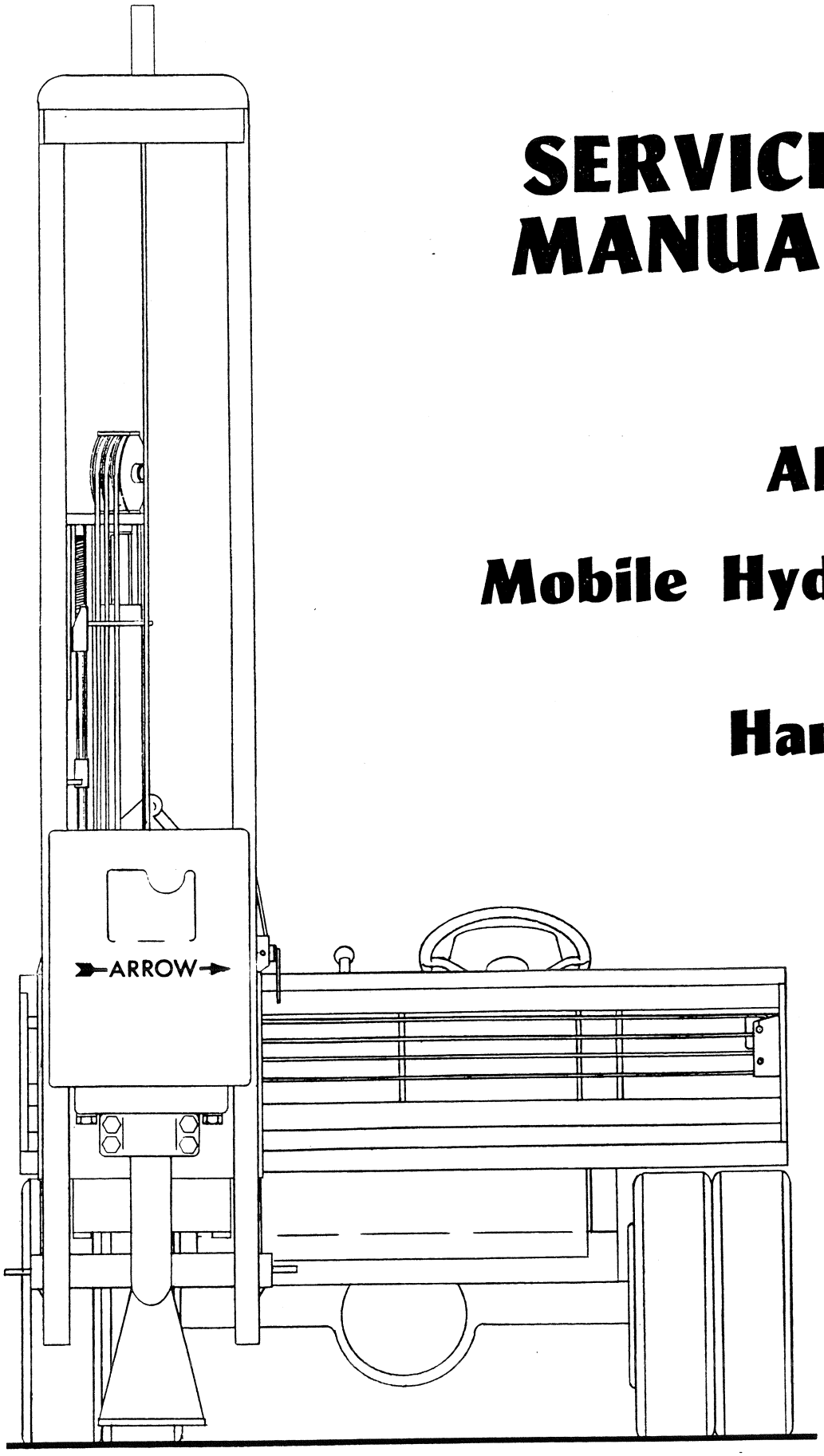
SERVICE MANUAL

for

ARROW

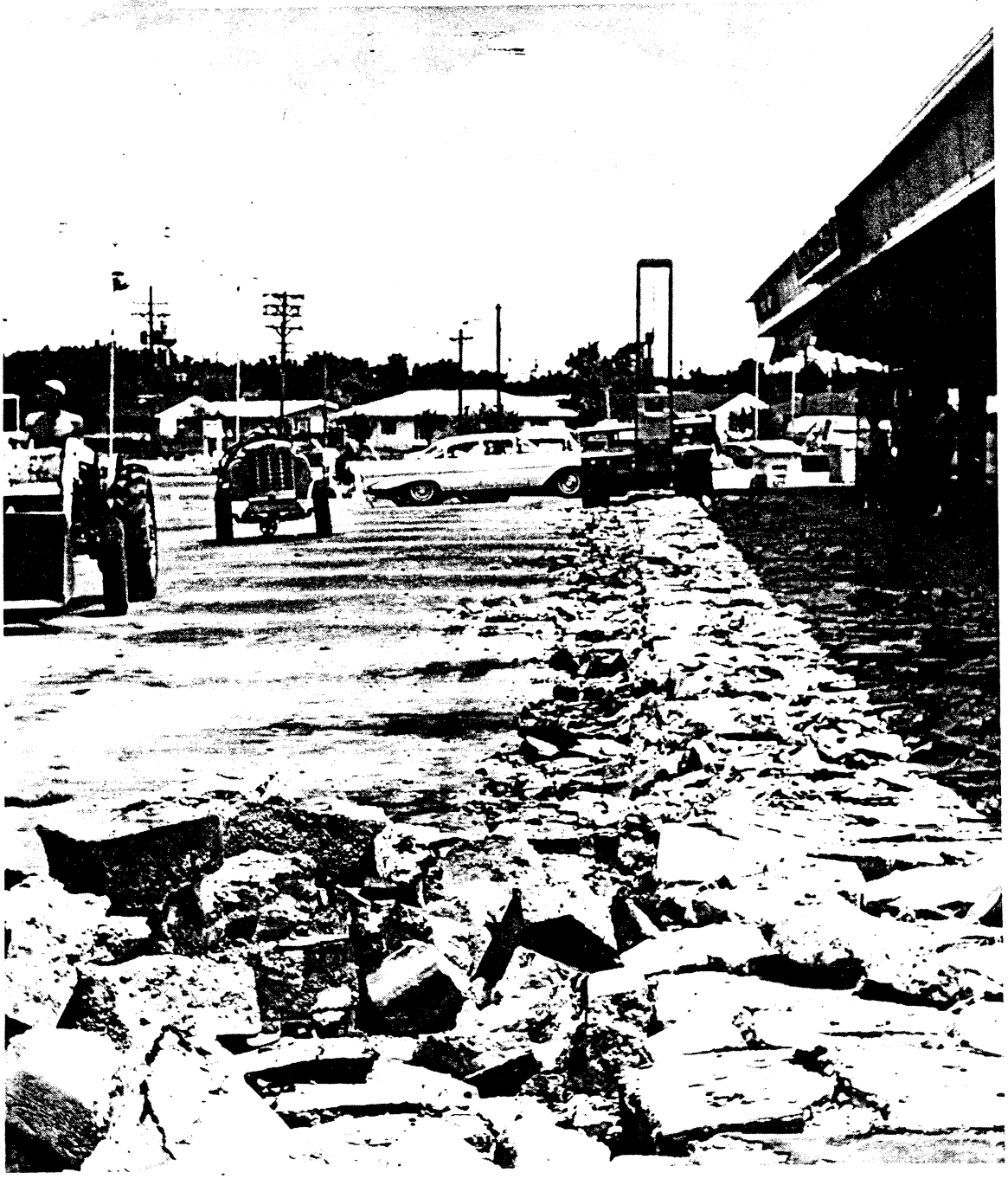
Mobile Hydraulic

Hammers



ARROW MFG. CO. 194 West Dakota Ave. Denver, Colo. 80209

HAMMER OPERATION



CONTENTS

HAMMER OPERATION

PREPARATION FOR TRANSPORTATION TO JOB

1. Allow engine and hydraulic system to warm up before applying full load.

2. Hammer weight is raised by pulling backward on handle of Hammer Control Valve. Raise hammer weight until the indicating arrow on hammer weight aligns with lock on side of leads. (Refer to Figure A.) Rotate lock handle to forward position until lock will slip into place in the hammer weight. Secure by turning handle down.

CAUTION: When transporting the machine the hammer weight must be locked in position. An unlocked hammer weight is dangerous and if the weight slides back in the leads it will be impossible to raise the leads hydraulically.

3. With weight in proper carrying position and locked, push forward on side shift control valve handle and move leads to extreme right (as viewed from the operator's position). Pull back on layback control valve handle until leads fully lay back. Use the tilt control valve to move leads into lead support. The leads may be centered for better balance and safety in sudden stops, however, the visibility will be somewhat impaired.

The safety latch on the side shift ways weldment must be manually raised to allow leads to fully lay back.

4. With leads in traveling position, release the brake twist lock. The machine is now ready for travel.

CAUTION: It is unsafe to use hand throttle in transporting machine.

PREPARATION FOR WORK

1. Use the tilt control valve to move leads out of lead support, then use layback control to raise leads to working position.

2. Raise hammer lift cylinder by pulling back on hammer control valve handle until slack is removed from cable. Unlock hammer weight by rotating hammer lock handle forward to horizontal position, pull out and rotate hammer lock handle down to secure in out position.

TOOL CLAMP

Lower hammer weight and install desired tool by clamping into position. Tighten tool clamp bolts to a torque of 250 foot pounds. After approximately five minutes of operation the hammer clamp bolts should be re-tightened to 250 foot pounds torque. Periodic tightening thereafter will ensure longer tool and clamp life. Do not overtighten. The four cap screws holding the tool head to the hammer weight should be checked periodically. These bolts should be torqued to 250 foot pounds.

HYDRAULIC CREEPER DRIVE

1. To engage creeper drive, put transmission shift lever in neutral. Swing creep gear lever up. It is not necessary to depress clutch pedal when using this lever. Creeper drive is now ready for operation. If gear does not mesh, jog with control.

2. To creep forward, push creeper control handle forward (Refer to Figure B). To creep backward, pull handle back. Control handle provides for an infinite variation of creeper speeds, depending on the position of the control handle.

3. To stop the creeper drive, merely depress the brake pedal or center the control handle. Applying the brakes operates the hydraulically actuated creeper stop valve. Therefore, frequent or continuous use of the brake will not cause any damage or overheating of the hydraulic system. Thus, the operator can make repeated blows to the same spot. When the brake pedal is released the creeper will again move the machine. Coordination of the use of this bypass with the hammer stroke will provide the desired spacing of blows.

CABLE ADJUSTMENT

1. Move auto-manual control valve handle forward to manual position (refer to Figure B). Install desired tool in hammer. Lower tool to working surface by pushing forward on hammer control valve handle.

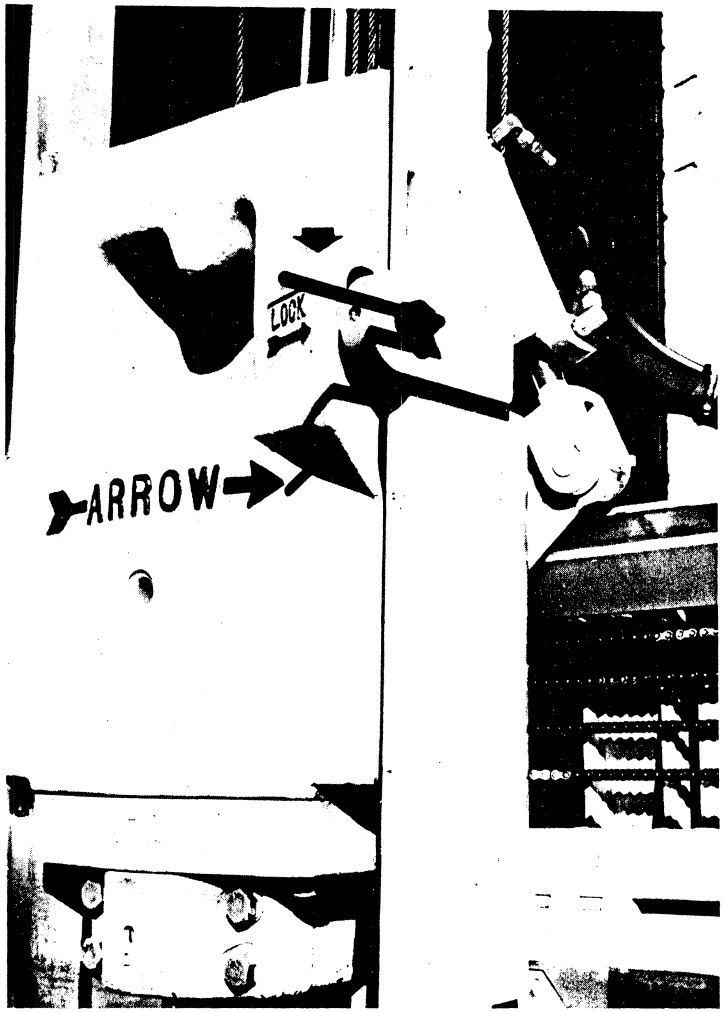
2. Loosen either cable wedge on hammer or on cylinder base, and raise hammer lift cylinder by pulling backward on hammer valve control handle until cylinder is extended upward 3 inches from bottom of stroke.

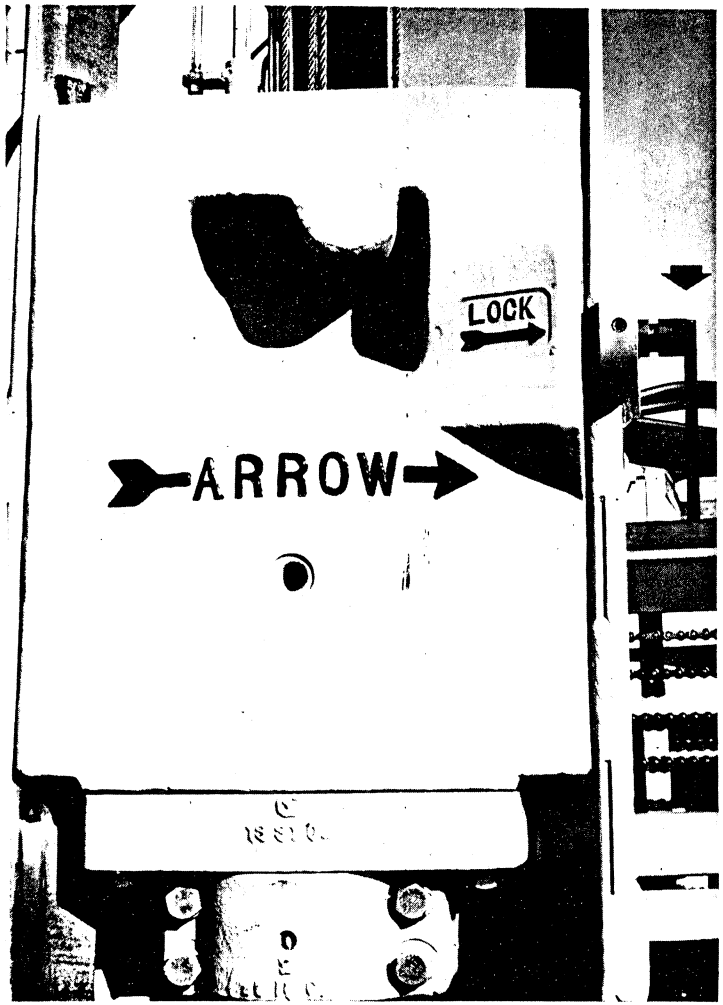
3. Pull slack out of cable and secure wedge. Position hand throttle in UP position when operating hammer.

When the Arrow Hammer is shipped from the factory, the cable has been set for use with a

ROTATE HANDLE TO FORWARD POSITION TO UNLOCK.

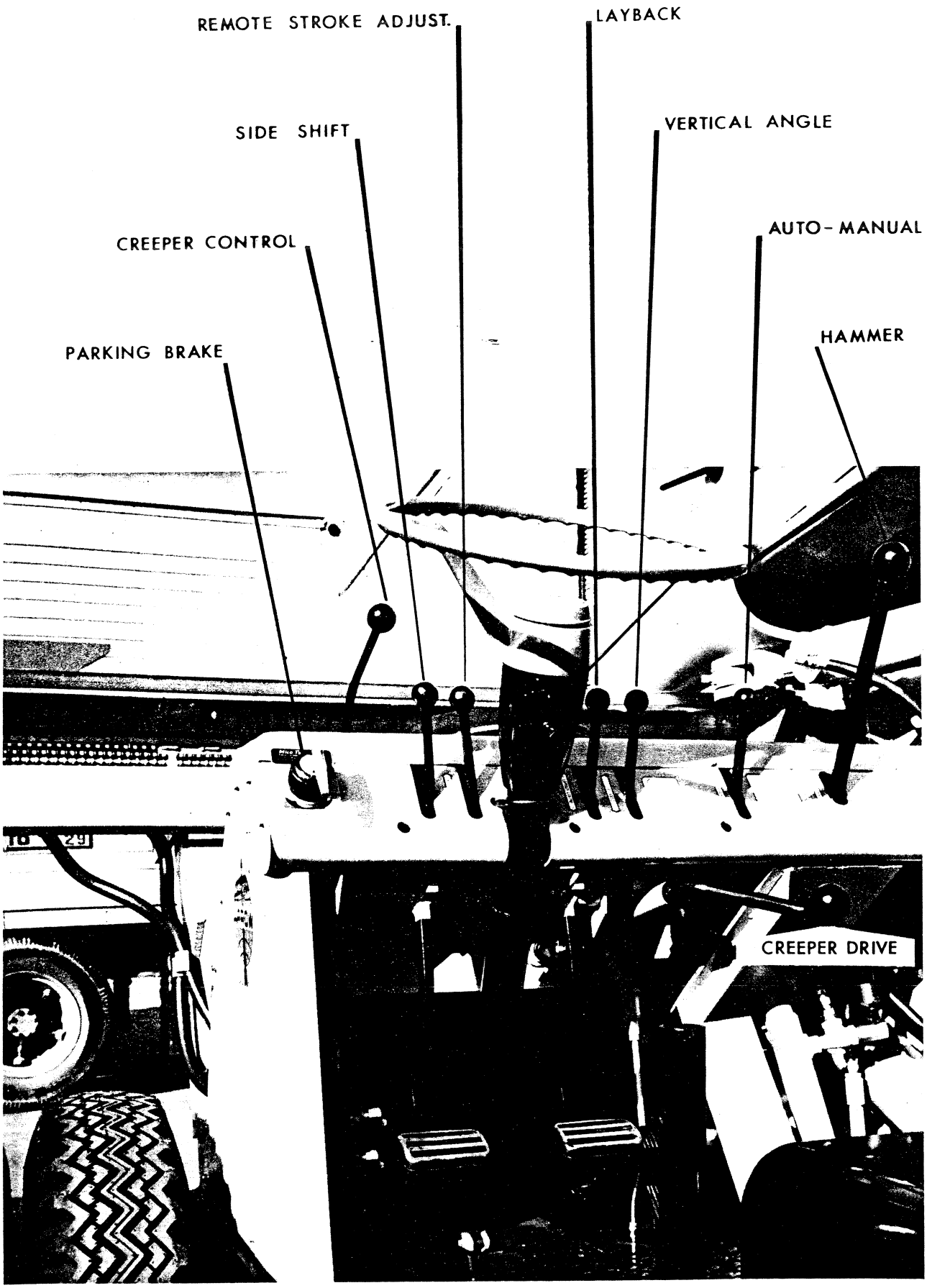
TURN HANDLE DOWN TO SECURE.



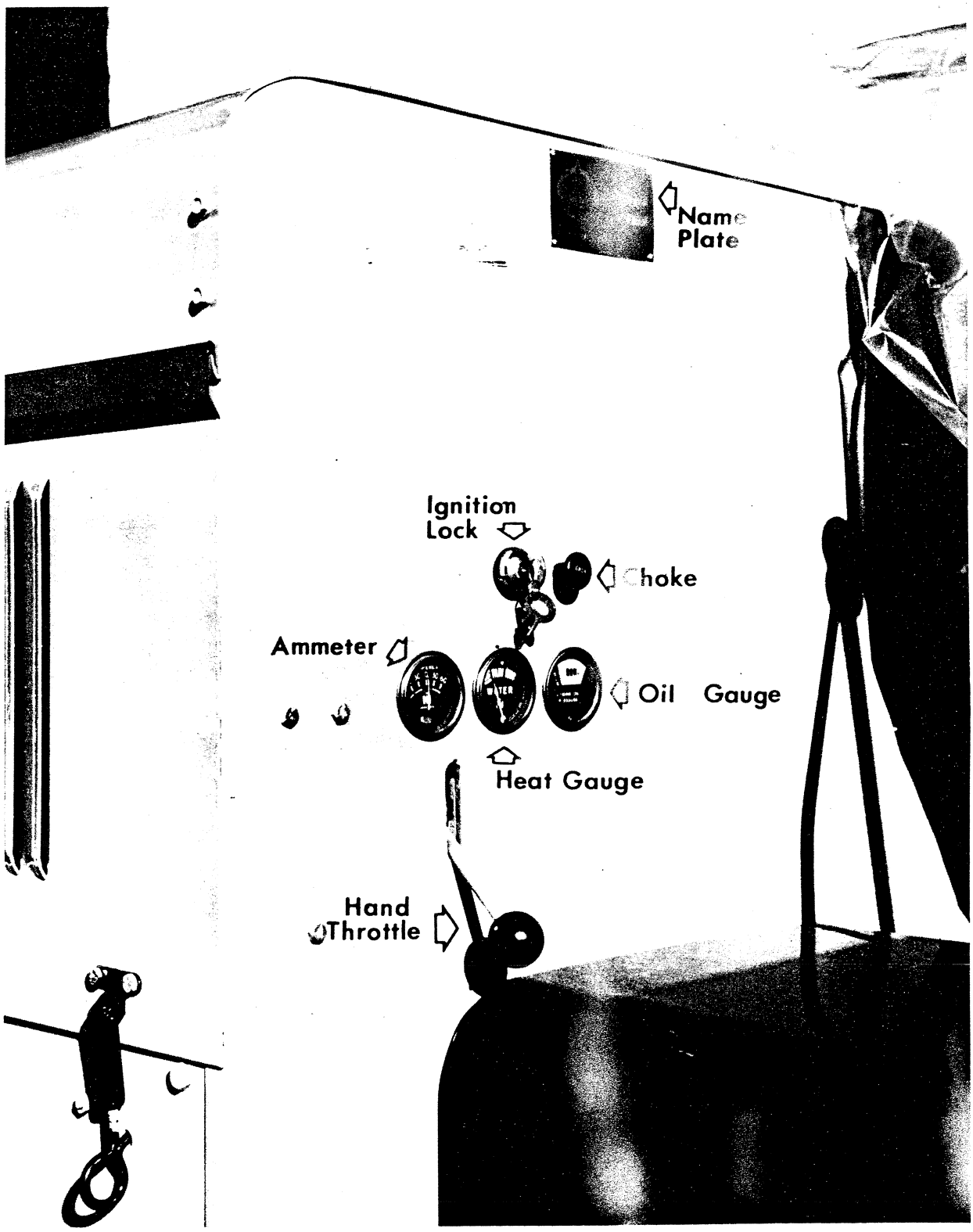


HAMMER LOCK

FIG. -A-



Controls Fig.-B-



INSTRUMENT PANEL Fig. -C-

HAMMER OPERATION

short tool such as a chisel. If a longer tool is to be used, it will be necessary to shorten the cable as described above. Otherwise, automatic trip fingers will not be in proper position in relation to hammer stroke. Cable length must be set long enough to enable hammer to strike a full blow before starting up stroke.

If the cable is too long, there will be a time lag between strokes. At certain times, it may be preferable to reset the DOWN stroke (refer to Figure E). This will accomplish the same purpose as resetting the cable.

AUTOMATIC OPERATION

Controls for the Automatic Hammer Operation are the Auto-Manual control valve, and the Auto-Adjust Control Valve. (Refer to Figures B and E). The Auto-Adjust Control allows the operator to change the length of hammer drop by remote control by hydraulically adjusting the UP-STROKE trip.

1. With the Auto-Manual valve in forward manual position, and the Hammer Control valve in normal center position, set throttle at full governed speed by flipping the hand throttle lever to UP position (refer to Figure C).
2. Check to see if the UP-STROKE trip is in proper position. If not, use the Auto-Adjust control to run the trip to the base where it will be cammed into proper position. Re-adjust UP-STROKE trip to desired position. Be sure that Pilot Valve lever is in down position. If the Pilot Valve lever should stop in center position, hammer valve will be locked. Pilot Valve lever will have to be moved manually to DOWN position.
3. Move Auto-Manual control valve handle backward to Automatic and hammer will operate automatically.
4. The automatic operation of the Hammer Control valve may be changed to manual at any time by moving the Auto-Manual control valve handle forward to manual position. To stop the automatic, move the Auto-Manual control valve handle forward to manual when hammer is on the DOWN stroke.

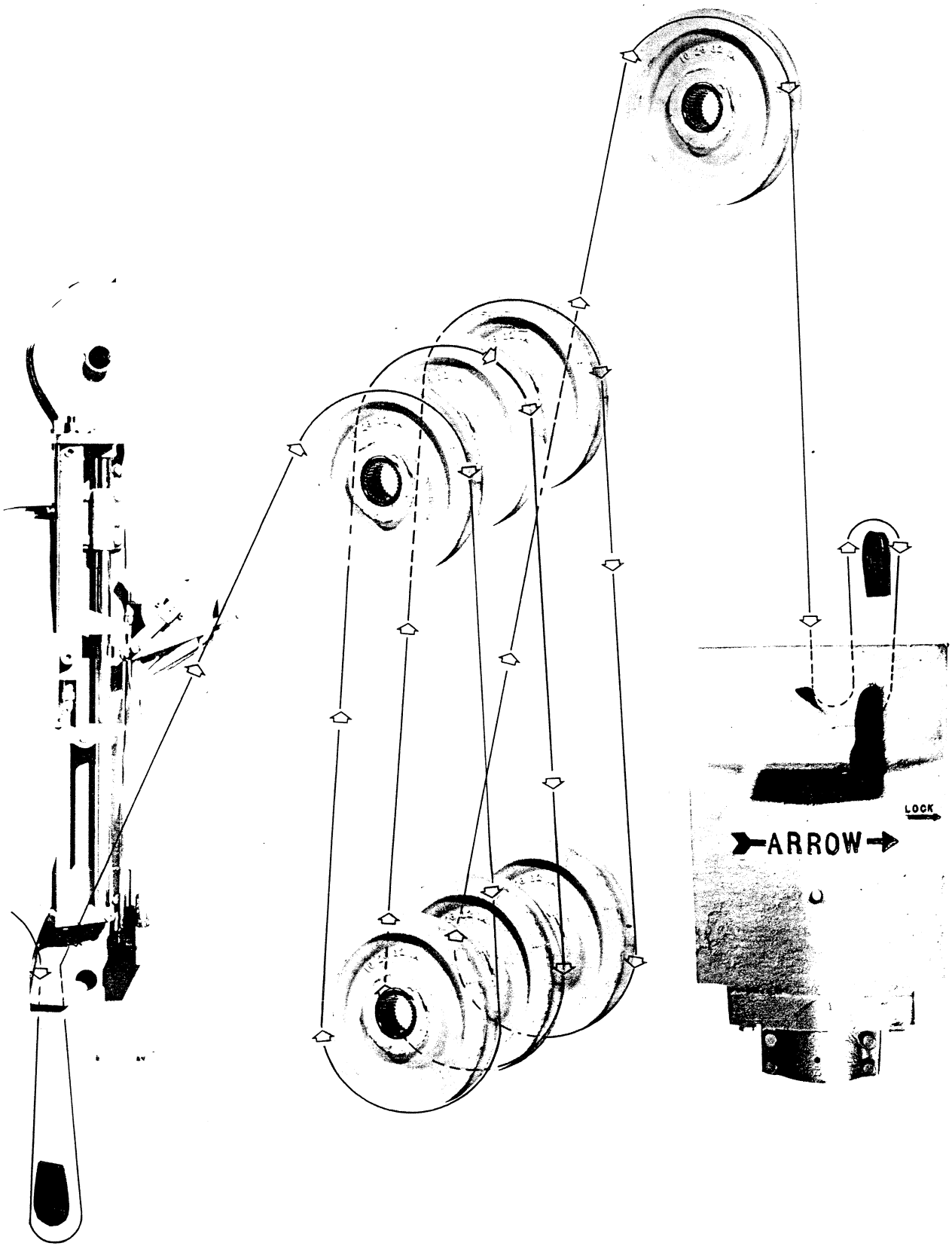
If the Auto-Manual control valve is moved to manual with the hammer on the UP stroke, no damage will be done, but the hammer will overrun the trip and continue to the end of the UP stroke until taken over manually. When this occurs, it will be necessary to reset the trip finger which snaps into the detent in the trip position.

5. When the machine is first started, or the oil is cold, it may be necessary to assist the automatic by actuating the hammer control valve handle until the oil has warmed up, or operate the machine manually until the oil has warmed up sufficiently so that the Pilot Valve is tripped by the UP-STROKE trip without overrunning the trip finger on the UP-STROKE trip. On a very short stroke operation, it is possible for the Pilot Valve Lever to stop in center position. When this happens, the hammer valve will be locked in HOLD position. It will then be necessary to lower the UP-STROKE trip to allow the Pilot Valve Lever to be actuated downward manually.

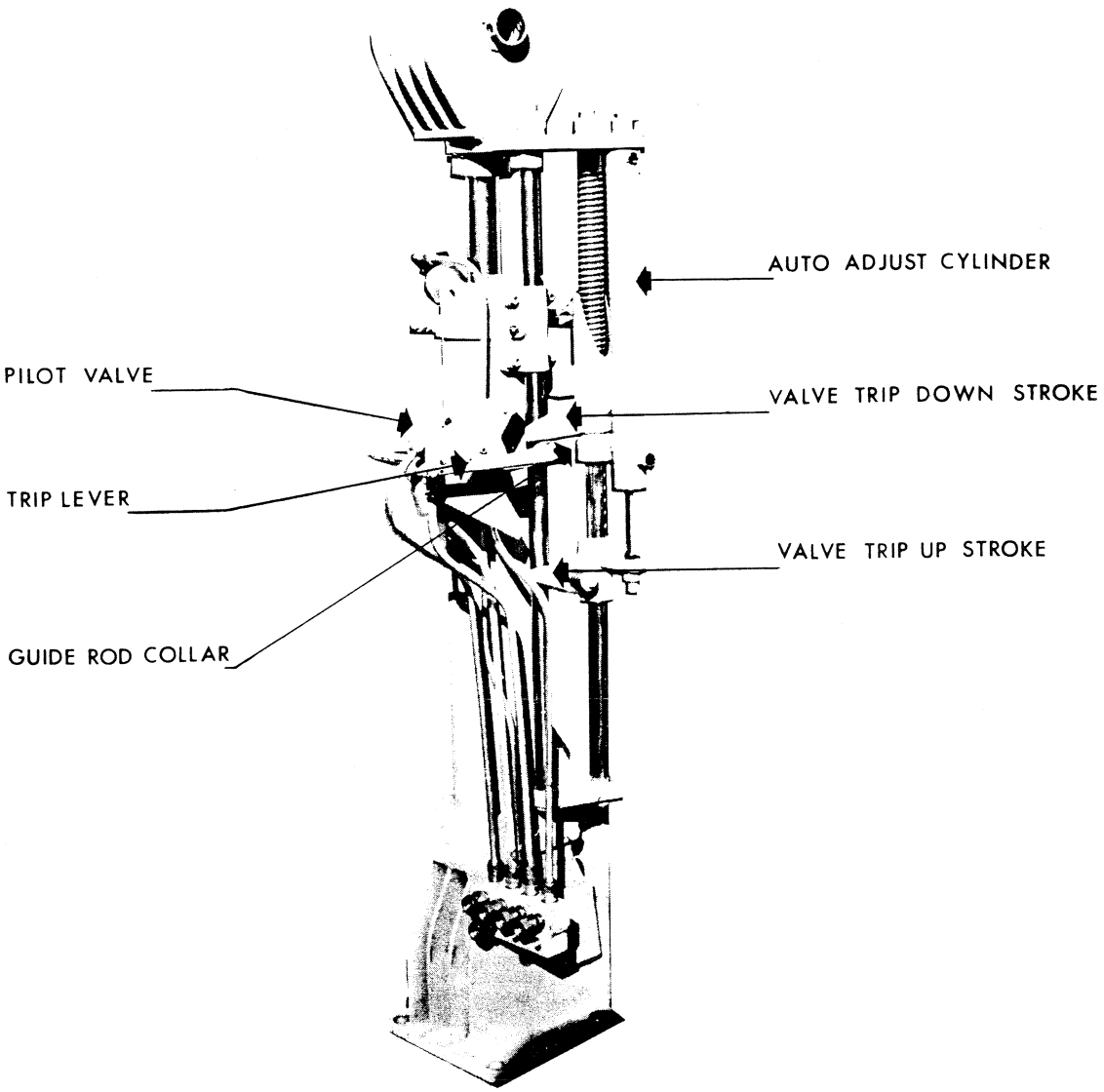
GENERAL OPERATING INSTRUCTIONS

1. SIDE SHIFT . . . The leads may be moved back and forth, laterally, by using the SIDE SHIFT control valve.
2. VERTICAL ANGLE . . . The leads may be angled laterally, to the left or to the right to a maximum of 9° by using the TILT valve control.
3. LAYBACK . . . The leads may be angled forward or backward while working by using the LAYBACK control valve to maintain the leads in vertical position forward and back. This control is also used to lay back leads for traveling. The safety latch must be raised to allow the leads to be layed back and secured in travel position.
4. PARKING BRAKE . . . The Twist Lock is for use as a parking brake. To apply brakes, turn lever to the right or left, then press on brake pedal. Release by turning lever to vertical position. The parking brake must be released before moving machine. The Hydraulic Creeper Drive will not operate with parking brake set as the brake pressure operates the creeper stop valve, making the creeper inoperative.

CAUTION: When parking the machine for an extended period of time, it is recommended that the hydraulic creeper engaging lever be put in UP position and the standard transmission be put in low or reverse gear. This will positively lock the machine from rolling on an incline.



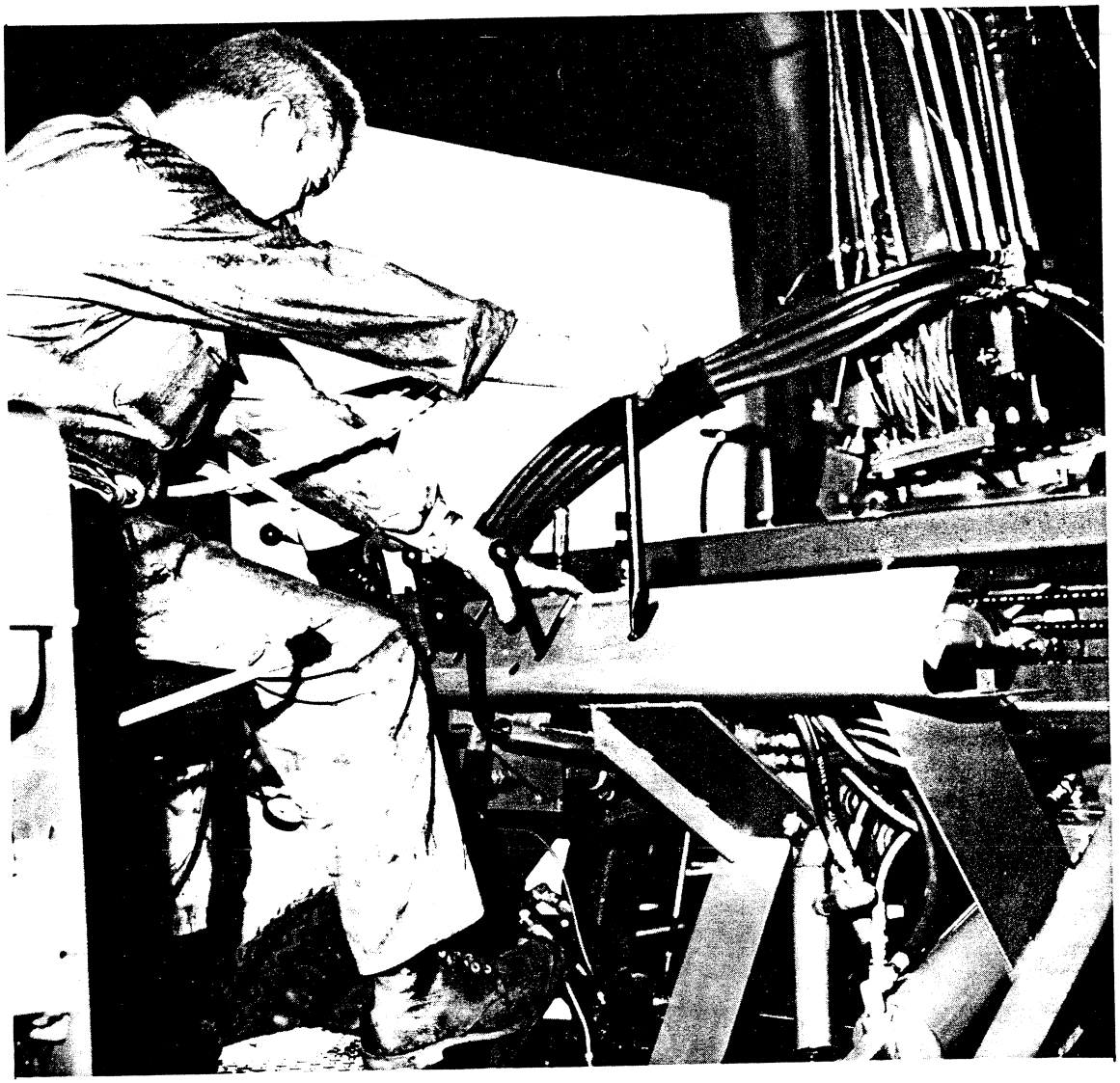
CABLE THREADING FIG. D



AUTOMATIC CYLINDER

Fig.-E-

MAINTENANCE & SERVICE



Setting Pressures in Control Circuit.

CONTENTS

MECHANICAL MAINTENANCE

SERVICE AND MAINTENANCE

MECHANICAL MAINTENANCE

1. Periodically check and tighten all bolts and nuts.
2. Check for chafing of hydraulic hose lines.
3. Carry spare cable. The proper cable to use is 3/8" diameter, 6 x 19 hemp center improved plow, 50 feet long on a G-400.
4. Carry one spare set of hammer tool clamp bolts.
5. Carry spare cable wedge. They are easily lost.
6. Wheel stud nuts should be tightened periodically. After changing tires nuts should be re-tightened after a short period of use.
7. Cross slide bearing adjustment. A minimum clearance of .005 and a maximum of .020 should be maintained at the back of the bearing block, Part #11-51-03-1. Refer to Figure K. Adjustments are made with leads in vertical position.
8. With leads in horizontal position the clearance between thrust washer, Part #12-23-06 and center tube on cross slide carriage should be .005 minimum and .010 maximum. Adjustment is made by loosening the lock bolt in the threaded nut. Part #12-23-05 and turning clockwise to tighten. Use standard feeler gauges for checking clearances.
9. The three belt drive on the small pump should be checked for proper belt tension. The proper tension is determined by putting a force of approximately 6 pounds at the center of the belt span with a deflection of 5/32 of an inch per belt. Refer to diagram — belt tension adjustment.
10. TIRE SPECIFICATIONS . . . Front drive tires . . . 7.50 x 16 Goodyear Extra-Grip Hi-Miler or equal. Inflate to 65 PSI. Rear steering tires . . . 6.00 x 16 Goodyear Extra-Grip Hi-Miler or equal. Inflated to 35 PSI.
11. WHEEL ALIGNMENT . . . steering axle toe in should be maintained at 1/8 inch in direction of forward travel.
12. STEERING AXLE MAXIMUM TURN STOPS should be maintained so that wheels contact stops before steering gear comes to end of travel, otherwise sector shaft may damage case. A drag link stop, which is available as an accessory item, is bolted to the frame and limits the travel of the Drag Link Bell Crank (Part #12-09-01), preventing over travel of the drag links and eliminates damage to the steering gear case.
13. **CAUTION:** Do not set hydraulic pressures by guess. Always use a Pressure Gauge and refer to detailed section, setting of hydraulic pressures. Failure to follow instructions can result in damage to pumps, drives, valves, hydraulic lines and structural members.

SERVICE AND REPAIR

HYDRAULIC SYSTEM

The Arrow Hydraulic Hammer utilizes two separate pumps delivering 30 GPM and 12 GPM at 2000 RPM engine speed. The larger pump actuates the hammer lift cylinder only. The smaller pump performs the following functions: (See Hydraulic Circuit Diagram)

1. Hydraulic creeper drive
2. Side shift on Models
3. Layback of tower or leads.
4. Tilt of tower leads.
5. Automatic control of hammer lift cycle.
6. Remote stroke adjustment.

NOTE: Oil flow through the auto-manual valve. When in manual and in center locked position oil flow from the small pump passes directly through to the oil reservoir. When the automatic selector valve is in backward or automatic position a small amount of the flow is required to actuate the Servo-Cylinder on the hammer lift valve. The balance of the flow passes over a relief valve set at approximately 200 PSI and returns to the oil reservoir.

HYDRAULIC SYSTEM ALTERATIONS

The factory should be consulted prior to making any changes in the hydraulic system. Additions of controls or changing to other makes or models of controls may cause serious damage to the hydraulic system, and, also, may be dangerous to operating personnel. It is possible to add control valves for operating accessory equipment, however, the factory should be consulted on proper installation and type of controls.

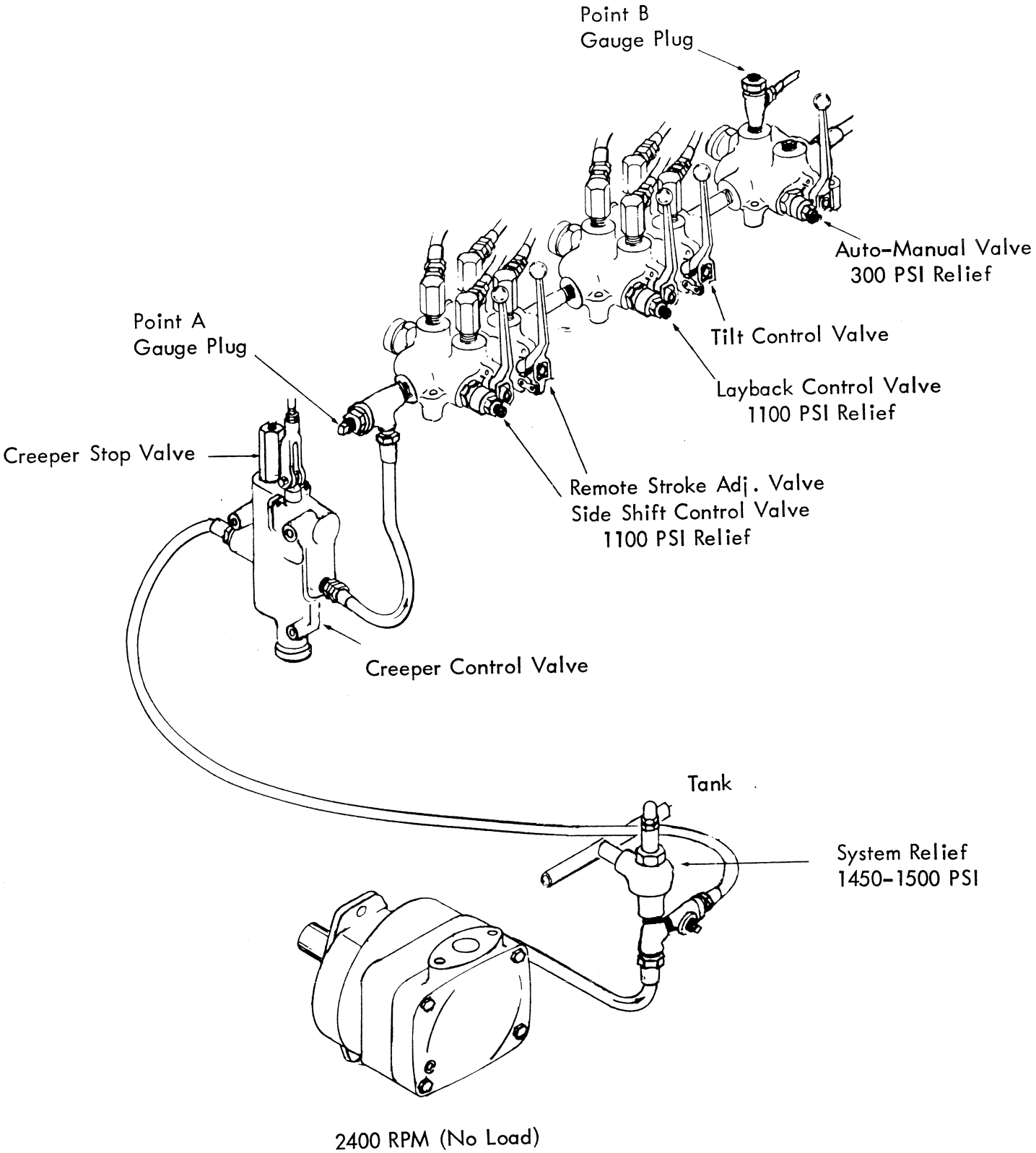


Fig. F

SMALL PUMP..Control Circuit

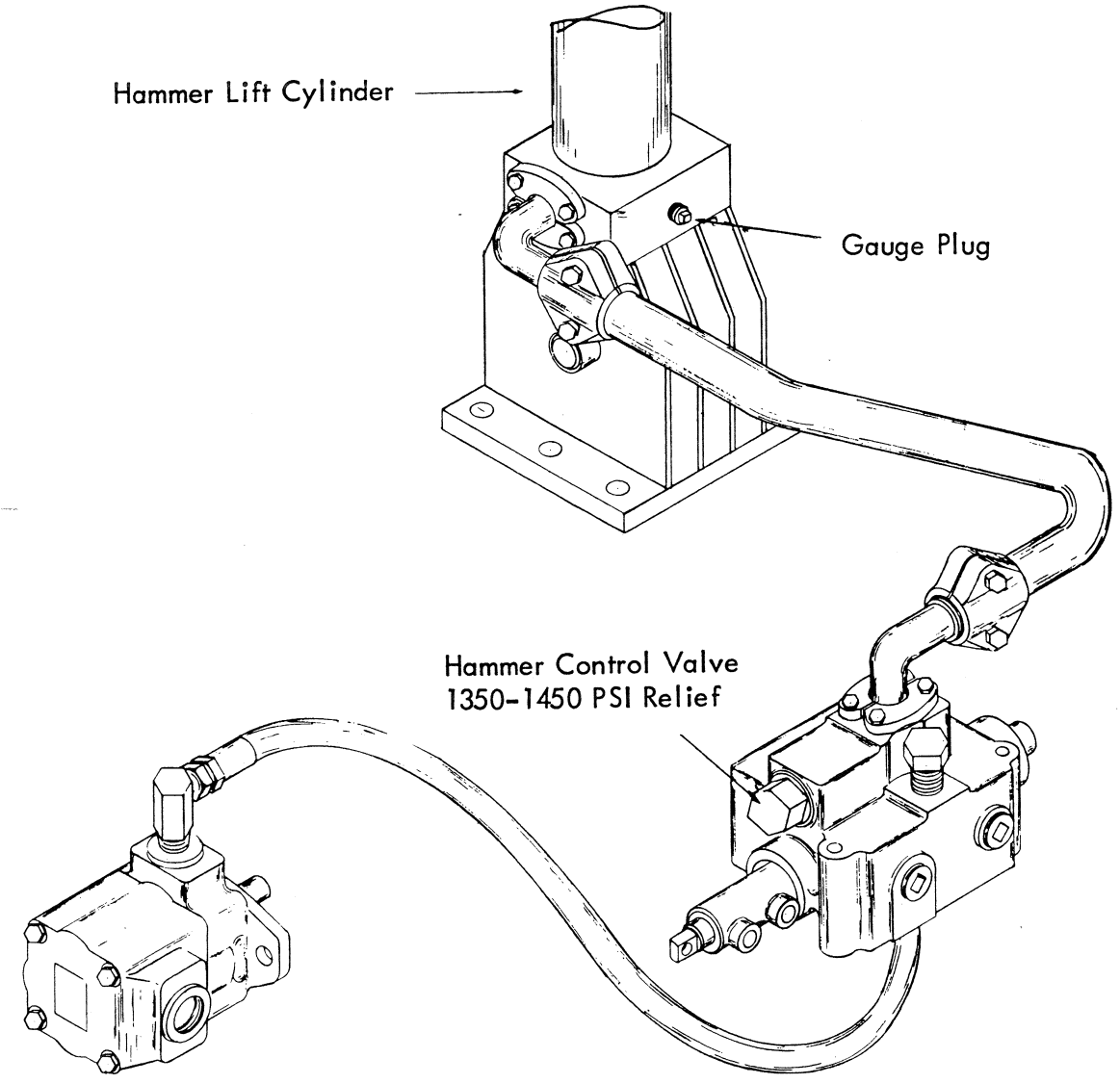


Fig. G

LARGE PUMP.. Hammer Circuit

SERVICE AND MAINTENANCE

PUMP INTAKE SCREENS OR FILTERS

One intake screen is provided for the pump. This screen should be removed only when the tank is drained. The screen can be reached easily through the tank opening and it is removed by unscrewing from its coupling at the bottom of the tank. This intake screen should be cleaned periodically. A plugged, or partially plugged screen will be indicated by a very noisy operating pump. Continued operation with a plugged screen will cause serious damage to the pump.

PROPER SETTING OF HYDRAULIC PRESSURES

CAUTION: The folowing procedure and sequence should be followed accurately when setting pressures. Failure to do this will result in poor and short service life of hydraulic components. Improper settings can result in pressures in excess of 4000 PSI which can result in broken pump shafts and even engine crankshafts. Always use an accurate pressure gauge for setting hydraulic pressures, never guess. Do not use functions of the machines' operation for setting relief valves. Increasing pressures above those recommended will not increase the operating speed of the machine but will cause unnecessary strain on machine components.

EQUIPMENT REQUIRED

1 2000 PSI accurate gauge, graduations 50 PSI or less, 3½" to 4½".

1 300 PSI accurate gauge, graduations 20 PSI or less, 2½" to 3½" diameter.

INSTALLING GAUGE IN HAMMER LIFT CIRCUIT AND SETTING PRESSURE (LARGE PUMP)

System should be full of hydraulic oil to the desired level 4½" below top of filler neck with Hammer Lift Cylinder retracted.

1. Remove ½" square head pipe plug at base of Hammer Lift Cylinder on the side facing the operator. Refer to **Figure G.** — Gauge Plug.
2. Install 2000 PSI Gauge.
3. Start engine and set engine at governed speed of 2000 RPM. Pull back slowly on Hammer Lift Valve. Weight should be locked in position, or it can be raised to the top of the leads. Pressure should read 1300 to 1375 PSI. Be sure oil is warm. (80° F.)
4. To correct pressure either add or remove shims. Part #12-20B-33. These shims are placed between Spring #10-20B-12 and Cap Nut #10-20B-11. The shims will change the pressure approximately 40 PSI per shim. CAUTION: If adding shims does not increase the pressure, there may be one or more of the following things wrong.

(a) Pump may be worn
(b) Improper oil
(c) Oil temperature too high
(d) Valve spool not being actuated to full stroke
(e) Plugged pump intake screen
(f) Defective or worn relief valve or seat, or both
(g) Defective or worn Hammer Lift Valve. Part #12-20C-00
(h) Leaking Hammer Lift Cylinder, Part #13-26-00
(i) Engine not maintaining governed speed, 2000 RPM

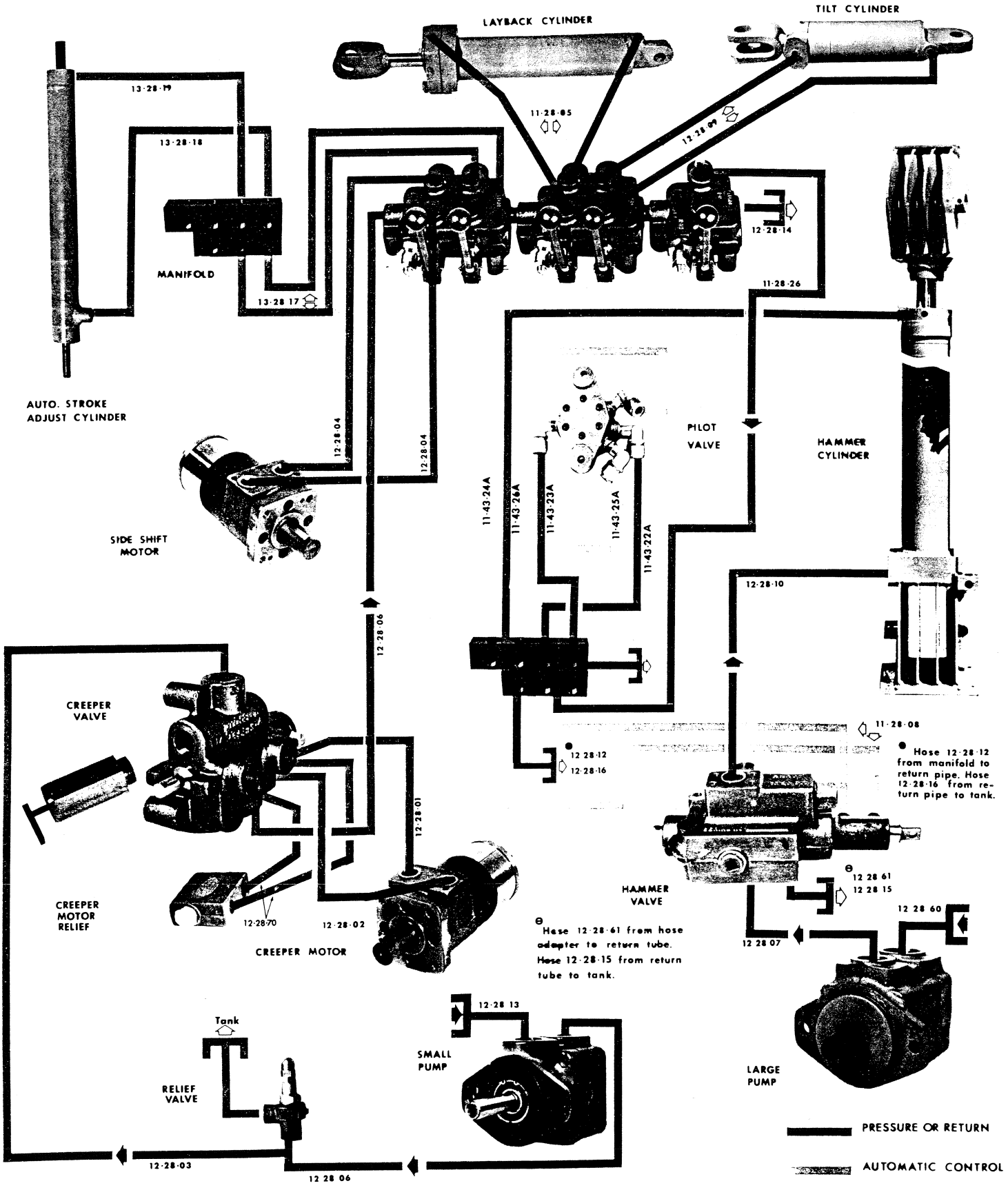
The Engine in proper operating condition will easily turn the Pump at the required pressure setting and RPM. (Service engine to correct difficulty).

INSTALLING GAUGES AND SETTING PRESSURE IN CONTROL CIRCUIT (SMALL PUMP)

Refer to **Figure F**

1. Remove cowling over valves. Remove cowling on left side only if checking pressure for side shift and layback.
2. Install **2000 PSI** gauge at **Point A.** Gauges should be installed with engine off. Gauge outlets are below oil level, however, gauges can be inserted without too much loss of oil.
3. Install **300 PSI** Gauge at **Point B.**
4. Observe cautions as to oil level above, start engine and set at full governed speed, 2000 RPM. Allow to operate until oil has reached approximately 100° F. Oil may be warmed by actuating Hammer Lift Valve with weight against top of leads or in locked position so oil is passing over the relief, this will warm the oil up quite rapidly.
5. To set system relief at 1400 to 1450 PSI use the following procedure:

   (a) Actuate side shift control lever forward


LAYBACK CYLINDER
TILT CYLINDER
13-28-19
13-28-18
11-28-05
12-28-09
12-28-14
MANIFOLD
13-28-17
11-28-26
AUTO. STROKE ADJUST CYLINDER
12-28-04
12-28-04
PILOT VALVE
HAMMER CYLINDER
11-43-24A
11-43-26A
11-43-23A
11-43-25A
11-43-22A
SIDE SHIFT MOTOR
12-28-10
12-28-06
11-28-08
12-28-12
12-28-16
● Hose 12-28-12 from manifold to return pipe. Hose 12-28-16 from return pipe to tank.
CREEPER VALVE
12-28-01
12 28 61
12 28 15
HAMMER VALVE
CREEPER MOTOR RELIEF
12-28-70
12-28-02
CREEPER MOTOR
⊖ Hose 12-28-61 from hose adapter to return tube. Hose 12-28-15 from return tube to tank.
12 28 60
12 28 07
Tank
12-28 13
SMALL PUMP
RELIEF VALVE
LARGE PUMP
12-28-03
12 28 06
PRESSURE OR RETURN
AUTOMATIC CONTROL
PRESSURE
BRAKE
RETURN TO TANK OR INTAKE TO PUMPS

Oil Reservoir

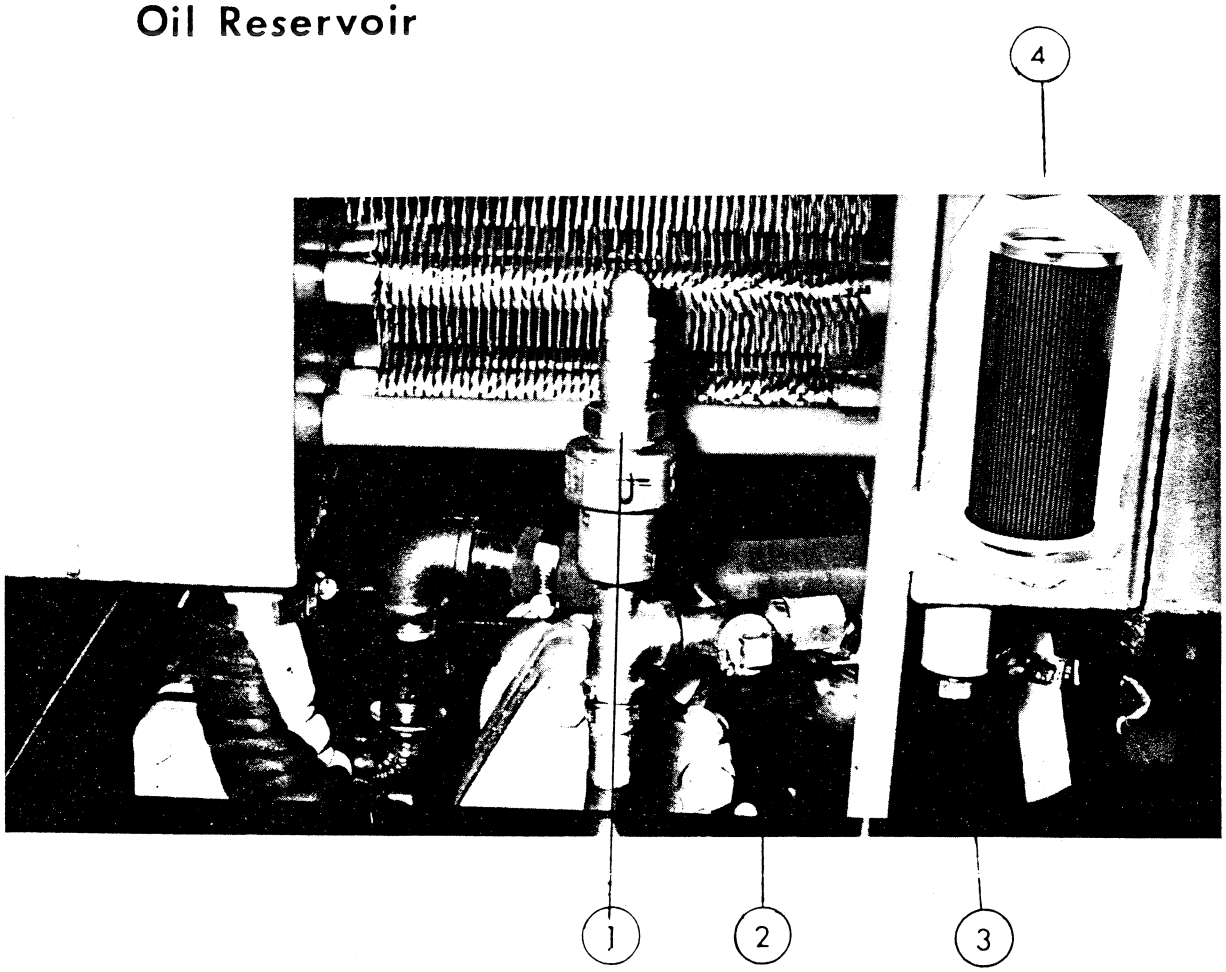
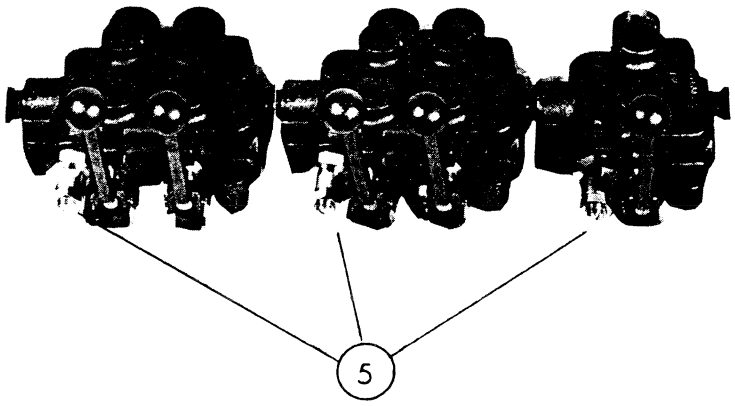


FIGURE ·1·

Control Valves



1. System Relief
2. Drain Plug
3. Magnetic Sump Plug
4. Sump Filter
5. Relief Adjustment

until side shift reaches end of travel.

(b) Actuate tilt control valve lever forward until leads are tilted to extreme travel of cylinder.

(c) Actuate both valves forward, side shift control and tilt control valve at the same time.

(d) With both control valve levers forward, gauge attached at outlet A should read 1400 to 1450 PSI.

6. If accurate gauge does not read 1400 to 1450 PSI use the following procedure:

(a) Check for correct oil level and make certain that pump inlet screen is cleaned. Check for proper belt tension as outlined in Preventative Maintenance.

(b) To set system relief remove acorn nut and loosen lock nut with 15/16" end wrench. Turn slotted screw clockwise to increase pressure. Approximately ¼ turn will increase the pressure approximately 50 PSI. Correct pressure is 1400 to 1450 PSI.

(c) **CAUTION:** Failure to push forward on side shift and tilt handles at the same time, when setting system relief can result in the hydraulic fluid passing through relief valves at either the side shift or Layback Control and the setting on the system relief will be incorrect (most likely a very high setting). There will be no protection for the pump, pump drive and Creeper control circuit.

(d) If pressure does not increase on screwing relief valve down, check for the following:

(1) Improper hydraulic fluid

(2) Broken relief valve spring or damaged seat or ball

(3) Worn pump

(4) Oil too hot, above 150° F.

(5) Belts slipping, pulley key missing and belt sheave slipping on shaft.

7. If valve spool travel is uneven in either direction, or spools do not return normally to center position on valves #12-19-01, #12-19-02, #12-19-03 and #12-19-04, check to see that screw #510 at the rear end of the spool is tight. These parts are illustrated in the Parts Book. This screw is reached by removing the stop disc and snap ring. #912.

8. The relief valves on the Side Shift Control Valve and the Tilt and Layback Control Valve can be set after the system relief valve is set.

(a) Side Shift and Remote Stroke Adjustable Valve. Push Side Shift Control Valve Handle forward and move Side Shift to end of travel. At this point the Side Shift Relief Valve will operate and gauge should read 900 PSI. If pressure is incorrect, loosen jam nut on Side Shift Relief Valve with 15/16" end wrench through slot in bottom of cowl. Reset Relief Valve using screw driver through hole in front of cowl to correct pressure. If this fails to correct pressure, check for broken Relief Valve spring, damaged ball, seat or valve not at full stroke position.

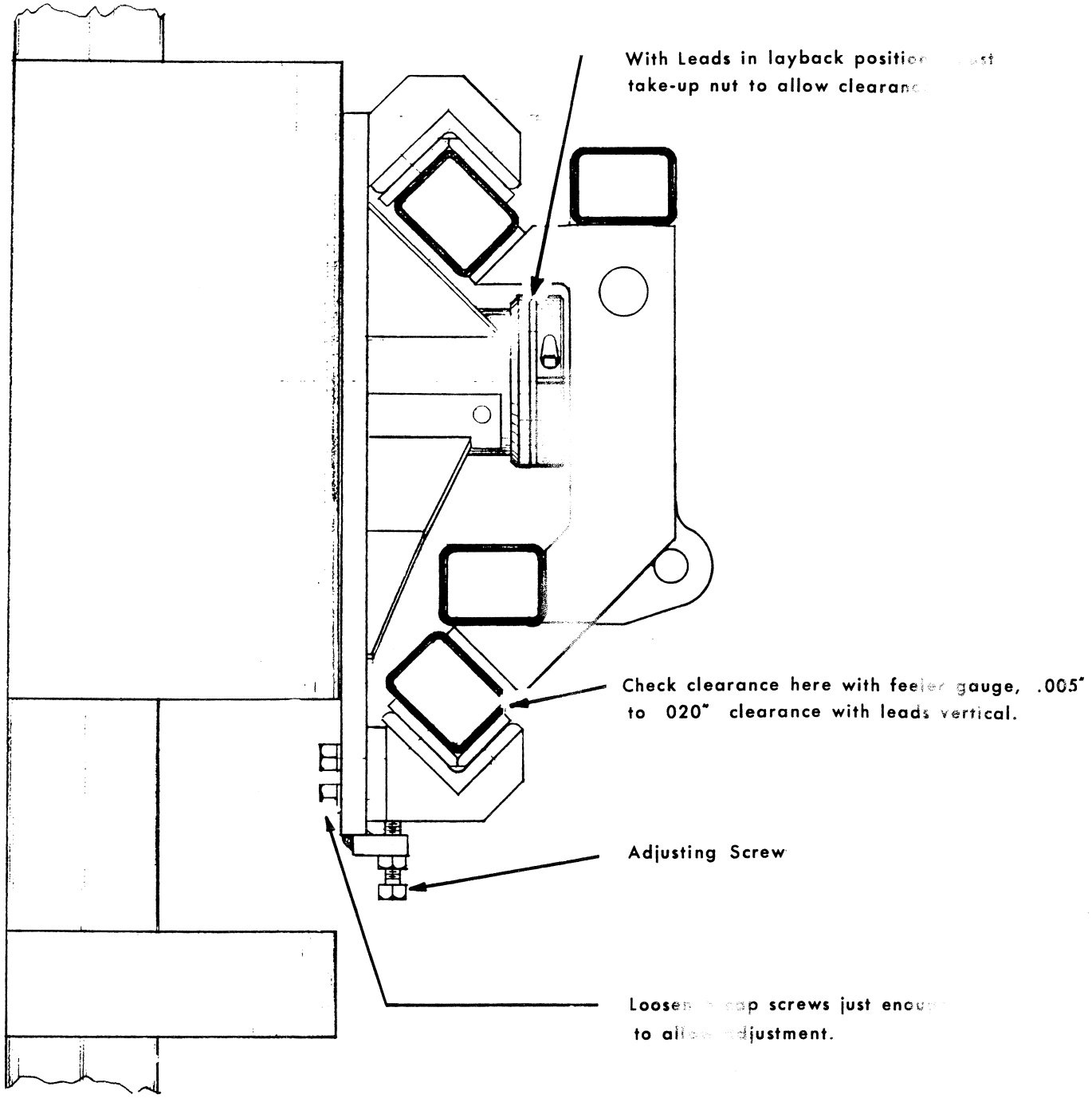
(b) Tilt and Layback Valve.
Push Tilt Valve forward until tilt cylinder bottoms. At this point the Relief Valve on this valve will operate and the gauge should read 1100 PSI. If pressure is incorrect, loosen jam nut on Tilt and Layback Valve Relief Valve with 15/16" end wrench through slot in bottom of cowl. Reset Relief Valve using a screw driver through hole in front of cowl to correct pressure. If this fails to correct pressure, check for broken relief valve spring, damaged ball, seat or valve not at full stroke position.

9.

(a) To set the Auto-Manual Control Valve relief, the Hammer Valve Control lever must be held forward when checking or setting the pressure. Hold the lever securely forward as it will require some effort to overcome the Servo Cylinder pressure that will be applied when the Auto-Manual Control Valve lever is put in automatic position.

(b) Push Auto-Manual Valve lever to forward position.

(c) Set the Relief Valve on the Auto-Manual



Carriage, Center Pin Adjustments, Fig. K

by using the same procedure as on other relief valves. The correct pressure is 300 PSI.

10. The operating functions of the Arrow Hammer will not be correct unless the engine speed is maintained at the proper RPM. Under normal conditions the engine speed should be 2000 RPM with the hand throttle in **UP** position. This is the full open governed speed. The Hoof velocity governor on the engine should be set at 2100 RPM. Refer to the engine section for complete information on proper setting of the governor. Altitude effects the setting of the governor. When starting out a new hammer, the engine speed should be checked with an electric tachometer and the governor should be set to the proper RPM. For each 1000 feet of altitude increase, the engine speed will increase approximately 50 RPM. Therefore, if a hammer is moved to a higher elevation which would change the engine speed over 150 RPM the governor should be reset. The engines supplied in Arrow Hammers can be operated at a higher speed than those specified, however, the speed of the engine is limited by the maximum operating speed of the hydraulic pumps. Increasing the speed of the engines and pumps above the recommended setting will not increase the operating speed of the hammer, but will prematurely wear out the hydraulic pumps. The intake capacity of the pumps is limited and an increase in speed will cause cavitation and short life for the pumps.

SERVICE

ENGINE WILL NOT START

1. The engine may not start if both the hydraulic creeper drive and the standard transmission are in gear. **Remedy:** Put either transmission in neutral and start engine.
2. Refer to Engine Service section for engine starting problems and general service requirements.

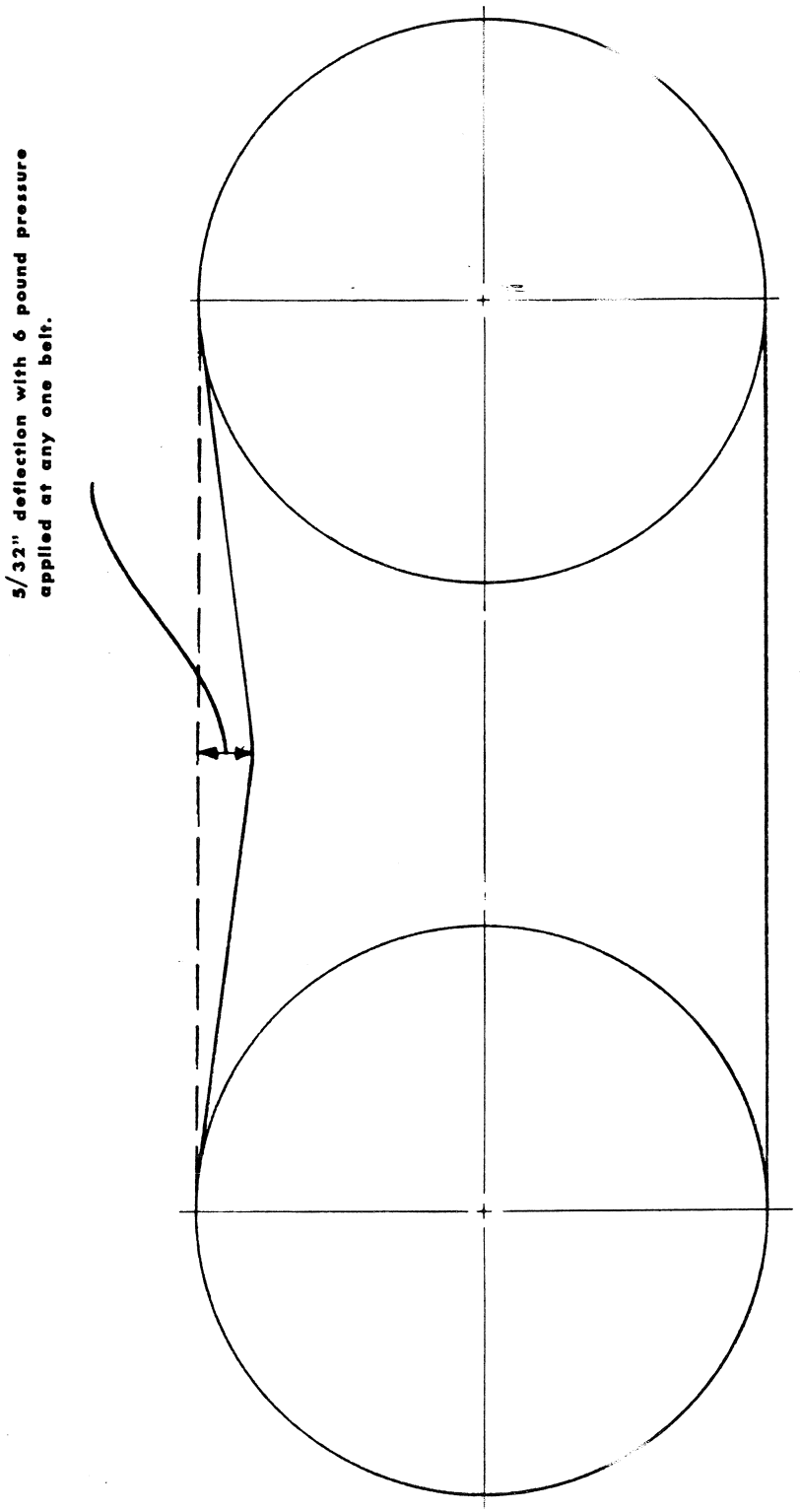
NOISY HYDRAULIC SYSTEM

1. Low oil level. **Remedy:** Add oil to correct level, 4½ inches from top of filler neck.
2. Cold Oil. **Remedy:** Allow machine to idle until oil has warmed up sufficiently.
3. Improper Oil. **Remedy:** Refer to oil recommendations.
4. Plugged inlet to screens. **Remedy:** Remove inlet screen and clean. Examine oil for contamination.
5. Valve left in operating position and oil is passing over relief valve. **Remedy:** Center control valve to neutral position.
6. Air entering hydraulic system: **Remedy:** Air can enter intake hoses at clamps or defective hose between oil reservoir and pumps. Air entering the intake side of the pumps will make them very noisy. Air in the system can be detected by the milky appearance of the oil. Sometimes the oil will foam. Air can enter a pump intake without a visible oil leak.
7. Defective or worn hydraulic pumps. **Remedy:** replace pumps.
8. Contaminated oil. **Remedy:** Replace with new oil. **Never use gasoline for cleaning or flushing the hydraulic system.**

HYDRAULIC CREEPER WILL NOT WORK

1. Creeper engaging lever not in correct position. **Remedy:** Engage creeper lever. Operate creeper control to facilitate engaging gears. Check for missing pins, keys and springs.
2. Creeper valve not operating properly. **Remedy:** Check creeper valve cam and linkage. Release parking brake. Replace worn or broken belts on small pump.
3. Low or no hydraulic pressure. **Remedy:** Refer to section on hydraulic maintenance. Replace defective hoses.
4. Creeper stop valve sticking. **Remedy:** Remove and disassemble. Check for broken or sticking parts.
5. Defective parking brake. **Remedy:** Refer to **Fig. R.** Parking brake service directions.
6. Defective creeper motor. **Remedy**: Replace with new motor.
7. Defective internal mechanism: Remedy: Remove creeper housing cover and examine. Refer to **Figure L.**

NOTE: If creeper, side shift, auto. adjust, leads tilt, layback. etc. fail to operate properly, check for proper oil level, inspect pump belts for breaks, wear or looseness. Check hydraulic pumps and control valves. Inspect hoses for breaks and kinks. Follow recommended procedures for setting pressures.



Belt Adjustment, Fig. J

SIDE SHIFT WILL NOT WORK

1. Defective or worn side shift motor. **Remedy:** Replace defective motor. To check for a worn or scored creeper motor, the following procedure should be followed.

   (a) Make certain control valve pressure is correct and oil temperature is normal.

   (b) Set engine at full governed RPM and push forward on side shift control lever and allow side shift to reach extreme right end of travel (if side shift will move.)

   (c) Remove bottom hose from side shift motor. This is a non-pressure hose when the control lever is pushed forward. Screw pipe cap on end of hose removed, and install length of clean, low-pressure drain hose in bottom port of motor. Place other end of hose in a clean 5 gallon container.

   (d) With engine at full governed speed, hold side shift control lever forward. If the container will fill in less than one minute, the motor is defective and should be replaced.

2. Seized motor. **Remedy:** It is possible for a motor to be seized and it will not show up as defective in step 1 above. If the side shift motor does not appear to rotate against the chain, remove the chain and attempt to rotate the motor by actuating the control lever. If it will not rotate, it is apparently seized in its bearings and must be replaced.

3. Carriage way bearings too tight. **Remedy:** Adjust way bearings according to instructions, **Figure K.**

4. Cross tubes bent or misaligned. **Remedy:** Repair or replace.

5. Dry or defective bearings in sprocket idlers. **Remedy:** Replace defective bearings or lubricate.

6. Improper Way lubrication. **Remedy:** Clean ways with suitable solvent and lubricate with SAE 20 or 30 motor oil. Do not use grease or transmission oil. Lubricate daily.

NOTE: It is advisable to exchange hydraulic motors instead of attempting to make field repairs. Servicing requires highly specialized equipment and only the factory can offer these services.

LEADS CANNOT BE RAISED TO WORKING POSITION

1. Hammer not in proper position for raising leads. **Remedy:** Weight should be carried in locked position. At this point the hydraulic system can easily raise the leads. If the leads are accidently laid down with the hammer weight in the top end of the leads, the weight can be slid forward by allowing a small amount of slack in the cable and stopping the machine in its forward motion abruptly. **Caution:** Do not leave an excessive amount of slack in the cable. It is dangerous.

2. Rapid and erratic layback action of leads. **Remedy:** If the oil has been drained for any reason, and none is present in both sides of the cylinder, the operator should be careful to actuate the layback cylinder a small amount in each direction until air has been expelled. Orifice fitting, part #11-25-15 must be installed at **piston rod end of cylinder: Do not install orifice fitting at anchor end of cylinder.** The layback safety latch must be raised manually in order to lay the leads down. This safety latch is for the operator's protection, and should never be made inoperative.

LEADS WILL NOT TILT

1. Lead Center Pin stuck. **Remedy:** This is either a lubrication or mechanical failure, and it will be necessary to disassemble the leads from the cross slide carriage and repair. Dress off pin, if necessary. Replace center pin bushings, if worn. Lubricate. Also, refer to **Figure K.**

LAYBACK OR TILT CYLINDER WILL NOT HOLD POSITION.

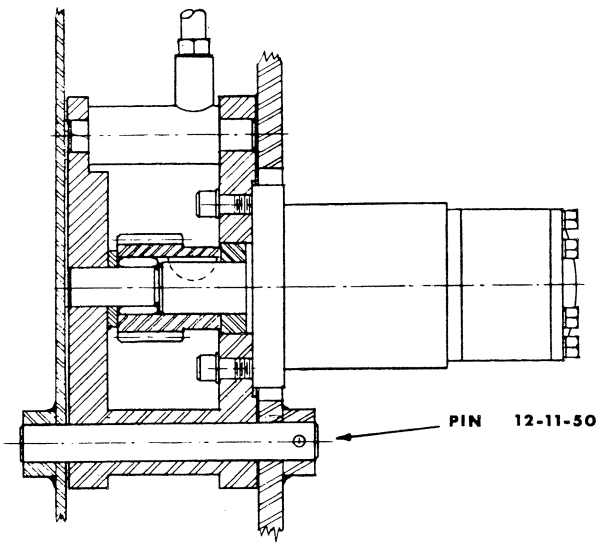
1. Control Valve not centering to hold position. **Remedy:** Check to see is Screw #510 (see parts book) is loose. Screw should be tight.

2. Leaky cylinder. **Remedy:** Repair or replace. To check for leaky cylinders, use the following procedure:

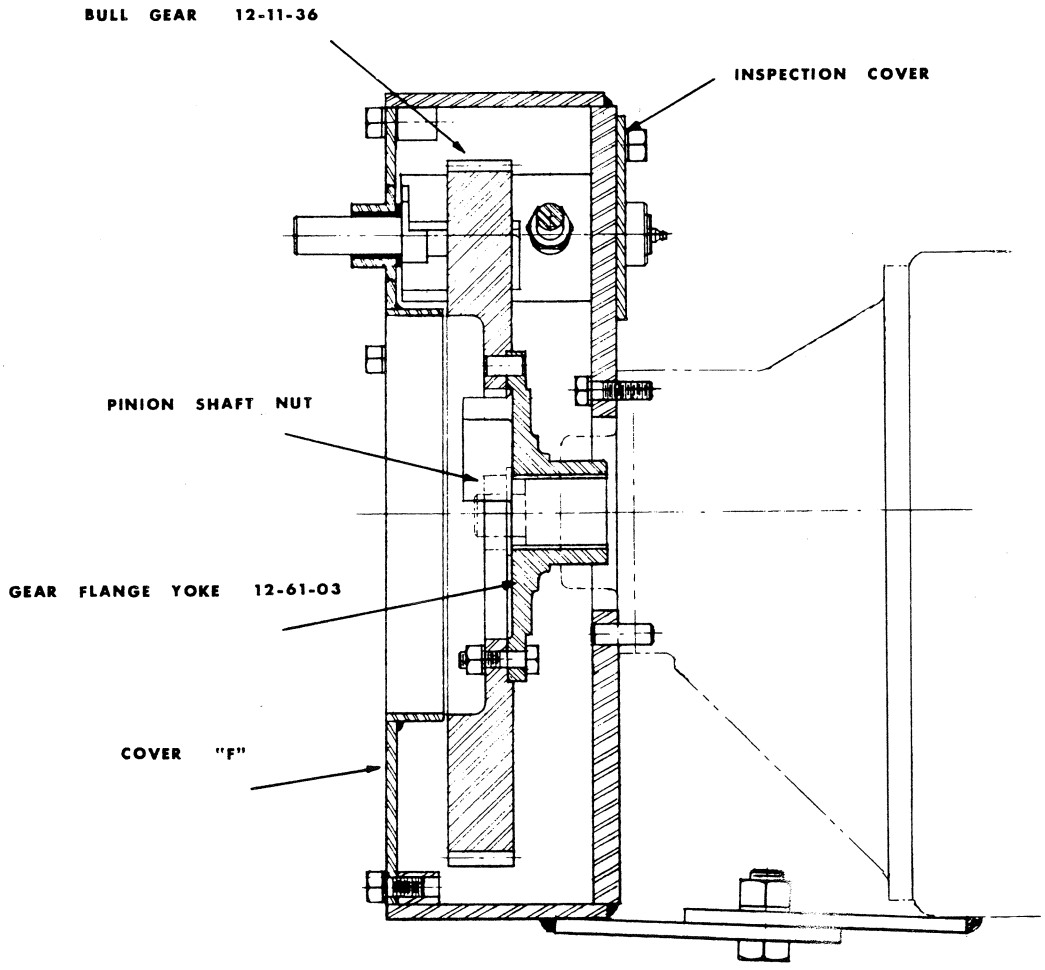
TILT CYLINDER

   (a) Tilt the top of the leads to the right and disconnect the lower hose from the tilt cylinder.

   (b) Cap the hose and apply pressure very slowly to tilt the leads to the right by metering the valve as slowly as possible. If oil does not discharge from cylinder

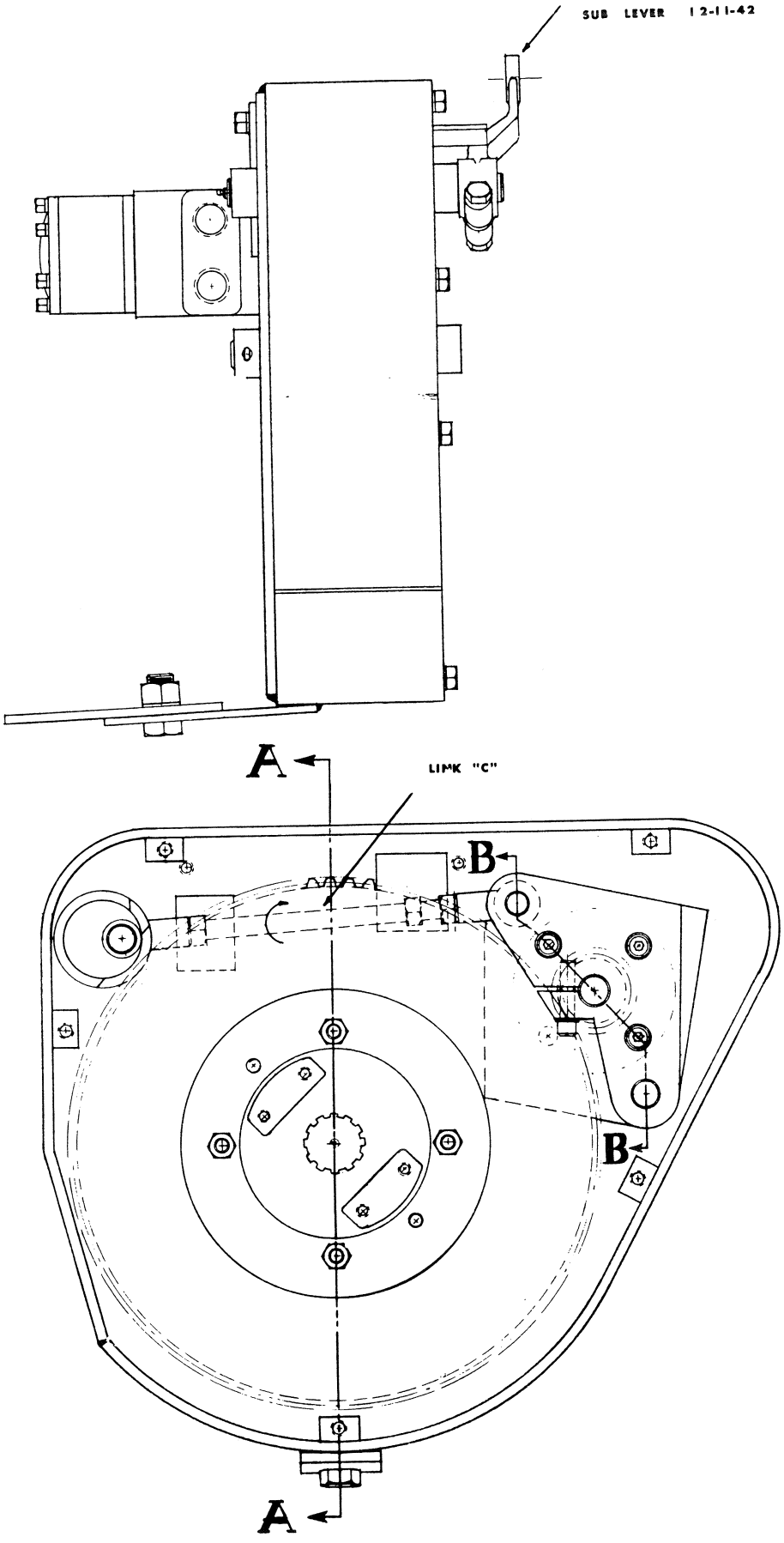


SECTION AT **B B**

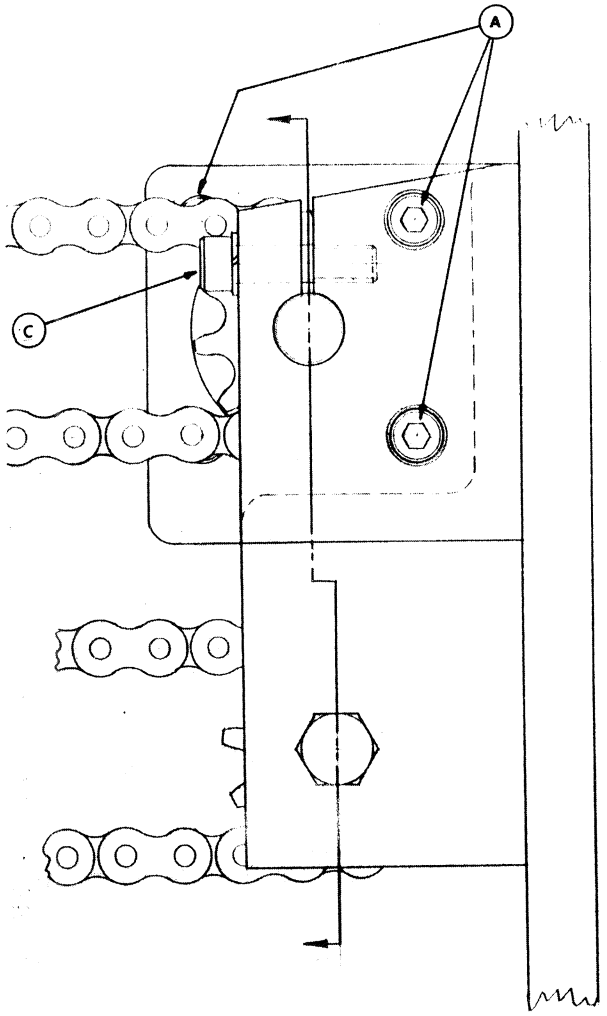


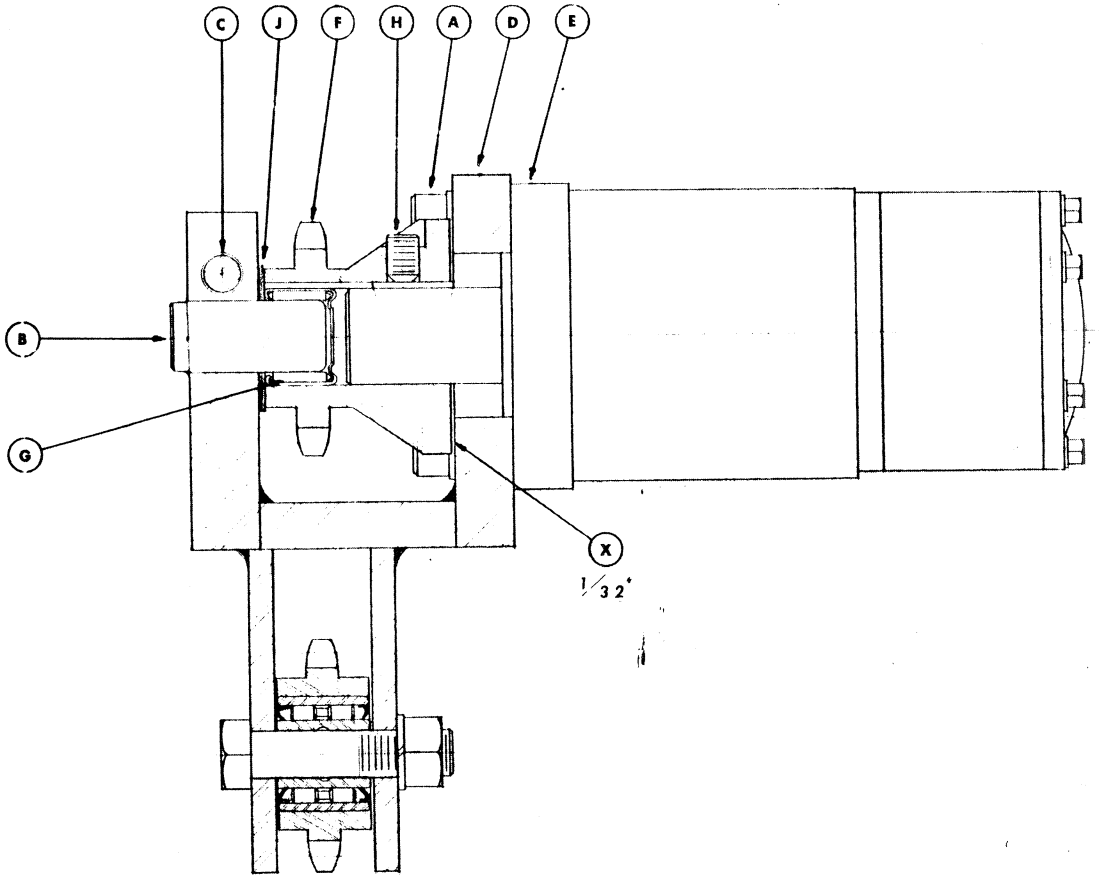
SECTION AT **A-A**

Creeper Gear Adjustments, No.1, Fig. L



Creeper Gear Adjustments, No. 2, Fig. L





Side Shift Motor and Sprocket, Fig. M

rod end port, the cylinder is O.K. Both hoses must be connected when repositioning leads.

(c) Tilt leads to left, reversing procedure, to test cylinder in opposite direction. The reason for testing in the opposite direction is that the piston rod nut could be loose and it would be possible to seal in one direction while leaking in the opposite direction. Also, a cylinder barrel can be defective at one end of the stroke and perfect at the other. By testing in this manner, both ends of the cylinder barrel are tested.

LAYBACK CYLINDER

(a) Push forward on layback control lever until leads are forward as far as possible.

(b) Disconnect hose from anchor end of cylinder and cap.

(c) Apply pressure slowly by moving layback control lever slowly forward. If cylinder is defective and leaking, oil will discharge out anchor end cylinder port. Both hoses must be connected when repositioning leads.

(d) To test the other end of the cylinder, connect hose to anchor end of cylinder. Lay leads down on lead support by pulling backward on layback control handle.

(e) Remove hose at cylinder rod end and cap.

(f) Apply pressure slowly by pulling backward on layback control lever. If oil discharges from cylinder rod end port, the cylinder is defective. **Remedy:** Remove defective cylinders to repair. Inspect bore finishes, replace rings and seals. If cylinder barrels are rough, replace with a new part.

MALFUNCTION OF HAMMER AUTOMATIC CYCLE

SAFETY LEVER (VALVE TRIP UP STROKE) MOVES OUT OF POSITION AND WILL NOT ACTUATE THE PILOT VALVE.

1. Cold oil. **Remedy:** Manually assist hammer lift control lever by pushing forward on the lever for several strokes as automatic operates, or until oil warms sufficiently to operate without tripping the safety lever.

2. Oil too heavy for operating temperature. **Remedy:** Refer to **Fig. N.**

3. Auto-Manual control valve pressure set too low. **Remedy:** Refer to section on setting pressures and **Figure F.**

4. Valve Trip Stops too close together. **Remedy:** Reset stops to wider position.

5. Pilot valve jammed. **Remedy:** Check for foreign material in valve. Free up valve. If valve is scored, replace with a new valve.

6. Check also for missing woodruff key, weak or missing trip lever spring, worn guide rod bushing, pinched hoses or dented tubes and hoses.

7. Hammer Control Valve sticking or linkage jammed. **Remedy:** Examine control linkage, loosen mounting bolts slightly. Mounting bolts too tight can cause bind in valve spool. Operate valve manually with auto-manual control valve in manual position. If valve does not free up, check to see that pilot valve is in tripped position down, that is, not on center position. If valve still binds, disconnect servo-cylinder lines and attempt to actuate control valve manually. If binding still persists, most likely foreign material is in the valve, causing the valve spool to bind in the body. Either mechanically repair hammer valve or replace with a new one. If hammer valve operates freely with servo lines disconnected, check for kinked or obstructed hydraulic lines. Also, recheck for items above, such as Woodruff key missing in lever, etc.

8. Hydraulic lines hooked up incorrectly. **Remedy:** Refer to Hydraulic Circuit Diagram, **Figure H.**

9. Pilot valve loose on mounting place. Trip misses pilot valve lever. **Remedy:** Retighten and align pilot valve. Also, check for bent guide rods. Repair or replace.

ON DOWNSTROKE, CIRCUIT DOES NOT REVERSE AND RAISE HAMMER

1. Review items 1 through 9 above.

2. Incorrect cable adjustment. **Remedy:** Refer to cable lengths setting instructions, also refer to ♯4 above.

HAMMER REVERSES BEFORE DOWNSTROKE IS COMPLETTED

1. Incorrect cable adjustment. Refer to cable lengths setting instructions.

RECOMMENDED TYPICAL OILS FOR THE ARROW MOBILE HYDRAULIC HAMMER

Engine Crankcase	Texaco URSA Extra Duty 30 wt.
Transmission	Texaco Multigear EP 90 wt.
Differential	Texaco Multigear EP 90 wt.
Manual Steering Gear	Texaco Multigear EP 90 wt.
Power Steering	Texaco Texamatic Fluid
Hydraulic System	Texaco URSA Extra Duty 20 wt.

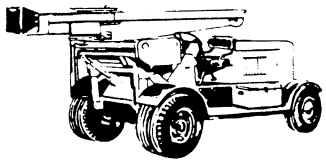


Fig. N

2. Stop loose. Refer to **Figure E.**

HAMMER WEIGHT DRIFTS DOWN

1. Hammer control valve not centering in hold position.

REMEDIES:

(a) Pilot valve lever on or near center position which traps oil in the servo-cylinder on hammer control valve, and does not allow spring to center the hammer control valve. Pushing lever to **DOWN** position will allow servo-cylinder to return to centered position on hammer control valve. Refer to **Figure E.**

(b) Check for damaged or defective valve control handle linkage. Repair or replace.

(c) Hammer control valve spool binding. This is caused either by foreign material in the valve, causing the spool to bind, or mounting bolts too tight.

(d) Cushion relief valve leaking. Leakage can be caused by either a defective valve or seat, or broken or weak springs (#10-20B-12 and 10-20B-13). Replace weak or broken springs .

(e) Too low a pressure relief valve setting. Pressure should be set at 1300 to 1375 PSI. Refer to section on setting pressures.

(f) Broken or weak spool return spring #10-20B-15.

(g) Leaking seals in hammer lift cylinder. To test for leaking cylinder, raise cylinder to maximum stroke with hammer weight to top of leads. Allow hammer lift control valve to remain in center position until hammer weight strikes ground. Disconnect line from top of hammer lift cylinder (rod end). Slowly raise hammer. If oil spews from disconnected cylinder port the cylinder is defective and seals will need to be replaced. If cylinder barrel surface is rough or grooved, it should be replaced with a new cylinder and base, #13-26-01. **NOTE:** Whenever cylinder nut #10-26-15A is replaced, it is possible that when the nut is tight, the outlet connection may not end up in the right position. It will then be necessary to install the proper thickness shim to allow the nut to end up in the right position when the nut is tight. This condition is also true when the cylinder and base assembly is replaced with a different cylinder nut.

(h) Worn hammer control valve spool. The valve must be replaced or sent to the factory for rebuilding.

WHEN RAISING WEIGHT, THE WEIGHT SETTLES BEFORE IT STARTS UPWARD

1. Worn or defective check valve #10-20B-08 or defective relief valve seat #10-20-41. **Remedy:** Replace defective parts, or entire control valve.

PREMATURE CABLE BREAKAGE

1. Not using proper cable, cable too dry or improperly threaded. **Remedies:** Refer to section on proper cable; use standard cable lubricant sparingly. Refer to **Figure D,** for cable threading.

2. Cable or trip stops improperly adjusted. **Remedy:** Refer to Automatic and Cable adjustments. A cable set too short or stops set so that hydraulic system reverses too quickly on **DOWN** stroke will cause the cable and hydraulic system to absorb the hammer impact, thereby shortening cable life and diminishing the working force of the machine. Setting cable too long, or the stops so that cylinder does not reverse soon enough, leaving extra slack in the cable, will cause the cable to whip between the hammer weight and the lead sheave, thereby shortening the life of the cable.

3. Defective sheave bearings. **Remedy:** Replace bearings. Refer to **Figure P** for lubrication specifications.

4. Cushion relief pressure set too high. **Remedy:** Refer to **Figure G,** and section on setting pressures.

5. Auto-manual control valve pressure set too high. **Remedy:** Refer to Figure F and section on setting pressures. Excessively high pressure on the Auto-manual valve causes the servo on the hammer control valve to actuate very rapidly. This, in turn, increases the shock load on the cable.

6. Stopping the hammer weight on the downward stroke with the hydraulic control. **Remedy:** Avoid stopping the weight wherever possible as it stresses the cable. Allow the tool to strike the ground. Avoid allowing the hammer weight to fall through to the end of the cylinder travel.

7. Worn cable sheaves. **Remedy:** Replace with new sheaves #12-23-17-1A (6 required) and sheave #13-23-17-1A (1 required at top of leads.)

DAMAGE TO STEERING GEAR

Steering gear, drag links and tie rods damaged. **Remedy:** Adjust steering axle wheel stops so that wheels strike stop screws before steering gear bottoms.

REPLACEMENT OF HYDRAULIC HOSE ASSEMBLIES

The parts book thoroughly describes the type and location of every hose used in the machine. Refer to pages 41 through 44. Some of the hoses are return hoses and are capable of withstanding only low pressures. Do not use them on the pressure system. A four color Hydraulic circuits diagram **(Figure H)**, is also found on page 44 of the parts book. It calls out the part number and routing of each hose in the system.

SERVICING OF CREEPER DRIVE TRANSMISSION

1. Length of connecting rod between sub-levers should be so adjusted that sub-levers are parallel to each other.

2. TO ADJUST CREEPER GEAR BACKLASH

(a) Remove inspection cover from housing. To **increase** backlash in gears, turn **Link C** in the direction of the arrow indicated in **Figure L.** Proper backlash is .005 to .008. To **decrease,** turn **Link C** in the opposite direction of the arrow. Loosen lock nuts at either end of link before making adjustments. Refer to **Figure P.** Lubrication chart.

REMOVAL OF CREEPER DRIVE MOTOR

1. Remove sub-lever ♯12-11-42 and Woodruff key in shaft. Remove Cover F, **Figure L** and slide cover assembly over drive line towards transmission. Disconnect U-joint assembly at large gear flange yoke ♯12-61-03. Remove two ½" hydraulic hoses from fluid motor.

NOTE: It is not necessary to drain the hydraulic system when removing the hoses from the creeper motor. Place the creeper control valve in neutral position and the only oil that will be lost is the oil contained in the motor and the short hydraulic hoses. If creeper valve is not in neutral position, the oil will siphon out until the system is drained.

2. Remove Pin ♯12-11-50 from creeper motor mounting bracket. Remove differential pinion gear shaft nut and pull large gear ♯12-11-36 and yoke ♯12-61-03. Creeper motor and bracket can now be removed from case.

REMOVAL AND INSTALLATION OF SIDE SHIFT HYDRAULIC MOTOR

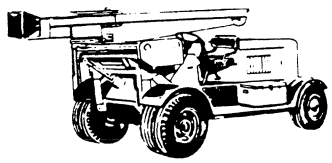
1. Refer to **Figure M,** Side shift motor and sprocket assembly.

2. To **remove** motor, loosen set screw **H** in sprocket **F.** Remove the four ⅜" diameter socket head cap screws, **A.** Hydraulic motor **E** can then be removed from bracket **D.** To remove bearing pin **B,** loosen clamping lock screw **C.**

3. To **install** hydraulic motor on mounting bracket, make sure that the mounting face on the flange of motor **E** is free from paint, dirt, nicks, etc. Also, that the motor mounting base on bracket **D** is clean, etc. Pack needle bearing **G** with a good grade of lubricant such as LubriPlate 630-A or equal. Hold sprocket gear **F** and felt **J** in place in bracket housing. Install motor in place and make sure that Woodruff key is in motor shaft, and stays in.

4. Insert pin **B** in housing and tap lightly until it is fully in place. Pin will project approximately 3/16" as shown.

5. Tighten socket cap screws **A** with lock screw **C** loose. Pry sprocket **F** away from housing **D** so that there is a clearance space of about 1/32" as indicated by the letter **X.** Tighten set screw **H.** Loosen the four socket head set screws **A** one turn and tighten bearing pin clamp bolt **C.** Now retighten socket head cap screw **A.** It is very important that bearing alignment is maintained between the motor mounting bracket and the motor. The above procedure should be followed in order to insure proper alignment.



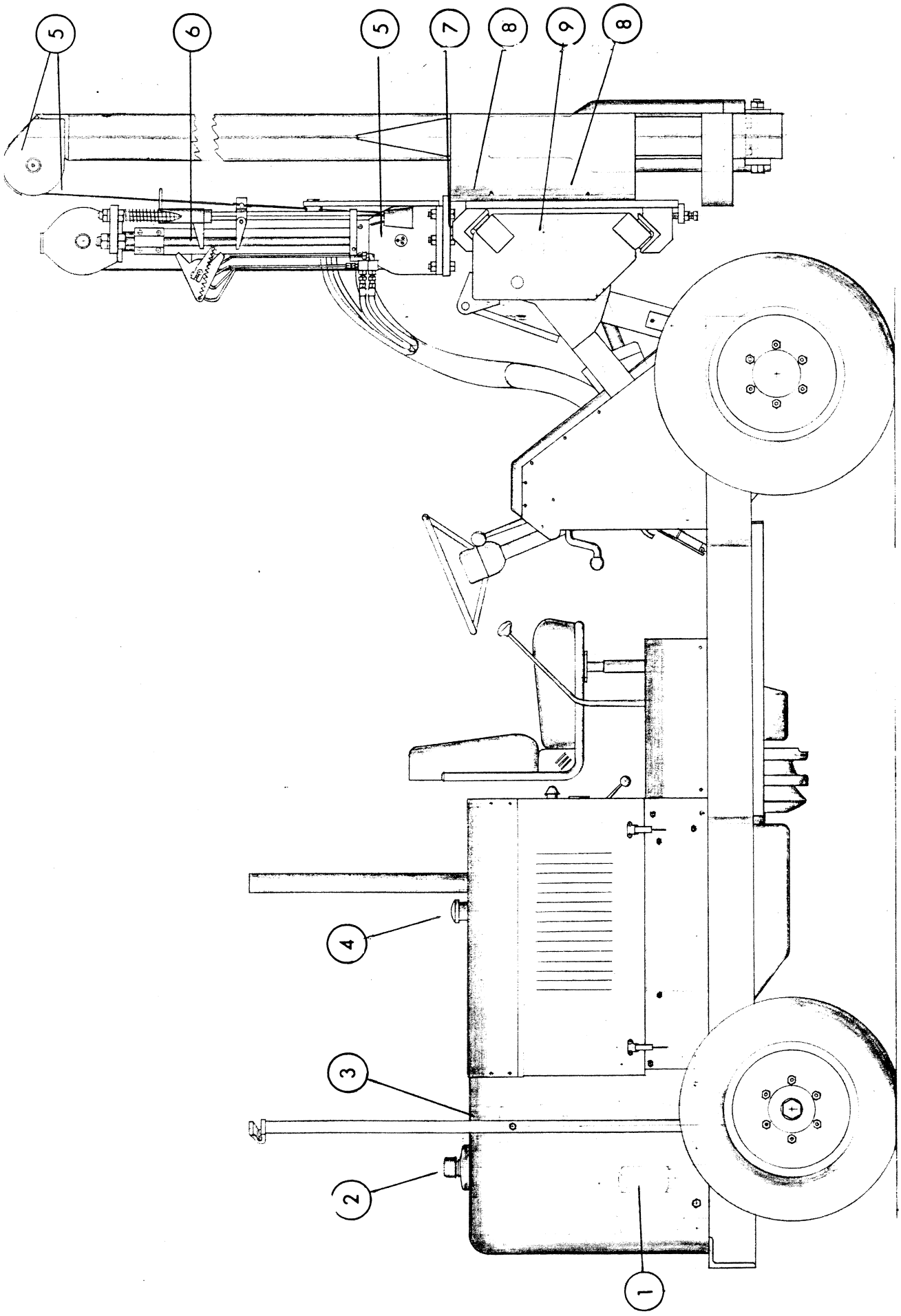
HAMMER LUBE CHART See FIG. O

No.	Item	Lubricant	Quantity	Period	Type of Fitting
1	Hydraulic Oil Filter	See Preventative Maintenance			
2	Hydraulic Oil Tank Breather	Clean out with solvent according to dust conditions.			
3	Engine Coolant	See engine coolant chart in the engine section.			
4	Engine Fuel Tank	Keep full to prevent water condensation in tank. Clean out vent hole.			
5	Cable Sheave Pins	Multi-purpose Grease (CL)	one shot	125 hrs.	Alemite hydraulic
6	Automatic Pilot Valve Cam Follower Bearing	Multi-purpose grease (CL)	one shot	125 hrs.	Alemite hydraulic
7	Cross Feed Ways	Engine oil	fill cups & wipe on thin film	125 hrs.	Oil cups (2)
8	Lead Tilt Bearing	Multi-purpose grease (CL)	three shots	125 hrs.	Alemite hydraulic
9	Lead Tilt Pin	Multi-purpose grease (CL)	three shots	125 hrs.	Alemite hydraulic
	Idler Sprocket Bearings	Lubriplate 630-A or equal	hand packed	125 hrs.	

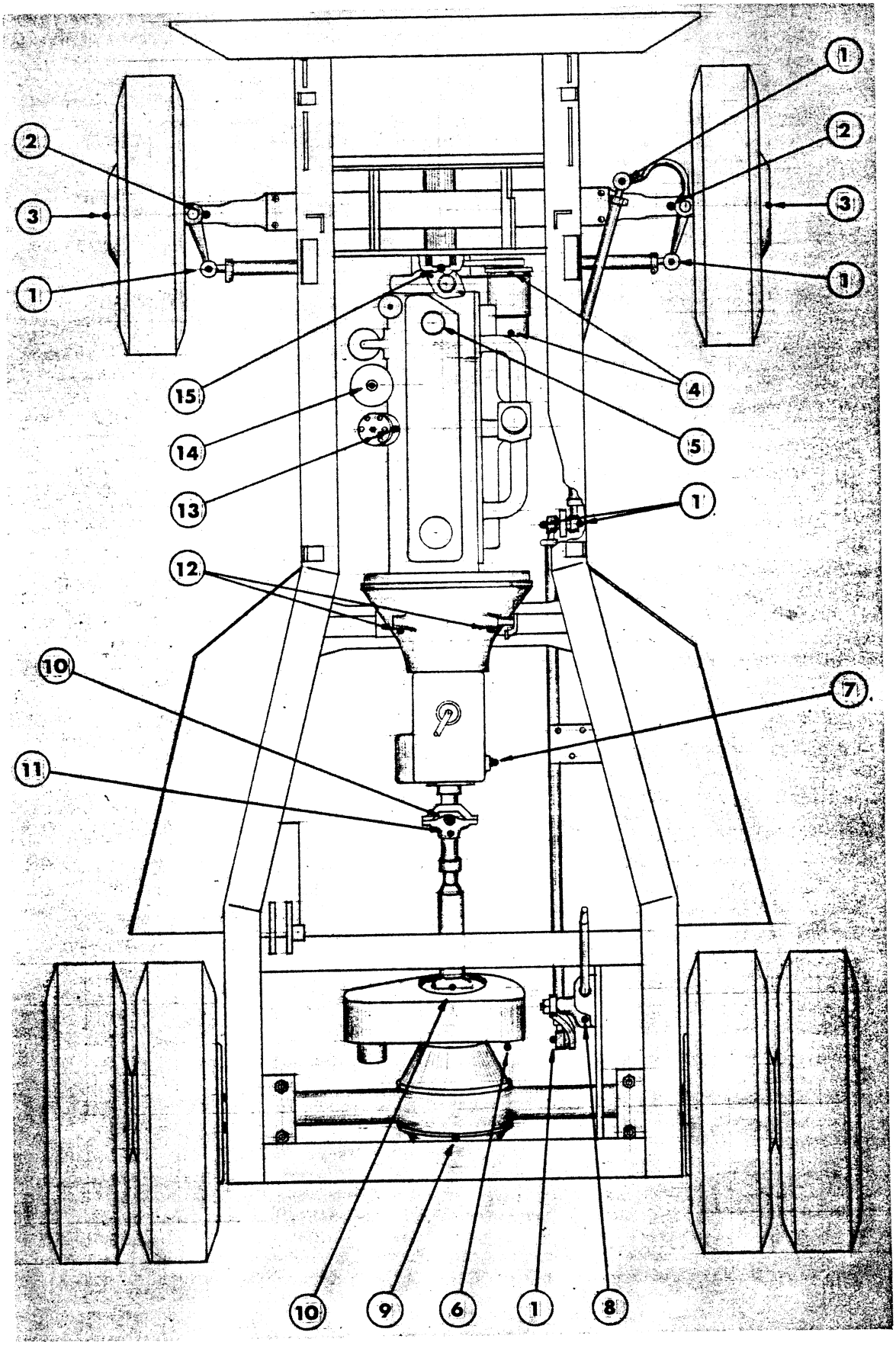
CHASSIS & ENGINE LUBE CHART See FIG. P

1	Ball & Socket Joint, Steering	Multi-purpose grease (CL)	one shot	125 hrs.	Alemite hydraulic
2	King,pin, Steering	Multi-purpose grease (CL)	one shot	125 hrs.	Alemite hydraulic
3	Bearing, Front Wheel	Multi-purpose grease (CL)	Clean & repack	500 hrs.	
4	Bearing, Generator	SAE 20 Wt. Engine Oil	eight to ten drops	125 hrs.	Oil cup
5	Ventilator & Refill Cap, Engine Crankcase	Wash in solvent		250 hrs.	
6	Shift Pin, Creeper gear	Multi-purpose grease (CL)	one shot	125 hrs	Alemite hydraulic
7	Transmission	Universal 90 Gear Lube	Check level Drain & refill	125 hrs. 1000 hrs.	Pipe plug
8	Housing, Steering Gear	Universal 90 Gear Lube	Check level	125 hrs.	Pipe plug
9	Housing,DDifferential	Universal 90 Gear Lube	Check level Drain & refill	125 hrs. 1000 hrs.	Pipe plug
10	Universal Joint	Multi-purpose grease (CL)	one shot	125 hrs.	Alemite hydraulic
11	Spline, Slip Joint	Multi-purpose grease (CL)	one shot	125 hrs.	Alemite hydraulic
12	Shaft, Clutch Throw-Out	High Temperature Grease	one shot	125 hrs.	Alemite hydraulic
13	Cam, Distributor	See Engine Lubrication Chart in the engine section			
14	Oil Filter, Engine	Drain & replace element		250 hrs.	
15	Pivot Pin, Front Axle	Multi-purpose grease (CL)	two shots	125 hrs.	Alemite hydraulic

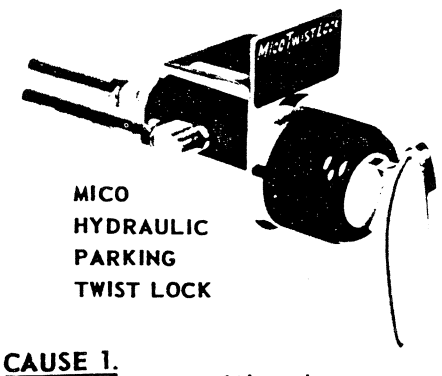
CL - Chassis Lube



Lube Guide, Hammer, Fig. O



Lube Guide, Chassis & Engine, Fig. P



MICO
HYDRAULIC
PARKING
TWIST LOCK

THE MICO TWIST LOCK, Model 8802, fills the large demand for a brake lock with a strictly manual release. It is a manually-closed and manually-opened hydraulic valve that locks the brake fluid, under pressure, in the brake lines and acts as a positive-holding brake. There need be no roll-back when using the MICO Twist Lock, as the operator simply twists the handle to release the brakes, leaving both feet free for clutching and accelerating.

SERVICE INSTRUCTIONS

TWIST LOCK VALVE WILL NOT HOLD

CAUSE 1.
Leaks at any of the tubing connections, or at a wheel cylinder, will cause a pressure bleed-off and TWIST LOCK will not hold vehicle.

CORRECTION 1.
Check by holding brake pedal down for a few minutes. A pedal loss, during this operation, indicates a leak in the system. Slight or slow leaks may not always be found by this method therefore check the system for indications of moisture caused by leaking fluid.
(The above indicates a dangerous service brake condition,as well as interfering with the TWIST LOCK operation.)

CAUSE 2.
Existence of excessive dirt in the brake system can cause internal Valve (LL40), Rod Assembly (LL492), or both, to stick in open position. When this happens Spring (103-11) may not have enough force to position valve against seat.

CORRECTION 2.
Disconnect brake lines from TWIST LOCK at inlet and outlet fittings. Loosen Jam Nut (LL140). Hold hex Body (LL10) with a wrench and unscrew Cam Block (LL482) with a pipe wrench. Place hex of Body in a vise and unscrew steel Plug (LL30) from end of Body. Compression Spring (103-11) and Valve (LL40) can be removed from open end. Push Rod Assembly (LL492) should be pulled out of small end of Valve Body. Flush entire brake system. Wash all component parts in alcohol and re-assemble. After re-installing, bleed system carefully.

CAUSE 3.
Use of inferior brake fluid or fluid other than brake fluid may cause "O" Ring, on Rod Assembly (LL492), to swell. Increased drag, due to this swelling, can hold the Valve in open position.

CORRECTION 3.
Same detailed disassembly for Correction 2 except replace Push Rod Assembly (LL492). (Order part No. LL492 which includes new "O" Ring.)
NOTE: Neither of conditions outlined in 2 or 3 will interfere with normal brake operations.

TWIST LOCK VALVE WILL NOT RELEASE

CAUSE 4.
Repeated operation in a dirty system or with a swollen "O" Ring can cause excessive wear of Cam (LL480). When this happens the Cam cannot move Valve (LL40) from its seat and the TWIST LOCK cannot be released.

CORRECTION 4.
To correct this condition, loosen Jam Nut (LL140) hold Body (LL10) with a wrench and unscrew Cam Block (LL482) with a pipe wrench. Replace Rod Assembly (LL492), (order Part No. LL492), or replace entire unit with a factory exchange unit. (Model No. 8802AZ)

CAUSE 5.
A gap between Cam (LL480) and Push Rod Assembly (LL492), when the handle is in the Release position which may be the result of loosening or mal-adjustment of Cam Block (LL482) and TWIST LOCK Body (LL10), prevents the unseating of Valve (LL40) and TWIST LOCK cannot be released.

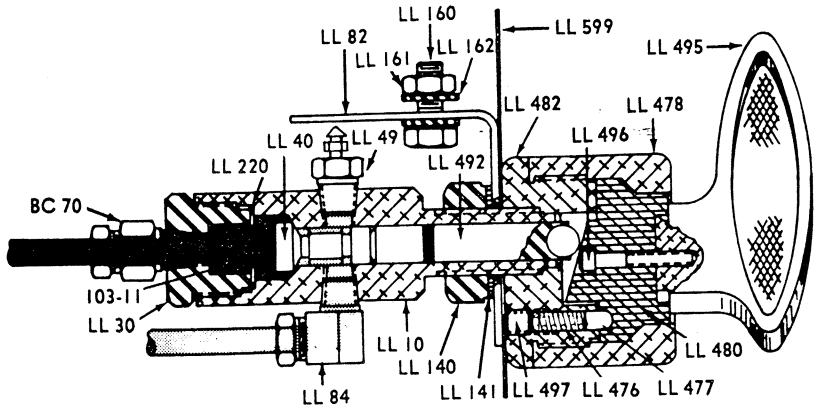
CORRECTION 5.
To check this, loosen Jam Nut (LL140). Hold Body (LL10) and turn Cam Block (LL482), with a pipe wrench, in a clockwise direction until both sections are secure. Now reposition complete assembly with Cam Block and Instruction Plate in original position, solid against Mounting Bracket (LL82), and re-tighten Jam Nut (LL140). In an emergency, if Corrections 4 and 5 are impractical, slightly unscrew nut on outlet tube, at end of TWIST LOCK, allow a few drops of brake fluid to escape and re-tighen nut. Now operate brake pedal. Brakes should release. Make complete correction before using TWIST LOCK again.

TWIST LOCK LEAKS

CAUSE 6.
Undue wear to "O" Ring (LL120, part of Push Rod Assembly (LL492), will permit escape of fluid.

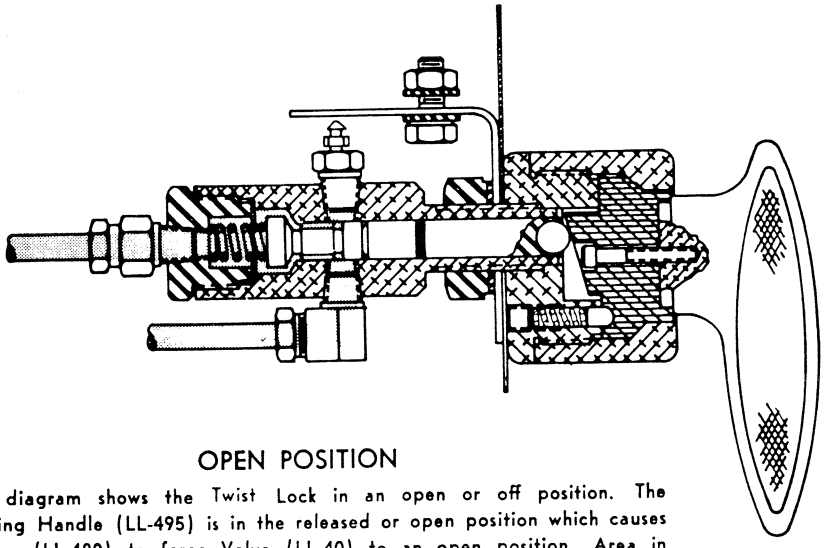
CORRECTION 6.
To correct this condition, loosen Jam Nut (LL140), hold Body (LL10) with a wrench and unscrew Cam Block (LL482) with a pipe wrench. Replace Rod Assembly (LL492), (Order Part No. (LL492) which includes new "O" Ring), or replace entire unit with a factory exchange unit. (Model No. 8802AZ).

TWIST LOCK (Parking Brake)



LOCKED POSITION

Above diagram shows the Twist Lock in a locked or applied position. Operating handle (LL-495) has been turned, moving Operating Cam (LL-480) to a position which will allow Spring (103-11) to seat Valve (LL-40), preventing return of fluid from the Wheel Cylinders. Area in heavy shading illustrates fluid held under pressure. Area in lighter shading indicates fluid at atmospheric pressure.



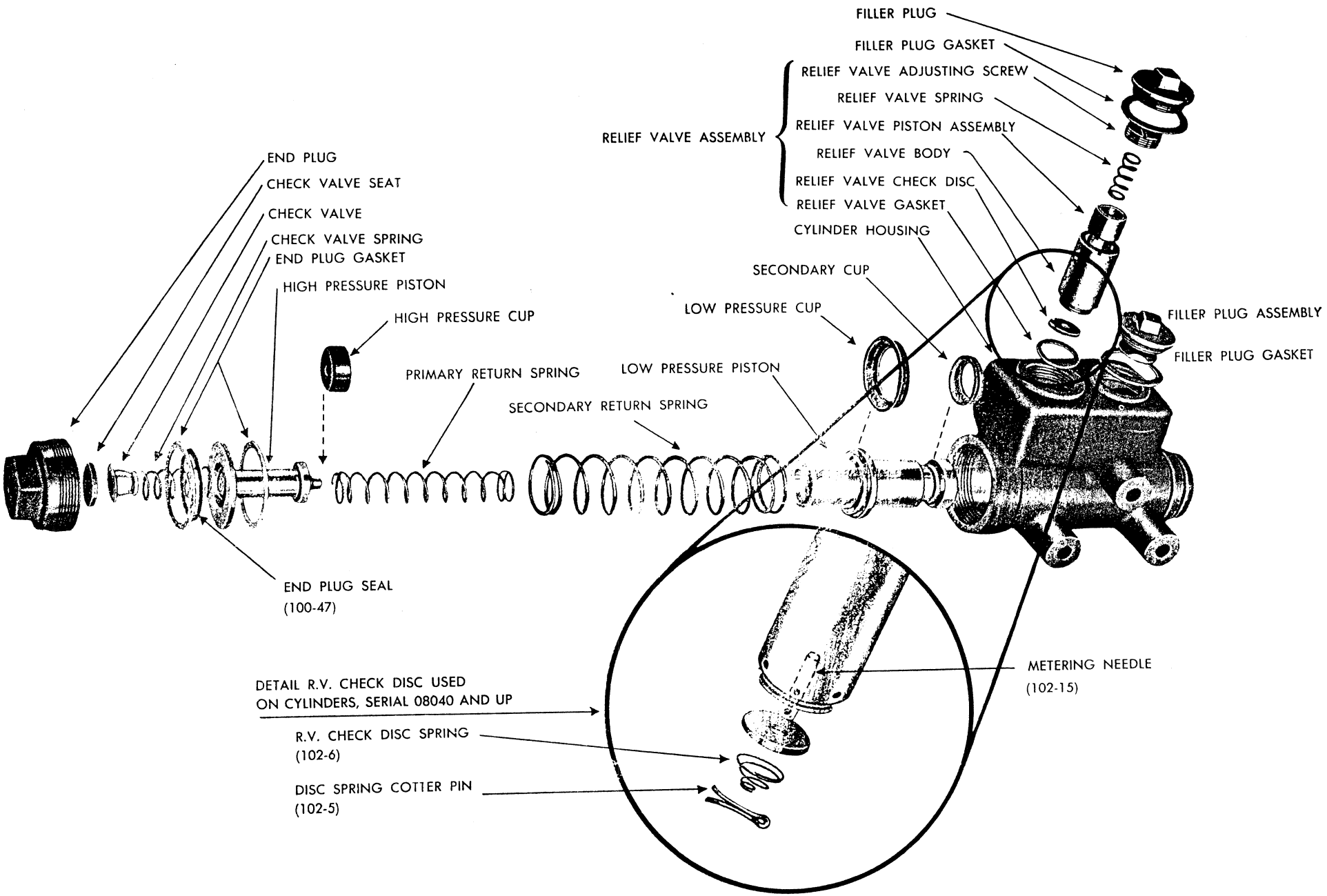
OPEN POSITION

Above diagram shows the Twist Lock in an open or off position. The Operating Handle (LL-495) is in the released or open position which causes the Cam (LL-480) to force Valve (LL-40) to an open position. Area in light shading indicates fluid which can flow unrestricted through the Twist Lock.

BILL OF MATERIALS

Part No.	Description	No. Req.
LL 10	BODY	1
LL 30	END PLUG	1
LL 40	VALVE	1
LL 49	ASSEMBLY, BLEEDER SCREW	1
LL 82	MOUNTING BRACKET	1
LL 84	ELBOW, 1/8 PIPE x 1/4 TUBE	1
LL 140	NUT, JAM	1
LL 141	WASHER, LOCK	1
LL 160	BOLT, BRACKET	2
LL 161	NUT, BRACKET	2
LL 162	WASHERS, SHAKEPROOF, BRACKET	4
LL 220	GASKET	1
LL 476	SPRING	1
LL 477	LUG, DETENT	1
LL 478	COVER, CAM	1
LL-480	CAM, NYLON	1
LL 482	BLOCK, CAM	1
LL 492	ASSEMBLY, ROD	1
LL 495	HANDLE	1
LL 496	SCREW, CAP	1
LL 497	SCREW, SET	1
LL 599	DASH PLATE	1
BC 70	MALE CONNECTOR, 1/4 TUBE	1
103-11	SPRING	1

Parking Brake Fig. R



Power Brake Fig. S

POWER BRAKE CYLINDER

SERVICE DIRECTIONS FOR MICO POWER BRAKE CYLINDER

DISASSEMBLE

1. Remove the Mico cylinder from vehicle. Do not attempt to repair the Mico while it is installed in the vehicle.
2. Place cylinder in a vise in horizontal position.
3. Remove the reservoir cover or cover plug.
4. Remove the relief valve by turning it counter-clockwise. The valve cylinder is slotted on the top edge to fit a wide screw driver (or Mico Relief Valve Tool, VT2000).
5. Remove the large end nut (1¼ inch hex). This nut is under spring pressure. The high pressure piston, the end plug gasket, and check valve assembly should "pop" out on the release of the end nut. If all parts do not come out upon removal of the end nut, loosen the outside gasket from binding in the threads by prying the gasket out with a screw driver.
6. The low pressure piston may be removed by pushing the piston through the cylinder from the push-rod end.

ASSEMBLE

1. Place the cylinder in horizontal position in a vise.
2. Replace the low pressure piston.
3. Replace first the small and then the large return springs.
4. Insert the inside end plug gasket.
5. In order to properly assemble the remainder of the Mico unit, it is necessary to push the low pressure piston forward about 1½ inches from the push-rod-end with a rod or screw driver and to hold the piston in this position until the high pressure piston has been installed.
6. While holding the low pressure piston in position, enter high pressure cup into the low pressure piston. At this time force the piston into the cylinder so that the base of the high pressure piston seats on the inside gasket. This operation will have to be performed under spring pressure because it is necessary to hold the low pressure piston forward in order to insure proper entry of the cup.
7. Release the pressure of the screw driver or rod against the push-rod end and at the same time apply enough pressure against the base of the high pressure piston so as to prevent the high pressure cup from coming out of the high pressure cylinder.
8. Insert a rod or screw driver into the relief valve opening and pry it sideways against the high pressure piston with enough force to prevent the assembled parts from moving out of position.
9. While holding the parts in position with the rod or screw driver, replace the outside gasket and rubber seal. Place the retarding valve assembly into the end nut and screw the end nut tightly into the brake cylinder.

IMPORTANT NOTICE

It is very important that the end nut be drawn in tightly. We recommend that a heavy wrench be used for this operation so that it may be struck with a hammer in order to properly tighten the end nut.

SERVICE AND MAINTENANCE

HYDRAULIC FLUID

The tank for this system should be kept reasonably full at all times with hydraulic fluid of grade and quality as recommended in **Figure N Recommended Hydraulic Oils.** Hydraulic oil level should be 4½" from top of tank neck with system filled and hammer lift cylinder retracted.

1. Best results from the hydraulic system cannot be obtained with any but the proper fluid. DO NOT use ordinary lubrication oils as a substitute for proper hydraulic fluid.

2. Be sure that fluid is clean and free from foreign matter.

3. The strainer for the hydraulic system is located inside and at the bottom of the hydraulic oil tank. It is secured by a 2 inch male pipe connection at the bottom inlet into the main suction opening to the hydraulic pumps.

4. The strainer is removable by reaching through the filler neck in top of hydraulic fluid tank, and unscrewing the strainer from the bottom connection.

5. The strainer should not be removed without first draining the fluid tank completely, and the strainer should be replaced before refilling the tank. A drain opening with magnetic plug is located at front of tank. The strainer should be inspected and cleaned each time the fluid tank is drained and renewed.

6. Under moderate climatic conditions and normal operations, the fluid in the entire system should be completely drained, and a fresh supply installed, after approximately 1000 hours of operation, or when the need for a change is otherwise indicated. This change should be made more frequently in warmer weather, or under severe operating conditions. Do not re-use any of the hydraulic fluid which has been drained from the hydraulic system. Return line hose at tank should also be removed to completely drain the tank.

7. Air breather cap should be removed and cleaned by flushing with solvent periodically depending on dust conditions.

HYDRAULIC OIL RECOMMENDATIONS FOR THE ARROW MOBILE HYDRAULIC HAMMER

THE OIL IN A HYDRAULIC SYSTEM SERVES AS THE POWER TRANSMISSION MEDIUM. IT IS ALSO THE SYSTEM'S LUBRICANT AND COOLANT. SELECTION OF THE PROPER OIL IS A REQUIREMENT FOR SATISFACTORY SYSTEM PERFORMANCE AND LIFE.

TWO IMPORTANT FACTORS IN SELECTING AN OIL FOR USE IN MOBILE HYDRAULIC SYSTEMS ARE:

1. ANTIWEAR ADDITIVES - The oil must contain the necessary additives to insure high antiwear characteristics.
2. VISCOSITY - The oil selected must have proper viscosity to maintain an adequate lubricating film at system operating temperature.

SUITABLE TYPES OF OIL FOR USE IN MOBILE HYDRAULIC SYSTEMS ARE:

1. CRANKCASE OIL meeting performance classification, letter designations, SC, SD or SE of SAE J183. Note that one oil may meet one or more of these classifications.
2. ANTIWEAR TYPE HYDRAULIC OIL - There is no common designation for oils of this type. However, they are produced by all major oil suppliers and provide the antiwear qualities of the above designated crankcase oils.
3. CERTAIN OTHER TYPES OF PETROLEUM OILS are suitable for Mobile hydraulic service if they meet the following provisions:
   (A) Contain the type and content of antiwear additives found in the above designated crankcase oils or have passed pump tests similar to those used in developing the antiwear type hydraulic oils.
   (B) Meet the viscosity recommendations shown in the following table.
   (C) Have sufficient chemical stability for Mobile Hydraulic system service.

THE FOLLOWING TABLE SHOWS OIL-VISCOSITY RECOMMENDATIONS FOR USE IN MOBILE HYDRAULIC SYSTEMS:

HYDRAULIC SYSTEM OPERATING TEMPERATURE RANGE (MIN.* TO MAX.)	SAE VISCOSITY DESIGNATION
*** -10° F. to 130° F. (-23° c. to 54° C.)	5W 5W-20 5W-30
0° F. to 180° F. (-18° C. to 83° C.) 0° F. to 210° F. (-18° C. to 99° C.) 50° F. to 210° F. (10° C. to 99° C.)	10W 10W-30** 20-20W

*Ambient Start-Up Temperature
**See Paragraph on Viscosity Index
***See Paragraph on Artic Conditions

OPERATING TEMPERATURES - The temperatures shown in table are cold start-up to maximum operating. Suitable start-up procedures must be followed to insure adequate lubrication during system warm-up.

ARTIC CONDITIONS - Artic conditions represent a specialized field when extensive use is made of heating equipment before starting. If necessary this and judicious use of the following recommendations may be used:

1. SAE 5W or SAE 5W-20 oil, in line with the viscosity guidelines shown in the table.
2. Oils especially developed for use in artic conditions such as synthetic hydrocarbons, esters, or mixtures of the two.
3. Dilution of SAE 10W oil with maximum of 20% kerosene or low temperature diesel fuel in permissible. However, dilution of the special oils (see 2 above) should not be attempted unless the supplier and Arrow concur. The addition of the dilutant will not necessarily improve the cold cranking and may have an adverse affect on the performance of the oils in (2) above.

During cold start-up, avoid high speed operation of hydraulic system components until the system is warmed up to provide adequate lubrication.

Operating temperature should be closely monitored to avoid exceeding a temperature of 130° F. (54° C.) with any of these light weight or diluted oils.

OTHER FACTORS IN SELECTING AN OIL ARE:

1. VISCOSITY - Viscosity is the measure of fluidity. In addition to dynamic lubricating properties, oil must have sufficient body to provide adequate sealing effect between working parts of pumps, valves, cylinders and motors, but not enough to cause pump cavitation or sluggish valve action. Optimum operating viscosity of the oil should be between 16 cSt (80 SSU) and 40 cSt (180 SSU).
2. VISCOSITY INDEX - Viscosity index reflects the way viscosity changes with temperature. The smaller the viscosity change, the higher the viscosity index. The viscosity index of hydraulic system oil should not be less than 90. Multiple viscosity oils, such as SAE as SAE10W-30, incorporate additives to improve viscosity index (polymer thickened). Oils of this type generally exhibit both temporary and permanent decrease in viscosity due to the oil shear encountered in the operating hydraulic system. The actual viscosity can, therefore, be far less in the operating hydraulic system than what is shown in normal oil data. Accordingly, when such oils are slected, it is desirable to use those with high shear stability to insure that viscosity remains within recommended limits.
3. ADDITIVES - Research has developed a number of additive agents which materially improve various characteristics of oil for hydraulic systems. These additives are selected to reduce wear, increase chemical stability, inhibit corrosion and depress the pour point. The most desirable oils for hydraulic service contain higher amounts of antiwear compounding.
4. CHEMICAL STABILITY - Oxidative and thermal stability are essential characteristics of oils for Mobile Hydraulic systems. The combination of base stocks and additives should be stable during the expected lifetime of the oil when exposed to the environment of these systems.

SPECIAL REQUIREMENTS

Where special considerations indicate a need to depart from the recommended oils or operating conditions, see your Arrow representative.

CLEANLINESS

Thorough precautions should always be observed to insure that the hydraulic system is clean, during assembly and start-up after overhaul or servicing.

A. Clean (flush) entire system to remove paint, metal chips, welding spatter, etc.
B. Filter each change of oil to prevent introduction of contaminant into the system.
C. Maintain continuous oil filtration to remove sludge and products of wear and corrosion generated during the life of the system.
D. During usage, proper oil filling and servicing of filters, breathers, reservoirs, etc. cannot be over emphasized.

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