld Control.

B. Relay K1 is energized through resistor R6, Diode D1 and normally closed contacts of TDI.

C. When K1 picks up, the contactor closes, which starts the wire feed motor.

D. If switch S3 if closed, TDI is also energized by the gun trigger. TDI times out after time set by rheostat R7.

E. When TDI times out, the relay transfers and opens the wire feed motor circuit. TDI also opens the circuit supplying voltage to K1 and closes the circuit to the discharge resistor R1.

F. After TDI operates, capacitor C1 discharges through resistor R1. R1 is an adjustable slide wire which can be used to vary the time delay in the dropout of K1. As K1 is delayed in dropping out, the contactor of the welder is held in for a short time after the feed motor is turned off to provide for proper stub burn off. The valves of R6, C1 and R1 are chosen to cause instantaneous pick up of K1 when voltage is applied to Spot - Weld Control. After the cycle is complete the gun trigger may be released.

G. If switch S3 is open, time delay TDI is not energized and the operation of the contactor and wire feed motor is controlled by the gun trigger.

2. CIRCUIT VOLTAGES

2.1 TRANSFORMER SECONDARY VOLTAGES

The open voltages on various sections of the transformer may be measured as follows:

Test Conditions - Rated input voltage, switch on, output indicator at maximum.

Section 1	Blade 16 to small tap lead connected to rear auxiliary switch on contactor	6.7 Volts AC
Section 2	Small tap lead to blade 17	11.8 volts
Section 3	Blade 17 to Blade 19	8.8 volts
Section 4	Blade 19 to Blade 21	51.6 volts

2.2 WIRE FEED MOTOR CIRCUIT VOLTAGES

The following voltages were taken across the wire feed motor leads at the front auxiliary switch of the contactor:

Test Conditions - Rated input voltage, switch on, output indicator at maximum, open circuit, not feeding wire

1.	Process Selector on Dip Transfer High, Wire Feed Speed Control on maximum	17.5 volts DC
2.	Process Selector on Dip Transfer High, Wire Feed Speed Control on minimum	14.0 volts DC
3.	Process Selector on Dip Transfer Low, Wire Feed Speed Control on maximum	9.5 volts DC
4.	Process Selector on Dip Transfer Low, Wire Feed Speed Control on minimum	7.0 volts DC

When welding, voltage inputs to the wire feed motor decreases from the open circuit test values given above. This decrease occurs because the wire feed motor circuit is supplied from the same windings as the welding circuit. The wire feed motor circuit voltage is also affected by the setting of the output indicator.

3. TYPICAL WELDING CONDITIONS

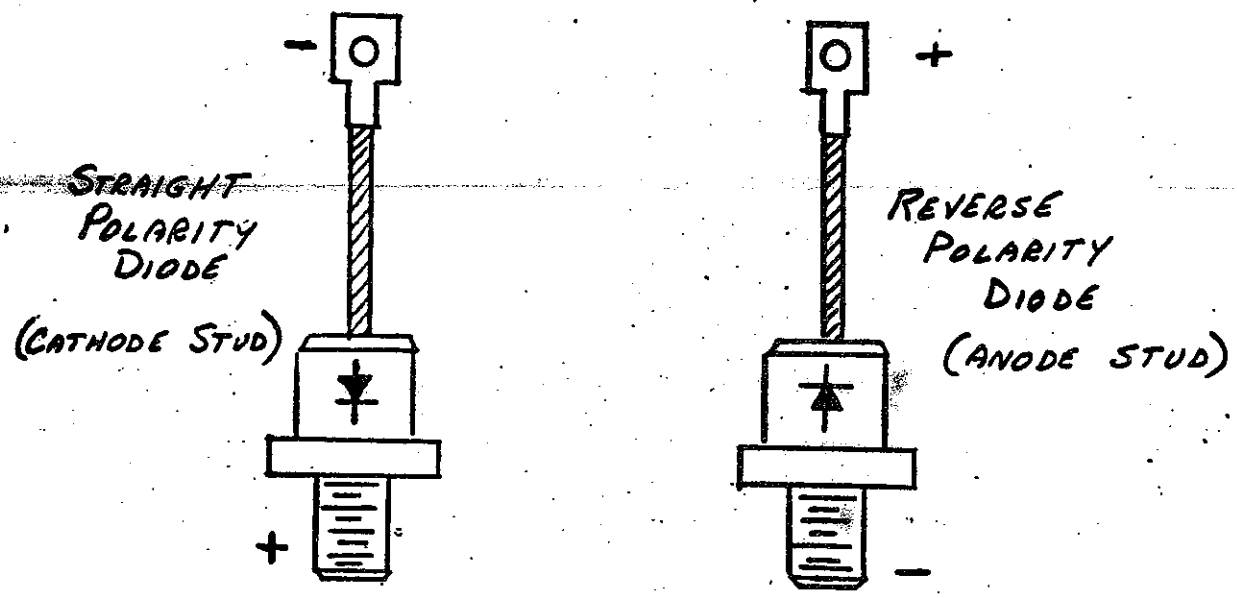
Typical approximate values of voltage and current corresponding to the various gage settings for which the equipment is calibrated are given below:

Gage Setting	Amp	Volts	Inches Min	Motor Volts
20	70	15	100	5.0
18	85	16	120	6.2
16Low	105	17	145	7.2
16High	120	16.5	170	8.4
14	140	18.5	220	10.1
12	165	20	290	12.5
3/16	180	22	340	14.2

The values in the above table were taken with .035 steel wire and 75% Argon - 25% CO2 sheild gas.

PROCEDURE FOR CHECKING DIODES

Inspect the diode to determine if it is of the " straight polarity " or "reverse polarity" type. (Refer to the following sketches for typical marking of diode polarity. It is essential that a replacement diode be of the same polarity as the one removed.

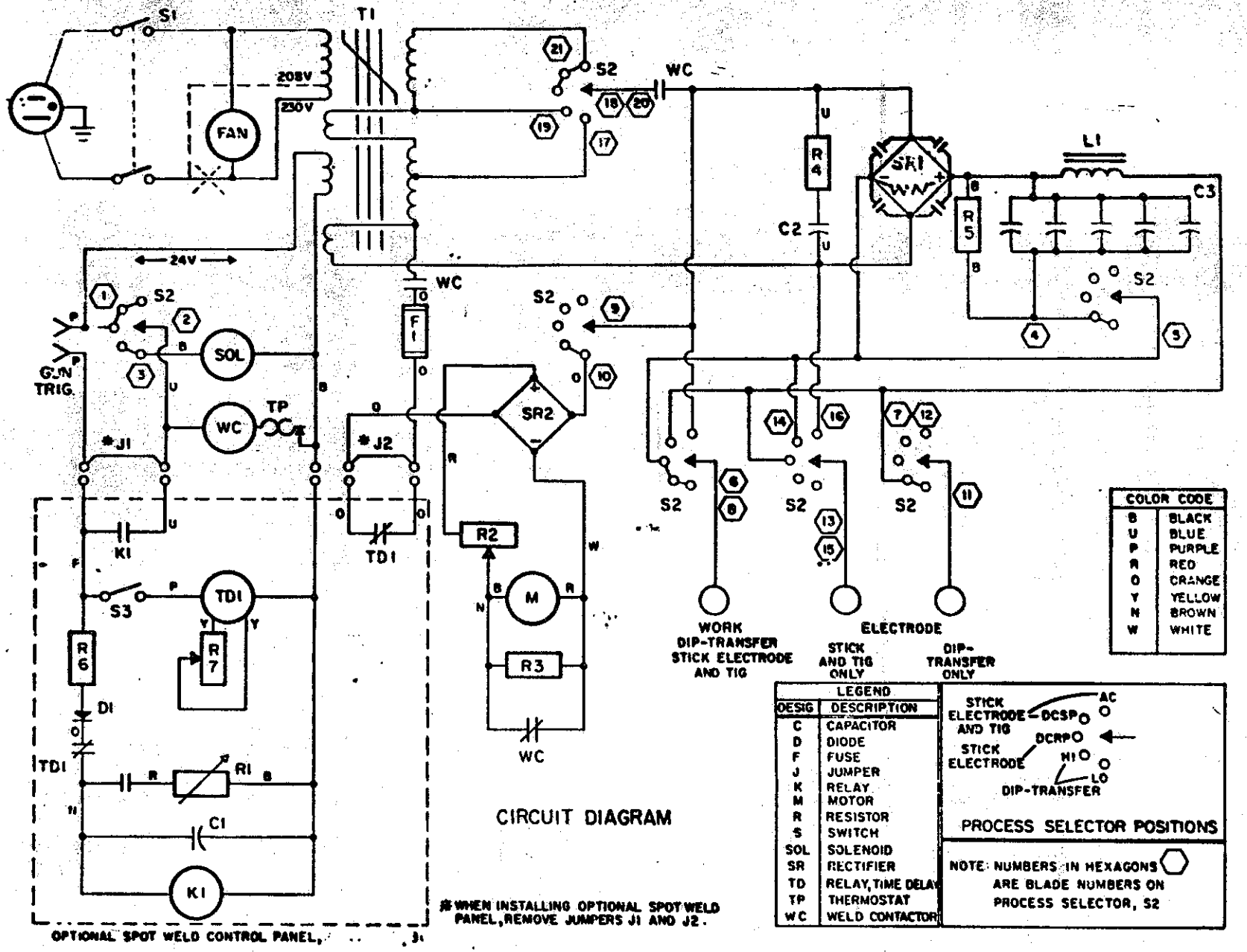


Usually when a diode fails, it becomes a short circuit. A simple diode test uses the resistance circuits of a multimeter; the diode should show better conductivity in one direction than in the other.

TEST AS FOLLOWS:

A: Set the mulitmeter on the low resistance range.
B: Connect one lead to the stud and one lead to the pigtail. Read the Resistance.
C: Reverse the leads and read the resistance. It should show a higher resistance in the "blocking" direction than in the "conducting" direction. If it shows a very low, resistance (or zero resistance) in both directions, the diode is shorted. If it does not show continuity in either direction, the diode is open.

As stated above, it is essential that a replacement diode must be of the same size, type, and polarity as the one it replaces.


S1
T1
208V
230V
FAN
21
S2
WC
18
20
19
17
U
R4
C2
U
SR1
L1
C3
R5
B
S2
4
5
24V
WC
F1
S2
9
1
S2
2
GUN TRIG.
P
3
SOL
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14
16
7
12
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6
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S2
13
15
S2
11
K1
TD1
R2
W
F
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S3
TD1
Y
Y
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R
N
R3
R6
R7
D1
TD1
R
R1
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C1
K1
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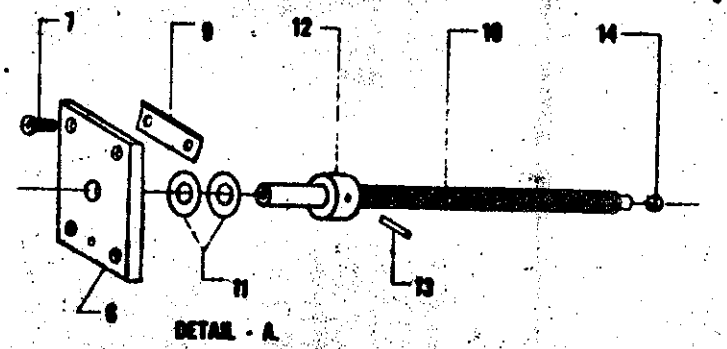
WORK
DIP-TRANSFER
STICK ELECTRODE
AND TIG
STICK
AND TIG
ONLY
ELECTRODE
DIP-
TRANSFER
ONLY
OPTIONAL SPOT WELD CONTROL PANEL,
CIRCUIT DIAGRAM
*WHEN INSTALLING OPTIONAL SPOT WELD
PANEL, REMOVE JUMPERS J1 AND J2.
COLOR CODE
B BLACK
U BLUE
P PURPLE
R RED
O ORANGE
Y YELLOW
N BROWN
W WHITE
LEGEND
DESIG DESCRIPTION
C CAPACITOR
D DIODE
F FUSE
J JUMPER
K RELAY
M MOTOR
R RESISTOR
S SWITCH
SOL SOLENOID
SR RECTIFIER
TD RELAY, TIME DELAY
TP THERMOSTAT
WC WELD CONTACTOR
STICK ELECTRODE AND TIG
AC
DCSP
DCRP
STICK ELECTRODE
HI
LO
DIP-TRANSFER
PROCESS SELECTOR POSITIONS
NOTE: NUMBERS IN HEXAGONS
ARE BLADE NUMBERS ON
PROCESS SELECTOR, S2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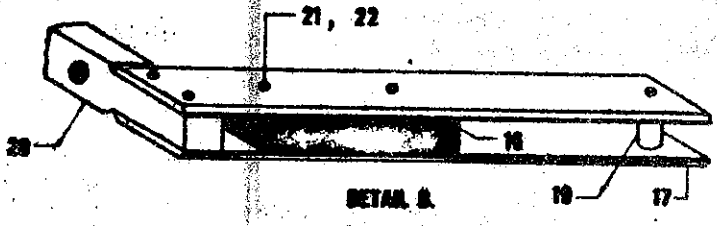
DETAIL - A.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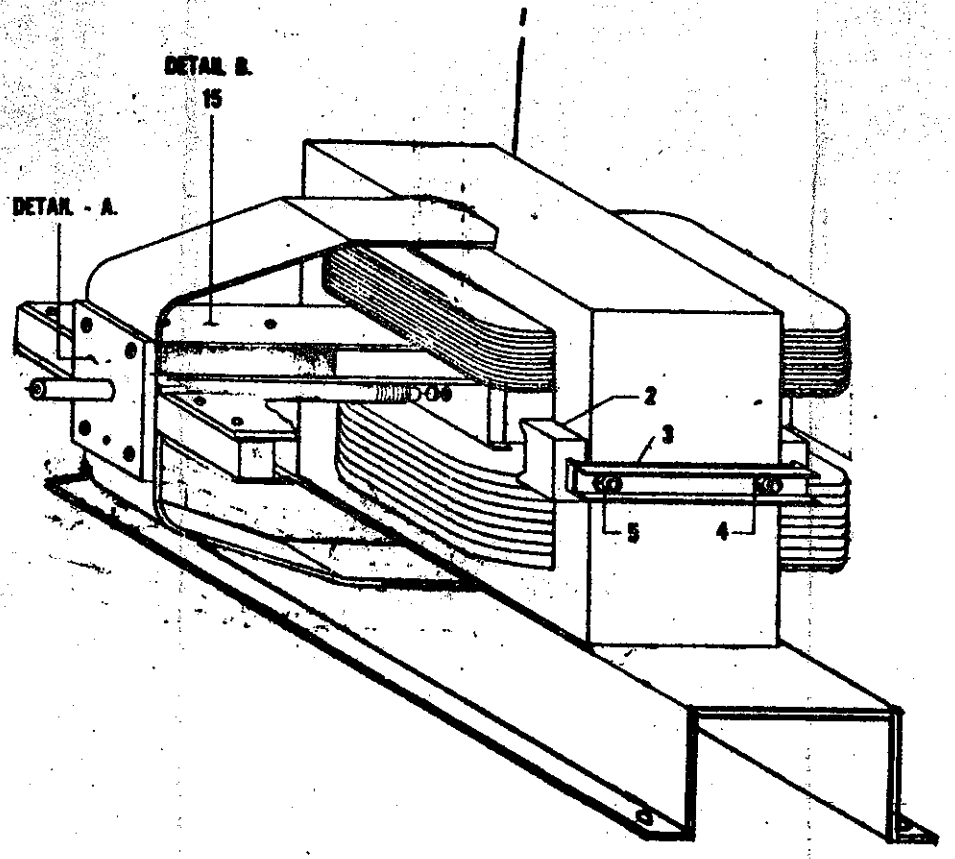
DETAIL B.


1
DETAIL B.
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DETAIL - A.
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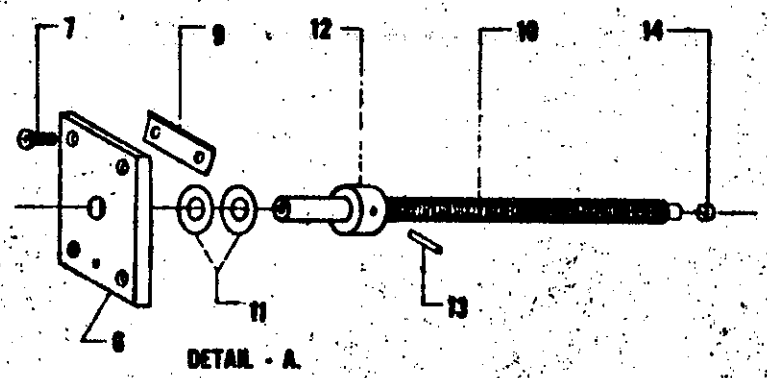
PARTS LIST

TRANSFORMER CORE & COIL ASSEMBLY

ITEM NO.	NAME	NUMBER REQUIRED	PART NO.
1	X-former Ass'y (with Base & Windings)	1	
2	Shuntlock	4	12733
3	Pressure Plate for Shuntlocks	2	12730
4	Spring Washer	4	134-5200
5	Nut, Self-locking	4	135-4332
6	Front Plate	1	12726
7	Screws,Pan Hd. Ph. $\frac{1}{4}$-20 X 3/4" lg.	4	131-6256
8	Washer, Lock $\frac{1}{4}$	4	134-4300
9	Nut, Hex. $\frac{1}{4}$-20	4	135-1331
10	Load Screw	1	12725
11	Washer Thrust (Nylon)	2	134-1762
12	Bushing	1	12734
13	Drive Pin (1/8 Dia.)	1	136-3815
14	Thrust Disk	1	12729
15	Shunt Ass'y	1	12728
16	Shunt Laminations	a.r.	127-4043
17	Shunt Plates	4	12721
18	Brass Insert (Threaded)	4	12722
19	Plastic Spacer	2	12723
20	Crossbar	1	12727
21	Rivet	12	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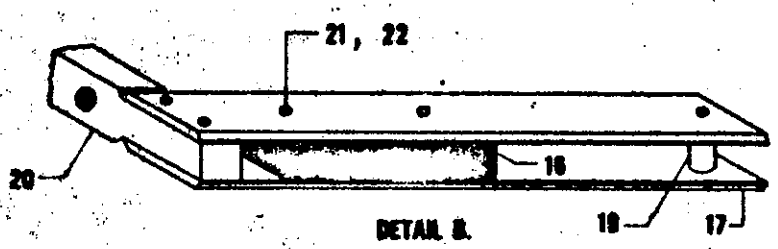
DETAIL - A.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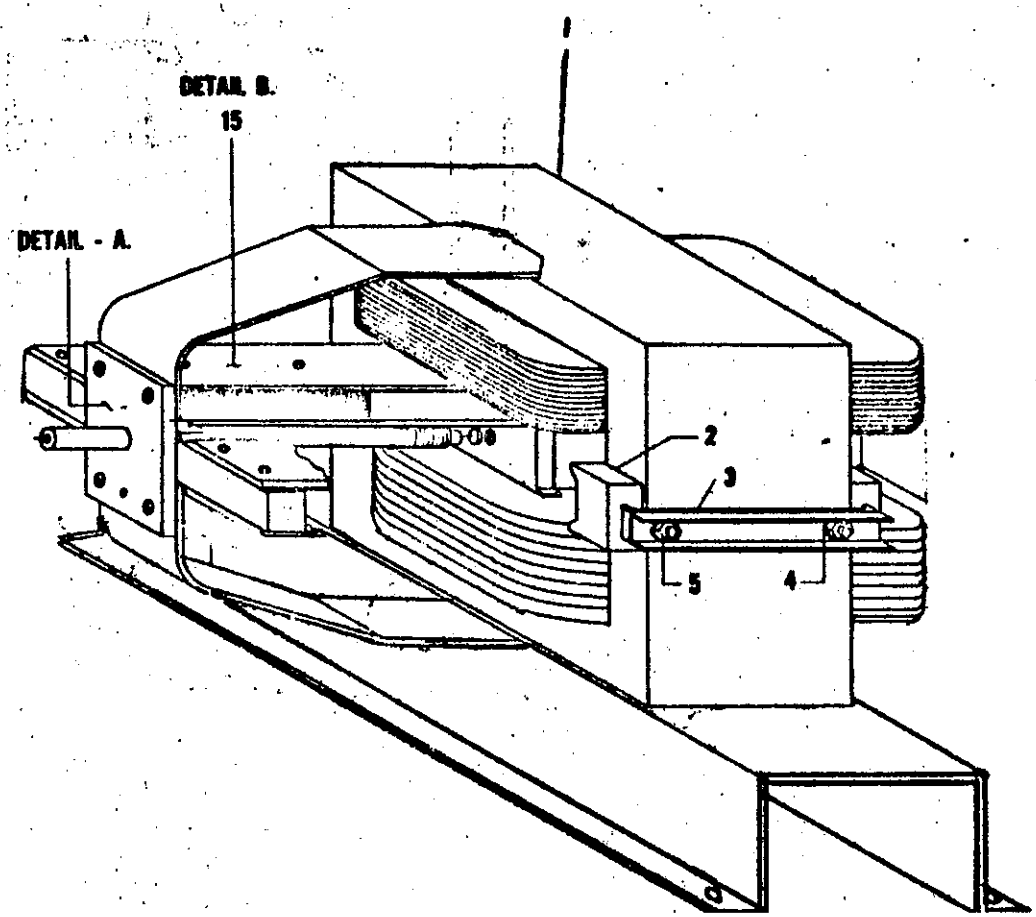
DETAIL B.


DETAIL B.
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DETAIL - A.
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