TECHNICAL MANUAL

ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOL LIST)

FOR

85’ AERIAL LADDER FIRE FIGHTING TRUCK

NSN 4210-00-965-1254

HEADQUARTERS, DEPARTMENT OF THE ARMY

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FOREWORD

Descriptions, instructions and parts listing pertaining to the Model QWT 85 are discussed throughout this manual under the general headings Chassis, Pump and Ladder. Foldout illustrations and schematics, other than those forming a part of a commercial manual are located at the end of this publication. The foldout format is provided in order that illustrations and schematics may be continuously refer-red to while the supporting text is examined and studied.

A detailed description is given in the Introduction of each Part of the manual to assist the user in finding the information required to main the equipment.

- Operator's Manual (TM 5-4210-227-10)
  This manual is designed to provide the information necessary for a fire fighter or mechanic to properly operate the truck, the pump and the ladder.

- Maintenance Manual (TM 5-4210-227-24&P)
  This manual contains the information necessary for an experienced mechanic to maintain and repair all facets of the apparatus. This manual also contains all the information necessary to obtain assemblies and subassemblies. or individual parts, required to repair and maintain the fire truck.

MAINTENANCE MANUAL

SECTION 1

1. INTRODUCTION/TABULATED DATA

1.1. INTRODUCTION

1.1.1. TM 5-4210-227-24&P, Organizational, Direct Support, and General Support Maintenance Manual for the 85' Aerial Ladder Fire Fighting Truck is divided into eight volumes. These eight volumes are further subdivided into specific sections consisting of both Government and commercial literature. TM 5-4210-227-10, Operator's Manual for the 85' Aerial Ladder Fire Fighting Truck is one separate manual consisting of four separate sections.

1.1.2. This volume consists of nine sections and is arranged as follows:

1. Introduction/Tabulated Data
2. Chassis Assembly
3. Pump Assembly
4. Ladder Assembly
5. Hydraulic System
6. Electrical System
7. Pneumatic System
8. Ladder Calibration and Adjustments
9. Illustrations

1.2 TABULATED DATA

a) Fire Truck

Federal Stock Number:	4210-00-965-1254
Manufacturer's Serial No.:	
Registration Nos.:	CM3653 through CM3664
Manufacturer:	Pierre Thibault Inc.
Model:	QWT 85
Contract Number:	DAAJ10-84-A218
Truck Length:	459"
Truck Width:	108"
Truck Height:	138"
Capacity or Payload:	51,000 GVWR
Shipping Weight:	43,880
Ground Clearance:	10.25"
Weight Loaded:	45,940
Front Axle	19,740
Rear Axle	26,200

b) Chassis

Manufacturer:	Duplex
I.D. Number:	I.C. lD91 D31 D6F 1008468
Model:	D350
Wheel Base:	230"

c) Engine

Manufacturer:	Detroit Diesel
Model:	8V-71 Turbo
Serial Number:	8VA437868
Fuel:	Diesel

d) Transmission

Manufacturer:	Allison
Model:	HT-740
Serial No.:	2510087501
Capacity:	7 1/2 Gals

e) Firefighting Water Pump

Manufacturer:	Hale
Model:	QSM FHD100
Capacity:	1000 GPM @ 150 psi

f) Front Axle

Manufacturer:	Rockwell International
Model:	FL 941 QX-70
Capacity:	20,000 lbs.
Serial No.:	N766718

f) 1. Front Shock Absorbers

Manufacturer:	Duplex
Model:	7605-1258

f) 2. Front Springs

Manufacturer:	Duplex
Model:	7804-6731

g) Rear Axle

Manufacturer:	Rockwell International
Model:	U-170 PX-99
Capacity:	31,000 lbs.
Serial No.:	NW8454892

g) 1. Rear Suspension

Manufacturer:	Hendrickson
Model:	Single Axle RS-SA-340

h) Alternator

Manufacturer:	Delco Remy
Model:	1117152
Amp.:	145

i) Batteries

Manufacturer:	Harris
Model:	7605-0670
Voltage:	12

j) Battery Isolator

Manufacturer:	Sure Power
Model:	1602
Rated Power:	3709 BHP @ 2,100 rpm

k) Steering Gear

Manufacturer:	Sheppard
Model:	7605-5478

1) Power Steering Pump

Manufacturer:	Vickers
Model:	7605-5256

m) Windshield Wipers

Manufacturer:	American Bosch
Model:	WWC-12L
Type:	Electric

n) Radiator

Manufacturer:	Blackstone
Model:	7605-3950

o) Air Cleaner

Manufacturer:	FAAR
Model:	62891-3

p) Driver's seat

Manufacturer:	Bostrom
Model:	Four-Way Adjustable
Type:	Standard

q) Wheels

Front:

Manufacturer:	Firestone
Size:	22.5 x 16.5

Rear:

Manufacturer:	Firestone
Size:	20 x 8.5

r) Tires

Front:

Manufacturer:	Goodyear
Size:	16.5 R 22.5 18PR
Capacity:	20,000 lbs.

Rear:

Manufacturer:	Michelin
Size:	12:00 R 20X - 18 P.R.
Capacity:	31,000 lbs.

s) Muffler

Manufacturer:	Nelson
Model:	86130-21

t) AC Inverter

Manufacturer:	Dynamote
Model:	A40-120

u) Siren/PA

Manufacturer:	Code 3
Model:	3100

CAPABILITIES

Fire Truck

Turning Radius - Inside 31.5' - Outside 42.25'
Rated Power: 370 BHP @ 2,100 rpm
Engine Governor Setting: No Load - 2,100; Top Speed 58 mph
Acceleration: 0 - 35 mph - 14 Seconds
Braking: 20 to 0 mph - 15 feet
Angle of Departure: Front - 15 degrees;
Rear - 15 degrees

Pump

Single Stage Centrifugal
Midship Mounted
Driven by the truck engine from the output shaft of transmission
Min discharge - 1000 gpm @ 150 psi
Min discharge - 700 gpm @ 200 psi
Min discharge - 500 gpm @ 250 psi
From dry condition - take suction and discharge water in 30 sec. with a lift of 10 deg. through 20' of 6" suction hose
12 VDC Priming Pump
Water Tank - 200 gals.

Ladder

Basic Weight - 11,560 lbs.
Outrigger Operation Speed
Lower: Front - 9 sec. Rear - 18 sec.
Raise: Front - 9 sec. Rear - 18 sec.
Complete extension, elevation and 90 degrees rotation within 60 sec.
Hydraulic Tank: 45 gals. (Imp.)

2. CHASSIS ASSEMBLY

2.1 GENERAL

The Truck Fire Fighting Ladder 85' (QWT 85) has a hybrid chassis made up of a Duplex basic assembly and a body assembly manufactured by Pierre Thibault.

The complete Chassis Assembly consists of a Chassis Subassembly, a Cab Assembly and a Body Assembly (see Figure 2-1).

The components that make up the Chassis Subassembly and the Cab Assembly are listed under "Tabulated Data" in Section 1. The detailed descriptions and maintenance and troubleshooting procedures for the operable chassis components are contained in the commercial manuals.

2.2 TAB INDEX

A TAB index is provided at the beginning of the commercial section in Volume 2. If the information you desire concerns a body component not listed in the TAB Index, it is probably manufactured by Thibault and details of the assembly components will be found in the "Parts List."

3. PUMP ASSEMBLY

3.1 GENERAL DESCRIPTION

The pump assembly consists of a Hale centrifugal, single-stage pump with power shift and electric priming, and a pump control panel. Also included are miscellaneous items such as an automatic pump relief valve, a foam system, suction and discharge valves and couplings and drain valves. Power for the operation of the pump is provided by the engine through the drive shaft linkage. Power is transferred from the truck drive train to the pump by operating the pump control valve in the cab. The paragraphs that follow describe the operation of the water system. The numbers in brackets refer to locations on Figure 3-1, "Water Plumbing Schematic".

3.2 OPERATING MODES

The pump is designed to pump up to 200 psi. Generally, there are three modes of operation: Hydrant, Static Water Supply and Water Tank. In the Hydrant mode the suction side of the pump is connected to a hydrant source, or an external source such as a second pumper. In the Static mode the suction side of the pump is connected through a suction hose to a static water supply, such as a stream, pond or storage tank. In the Water Tank mode the pump utilizes the water stored on the truck.

3.3 HYDRANT MODE

Water is introduced into the pump by two 2-1/2" hydrant valves (9), located on the Pump Control Panel. Water may also be introduced to the Water Tower by a second pumper through the two valves (8) located at the rear of the truck. The panel intakes are Hale valves and are described, along with the pump, in the HALE pump manual. The two rear valves are similar in operation and are built by Thibault. For a parts breakdown of the Thibault valves refer to Figure 3-2.

Water pressure is controlled by the pressure relief valve described in the Hale manual.

Water is discharged through the 2-1/2" ball valves (10), two to each side of the truck, and the 1-1/2" ball valves (38) located on top of the truck over the Pump Control Panel. These valves are described in detail in the Hale manual.

Water from the pump can be diverted to the Water Tower by operating the 3" ball valve (6) and the 4" butterfly valve (37). Water passes from the pump through the 3-1/2" galvanized pipe (30) through the slip joint (24), thence through the Ladder Section Water Pipe Assembly (31), (32) and (33) to the Nozzle Assembly (35). Water may be introduced directly to the Water Tower through the rear intake valves (8). If the external source pressure exceeds 200 lbs., the relief valve (14) will dump the excess pressure. For details of the Thibault Central Joint Assembly (24), the Water Joint Assembly (23) and the Nozzle Assembly (35) refer to Figures 3-5, 3-4 and 3-9.

3.4 STATIC WATER SUPPLY MODE

Two 6" suction intakes (11) are located one on each side of the truck.

A 6" Intake, to receive water under pressure, is located at the front of the truck and is controlled by a Thibault butterfly valve (13). A relief valve (14) controls the water pressure to the suction side of the pump.

3.5 WATER TANK MODE

Water is introduced into the pump from the truck water tank (50) through a Hale 3" ball valve (7). For details of the water tank assembly (50) refer to Figure 3-12.

3.6 FOAM SYSTEM

Foaming agent from the foam tank (49) is introduced into the pump through the Feecon Proportioner Assembly (15) through (21). The 1" gate valve (47) drains the foam tank. For details of the Feecon Model AP Proportioner refer to the Feecon Service Bulletin. For details of the foam tank refer to Figure 3-11.

NOTE: For a description of the plumbing fittings referenced on the schematic, refer to the plumbing parts list.

4. LADDER ASSEMBLY

4.1 GENERAL DESCRIPTION

The Ladder Assembly consists of a Turntable, a Substructure, three Ladder Sections, a Ladder Control Console, four Outriggers and two Outrigger Control Panels.

The Turntable is supported by the truck Substructure which is positioned over the rear wheel assembly (see Figure 4-1). The Turntable assembly consists of a heavy gauge steel plate and a three-part bearing surface of high quality cast steel. One part of the bearing is bolted to the Turntable, the second to the ladder Substructure. The third part, the pressure ring, turns on 260 balls located in twin raceways between the Turntable and the Substructure. The Turntable is rotated horizontally through a worm gear assembly, driven by a hydraulic motor (see Figure 4-2, number 1) .

A pair of heavy steel castings on the Turntable form a cradle to support the weight of the ladder sections and allow ladder Section One to pivot on its base under control of the elevating jacks (see Figure 4-3, number 1). A pintle pin (2) attaches ladder Section One to the cradle and allows it to rotate from -3 degrees through 75 degrees. The elevating jack cylinders are fitted with pistons which are connected through piston rods to pivot points on the Turntable (4).

Section One of the ladder is bolted to the Ladder Support Assembly (see Figure 4-3, number 5) which is connected to the elevating jack cylinders.

When hydraulic pressure is applied to the cylinders they rise, causing the ladder sections to rotate at the cradle and thus elevate the forward end of the ladder.

The three ladder sections are nested, with Section Two nested in Section One and Section Three nested in Section Two. The ladder sections are manufactured of steel rails, separated by the ladder rungs, and are designed to slide over one another on nylon slides.

The ladder trussing is square tubular steel welded to the main rails to provide rigidity and strength. The ladder rungs are also square tubular steel and each has a no-slip tread.

Ladder Section One (see Figure 4-4) includes the Extension Drive Sub-assembly (9), the Ladder Support Assembly attaching points (8), the ladder section pivot points (7), and the Stop Pawl Lever Control mechanism (6). Two extension cable pulleys (2) and three pairs of nylon slides (1) are mounted at the forward end of the ladder section, along with a set of Locking Pawls (3) to engage in the rungs of the second section when the ladder is extended. For a description of the Locking Pawl Mechanism, refer to para 4.3.

Two pulleys are mounted between rungs, located toward the forward end of Section One (4), to direct the Retraction Cable from the top-side to the underside of Section One in order that the Retraction Cable may be attached to the retraction winding drum on the winch.

A safety rail (10) is attached to the sides of Section One to catch the rear end of Section Two if it should ever, by reason of excessive torque, become disengaged from the Section One rail. The second ladder section (see Figure 4-5) is nested into Section One and is free to ride over Section One on the rear mounted nylon slides (7) and the Section One Nylon Slides. Two sets of pulleys are mounted horizontally at the forward end of the second section (1) and are canted to cause the Extension Cables to pass under the ladder section in order to feed onto the winch winders, located on the underside of Section One. For a description of the extension system and placement of cables and pulleys, refer to para 4.2.

Also located on the forward end of Section Two are three pairs of nylon slides (4) to support Section Three and a set of Locking Pawls (2) to engage in the rungs of Section Three when the ladder is extended. Two pulleys are mounted between rungs toward the forward end (3) to direct the Retraction Cable from the top-side of Section Two to the under-side. Each rung is equipped with a no-slip tread (5).

Two pulleys, having two sheaves each, are mounted horizontally at the rear of Section Two (6) to change the direction of the Extension Cables. A safety rail (8) is attached to the sides of Section Two to catch the rear end of Section Three if it should become disengaged from the Section Two rail.

The third ladder section (see Figure 4-6) nests into Section Two and is free to ride over Section Two on the rear mounted nylon slides (7) and the Section Two nylon slides. A Retraction Cable Compensator Assembly (3) is mounted toward the forward end of the ladder section.

Also mounted at the forward end of Section Three is the Water Tower Assembly and guard rails (8), the Water Tower Control Panel, the PA System (9), two each of folding foot steps and kneeling guard assemblies (1,2) and axe (4) and pike pole (5) holding brackets. The rungs are equipped with no-slip treads (6).

Clamped to the underside of ladder Section One is a telescoping pipe which carries water to the Water Tower. The second section of the pipe is clamped to the underside of the forward end of Section Two of the ladder and Section Three of the pipe is connected to the Water Tower located on the forward end of Section Three of the ladder. When the ladder is extended or retracted, the water pipe extends or retracts at the same rate with the second and third sections of the pipe telescoping through waterproof seals.

The Ladder Control Console is located at the right rear of the turntable and contains all the controls necessary for one person to operate the ladder and the Water Tower. The following controls are mounted on the Ladder Control Console (see Figure 4-7).

1. Hydraulic Pressure Gauge - Indicates main hydraulic pressure.

2. Console Speaker Volume Control - Controls the volume at the end-of-ladder speaker.

3. Push-to-Talk Switch - Allows the operator to converse with personnel at the end of the ladder.

4. End-Ladder Speaker Volume Control - Controls the volume of the output from the end-ladder speaker.

5. Console Lights.

6. Ladder Load Gauge - Indicates the load at the end of the ladder.

7. Ladder Overload Warning Lamp - Lights automatically when the ladder is overloaded.

8. Energy Control Light - When lit, indicates there is current to the Ladder Control Joysticks.

9. Ladder Load Dial - Indicates inclination in degrees (O degrees to 75 degrees) and suggests maximum ladder extension permissible for varying load conditions.

10. Water Tower Nozzle Pattern Select Switch - Selects spray or fog mode for the Water Tower nozzle delivery.

11. Water Tower Nozzle Sweep Control Switch - Controls movement of nozzle left and right.

12. Water Tower Nozzle Elevation Control Switch - Controls elevation and depression of the Water Tower nozzle.

13. Ladder Elevation Control Joystick - Controls ladder elevation and depression.

14. Ladder Console Throttle Switch - When engaged, increases engine RPM to 1200.

15. Ladder Rotation Control Joystick - Controls ladder movement left and right.

16. Emergency Override Switch - when engaged, will override automatic overload controls and allow extra extension and depression of the ladder for emergencies.

17. Cut Off Switch - When pushed in, stops all ladder movement by cutting the current to the Ladder Control Joysticks.

18. Ladder Extension Control Joystick - Controls ladder extension and retraction.

19. Engine Start Button - Allows the operator to re-start a stalled engine at the Ladder Control Console.

20. Control Panel Light Switch - Controls panel illumination.

21. Ladder Extension Dial - Indicates, in feet, the length the ladder is extended.

22. Water Tower Pressure Gauge - Indicates water pressure to the water tower.

A detailed description of the operation of the ladder controls is given under the heading "Ladder Hydraulics".

The Ladder Extension Dial (see Figure 4-8, number 6) is controlled through a cabling system attached to a vernier screw on the extension winch drum and is channelled to the ladder Control Console through a series of pulleys to attach to a dial mechanism which positions the indicator. For a description of the operation and calibration procedures for the Ladder Extension Dial, refer to Section 8.

The Ladder Inclination Dial (see Figure 4-8, number 3) is controlled through a cabling system attached to Section One of the Ladder Assembly and channelled to the Ladder Control Console through a series of pulleys to attach to a mechanical dial mechanism which positions the indicator. A detailed description of the operation and calibration of the inclination dial is given in Section 8.

Four Outriggers provide stability for the ladder when it is in operation and must be deployed before the ladder is used. Two Outriggers are located at mid-chassis, on each side of the truck and two are located immediately aft of the rear wheel wells (see Figure 4-9).

The Outriggers consist of the four main assemblies (see Figure 4-10), the main support (not shown), the hydraulic cylinder (1), the outrigger arm (5) and the foot pad (7). The main support is welded to the chassis and has an abutment on its lower end to provide a pivot position (3) for the outrigger arm. The upper end of the outrigger hydraulic cylinder is attached to the main support and the piston rod is connected to the outrigger arm (4). The outrigger arm is connected to the main support at one end and has a foot pad connected to the opposite end. The foot pad and the outrigger arm are connected by pins (6) and are free to pivot. Hydraulic pressure applied to the piston causes the Outriggers to be extended or retracted. When fully retracted, a Jack Foot Hook (2) hooks onto the pin (4) that secures the piston rod to the outrigger arm. The hook prevents outrigger movement when the truck is moving.

The outriggers are equipped with red flashing lights (8). An electric ladder disable switch is provided at each rear outrigger to prevent deployment of the ladder before the outriggers are deployed. The operation of the Outriggers is controlled at the two Outrigger Control Panels located on each side of the chassis. A detailed description of the operation of the Outriggers is given under the heading "Outrigger Hydraulics".

4.2 LADDER EXTENSION AND RETRACTION

4.2.1 General

The 85’ Ladder consists of three sections. Section 1 is attached to the Turntable and supports Sections 2 and 3. Sections 2 and 3 extend outwards from Section 1, under the control of a series of cables (see Figure 4-11).

Figure 4-11 is a composite illustration showing the complete ladder cable layout. The numbers in the square boxes indicate to which ladder sections the cables or pulleys are attached. This illustration is broken down into groups to support the descriptions in the text that follows. The arrow with a numbered box indicates direction of ladder section movement.

NOTE: Ladder extension is controlled by pairs of cables and, in the event one extension cable is broken, the ladder can be extended by means of the remaining one.

4.2.2 Ladder Extension

The ladder extension cables are wound on the top-side (anti-clockwise) of each of the two winch drums (see Figure 4-12, numbers 1 and 8). They pass around the two vertical pulleys mounted on the forward end of Section 1 (4) and (5) and then around the double sheaves mounted horizontally to Section 2 (2) and (7). Finally, they are fastened to the forward end of the left and right underside of Section 1, (3) and (6).

When the winch drums are rotated anti-clockwise by the hydraulic motor, the extension cables are wound onto the drums causing Section 2 to extend as the cables shorten. When Section 2 extends, it causes Section 3 to extend at the same rate through the action of the cables shown at Figure 4-13.

As Section 2 moves away from the winch, the canted sheaves mounted on Section 2 (3) and (4) push on the cables connected to Section 1 (1) and (6) and cause Section 3 to move with Section 2.

4.2.3 Ladder Retraction

The ladder retraction cable (see Figure 4-14) is wound on the underside (clockwise) of the right-hand winch drum (1). It passes around the two pulleys on Section 1 of the ladder (2) which transfers it from the underside of Section 1 to the topside. It then passes around the two pulleys fastened to Section 2 of the ladder (3) which transfers it from the underside of Section 2 to the topside. The cable terminates at the Retraction Cable Compensator (4) mounted on the underside of Section 3. The Retraction Cable Compensator keeps tension on the retraction cable (5).

When the winch drum is rotated in a clockwise direction, the retraction cable is wound onto the right-hand drum, which causes ladder Section 3 to retract toward the winch.

When ladder Section 3 is retracted, it causes Section 2 to retract at the same rate through the action of the cables shown in Figure 4-15. These are the same cables used for extension. One cable is fastened to the left rear underside of Section 3 (1). It passes around one set of canted pulleys on Section 2 (3) and is fastened to ladder Section 1 (5). A second cable is fastened to the right rear underside of ladder Section 3 (6). It passes around the other set of canted pulleys on Section 2 (4) and is fastened to the opposite side of Section 1 (2).

As Section 3 is retracted by the action of the retraction cable (previously described), the two cables shown in Figure 4-15 pull on the canted pulleys mounted on Section 2 and cause that section to retract along with Section 3.

4.3 LADDER LOCKING PAWL ASSEMBLY

4.3.1 General

The ladder is equipped with a Locking Pawl Assembly which is designed to take the weight off the cables when the ladder is extended. The pawl mechanisms are controlled by an operating lever located on ladder Section 1. The lever is connected to the Locking Pawl Assembly by a series of cables and pulleys (see Figure 4-16).

4.3.2 Description

The number references in brackets in the following description refer to the call-outs on Figure 4-16. For the sake of simplicity, only one Locking Pawl and Locking Lever are illustrated. For a view of the complete Locking Pawl Assembly, refer to the ladder parts list in Part 3.

When the Operating Lever (1) is down, i.e., the lever handle is parallel with the rails of ladder Section 1, the cable is pulled taught and the Locking Pawls are disengaged and are stored in their own ladder section.

When the Operating Lever is lifted, i.e., the handle is vertical to the rails of ladder Section 1 (1 dotted line), the cable (12) is released from tension. The cable is fastened to the Lock Balancer (4) which rotates under pressure of the Locking Pawl spring rearward, thereby allowing the Wire Lever (10) on Section 1, which is fastened to the Pawl Shaft (9), to rotate downward. The downward movement of the Wire Lever allows the spring loaded Locking Pawls (8) to swing up from their stored position in Section 1 and project between the rails of ladder Section 2, above. The Locking Pawls are positioned to engage a rung of the ladder section above by two Locking Levers (7). The position of the Locking Levers can be adjusted by loosening cap screws.

The Locking Pawls are designed to allow ladder rungs to ride over the top of the pawls during extension, when the Operating Lever is unlocked by pressing them down under tension of their return springs (11). When the ladder rung has passed over the Locking Pawl, the pawl is returned to its original position by the return spring.

When the Lock Balancer (4) rotates forward, it carries the Grooved Roller (3) forward at the same time. This lengthens the cable (12) which is held vertically over the Wire Lever (10) controlling the Locking Pawl on ladder Section 2, by the pulley (6). Lengthening cable (12) causes the Wire Lever (10) to rotate under pressure of the Locking Paul springs, thereby causing the Locking Pawls stored in Section 2 to swing up between the rails of Section 3. The action of the Locking Pawl Assembly in Section 2 is identical to the action of the pawl assembly in Section 1, described above, and takes place concurrently.

As cable (12) acts on fittings mounted on both Section 1 and Section 2, it must be long enough to reach between the Grooved Roller (3) and the pulley (5) when the ladder is fully extended. It must also be channelled to run from Section 1 to Section 2. This is accomplished by running an appropriate length of cable, equivalent to the distance between (3) and (5) when the ladder is fully extended, along the outside of Section 2. The Cable is fastened to Section 2 at (13) and passes around the canted pulley welded to Section 1 (5) which transfers it to the outside of Section 1 and onto the Grooved Pulley (3). This arrangement ensures the proper length of cable and acts as a "take-up" to prevent slack during the operation of the ladder.

With the Locking Pawl Assembly engaged, i.e., the Operating Lever pulled up, the Locking Pawls are protruding through the rails of the ladder section above, ready to engage in the rungs of that section as soon as retraction is executed at the Ladder Control Console. The ladder sections will retract until the Locking Pawls engage in ladder rungs. This will transfer the weight of the ladder from the extension cable to the Locking Pawl Assemblies which, in turn, will reduce the hydraulic pressure applied to the hydraulic winch motor. This will cause a hydraulic relief valve to operate and prevent the hydraulic system from operating against the Locking Pawls by attempting further retraction.

4.4 LADDER MAINTENANCE INSTRUCTIONS

4.4.1 General

To maintain the ladder in good order, the following procedures should be carefully followed.

After each use, the ladder must be thoroughly cleaned and greased. The outriggers must be treated with care, and checked constantly. The general condition and functioning of the ladder should be checked at least once a year. All screws, nuts and bolts throughout should be inspected, and tightened, if necessary. Unpainted parts, such as the ladder slides, require frequent cleaning and greasing. Painted surfaces should be kept in good condition, since the ladder's service life depends upon this. Damaged paint should be touched up at once.

If any of the cable strands are broken or frayed the cable must be replaced.

4.4.2 Hydraulic System

The oil tank, located on the vehicle chassis, has a capacity of 45 gallons, the amount needed to ensure the hydraulic system operates at maximum efficiency. The hydraulic oil level should be checked frequently. Refill as required.

When the ladder is in regular service, maximum time between oil changes must not exceed 1 year. However, it is recommended that an oil probe be taken from the tank for analysis by an oil company laboratory. Oil should not contain flakes.

4.4.3 Oil Analysis

For hydraulic oil analysis, a sample should be taken from the bottom of the reservoir after the hydraulic system has been operating for not less than 10 minutes.

Analysis must be made at the oil manufacturer's laboratory. Any foreign matter in the oil may endanger the hydraulic system.

Utmost cleanliness must be observed in storing hydraulic oil. The oil may be affected by:

a) **Water caused by condensation**:

Traces of more than 0.1% of water in the oil are damaging to the hydraulic system. 0.3% to 0.5% of water in the oil mean that the hydraulic system cannot be operated safely.

b) **Air:**

The hydraulic system and reservoir must be completely tight, except for a very small vent to take care of any overflow due to expansion of the fluid.

Turbing oil indicates there is an improper amount of water or oil present. To determine if cloudiness is present, place an oil sample in a test tube for at least one hour. If there is too much water or air present in the oil, the following may occur:

Corrosion of hydraulic parts, or malfunction of hydraulic system (foam, air pockets, jerky movement or sudden drop in pressure).

Gasoline, diesel fuel or any other chemical fluid may alter the oil in the hydraulic system. Metallic particles, soot and dirt can cause mechanical damage to the hydraulic system components.

4.4.4 Lubricating

All grease fittings, joints of the ladder cylinders and joints of the base must be greased with a high pressure gun from time to time.

NOTE: All sliding parts should be greased with "LUBRIPLATE LOW TEMP" or equivalent. This grease can resist temperatures as low as -40 degrees. This operation is made simpler by extending the ladder to its full length at 0 degrees. This will expose the slides, which can then be easily cleaned and greased. It is very important that this maintenance work be done frequently - possibly after each occasion the ladder is used at fire calls, since dirt or dust mixed with grease forms a sticky, rubbery compound.

4.5 LADDER TROUBLE-SHOOTING GUIDE

	PROBLEM	PROBABLE CAUSE	REMEDY
1.	No hydraulic pressure at either Outrigger.	a) PTO not engaged.	a) Switch PTO to "ENGAGED".
		b) Ladder/Outrigger Selector Valve not pulled out.	b) Pull valve out to select Outrigger.
		c) Electric/PTO Pump Switch not in correct position.	c) Move switch to "Down" position.
		d) Pre-set engine rpm is too low.	d) Increase engine rpm setting to a minimum of 1200.
2.	PTO/Hydraulic Pump is noisy.	a) Pre-set throttle setting is too high.	a) Reduce setting to a minimum of 1200.
		b) Hydraulic oil level too low.	b) Fill the hydraulic oil tank to the correct setting on the dip stick.
		c) Valve on hydraulic suction line partially closed.	c) Ensure valve 6 (see Figure 5-2) is fully open.
3.	Outrigger fails to operate.	a) Ladder/Outrigger Selector valve not pulled out.	a) Pull valve out to select Outrigger.
		b) Hydraulic pressure too low.	b) Check hydraulic Pressure A minimum of 1000 psi. is required.
4.	Ladder will not elevate.	a) Ladder Bed Lock Assy not disengaged.	a) Ensure the PTO Switch is at "ENGAGED".

5.	Ladder will not lower.	a) Ladder overloaded.	a) Reduce torque on the end of the ladder by retracting or reducing weight.
6.	Ladder will not extend.	a) Ladder inclination angle below minimum limit. b) Ladder is overloaded. c) Defective full extension micro switch. d) Manual by-pass valve is open.	a) Increase elevation before extending. b) Reduce torque on the end of the ladder by reducing the load. c) Replace micro switch. d) Close by-pass valve (see Figure 5-2, number 17).
7.	Ladder will not retract.	a) Locking Pawls are engaged. b) Ladder inclination angle too low. c) Ladder overloaded.	a) Ensure Locking Pawl Lever is in the disengaged position and all locking pawls are disengaged. b) Increase ladder elevation to reduce torque. c) Reduce torque on the end of the ladder by reducing the load.

8.	Ladder will not rotate.	a) Turntable not level.	a) Level the truck bed with the Outriggers or move to more level ground.
		b) Rotating relief valve set too low.	b) Set relief valve (see Figure 5-2, number 16) to 900 psi.
		c) Manual by-pass valve is open.	c) Close by-pass valve (see Figure 5-2, number 19).
9.	Ladder operates too slowly.	a) Engine rpm too low.	a) Set engine rpm to 1200.

NOTE: For adjustment of hydraulic pressure, and relief valves refer to Section 8.

5. HYDRAULIC SYSTEMS

5.1 GENERAL

The main hydraulic pump (see Figure 5-1, number 1) is operated by a power-take-off (PTO)(2) from the truck engine. The PTO is selected by a switch located in the cab. When the PTO switch is moved to the "ENGAGED" position, a pneumatic circuit is energized which engages the PTO with the engine. For a description of the Pneumatic circuit refer to "Pneumatic System" Section 7. When the PTO is engaged, the red indicator light in the cab will be lit.

NOTE: Concurrent with the engagement of the PTO, the Ladder Securing Clamps will release.

The paragraphs that follow describe the operation of the outrigger and ladder hydraulics. The numbers in brackets refer to locations on Figures 5-2 and 5-2-1, the Hydraulic Schematic.

5.2 MAIN POWER

With the truck engine idling and the PTO engaged, the main pump (7) is running and draws oil through a filter (2) from the reservoir (1) and pumps the oil through a check valve (10). The check valve prevents the flow of oil to the main hydraulic pump when either the electric pump (8) or hand pump (9) is used and check valves (11) prevent the flow of oil through the auxiliary pumps when the main pump (7) is operating. The oil is then pumped through the selector valve (12) and flows either to the outrigger control valves (50) and returns to the reservoir (1) after passing through a filter (4), or flows via the main joint (13) to the Relief/Unloader Valve (14) which opens and allows

the oil to return to the reservoir (1) via the filter (4). To prevent a build-up of excess pressure in the hydraulic lines, the check valve, which is part of the filter (4), allows oil to return to the Reservoir (1) if the filter is clogged.

When the accelerator button on the Outrigger Control Panel is pressed, or the green Throttle Control Button on the Ladder Control Console is pulled up, the hydraulic oil follows the same path as described above and the Relief/Unloader Valve (14) opens a little more. When oil is directed to the ladder hydraulic circuit, the Hydraulic Pressure Gauge (15) on the Ladder Control Console indicates that there is hydraulic pressure to the ladder hydraulic circuit. When the green Throttle Control Button is pulled up and the ladder is stationary, pilot pressure is 450 psi.

5.3 AUXILIARY POWER

If truck engine power is not available, pressure still can be raised by either the electric pump or the hand pump. The hydraulic flow follows the same path as that used when the main pump (7) is available. However, the rate of oil flow when using either auxiliary system is less than that provided by the main pump.

5.4 OUTRIGGER HYDRAULICS

Selector valve (12) directs the flow of oil to the outrigger circuit (see Figure 5-2-1) when the "OUTRIGGER" position is selected. The outrigger cylinders (52 and 54) are activated in one direction or the other by the Outrigger Control Valves (50 and 53). When the Outrigger Control Valve is in the "EXTEND" position, the flow of oil is directed to the upper side of the outrigger cylinders. In the "RETRACT" position, the flow of oil is directed to the lower end of the cylinders.

A twin pilot check valve (51) is located at each cylinder to lock the cylinder in place in the event of a line pressure drop.

The relief valve of the outrigger control valve (50) limits the outrigger operating pressure to 1000 psi.

To prevent ladder operation before the outriggers are deployed, micro switches (see Figure 6-7, number 150) at the outrigger control the current to the ladder control console. When the outriggers are deployed, the outrigger micro switches close causing the solenoid-operated switches (see Figure 6-7, number 154) to close allowing current flow to the ladder control console via a contact ring (see Figure 6-7, number 10).

5.5 LADDER HYDRAULICS

Selector valve (12) directs the flow of oil to the ladder circuit through the main oil joint (13) at the Turntable, when the "In-Ladder" position has been selected. The Relief/Unloader Valve allows the unused oil to return to the reservoir (1).

In the compartment under the Ladder Control Console there are three Proportional Valves incorporated in a monoblock design (16). The valves are part of the ladder hydraulic circuits controlling elevation, depression, rotation, extension and retraction. Each Proportional Valve consists of a pressure compensated flow control valve, a solenoid-actuated, four-way, three position, spring-centered directional control valve, and a pressure relief valve. Refer to Section 8 for adjustments to the Proportional Valves.

The Relief/Unloader Valve (14), which is on the Ladder Turntable (see Figure 8-1), is also adjustable. Refer to Section 8 for adjustments to this valve.

Elevating and Lowering the Ladder - to elevate the ladder, the directional control valve in the Proportional Valve (16) is operated by a solenoid and oil passes through the pressure compensated flow valve which controls the amount of hydraulic fluid the directional control valve receives by controlling the rate of flow. The relief valve in the Proportional Valve is set at about 1550 psi and protects the ladder from an overload caused by striking an object when raising or lowering the ladder.

From the flow valve, oil passes through the directional control valve to the overcenter valves (21) and passes via the check valve in each overcenter valve to the upper portion of the hydraulic cylinders (22). At the same time, the oil in the lower portion of the cylinders flows via the Proportional Valve (16) and hydraulic return lines to the reservoir (1). The check valves in the overcenter valves prevent the oil from draining from the upper portion of the cylinders when there is no pressure in the hydraulic lines to the overcenter valves. When it is necessary to lower the ladder, the relief valve section of the overcenter valves open, allowing oil to flow out of the upper portions of the cylinders as oil flows into the lower portion of the cylinders.

When elevating the ladder, oil also flows through the check valve in the Proportional valve (16) and then flows to the Relief/Unloader Valve (14) at the same time that oil flows to the overcenter valves. The check valve prevents the return of oil to the directional control valve. The Relief/Unloader Valve will close, permitting the ladder to elevate. The valve will remain closed at this point until the hydraulic pressure changes. If the pressure to the Relief/Unloader Valve (14) exceeds 1550 psi the pressure relief valve of the Relief/Unloader Valve will open and the oil will flow to the reservoir via the filter (4).

The overload indicator (23) measures the pressure in the upper portion of the elevating cylinders and indicates when the ladder is operating within safe limits.

The Bourdon Tube (24), which is connected to the right elevating cylinder, measures the pressure in the elevating cylinders. The Bourdon Tube operates a micro switch (see Figure 6-6, number 25). When the pressure in the elevating cylinders exceeds 1050 psi, the micro switch opens and the Automatic Stop Lamp (see Figure 6-6, number 26) lights. Current is cut to the depression solenoid of the Elevation Valve (see Figure 6-6, number 20) and to the extension solenoid of the Extension Valve (see Figure 6-6, number 18). When the pressure is again below 1050 psi the Bourdon Tube micro switch will close and all ladder movement is restored. Refer to paragraph 6.4.7. for an explanation of the ladder electrical circuits above the turntable.

Rotating System - the Proportional Valve (16) that controls ladder rotation operates in the same way as the Proportional Valve for ladder elevation. When the directional control valve in the Proportional Valve is opened in either direction, oil passes through the pressure compensated flow valve. The relief valve in the Proportional Valve (16) is set at approximately 900 psi and protects the ladder from an overload in the event the ladder strikes an obstacle during ladder rotation. From the flow valve, oil passes through the directional control valve to the hydraulic motor (20) causing the turntable to turn in either direction, depending on the direction of oil flow to the motor. After leaving the hydraulic motor, the oil passes through the directional control valve in the Proportional Valve and returns to the reservoir (1) via the filter (4). The directional control valve also directs oil, via a check valve, to the Relief/Unloader Valve (14) at the same time that oil is directed to the hydraulic motor. The check valve prevents the return flow of oil to the directional control valve in the Proportional Valve (16). The Relief/Unloader Valve (14) will close permitting the hydraulic motor to turn. The valve will remain closed at this point until the hydraulic pressure changes.

A by-pass valve (19) serves as an oil by-pass. When the valve is opened the ladder can be rotated with the hand crank. The by-pass is closed during normal operations.

Extension System - the Proportional Valve (16) that controls ladder extension and retraction operates in the same way as the Proportional Valves for ladder elevation and rotation. When the directional control valve in the Proportional Valve is opened in either direction, oil passes through the pressure compensated flow valve. The relief valve in the Proportional Valve (16) is set at approximately 1300 psi and protects the ladder from an overload in the event the ladder strikes an obstacle during ladder extension. From the flow valve, oil passes through the directional control valve and overcenter valve (25) to the Winch Motor (18), causing the winch to turn and the ladder to extend or retract, depending on the direction of oil flow to the motor. Extension and retraction are controlled by cables which are payed in or out on the winding drums of the winch. Oil leaves the Winch Motor, passes through the directional control valve in the Proportional Valve (16) and returns to the reservoir (1) via the filter (4). The directional control valve also directs oil, via a check valve, to the Relief/Unloader Valve (14) at the same time that oil is directed to the Winch Motor (18). The check valve prevents the return flow of oil to the directional control valve in the Proportional Valve (16). The Relief/Unloader Valve (14) will close permitting the Winch Motor to turn. The valve will remain closed at this point until the hydraulic pressure changes.

A by-pass valve (17) serves as an oil by-pass. When open, the ladder can be extended or retracted using the hand crank. The by-pass valve is always closed during normal operations.

5.6 WATER TOWER NOZZLE ASSEMBLY HYDRAULICS

The Water Tower Nozzle Assembly is built by Pierre Thibault and is designed to provide a water discharge of spray, or fog, at the tip of the ladder. It can be controlled remotely from the Ladder Control Console or directly at the ladder tip.

The Nozzle Assembly (see Figure 5-3) is divided into the Tip (1), the Body (2), the Hydraulic Pump and Electric Valves and the Actuators (3) and (4). The Tip is made by Task Force and is described in detail in Part 2, Volume 3, TAB 17. The Hydraulic Pump and Valves are controlled by a set of three switches located at the tip of the ladder (see Figure 5-4) or by a duplicate set located at the Ladder Control Console (see Figure 4-7, numbers 10, 11 and 12).

Deflecting a nozzle control switch causes the Electric Motor (see Figure 5-5, number 3 and Figure 5-5-1, number 1) to operate the Hydraulic Pump in the Power Pack and energizes the appropriate solenoid on the valve selected (see Figure 5-5, number 1 and Figure 5-5-2, number 1). Hydraulic fluid is directed to the Sweep, Elevation or Pattern Actuator by one of the electrically controlled valves (see Figure 5-6). Oil entering one side of an actuator cylinder causes the actuator piston to move and force an equal amount of oil to exit the other side of the cylinder. The actuator piston rod, through the action of a rack and pinion assembly, causes movement of the nozzle in elevation or sweep (see Figure 5-7). Pattern selection is caused by an actuator integral to the Task Force Nozzle (refer to Part 2, Volume 3, TAB 17).

6. ELECTRICAL SYSTEM

6.1 GENERAL

The electrical system is described under the main headings Chassis, Pump and Ladder.

The electrical wiring and components, other than those provided by Pierre Thibault Trucks Inc., are described in the manufacturer's literature included in this manual. All electrical wiring installed by Pierre Thibault is described in Section 6. Explanations are provided pertinent to the QWT 85 where schematics have been supplied which cover more than one model of the equipment.

6.2 CHASSIS

The Chassis wiring is described under the headings Controls, Dials and Indicators; Truck Warning Lights; Truck Operating Lights; and Chassis Outlets. For numbered references to wiring diagrams, refer to Figures 6-1 and 6-2.

6.2.1 Controls, Dials and Indicators (Figure 6-1)

Dial and Indicator Lights for the Hydraulic Control Panel (Nos. 36, 37 and 38), along with the Panel Light (No. 164), are controlled by a switch (No. 165) located on the Hydraulic Control Panel.

A push-button switch (No. 24), located at the rear of the chassis, operates a buzzer (No. 22) located in the truck cab.

6.2.2 Truck warning Lights (Figure 6-1)

A bank of switches (Nos. 2 through 12), mounted in the cab, control the Truck Warning Lights and the Siren Brake. These include the external Warning and Spot Lights (Nos. 17, 18 and 19) and internal Warning Lights (Nos. 13, 14 and 20). The Compartment Light Switches (No. 16) are operated by the compartment doors and each controls a Compartment Light (No. 14). The Door Open Warning Light (No. 20) is controlled by a switch (No. 15) on each set of compartment doors. The Outriggers Out of Rest Warning Light (51) is controlled by a switch (No.52) at each outrigger.

6.2.3 Truck Operating Lights

The truck operating lights installed by Pierre Thibault Trucks Inc. are diagrammed in Figure 6-2.

These lights include Directional Lights (No. 5), Back-Up Lights (No. 4) and Back-up Alarm (No. 3), Stop Lights (No. 5), Tail Lights (No. 5), Licence (No. 2) and Clearance Lights (No. 1 RED and No. 6 AMBER), Step Lights (No. 2) and Ladder Clearance Lights (No. 9).

6.2.4 Chassis Outlets

Four all-weather duplex 110 VAC Outlets are mounted, two each, on the left and right side of the truck chassis (see Figure 6-3, numbers 5, 6 and 7). They are connected to the 15 Amp Circuit Breakers (No. 4) in the Electrical Box (No. 3), located in the truck cab.

Each outlet is protected by one circuit breaker, as indicated in Figure 6-3. The line side of Electrical Box (No. 3) is common with the Dynamote Inverter output at Electrical Box (No. 1). The neutral buss bar of Electrical Box (No. 3) is connected to the neutral buss bar of Electrical Box (No. 1), which in turn is connected to the Inverter.

6.3 PUMP

The wiring used to control the dials, indicators and lamps on the Pump Control Panels is described under this heading. For numbered references to the Pump Wiring Diagram, refer to Figure 6-1.

Power for the Pump Control Panels is provided through the 20 Amp Circuit Breaker (No. 1).

The Panel Lights on each side of the chassis (No. 29), the Indicator Lights (Nos. 30, 31 and 36) and the Pump Compartment Lights (No. 28) are controlled by a single switch (No. 27) on the left-hand Pump Control Panel. The Hour Meter (No. 32) and the Pump Power Shift Indicator Lamp (No. 41) are wired in series with the Pump Power Shift Switch (No. 39). The Priming Pump (No. 42) is controlled by a Switched Priming Valve (No. 33) through a Solenoid Switch (No. 40).

A Relief Valve Pressure Switch (No. 44) controls the Relief Valve Indicator Lamp (No. 45) on the Pump Control Panel.

6.4 LADDER

6.4.1 General

The description of the electrical wiring for the ladder is divided into four areas: the 110 VAC Circuits, the Water Tower Circuits, the Ladder Circuits Above the Turntable, which includes the Ladder Control Console; and the Ladder Circuits Below the Turntable, which includes the Outriggers and Outrigger Control Panels.

6.4.2 110 VAC Circuits

Refer to Figure 6-3 for numbered references in brackets in the following 110 VAC description.

Current for the 110 VAC Circuits is provided by the Dynamote Inverter located in the truck cab (see the Dynamote Manual for details of the operation and construction of the Inverter). Output from the Inverter goes to the 30 Amp Breaker (No. 2) in the Electrical Box (No. 1) and the 15 Amp Breaker (No. 4) in the Electrical Box (No. 3), both mounted on the rear fire wall of the truck cab.

The 30 Amp Breaker (No. 2) controls the current to the 15 Amp Twist Lock Outlet (No. 8) located at the tip of ladder Section 3. Cabling is from the Electrical Box (No. 1) to the Contact Rings in the Turntable (No. 10), to a Junction Box (No. 11) located at the base of the ladder, to the weather proof Outlet Box (Nos. 7, 8 and 9) at the tip of the ladder. The 30 AMP Breaker (No.2) is a Ground Fault Interceptor (GFI) which activates at 5 mA.

6.4.3 110 VAC Ladder Cable Layout

The 110 VAC Cable must reach from the junction box at the base of the ladder to the outlet in Section 3 in all attitudes of extension from 0’ to 85’. This is accomplished by means of the cable layout, illustrated in Figure 6-5 "110 VAC Cable Layout-Ladder Extended". The circled numbers are the call-outs referred to in the text.

6.4.4 Ladder Retracted

With the ladder retracted, the cable is in the position illustrated in Figure 6-4.

The 110 VAC Cable is strung inside the top rail of ladder Section 1, from rear to front (9). It returns to the rear of Section 1 via a trough welded to the inside of the Section 1 rail (8). The cable is laid in the trough and then passes under and over a canted compensating pulley (3) mounted at the rear of Section 2. This pulley serves to change the direction of the cable from rear to front and to pass it from the inside of Section 1 to the inside of Section 2.

A second trough is welded to the inside rail of section 2 (7) to receive the cable when the ladder is extended. As the cable comes off the top of the compensator pulley (3), it passes through a curved conduit (4) welded to Section 3. This conduit passes the cable from the outside of Section 3 to the inside, and the cable is then strung through a conduit welded to the inside rail of Section 3 (5) to the front of the ladder where it connects to the all-weather outlet (6).

6.4.5 Ladder Extended

When the ladder is extended, the cable is in the position illustrated in Figure 6-5.

As the ladder extends, Section 3 draws the cable over the compensator pulley (2) and it is thereby picked up from the trough on Section 1 and is directed into the trough on Section 2.

6.4.6 Water Tower Circuits

For numbered references to the Water Tower wiring diagram, refer to Figure 5-5.

The Water Tower is located at the tip, or fly, of ladder Section 3. Movement of the Water Tower Nozzle is provided by a self-contained Power Pack (No. 3). Direction of movement and type of water delivery are controlled by two sets of switches, one located at the tip of ladder Section 3 and the other on the Ladder Control Console (No. 2). Cabling for the Power Pack and control switching travels up the right side of the ladder in the same manner as the 110 VAC Cable on the opposite side, as previously described. 12 VDC is provided from the buss bar (No. 5) to the Solenoid (No. 4) for the elements at the end of the ladder.

The Power Pack (No. 3) is an electric, hydraulic pump which provides movement of the Water Tower nozzle in elevation, sweep and pattern in response to electrically controlled valves (No. 1). The valves are operated by either the Ladder Control Console switches or the switches at the ladder fly (No. 2).

6.4.7 Ladder Circuits Above the Turntable

For the wiring diagram of circuits above the Turntable, refer to Figure 6-6. 12 VDC current is supplied from the batteries through Contact Rings (No. 10) in the Turntable to the buss bar (No. 36). The Current Regulators (13) and (14) are located in the compartment under the Ladder Control Console. The right Current Regulator (see Figure 6-6-1, number 2) is part of the ladder circuitry controlling ladder elevation and depression. The left Current Regulator (see Figure 6-6-1, number 1) is part of the ladder circuitry controlling ladder rotation, extension and retraction. Refer to Part 2, Volume 3, tab 28 for the Description, Adjustment Set-up and Adjustment Procedure of the regulators. Part 2, Volume 3, tab 28 also includes commercial data for the Joysticks (1), (2) and (3).

The rate of the ladder elevation, depression, rotation, extension and retraction is controlled by the amount of current received by the Elevation, Rotation and Extension Solenoids (18), (19) and (20). The farther the Joysticks are moved away from their neutral positions, the greater the current to the solenoids, which control how much the Proportional Valves (see Figure 5-2, number 16) will open. Solenoids (18), (19) and (20) must overcome a slight hydraulic pressure before the Proportional Valves will open. At 12 VDC a solenoid will cause the corresponding Proportional Valve to be fully open in one direction or the other, depending on which way the Joystick has been moved. As the Joystick is returned to its neutral position, current to the solenoid is reduced and the corresponding Proportional Valve will close as the current is reduced. There is a deadman switch on top of each Joystick. When a Joystick is moved from its neutral position, the switch must be pressed down in order for current to flow from the Joystick to the corresponding solenoid via a Current Regulator. When the switch is released, current from the Joystick to the solenoid is cut.

The Throttle Control Button (21) increases engine rpm from 550 to 1200 when the button is pulled up. When the Energy On Control Light (24) is lit, it indicates there is current to the Joysticks. When pressed down, the Cut-Off Switch (23) cuts current to the Joysticks. Switch (31) controls the Ladder Console Lights (32). The Engine Start Button (27) can be used to restart a stalled engine and the Contact Rings (10) direct current from below the Ladder Turntable to above the Turntable. The Diodes (15) and (17) protect the Solenoids (18), (19) and (20) against a high voltage surge.

Ladder Extension and Retraction - when the Ladder Extension Joystick (1) is moved toward A+, current is directed via the Current Regulator (13) to the A side of the Extension solenoid (18), causing the corresponding Proportional Valve to open and the ladder to extend. When the Ladder Elevation Joystick (1) is moved toward B-, current is directed via the Current Regulator (13) to the B side of the Extension Solenoid (18) causing the corresponding Proportional Valve to open in the opposite Direction and the ladder to retract.

When the ladder extension is about five feet from its maximum, speed is reduced automatically by a micro switch (4). The lug on a Limit Switch Activating Cam closes the micro switch (see Figure 8-9, numbers 5 and 7) and current is reduced to the A side of the Extension Solenoid (18) by two resistors (9), causing the rate of ladder extension to slow.

When the ladder is fully extended, a second micro switch (5) contacts the Limit Switch Activating Cam (see Figure 8-9, number 8). The micro switch opens and current is cut to the A side of the Extension Solenoid. The Extension Solenoid operates the corresponding Proportional Valve, preventing further extension of the ladder using the Ladder Extension Joystick.

When the ladder is fully retracted, a micro switch (6) contacts the Limit Switch Activating Cam (see Figure 8-9, numbers 5 and 4). The micro switch opens and current is cut to the B side of the Extension Solenoid (18). The Extension Solenoid operates the corresponding Proportional Valve, preventing further retraction of the ladder using the Ladder Extension Joystick.

The solenoid-operated switches (34) and (35) are controlled by the Bourdon Tube Micro Swtich (25). When the pressure in the ladder lifting cylinders exceeds 1050 psi, the Bourdon Tube Micro Switch opens, causing the solenoid-operated switches to open. Current is cut to the A side of the Extension Solenoid (18) and the A side of the Elevation solenoid (20). The ladder cannot be extended or depressed until the pressure is reduced in the ladder lifting cylinders or the Emergency Override Button (22) is depressed, which will cause the solenoid-operated switches to close and allow current flow to the A side of the Extension Solenoid and the A side of the Elevation Solenoid while the Emergency Override Button is depressed. When the Bourdon Tube Micro Switch opens, an amber light (26) on the Ladder Control Console will light.

Ladder Rotation - when the Ladder Rotation Joystick (2) is moved toward C+, current is directed via the Current Regulator (13) to the C side of the Rotation Solenoid (19), causing the corresponding Proportional Valve to open and the ladder to rotate in a clockwise direction. When the Ladder Rotation Joystick (2) is moved toward D-, current is directed via the Current Regulator (13) to the D side of the Rotation Solenoid (19) causing the corresponding Proportional Valve to open in the opposite direction and the ladder to rotate counterclockwise.

Ladder Elevation and Depression - when the Ladder Elevation Joystick (3) is moved toward A+, current is directed via the Current Regulator (14) to the A side of Elevation Solenoid (20), causing the corresponding Proportional Valve to open and the ladder to depress. When the Ladder Elevation Joystick (3) is moved toward B-, current is directed via the Current Regulator (14) to the B side of the Elevation Solenoid (20) causing the corresponding Proportional Valve to open in the opposite direction and the ladder to elevate.

Ladder deceleration prior to maximum elevation and ladder stoppage at maximum elevation of 75 degrees are controlled by two micro switches (7) and (8) in the Elevating Cylinder Limit Switch Assembly on the left side of the ladder turntable (see Figure 8-10). As the ladder is elevated, a wire connected between the assembly and Section One of the ladder causes a camshaft to turn. A few degrees before maximum elevation, a cam lobe closes the deceleration micro switch (7). Current is reduced to the B side of the Elevation Solenoid (20) by two resistors (11). The reduced current causes the Elevation Solenoid to operate and the rate of ladder elevation is reduced. When the ladder reaches maximum elevation a second cam lobe opens a micro switch (8). Current is cut to the B side of the Elevation Solenoid. The Elevation Solenoid operates and the corresponding Proportional Valve closes, preventing further elevation of the ladder using the Ladder Elevation Joystick. When the ladder is lowered, a spring in the Elevating Cylinder Limit Switch Assembly turns the camshaft in the opposite direction and retracts the wire.

To protect the ladder and ladder bed from undue stress, a micro switch (12) at the ladder bed opens when the ladder is brought to rest on the ladder bed, causing a solenoid-operated switch (35) to open. Current is cut to the A side of the Elevation Solenoid (20), preventing any further attempt to depress the ladder.

6.4.8 Ladder Circuits Below the Turntable

For the wiring diagram of circuits below the Turntable, refer to Figure 6-7.

The Outrigger Marker Lamps (No. 151) are controlled through a Flasher Relay (No. 152) and a 20 Amp Circuit Breaker (No. 157). The Outrigger By-Pass Switch (No. 161) and the switches which prevent ladder movement before the Outriggers are deployed (No. 150), are connected through the Solenoid Switch (No. 154).

The Electric/PTO Pump Switch (No. 160), located on the Hydraulic Control Panel, powers the Electric Pump (Figure 5-2, No. 8) and controls the Pilot Lights (No. 163) through the Solenoid Switch (No. 154) and electrically connects the Throttle Switches (No. 162) to the Engine Throttle (No. 166).

7. PNEUMATIC SYSTEM

7.1 GENERAL

For numbered references of the Pneumatic Diagram, refer to Figure 7-1.

Air is provided by the engine air compressor through the Air Compressor Governor (9) to the Air Pressure Regulator (6). The engine air compressor operates whenever the engine is running. If the Engine Throttle Solenoid Valve (5) is closed, the air pressure will recirculate through the air compressor. When the Engine Throttle Solenoid Valve is opened, by actuating one of the remote Engine Throttle Controls, air pressure is allowed to build up in the system. When the pressure in the lines and in the Air Tank (2) arrives at the pressure set on the Regulator pump (6), air is once again recirculated through the air compressor. For a description of the operation of the Engine Air Compressor, refer to Part 2, Volume 2, "Detroit Diesel Engine V-71 Highway Vehicle Service Manual, Section 12.4".

When the PTO Control Valve (1), located in the cab, is switched to "ENGAGE", air pressure is transferred to the PTO Shift (7) and to the Ladder Bed Lock (4). Air pressure then causes the PTO to be engaged with the engine and causes the piston in the Ladder Bed Lock to move and withdraw the locking arms from the ladder rails. When the PTO shift switch is switched to "DISENGAGE", air pressure stored in the Air Tank is allowed to activate the PTO Shift and disengage it from the engine. At the same time, it moves the Ladder Bed Lock Piston in the opposite direction to re-engage the locking arms on the ladder rails.

When the Pump Control Valve in the cab (3) is pulled out, air pressure from the Air Tank is applied against one side of the Cylinder Shifting Pump (8) and causes the engine drive train to disengage from the axle and the Hale pump to engage with the engine. When the Pump Control Valve is pushed in, air from the Air Tank is transferred to the opposite side of the Cylinder Shifting Pump, which causes the pump to disengage from the engine and the truck drive train to re-engage with the axle.

7.2 LADDER BED LOCK ASSEMBLY

The Ladder Bed Lock is designed to hold the ladder on the Ladder Bed while the truck is travelling. It is controlled pneumatically and operates in conjunction with the PTO control switch in the cab. When the PTO Shifting Valve is switched to "ENGAGE" air pressure is transferred to the Air Cylinder Assembly (see Figure 7-2, number 12). This causes the piston in the Air Cylinder (see Figure 7-3, number 4) to move to the opposite end of the cylinder.

The Air Cylinder piston is linked to the right locking arm and the cylinder housing is linked to the left arm (see Figure 7-2). When the piston moves in the Air Cylinder it lengthens or shortens the linkage to the arms. When the piston moves inward and shortens the linkage, the Locking Arms (see Figure 7-2, number 1) slide inward, away from the ladder rails, and unlock the ladder from the ladder bed. When the piston moves outward and lengthens the linkage, the locking arms slide outward, toward the ladder rails, and lock the ladder to the ladder bed (see Figures 7-4 and 7-5).

7.3 PARKING BRAKE OVERRIDE VALVE

The Parking Brake Override Valve is located under the dash, to the right of the Warning Light Control Panel (see Figure 7-6). By stopping the flow of compressed air from the truck air tank to the Parking Brake Control Valve which is operated by the yellow Parking Brake Control on the dash, the Override. Valve prevents the release of the Parking Brake by the truck operator when the ladder is not on the ladder bed.

When the ladder leaves the ladder bed, a micro switch at the ladder bed closes energizing the solenoid of the Override Valve. The valve closes, preventing the flow of compressed air to the Parking Brake Control Valve. The Parking Brake cannot be released unless the ladder is returned to the ladder bed or the red Parking Brake Override Button is pressed. When the Override Button is pressed, current to the solenoid is cut and the Override Valve opens, releasing the Parking Brake. When the Override Button is released, the solenoid is re-energized, causing the Parking Brake Override Valve to close and the Parking Brake to re-set. When the ladder is returned to the ladder bed, the micro switch at the ladder bed opens and current to the solenoid is cut, causing the override valve to open. The Parking Brake can now be released using the yellow Parking Brake Control.

8. LADDER CALIBRATION AND ADJUSTMENT

8.1 GENERAL

Section 8 describes how the Ladder Assembly is calibrated and how adjustments are made to the Relief Valves, Limit Switches and Ladder and Dial Cables. To assist in locating components discussed in the text, all the electric and relief valves on the truck have been tagged with an identifying number, which corresponds with their identifying number on the hydraulic schematic (see Figure 5-2).

8.2 ADJUSTMENT OF RELIEF VALVES

To determine if relief valves require adjustment, pressure is applied to the system by operating components against mechanical stops. Pressure should only be applied long enough to adjust the valves. Then the valve should be closed. Prolonged application of pressure will cause damage to the assembly.

Although there are adjusting screws (see Figure 8-2, numbers 7, 8 and 9) for the flow control valves, which are integral to the Proportional Valve, the flow control valves are factory set and do not require adjustment.

8.3 LADDER OPERATION - FAST IDLE ADJUSTMENT

The Fast Idle System is air activated. It consists of a Limiting Speed Mechanical Governor located on the engine governor cover. It is activated by air pressure controlled by the engine air compressor governor. The higher the air pressure the greater the engine RPM. The pressure is adjusted by a regulator located near the PTO (see Figure 5-1, number 3).

To set the engine RPM, one operator pushes the throttle control on the left Outrigger Panel and observes the RPM Gauge, while a second operator adjusts the Regulator until the desired RPM is reached (the engine should be set at 1200 RPM).

8.4 MAIN HYDRAULIC PRESSURE - RELIEF VALVE ADJUSTMENT

The main hydraulic pressure adjustment is controlled by a Relief/Unloader MUV 3 Way Flow Control Valve on the turntable (see Figure 8-1). When ladder hydraulics are engaged and the green Throttle Control Button pulled up, pilot pressure is 450 psi while the ladder is stationary. Pilot pressure is indicated by the Hydraulic Pressure Gauge on the Ladder Control Console. Adjust pilot pressure before adjusting the main hydraulic pressure. Start the engine and switch the PTO to "ENGAGED". Deploy the outriggers. Push in the Ladder/Outrigger Selector Control Valve to select ladder hydraulics. Pull up the green Throttle Control Button on the Ladder Control Console. The engine rpm is 1200. With assistance, loosen the lock nut and turn the adjusting screw (see Figure 8-1, number 1) clockwise to increase pressure to 450 psi or turn the adjusting screw counterclockwise to decrease pressure to 450 psi. Tighten the lock nut.

After adjusting pilot pressure, adjust the main hydraulic pressure. Remove the cap nut on the adjusting screw (see Figure 8-2, number 5) and loosen the lock nut. Turn the adjusting screw clockwise as far as it will go until it is difficult to turn. Tighten the lock nut and install the cap nut. Push down on the Ladder Elevation Auxiliary Control Lever (see Figure 8-2, number 6) to raise the end of the ladder above the lights on the cab roof. Rotate the ladder either left or right using the Ladder Rotation Auxiliary Control Lever (see Figure 8-2, number 4) .

Rotate the ladder far enough that the ladder can later be lowered below the horizontal position to fully retract the Ladder Elevating Cylinders. Do not lower the ladder below the horizontal position at this time. Loosen the lock nut and turn the relief valve screw (see Figure 8-1, number 2) counterclockwise about two full turns. Pull up the green Throttle Control Button. Pull up the Ladder Elevation Auxiliary Control Lever to lower the ladder below the horizontal and fully retract the Ladder Elevating Cylinders. Hydraulic pressure will increase once the Ladder Elevating Cylinders are fully retracted. With assistance, continue to pull up on the Ladder Elevation Auxiliary Control Lever and slowly turn the relief valve screw (see Figure 8-1, number 2) until the Hydraulic Pressure Gauge on the Ladder Control Console indicates 1550 psi. Tighten the lock nut on the screw.

8.5 EXTENSION AND RETRACTION - RELIEF VALVE ADJUSTMENT

Elevate the ladder to 30 degrees and extend the ladder about 40 feet. Remove the cap nut and loosen the lock nut on the adjusting screw (see Figure 8-2, number 1). Turn the adjusting screw counterclockwise about two full turns. Pull up the green Throttle Control Button. Push down the Ladder Extension Auxiliary Control Lever (see Figure 8-2, number 2) and fully retract the ladder. When fully retracted the second Ladder Section should be against the mechanical retraction stops.

Continue to press down the Control Lever and slowly turn the adjusting screw clockwise until the Hydraulic Pressure Gauge on the Ladder Control Console indicates pressure is 1300 psi. Tighten the lock nut and install the cap nut on the adjusting screw.

8.6 ROTATION - RELIEF VALVE ADJUSTMENT

This adjustment is done with the ladder resting on the ladder bed. Remove the cap nut and loosen the lock nut on the rotation adjusting screw (see Figure 8-2, number 3). Turn the adjusting screw counterclockwise about two full turns. Pull up the green Throttle Control Button. Push down the Ladder Rotation Auxiliary Control Lever (see Figure 8-2, number 4). The ladder will not turn, but hydraulic pressure will increase, as indicated by the Hydraulic Pressure Gauge on the Ladder Control Console. Continue to push down the Control Lever and slowly turn the adjusting screw clockwise until hydraulic pressure is 900 psi. Tighten the lock nut and install the cap nut on the adjusting screw.

8.7 OUTRIGGER -RELIEF VALVE ADJUSTMENT

Select "OUTRIGGER" with the Ladder/Outrigger Selector Valve. Extend the outriggers on the left side of the vehicle until the foot plates press against the ground. The hydraulic pressure should be 1000 psi. Hydraulic pressure is indicated by the hydraulic pressure gauge on the Outrigger Control Panel. If hydraulic pressure is less that 1000 psi, remove the capscrew (see Figure 8-3, number 1) from the valve behind the Outrigger Control Panel and remove the spring with a magnetic rod. Withdraw the relief valve cartridge. Disassemble, clean and assemble the cartridge. Install the cartridge, spring and capscrew and test the hydraulic pressure a second time following the procedure described above. If the hydraulic pressure is still less than 1000 psi, replace the cartridge.

8.8 CABLE REPLACEMENT

If it is necessary to replace a cable, ensure the correct size and type is employed. Start with a cable the same length as the one being replaced and with appropriate fittings attached (refer to Part 3, Parts List).

8.8.1 Replacing Extension Cables

With the ladder retracted thread the left Section 2 Extension Cable through the pulleys of the ladder as described in para. 4.2.2 (see Figure 4-11). Insert the threaded ferrule on the end of the Extension Cable through the cable attaching bracket welded to Section 1 of the ladder. Thread the two locking nuts onto the ferrule until the end of the ferrule is flush with the end of the second nut.

Elevate the ladder, to provide working room, and employ two persons to pull the cable tight toward the Extension Hoist drums. A third person is required to wrap the cable twice around the left extension drum as described in para. 4.2.2 (see Figure 4-12) and with the cable pulled as tight as possible fasten the curved ferrule to the flange of the cable drum with the attaching bolts.

Repeat the procedure with the right Extension Cable, taking care that both cables receive equal tension.

Thread the left Section 3 Extension Cable as indicated in Figure 4-13 and fasten one end of the cable to the left cable attaching bracket on Section 1. Thread the locking nuts on the ferrule, only until the end of the ferrule is flush with the end of the second nut. Extend the Second Section of the ladder, using the ladder hydraulics, until the rungs of the Section 2 exactly coincide with the rungs of Section 1. Pull the Section 3 Extension Cable tight and thread the ferrule through the cable attaching bracket on Section 3 of the ladder. Adjust the locking nuts on each end of the cable until the rungs of Section 3 exactly coincide with the rungs of Sections 2 and 1.

8.8.2 Replacing the Retracting Cable

With the ladder hydraulics, extend the ladder to full extension. Thread the Retraction Cable as described in para. 4.2.3 (see Figure 4-14). Attach the threaded ferrule to Section 3 Compensator with the end of the ferrule flush with the second locking nut. Pry the Compensator with a pry bar until half of the available adjustment is taken up and block in this position.

Employ two persons to pull the cable as tight as possible towards the Extension Hoist drums while a third person puts two wraps of cable, clockwise, on the right-hand drum and fastens tne curved ferrule to the flange of the drum with attaching bolts.

Release the tension on the Compensator and then tighten the locking nuts on the ends of the threaded ferrules until half of the Compensator adjustment is again taken up. If there is not sufficient adjustment available on the ferrules to tighten the Compensator, block it once again, pull the cable tighter and advance the curved flange on the drum.

8.8.3 Replacing the Locking Pawl Assembly Cables

Refer to the description of the Ladder Locking Pawl Assembly in para. 4.3.2 and Figure 4-16. Install the cable (2) first by attaching one end to the Locking Pawl assembly at (10), threading the cable through the Balancer Assembly (4) and the other end to the Locking Lever (1). Ensure the Locking Lever is down in the unlocked position and pull the cable tight before attaching to the lever. The locking nuts should be at the end of the threaded ferrule to allow maximum adjustment. Attach one end of cable (12) to the Locking Pawl Assembly on Section 2 and thread as shown in Figure 4-16. Pull the cable as tight as possible and attach at the cable attaching bracket on Section 2 (13).

The locking nuts should be at the end of the threaded ferrule to allow maximum adjustment.

8.8.4 Calibrating the Locking Pawl Assemblies

Before calibrating the Locking Pawl Assemblies ensure the three Ladder Sections are in alignment (refer to para 8.9.1). It is important that the Locking Pawls on Section 2 engage the rungs of Section 3 at exactly the same instant that the Pawls on Section 1 engage the rungs of Section 2.

With the ladder hydraulics, extend the ladder a minimum of the distance between two rungs. Move the Locking Pawl Control Lever forward to allow the Locking Pawls to swing up under control of their springs. Retract the ladder until a rung of Section 2 is approximately 1/4" from engaging the abutment on the face of the Locking Pawls on Section 1 (see Figure 8-4, number 4).

The distance that the Locking Pawls on Section 1 may swing up is controlled by the lug on the Section 1 Pawls and is factory set. Take note of the distance between the rung of Section 2 and the lower face of the Locking Pawls on Section 1 (see Figure 8-4, number 3).

Adjust the adjusting screw on the Locking Pawl Adjusting Block on Section 2 (see Figure 4-16, number 14) until the Locking Pawl Assembly on Section 2 is the same distance from a rung on Section 3 as the Section 1 Pawl is from the Section 2 rung as previously noted.

The distance between the rung of Section 3 and the abutment on the face of the Pawls on Section 2 (see Figure 8-4, number 4) should be the same as previously set for Section 2. If the distance is too great, tighten the Section 3 Retraction Cable. If it is too small tighten both Section 3 Extension Cables until the distances are equal.

Pull the Locking Pawl Control Lever to the rear to withdraw the Locking Pawl Assemblies to the disengaged position. If the Pawls do not retract completely into their own Sections, tighten the adjustment at the Control Lever for Locking Pawl Assembly 1 and at the attaching bracket on Ladder Section 2 for Locking Assembly 2.

8.9 CALIBRATING THE LADDER SECTIONS

8.9.1 General

Ladder Sections 2 and 3 ride on nylon slides during Extension and Retraction, which are designed to separate the Section's overlapping flanges by 1/16" (see Figures 8-5, 8-6 and 8-7). If the Ladder Sections are allowed to rub, Extension and Retraction will be impeded and greater hydraulic pressure will be required to operate the ladder. Also, an unacceptable increase in ladder wear will result.

8.9.2 Ladder Spacing Adjustment

With the ladder retracted, check the spacing separating each Section. If the spacing between the sections is greater than 1/16" but less than 1/4", install shims at the nylon slides to reduce the spacing between the sections to 1/16". If the spacing between the sections is 1/4" or greater, remove the nylon slides and install new slides.

8.10 CALIBRATING LADDER DIALS AND LIMIT SWITCHES

8.10.1 General

The Ladder Extension Dial and Limit Switches are controlled through the operation of the Extension Indicator Assembly (see Figure 8-8). The Extension Indicator Assembly is driven through a gear train (2) by the right drum of the ladder winch (1). As the winch rotates to extend or retract the ladder the threaded screw on the Indicator Assembly (3) is moved left or right. A control cable attached to the Indicator Assembly Screw rotates the Indicator Dial on the Ladder Control Console (see Figure 8-9). At the same time adjustable cams attached to the screw activate Extension and Retraction Limit Switches.

The Inclometer Dial is connected by a control cable and a series of pulleys to Ladder Section 1. As Section 1 rotates about its axis the Inclometer Dial is rotated to indicate the angle of elevation. Deceleration and stoppage of ladder elevation are controlled by the Elevating Cylinder Limit Switch Assembly. For an explanation of the operation of this assembly, refer to paragraph 6.4.7.

8.10.2 Calibrating the Limit Switches

The position of the Limit Switch Activating Cams can be adjusted by loosening the set screws and sliding the Cam, left or right, on the Indicator Assembly Screw (see Figure 8-9, numbers 1, 2, 6 and 9). One cam has a lug which activates the limit switch controlling the ladder deceleration during extension. The same cam then trips the limit switch controlling maximum ladder extension (8). To set this cam extend the ladder until it is approximately 8" from maximum extension. Loosen the set screw on the controlling cam (6) and slide the cam until its lug trips the Extension Deceleration Limit Switch and just trips the Extension Control Switch. Tighten the set screw.

CAUTION

Do not adjust the cam to activate the Extension Limit Switch at maximum extension. This action could result in the ladder being locked in the fully extended position by the Locking Pawls.

To set the ladder Retraction Limit Switch, elevate the ladder to approximately 45 degrees and extend the ladder until the rear of Section 2 is 1" from the retraction stop on Section 1. Loosen the set screw on the controlling cam and move the cam until the Retraction Limit Switch is just activated.

CAUTION

Do not set the Retraction Limit Switch with the Ladder at 0 degrees. Without the weight of the ladder hanging in the cables at the time the switch is adjusted, the 1" separation may not be sufficient to prevent the ladder from slamming into the rear stop.

With the Ladder on the Ladder Bed, check the wire from the Elevating Switch Assembly to the Ladder Assembly for slackness. If the wire is slack, loosen the cap screw that secures the wire to the Ladder Assembly and pull the wire just enough to remove all slackness. Tighten the cap screw.

Check and adjust the Elevating Limit Switch Assembly. Elevate the ladder. At 70 degrees the rate of ladder elevation should decrease. When the ladder is fully elevated, check the angle of elevation. The angle should be 75 degrees. If the ladder begins to slow either too soon or too late, elevate the ladder to 70 degrees and adjust the Elevating Cylinder Limit Switch Assembly. Remove the cover (see Figure 8-10). The bottom micro switch (4) causes the rate of ladder elevation to decrease when the ladder reaches 70 degrees. Loosen the cam screw and adjust the cam (3) until it contacts the micro switch. Tighten the cam screw. If the ladder does not stop at 75 degrees, adjust the Elevating Cylinder Limit Switch Assembly. Elevate the ladder to 75 degrees. The top micro switch (1) stops ladder elevation. Loosen the cam screw and adjust the cam (2) until it contacts the micro switch. Tighten the cam screw. Lower and raise the ladder to its maximum elevation after adjusting the cams and check the angle of elevation at which the ladder begins to slow and the angle at which the ladder stops. Install the cover.

8.10.3 Calibrating The Indicator Dials

The Indicator Dials should not be calibrated before the Limit Switches have been correctly set.

To calibrate the Inclinometer Dial, first lower the ladder onto its bed. Loosen the set screw on the Dial drum (see Figure 4-8, number 2) and rotate until a 0 reading is seen in the Dial Window on the Control Console. Tighten the set screw. Check that the control cable is tight. If it requires tightening, loosen the clamp screws holding the end of the cable to Ladder Section 1 and, with pliers, pull the cable tight. Ensure the dial setting remains at 0 degrees. Tighten the clamping screws.

To calibrate the Extension Dial, first fully retract the ladder. Loosen the set screw holding the Extension Control Cable in the end of the Extension Indicator Assembly Screw (see Figure 8-9, number 3). Move the Control Cable until the Dial reads 35 degrees and tighten the set screw. If more adjustment is required, loosen the set screw on the Extension Dial drum (See Figure 4-8, Number 8) and rotate the dial until 35 degrees is indicated. Tighten the set screw.

8.11 CALIBRATING THE OVERLOAD SWITCH

Pull up the green Throttle Control Button. Pull up on the Ladder Elevation Auxiliary Control Lefver (see Figure 8-2, number 6). When the Ladder Elevating Cylinders are fully extended, the hydraulic pressure will continue to increase as indicated by the Hydraulic Pressure Gauge on the Ladder Control Console. When hydraulic pressure reaches 1050 psi the Automatic Stop Light on the Ladder Control Console should light. If the light comes on when hydraulic pressure is less than 1050 psi or greater than 1050 psi, the limit switch in the bourdon tube, which is in the Ladder Control Console requires adjustment. If the light comes on when hydraulic pressure is less than 1050 psi, turn the spring tensioner adjusting screw counterclockwise to increase the pressure at which the light will come on. If the light comes on when hydraulic pressure is greater than 1050 psi, turn the spring tensioner adjusting screw clockwise to decrease the pressure at which the light will come on.

9. ILLUSTRATIONS

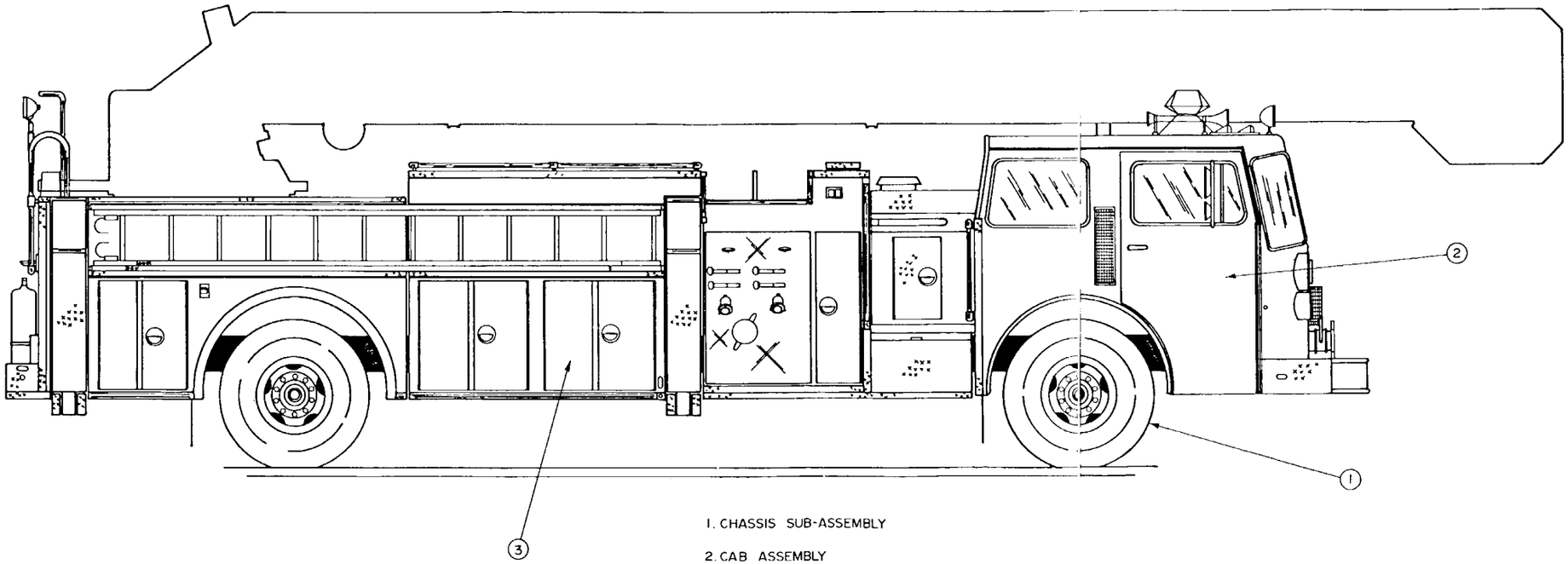
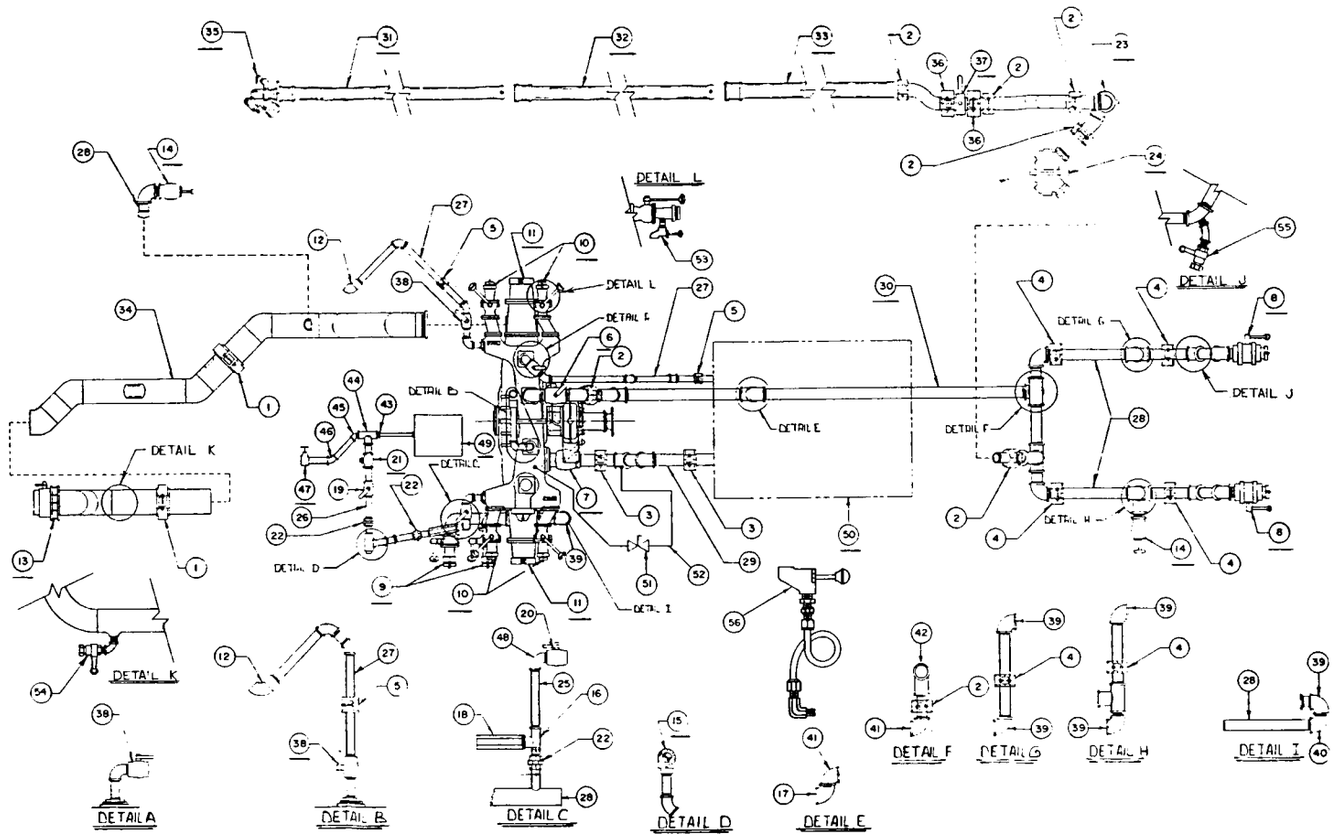


FIGURE 2-1.
QWT-85 Chassis Assembly



See pages 9 to 11 for identification

FIGURE 3-1.
Water Plumbing Schematic

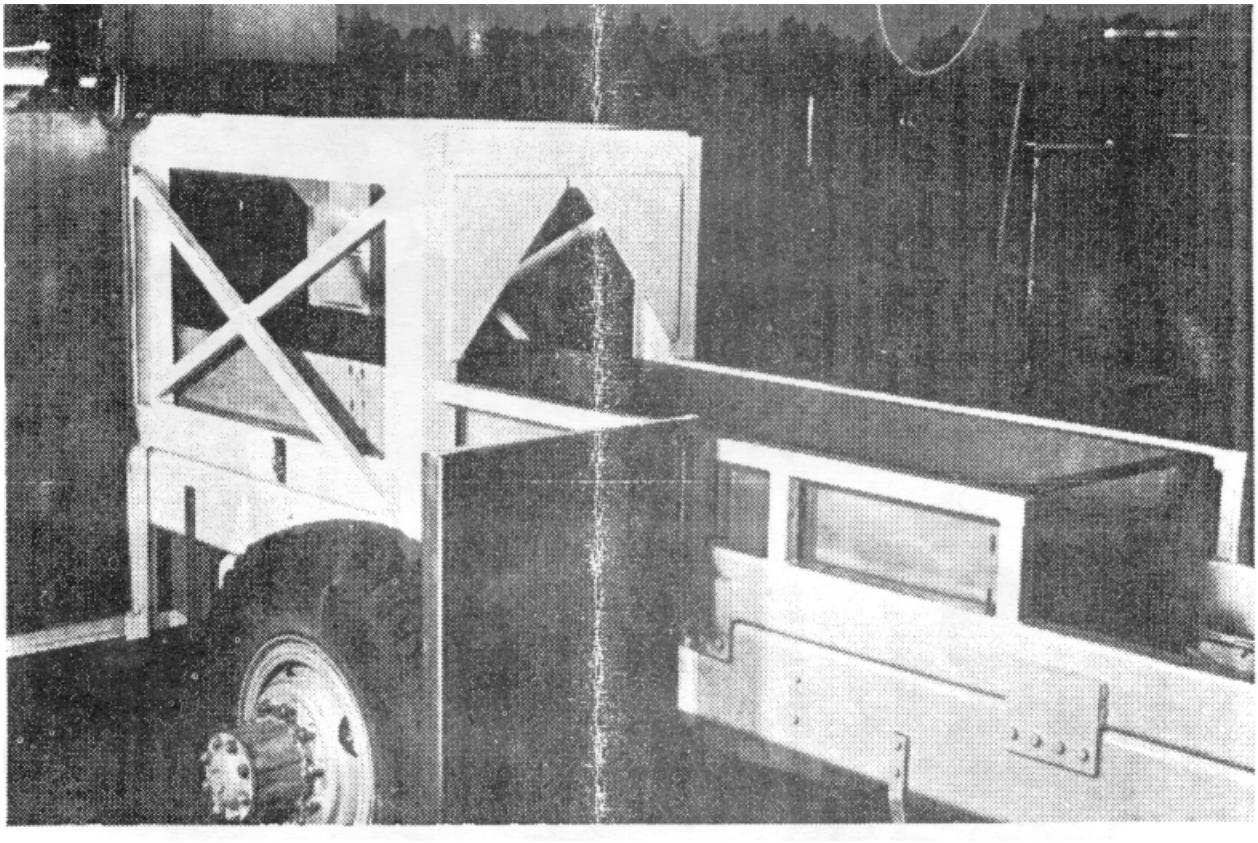
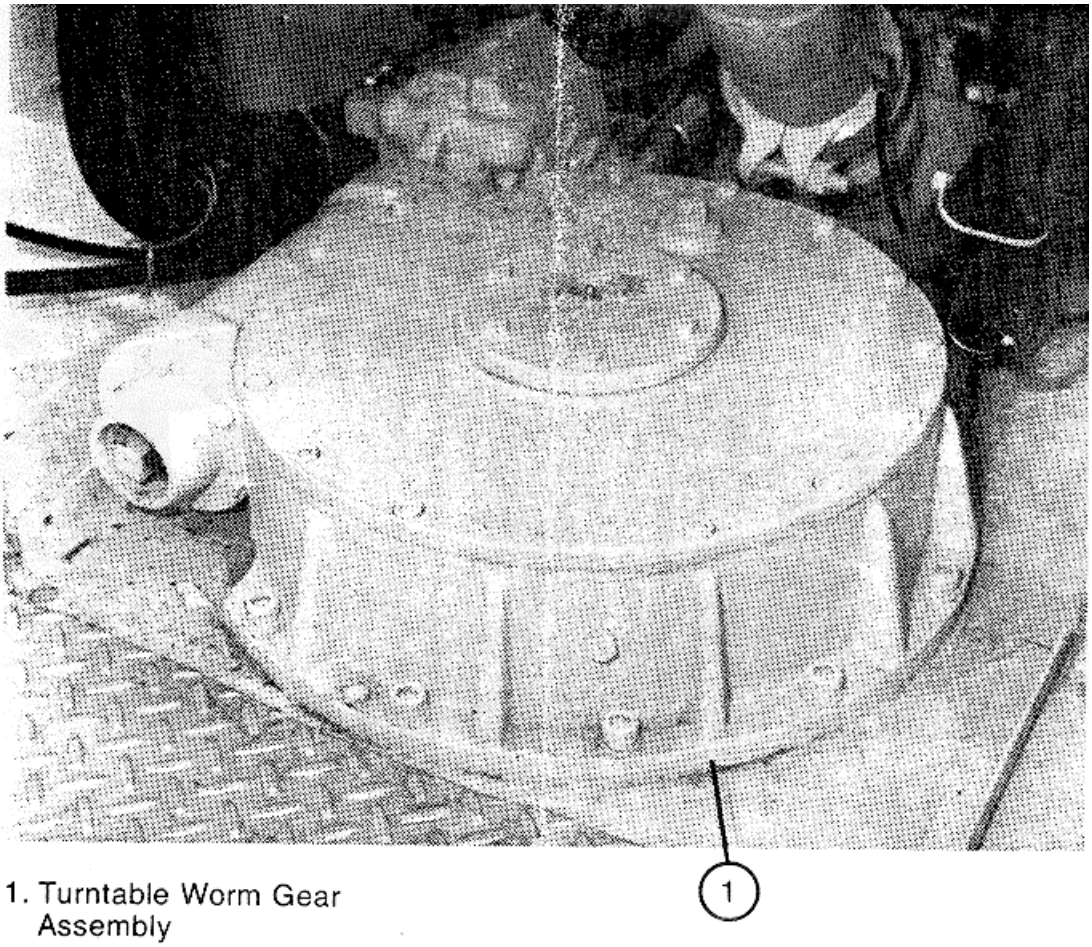
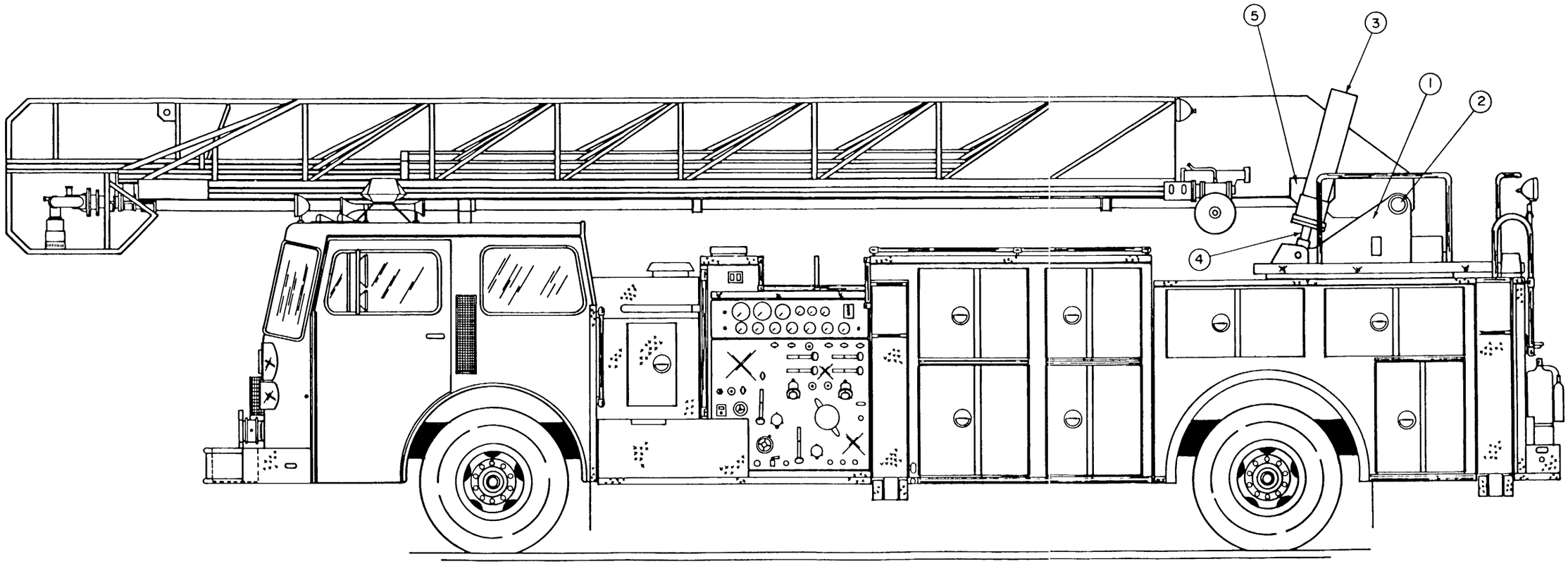


FIGURE 4-1.
QWT-85 Truck Sub-Structure



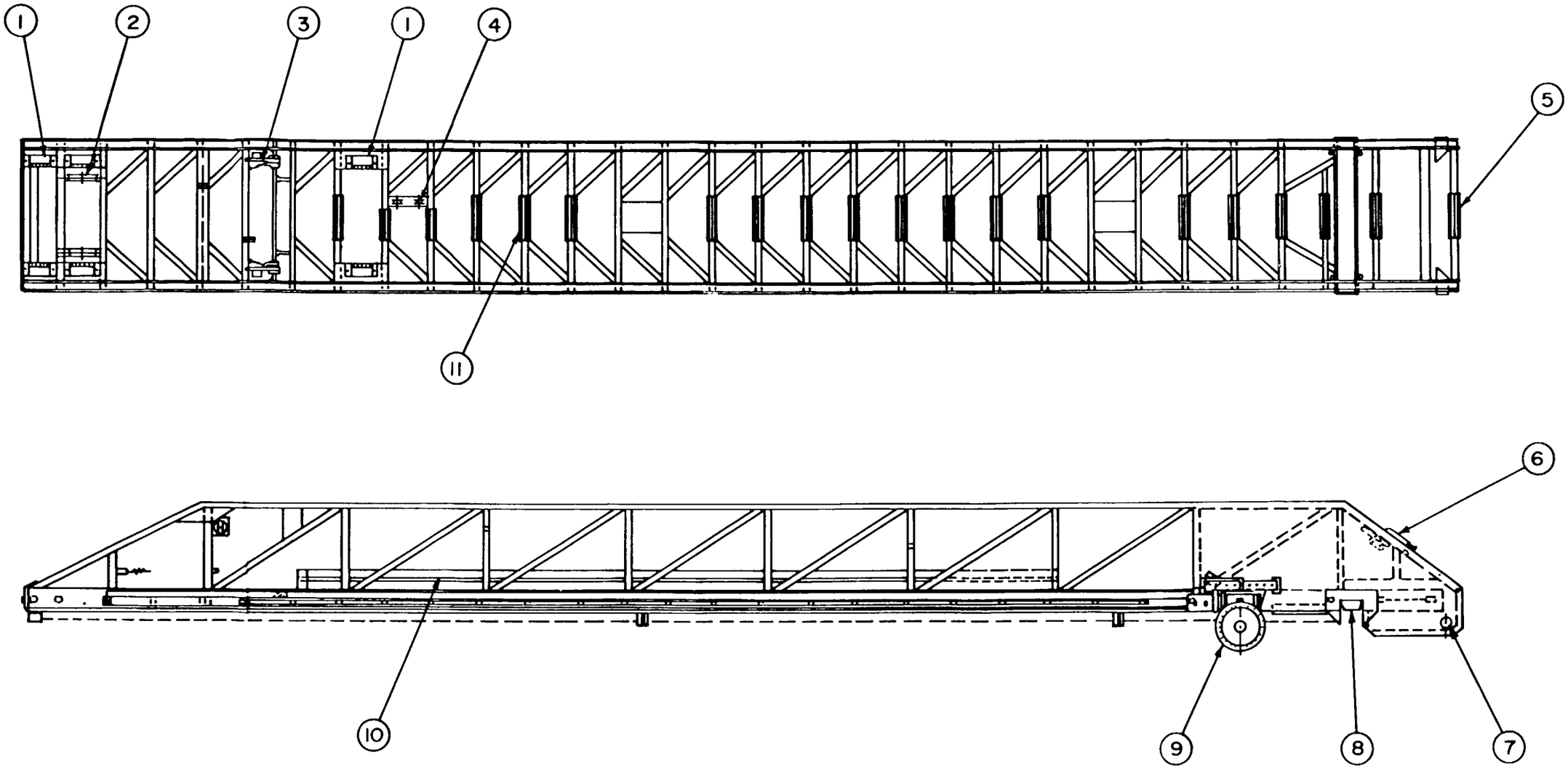
1 Turntable Worm Gear Assembly

FIGURE 4-2.
Turntable Drive Assembly



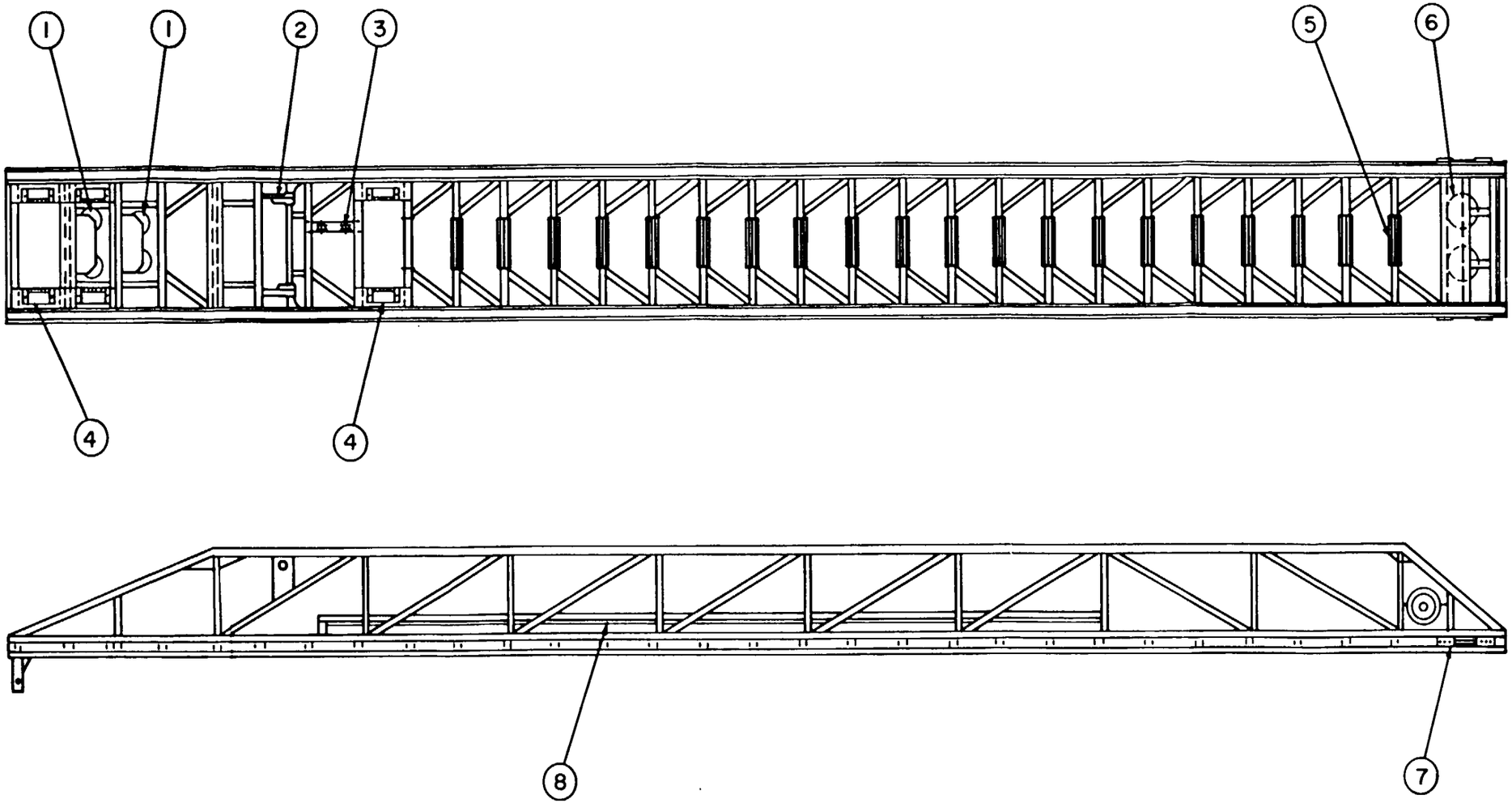
For Explanation See Pages 12 to 13

FIGURE 4-3.
Ladder Elevation Assembly



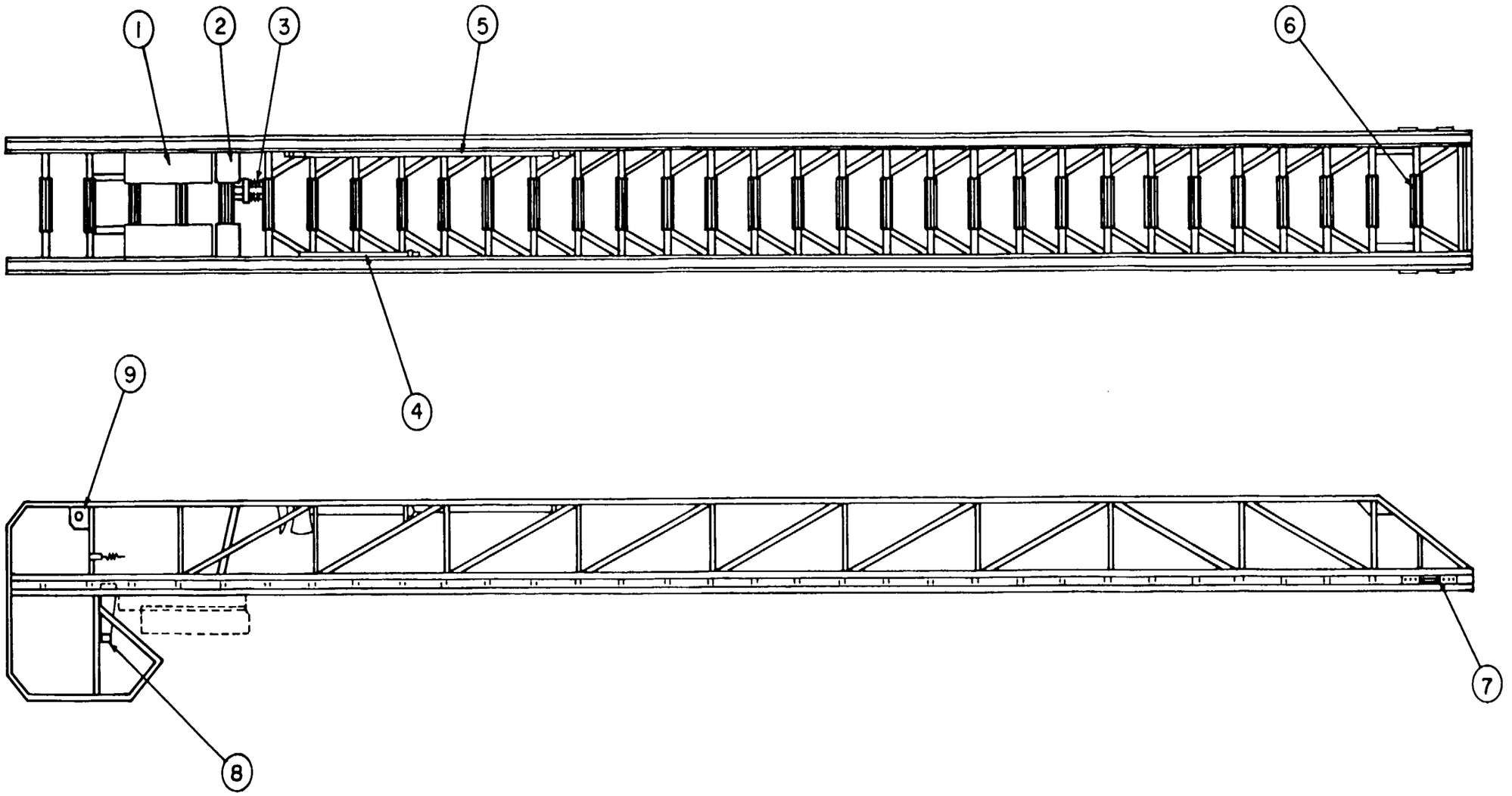
For Explanation See Pages 13 to 14

FIGURE 4-4.
Ladder Section 1



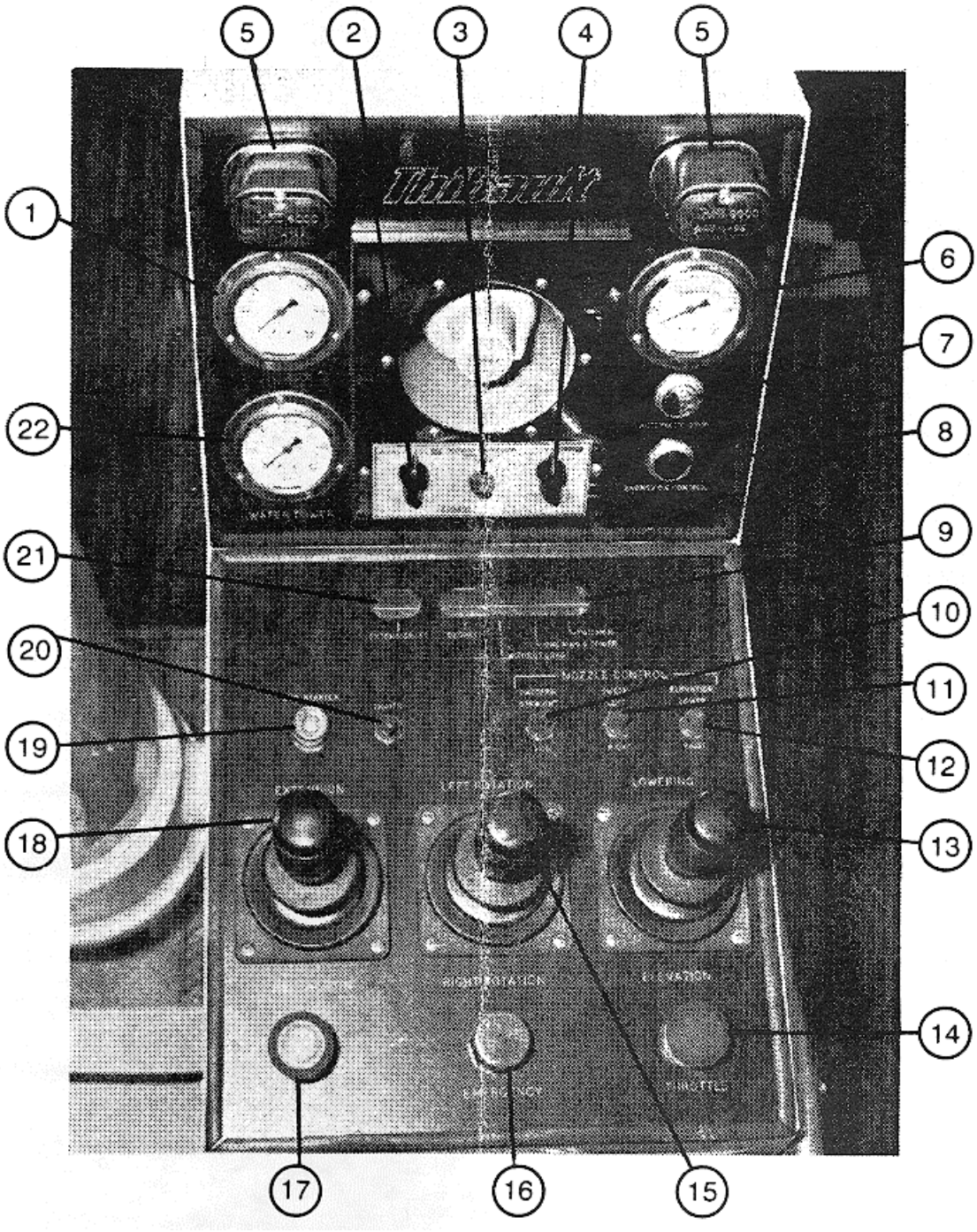
For Explanation See Page 14

FIGURE 4-5.
Ladder Section 2



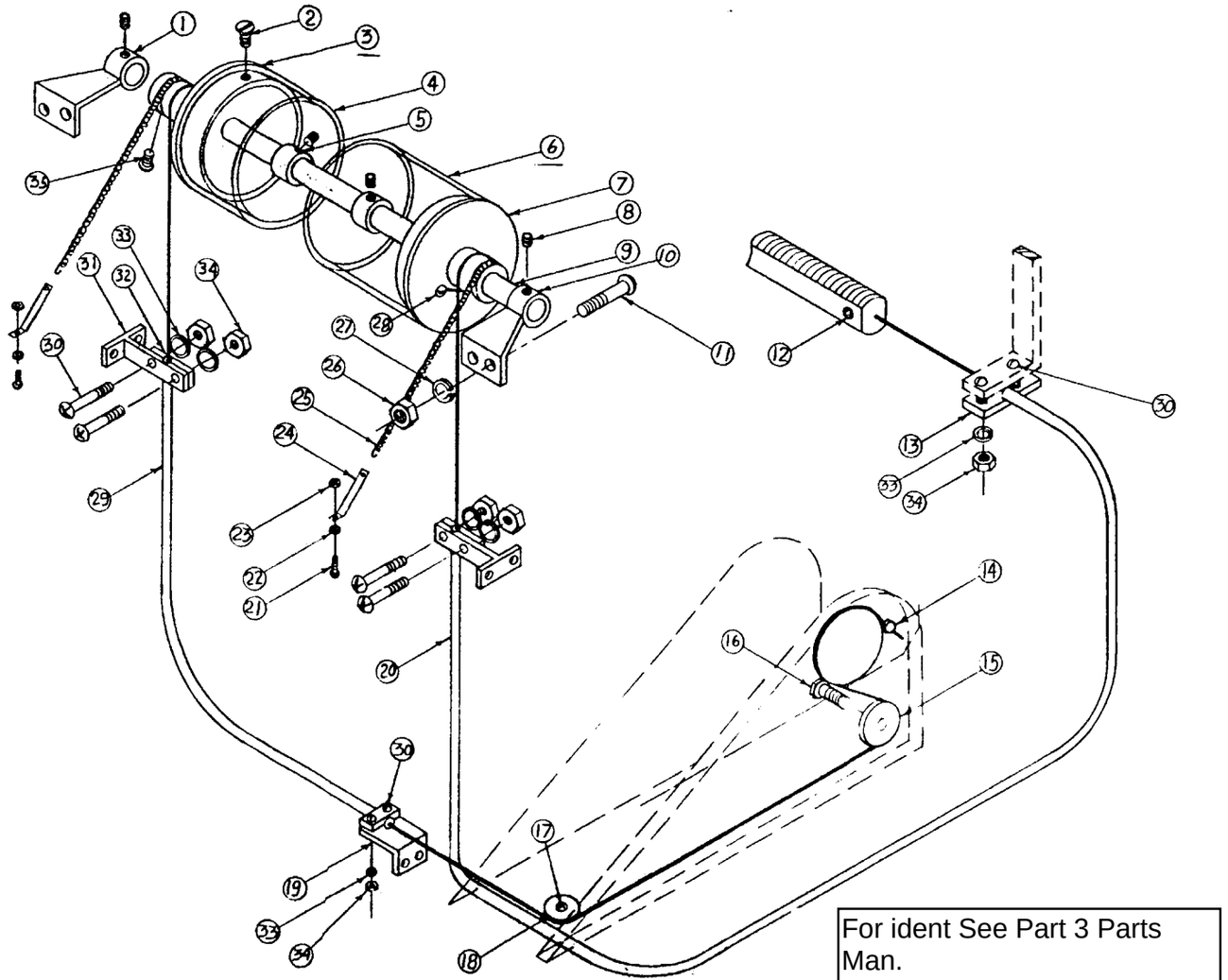
For Explanation See Page 14

FIGURE 4-6.
Ladder Section 3



See Pages 15 to 17 for identification

FIGURE 4-7.
Ladder Control Console



For ident See Part 3 Parts Man.

For Explanation See

FIGURE 4-8.
Ladder Dial Assembly

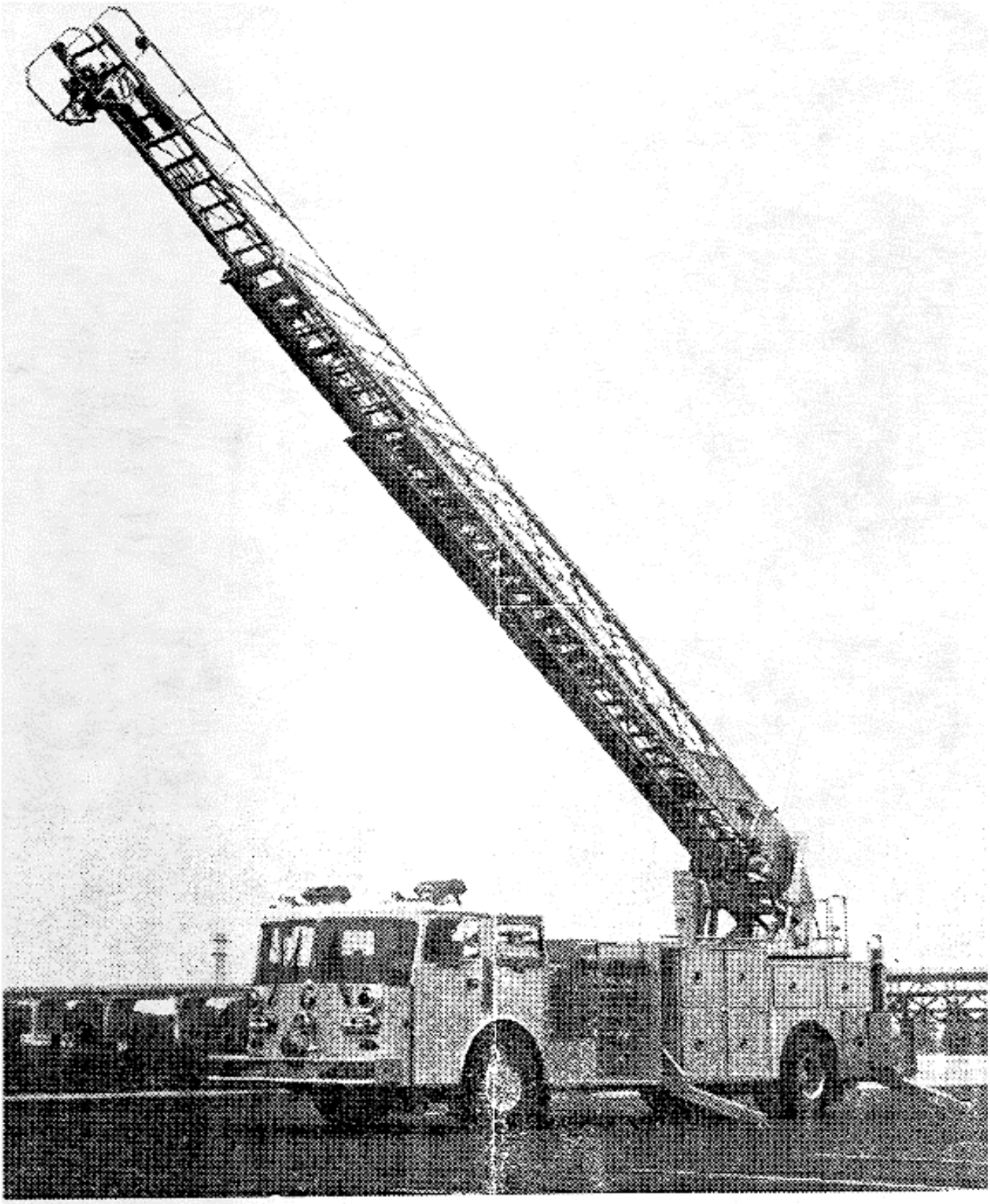
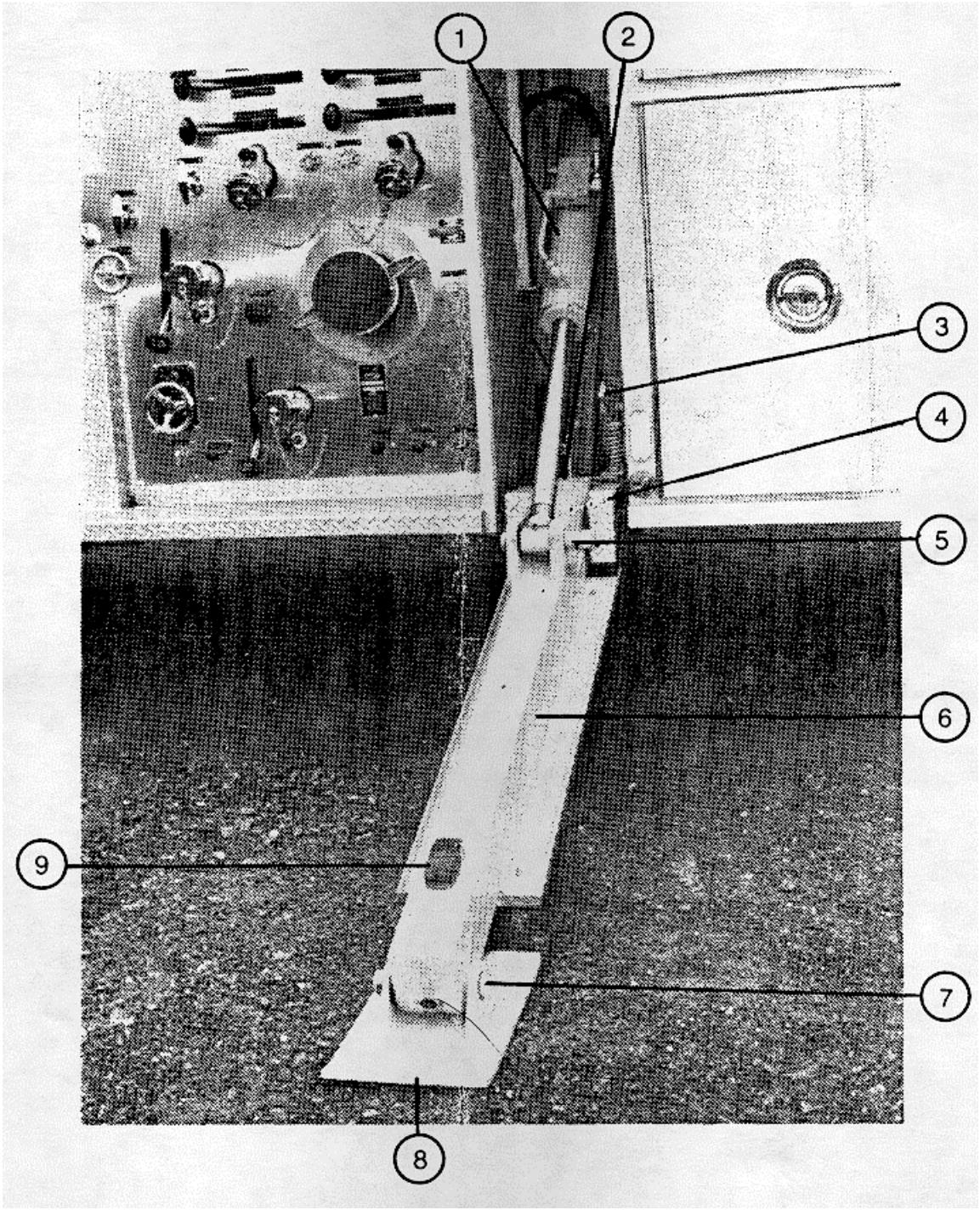


FIGURE 4-9.
QWT-85 Truck Deployed



See page 18 for identification

FIGURE 4-10.
Outrigger Assembly

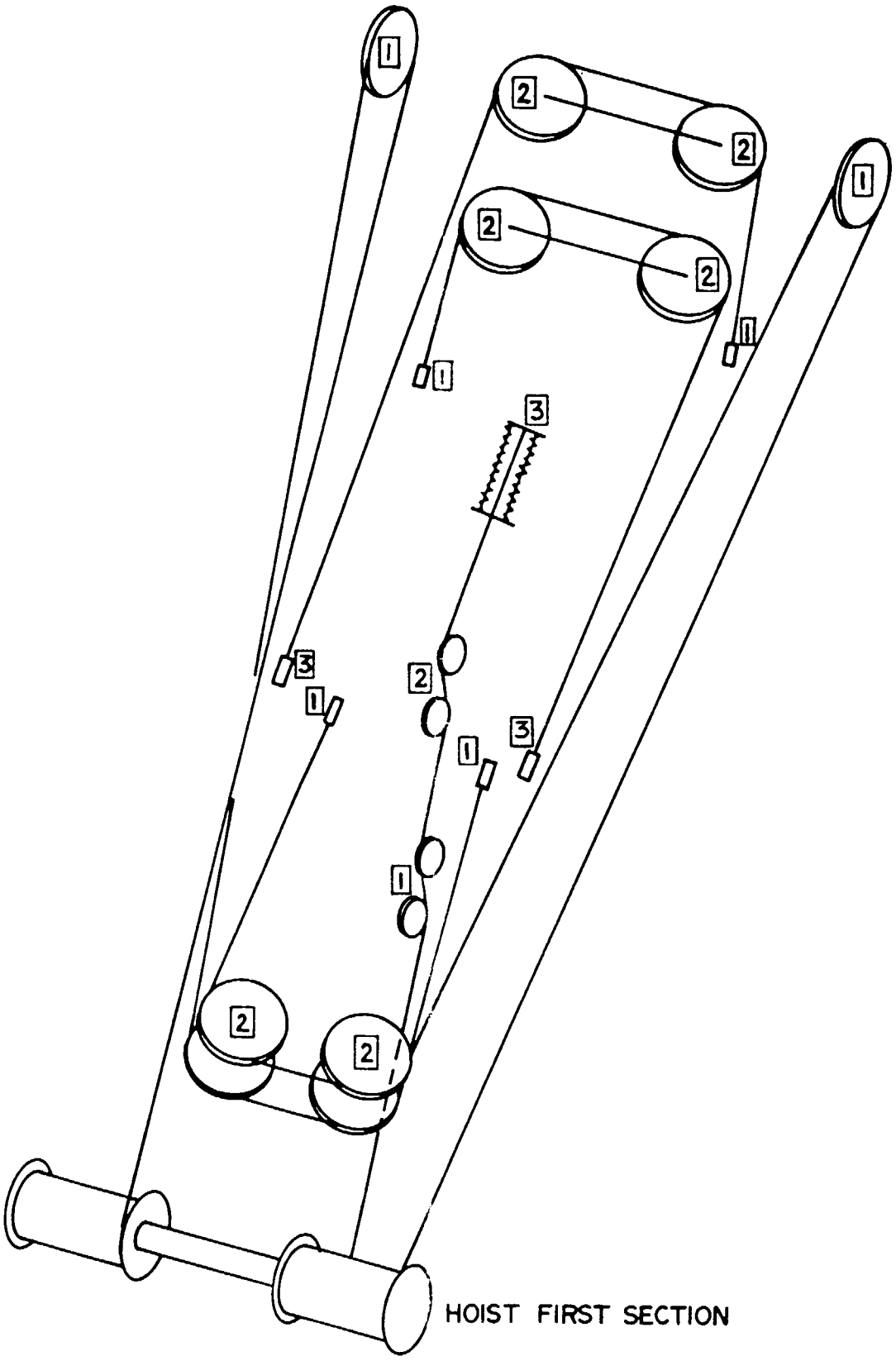


FIGURE 4-11. Ladder Cable Layout

For Explanation See
Page 18

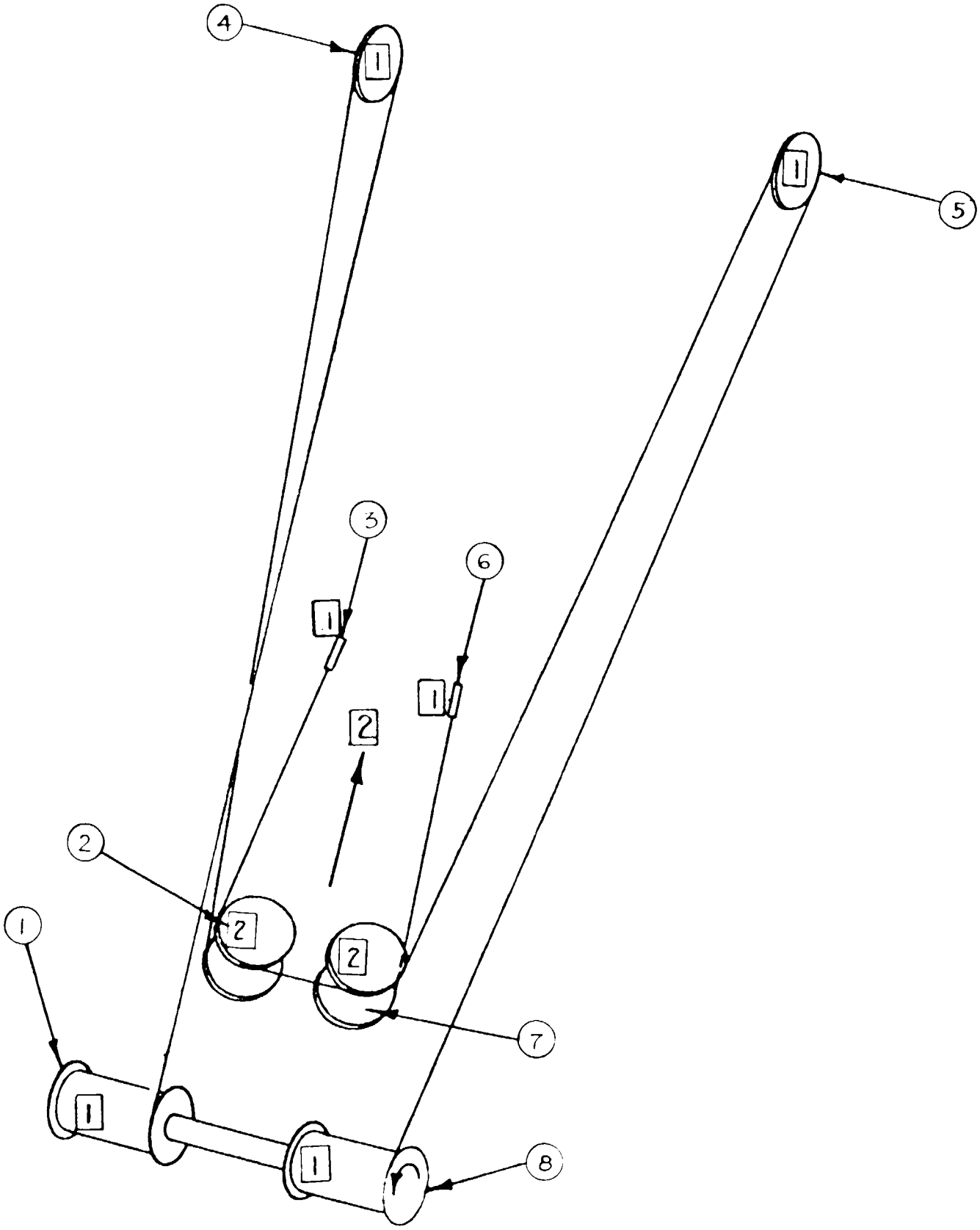


FIGURE 4-12. Ladder Extension Section 2

For Explanation See
Page 19

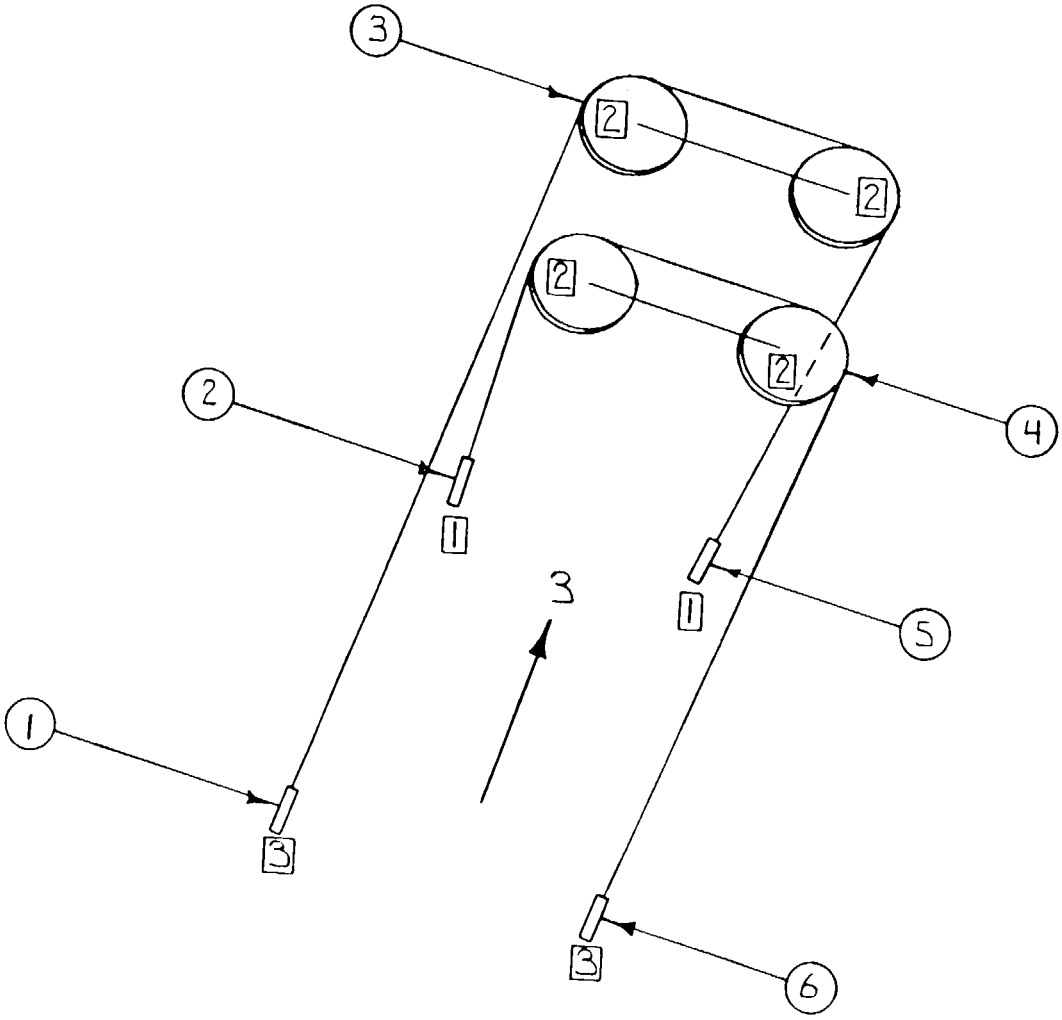


FIGURE 4-13. Ladder Extension Section 3

For Explanation See
Page 19

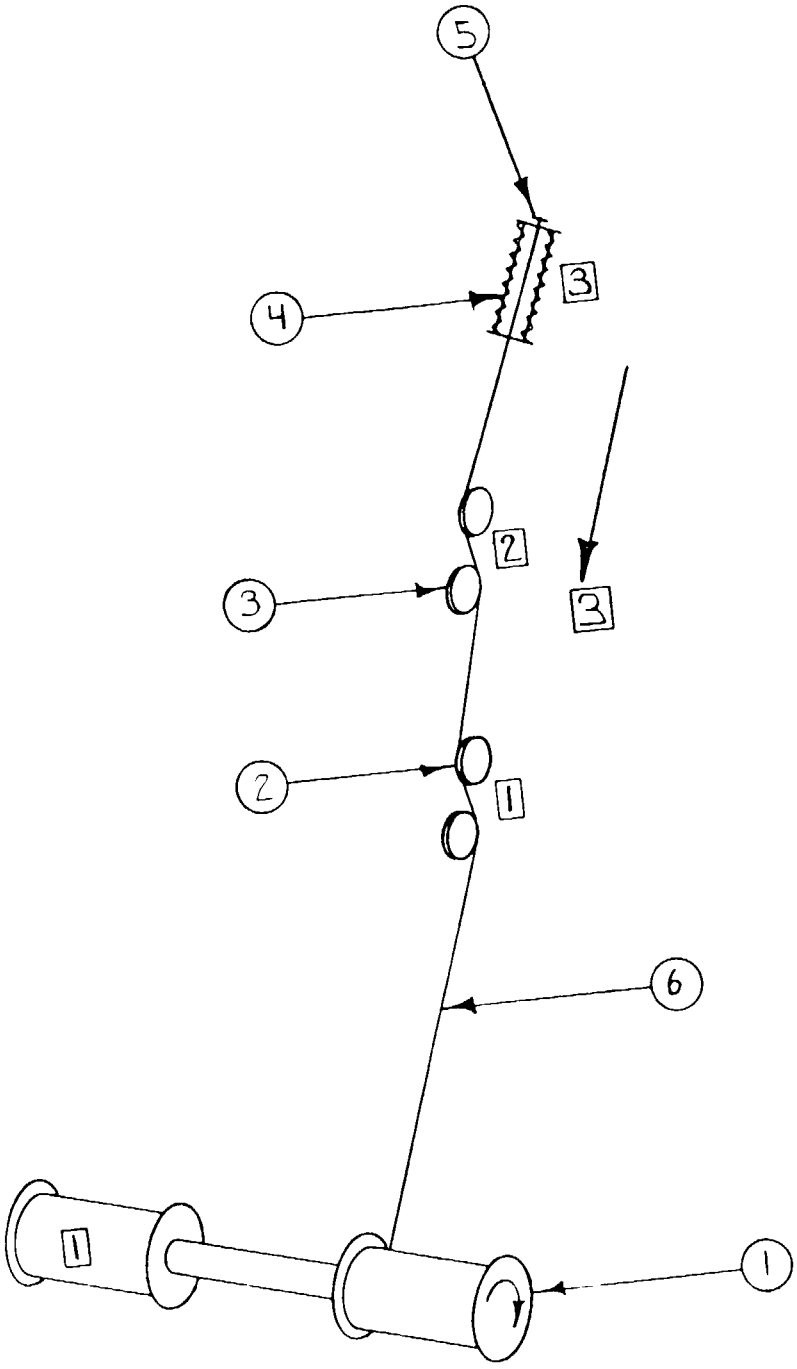


FIGURE 4-14. Ladder Retraction Section 3

For Explanation See
Page 20

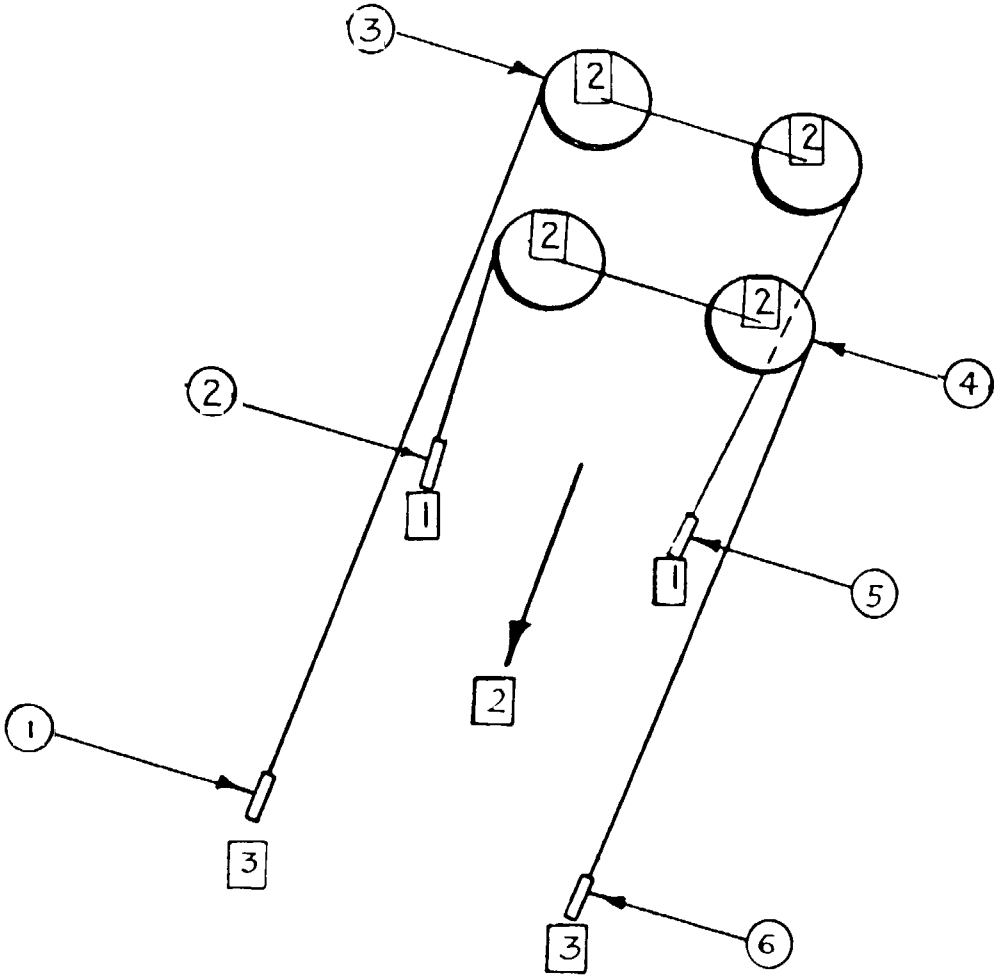


FIGURE 4-15. Ladder Retraction Section 2

For Explanation See
Page 20

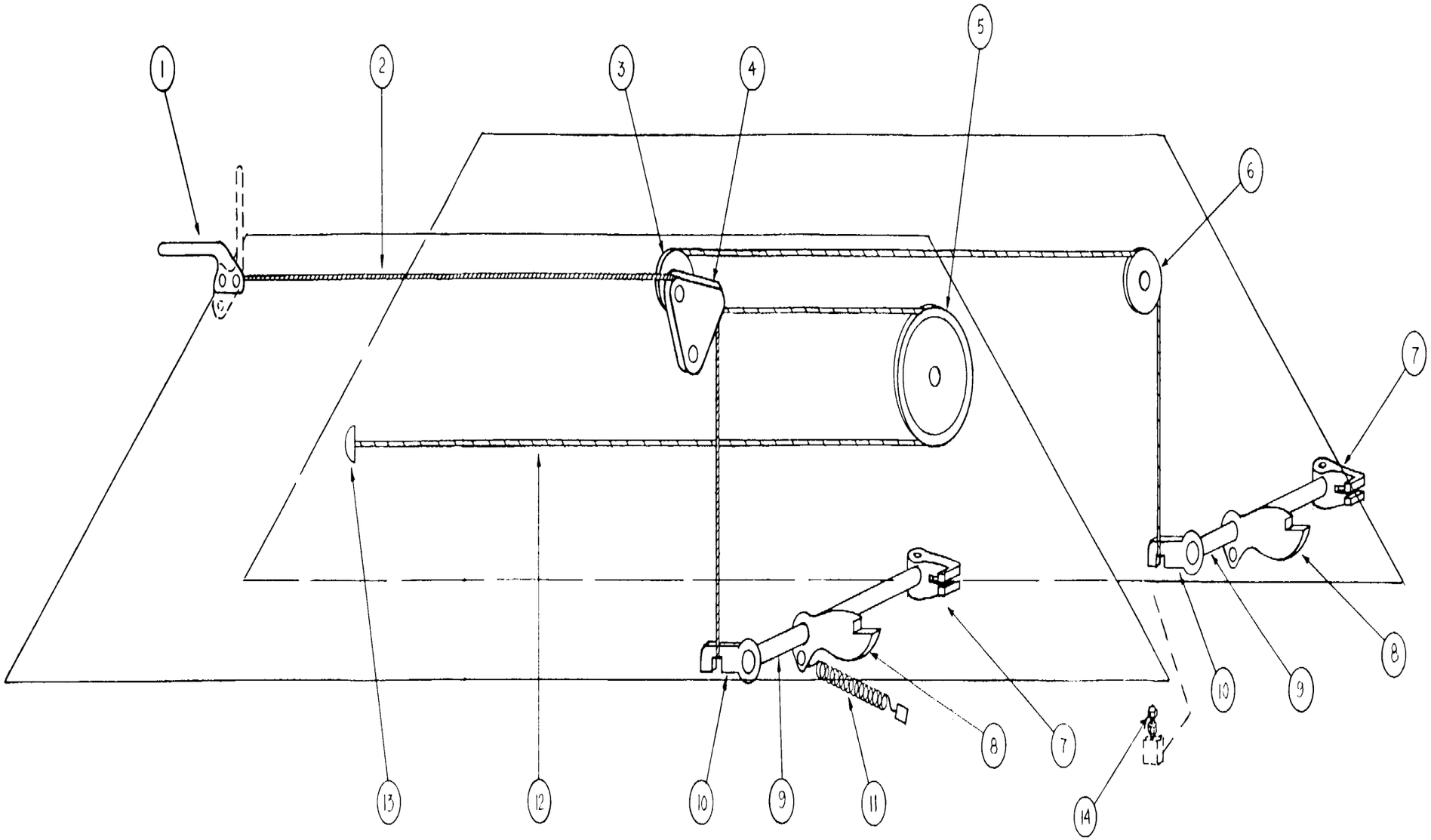
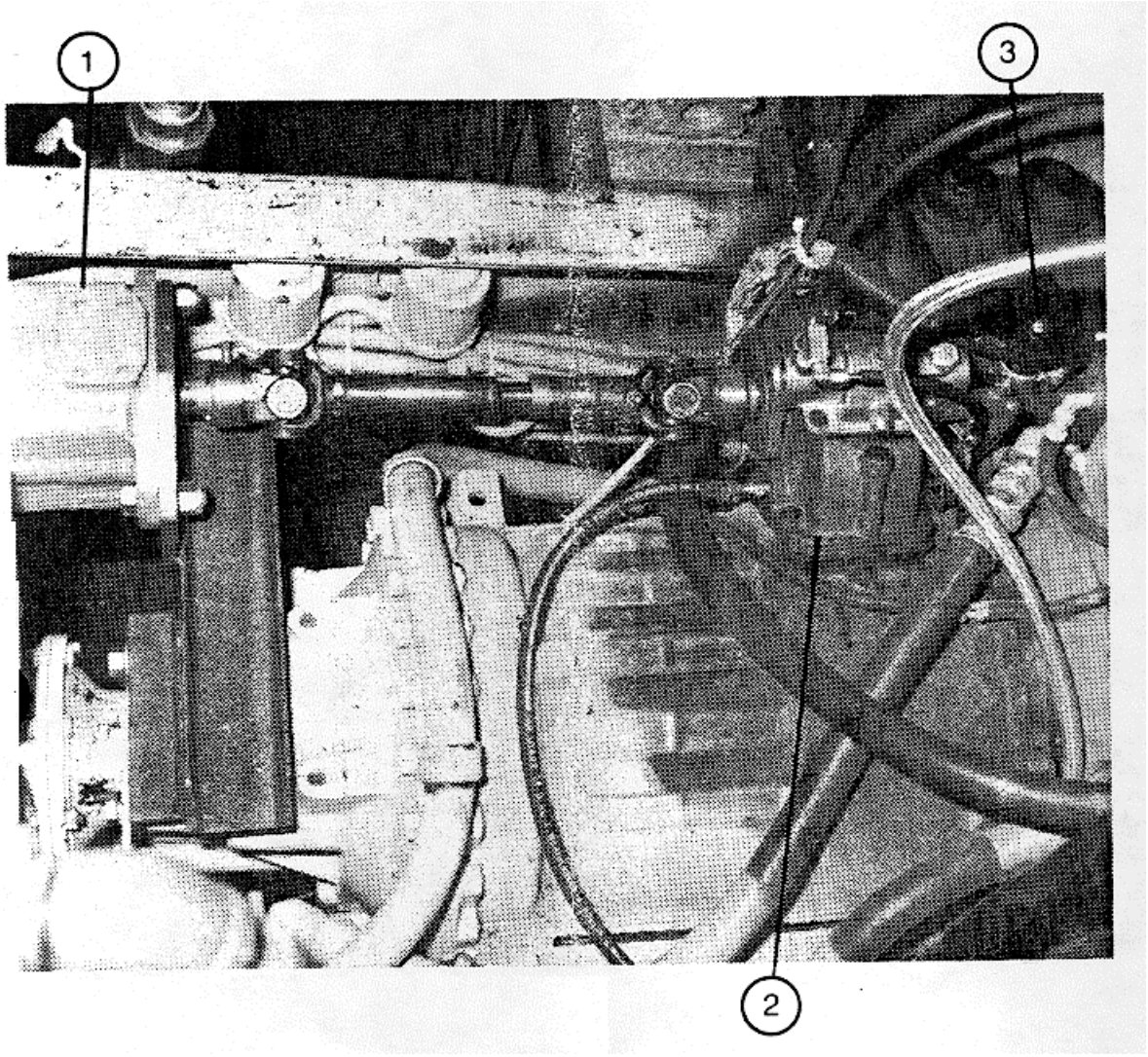


FIGURE 4-16. Locking Pawl Cable Assembly

For Explanation See Pages 21-22



1. Main Hydraulic Pump
2. PTO
3. Regulator Adjustment

FIGURE 5-1. PTO Assembly

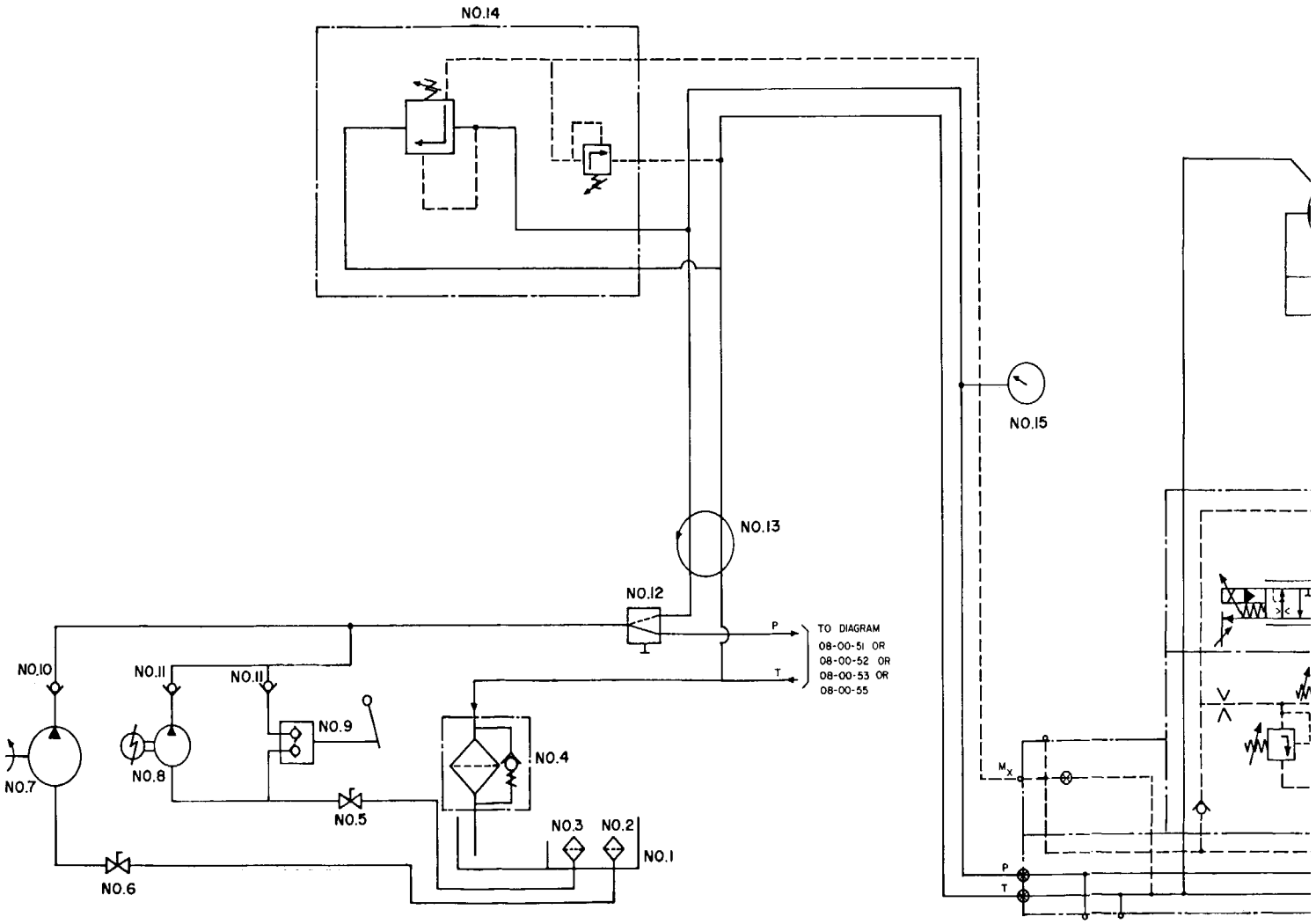


FIGURE 5-2. Ladder Hydraulic Schematic

For Explanation See
Pages 29 to 34

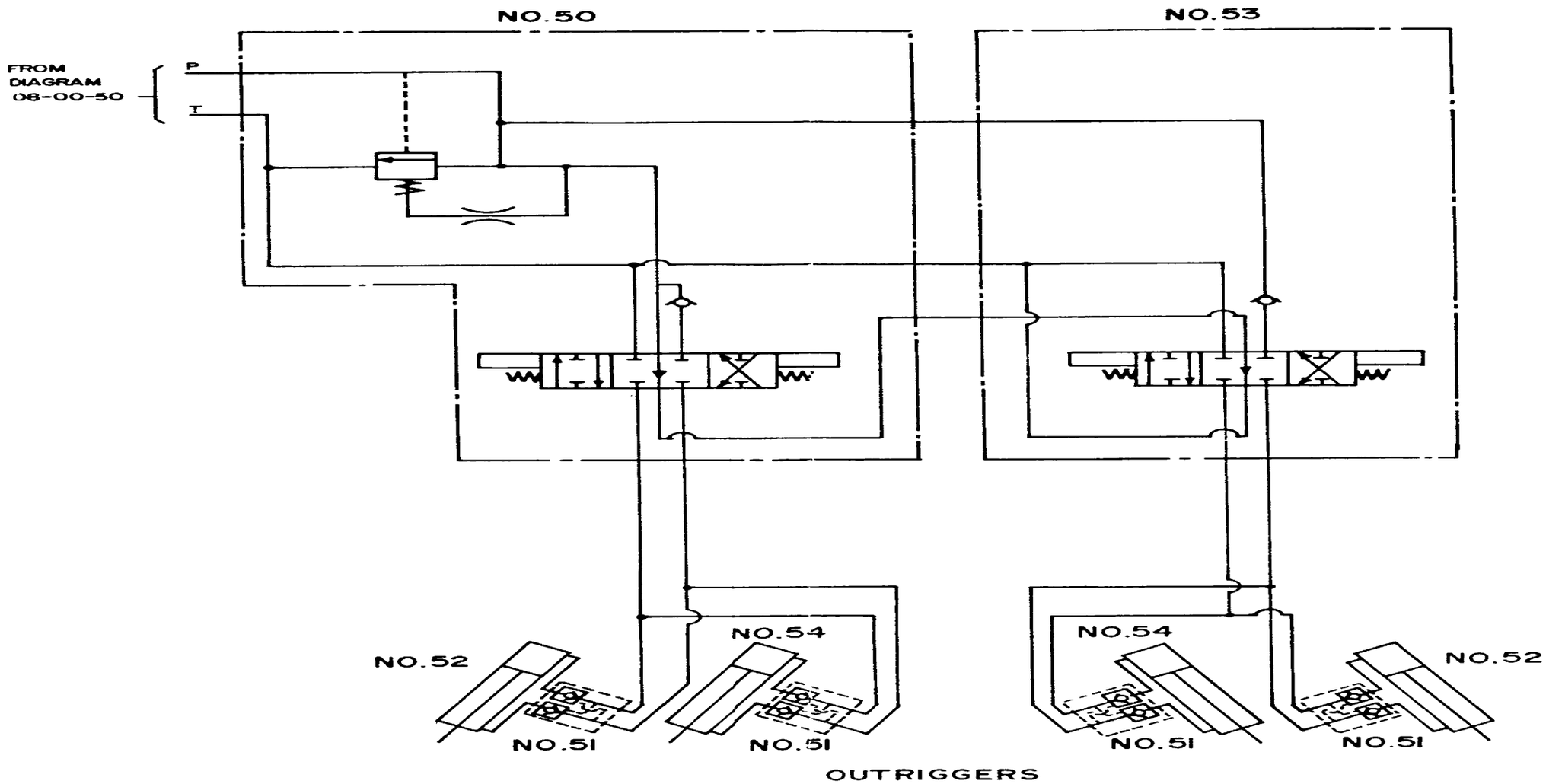


FIGURE 5-2-1. Outrigger Hydraulic Schematic

For Explanation See
Pages 30 to 31

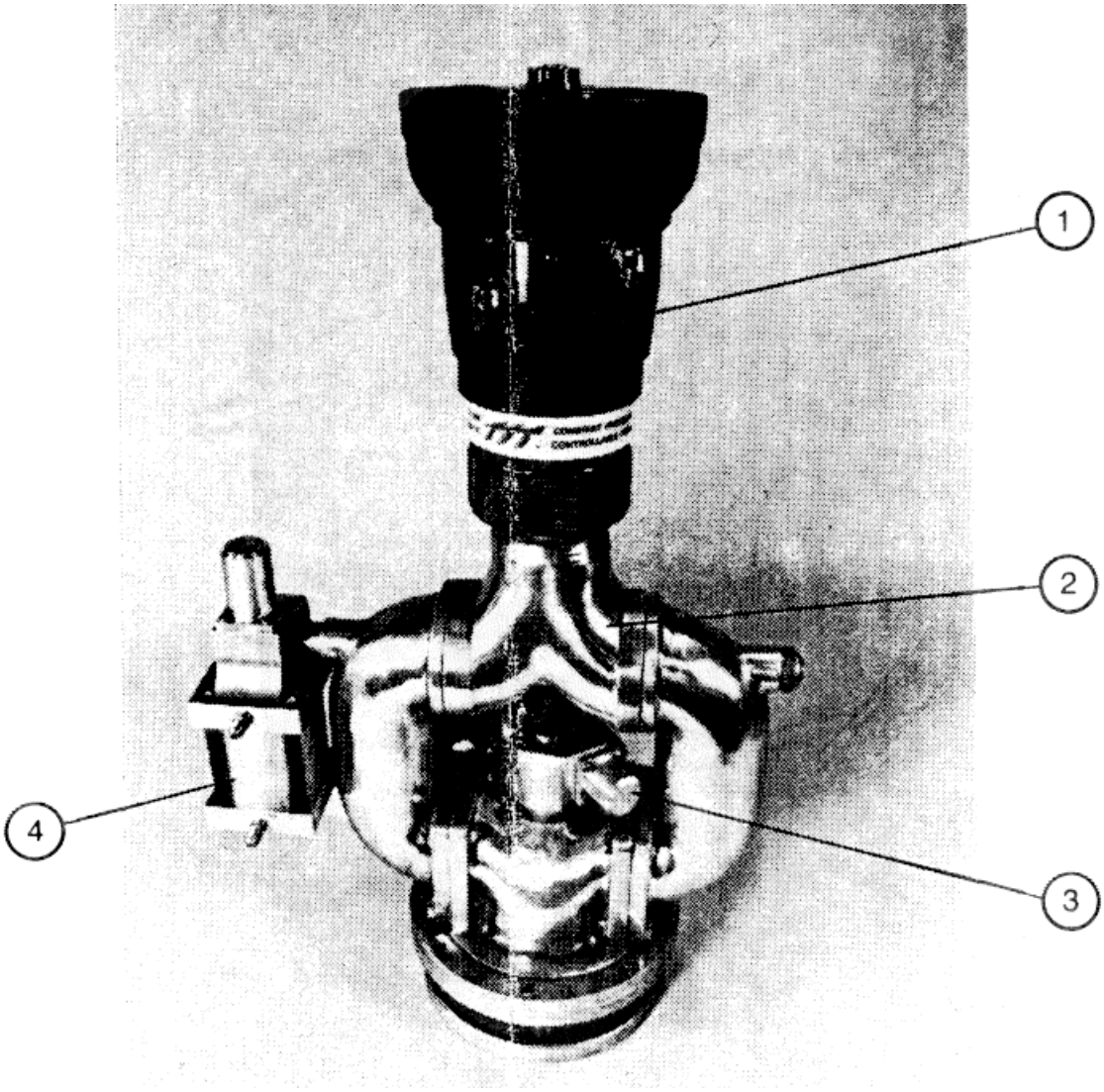


FIGURE 5-3. Water Tower Nozzle Assembly

For Explanation See Page 35

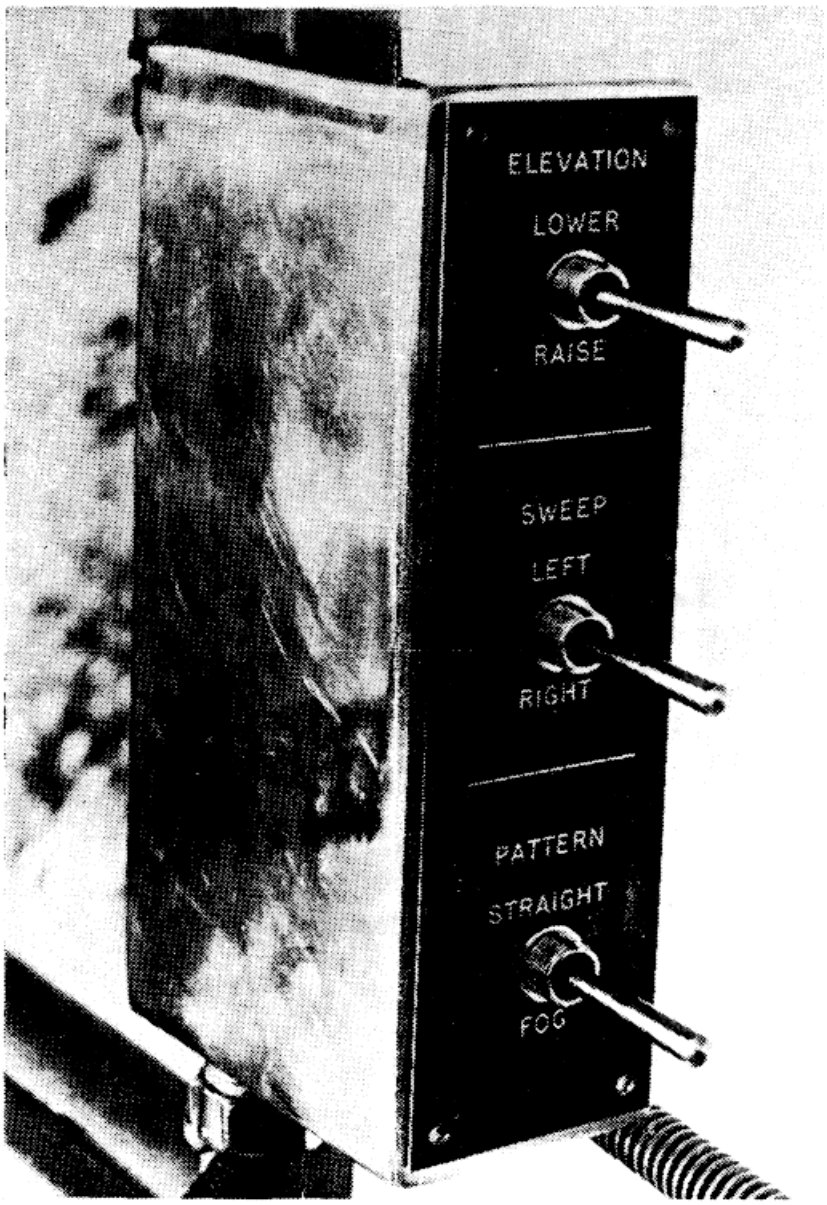


FIGURE 5-4. Nozzle Control Switches

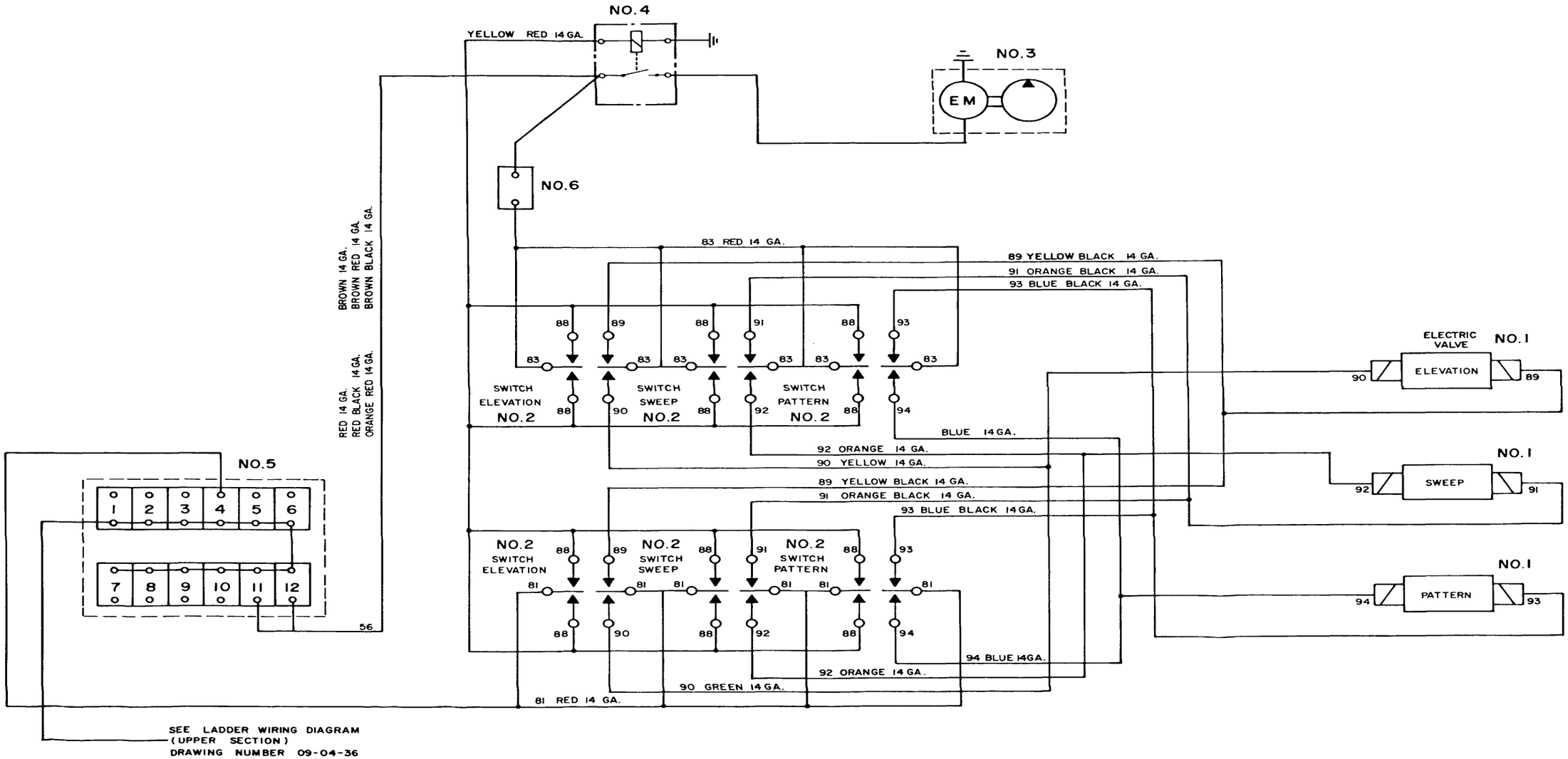
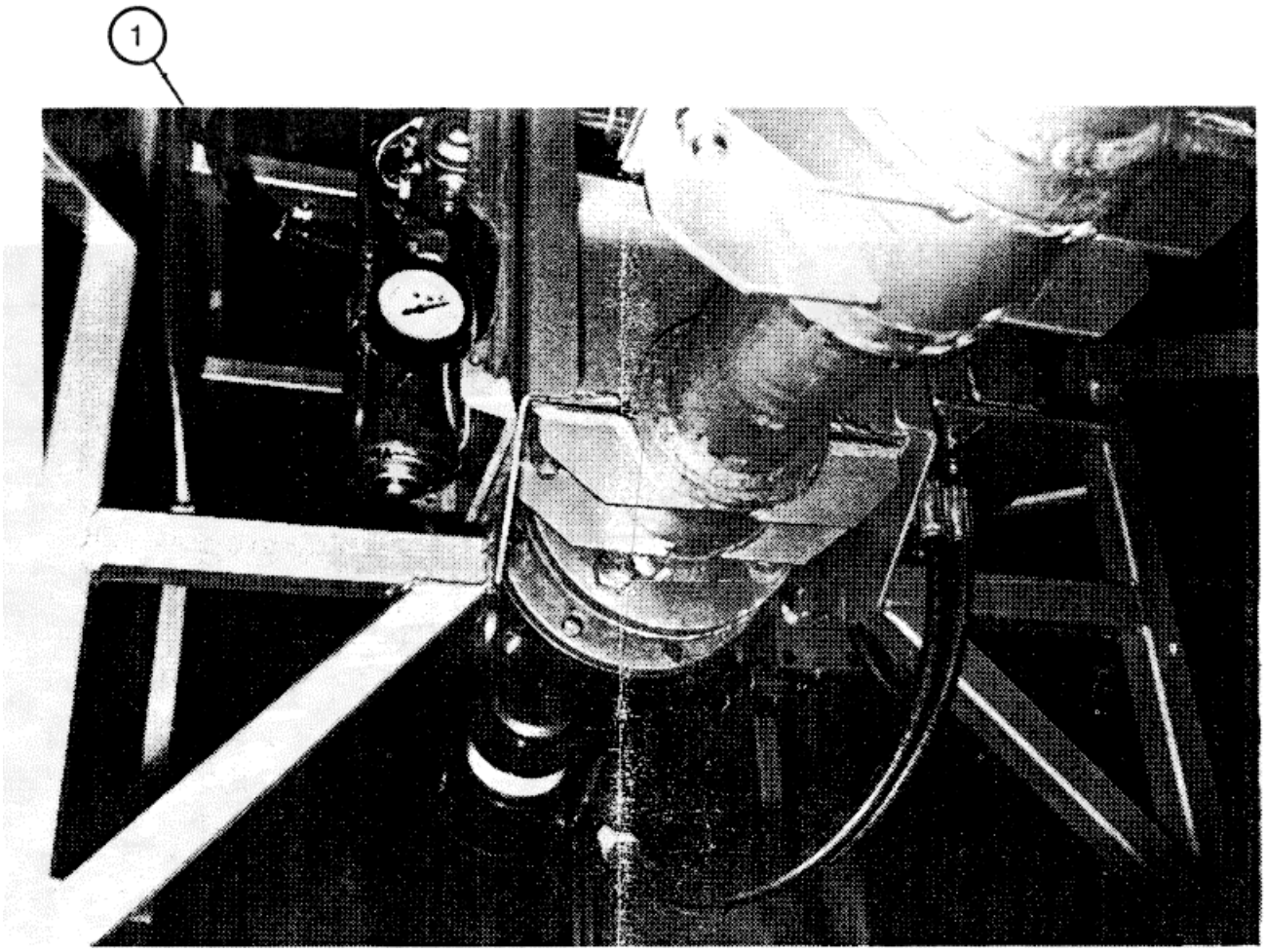


FIGURE 5-5. Water Tower Nozzle Electric Schematic

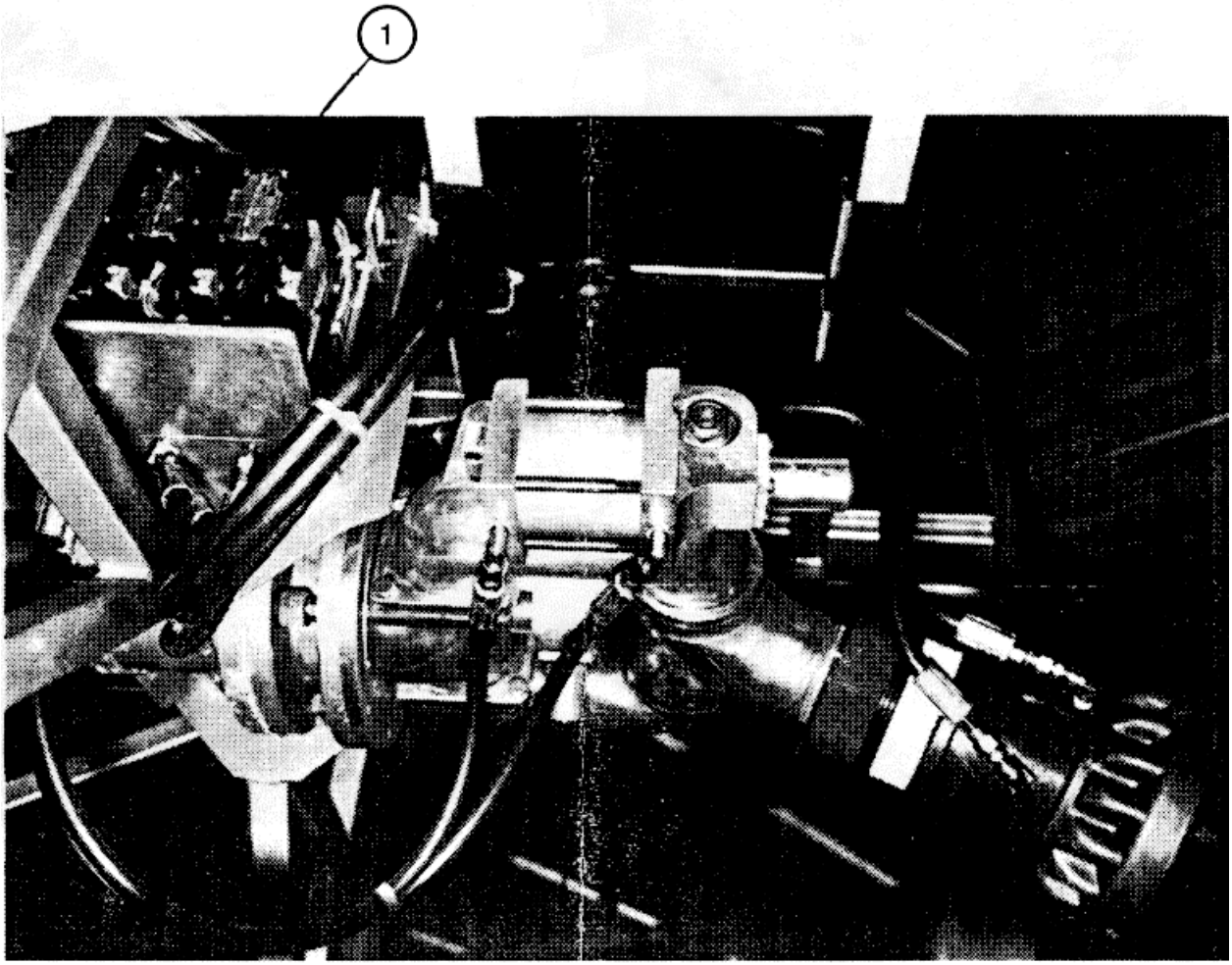
For Explanation See
Pages 40 to 41



1. Hydraulic Pump

FIGURE 5-5-1. Water Tower Nozzle Hydraulic Pump

For Explanation See
Page 35



1. Control Solenoids

FIGURE 5-5-2. Water Tower Nozzle Hydraulic Control Valves

For Explanation See
Page 35

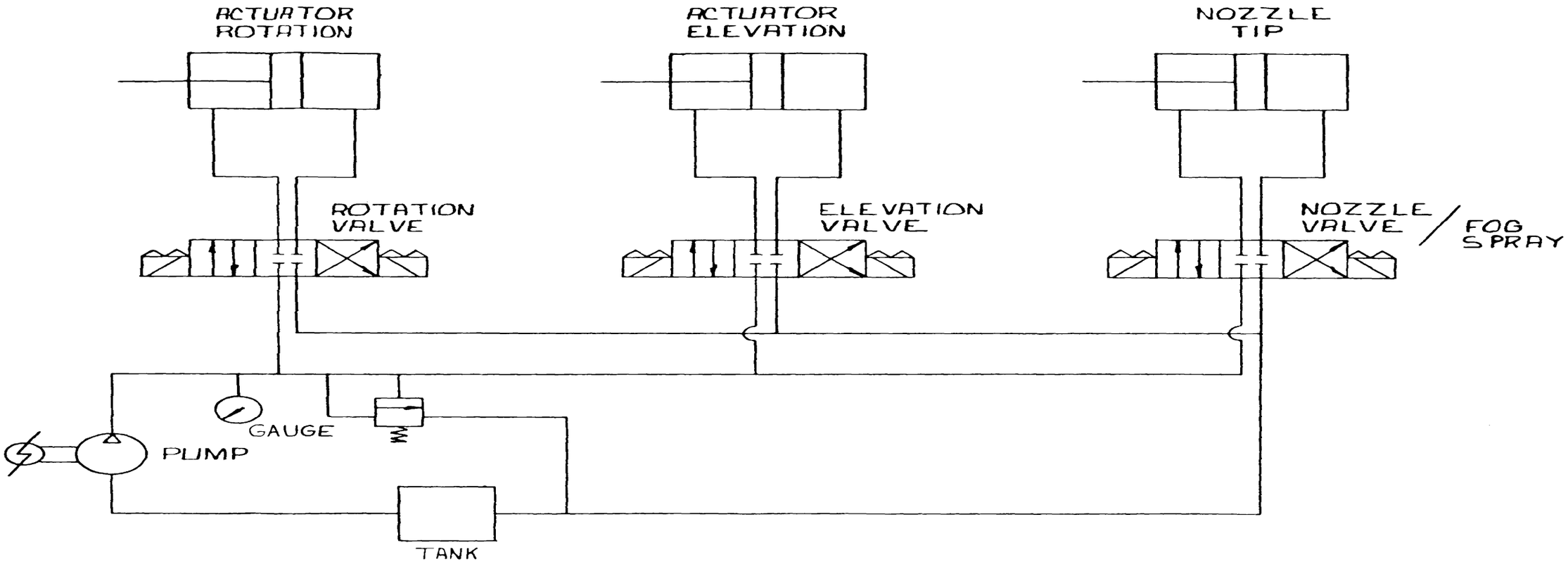


FIGURE 5-6. Water Tower Nozzle Hydraulic Schematic

For Explanation See
Page 35

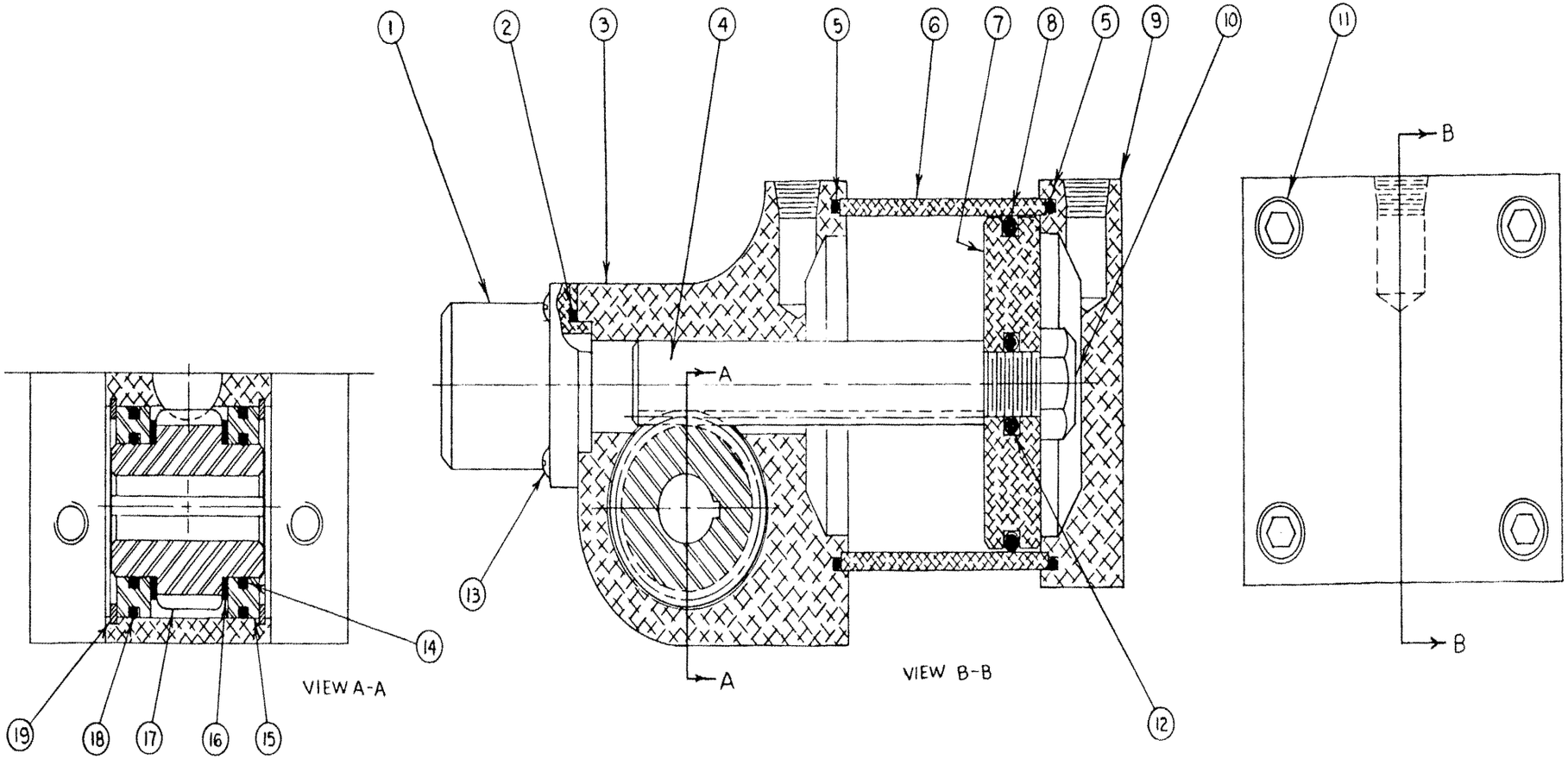


FIGURE 5-7. Nozzle Hydraulic Actuator

For Explanation See
Page 35

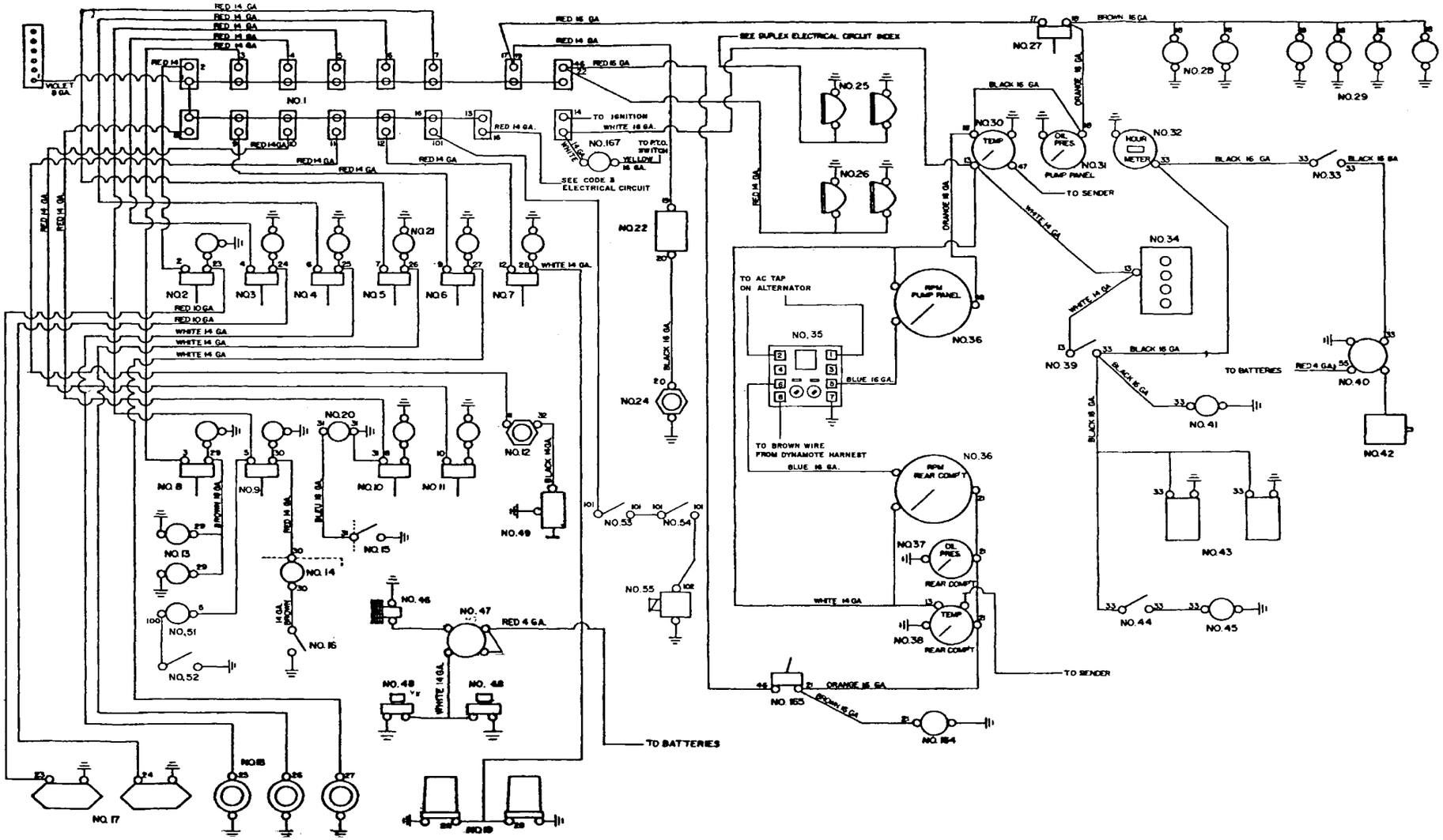


FIGURE 6-1. Electric Schematic Controls Dials and Indicators

For Explanation See Pages
36 to 37

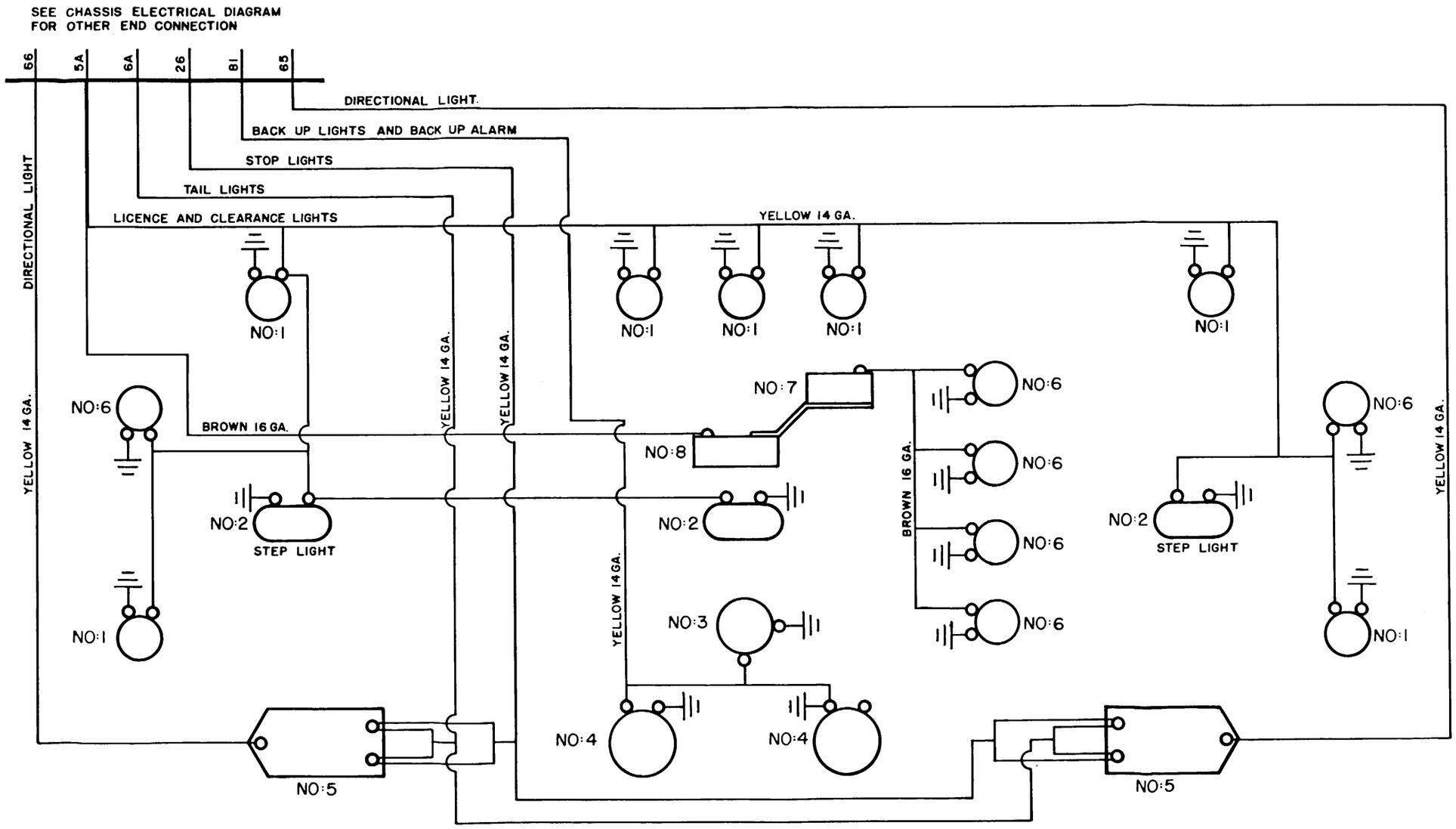


FIGURE 6-2. Electric Schematic - Truck Operating Lights

For Explanation See
Page 37

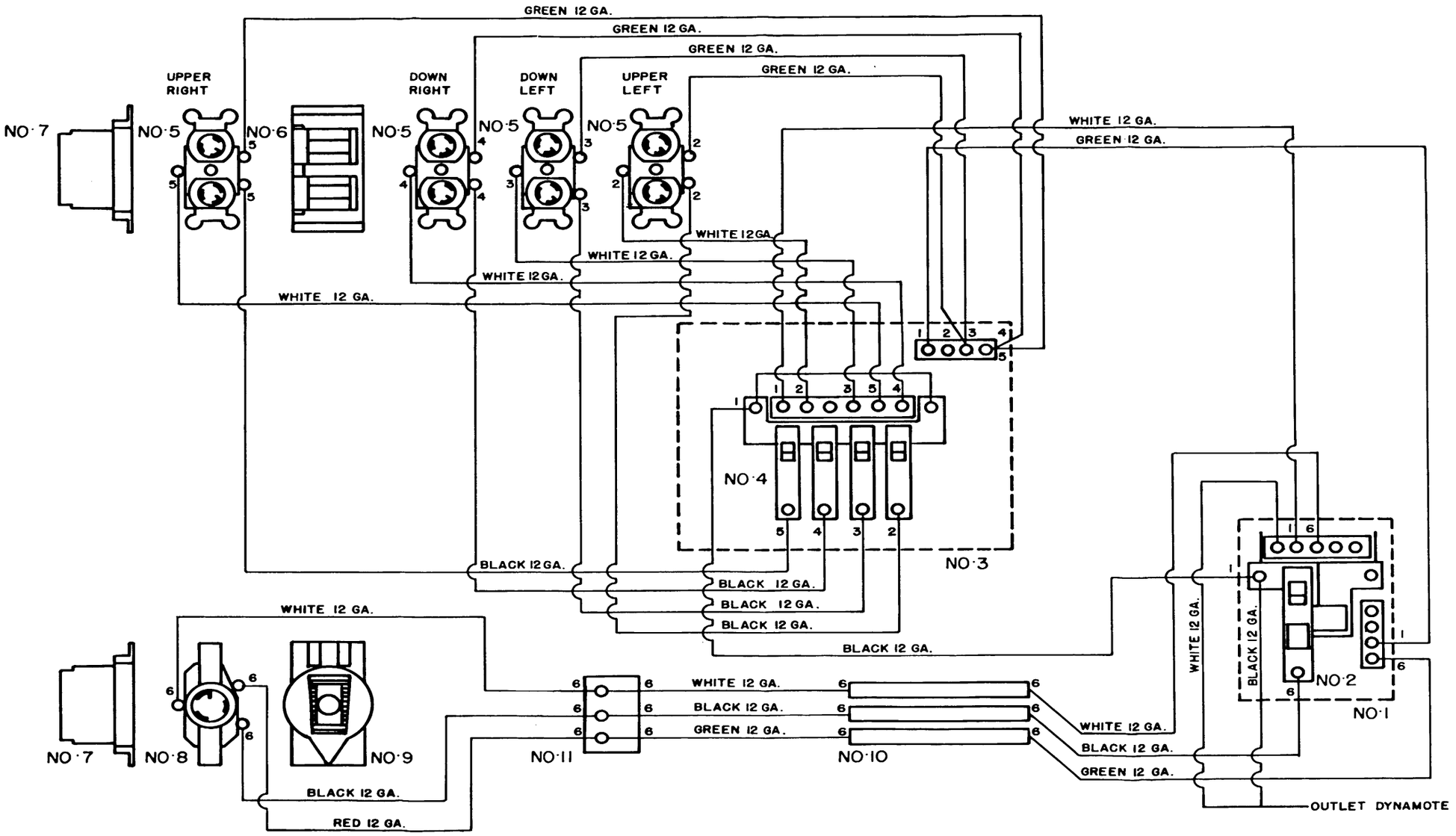


FIGURE 6-3. Electric Schematic- 110 VAC

For Explanation See
Page 39

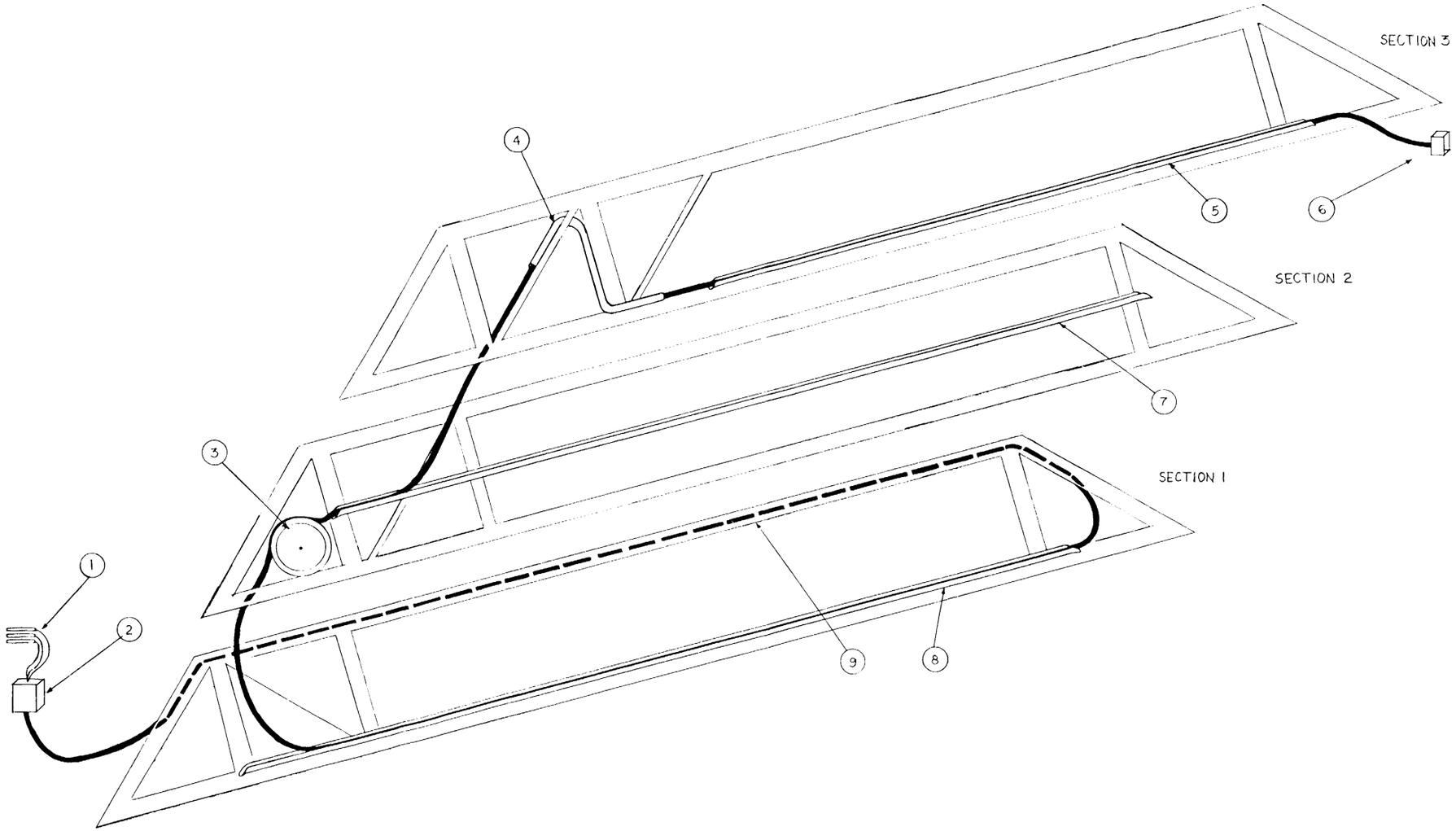


FIGURE 6-4. 110 VAC Cable Layout Ladder Retracted

For Explanation See
Pages 39 to 40

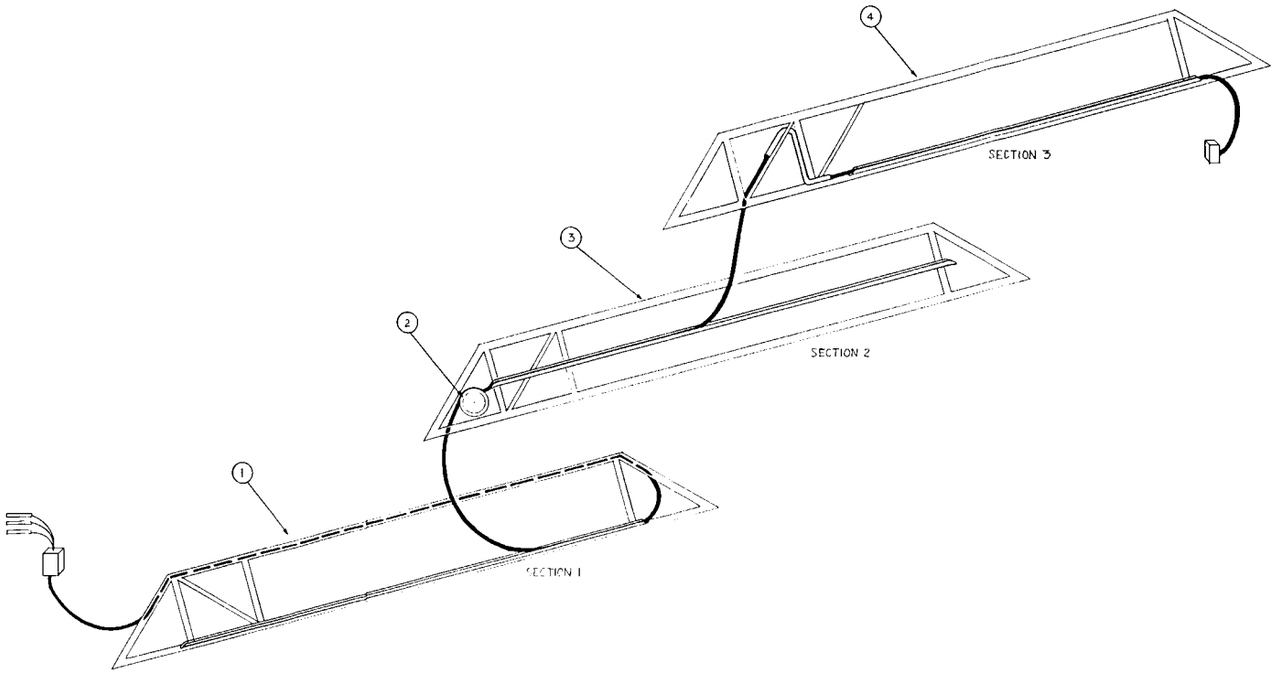


FIGURE 6-5. 110 VAC Cable Layout Ladder Extended

For Explanation See Page 40

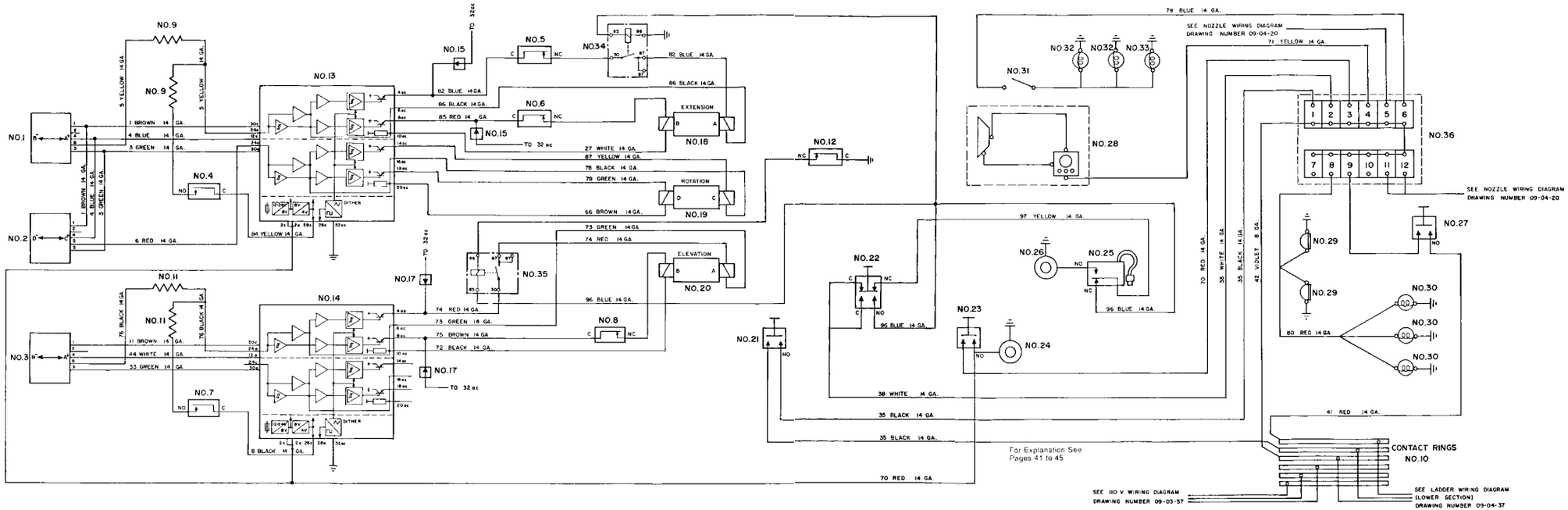
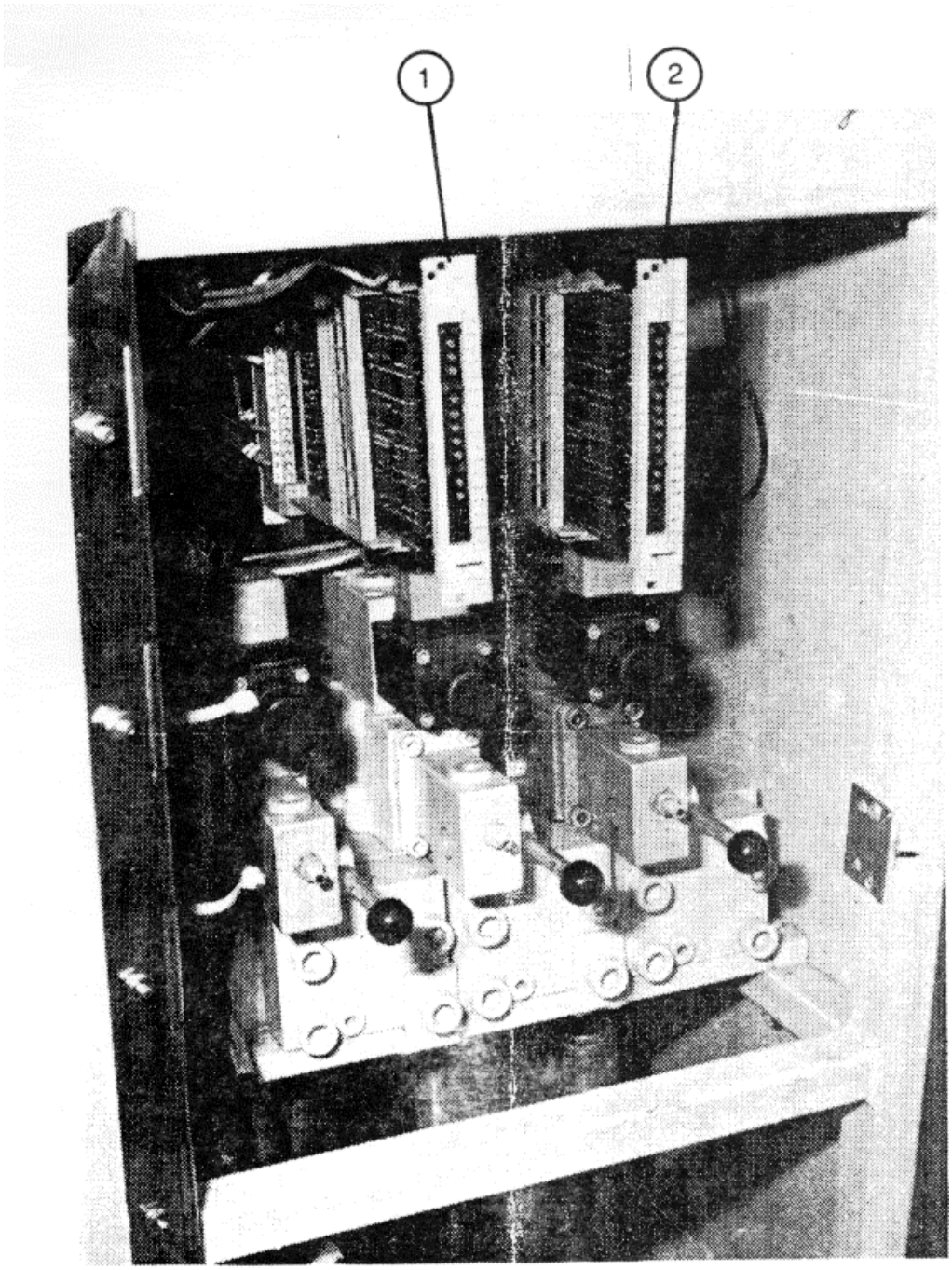


FIGURE 6-6. Electric Schematic - Circuit Above the Turntable

For Explanation See Pages 41 to 45



For Explanation See Page 41

FIGURE 6-6-1. Current Regulators

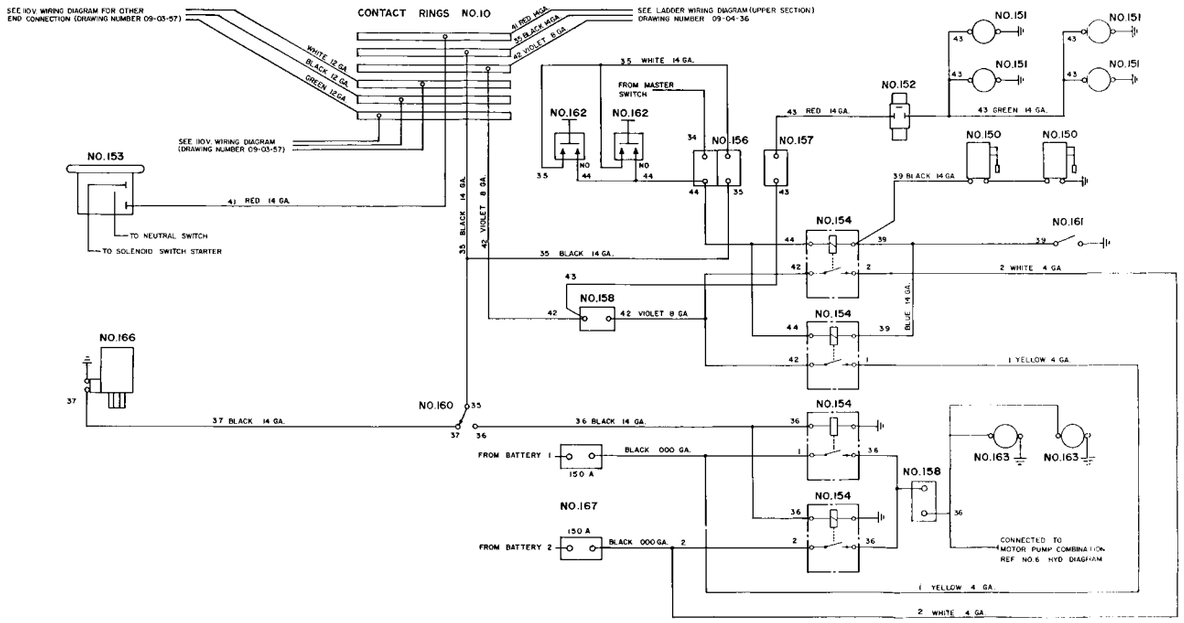


FIGURE 6-7. Electric Schematic - Circuits Below the Turntable

For Explanation See Pages 45 to 46

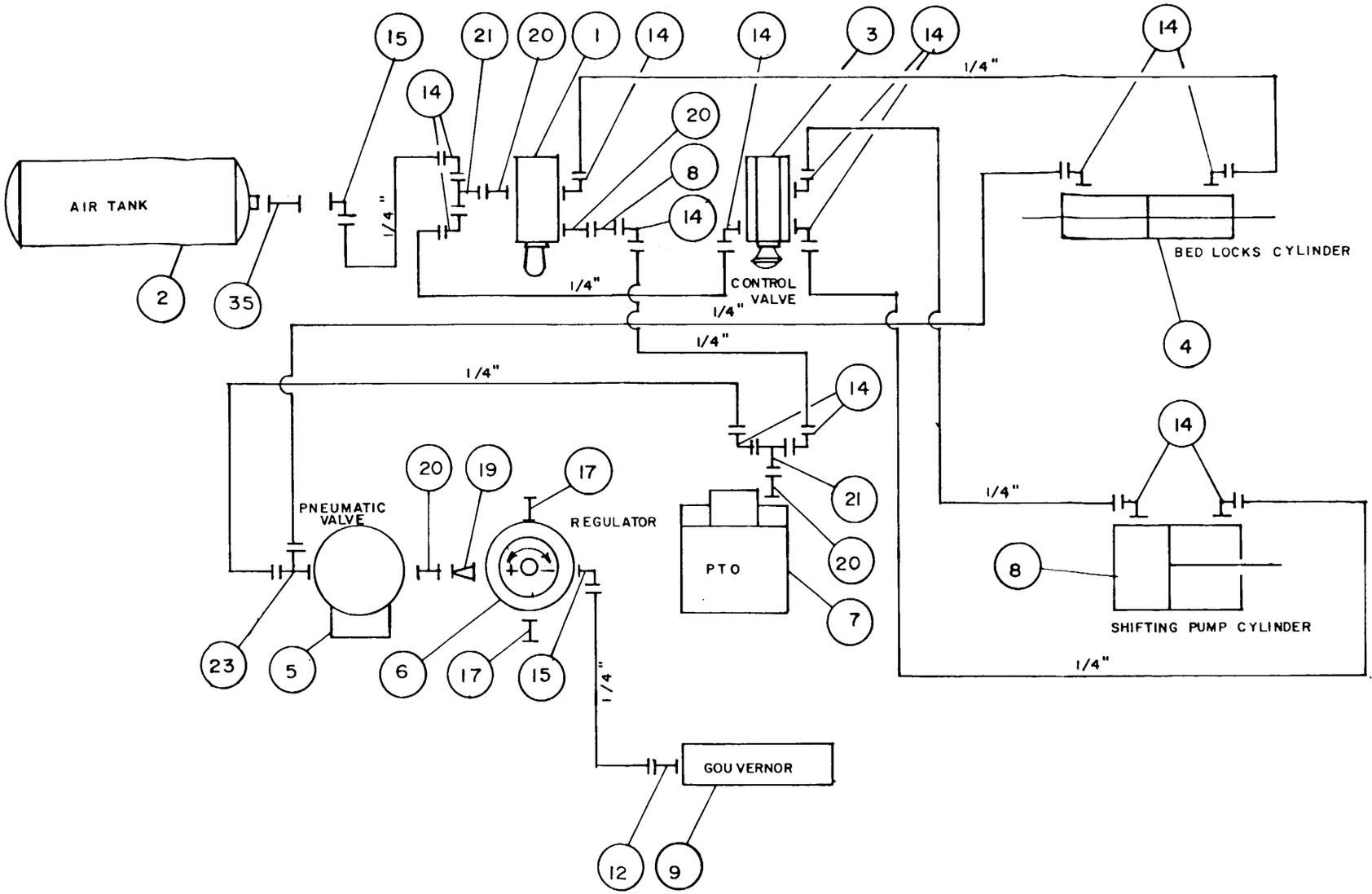


FIGURE 7-1. Pneumatic System Diagram

For Explanation See Pages 47 to 48

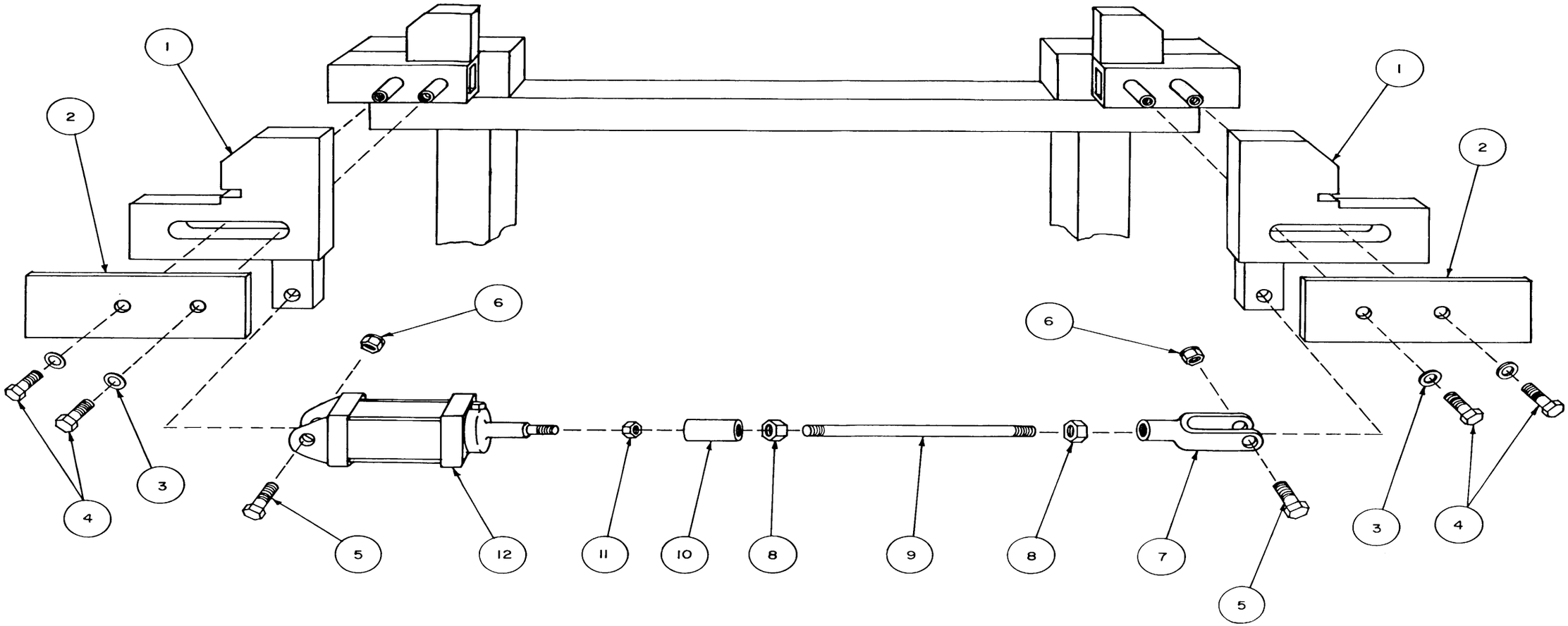


FIGURE 7-2. Bed Lock Assembly

For Explanation See page 49

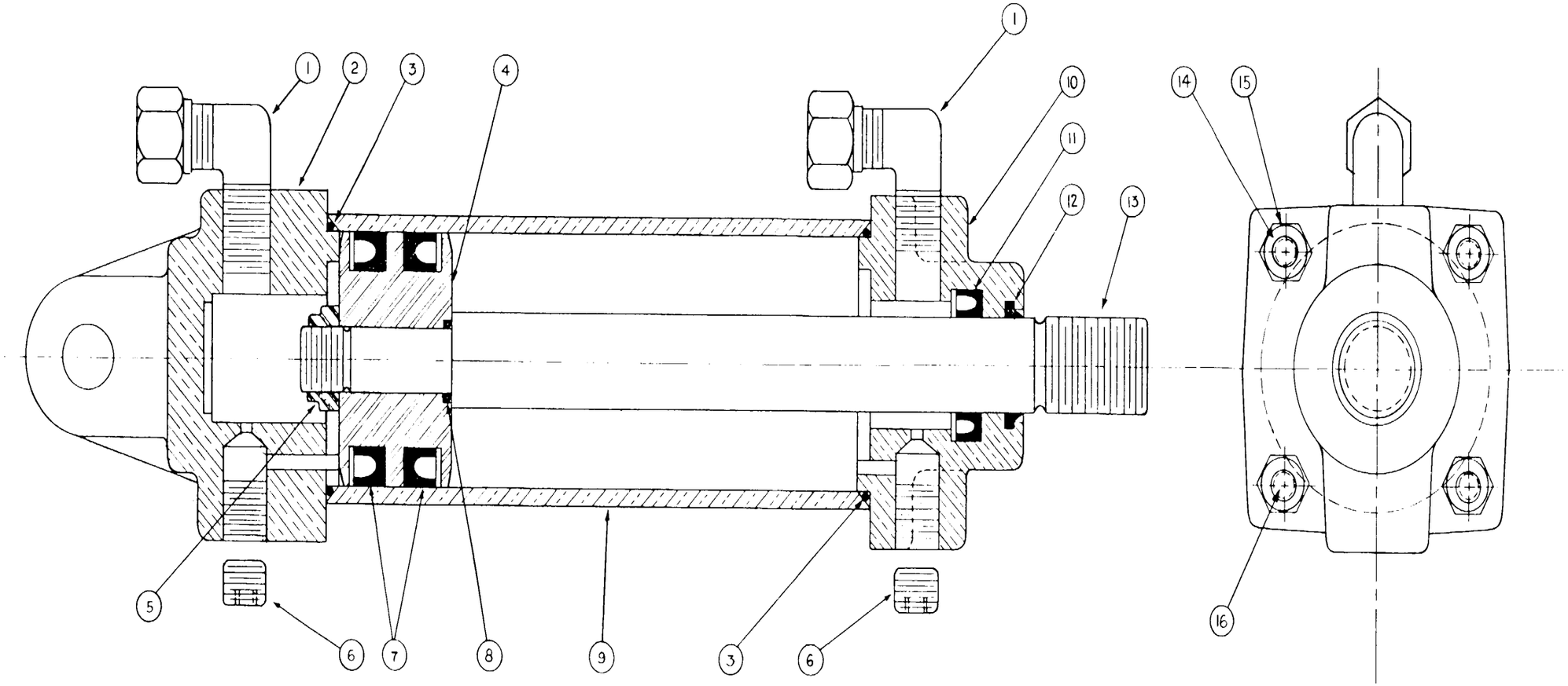


FIGURE 7-3. Bed Lock Air Cylinder

For Explanation See Page 49

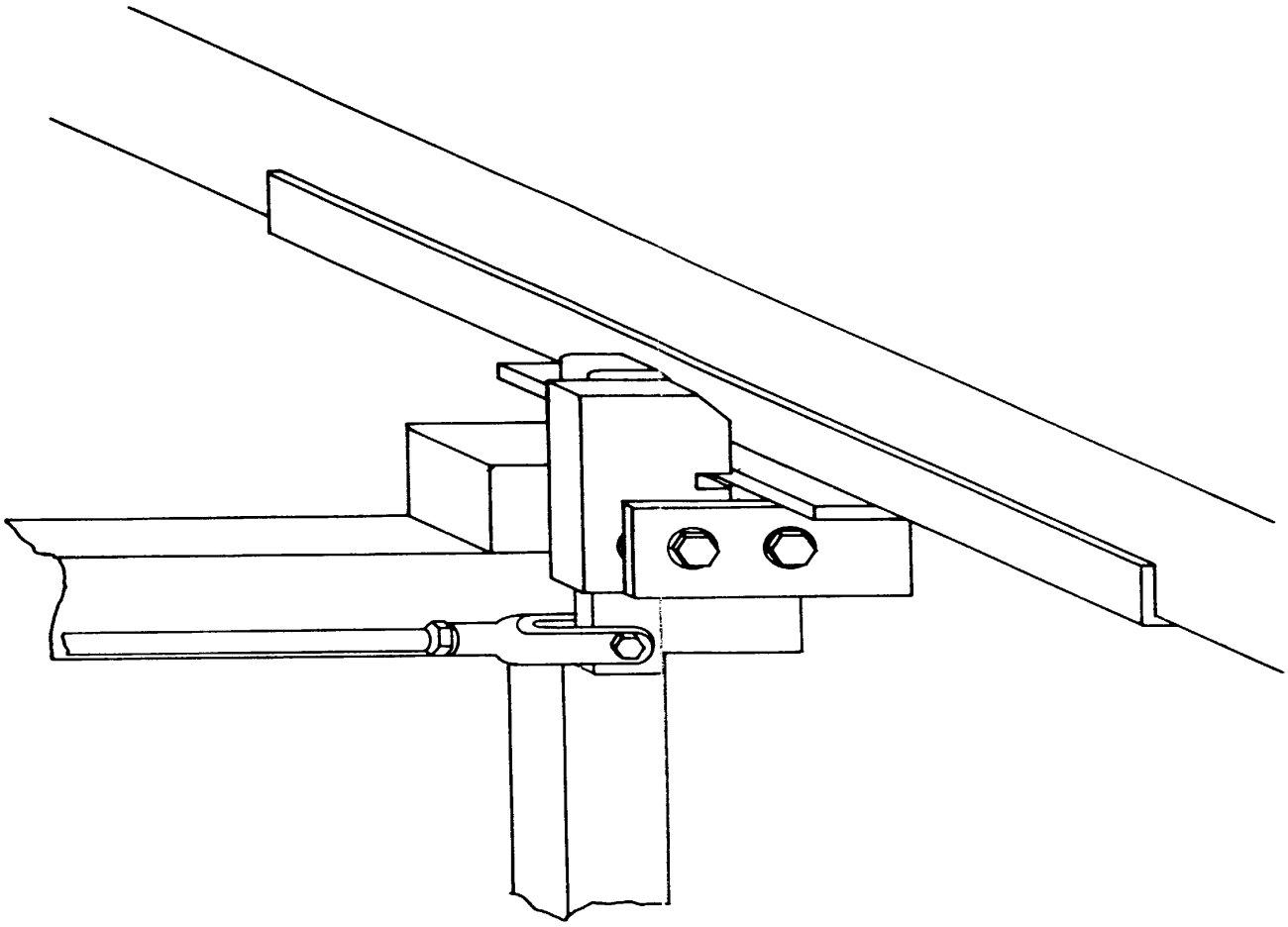


Figure 7-4. Bed Lock Disengaged

For Explanation See Page 49

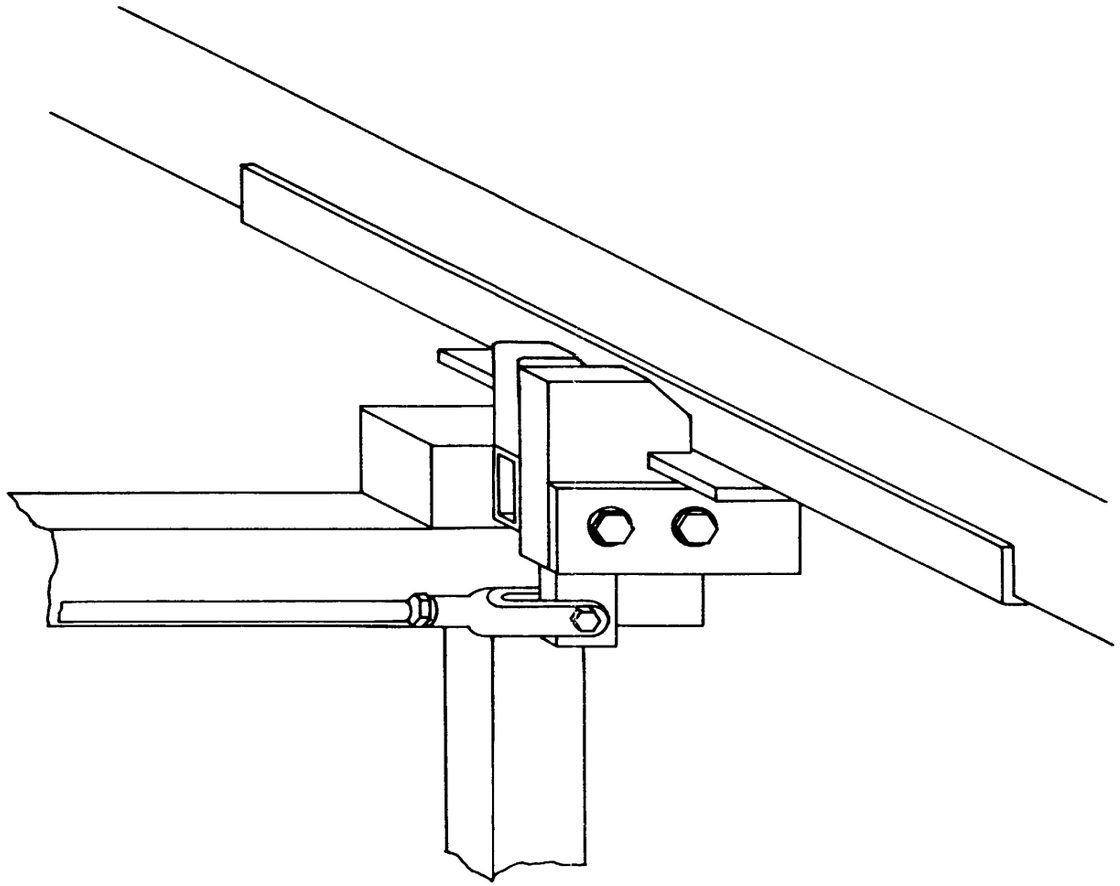
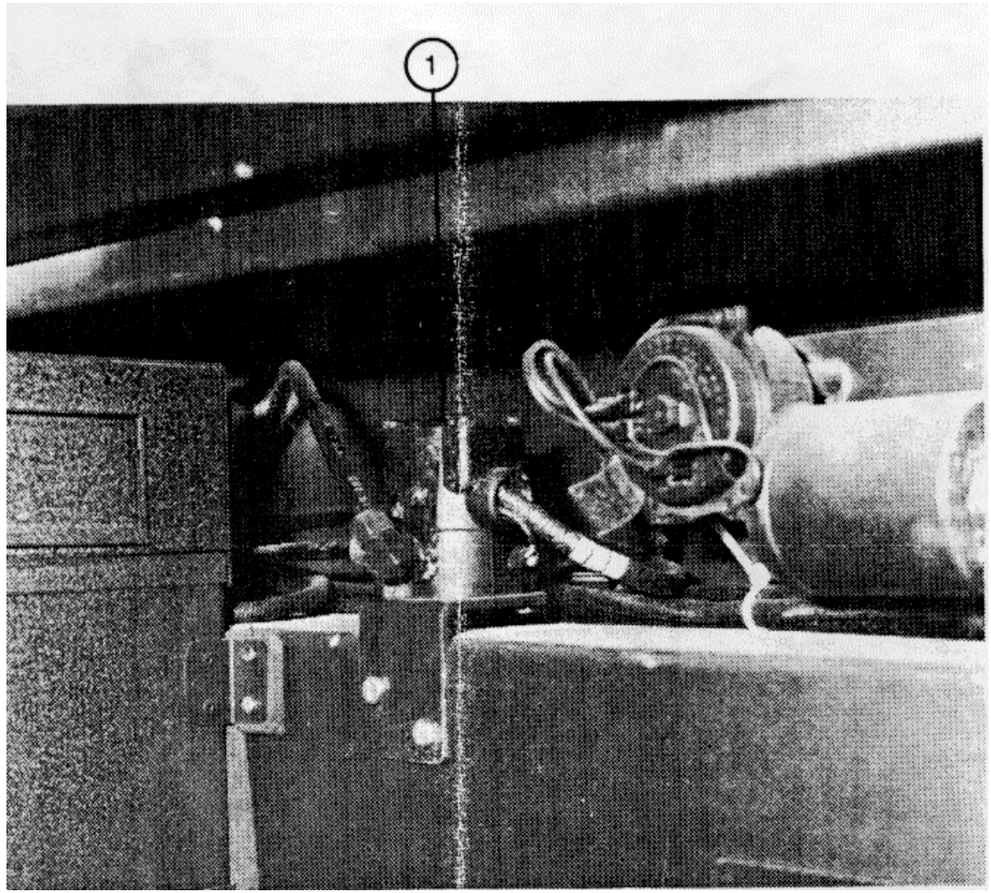


FIGURE 7-5. Bed Lock Engaged

For Explanation See Page 49



1. Parking Brake Override Valve

FIGURE 7-6. Parking Brake Override Valve

For Explanation See Pages 49 to 50

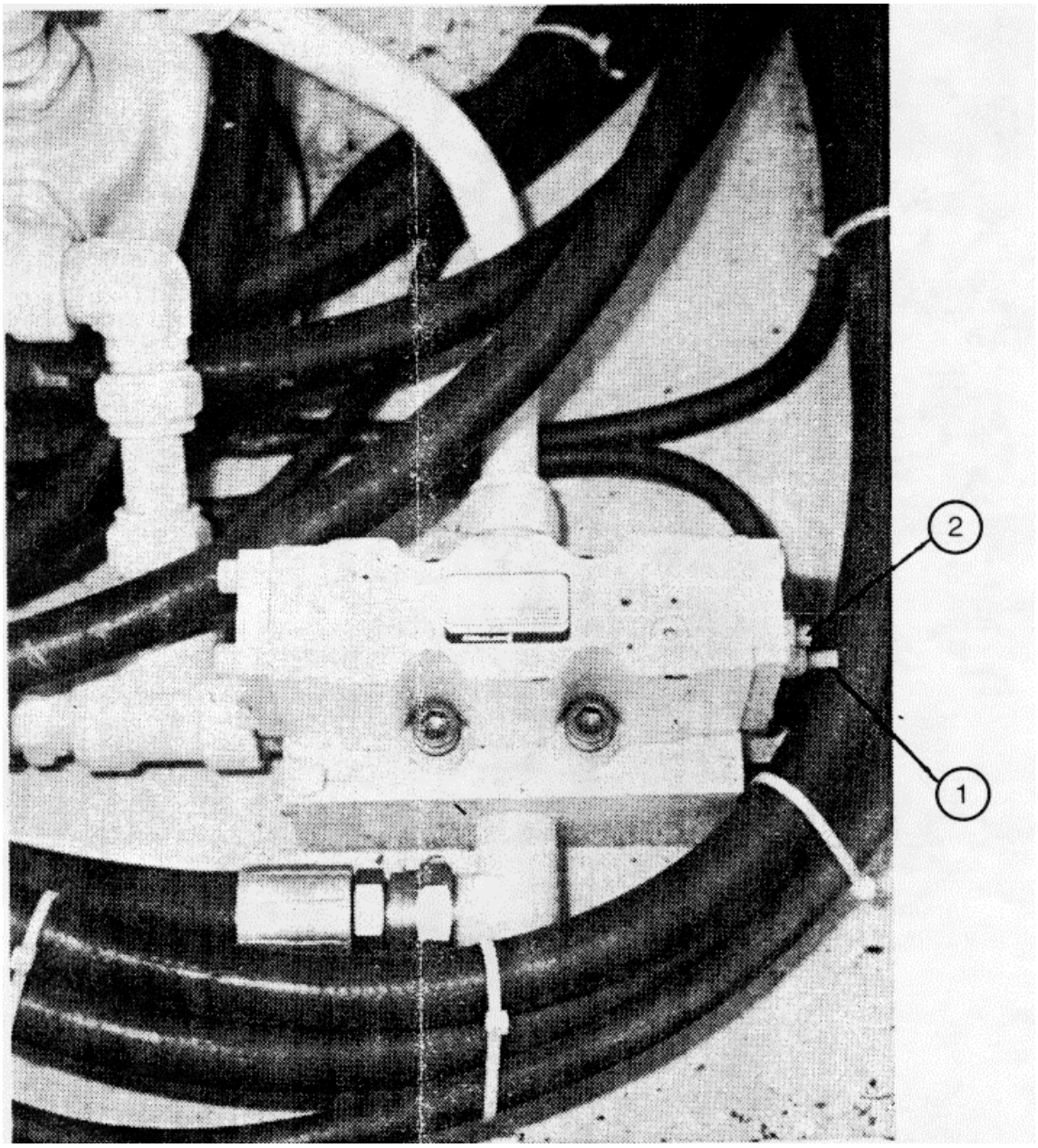


FIGURE 8-1. Relief/Unloader Valve

For Explanation See Pages 52 to 53

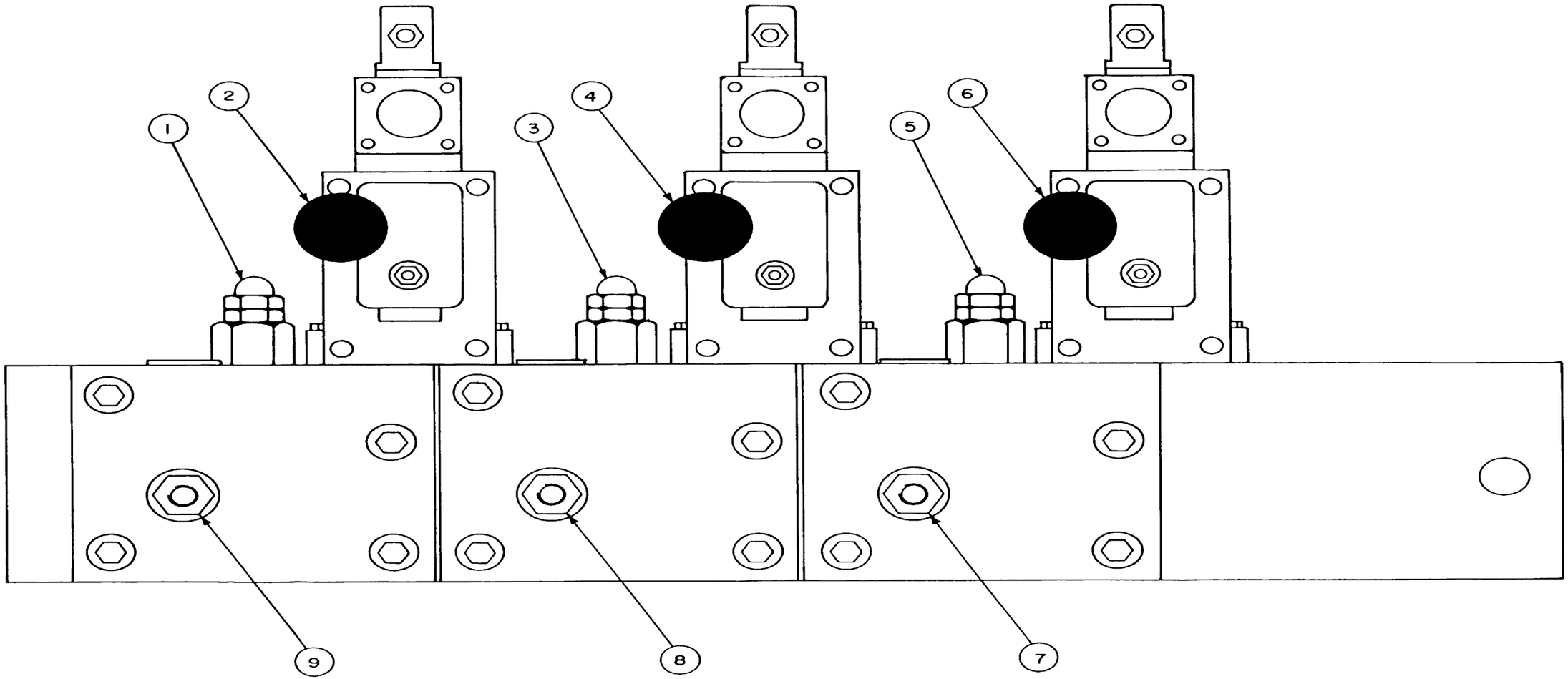


FIGURE 8-2. Proportional Valve

For Explanation See Pages 53 to 54

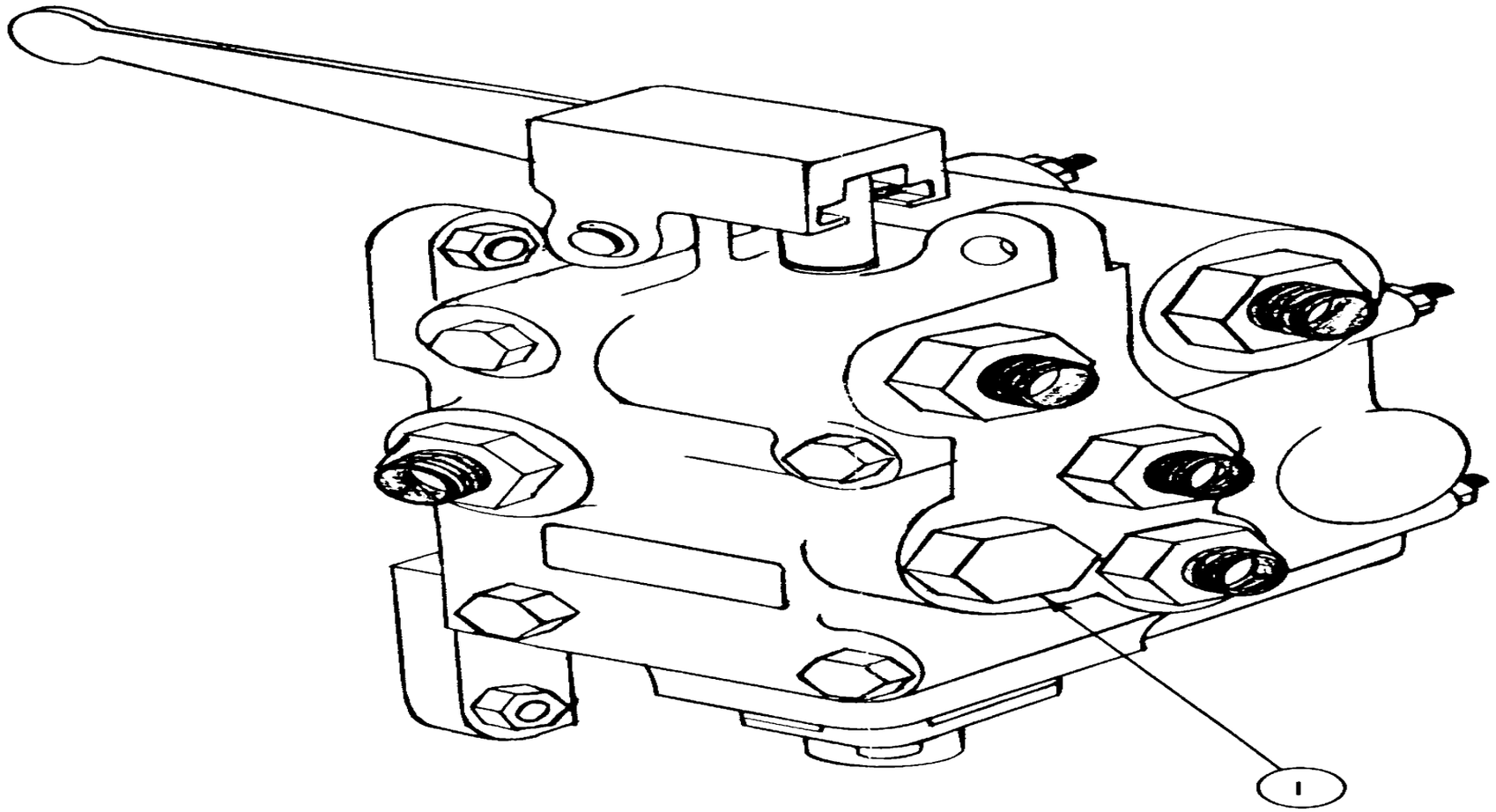


FIGURE 8-3. Outrigger Control Valve

For Explanation See Page 54

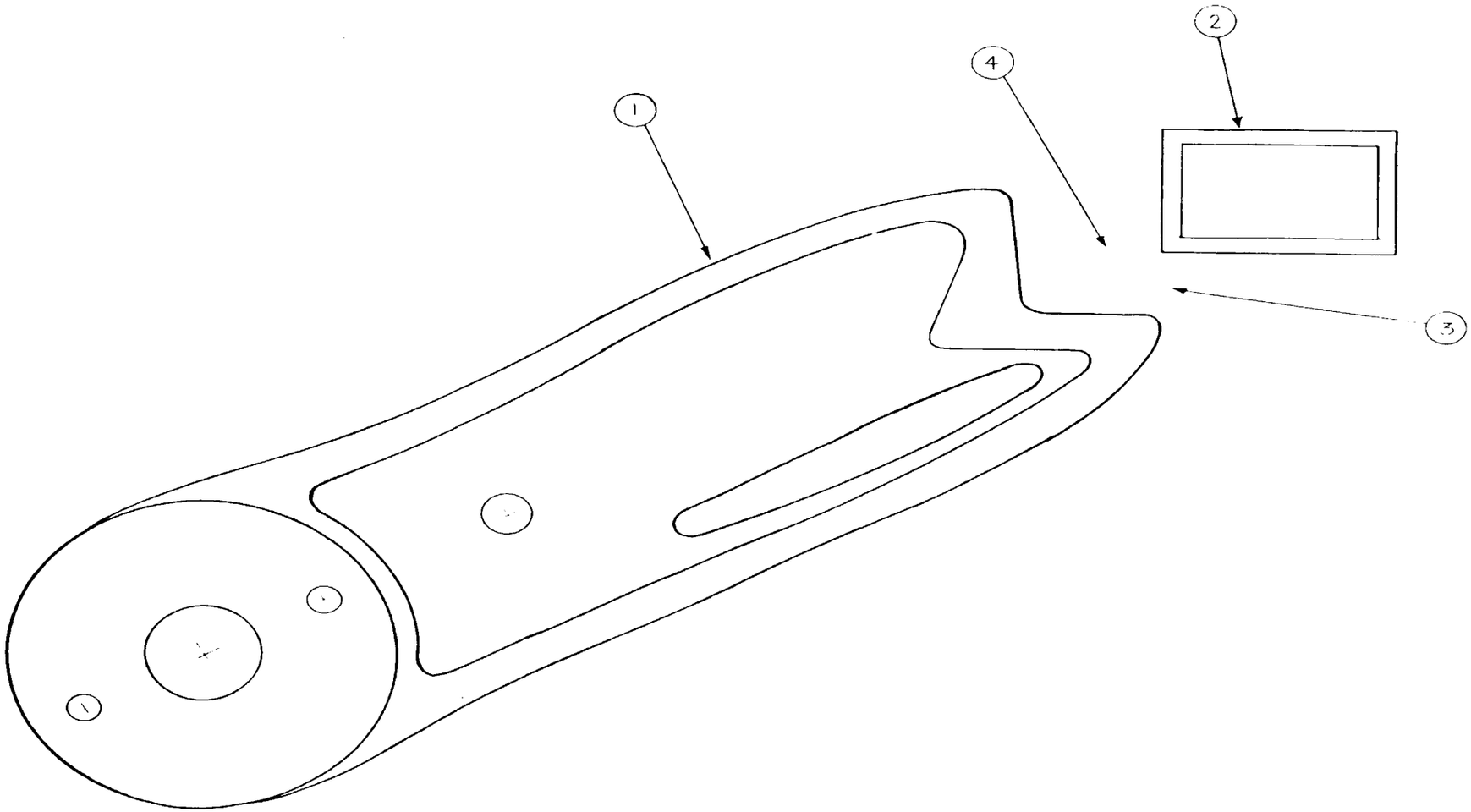


FIGURE 8-4. Locking Pawl Adjustment

For Explanation See Pages 57 to 58

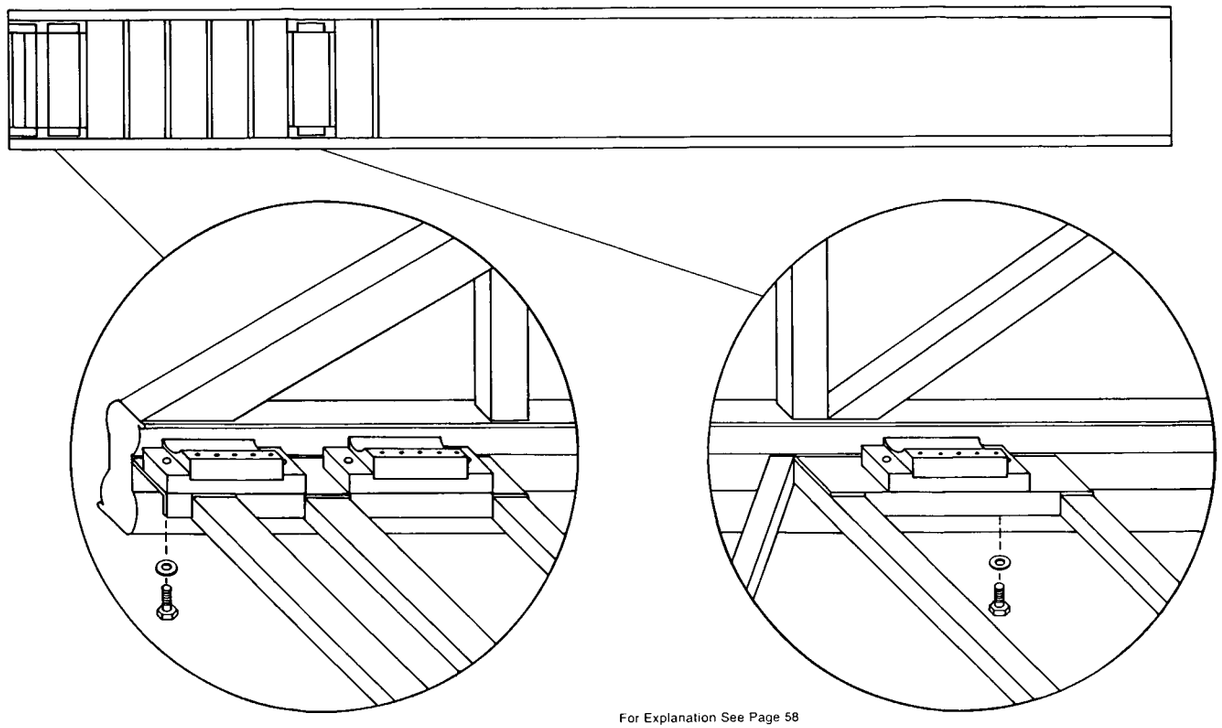


FIGURE 8-5. Section 1 - Nylon Slides

For Explanation See Page 58

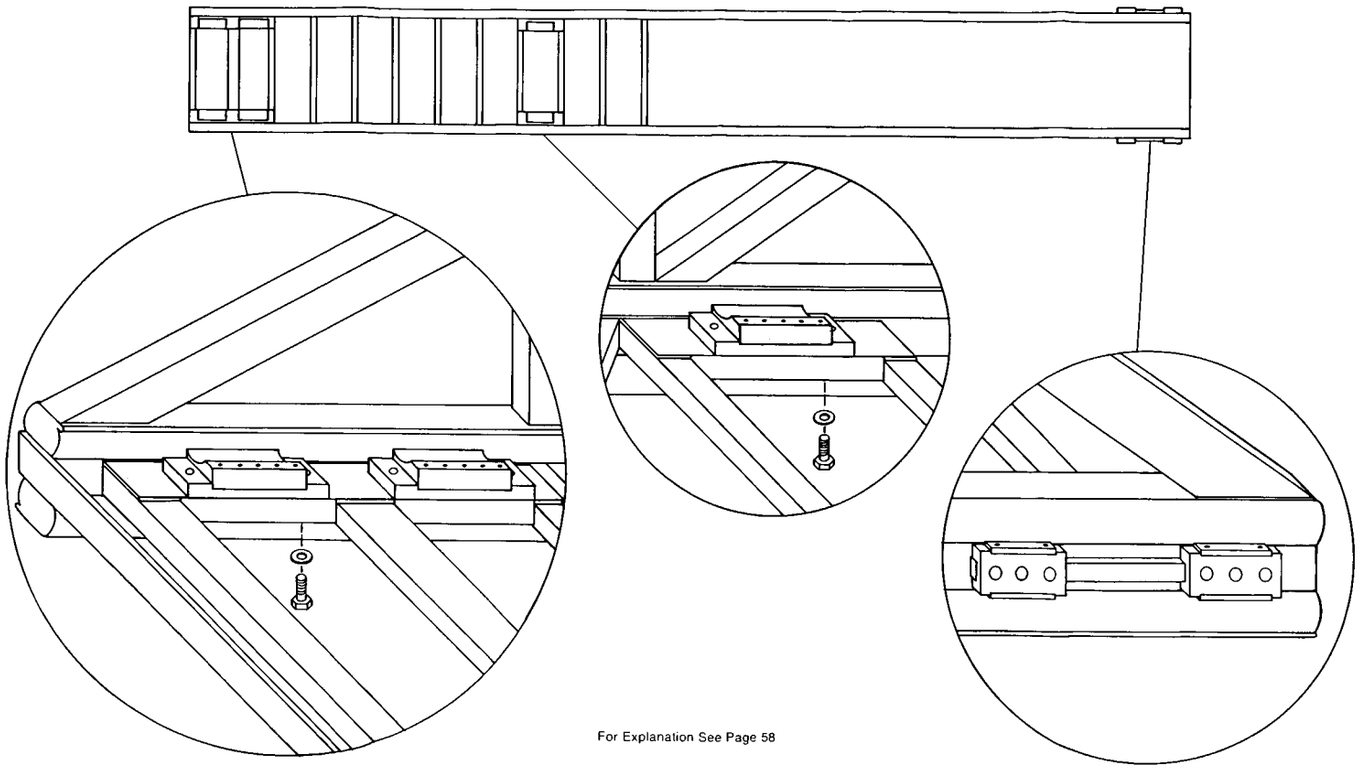


FIGURE 8-6. Section 2 - Nylon Slides

For Explanation See Page 58

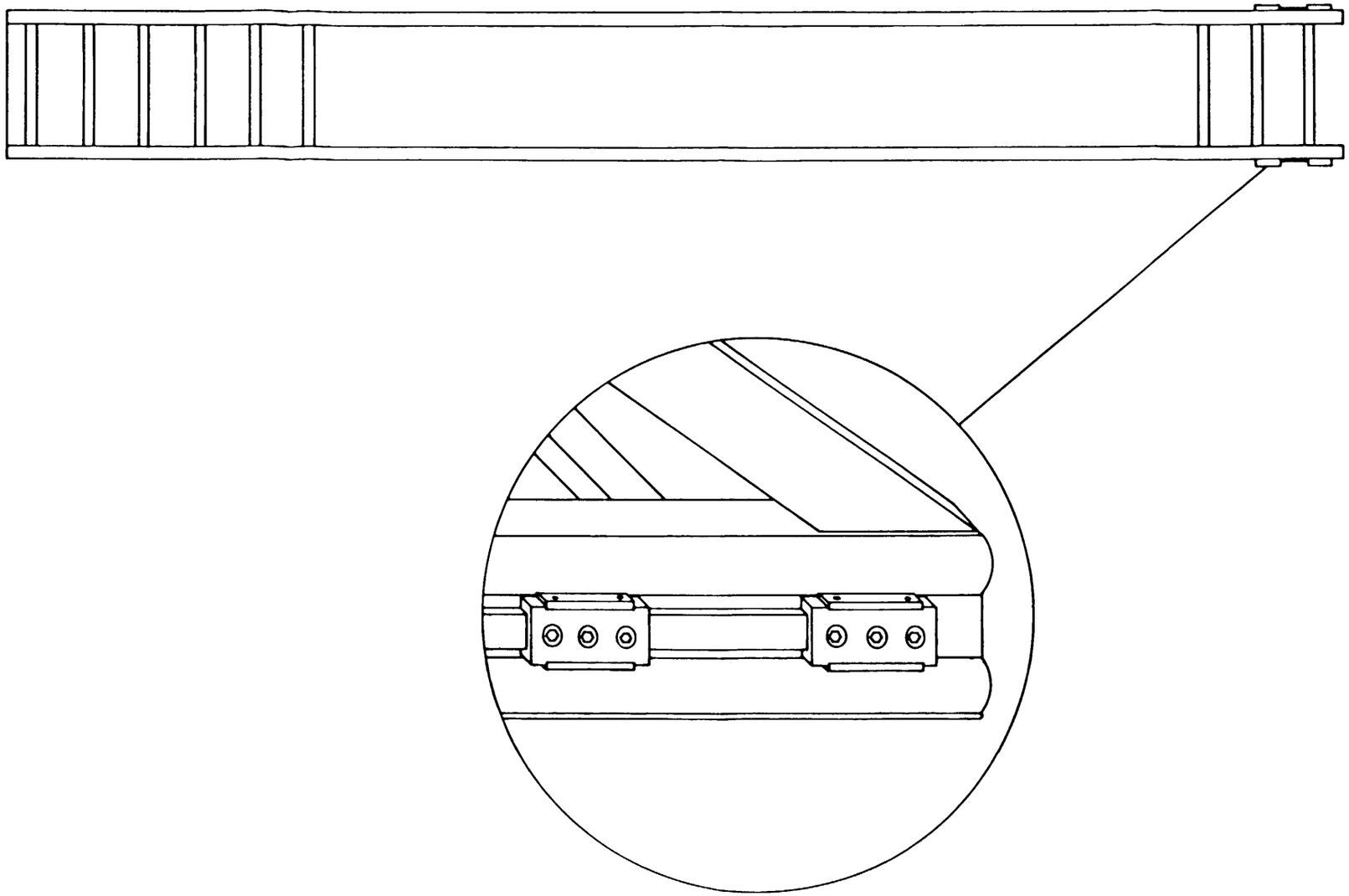


FIGURE 8-7. Section 3 - Nylon Slides

For Explanation See Page 58

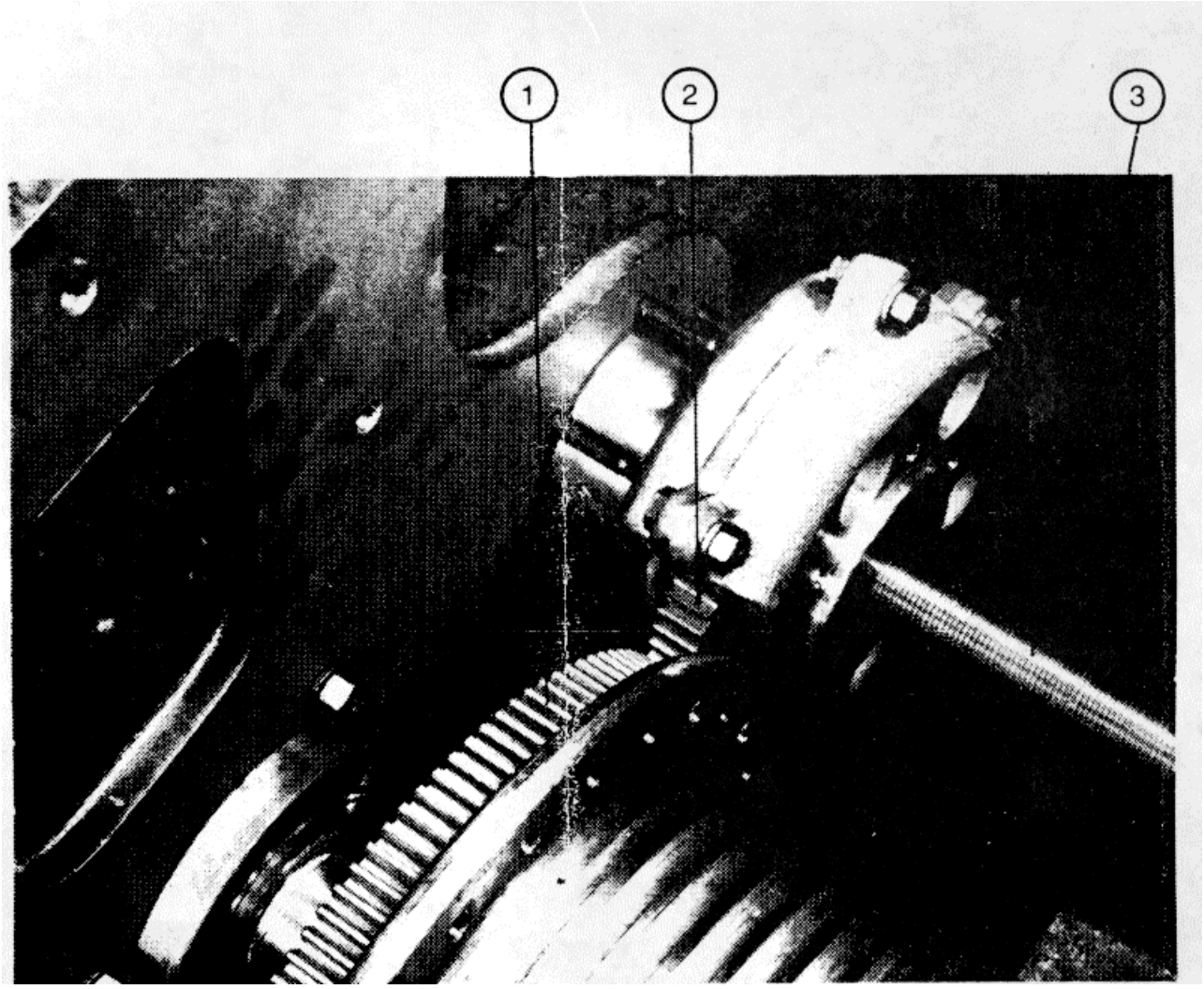


FIGURE 8-8. Ladder Extension Indicator Assembly

For Explanation See Page 59

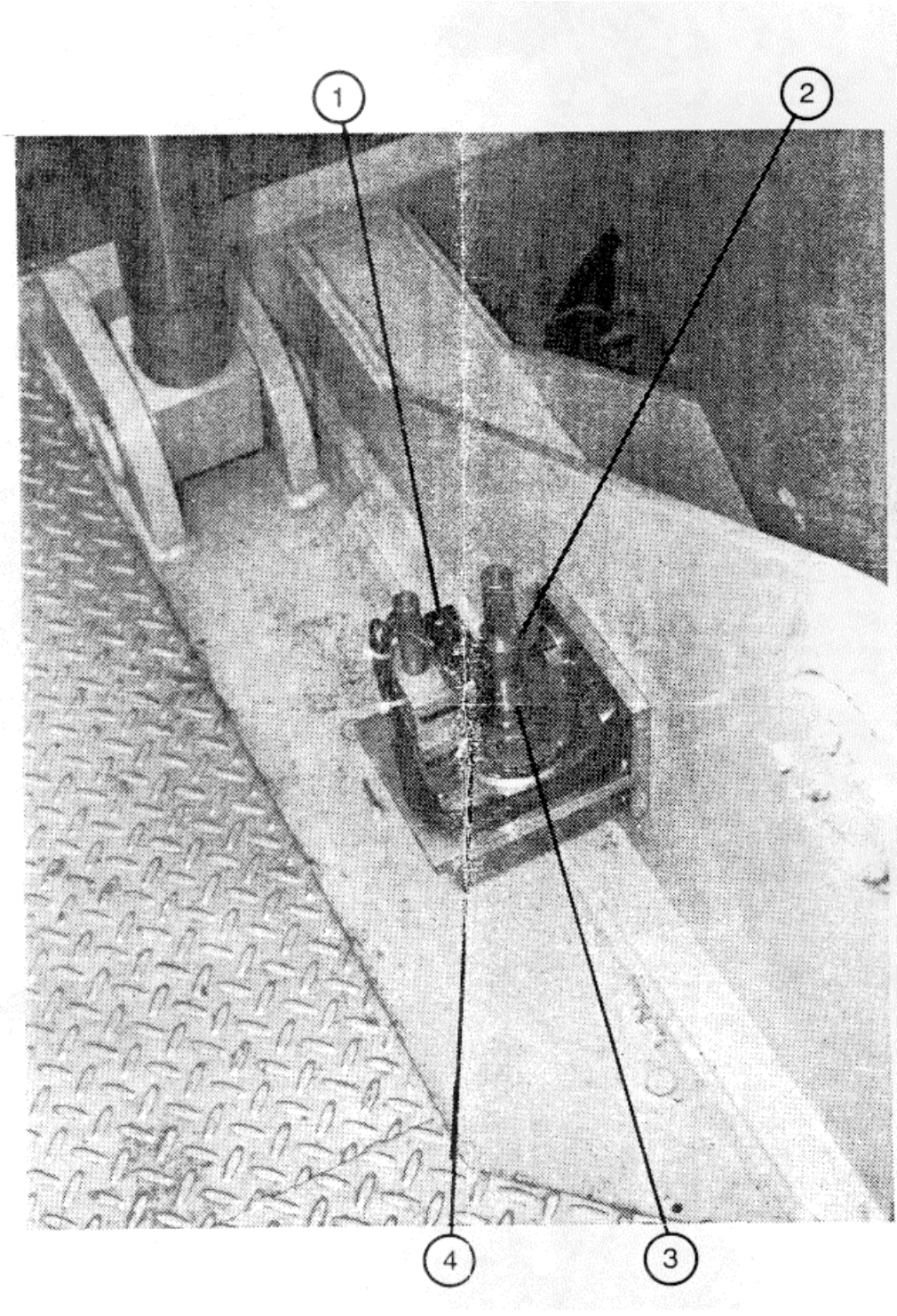


FIGURE 8-10. Elevating Limit Switch Assembly - Cover Removed

For Explanation See Page 61

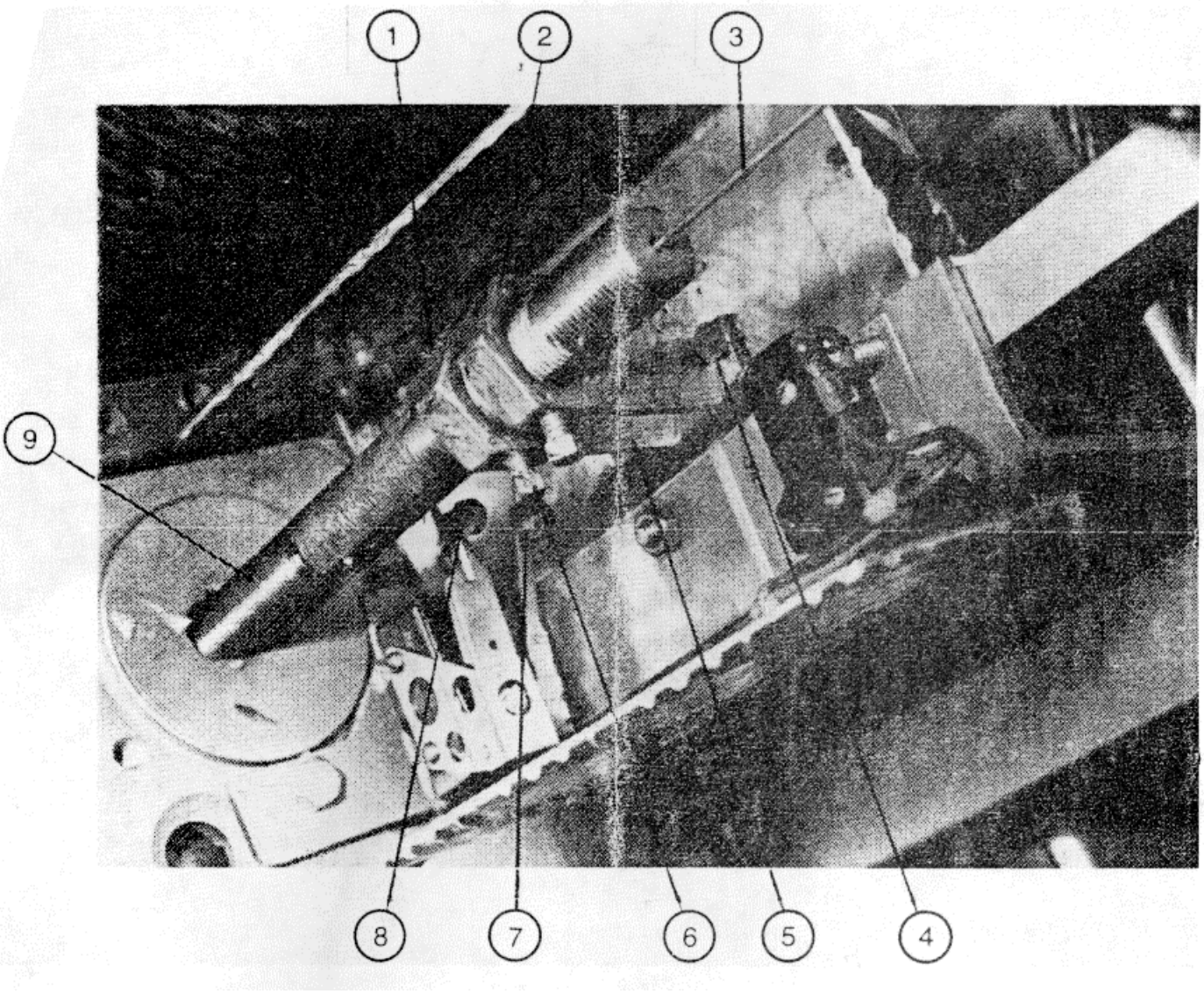


FIGURE 8-9. Ladder Extension Indicator Adjustment

For Explanation See Pages 60 to 62

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1 Kilogram 1000 Grams 2 2 Lb
1 Metric Ton 1000 Kilograms 1 Megagram 1 1 Short Tons

LIQUID MEASURE

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1 Liter 1000 Milliliters 33 82 Fluid Ounces

SQUARE MEASURE

1 Sq Centimeter 100 Sq Millimeters 0 155 Sq Inches
1 Sq Meter 10,000 Sq Centimeters 10 76 Sq Feet
1 Sq Kilometer 1,000,000 Sq Meters 0 0386 Sq Miles

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1 Cu Meter 1,000,000 Cu Centimeters 35 31 Cu Feet

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Yards	Meters	0 914
Miles	Kilometers	1 609
Square Inches	Square Centimeters	6 451
Square Feet	Square Meters	0 093
Square Yards	Square Meters	0 836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0 405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29 573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0 907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
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Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubit Feet	35.315
Cubic Meters	Cubic Yards	1,308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1 102
Newton-Meters	Pound-Feet	0.738
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Kilometers per Liter	Miles per Gallon	2.354
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