



INDUSTRIAL TRUCK DIVISION



# OPERATORS MANUAL

FOR

ECLS 30 B

ECLS 40 B

2nd REVISION  
0-150

## CLARK EQUIPMENT COMPANY

PUBLISHED BY

TECHNICAL SERVICE DEPARTMENT,  
BATTLE CREEK, MICHIGAN, U.S.A.



## **SAFETY INSTRUCTIONS** FOR MAINTAINING INDUSTRIAL TRUCKS

Powered industrial trucks may become hazardous if adequate maintenance is neglected. Therefore, adequate maintenance facilities, personnel and procedures should be provided.

Maintenance and inspection of all powered industrial trucks should be performed in conformance with the recommendation in this manual and the following practices.

1. A scheduled preventive maintenance, lubrication, and inspection system should be followed.
2. Only qualified and authorized personnel should be permitted to maintain, repair, adjust, and inspect industrial trucks.

3. Before Leaving The Truck:

- A. Stop truck.
- B. Fully lower the load engaging means.
- C. Place directional controls in neutral.
- D. Apply the parking brake.
- E. Stop the engine or turn off power.
- F. Lock the control or ignition circuit.
- G. Block the wheels if truck is on a ramp, or being worked on.

4. Before Working On Truck:

- A. Raise wheels free of floor or disconnect power source.
- B. Use chocks or other positive truck positioning devices.
- C. Block load engaging means, innermast(s), or chassis before working under them.

Before working on engine fuel system of gasoline powered trucks with gravity feed fuel systems, be sure fuel shutoff valve is closed.

Before working on engine fuel system of LP gas powered trucks, close LP gas cylinder valve and run engine until fuel in system is depleted and engine stops running.

Operation to check performance of the truck or attachments should be conducted in an authorized, safe clearance area.

5. Before Starting To Operate The Truck:

- A. Be in operating position.
- B. Depress clutch (or brake pedal on automatic transmission and electric trucks).
- C. Place directional controls in neutral.
- D. Start engine or turn on power.
- E. Before operating truck, check functioning of lift and tilt systems, directional and speed controls, steering, warning devices, brakes, and any attachment. (If used)
- F. Release parking brake.

- continued -

## **SAFETY INSTRUCTIONS** FOR MAINTAINING INDUSTRIAL TRUCKS

6. Avoid fire hazards and have fire protection equipment present. Do not use an open flame to check level, or for leakage, of fuel, electrolyte or coolant. Do not use open pans of fuel or flammable cleaning fluids for cleaning parts.
7. Properly ventilate work area, vent exhaust fumes and keep shop clean and floor dry.
8. Handle LP gas cylinders with care. Do not drop, dent, or damage in any way.
9. Brakes, steering mechanisms, control mechanisms, warning devices, lights, governors, lift overload devices, guards and safety devices should be inspected regularly and maintained in a safe operating condition.
10. All parts of lift and tilt mechanisms and frame members should be carefully and regularly inspected and maintained in a safe operating condition.
11. Special trucks or devices designed and approved for hazardous area operation should receive special attention to ensure that maintenance preserves the original, approved safe operating features.
12. Fuel systems should be checked for leaks and condition of parts. Extra special consideration should be given in the case of a leak in the fuel system. Action should be taken to prevent the use of the truck until the leak has been corrected.
13. All hydraulic systems should be regularly inspected and maintained in conformance with good practice. Tilt cylinders, valves, and other similar parts should be checked to assure that "drift" has not developed to the extent that it would create a hazard.
14. Capacity, operation and maintenance instructions plates, tags, or decals should be maintained in legible condition.
15. Batteries, motors, controllers, limit switches, protective devices, electrical conductors and connections should be inspected and maintained in conformance with good practice. Special attention should be paid to the condition of electrical insulation.
16. Industrial trucks should be kept in a clean condition to minimize fire hazards and facilitate detection of loose or defective parts.
17. Modifications and additions which affect capacity and safe truck operation should not be performed by the customer or user without manufacturers prior written approval. Capacity, operation and maintenance instruction plates, tags or decals should be changed accordingly.
18. Care should be taken to assure that all replacement parts are interchangeable with the original parts and of a quality equal to that provided in the original equipment.



# INDUSTRIAL TRUCK DIVISION



## P L E A S E      N O T E

### I N S T R U C T I O N S      O N      U S E      O F      M A N U A L

This Operator's Manual is published as a service reference guide and includes Specifications, Operating Instructions, Lubrication and Preventive Maintenance Instructions, and Trouble Shooting Guide.

The TABLE OF CONTENTS for this manual is printed on green paper and is placed at the front for easy reference. A separate INDEX (also printed on green paper) is placed in front of the Lubrication and Preventive Maintenance Section.

Lubrication and Preventive Maintenance Instructions are listed under the TIME INTERVALS that they should be performed.

The TIME INTERVAL is part of the page number and code number.

Example: 8H 002-0; 8H is the TIME INTERVAL (8 operating hours), 002 is the PAGE NUMBER, and -0 is a CODE NUMBER that you as a customer should disregard. The dash number or code number is for the benefit of the publisher only.

The INDEX is set up under the TIME INTERVALS that the Lubrication and Preventive Maintenance should be performed.

Example: (8 Hours)	Time Interval (H=Hours)	&	Page Number (000-)
Hydraulic Sump Tank, level check...	8H		503
Brake Pedal Free Travel, check.....	8H		373

The above states to check the sump tank fluid level every 8 operating hours and refer to page 503 for fluid recommendations etc. Also, to check brake pedal free travel at this interval and turn to page 373 for instructions.

Turn to the eight (8) hour section (8H) and then to the page listed — 503 or 373 etc. The instructions covered therein will pertain only to the checks or adjustments that should be performed at this TIME INTERVAL.

If, for instance, the Brake Pedal Free Travel is incorrect, you would then refer to the INDEX for "Brake Pedal Free Travel, adjust" which would be listed in the TIME INTERVALS following the 8 hour section.

Example: (100 Hours)	Time Interval (H=Hours)	&	Page Number (000-)
Brake Pedal Free Travel, adjust....	100H		302

Turn to the one hundred hour section (100H) and then to



# INDUSTRIAL TRUCK DIVISION



(continued)

## I N S T R U C T I O N S   O N   U S E   O F   M A N U A L

page 302. Complete instructions as to the importance of pedal free travel, the method to check and adjust for correct free travel with illustrations are included therein.

### N O T E

YOU WILL NOTE THAT AT THE BEGINNING OF EVERY SECTION A LUBRICATION AND PREVENTIVE MAINTENANCE ILLUSTRATION IS SHOWN GIVING THE LOCATION OF THE COMPONENTS TO BE SERVICED.

It is impossible to cover all types of machine operations in one manual. Operating conditions should determine the lubrication and maintenance intervals. Common sense and a close observance can best determine the frequency with which you should service your machine.

The care you give your machine will greatly determine the satisfaction and service life that you will obtain from it. A definite maintenance program should be set up and followed. Haphazard maintenance will only lead to faulty performance and short life.

T A B L E O F C O N T E N T S

<u>Page</u>	<u>Description</u>
A001	Instructions On Use Of Manual
A073	Table Of Contents
B071	Illustration Of Machine
B073	Specifications
B171	New Machine 50 Hour Inspection

O P E R A T I O N S

C072	Overall Controls
C073	Instrument Indicators
C173	To Operate Machine
C303	To Move, Stack and Lower Loads. Safety and Operating Suggestions

L U B R I C A T I O N A N D P R E V E N T I V E M A I N T E N A N C E

<u>Time Interval (H=Hours)</u>	<u>&amp; Page Number (0000-)</u>	<u>Description</u>
H	071	Index
8H	072	<u>8 Hour Lubrication and Preventive Maintenance Illustration</u>
8H	073	Control Circuit Fuse, Horn and Lights.
8H	273	Instrument Indicators, check
8H	373	Brake Pedal Free Travel check; Seat Safety Brake test
8H	374	Brake Interlock Switch check; Seat Safety Switch check
8H	473	Battery Inspect; Verify Electrolyte Level and Specific Gravity.
8H	477	Cables, Terminals and Receptacles inspect
8H	503	Hydraulic Sump Tank and Breather inspect; Lift and Tilt Cylinder Operations check
8H	603	Tires inspect
100H	072	<u>100 Hour Lubrication and Preventive Maintenance Illustration</u>
100H	073	Axle Adapter Lubricant Level check; Axle Vent inspect
100H	173	Speed Control Cylinder Fluid Level check; Cylinder Vent inspect
100H	273	Brake Interlock Switch adjust
100H	274	Seat Safety Switch adjust
100H	302	Brake Pedal Free Travel check
100H	303	Brake Pedal Free Travel adjust; Master Cylinder Level check
100H	403	Lift and Tilt Cylinders inspect; Lift Chains check and adjust; Visually inspect all wiring and hydraulic piping; Lubricate all miscellaneous linkage
100H	473	Pump Control Switches check and adjust
100H	475	Pedal Height and Stop Adjustment; First point of Power and 2MS Switch adjust
100H	503	Sump Tank Breather inspect
100H	603	Steering Gear Verify Lubricant Level
100H	674	Contacto Panel, Switchettes, inspect adjust
100H	773	Lubrication Chart
500H	072	<u>500 Hour Lubrication and Preventive Maintenance Illustration</u>
500H	173	Hydraulic Sump Tank drain & refill; Sump Tank Oil Filter change
500H	202	Steering Gear adjust
500H	302	Steering Axle and Linkage adjust
1000H	072	<u>1000 Hour Lubrication and Preventive Maintenance Illustration</u>
1000H	073	Carbon Pile Control Bleeding Procedure
1000H	173	Carbon Pile Accumulator and Actuator adjust
1000H	671	Drive Motor inspect and clean
1000H	771	Pump Motor inspect and clean
1000H	803	Steering Wheel Bearings clean and repack; adjust
1000H	805	Axle Ends clean and repack
1000H	912	Bleeding Brake System
1000H	1002	Service Brake Adjusters



# INDUSTRIAL TRUCK DIVISION



## TABLE OF CONTENTS

(Continued)

<u>Time Interval &amp; Number (H=Hours)</u>	<u>Page Number (0000-)</u>	<u>Description</u>
1000H	1173	Seat Safety Brake Linkage Adjust
1000H	1303	Axle Adapter Drain and Refill
1000H	1506	Main Hydraulic System Pressure Check
1000H	1803	Upright Roller Adjustments

## TROUBLE SHOOTING GUIDE

<u>Page</u>	<u>Description</u>
TS 483	Drive Axle
TS 521	Steering Axle
TS 541	Brakes
TS 653	Hydraulic System
TS 837	Solid State Control



**CLARK**  
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# INDUSTRIAL TRUCK DIVISION

**CLARK**  
EQUIPMENT

LUBRICATION AND PREVENTIVE MAINTENANCE







# INDUSTRIAL TRUCK DIVISION



SPECIFICATIONS ECLS30B

Weight with 1550 pound battery and 112" MFH standard upright..... 6456 lbs.  
 without battery..... 4906 lbs.  
 weight with 1550 pound battery and 112" MFH Hi-lo upright..... 6496 lbs.  
 without battery..... 4946 lbs.

Weight distribution  
 Percent on drive wheels - 49% (empty)  
 Empty (on drive wheels)....3181 lbs.  
 Loaded (on drive wheels)... 8401 lbs.

Service weight (with 112" MFH standard upright and 1550 pound battery)..... 6456 lbs.

Power supply  
 Type battery (18 Cell 17 Plate)..Lead acid  
 Voltage (18 Cell 17 Plate)... 36 volts  
 Kilowatt hour capacity (18 Cell 17 Plate)..  
 ..... 18.07 kw. hr.  
 Battery weight (18 Cell 17 Plate) 1550 lbs.

Battery compartment size  
 Standard: 32 3/4 W x 28 3/4 L x 19 H

Tires  
 Front drive (type) Cushion, non-directional  
 (size) 18" x 7" x 12 1/8"  
 Rear steer (type) Flat base solid  
 (size) 12" x 4 1/2" x 8"

Dimensions  
 Length (with Std. 40" forks) 118 7/8 inches  
 Length (without forks).... 78 7/8 inches  
 Height (with 112" MFH upright lowered)..  
 ..... 74 inches  
 Basic aisle for right angle stacking  
 (plus length of load)... 85 1/2 inches  
 Free lift (Standard upright)... 17 inches  
 (Hi-Lo upright).. 54 1/2 inches  
 Overall height with 112" MFH upright raised  
 ..... 133 inches  
 Overall width..... 38 1/2 inches  
 Turning radius (with standard 28 3/4 inch  
 battery compartment).....  
 (outside)..... L.H. 73" @ 55 deg.  
 ..... R.H. 73" @ 55 deg.  
 (inside).....L.H. 4" @ 76 deg. - 30"  
 .....R.H. 4" @ 76 deg. - 30"  
 Tread, front tires ..... 31 inches  
 Tread, rear tires ..... 26 inches  
 Ground clearance (under rear axle).....  
 ..... 3 3/4 inches  
 Ground clearance (under front axle).....  
 ..... 3 inches  
 Ground clearance (between axles).....  
 ..... 4 1/2 inches  
 Grade clearance (under frame)..... 45%  
 Grade clearance (under counterweight)....  
 ..... 5 inches

Hydraulic System  
 System pressure relief setting @ valve  
 ..... 1750 to 1800 P.S.I.  
 Sump tank filter (cleanable).....  
 ..... 25 to 40 micron  
 Sump tank breather (replaceable).....  
 ..... 5 micron  
 Brake System..... Hydraulic internal expand-  
 ing double shoe mounted in drive axle  
 housing.  
 Parking Brake... Two shoe, external compress-  
 ing, spring applied - mechanically  
 released, mounted on end of drive motor.

Brake Pedal Free Travel ... 1/2 inch  
 (as measured from top pedal position  
 -to- where pedal meets resistance from  
 the master cylinder)  
 Parking Brake Effectiveness -- must be  
 capable of holding truck with full rated load  
 on a 15% grade. This should be tested (with  
 the seat brake linkage disconnected) while  
 occupying the driver's seat (parking brake  
 thus applied) and truck power off.

Speeds and Grades  
 Forward (loaded) ..... 6.3 M.P.H.  
 (empty) ..... 6.6 M.P.H.  
 Reverse (loaded) ..... 6.3 M.P.H.  
 (empty) ..... 6.6 M.P.H.  
 Gradeability (with rated load) 10%  
 Lifting Speed Standard Hi-Lo  
 (Loaded) 60 F.P.M. 45 F.P.M.  
 (empty) 90 F.P.M. 69 F.P.M.  
 Lowering Speed Standard Hi-Lo  
 (Loaded) 70 F.P.M. 70 F.P.M.  
 (empty) 85 F.P.M. 80 F.P.M.

Battery Connector ..... Type SB, 175 AMP  
 Sump tank capacity (usable).... 3.32 gallons

Main Hydraulic Pump (type) Gear - dual ....  
 ..... 2.7 G.P.M. and 10.9 G.P.M. capacity

Drive Motor  
 Brush spring tension, initial 63-60 oz.  
 final 42-40 oz.

Pump Motor  
 Brush spring tension, initial .....  
 ..... 50-47 1/2 oz.  
 Brush spring tension, final .....  
 ..... 35-33 oz.



# INDUSTRIAL TRUCK DIVISION



SPECIFICATIONS ECLS40B

Weight with 1550 pound battery and 112" MFH standard upright.....7110 lbs.  
 without battery..... 5560 lbs.  
 weight with 1550 pound battery and 112" MFH Hi-lo upright..... 7150 lbs.  
 without battery..... 5440 lbs.

### Weight distribution

Percent on drive wheels - 40% (empty)  
 Empty (on drive wheels).... 2844 lbs.  
 Loaded (on drive wheels)... 9784 lbs.

Service weight (with 112" MFH standard upright and 1550 pound battery)..... 7110 lbs.

### Power supply

Type battery (18 Cell 17 Plate)..Lead acid  
 Voltage (18 Cell 17 Plate)... 36 volts  
 Kilowatt hour capacity (18 Cell 17 Plate)..  
 ..... 18.07 kw. hr.  
 Ampere hour capacity 520 @ 6 hr. rate  
 Battery weight (18 Cell 17 Plate) 1550 lbs.

### Battery compartment size

Standard: 32 3/4 W x 31 1/4 L x 19 H

### Tires

Front drive (type) Cushion, non-directional  
 (size) 18" x 8" x 12 1/8"  
 Rear steer (type) Flat base solid  
 (size) 12" x 4 1/2" x 8"

### Dimensions

Length (with Std. 40" forks) 122 7/8 inches  
 Length (without forks)..... 82 7/8 inches  
 Height (with 112" MFH upright lowered)..  
 ..... 74 inches  
 Basic aisle for right angle stacking  
 (plus length of load)..... 88 1/2 inches  
 Free lift (Standard upright)... 17 inches  
 (Hi-Lo upright).. 54 1/2 inches  
 Overall height with 112" MFH upright raised  
 ..... 133 inches  
 Overall width..... 38 1/2 inches  
 Turning radius (with standard 31 1/4 inch  
 battery compartment).....  
 (outside)..... L.H. 76" @ 55 deg.  
 ..... R.H. 76" @ 55 deg.  
 (inside).....L.H. 4" @ 76 deg. - 30'  
 .....R.H. 4" @ 76 deg. - 30'  
 Tread, front tires ..... 30 inches  
 Tread, rear tires ..... 26 inches  
 Ground clearance (under rear axle).....  
 ..... 3 3/4 inches  
 Ground clearance (under front axle).....  
 ..... 3 inches  
 Ground clearance (between axles).....  
 ..... 4 1/2 inches  
 Grade clearance (under frame)..... 45%  
 Grade clearance (under counterweight)....  
 ..... 5 inches

### Hydraulic System

System pressure relief setting @ valve  
 ..... 1750 to 1800 P.S.I.  
 Sump tank filter (cleanable).....  
 ..... 25 to 40 micron  
 Sump tank breather (replaceable).....  
 ..... 5 micron

Brake System.... Hydraulic internal expanding double shoe mounted in drive axle housing.

Parking Brake... Two shoe, external compressing, spring applied - mechanically released, mounted on end of drive motor.

Brake Pedal Free Travel ... 1/2 inch  
 (as measured from top pedal position -to- where pedal meets resistance from the master cylinder)

Parking Brake Effectiveness -- must be capable of holding truck with full rated load on a 15% grade. This should be tested (with the seat brake linkage disconnected) while occupying the driver's seat (parking brake thus applied) and truck power off.

### Speeds and Grades

Forward (loaded) .....	6.1 M.P.H.
(empty) .....	6.4 M.P.H.
Reverse (loaded) .....	6.1 M.P.H.
(empty) .....	6.4 M.P.H.
Gradeability (with rated load)	10%
Lifting Speed	<u>Standard</u> <u>Hi-Lo</u>
(Loaded)	50 F.P.M.      40 F.P.M.
(empty)	90 F.P.M.      69 F.P.M.
Lowering Speed	<u>Standard</u> <u>Hi-Lo</u>
(Loaded)	70 F.P.M.      70 F.P.M.
(empty)	85 F.P.M.      80 F.P.M.

Battery Connector ..... Type SB, 175 AMP  
 Sump tank capacity (usable).... 3.32 gallons

Main Hydraulic Pump (type) Gear - dual .....  
 ..... 2.7 G.P.M. and 10.9 G.P.M. capacity

### Drive Motor

Brush spring tension, initial 63-60 oz.  
 final 42-40 oz.

### Pump Motor

Brush spring tension, initial .....  
 ..... 50-47 1/2 oz.  
 Brush spring tension, final .....  
 ..... 35-33 oz.

**E**NGINEERING  
**S**PECIFICATIONS

**CLARKLIFT® ECLS-30**

3,000 pounds capacity, 24 inch load center

**MODEL ECLS-30** Weight with 1,550 lb. lead acid battery . . . . . **Standard** 6,456 lbs. **Hi.Lo** 6,496 lbs.

**CAPACITY** Rated Capacity . . . . . 3,000 lbs. at 24" load center  
(See capacity chart for other ratings)

**DIMENSIONS**

Length (to front face of forks) . . . . . 78<sup>7</sup>/<sub>8</sub>"  
Wheelbase . . . . . 49<sup>1</sup>/<sub>2</sub>"  
Width . . . . . 38<sup>1</sup>/<sub>2</sub>"  
Tread (drive) . . . . . 31"  
Tread (steer) . . . . . 26"  
Turning radius . . . . . 73"  
Basic aisle for right angle stacking (add load length) . . . . . 85<sup>1</sup>/<sub>2</sub>"

**UNDERCLEARANCES**

Upright . . . . . 3"  
Drive axle . . . . . 3"  
Steer Axle . . . . . 3<sup>3</sup>/<sub>4</sub>"  
Center of frame . . . . . 4<sup>1</sup>/<sub>2</sub>"  
Counterweight . . . . . 5"  
Grade clearance at counterweight . . . . . 45%

**SPEEDS AND GRADES AT 36 VOLTS**

Travel speed, forward and reverse . . . . . Loaded up to 6.3 m.p.h.  
(555 f.p.m.)  
Travel speed, forward and reverse . . . . . Empty up to 6.6 m.p.h.  
(580 f.p.m.)  
Gradeability with rated load . . . . . 10%

	STANDARD		HI-LO	
	Loaded	Empty	Loaded	Empty
Lifting speed (f.p.m.) . . . . .	60	90	45	69
Lowering speed (f.p.m.) . . . . .	70	85	70	80

**POWER SUPPLY**

Lead acid battery in steel trays 30 to 36 volt, having adequate kilowatt hours capacity.  
15 cells, 23 plate, 3 x 5 layout  
16 cells, 19 plate, 4 x 4 layout  
18 cells, 17 plate, 4 x 5 layout  
Exide Types: RCS, RGP  
Gould Types: 55X, (specify special 18<sup>1</sup>/<sub>2</sub>" height)  
C & D Types: CMS  
K-W Types: FL

Standard compartment size . . . . . 32<sup>3</sup>/<sub>4</sub>" W x 28<sup>3</sup>/<sub>4</sub>" L x 19" H.

**BATTERY CONNECTOR.** Anderson type SB, 175 ampere continuous rating with ample capacity for overloads. Both halves are identical and interchangeable.

**MOTORS.** Drive motor is dual wound. Pump motor is series wound. Both motors are fan cooled, ventilated and protected by class "F" insulation.

**DRIVE AXLE.** Heavy-duty drive axle by Clark, with double reduction of bevel and spur gears. Final gear reduction is at the drive wheels through pinion and internal ring gear; sealed in grease for longer life.

**BRAKES.** Two systems: Foot brake, torque multiplied, hydraulic internal expanding double shoe with bonded brake lining. Parking brake is mounted on the drive motor armature shaft and applies when operator leaves the seat.

**STEERING.** Vanadium steel steer axle is mounted on two torsional rubber bushing assemblies, with inclined king pins. Recirculating ball type steering gear with 18" diameter steering hand wheel.

**UPRIGHT.** Nested roller type telescopic upright. I-beam inner section of chrome alloy steel is nested within the 1045 steel outer channel. Carriage has lateral thrust rollers mounted on outside. Latch assures completion of free lift before inner section rises. Dual tilt cylinders have chrome plated rods. Anti-cavitating control valve prevents drifting. Tilting range is 10° back and 3° forward.

**LIFT CYLINDER.** Piston type, with free-floating mounting to eliminate side strains. Oil drain line to sump prevents external seal leakage. Flow regulator controls lowering speed.

**FORKS**

	Length	Width	Thickness
Standard . . . . .	40"	5"	1 <sup>3</sup> / <sub>4</sub> "

Optional . . . . . Contact Factory

Forks are heat treated and upset forged from SAE 1045 steel; bottom is tapered from chisel tip, 30 inches to specified thickness. Fork spread from 0" inside to 36" outside width. Carriage is welded construction from SAE 1045 steel.

**SEATING.** Rubber mounted wide seat and back rest are Polyurethane foam, covered with vinyl plastic. Backrest is curved, and swivels to fit driver. Automotive type latch releases the seat for horizontal adjustment up to 4 inches.

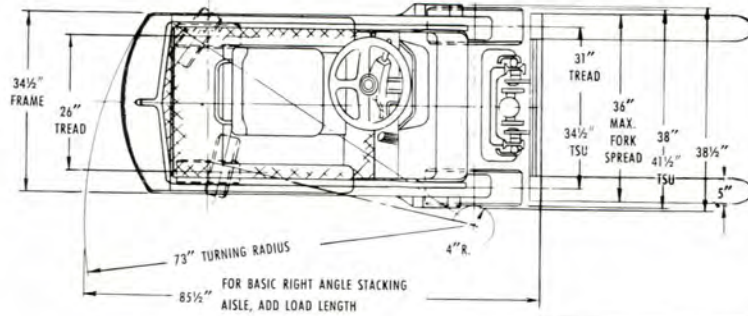
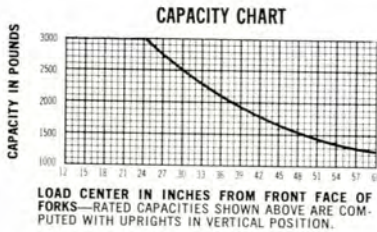
**MAINTENANCE.** Removable hood and side plates provide top and side removal of battery. Pump, pump motor, control panel and carbon pile unit quickly exposed for inspection and maintenance. Pressure gun fittings at all lubrication points.

**ADDED ADVANTAGES.** The following are all standard equipment: Driver's overhead guard and load back rest, electric horn, shock mounted direct reading hour meter and battery discharge indicator. All exposed surfaces are shot blasted and prime painted with weather resistant paint. Standard color is two tone silver-grey and red; optional colors with grey are orange, yellow, green or blue.

**D**IMENSIONAL  
**S**PECIFICATIONS

**CLARKLIFT® ECLS-30**

3,000 pounds capacity, 24 inch load center



UPRIGHT DIMENSION TABLE

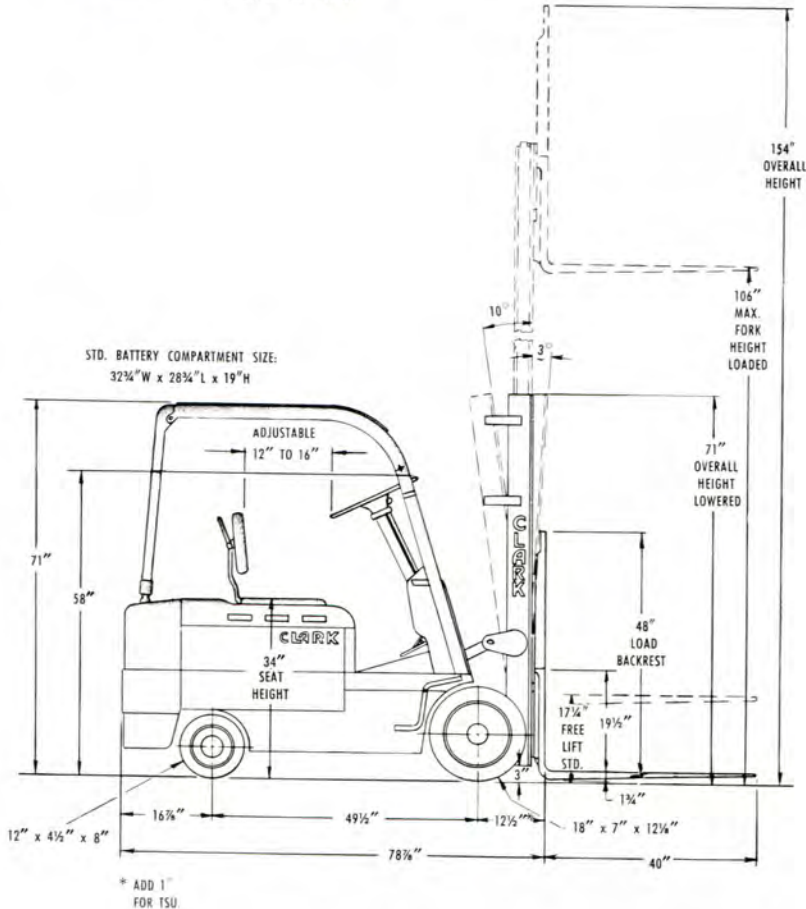
MFH		OAHL	FREE LIFT		
STD HI-LO	STD&FFL TSU		STD	HI-LO&FFL TSU **	STD TSU
70	—	53	17 1/4	—	—
76	—	56	17 1/4	—	—
82	—	59	17 1/4	—	—
88	—	62	17 1/4	—	—
94	135	65	17 1/4	45	12 1/2
*100	138	68	17 1/4	48	12 1/2
*106	*153	71	17 1/4	51	12 1/2
*112	162	74	17 1/4	54	12 1/2

\* INDICATES PREFERRED STANDARD SIZES.  
INTERMEDIATE HEIGHTS AVAILABLE IN INCREMENTS OF 3 MAXIMUM FORK HEIGHT.  
MAXIMUM FORK HEIGHTS LESS THAN 94 AVAILABLE ONLY IN STANDARD UPRIGHT.  
FOR OVERALL HEIGHT RAISED, ADD 48" TO MFH.  
\*\*LESS LOAD BACKREST



On all CLARK literature, dimensional and performance specifications are checked for accuracy by the engineering department.

NOTE: Clark products and specifications are subject to improvements and changes without notice.



**E**NGINEERING  
**S**PECIFICATIONS

**CLARKLIFT® ECLS-40**

4,000 pounds capacity, 24 inch load center

**MODEL ECLS-40** Weight with 1,550 lb. lead acid battery . . . . .

	Standard	Hi. Lo
	7,110 lbs.	7,150 lbs.

**CAPACITY** Rated Capacity . . . . . 4,000 lbs. at 24" load center  
(See capacity chart for other ratings)

**DIMENSIONS**

Length (to front face of forks) . . . . . 82 $\frac{7}{8}$ "  
Wheelbase . . . . . 49 $\frac{1}{2}$ "  
Width . . . . . 38 $\frac{1}{2}$ "  
Tread (drive) . . . . . 30"  
Tread (steer) . . . . . 26"  
Turning Radius . . . . . 76"  
Basic aisle for right angle stacking (add load length) . . . . . 88 $\frac{1}{2}$ "

**UNDERCLEARANCES**

Upright . . . . . 3"  
Drive axle . . . . . 3"  
Steer Axle . . . . . 3 $\frac{3}{4}$ "  
Center of frame . . . . . 4 $\frac{1}{2}$ "  
Counterweight . . . . . 5"  
Grade clearance at counterweight . . . . . 45%

**SPEEDS AND GRADES AT 36 VOLTS**

Travel speed, forward and reverse . . . . . Loaded up to 6.1 m.p.h.  
(537 f.p.m.)  
Travel speed, forward and reverse . . . . . Empty up to 6.4 m.p.h.  
(563 f.p.m.)  
Gradeability with rated load . . . . . 10%

	STANDARD		HI-LO	
	Loaded	Empty	Loaded	Empty
Lifting speed (f.p.m.) . . . . .	50	90	40	69
Lowering speed (f.p.m.) . . . . .	70	85	70	80

**POWER SUPPLY**

Lead acid battery in steel trays 30 to 36 volt, having adequate kilowatt hours capacity.  
15 cells, 25 plate, 3 x 5 layout  
16 cells, 19 plate, 4 x 4 layout  
18 cells, 19 plate, 4 x 5 layout  
Exide Types: RSC, RGP  
Gould Types: 55X, (specify special 18 $\frac{1}{2}$ " height)  
C & D Types: CMS  
K-W Types: FL

Standard compartment size . . . . . 32 $\frac{3}{4}$ " W x 31 $\frac{1}{4}$ " L x 19" H.

**BATTERY CONNECTOR.** Anderson type SB, 175 ampere continuous rating with ample capacity for overloads. Both halves are identical and interchangeable.

**MOTORS.** Drive motor is dual wound. Pump motor is series wound. Both motors are fan cooled, ventilated and protected by class "F" insulation.

**DRIVE AXLE.** Heavy-duty drive axle by Clark, with double reduction of bevel and spur gears. Final gear reduction is at the drive wheels through pinion and internal ring gear; sealed in grease for longer life.

**BRAKES.** Two systems: Foot brake, torque multiplied, hydraulic internal expanding double shoe with bonded brake lining. Parking brake is mounted on the drive motor armature shaft and applies when operator leaves the seat.

**STEERING.** Vanadium steel steer axle is mounted on two torsional rubber bushing assemblies, with inclined king pins. Recirculating ball type steering gear with 18" diameter steering hand wheel.

**UPRIGHT.** Nested roller type telescopic upright. I-beam inner section of chrome alloy steel is nested within the 1045 steel outer channel. Carriage has lateral thrust rollers mounted on outside. Latch assures completion of free lift before inner section rises. Dual tilt cylinders have chrome plated rods. Anti-cavitating control valve prevents drifting. Tilting range is 10° back and 3° forward.

**LIFT CYLINDER.** Piston type, with free-floating mounting to eliminate side strains. Oil drain line to sump prevents external seal leakage. Flow regulator controls lowering speed.

**FORKS**

	Length	Width	Thickness
Standard . . . . .	40"	5"	1 $\frac{3}{4}$ "
Optional . . . . .	Contact Factory		

Forks are heat treated and upset forged from SAE 1045 steel; bottom is tapered from chisel tip, 30 inches to specified thickness. Fork spread from 0" inside to 36" outside width. Carriage is welded construction from SAE 1045 steel.

**SEATING.** Rubber mounted wide seat and back rest are Polyurethane foam, covered with vinyl plastic. Backrest is curved, and swivels to fit driver. Automotive type latch releases the seat for horizontal adjustment up to 4 inches.

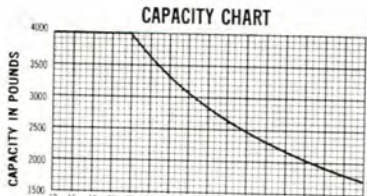
**MAINTENANCE.** Removable hood and side plates provide top and side removal of battery. Pump, pump motor, control panel and carbon pile unit quickly exposed for inspection and maintenance. Pressure gun fittings at all lubrication points.

**ADDED ADVANTAGES.** The following are all standard equipment: Driver's overhead guard and load back rest, electric horn, shock mounted direct reading hour meter and battery discharge indicator. All exposed surfaces are shot blasted and prime painted with weather resistant paint. Standard color is two tone silver-grey and red; optional colors with grey are orange, yellow, green or blue.

**D**IMENSIONAL  
**S**PECIFICATIONS

**CLARKLIFT® ECLS-40**

4,000 pounds capacity, 24 inch load center



LOAD CENTER IN INCHES FROM FRONT FACE OF FORKS—RATED CAPACITIES SHOWN ABOVE ARE COMPUTED WITH UPRIGHTS IN VERTICAL POSITION.

UPRIGHT DIMENSION TABLE

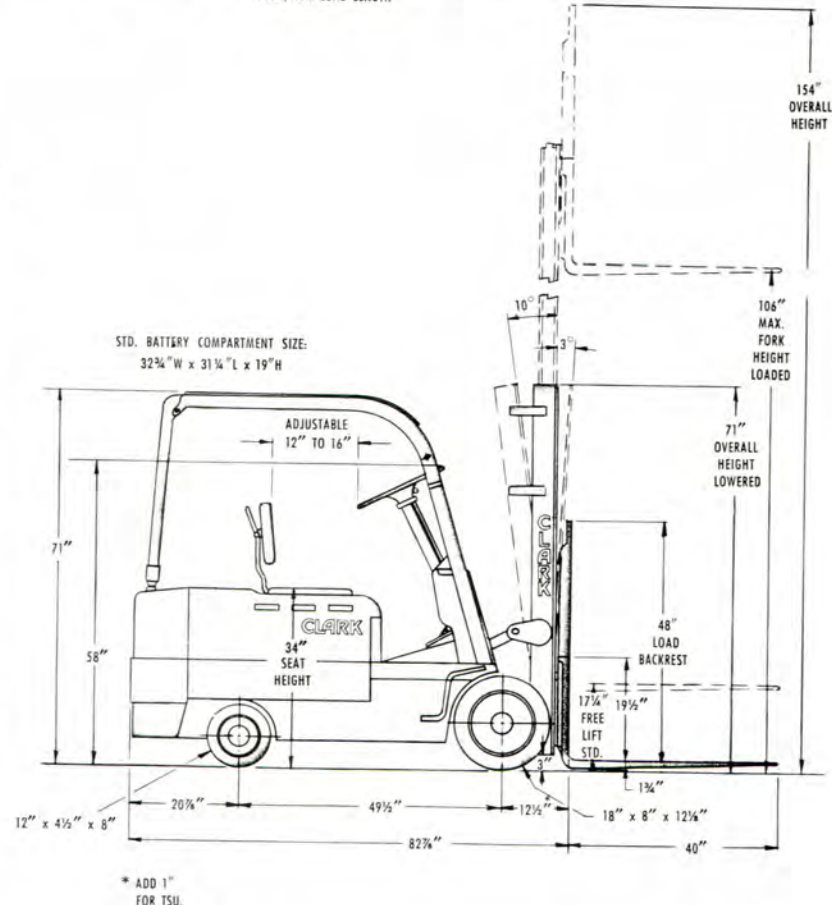
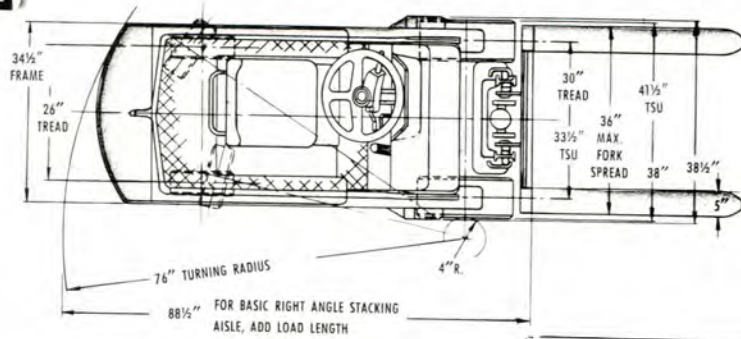
MFH		OAHL	FREE LIFT		
STD HI-LO	STD&FFL TSU		STD	HI-LO&FFL TSU**	STD TSU
70	—	53	17½	—	—
76	—	56	17½	—	—
82	—	59	17½	—	—
88	—	62	17½	—	—
94	135	65	17½	45	12½
*100	138	68	17½	48	12½
*106	*153	71	17½	51	12½
*112	162	74	17½	54	12½

\* INDICATES PREFERRED STANDARD SIZES.  
INTERMEDIATE HEIGHTS AVAILABLE IN INCREMENTS OF 3 MAXIMUM FORK HEIGHT.  
MAXIMUM FORK HEIGHTS LESS THAN 94 AVAILABLE ONLY IN STANDARD UPRIGHT.  
FOR OVERALL HEIGHT RAISED, ADD 48" TO MFH.  
\*\*LESS LOAD BACKREST



On all CLARK literature, dimensional and performance specifications are checked for accuracy by the engineering department.

NOTE: Clark products and specifications are subject to improvements and changes without notice.



\* ADD 1" FOR TSU.





# INDUSTRIAL TRUCK DIVISION



NEW MACHINE 50 HOUR SERVICE AND INSPECTION

Axle Adapter Level Check .....	100H 073
Battery, Terminals, Cables, Receptacles Inspect .....	8H 473
Brake Pedal Free Travel, Check and Adjust .....	100H 302
Brakes, Master Cylinder Level Check.....	100H 303
Brake Interlock Switch Check and Adjust .....	100H 273
Carbon Pile Actuator and Accumulator, Check and Adjust.....	1000H 173
Contacto Panel, Switchettes, Check and Adjust .....	100H 674
First Point of Power Switch, 2MS Switch Check and Adjust .....	100H 475
Hydraulic Sump Tank Strainer, Clean.....	500H 173
Lift Chain, Adjust .....	100H 403
Lubricate Machine .....	100H 773
Nuts, Bolts and Capscrews, Tighten .....	500H 072
Pressure Check Main Hydraulic System .....	1000H 1507
Pump Control Switches Adjust .....	100H 473
Seat Safety Brake Switch, Check and Adjust .....	100H 274
Seat Safety Brake Linkage, Check and Adjust .....	1000H 1173
Speed Control Cylinder, Level Check .....	100H 173
Steering Gear, Level Check .....	100H 603

## N O T E

PERFORM THIS SERVICE AND INSPECTION  
AFTER THE FIRST 50 HOURS OF OPERA-  
TION ON NEW MACHINES.

## OPERATIONS

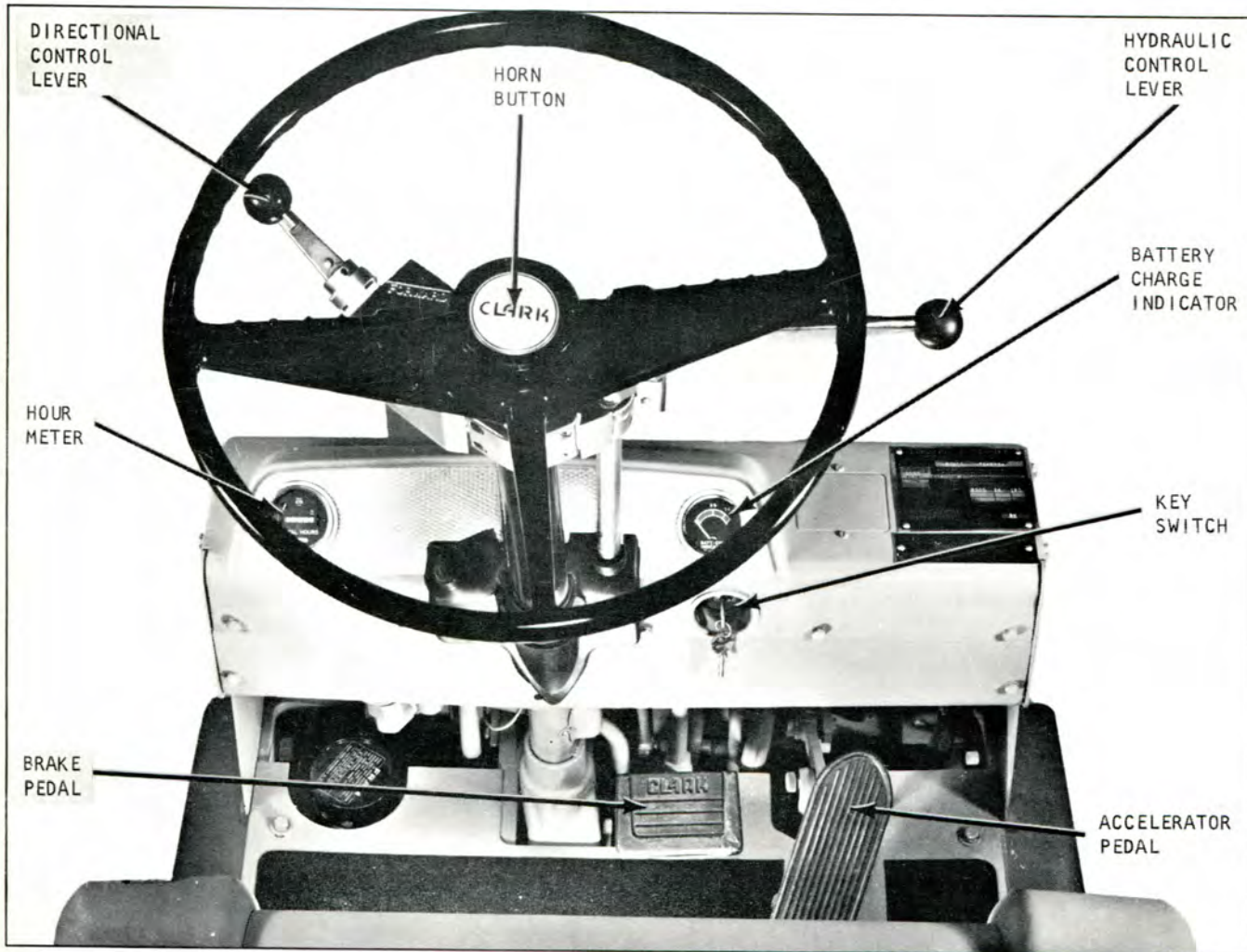


Plate 7412. Overall Controls



Plate 7216. Directional Control Lever

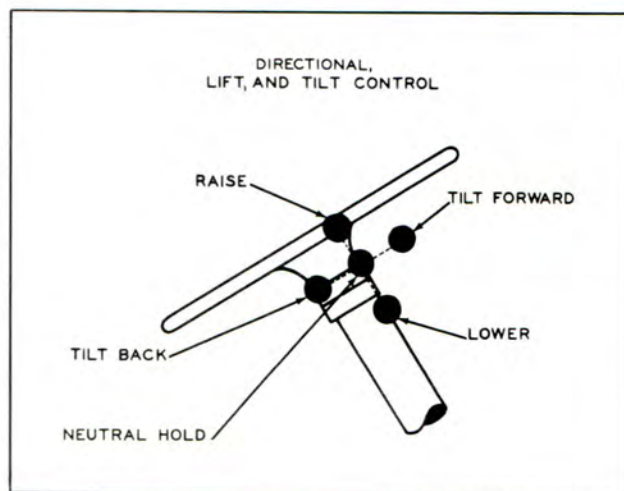


Plate 4448. Hydraulic Control Lever



Plate 7388. Battery Charge Indicator

With the key switch in the "on" position the battery charge indicator will show the available battery voltage. When the indicator needle registers in the red portion of the indicator scale the battery should be recharged. It is recommended that at this time a specific gravity test be taken with a hydrometer to more accurately determine battery condition.



Plate 7162. Hour Meter

The hour meter accurately records the actual hours of machine operation. This will serve as an aid in determining the time intervals for lubrication and preventative maintenance services.

## O P E R A T I O N S

## TO OPERATE MACHINE

1. When the driver's seat is occupied the seat safety brake (deadman brake) will be released.

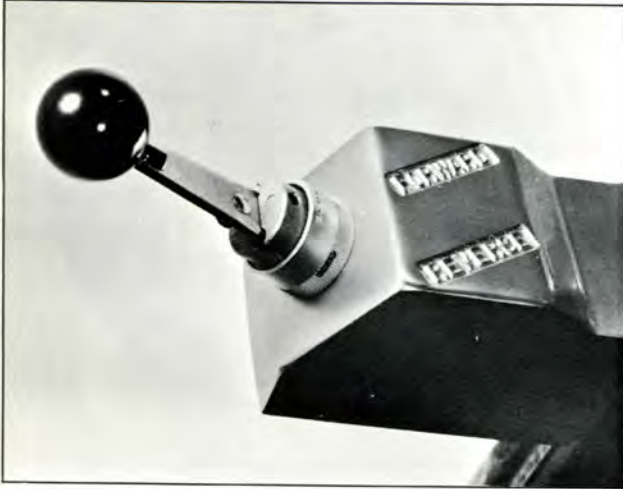


Plate 7216. Directional  
Control Lever

2. Place directional control lever in neutral position.
3. Turn switch key to the "on" position, allow accelerator pedal and brake pedal to assume it's free or undepressed position.
4. Move the directional lever in position for the desired direction of travel.

5. Depress accelerator pedal as required for the speed desired. (Maximum acceleration is regulated by a time delay feature incorporated in the electrical circuit).

## REVERSE TORQUE BRAKING

Release accelerator pedal and move directional control lever to opposite position or direction in which the truck is moving. At this time "Minimum Reverse Torque Braking" is applied. As the truck coasts and the accelerator pedal is depressed, up to a safe predetermined maximum, a controlled flow of power is directed to the drive motor which speeds up reversal of direction by allowing battery power to overcome truck momentum. This is called "Variable Reverse Torque Braking".

## TO STOP MACHINE

Remove foot from accelerator pedal and depress brake pedal sufficiently to allow a safe smooth stop. If the machine is to be parked, turn switch key to "off" and place directional lever in "neutral". When the driver's seat is unoccupied, the (deadman brake) Parking Brake is applied.



# INDUSTRIAL TRUCK DIVISION



## OPERATIONS

### To Move A Load.

The forks should be adjusted sidewise on the fork bars to obtain firm support and maximum balance of the load. Raise or lower the forks to the proper level and engage the load by driving forward. Tilt the upright backward sufficiently to adequately cradle the load, and raise load sufficiently to clear obstructions. Back away from stack.

The operator should have clear vision ahead when moving in a forward direction. When this is not possible, the operator should drive in reverse and turn in his seat to obtain clear vision backward.

When the load is to be deposited, enter the area squarely, especially when placing one load on top of another, in order that all piles will be square and secure. Place load directly over desired area and slowly lower into position. Disengage forks from the load by using necessary lift-tilt and then back away.

Loads will vary in size, shape, method of packaging, stacking procedures, etc. The best way to handle a load will depend on these factors. If in doubt, consult with your supervisor.

### I M P O R T A N T

EVERY 8 OPERATING HOURS (OR EVERY SHIFT) ELEVATE UPRIGHT TO THE UPPER LIMIT. THIS WILL PROVIDE LUBRICATION TO THE TOP PORTION OF THE LIFT CYLINDER. CHECK FOR NORMAL SEQUENCE OF OPERATION.

### OPERATING SAFETY RULES AND PRACTICES.

1. Operators of powered industrial trucks should be physically qualified. An examination should be made on an annual basis and include such things as field of vision, hearing, depth perception and reaction timing.

2. Only trained and authorized operators should be permitted to operate a powered industrial truck. Methods should be devised to train operators in the safe operation of powered industrial trucks. It is recommended that badges or other visual indication of the operator's authorization should be displayed at all times during work period.

### GENERAL.

1. Safeguard the pedestrians at all times. Do not drive a truck up to anyone standing in front of a bench or other fixed object.

2. Do not allow anyone to stand or pass under the elevated portion of any truck, whether loaded or empty.

3. Unauthorized personnel should not be permitted to ride on powered industrial trucks. A safe place to ride should be provided where riding of trucks is authorized.

4. Do not put arms or legs between the uprights of the mast or outside the running lines of the truck.

5. When leaving a powered industrial truck unattended, load engaging means should be fully lowered, controls should be neutralized, power shut off, brakes set, key or connector plug removed. Block wheels if truck is parked on an incline.

6. Maintain a safe distance from the edge of ramps or platforms and do not, while on any elevated dock or platform, push freight cars. Do not use trucks for opening or closing freight doors.

7. Have brakes set and wheel blocks in place to prevent movement of trucks, trailers, or railroad cars while loading or unloading. Fixed jacks may be necessary to support a semi-trailer during loading or unloading when the trailer is not coupled to a tractor. Check the flooring of trucks, trailers, and railroad cars for breaks and weakness before driving onto them.

8. Be sure of sufficient headroom under overhead installations, lights, pipes, sprinkler system, etc.

9. Use an Overhead Guard and Load Backrest Extension unless conditions prevent their use.

```

x x x x x x x x x x x x x x x x x x x x x x x
x
x           W A R N I N G           x
x
x AN OVERHEAD GUARD IS INTENDED TO OFFER x
x PROTECTION FROM THE IMPACT OF SMALL x
x PACKAGES, BOXES, BAGGED MATERIAL, ETC., x
x REPRESENTATIVE OF THE JOB APPLICATION, x
x BUT NOT TO WITHSTAND THE IMPACT OF A x
x FALLING CAPACITY LOAD. x
x
x x x x x x x x x x x x x x x x x x x x x x x

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10. Use only approved industrial trucks in hazardous locations.



# INDUSTRIAL TRUCK DIVISION



## OPERATIONS

11. Elevate personnel only on an approved safety platform firmly secured to the lifting carriage and/or forks.

12. Report all accidents involving personnel, building structures, and equipment.

13. Fire aisles, access to stairways, and fire equipment should be kept clear.

### TRAVELING.

1. Observe all traffic regulations including authorized plant speed limits. Under normal traffic conditions, keep to the right. Maintain a safe distance, approximately three truck lengths from the truck ahead, and keep the truck under control at all times. Use of truck on public roads should conform to local traffic regulations.

2. Yield the right of way to ambulances, fire trucks, or other vehicles in emergency situations.

3. Do not pass another truck traveling in the same direction at intersections, blind spots, or at other dangerous locations.

4. Slow down and sound horn at cross aisles and other locations where vision is obstructed. If the load being carried obstructs forward view travel with the load trailing.

5. Cross railroad tracks diagonally wherever possible. Do not park closer than 8 feet from center of railroad tracks.

6. Look in the direction of, and keep a clear view of the path of travel.

7. Ascend or descend grades slowly.

When ascending or descending grades in excess of 10%, loaded trucks should be driven with the load upgrade.

Unloaded trucks should be operated on all grades with the load engaging means downgrade.

On all grades the load and load engaging means should be tilted back if applicable, and raised only as far as necessary to clear the road surface.

8. Under all travel conditions the truck should be operated at a speed that will permit it to be brought to a stop in a safe manner.

9. Travel with load engaging means or load low and, where possible, tilted back. Do not elevate the load except during stacking.

10. Make starts, stops, turns or direction reversals in a smooth manner so as not to shift load and/or overturn the truck.

11. Stunt driving and horseplay should not be permitted.

12. Slow down for wet and slippery floors.

13. Before driving over a dockboard or bridgeplate, be sure that it is properly secured. Drive carefully and slowly across the dockboard or bridgeplate and never exceed its rated capacity.

14. Do not run vehicles onto any elevator unless specifically authorized to do so. Approach elevators slowly, and then enter squarely after the elevator car is properly leveled. Once on the elevator, neutralize the controls, shut off power, and set brakes. It is advisable that all personnel leave the elevator before a truck is allowed to enter or leave.

15. Avoid running over loose objects on the roadway surface.

### LOADING.

1. Handle only stable or safely arranged loads. When handling off-center loads which cannot be centered, operate with caution.

2. Handle only loads within the rated capacity of the truck.

3. Adjust for long or high (including multiple tiered) loads which may affect capacity.

4. When attachments are used, particular care should be taken in securing, manipulating, positioning, and transporting the load. Operate trucks equipped with attachments as partially loaded trucks when not handling a load.

5. Place load engaging means under the load as far as possible and carefully tilt the mast backward to stabilize the load. Caution should be used in tilting backward with high or segmented loads.

6. Use extreme care when tilting load forward or backward particularly when high tiering. Do not tilt forward with load engaging means elevated except to pick up a load. Do not tilt an elevated load forward except when the load is in a deposit position over a rack or stack. When stacking or tiering use only enough backward tilt to stabilize the load.

### OPERATOR CARE OF THE TRUCK.

1. Give special consideration to the proper functioning of tires, horn, lights, battery, controller, lift system (including load engaging means, chains, cable, and limit switches), brakes and steering mechanism. If at any time



# INDUSTRIAL TRUCK DIVISION



OPERATIONS

OPERATOR CARE OF THE TRUCK (CONT.)

a powered industrial truck is found to be in need of repair, defective, or in any way unsafe, the matter should be reported immediately to the designated authority, and the truck should be taken out of service until it has been restored to safe operating condition.

2. Do not make repairs or adjustments unless specifically authorized to do so.
3. Do not use open flames for checking electrolyte level in storage batteries.



# INDUSTRIAL TRUCK DIVISION



## OPERATIONS

### PREVENTIVE MAINTENANCE:

1. Arrange for systematic inspection and lubrication. See that the truck is properly lubricated and in good repair at all times. Refer to pertinent lubrication chart for lubrication instructions.
2. Avoid overloading the truck, as a safety measure against possible injury to the driver and fellow workmen. Overloading also shortens the life of the truck and increases maintenance. Refer to Name (Serial No.) Plate.
3. Take proper care of the battery. Check height of electrolyte solution daily. Never allow the water level to be below the top of the plates. When replacing evaporation, fill cells to proper level only -- overfilling causes loss of acid and reduces capacity. Use only water approved for battery use. Keep top of battery clean and dry at all times. A light coating of vaseline or a light cup grease on the battery terminals will help prevent corrosion. If terminals become corroded, wash off corrosion with a soda and water solution and rinse thoroughly. See that the battery is properly charged after each day or shift.
4. Wiring should be checked periodically to make certain all connections are tight and intact.
5. The hydraulic system should be checked periodically for worn hoses, loose fillings and/or leaks, and security of mountings.
6. A periodic check of the brake system should be made for lining wear. Proper brake adjustment should be maintained at all times.
7. Charging equipment should be carefully maintained. Maintenance, operation, and service of charging equipment should be carried out in accordance with the battery manufacturers instructions.





# INDUSTRIAL TRUCK DIVISION



## OPERATIONS

### CHANGING AND CHARGING STORAGE BATTERIES:

#### N O T E

The two types of batteries in common use are (1) lead and (2) nickel-iron. They contain corrosive chemical solutions, either acid or alkali, and therefore present a chemical hazard. On charge, they give off hydrogen and oxygen which, when mixed with air in certain concentrations, may be explosive. They are of relatively small bulk and great weight making handling a special consideration.

1. Battery charging installations should be located in areas designated for that purpose. Facilities should be provided for flushing and neutralizing spilled electrolyte, for fire protection, for protecting charging apparatus from damage by trucks, and for adequate ventilation for dispersal of fumes from gassing batteries.

2. When racks are used for support of batteries, they should be made of materials not conducive to spark generation or be coated or covered to achieve this objective.

#### Handling Batteries:

1. A conveyor, overhead hoist, or equivalent material handling equipment should be provided for handling batteries.

2. Chain hoists should be equipped with load-chain containers. When hand hoist is used, uncovered batteries should be covered with a sheet of plywood or other non-conducting material to prevent the hand chain from shorting on cell connectors or terminals. A properly insulated spreader bar should be used with any overhead hoist.

3. Reinstalled batteries should be properly positioned and secured in the truck.

4. A carboy tilter or siphon should be provided for handling electrolyte. Always pour acid into water; not water into acid. Personnel maintaining batteries should wear protective clothing such as face shield, long sleeves and gauntlet gloves.

5. Electrical installations should conform to the National Electrical Code (NEPA No. 70; USA Standard C1-1965) and any local ordinances.

6. Trained and authorized personnel should change or charge batteries.

7. Trucks should be properly positioned and brake applied before attempting to change or charge batteries.

8. When charging batteries, the vent caps

should be kept in place to avoid electrolyte spray. Care should be taken to assure that vent caps are functioning. The battery (or compartment) cover (s) should be open to dissipate heat.

9. Smoking should be prohibited in the charging area.

10. Precautions should be taken to prevent open flames, sparks, or electric arcs in battery charging areas.

11. Tools and other metallic objects should be kept away from the top of uncovered batteries.

SERVICE RECORDER:

The service recorder records number of productive lifts in addition to busy and idle time of each truck. The records are made on a 6-inch diameter chart, revolving once. This model records the raising or lowering of a predetermined load. The limits generally are between 5% of the truck's capacity and a full load. Minimums may be established, and the chart will show only those lifts of the minimum weight or greater. Selective load records are made by using an adjustable pressure switch. This switch fits into the hydraulic system between the lift control and the cylinder. It is sensitive to system pressure changes but insensitive to surges or vibration. Switch setting can be adjusted externally and then sealed. The load recording stylus is always in contact with the chart. When the predetermined load or more is lifted, an electrical circuit is closed and this stylus is lifted up, making a record. A surge dampener is recommended particularly when lift trucks are in service where rough or uneven floors occur.

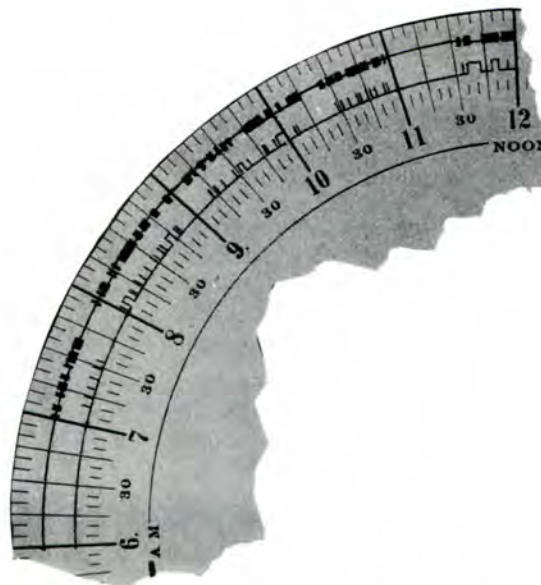


Plate 10161. Service Recorder Chart

HOW TO OPERATE SERVICE RECORDERS

**Wind the Clock Movement:** No key is needed. Turn the star-shaped winding disc clockwise until the movement is wound fairly tight. Do not overwind. It is a good practice to wind the clock each time a chart is changed even if it is not run down.



Plate 10164

**Place Chart in the Recorder:** Snap up the two finger-like clamps. Slip the chart down over the now vertical clamps to the face of the winding disc.



Plate 10165

**To Set the Chart:** Before clamping it down, turn the chart so that the place on it that corresponds to the present time of the day is at the little white spot on rim of Recorder case. If this is not done correctly, the recorder will be "that much off" all day.



Plate 10166

**Fasten the Chart in Place** By snapping down the two clamping fingers. Now close and lock the Recorder and it is ready to operate for its full cycle, the length of time depending on the model and clock speed.



Plate 10167

HOW TO READ THE CHART:

This section of chart shows a typical record. The wide marks in the outer record band show when the truck was in motion. The fine line shows down time.

Inner record band shows lifts. Load recording stylus normally rests at lower or inner position. When activated by pressure switch, it is moved outward to record each lift.



Plate 10162. Service Recorder Chart

When the key is turned to lock or unlock the Recorder, the stylus makes a round dot at the exact time of locking or unlocking. The mark appears on the face of the chart, and it is also embossed on the back. It is unmistakable.

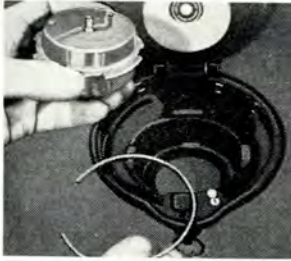


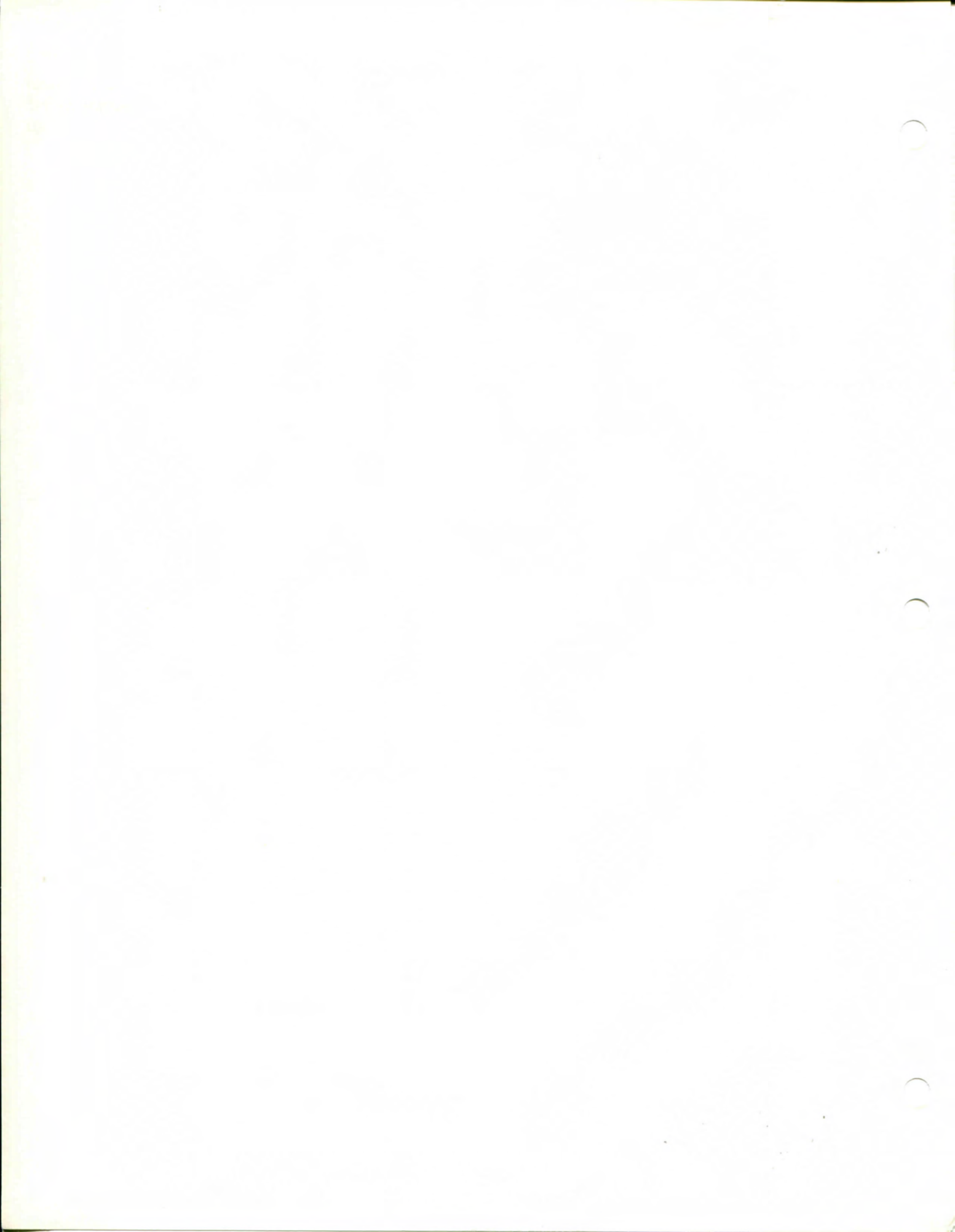
Plate 10163. Clock Exchange

HOW TO EXCHANGE CLOCK MOVEMENTS:

A clock movement is inherently a delicate mechanism that should receive reasonably good care. We have tried to make the clocks in Servis Recorders as rugged as possible to withstand the rough use they sometimes get. If the clock should fail, it can be easily lifted out and mailed in for repair or replacement. Merely unscrew the winding disc by turning it counter-clockwise and pry out wire retaining ring.

To replace the clock movement, first notice that one of the four retaining lugs in the Recorder case is wider than the rest. Match this wide space in movement top and settle movement into place. Then force wire retaining ring into place securely under lugs.

It is a good policy to have a spare clock movement in stock to insure uninterrupted service. Extra clocks are inexpensive.





# INDUSTRIAL TRUCK DIVISION



## LUBRICATION AND PREVENTIVE MAINTENANCE INDEX

( 8 HOURS )	Time Interval (H=Hours)	Page Number (0000-)	( 100 HOURS Cont'd )	Time Interval (H=Hours)	Page Number (0000-)
Battery, service.....	8H	473	Speed Control Cylinder, Level Check.....	100H	173
Battery Charge Indicator.....	8H	273	Speed Control Pedal Height and Stop, Adjust.....	100H	475
Brake Interlock Switch.....	8H	374	Steering Gear, Level Check...	100H	603
Brake Pedal Free Travel.....	8H	373	( 500 HOURS )		
Cables, Terminals, Receptacle.	8H	477	Hydraulic Oil Strainer, Clean	500H	173
Control Circuit Fuse.....	8H	073	Hydraulic Sump Tank, Drain and Refill .....	500H	173
Horn.....	8H	073	Nuts Bolts and Capscrews, Tighten .....	500H	072
Hour Meter.....	8H	073	Steering Axle and Linkage, Adjust .....	500H	302
Hydraulic Cylinders.....	8H	503	Steering Gear, Adjust .....	500H	202
Hydraulic Sump Tank Level Check .....	8H	503	( 1000 HOURS )		
Lights .....	8H	073	Axle Adapter, Drain and Refill .....	1000H	1303
Tire Maintenance .....	8H	603	Axle Ends, Clean Repack ....	1000H	805
Seat Safety Brake .....	8H	373	Brake Adjusters .....	1000H	1002
Seat Safety Brake Switch.....	8H	374	Brake Bleeding Procedures...	1000H	913
( 100 HOURS )			Carbon Pile Accumulator and Actuator, Adjust....	1000H	173
Axle Adapter Lubricant Level Check .....	100H	073	Carbon Pile Control Bleeding Procedure .....	1000H	073
Axle Adapter Vent, Clean....	100H	073	Drive Motor .....	1000H	671
Brake Interlock Switch, Adjust .....	100H	273	Hydraulic Pressure Check....	1000H	1506
Brake Master Cylinder, Level Check .....	100H	303	Pump Motor .....	1000H	771
Brake Pedal, Adjust .....	100H	302	Seat Safety Brake Linkage Adjust .....	1000H	1173
Contacto Panel, Switchettes, Adjust ....	100H	674	Steering Wheel Bearings.....	1000H	803
Hydraulic Sump Breather.....	100H	503	Upright and Lift Carriage Roller Adjustments.....	1000H	1803
Lift Brackets, Inspect .....	100H	403			
Lift Chains, Adjust .....	100H	403			
Lubrication Chart .....	100H	773			
Pump Control Switches, Adjust .....	100H	473			
Seat Safety Switch, Adjust..	100H	274			



# INDUSTRIAL TRUCK DIVISION



## LUBRICATION AND PREVENTIVE MAINTENANCE INDEX

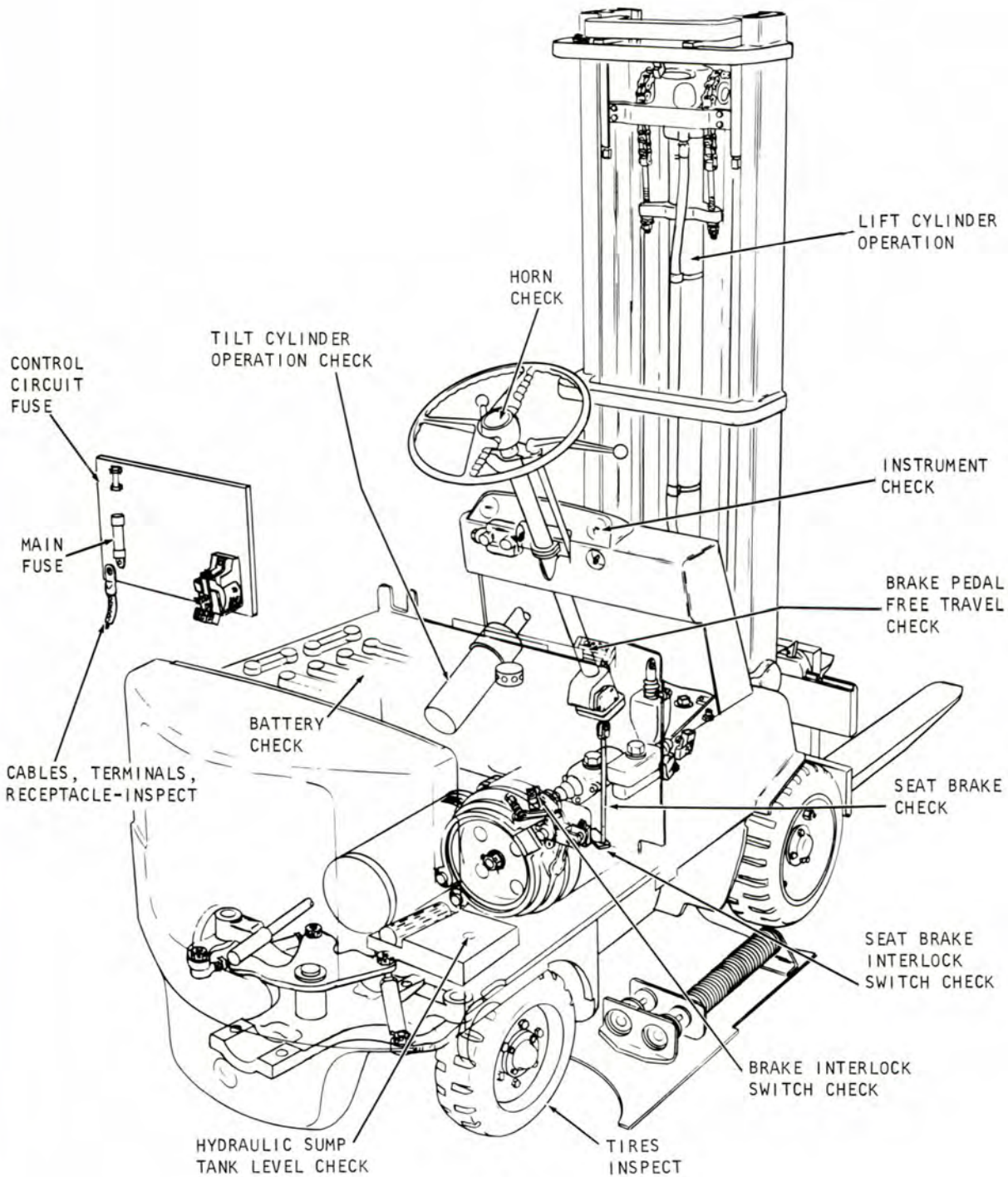
### LUBRICATION AND PREVENTIVE MAINTENANCE ILLUSTRATIONS

<u>Description</u>	<u>Time Interval (H=Hours)</u>	<u>&amp;</u>	<u>Page Number (0000-)</u>
Plate 7492	Lubrication and Preventive Maintenance Illustration.....	8H	072
Plate 7401	Lubrication and Preventive Maintenance Illustration.....	100H	072
Plate 7493	Lubrication and Preventive Maintenance Illustration.....	500H	072
Plate 7403	Lubrication and Preventive Maintenance Illustration.....	1000H	072

#### N O T E

WHEN PERFORMING THE 100, 500 OR 1000 HOUR LUBRICATION AND PREVENTIVE MAINTENANCE, ALWAYS INCLUDE THE PREVIOUS LUBRICATION AND PREVENTIVE MAINTENANCE SCHEDULES.

8 HOURS



NOTE

AFTER EACH 8 HOURS OF OPERATION, PERFORM THE ABOVE SERVICES.

Plate 7492. Lubrication and Preventive Maintenance Illustration

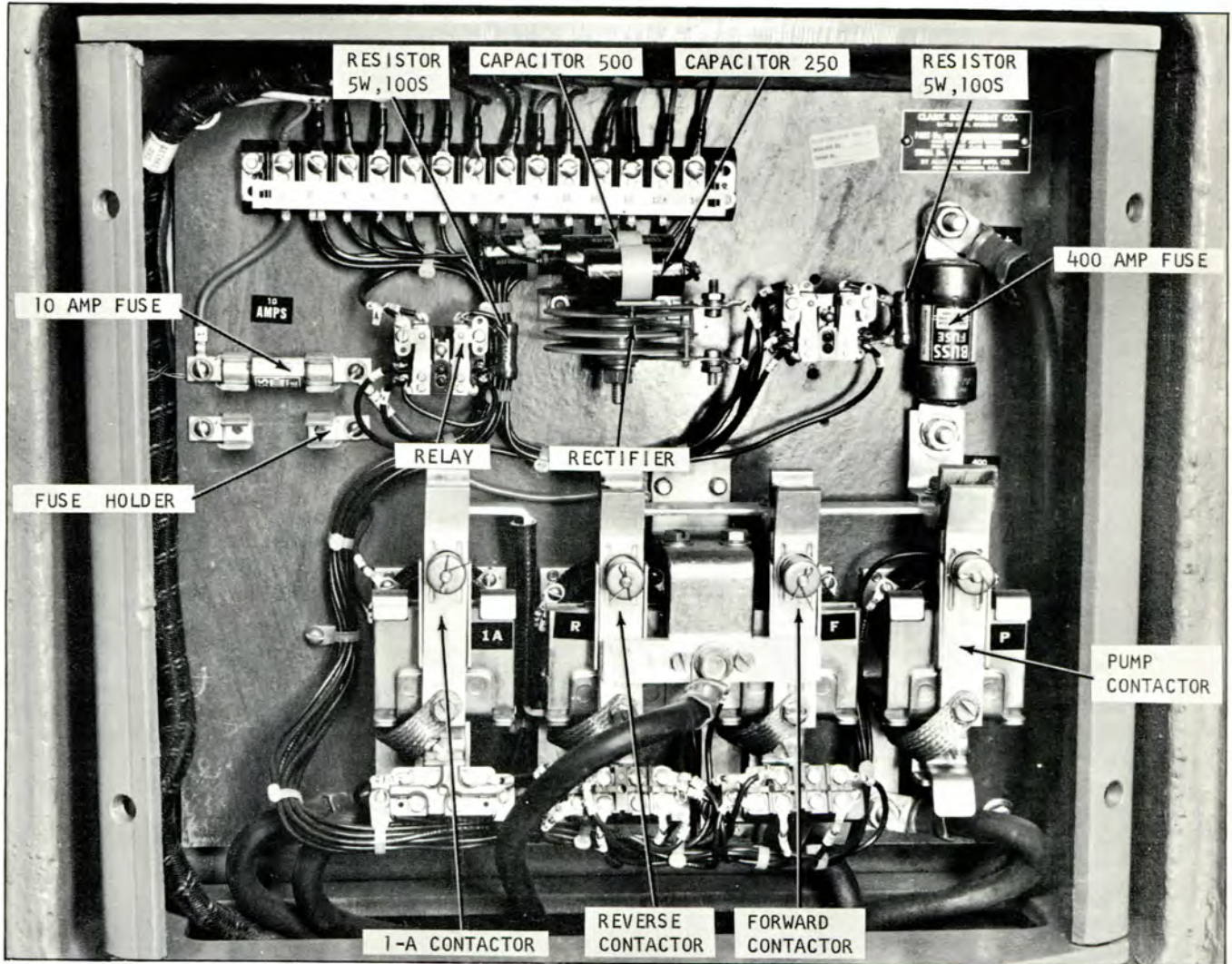


Plate 7213. Contactor Panel

**HORN**

Check to be sure the horn is working properly.

**LIGHTS (Machines so equipped)**

Check all lights to see if they are functioning properly.

**SYSTEM FUSES**

Control Circuit Fuse..... 10 amp.  
Main Fuse ..... 400 amp.



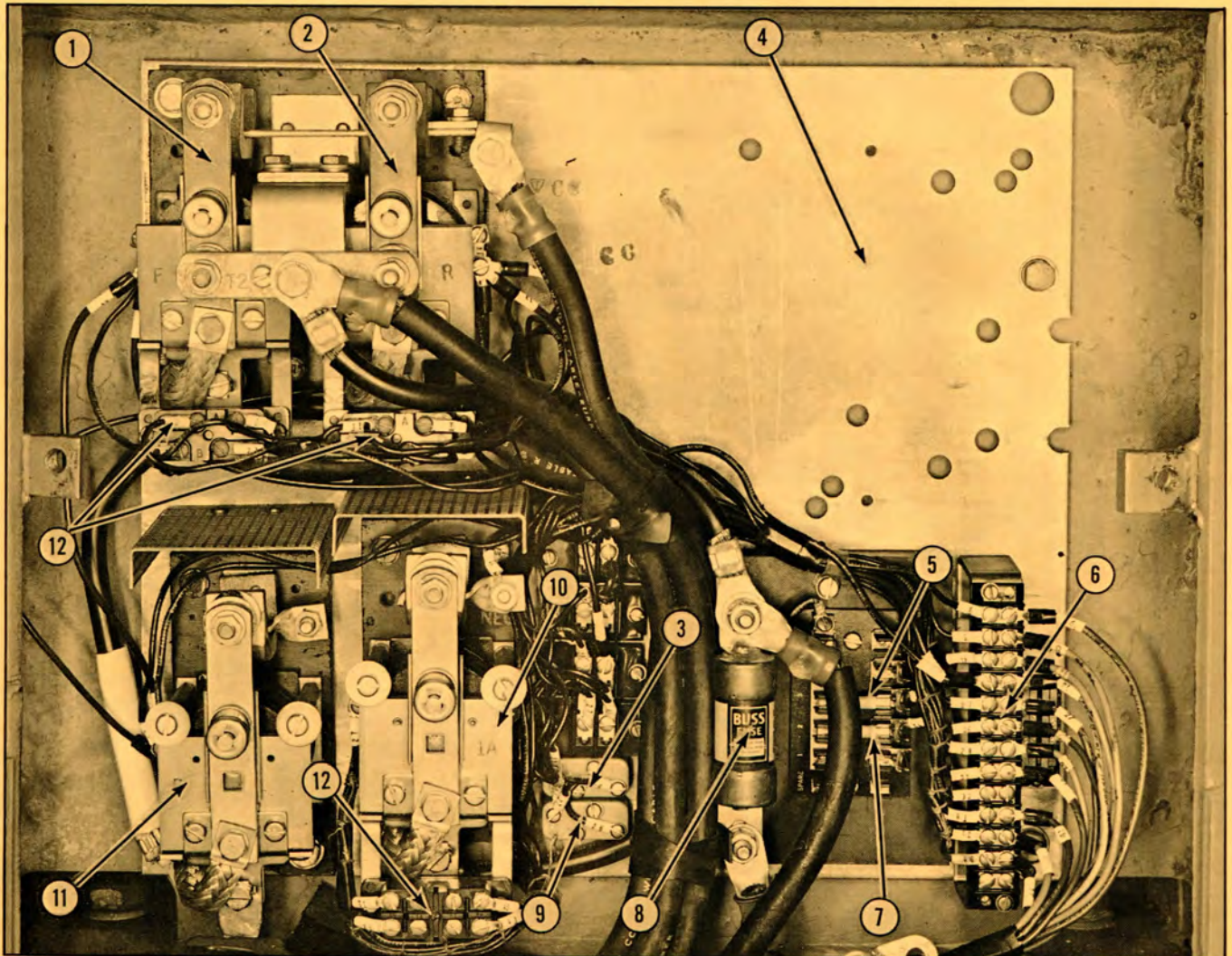


Plate 9701. Typical Contactor Panel

KEY

- |                         |                      |
|-------------------------|----------------------|
| 1.....Forward Contactor | 7.....10A Fuse       |
| 2.....Reverse Contactor | 8.....400A Fuse      |
| 3.....15 REC            | 9.....16 REC         |
| 4.....Field Weakening   | 10....1A Contactor   |
| 5.....15A Fuse          | 11....Pump Contactor |
| 6.....Terminal Block    | 12....Interlock      |

ECLS 20/40





Plate 7388. Battery Charge Indicator

With the key switch in the "on" position the battery charge indicator will show the available battery voltage. When the indicator needle registers in the red portion of the indicator scale the battery should be recharged. It is recommended that at this time a specific gravity test be taken with a hydrometer to more accurately determine battery condition.



Plate 7162. Hour Meter

The hour meter accurately records the actual hours of machine operation. This will serve as an aid in determining the time intervals for lubrication and preventative maintenance services.

FREE TRAVEL

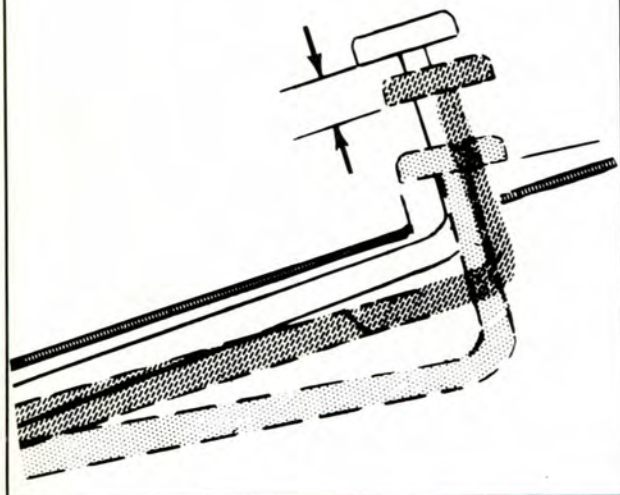


Plate 7048. Brake Pedal Free Travel

**BRAKE PEDAL**

1. Brake pedal should have 1/2 inch free travel. Depress pedal by hand. When pedal meets resistance from the master cylinder, the distance traveled should be as specified.

2. Depress brake pedal and hold foot pressure for at least ten seconds. Pedal must be solid, not be spongy or drift under foot pressure.

**SEAT SAFETY BRAKE**

The Safety Brake (Dead man Brake) is mounted to the end of the drive motor and is operated by means of linkage attached to the driver's seat.

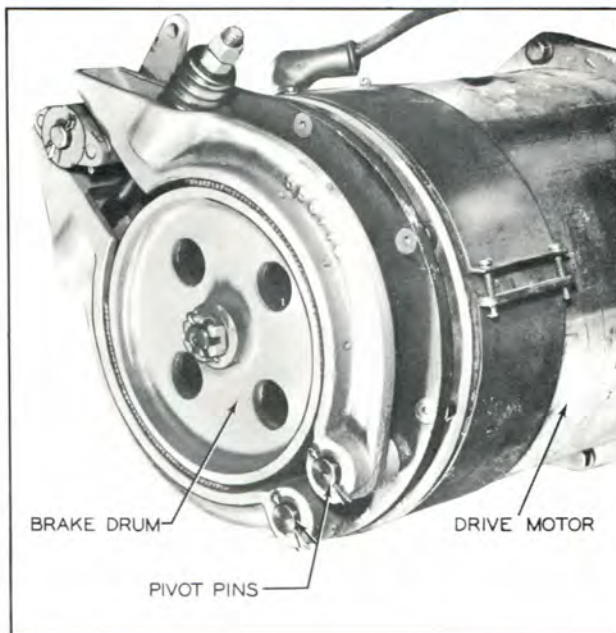


Plate 5031. Seat Safety Brake

**SEAT BRAKE EFFECTIVENESS**

The brake must be capable of holding the truck, with full rated load on a 15% grade. To test: Remove seat linkage pin (Plate 7410). The driver's seat should be occupied and truck power off.



Plate 7410. Seat Linkage Disconnect Pin

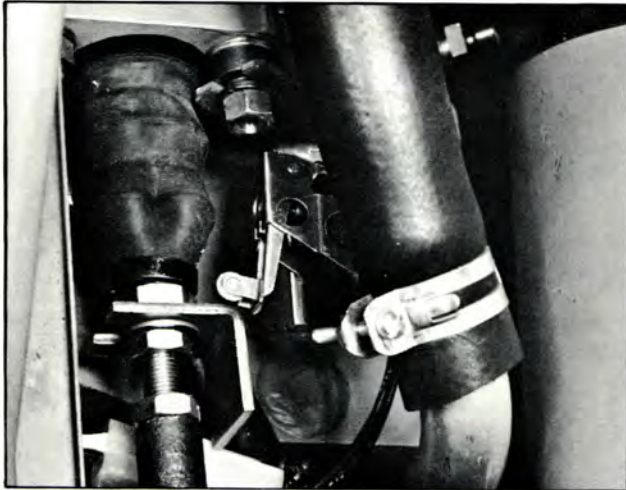


Plate 7615. Typical Brake  
Interlock Switch

#### BRAKE INTERLOCK SWITCH

This normally closed switch is so mounted that when the brake pedal is in the up position the switch is closed. This switch should actuate (open) during the free travel portion of the brake pedal stroke, thus cutting all power to the drive motor.

#### C A U T I O N

THE SWITCH ARM MUST NOT OVER-TRAVEL DURING APPLICATION OF THE BRAKES. ANY OVER-TRAVEL WILL CAUSE PREMATURE FAILURE OF THE SWITCH.

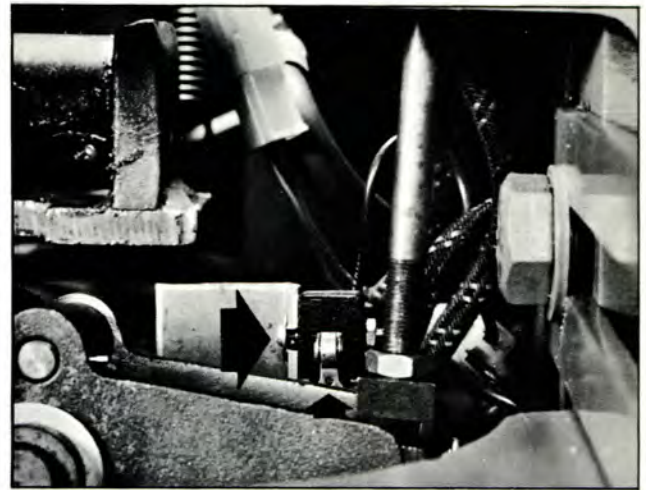


Plate 7207. Seat Safety Switch

#### SEAT SAFETY SWITCH

This normally open switch should actuate when the seat frame bumpers are approximately 2 to 3 inches from the battery compartment hood during the seat downward travel. In this manner the switch will close as soon as the safety brake is released thus providing a complete circuit.



# INDUSTRIAL TRUCK DIVISION



LUBRICATION AND PREVENTIVE MAINTENANCE

## BATTERIES - LEAD-ACID

The lead-acid battery has a lead peroxide positive plate, a sponge lead negative plate, and the electrolyte is a solution of sulphuric acid.

The battery does not store electricity. When the battery is connected to an electrical circuit, a chemical reaction starts inside the battery. This chemical action produces lead sulphate on both the positive and negative plates, and the chemical actions produces the electric current through the electrical circuit. This action continues only as long as the circuit is complete from negative pole to the positive pole. As the battery plates become coated with lead sulphate the voltage output of the battery decreases. When both the positive and negative plates have become thoroughly coated with lead sulphate, both plates act alike (or like similar metals). This causes the current to stop flowing.

When the point is reached where the battery is discharged, the battery must be charged. Charging is accomplished by connecting the battery to a direct current source in such a manner that the electricity flows through the battery in the opposite direction of the normal battery current.

## BATTERY LIFE

Economical and efficient operation of the electric fork lift truck depends, to a great extent, upon the efficiency and life of the battery.

During the operation of the fork lift truck, many things occur which, if not corrected or prevented, can greatly reduce the life of the battery.

The operator should be acquainted with the limits, capacities and capabilities of his truck. He should know the correct point of power to use to move all loads up to the rated capacity of the truck.

Batteries are rated in ampere hours over a set period of time, and should be of a proper size for the particular work intended. Extending the work means over-discharging the battery. This will greatly shorten its life. Overcharging the battery by using too high a rate of charge, will cause it to gas vigorously after it has reached its fully charged state and will also shorten its life.

If service requirements demand only partial discharge of the battery, it is unnecessary to recharge following each partial discharge. When the hydrometer reading indicates the battery is 75% discharged, (approximately 1120 specific gravity) arrangements should be made to recharge.

Controlling the "charge" and "discharge" of the battery is a very important contributing factor in determining battery life.

The discharge of a battery can be controlled in several ways.

Batteries are rated according to the job for which they are being used. A fully charged battery is capable of doing a certain amount of work or lasting a certain length of time in a specific service. With information of this type, a schedule or duty cycle can be worked out and the batteries can be changed or serviced with very few failures.

Experienced operators can tell from the action of the truck, when the battery is reaching the point where it should be charged or changed. Prompt action in seeing that the battery is serviced at this time can result in longer battery life.

Several "meters" or "indicators" are available for use on battery powered trucks. These indicators show the operator the state of charge of the battery, how much useful power is left in the battery, or just simply warns the operator when the battery should be charged.

## MAINTENANCE

Keep the "tops" of the battery clean and dry at all times. Normally wiping the top of the battery with a damp cloth is sufficient. If the battery is removed from the truck, it can be hosed off with clean water. If electrolyte is spilled, it will not dry off. Neutralize the acid with a solution of ordinary "bicarbonate of soda" and rinse thoroughly with clean water.

A light coating of vasoline or a light cup grease on the terminals will help prevent corrosion. If the terminals have become corroded, wash off the corrosion with a soda solution and rinse thoroughly.

The vent plugs should be in place at all times when using, cleaning, and charging the battery. They should be cleaned weekly by immersing in a bucket of clean water for one half hour. Check the vent holes in the vent plugs and clean out.

The vent holes must be open to allow gas to escape from the cell.

The batteries should be numbered and assigned to a given truck. A record should be kept of (1) daily hydrometer reading on a pilot cell at the beginning of each charging, (2) a weekly reading of the pilot cell after charge, and (3) a hydrometer reading of all cells and temperature of one cell each "4" months before and after charging. When battery shows nonuniformity of these readings and an inability to work through a shift, it is an indication that replacement is necessary.

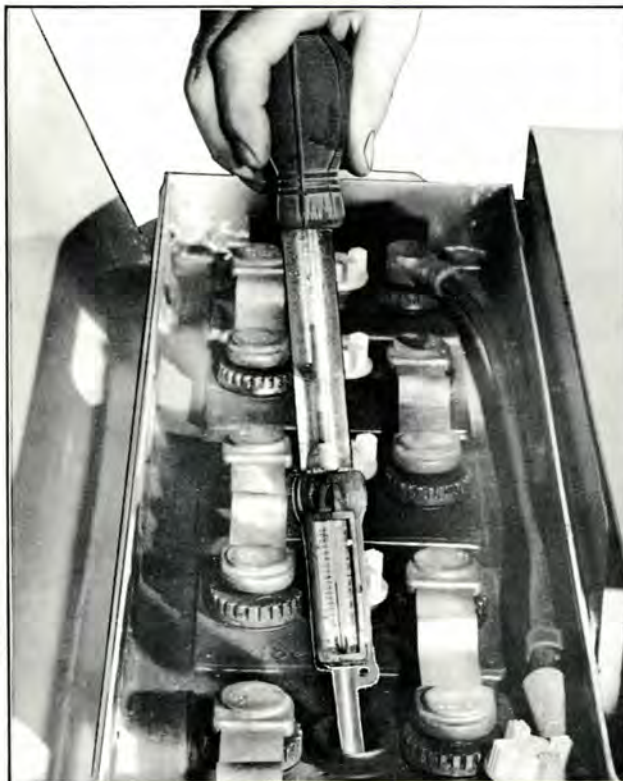


Plate 4018. Hydrometer Check Method

**TWO-RATE CHARGING**

"Two-Rate" charge, as the name implies, consists of two average rates. A "high" rate is provided at the beginning of the charge, while, toward the end of the charge, this is automatically changed to a "low" rate. (In actual operation, both high and low-rate is obtained in modern charging equipment by the use of a voltage relay in a rate charging circuit). When the battery cell voltage rises to approximately 2.37 volts per cell, at

77° F., the voltage relay automatically lowers the charging rate. The same voltage relay operating with a time switch can also be used to stop the charge automatically.

"Two-Rate" charging is generally used with rectifiers, although it is also used with a generator when the voltage is too high for the taper charge. For dependable, day-in and day-out repeat performance, the quality of the voltage relay and time switch is important.

**TAPER-CHARGING**

The "Taper" charge (Modified constant potential) is obtained inherently (a natural characteristic) in a circuit design by balancing the charging voltage source against the battery voltage rise during charge. As the battery voltage rises, it approaches the value of the charging source and hence, there is less difference between the charging source and battery voltage. As a consequence, the flow of charging current will taper off in value opposite to the way the battery voltage rises.

"Taper" charge requires a close tolerance (plus or minus 3%) of charging source voltage (2.63 times the number of cells) when more than one charge circuit is on the same machine. A single circuit taper charge does not need this close voltage limit as the inherent taper is obtained as a natural part of the shunt generator load characteristic.

However, taper charge circuits are specifically designed for a definite number of cells, in the battery, to achieve the inherent taper. The only duty performed by a voltage relay time switch control, on the taper circuit, is to stop the charge.

**NICKEL-IRON-ALKALINE STORAGE BATTERIES**

The alkaline storage battery is known as the "nickel-iron-alkaline type" because nickel oxide is used in the positive elements, and iron in the negative elements; while the electrolyte is an alkaline solution containing potash and lithia.

**TYPE AND SERIES**

Each cell bears a distinguishing type letter and size number plainly stamped upon the cover. A serial number, just under the type letter and size number combination, denotes date of manufacture. All cells having the same type letter are similar in operating characteristics and



# INDUSTRIAL TRUCK DIVISION



## LUBRICATION AND PREVENTIVE MAINTENANCE

are made from the same class of plates and size. Therefore, the capacity of the cell simply varies with the number of plates. The "size number" indicates the number of positive plates. The total number of positive and negative plates is one more than twice the size number.

### INSPECTION ON RECEIPT

Alkaline batteries are shipped in either a "charged" or "discharge" condition. The cells shipped charged, are intended for service within a short time without further charging. If the cells are not put into service within a month, it will be found advisable to charge one or two hours before using.

A red label, included with the battery in each shipment, indicates that the cells are charged ready for immediate use on receipt.

A green label, indicates that the cells are in a discharged condition and must be given an extra charging time as specified by the manufacturer.

Upon receipt of the battery, inspect each cell for solution height. Use a glass tube for this purpose. DO NOT use a match or other open flame for inspection.

If electrolyte has been spilled, if plate tops are visible above the surface of the solution, or if the inside of packing case, etc., shows yellowish stains. The loss must be replaced; preferably with Refill Alkaline Storage Battery Solution, or lacking this, with RENEWAL Solution diluted to a specific gravity of 1.215 by the addition of distilled water. The proper height of solution above plate tops is as follows: Cell type is stamped on the cover of each cell.

- "A" Type Cells - 1/2"
- "C" Type Cells - 1"
- "D" Type Cells - 1 1/4"

When the level of solution is only a small amount below the proper height, fill with pure distilled water and in the future, use pure distilled water for replenishing the solution.

### CONNECTIONS

The positive pole of an "alkaline cell" is designated by a red bushing around the pole and a plus (+) mark stamped on the cell cover.

The negative pole, is designated by a black bushing around the pole; no designating mark on the cover.

The connections between cells, in a tray, are made of solid wire with lugs on both ends. These are known as "connectors". The flexible, rubber-covered cables used to join trays together are known as "jumpers".

To avoid unnecessary electrical losses, all electrical connections must be tight. (To obtain this, it is necessary to see that all the contact surfaces between the poles and lugs are clean and make good contact.) Remove any Esbaline, grease, or dirt that may stick to the tapered surfaces of the poles or the inside of the lugs before connecting. If necessary, use 00 sandpaper or 00 emery cloth for this purpose. NEVER use a file or anything that will harm the contact surfaces.

A loose or dirty contact on a cell pole will cause excessive heating, and may be detected by touching the connectors after the current has been passing through them for some time.

### DISCONNECTING LUG

A "disconnecting jack" or "lug puller" is supplied with each battery. This jack is designed to straddle the connector or jumper lug and, by means of a jack screw, break the lug loose from the cell pole.

### CHARGING

Direct current must be used to charge any storage battery. If only alternating current is available, it is necessary to convert to direct current by the use of a motor generator set, mercury arc rectifier, or other suitable form of current rectifier.

An alkaline battery may be charged at either a constant current rate throughout the entire charging period, or at a modified constant potential rate. In either case the average rate should be such that the battery can be brought from a discharged state to full charge within between six and seven hours. In connecting a battery to the charging circuit, always connect the positive terminal to the positive side of the line, and the negative terminal to the negative side of the line.

It is not necessary to take specific gravity reading during charge, as the electrolyte does not change appreciably.



Before starting to charge, see that the solution is at the proper level. If the solution is low, bring it to the proper level by adding pure distilled water as instructed under watering. If the battery is in a compartment, open the cover before starting a charge. DO NOT charge in a hot place or allow the temperature of the solution to exceed 115° Fahrenheit on charge.

**CHARGE TEST FORK**

The charge test fork was developed to provide an easy means of determining the state of charge of an alkaline battery.



Plate 4008. Charge Test Fork Check

This is done by obtaining a key voltage reading which, on reference to the charts supplied for use with instrument, will indicate the amount of charge necessary to restore the battery to a fully charged condition.

**ELECTROLYTE**

The specific gravity of the electrolyte in fully charged alkaline cells has a normal operating range of between 1.215 and 1.160, with electrolyte at the proper level and corrected for temperature.

The specific gravity reading of the electrolyte (of an alkaline cell) has no value in determining its state of charge, as the specific gravity does not change during the charging or discharging periods

to any marked extent. It, therefore, is only necessary to take infrequent readings, to determine if the specific gravity has dropped to the point where a change of electrolyte is desirable.

There are two kinds of alkaline potash electrolyte which are normally used when a "change" of solution is found necessary. Renewal solution, which has a specific gravity of approximately 1.250; is normally used to replace old electrolyte, the gravity of which has dropped to the low limit ranging between 1.160 and 1.170. Refill solution has a specific gravity of approximately 1.215 and is used to replace spillage. DO NOT use any potash solution other than alkaline electrolyte, as the presence of impurities or improper compounding of such solution may permanently injure your battery.

**WATERING CELLS**

Before putting a new electric filler into service; see that the tank is washed thoroughly to remove any foreign matter and then rinse tank, hose and filler thoroughly by running distilled water through them. Then fill the tank with distilled water and mount in a convenient place at least four or five feet above the cells to be watered.

To operate, insert the nozzle into the filler opening in the top of the cell. If the solution is already at the proper height, the bell signal will ring. If bell does not ring, start flow of water by opening valve by pushing down lever on filler handle. When the bell rings, remove the nozzle from the cell, close cell filler cap and proceed to next cell.

**LAYING UP BATTERY**

If battery is to be laid up for any length of time (in excess of one year) be sure that the plates are covered to the proper height with solution and that the battery is discharged and short circuited. The battery should be stored in a cool dry place.

Alkaline batteries are easy to lay up. Merely discharge to zero voltage and short circuit. They may be left standing idle indefinitely, without injury, if stored in this short circuited condition. The battery may be stored for 6 months to a year without discharging and short circuiting.



# INDUSTRIAL TRUCK DIVISION



## LUBRICATION AND PREVENTIVE MAINTENANCE

### CAUTIONS

NEVER put lead battery acid into an alkaline battery or use utensils that have been used with acid; you may ruin the battery.

NEVER bring a "lighted match" or other "open flame" near a battery.

NEVER lay a "tool" or any piece of "metal" on a battery. Always keep the filler caps closed except when necessary to have them open for filling as provided for in these instructions.

ALWAYS keep batteries clean and dry externally.

ALKALINE ELECTROLYTE is injurious to the skin or clothing and must be handled carefully. Solution spilled on the person should be immediately washed away with plenty of water.

DO NOT use the electric filler, or fill cells while a battery is on charge.

USE ONLY pure distilled water for watering the battery.

WEAR GOGGLES when cleaning or changing solution.

### CABLES, TERMINALS AND BATTERY RECEPTACLE.

Check cables, terminals and receptacle for condition and security of mounting. Correct as necessary.

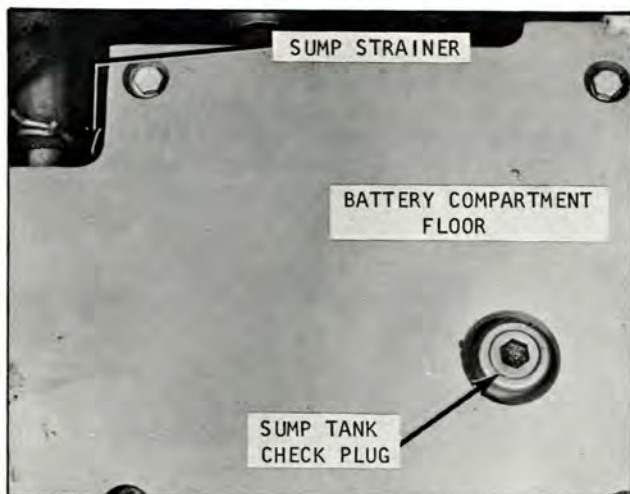


Plate 7489. Hydraulic Sump Tank Check Plug

**HYDRAULIC SUMP TANK**

Check hydraulic sump tank fluid level in the following manner:

1. Lower upright.
2. Turn switch key to off position.
3. Remove Battery to expose sump tank check plug located on floor of battery compartment. See Plate 7489.
4. Clean any existing foreign material from around check plug and remove plug. Fluid level should be maintained to within 1 1/2 inch of the top of sump tank.

If necessary, fill sump tank using MS 68 Hydraulic fluid. Move valve control levers with hydraulic pump operating to allow any air in the lines to escape, then recheck sump tank fluid level and fill as required before putting machine in operation.

**HYDRAULIC CONTROL LEVERS**

**I M P O R T A N T**

EVERY 8 OPERATING HOURS (OR EVERY SHIFT)

ELEVATE UPRIGHT TO THE UPPER LIMIT. THIS WILL PROVIDE LUBRICATION TO THE TOP PORTION OF THE LIFT CYLINDER.

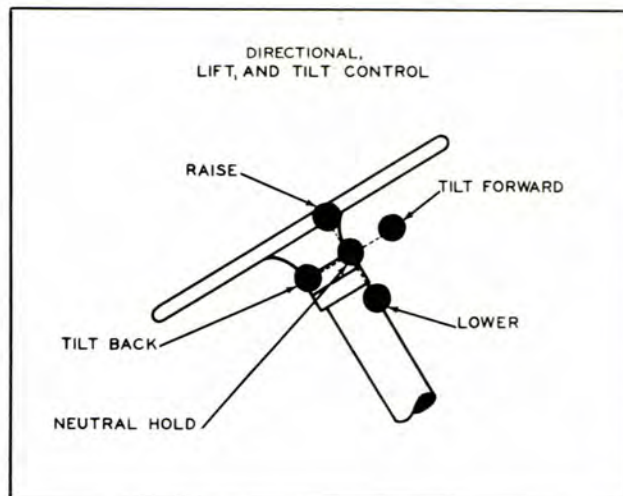


Plate 4448. Lift and Tilt Lever

Check lift and tilt operation. The lift and tilt cylinders should actuate when lift or tilt levers are moved either way from neutral position.

When load is elevated and control lever returned to neutral position, load should remain in elevated position with no noticeable downward drift. If load drifts downward excessively, this may indicate lift cylinder U-Cup or seal damage -- report to designated person in authority.

With tilt lever in neutral position, upright should remain steady with no noticeable backward or forward drift. If upright drifts excessively either way, this may indicate tilt cylinder seal or U-Cup damage -- report to designated person in authority.

**C A U T I O N**

NEVER ALLOW LOADED OR UNLOADED LIFT CARRIAGE TO REMAIN IN AN ELEVATED POSITION FOR ANY PROLONGED PERIODS. LIFT CARRIAGE SHOULD BE LOWERED WHEN NOT IN USE.

DO NOT HOLD CONTROL LEVERS IN EXTREME POSITIONS AFTER A LOAD HAS REACHED ITS LIMITS. TO DO SO WILL RESULT IN HIGH OIL PRESSURE THAT MAY RESULT IN HEATING OF THE HYDRAULIC OIL.



# INDUSTRIAL TRUCK DIVISION



LUBRICATION AND PREVENTIVE MAINTENANCE

TIRE AND R,IM MAINTENANCE

1. Inspect tires regularly - remove all sharp objects picked up by treads before they have a chance to cut further into the rubber and cause chipping or possible separation of the rubber from the base metal.
2. Avoid overloading and do not allow vehicle to stand under heavy loads for prolonged periods as this will cause a "flat" spot on the tires.
3. Check steering axle alignment regularly to protect against fast, irregular tread wear and separation.

4. If rubber tires come in contact with oils, grease, and gasoline they should be wiped off without delay.

5. Regular lubrication of all wheel bearings will assure free-rolling and elimination of tire drag when stopping or starting.



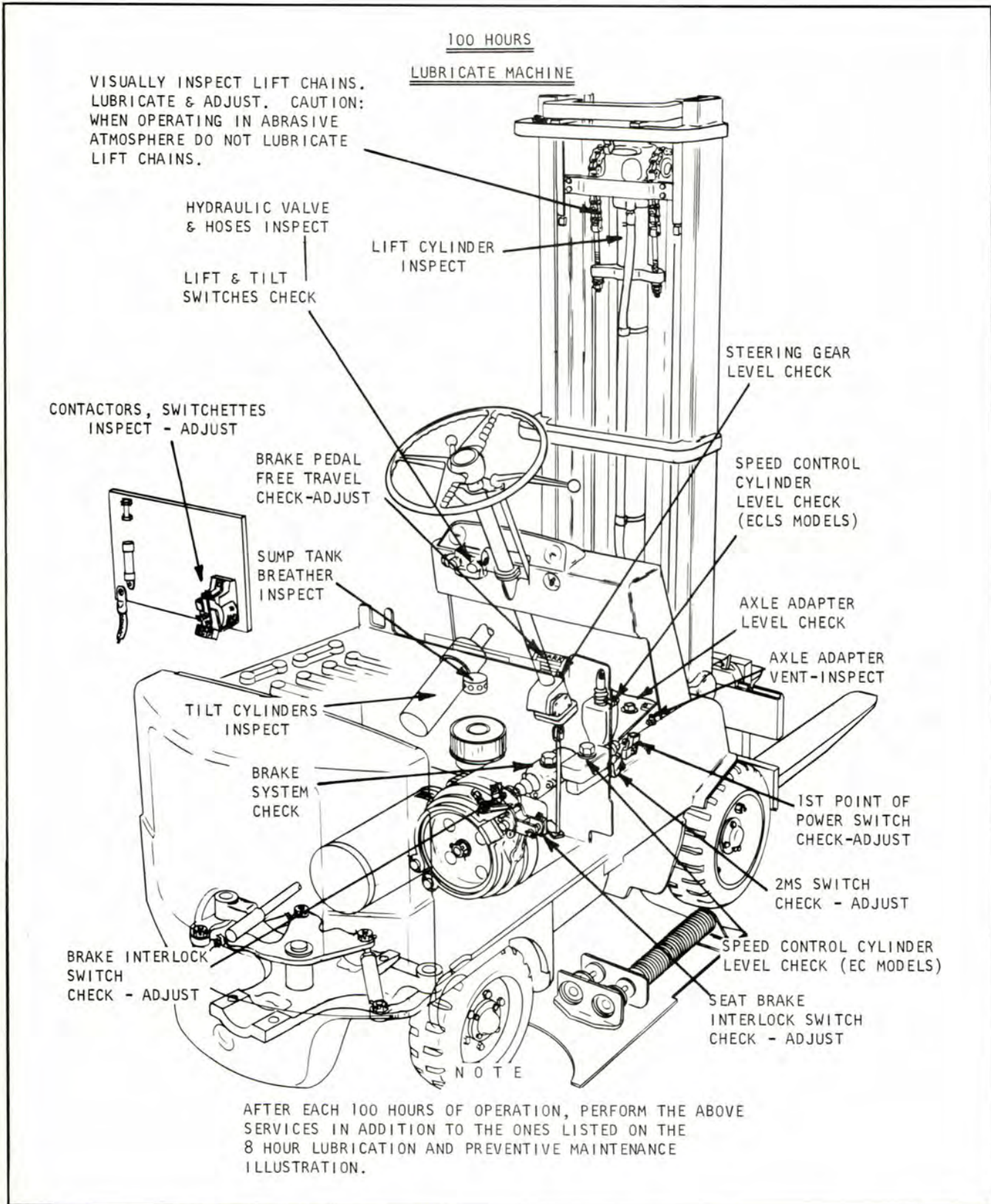


Plate 7401. Lubrication and Preventive Maintenance Illustration

## AXLE ADAPTOR FLUID LEVEL CHECK

Verify fluid level....fill if necessary until level reaches the height of the Axle Adaptor LEVEL PLUG OPENING (E).

1. Clean dirt from around filler plug (D), and remove plug.
2. Fill until level reaches the height of the level plug opening. Replace plugs.

Do not overfill as the excess quantity will serve no useful purpose. If the oil is too high, it will cause excessive oil churning and attendant high oil temperature and possible leakage.

For LUBRICATION RECOMMENDATIONS....refer to the right hand column.

## AXLE ADAPTOR VENT

Inspect Axle Vent (C) to be sure it is free of obstructions. If vent is not open, remove and clean in a Stoddard type cleaning solvent. Be sure vent is completely dry before replacing in the axle adaptor.

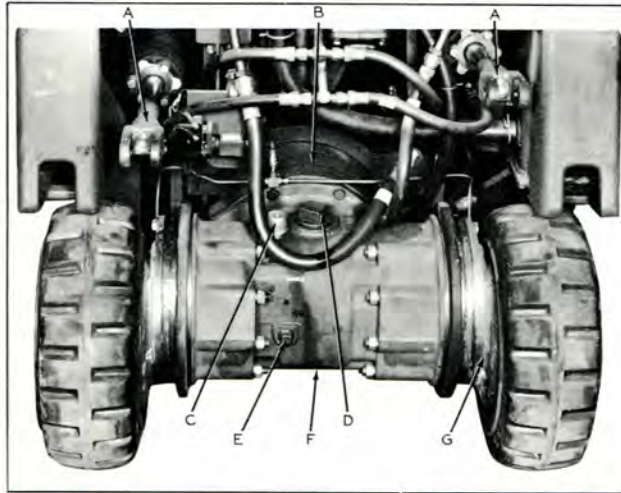


Plate 5988. Axle Adaptor

## LUBRICATION RECOMMENDATIONS

Refer to your Machine Serial Number Plate....located on the instrument panel.

Machines built beginning with the following Machine Serial Numbers....use Type 'A', Suffix 'A' Automatic Transmission Fluid. Fluid Containers must display a qualification number prefixed by AQ-ATF. Clark Part No. 879803.

EC20C & EC25C-1-763 and above  
EC30B & EC40B-1-764 and above

EC30C & EC40C-1-919 and above

ECS50C-1-919 and above  
EC50-60-70-1-831 and above

ECLS20B & ECLS25B-1-983 and above  
ECLS30B & ECLS40B-1-984 and above

Machines built prior to the above Machine Serial Numbers.....use EPGL SAE #90 Gear Lubricant.

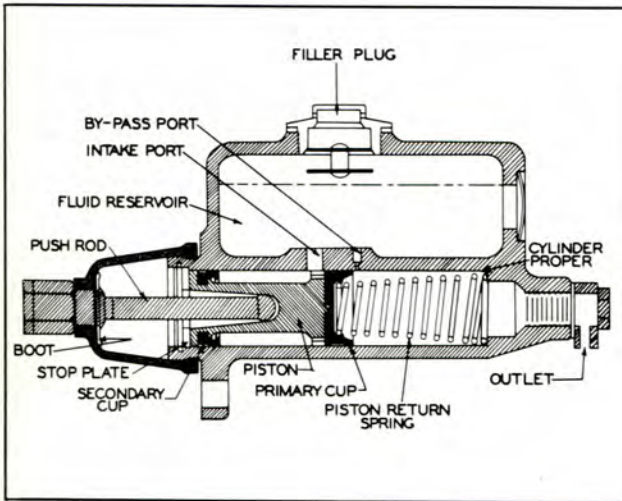


Plate 5772. Speed Control Cylinder  
(EC MODELS)

Speed Control Cylinder: Verify fluid level. Fluid should be within 1/4 inch of the top. Fill with S.A.E. 70R3 Heavy Duty Brake fluid.

Cylinder Filler Cap Vent Hole: Check cap vent hole for obstruction. Vent hole must be open at all times. Clean if necessary.

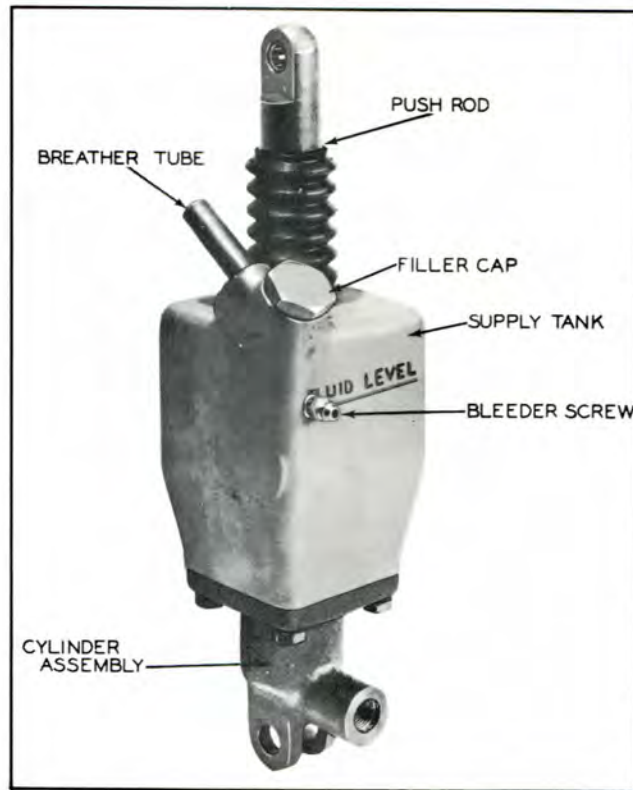


Plate 5334. Speed Control Cylinder  
(ECLS MODELS)

Speed Control Cylinder: Verify fluid level. Fluid should be to the height of the level bleed screw. Fill if necessary with S.A.E. 70R3 Heavy Duty Brake fluid.

Cylinder Vent Tube: Cylinder vent must be open at all times. Clean vent hole if necessary.





Plate 7615. Brake Interlock Switch

#### BRAKE INTERLOCK SWITCH ADJUSTMENT

This normally closed switch is so mounted that when the brake pedal is in the "up" position the switch is closed. The switch should be adjusted so that it will actuate (open) during the free travel portion of the brake pedal stroke. Adjustment is made by loosening the switch mounting screws and moving the switch in the necessary direction to attain the correct adjustment. Tighten the screws retaining the switch to its mounting bracket without moving switch out of adjustment.

#### C A U T I O N

CAREFULLY CHECK ADJUSTMENT TO SEE THAT SWITCH ARM DOES NOT OVER-TRAVEL DURING BRAKE APPLICATION. OVER-TRAVEL WILL CAUSE DAMAGE TO THE SWITCH.

#### N O T E

Depression of the brake pedal will cause the interlock switch to open a circuit, cutting all power to the drive motor. This prevents the possibility of trying to drive and brake the truck at the same time.

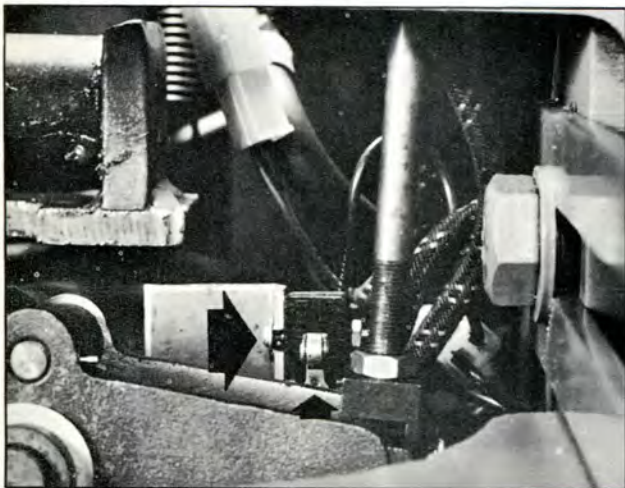


Plate 7207. Seat Safety Switch

#### SEAT SAFETY SWITCH ADJUSTMENT

This normally open switch should be adjusted so that it will actuate (close) when the seat frame bumpers are approximately 2 to 3 inches from the hood during the seat downward travel. The adjustment is made by loosening the switch mounting screws and moving the switch fore or aft as required on the elongated mounting bracket holes. Securely tighten mounting screws when correct adjustment is obtained.

BRAKE PEDAL FREE TRAVEL

Using a rule, measure pedal free travel at either of the two places shown below.

Depress brake pedal by hand. When pedal meets resistance from the master cylinder, the distance traveled should be 1/2 inch — if free travel is incorrect, adjust as follows:

1. Loosen lock nut, see Plate 6633.
2. Rotate adjuster to obtain specified pedal free travel.
3. Tighten lock nut to hold adjustment.

ACTUATION STROKE

The Automatic Brake Adjustors will maintain pedal stroke, with little variation, until such time as the brake linings require replacement. At this time the brake pedal will drop toward the floor board.

If brake pedal travels beyond this point----- this indicates either lack of fluid in the master cylinder; air in the system, or the brake linings require replacement.

CLEARANCE - measured here -  
TOP PEDAL POSITION -TO- WHERE PEDAL MEETS RESISTANCE FROM THE MASTER CYLINDER.

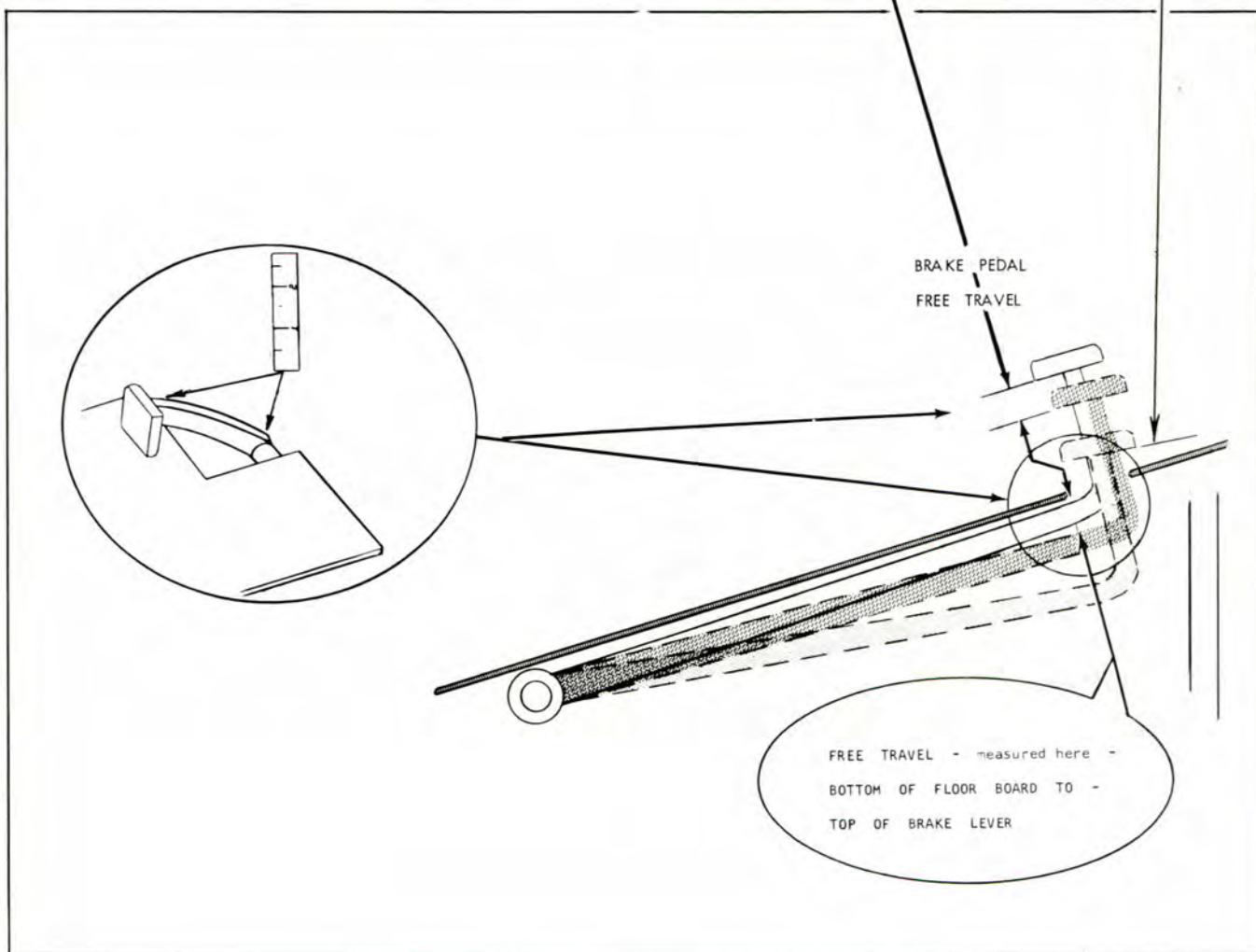


Plate 7042. Brake Pedal Check and Adjustment



# INDUSTRIAL TRUCK DIVISION



## LUBRICATION AND PREVENTIVE MAINTENANCE

### BRAKE SYSTEM

Check brake fluid level in the master cylinder. Brake fluid should be within 1/4 inch of the top. Fill with S.A.E. 70 R3 Heavy Duty Hydraulic Brake Fluid.

Master Cylinder Filler Cap Vent Hole: Check cap vent hole for obstruction. Vent hole must be open at all times. Clean if necessary, see Plate 6633.

### BRAKE PEDAL

#### WARNING

CORRECT BRAKE PEDAL FREE TRAVEL IS IMPORTANT FOR SAFE OPERATING BRAKES.

A correctly adjusted brake pedal is important so that the internal ports in the master cylinder are not blocked by the

cylinder piston. The following lists two important reasons for proper brake pedal free travel.

Inadequate pedal free travel will block the internal ports so that upon releasing the brake pedal fluid will be trapped in the lines and hold the brake linings in contact with the brake drums. Resulting in lining wear and premature discharge of the battery.

Brake Pedal Adjustment: Refer to Plate 7042 and follow the instructions and diagrams.

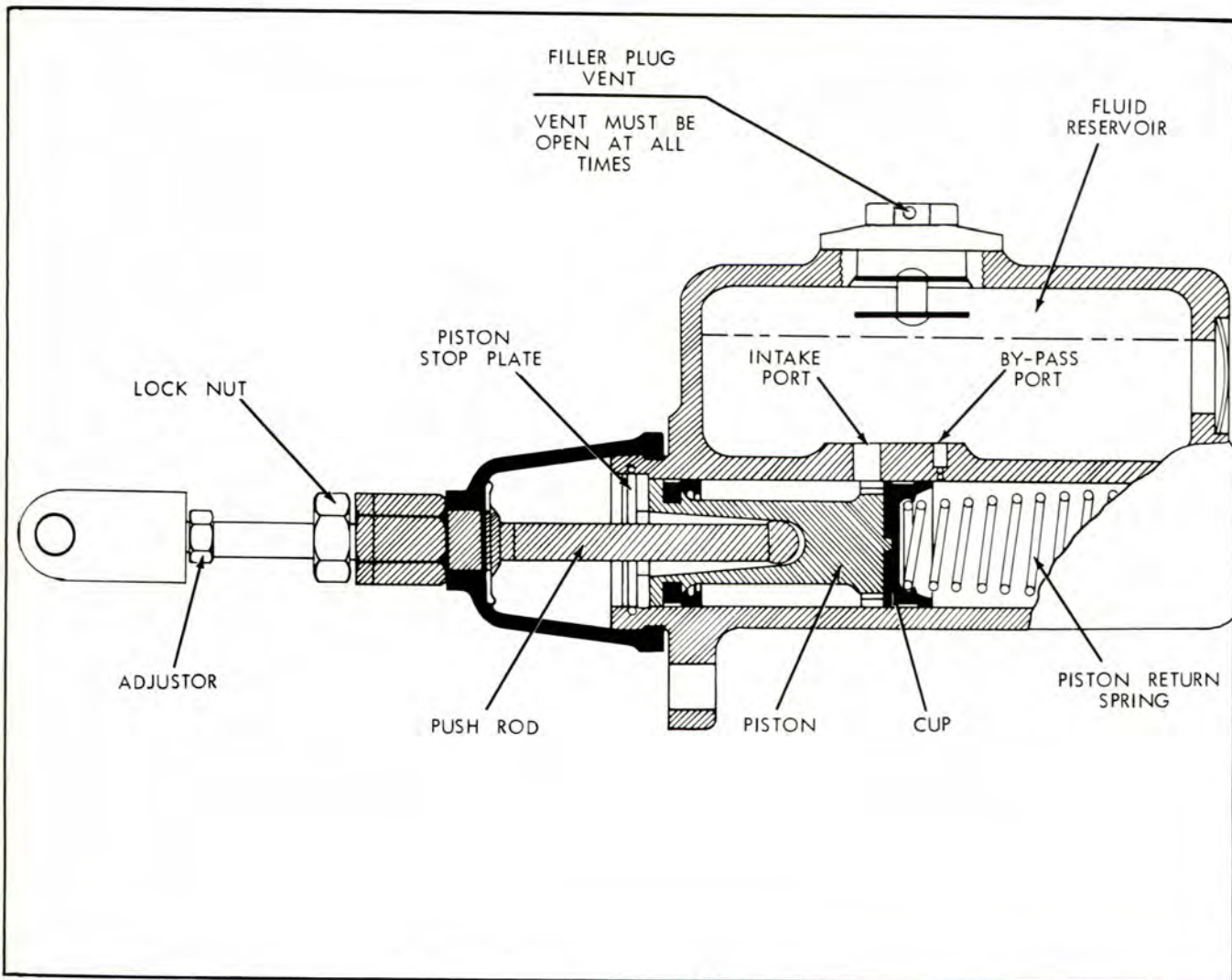


Plate 6633. Brake Pedal Adjustment  
100H 303-6

## LUBRICATION AND PREVENTIVE MAINTENANCE

## LIFT AND TILT CYLINDERS

Check for drift, leakage at packings, damage and security of mountings (Anchor Pivot Pins, Flanges and Mounting Rings).

## LIFT CHAINS

The lift chains are mounted to the chain anchors on the lift carriage and at the chain anchor rods near the lift cylinder piston head.

If it becomes necessary to adjust the lift chains place a capacity load on forks (or device if used) and adjust chains so center line of lower carriage roller is at least 1/2" above the bottom end of the innerslide channel. It is important that the chain adjustment be made with a capacity load. In this manner you will allow for chain stretch.

## W A R N I N G

KEEP CLEAR OF LOAD DURING ADJUSTMENT TO AVOID INJURY IF ANY MALFUNCTION SHOULD OCCUR AND CAUSE LOAD TO FALL.

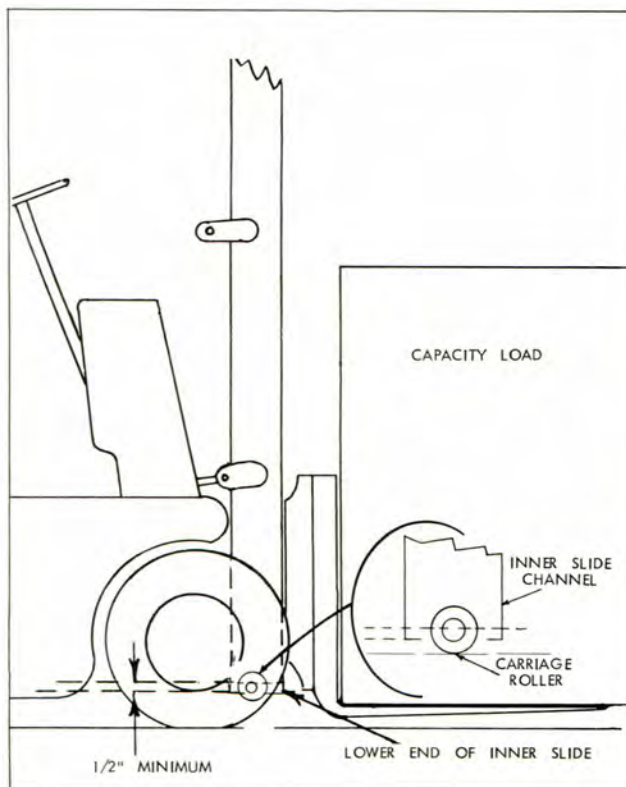


Plate 6884. Lift Chain Adjustment  
(Place Maximum Load On Forks)

## LUBRICATE MACHINE

## C A U T I O N

WHEN LUBRICATING THE TRUCK, MAKE A VISUAL INSPECTION OF ALL HYDRAULIC LINES, FITTINGS AND ALL ELECTRICAL WIRING. LUBRICATE ALL MISCELLANEOUS LINKAGE WITH S.A.E. NUMBER 20 OIL.

## HYDRAULIC CONTROL VALVE AND LINES

Inspect for damage, leakage and security of mounting.

## LIFT BRACKET

Inspect for damage, bent forks etc.

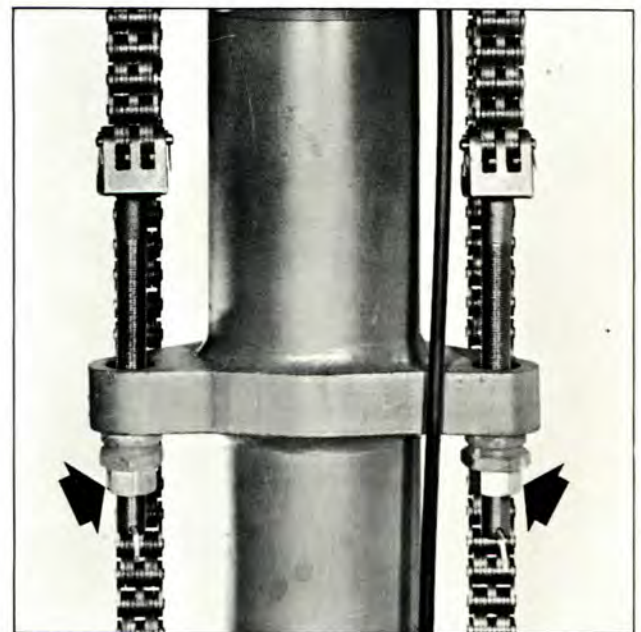


Plate 6634. Lift Chain Adjustment  
(Chain Anchor Rods)

## PUMP CONTROL SWITCHES

The pump control switches are mounted at the valve spool end covers and are activated by movement of the valve spool.

## SWITCH ADJUSTMENT

1. Loosen the two screws clamping switch to valve.
2. Position switch on spool end cover so that movable switch contacts are centered between stationary contacts. (Switch contacts are viewed thru clear plastic cover on switch.)

## NOTE

ADJUSTMENT OF SWITCHES MUST BE MADE WITH VALVE SPOOL IN NEUTRAL POSITION.

3. After correct adjustment is obtained tighten switch clamping screws.

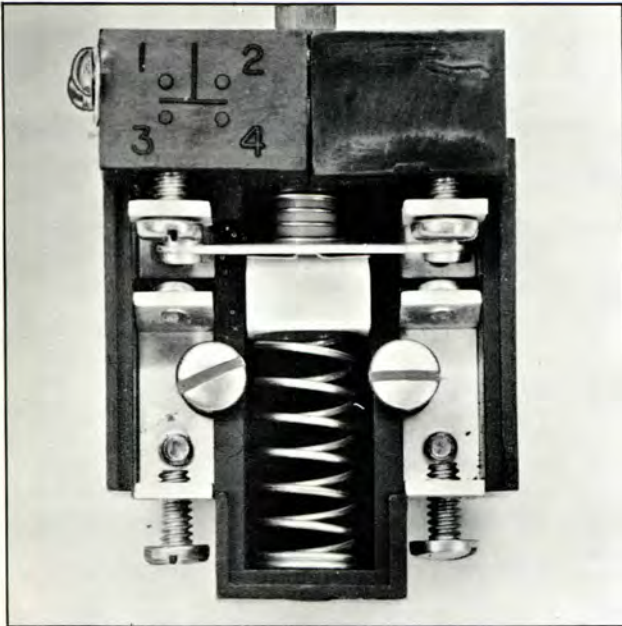


Plate 7443. Typical Pump Control Switch

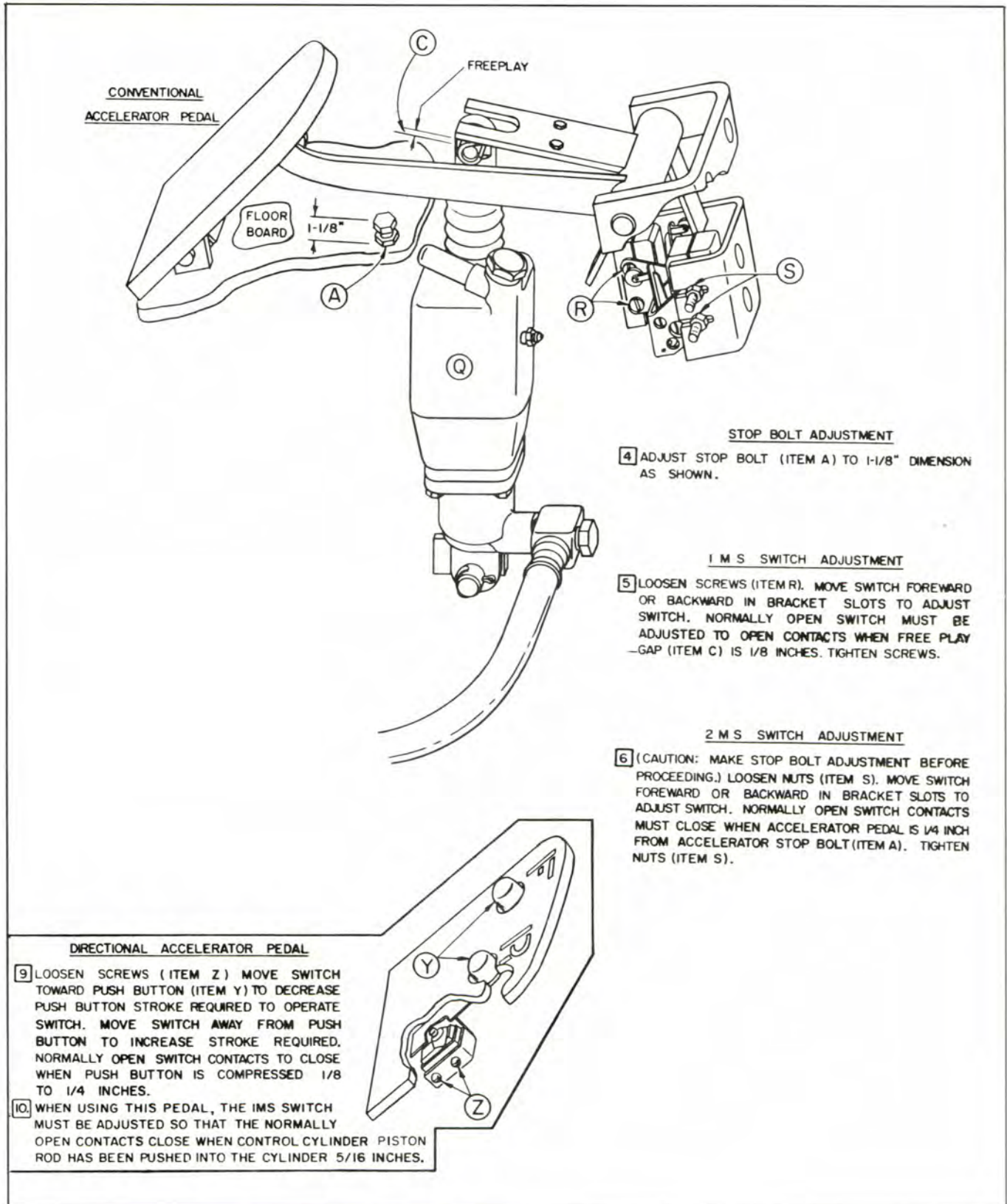
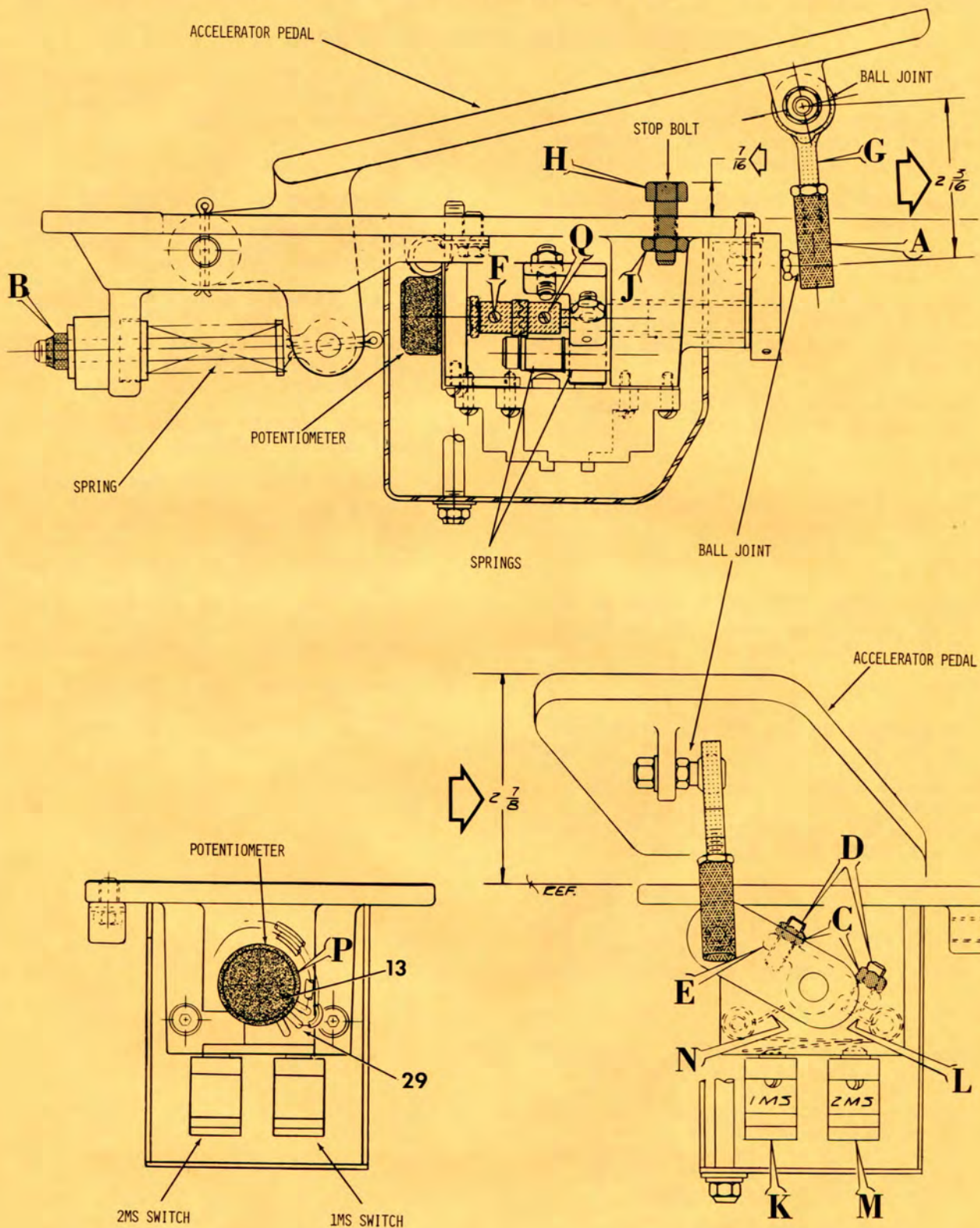


Plate 7498. Speed Control Stop Bolt & Switch Adjustment





ECLS-20B, ECLS-25B, ECLS-30B, ECLS-40B, ACCELERATOR ADJUST-  
MENT.....C-185 SCR CONTROL.....SOLID STATE CONTROL SYSTEM...



ACCELERATOR CONTROL ASSEMBLY ADJUSTMENT



# INDUSTRIAL TRUCK DIVISION



SOLID STATE CONTROL ..... ACCELERATOR ADJUSTMENT ..... C-185 SCR CONTROL FOR ...  
ECLS-20B, ECLS-25B, ECLS-30B, ECLS-40B

## STEP #1

- A. DISCONNECT BALL JOINT (ITEM A), POSITION PEDAL TO 2-7/8" DIMENSION, FROM MACHINED SURFACE OF CASTING.
- B. TURN STOP NUT (ITEM B) TO HOLD THIS POSITION.

## STEP #2

- A. LOOSEN NUTS (ITEM C) AND BACK OFF (2) SET SCREWS (ITEM D) UNTIL FLUSH WITH CAST SURFACE OF SPRING ACTUATOR (ITEM E)
- B. DO NOT TIGHTEN SET SCREWS (ITEM F) IN COUPLER AT THIS TIME.

## STEP #3

- A. ADJUST LINKAGE ROD (ITEM G) TO 2-3/16" DIMENSION.

## STEP #4

- A. ADJUST PEDAL STOP BOLT (ITEM H) TO 7/16" DIMENSION, AND LOCK IN PLACE WITH JAM NUT (ITEM J).

## STEP #5

- A. ADJUSTMENT OF 1MS SWITCH WITH PEDAL IN THE UP POSITION: ADJUST 1MS SWITCH (ITEM K) WITH SET SCREW (ITEM D) BY TURNING SCREW IN AGAINST SPRING (ITEM L) UNTIL 1MS JUST ACTUATES. TURN SCREW AN ADDITIONAL 1/4 TURN.. ....TIGHTEN LOCK NUT (ITEM C).
- B. DEPRESS PEDAL SEVERAL TIMES TO BE CERTAIN 1MS IS ACTUATED EACH TIME. IF NOT, UNLOCK NUT (ITEM C) AND TURN SCREW (ITEM D) IN AN ADDITIONAL 1/4 TURN.....LOCK NUT AND REPEAT ABOVE.

## STEP #6

- A. ADJUSTMENT OF 2MS SWITCH: WITH 1/8" SPACER PLACED BETWEEN PEDAL AND STOP BOLT (ITEM H).....AND WITH PEDAL DEPRESSED.....ADJUST 2MS SWITCH (ITEM M) WITH SET SCREW (ITEM D) (OFF-SET TAB OF SPRING ACTUATOR) BY TURNING SCREW IN AGAINST SPRING (ITEM N) UNTIL 2MS ACTUATES.  
TIGHTEN LOCK NUT (ITEM C).

- B. REMOVE 1/8" SPACER AND DEPRESS PEDAL FULLY TO BE CERTAIN THAT 2MS SWITCH ACTUATES EACH TIME.

## STEP #7

- A. ADJUSTMENT OF POTENTIOMETER (ITEM P) WITH SET SCREW (ITEM F) TIGHTENED, AND SET SCREW (ITEM Q) LOOSENED..... DISENGAGE COUPLER HALVES.
- B. WITH OHMMETER CONNECTED BETWEEN WIRES 13 & 29.....RS100 SCALE.... REVOLVE COUPLER HALF & POTENTIOMETER UNTIL OHMMETER READS APPROXIMATELY 10,000 OHMS.
- C. ENGAGE COUPLER HALVES AND TIGHTEN SET SCREWS (ITEM Q).
- D. DEPRESS PEDAL UNTIL 1MS ACTUATES.... OHMMETER SHOULD READ BETWEEN 8,500 AND 9,500 OHMS.....TERMINALS 13 & 29.....RS100 SCALE. IF NOT, MINOR ADJUSTMENT CAN BE MADE BY LOOSENING THE COUPLER SET SCREW (ITEM Q) AND REVOLVING COUPLER AND POTENTIOMETER SHAFT (WITH 1MS JUST ACTUATED) TO WITHIN RANGE....TIGHTEN SET SCREW.
- E. DEPRESS PEDAL UNTIL 2MS JUST ACTUATES.....OHMMETER SHOULD READ 300 OR LESS OHMS....RS1 SCALE.

## HYDRAULIC SUMP TANK BREATHER

Check breather to be sure it is not dirty or clogged with foreign matter. Install a new breather if this condition exists.

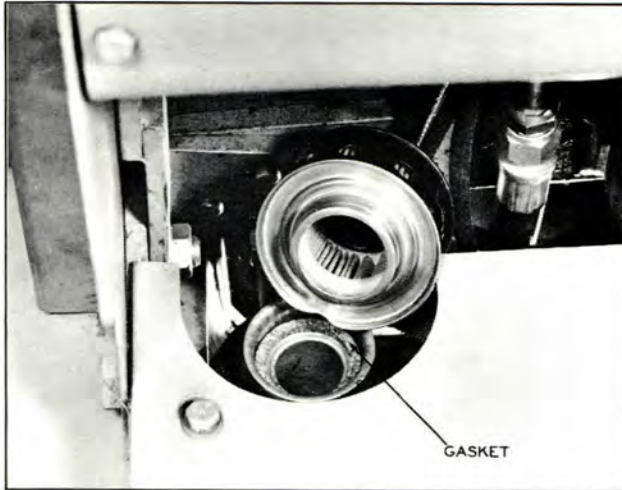
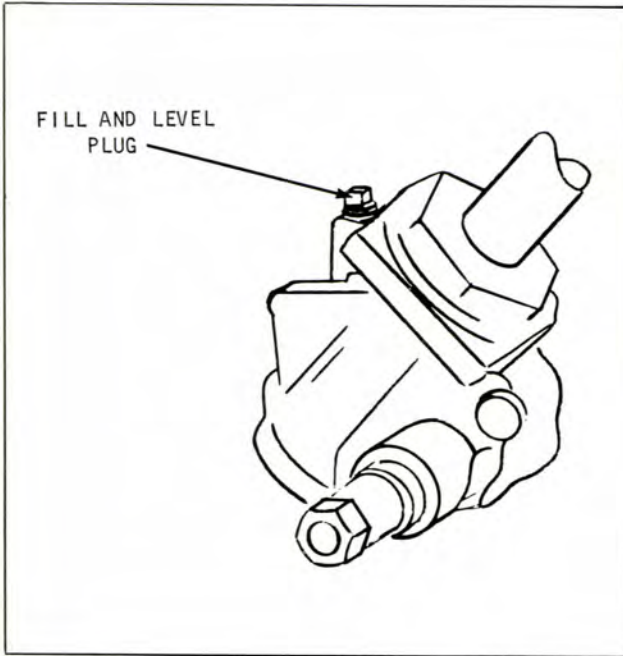


Plate 6586. Sump Tank Breather

**STEERING GEAR**

The gear lubricant level should be checked every 100 operating hours and filled if necessary with NLGI #1 (Amolith grease EP #1 or its equivalent). Fill to level of filler plug opening only. Replace plug after filling.

**N O T E**

Before removing fill/level plug, be sure to wipe all dirt from around the plug and opening.

Plate 6429. Steering Gear

CONTACTOR PANEL ADJUSTMENTS

Tools Required

Before going into the adjustment procedures, you should have with you (or available at the job-site) all of the tools and gages we illustrate and list.

Tools 0-1 and 0-3 are ones you can make and will save you considerable time in making these special adjustments. Seeing they cannot be purchased, they call for more discussion.

Tool # 0-1 make from 3/8" diameter drill rod and form to shape shown. Slot with a hacksaw with two blades inserted if necessary to obtain in one cut a proper width slot to dimensions shown....Plate 9731.

Tool # 0-3 pusher rod. Make from 3/32" welding rod and remove flux. Point end as shown for best results. Form an S shape on opposite end as shown....Plate 9678.

Before starting adjustments you should be prepared and have a full set of normally open moveable and normally open stationary arms and replaceable tips with you for each machine to be serviced or checked.

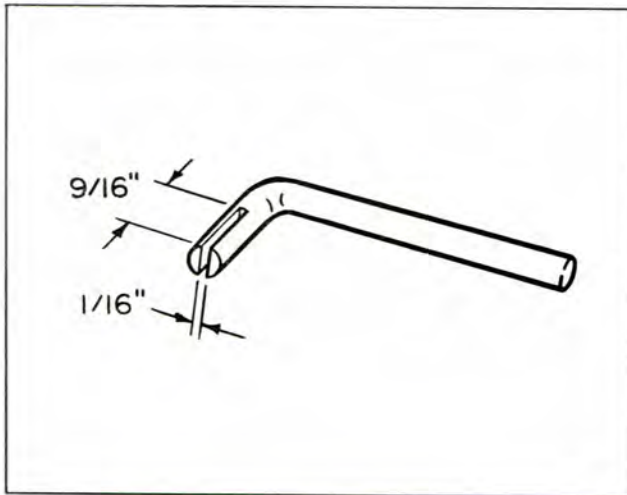


Plate 9731. Typical Tool # 0-1

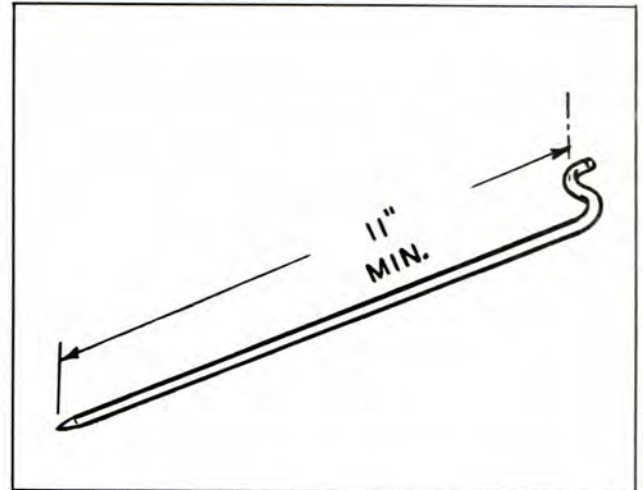


Plate 678. Typical Pusher Rod - Tool # 0-3 (Used only in connection with type "T" Chatillon Spring Tension Gage).



Plate 9679. Typical Instrument Type "T" - Chatillon Spring Tension Gage, Mfg. by Chatillon Inst. Co., New York, N.Y.

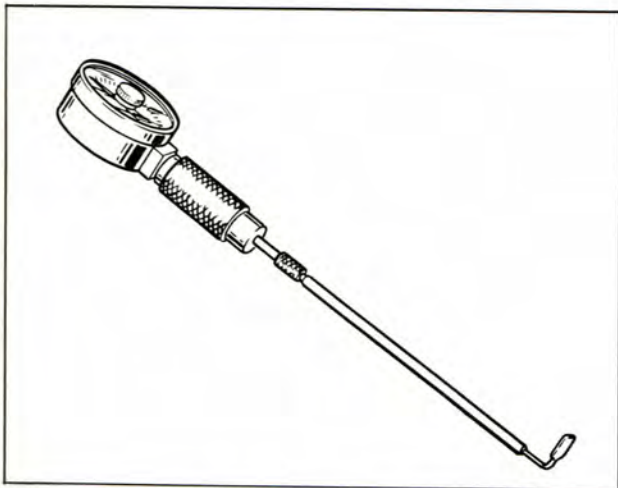


Plate 9680. Typical Spring Tension Gage.....  
Clark Part # 886717.

N O T E

It is not necessary that you have both types of Spring Tension Gages we have illustrated. Either type will suffice.

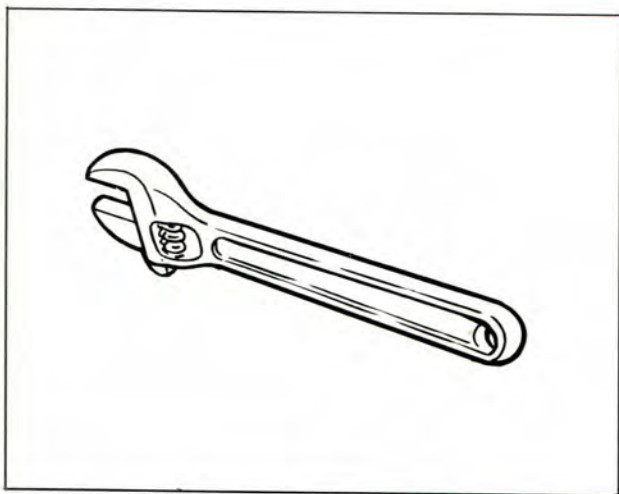


Plate 9681. Typical 8" Crescent Wrench.

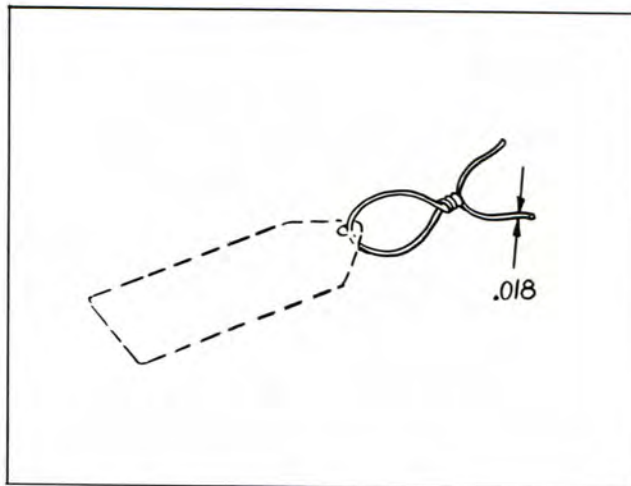


Plate 9682. Typical Tag Wire .018 Diameter  
Maximum.

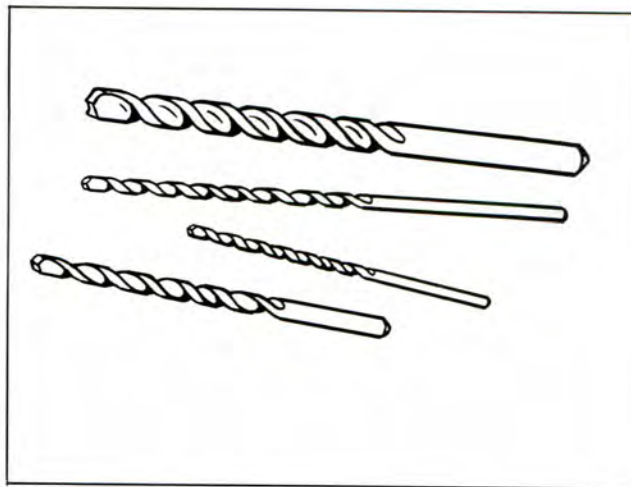


Plate 9683. Typical Twist Drills - Sizes  
13/32", 3/8", 5/32", 1/8", 3/32", 1/4".

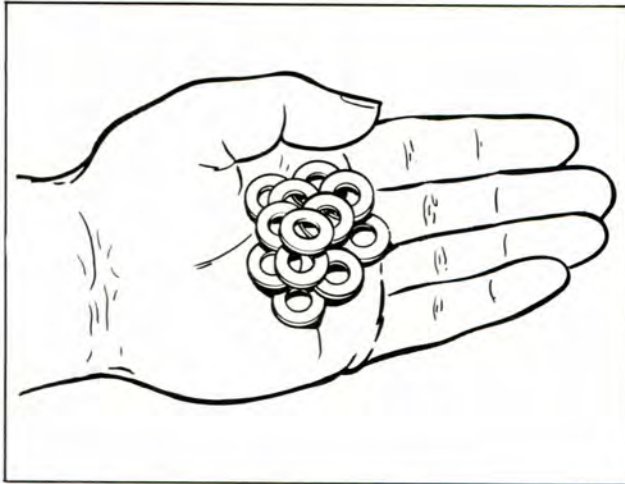


Plate 9684. Typical Handful of 1/4" Flat Washers.

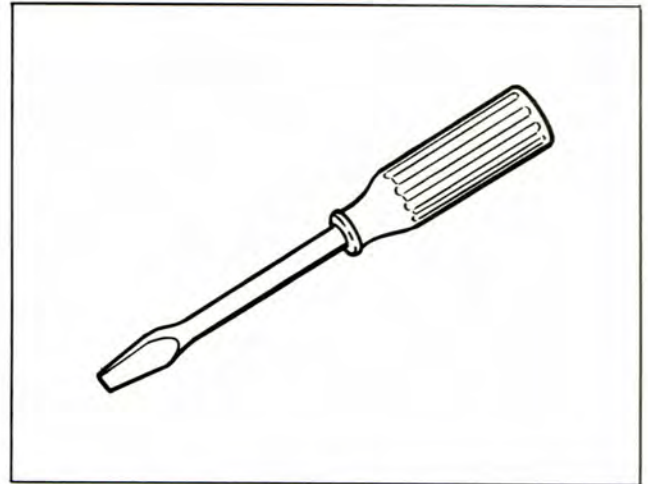


Plate 9686. Typical Screwdriver approximately 8" length.

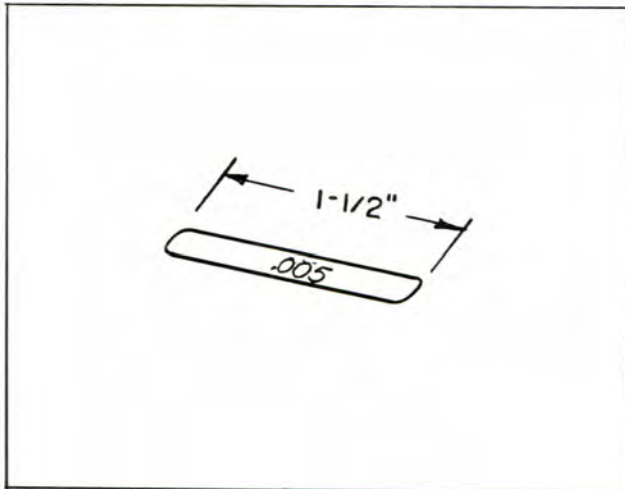


Plate 9685. Typical Brass or Steel Shim Stock .005" Thick.

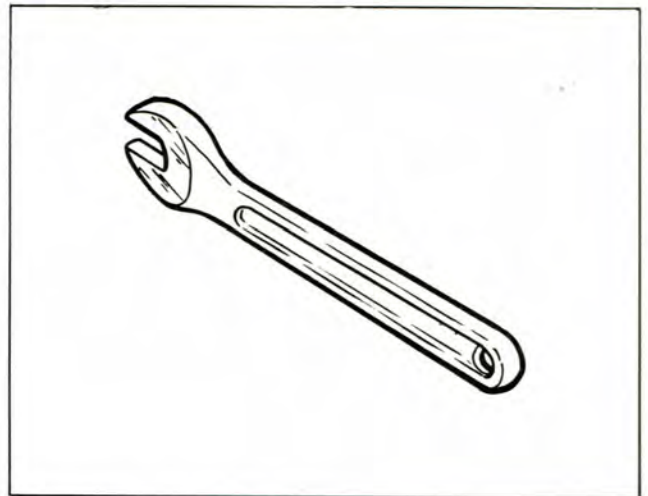


Plate 9687. Typical Open End Wrenche size - 7/16".

Contactor Tip Replacement (Refer to Plate 3197).

CAUTION

BEFORE MAKING ANY REPLACEMENTS OR ADJUSTMENTS..

...DISCONNECT BATTERY.



Plate 9688. "Typical" Battery Disconnect

Actual replacement of contacts should only be made after 90% of the tip material has been burned away.

The following figures show six contacts in various stages of wear. These are reference numbered from 1 through 6. Of these six illustrated, only the contact numbered 1 is worn or burned badly enough that it should be replaced. All of the other contacts shown have a great deal of life left in them, although the contact surfaces are burned to a dark color and they show pitting.

Refer to contact number 6. This is the worst of the five contacts that are still serviceable. The pits in this contact are 1/16 inch deep, yet despite the appearance, 80% of the contact tip material is still present, hence 70% of the original life expectancy could be obtained by continued use of this contact.

When a projection of as much as 1/16 inch high

builds up on a tip, it should be removed by filing. Tips should not be filed flat, but projection should be filed down to general level of the tip surface. A projection on a contact tip does not impair its operating efficiency and the only reason for removal of the projection is to eliminate the possibility of the projection building up to a size that would mechanically lock the tips together.

Don't file away contact life trying to eliminate discoloration or trying to smooth up the contact surfaces. File only to remove a projection which has built up to as much as 1/16 inch.

Contact tips should not be greased or oiled under any circumstances. Grease or oil on the contact surfaces increases the surface resistance and may be the cause of collecting sufficient dirt to prevent contacts closing and making a circuit. In addition, the high resistance, caused by the grease or oil, results in more heat and contact burning at the time of making a circuit.

NOTE

CONTACTOR TIP STUD TORQUE

Contactor	Torque (in. lbs.)
F-R	80-100 (5/16 stud)
P-1A	80-100 (5/16 stud)
P-1A	45-60 (1/4 stud)

Stud to be peened after torquing to above figure or locking device used.

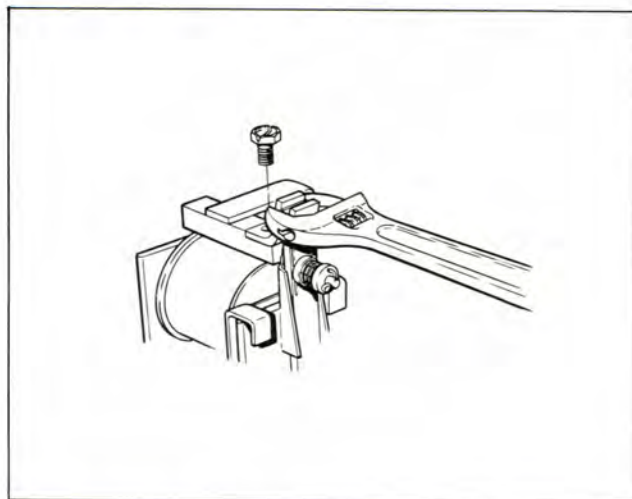


Plate 9690. Typical Contactor Arm Alignment

Use Plate 9690 for an easy approach to aligning normally open stationary and moveable tips.



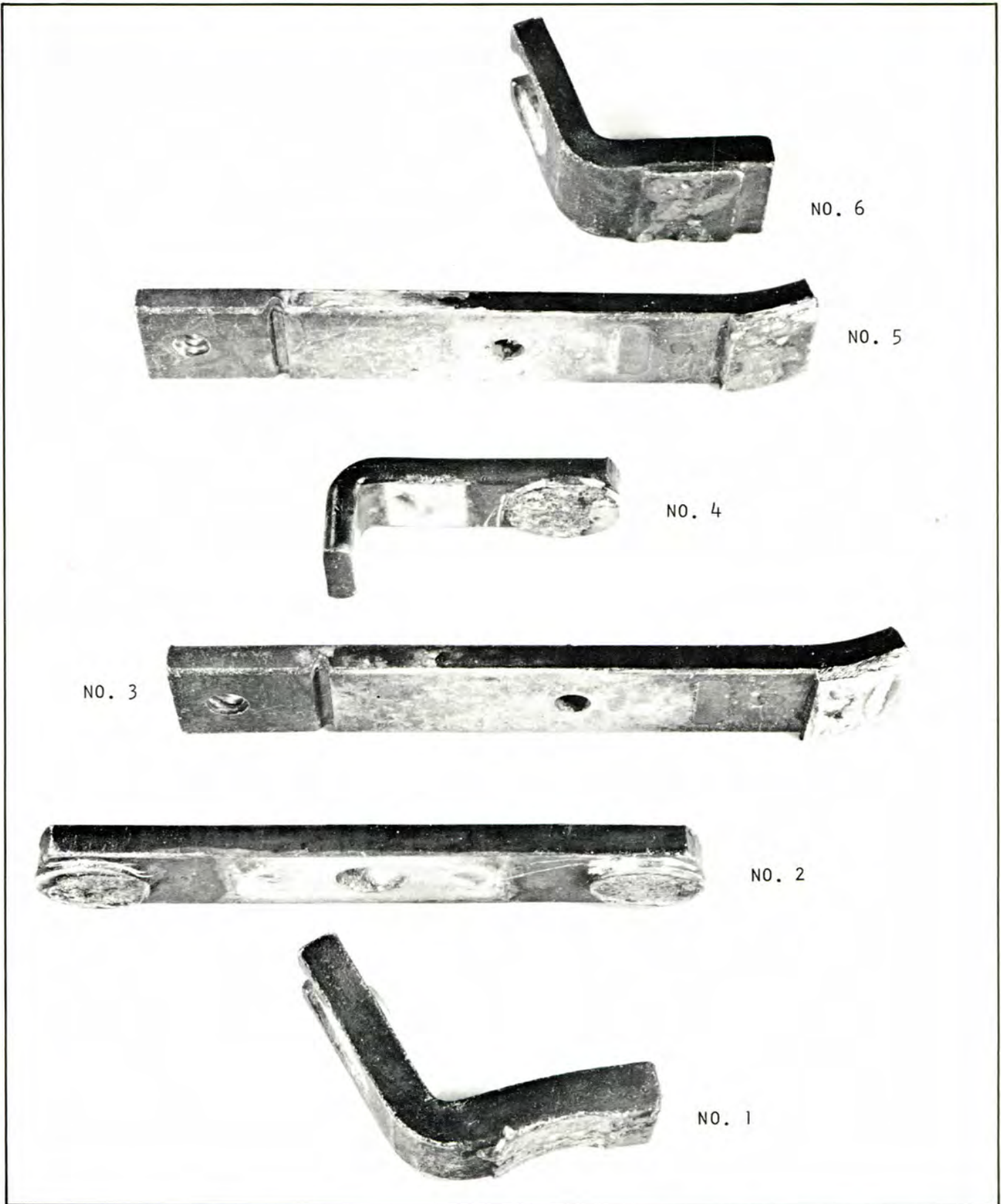


Plate 3197. Typical Contactor Tips

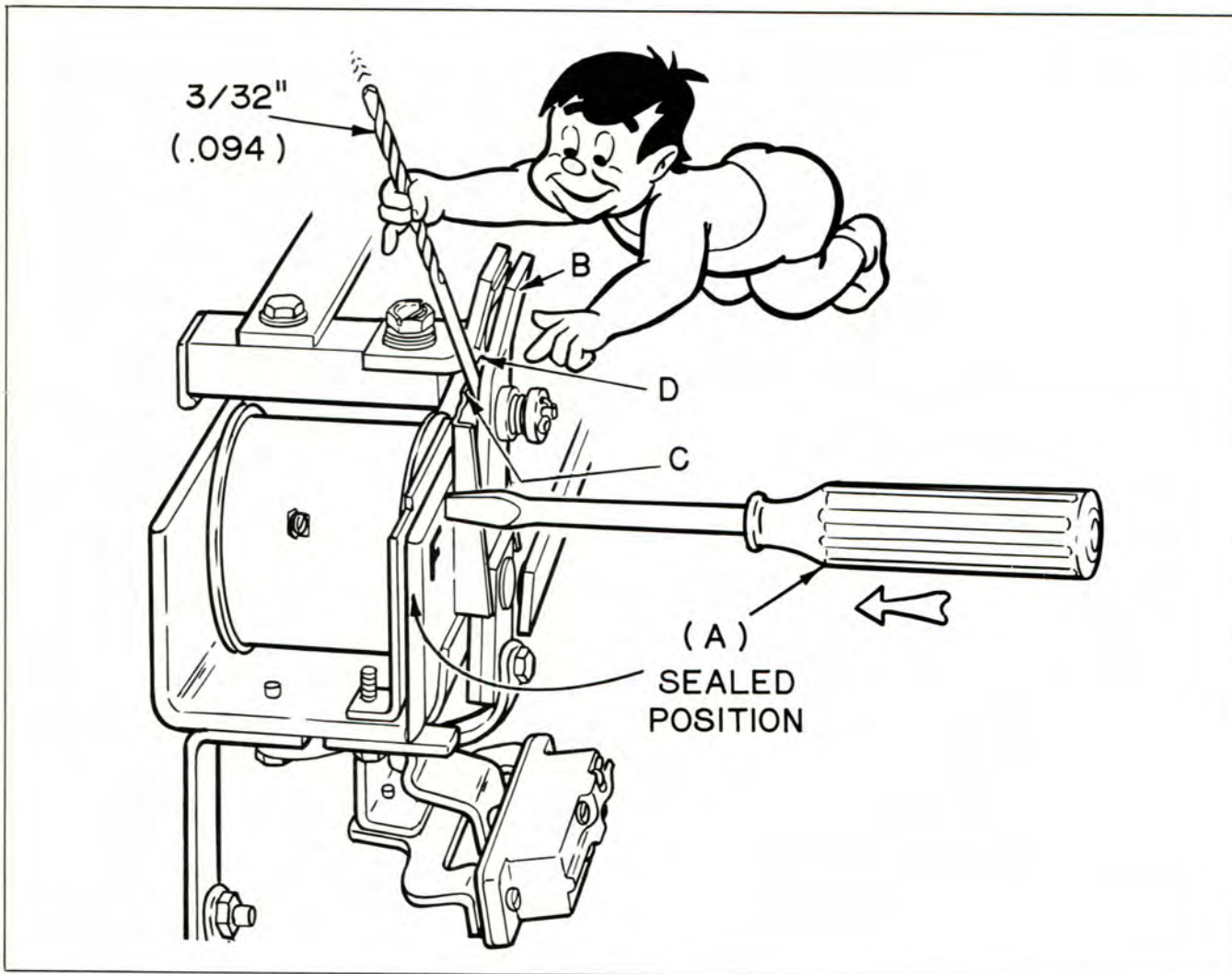


Plate 9691. Typical Wipe Check

Checking Wipe

To measure wipe (Plate 9691) seal the armature plate fully and hold with screwdriver (A) while measurement is taken with a 3/32" drill. This drill, when held parallel to the back surface of moveable arm (B) must slide freely between points C & D.

The wipe is found in specifications in the front of this manual under CONTACTORS.

Adjusting Wipe

Wipe is controlled by three conditions:

- (1) Stationary normally open tip, (new or worn).
- (2) Improper (off brand) tips or tip kits supplied by anyone but Clark which could have wrong angle bends in the moveable or stationary arms.
- (3) Angle at end (A) Plate 9692 of moveable contact arm support stop. Correct wipe can be obtained by the bending of (A) which will either increase or decrease wipe. When bending must be done to get proper wipe, then a special tool (C) # 0-1 is recommended. This tool, if used carefully, will guarantee the whole surface of the stop will be bent evenly and kept parallel to the back surface of the moveable tip (D). To increase wipe bend up (E). To decrease wipe bend down (F).

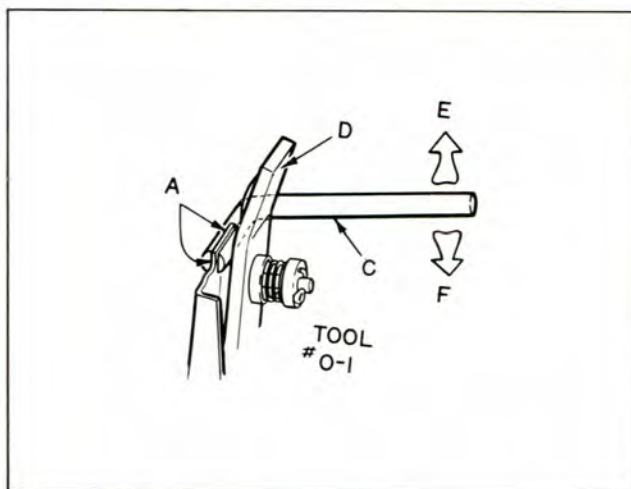
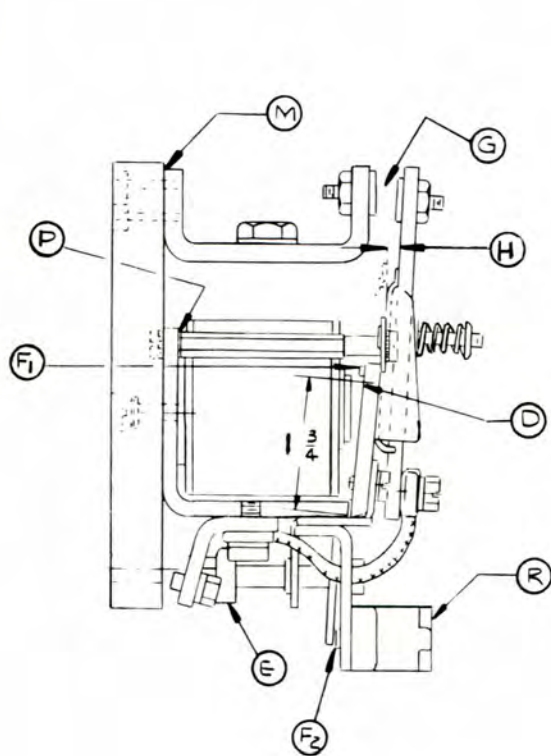
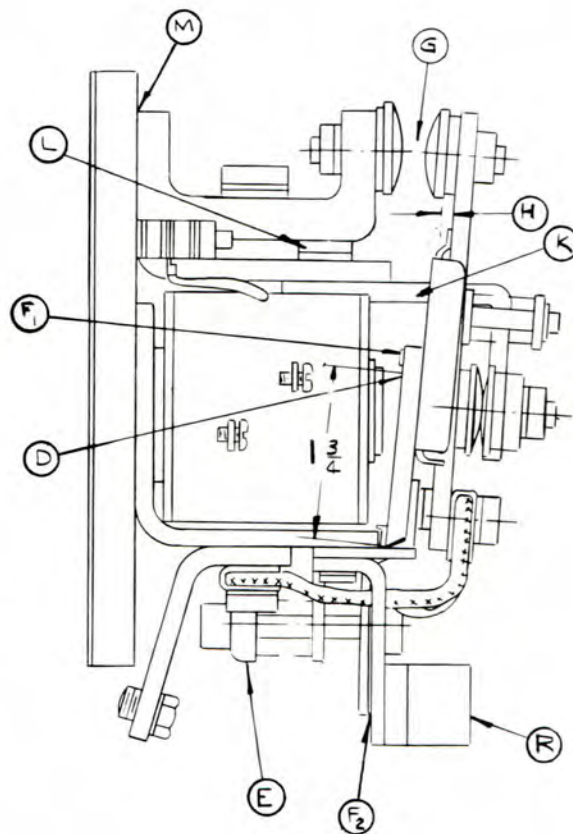


Plate 9692. Typical Wipe Adjustment



P & 1A CONTACTOR



F & R CONTACTOR

Plate 9703. Typical Contactors

Adjustment of Interlock (R)

The electrical interlock must operate with a (0.015 in. P and 1A or 0.035 in. F and R) thick shim (F1) between armature and core. Snapping noise indicates interlock (R) has operated. Also, with a 0.015 in. thick shim (F2 - all contactors) between interlock operator and plunger. Plunger must not bottom with armature seated against core.

Contactor Tip Gap Check

Proper settings can best be measured by using new twist drills of proper sizes. See Plate 9693. The air gaps are listed in specifications in the front of this manual under CONTACTORS.

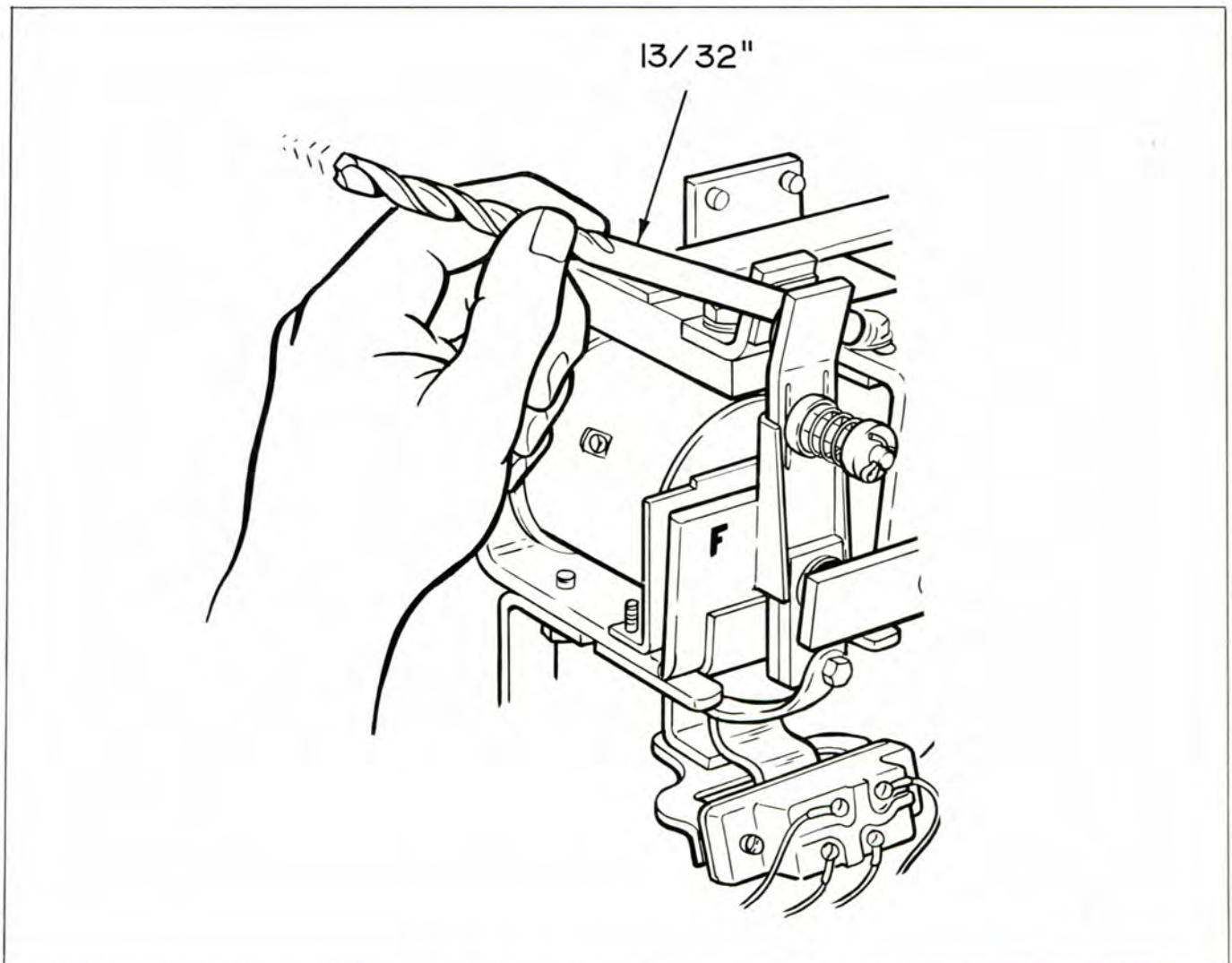


Plate 9693. Typical Gap Check

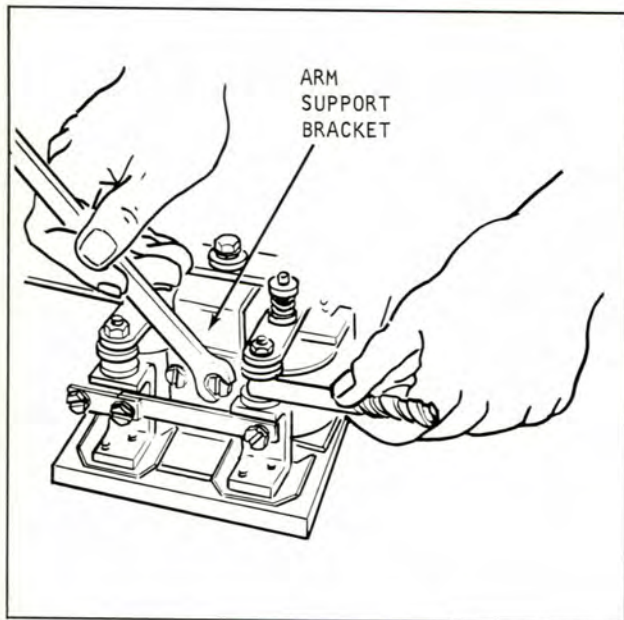


Plate 9694. Typical Gap Adjustment

#### F-R Gap Adjustment

The normally open contact gap of F & R contactor is adjustable by moving arm support bracket (Plate 9694) which has slotted holes to permit either increasing or decreasing contactor air gap.

#### N O T E

If wipe and normally open gap are correct..... normally closed gap should be within limits.

The air gaps are listed in specifications in the front of this manual under CONTACTORS.

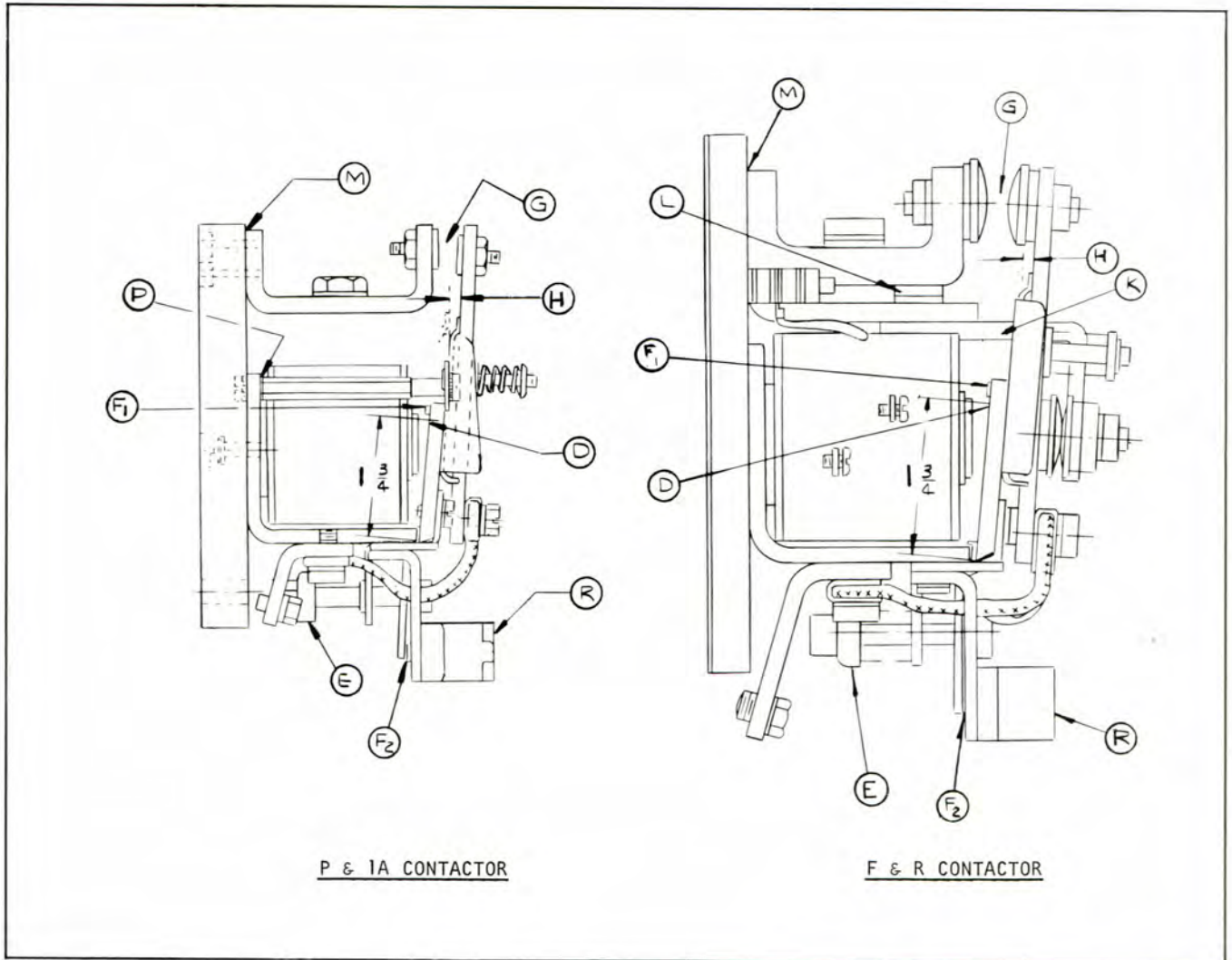


Plate 9703. Typical Contactors

P-1A Gap Adjustment

To obtain proper gaps on 1A and pump tips, adjust by adding or removing equal number of washers under armature stop posts (P). The air gaps are listed in specifications in the front of this manual under CONTACTORS.

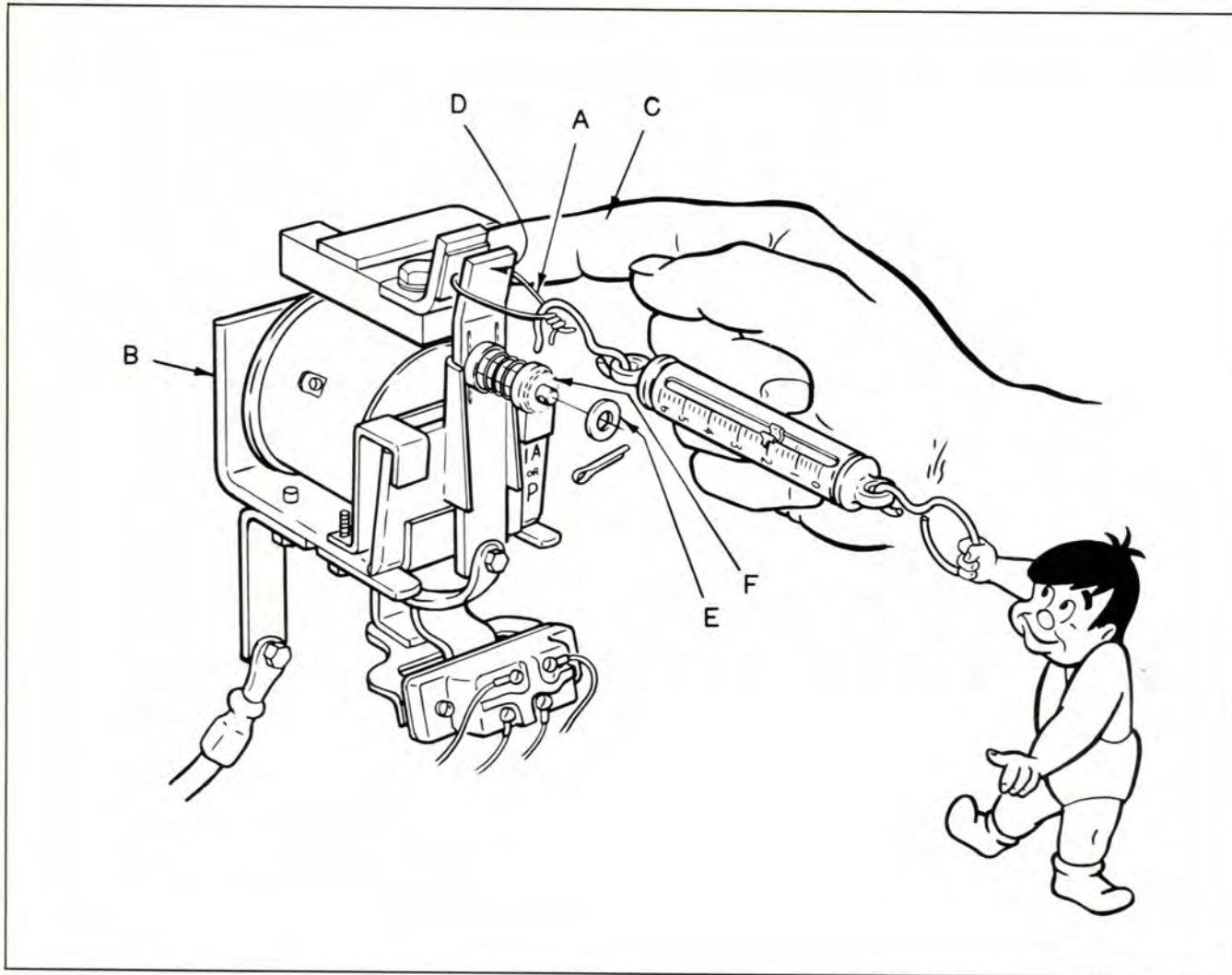


Plate 9696. Typical Spring Adjustment

Spring Tension Adjustments

Spring tensions consists of three to each contactor (1A-P-F & R). All three are explained and illustrated in detail. The three spring tensions can be identified as follows:

1. Initial
2. Armature Opening Force
3. Final

Starting with Initial, known as Initial, Normally Open Tip Pressure refer to Plate 9696 for P & 1A and Plate 9697 for F & R.

Pump and 1A Adjustments

To avoid confusion let's take them separately, starting with 1A and P.

With contactor in its normal open position, insert tag wire (A) at a vertical mid point on the tip surface and attach spring tension gage of either type, being sure it is held at a right angle to surface (B). Using index finger placed lightly in position (C) to detect slightest movement of normally open tip (D) read scale when tip first begins to re-seat on its stop after being slightly moved away from stop. Proper spring tension is 56 - 64 oz.

If pressure is less than minimum, add a plain 1/4" flat washer (E) as shown in its proper position just under cotter key or "E" ring (indicated by dotted lines) (F) and reassemble. Repeat procedure of reading pressure and add additional washer if necessary.



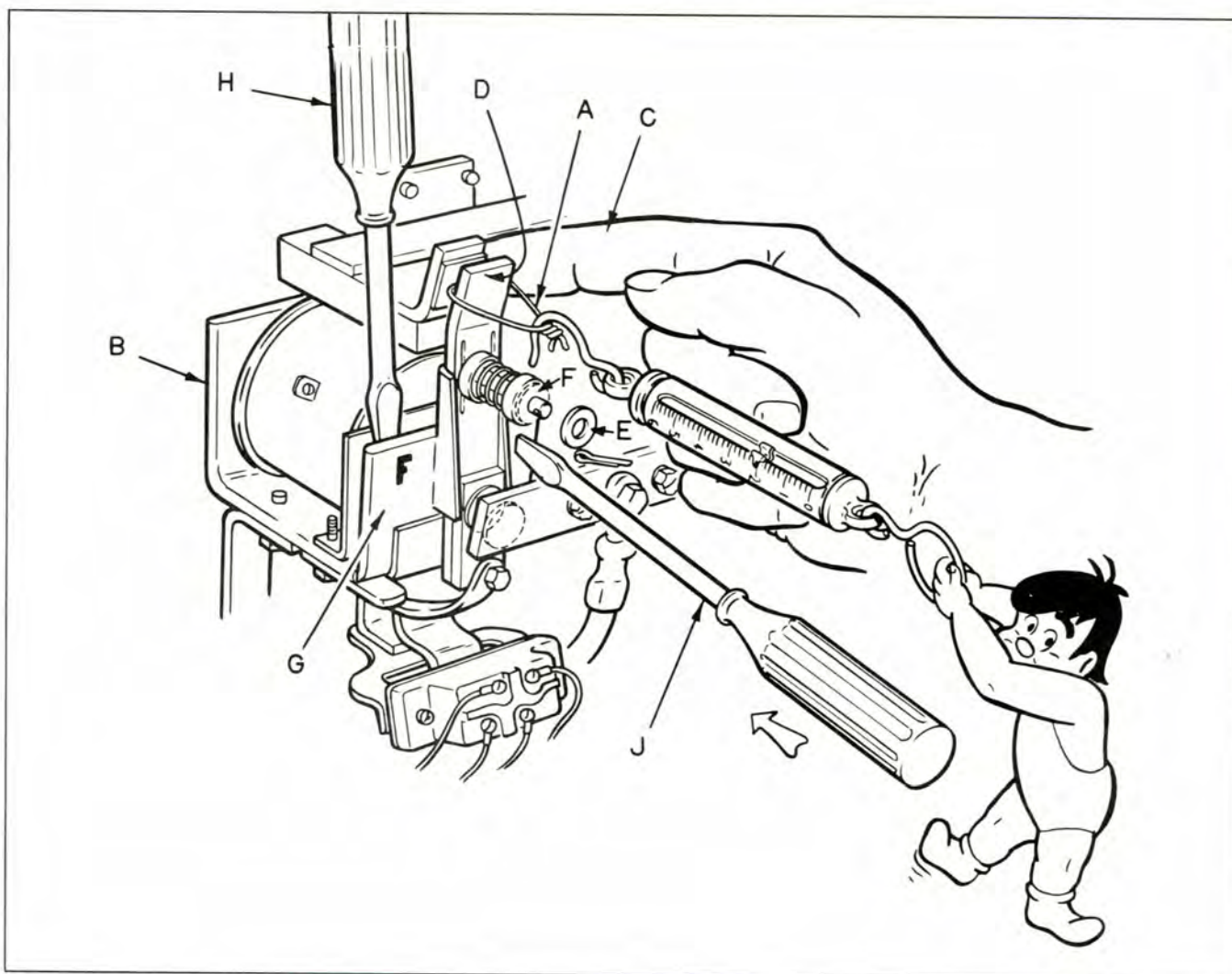


Plate 9697. Typical Spring Adjustments

F-R Spring Tension Adjustments

The adjustment of F & R (Plate 9697) has a slightly different approach and set-up.

The change in set-up is due to the F & R contactors having both normally open and normally closed tips. We must then block the armature plate (G) at a mid point to be sure both sets of tips (normally open and normally closed) are in an open position so the initial contact tip pressure can be read correctly. To accomplish this we utilize two screwdrivers (H & J). Screwdriver H to limit action of armature plate (G) at a mid point and screwdriver (J) to hold armature in mid position. Insert tag wire (A) at a vertical mid point on the tip surface and attach spring tension gage of either type being sure it is held at a right angle to surface (B).

Using index finger placed lightly in position

(C) to detect slightest movement of normally open tip (D) read scale when tip first begins to re-seat on its stop after being slightly moved away from stop. Proper spring tension is listed in specifications in front of this manual under CONTACTORS.

If pressure is less than minimum, add a plain 1/4" flat washer (E) as shown in its proper position just under cotter key (indicated by dotted lines) (F), and reassemble. Repeat procedure of reading pressure and add additional washers if necessary.

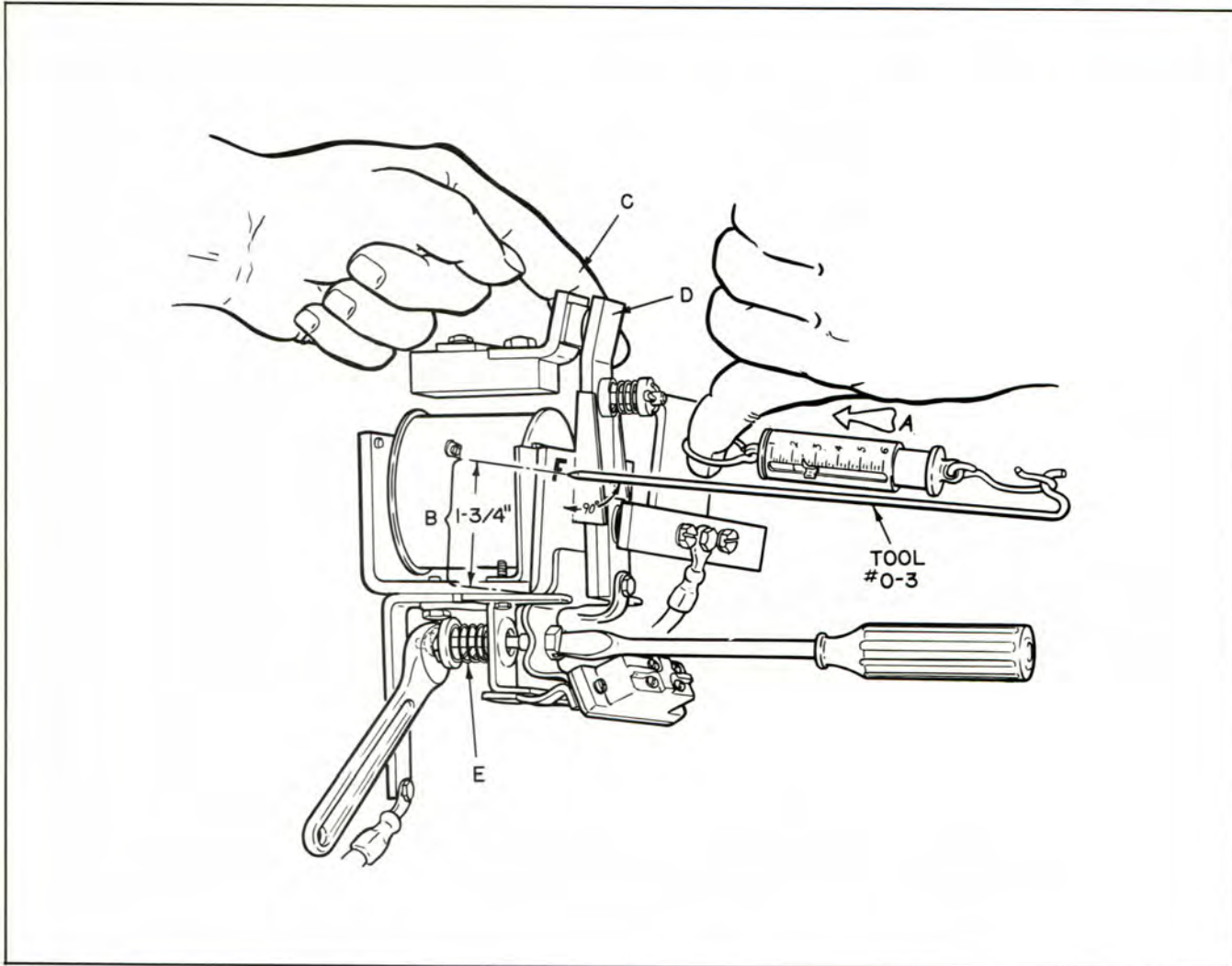


Plate 9698. Typical Armature Adjustment

Armature Spring Pressure Adjustment

Depending upon type of spring tension gage used, follow either Plate 9698 or 9699. Proper spring tension is 32 - 38 oz. on all contactors.

A push action (A) (Plate 9698) from the spring tension gage is utilized here to check pressure.

With the contactor in its normal open position, place spring tension gage and tool # 0-3, Plate 9698 at a point 1 3/4" up from pivot point (B). Use index finger (C) to again detect slightest movement of normally open tip (D). Read scale when armature first begins to contact stop after being moved away slightly. If high or low, adjustment can be made through varying tension of spring (E) to bring to proper setting.

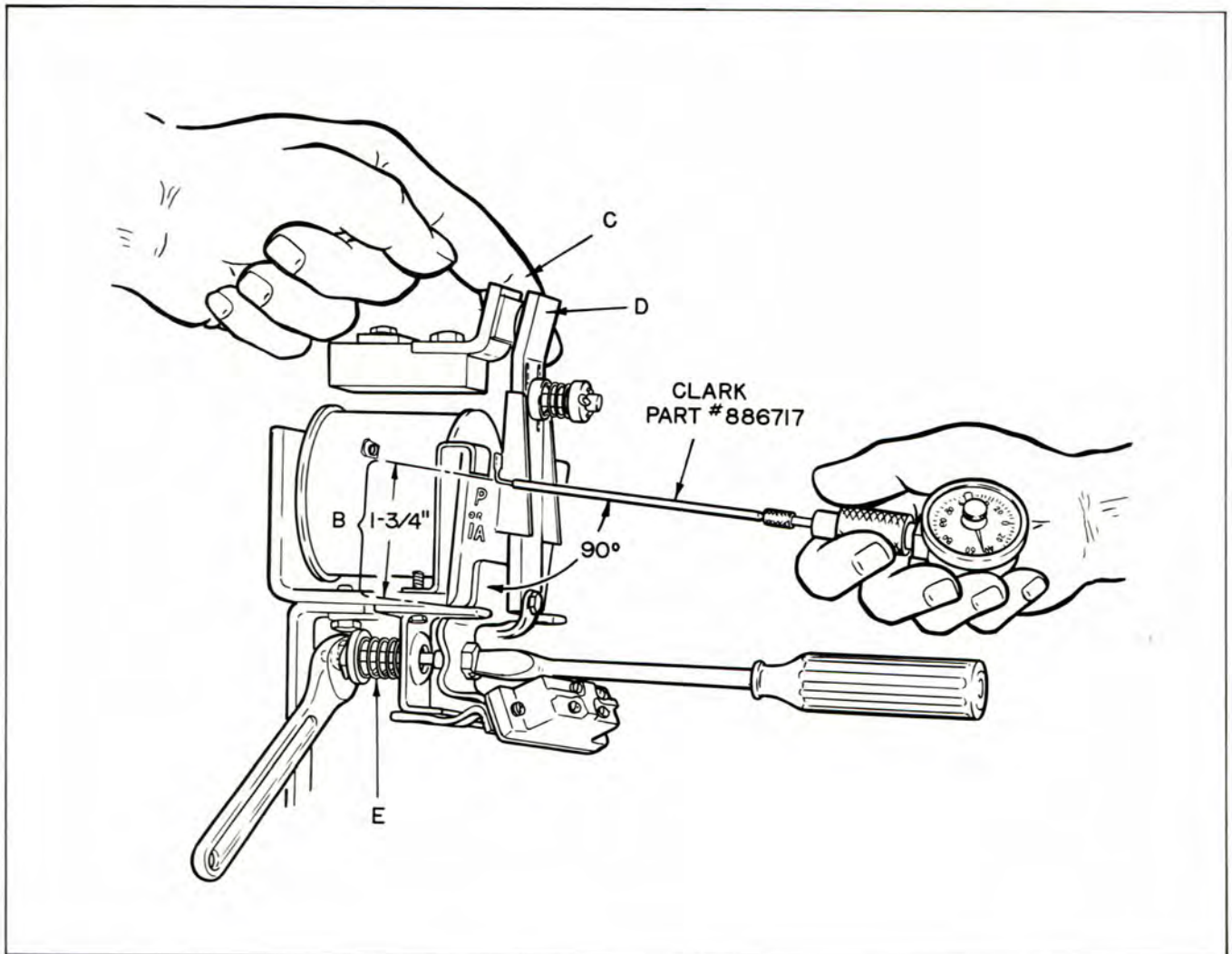


Plate 9699. Typical Armature Adjustment

Armature Spring Pressure Adjustment (Cont.)

bring to proper setting.

Plate 9699 merely shows use of a different type of spring tension gage. Your procedure, however, is the same. But for your convenience we will repeat this procedure.

Proper spring tension is 32 - 38 oz. for all contactors.

A push action (Plate 9699) from the spring tension gage is utilized here to check pressure.

With the contactor in its normal open position, place spring tension gage at a point  $1\frac{3}{4}$ " up from pivot point (B). Use index finger (C) to again detect slightest movement of normally open tip (D). Read scale when armature first begins to contact stop after being moved away slightly. If high or low, adjustment can be made through varying tension of spring (E) to

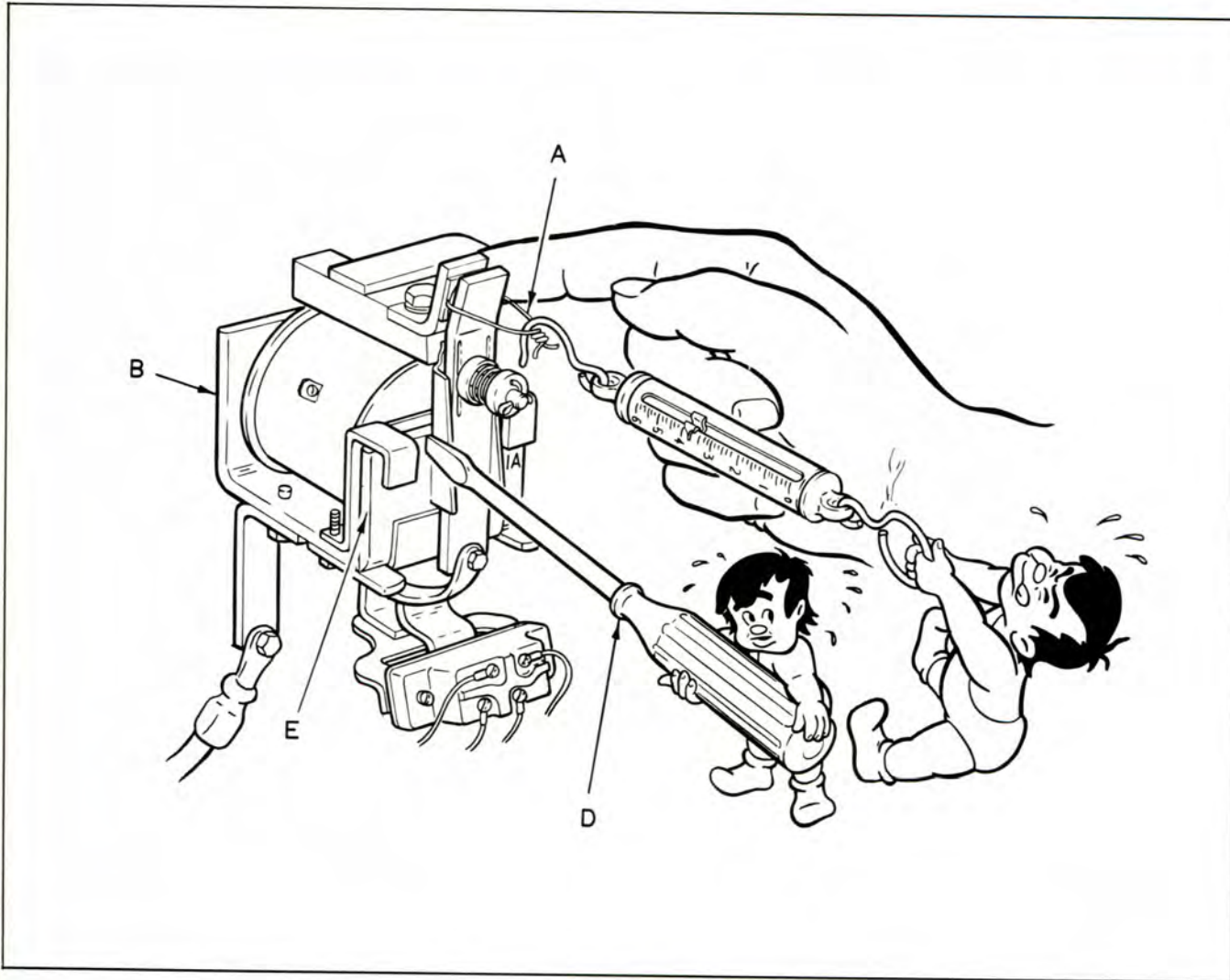


Plate 9700. Typical Spring Check

Final Normally Open Contact Tip Pressure

Follow the one procedure explained and illustrated above for all contactors (1A-P-F & R). See Plate 9700.

With tag wire (A) positioned at a mid point vertically on the tip itself and spring tension gauge held at a right angle to surface (B), seal the armature plate (E)...and while keeping sealed with a screwdriver (D)...read spring tension gauge when tips first begin to re-seat after being slightly separated.  
tension for machine serial

Proper spring tension is listed in specifications in the front of this manual under CONTACTORS.

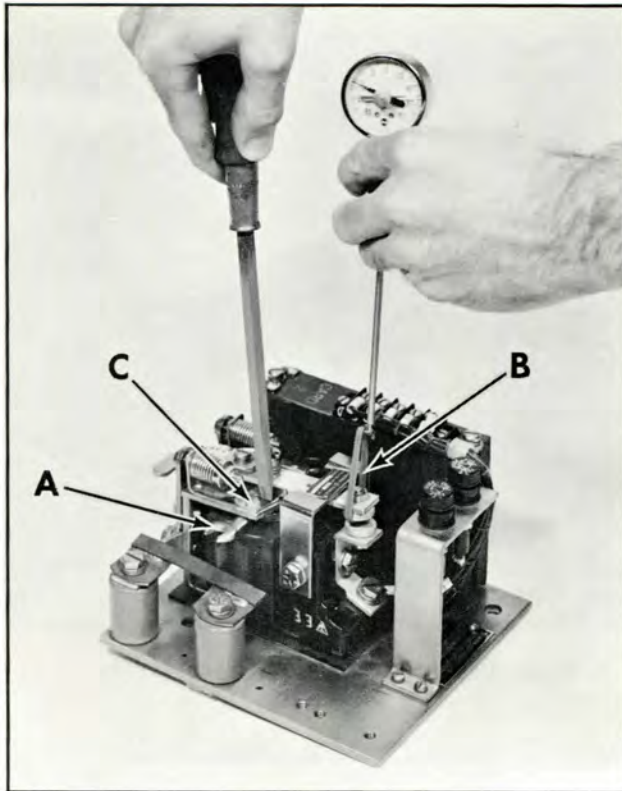


Plate 10600. Typical Initial Spring Pressure

FIELD WEAKENING CONTACTOR ADJUSTMENT:

Initial Spring Pressure (Plate 10600):

1. Place a small wrench between the armature and armature plate (A).
2. Hook a gauge to the contactor tip with a tag wire (B).
3. Push the armature plate down with a screw driver and hold (C).
4. Now....pull up on the gauge and take your reading when it first moves up.
5. This initial pressure should be between 40-48 oz. If not, adjust tension by adding a washer as shown in Plate 10601.

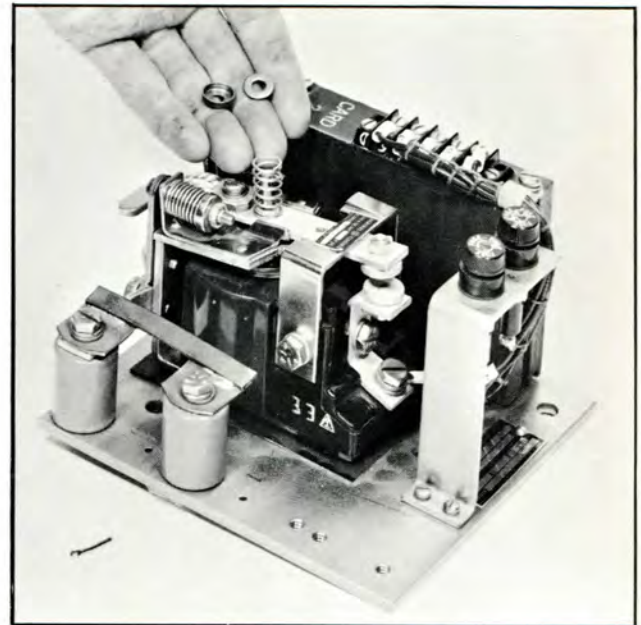


Plate 10601. Typical Spring Pressure Adjustment

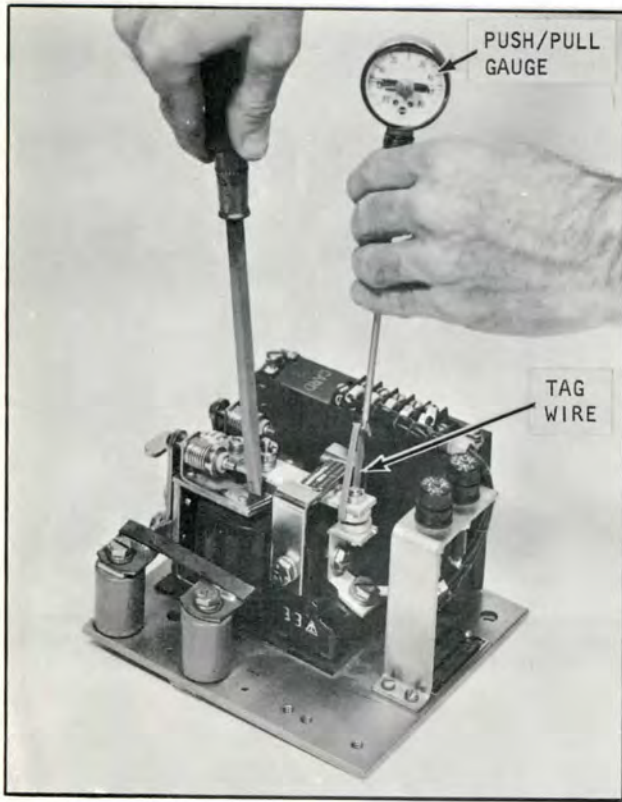


Plate 10602. Typical Final Spring Pressure

Final Spring Pressure (Plate 10602):

1. Attach gauge to contactor tip with a tag wire.
2. Push down on armature plate with screw driver and hold.
3. Take your \*reading when the tip first moves up.
4. No adjustment should be necessary once initial pressure is set properly.

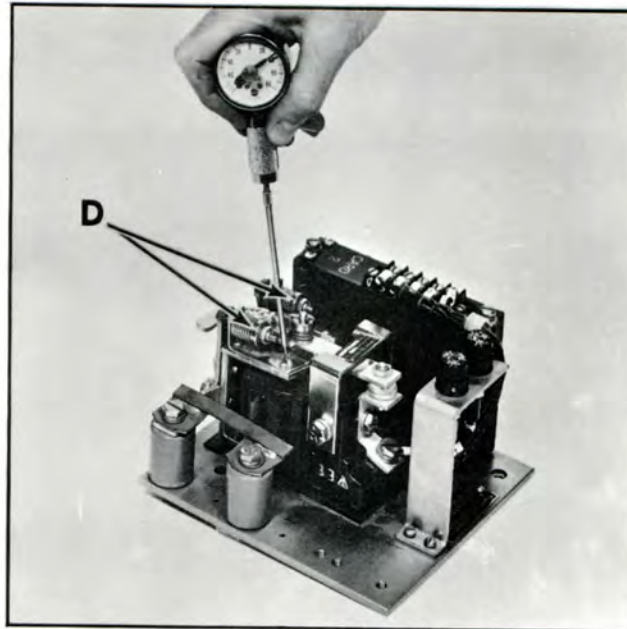


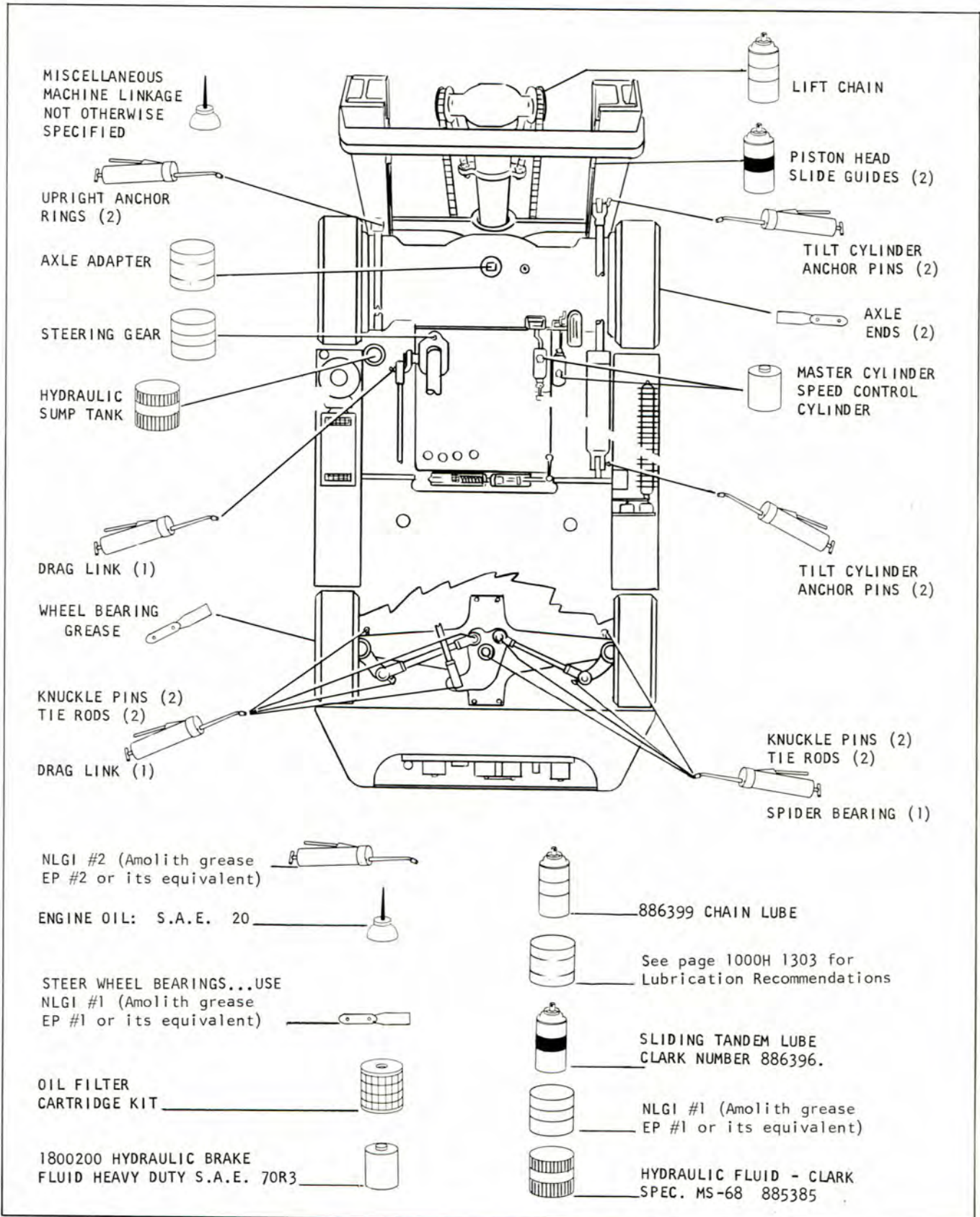
Plate 10603. Typical Armature Spring Pressure

Armature Spring Pressure (Plate 10603):

1. With a spring gauge, push down on the armature plate.
2. Take your reading when the plate first moves down.
3. If \*pressure is not right, make adjustments at nuts (D) so that the same amount of threads is shown on each bolt.

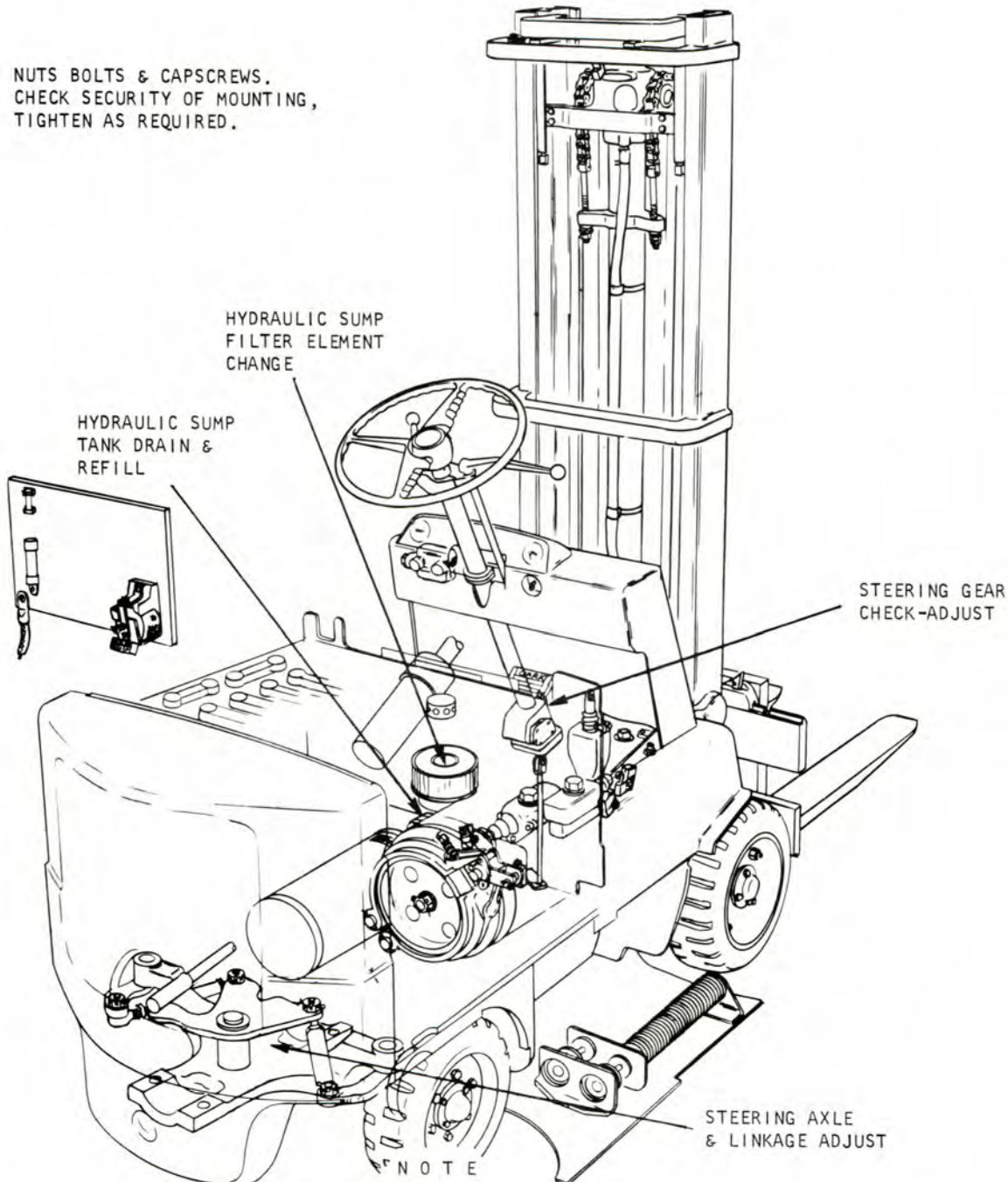
\*  
Final Spring Pressure: 45-56 oz.

Armature Spring Pressure: 32-38 oz.



500 HOURS

NUTS BOLTS & CAPSCREWS.  
CHECK SECURITY OF MOUNTING,  
TIGHTEN AS REQUIRED.



AFTER EACH 500 HOURS OF OPERATION, PERFORM THE ABOVE SERVICES IN ADDITION TO THE ONES LISTED ON THE 8 HOUR AND 100 HOUR LUBRICATION AND PREVENTIVE MAINTENANCE ILLUSTRATIONS.

Plate 7402. Lubrication and Preventive Maintenance Illustration



**DRAIN SUMP TANK AND CLEAN  
SUMP TANK STRAINER**

1. Lower upright and turn switch key to "off" position.
2. Disconnect the battery at the receptacle and remove the battery from the vehicle.
3. Place a shallow container (Capacity should be approximately 4 gallons) beneath the sump tank and remove the drain plug located on the bottom of the tank.
4. Allow fluid to "completely" drain.
5. Disconnect the suction hose from the strainer assembly, and remove the four nuts and lockwashers that retain the strainer to the sump tank. See Plates 5328 and 7489. Remove the strainer assembly from the tank.

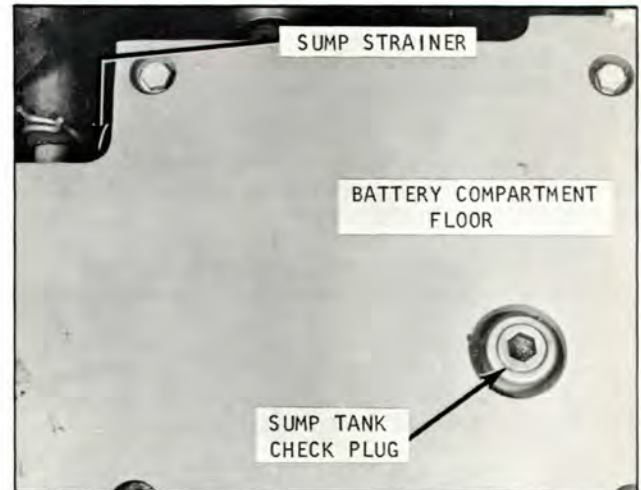


Plate 7489. Sump Tank Check Plug



Plate 5328. Hydraulic Fluid Strainer

6. Remove the sump tank check plug and flush the tank by pouring about 2 quarts of clean hydraulic fluid thru the check plug opening.
7. Disassemble the strainer assembly and wash all metal parts in a Stoddard Type cleaning solvent. Dry the components with filtered compressed air.
8. Discard all gaskets and seals and replace with new upon reassembly of the strainer.
9. Install the strainer assembly in the sump tank and tighten the retaining nuts.

10. Install the suction hose and securely tighten clamps so the connections will be air tight.

11. Replace the drain plug and fill sump tank to within 1 1/2" of the top. Use Clark Specifications MS 68 Hydraulic fluid.

12. Connect the battery to the vehicle receptacle and operate the hydraulic cylinders for a short period of time. Then, check system for any possible leaks and correct where necessary.

**CAUTION**

DO NOT OPERATE HYDRAULIC PUMP WHILE SUMP TANK IS EMPTY AS DAMAGE TO THE HYDRAULIC PUMP WILL RESULT.

13. Recheck fluid level and fill if necessary to within 1 1/2" of the top.

14. Replace check plug and install battery in its compartment. Be sure all hood panels are in place and see that the drain oil container has been removed from beneath the sump tank before moving the machine.

STEERING GEAR

Steering gear adjustments must be made in the following manner (see Plates 6636 and 6637).

Always check worm bearing thrust adjustment, and adjust if necessary, before making sector gear lash adjustment.

Before making above adjustments, the following preliminary operations are necessary.

1. Disconnect steering drag link from pitman arm. Note relative position of drag link parts when disconnecting link so the parts may be re-assembled correctly.
2. Check lubricant level in steering gear housing. If low, add enough lubricant to bring level up to filler plug hole. (Use NLGI #1 Amolith grease EP #1 or its equivalent).
3. Tighten steering gear housing to frame side member bolts, see Plate 6636.
4. Determine straight-ahead position of steering mechanism by turning steering wheel to extreme right.

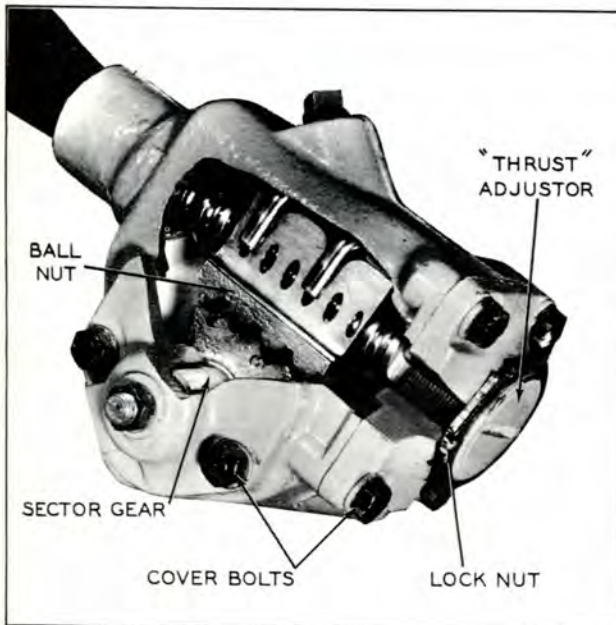


Plate 6636. Steering Gear Thrust Adjustment (Worm Bearings)

CAUTION

APPROACH EXTREME ENDS CAUTIOUSLY; WORM BALL NUT MUST NOT STRIKE ENDS WITH ANY DEGREE OF FORCE.

Then turn to extreme left, counting the exact number of turns from right to left end. Turn wheel back one-half number of wheel turns. Mark wheel with respect to steering column so center position may readily be found during adjustment procedures.

Worm Bearing THRUST Adjustment: Refer to Plate 6636 and proceed as follows:

1. Check tightness of cover bolts, see Plate 6636. Loosen lock nut and turn lash adjuster screw (Plate 6637) counterclockwise a few turns to provide clearance between sector gear and worm ball nut.

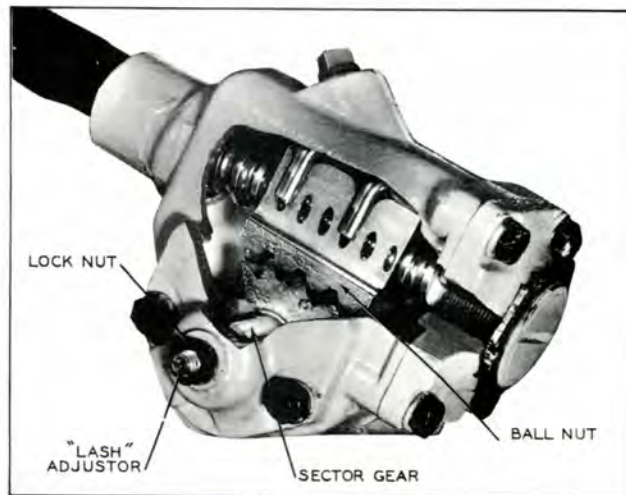


Plate 6637. Steering Gear Lash Adjustment (Sector Gear)

2. Turn steering wheel GENTLY to one extreme end. Turn wheel back one full turn. With spring scale on spoke of wheel, measure pull required to KEEP WHEEL MOVING. Pull on scale should be made at right angles to wheel spoke. If pull is within 1 1/2 to 2 pounds, proceed to lash adjustment in the following paragraphs. If pull is not within 1 1/2 to 2 pounds, adjust worm bearings. The pitman shaft adjustment must be made if worm bearing check is accomplished, or if the worm bearings are adjusted.

3. If it is necessary to adjust the worm bearings, loosen lock nut and then turn worm bearing adjuster nut clockwise until all end play is removed, see Plate 6636. Using



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spring scale, as directed in Step 2, check pull and readjust as necessary; then tighten lock nut securely.

Sector Gear Lash Adjustment: Refer to Plate 6637 and proceed as follows:

1. Steering Gear Mechanism must be in straight ahead position as previously explained.
2. Turn lash adjuster screw clockwise to remove all lash between gear teeth. Tighten adjuster screw lock nut. Position spring scale on steering wheel so pull may be made at right angles to wheel spoke.
3. Measure pull while wheel is TURNED THROUGH CENTER POSITION. Readjust if reading is not within 2 1/2 to 3 pounds.
4. Tighten adjuster screw lock nut, check pull again.
5. After adjustments are made, install drag link on pitman arm.

#### N O T E

If steering linkage adjustment is necessary do not install drag link to pitman arm.

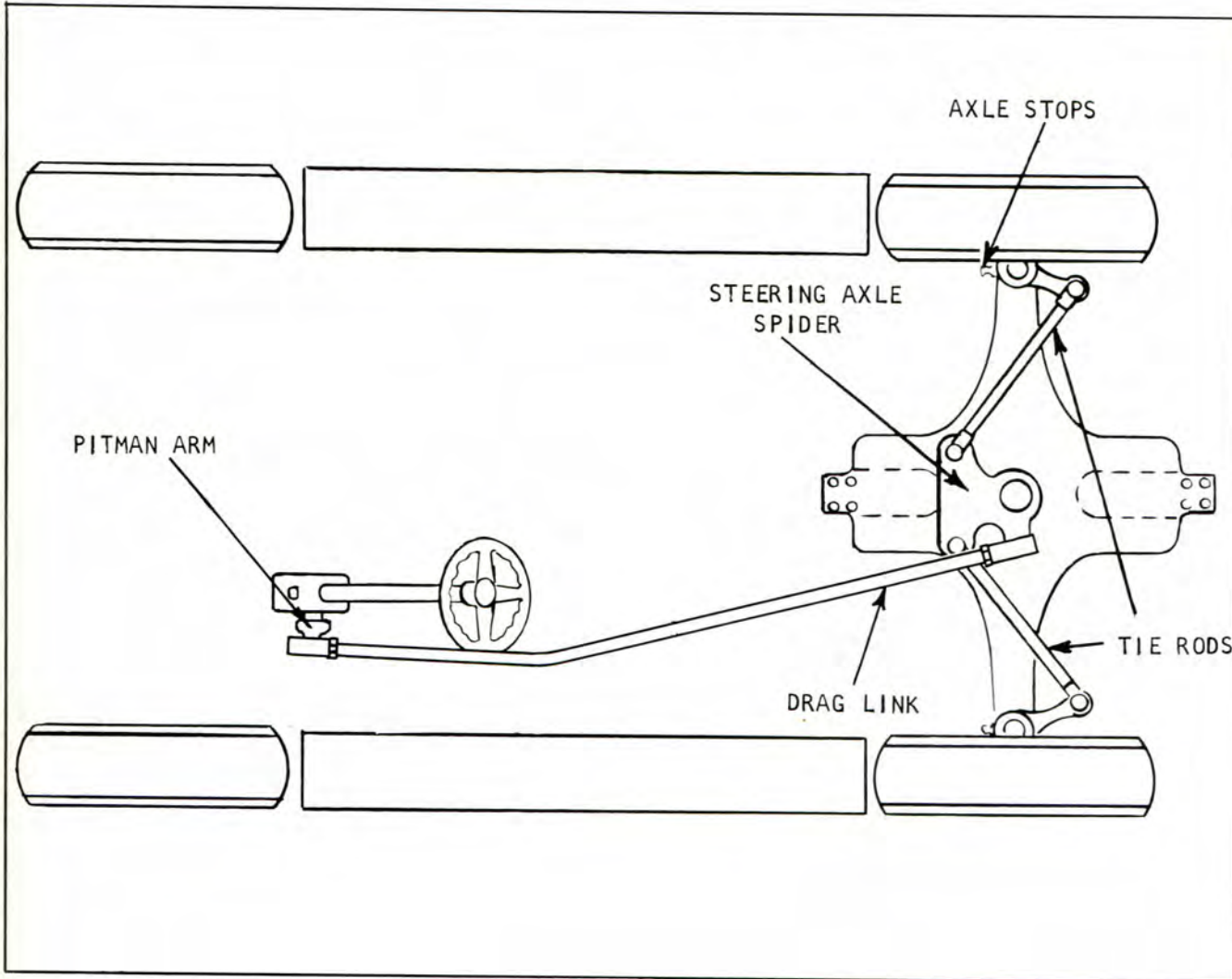


Plate 7419. Steering Linkage

STEERING AXLE AND LINKAGE ADJUSTMENTS

1. Raise the steering wheels far enough to clear the floor.

**WARNING**

AFTER RAISING THE VEHICLE AND PRIOR TO ANY ADJUSTMENT CHECKS, PLACE HEAVY "BLOCKING" UNDER THE FRAME SO THAT THE VEHICLE CANNOT BECOME LOWERED BY ACCIDENT, THEREBY, CAUSING PERSONAL INJURY OR COSTLY DAMAGE.

"BLOCKING" MUST BE OF ADEQUATE STRENGTH TO SUPPORT THE WEIGHT OF THE VEHICLE.

2. The steering wheels should track square with the drive wheels with no toe-in or toe-out. If adjustment is necessary loosen the lock nuts at the tie rod ends and turn each tie rod in a manner so they will be the same length when the correct adjustment is obtained. Tighten tie rod lock nuts to secure this adjustment.

3. Disconnect the drag link socket from the steering pitman arm noting the relative position of the socket parts so they may be re-installed correctly after checking wheels for correct turning geometry.

4. Check wheels for correct turning geometry by turning the wheels all the way for a left turn - this should allow the left wheel to attain an angle of



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## LUBRICATION AND PREVENTIVE MAINTENANCE

80 degrees to the frame. If an adjustment is necessary, the axle stop on the left side should be turned in or out whichever is necessary to achieve the correct angle. Repeat this procedure in a right turn with the opposite wheel and adjust the right axle stop as required.

5. Turn Steering wheels to straight ahead position.

6. Determine center position of steering gear. (Refer to Steering Gear adjustments for correct procedure).

7. Adjust drag link socket so that the grease fitting lines up with the centerline of the pitman arm ball stud and secure with lock nut and cotter pin.

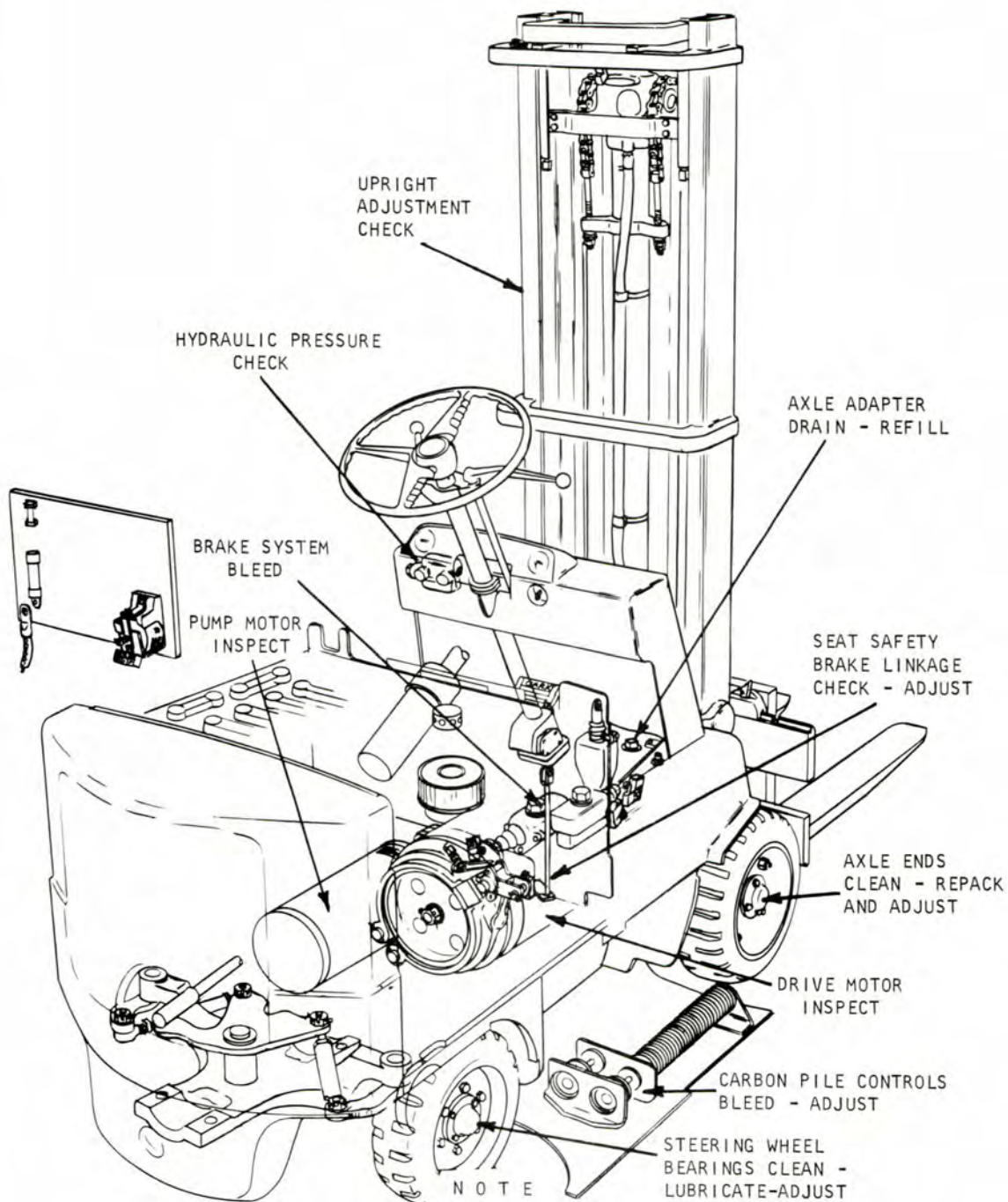
8. Turn the handwheel until wheels are in straight ahead position. Remove handwheel and replace on steering column with the center spoke aligned minus or plus 10 degrees with the center line of the machine, the center spoke pointing back.

### NOTE

CHECK STEERING GEAR SUPPORT BOLTS FOR SECURITY OF MOUNTING. TIGHTEN MOUNTING BOLTS AND CLAMP BOLTS TO 90 FOOT POUNDS TORQUE.

9. Remove blocking from under frame and lower machine to the floor.

1000 HOURS



AFTER EACH 1000 HOURS OF OPERATION, PERFORM THE ABOVE SERVICES IN ADDITION TO THE ONES LISTED ON THE 8 HOUR, 100 HOUR AND 500 HOUR LUBRICATION AND PREVENTIVE MAINTENANCE ILLUSTRATIONS.

Plate 7403. Lubrication and Preventive Maintenance Illustration

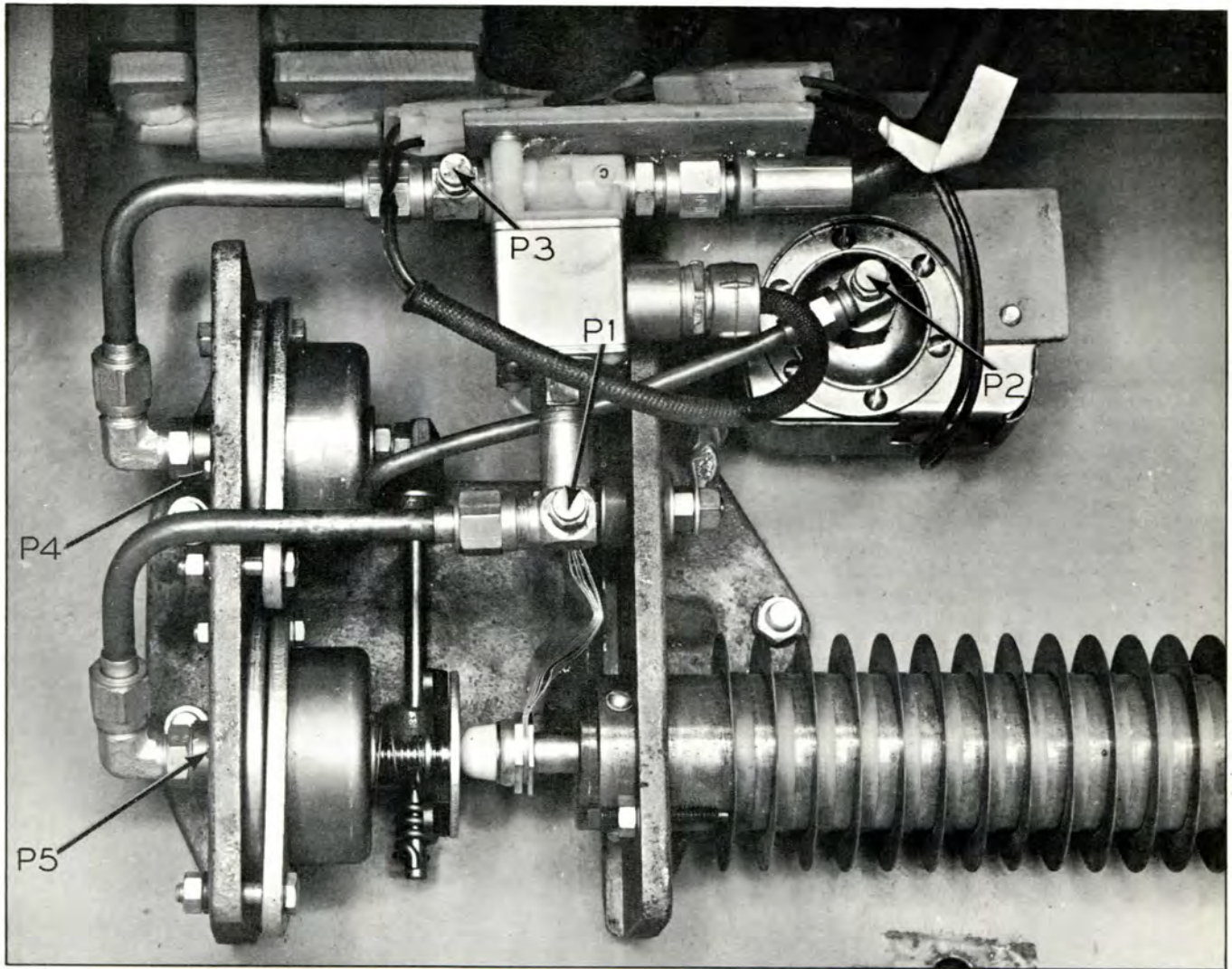


Plate 7408. Carbon Pile Controls

**CARBON PILE CONTROL BLEEDING PROCEDURE**  
(ECLS Model Machines)

To properly bleed the system it is recommended that a pressure bleeder be connected to the speed control cylinder. It will be necessary to remove the cylinder mounting pins and invert the cylinder (this will allow any air trapped beneath the primary cup to escape during bleeding). The cylinder plunger should be wired to the cylinder so it cannot accidentally be removed from the cylinder when it is in the inverted position. It will be necessary to plug the cylinder vent (see Plate 5334) by a suitable means. One method used is to place two flat section

"O" rings in the fill cap cavity and screw the adapter plug from the pressure bleeder down against "O" rings to seal off the vent orifice. A pressure bleeder containing about two quarts of S.A.E. 70R3 heavy duty brake fluid should then be pressurized to approximately 5 to 10 P.S.I. Turn on bleeder hose valve and proceed in the following sequence. (The reference key letters are shown on Plate 7408.

1. Open bleeder valve P1 and allow fluid to flow until free of air. Shut-off bleeder valve. Repeat this procedure with bleeder valve P2, P3, P4 and P5 in sequence.
2. Remount speed control cylinder to the machine.

3. Close pressure bleeder hose valve and open speed control cylinder level plug (see Plate 5334). Allow fluid to escape until it reaches this level. Tighten level plug.

4. Remove pressure bleeder adapter from cylinder. Remove "O" rings if used to block vent orifice. (This vent must be open for proper operation of the cylinder). Install cylinder cap.

**ALTERNATE BLEEDING PROCEDURE**

Fill control cylinder with S.A.E. 70R3 heavy duty brake fluid. Replace cap, depress accelerator pedal and hold. Open bleeder valve P1 and allow flow until almost stopped. (CAUTION: CLOSE BLEEDER VALVE WHILE FLUID IS STILL FLOWING TO PREVENT AIR FROM BEING DRAWN BACK INTO SYSTEM). Repeat this procedure with bleeder valve P2, P3, P4, and P5 sequence. Allow about one minute between pedal strokes to allow fluid to return to control cylinder. Check level of fluid in cylinder periodically and replenish as necessary. It may be necessary to repeat the complete bleeding sequence several times to expel air in the system. Maintain fluid to the height of level plug (Plate 5334).

**WARNING**

DISCONNECT VEHICLE BATTERY AT THE RECEPTACLE TO PREVENT MOVEMENT OF THE MACHINE DURING SPEED CYLINDER BLEEDING.

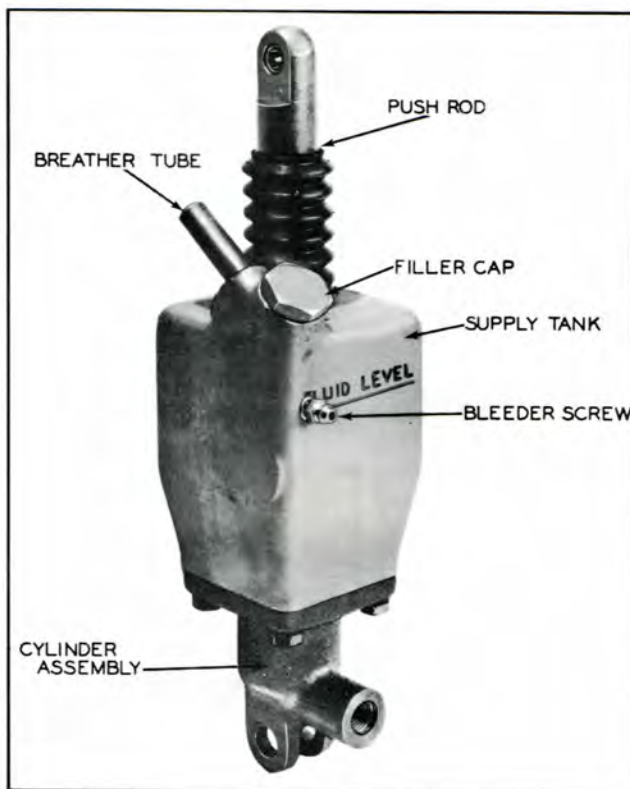


Plate 5334. Speed Control Cylinder



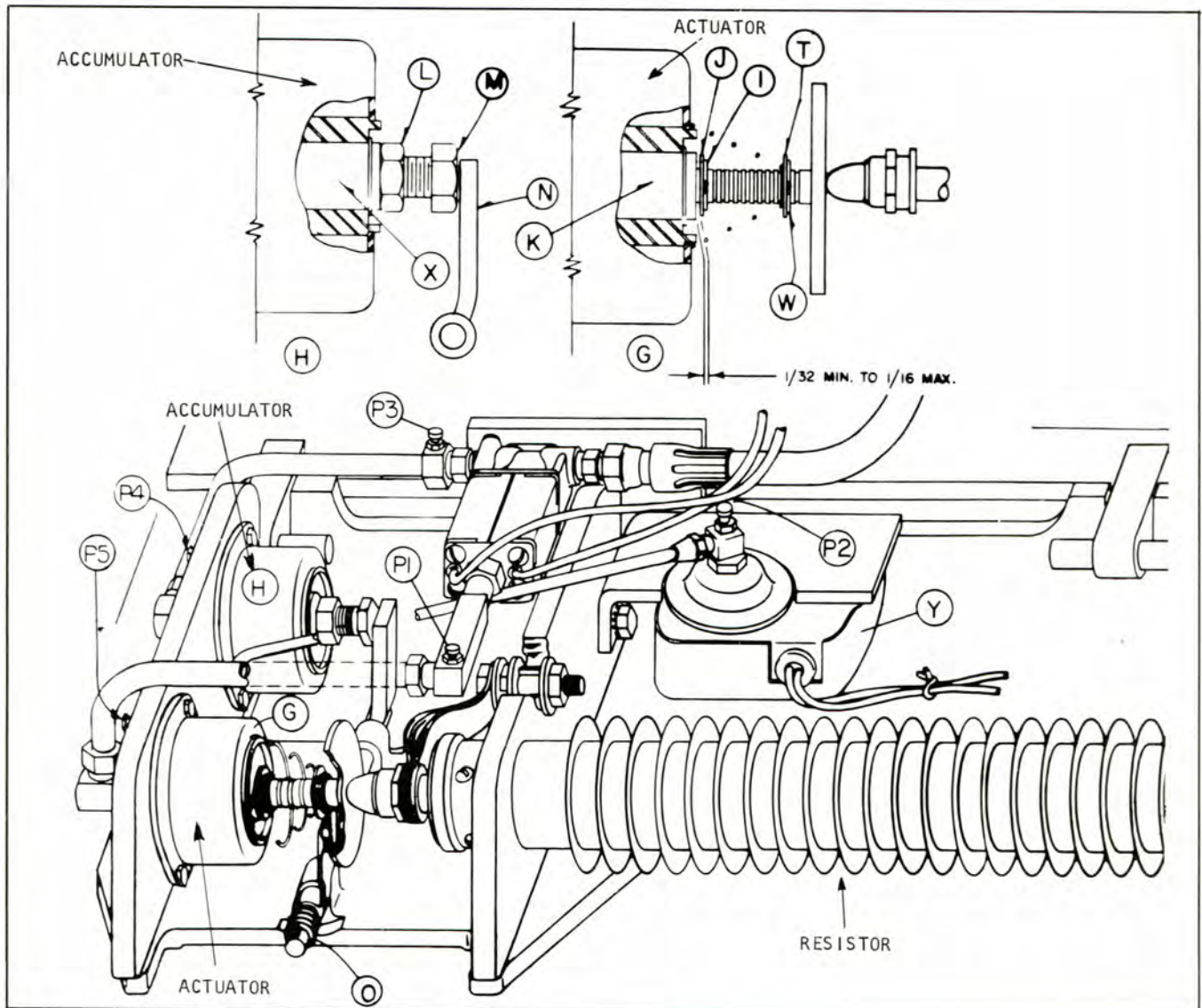


Plate 7411. Carbon Pile Resistor, Accumulator and Actuator

**CARBON PILE ACCUMULATOR AND ACTUATOR ADJUSTMENTS.** (Key letters on plate 7411).

**ACCUMULATOR ADJUSTMENTS**

Loosen nut "L". (During adjustment prevent piston rod "X" from turning more than necessary by placing wrench on screw "M" when loosening or tightening nut "L" or screw "M"). Adjust screw "M" to obtain 1/64 to 1/32 inch of free play between screw and arm "N". This adjustment must be made when the resistor is hot.

**ACTUATOR CREEP SPEED ADJUSTMENT**

Remove snap ring "W" from groove. Reinsert snap ring into groove closer to

actuator by compressing spring to increase creep speed. Reinsert snap ring into groove farther away from actuator to decrease creep speed.

To check adjustment - with the key switch in the "on" position, driver's seat occupied and directional control in selected direction of travel, depress accelerator carefully to the position where the 1st point of power switch just actuates - hold pedal at this level. (1st point of power switch operation is outlined on page 100H 475). As soon as this switch actuates the carbon pile control is in creep speed. If the creep speed adjustment is correct the truck should just move (when the resistor is cold) with no load on the forks. When the resistor is hot



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## LUBRICATION AND PREVENTIVE MAINTENANCE

the truck should just move with a rated load on forks.

### C A U T I O N

A CORRECT CREEP SPEED ADJUSTMENT IS IMPOR-  
TANT TO MAINTAIN A MINIMUM FORCE OF 1/2  
POUND AGAINST THE CARBON PILE PLUNGER TO  
PREVENT MOVEMENT OF THE CARBON DISCS  
RELATIVE TO EACH OTHER, AND THE ASSOCIATED  
ARCING WHICH DAMAGES THE DISCS. THIS MINI-  
MUM SQUEEZE IS MAINTAINED BY THE CREEP  
SPEED SPRING.

### ACTUATOR PLUNGER ADJUSTMENT

Adjust snap ring "I" on actuator shaft  
to maintain 1/32 to 1/16 inch clearance  
between washer "J" and end of piston rod  
"K".

### N O T E

USE EXTRA WASHERS IF NECESSARY FOR ADJUST-  
MENT - KEEP WASHER "J" WHICH IS SUPPLIED  
WITH ACTUATOR - ADJACENT TO SNAP RING  
"I". MAKE THIS ADJUSTMENT WHEN RESISTOR  
IS HOT.



Plate 7562. Typical Drive Motor Assembly

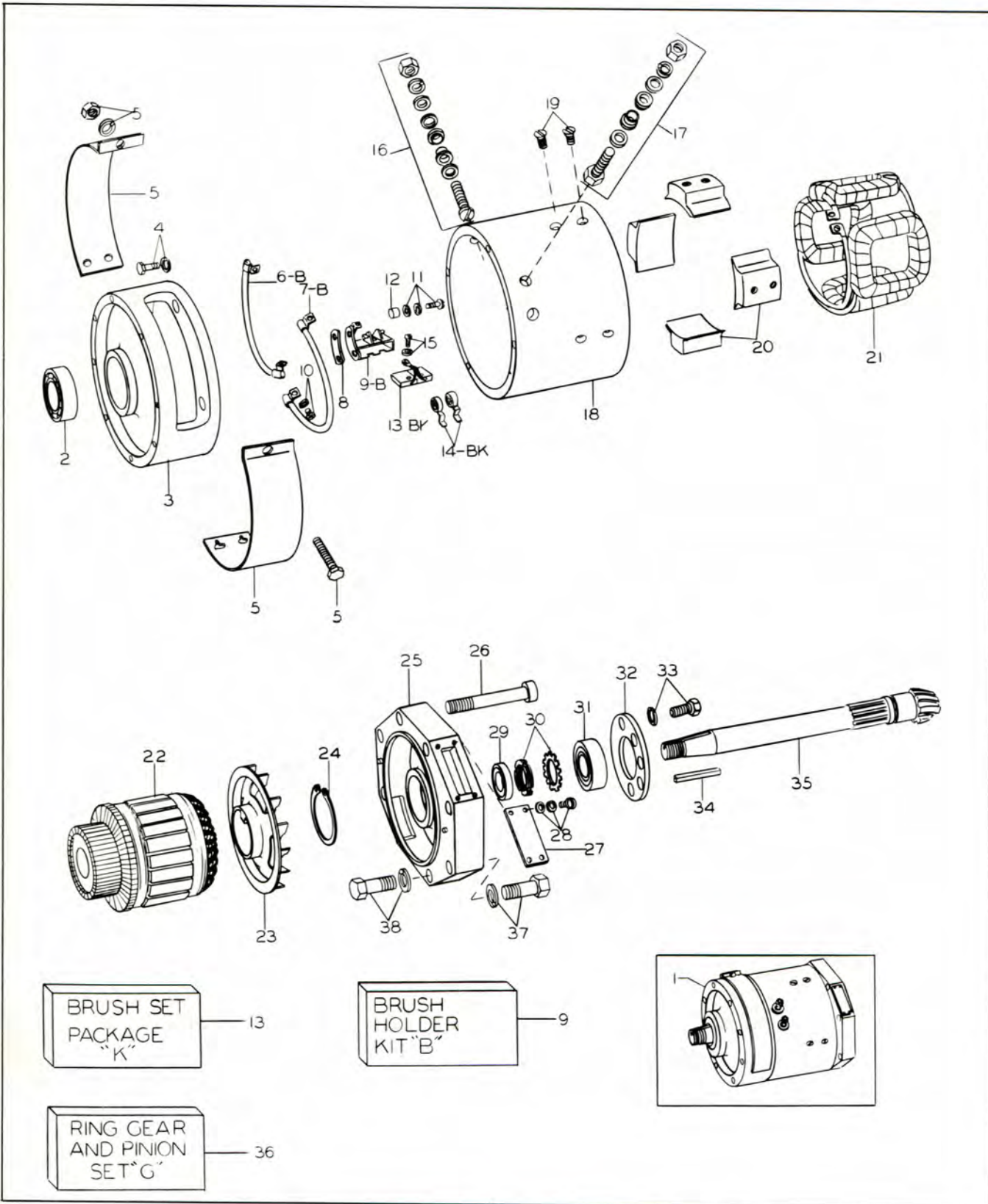


Plate 7491. Typical Drive Motor (Disassembled View)

## MOTOR INSPECTION AND CHECKS

Wiring: Inspect all connecting wires to be sure they are secure. Insulation should not be worn or damaged.

Commutator: If commutator is glazed or dirty clean with a strip of No. 00 sandpaper. Blow out all dirt and grit with compressed air.

## CAUTION

DO NOT USE EMERY CLOTH TO CLEAN COMMUTATOR.

Brushes: The brushes should slide freely in their holders and make full contact on the commutator. Worn brushes (worn beyond half the original length) should be replaced. Badly chipped, broken or oil soaked brushes should also be replaced. Brushes may be wiped with a dry clean cloth to remove loose particles of dirt.

## NOTE

DO NOT CLEAN THE BRUSHES IN ANY KIND OF SOLVENT OR ALLOW THEM TO COME IN CONTACT WITH GREASE OR OIL.

Check brush spring tension with a spring scale. To check reaction type brush springs, hook the scale under the brush spring near the brush and pull on a line parallel with the side of the brush. Take the reading just as the spring leaves the brush. To assist in telling the exact instant that the pressure is relieved, a small strip of paper can be placed under the brush. Pull slightly on the paper and the paper will slip out at the correct instant for reading the spring scale.

If the brush spring tension is too great, the commutator and brushes will wear excessively and result in short life. If the brush spring tension is too low, there will be a loss of efficiency due to poor brush contact.

To change brush spring tension, twist the spring at the holder with long nose pliers.

## CAUTION

DO NOT ALLOW SPRING TO SNAP DOWN ON A BRUSH.

Refer to Specifications for correct brush spring tension.



Plate 6560. Typical Method Checking Brush Spring Tension

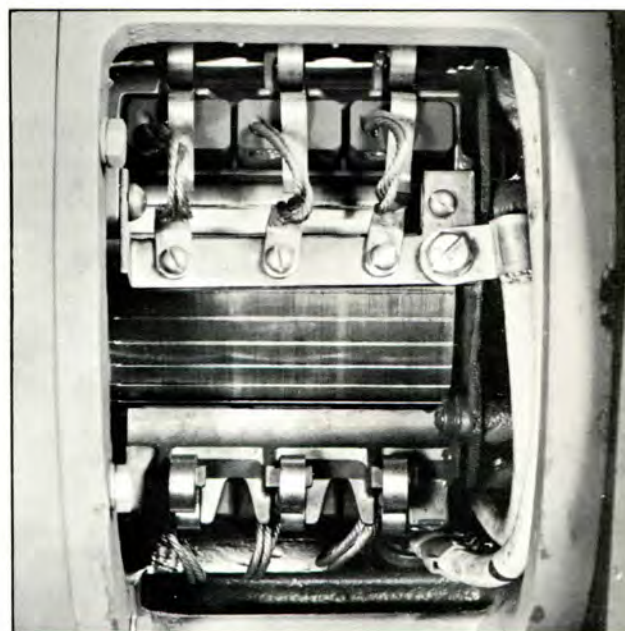


Plate 7564. Typical Motor Brushes

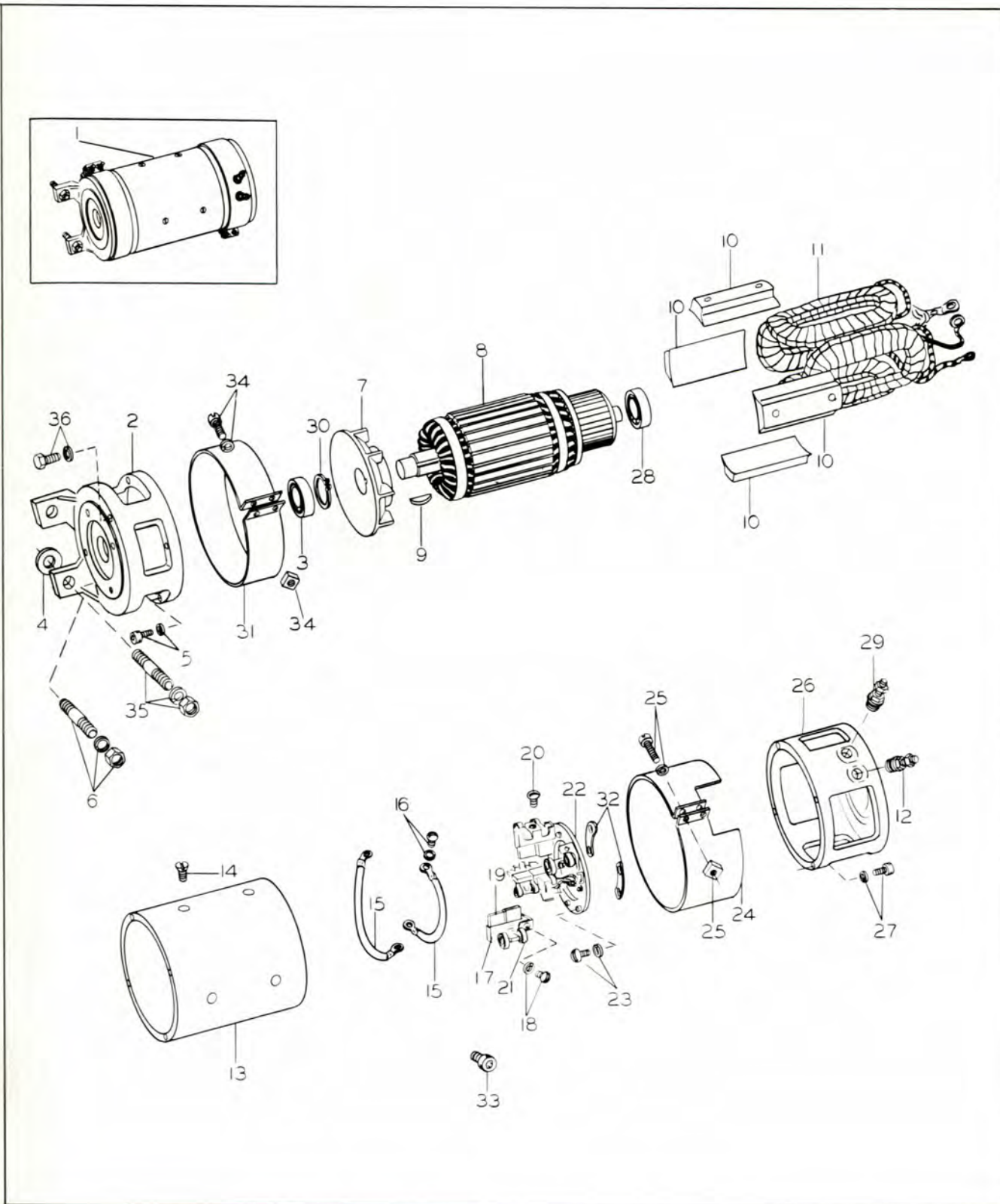


Plate 7563. Typical Pump Drive Motor  
(Refer to preceding page 1000H 673 for Inspection and Checks)



LUBRICATION AND PREVENTIVE MAINTENANCE

CLEAN AND REPACK AXLE ENDS

Every 1000 operating hours remove and re-pack the axle ends with NLGI #1 (Amolith grease #1 or its equivalent).

1. Tilt upright back. Place solid heavy blocks under each upright rail. Tilt upright forward until vertical to the floor. This should allow the drive wheels to clean the floor. Remove drive wheels.

2. Remove hub cap, cotter pin, washer, spindle nut and pull hub assembly from spindle.

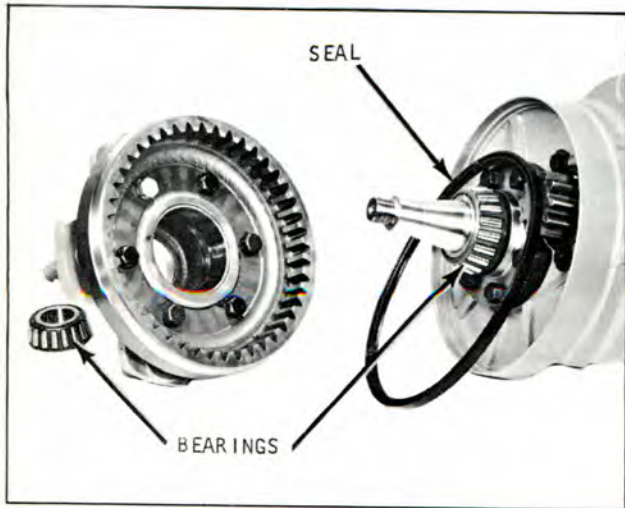


Plate 6892. Axle End Assembly

3. Remove bearings and clean in a Stoddard type cleaning solvent. Sloss bearings up and down in solvent. Remove and tap large side of bearing against a block of wood to dislodge solidified particles of lubricant. Repeat operation until bearings are thoroughly clean. Blow bearings dry with compressed air. Direct air stream across bearing to avoid spinning. Slowly rotate bearing by hand to facilitate drying. Dip bearings in gear oil and wrap in paper until they are to be reinstalled.

4. Clean ring gear, pinion drive shaft, hub assembly, spindle and spindle support.

5. Inspect seal for cuts, scratches and nicks. If is necessary to replace seal if such a condition is found.

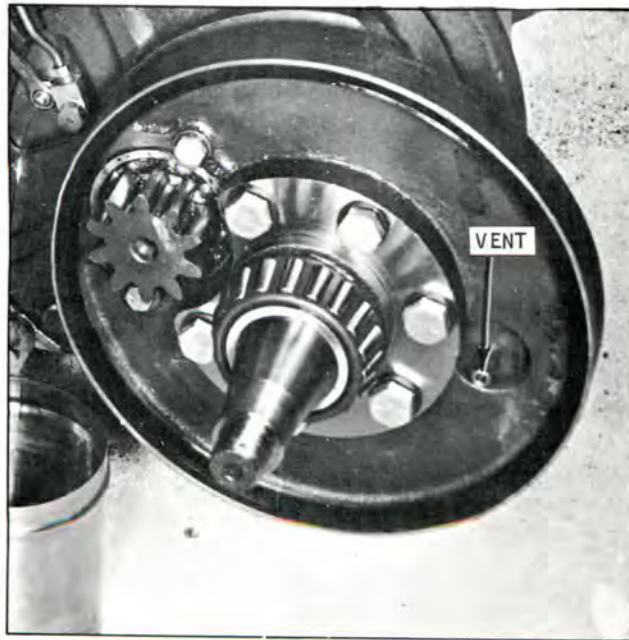


Plate 6893. Axle End Vent

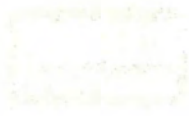
6. Repack each axle end (bearings, spindle, ring gear and pinion) with one pound of NLGI #1 (Amolith grease #1 or its equivalent). Check the axle end vent for obstructions, the vent must be open.

7. Install bearings, seal and hub assembly.

8. Install washer, spindle nut and hub cap.

9. Tilt upright back and remove blocking.





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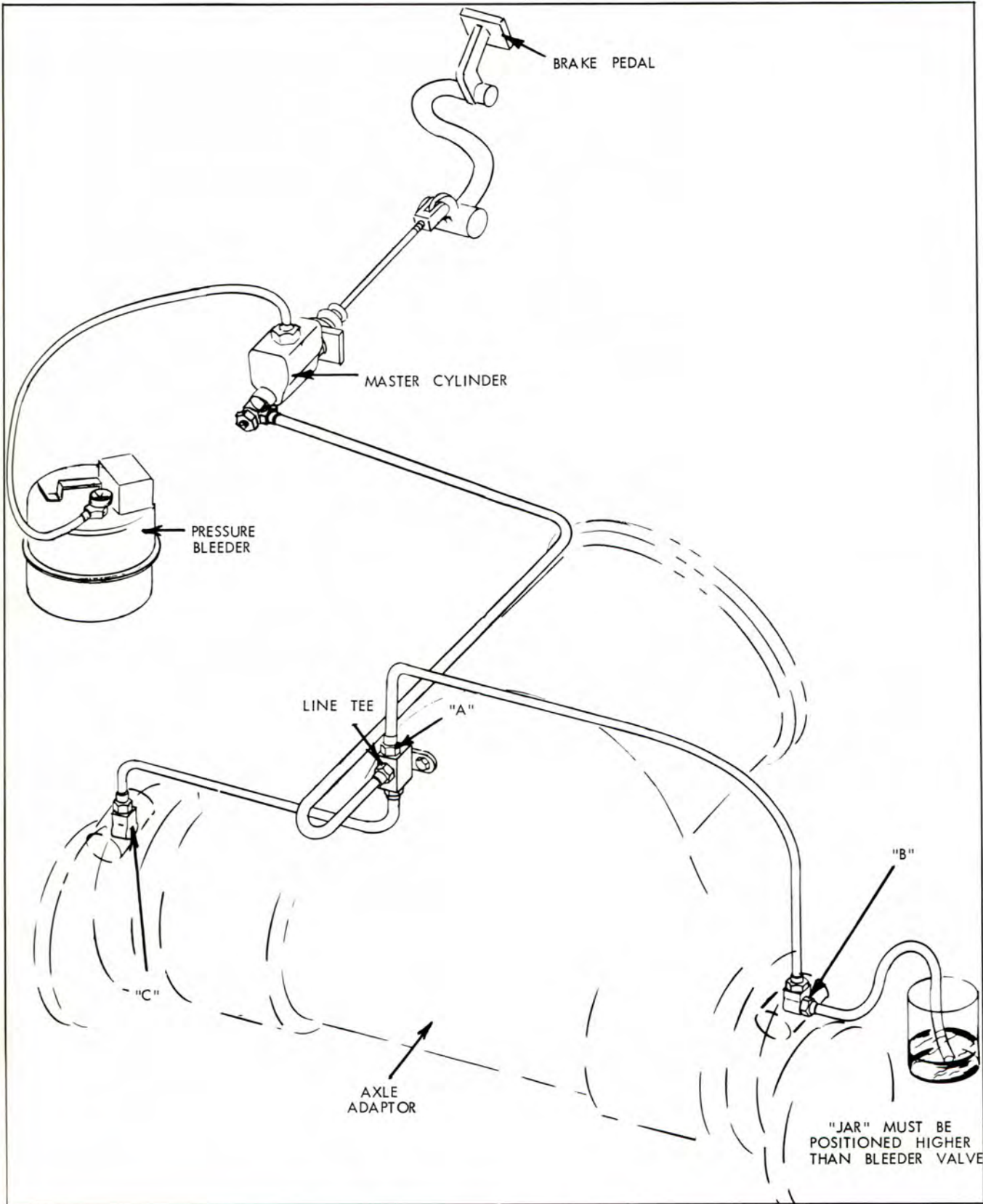


Plate 6883. Bleeding Brake System

1000H 912-1



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## LUBRICATION AND PREVENTIVE MAINTENANCE

### BRAKE BLEEDING PROCEDURE

Proper operation of the hydraulic brake system requires a solid column of fluid without air bubbles at all points in the pressure system. Under certain conditions it becomes necessary to bleed fluid from the system in order to expel air bubbles which have become mixed with the fluid. The necessity of bleeding is indicated by a soft or spongy pedal, or at any time a brake line is removed (or broken) the system must be bled.

Step 1. Tilt upright back. Place solid heavy blocks under each upright rail. Tilt upright forward until vertical to the floor. This should allow the drive wheels to clear the floor. Remove drive wheels.

#### NOTE

MACHINES EQUIPPED WITH PNEUMATIC TIRES,  
DEFLATE TIRES BEFORE REMOVING DRIVE WHEELS  
FROM MACHINE.

Step 2. Check the brake pedal free travel (Refer to Specifications). Clean dirt from around the filler cap of the master cylinder reservoir. Brake fluid should be within 1/4" of the top. With filler cap off the master cylinder, depress and release brake pedal. A small displacement of fluid should be noticed in the cylinder reservoir. If this happens, the brake pedal (upon being released) is returning the master cylinder piston to its normal position to open a master cylinder port. This port must be open. If fluid does not return to the reservoir (when releasing brake pedal), this indicates improper pedal free travel and a pedal adjustment is required.

Step 3. To properly bleed the system it is recommended that a pressure bleeder filled with about two quarts of SAE 70R3 heavy duty brake fluid be connected to the master cylinder reservoir. Pressure bleeder should then be pressurized to approximately 30 P.S.I.

Step 4. Loosen line connection at highest position on "T" block point "A" (Plate 6883) and allow fluid and air to escape. Tighten fitting at this point when escaping fluid is free of air bubbles.

Step 5. Install a bleeder hose on one of the wheel cylinder bleeder screws and submerge the unattached end of the hose in a clean transparent jar containing several inches of brake fluid. NOTE: DURING BLEEDING OF THE WHEEL CYLINDERS THE JAR SHOULD BE ELEVATED TO A POSITION HIGHER THAN THE BLEEDER SCREWS MAKING SURE THAT THE END OF THE HOSE REMAINS SUBMERGED IN THE FLUID AT ALL TIMES. Loosen bleeder screw "B" (Plate 6883) enough to allow fluid and air to escape. Tighten bleeder screw at this point when escaping fluid is free of air bubbles.

Step 6. Install bleeder hose on the remaining bleeder screw and proceed as in step five. After all bleeding has been completed close the pressure bleeder shut-off cock and loosen hose connection at master cylinder to allow pressure to escape. Replace master cylinder cap.

Step 7. Replace drive wheels. (Inflate tires if they are of the pneumatic type).

Step 8. Tilt upright back and remove blocking from under each upright rail.

If a pressure bleeder is unavailable the system may be bled manually by following steps four thru eight. It must be remembered that the brake pedal should be depressed slowly and held to the floor-board until the line connections or bleeder screws are securely tightened. This prevents the possibility of air being drawn into the system during the bleeding operation. Check master cylinder reservoir level periodically during manual bleeding and fill to within 1/4 inch of the top as required.

**BRAKE ADJUSTERS (2ND. DESIGN)**

When the brake system is operating properly, the cam like action of the reaction arm allows self-adjustment for the total thickness of the brake linings, without any noticeable increase in brake pedal free travel. The self-adjustment feature eliminates the need for manual adjustment of the brakes.

When the brake linings become worn beyond their designed limits there will be a noticeable change in the brake pedal effort required to stop the machine or, brakes will become noisy during application. If either of these conditions exist the axle ends should be removed so an inspection of the brake linings can be made to determine their further serviceability.

Before installing new brake linings the adjuster arm mounting bolt torque should be checked with a torque wrench. The bolt should not turn in the backing plate until a minimum of 40 lb. inches or a maximum of 50 lb. inches is reached. See Plate 7198 for correct procedure.

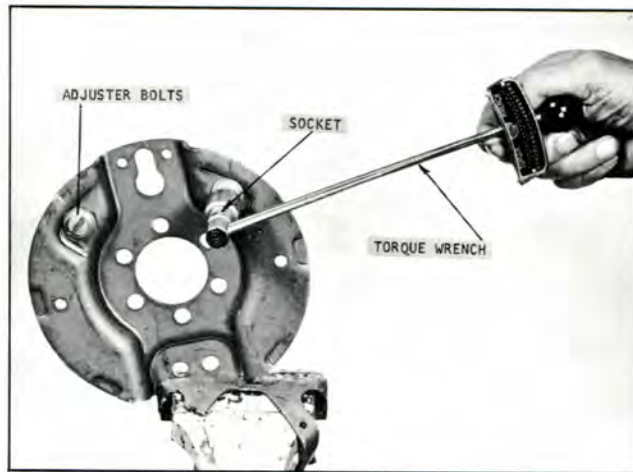


Plate 7198. Checking Adjuster Arm Torque

The backing plate and adjuster arm components must be clean, dry and free from rust when this torque test is made.

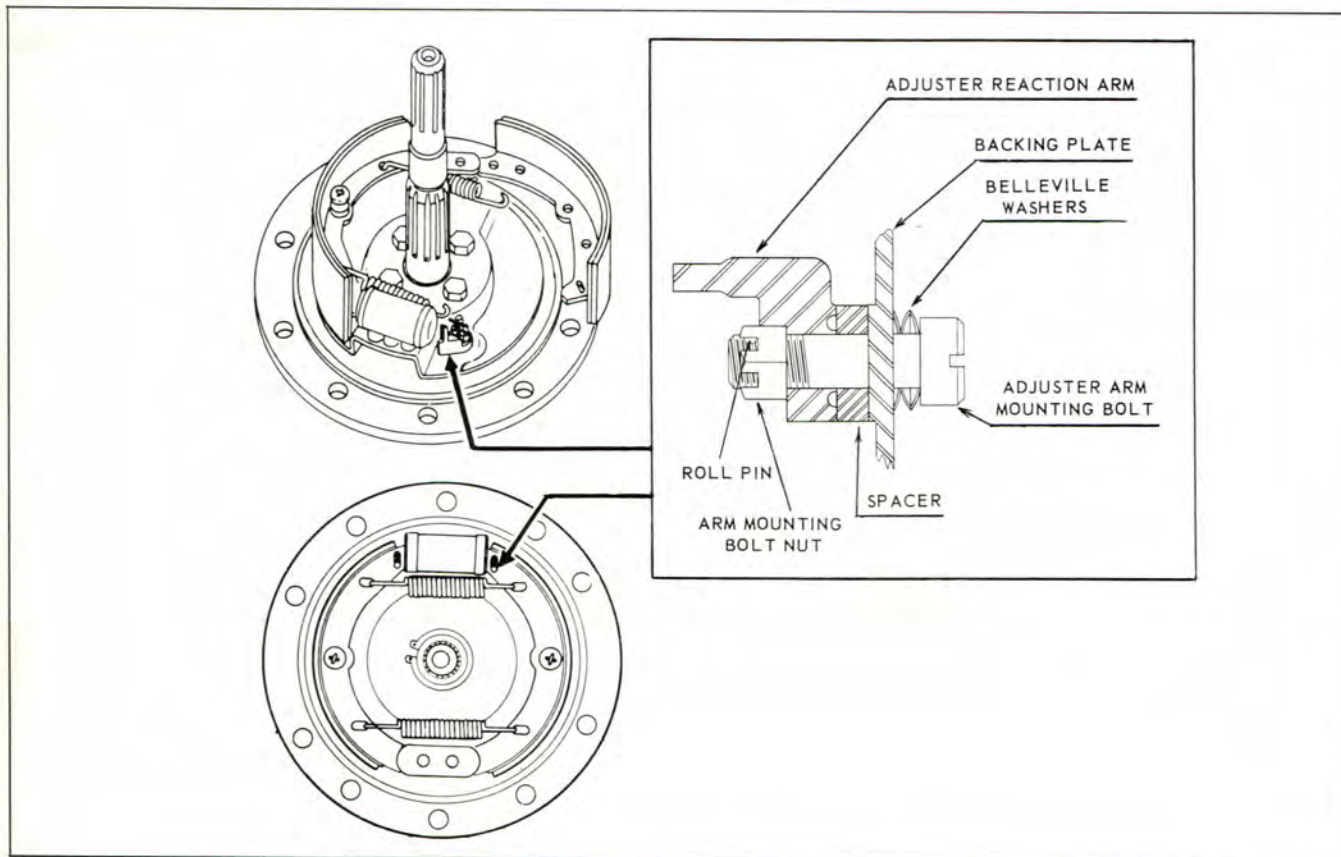


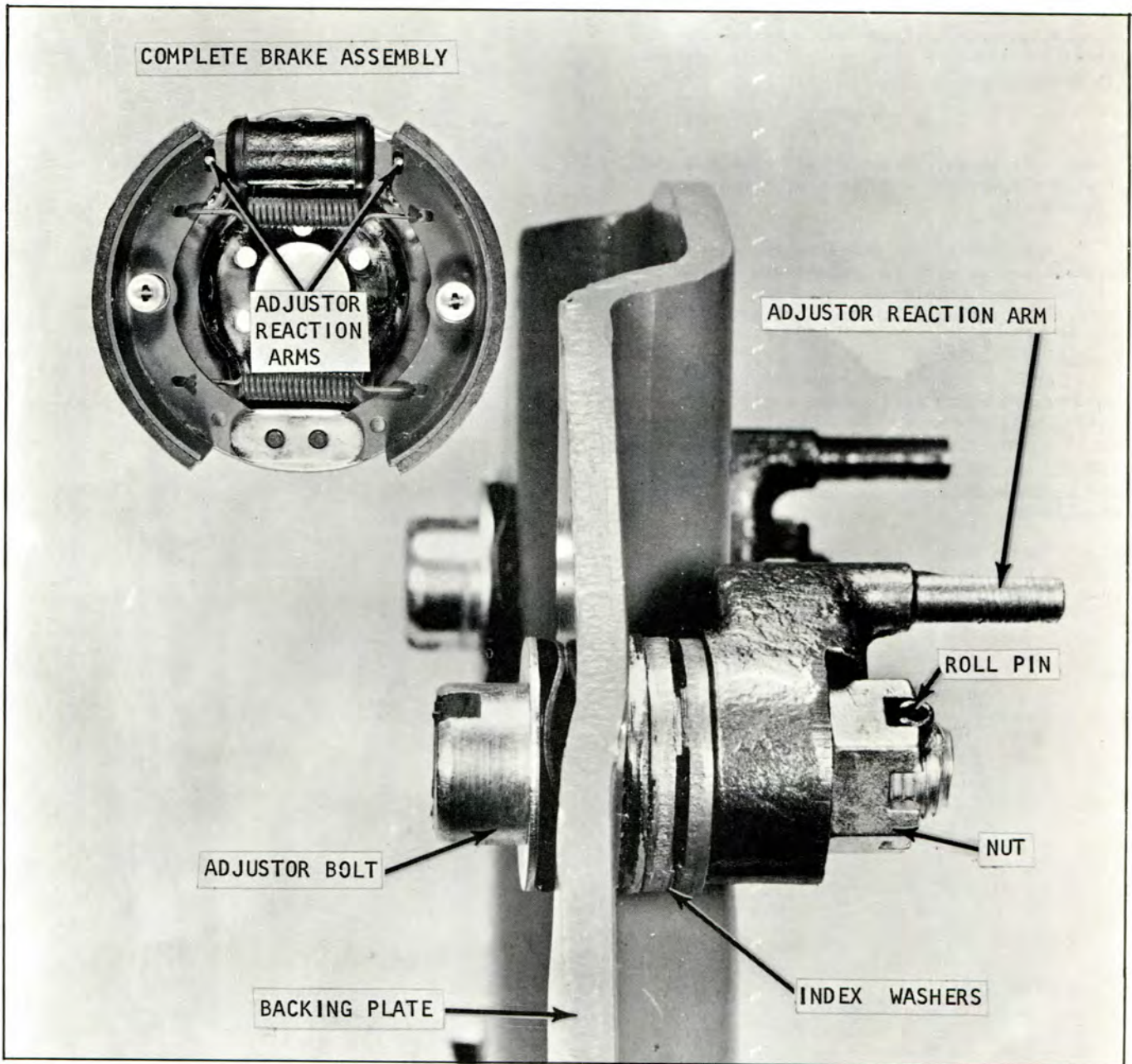
Plate 7494. Automatic Brake Adjusters

**BRAKE ADJUSTERS (1ST DESIGN)**

The mechanical brake adjusters maintain proper brake lining clearance until such time as the brake linings require replacement.

If it is found that during brake applications the brake pedal travel has gradually become excessive (and the system has been properly bled and pedal free travel is correctly adjusted) the brake linings are worn beyond their designed

limits and the mechanical adjusters can no longer maintain proper brake lining clearance. If lining wear has reached this point and replacement of linings are necessary report to designated person in authority. When the Adjuster Reaction Arm INDEX WASHER "High Spot" rotates past the backing plate index washer "High Spot", excessive pedal travel will be noticed indicating that the brake linings have worn beyond their designed limits.





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## BRAKE ADJUSTERS (3rd & 4th Design)

When the brake system is operating properly, the cam like action of the reaction arm allows self-adjustment for the total thickness of the brake linings, without any noticeable increase in brake pedal free travel. The self-adjustment feature eliminates the need for manual adjustment of the brakes.

When brakes become noisy during brake application, this may indicate the linings are worn enough to allow brake shoes to contact brake drum. If such a condition exists, the axle ends shall be removed and a brake lining inspection shall be made to determine further serviceability. Report to designated person in authority.

### N O T E

When it is necessary to install new shoe and lining assemblies, consult your authorized Clark dealer.

When installing new shoe and lining assemblies, be sure to install new assemblies at each wheel. Refer to following instructions covering mounting bolt torque specifications and procedures.

Before installing new brake linings the adjuster mounting bolt torque should be checked with a torque wrench. This should be torqued to 23 to 26 ft. lbs. The brake adjuster with nut and washer assembly has been preassembled and properly torqued and should never need to be changed.

The backing plate and adjuster arm components must be clean, dry and free from rust when this torque test is made.

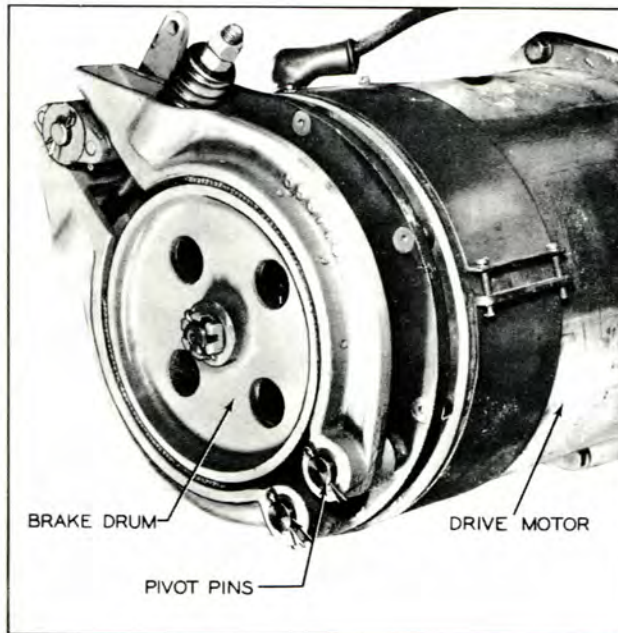


Plate 5031. Parking Brake

SEAT SAFETY BRAKE (PARKING BRAKE)

1. The parking brake is mounted to the end of the drive motor and is operated by means of linkage attached to the driver's seat.

2. When properly adjusted, the brake cam will, with action of the seat linkage, raise new brake shoes off of the drum 1/8 inch at a point half way between the shoe pivot and the brake cam pivot. The gap will increase as the shoe lining wears.

3. Adjust seat return spring tension to allow the seat to raise as soon as the driver leaves the seat.

4. With the return spring installed the bottom of the seat plate should form an angle of 40 degrees with the top of the hood when brakes are applied.

5. The brake shoe return spring should be adjusted to a length of approximately 2 1/2 inches to enable the brake to meet the following specifications.

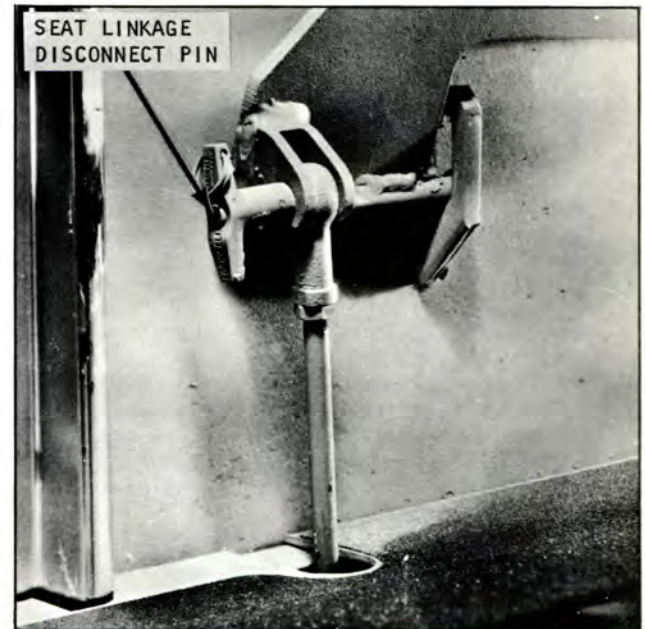


Plate 7410. Seat Linkage Disconnect Pin

SEAT BRAKE EFFECTIVENESS

The brake must be capable of holding the truck with full rated load on a 15% grade. To Test: Disconnect seat linkage pin (Plate 7410). The driver should be seated on the truck with all power off.

**AXLE ADAPTOR, DRAIN AND REFILL**

Every 1000 operating hours drain and refill adaptor.

1. Clean dirt from around filler plug (D), and remove plug....remove level plug (E).

2. Remove drain plug (F).... flow assembly to completely drain.

3. Replace drain plug and fill the assembly until fluid reaches the height of the level plug opening. Replace plugs.

Do not overfill as the excessive quantity will serve no useful purpose. If the oil is too high, it will cause excessive oil churning and attendant high oil temperature and possible leakage.

For LUBRICATION RECOMMENDATIONS....refer to the right hand column.

**AXLE ADAPTOR VENT**

Inspect axle vent (C) to be sure it is free of obstructions. If vent is not open, remove and clean in a Stoddard type cleaning solvent. Be sure vent is completely dry before replacing in the axle adaptor.

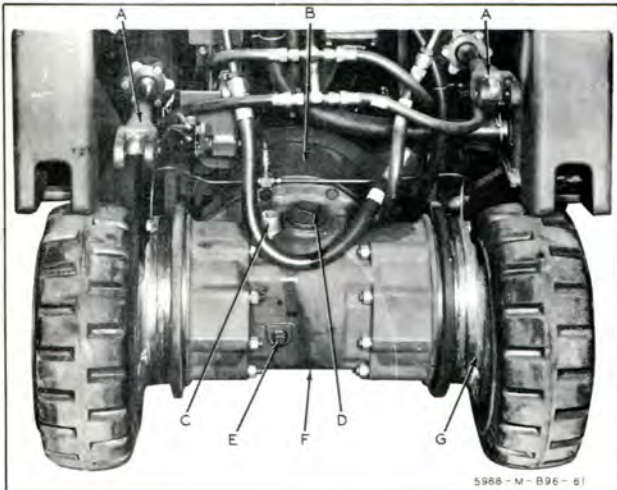


Plate 5988. Axle Adaptor

**LUBRICATION RECOMMENDATIONS**

Refer to your Machine Serial Number Plate....located on the instrument panel.

Machines built beginning with the following Machine Serial Numbers.....use Type 'A', Suffix 'A' Automatic Transmission Fluid. Fluid Containers must display a qualification number prefixed by AQ-ATF. Clark Part No. 879803.

EC20C & EC25C-1-763 and above  
EC30B & EC40B-1-764 and above

EC30C & EC40C-1-919 and above

ECS50C-1-919 and above  
EC50-60-70-1-831 and above

ECLS20B & ECLS25B-1-983 and above  
ECLS30B & ECLS40B-1-984 and above

Machines built prior to the above Machine Serial Numbers.....use EPGL SAE #90 Gear Lubricant.





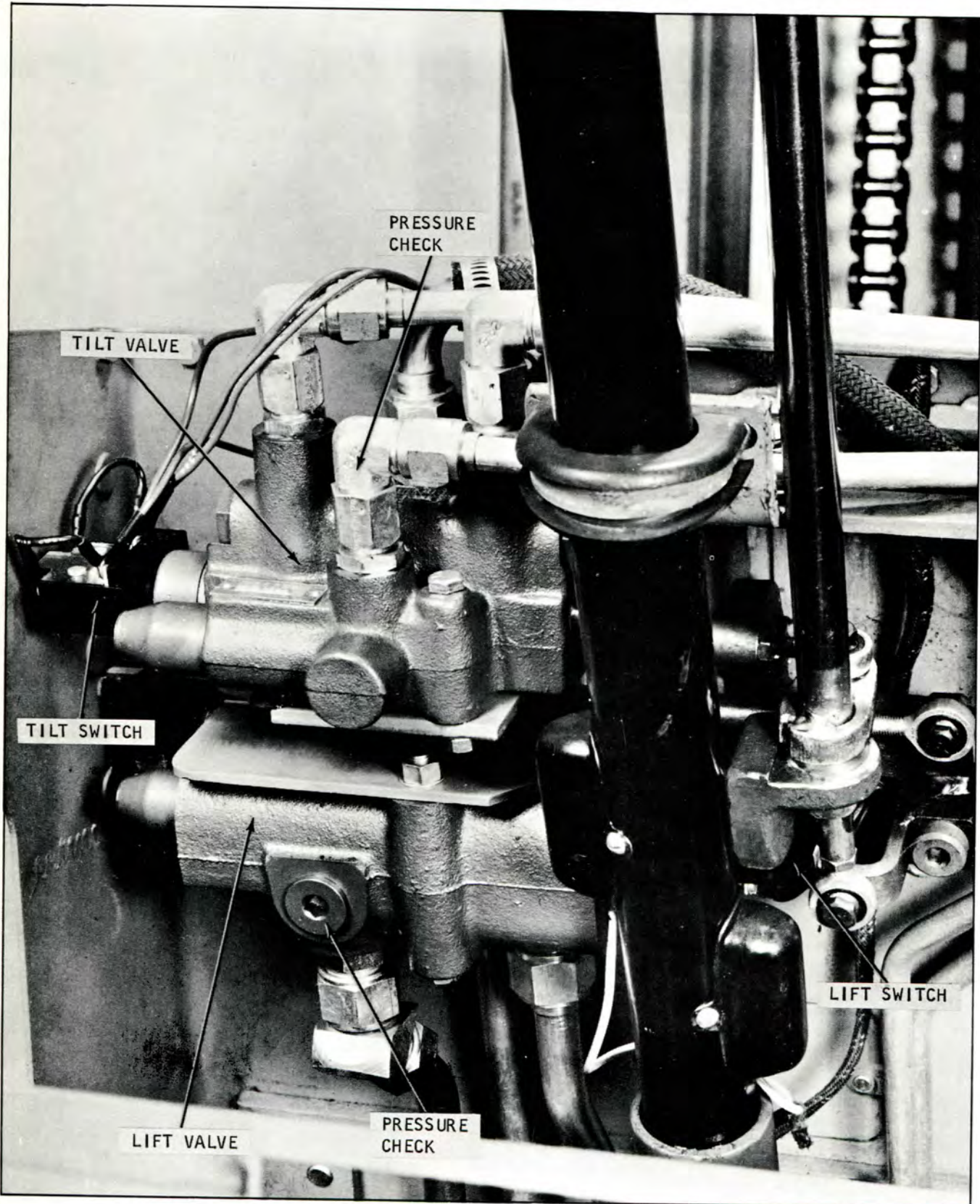


Plate 7224. Typical Control Valve



# INDUSTRIAL TRUCK DIVISION



LUBRICATION AND PREVENTIVE MAINTENANCE

## MAIN HYDRAULIC SYSTEM PRESSURE CHECK

### 1. Pressure check at lift valve.

a. Remove the pressure check plug from the lift valve (Plate 7224) and install a 0-4000 P.S.I. gauge at this location.

b. Turn key switch on and move hydraulic control lever to the "lift" position. When the upright has reached its maximum height the gauge should register 1750 to 1800 P.S.I. If pressure is not within this range report to designated person in authority.

### NOTE

DO NOT HOLD LIFT LEVER IN "LIFT" POSITION FOR ANY PROLONGED PERIOD AFTER UPRIGHT HAS REACHED IT MAXIMUM HEIGHT. THIS WILL CAUSE HEATING OF THE HYDRAULIC OIL AND SHOULD BE AVOIDED.

c. If pressure readings are satisfactory remove pressure gauge and install plug securely.

### NOTE

ONLY REPRESENTATIVES OF AN AUTHORIZED CLARK INDUSTRIAL TRUCK DEALER OR THE VENDOR SHOULD REPAIR OR ADJUST THE CONTROL VALVES.

### 2. Pressure Check at Tilt Valve.

a. Provide a means for connecting a 0-4000 P.S.I. pressure gauge at the inlet side of the valve (refer to Plate 7224). A tee at the inlet port may be used.

b. Turn key switch on and hold tilt lever back until upright reaches maximum back tilt. With the lever held momentarily in this position the pressure gauge should register 1750 to 1800 P.S.I. If pressure is not within this range report to designated person in authority.

c. If pressure readings are satisfactory remove pressure gauge and securely install inlet line in its original position.

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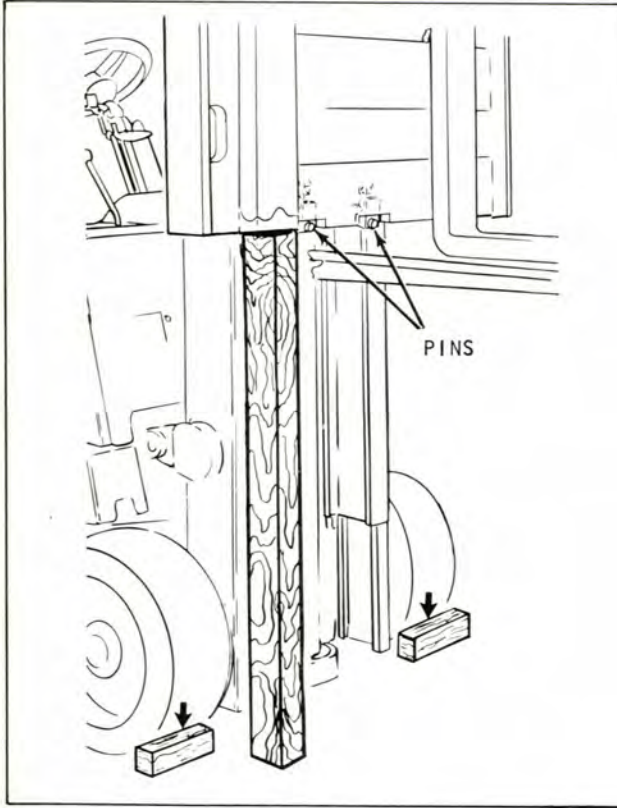


Plate 9593 Carriage Pin Replacement

Step 2. Remove anchor pins and replace with 3/8" x 2" bolts. FOR SAFETY REASONS, REMOVE ONLY ONE PIN AT A TIME. This will make pin removal easier when carriage is lowered.

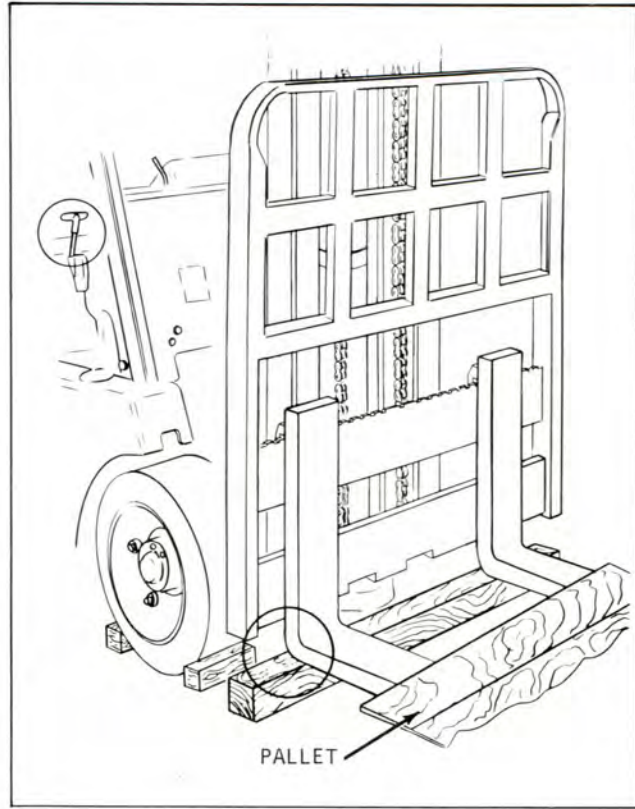


Plate 9560 Fork and Carriage Blocking

Step 3. Raise carriage off beam. Place beam on floor so, when lowered, the heel of the fork will rest on it as shown.

Step 4. Tilt upright full forward.

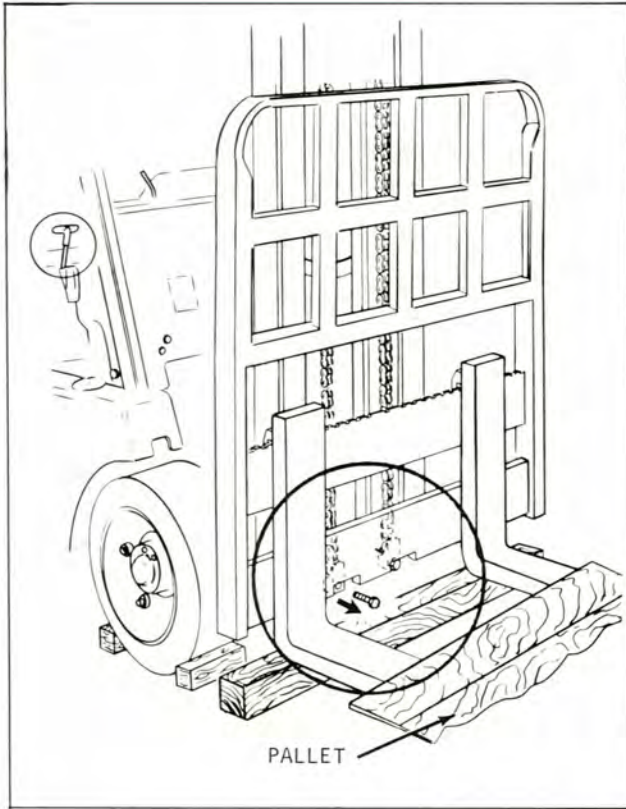


Plate 9561 Removing Bolts

Step 5. Remove 3/8" x 2" bolts. Place pallet on fork ends.

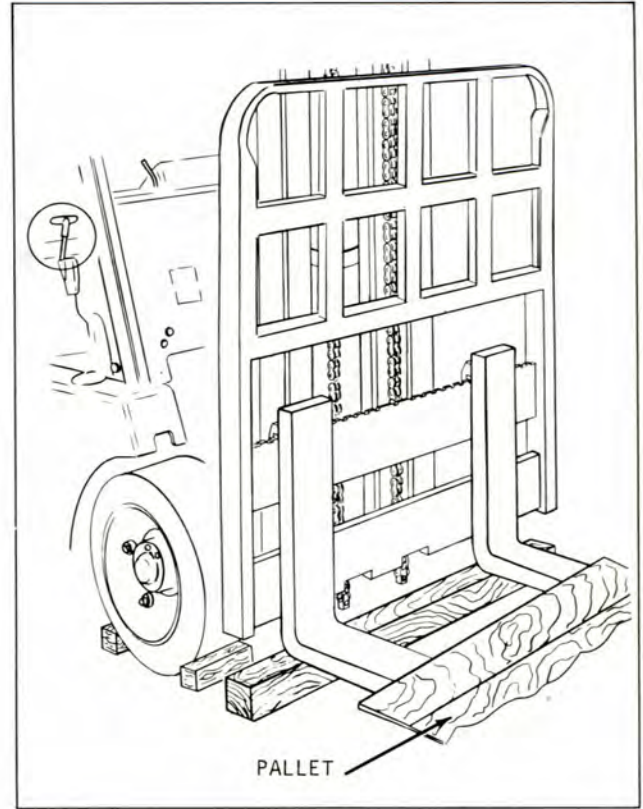


Plate 9562 Removing Chains From Anchors

Step 6. Pull chains out of carriage anchor brackets.

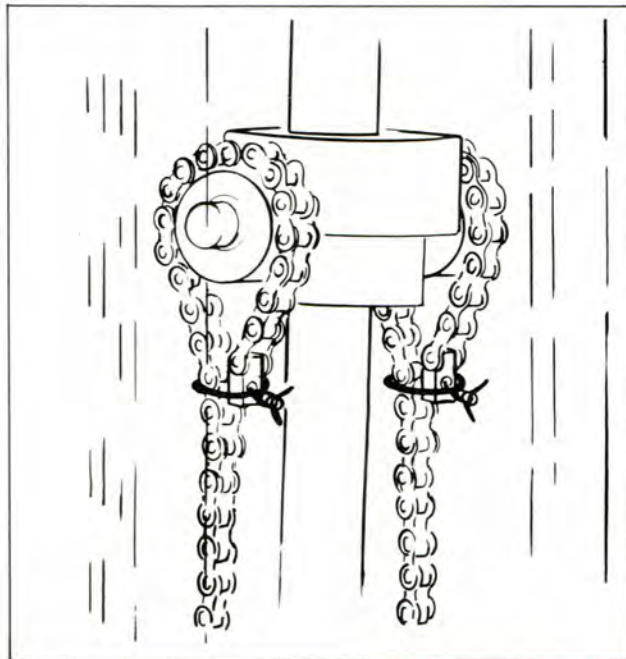


Plate 9563 Securing Chains (Typical)

Step 7. Wire chains around chain sheaves as shown

**N O T E**

Use the same method on all cylinders.

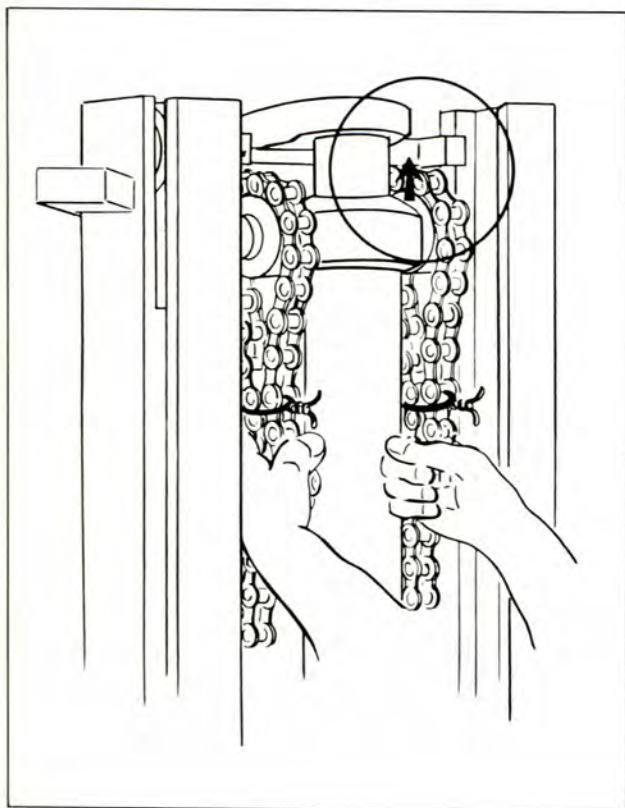


Plate 9564 Guiding Piston Head

Step 8. Guiding piston head with hands on chains raise piston to full up position.

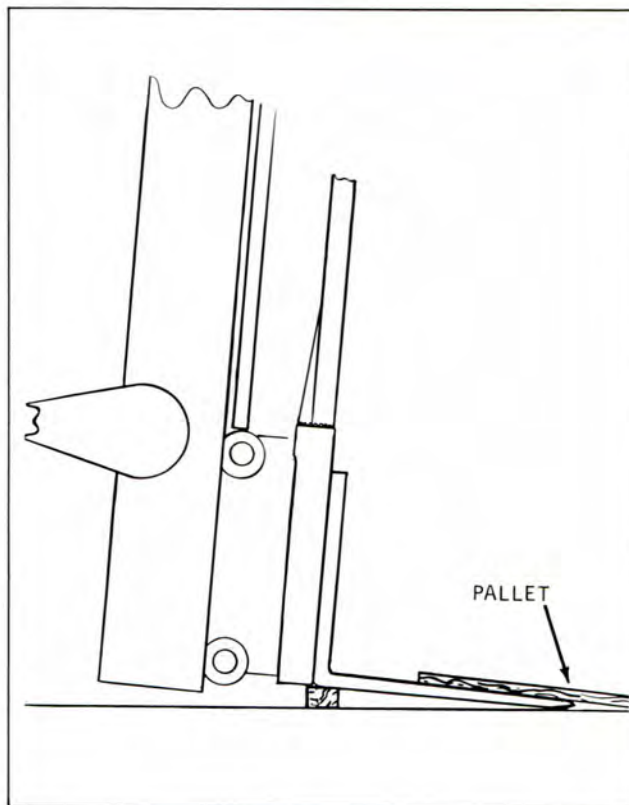


Plate 9565 Inner Rail Clearing Carriage Rollers

Step 9. Raise inner rail so it just clears upper carriage rollers. Leave upright at full forward tilt.

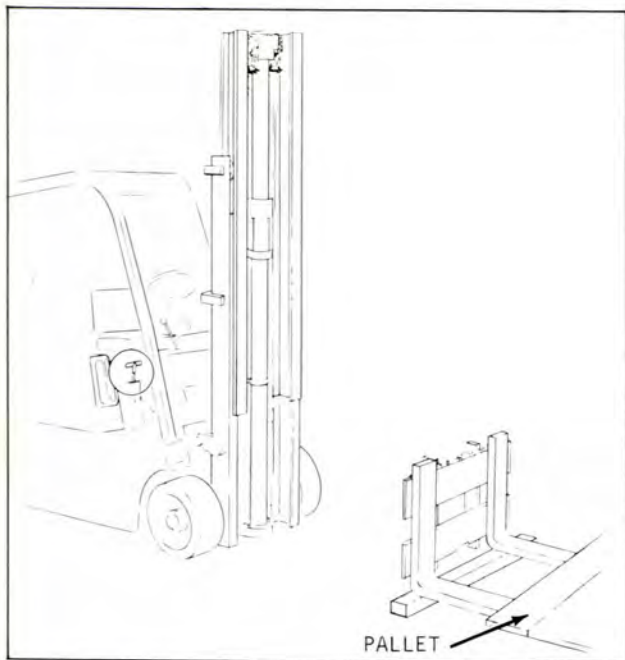


Plate 9566 Backing Machine Away From Carriage

Step 10. Remove blocks and release brake. Back machine away from carriage.



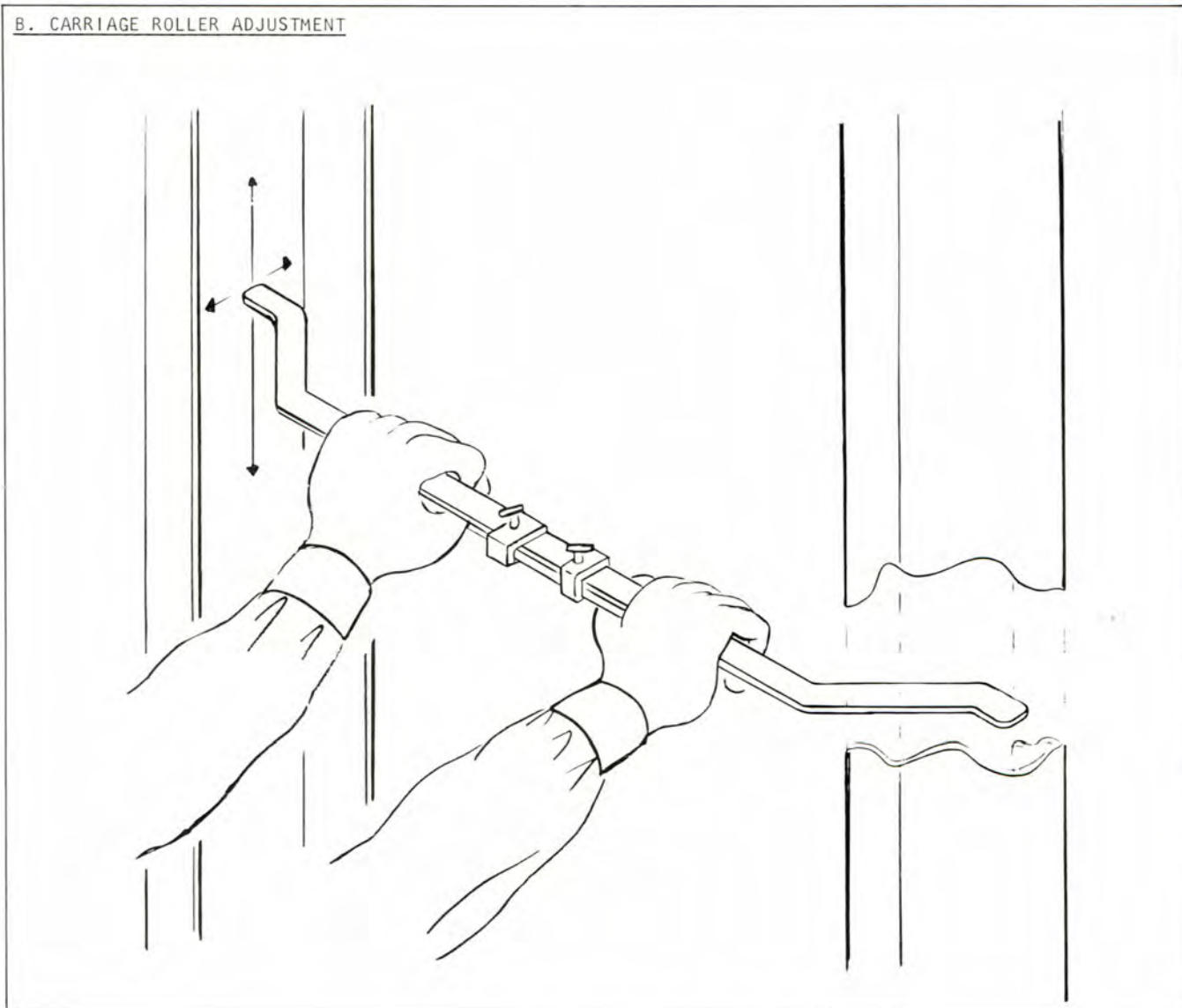
B. CARRIAGE ROLLER ADJUSTMENT

Plate 9567 Spanning Inner Rail

Step 1. Span inner rail with inside spanning tool to find the smallest distance between the rails. Lock tool in position.

## NOTE

## FOR SIX ROLLER CARRIAGE ONLY

After finding the smallest distance between rails, place a shim between the spanning tool and the inner rail, then lock spanning tool in position.

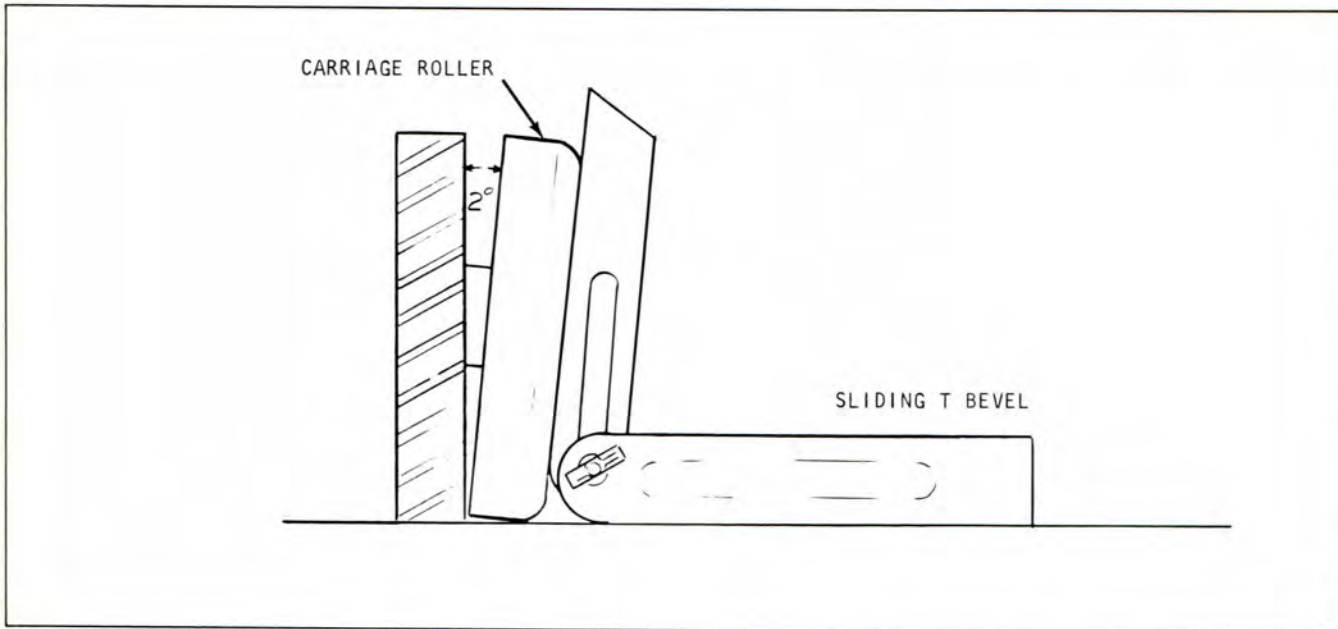


Plate 9589 Setting T Bevel

N O T E

Check angle of carriage rollers. Roller pin bosses are welded at  $2^\circ \pm 1/2^\circ$  and if damaged, replace carriage roller pin boss assembly. To obtain this, contact Central Parts.

To check roller angle use a Sliding T Bevel and Protractor. Lay one side against roller surface and lock in place.

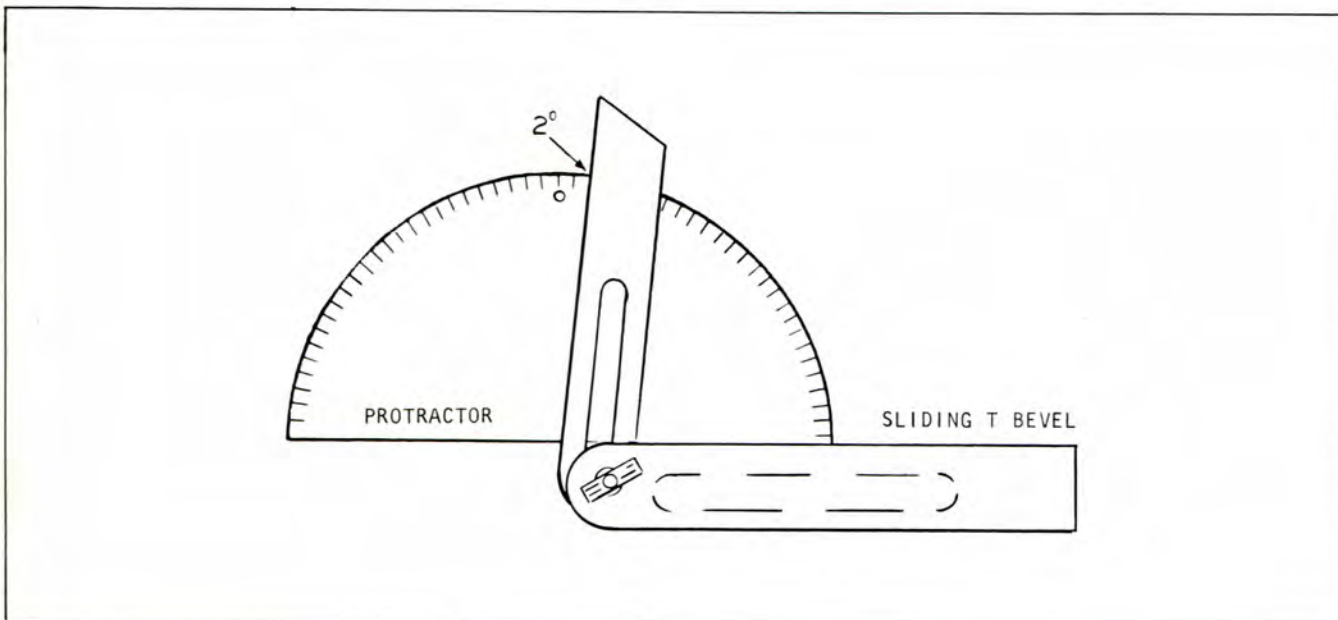


Plate 9590 Checking Roller Angle

Determine degree of angle by placing Protractor on Sliding T Bevel.

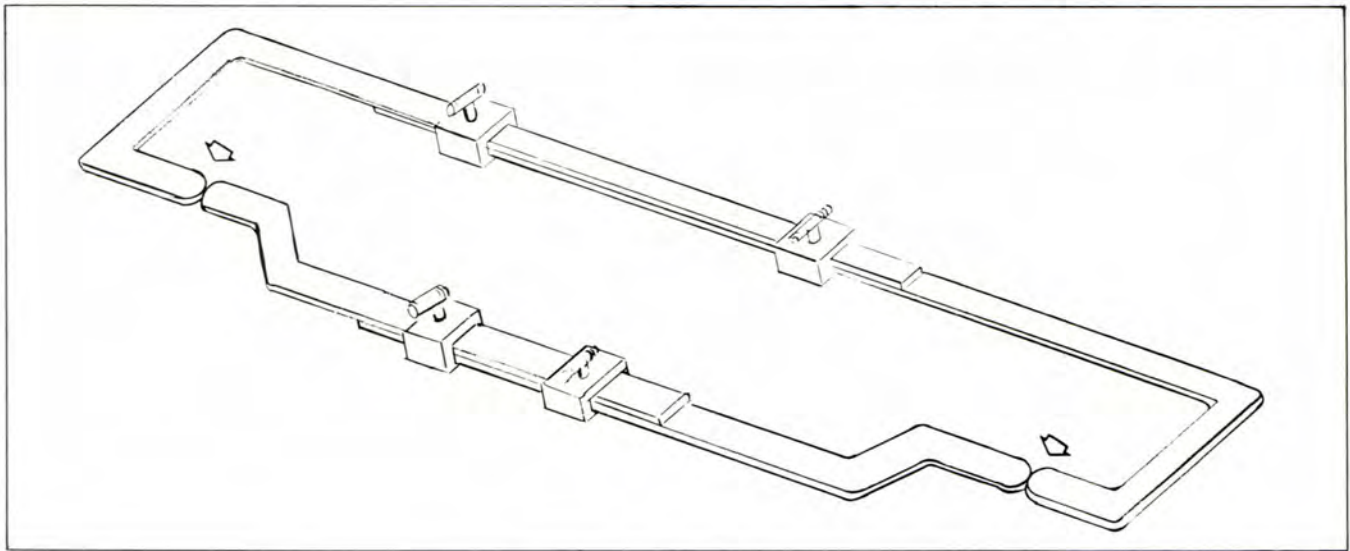


Plate 9568 Setting Outside Spanning Tool

Step 2. Set outside spanning tool to match inside spanning tool. Lock tool in position.

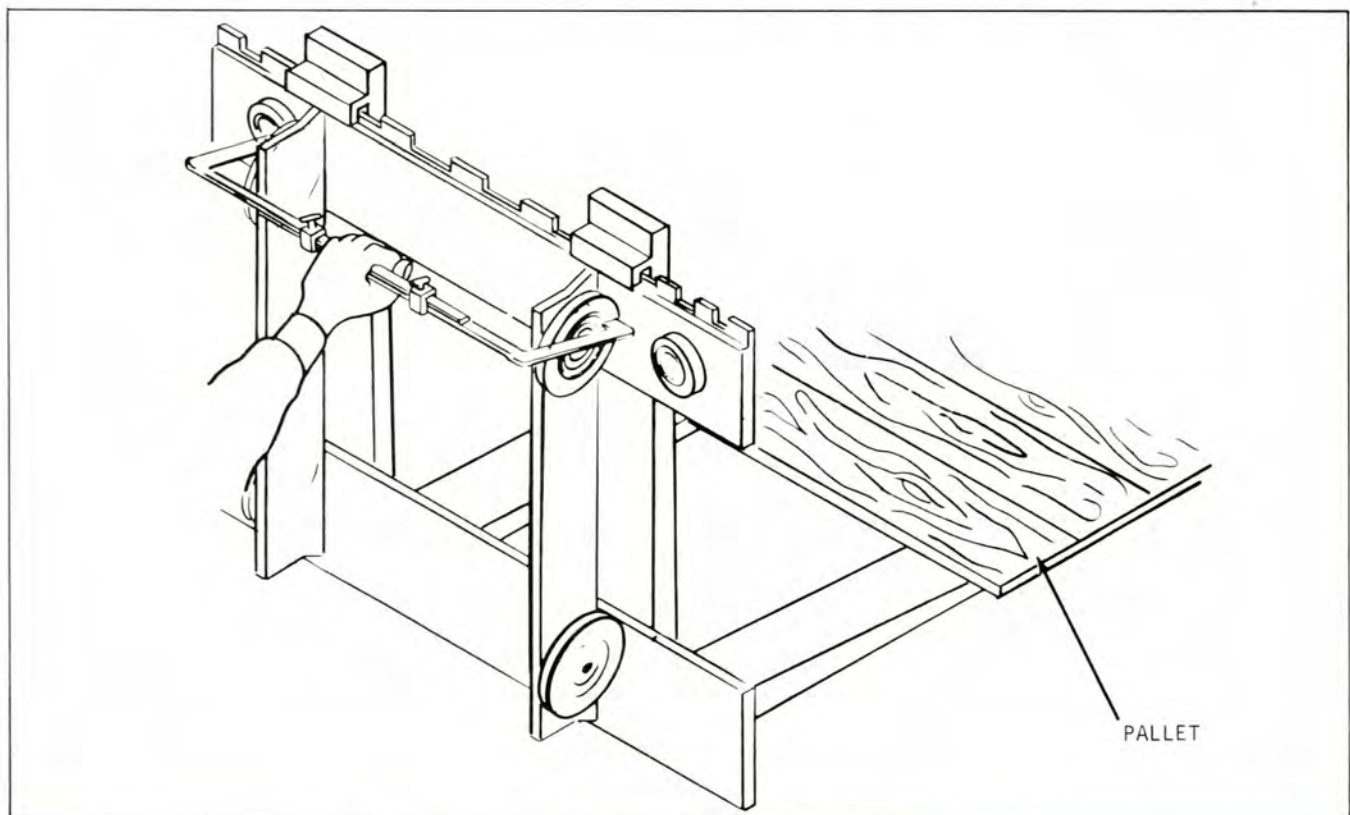


Plate 9569 Spanning Upper Rollers (Four Roller Carriage)

Step 3. Span upper carriage rollers at their outer most camber point. Add or subtract ...

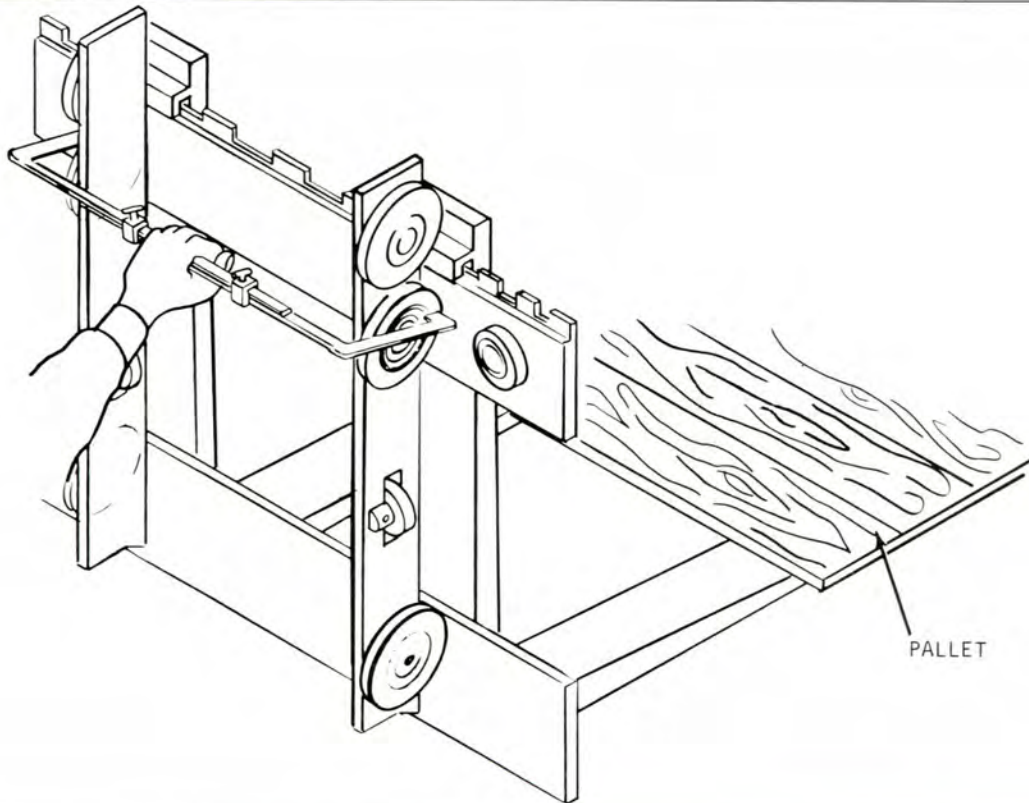


Plate 9570 Spanning Upper Rollers (Six Roller Carriage)

...shims at roller shaft to reach tool size.

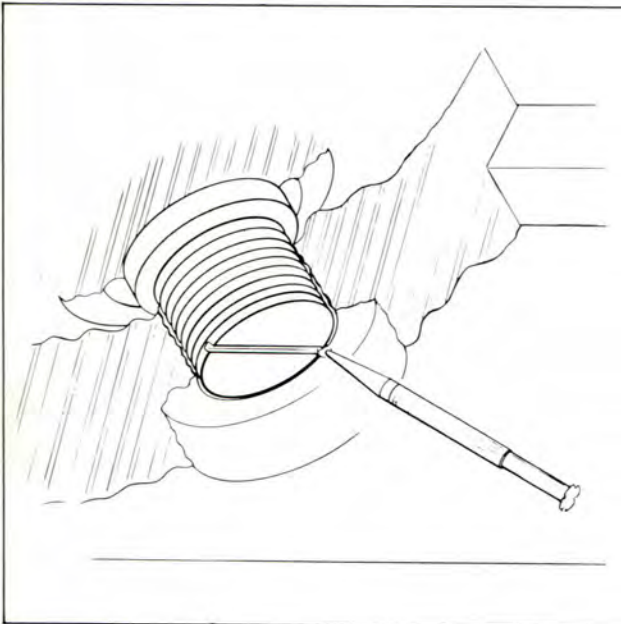


Plate 9571 Securing Outer Thrust Roller

#### NOTE

Before centering carriage rollers check outer thrust rollers for security and condition of bearings. If loose tighten and stake. If worn replace.

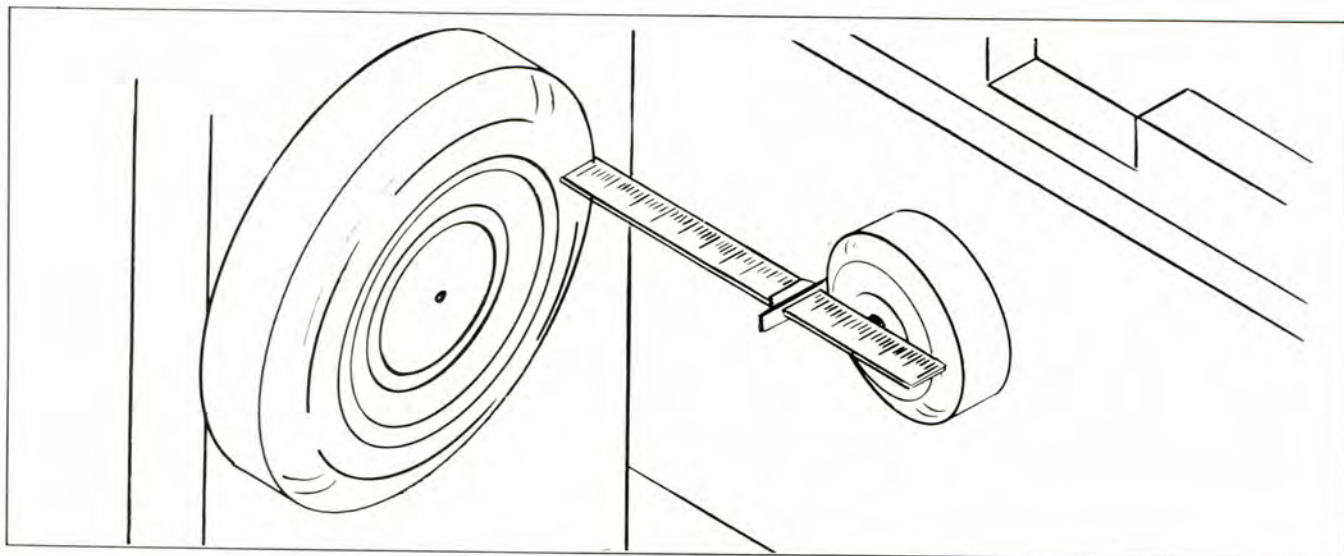


Plate 9572 Centering Carriage Rollers

Step 4. Center carriage rollers within outer thrust rollers by placing 6" scale on the carriage roller surface and measuring the distance to the outer thrust roller face. Add or subtract shims from one roller to the other to make measurement equal.

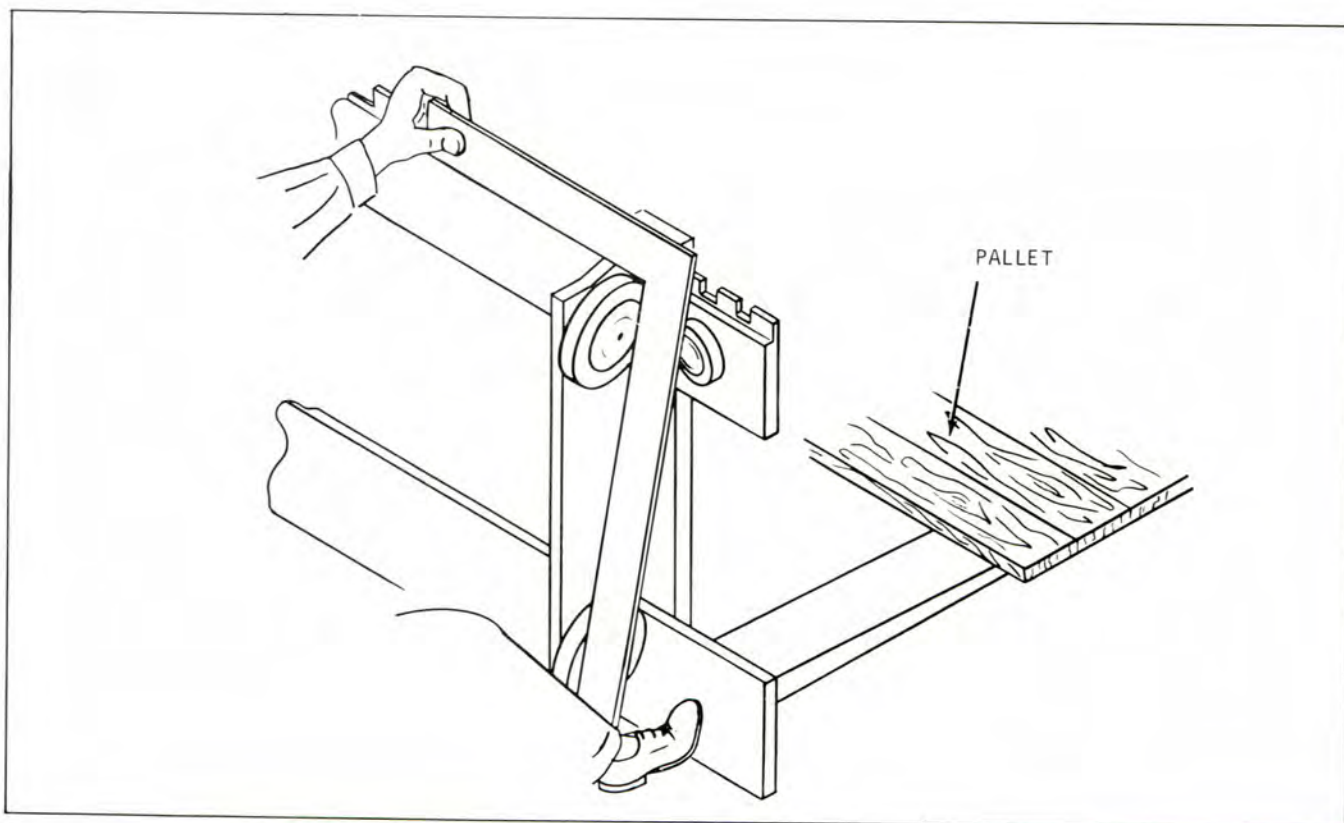


Plate 9573 Squaring Carriage Rollers (Four Roller Carriage)

Step 5. Square carriage rollers by placing carpenters square at the outer most camber of the ...

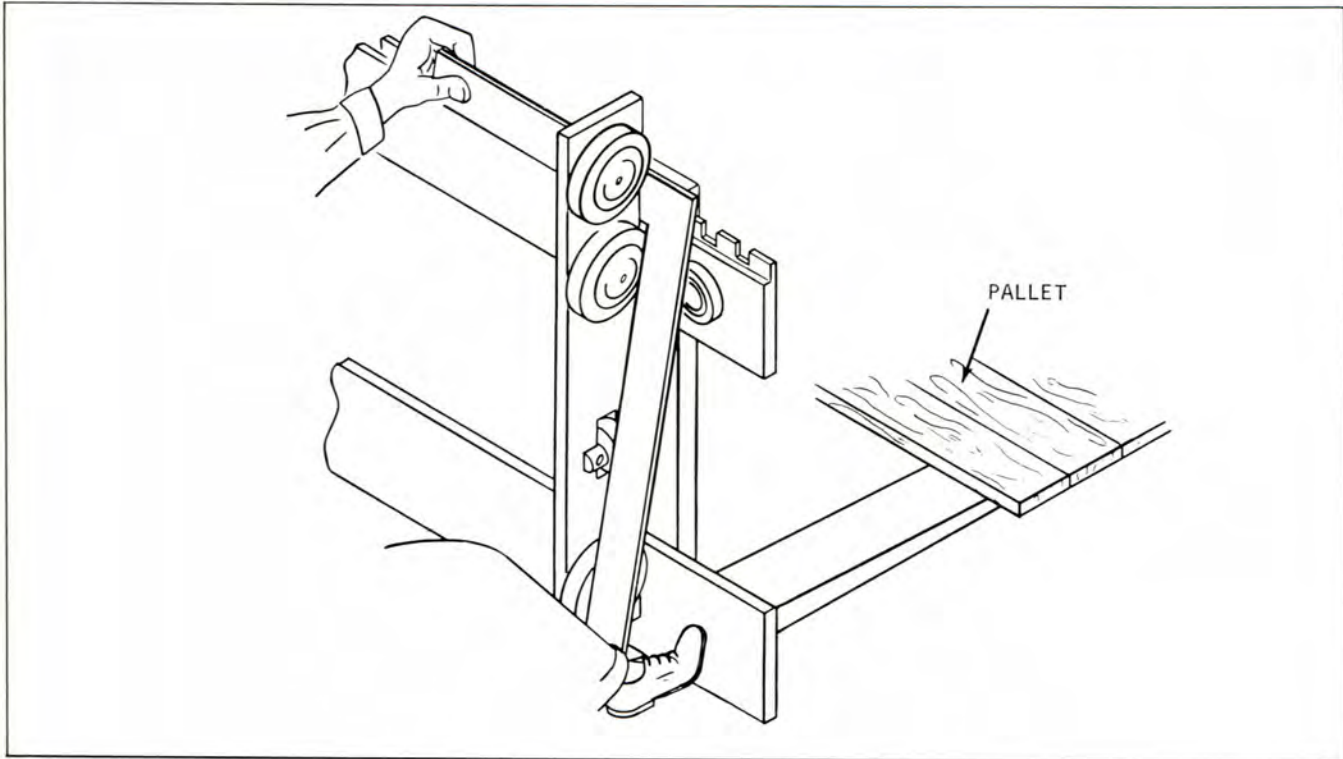
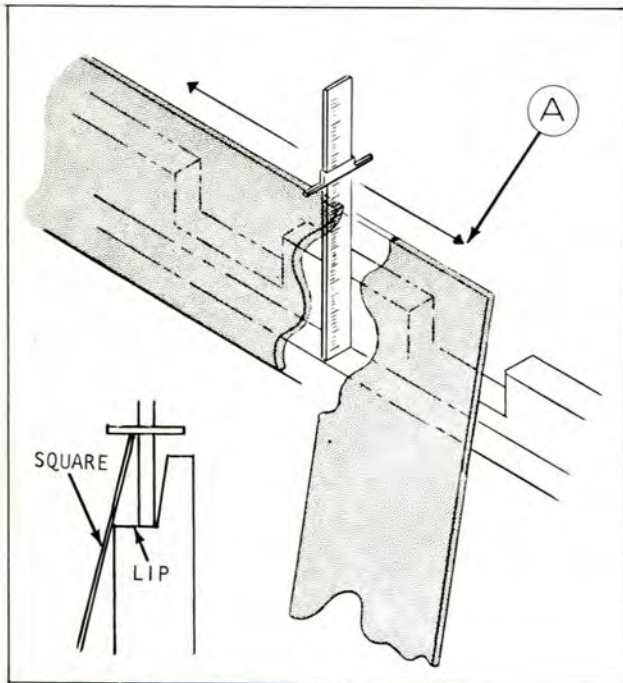


Plate 9574 Squaring Carriage Rollers (Six Roller Carriage)

... upper and lower rollers. Hold square in place with ankle and hand as shown.



Step 6. Hold square and measure the distance between the top face (or lip) of the upper fork bar to the edge of the square at Point A. Now take a measurement at opposite end of square .... these measurements should be the same. If they are not, add or remove shims on lower roller shaft until distance measured at each end is equal.

Plate 9575 Measuring For Squareness

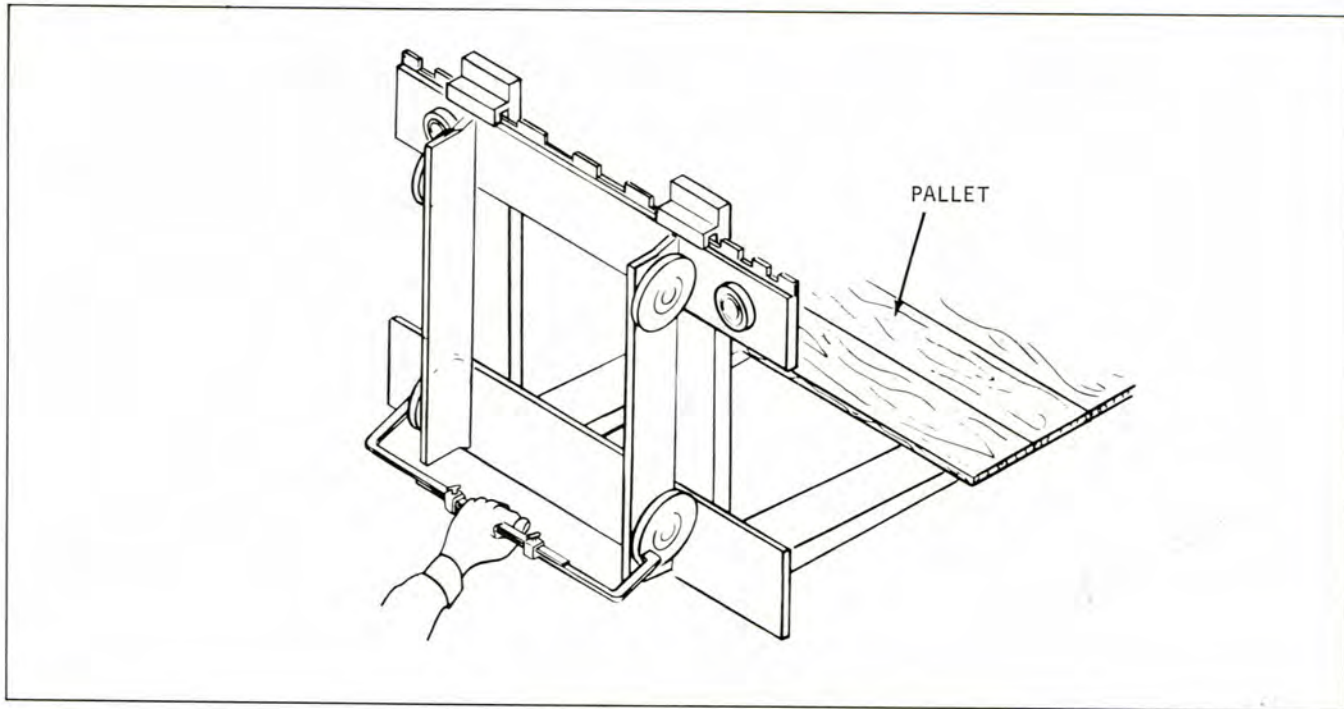


Plate 9576 Spanning Lower Rollers (Four Roller Carriage)

Step 7. Span lower rollers. Add or subtract shims to (the roller that has not been squared) ...

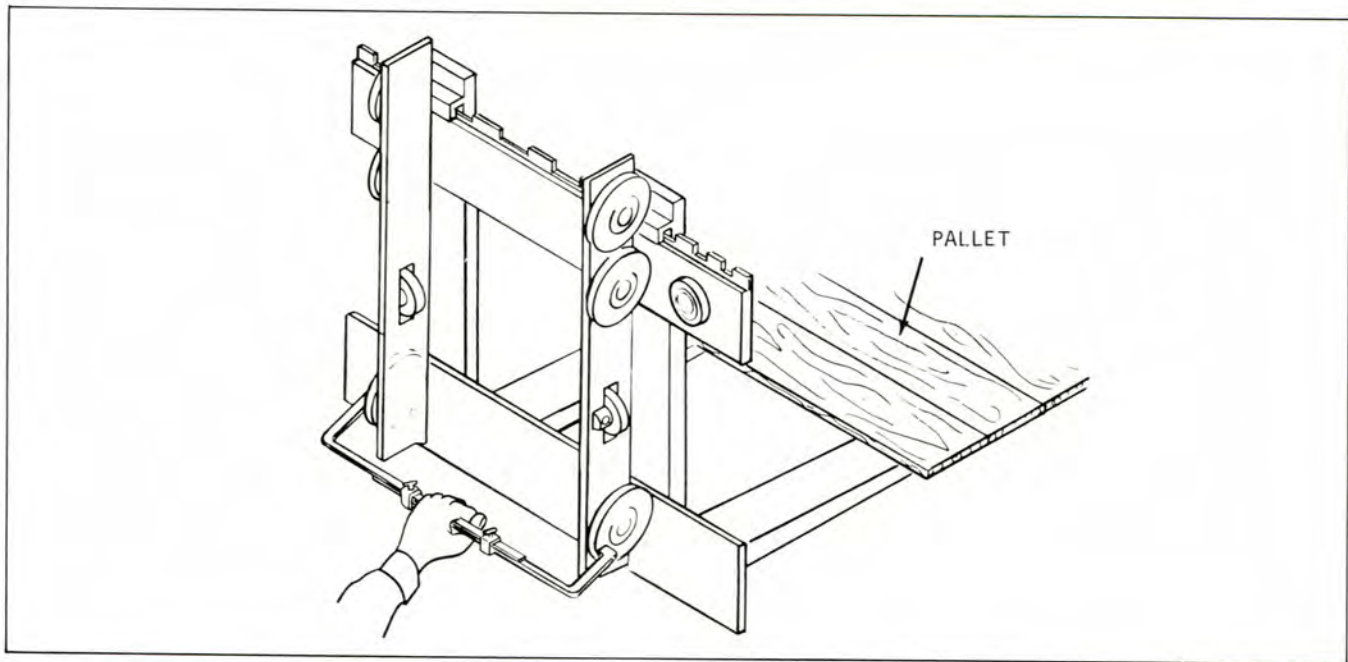


Plate 9577 Spanning Lower Rollers (Six Roller Carriage)

... reach the size of the outside spanning tool.

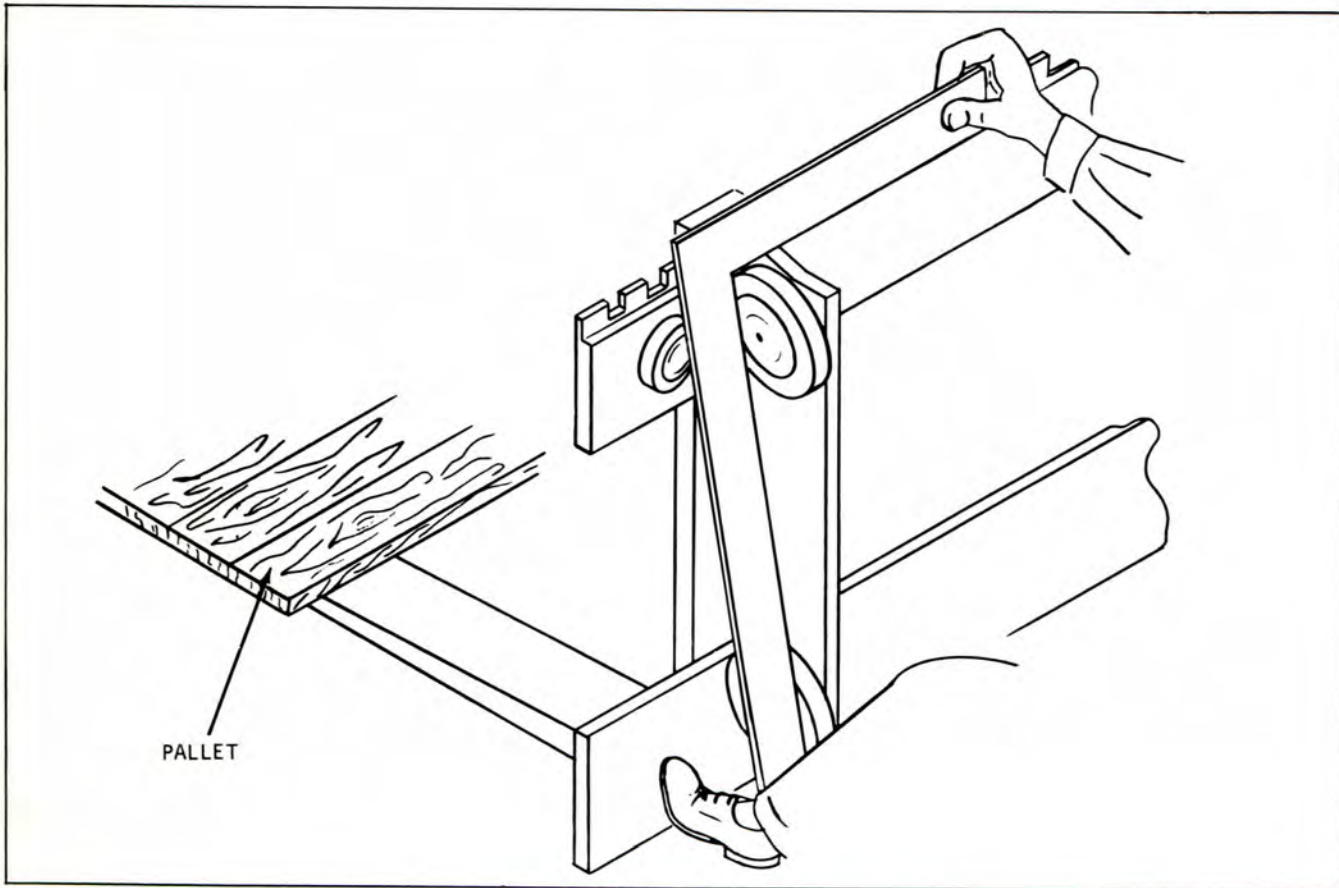


Plate 9578 Checking Squareness (Four Roller Carriage)

Step 8. Check opposite side for squareness (by holding square in the same manner as before and checking ...)



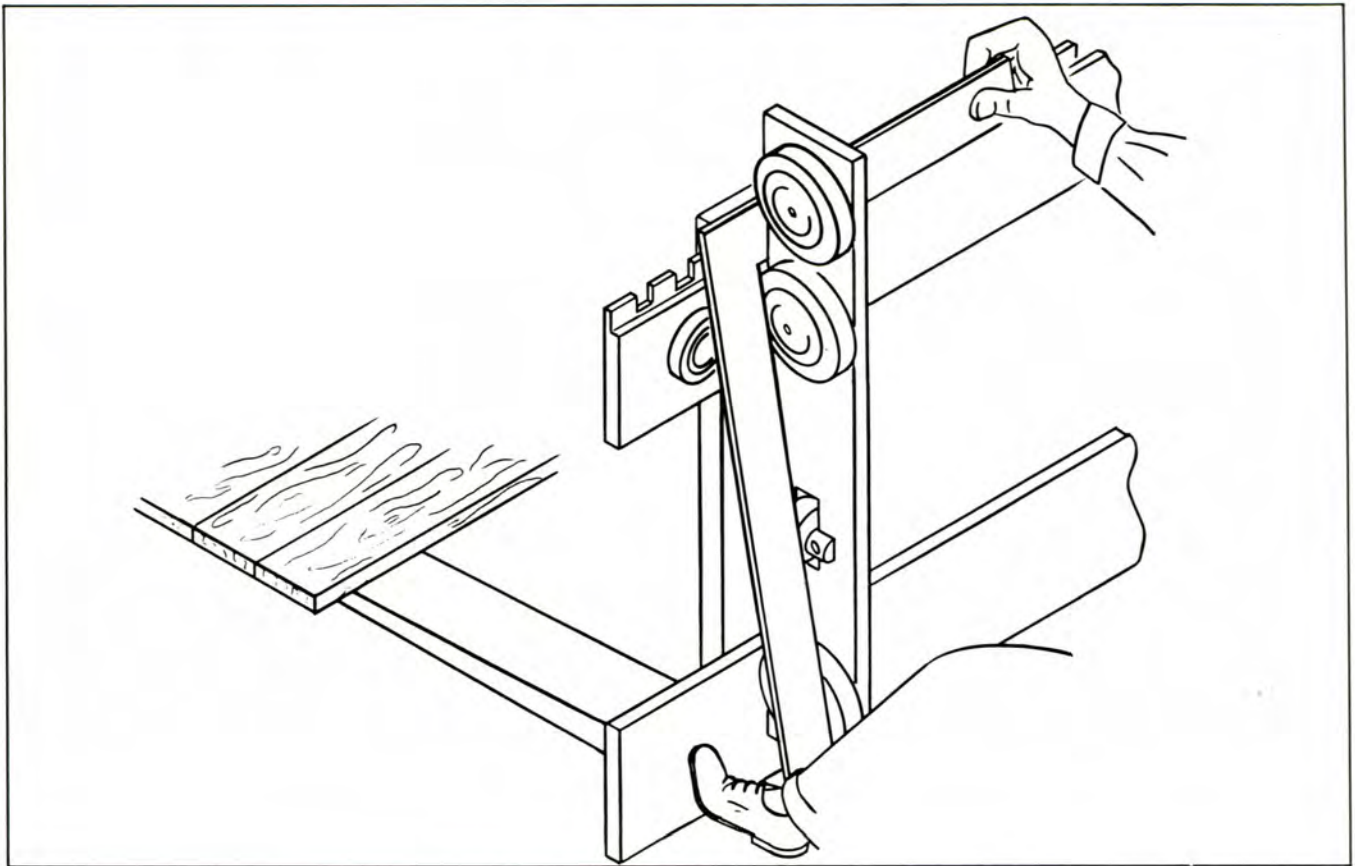


Plate 9579 Checking Squareness (Six Roller Carriage)

... measurement). This side will be square within  $1/32''$ ; if not, return to Step 5. and repeat procedure.

SIX ROLLER CARRIAGE ONLY

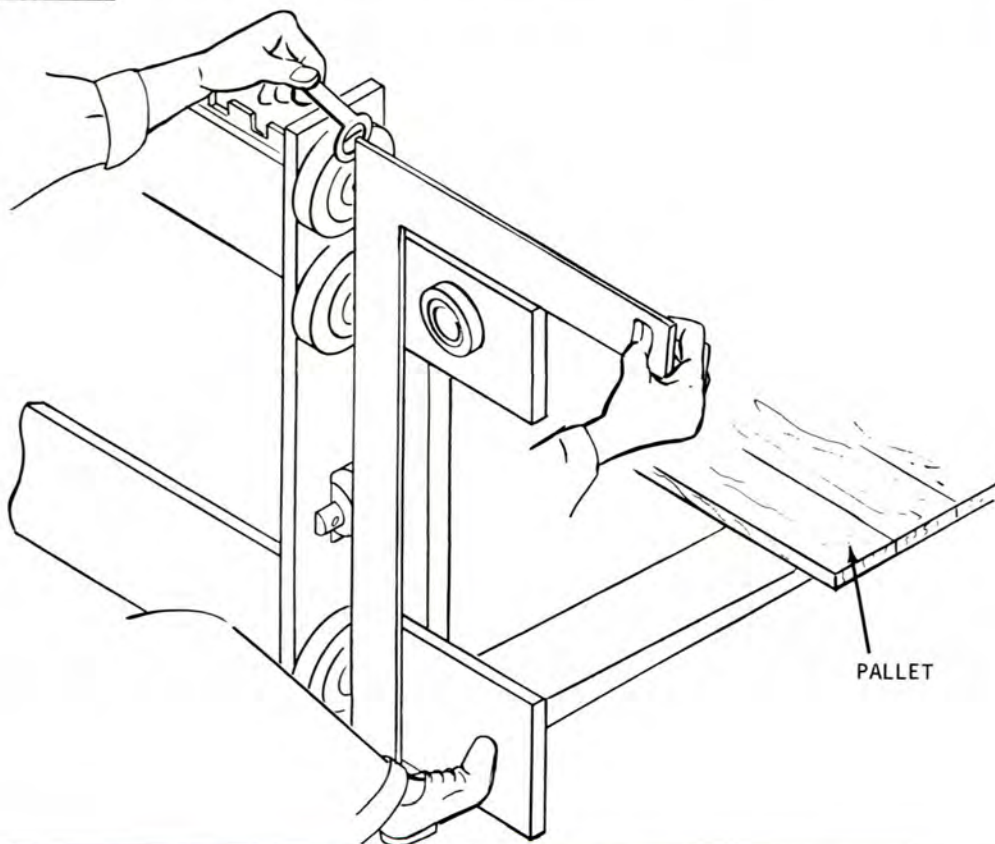


Plate 9580 Top Roller Clearance

Step 1. Place square on the vertical center line of the carriage rollers, as shown above. There must be some clearance between the square and the side surface of the top roller. This clearance should not exceed 1/32" or one shim

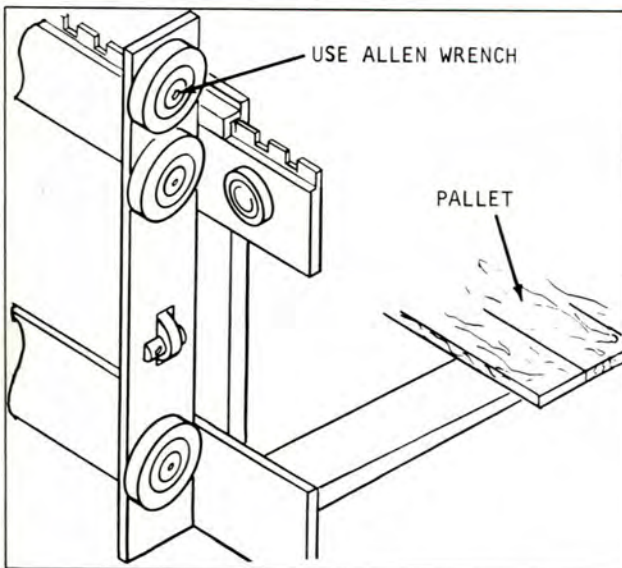


Plate 9581 Removing Top Roller

Step 2. If adjustment is necessary, remove allen screw, lock washer and flat washer to add or remove shims on shaft. Tighten screw securely after completing adjustment.

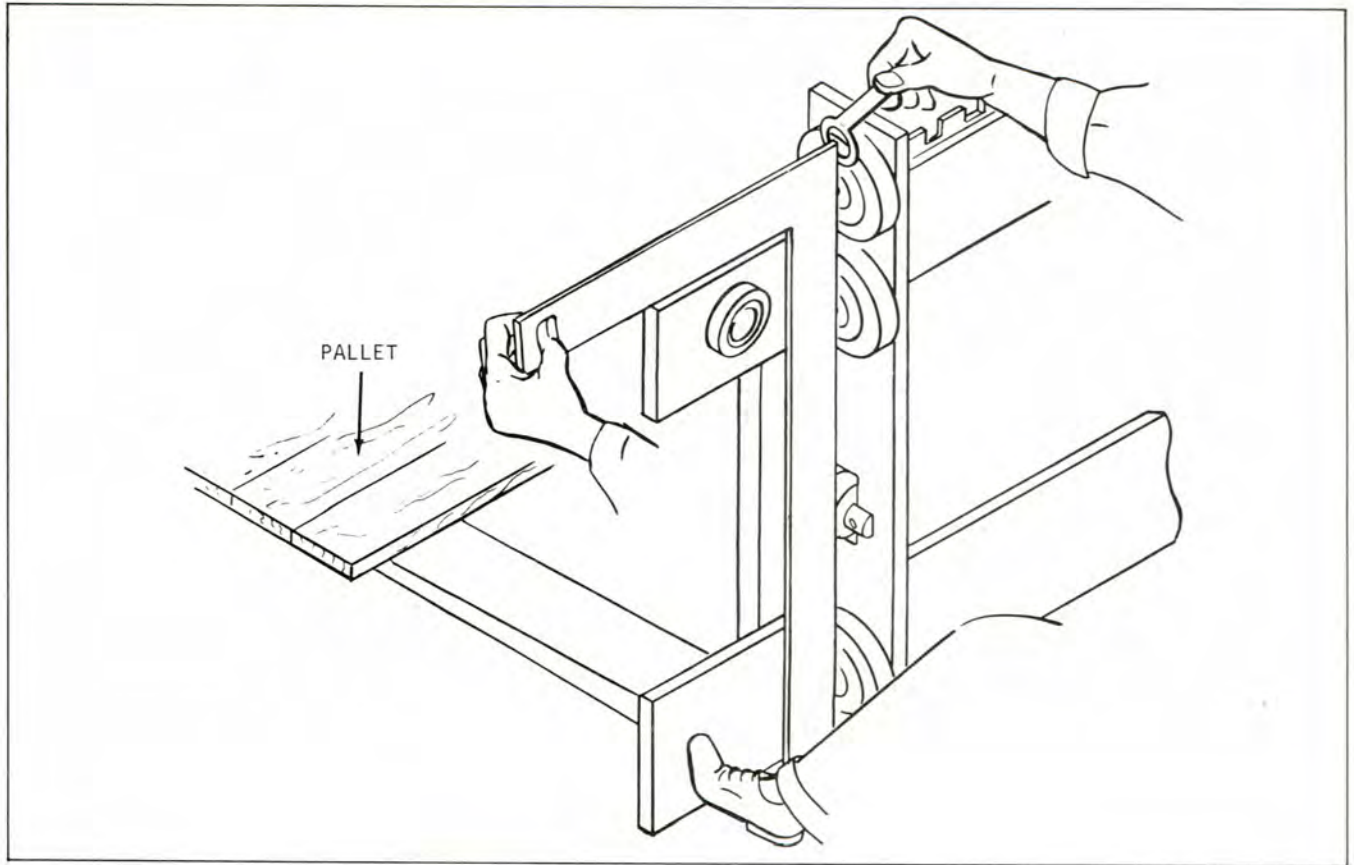


Plate 9582 Top Roller Clearance

Step 3. Check opposite upper roller in the same manner; adjust if necessary.

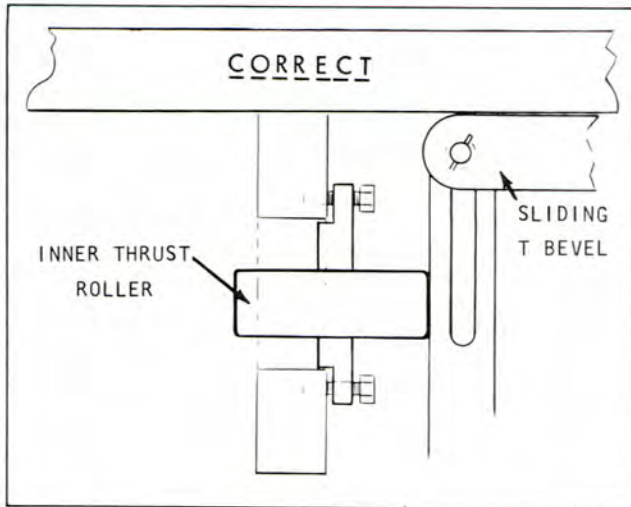


Plate 9583 Checking Squareness ■ CORRECT

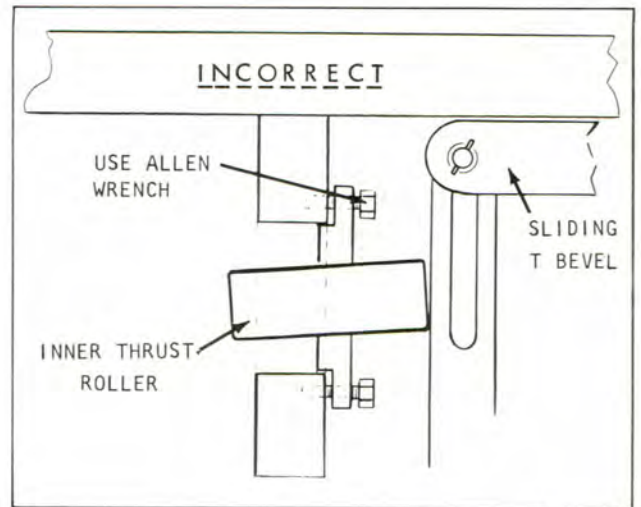


Plate 9584 Checking Squareness ■ INCORRECT

Step 4. Check squareness of inner thrust rollers with Sliding T Bevel. Set Sliding T Bevel to 90° using carpenter's square.

Step 5. Add or subtract shims for adjustment (Use allen wrench see Plate 9584).

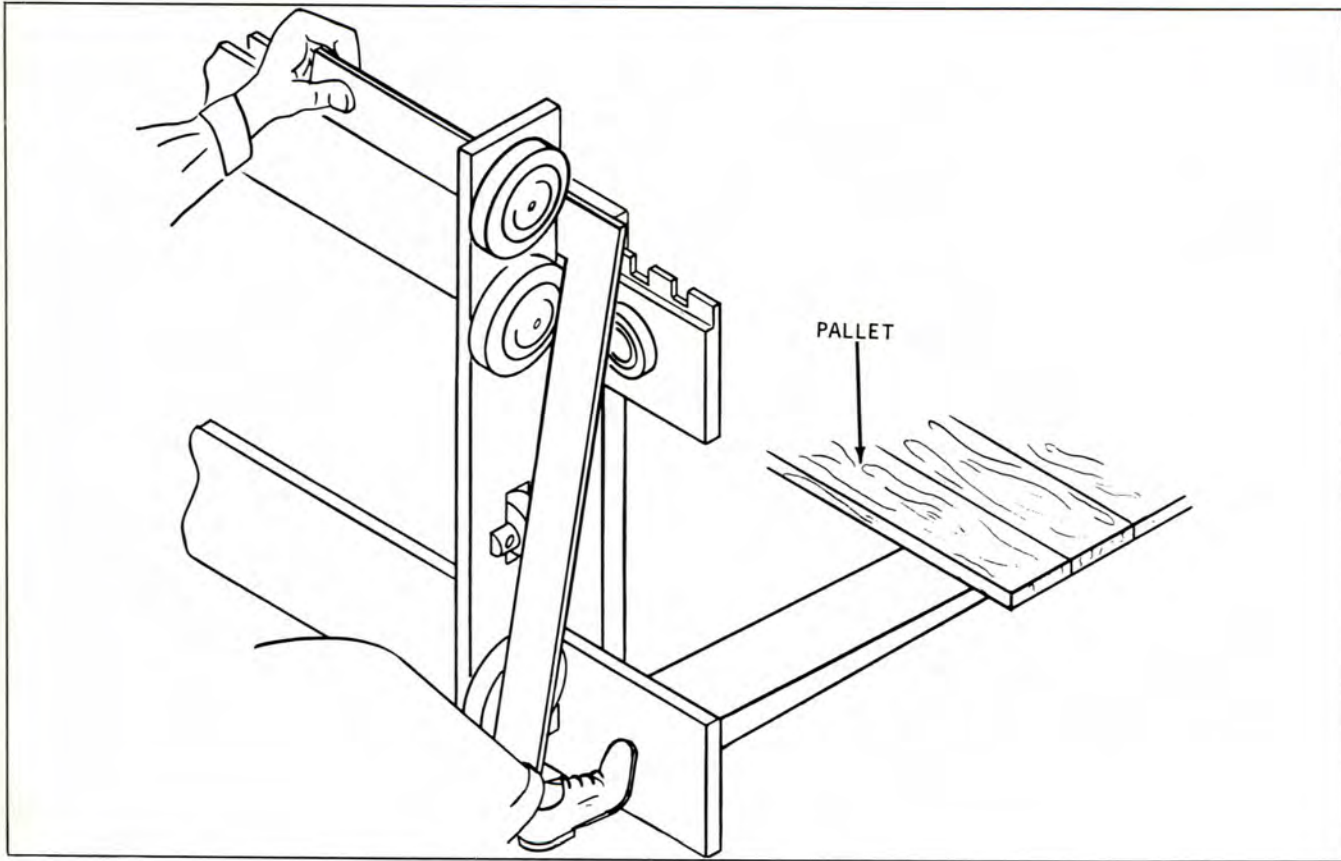


Plate 9574 Square And Side Thrust Roller

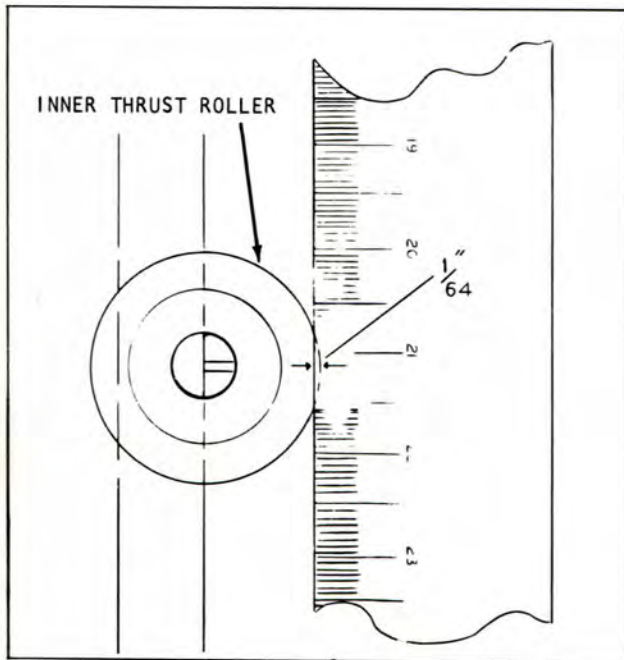


Plate 9585 Reading Roller Projection

Step 6. The inner thrust roller is to project 1/64" past line of square. Use one thrust roller shim and eyeball distance as shown (Plate 9573 and Plate 9585).

Step 7. Repeat Step 6. on opposite side.

C. CARRIAGE INSTALLATION

## NOTE

Before installing carriage, check upright for proper shimming adjustment.

Step 1. Drive machine up to carriage and position upright to match tilt of carriage.

Step 2. Raise inner rails to just clear upper carriage rollers.

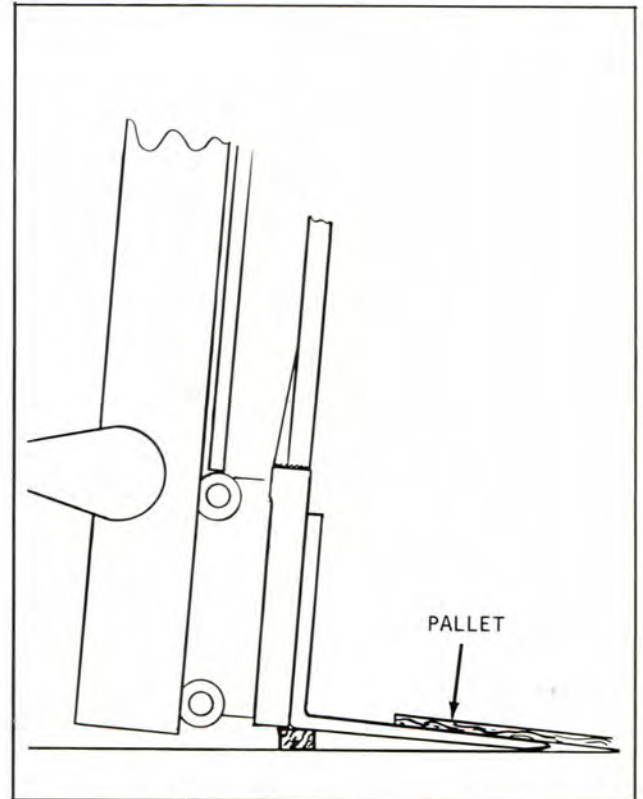


Plate 9565 Inner Rail Clearing Carriage Rollers

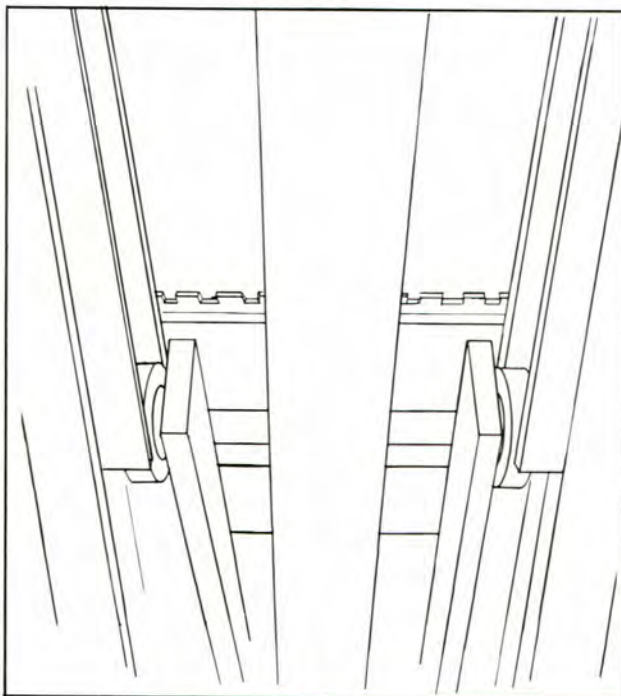


Plate 9591 Rollers Guiding Into Inner Rail

Step 3. Continue to drive machine forward until inner rails line up with upper carriage rollers, then... slowly lower inner rails to full down position.

CAUTION

CHECK TO BE SURE THE TOP CARRIAGE ROLLERS ARE GUIDING INTO INNER RAIL.

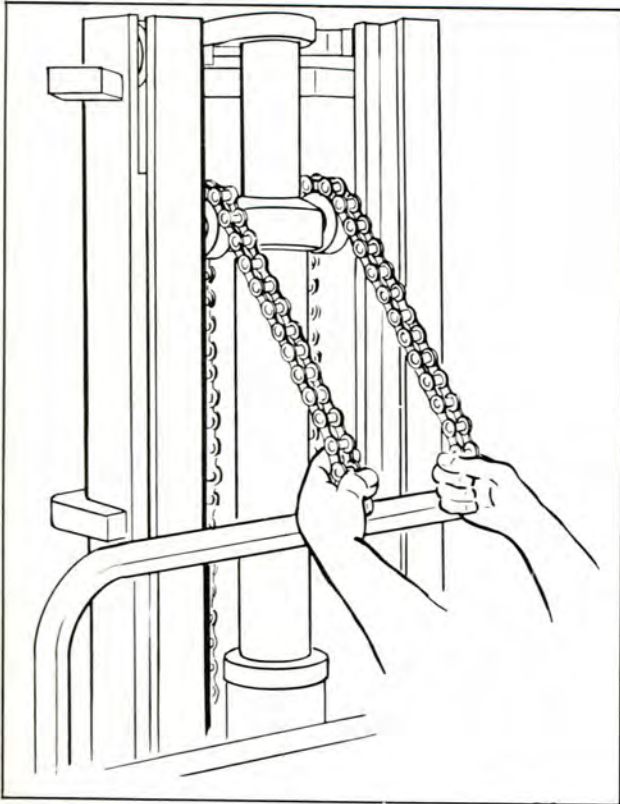


Plate 9586 Pulling Piston Head Down

Step 3(a). Remove wires holding lift chains.

(b). With a chain in each hand and someone holding the lift cylinder lever down, pull the piston to full down position. Place chains behind carriage.

Step 5. Raise carriage about 5' and place a 3' to 4' long 4"x4" wooden beam under it. DO NOT stand directly under forks. Lower carriage onto beam.

Step 6. Replace bolts with anchor pins.

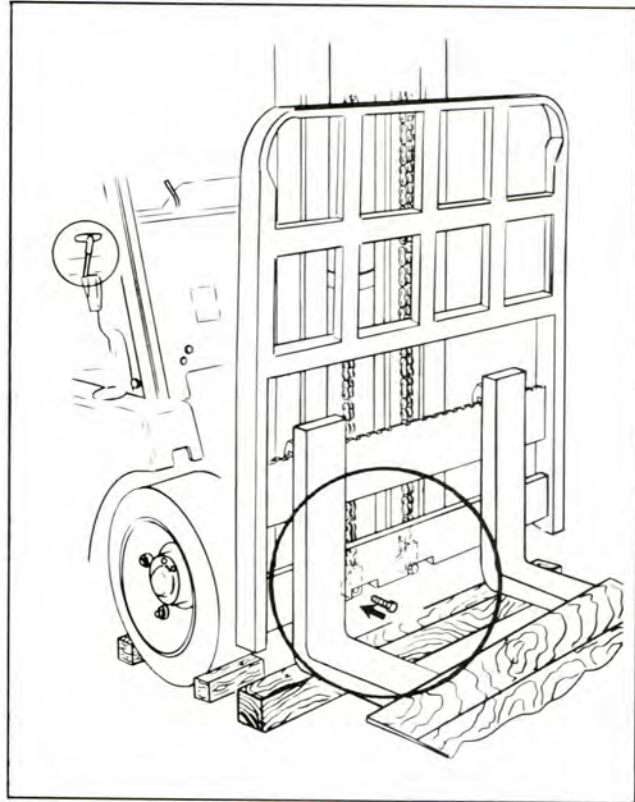


Plate 9587 Installing Bolts

Step 4. Put chain anchors in carriage anchor brackets and install 3/8" x 2" bolts in anchor pin holes.

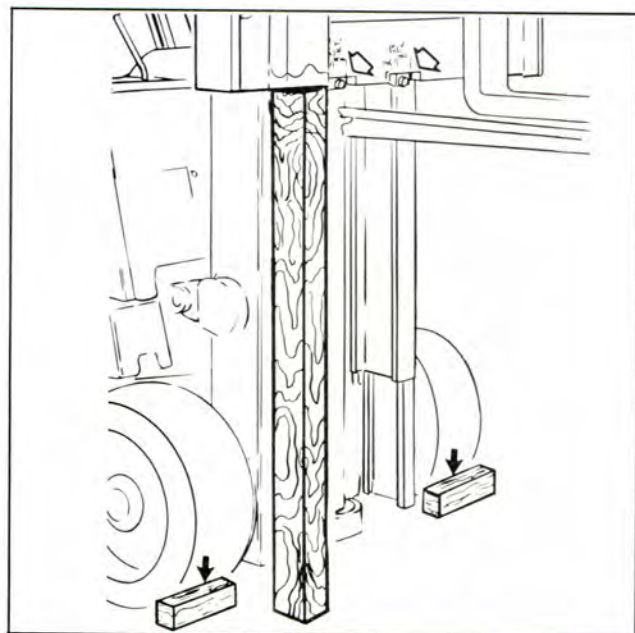


Plate 9593 Carriage Pin Replacement

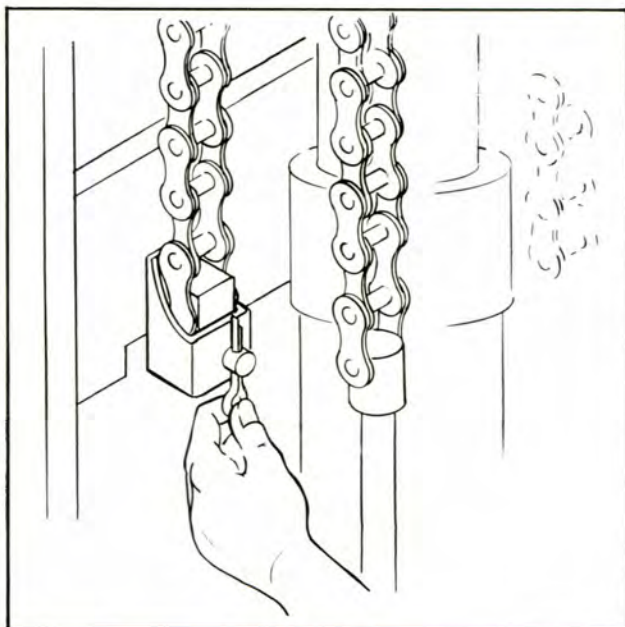


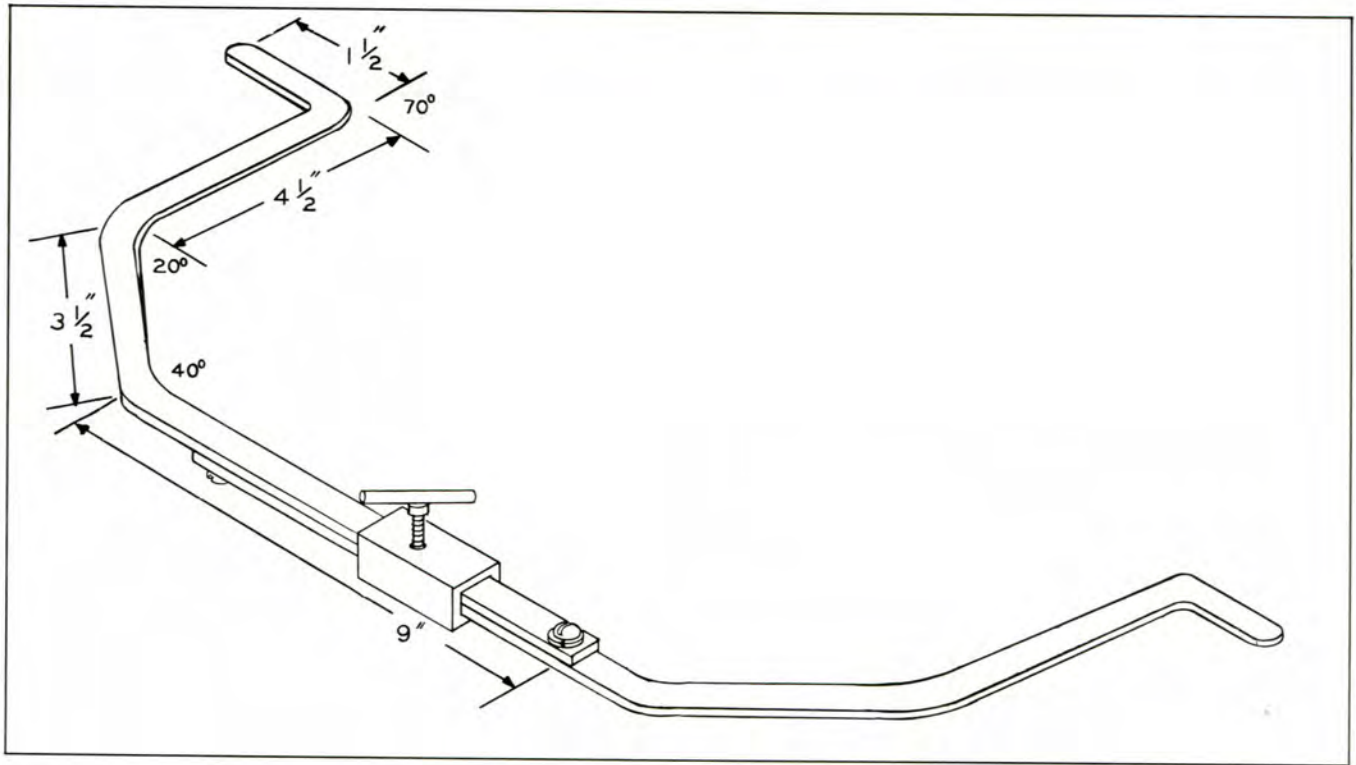
Plate 9588 Installing Cotter Pins

Step 7. Replace cotter pins in anchor pins.

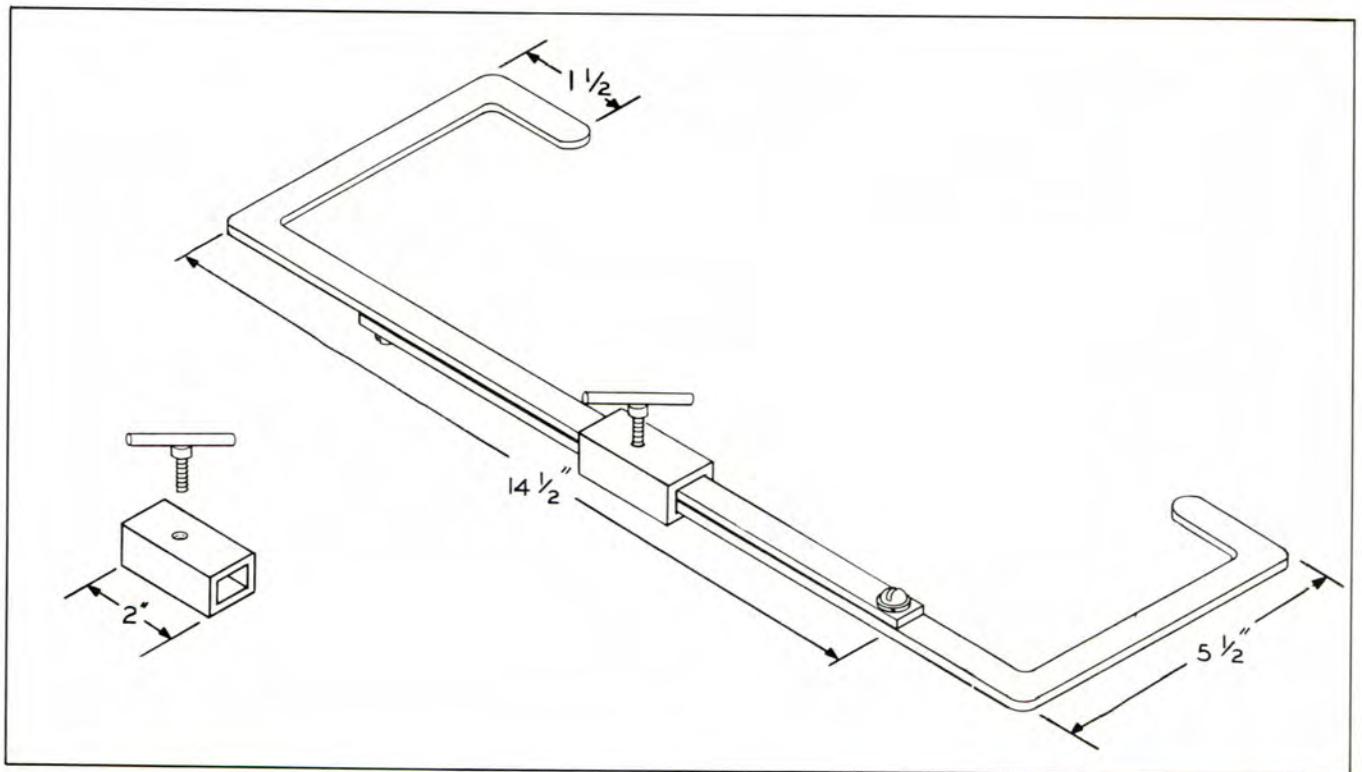
Step 8. Raise and lower carriage to full positions checking all phases of operation.



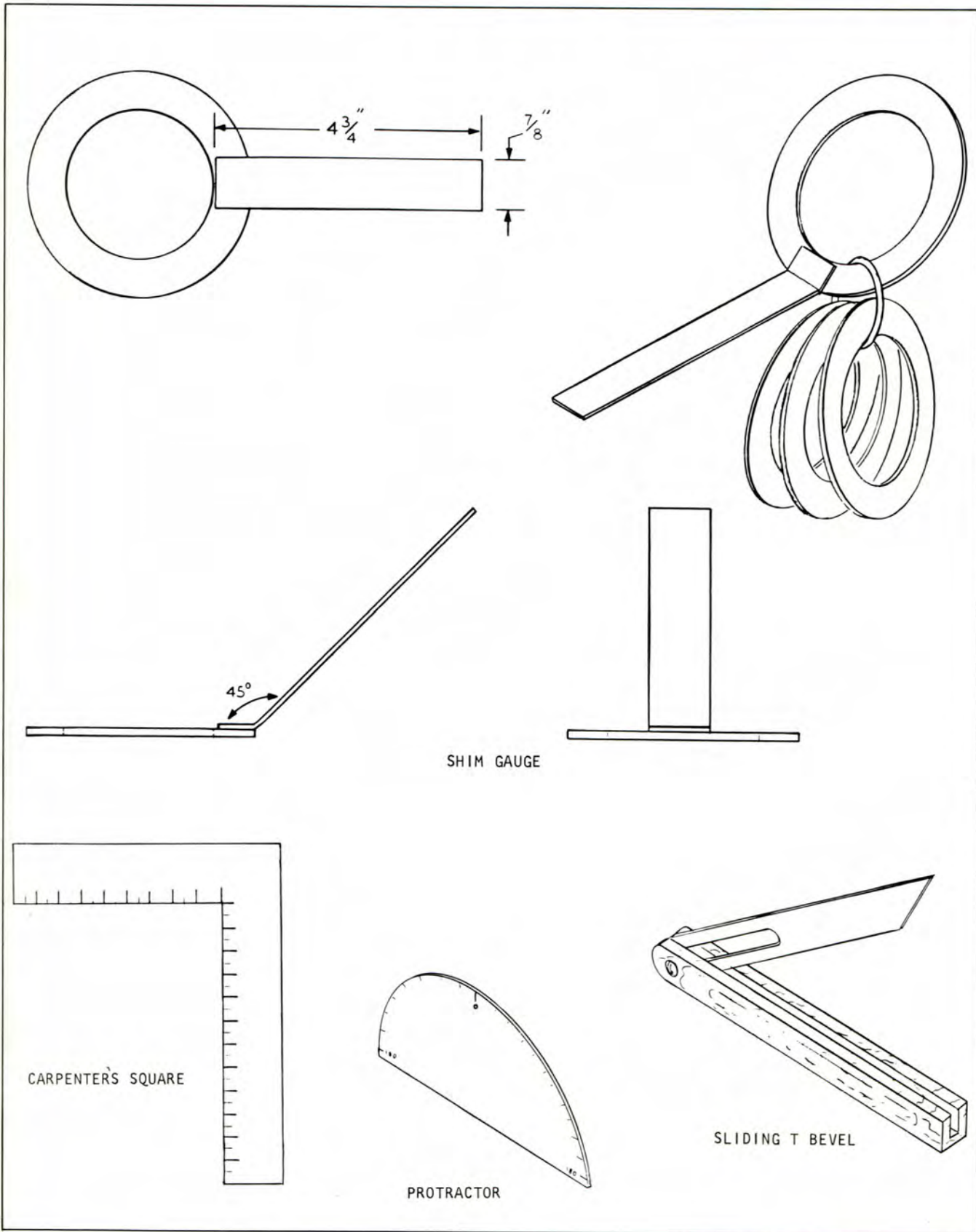




INSIDE SPANNING TOOL

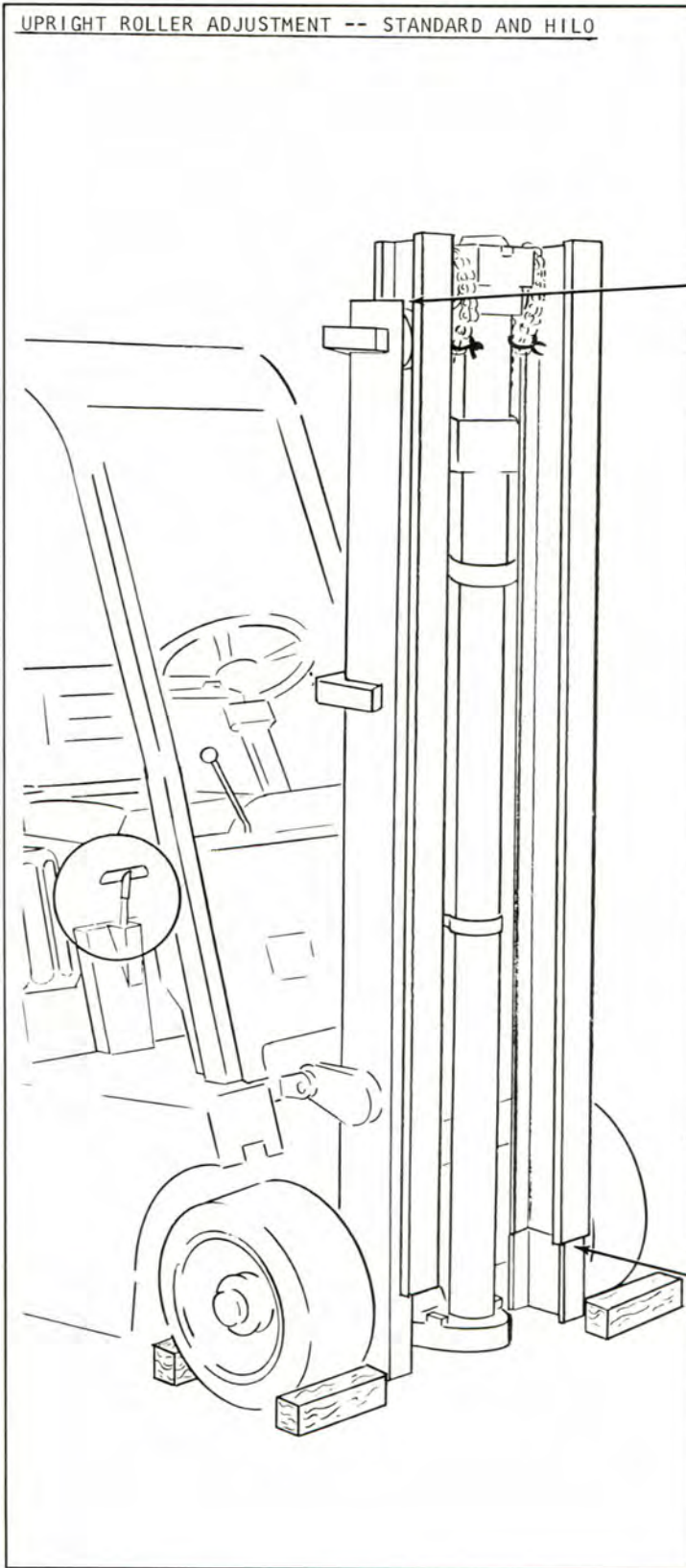


OUTSIDE SPANNING TOOL



UPRIGHT ROLLER ADJUSTMENT

UPRIGHT ROLLER ADJUSTMENT -- STANDARD AND HILO

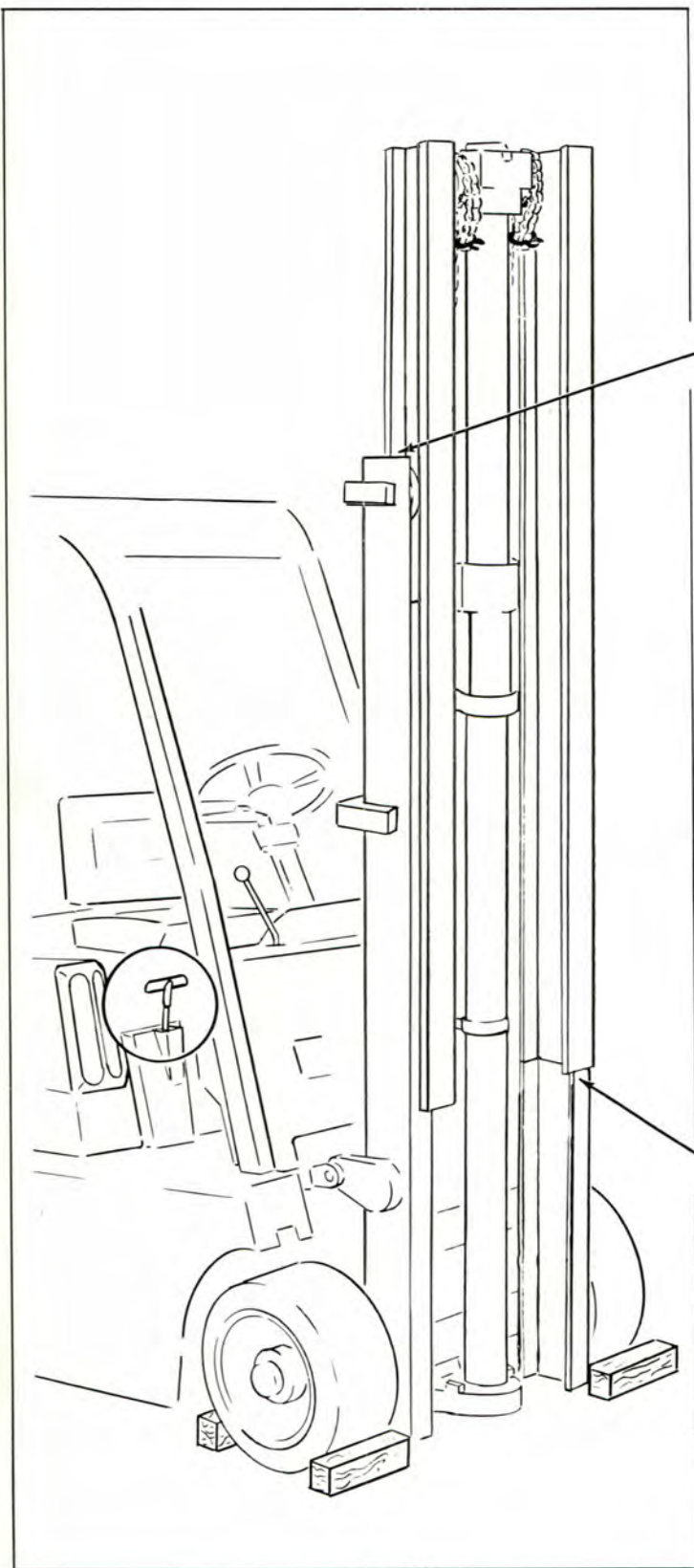


Step 1(a). Remove carriage. Refer to CARRIAGE REMOVAL.

Before checking roller clearance, position inner rail about 5" above full down position.

Check both sides for roller clearance at (top and bottom) of inner rail. Use tool to determine the number of shims to be added and record this number on the rail. Record number of shims to be used, on outer rail (for top rollers only). Record number of shims to be used on inner rail (for bottom rollers only).

There is to be some clearance but it is not to exceed 1/32".

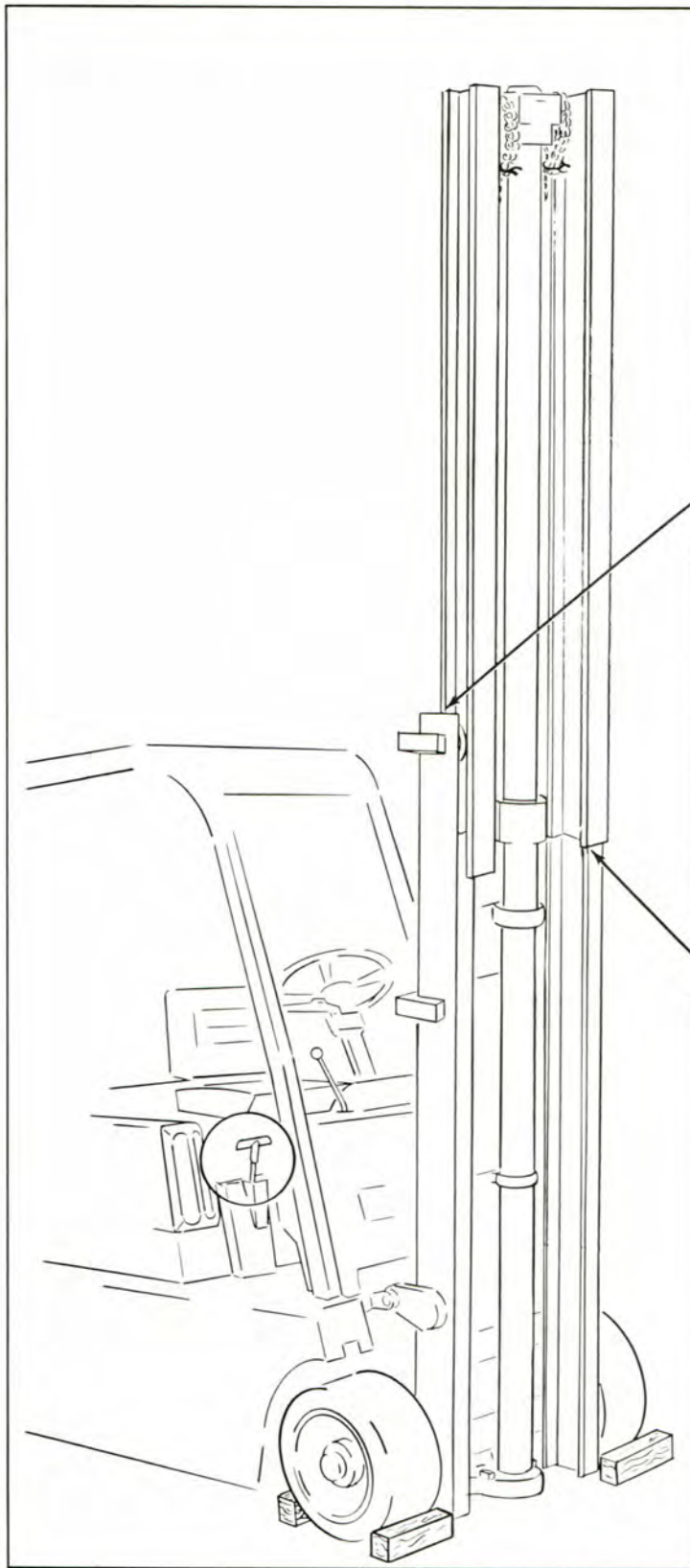


Step 1(b). Raise inner rail to 1/2 of its full up position. With tool and bar, check the roller clearance in the same manner as before.

Record number of shims to be used, on outer rail (for top rollers only).

Record number of shims to be used on inner rail (for bottom rollers only).

Plate 9625



Step 1(c). Raise inner rail to full up position and with tool and bar, check for roller clearance in the manner as before.

Record number of shims to be used, on outer rail (for top rollers only).

Record number of shims to be used, on inner rail (for bottom rollers only).

Plate 9626

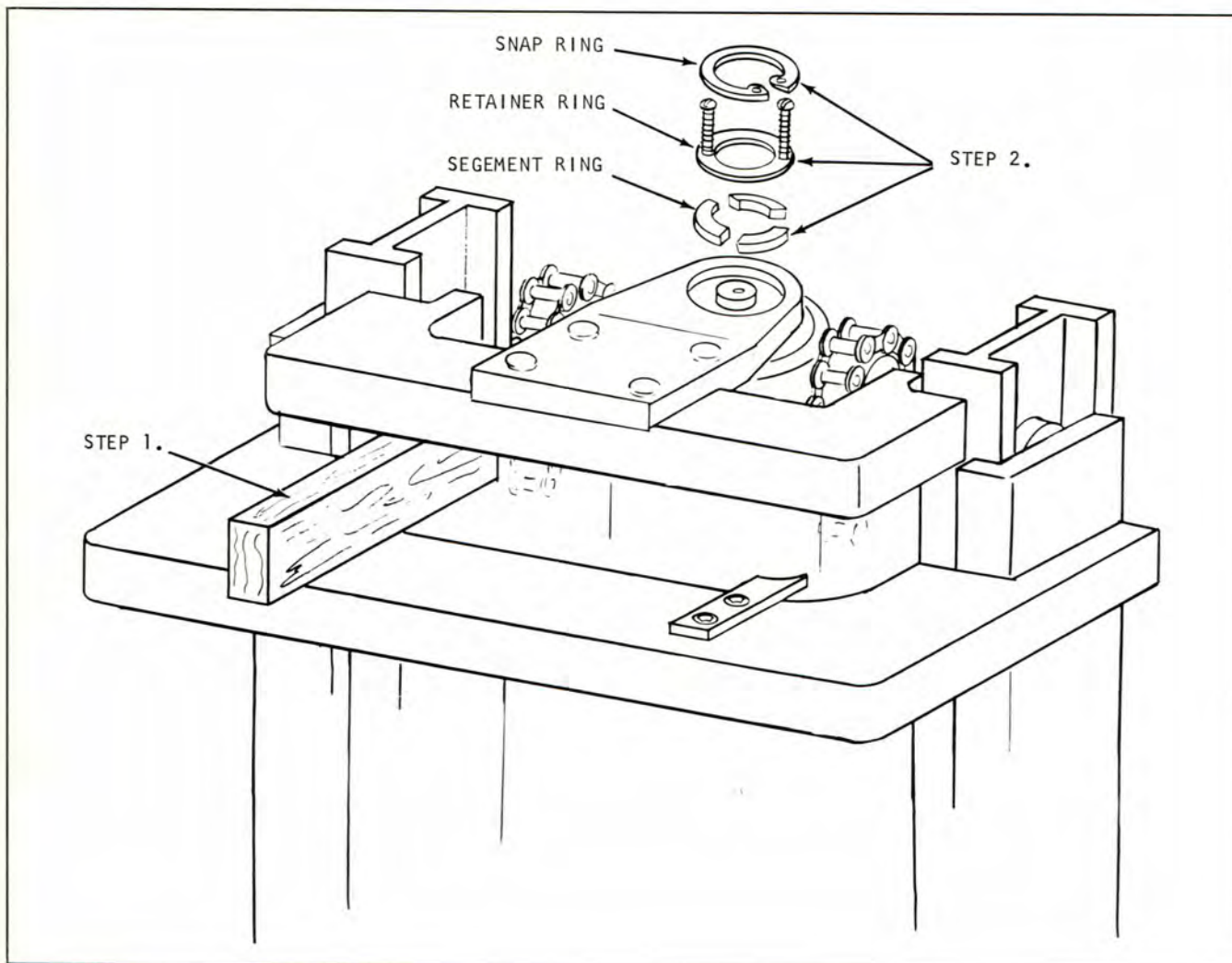


Plate 9627

REMOVAL OF INNER RAIL

Step 1. Raise inner rail about 5 inches and place a 2" x 4" block between upper tie bars. Lower inner rail until block supports it.

The upright you are working with may have a different piston anchor than the one shown above, remove it accordingly.

Step 2(a). Secure piston head with chain hoist.

(b). Remove lift cylinder from upper anchor

1. Remove snap ring

2. Place two (2) #6-32X2" round head slotted machine screws (in holes provided) in retainer ring.

(c). Remove segment ring.

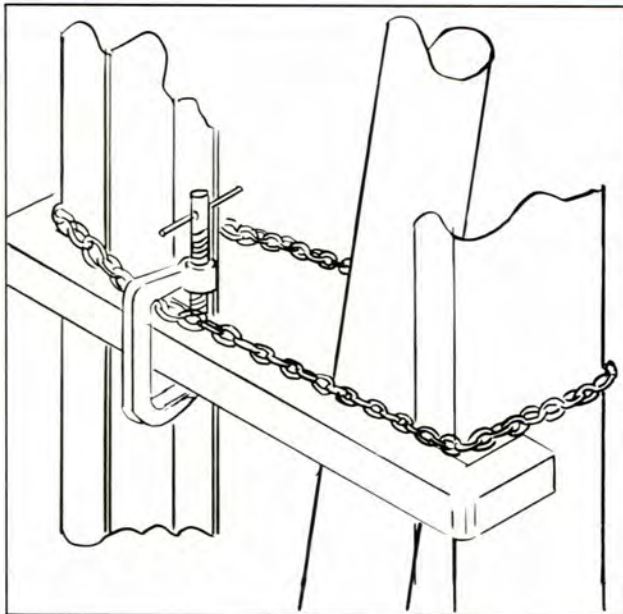


Plate 9628

Step 3. Place a safety strap or chain around outer rail as shown.

Step 4. Lower piston head out of anchor using pry bar. With the upright tilted forward the piston will rest on the strap or chain.

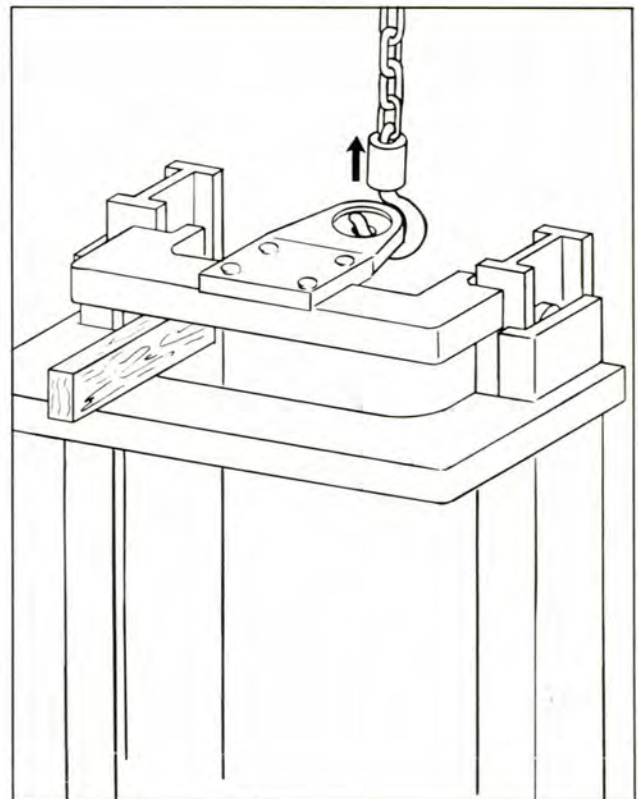


Plate 9630

Step 6. Place lifting device hook in hole of cylinder anchor. Raise about 2" and remove block between tie bars.

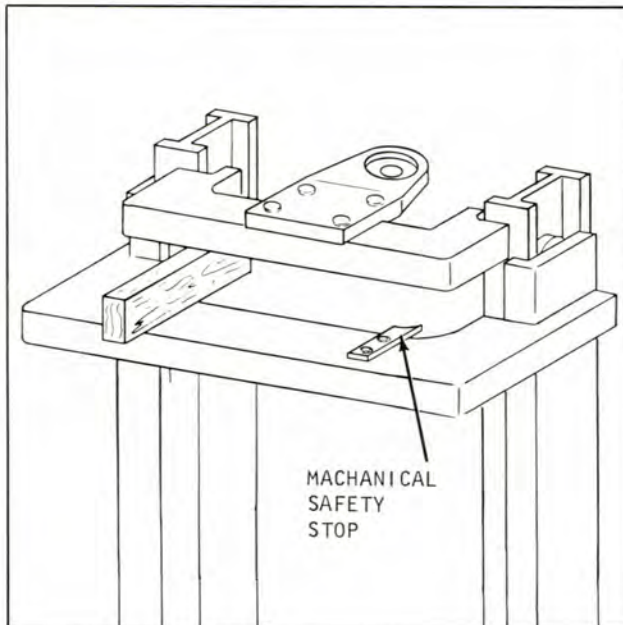
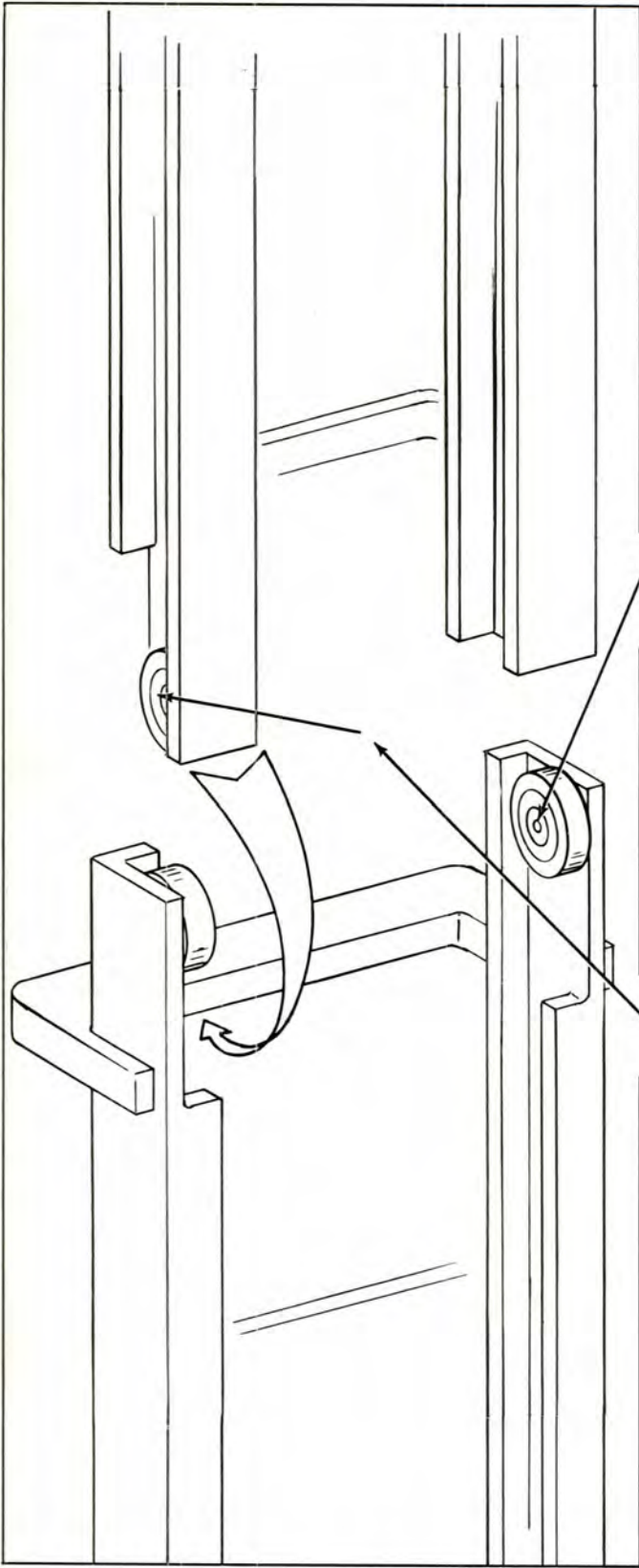


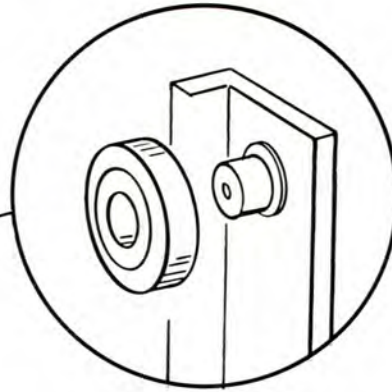
Plate 9629

Step 5. Remove mechanical safety stops with allen wrench.



Step 7. Raise inner rail out of outer rail.

Step 8. Leave inner rail in this position while adjusting rollers.



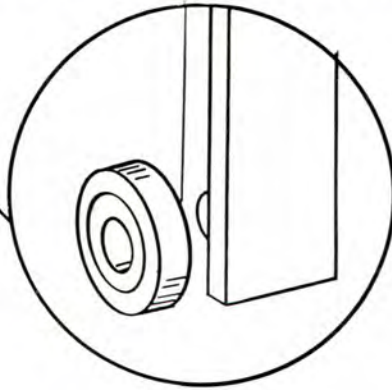
Step 9. Adjusting upright rollers:

A. Outer rail rollers.

1. Count the number of shims at the right and left hand rollers.

2. Look at the three (3) numbers you recorded on the outer rail in Step 1. The smallest of these numbers is the total number of shims to be added. A "0" means DO NOT add shims.

3. Your target for adjustment is to have the same number of shims at each upper roller. If you end up with an extra shim DO NOT remove it. Mark the side having an extra shim.



B. Inner rail rollers

1. Count the number of shims at the right and left hand rollers.

2. Look at the three (3) numbers you recorded on the inner rail in Step 1. Go through the same steps you followed in adjusting the upper rollers.

3. If you end up with an extra shim here too, be sure it is on the same side as the extra upper shim.

C. Replace inner rail.

Plate 9631



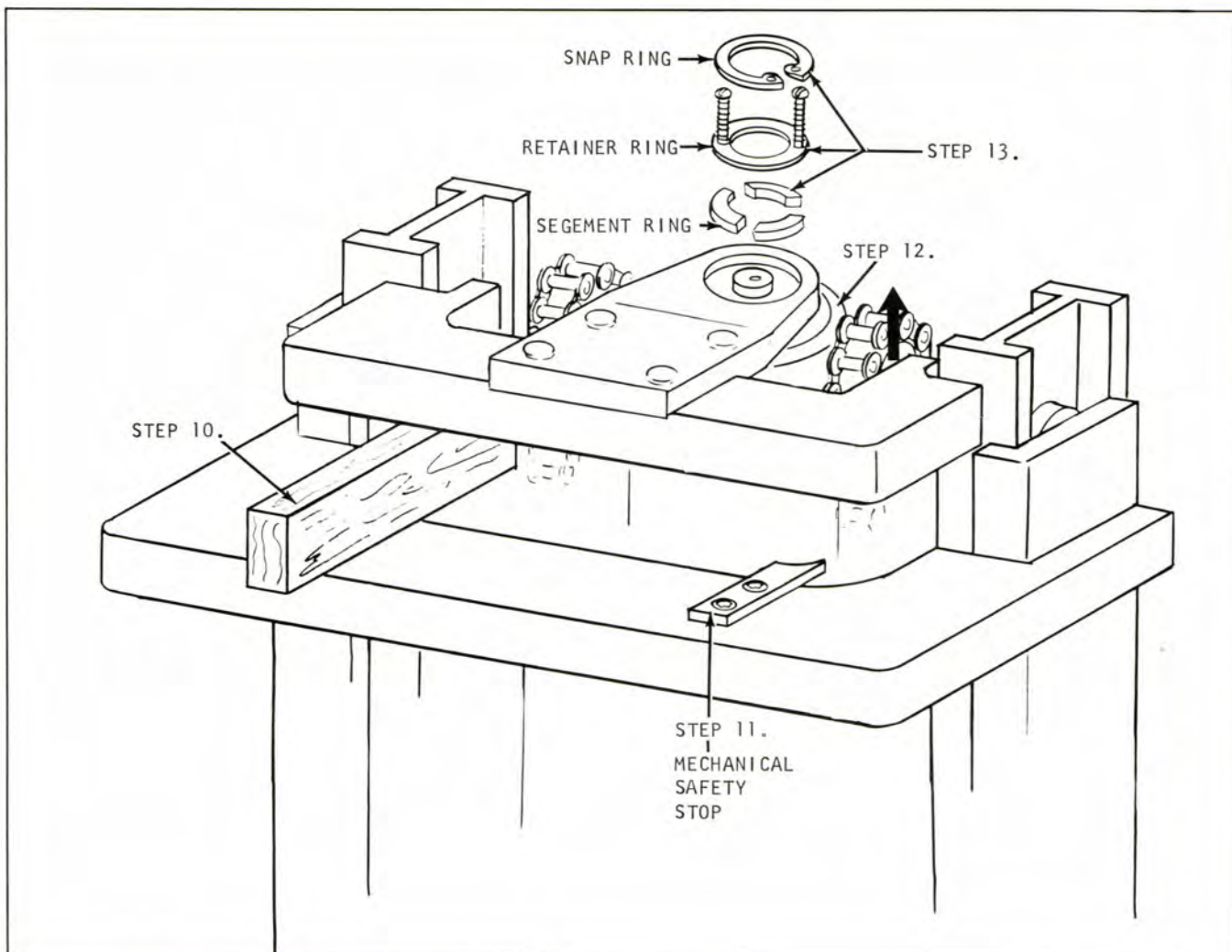


Plate 9632

Step 10(a). Place block between upper tie-bars. Lower inner rail until block supports it.

(b). Unhook lifting device.

Step 11. Install mechanical safety stops. Be sure to install lock washer and screw fasteners.

Step 12. Guide piston into anchor with one hand and move the lift lever with the other.

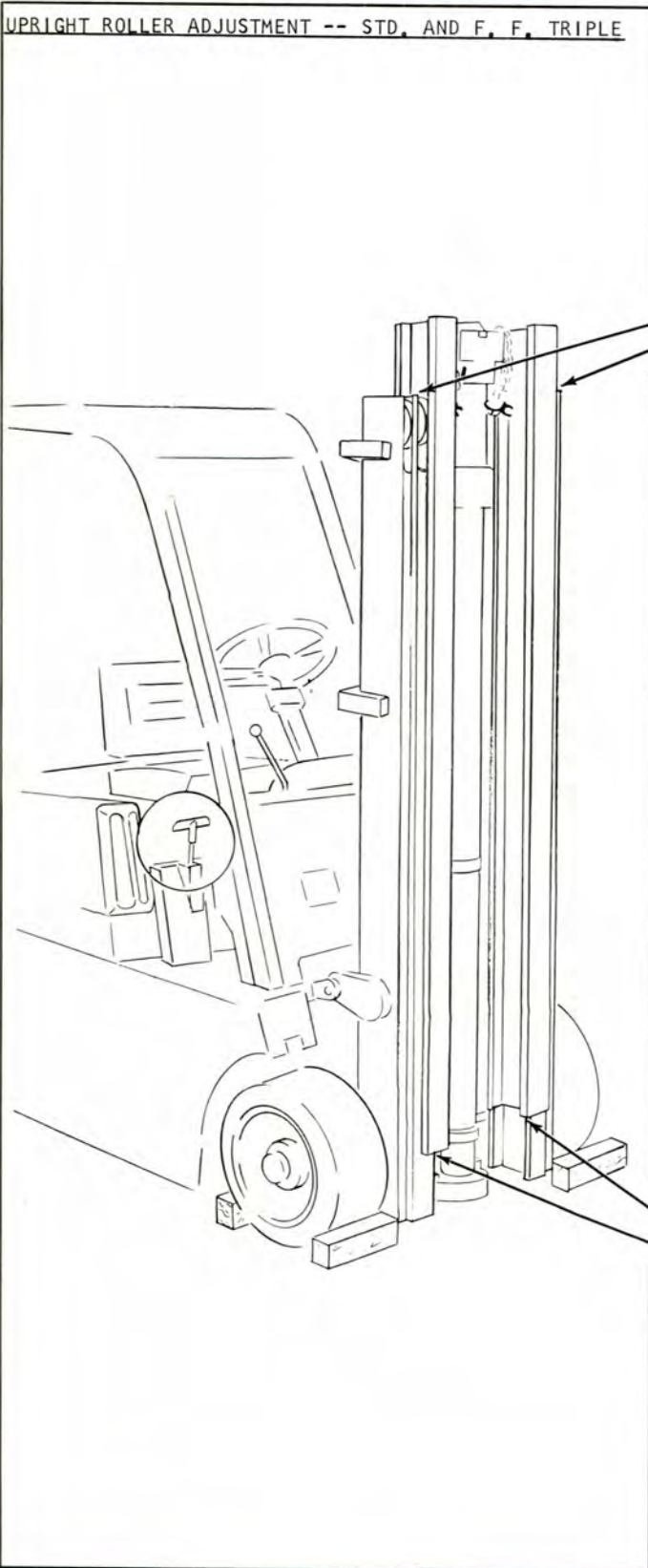
Step 13. Secure lift cylinder to anchor.

(a). Install segment ring.

(b). Install retainer ring and remove both slotted machine screws.

(c). Install snap ring.

(d). Raise and lower to full positions checking piston and anchor. Remove block between tie bars.

UPRIGHT ROLLER ADJUSTMENT -- STD. AND F. F. TRIPLE

Step 1(a). Remove carriage.

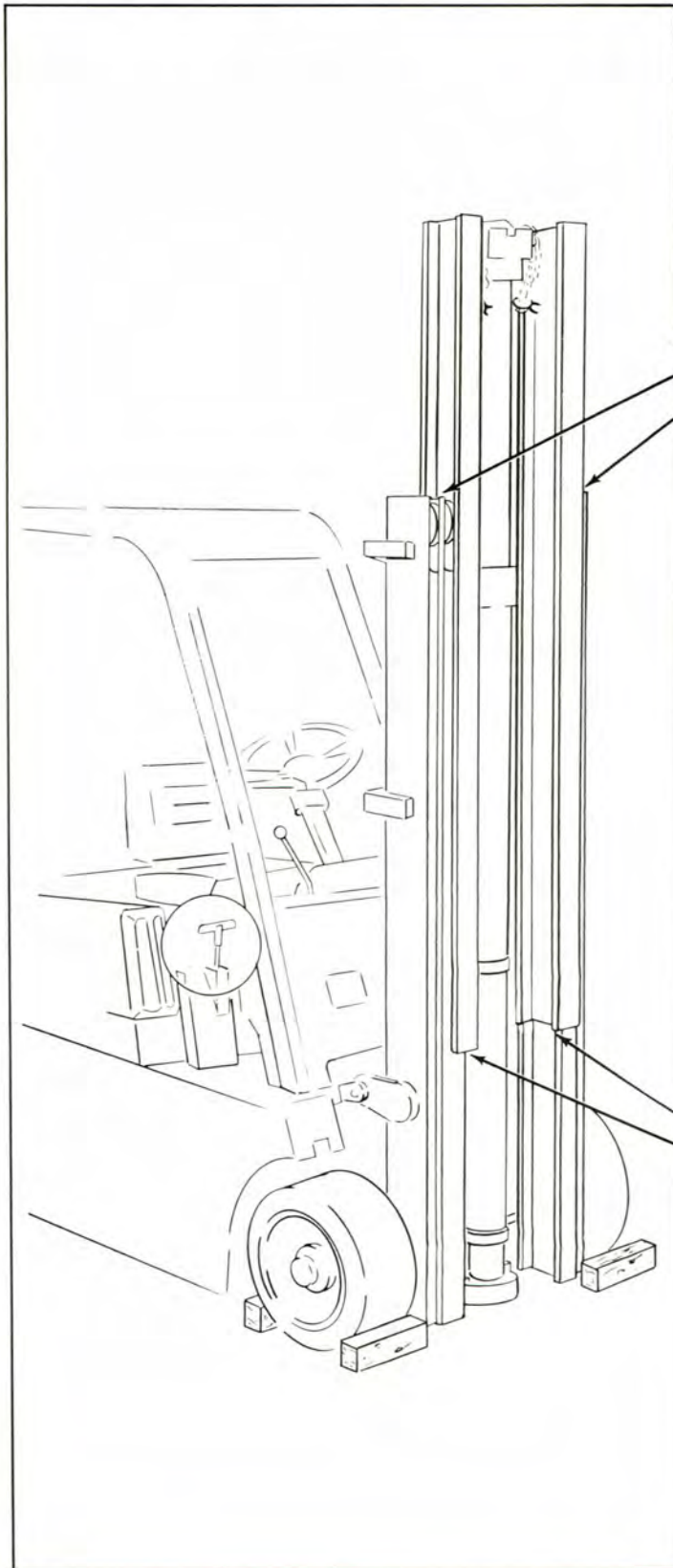
Before checking, position inner rail about 5 inches above full down position.

Check both sides for roller clearance at (top and bottom) of inner rail. Use tool to determine the number of shims to be added and record this number on the rail.

Record number of shims to be used, on intermediate rail (for top rollers only).

Record number of shims to be used on inner rail (for bottom rollers only).

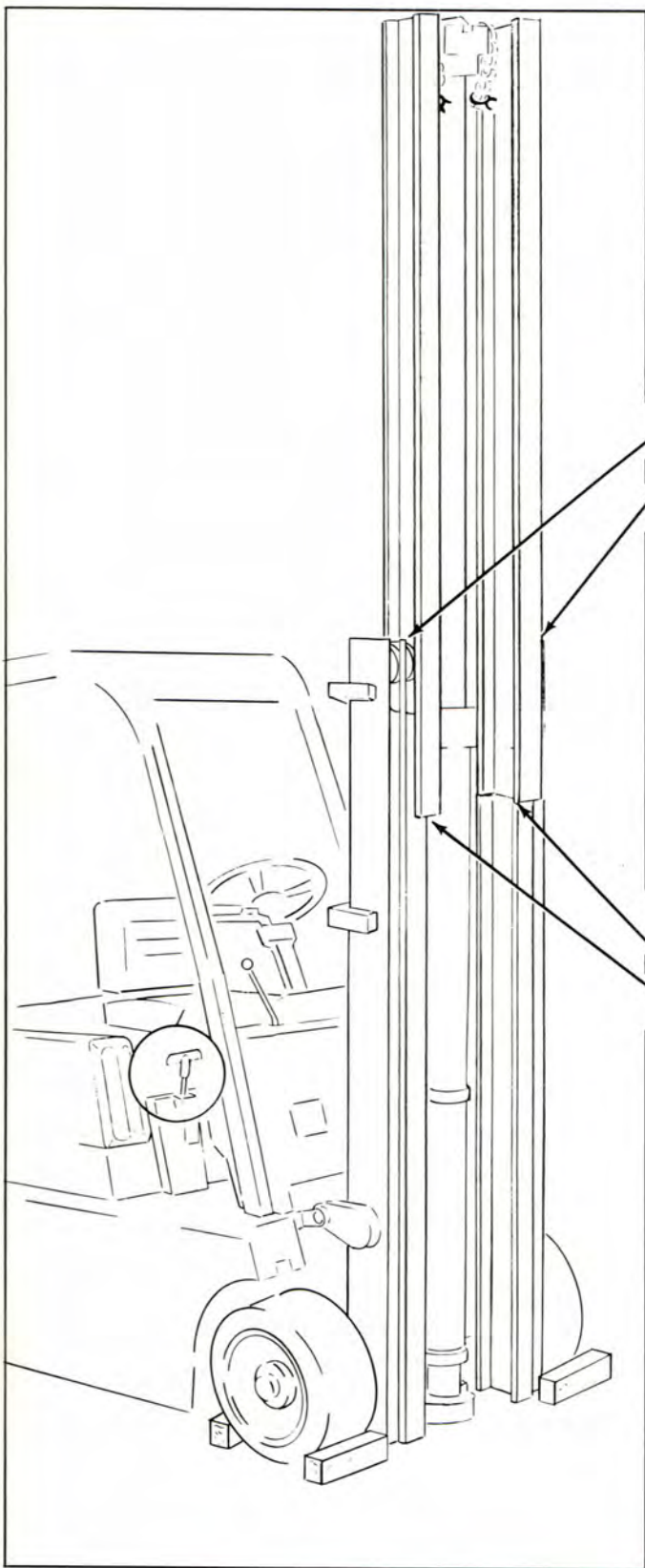
There is to be some clearance but it is not to exceed 1/32 inch.



Step 1(b). Raise inner rail to 1/2 of its full up position. Check roller clearance in the same manner as before.

Record number of shims to be used, on intermediate rail (for top roller only).

Record number of shims to be used, on inner rail (for bottom rollers only).

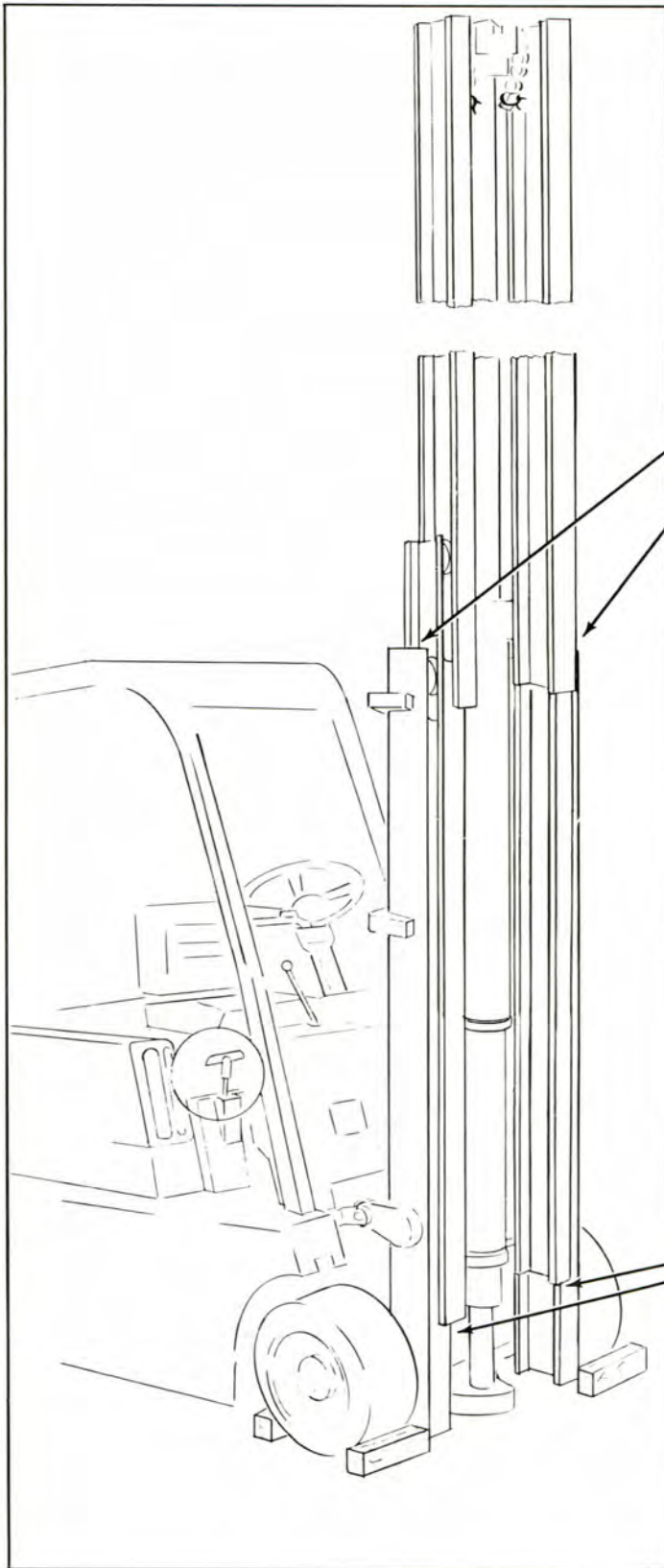


Step 1(c). Raise inner rail to full up position. Check roller clearance in the same manner as before.

Record number of shims to be used, on intermediate rail (for top rollers only).

Record number of shims to be used, on inner rail (for bottom rails only).

Plate 9638

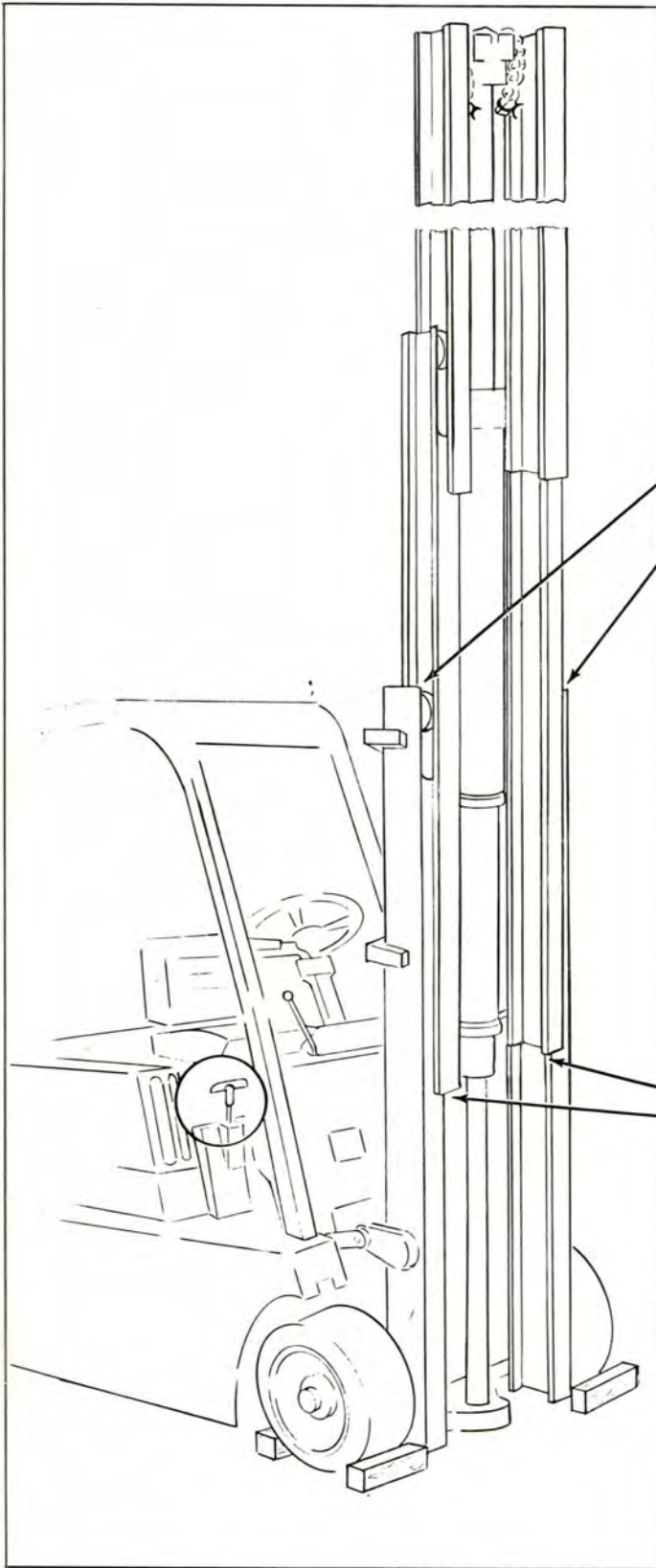


Step 2(a). Raise intermediate rail about 5 inches. Check roller clearance in the same manner as before.

Record number of shims to be used, on outer rail (for top rollers only).

Record number of shims to be used, on intermediate rail (for bottom rollers only).

Plate 9639

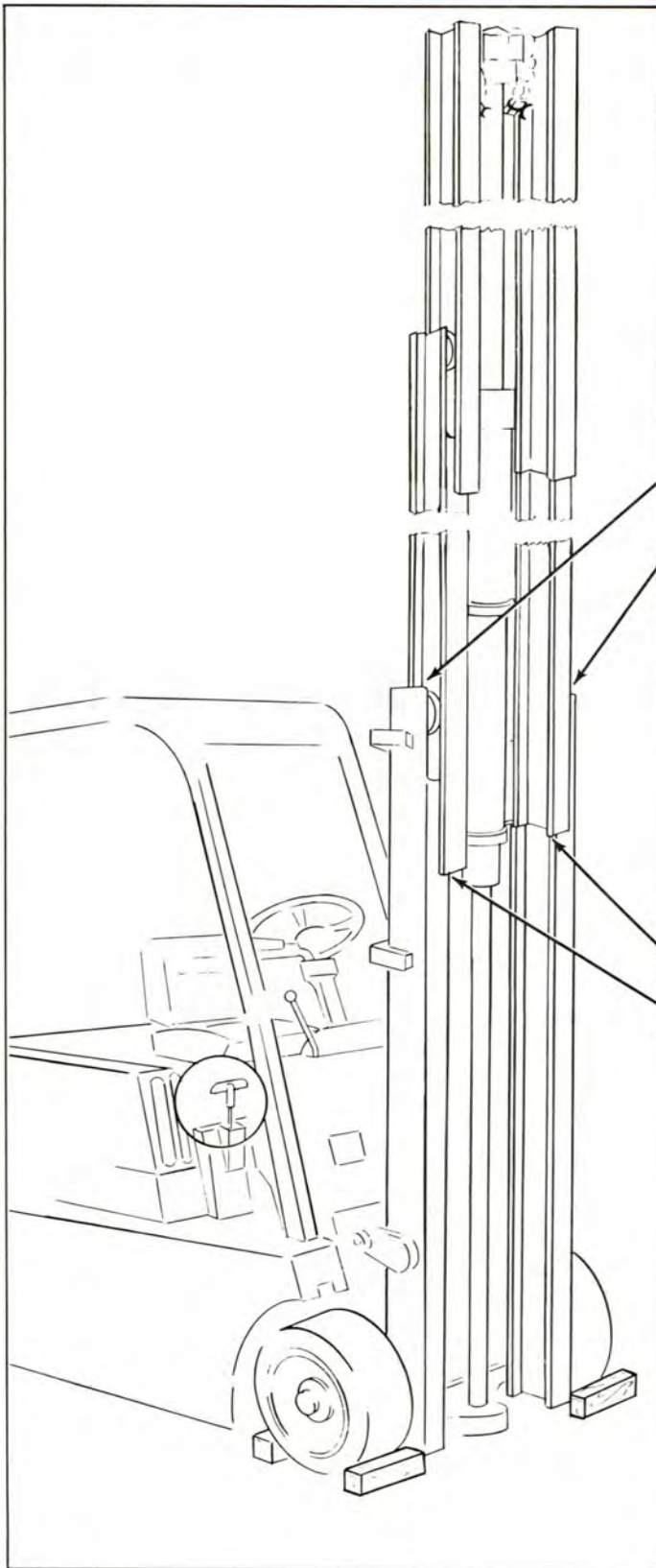


Step 2(b). Raise intermediate rail to 1/2 its full up position. Check roller clearance in the same manner as before.

Record number of shims to be used, on outer rail (for top rollers only).

Record number of shims to be used, on intermediate rail (for bottom rollers only).

Plate 9640



Step 2(c). Raise intermediate rail to full up position. Check roller clearance in the same manner as before.

Record number of shims to be used, on outer rail (for top rollers only).

Record number of shims to be used, on inner rail (for bottom rollers only).

Plate 9641

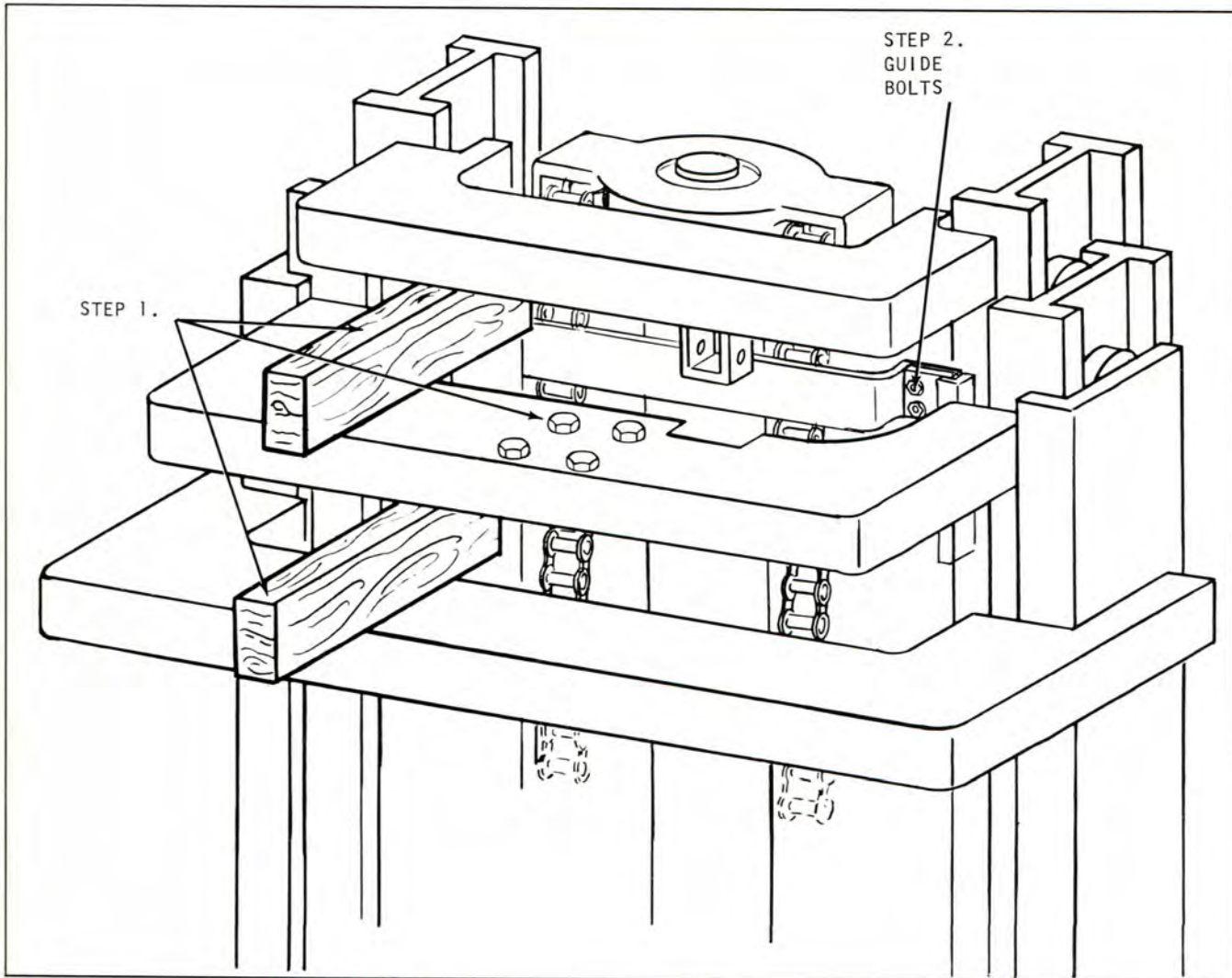


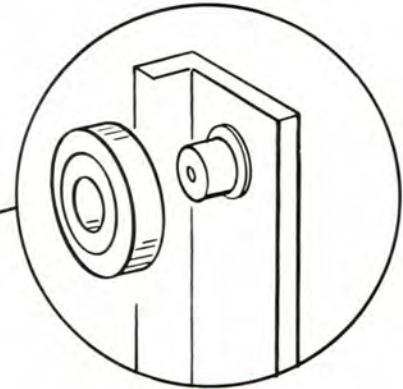
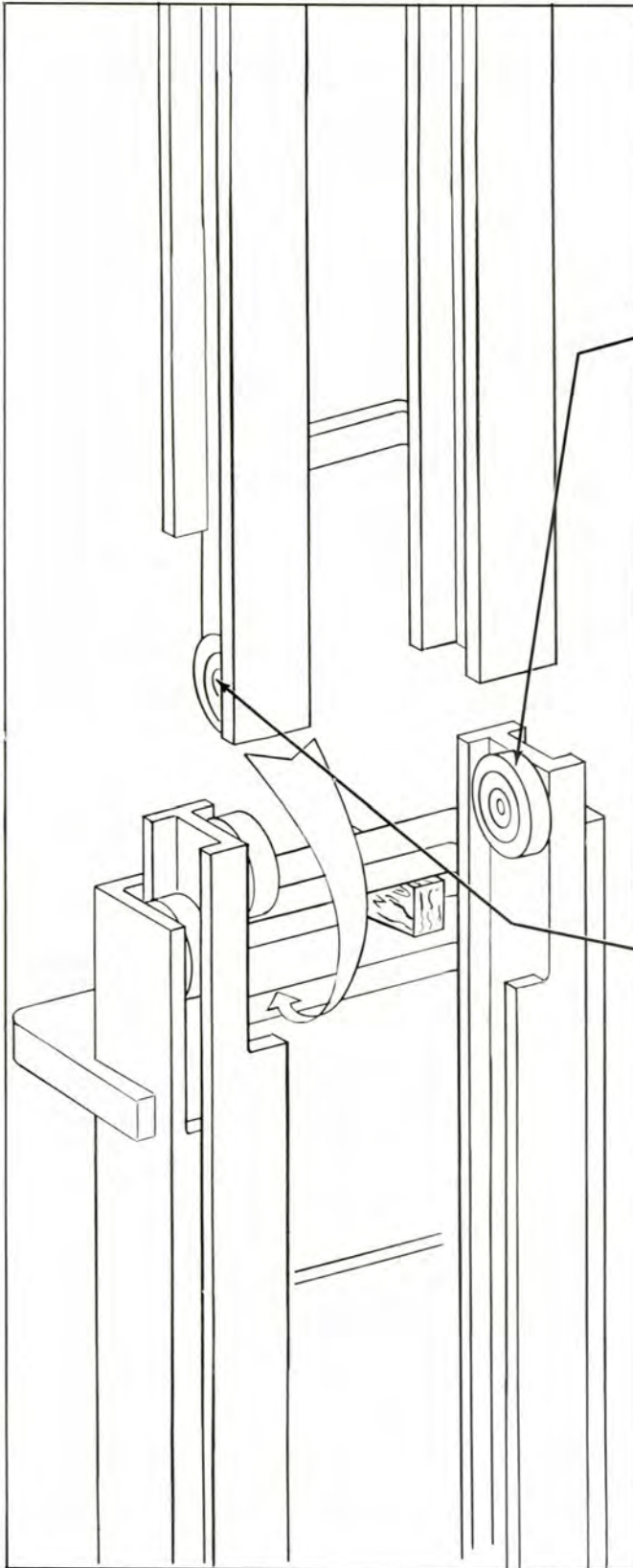
Plate 9642 Standard Triple Piston Head

REMOVAL OF RAILS--STANDARD TRIPLE

- Step 1. Place blocks between inner and intermedaite rail tie bars. Remove mechanical safety stops.
- Step 2. Pull piston head down far enough to get at piston head guide bolts. Remove both piston head guides.
- Step 3. Pull piston head to full down position.



Step 4. Remove inner rail and leave it in this position while adjusting rollers.

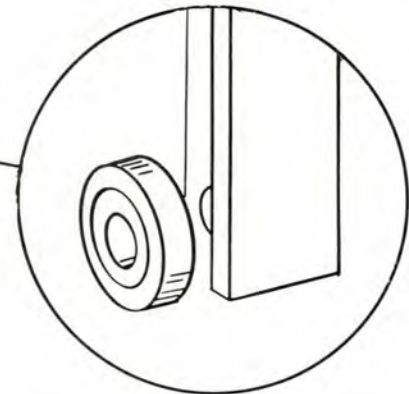


A. Intermediate rail rollers:

1. Count the number of shims at the right and left hand rollers.

2. Look at the three (3) numbers you recorded on the intermediate rail in Step 1. The smallest of these numbers is the total number of shims to be added. A "0" means DO NOT add shims.

3. Your target for adjusting is to have the same number of shims at each upper roller. If you end up with an extra shim DO NOT remove it. Mark the side having an extra shim.



B. Inner rail rollers.

1. Count the number of shims at the right and left hand rollers.

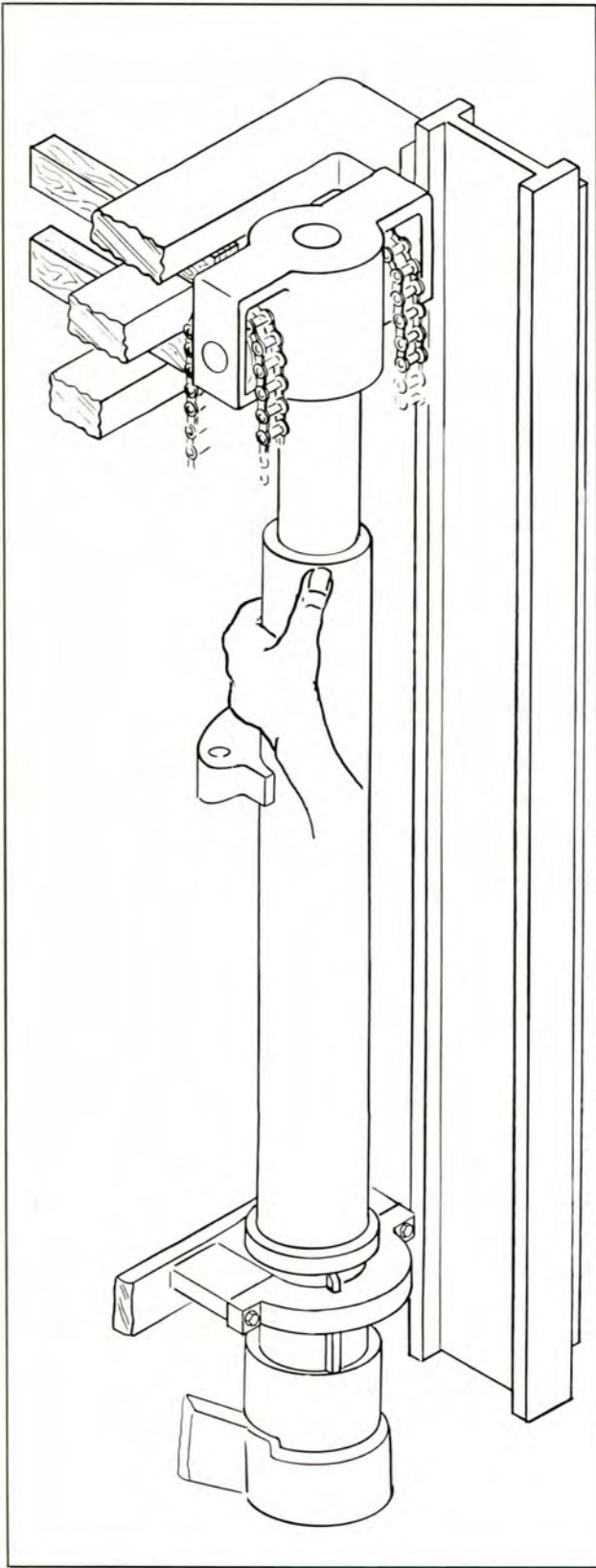
2. Look at the three (3) numbers you recorded on the inner rail in Step 1. Go through the same steps you followed in adjusting the upper rollers.

3. If you end up with an extra shim here too, be sure it is on the same side as the extra upper shim.

C. Replace inner rail.

**NOTE**

Refer to next page.



N O T E

With one hand pull piston head forward to let tie bar pass by piston head freely.

Plate 9644

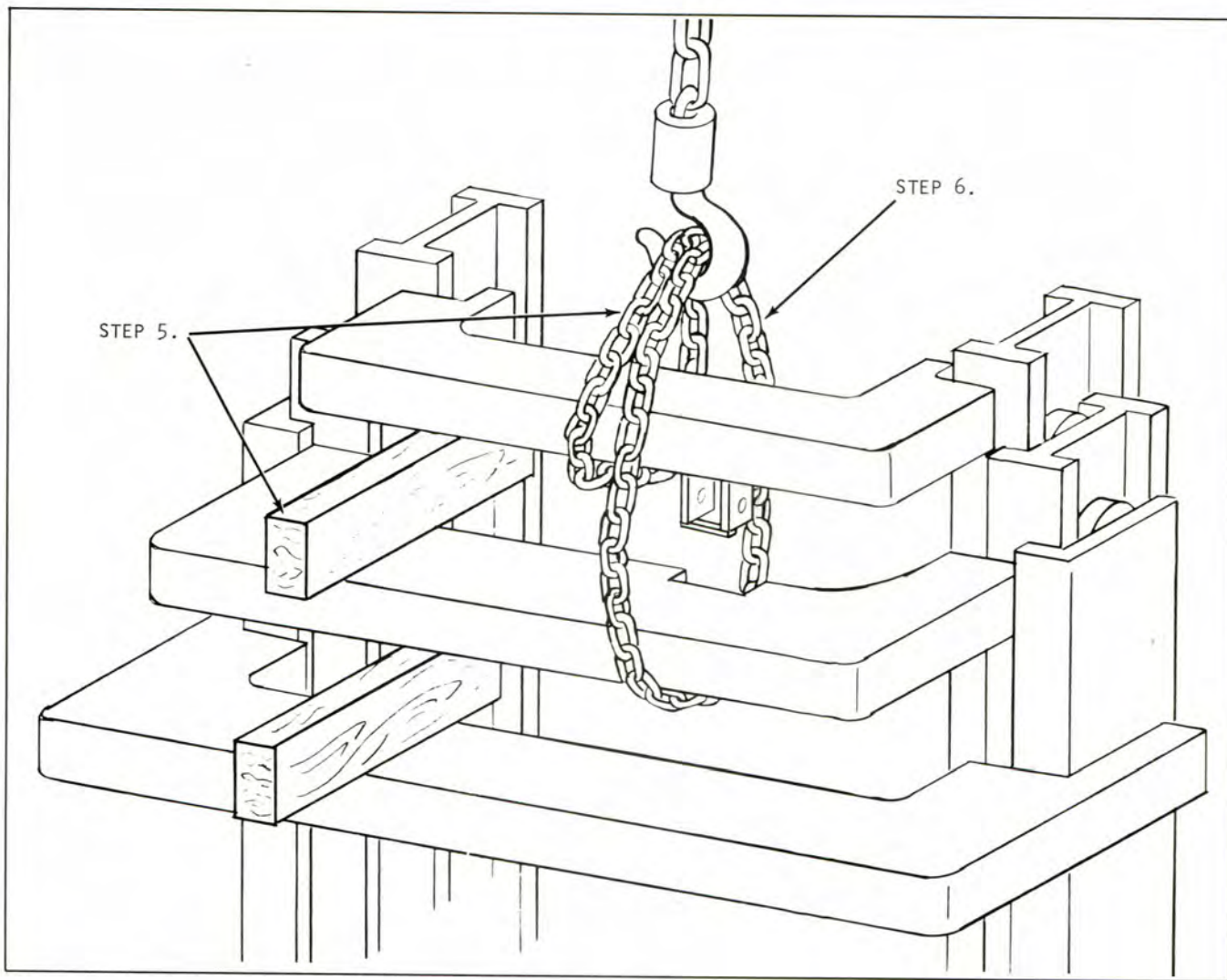


Plate 9645 Chain Placement

Step 5. Replace block and remove chain hoist.

Step 6. Remove intermediate rail assembly.

(a). Place chain around inner and intermediate rail assembly as shown above.

Step 6(b). Place a strap or chain around outer rail and secure. This will support lift cylinder.

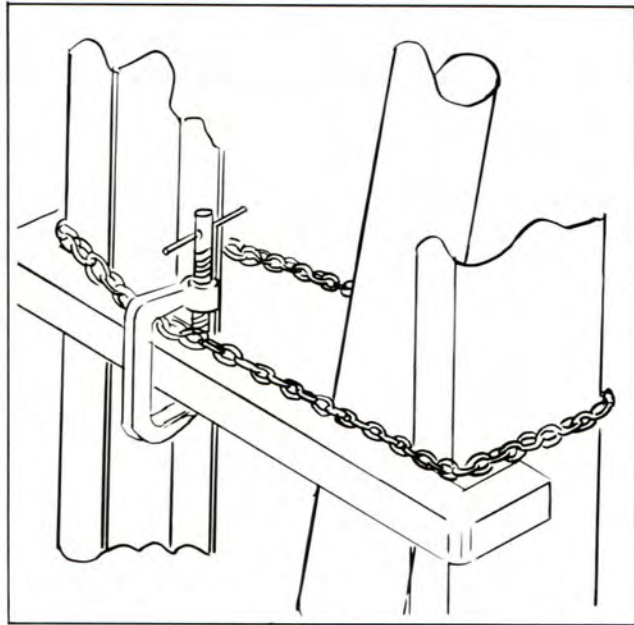


Plate 9628

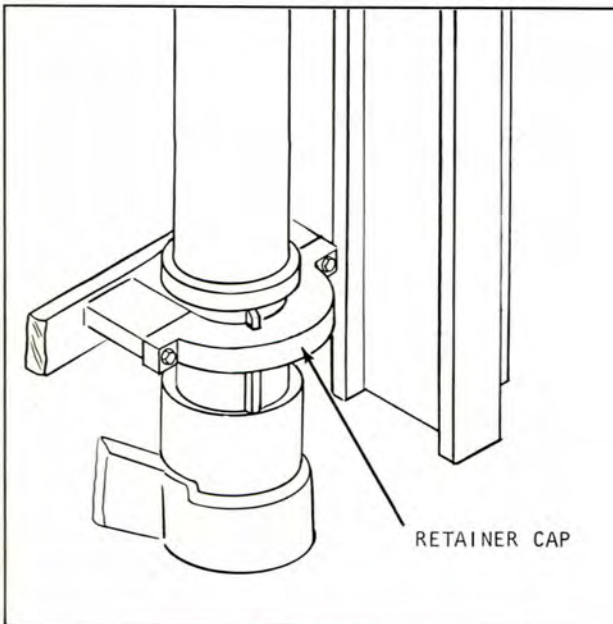
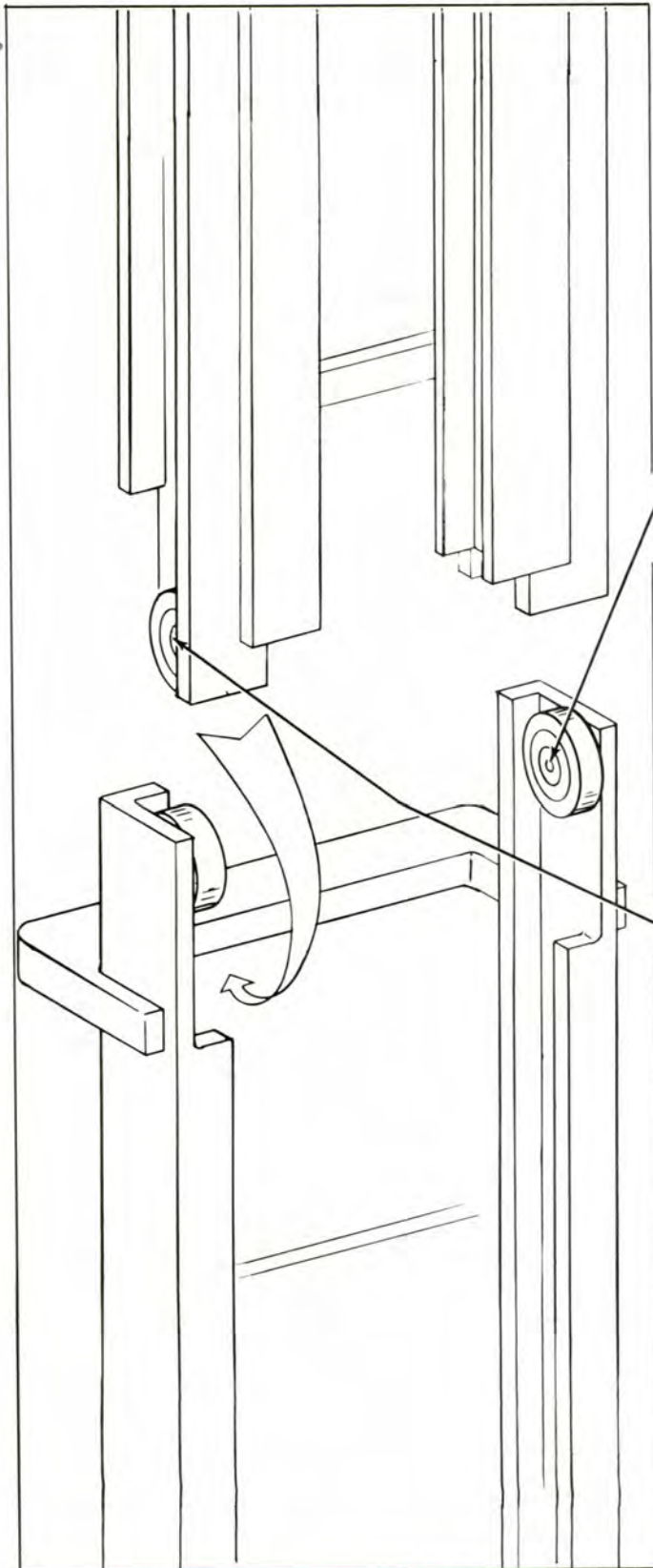


Plate 9646

Step 6(c). Remove lift cylinder retainer cap.



Step 6(d). Lean cylinder forward to rest on strap, as shown in Plate

Step 6(e). Leave intermediate rail assembly in this position while adjusting rollers.

**A. Outer rail rollers:**

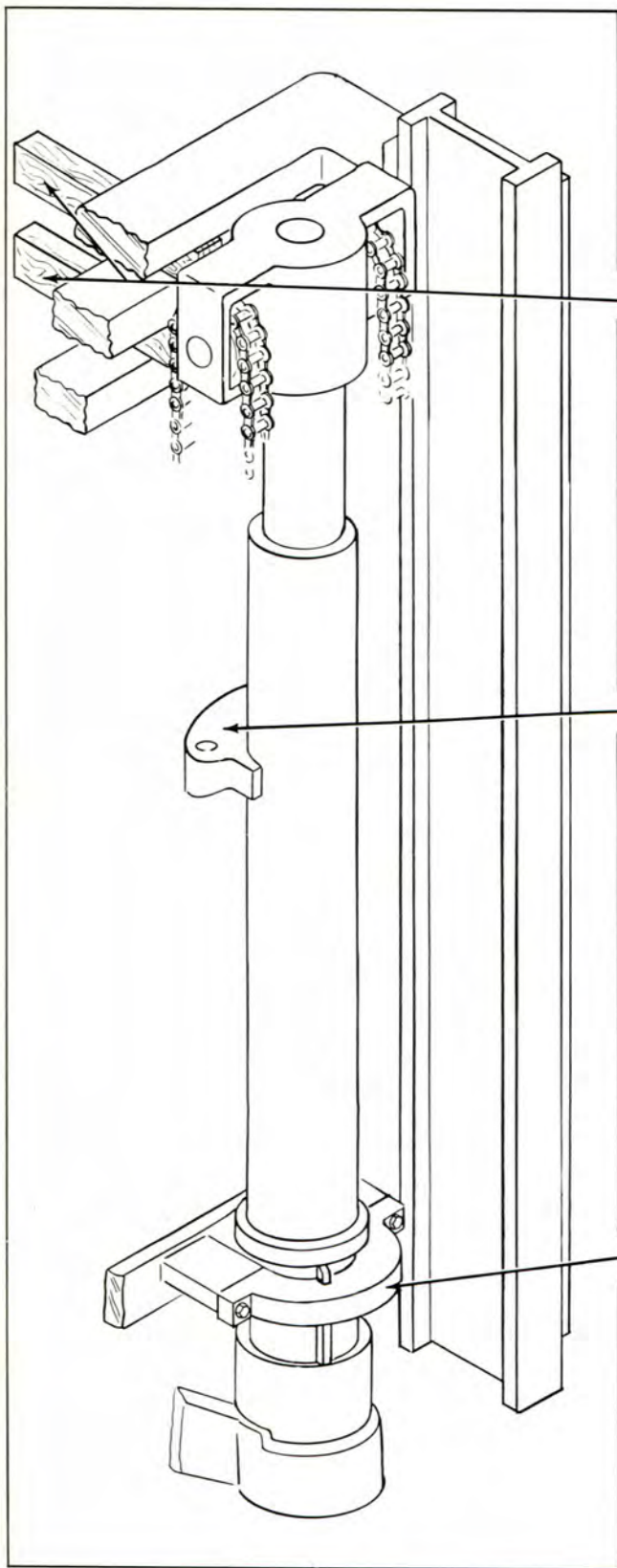
1. Count the number of shims at the right and left hand rollers.
2. Look at the three (3) numbers you recorded on the outer rail in Step 1. The smallest of these numbers is the total number of shims to be added. A "0" means DO NOT add shims.
3. Your target for adjustment is to have the same number of shims at each upper roller. If you end up with an extra shim DO NOT remove it. Mark the side having an extra shim.

**B. Intermediate rail rollers:**

1. Count the number of shims at the right and left hand rollers.
2. Look at the three numbers you recorded on the intermediate rail in Step 1. Go through the same steps you followed in adjusting the upper rollers.
3. If you end up with an extra shim here too, be sure it is on the same side as the extra upper shim.

C. Replace intermediate rail assembly.

Plate 9647



Step 6(f). Replace block between intermediate rail assembly tie bar and remove chain.

Step 7. Place chain around chain anchors on cylinder. Use hoist to support cylinder.

Step 8. Remove supporting strap.

Step 9. Install cylinder retainer cap.

Plate 9648

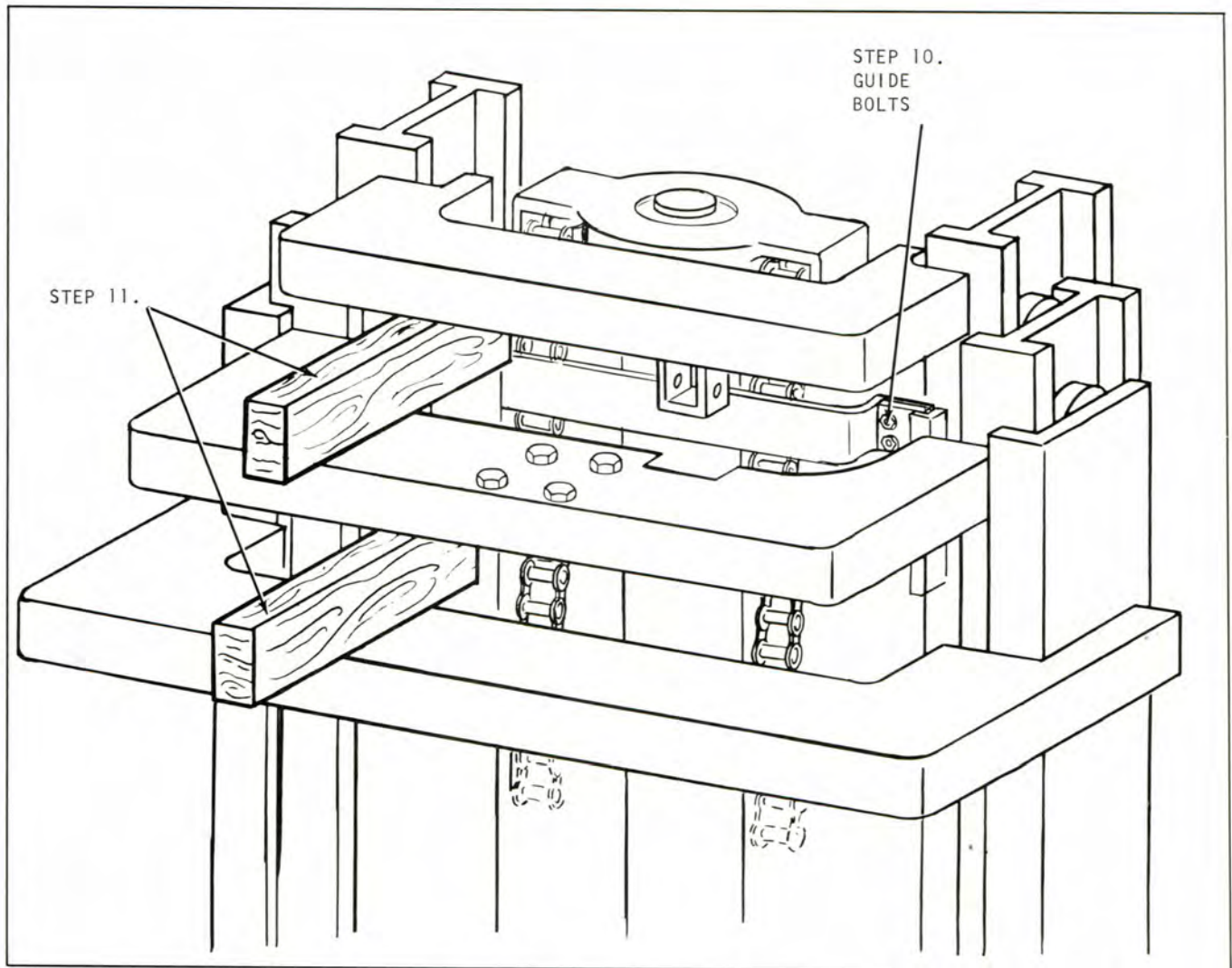


Plate 9649 Standard Triple Piston Head

Step 10. Install both piston head guides.

Step 11. Install mechanical stop. Raise rails and remove blocks.

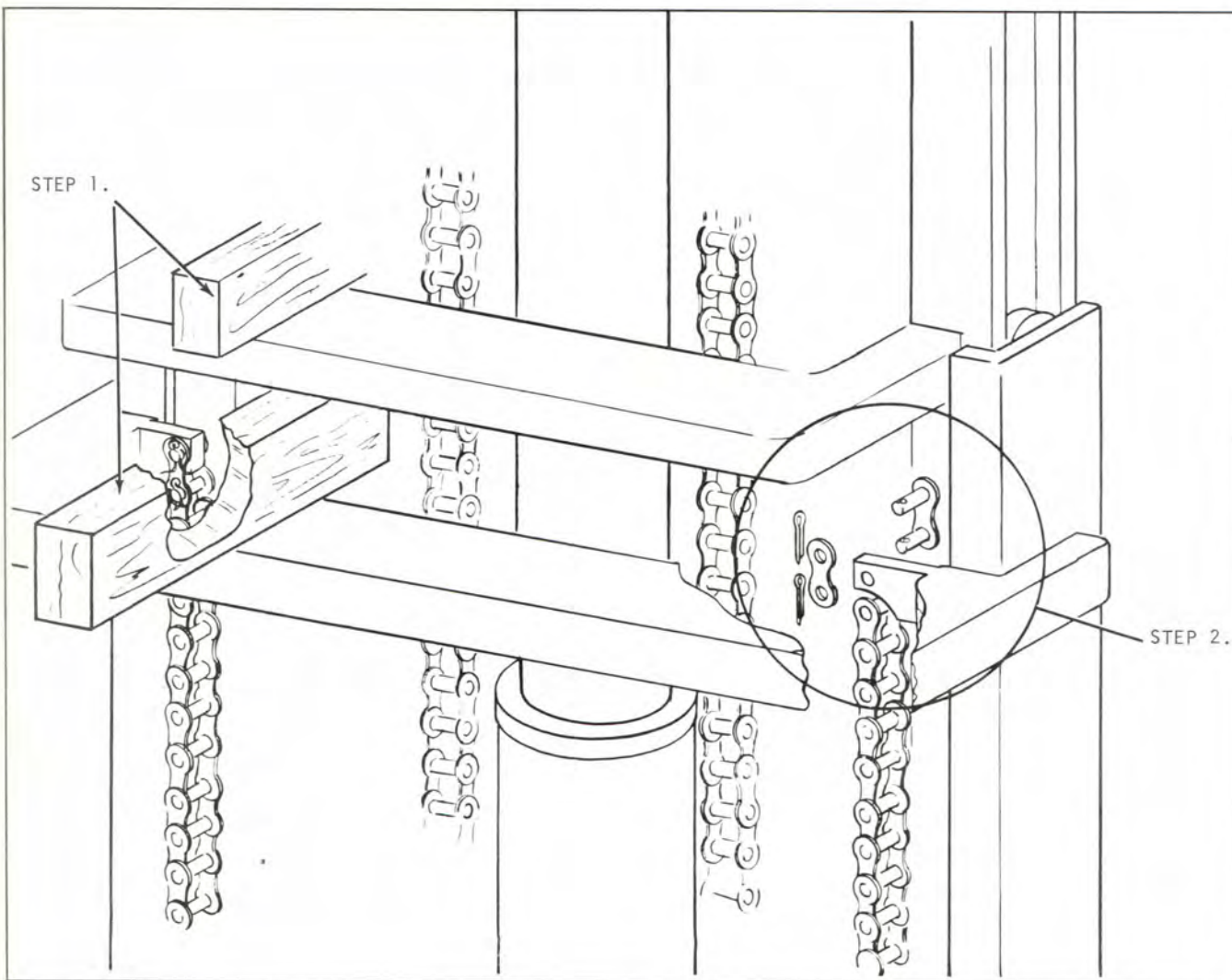


Plate 9650 Rear Lift Cylinder Removal

UPRIGHT REMOVAL--FULL FREELIFT TRIPLE

Step 1. Place blocks between inner and intermediate rail tie bars.

Step 2. Remove rear lift chains at the top or master link end.



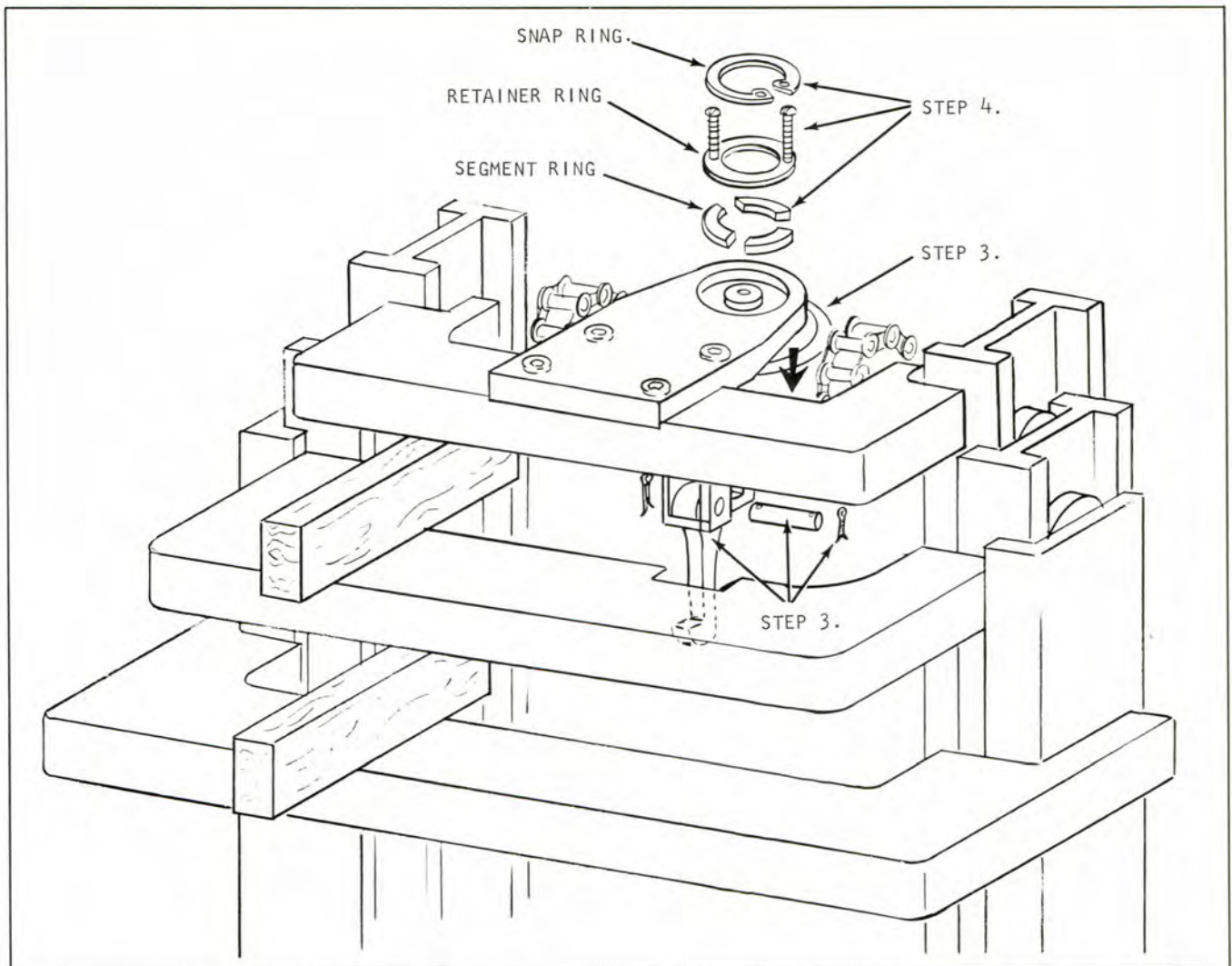


Plate 9651 F.F.T. Piston Head

Step 3. Pull piston head down

Remove mechanical safety stop pin and remove stop.

Step 4(a). Secure piston head with chain hoist.

- (b). Remove lift cylinder from upper anchor.
  1. Remove snap ring.
  2. Place two (2) #6-32X2" round head slotted machine screws (in holes provided) in retainer ring.

- (c). Remove segment ring.

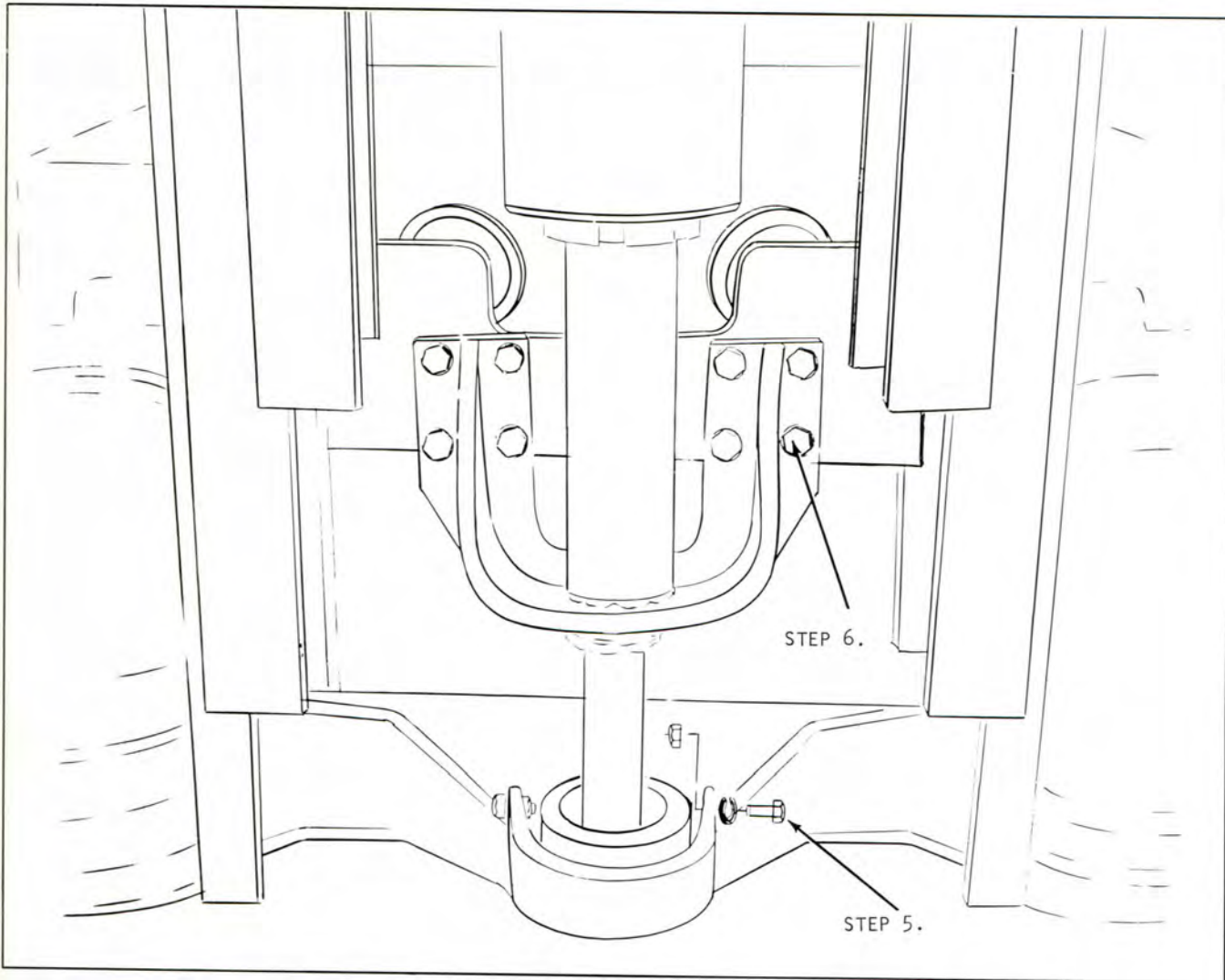


Plate 9652 Cylinder Lifting Bracket

Step 5. Remove lift cylinder support bolts.

Step 6. Remove cylinder lifting bracket.

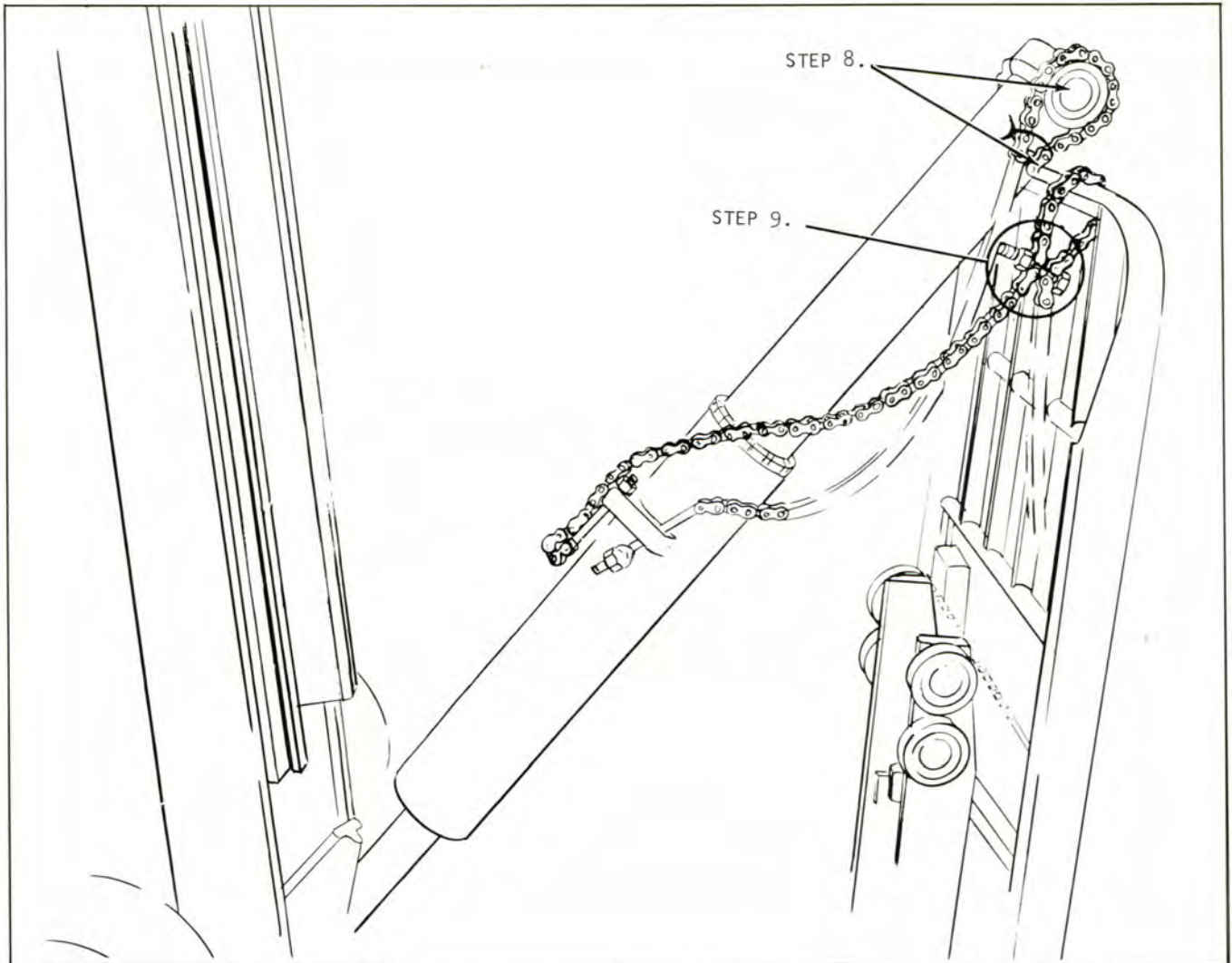


Plate 9653 Supporting Cylinder

Step 7. Lower cylinder and lean it toward the load back rest (on the carriage).

Step 8. Place padding type material on the load back rest to prevent scoring of the cylinder.

Let cylinder rest onto load back rest.

Step 9. Place rear lift chains around top bar of load back rest and place bolts through chains, as shown above. This will prevent cylinder from falling.

Step 10. Remove inner rail and leave it in this position while adjusting rollers.

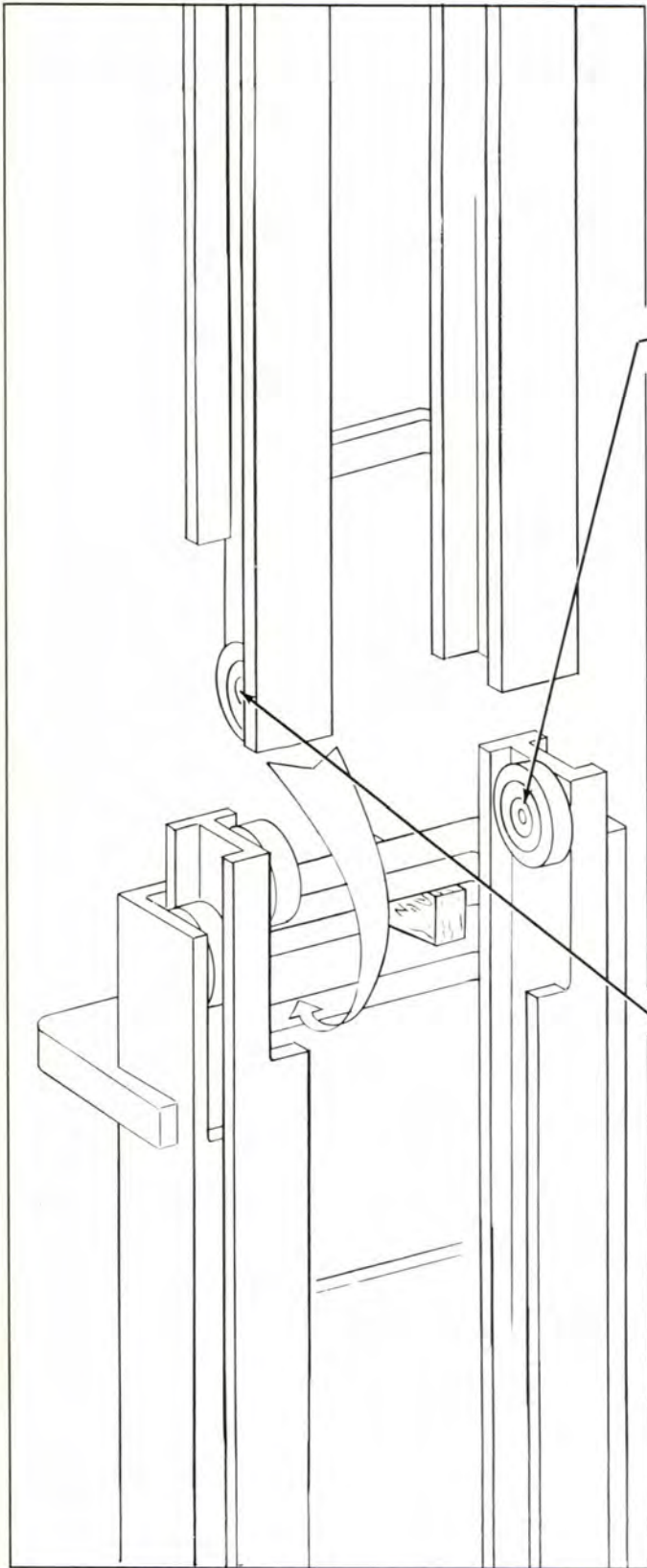
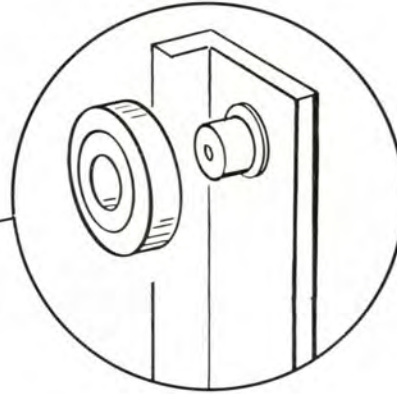
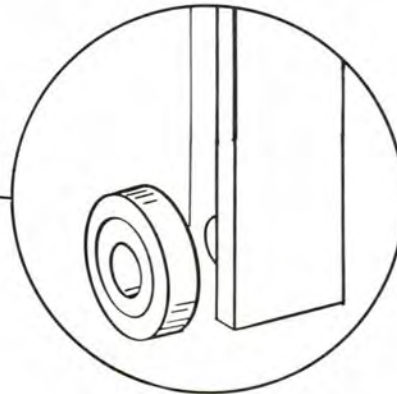


Plate 9654



**A. Intermediate rail rollers:**

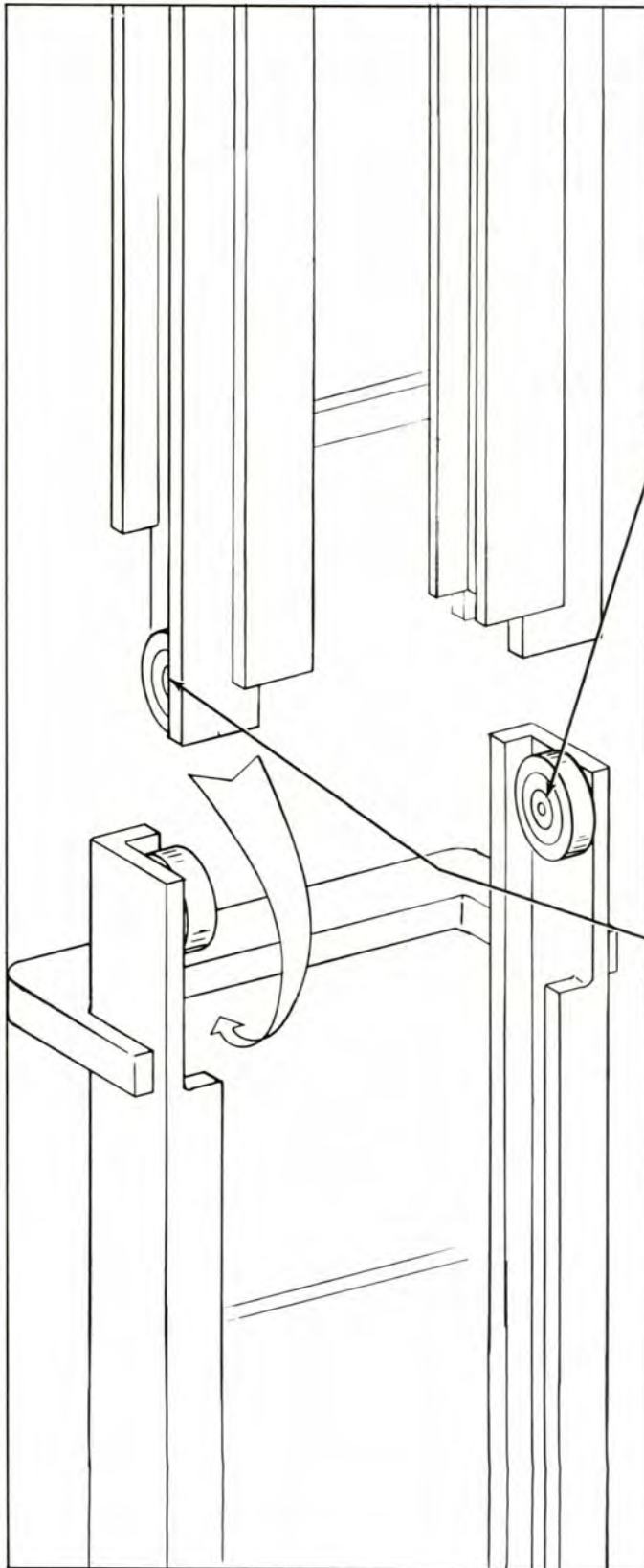
1. Count the number of shims at the right and left hand rollers.
2. Look at the three (3) numbers you recorded on the intermediate rail in Step 1. The smallest of these numbers is the total number of shims to be added. A "0" means DO NOT add shims.
3. Your target for adjusting is to have the same number of shims at each upper roller. If you end up with an extra shim DO NOT remove it. Mark the side having an extra shim.



**B. Inner rail rollers.**

1. Count the number of shims at the right and left hand rollers.
2. Look at the three (3) numbers you recorded on the inner rail in Step 1. Go through the same steps you followed in adjusting the upper rollers.
3. If you end up with an extra shim here too, be sure it is on the same side as the extra upper shim.

**C. Replace inner rail.**



Step 11. Leave intermediate rail assem. in this position while adjusting rollers.

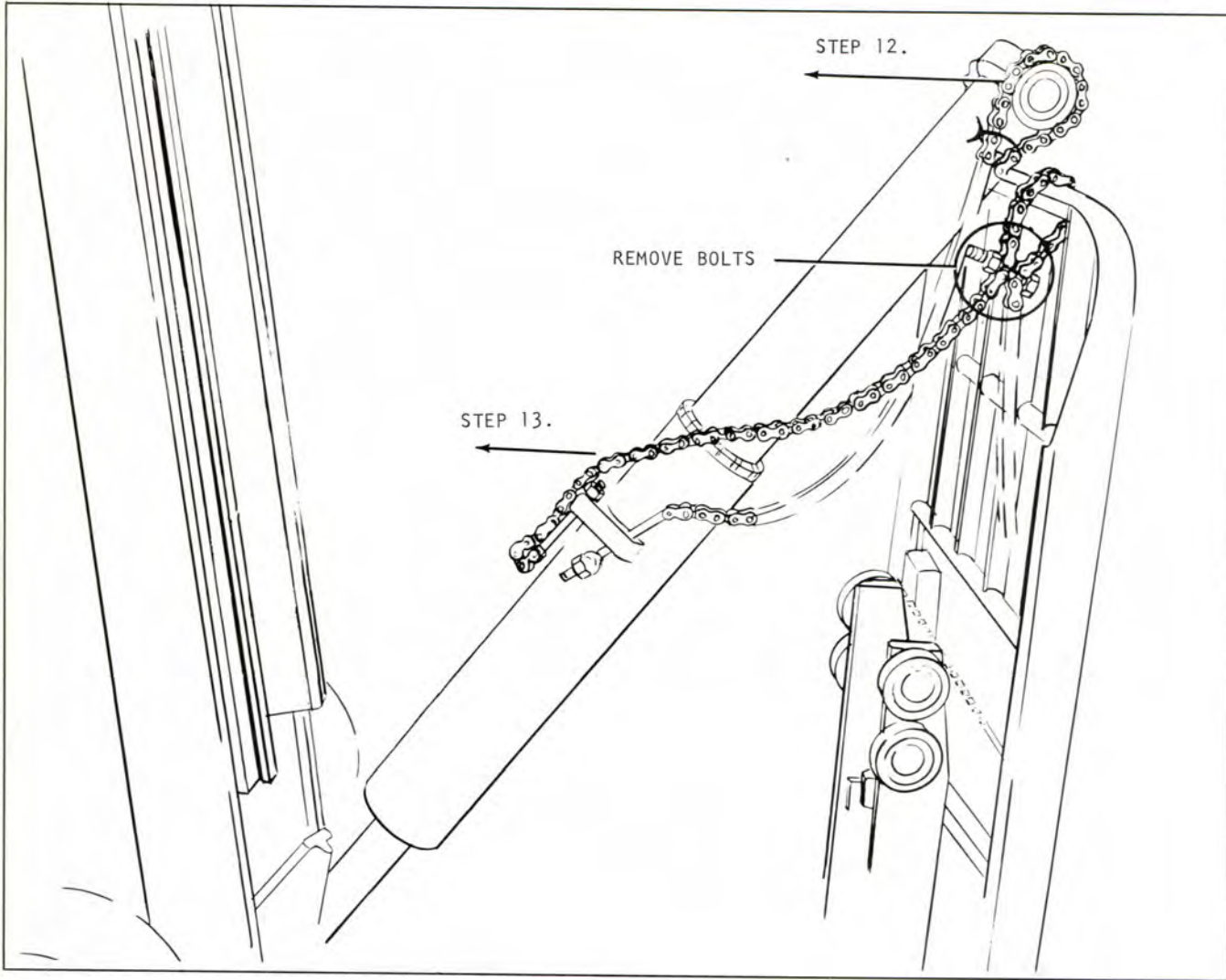
**A. Outer rail rollers:**

1. Count the number of shims at the right and left hand rollers.
2. Look at the three (3) numbers you recorded on the outer rail in Step 1. The smallest of these numbers is the total number of shims to be added. A "0" means DO NOT add shims.
3. Your target for adjustment is to have the same number of shims at each upper roller. If you end up with an extra shim DO NOT remove it. Mark the side having an extra shim.

**B. Intermediate rail rollers:**

1. Count the number of shims at the right and left hand rollers.
2. Look at the three numbers you recorded on the intermediate rail in Step 1. Go through the same steps you followed in adjusting the upper rollers.
3. If you end up with an extra shim here too, be sure it is on the same side as the extra upper shim.

C. Replace intermediate rail assembly.



### Plate 9656 Cylinder Replacement

Step 12. Using chain hoist, place cylinder back between rails.

#### N O T E

When installing cylinder watch position of cylinder line and tube, to prevent damage.

Step 13. Pull rear lift chains through back of upright.

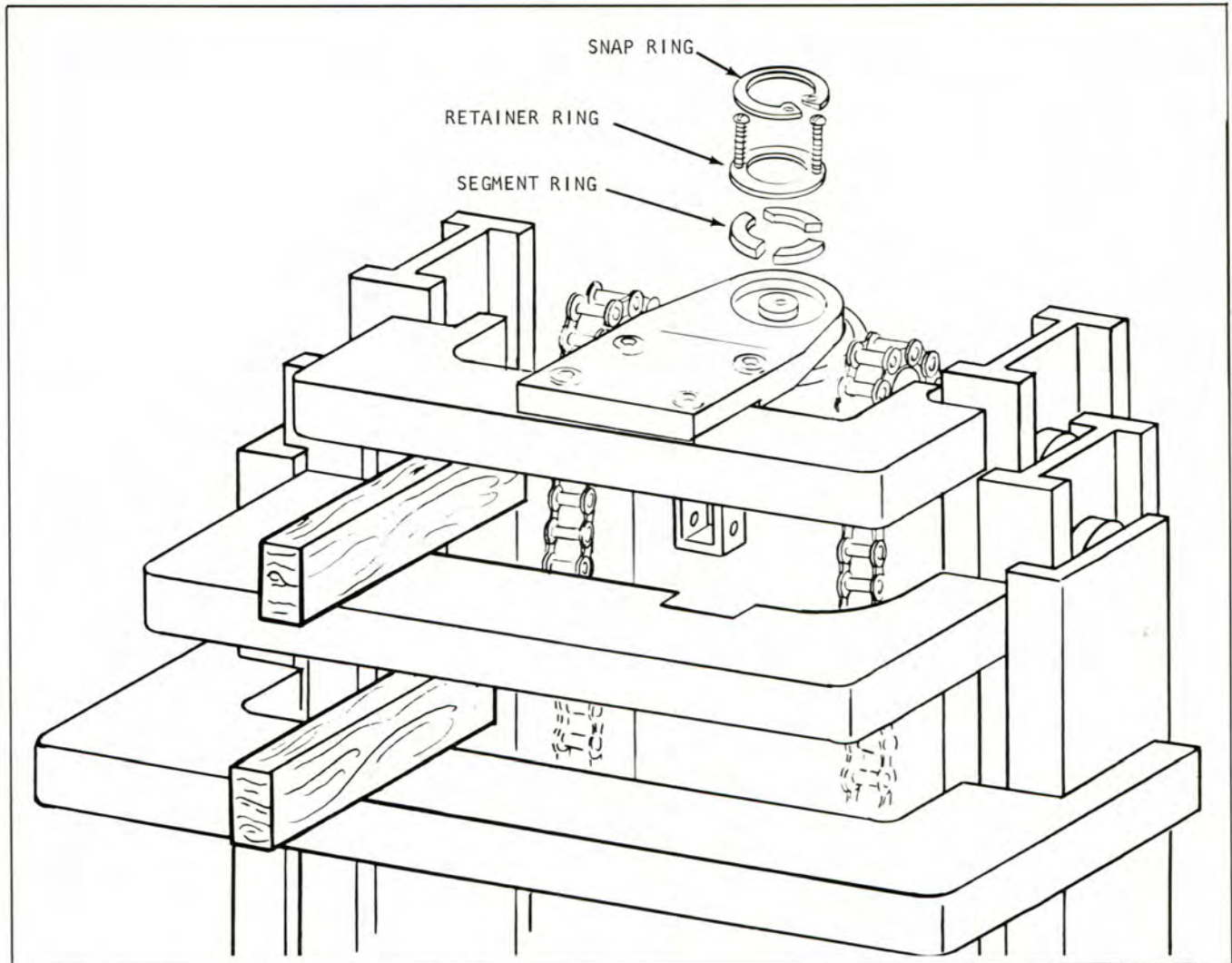


Plate 9657 Piston Head F.F.T.

Step 14(a). Install segment ring.

(b). Install retainer ring and remove both slotted machine screws.

(c). Install snap ring.

(d). Raise and lower to full positions checking piston and anchor. Remove blocks between tie bars.

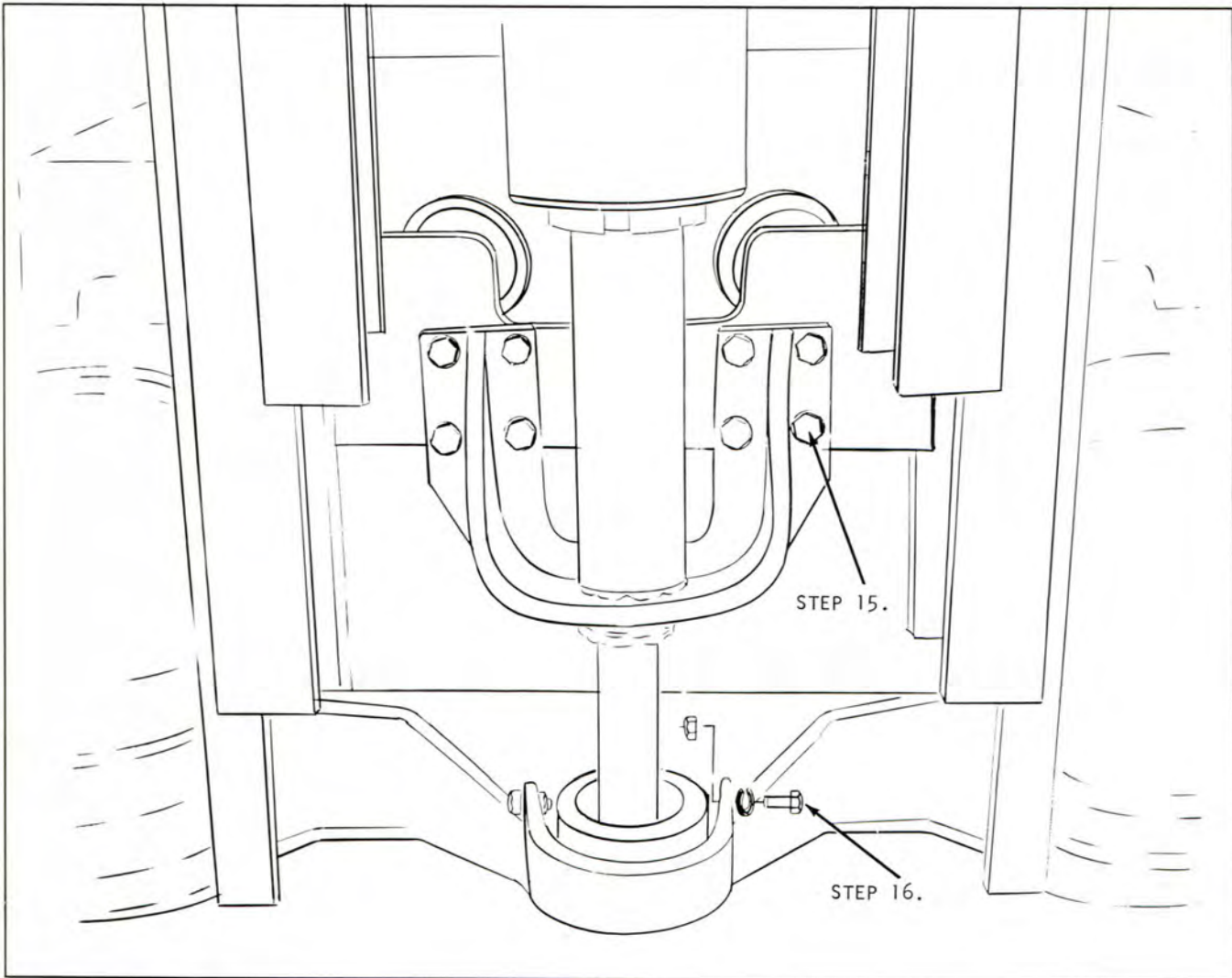


Plate 9658 Cylinder Lift Bracket

Step 15. Install cylinder lifting bracket.

Step 16. Install lift cylinder support bolts.



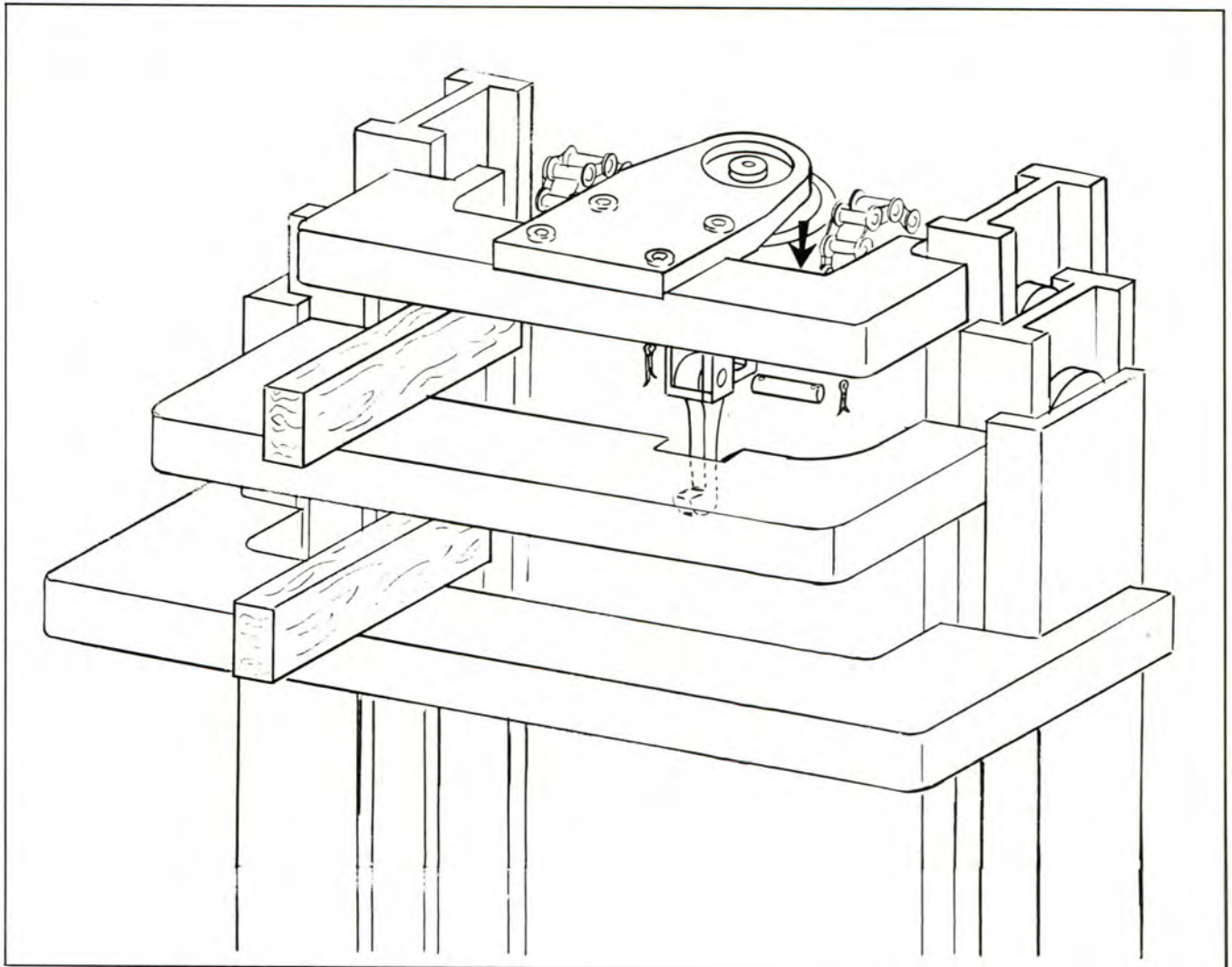


Plate 9659 Safety Stop

Step 17. Pull piston head down.

Install mechanical safety stop.

Replace cotter keys.

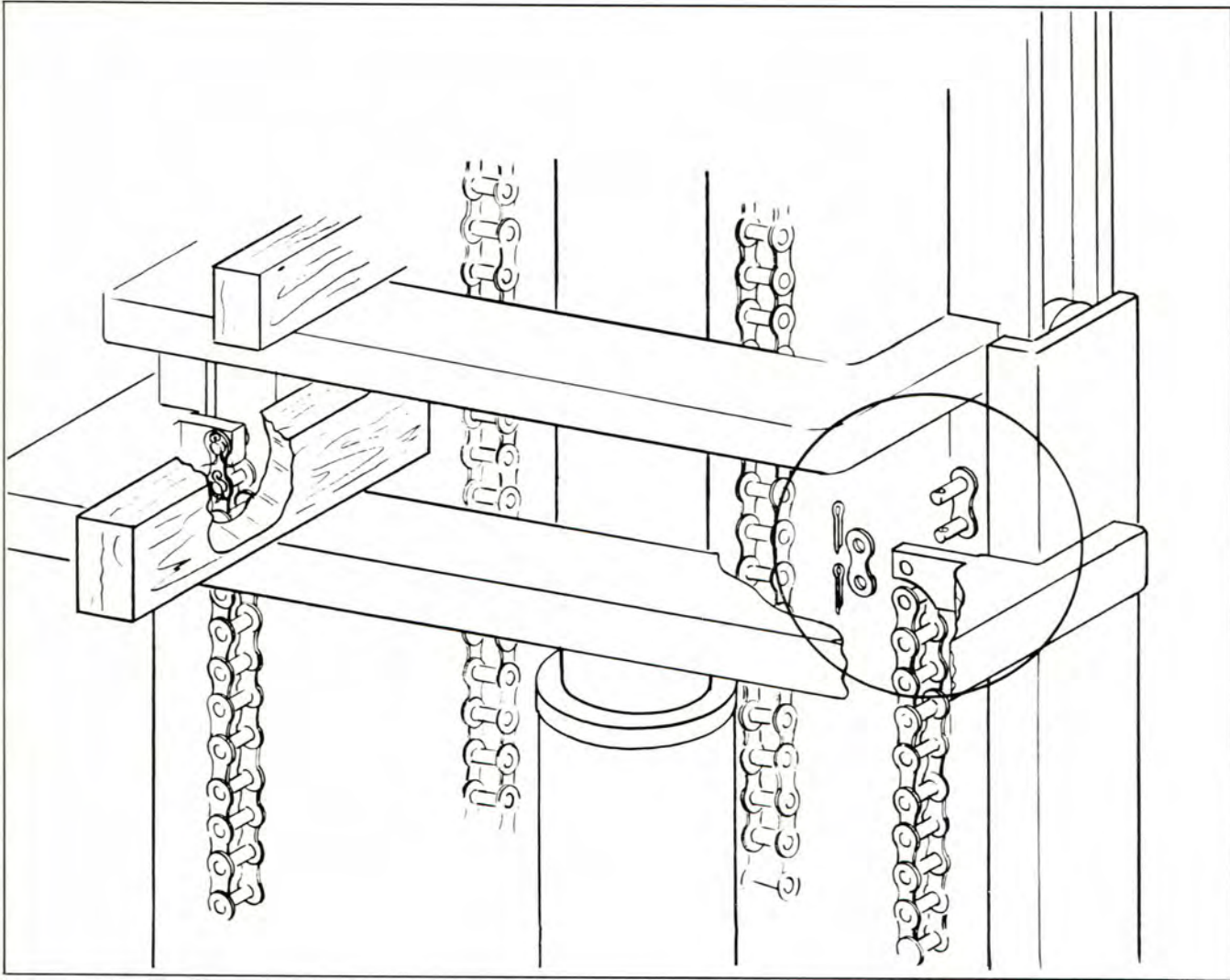


Plate 9660 Replacing Rear Lift Chains

Step 18. Install rear lift chains.

Check chain tension for adjustment. If adjustment is necessary be sure to secure adjusting nuts before operating machine.



# INDUSTRIAL TRUCK DIVISION



## TROUBLE SHOOTING GUIDE

### DRIVE AXLE

TROUBLE	PROBABLE CAUSE	REMEDY
Continuous Axle Noise.	Badly worn parts. Unevenly worn tires. Improperly adjusted wheel bearing. Lack of lubricant.	Replace worn parts with new. Replace tires. Adjust correctly. Add sufficient lubricant of correct grade.
Axle Noise on Drive or on Coast Only.	Differential pinion gear and ring gear out of adjustment or worn excessively.	Adjust, repair or replace entire unit if conditions warrants.
Excessive Backlash in Axle Driving.	Loose axle shaft drive flange cap screws. Flange loose on axle shaft. Worn splines on axle shaft at differential end. Differential drive pinion gear and ring gear out of adjustment or worn excessively.	Tighten cap screws. Reweld flange to shaft. Replace drive flange and shaft assembly. Adjust or replace as condition warrants.
Complete Failure to Function.	Broken axle shaft. Broken teeth on ring gear or pinion gear.	Replace axle shaft. Replace ring gear and pinion and other parts of differential necessary. Adjust ring gear and pinion gear correctly.



# INDUSTRIAL TRUCK DIVISION



## TROUBLE SHOOTING GUIDE

### STEERING AXLE

TROUBLE	PROBABLE CAUSE	REMEDY
Trouble.	Damaged axle. Lubrication leaks. Incorrect caster or camber. Uneven tire wear.	Replace axle. Replace oil seals. (Refer to Lubrication Section). Report to designated individual in authority. Report to designated individual in authority. Inflate tires properly. Check wheel alignment.

BRAKES

TROUBLE	PROBABLE CAUSE	REMEDY
Brakes drag.	Improper pedal adjustment. Brake pedal return spring broken or weak. Brakes improperly adjusted. Brake shoe anchor pin tight in shoe. Brake shoe return spring broken or weak. Loose or damaged wheel bearings. Insufficient brake shoe clearance, or improper brake anchor pin adjustment. Brake backing plate loose. Grease on linings. Dirt imbedded in lining. Drums scored or rough.	Adjust brake pedal free travel. Replace spring. Adjust brakes. Free-up pin and lubricate lightly. Replace spring. Adjust or replace wheel bearings. Adjust brakes. Tighten plate. Correct grease leakage; clean or install new shoes and lining assemblies. Clean lining with wire brush. Replace drum and brake shoe and lining assemblies.
Severe brake action on light pedal pressure.	Brake shoes improperly adjusted. Grease on linings. Loose brake shoe anchor.	Adjust brakes. Correct grease leakage; clean or install new shoes and lining assemblies. Adjust and tighten.
Brake locked.	Brake pedal lacks free travel. Brakes frozen to drums (cold weather).	Adjust pedal free travel. Break loose by driving vehicle.
Brake noisy or chatters.	Brake lining worn. Grease on linings. Dirt embedded in linings. Improper or loose linings. Brake shoe or drum distorted.	Replace shoe and lining assemblies. Correct leakage; clean or replace shoe and lining assemblies. Clean lining with wire brush. Replace shoe and lining assemblies. Straighten or replace.



# INDUSTRIAL TRUCK DIVISION



## TROUBLE SHOOTING GUIDE

### BRAKES (Continued)

TROUBLE	PROBABLE CAUSE	REMEDY
Excessive pedal travel.	Lining worn. Brake improperly adjusted. Scored brake drums.	Adjust or replace shoe and lining assemblies. Adjust brake. Repair or replace drums.
Excessive pedal pressure.	Grease on linings; worn or glazed lining. Warped brake shoes, or defective brake linings. Shoes improperly adjusted. Brake drum scored or distorted. Shoes improperly adjusted. Insufficient fluid in master cylinder.	Correct grease leakage; clean up and replace shoe and lining assemblies. Replace shoe and lining assemblies. Adjust brakes. Repair or replace drums. Adjust brakes. Fill master cylinder to within 1/4 inch of the top.
Wheel troubles.	Wheel wobbles; bent. Wheel loose on hub. Wheel out of balance. Wheel bearings run hot.	Inspect mounting on hub, spindles, and drive axle; replace defective wheel or mounting. Tighten. Balance wheel. Adjust, lubricate wheel bearings.



# INDUSTRIAL TRUCK DIVISION



## TROUBLE SHOOTING GUIDE

### HYDRAULIC SYSTEM

TROUBLE	PROBABLE CAUSE	REMEDY
Pump not delivering oil.	<p>Wrong direction *of rotation.</p> <p>Tank oil level low.</p> <p>Oil intake pipe or suction filter plugged.</p> <p>Air leak in suction line.</p> <p>Oil viscosity too heavy to pick up prime.</p> <p>Broken pump shaft or gear.</p>	<p>Must be reversed immediately to prevent seizure and breakage of parts due to lack of oil.</p> <p>Add recommended oil.</p> <p>Replace filter cartridge, clean strainer if so equipped.</p> <p>Will prevent priming, or cause noise and irregular action of control circuit.</p> <p>Thinner oil should be used, per recommendations for given perature and service.</p> <p>Report to designated individual in authority.</p>
Pump not developing pressure.	<p>Pump not delivering oil for any of the above reasons.</p> <p>Relief valve setting not high enough.</p> <p>Relief valve sticking open.</p> <p>Leak in hydraulic control system (cylinders or valves).</p> <p>Partially clogged intake line, intake filter or restricted intake pipe.</p>	<p>Check oil circulation by watching oil in tank.</p> <p>Refer to relief valve instructions.</p> <p>Dirt under pressure adjustment valve. Refer relief valve instructions.</p> <p>Find leak and correct.</p> <p>Pump must receive intake oil freely or cavitation will take place.</p>
Pump making noise.	<p>Small air leak at pump intake piping joints.</p> <p>Air leak at pump shaft packing.</p> <p>Tank air vent plugged.</p> <p>Too high oil viscosity.</p> <p>Shaft packing worn.</p> <p>Oil filter dirty.</p>	<p>Test by pouring oil on joints while listening for change in operation. Tighten as required.</p> <p>Repair or replace.</p> <p>Must be open thru breather opening or air filter.</p> <p>Use recommended oils.</p> <p>Replace shaft packing per preceding instructions.</p> <p>Replace filter element.</p>
Forks do not lift to maximum height.	<p>Hydraulic Oil level low.</p>	<p>Fill sump tank.</p>



# INDUSTRIAL TRUCK DIVISION



## TROUBLE SHOOTING GUIDE

### HYDRAULIC SYSTEM CONTINUED

TROUBLE	PROBABLE CAUSE	REMEDY
Lift or tilt action fails.	Loss of oil pressure.	Report to designated individual in authority.
Oil leak at top of lift cylinder assembly.	Worn or damaged lift piston seal. Scored cylinder wall. Plugged vent line.	Replace seal. Replace cylinder. Clean out vent line. Replace if collapsed.
Oil leak around piston rod at tilt cylinder.	Worn seal. Scored piston rod.	Replace seal. Replace rod and eliminate cause of scoring which may be caused by misalignment, worn bearing or foreign matter.
With load centered on lift forks load is lifted unevenly.	Lift chains out of adjustment.	Adjust chains.





# INDUSTRIAL TRUCK DIVISION



Solid State Control

ECLS20, 25, 30, 40B

## I M P O R T A N T

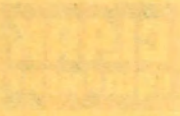
This machine must be thoroughly checked before it is put into service.

The attached CHECKING FORM must be filled out and has to accompany the INSTALLATION REPORT before we will accept any warranty claims for this machine.

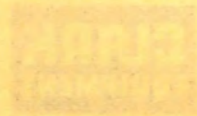
DO NOT use a motor generator unit such as ready power to move and/or check this machine as serious damage may occur.

If, for any reason, the machine does not comply with the adjustment, inspection and test procedures, the figures you enter on the checking form will have to be known prior to contacting the factory.

The following checks MUST be made with a.....Simpson V-0-M 260 Meter or equivalent.



INDUSTRIAL TRUCK DIVISION



1. The purpose of this document is to provide a detailed description of the various components and parts of the industrial truck, including the chassis, engine, transmission, and drive shafts. This information is intended to assist in the identification and repair of these components.

2. The chassis is the structural frame of the truck, which supports the engine, transmission, and drive shafts. It is made of heavy-duty steel and is designed to withstand the stresses of heavy-duty work.

3. The engine is the power source of the truck, which converts fuel into mechanical energy. It is a diesel engine and is located at the front of the truck. The engine is connected to the transmission, which is responsible for changing gears.

4. The transmission is a mechanical device that transfers power from the engine to the drive shafts. It consists of a series of gears that are selected by the operator. The drive shafts are connected to the axles, which support the wheels.

5. The drive shafts are the shafts that connect the transmission to the axles. They are made of heavy-duty steel and are designed to transmit torque from the transmission to the axles. The axles are supported by bearings and are connected to the wheels.

6. The wheels are the contact points of the truck with the ground. They are made of heavy-duty rubber and are designed to provide traction and stability. The wheels are mounted on the axles and are supported by the chassis.

7. The suspension system is the mechanism that supports the truck's weight and absorbs shocks from the ground. It consists of springs, dampers, and other components that are designed to provide a smooth ride and to protect the truck's components from damage.

8. The steering system is the mechanism that allows the operator to control the direction of the truck. It consists of a steering wheel, a steering column, and other components that are designed to provide precise control.

9. The braking system is the mechanism that allows the operator to slow down or stop the truck. It consists of a brake pedal, a brake master cylinder, and other components that are designed to provide reliable stopping power.

10. The electrical system is the mechanism that provides power to the truck's lights, horn, and other electrical components. It consists of a battery, a generator, and other components that are designed to provide a reliable power source.



# INDUSTRIAL TRUCK DIVISION



DEALER CHECK-OUT SHEET FOR GE C-185  
SOLID STATE CONTROL SYSTEM

ECLS20, 25, 30, 40B

Truck Serial No. \_\_\_\_\_ Date \_\_\_\_\_

1. Battery Polarity Checked? \_\_\_\_\_ Battery Voltage \_\_\_\_\_ Volts

2. Truck Polarity

A. Positive Lead TO 1FU fuse checked? \_\_\_\_\_

B. Negative lead to pump contactors checked? \_\_\_\_\_

3. GROUND TEST (+) to frame \_\_\_\_\_ ohms, (-) to frame \_\_\_\_\_ ohms

4. CHECKING CONTROL WIRING.

A. Terminals 12 (+) to 13 (-) (all switches open) \_\_\_\_\_ ohms

B. Terminals 12 (+) to 13 (-) (key switch closed) \_\_\_\_\_ ohms

C. Terminals 12 (+) to 13 (-) (key, seat, 1ms & directional switch closed)

Directional Switch .... Forward Closed \_\_\_\_\_ ohms

Directional Switch .... Reverse Closed \_\_\_\_\_ ohms

5. SPEED POTENTIOMETER 1MS AND 2MS AND 1A SWITCHETTE OPERATION

A. Wires 29A and negative (-) .... 1ms switch actuates \_\_\_\_\_ ohms

B. Wires 29A and negative (-) .... 2ms switch actuates \_\_\_\_\_ ohms

6. CHECKED contactors manually? \_\_\_\_\_

7. Checked contactors electrically? \_\_\_\_\_

8. Checked creep speed? \_\_\_\_\_

9. CHECKING SPEED VOLTAGE AND CURRENT LIMIT

C. Maximum speed voltage \_\_\_\_\_ volts

D. Current limit \_\_\_\_\_ amps

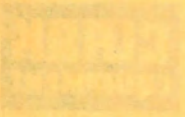
10. Plugging distance \_\_\_\_\_ feet

11. Field Weaking: Pickup current \_\_\_\_\_ amps

Dropout current \_\_\_\_\_ amps

SEAL ADJUSTMENT TRIMPOTS ON CARD #1

MECHANIC \_\_\_\_\_ HOUR METER READING \_\_\_\_\_



INDUSTRIAL TRUCK DIVISION



Form No. 100 (Rev. 1-15-64)

UNITED STATES DEPARTMENT OF COMMERCE

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# INDUSTRIAL TRUCK DIVISION



DEALER CHECK-OUT SHEET FOR GE C-185  
SOLID STATE CONTROL SYSTEM

ECLS20, 25, 30, 40B

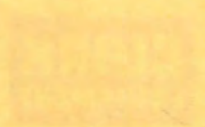
Truck Serial No. \_\_\_\_\_ Date \_\_\_\_\_

1. Battery Polarity Checked? \_\_\_\_\_ Battery Voltage \_\_\_\_\_ Volts
2. Truck Polarity
  - A. Positive Lead TO 1FU fuse checked? \_\_\_\_\_
  - B. Negative lead to pump contactors checked? \_\_\_\_\_
3. GROUND TEST (+) to frame \_\_\_\_\_ ohms, (-) to frame \_\_\_\_\_ ohms
4. CHECKING CONTROL WIRING.
  - A. Terminals 12 (+) to 13 (-) (all switches open) \_\_\_\_\_ ohms
  - B. Terminals 12 (+) to 13 (-) (key switch closed) \_\_\_\_\_ ohms
  - C. Terminals 12 (+) to 13 (-) (key, seat, 1ms & directional switch closed)
    - Directional Switch .... Forward Closed \_\_\_\_\_ ohms
    - Directional Switch .... Reverse Closed \_\_\_\_\_ ohms
5. SPEED POTENTIOMETER 1MS AND 2MS AND 1A SWITCHETTE OPERATION
  - A. Wires 29A and negative (-) .... 1ms switch actuates \_\_\_\_\_ ohms
  - B. Wires 29A and negative (-) .... 2ms switch actuates \_\_\_\_\_ ohms
6. CHECKED contactors manually? \_\_\_\_\_
7. Checked contactors electrically? \_\_\_\_\_
8. Checked creep speed? \_\_\_\_\_
9. CHECKING SPEED VOLTAGE AND CURRENT LIMIT
  - C. Maximum speed voltage \_\_\_\_\_ volts
  - D. Current limit \_\_\_\_\_ amps
10. Plugging distance \_\_\_\_\_ feet
11. Field Weaking: Pickup current \_\_\_\_\_ amps  
Dropout current \_\_\_\_\_ amps

SEAL ADJUSTMENT TRIMPOTS ON CARD #1

MECHANIC \_\_\_\_\_ HOUR METER READING \_\_\_\_\_

INDUSTRIAL TRUCK DIVISION



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CHECK-OUT PROCEDURE FOR GE C-185 SOLID STATE CONTROL SYSTEM

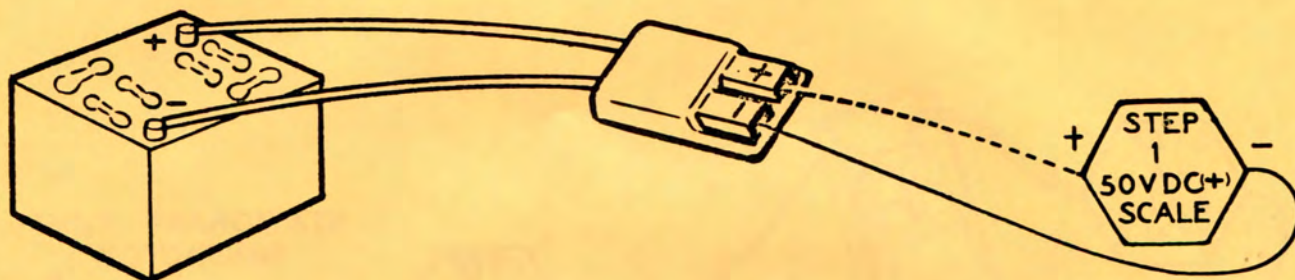
## NOTE

If meter readings are not within specifications of each step, refer to additional TROUBLE SHOOTING instructions following this check-out procedure.

ECLS-20B, ECLS-25B, ECLS-30B, ECLS-40B

## 1. CHECKING BATTERY POLARITY AND BATTERY VOLTAGE:

With voltmeter set on 50 V DC (+) scale, place the red lead on positive (+) and black lead on negative (-) battery connector ..... you should read battery volts ..... if meter needle moves backwards, the power cables are connected wrong on the battery and should be reversed before connecting to machine.

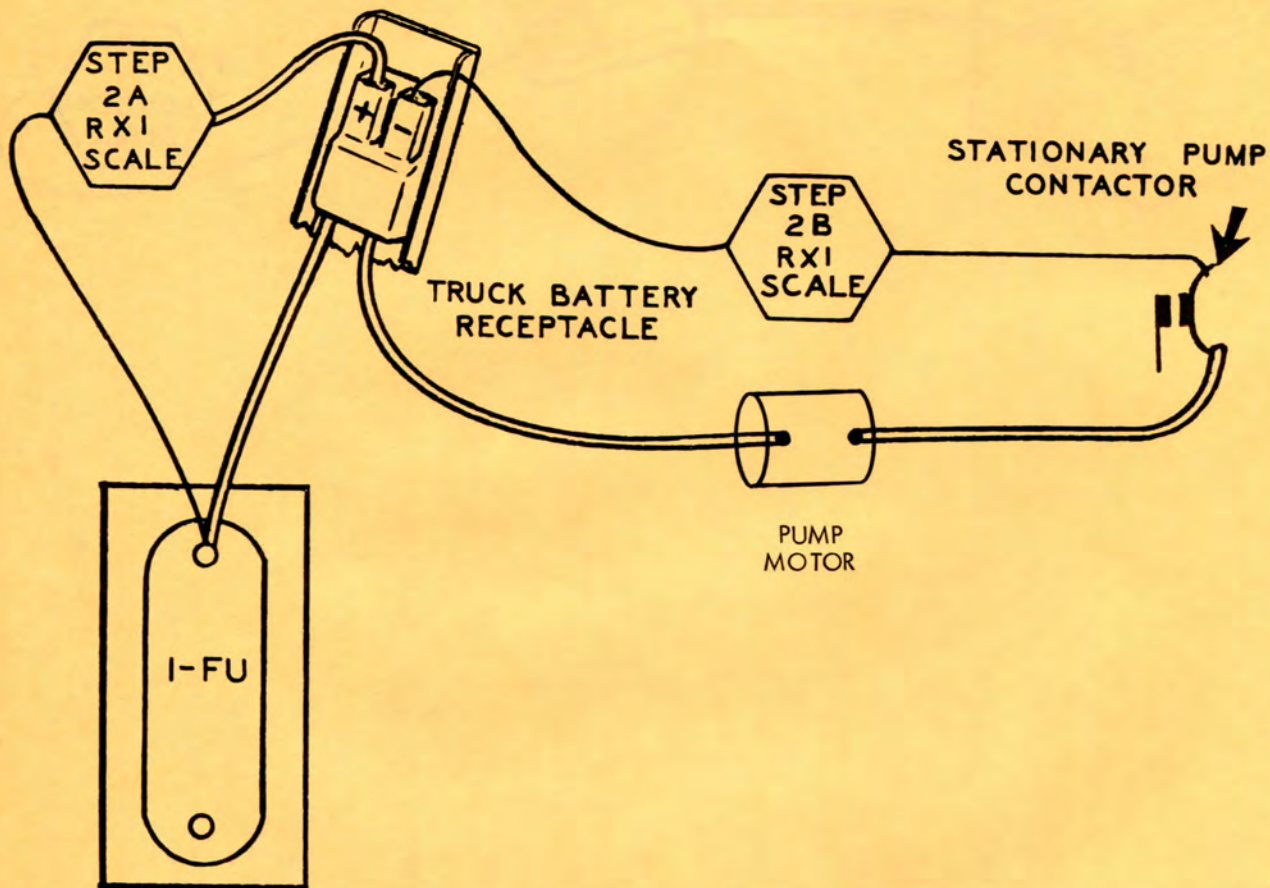


STEP #1

2. CHECKING TRUCK POLARITY:

Checking continuity of power cables for proper polarity.

- a) With ohmmeter on RX1 scale, connect either lead (red or black) on the positive side of truck battery receptacle.....the other lead on the 1FU fuse.....should have no resistance.
- b) With ohmmeter still set on RX1 scale and either (red or black) on the negative side of truck battery receptacle.....the other lead on the stationary pump contactor power tip.....should have no resistance.



STEP #2

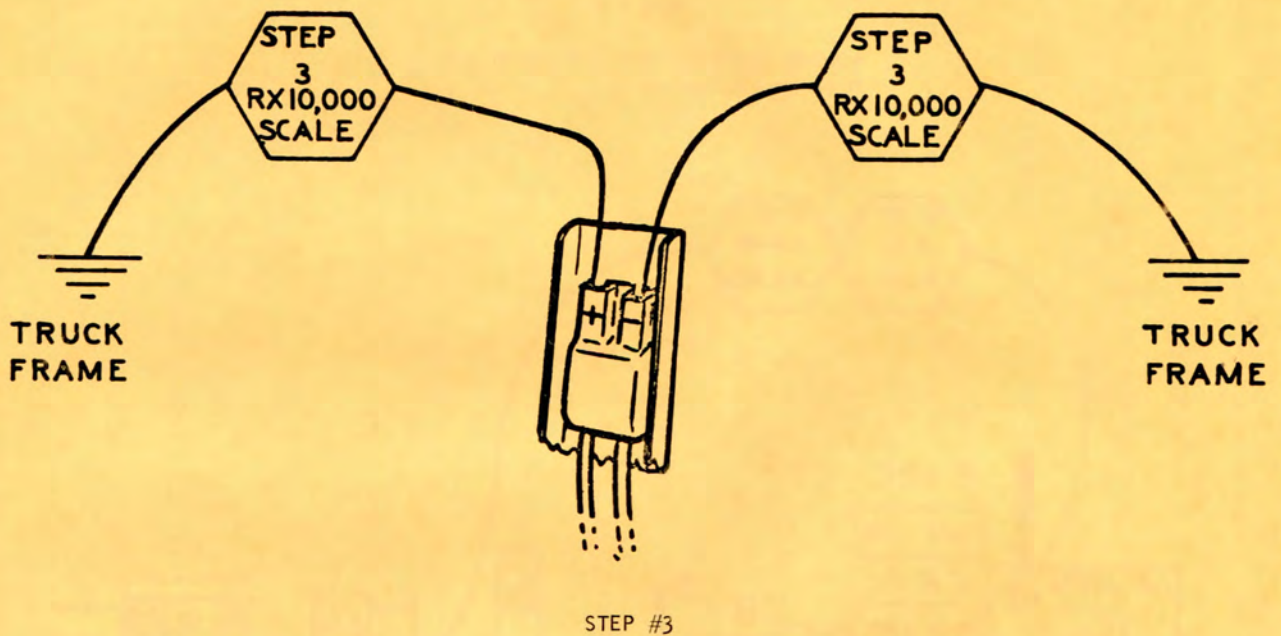


3. GROUND TEST:

With ohmmeter set on RX10,000 ohm scale.....check for grounds.

- a) Connect positive (+) of truck receptacle to truck frame.
- b) Connect negative of truck receptacle to truck frame.

With 1A contactor held closed....resistance for 3A and 3B should be 50,000 ohms or higher on new trucks.....30,000 ohms is acceptable on used trucks.



TRUBLE SHOOTING

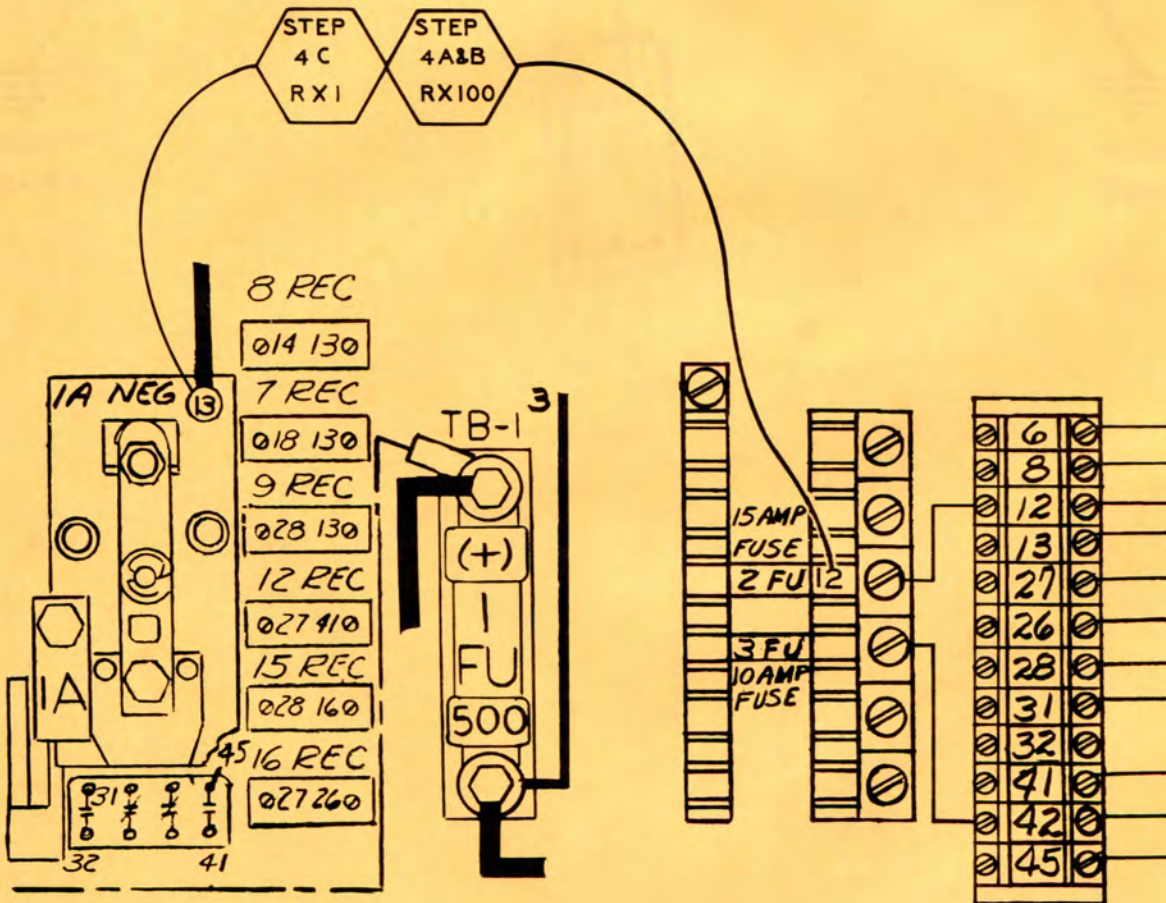
4. CHECKING CONTROL WIRING USING OHMMETER:

- a) With all switches open, measure open circuit between wires 12 (+) and 13 (-).....RX100 scale.
- b) Close key and seat switches and measure approximately 300 to 750 ohms between wires 12 (+) and 13 (-).....RX100 scale.
- c) Close key, seat, accelerator 1MS and directional switches and measure 30 or more ohms between wires 12 (+) and 13 (-).....RX1 scale.

Repeat check with directional switch in reverse.

**NOTE**

Remove backup light (if used) at reverse contactor.



STEP #4

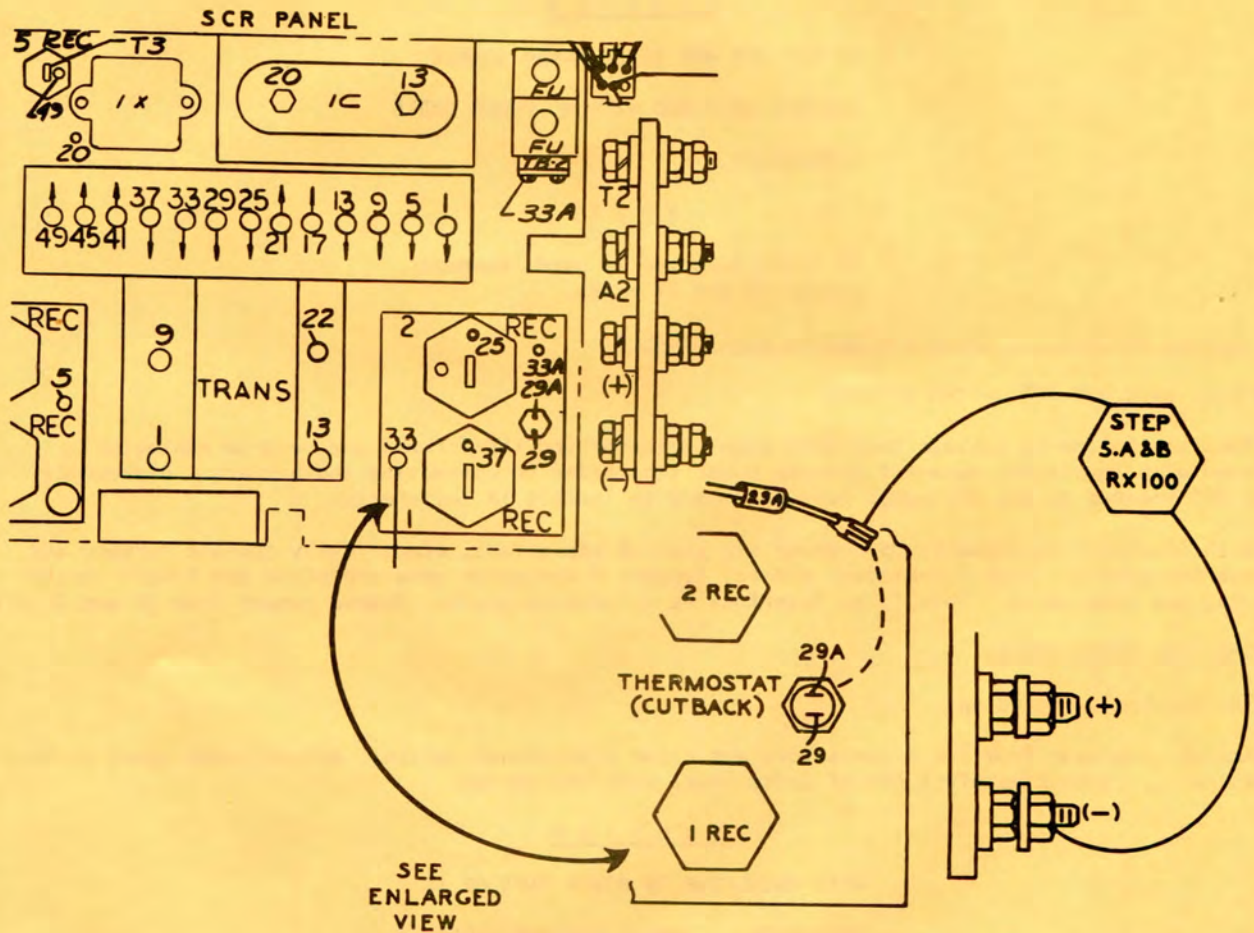
TROUBLE SHOOTING

5. CHECKING SPEED POTENTIOMETER, 1MS AND 2MS SWITCHETTE OPERATION:

- a) Disconnect wire spade 29A on SCR panel thermostat (cut-back). Connect ohmmeter.....RX100 scale..... on wire 29A and negative power terminal on SCR panel.....measure 8,000 to 9,500 ohms as 1MS switch clicks, when pedal is depressed slightly.
- b) With ohmmeter on RX1 scale.....depress accelerator completely.....2MS switch will click..... ohmmeter should read 300 ohms or less.

N O T E

If 1MS, 2MS or speed potentiometer are improperly adjusted.....refer to write-up covering this adjustment; page 100H 477.



STEP #5



# INDUSTRIAL TRUCK DIVISION



## TROUBLE SHOOTING

### 6. CHECKING CONTACTORS MANUALLY:

Before connecting battery.....manually push the armature plate in until power tips contact and wipe.

#### N O T E

This check is performed to detect contactor binding, switchette operation and wire interference with contactor tips.

The battery should be fully charged and specific gravity should be 1,250 or higher.

#### C A U T I O N

DO NOT USE ANY OTHER POWER SOURCE ....  
BATTERY ONLY AND WITH NO POWER CABLE  
EXTENSIONS.

#### N O T E

If fault detector is used, connect jumper 2X and 2Y wires.

### 7. CONNECT BATTERY.....CHECK CONTACTORS ELECTRICALLY:

With key, seat and 1MS switch closed:

- a) Make the following voltage test with pump contactor and the forward and reverse contactors isolated with insulating material between power tips prior to connecting the battery. Disconnect wires #45 located on the SCR panel terminal board to isolate 1A switchette.
- b) With insulator in normally open power tip gaps of contactors, electrically operate forward and reverse contactors. With F contactor closed, depress R contactor armature plate and F coil should drop out and vice versa. This is an interlocking switchette check. Remove jumper from 2X and 2Y wires.

### 8. CHECKING CREEP SPEED:

With drive wheels jacked up:

- a) Remove insulator from F & R contactors and close directional switch. Adjust creep speed on Card 1 as desired.....approximately 1 RPM of drive wheel with 1MS closed.

#### C A U T I O N

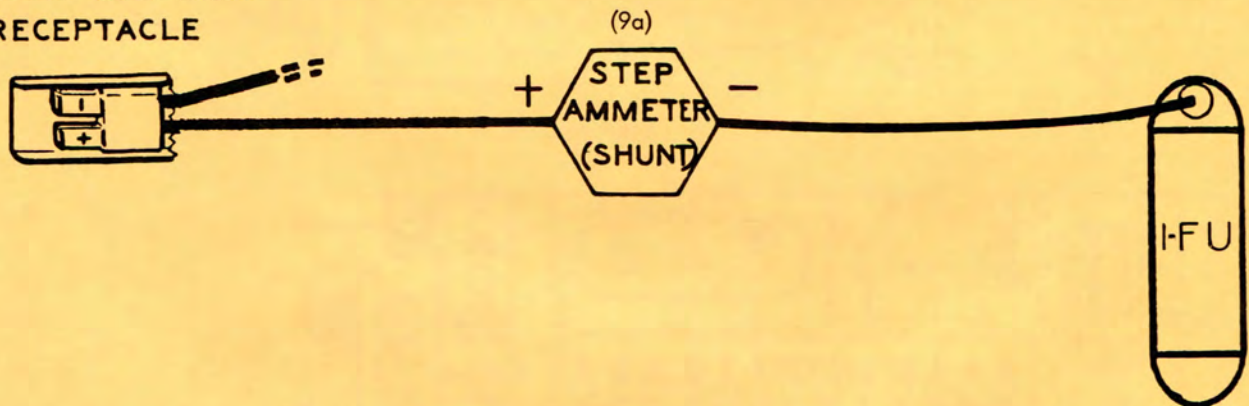
WITH INSULATOR IN POWER TIPS OF 1A  
CONTACTOR.....CHECK MAXIMUM SPEED  
VOLTAGE AND CURRENT LIMIT. THESE  
ADJUSTMENTS HAVE BEEN PRESET AT THE  
FACTORY AND SHOULD NOT REQUIRE AD-  
JUSTMENT.

9. CHECKING SPEED VOLTAGE AND CURRENT LIMIT:C A U T I O N

DO NOT STALL MOTOR FOR MORE THAN 30  
SECONDS AT A TIME.....ALLOW TIME FOR  
MOTOR COOLING BETWEEN STALLS. DO NOT  
OPERATE MOTOR AT HIGH SPEEDS OR REVERSE  
DRIVE MOTOR WITH DRIVE WHEELS JACKED  
UP.

Equipment Required:

1. Volt Ohmmeter, Simpson 260-5P or equivalent.
  2. Sun Ammeter, Clark #1800979 or.....100 MV 200 amp shunt and Simpson 260-5P VOM.
- a) Disconnect the positive power cable from 1FU fuse and connect the ammeter (shunt) between the power cable and the 1FU fuse.

**TRUCK BATTERY  
RECEPTACLE**

STEP #9A

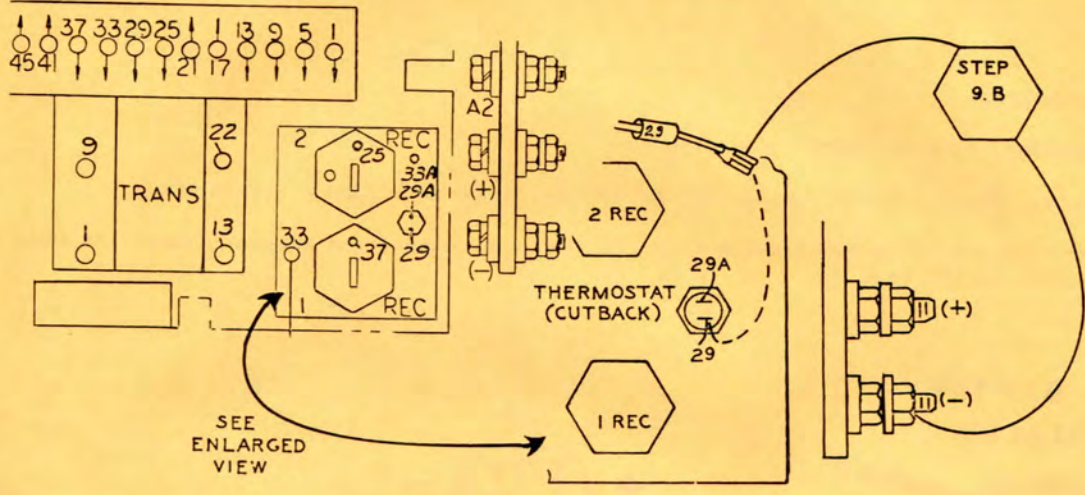
TROUBLE SHOOTING

b) Remove wire spade 29 from the thermostat (cut back). Connect a jumper from wire spade 29 to negative of the SCR panel.

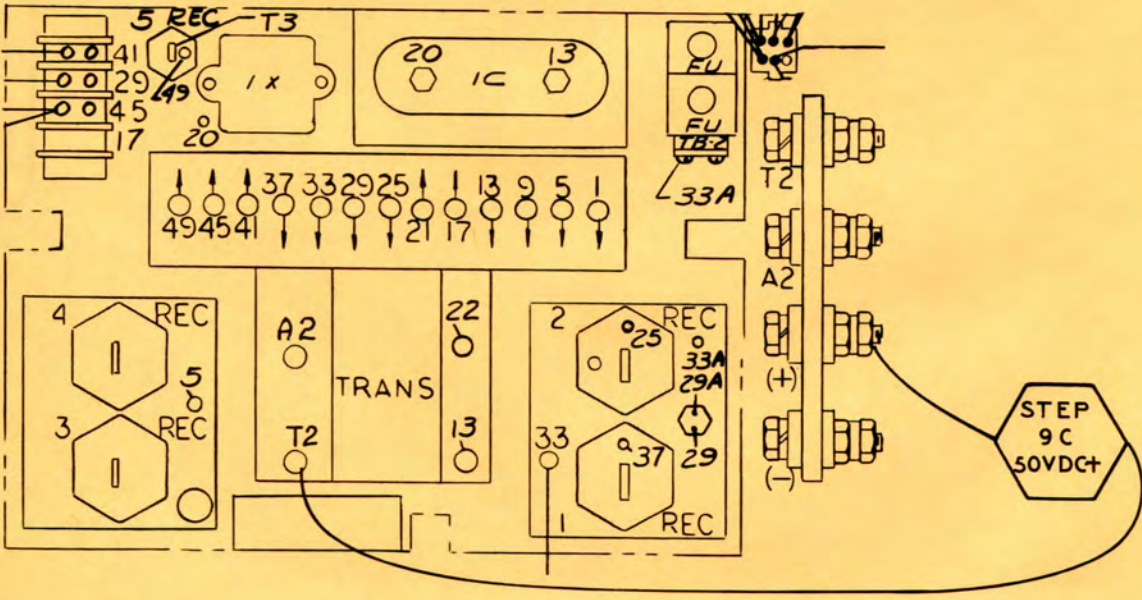
CAUTION

THIS PRODUCES FULL SCR WITH ACTUATION OF  
1MS WHEN DIRECTIONAL CONTACTOR IS  
PICKED UP.

c) Connect the volt meter between the positive terminal and T2 on the SCR panel.



STEP #9B



STEP #9C

## TROUBLE SHOOTING

- d) Check maximum speed voltage first by depressing accelerator pedal for full SCR speed and applying the brakes until battery current is 70 to 80 amps. Volt meter reading should be 25 to 32 volts. If not, adjust the top SCR speed on Card #1.
- e) Now check current limit by depressing accelerator pedal for maximum SCR and apply the brakes until the wheels come to standstill. There must be no rotation of drive wheel/s for this check. The meter should read 190 amps minimum.....210 amps maximum. If not, adjust current limit on Card #1.
- f) Remove jumper and reconnect wire spade 29 to thermostat (cut back). Remove voltmeter and ammeter (shunt).

10. OPERATION:

Reconnect wires #45, remove insulator from 1A contactor tips and check 1A contactor pick up time for approximately 1 second; if adjustment is required, adjust 1A timer on Card #1. With drive wheels on the ground.....give truck a general operational check-out.....including plugging without load from various speeds. Adjust plugging distance with trimpot on Card #1 as desired (CW to decrease distance). Seal all trimpots on Card #1.

INDUSTRIAL TRUCK DIVISION



[The body of the document contains several paragraphs of text that are extremely faint and illegible due to the low contrast and quality of the scan. The text appears to be organized into sections, possibly including a header, a main body of text, and a footer, but the specific content cannot be discerned.]



11. TRUCKS EQUIPPED WITH FIELD WEAKENING KIT:

Install ammeter (shunt) per STEP #9 and remove insulators from all contactors. With wheels jacked up...check FW CONTACTOR picks up and drops out at correct values of current...stall the DRIVE MOTOR by depressing the brake pedal, then...release brake pedal until pick-up occurs ...then depress brake pedal until drop out occurs.

ECLS 20 & 25.....Pick-Up 125 to 150 amps  
Drop-Out 250 to 300 amps

ECLS 30 & 40.....Pick-Up 150 to 175 amps  
Drop-Out 300 to 350 amps

If values are incorrect...adjust CURRENT TRIMPOT at CARD #2, (counterclockwise to increase current values and vice-versa to decrease values).

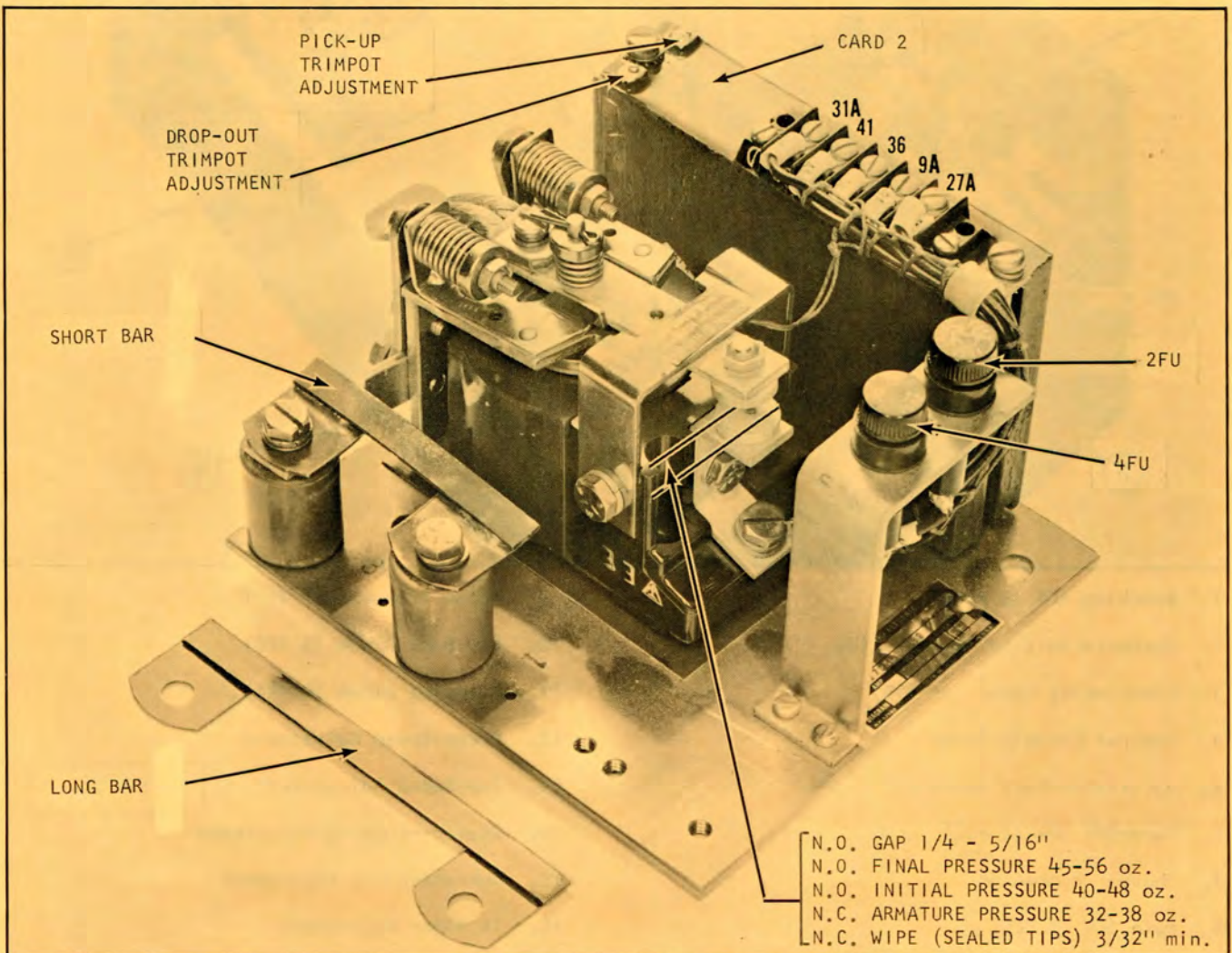
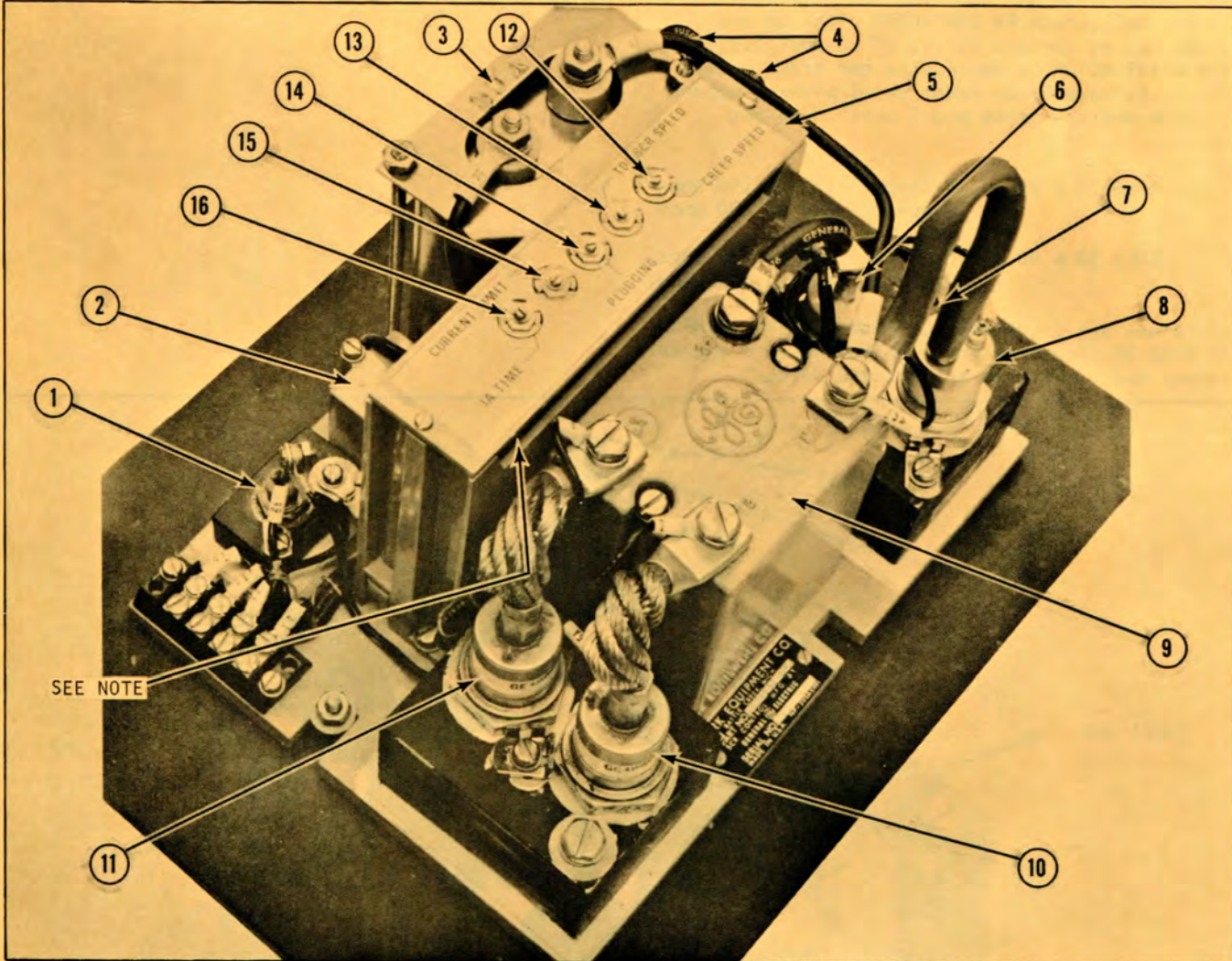


Plate 10595. Typical Field Weakening Unit

TYPICAL PHYSICAL ARRANGEMENT AND IDENTIFICATION OF COMPONENTS

(Refer to wiring diagram furnished with truck for precise arrangement of components.)



- |                                  |                                |
|----------------------------------|--------------------------------|
| 1. Blocking SCR (5 REC)          | 9. Pulse Transformer (1 T)     |
| 2. Current-Limiting Reactor (1X) | 10. Fly-Back Diode (3 REC)     |
| 3. Commutating Capacitor (1C)    | 11. Plugging Diode (4 REC)     |
| 4. Control Circuit Fuses         | 12. Creep-Speed Adjustment     |
| 5. Oscillator Card (Card #1)     | 13. Top-Speed Adjustment       |
| 6. Turn-Off SCR (2 REC)          | 14. Static-Plugging Adjustment |
| 7. Thermal Protector             | 15. Current-Limit Adjustment   |
| 8. Main SCR (1 REC)              | 16. 1A Timer Adjustment        |

## TROUBLE SHOOTING

FAILURES WHICH CAUSE NO MOTOR TORQUE WITH SCR CONTROL

GE C-185 SCR CONTROL ..... SOLID STATE CONTROL SYSTEM..

ECLS-20B, ECLS-25B, ECLS-30B, ECLS-40B

SYMPTOMSWHAT TO DO

- 1A. Contactors do not pick up. No control voltage from positive to negative.
- 1B. Contactors do not pick up. Control volts present from positive to negative.
- 1C. Contactors close. No power and no SCR hum with accelerator in SCR range.
- Check power fuses.
- Check battery for low specific gravity connections for looseness or broken fittings.
- (For these test, if fault detector is used, disconnect wire #27 from fault detector terminal #3).
- \* Connect jumper from battery positive to positive side of F or R coil. If device does not pick up, check coil for continuity. Also jumper negative to opposite terminal to check for opens in negative connections.
  - \* With jumper on battery positive move other end to wire #8 on F interlock or #6 on R interlock. Coils should pick up. This proves F and R electrical interlocks.
  - \* Using jumper continue to check remaining components in circuit such as directional switch, seat switch and key switch by moving end of jumper to positive side of each of these devices.
  - \* With F or R picked up and wire #45 disconnected at SCR terminal board, check for control volts positive at SCR terminal board (wire #41) to negative (wire #13A). If there is zero volts at this point, check F or R normally open interlocks and 1A coil for continuity.
  - \* With F or R picked up and wire #45 disconnected at SCR terminal board, check for control volts positive at 1 REC heat sink (wire #33) to negative (wire #13A). If there is zero volt at this point, check: FUB, F or R power tips, and continuity of wiring from battery positive to 1 REC heat sink.
- \* Drive wheels should be off the floor.



# INDUSTRIAL TRUCK DIVISION



## TROUBLE SHOOTING

1C. (Continued)

\* With F or R picked up and wire #45 disconnected from SCR terminal board, measure approximately 3 volts from (wire #29) to negative (wire #13A) with accelerator potentiometer near creep speed. Volts will drop to zero as accelerator is moved toward full speed. If readings are not correct, first place a jumper wire between wires #29 and #29A which bypasses the thermal protector. Depress the accelerator and check for the above voltage. If voltage readings are correct, replace thermal protector.

If the above tests will produce no voltage change, place a jumper between wires #29A and 13A. This bypasses the accelerator and the truck should now run at top SCR speed. If top speed is obtained, check accelerator potentiometer per table #4I. If motor fails to operate, check card per table #4A.

Check #1 REC for open circuit or open gate (See 4H).

Check card (See 4A).

1D. Contactors close, but very little power and high-pitch SCR hum.

Check #2 REC for a shorted condition in the conducting direction (See 4H).

1E. Contactors close. Very little or no power with low SCR hum, even when accelerator is in top SCR position.

\* Disconnect wire #5A from 3 and 4 REC heat sink and wire #9 from F and R contactors. Reapply power and if control operates normally, replace card.

\* Check setting on card, creep speed and top speed. Also if current limit is full counter-clockwise speed will be slow.

1F. Contactors close. Very little power with a normal SCR hum.

Check 3 REC for open condition (See 4G). If 3 REC is found to be open, check 1, 2, and 5 REC for proper operation.

Check #4 REC for short (See 4G).

\* Drive wheels should be off the floor.

### FAILURES WHICH CAUSE FULL MOTOR TORQUE WITH SCR CONTROL

TABLE 2

2A. Contactors close. Full SCR speed immediately with audible hum.

Check potentiometer for proper resistance (see #4I).

Check for grounds in wires #29 and #29A or shorted accelerator potentiometer.

TROUBLE SHOOTING

- |   |  |
|---|--|
| <p>2B. Contactors close. Full speed immediately with no audible hum.*</p>                                 | <p>Check for welded power tips on 1A contactor.</p> <p>Check timer section of card (See #4Ad).</p>   |
| <p>2C. Contacts close. Full speed immediately with no audible hum.*<br/><u>Capacitor not charged.</u></p> | <p>Check for open gate circuit to 5 REC (See 4H and 4Aa).</p> <p>Check 5 REC for shorted condition (See 4H).<br/>If 5 REC shorted, also check 4Ac.</p> <p>Check continuity of wiring from 1C to 5 REC and from 5 REC through 13, 14 to T1 and 1 REC wire #33.</p> <p>Check capacitor 1C (See 4D).</p> <p>Check 1 REC for short (See 4H).</p> |
| <p>2D. Contactors close. Full speed immediately with no audible hum.*<br/><u>Capacitor charged.</u></p>   | <p>Check for open 2 REC (See 4H).</p> <p>Check for open gate in 2 REC (See 4H).</p> <p>Check for open gate circuit to 2 REC (See 4Ab).</p>   |
- \* If truck is equipped with a fault detector and it fails to shut down the control on the above faults, check fault detector per instructions listed in following pages.

MISOPERATION OF SPECIAL FEATURES

TABLE 3

- |  |  |
|--|--|
| <p>3A. Failure of 1A contactor to operate.</p> | <p>* With all direction switches closed, jumper negative to SCR terminal board (wire 41). 1A should pick up immediately. This checks the 1A coil.</p> <p>* Move negative jumper to SCR terminal board (wire #45). 1A should pick up after approximately 1 delay. This checks the timer section of Card #1.</p> <p>If the two above tests check good, then check 1A switch in directional speed control for proper operation.</p> |
| <p>3B. Failures in FW circuit.</p>             | <p>Refer to procedures in Table 3B.</p>  |
| <p>3C. Severe reversal.</p>                    | <p>Check settings of plugging trimpot on Card #1 (See 6B).</p> <p>Check 4 REC (See 4G).</p> <p>Check continuity of wires #5 and #9.</p>  |
| <p>3D. Very soft reversal.</p>                 | <p>Check FUA (if used).</p> <p>Check same as 3C.</p>   |

\* Drive wheels should be off the floor.

## TROUBLE SHOOTING

TABLE 4

Checking Components

Before touching electrical components, disconnect the battery and discharge capacitor 1C.

4A. CARD 1 (See Table 6 for tuneup of Card 1).

The following is a list of simple tests that can be performed with a volt-ohm meter. Remove card from panel by loosening two screws at bottom of box, pull box straight up to disengage from receptacle. Connection can be made to card pins with insulated clips.

a) 5 REC FIRING CIRCUIT:

VOM on RX100 scale. Connect VOM positive lead to pin 13, negative lead to pin 49, circuit should read 1700 to 2100 ohms. Reverse leads and read infinity.

b) 2 REC FIRING CIRCUIT:

VOM on RX100 scale. Connect VOM positive lead to pin 21, negative lead to pin 25; circuit should read 1170 to 1430 ohms. Reverse leads and read infinity.

c) TRANSFORMER FILTER:

VOM on RX100 scale. Connect VOM positive lead to pin 21, negative lead to pin 33; circuit should read 2050 to 2750 ohms. Reverse leads and read infinity.

d) 1A TIMER:

Connect volt-ohm meter positive to 41, negative to 45, and set scale to 50-volts d-c. Using a 36-volt test battery, connect battery positive through a 25-ohm 2-watt resistor to terminal 41. Connect battery negative through a normally open switch to terminal 45. Close switch and observe battery voltage on VOM, after approximately 1 second voltage should drop to 0 volts indicating timer action. Do not hold power on after timer turns on.

4D. CAPACITOR 1C:

Disconnect battery and discharge capacitor. Remove Card 1. Measure ohms through the capacitor using the RX10,000 scale. Meter should read zero ohms and then swing to above 100,000 ohms. Replace capacitor if above reading is not obtained.

TROUBLE SHOOTING

4F. CONTACTOR COIL AND ACCESSORY FILTER:  
(7,8,9, and 12 REC)

On some magnetic panels, the contactor coils will either be varnish tape-wound or encapsulated in green epoxy. For the varnish tape-wound type, a separate filter is required and will be mounted adjacent to the coil. The new green epoxy encapsulated coil contains the necessary filtering and is not visible from the exterior of the device.

a) Separate Filter (Typical Cat. No. 148B6203G14)

These are varistors and should be checked as follows: Disconnect battery and discharge capacitor 1C. Disconnect the leads to the filter block. Connect a 36-volt d-c test battery in series with the varistor and a volt-ohm meter set on the 1ma. scale as shown in Figure 7. If the varistor is good, there will be a noticeable deflection of the meter needle when the leads are touched to the filter block terminals. If no deflection is obtained, replace the filter block.

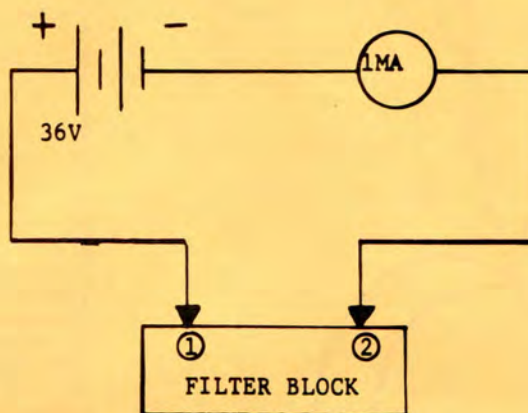


Figure 7

b) Integral Coil Filter:

When this filter fails, it will be evident by a severe cracking of the coils in the vicinity of the coil terminals.

4G. RECTIFIERS:

When checking diodes, disconnect battery and discharge capacitor 1C to prevent burning out the ohmmeter. When reassembling rectifiers, refer to Table 5.

3 and 4 REC: Disconnect pigtail. 3 and 4 REC are diodes with about 7 to 12 ohms in the conducting direction (  $\begin{matrix} + & \rightarrow & - \end{matrix}$  ) measured on the RX1 scale, and infinite resistance in the non-conducting direction (  $\begin{matrix} - & \rightarrow & + \end{matrix}$  ) measured on the RX10,000 scale.

15 and 16 REC: Disconnect one lead. Check same as 3 and 4 REC above.

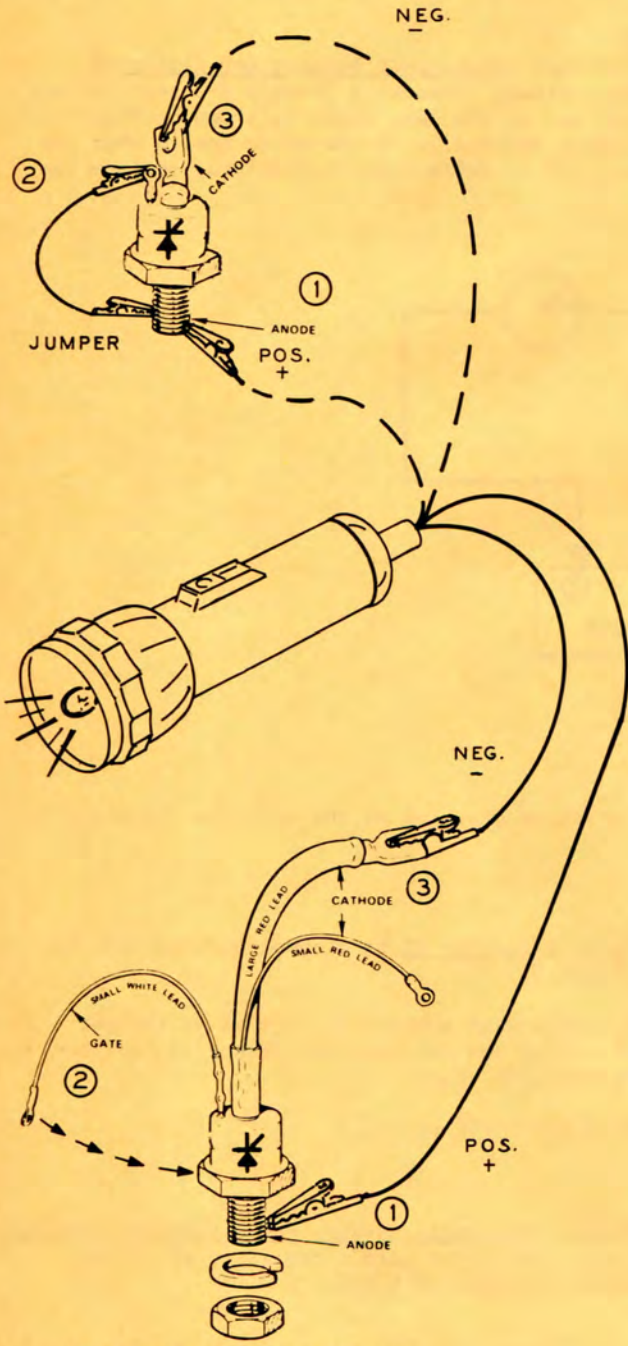
4H. SCR'S (1 REC, 2 REC, 5 REC):

These are silicon control rectifiers. Before checking, disconnect battery and discharge capacitor 1C. Remove card and box from panel and lay aside, this opens the gate circuits to all three devices. Disconnect pigtail of 1 and 2 REC or lead to terminal of 5 REC.

CHECKING RECS 1-2&5 ON ALL G.E. SCR SYSTEMS:

To check an SCR, it is necessary to have a 3-volt battery and a 3-volt lamp. (A test flashlight such as a BRIGHT STAR No. 1618CT circuit continuity tester is excellent for this test.) (Everready 308 ct., or equivalent.)

REFER TO DRAWINGS AND INSTRUCTIONS BELOW



When checking recs 1-2&5 on all G.E. SCR systems

**WHAT IS AN SCR?**

Since the heart of the control is a silicon controlled rectifier (SCR), a general understanding of the characteristics of the device will be helpful. The SCR is a semiconductor rectifier used as a latching switch; i.e., it may assume either a conducting or nonconducting state (On or Off).



The SCR can be turned on by a momentary application of control current to the gate. To turn it off, it is necessary in addition to removing the turn-on signal from the gate, either to remove all power from the SCR or to apply momentary reverse voltage between cathode and anode.

**I M P O R T A N T**

CHECK POLARITY OF FLASHLIGHT LEADS WITH VOLT-METER. NORMALLY RED IS POSITIVE AND BLACK IS NEGATIVE, BUT ON SOME TESTER LIGHTS THEY MAY BE REVERSED.

To Check RECS 1-2&5 on all G.E. SCR systems:

1. Connect the plus lead to the stud (1), connect negative lead to the pigtail (3) as shown.
2. The lamp should not light. If it does light, the SCR is shorted and must be replaced.
3. If check (2) was satisfactory, test SCR for its ability to be turned on by the gate. Touch gate (point 2) to point 1. If gate is operative, the lamp should come on and must remain on when the gate is removed.
4. If lamp cannot be lit under step (3), the SCR must be replaced.



To check an SCR, it is necessary to have a 3-volt battery and a 3-volt lamp. (A test flashlight such as a BRIGHT STAR No. 1618CT circuit continuity tester is excellent for this test. See 1113-2.

Connect the plus lead to the stud (1), connect negative lead to the pigtail (3) as shown in Figure 8.

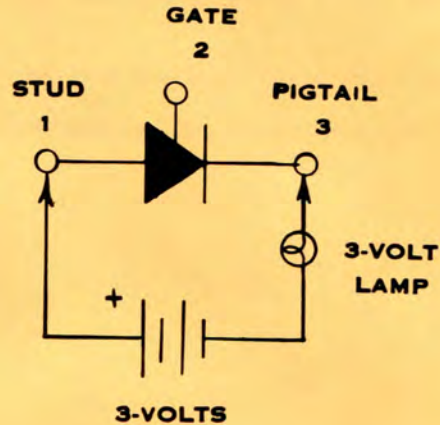


Figure 8

- a) The lamp should not light. If the lamp does light, the SCR is shorted and must be replaced.
  - b) If check (a) was satisfactory, test the SCR for its ability to be turned on by the gate. Touch gate (point 2) to point 1. If gate is operative, the lamp should come on and must remain on when the gate is removed.
  - c) If lamp cannot be lit under step (b) the SCR is open and must be replaced. When reassembling SCR's refer to Table 5.
- 4I. POTENTIOMETER IN ACCELERATOR CONTROL:
- To check operation of the potentiometer, disconnect battery and disconnect wire 29A from thermal protector or SCR terminal board. Connect VOM from wire 29A to negative (13A) with scale set to RX 100. With accelerator in creep-speed position, the ohm reading should be 8,000 to 9,500 ohms; with accelerator in top-speed position, reading should be 300 ohms or less. If these readings are not obtained, loosen pinion gear clamp and adjust rotation of pot shaft relative to accelerator shaft or replace.
- With wires disconnected as above, check for resistance of 1 megohm or higher from pot wires to truck frame.
- 4J. THERMAL PROTECTOR (TP):
- Remove both connections from TP and with a VOM read approximately 50 ohms terminal to terminal, if heat sink is at room temperature. Set VOM to highest ohm scale and check pins to heat sink, reading should be infinity.
- 4K. FILTER BLOCK (HF):
- To check, disconnect all wires from filter block. With VOM on RX10,000 scale, touch the leads to the filter terminals to charge the filter. After a few seconds, reverse the meter leads and touch the filter terminals. The VOM needle will deflect and return to infinity. If this capacitor action is not observed, replace the filter block.



# INDUSTRIAL TRUCK DIVISION



TROUBLE SHOOTING

TABLE 5

Replacement of Semiconductors

When replacing semiconductors such as 1, 2, 3, 4 and 5 REC; it is not necessary to torque these devices to a specific value. However, the device should be screwed into the heat sink and tightened to a snug fit.

The use of a heat transfer grease (such as GE Versilube G-350-M or equivalent) is recommended.

Locking devices must be properly adjusted to prevent semiconductor from becoming loose.



# INDUSTRIAL TRUCK DIVISION



## TROUBLE SHOOTING

TABLE 6

### Tuneup for New or Mistuned Card 1

#### IMPORTANT NOTES:

1. Panels are factory adjusted for a particular motor and truck and should not need adjustment when used with this motor and truck. However, checks and or touchup adjustments may be made per Table 6A because these adjustments are so designed that they do not interact when near their proper setting.
2. The TOP SCR SPEED setting is a factory made and sealed setting! Under normal conditions, this setting should not be touched.  
If setting is required, the complete tuneup procedure, Table 6B, must be followed.
3. If the panels are used to control motors or trucks for which they were not factory adjusted, the settings may be out of optimum adjustment to the extent that they do interact and the complete tuneup procedure, Table 6B, must be followed.
4. All adjustments are such that CW rotation increases function being adjusted.
5. Connect the shunt, the millivoltmeter and the voltmeter to measure battery current and motor volts. Connect the shunt and millivoltmeter between battery negative and 1REC (or between truck receptacle and battery plug.) Connect voltmeter between battery positive and T2 on the SCR panel. Remove wire 29 from the thermal protector and connect a jumper from wire 29 to negative (pigtail of 1 REC).

NOTE: Be sure to insulate or wrap the jumper connection to wire 29 to prevent accidental contact of this point to the truck frame. If this point touches the truck frame, it will damage the control card.

Jack up the truck so that the drive wheels are free to rotate.

If a brake interlock is used, jumper it out so that power and brakes can be applied at the same time.

6. Equipment required:

50-millivolt d-c shunt\*

50-millivolt d-c meter (d'Arsonval movement)

50-volt d-c meter (d'Arsonval movement) (250 volt scale needed for 72V)

Battery with equal or greater ampere-hour capacity than used on truck, charged to 1200 or higher specific gravity.

* <u>Typical Shunt Ratings</u>	<u>SCR Model</u>
200 Amp	100
*300 or 400 Amp	200
400 or 500 Amp	300
*ECLS20B, ECLS25B, ECLS30B, ECLS40B	

NOTE: Shunt rating must be greater than current to be measured. Best results are obtained when reading is between half and full scale on meter. If a shunt of too high a rating is used (ie. a 500 amp rating to read 100 amps), it will be hard to read and the accuracy of the reading will be poor.

7. Check that the ohms in accelerator potentiometer are less than 200 ohms in top SCR range (See Table 41). Refer to Figure 3 for potentiometer locations.



# INDUSTRIAL TRUCK DIVISION



## TROUBLE SHOOTING

### TABLE 6A

#### Checking of Card Settings

Checks and/or minor touchup adjustments can be made without following complete tuneups as given in Table 6B.

a) CREEP SPEED:

With truck on the ground check creep speed of truck as F or R contactor operate.

b) TOP SCR SPEED:

Refer to Note 5.

Check TOP SCR SPEED by first moving the accelerator until the F or R contactor operate. Do not move accelerator to the point where 1A picks up.

Apply brakes until battery current reads per the valve as given in Table 6Bd and read motor volts to see if it falls within values given in Table 6Bd.

Disconnect shunt, voltmeter, and jumper to wire 29, and reconnect wire 29 on the thermal protector.

c) CURRENT LIMIT:

Refer to Note 5.

Check CURRENT LIMIT by first moving the accelerator until the F or R contactor operate. Do not move accelerator to the point where 1A picks up.

Apply brakes until wheels come to a STANDSTILL (the wheels must not be turning) and read current to see if it falls below the maximum rating given in Table 6Bd and within the rating specified by the truck manufacturer.

NOTE: DO NOT STALL the motor for more than 30 seconds at a time. Allow time for motor cooling between stalls. Do not operate motor at high speeds or plug the motor with wheels jacked up.

Disconnect shunt, voltmeter, and jumper to wire 29, and reconnect wire 29 on the thermal protector.

d) STATIC PLUGGING:

With truck on the ground plug truck from top speed. If stopping distance is not as desired, adjust plugging trimpot.

NOTE: There may be a coarse trimpot adjustment on the card accessible from the slot on the side of the card box.

e) 1A TIMER:

With truck on the ground check operation on a full acceleration. If 1A contactor picks up too early or if truck is sluggish, adjust trimpot to obtain desired operations.



# INDUSTRIAL TRUCK DIVISION



## TROUBLE SHOOTING

TABLE 6B

### Tuneup Procedure

COMPLETE ALL STEPS a thru e:

- a) Turn CURRENT-LIMIT trimpot fully clockwise.
- b) Turn PLUGGING trimpot fully clockwise. (Steps a and b prevent any interaction when setting the speed adjustment.)
- c) Adjust CREEP SPEED as desired.
- d) TOP SCR SPEED

Refer to Note 5.

Check TOP SCR SPEED by first moving the accelerator until the F or R contactor operate. Do not move accelerator to the point where 1A picks up.

Apply the brakes until battery current is about 70 to 80 percent of the loaded level amperes with motor directly across the battery and motor fields connected the same as are used in the SCR control.

<u>Typical Battery Current</u>	<u>SCR Model</u>
45 - 50 Amps	100
*75 - 80 Amps	200
120 - 130 Amps	300
*ECLS20B, ECLS25B, ECLS30B, ECLS40B	

Adjust the TOP SCR SPEED trimpot until the voltmeter reads motor volts as indicated below:

<u>Battery Volts</u>	<u>Motor Volts</u>	<u>CURRENT LIMIT AMPS (MAXIMUM)</u>		
		<u>C155 Model 100</u>	<u>C185 Model 200</u>	<u>C290 Model 300</u>
12	7 - 9	100	200	300
18	13 - 16	100	200	300
24	17 - 22	100	200	300
*36	25 - 32	100	*200	300
48	34 - 43	NA	185	300
72	50 - 65	NA	150	300
*ECLS20B, ECLS25B, ECLS30B, ECLS40B				

e) CURRENT LIMIT

Turn the current limit trimpot fully counterclockwise. When the trimpot is fully counterclockwise, the card is designed so that the control may be cut off (no pulsing occurs). Check to be sure the plugging trimpot is turned fully clockwise. Depress the accelerator until F or R operate but not the 1A contactor. Apply the brakes until the wheels come to a standstill and remain at a standstill. Slowly turn the CURRENT LIMIT TRIMPOT in a clockwise direction until the current reaches a value as shown in the above table.

NOTE: The current limit values as given in the table above represent the typical maximum values that we suggest for each control when operated on a given voltage and these values must not be exceeded.



# INDUSTRIAL TRUCK DIVISION



## TROUBLE SHOOTING

Since these controls are used on a variety of types and sizes of trucks for various applications, it is recommended that you obtain the actual current limit setting for your particular truck. ECLS20, 25, 30, 40B current limit setting is 190 amps min., 210 amps max.

NOTE: Do not stall the motor for more than 30 seconds at a time. Allow time for motor cooling between stalls. Do not operate motor at high speeds or plug the motor with wheels jacked up.

After setting to correct value, disconnect meter and reconnect wire 29 to the thermal protector.

### f) STATIC PLUGGING

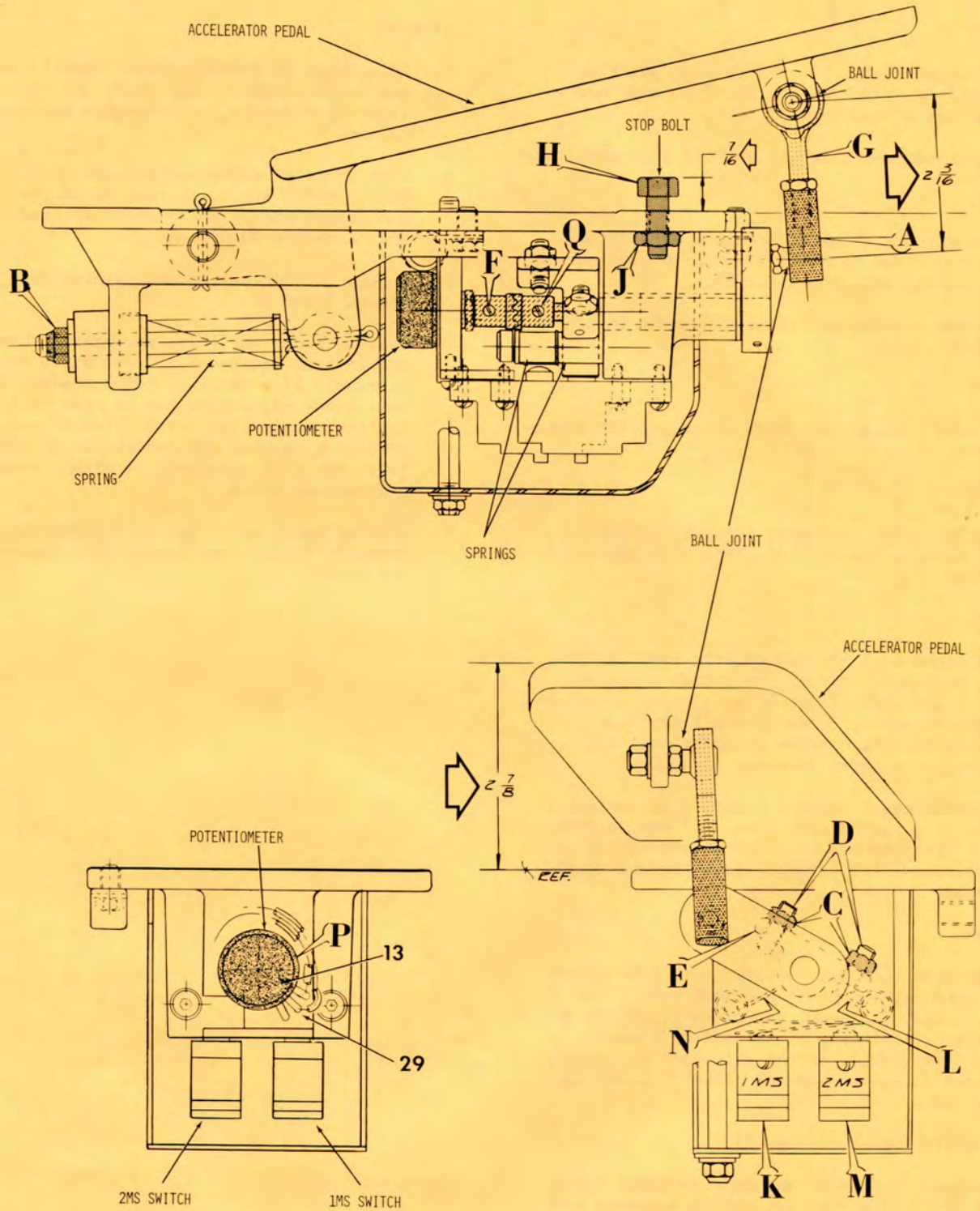
To adjust the static plugging, the truck should be in its normal running condition and on the ground. Turn the PLUGGING trimpot fully counterclockwise (this may cut off control operation no pulsing). This will give the longest distance for stopping. If pulsing of the control has stopped, turn plugging trimpot clockwise (clockwise rotation decreases stopping distance) until control just starts to pulse. Then turn the trimpot about 30 degrees more clockwise rotation and try truck for stopping distance. If stopping distance is too short or too long, continue to adjust trimpot until desired stopping distance is obtained.

If the desired stopping distance cannot be obtained, there may be a coarse trimpot adjustment on the card that is accessible from the slot on the side of the card box. This may be turned CW or CCW to give extended range to the normal plugging trimpot.

### g) 1A TIMER

The 1A TIMER is factory set at approximately 1 second on all models. Check truck performance. If the 1A contactor picks up too early, resulting in jerky operation, turn the 1A Timer trimpot CW to increase time delay, to a value that provides desired operation.

After all the trimpots have been set, each should be sealed with a silicon rubber compound such as RTV (bath-tub sealer). This will discourage further adjusting by unauthorized personnel.





# INDUSTRIAL TRUCK DIVISION



## TROUBLE SHOOTING

SOLID STATE CONTROL ..... ACCELERATOR ADJUSTMENT ..... C-185 SCR CONTROL FOR .....  
ECLS-20B, ECLS-25B, ECLS-30B, ECLS-40B

### STEP #1

- A. Disconnect ball joint (Item A), position pedal to 2-7/8" dimension, from machined surface of casting.
- B. Turn stop nut (Item B) to hold this position.

### STEP #2

- A. Loosen nuts (Item C) and back off (2) set screws (Item D) until flush with cast surface of spring actuator (Item E).
- B. Do not tighten set screws (Item F) in coupler at this time.

### STEP #3

- A. Adjust linkage rod (Item G) to 2-3/16" dimension.

### STEP #4

- A. Adjust pedal stop bolt (Item H) to 7/16" dimension, and lock in place with jam nut (Item J).

### STEP #5

- A. Adjustment of 1ms switch with pedal in the up position: Adjust 1ms switch (Item K) with set screw (Item D) by turning screw in against spring (Item L) until 1ms just actuates. Turn screw an additional 1/4 turn.....tighten lock nut (Item C).
- B. Depress pedal several times to be certain 1ms is actuated each time. If not, unlock nut (Item C) and turn screw (Item D) in an additional 1/4 turn.....lock nut and repeat above.

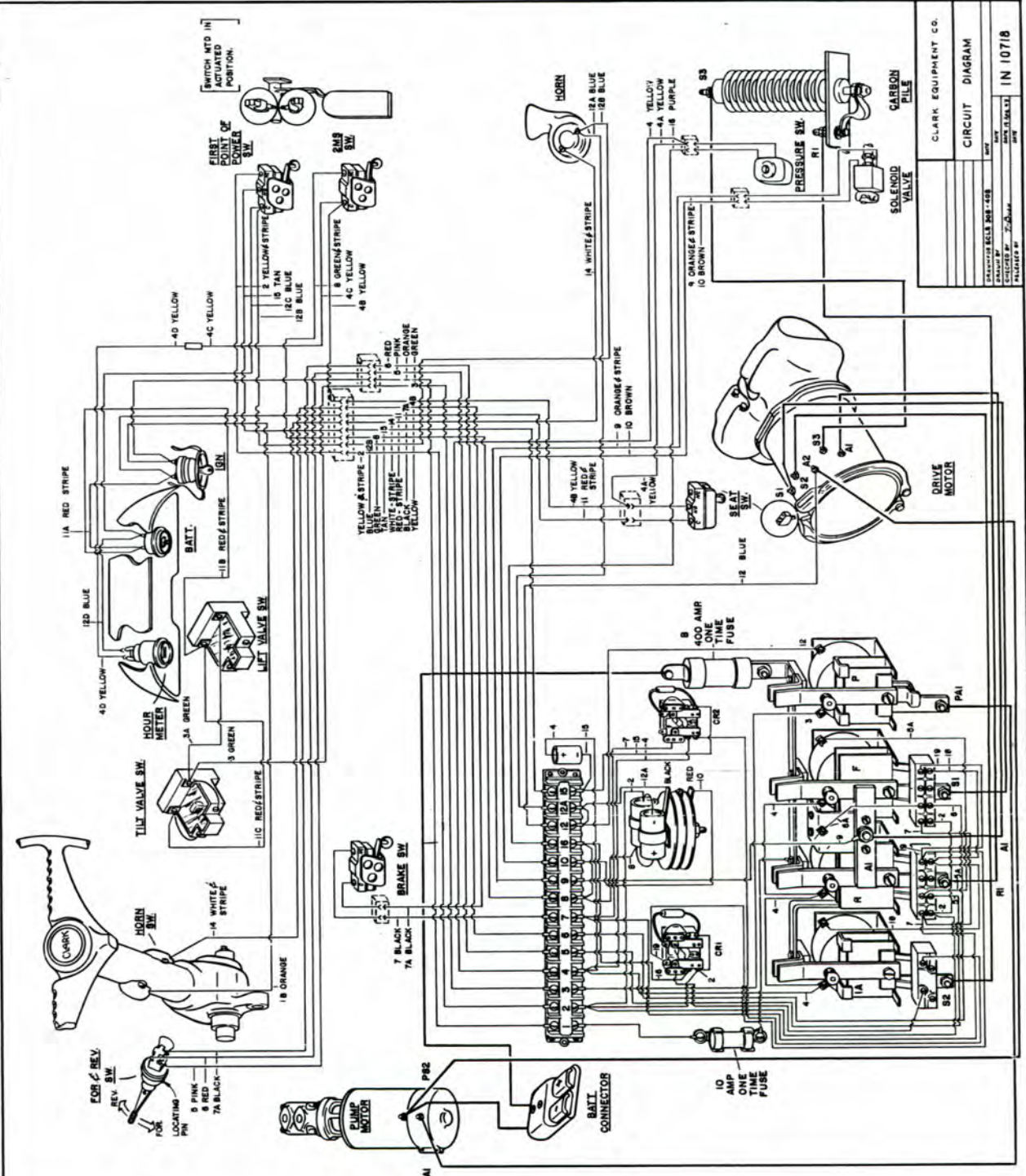
### STEP #6

- A. Adjustment of 2ms switch: With 1/8" spacer placed between pedal and stop bolt (Item H) .....and with pedal depressed....adjust 2ms switch (Item M) with set screw (Item D) (off-set tab of spring actuator) by turning screw in against spring (Item N) until 2ms actuates.  
  
Tighten lock nut (Item C).
- B. Remove 1/8" spacer and depress pedal fully to be certain that 2ms switch actuates each time.

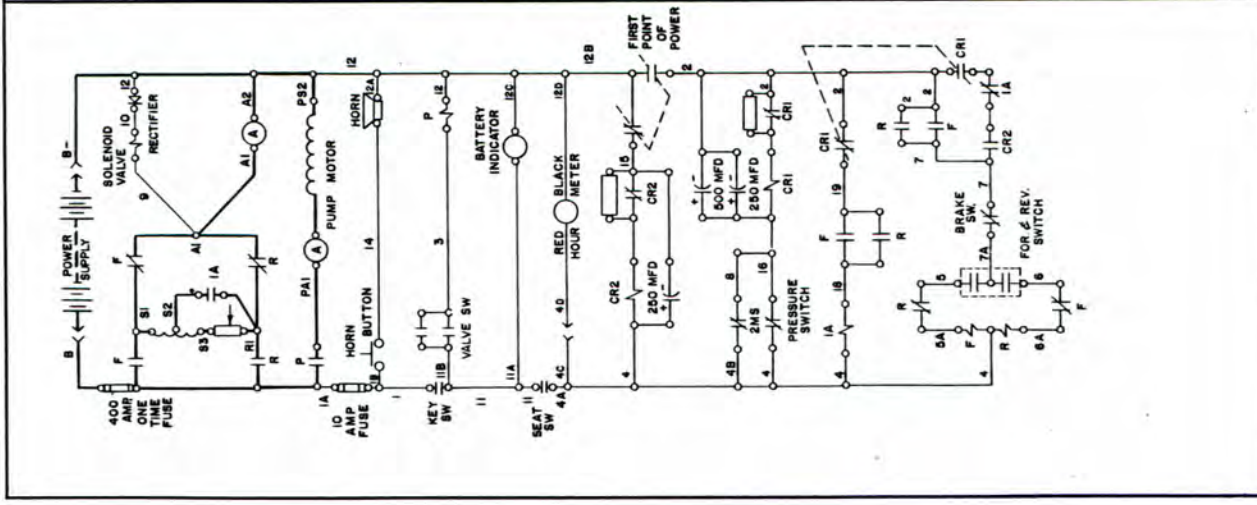
### STEP #7

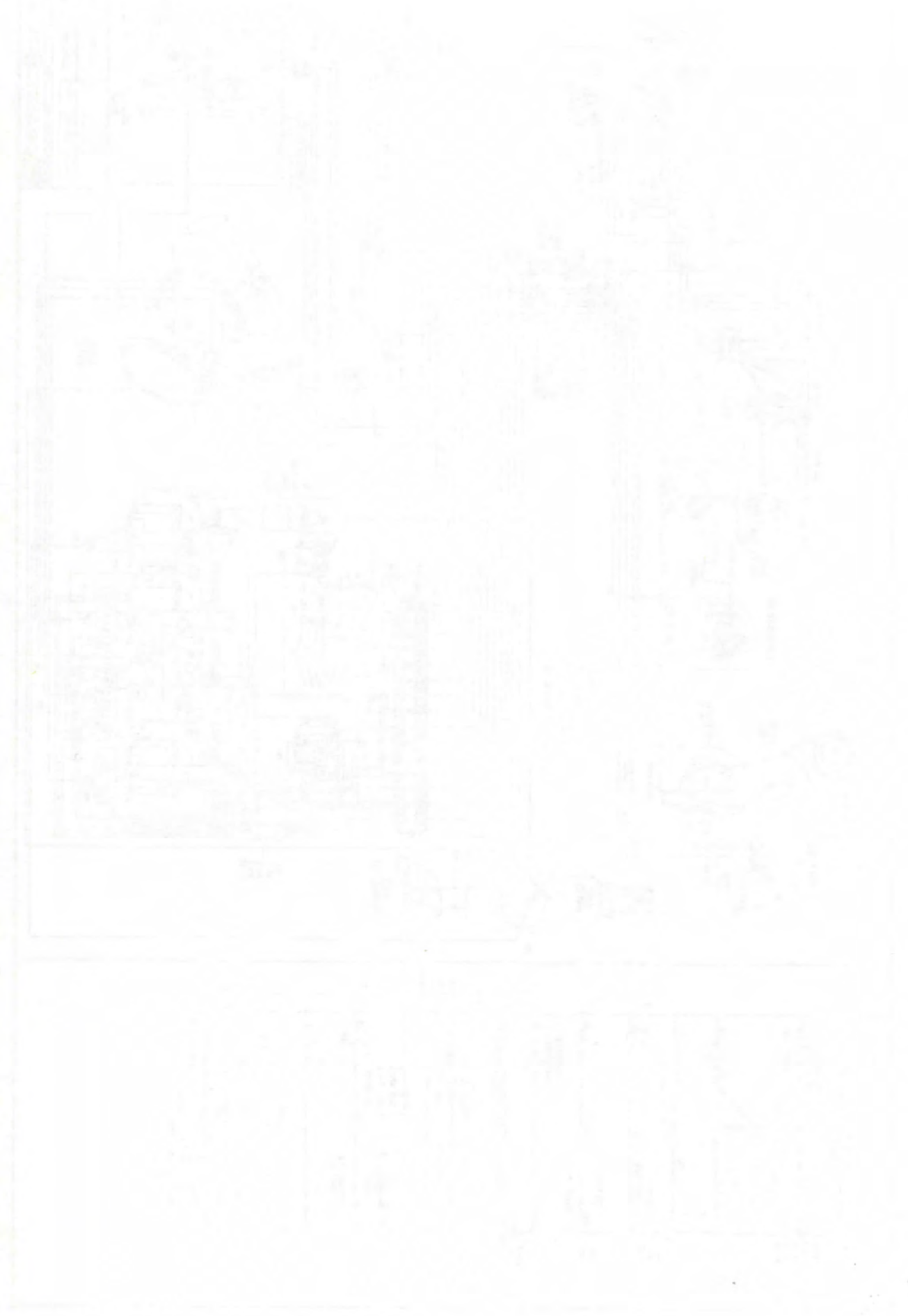
- A. Adjustment of potentiometer (Item P) with set screw (Item F) tightened, and set screw (Item Q) loosened.....disengage coupler halves.
- B. With ohmmeter connected between wires 13 & 29.....RS100 scale.....revolve coupler half and potentiometer until ohmmeter reads approximately 10,000 ohms.
- C. Engage coupler halves and tighten set screws (Item Q).
- D. Depress pedal until 1ms actuates...ohmmeter should read between 8,500 and 9,500 ohms... terminals 13 & 29 ..... RS100 scale. If not, minor adjustment can be made by loosening the coupler set screw (Item Q) and revolving coupler and potentiometer shaft (with 1ms just actuated) to within range... tighten set screw.
- E. Depress pedal until 2ms just actuates..... ohmmeter should read 300 or less ohms..... RS1 scale.



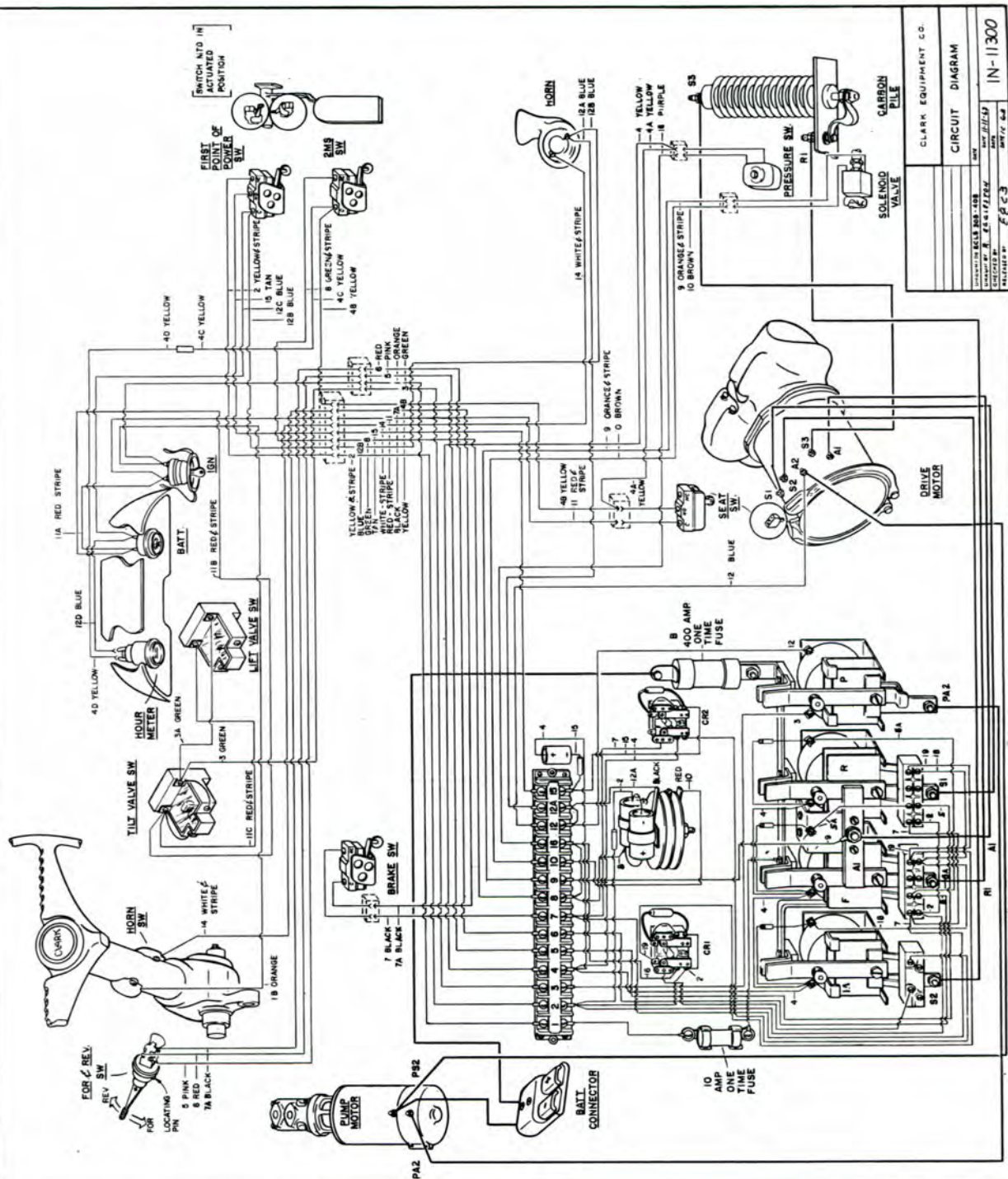
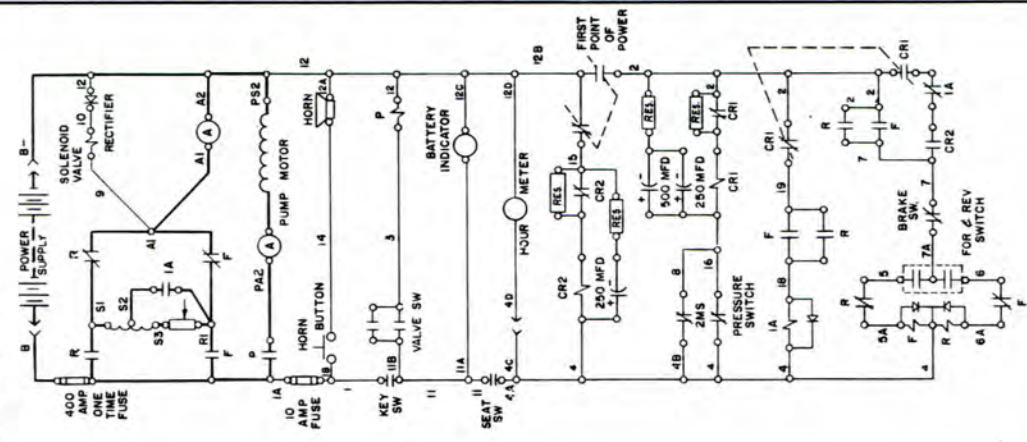


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DESIGNED BY: J. J. [unreadable]	CHECKED BY: [unreadable]
DATE: [unreadable]	FILED BY: [unreadable]



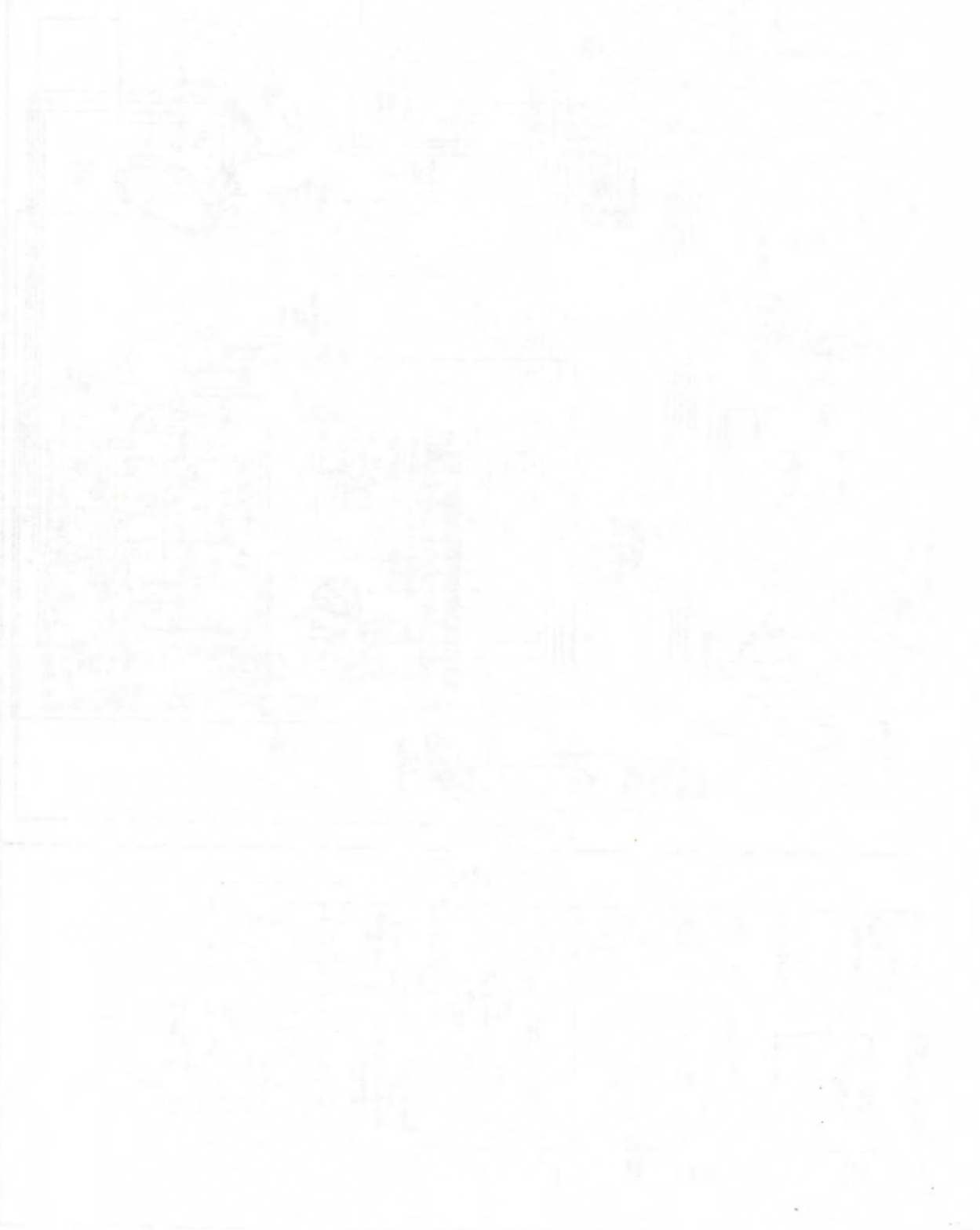


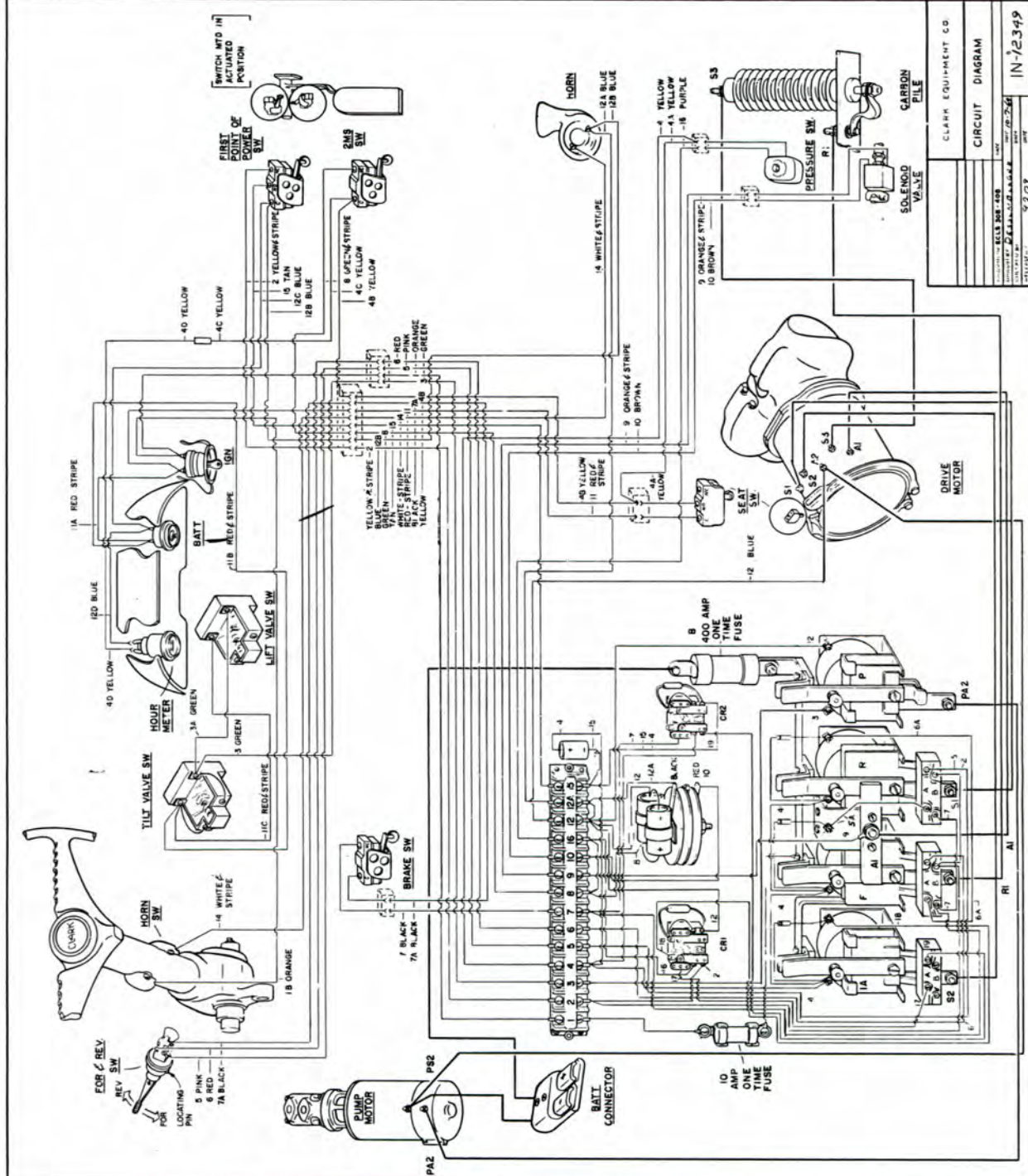
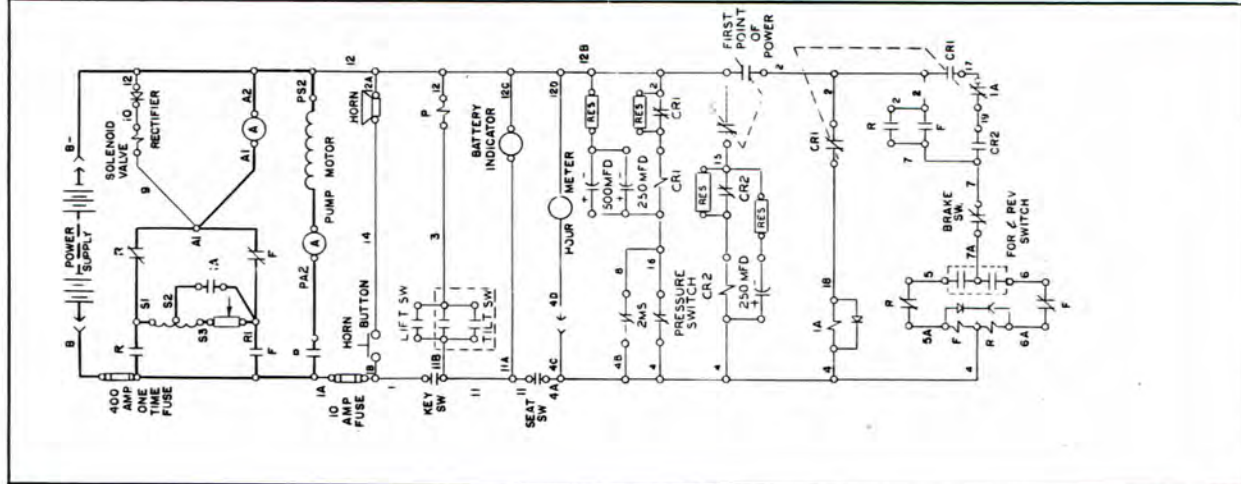
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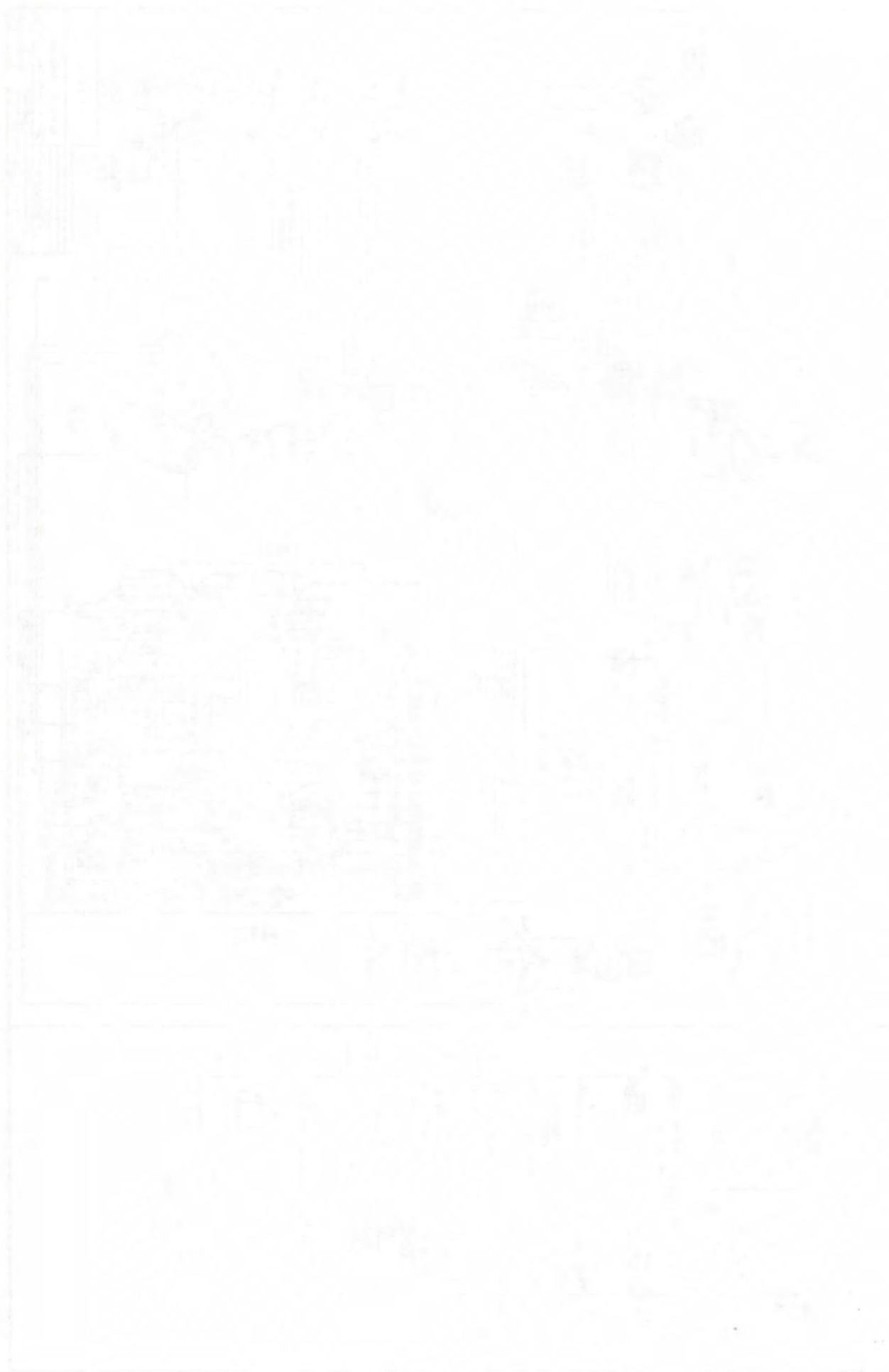
CLARK EQUIPMENT CO.  
CIRCUIT DIAGRAM  
IN-11300

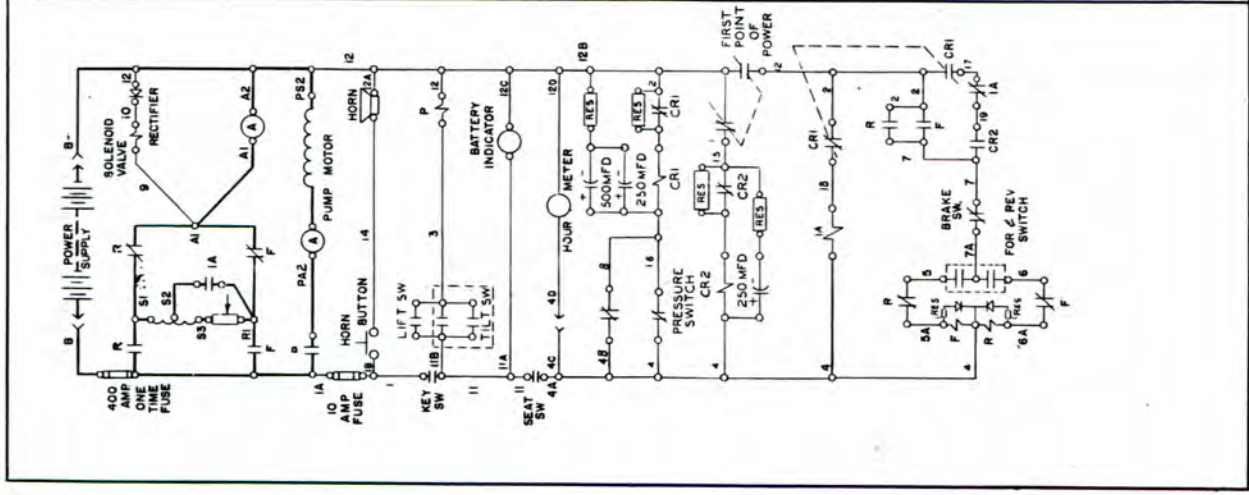
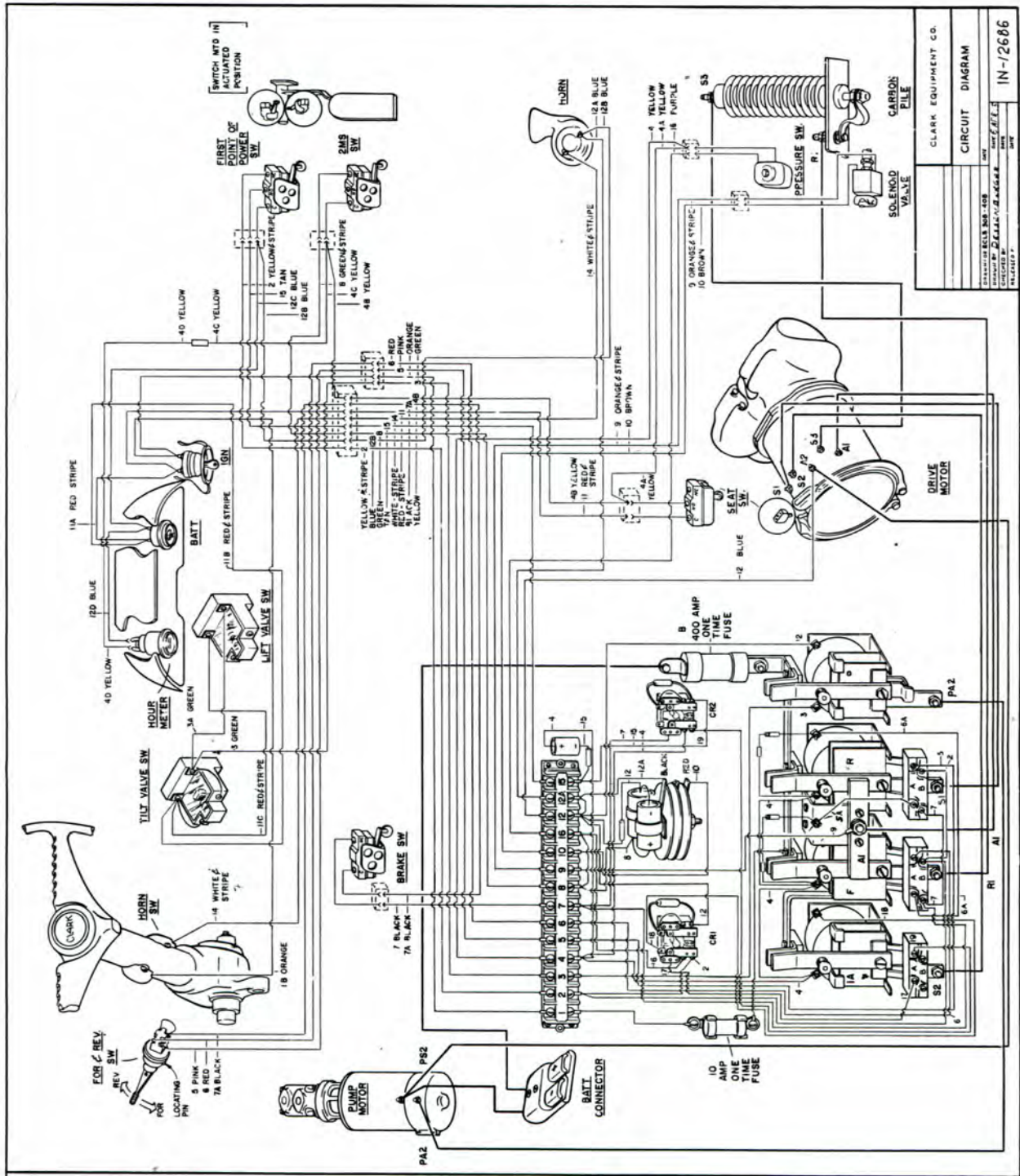
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CLARK EQUIPMENT CO
CIRCUIT DIAGRAM
MODEL NO. 640
REVISION NO. 10-2-64
DATE



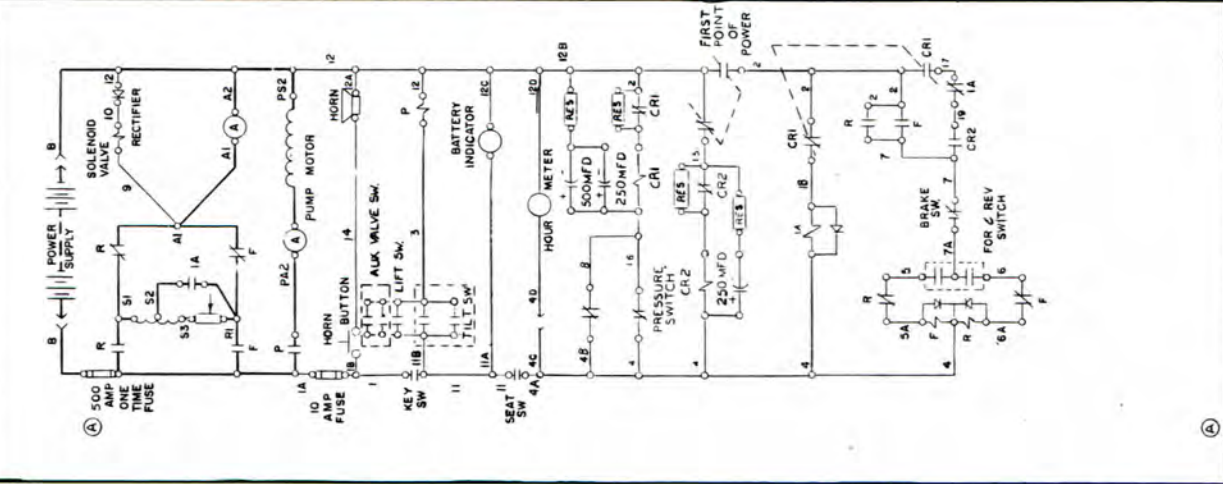
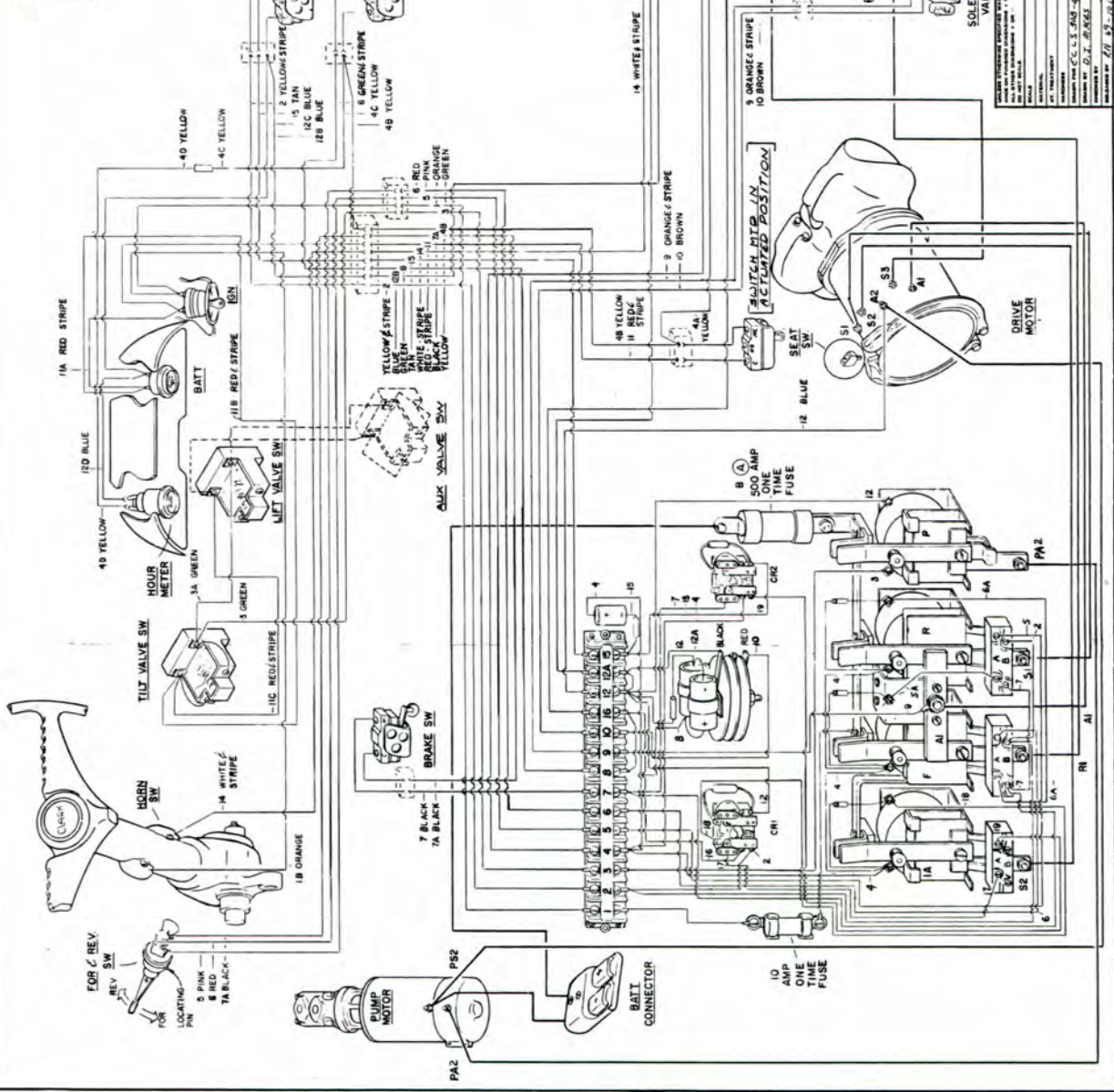


CLARK EQUIPMENT CO.  
 CIRCUIT DIAGRAM  
 DRAWN BY: DALLAS  
 CHECKED BY: [Signature]  
 IN-2686

Year	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900
Population	1,000	1,100	1,200	1,300	1,400	1,500	1,600	1,700	1,800	1,900	2,000
Area	100	100	100	100	100	100	100	100	100	100	100
Population Density	10	11	12	13	14	15	16	17	18	19	20
Area (sq. miles)	10	10	10	10	10	10	10	10	10	10	10
Population per sq. mile	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
Area (sq. miles)	10	10	10	10	10	10	10	10	10	10	10
Population per sq. mile	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0

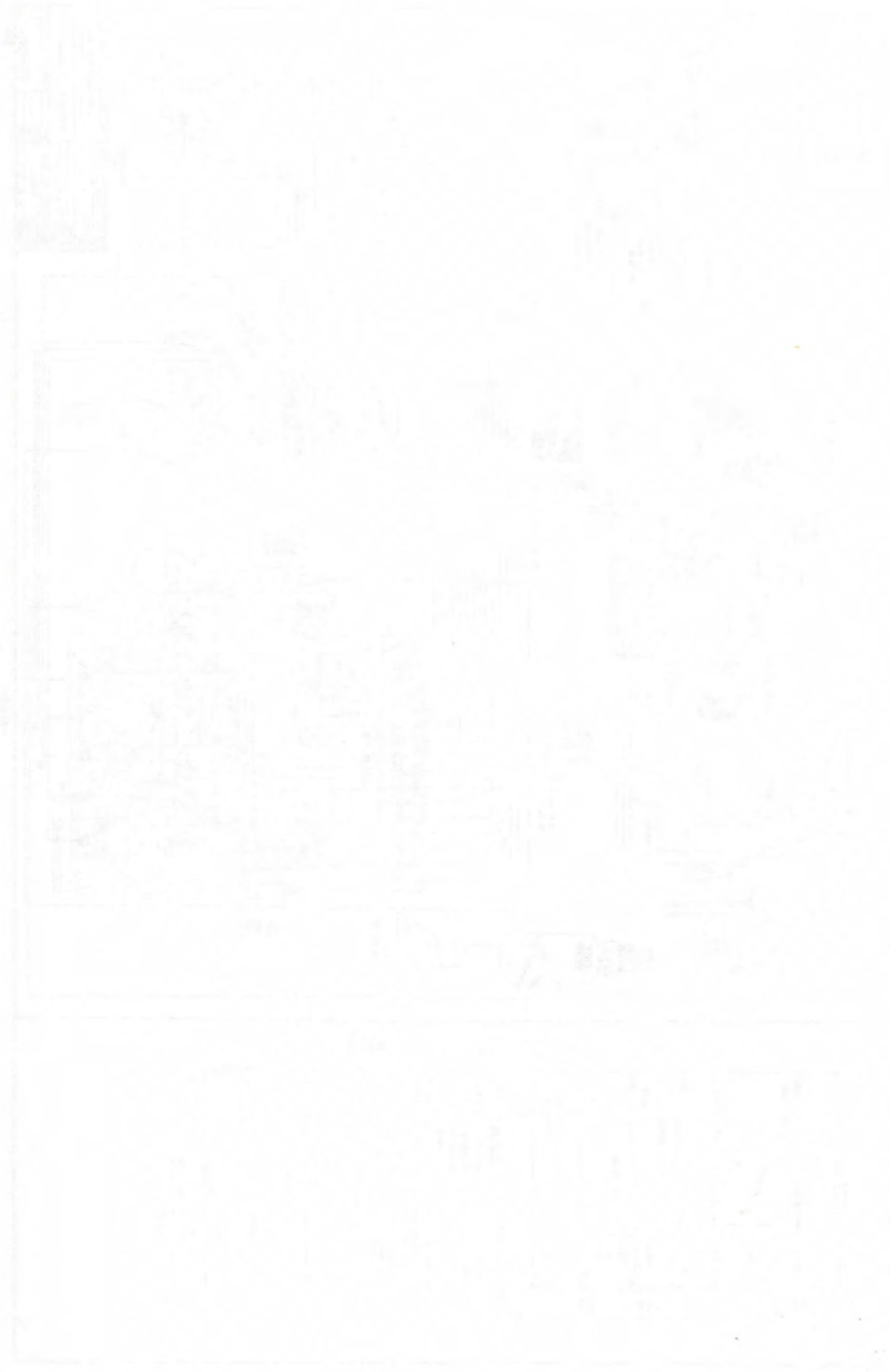


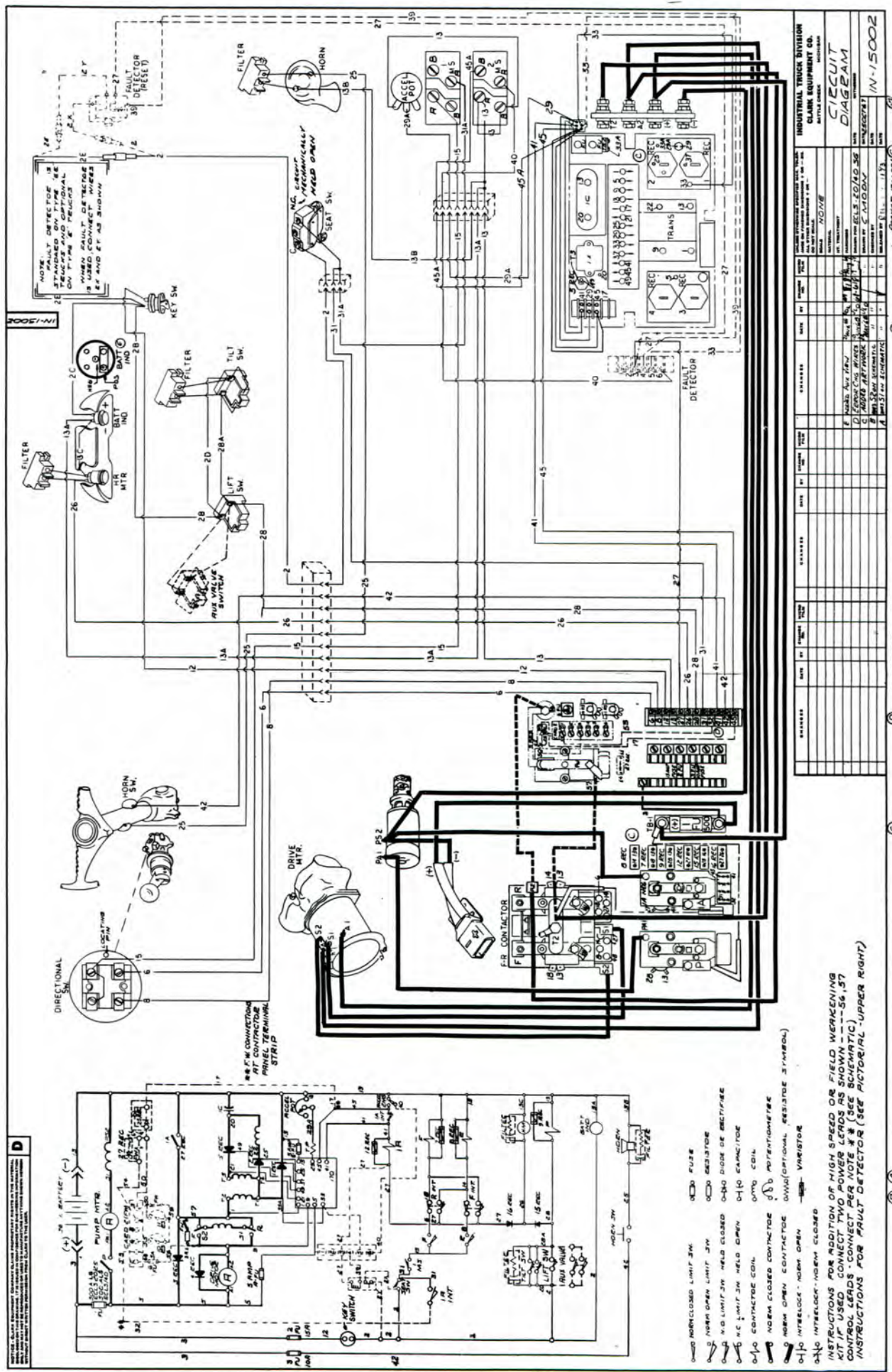
REVISIONS	DATE	BY	REASON
A	1943.11.15	W.D.	INITIAL DESIGN
B	1944.01.15	W.D.	REVISED - BULB W/ 115V



INDUSTRIAL TRUCK DIVISION	INDUSTRIAL TRUCK DIVISION
CLARK EQUIPMENT CO.	CLARK EQUIPMENT CO.
BATTLE CREEK, MICHIGAN	BATTLE CREEK, MICHIGAN
CIRCUIT DIAGRAM	CIRCUIT DIAGRAM
DATE	DATE
BY	BY
11-14992	11-14992

IN-14992





**D**  
 NOTE: ALL ELECTRICAL CONNECTIONS TO BE MADE IN ACCORDANCE WITH THE WIRING INSTRUCTIONS AND THE ELECTRICAL SCHEMATIC. THE WIRING INSTRUCTIONS AND ELECTRICAL SCHEMATIC ARE TO BE USED AS A GUIDE ONLY. THE WIRING INSTRUCTIONS AND ELECTRICAL SCHEMATIC ARE TO BE USED AS A GUIDE ONLY. THE WIRING INSTRUCTIONS AND ELECTRICAL SCHEMATIC ARE TO BE USED AS A GUIDE ONLY.

- OPEN CIRCUIT
  - NO OPEN LIMIT SW
  - NO LIMIT SW HELD CLOSED
  - N.C. LIMIT SW HELD OPEN
  - NO CONTACT COIL
  - NORM. CLOSED CONTACT
  - NORM. OPEN CONTACT
  - INTERLOCK - NORM. OPEN
  - NO INTERLOCK - NORM. CLOSED
- INSTRUCTIONS FOR ADDITION OF HIGH SPEED OR FIELD WEAKENING KIT IF USED. CONNECT TWO POWER LEADS AS SHOWN. CONTROL LEADS - CONNECT PER NOTE \*\* (SEE SCHEMATIC) - INSTRUCTIONS FOR FAULT DETECTOR (SEE PICTORIAL - UPPER RIGHT)

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