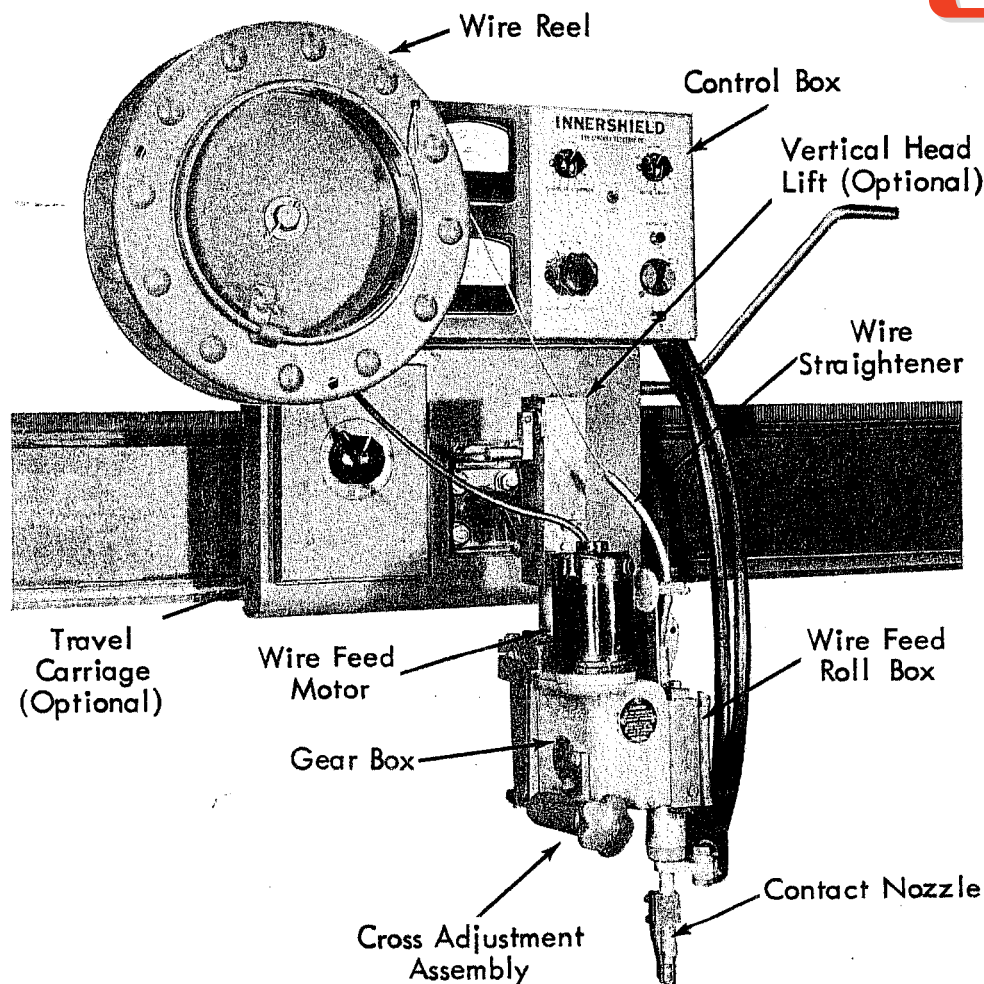


OPERATING MANUAL

"Innershield" NA-1 Automatic Welder

This manual covers equipment which is obsolete and no longer in production by The Lincoln Electric Co. Specifications and availability of optional features may have changed.



THE LINCOLN ELECTRIC COMPANY

"World's Largest Manufacturer of Arc Welding Equipment and Electrodes"

Cleveland 17, Ohio

SEC. B1 CONTENTS

This manual is divided into sections. The index below lists the titles of these sections and tells what type information each section contains. The first page of each section consists of a complete index of the information included in the section.

Notice, on the right edge of this page there are black blocks containing the number and title of each section. The index page of each section has a similar block. To quickly find the index page of a particular section, open the book to this page and bend the book so you can see the edge of every page in the manual. Open to the page where a black block shows in line with the block on this page corresponding to the section title you desire.

There are no page numbers in this manual. The pages are arranged in numerical order by section number in Sections B1, B2, B3, and B6; by parts list number in Section B7, and in alphabetical-numerical order of diagram numbers in Section B8.

Some pages in this manual are also used in the LAF manual, IM-198-B. On these pages the section number is not preceded by "B". Pages with and without the "B" are arranged in numerical order as if there was no "B" on any of the pages.

SEC. B2 ASSEMBLY AND INSTALLATION

This section provides a list of equipment required for an Innershield installation. It gives detailed instructions for mounting and wiring the NA-1 head, controls, the travel carriage, accessories and special set-ups. See Sec. B3 for instructions on how to operate this equipment.

SEC. B3 OPERATING INSTRUCTIONS

This section describes how to adjust the controls and how to operate the equipment.

SEC. B6 MAINTENANCE INSTRUCTIONS

This section provides detailed instructions on regular mechanical and electrical maintenance of the NA-1 head and controls. It includes a trouble shooting table for mechanical or electrical failures.

SEC. B7 PARTS LISTS

Contains a list of parts for the NA-1 head, controls, travel carriage and accessories.

SEC. B8 DIAGRAMS

Includes all wiring diagrams and dimension prints necessary to install and operate standard and some special Innershield installations.

B2
Assembly &
Installation

B3
Operating
Instructions

B6
Maintenance
Instructions

B7
Parts Lists

B8
Diagrams

SEC. B2 ASSEMBLY AND INSTALLATION

Sec. B2.1 Contents

Required Equipment for Innershield Installations	B2.2
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35-Volt Control Exciter	B2.6.2
Accessories	B2.7
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B2
Assembly &
Installation

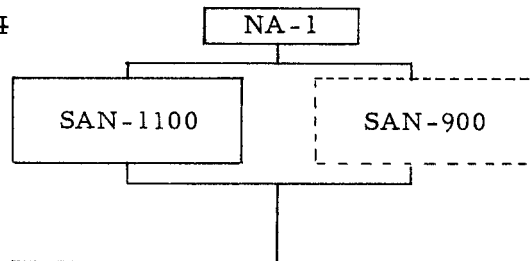
SEC. B2.2 REQUIRED EQUIPMENT FOR INNERSHIELD INSTALLATIONS

Sec. B2.2.1

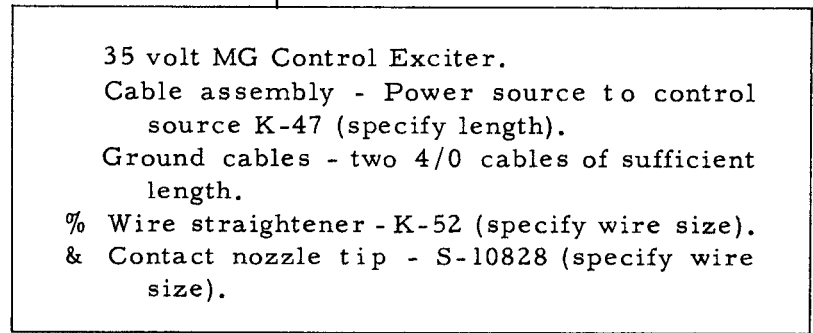
Single Arc Installations

Head and Controls, K-46 and K-65 ‡

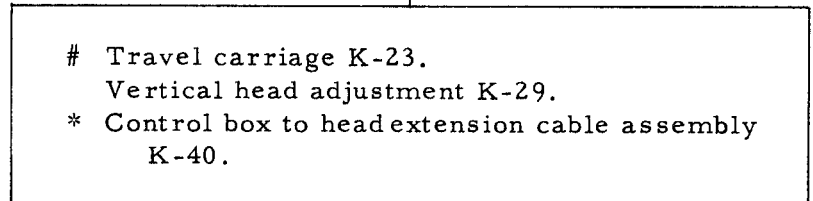
Power Source



Additional required equipment
which must be ordered.



Available accessories



The SAN-900 power source is no longer manufactured by The Lincoln Electric Company. It is, however, a satisfactory power source for the Innershield process.

Provide the necessary ventilation and shielding to protect the operator and other employees from the arc rays and smoke.

‡ The K-46 and K-65 head and controls are identical except for the wire feed speed range as listed below.

Type No.	Min. Current Control Setting	WIRE FEED SPEED RANGE		Gear Box Ratio
		Max. Current Control Setting		
K-46	87 ipm	450 ipm		81-1
K-65	48 ipm	265 ipm		144-1

% One K-52 wire straightener of specified size is supplied with the head and controls. If other size electrode is also to be used, order the extra wire straighteners.

& One S-10828 contact nozzle tip of specified size is supplied with the head and controls. If other size wire is to be used, order the extra contact nozzle tips.

Available in three speeds (see Sec. 2.4.4). Specify which is required.

* A 34 inch length of K-40 cable assembly comes with the head and controls. Longer lengths must be ordered separately.

SEC. B2.3 GENERAL INSTRUCTIONS

Sec. B2.3.1

Preparation

<u>Dimension Prints</u>		
<u>Carriage and Beam</u>	<u>NA-1 Head</u>	<u>Control Box</u>
G-1061	L-3476	M-9807

When Lincoln equipment is shipped, title passes to the purchaser upon receipt by the carrier. Consequently, claims for material damaged in shipment must be made by the purchaser against the transportation company at the time the shipment is received.

To facilitate the assembly and installation of the Innershield Automatic Welder, carefully study the dimension prints. From these drawings an overall layout may be visualized which will materially aid in setting up the welder.

The angle of the NA-1 head and the angle of the work piece must be carefully set to make sound Innershield welds. As a result, the NA-1 head is often positioned at odd angles depending on the type of weld and procedure to be used. This is an extremely important consideration when designing fixturing. Be sure the fixtures have maximum flexibility to permit easy adjustment for procedure changes.

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Sec. 2.3.2

Sequence of Installation

The following sequence of installation is recommended as a guide in the installation of the Innershield Automatic Welder.

1. Uncrate Power Source (inspect).
2. Install Power Source - See IM-231.
3. Install the control exciter - See Sec. B2.6.2

4. Unpack carriage if used - See Sec. 2.4.4
 - a. Inspect.
 - b. Install handle.
 - c. Install head mounting bracket. (Insulate properly).
 - d. Place carriage on beam.
 - e. Shim carriage for proper operation (if necessary). See G-1061.
 - f. Install wire reel support.
 - g. Fill carriage gear box with oil to proper level. See Sec. B2.4.1.
5. Unpack Control Box
 - a. Inspect.
 - b. Open the control box and remove the dust cover.
 - c. Remove the wooden platform from the bottom of the control box.
 - d. Install control box on carriage or fixture (insulate properly). Replace dust cover and close the box. See Sec. 2.4.4
6. Unpack the Head
 - a. Inspect.
 - b. Install the Head. See Sec. B2.4.3 or Sec. 2.4.4.
 - c. Fill the wire drive gear box with oil to the proper level. See Sec. B2.4.1.
 - d. Install nozzle and wire straightener. See Sec. B2.4.1.
 - e. Connect electrode cable and control cable from head to control box. See Sec. B2.4.5.
7. Install the wire reel mounting bracket. See Sec. B2.4.3 or Sec. 2.4.4.
8. Unpack the wire reel.
 - a. Inspect.
 - b. Load with Innershield Electrode.
 - c. Install Loaded reel.
9. Unpack the control cable.
 - a. Inspect.
 - b. Install between power source and control box. See Sec. B2.4.5.
10. Thread the Electrode Through the Head.
11. Check the equipment for proper operation by running a test weld. See Sec. B3.2.10.

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SEC. B2.4 HEAD AND CONTROLS

Sec. B2.4.1

General Information

The "Innershield" NA-1 head and controls can be mounted on a stationary fixture or on the standard Lincolnweld carriage. Specific instructions for making either installation are given in Sec. B2.4.3 and Sec. 2.4.4, respectively. Wiring instructions for either installation are given in Sec. B2.4.5. Other general installation operations are as follows:

a. Wire Straightener

After the head is installed, place the wire straightener on top of the drive roll box. Rotate the straightener so the top of the straightener points toward the wire reel as shown in the dimension print. Tighten the two clips to hold the wire straightener in place.

A wire straightener operates properly on only one electrode size. When you change electrode size, change the straightener also. Always specify electrode size when ordering a wire straightener.

b. Contact Nozzle

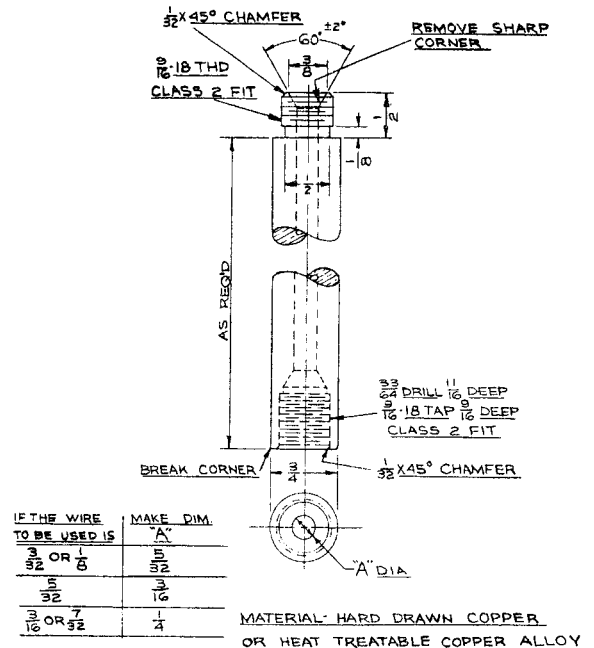
After the head is installed, insert the lower wire guide into the nozzle assembly. Place the combined assembly in position on the bottom of the wire feed roll box. Clamp it in place using the two clamps supplied with the head.

Each electrode size requires a different nozzle tip. Specify electrode size when ordering nozzle tips.

Be sure the spring assembly holds the contact shoe tightly against the electrode inside the nozzle tip. When the contact shoe becomes worn so it no longer makes good contact with the electrode, replace the shoe.

If required for special applications, an extension can be made for the nozzle assembly. Proper dimensions for this extension are given in the drawing

below. Screw the extension in where the nozzle tip is normally placed. Screw the nozzle tip into the end of the extension. Move the spring assembly down onto the extension so the contact shoe is still held tightly against the electrode inside the nozzle tip.



c. Wire Feed Gear Box

The Innershield wire feed gear box is drained of oil before leaving the factory. To add oil, mount the head in an upright position. Unscrew the three screws in the motor base plate and remove the motor. Remove the screw at the oil level mark on the "Caution Plate" below the motor. Fill the gear case with the oil furnished or with SAE-140 oil until it runs out the level screw hole. It will hold approximately 3/4 pint of oil.

The head can be rotated up to 45 degrees from the vertical without special precautions. If operated in a position of more than 45 degrees from the vertical, the oil level must be carefully checked to make certain the oil cannot run into the motor and ruin the windings. Also be sure the oil level is sufficient to properly lubricate the input and output worm gears.

Sec. B2.4.1 (Continued)

d. Carriage Drive Gear Box

The travel carriage gear case is drained of oil before leaving the factory. To add the oil, mount the carriage on the beam. Remove the 3/8" slotted pipe plug which is on the top surface of the gear case. Remove the oil level screw from the dust cap which faces the rear of the carriage. Fill the gear case with the oil furnished or with SAE-140 oil until it runs out the oil level hole. The gear case will hold approximately 1/2 pint of oil.

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Sec. B2.4.3

Stationary Mounted Heads

Dimension Prints

<u>Head</u>	<u>Control Box</u>
L-3476	M-9807

2-1-60

To make a stationary mounting of an Inner-shield head, provide a fixture of the proper dimensions and with the mounting holes required by the dimension print. These mounting holes should be slotted to permit some vertical adjustment. All parts necessary for mounting and insulating the head and control box are included with the equipment. Note on the dimension print that the mounting bracket can be connected to the head in either of two positions 90° apart. For good arc striking characteristics, rigidly mount the head so that it does not move when the electrode contacts the work.

Mount the control box for easy accessibility to the operator. Distance from the control box to the welding head should not ordinarily exceed the length of the control cable, which is 34 inches. Longer lengths of cable must be ordered separately.

All parts and insulation required to mount the wire reel are furnished with the reel. If possible, mount the reel so the wire is in the position shown in the dimension print.

If this is impossible, the wire straightener can be rotated through 360° in order that the wire can be straightened no matter where the reel is located. The plane of the wire reel, however, must pass through the center lines of the top and bottom guides. To operate properly, the curve in the wire straightener must point toward the wire reel as shown in the dimension print.

Power to operate the travel mechanism can be obtained from the receptacle on the back of the control box. It is a three prong receptacle connected to leads #31, #32 and #25. Leads #31 and #32 supply 115 volts AC power. #25 to #31 is 115 volts AC with #25 connected through the relays and switches for automatic starting and stopping. This is the same receptacle used for the standard Lincolnweld travel carriage. 250 volt-amperes is available from this receptacle.

HEAD AND CONTROLS - CONT'D.

Sec. 2.4.4

Travel Carriage Mounting

The same travel carriage is used with the LAF-3, LAF-4, LAF-5, NA-1 and NA-2. It is designed to carry the head and controls on a beam or special fixture provided by the customer.

To provide the greatest range of speeds, the carriage is available with three possible gear box ratios. Each model covers a continuous range of speed without changing gears. After determining the speed range most suited to your needs, order the carriage gear box ratio required - slow speed, medium speed or fast speed.

Actual travel speeds are listed below:

<u>Carriage</u>	<u>Gear Box Ratio</u>	<u>Carriage Speed in in. per min.</u>
K-23-S	648 - 1	6.5 - 52
K-23-M	324 - 1	13 - 104
K-23-F	144 - 1	27 - 216

Speed range is actually from maximum range show to zero. However, as the reduction goes beyond the 8 to 1 ratio shown, the percentage of speed variation at a given setting increases rapidly with uneven loading of the carriage.

The carriage operates on 115 volts AC, 50 or 60 cycle power.

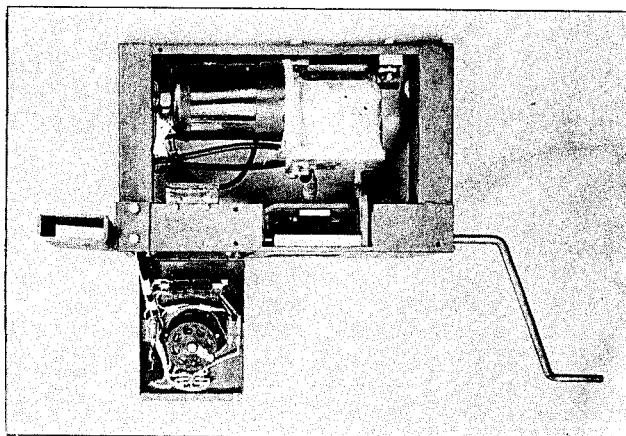


Fig. 2.4.4-1 Top View of Travel Carriage.

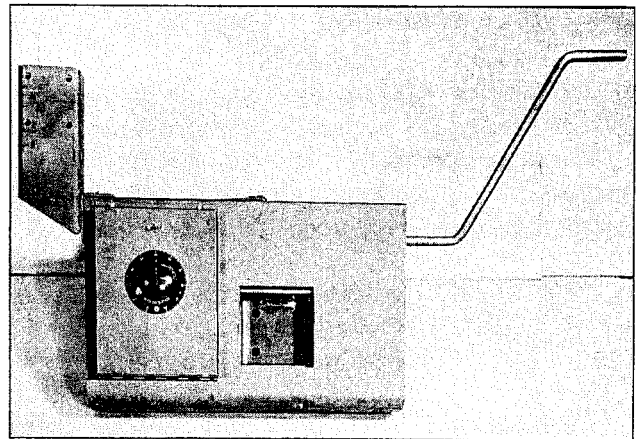


Fig. 2.4.4-2 Front View of Travel Carriage.

For proper leveling of carriage and construction of beam, see drawing G-1061. Install the handle and head mounting bracket while the carriage is on the floor. Set the carriage on the beam with the clutch handle all the way down. Now the carriage should run freely on the track. With the clutch handle all the way up, the drive roll should engage the track and hold the carriage securely in position. If necessary add shims per G-1061.

The travel carriage gear case is drained of oil before leaving the factory. To add the oil, mount the carriage on the beam. Remove the 3/8" slotted pipe plug which is on the top surface of the gear case. Remove the oil level screw from the dust cap which faces the rear of the carriage. Fill the gear case with the oil furnished or with SAE-140 oil until it runs out of the oil level hole. The gear case will hold approximately 1/2 pint of oil.

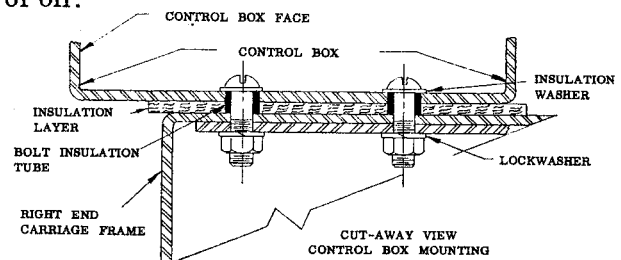


Fig. 2.4.4-3 CUT-AWAY VIEW

Attach the wire reel mounting bracket to the left end of the carriage. Mount the control box on top of the carriage. Parts needed for mounting and insulating the control box from the carriage are included with the carriage. (See Fig. 2.4.4-3).

Sec. 2.4.4 (Continued)

Mount the head to the front of the carriage. Parts needed for insulating the head are included with the head. Check the insulation at the head and wire reel mounting brackets. Make certain neither head nor wire reel is grounded.

The 3prong plug from the carriage control box is to be plugged into the receptacle in the automatic welder control box or NA-2 relay panel.

The load on the carriage should be as uniform as possible. Cables should be installed so that they will move smoothly with the carriage.

The two 4/0 electrode cables from the control box to the welding generators must be anchored at the back of the carriage on the left-hand side. Holes in the carriage are provided for an anchor clamp. The electrode and control cables must be suspended off the floor. If they are allowed to drag, the wire insulation wears rapidly and the cables are subject to accidental damage.

June 1963

HEAD AND CONTROLS - CONT'D.

Sec. B2.4.5

Wiring the NA-1

a. Control Cable

Wiring Diagram M-8856

Connect the necessary leads of the multi-conductor control cable to the terminal strips provided on the SAN power source. Connect the necessary control cable leads to the 35 volt control exciter. The control cable is connected to the control box by means of multiconductor polarized plug. Knockouts are provided in the control box to make it convenient to bring in auxiliary wiring.

The polarized plug on the wire feed motor leads is plugged into a receptacle on the back of the control box.

For best operation, the sum of the cable lengths from power source to control box and from control box to automatic head should not exceed 80 feet. The automatic head loses its sensitivity as the control leads are made longer. If control cables longer than 80 feet are needed, consult the Lincoln factory giving full details of the installation and application.

b. Welding Cables

Connect the two 4/0 electrode cables of the K-47 assembly and two 4/0 ground cables to their respective studs on the power source. Connect the other end of the ground cables to the work. Connect the electrode cables to the left side of the current relay in the control box. (In all cases, left or right side designates left or right side when facing the front of the control box.)

Connect the cables from the contact nozzle assembly to the right hand side of the shunt on the back of the control box. With this connection, the ammeter will read properly when operating with positive polarity.

Two 4/0 cables are included in the K-47 electrode cable assembly. For welding currents over 1200 amperes, add another 4/0 cable to the electrode cable assem-

bly and another 4/0 cable to the ground cables.

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Sec. B2.4.6

Rewiring for Standstill Starting

As shipped, the NA-1 is wired for on-the-fly starting. That is, the travel starts at the instant the Start button is pushed so there is relative motion between the head and work when the arc starts. The NA-1 can be easily rewired for standstill starting. With this arrangement, the travel starts when the arc starts so there is no relative motion between head and work until the arc starts. For a description of when each method is used, see Sec. B3.2.7.

To rewire the travel control circuit for standstill starting, move the red lead at the NA-1 control box terminal strip to terminal #22.

2-1-60

Sec. B2.4.7

Rewiring the Travel Stopping Circuit

As shipped from the factory the NA-1 is wired so the travel motor stops at the instant the stop button is pushed. It can be rewired so the travel continues until the arc goes out. See Sec. B3.2.9 for a brief description of when this system is used.

To change the travel stopping circuit so the travel motor runs until the arc goes out, put a jumper between terminals #22 and #23 on the main relay inside the control box.

2-1-60

Sec. B2.4.8

Rewiring for Timed Welds

To install a reset timer for making timed welds, connect the timer motor to #31 and #22 at the NA-1 control box terminal strip. Remove the jumper between terminals #20 and #26. Connect the leads from the normally closed contacts on the timer to terminals #20 and #26. The leads to the timer can be channeled through one of the knockouts provided in the NA-1 control box. The timer motor must operate on 110 volts, AC 50 or 60 cycle power.

2-1-60

SEC. B2.6 POWER SOURCES

Sec. B2.6.1

SAN-900 and SAN-1100

The SAN-900 and SAN-1100 power sources were designed specially to supply power for the Innershield welding process. They have a slightly rising output characteristic to compensate for voltage drop in the leads. The result is a flat volt-amp curve or constant potential characteristic at the arc. 110 volt AC and 125 volt DC power required for the NA-1 control circuits are supplied by the SAN power source.

Although the SAN-900 is no longer manufactured by The Lincoln Electric Company, it is still a satisfactory power source for Innershield applications.

To permit the adjustment of the O.C.V. on SAN welders of Code No. 4164 and lower, the following wiring change is necessary:

1. Turn off the input power to the machine.
2. Remove the control box cover.
3. See the power source wiring diagram. Find the brown lead that connects one contact on the full field relay to the connection stud on the SAN reversing switch.
4. Remove this lead from the connection stud. Extend it through the grommet in the back panel. Connect it to #24 at the terminal strip.
5. Replace the cover.

The O.C.V. can now be adjusted by turning the SAN voltage control rheostat.

2-1-60

Sec. B2.6.2

35-Volt Control Exciter

Wiring Diagram
Power Source to Exciter

M-8856

The 35 volt DC power required for the NA-1 wire feed control circuit is supplied by a

separate MG set. This control exciter is furnished without a starter. Therefore, connect it to the motor side of the power source starter. With this arrangement, the power source and control exciter are started and stopped at the same time. To protect the control exciter, the connecting line should be fused with a 4 amp lag type fuse for 220 volt operation or a 2 amp lag type fuse for 440 volt operation. Connect the exciter as shown in the wiring diagram.

2-1-60

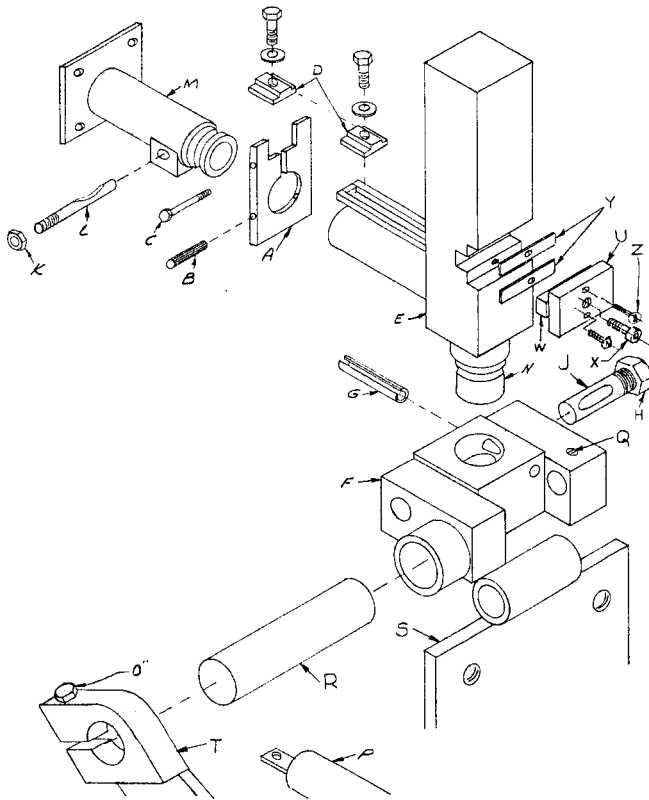
ACCESSORIES - CONT'D.

Sec. 2.7.7

Vertical Head Adjustment

a. ASSEMBLY

Lincolnweld automatic applications frequently require raising and lowering the head assembly. The Vertical Head Adjustment provides a quick,



2.7-1 Vertical Head Adjustment with offset slide.

simple and easy method of doing this. A height variation of four inches can be achieved with this attachment.

b. INSTALLATION

Check the carton for the following items:

1. Head adjustment lock (A).
2. 1/4" diameter roll pin (B).
3. 1/2 - 13 clamping screw (C).
4. Two adjustable clamps and their respective screws and washers (D).
5. Vertical head adjustment (E).

To install proceed as follows:

1. Make certain that nut (H) is pulled up tight and then drive out the 5/16 diameter roll pin (G) which is located between the yoke arms (F). Now support the head and loosen the nut (H) which clamps the draw bolt (J). The welding head can now be lowered off the end of the stationary head mount.
2. Loosen the nut (K) on the draw bolt (L); now remove the stationary mount.
3. Slide the clamp ring (A) over the end of the mounting bracket (M).
4. Drive the 1/4" roll pin (B) into clamp ring (A) when the hole in the ring lines up with the groove in the mounting bracket (M).
5. Tighten clamp ring (A) with the open slot in the up position, using the 1/2" clamping bolt (C).
6. Slide the vertical head adjustment unit (E) into the mounting bracket (M). Tighten the draw bolt nut (K).
7. Install one adjustable clamp (D) on each side of the clamp ring (A).
8. Raise the welding head back into position so that the yoke slides over the up and down lift shaft (N). Drive the 5/16 roll pin (G) back into its original position.
9. Tighten draw bolt nut (H).

c. ADJUSTMENT

To prevent rotational movement of (N) as it moves up and down, the key is made of two parts (U) and (W). These parts are spaced by the required number of shims (Y) to allow vertical movement of (N) with the minimum amount of rotational movement when screws (Z) are tight and socket head screw (X) is loose. If it is desired to lock (N) so there is no movement, tighten socket head screw (X).

May 1963

SEC. B3 OPERATING INSTRUCTIONS

Sec. B3.1 Contents

Operation of Standard Equipment.	B3.2
Introduction.	B3.2.1
Arc Current and Voltage	B3.2.2
Travel Control.	B3.2.3
Head Mounting Adjustments	3.2.5
Inching the Electrode	B3.2.6
Starting the Arc	B3.2.7
Stopping the Weld.	B3.2.8
Stopping the Travel.	B3.2.9
Sequence of Operation and Test Weld.	B3.2.10



SEC. B3.2 OPERATION OF STANDARD EQUIPMENT

Sec. B3.2.1

Introduction

The NA-1 control box is divided into two sections. The front section contains all the controls normally used for day-to-day operation. A second control panel is located behind the front panel. The controls on the sub-panel provide proper crater filling or overlapping on roundabouts. They affect the weld only after the stop button has been pushed and are generally adjusted only when setting up a new application.

To expose the sub-panel, remove the two screws holding the front panel section and swing this hinged panel up. All the crater filling relays are mounted in the back half of the control box. They are readily accessible by removing the dust seal plate just above the sub-panel controls.

2-1-60

Sec. B3.2.2

Arc Current and Voltage

When connected to the SAN power source, the voltage control rheostat on the NA-1 front control panel is wired in series with the voltage control rheostat on the SAN power source. Set the SAN voltage control to the 1 o'clock position. This provides the proper O.C.V. for best starting characteristics. All day-to-day voltage adjustments are made by turning the voltage control rheostat on the NA-1 front control panel. Arc voltage is indicated by the voltmeter on the NA-1 control box.

To change the welding current, turn the welding current control on the NA-1 front control panel. Welding current is indicated by the ammeter on the control box.

2-1-60

Sec. B3.2.3

Travel Controls

When the travel mechanism is plugged into the travel carriage receptacle on the back of the NA-1 control box, it is controlled by the travel switch on the NA-1 main control panel. This switch has three positions.

When set on Manual Travel, the travel mechanism operates, but the welding circuit is off. This setting is used to time the travel for exact speeds or for positioning the head or work. When the travel switch is set on Automatic Travel, the travel circuit is controlled by the relays in the NA-1 control box during welding. The travel mechanism will not operate with the travel switch set on off.

The toggle switch on the Lincoln travel carriage controls the direction of travel. It has three positions; carriage moving to the right, left or off.

Travel speed is controlled by the dial on the front of the carriage. With this control, it is possible to get an 8-1 speed variation. If the load on the carriage is uniform, higher speed variations are possible.

Speed range actually is from maximum speed shown to zero. However, as the reduction goes beyond 8 to 1, the percentage of speed variation at a given setting increases rapidly with uneven loading of the carriage.

The input voltage of the carriage is 115 volts AC, 50 or 60 cycle.

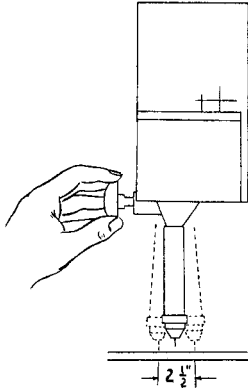
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OPERATION OF STANDARD EQUIPMENT - CONT'D.

Sec. 3.2.5

Head Mounting Adjustments

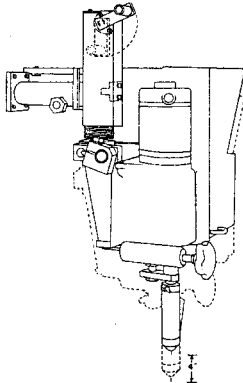
1. CROSS SEAM FINE ADJUSTMENT



3.2.5-1

Operation of the hand screw of the cross adjustment assembly permits a 2-1/2 inch cross seam adjustment. See Figure 3.2.5-1. This adjustment can be done while welding.

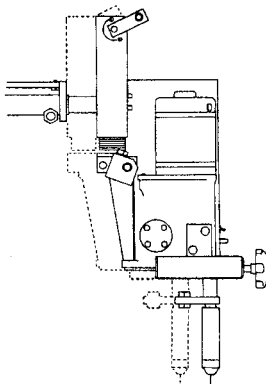
2. VERTICAL HEAD ADJUSTMENT (Optional)



3.2.5-2

See Figure 3.2.5-2. The head can be raised 4 inches vertically by turning the hand crank of the vertical head adjuster. This adjustment is used during setup or while welding.

3. IN AND OUT ADJUSTMENT

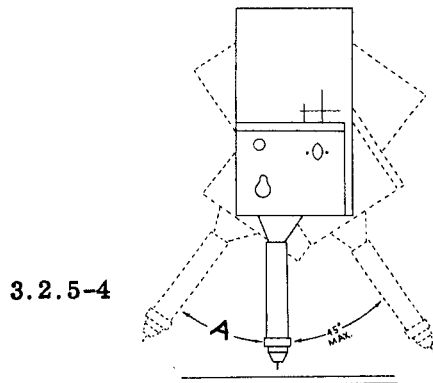


3.2.5-3

With a vertical head adjuster mounted, the head can easily be slid in and out 3-3/4 inches. The head adjustment lock holds the head vertical while this adjustment is being made. The adjustable clamps of the vertical head adjustment assembly can be put in position to restrict the in and out movement to any desired distance less than 3-3/4 inches. With this arrangement the head can be slid in and out after each pass without loosening any nuts or clamps.

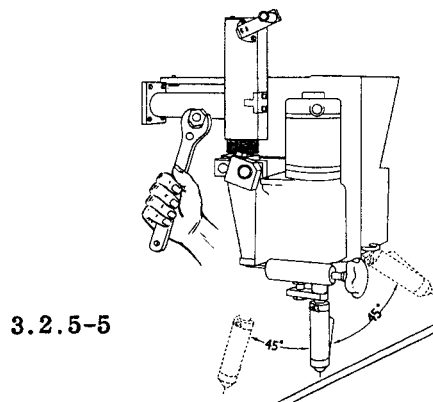
Sec. 3.2.5 (Continued)

4. CROSS SEAM COARSE POSITIONING



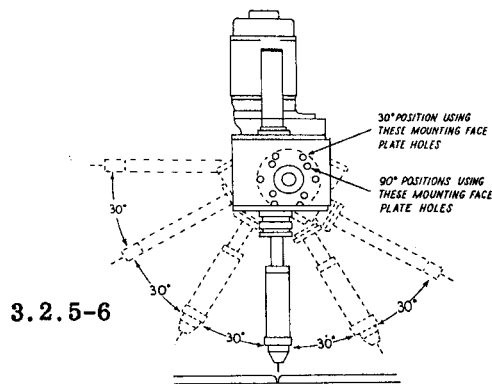
Head and flux hopper can be swung across the seam for coarse positioning as shown in Figure 3.2.5-4. With a LAF, "A" dimension is 25° if a vertical head adjuster is used or 40° for standard mountings. With a NA-1, "A" dimension is 15° if a vertical head adjuster is used or 35° for the standard mounting.

5. ALONG SEAM POSITIONING



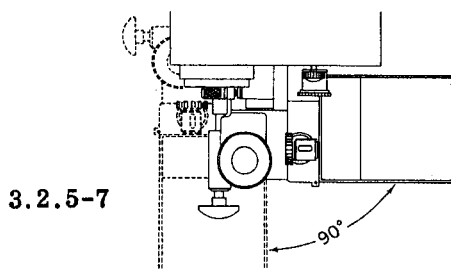
Loosening the hex head nut as shown in Figure 3.2.5-5 permits the head and hopper to swing 45° in either direction for along the seam positioning. If a vertical head adjustment assembly is installed, the head adjustment lock must also be loosened to make this adjustment. Be careful when making this adjustment as the head tends to swing itself as soon as the locking pressure is loosened. If the head is operated at more than 45° from the vertical, check the oil level to be certain the oil cannot run into the motor and ruin the windings.

6. ELECTRODE POSITIONING FOR 3 O'CLOCK



The wire feed box and wire straightener swing 360° in 30° increments relative to the stationary gear box. This permits angular positioning as shown in Figure 3.2.5-6.

7. ROTATION OF HEAD



Head and hopper rotate 90° on a vertical axis as shown in Figure 3.2.5-7. This is particularly useful when welding a longitudinal seam and a roundabout on one piece when using contact jaws. This adjustment is not generally necessary for NA-1 installations.

OPERATION OF STANDARD EQUIPMENT - CONT'D.

Sec. B3.2.6

Inching the Electrode

The Inch Up and Inch Down buttons on the NA-1 main control panel inch the electrode up and down respectively for set up operations. The electrode is electrically "cold" during this operation. Unlike the LAF-3, the electrode does not stop automatically when it touches the work. When operating these two buttons, the speed of inching "cold" is altered by changes in both the Current Control and Inch Speed Control.

The primary function of the Inch Speed control on the NA-1 main control panel is to set the inching speed of the electrode after the start button is pushed. The electrode is electrically "hot" after the start button is pushed. The speed at which the electrode approaches the work is critical. Normally, the inching "hot" speed should be slightly less than the feeding speed of the electrode while welding. With the Inch Speed dial set at #1, the inch speed is considerably less than the feed speed while welding. With the Inch Speed dial set at #11, the Inch Speed is equal to the feed speed while welding.

2-1-60

Sec. B3.2.7

Starting the Arc

When the work is set up, turn the Travel switch to Automatic. Push the Arc Start button to start the arc.

The NA-1 is designed to always start "hot". That is, the electrode is electrically hot as it approaches the work after the Arc Start button is pushed.

As shipped from the factory, the NA-1 is wired for on-the-fly starting. That is, the travel starts the instant the arc start button is pushed so there is relative motion between the head and work when the arc is started. The travel stops the instant the Stop button is pushed. This starting characteristic is

commonly used in applications where the weld makes a complete cycle, stopping at the starting point.

For applications where the weld must be started at a particular spot, the NA-1 can be rewired for "standstill" starting (see Sec. B2.4.6). In this type starting, the travel starts the instant the arc starts so there is no relative motion between the head and work as the electrode inches down before starting.

When desired, a timer can be wired in the circuit. See Sec. B2.4.8 for installation instructions. With this setup, the timer stops the weld after a set length of time without the necessity of the operator pushing the Stop button. This is particularly useful for applications such as roundabouts, where the weld makes a complete cycle, stopping at the starting point.

An O.C.V. of 30-35 volts provides the best starting characteristics for most applications. Higher O.C.V. gives more consistent starting but the starts have more spatter. If the O.C.V. is lowered to the welding voltage the tendency to miss or stub is greater.

To change the O.C.V. adjust the Voltage Control rheostat on the SAN power source control box. The O.C.V. is generally set when the SAN is first installed and later changes are not often required. Remember however, changing the O.C.V. also changes the arc voltage. Adjust the Voltage Control on the NA-1 control box to compensate for any changes in arc voltage. To check the O.C.V. remove the electrode from the NA-1 head. Push the Start button and read the O.C.V. on the voltmeter. Be sure you push the Stop button before rethreading the electrode.

NOTE: To adjust the O.C.V. on SAN power sources of Code No. 4164 and lower, rewiring within the control box is necessary. See Sec. B2.6.1 for these instructions.

2-1-60

Sec. B3.2.8

Stopping the Weld

Pressing the Stop button on the NA-1 main control panel begins the stopping cycle. Two time delay relays operate after the Stop button is pushed. The first fills the crater and the second keeps the electrode from sticking in the crater. Both delay relays operate before the circuit is dead.

The controls on the sub-control panel affect the weld only after the Stop button is pushed. There are three controls on the sub-panel:

1. The Current Control for Crater Filling or Overlapping -- controls the welding current from the time the Stop button is pushed until the Time Delay for Crater Filling or Overlapping is timed out. Current is adjusted for equal to or less than the welding current.
2. The Time Delay for Crater Filling or Overlapping -- controls the length of time the unit continues to weld after the Stop button is pushed. Maximum time delay is about six seconds. It is set for whatever time is required to fill the crater or give proper overlap.
3. The Time Delay to Prevent Electrode Sticking in Crater -- holds the welding line contactor in until the wire feed motor slows down sufficiently so the electrode does not stick in the crater. It begins operating after the Time Delay for Crater Filling or Overlapping is timed out. When the first delay relay de-energizes the wire feed motor, the welding current starts to drop off rapidly. This second relay should be set to stop the welding current when the current drops to about 300 - 400 amperes. Maximum time delay is about 2 seconds.

2-1-60

Sec. B3.2.9

Stopping the Travel

As shipped from the factory, the NA-1 is wired so the travel motor stops the instant

the Stop button is pushed. It can be rewired (See Sec. B2.4.7) so the travel continues until the arc goes out spreading the high heat of the finish over a larger area.

Generally, if you have a large crater to fill at the end of the weld, the standard arrangement is better. If you have trouble with burn throughs at the end of the weld, stopping the travel when the arc goes out is better.

2-1-60

Sec. B3.2.10

Sequence of Operation and Test Weld

1. With the Travel Control switch on the NA-1 control panel off, start the SAN power source and the 35 volt motor generator. Set the SAN polarity switch for positive polarity. Set the Voltage Control on the SAN control box to the 1 o'clock position.
2. Set the controls on the NA-1 main control panel. For a test weld, set the Voltage Control in the 9 o'clock position. Turn the Current Control to #4.5 and the Inch Speed control to #10.
3. The controls on the sub-panel are set at the factory and should not be adjusted for a test weld. The factory setting of these controls is as follows: the Current Control for Crater Filling and Overlapping is set at maximum; the Time Delay for Crater Filling or Overlapping is set on minimum time and fill; and the Time Delay to Prevent Electrode Sticking in Crater is set for about one second.
4. Turn the Travel Switch to Hand Travel and set the desired travel speed. For a test weld, set the Travel Speed at approximately 125-150"/min. Turn the Travel Switch to Automatic Travel. Set the travel direction switch for the proper direction of travel.
5. Insert the electrode into the wire straightener and push it down to the drive rolls. Press the Inch Down button and push the electrode into the drive rolls until it starts feeding down. Inch the electrode down until it comes out the con-

OPERATION OF STANDARD EQUIPMENT - CONT'D.

Sec. B3.2.10 (Continued)

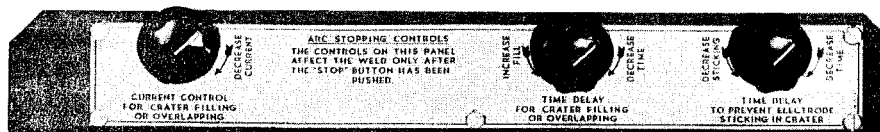
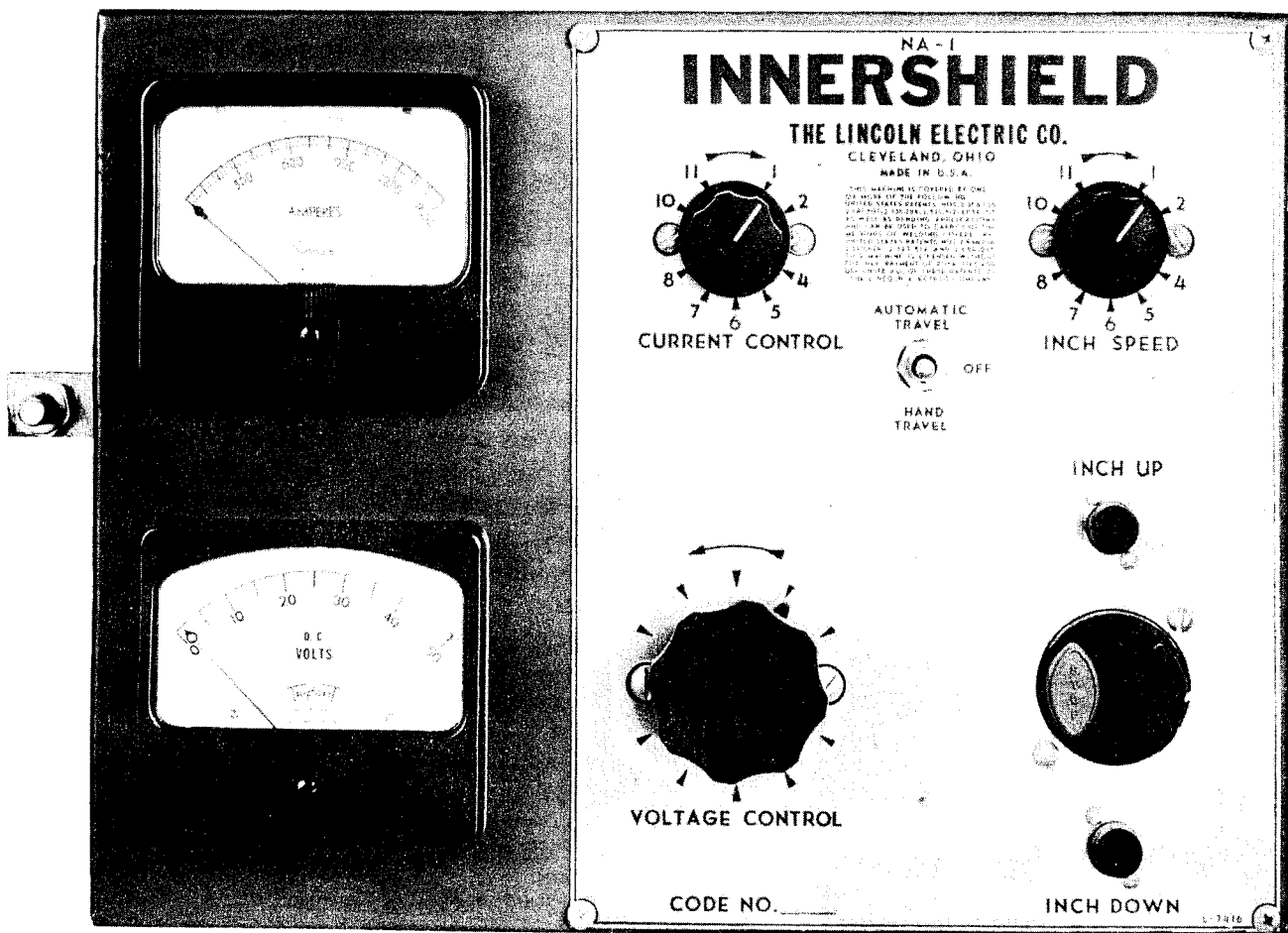
tact assembly. Clip at least 12" off the end of the electrode near the contact assembly.

6. Adjust the head for the proper drag angle and electrode stickout.
7. Set up, clamp and ground the work at the finish end. For a test weld, use a piece of mild steel plate 1/4" thick or thicker.
8. Press the Start button and proceed with

the weld. Welding current and voltage are indicated on the meters on the NA-1 control box. At the end of the weld, push the Stop button.

When making a test weld, quickly adjust the voltage to 24 to 25 volts. Then adjust the current to 700-800 amperes. Settings for an actual application can easily be adjusted from these values once you determine that the machine is operating properly.

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SEC. B6 MAINTENANCE INSTRUCTIONS

Sec. B6.1 Contents

Head and Controls	6.2
Gear Case Lubrication	6.2.1
Wire Drive Mechanism	6.2.2
Controls	6.2.4
Spare Parts	6.2.5
Gear Box Disassembly	6.2.6
Contact Nozzle	B6.2.7
Vertical Head Adjustment	B6.2.8
Travel Carriage	6.3
Trouble Shooting	B6.11



SEC. 6.2 HEAD AND CONTROLS

Sec. 6.2.1

Gear Case Lubrication

The wire feed drive gear case oil should be changed about once a year. To do this remove the motor and the drain plug. Drain and flush the gear case thoroughly. Replace the drain plug and fill with oil to the proper level as marked on the caution plate. For operating at temperatures above 60°F use SAE140 oil or the equivalent. For temperatures below 32°F use SAE 90 oil. Use either grade when operating at temperatures between 32°F and 60°F.

No other lubrication is necessary for proper maintenance of the welding head.

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Sec. 6.2.2

Wire Drive Mechanism

The electrode is driven by gripping the wire between knurled grooved driving rolls and a spring loaded idle roll. When operating properly the drive rolls make definite indentations in the electrode. To inspect the drive rolls, loosen the thumb screw behind the flux hopper. With this screw loose the flux hopper swings out on a hinge. The drive rolls have two sets of teeth so they can be reversed when the first set becomes worn.

12-15-59

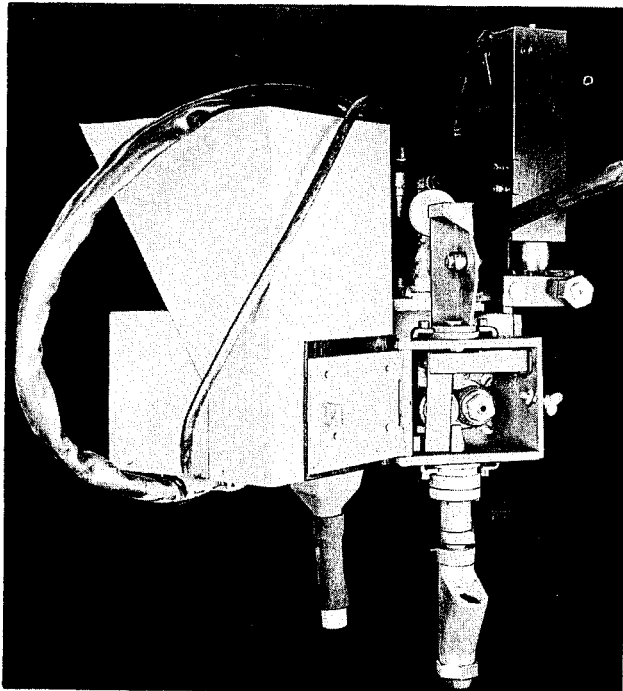


Fig. 2.6.4-1 View of drive roll box with door open.

Sec. 6.2.3

Wire Straightener, LAF Only

The top slide bushing (item 28 in the parts list) and the incoming wire guide (item 4) should be inspected periodically for signs of wire milling. The slide bushing can be reversed. Remove the cross adjustment screw (item 25), turn the slide bushing over and reassemble the adjustment screw.

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Sec. 6.2.4

Controls

a. Control Box

Inspect and clean the control box every three months. No other regular maintenance of the control box is required.

b. LAF-3 Field Relay

The field relay is installed in the control box of power sources used with the LAF-3. It is important to keep the relay free of dust. Be certain to replace the cover after cleaning.

12-15-59

Sec. 6.2.5

Spare Parts

We recommend that you keep the following spare parts on hand:

- 1 set of drive rolls S-10110
- 1 upper wire guide S-10168, LAF only
- 1 wire straightener bushing T-10584, LAF only
- 1 wire straightener, K-52 specify wire size, NA-1 only
- 1 set of motor brushes for each motor

When ordering motor brushes, give the code number of the head and the nameplate data on the motor.

12-15-59

Sec. 6.2.6

Gear Box Disassembly

a. Disassembly

Should it become necessary to disassemble your wire feed or carriage drive gear box follow these instructions. The numbers used refer to the item numbers used on the gear box parts lists.

1. Remove motor assembly (item 191). Drain the oil from the gear box cavity. Use care so as to avoid damage to gaskets. If damage does result, replace.

Sec. 6.2.6 (Continued)

2. Remove dust cap (180).
3. Remove the small bearing cage (184). To remove small bearing cage, push the cross shaft (199) by hand toward the small bearing cage, just far enough to be able to grip the outer diameter of the small bearing cage. Pull the small bearing cage off the bearing by hand. Since the bronze worm gears may be in contact with each other at this time, do not force or pry this small bearing housing off, otherwise the gear teeth may be damaged.
4. After the small bearing cage has been removed, push the cross shaft back through the gear box housing until the bearing on the dust cap end comes completely through the bearing housing. Leave the cross shaft suspended in this position until the output shaft is removed.
5. Remove the screws which hold the dust cap (176) and the output bearing cage (187).
6. Remove the dust cap. Push the output shaft assembly out of the gear box housing by hand.
7. Insert the cross shaft bearing back into its housing and then push the cross shaft, by hand, out of the housing.
8. All gears are keyed to their respective shafts, with the exception of the motor pinion which is pinned. All bearings are press fits to their respective shafts.
9. If the large bearing cage is removed from the output shaft, care must be taken to protect the grease seal (190) from being damaged when sliding it over the keyway slot. A layer of paper or cellophane tape will afford this protection.

b. Reassembly

1. Insert cross shaft (199) back into the housing. Push the shaft through until the bearing on the far end comes completely through the housing. Leave the shaft suspended in this position until the output shaft is installed.

2. Assemble these parts in the following order:
 - a. Output shaft assembly.
 - b. Large bearing cage gasket (180).
 - c. Large bearing cage (188). Protect grease seal when cage is slipped over the shaft.
 - d. Install the six screws (189) which hold large bearing cage.
 - e. Install gaskets* (177 & 178), dust cap (176), and mounting screws. Check shaft for a small amount of end play (.001" to .005"). This is adjusted by adding or subtracting gaskets on the dust cap end.
 - f. Push cross shaft back to its normal position.
 - g. Install small bearing cage gasket (185), small bearing cage (184) and the four mounting screws.
 - h. Install gaskets* (177 & 178), dust cap (180), caution nameplate (181) and the four mounting screws. Check cross shaft for a small amount of end play (.001" to .010").
 - i. Fill gear box with T-8484 oil to the proper level.
 - j. Install motor gasket (209), motor assembly (191) and the three motor mounting screws.

*Both .005 and .010 inch thick gaskets are used.

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HEAD AND CONTROLS - CONT'D.

Sec. B6.2.7

Contact Nozzle

Be sure the nozzle contact shoe (Item 9) rides solidly on the electrode. Replace the shoe before it is worn sufficiently to ride against the nozzle tip instead of against the electrode. Life of the shoe depends largely upon the condition of the electrode and the amount of current being used.

After finishing each coil of electrode, brush or knockall spatter and dust off the nozzle tip. Make certain the contact shoe moves in and out as the electrode is inched into and backup out of the tip.

Should the nozzle tip be fused over, remove the tip and redrill per the following table:

<u>Wire Size</u>	<u>Nozzle Tip Size</u>	<u>Drill Size</u>
1/8"	S-10828-8	#29 (.101)
5/32"	S-10828-10	#20 (.161)

We recommend that you keep 2 spare tips and 6 spare shoes (part number T-10980) on hand.

Be sure the brass rivet on the spring assembly makes good electrical contact with the shoe. Also be sure the copper strap makes good electrical contact with the spring holder block. Keep the electrical connections bright.

The socket head screw (Item 2) holding the nozzle body to the insulator must be kept tight. Should it loosen, remove the nozzle from the head. Tighten the screw and reinstall the nozzle. The electrode cables can remain attached during this operation.

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Sec. B6.2.8

Vertical Head Adjustment

Every month: Add a few drops of SAE-140 oil or equivalent to the oil cup on the back of the vertical lift housing. (SAE-140 is the same oil that is used in the gear box.)

Every year: Replace the grease in the top section (gear cavity) with a medium grease.

Should the unit be disassembled for cleaning, lubricate as follows: Apply a layer of medium grease to the screw threads of the head lift tube (Item 2) and the head lift screw (8). Apply a thin layer of grease to the O.D. of the head lift tube and to the I.D. of the long hold in the head lift body (1). Slide the head lift tube into the head lift body. Screw in the head lift screw. Fill the upper section (gear cavity) 1/2 full of grease. Be sure the needle bearings are packed with grease.

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SEC. 6.3 CARRIAGE, LAF & NA-1

a. Lubrication

The carriage drive gear case oil should be changed about once a year. To do this remove the drive unit from the carriage. Remove the drive motor and the drain plug. Drain and flush the gear box thoroughly. Remove the output shaft dust cap (item 176) and wipe some clean bearing grease into the bearing. Replace the dust cap.

Replace the motor and the drain plug. Reassemble the drive unit on the carriage. With the carriage on the beam fill the gear case with oil as per instructions in Sec. 2.4.12.

For operating at temperatures above 60°F. use SAE 140 oil or the equivalent. For temperatures below 32°F. use SAE 90 oil. Use either grade when

operating at temperatures in between 32°F and 60°F.

Should it become necessary to disassemble the gear box, follow the instructions in Section 6.2.6.

Oil the following parts with a light machine oil once a week:

- (a) Clutch handle bearings
- (b) Gear box pivot points
- (c) Pins and bearings on the mechanism which raises and lowers the welding head.

b. Carriage Control Box

Clean and inspect the control box every three months. No further maintenance should be required.

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SEC. 6.4 TRACTOR, LAF ONLY

Lubrication

The tractor drive gear case grease should be changed about once a year. Remove the old grease. Flush out both the spur and worm gear compartments. Pack the compartments with a Keystone #45 grease or the equivalent. In cold weather do not use a lighter grease in the worm gear com-

partment. The heat from the seam passing under the gear box will thin lighter grease to the leaking point.

Grease the rear axel bearings and the front wheel bearings about once a week. Apply a light oil to the splined shaft and the clutch shaft bearing every few days.

12-15-59

SEC. B6.11 TROUBLE SHOOTING

TROUBLE	REMEDY
1. Electrode will not inch in either direction.	a. Control Exciter may not be turned on. b. Check to be certain Current Control and Inch Rheostats are not set for minimum.
2. The electrode sticks at the start of the weld.	a. Inching speed may be set too high. b. Arc voltage may be set too low. c. Be sure the head and work are rigidly mounted.
3. The control box meters read backwards.	a. When shipped the meters are connected to read properly with the electrode positive. Check the power source polarity switch and the polarity of the machine.
4. Carriage will not run or runs at an uneven speed in one direction only.	a. Check for a loose plug. b. Check the carriage fuses. Be certain only the right type fuses are used.
5. Wire continues to feed after Arc Stop button is pushed.	a. This is normal. To reduce the time the electrode continues to feed, reduce the setting of the "Time Delay for Crater Filling or Overlapping" relay on the control panel inside the control box. Maximum time delay is six seconds.

SEC. B8 DIAGRAMS

Sec. B8.1 Contents

This section contains the wiring diagrams and dimension prints required for most Innershield automatic welding set-ups. For special diagrams covering special set-ups or combinations of equipment not included in this manual, write to the Lincoln Electric Company, Application Engineering Department. Give all details of the set-up and all nameplate data of the equipment involved.

The diagrams are listed in simple categories in the index for ease in finding the desired diagram number. The printed diagrams are arranged in alphabetical-numerical order in the section.

WIRING DIAGRAMS

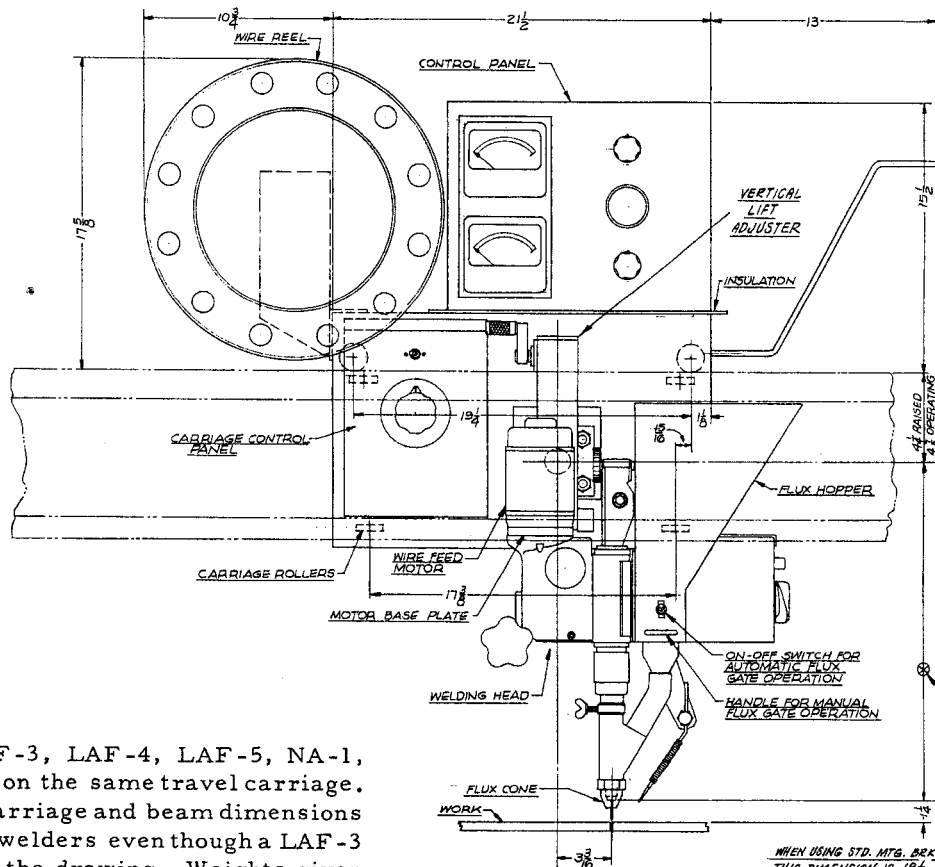
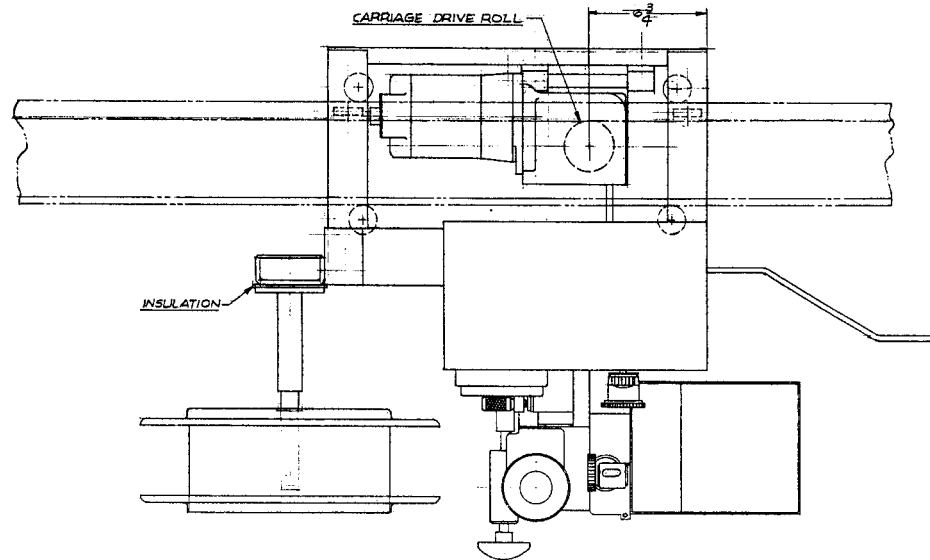
NA-1 Control Box	L-3442
NA-1 Control Circuit Schematic	M-8854
NA-1 Connection to SAN-900 or 1100	M-8856
Travel Carriage Control Circuit	M-8383
SAN-900 or 1100	See M-8857 included with SAN-1100 Instruction Manual IM-231.

DIMENSION PRINTS

NA-1 Head	L-3476
NA-1 Control Box	M-8907
Travel Carriage and Carriage Beam	G-1061



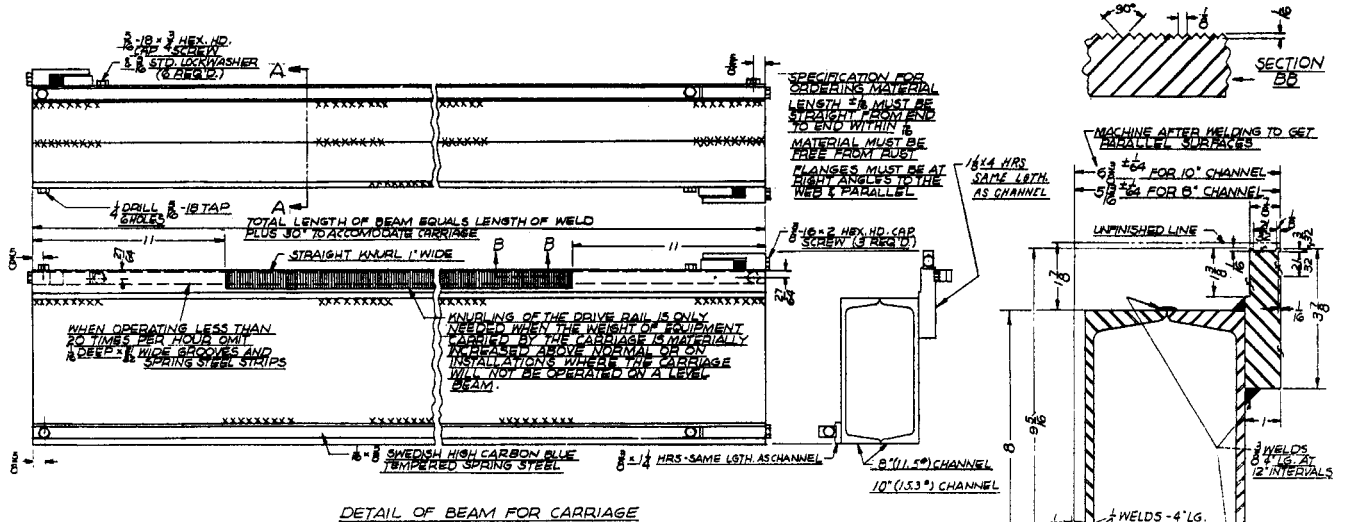
TRAVEL CARRIAGE



NOTE: The LAF-3, LAF-4, LAF-5, NA-1, and NA-2 all fit on the same travel carriage. Therefore, all carriage and beam dimensions apply to all five welders even though a LAF-3 is illustrated on the drawing. Weights given apply to the LAF-3.

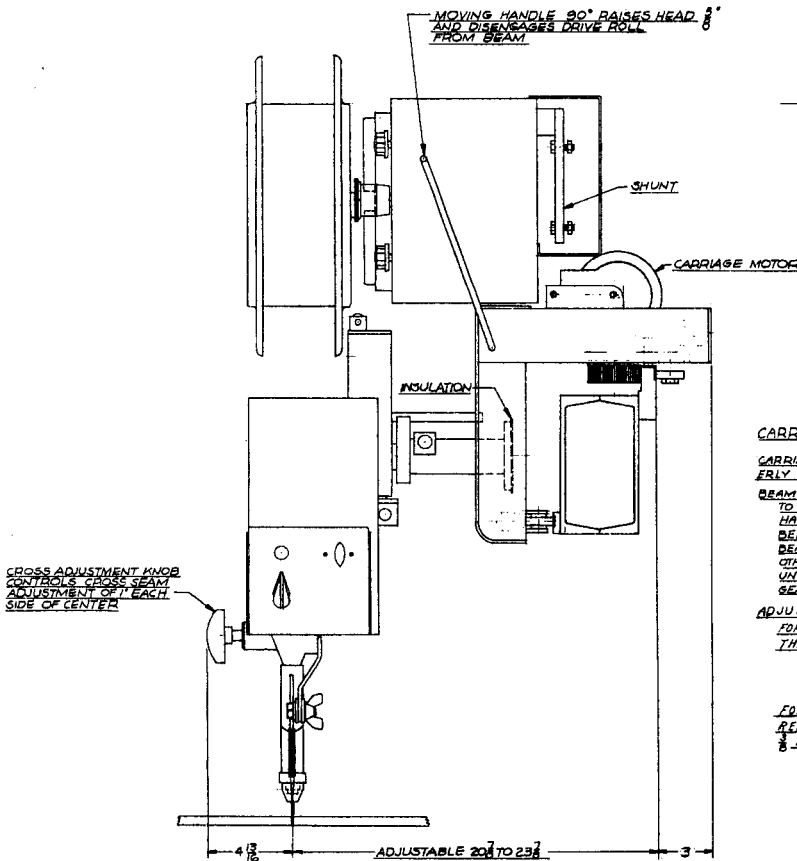
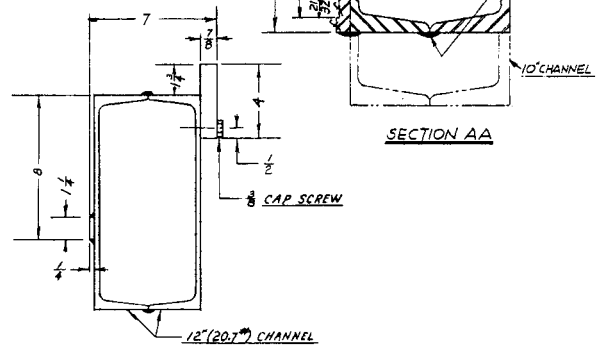
WHEN USING STD. MFG. BCKT. (NOT SHOWN)
 THIS DIMENSION IS 19 1/4"
 WHEN USING VERTICAL LIFT ADJUSTER (OPTIONAL
 FEATURE SHOWN) THIS DIMENSION CAN BE VARIED
 FROM 19 1/4" TO 23 1/4"

and Carriage Beam



DETAIL OF BEAM FOR CARRIAGE

SECTION AA



WEIGHT, LBS.

CARRIAGE & HEAD MFG. BRKT.	117#
WELDING HEAD & NOZZLE	71#
CONTROL PANEL	56#
REEL & SUPPORT	28#
ELECTRODE CAPACITY	60#
FLUX CAPACITY	20#
HEAD LIFT	20#

CARRIAGE LEVELING & ADJUSTMENT INSTRUCTIONS

CARRIAGE AS SHIPPED IS ASSEMBLED SUCH THAT IT WILL FIT PROPERLY ON AN "A" BEAM HAVING A $\frac{1}{8}$ " WIDE FLANGE WITH NO KNURL.

BEAMS WITH KNURLED OR NON-STANDARD FLANGES: TO OBTAIN THE BEST BEAM AND DRIVE ROLL LIFE ON BEAMS WHICH HAVE $\frac{1}{8}$ " WIDE KNURLED FLANGES, REMOVE THE $\frac{1}{16}$ " SHIM FROM BEHIND EACH DRIVE UNIT MOUNTING BLOCK, TO OBTAIN THE BEST BEAM & DRIVE ROLL LIFE ON BEAMS WHOSE FLANGES ARE SOME OTHER DIMENSION, ADD OR REMOVE SHIMS BEHIND THE DRIVE UNIT MOUNTING BLOCKS UNTIL THE FACE OF THE KNURLED DRIVE GEAR IS FULLY SEATED ON THE BEAM FLANGE.

ADJUSTING CARRIAGE TO FIT TRAVEL BEAM.

FOR USE WITH STANDARD TRAVEL BEAMS.

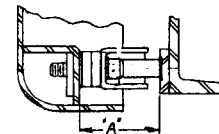
THE DIMENSION "A" SHOULD BE AS FOLLOWS:

- FOR AN 8" BEAM THE DIMENSION "A" SHOULD BE 2 1/4"
- FOR A 10" BEAM THE DIMENSION "A" SHOULD BE 2 1/4"
- FOR A 12" BEAM THE DIMENSION "A" SHOULD BE 1 1/4"

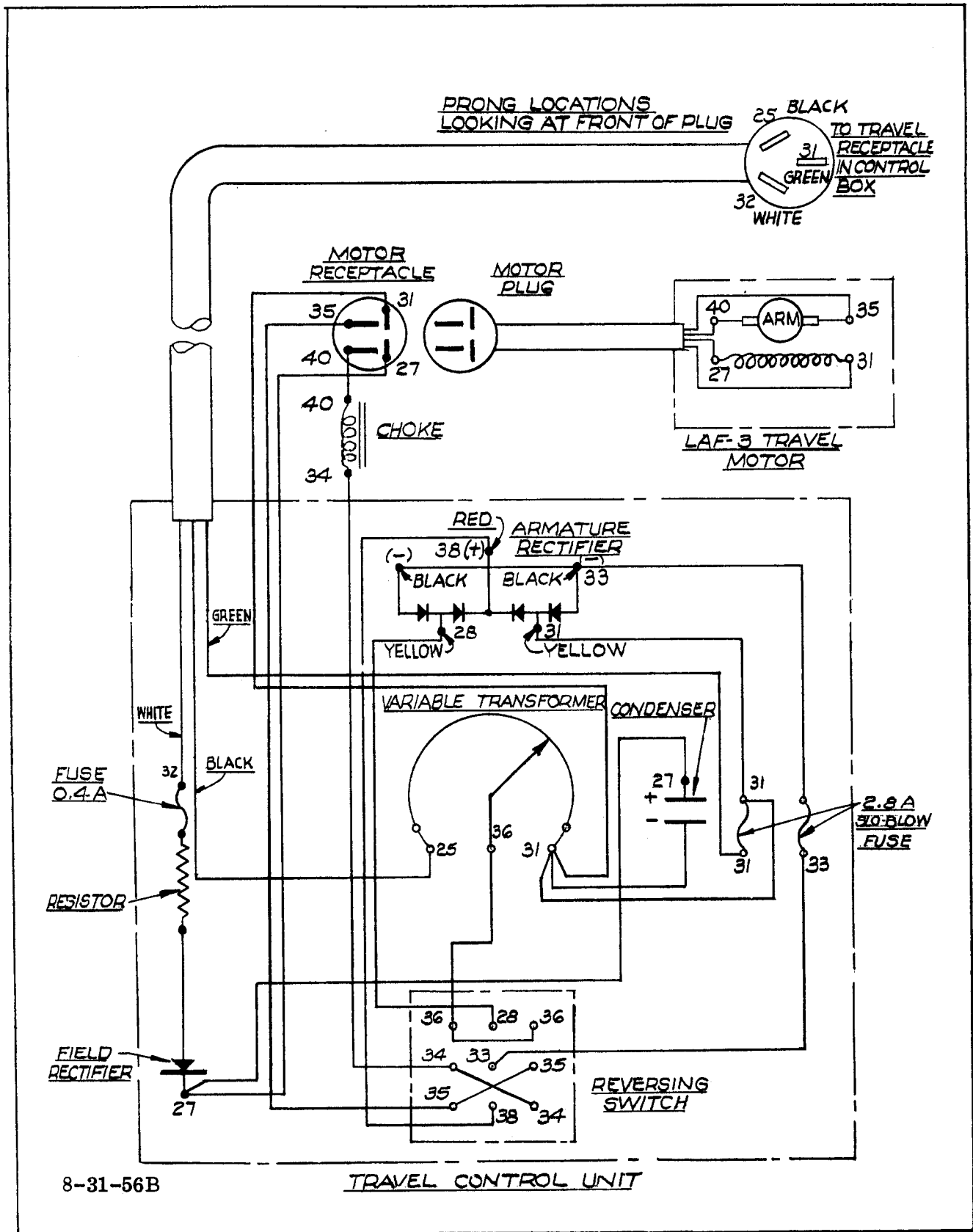
FOR USE WITH NON-STANDARD TRAVEL BEAMS

REMOVE ONE OF THE SPACERS AND THEN USE $\frac{1}{8}$ " FLAT WASHERS TO SHIM UNTIL THE CARRIAGE IS LEVEL.

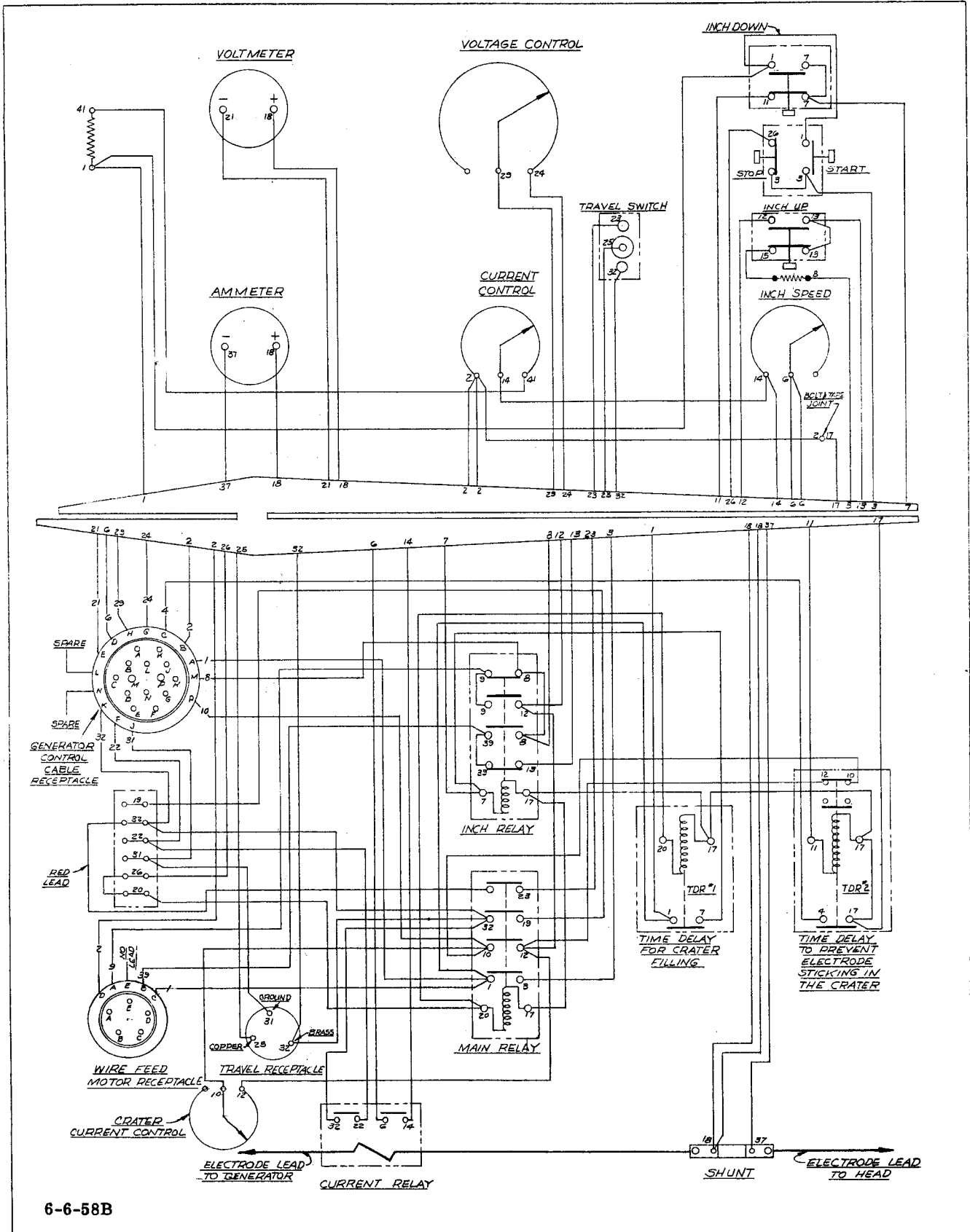
VIEW SHOWING LOWER CARRIAGE ROLL ASSEMBLY



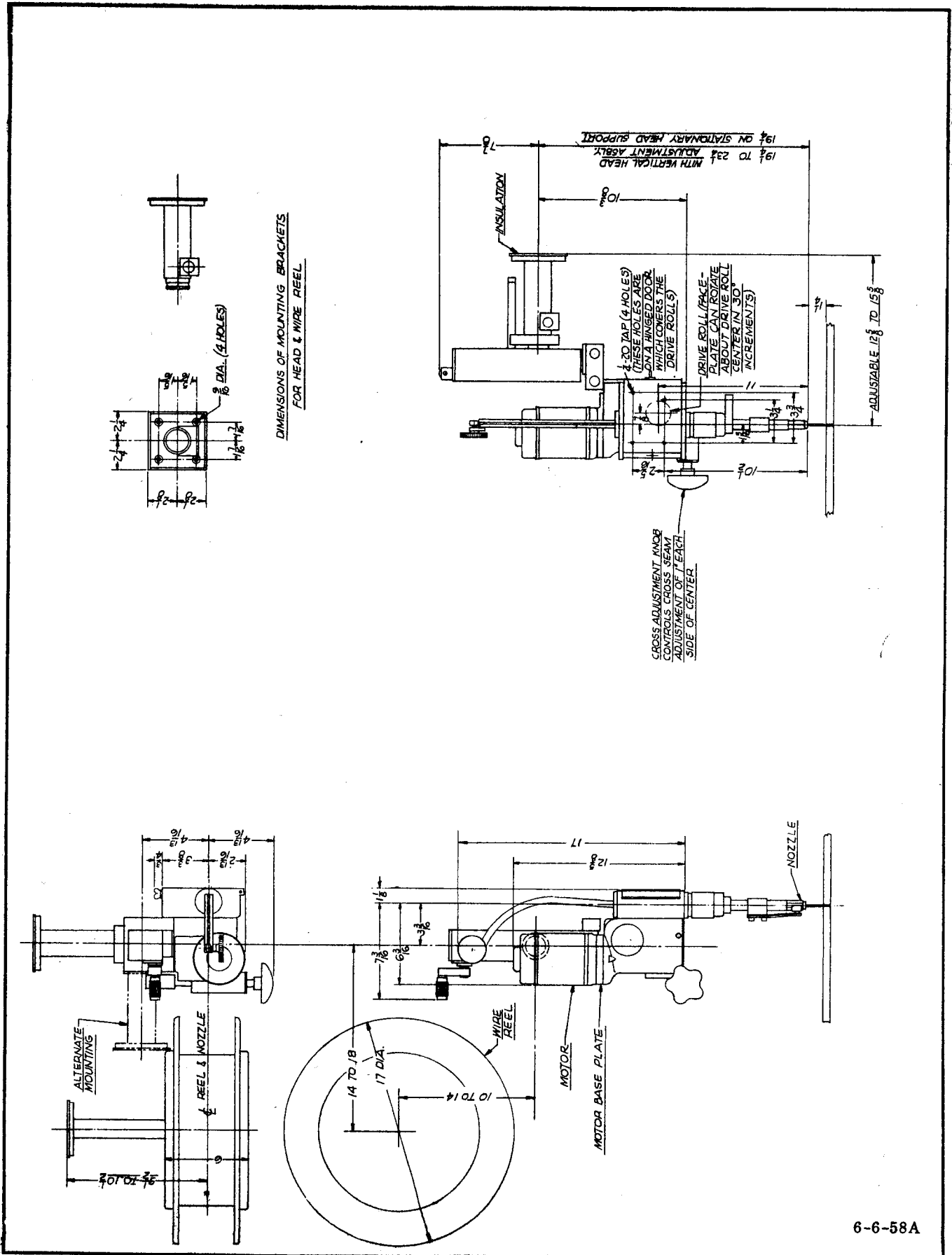
Travel Carriage Circuit



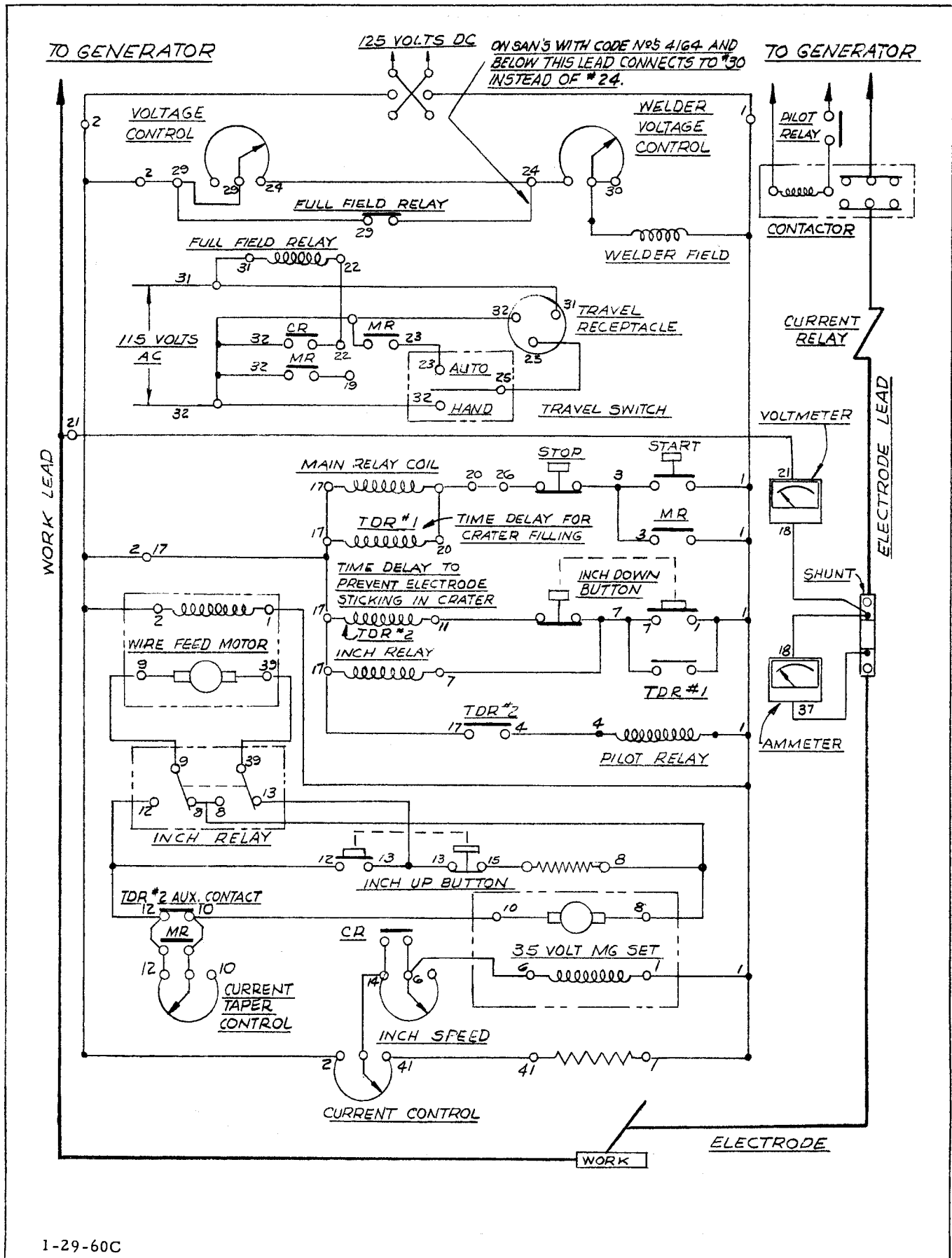
NA-1 Control Box



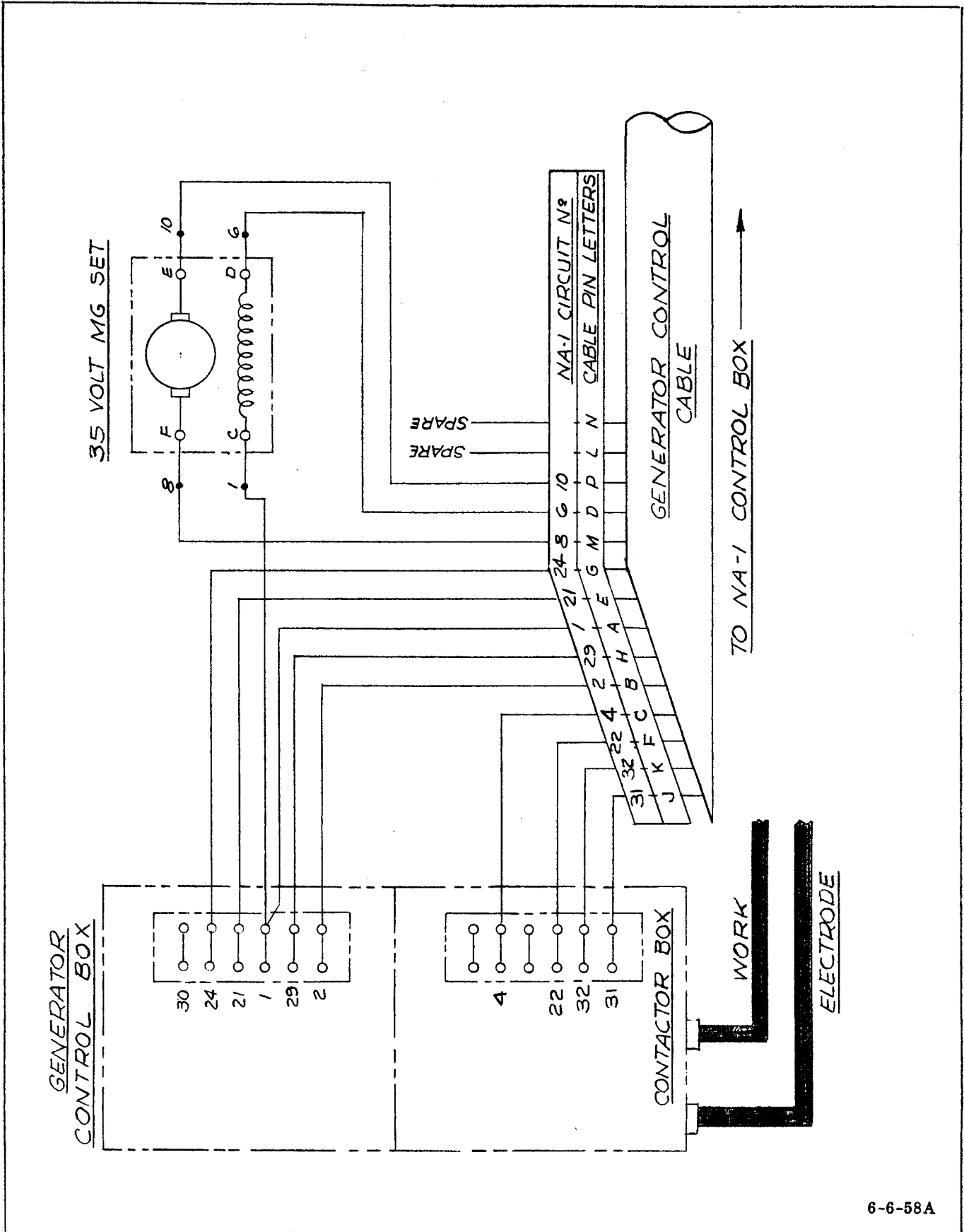
NA-1 Head



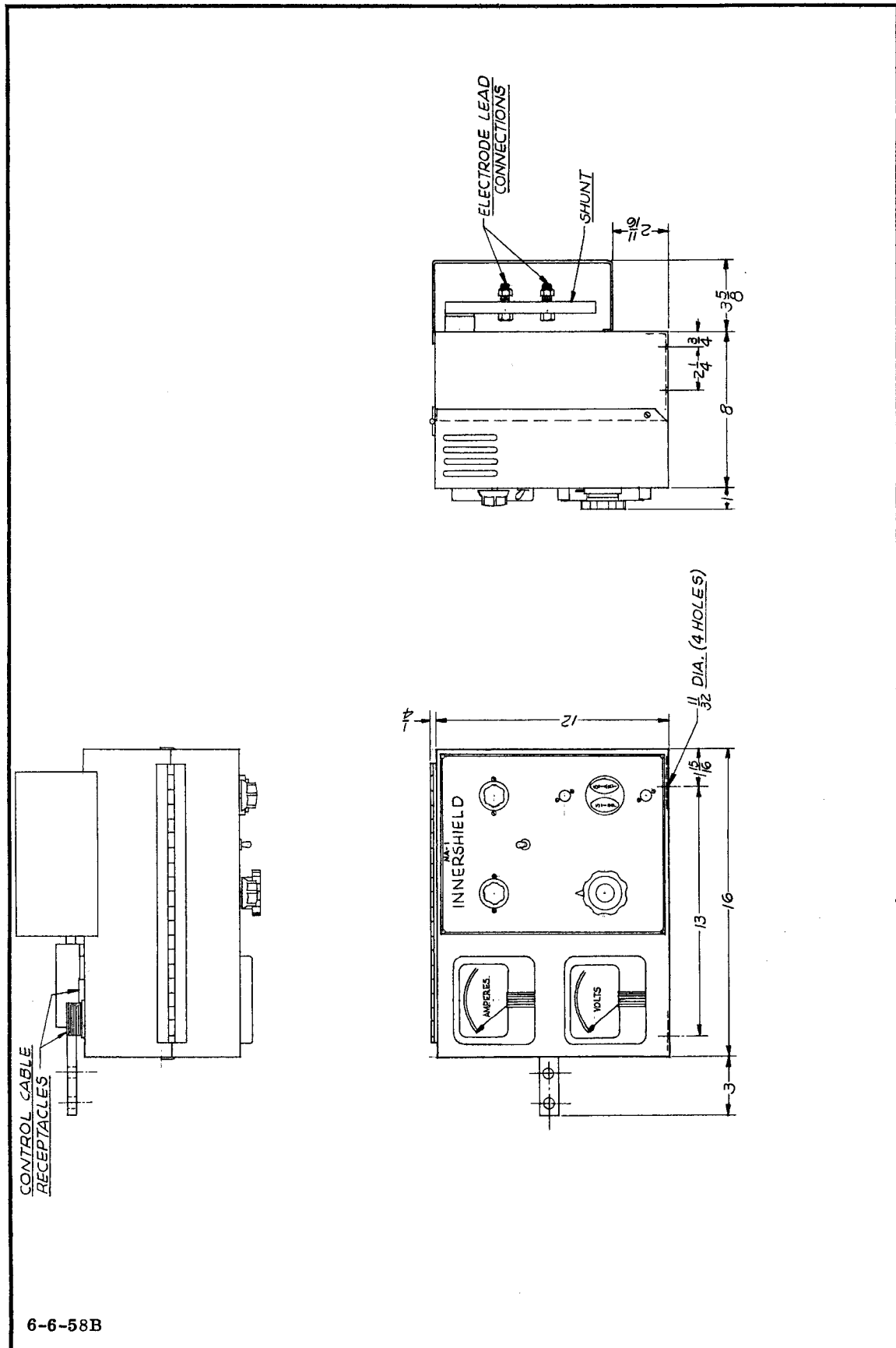
NA-1 Control Circuit Schematic



NA-1 Connection to SAN-900 or 1100



NA-1 Control Box



HOW TO ORDER REPLACEMENT PARTS

All parts should be ordered from Authorized Field Service Shops or branch offices. The "Field Service Directory" listing all Authorized Field Service Shops geographically is supplied with each machine or is available upon request. These shops stock GENUINE replacement parts and have factory trained men to service your machine.

In ordering replacement parts give the following information:

- (a) From the machine nameplate - Machine model, code number and serial number.
- (b) From the Instruction Manual - Part name, item number, quantity required, and the number of the parts list used to get this information. To obtain this information refer to the pictures of the machine shown in this manual and find the required part and its item number. Get the part name and quantity required from the accompanying parts list.

All items in the parts lists which are indented in the parts name column are integral parts of the assembly which they are listed immediately under. If the entire assembly is required, do not order the indented items as they will be supplied as part of the assembly. The indented parts may be ordered separately if only parts of the assembly are required.

SAFETY PRECAUTIONS

When using a welder, as with all machinery, certain safety precautions should be observed:

- (1) Protect the arms and hands from rayburns and hot slag by wearing good leather gloves whenever welding.
- (2) Wear a good shield fitted with the proper safety lenses to protect your eyes from sparks and arc flash.
- (3) Use extreme care whenever chipping slag that chips do not fly and hit your eyes or those of your helper.
- (4) Although, with rated input, this welder will have a maximum output voltage well within prescribed safety limits, carelessness can result in a serious accident. Be Careful.
 - (a) Ground the welder frame.
 - (b) Use a well constructed, properly insulated electrode holder connected to the welder by insulated welding cable.
 - (c) Make certain the work is well connected to the ground cable, as close to the point of welding as possible. This is particularly important when standing on wet ground or a metal framework. Under such conditions be sure you are well insulated from the ground by dry gloves and rubber sole shoes.
 - (d) The electrode holder should be used for welding and not for lighting cigarettes.
- (5) Provide adequate ventilation for weldor.

WARRANTY

The Lincoln Electric Company, Cleveland, Ohio, the Seller, warrants all new equipment except engines and accessories thereof, against defects in workmanship and material for a period of one year from date of shipment, provided the equipment has been properly cared for and operated under normal conditions. Engines and engine accessories are warranted free from defects for a period of ninety days from the date of shipment.

If the Buyer gives the Seller written notice of any defects in equipment or electrode within any period of warranty and the Seller's inspection confirms the existence of such defects, then the Seller shall correct the defect or defects at its option, either by repair or replacement at its own factory or other place as designated by the Seller.

No expense, liability or responsibility will be assumed by the Seller for repairs made outside of the Seller's factory without written authority from the Seller.

The Seller shall not be liable for any consequential damages in case of any failure to meet the conditions of any warranty. The liability of the Seller arising out of the supplying of said equipment or electrode or its use by the Buyer whether on warranties or otherwise, shall not in any case exceed the cost of correcting defects in the equipment or replacing defective electrode in accordance with the above guarantee. Upon the expiration of any period of warranty, all such liability shall terminate.

The foregoing guarantees and remedies are exclusive and there are no other guarantees or warranties either expressed or implied.

THE LINCOLN ELECTRIC COMPANY

The World's Largest Manufacturer of Arc Welding Equipment and Electrodes
CLEVELAND 17, OHIO



Branch Offices, Field Service Shops, and Distributing Agencies in All Principal Cities

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Export Representatives

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