INSTRUCTIONS

for

the Installation, Care and Operation of Circuit Breakers and Accessories

TYPE PH-20-C2

"PNEU-DRAULIC" OPERATOR

BOOK BWX-6439-1

These instructions are not intended to cover all details or variations that may be encountered in connection with the installation, operation, and maintenance of this equipment.
Should additional information be desired contact the Allis-Chalmers Mfg. Company.

ALLIS-CHALMERS MFG. CO.
BOSTON WORKS · BOSTON · MASS.

ALLIS-CHALMERS MANUFACTURING COMPANY

BWX-6439

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TYPE PH-20-C2 "PNEU-DRAULIC" OPERATOR

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CAUTIONS TO BE OBSERVED IN THE INSTALLATION, OPERATION AND MAINTENANCE OF OPERATING MECHANISM

THIS EQUIPMENT CANNOT BE OPERATED UNTIL THE SHIPPING WEDGES AND TIES HAVE BEEN REMOVED AND ALL ADJUSTMENTS HAVE BEEN CHECKED.

THIS EQUIPMENT IS SHIPPED WITH THE HYDRAULIC OIL IN THE RESERVOIR. THE PIPING SYSTEM SHOULD BE CHECKED FOR POSSIBLE LEAKS THAT MAY DEVELOP DURING SHIPMENT.

THE HYDRAULIC OIL SHIPPED IN THE RESERVOIR IS TEXACO AIRCRAFT HYDRAULIC OIL AA. ANY OIL ADDED SHOULD BE THE SAME AS ORIGINALLY FURNISHED. THE SYSTEM MAY BE DRAINED AND REFILLED WITH AN OIL OF EQUIVALENT PROPERTIES.

NEVER MANUALLY OPERATE THIS MECHANISM FOR INSPECTION OR MAINTENANCE PURPOSES WITH PRE-CHARGE PRESSURE OF THE ACCUMULATOR BELOW SPECIFIED PRESSURE.

PRESSURE IN ACCUMULATOR MUST AT LEAST BE AT MINIMUM PRESSURE BEFORE ATTEMPTING A POWER CLOSURE OF BREAKER THROUGH MEANS OF MANUAL OPERATING LEVER ON CONTROL VALVE.

IN CONNECTING UP AND TESTING THIS OPERATOR, USE ACCOMPANYING WIRING DIAGRAM.

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CAUTIONS TO BE OBSERVED IN THE SERVICING OF HYDRAULIC SYSTEM

BEFORE SERVICING OPEN DISCONNECTING SWITCHES ON BOTH SIDES OF BREAKER.

IF THIS IS NOT POSSIBLE, AFTER BREAKER OR OPERATOR MAINTENANCE, AND BEFORE REBUILDING PRESSURE IN HYDRAULIC SYSTEM LOCK THE OPERATOR IN TRIP FREE POSITION, BY POSITIONING OUTSIDE TRIP FREE HANDLE IN ITS TRIP POSITION.

THIS PRECAUTION IS NECESSARY WHENEVER BUILDING UP PRESSURE FROM ZERO. SINCE THE TOLERANCES BETWEEN THE CONTROL VALVE SPOOL AND BODY ARE EXTREMELY CLOSE, IT IS POSSIBLE AT MAINTENANCE PRESSURE FOR THE SPOOL TO FAIL TO RESET TO ITS NORMAL POSITION (DIRECTING OIL ABOVE THE RAM). IN SUCH A CASE, WITH THE BREAKER OPEN, ANY ATTEMPT TO PRESSURIZE THE SYSTEM FROM ZERO PRESSURE MIGHT CAUSE THE RAM TO RISE SLOWLY UNTIL THE HYDRAULIC SYSTEM PRESSURE WAS HIGH ENOUGH TO SHIFT THE MAIN SPOOL TO ITS NORMAL POSITION AT WHICH TIME THE RAM WOULD DESCEND. THIS WOULD NORMALLY RESULT IN SLOWLY CLOSING AND OPENING THE BREAKER CONTACTS INTO THE ARCING ZONE.

BY PUTTING THE BREAKER IN ITS TRIP FREE POSITION, HOWEVER, ALTHOUGH THE OPERATOR RAM MAY RISE, THE BREAKER MECHANISM WILL NOT MOVE. WHEN THE OPERATOR RAM HAS RAISED TO ITS UPPER MOST POSITION, THE HYDRAULIC SYSTEM PRESSURE WILL BUILD UP WHICH WILL SHIFT THE VALVE SPOOL AND THE RAM WILL RETURN TO ITS NORMAL POSITION.

THE PRESSURE NECESSARY TO RESET THE MAIN SPOOL OF THE CONTROL VALVE WILL IN ALL CASES BE LESS THAN ACCUMULATOR PRECHARGE PRESSURE AND NO STICKING OF THE CONTROL VALVE WILL BE EXPERIENCED WHEN THE BREAKER IS IN SERVICE. HOWEVER, DURING MAINTENANCE PERIODS, OR WHENEVER THE HYDRAULIC PRESSURE IS BEING BUILT UP FROM ZERO PRESSURE, SINCE THE PRESSURE REQUIRED TO START CLOSING THE BREAKER IS LESS THAN THE PRESSURE REQUIRED TO MOVE THE SPOOL, THE ABOVE PRECAUTIONS SHOULD ALWAYS BE OBSERVED.

TO CHECK PRECHARGE PRESSURE

A. With Hydraulic System Pressurized

To check precharge pressure with breaker either open or closed, open DC control and pump motor control switches, release accumulator pressure by draining fluid back into reservoir by opening pressure bleed valve. When pressure is zero, close pressure bleed valve, close pump motor control switch and check precharge pressure (pressure to which pressure gage needle rises rapidly). If precharge pressure is correct continue pumping to operating pressure and close DC control switch.

B. With Hydraulic System at Zero Pressure

With breaker closed open DC control switch, close pump motor switch and check precharge pressure. If power is not abailable, hand pump may be used in place of power pump. After checking precharge pressure, open pressure bleed valve to return pressure to zero.

With breaker open, either open disconnect switches or put breaker in trip-free position (see "Cautions to be observed in the Servicing of Hydraulic System"). Open DC control switch, close pump motor switch and check precharge pressure.

Whenever checking or correcting precharge pressure always be sure to check and tighten cap on top of accumulator and test with soap suds if possible.

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PH-20-C2
"PNEU-DRAULIC" OPERATOR

GENERAL

INTRODUCTION

The instructions included in this book are to aid you in obtaining longer and more economical service from your Allis-Chalmers equipment. The successful operation of this equipment is dependent upon proper installation and care as well as proper design and manufacture. By distributing this information to your operators and engineers you can assure proper installation and operation-resulting in better service and lower maintenance cost.

RECEIVING

Each operator and its associated apparatus has been carefully checked,inspected and packed at the factory by workmen experienced in the proper handling of electrical equipment. Immediately upon receipt of this equipment, remove all packing traces and examine parts, checking them against the packing list and carefully noting any damages incurred in transit. If damage is disclosed, a damage claim should be filed at once with the transportation company. In addition the Allis-Chalmers Mfg.Company should be notified.

STORAGE

When this apparatus is to be stored for any length of time, a location should be selected which is clean, dry and not exposed to possible corrosive gases or mechanical injury. All machined surfaces should be slushed to prevent corrosion. Particular care should be taken to protect insulating parts which might absorb moisture. All conduit openings should be sealed. A periodic inspection schedule should be set up for the protection of this stored equipment.

The operating mechanism housing is weatherproof. However, to prevent corrosion, due to moisture condensation within the cabinet, the space heaters furnished should be energized as soon as possible even to the extent of using temporary wiring. Machine parts of operating mechanism,etc., should be slushed to insure them against corrosion.

INSTALLATION

Before shipment, each device has been completely assembled and adjusted, then wedged and tied in the closed position.

CAUTION: THIS EQUIPMENT CANNOT BE OPERATED UNTIL THESE WEDGES AND TIES HAVE BEEN REMOVED. THIS EQUIPMENT SHOULD NOT BE OPERATED UNTIL ALL ADJUSTMENTS HAVE BEEN CHECKED. SEE ADJUSTMENTS.

INSTALLATION (CONTINUED)

In general, when the operator is shipped with the breaker, no adjustments are necessary. If, after careful observation and several operations by hand, adjustments seem necessary, proceed as outlined under "Trip Unit Adjustments".

DESCRIPTION

The type "C" "Pneu-Draulic" operator is designed for use in outdoor oil circuit breakers of the intermediate voltage ratings (15 KV to 69 KV). This unit includes a mechanical trip-free operating mechanism, a high speed tripping device and a "Pneu-Draulic" system for closing power. The entire unit is located within the operator cabinet fastened to the front of the leading breaker tank.

"PNEU-DRAULIC" SYSTEM ASSEMBLY
REF. FIG. 1

The "Pneu-Draulic" fluid system is composed of a power cylinder, (101), an hydraulic control valve, (102), an hydraulically operated seal-in switch (103), an hydraulic power unit (104), an accumulator (105), a manual pump (106), pressure switches, a pressure gauge, hydraulic fluid and the necessary tubing and fittings to assemble and operate the system.

The "Pneu-Draulic" fluid system stores oil in the accumulator at high pressure and in sufficient quantity to supply the necessary power required for satisfactory operation or operations of the hydraulic cylinder.

The oil flows at low pressure in the reservoir through the strainer to the power pump and hand pump. To build up pressure in the system, the pressure-bleed valve must be closed (turned clock-wise). Pressure may then be raised by operation of the power pump or hand pump. Oil flows thru the power pump, check valve and filter into the accumulator. The pressure relief valve prevents excessive pressures from arising during power pump operation. Oil flows through the hand pump and directly through the filter to the accumulator. The hand pump has a built-in check valve.

High pressure oil flows from the accumulator through the control valve as described under "Control Valve" and is exhausted back to the reservoir.

Air is bled from the high pressure system by cracking the bleeder valve located on the front of the cylinder after any maintenance of the hydraulic system.

POWER CYLINDER (Ref. Fig. 2)

The power cylinder of the "Pneu-Draulic" operator is a high speed double-acting cylinder specifically designed for operations previously described. Shock absorber action is designed into the cylinder and piston, to cushion the shock at the end of the power stroke.

"O" rings are used for static seals in the assembly of cylinder (201) to upper (202) and lower (203) plates. "Quad" rings are used for static seals between tube (204) and upper and lower plates, and for the moving seal between ram gland (205) and ram (206). A "Quad" ring is used for moving seal between piston (207) and cylinder(201).

CONTROL VALVE (Ref. Fig. 3)

The control valve is a pilot operated four-way spool type valve. Fig.(3) is a flow diagram explaining the operation of this valve and is not intended to be a picture of the valve.

Fig. 3a shows the control valve in its normal position with pressure on top of the piston (301).

Fig. 3b shows the control valve energized with pressure underneath the piston (301) and the ram (302) moving upward.

Line #1 is connected directly to the accumulator so that the control valve and power cylinder are always under pressure when the accumulator is charged with oil.

Line #2 is the main exhaust line and it accomodates the oil which is displaced from either end of the operating cylinder when the operating cylinder is actuated.

Line #3 is an exhaust line. It accomodates the oil which is displaced by the valve spools (both main and pilot) when the valve spools are actuated.

In Fig. 3a high pressure oil from the accumulator passes into the control valve. In this position the port leading to the top of the piston(301) is exposed to the high pressure oil. At the same time the pilot valve (304) is exposed to the high pressure oil. The pilot valve is spring (303) biased when de-energized. In this position it directs high pressure oil to the end of the main spool (305) which keeps it in the position shown.

When the pilot valve is energized as shown in Fig. 3b it shifts so that it directs the high pressure oil to the opposite end of the main valve spool (305). At the same time it exposes the end that had been pressurized (in Fig. 3a) to line #3 which is vented directly to the reservoir allowing the main valve spool (305) to shift to the opposite end.

When the main valve spool (305) shifts to the position shown in Fig. 3b it seals off the pressure from the port leading to the top of the piston (301) and instead exposes that port to line #2 which is the main exhaust line to the reservoir. As it shifts, it also exposes the port leading to the bottom of the piston (301) to high pressure oil from the accumulator causing the ram (302) to move upward.

When the current to the control valve coil (306) is cut off the spring (303) returns the pilot valve spool (304) to the position shown in Fig. 3a and the sequence of operation described above is reversed.

The hydraulically actuated "seal-in" switch (307) is installed in the hydraulic circuit in such a manner that it is pressurized when the ram is moving upward.

HYDRAULICALLY OPERATED "SEAL-IN" SWITCH (Ref. Fig. 10)

The adaptor (1009) is threaded into the end cap of the control valve on the end that is pressurized when the breaker is closing (See Fig. 3B). The hydraulic pressure forces the piston (1010) down overcoming the resistance of the spring (1004) until the piston (1010) is down solidly against the adaptor (1009). Shortly before this occurs the movable contacts (1001) strike the stud Contacts (1002) closing the "seal-in" circuit, the function of which is described in the paragraph on CLOSING, ELECTRICAL SEQUENCE.

HYDRAULIC POWER UNIT (Ref. Fig. 5)

The hydraulic power unit consists of a motor driven hydraulic pump (501) mounted inside a reservoir (502) and integrally mounted pressure relief valve (503) and check valve (504 & 514).

The entire unit can be removed by disconnecting the piping and removing four bolts, or the reservoir alone may be dropped for inspection without draining the system merely by removing six bolts (507).

The reservoir (502) has a capacity of approximately 4-1/2 gallons. It is equipped with two sight gauge buttons. The upper gauge button indicates the fill level with no pressure in the system. The lower gauge button indicates the minimum fill level with the system at full operating pressure.

The power pump (501) is submerged in oil within a basket (509) made of wire screen having a filter rating of forty microns or less.

The relief valve (503) is adjustable within a range of 1000 PSI to 3300 PSI. While the relief valve is mounted inside the reservoir it is easily accessible through an inspection plate (510) located on the front of the reservoir (502).

The filler cap is mounted on the top of the reservoir (502) at the manifold (505) and has a porous filter which allows the reservoir to breathe.

The check valve (504) is mounted within the manifold (505) in the discharge line from the power pump (501). It protects the power pump from the system pressure.

The check valve (514) is built into the tubing fitting at the manifold (505) in the discharge line from the hand pump. It protects the hand pump from the system pressure.

ACCUMULATOR (Ref. Fig. 1 Item 105)

The accumulator is a high pressure storage chamber in which the potential energy of incompressible oil under high pressure is stored against the dynamic force of a compressible gas, in this case nitrogen. The accumulator consists of a steel alloy shell, a Buna N synthetic rubber separator bag incorporating an integrally molded high pressure air valve and an oil port assembly.

The accumulator furnished is a Greer Hydro-Pneumatic Accumulator, 2-1/2 gallon size, 3000 PSI pressure rating, Model 30A-2-1/2A. The accumulator bag is precharged with dry nitrogen gas to pressure specified for each circuit breaker. The poppet valve in the bottom of the accumulator prevents the extrusion of the bag out of the accumulator with zero oil pressure. When oil pressure is applied above gas precharge pressure, the poppet valve is lifted open and the relatively incompressible oil compresses the nitrogen in the bag, filling the shell as pressure is increased.

The accumulator precharge pressure is set above the maximum hydraulic pressure required to manually jack the breaker closed. Therefore, when manually operating the breaker, no oil is forced into the accumulator. Before closing in manually for adjustments or maintenance, check precharge pressure to insure that it is at specified pressure.

Precharge pressure is checked readily by pumping from zero pressure, either with power or hand pumps. The pressure gage needle will rise rapidly to precharge pressure, then level off and rise slowly above it.

ALLOW SYSTEM TO REMAIN AT ZERO PRESSURE FOR AT LEAST TEN MINUTES BEFORE CHECKING PRECHARGE.

MANUAL PUMP (Ref. Fig. 6)

The manual pump is a COMMERCIAL SHEARING AND STAMPING MODEL B-303-B. It is a double acting pump.

The hand pump may be used for jacking the breaker closed slowly for maintenance operations or for charging the accumulator in an emergency.

PRESSURE SWITCH AND GAUGE ASSEMBLY (Ref. Fig. 7)

Pressure switch (703) is the motor control switch 63M (See Fig. 15). It is a bourdon tube type of pressure switch. Adjusting screw (705) is used to set and adjust the switch to open at normal operating pressure on rising pressure. Lock screw (706) is tightened to lock adjusting screw (705) in place after adjustment.

Pressure switch (702) contains the alarm and lockout switches 63A1 and 63A2 (See Fig.15). Both switches operate from a single bourdon tube, 63A1 switch being normally open and 63A2 switch being normally closed. Adjusting screws (708) are used to individually adjust settings and lock screw (707) locks the adjustments.

The pressure gauge (701) is a heavy duty bourdon tube gauge rated at 4000 PSI.

FILTER (Ref. Fig. 1 Item 113)

The filter located between the pump and accumulator is rated at 15 micron to protect the control valve and cylinder. The filter element should be inspected or replaced annually.

FITTINGS

Tube fittings used throughout the system are the Ermeto flareless tube type, requiring no special tools for assembly.

HYDRAULIC FLUID

The oil supplied (Texaco Aircraft Hydraulic Oil AA) is a petroleum base, constant viscosity oil having a pour point of -75°F and a flash point of 205°F. The viscosity index is 232, the viscosity being 77 SSU at 100°F.

Q-9 AUXILIARY SWITCH (Ref. Fig. 8)

The type Q-9, 10-stage auxiliary switch is standard equipment with this operator. The rotor contacts of each stage of the switch are adjustable in steps of 22-1/2 degrees. This switch is mounted on back of control panel and is operated by a crank on the operator shaft through an adjustable connecting rod.

LATCH CHECK SWITCH (Ref. Fig. 12 Item 1220)

A latch checking switch is provided to insure that the trip-free mechanism is properly recoupled and ready for closing operation at the time closing relay is energized.

The latch check switch is a micro switch. It is mounted on the right hand side of the operator frame directly above the trip toggle shaft (Fig. 12 Item 1207). This switch is operated by a cam (1214) mounted on the right end of the trip toggle shaft(1207).

The latch check switch is factory adjusted and should not need field adjustment. If it should become necessary to adjust this switch adjustments are obtained through slotted holes in the bracket to which the micro switch is mounted.

LIMIT SWITCH (Ref. Fig. 9)

A limit switch is supplied for the purpose of interrupting the current to the closing coil at the end of the closing stroke. This switch also serves as an "anti-pump" Device.

The limit switch contacts (904) are mechanically opened through the action of an extension of the plunger roll shaft (Fig. 12 Item 1212) on the arm (901).

The coil (908) when energized, exerts a pull on the armature (909) which is attached to the contacts. The armature is adjusted so that the coil is not strong enough to part the contacts if they are closed but is strong enough to keep them open once they are opened, if the coil is energized.

The electrical operation of this switch is described in the paragraph titled CLOSING, ELECTRICAL SEQUENCE.

This switch is factory adjusted and should not require field adjustment. However, if mis-adjustment is suspected it may be checked as follows:

With closing ram in fully retrieved position, and contact of limit switch closed, there should be adequate contact pressure and contacts should not move when coil (908) is energized.

1. Check bolt at panel end of arm (901) to make certain it is tight and as far toward the panel end of the slot as it will go.

2. For good contact pressure the distance ("a" in Fig. 9) between contact arm and tip of bakelite contact insulator should be approximately 1/8". This distance may be adjusted by turning adjusting screw (906).

3. Open contacts by hand until armature (909) just seats firmly against its pole head. Gap between contacts should then be 1/4". If gap is more or less, adjust by loosening set screw in end of armature (909) and turning armature in or out.

4. Release Contacts and with contacts fully closed check distance ("b" in Fig. 9) between end of armature (909) and bakelite panel. It should be at least 1/2". If less, increase by increasing distance "a" by means of adjusting screw (906). If resulting dimension "a" is more than the 1/8" mentioned above, it will do no harm.

5. With closing ram in fully closed position so that extension of plunger roll shaft (Fig. 12, item 1212) strikes arm (901 of Fig. 9) check to see that armature (909) is firmly seated against its pole head. The only adjustment here is by means of slotted holes in mounting brackets of limit switch. Usually the switch may be moved as far down as it will go as spring on switch will permit considerable overtravel without damage.

HAND TRIPPING DEVICE (Ref. Fig. 11)

A hand tripping device is provided which will permit tripping of the circuit breaker from the outside of operator cabinet by mechanical means and open the reclosing circuit through a cut-off switch at the same time. This prevents a reclosing of the circuit breaker upon a manual tripping of breaker by this device.

This device is mounted on the right side of the operator cabinet.

The handle(1106) is attached through mechanical linkage to the manual trip pin (1109) when the handle (1106) is pulled towards the front of the cabinet. The manual trip pin (1109) is driven forward until it strikes the trip latch thereby tripping the breaker.

The cover (1105) is supplied with a hole through which a pin or a lock may be inserted to prevent accidental tripping of the breaker.

HEATER

Within the operator cabinet is a heating element continuosly energized without a thermostat. Its purpose is to reduce inside condensation by maintaining a higher temperature within the cabinet than outside of it.

OPERATION

CLOSING, MECHANICAL SEQUENCE (Ref. Fig. 12)

Referring to Fig. 12 through the action of the plunger on plunger roll (1208) the toggle joint is raised until the prop latch (1209) drops under the plunger roll (1208) latching the toggle joint in the closed position. During the upward travel of

the toggle joint, toggle links (1219) working through the out put crank (1211) rotate it clockwise on shaft (1215) to close circuit breaker through operating rod which is attached to end of output crank (1211).

CLOSING, ELECTRICAL SEQUENCE (Ref. Fig. 15)

The closing of the breaker is initiated by the closing of the control switch (01C) which energizes the closing coil of the control valve (52C) through the normally closed contacts (69), (52LC) (52B), (63C) and(52YB).

As soon as the control valve is actuated high pressure oil is admitted to the bottom of the ram in the power cylinder. At the same time the hydraulically operated "seal-in" switch is pressurized closing the contacts (63S) thereby sealing in the closing circuit.

When the operator plunger roll shaft (Fig. 12 Item 1212) nears its closed position an extension on the end of the plunger roll shaft actuates the mechanically operated switch (52YB) opening its contacts. The (52YB) contacts are opened mechanically but held open electrically by the operation of the 52YB coil as long as that coil is energized thereby preventing "pumping" of the breaker.

When the 52YB contacts open, the closing coil (52C) is de-energized causing the control valve to reset the power cylinder and open the seal in contacts (63S).

OPENING, MECHANICAL SEQUENCE (Ref. Fig. 12)

In order for a normal opening to occur the breaker and operator must be at rest in the closed position, with the ram down.

The operator trip coil (1201) when energized by the control switch or fault responsive relays forces trip pin (1202) down causing trip latch (1203) to rotate counter-clockwise about trip latch pin (1204). As trip latch (1203) is forced off trip latch roll (1205) the breaker load causes trip toggle crank (1206) to rotate counter-clockwise about trip toggle shaft (1207). This motion allows plunger roll (1208) to be forced to the left and drop off prop latch (1209). When the plunger roll is free to move downward under influence of operator reset springs (1210) output crank (1211) is rotated counter-clockwise by breaker load. In addition to forcing plunger roll shaft (1212) into the down (Open) position the operator reset springs (1210) cause the trip toggle crank (1206) to rotate clockwise about the trip toggle shaft (1207) until the trip latch roll (1205) returns to its stop (1213). This is quickly followed by the reset of the trip latch (1203). The operator is now latched in the open position and is ready to be closed.

OPENING, ELECTRICAL SEQUENCE (Ref. Fig. 15)

Opening of the breaker is initiated by the closing of the control switch (01T), which energized the trip coil (52T) through the auxiliary switch contacts (52A). Early in the opening stroke the auxiliary switch contacts (52A) open, cutting off the current to the trip coil (52T).

MANUAL OPERATION FOR MAINTENANCE (Ref. Fig. 4)

To manually operate the breaker for adjustment or maintenance purposes, the "Pneu-Draulic" system must be at zero pressure. This is accomplished by opening the by-pass valve to bleed system pressure.

Rotate control valve lever (401) counter clockwise until hole "B" in handle aligns with hole "C" in plate and insert pin through both holes. Then close pressure bleed valve and using hand pump, slowly jack the mechanism closed or to desired position.

(Refer to Fig. 12). To open mechanism slowly if latched closed, raise plunger roll shaft (1212) to uppermost position by raising piston and ram to extreme position. Block prop latch (1209) out of way and allow ram to lower by cracking open slowly the pressure bleed valve. This allows the force exerted by breaker load to force ram down, exhausting oil from under the piston back to the low pressure lines.

After manual operation as described, the following steps must be followed:

1. Remove any block behind prop latch - 1209 (Fig. 12)
2. Return pilot valve spool to normal position by removing pin (403) from hole "C" (Fig. 4) allowing springs to return valve to normal position.
3. Close pressure bleed valve.

The system is now ready to raise pressure for power operations.

CAUTION: NEVER CLOSE BREAKER MANUALLY WITHOUT FIRST OPENING DC CONTROL SWITCH (FIG. 15 ITEM 08).

FULL SPEED CLOSING, MANUAL OPERATION (Ref. Fig. 4)

The closing operations previously described were for power closing through action of closing coil.

For full speed manual closing, with oil at normal operating pressure, the manual operating lever is actuated rapidly, forcing the control valve to shift as previously described under "Closing Mechanical Sequence." This allows high pressure oil to flow through valve port under the piston forcing the ram upward to close

the operating mechanism.

Upon release of manual operating lever the control valve will return to its normal position. High pressure oil will now be admitted to the top of piston and oil under piston will be exhausted back through the control valve to the reservoir as the piston returns to its normal position (down).

OPERATOR ADJUSTMENTS FIG. 12

GENERAL

All of the mechanism has been checked, adjusted and tested before leaving the factory. However, it is advisable to check the following to be sure that no changes have occurred during the shipping and handling of this equipment.

All preliminary inspection should be made using the hand pump for operation of breaker. Electrical operation should not be attempted until adjustments have been checked and final inspection made.

TRIP LATCH ADJUSTMENTS "C" & "B" - (Ref. Fig. 12)

ADJUSTMENT "C" - Trip pin (1202) is adjusted to have overtravel of 1/32 ± 1/64 after operator has been tripped. When trip coil is de-energized, dimension "C" should be 1/8" ± 1/16". This dimension is obtained by adding or substracting spacers (1216).

ADJUSTMENT "B" - Adjustment screw (1217) is set to give a dimension "B", of 1/4 ± 1/16" between center of corner radius on latch and point of tangency between latch face and roll. Adjustment screw (1217) is provided with a nut and lockwasher so that dimension "B" may be held securely.

TRIP LATCH ROLL - ADJUSTMENT "A" (Ref. Fig. 12)

Trip latch roll stop (1213) is adjusted and locked with nut and lockwasher, so that with breaker open, dimension "A" between trip latch roll (1205) and trip latch (1203) is .020" ±.015".

LATCH CHECK SWITCH ADJUSTMENT (Ref. Fig. 12 Item 1220)

Latch check switch cam is adjusted so that contacts are closed when trip toggle crank (1206) is in position shown.

FINAL INSTALLING INSPECTION

LUBRICATION

See that all bearing surfaces of the operating mechanism have been lubricated with light, non-gumming lubricating oil.

WIRING

Inspect all insulation on wiring and see that no damage has resulted during the process of installing the breaker.

Test the wiring for possible ground or short circuits.

Make sure that all current carrying parts outside the oil circuit breaker have an adequate current carrying capacity and are correctly insulated in accordance with standard practice.

MAINTENANCE

GENERAL

Upon the proper operation and maintenance of the oil circuit breakers depends the safety of the operators and the successful functioning of the connected apparatus; therefore, the operator must have regular, systematic, and thorough inspection.

Be sure that the operator and breaker is disconnected from all electric power before inspecting or repairing.

LUBRICATION

All bearing surfaces should be lubricated with a good quality, light non-gumming lubricating oil, having a pour point below -40 degrees Centigrade. (Arctic Oil "C")

Operating the mechanism several times each month will insure continued free operation of the mechanical parts. It is recommended that this practice be followed by all users of operators and oil circuit breakers.

CONNECTIONS

Check all mechanical and electrical connections for tightness.

ACCUMULATOR PRECHARGE

Accumulator precharge should be checked periodically referring to curves shown in Fig. 14. If the precharge varies from its factory rating it may be due to temperature conditions; if so, this may be determined from the curves on Fig. 14.

If the precharge has dropped below its rated value (considering temperature factor) it should be recharged immediately. Instructions for precharging the accumulator are outlined in Fig. 14.

STANDARD OPERATING PROCEDURE FOR HYDRAULIC TANKLIFTER (WHEN SUPPLIED) MAY BE POWER OR MANUALLY OPERATED.

TO APPLY TANKLIFTER FOR LOWERING TANK

1. Remove 2 diagonally opposite tank bolts, at locations provided with slotted tank lugs.

2. Remove nuts from end of tanklifter rods - insert rods through slotted lugs into bolt holes in top assembly - replace nuts.

3. Attach hose assembly.

CAUTION: PRESSURE VALVE "A" MUST BE CLOSED, AND EXHAUST VALVE "B" OPEN TO RELIEVE BACK PRESSURE BEFORE ATTACHING HOSE. *

TO LOWER TANKS WITH SYSTEM PRESSURE AT ZERO

1. Close exhaust valve "B" and open pressure valve "A". Raise system pressure to 1000 PSI minimum with power or hand pump.

2. Close pressure valve "A".

3. Remove remaining tank bolts.

4. Gradually open exhaust valve "B" allowing tank to descend.

5. Remove nuts from end of rods and transfer lifter to next tank. With rod through slotted lug, close exhaust valve "B" and open pressure valve "A". Pump lifters up to engage tank lugs. Repeat steps 1, 2, 3 and 4.

TO LOWER TANKS WITH SYSTEM AT OPERATING PRESSURE

1. Close exhaust valve "B" and open pressure valve "A" pressurizing cylinders.

2. Remove remaining tank bolts.

3. Close pressure valve "A".

4. Gradually open exhaust valve "B" allowing tank to descend.

5. Remove nuts from end of rods and transfer lifter to next tank. With rod through slotted lug, close exhaust valve "B" and gradually open pressure valve "A" allowing pressure to raise lifters to engage tank lugs. Repeat steps 2,3 and 4.

TO RAISE TANKS WITH SYSTEM PRESSURE AT ZERO

1. With pressure valve "A" open and exhaust valve "B" closed, and tanklifter rods extended, raise tank by operation of either manual or power pump.

2. Install tank bolts.

3. Close pressure valve "A" and open exhaust valve "B".

4. Grasp lifter cylinder and pull down extending rod. Transfer to next tank and repeat.

TO RAISE TANKS WITH SYSTEM AT OPERATING PRESSURE

1. Close exhaust valve "B" with extended tanklifter rods.

2. Open pressure valve "A" gradually to control speed of raising. When approaching raised position reduce speed and observe whether tank will seat properly.

3. Install tank bolts.

4. Repeat steps 3 and 4 immediately above.

CAUTION: BEFORE REMOVING HOSE ASSEMBLY, EXHAUST VALVE "B" MUST BE OPEN TO RELIEVE PRESSURE.

CAUTION: WHEN TANKLIFTER IS NOT BEING USED, PRESSURE VALVE "A" MUST ALWAYS BE TIGHTLY CLOSED.

REPAIR PARTS

HOW TO ORDER

In ordering parts, specify quantity, figure number, reference number, and description of parts required; also furnish information as to type, amperage, voltage and serial number of the equipment on which the parts are to be used.

EXAMPLE: Furnish 1 outside trip device handle Ref. Fig. 11, Item (1106), Cat. 71-400-695 for Type PH-20-C" "Pneu-Draulic" Operator, Oil Circuit Breaker, Serial Number 305430.

A sketch of the part wanted will help materially if any uncertainty exists.

ALLIS-CHALMERS MFG. COMPANY
BOSTON WORKS
BOSTON, MASS.

April 17, 1957
BWX-6439-1

ALLIS-CHALMERS MANUFACTURING COMPANY

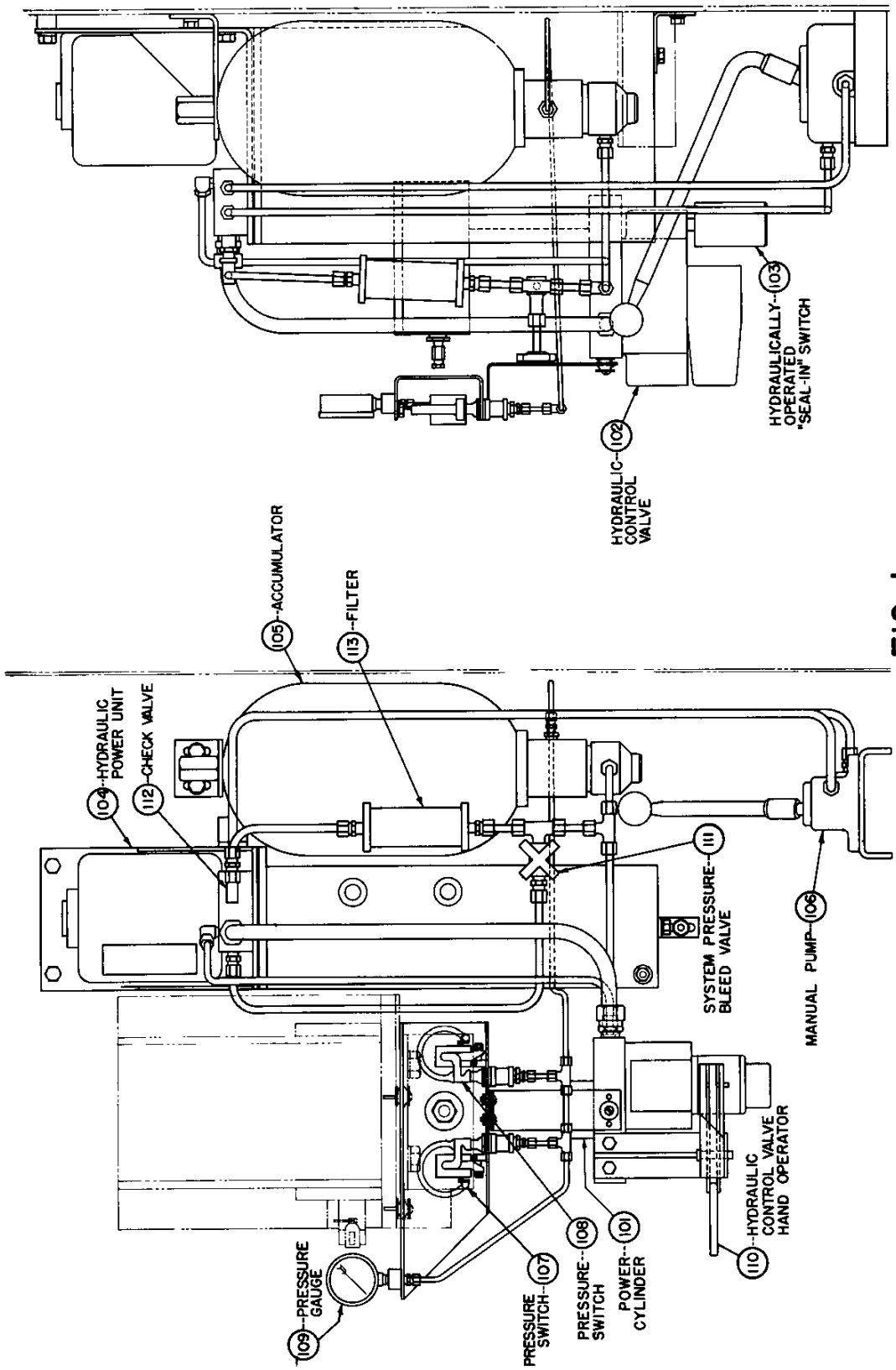


FIG. 1

TYPICAL *PNEU-DRAULIC* SYSTEM ASSEMBLY

FEBRUARY 3, 1956

71-500-208

ALLIS-CHALMERS MANUFACTURING COMPANY

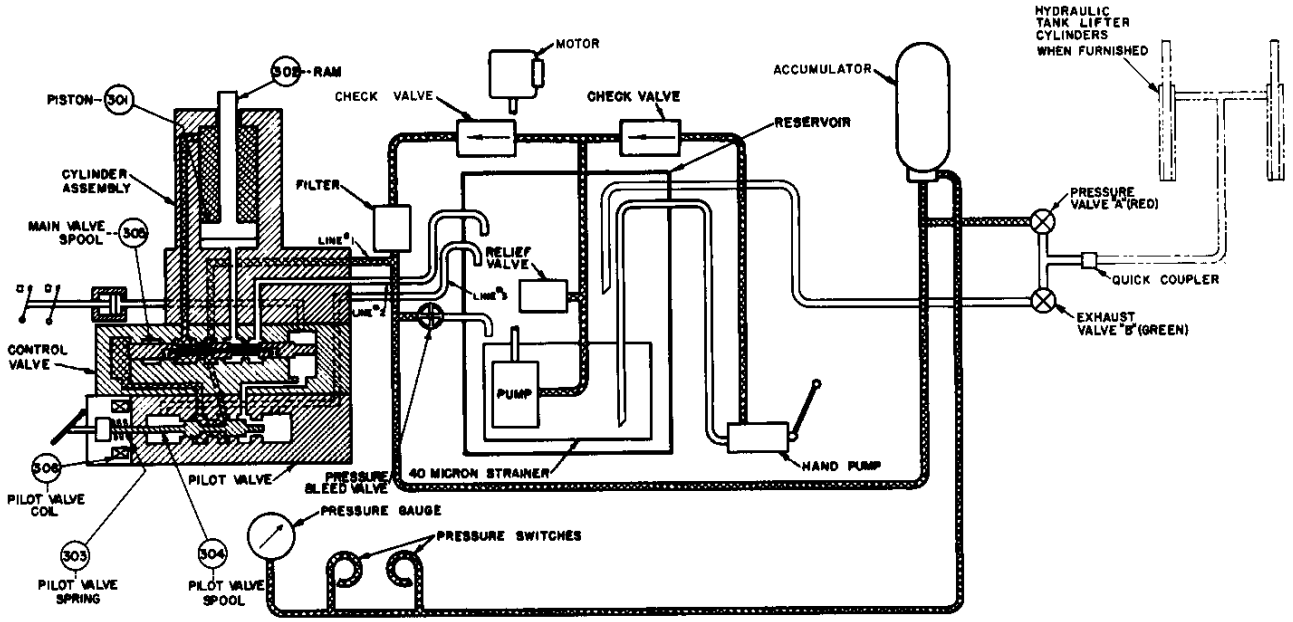


FIG.3A

PILOT VALVE COIL DE-ENERGIZED

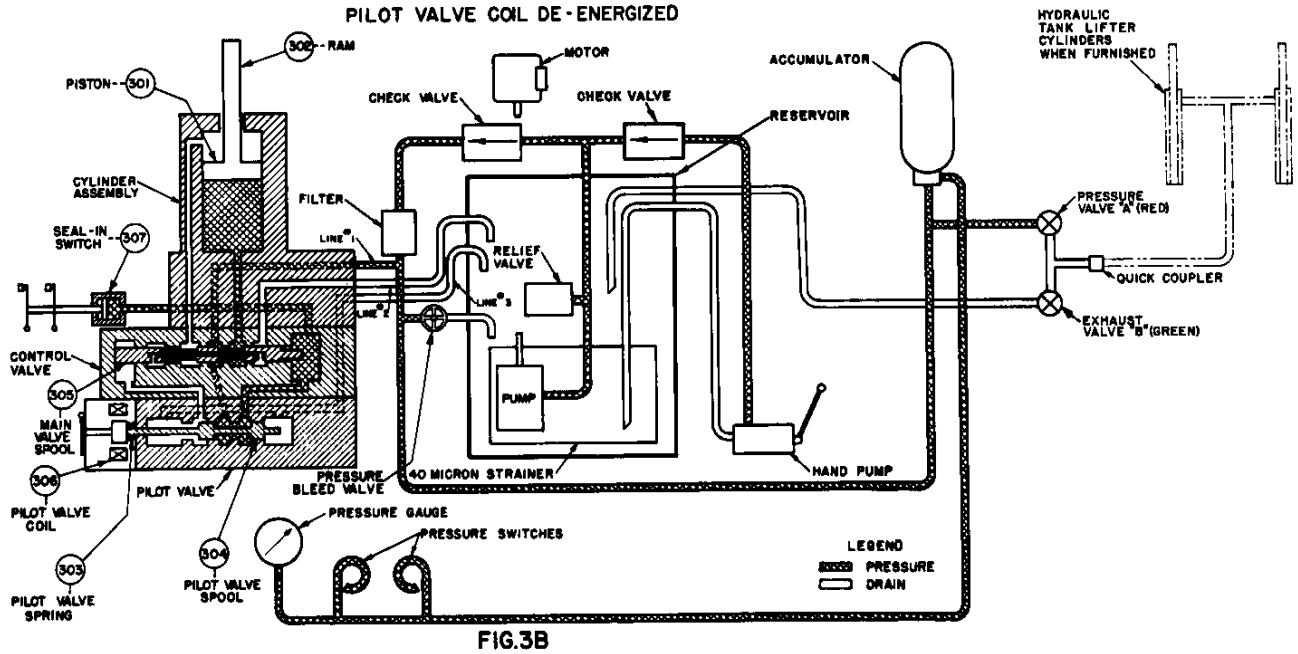


FIG.3B

PILOT VALVE COIL ENERGIZED

TYPICAL *PNEU-DRAULIC* FLUID SYSTEM

OCTOBER 23, 1956

71-400-873

ALLIS-CHALMERS MANUFACTURING COMPANY

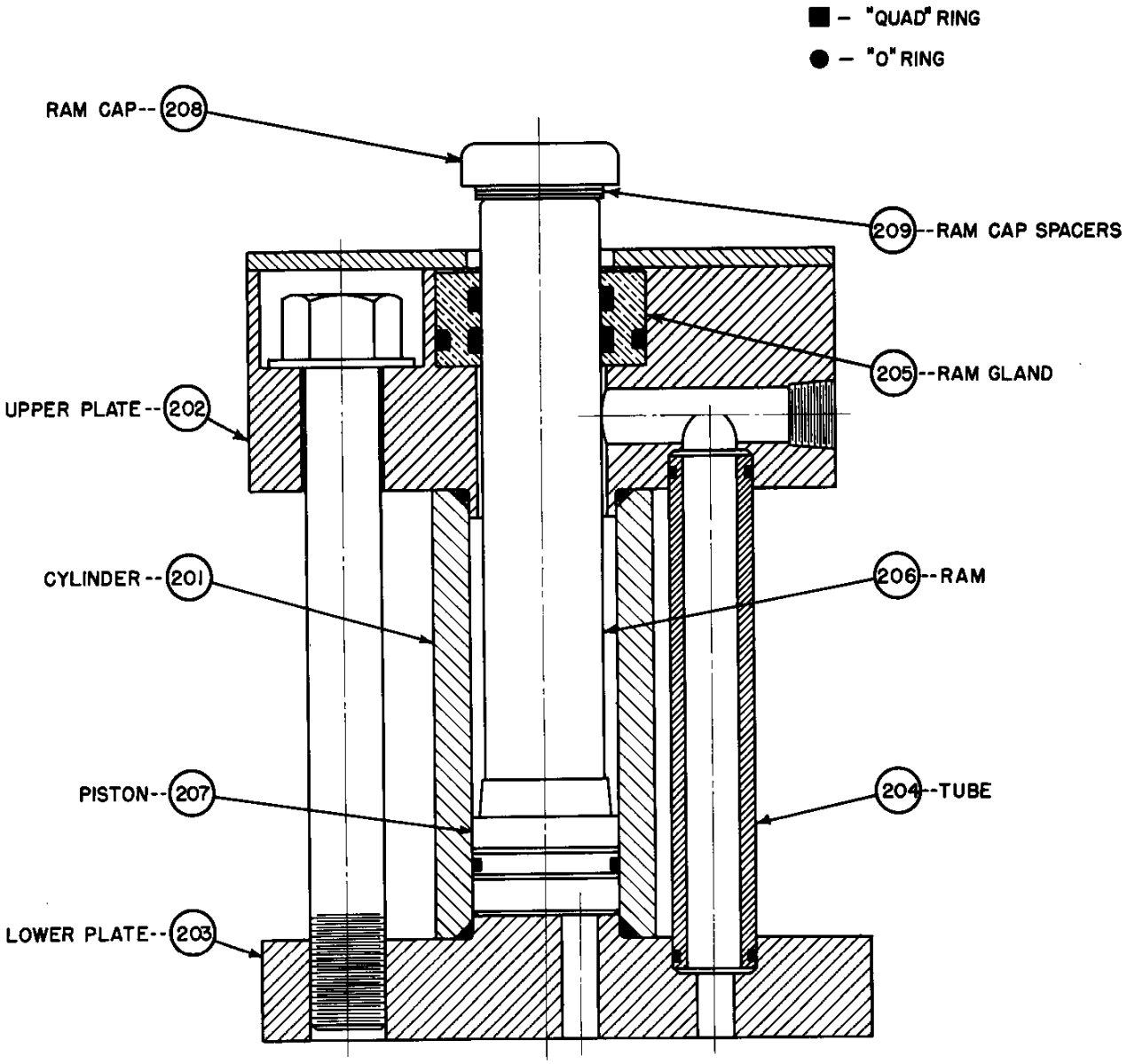


FIG. 2

TYPICAL POWER CYLINDER ASSEMBLY

JANUARY 24, 1956

71-301-167

ALLIS-CHALMERS MANUFACTURING COMPANY

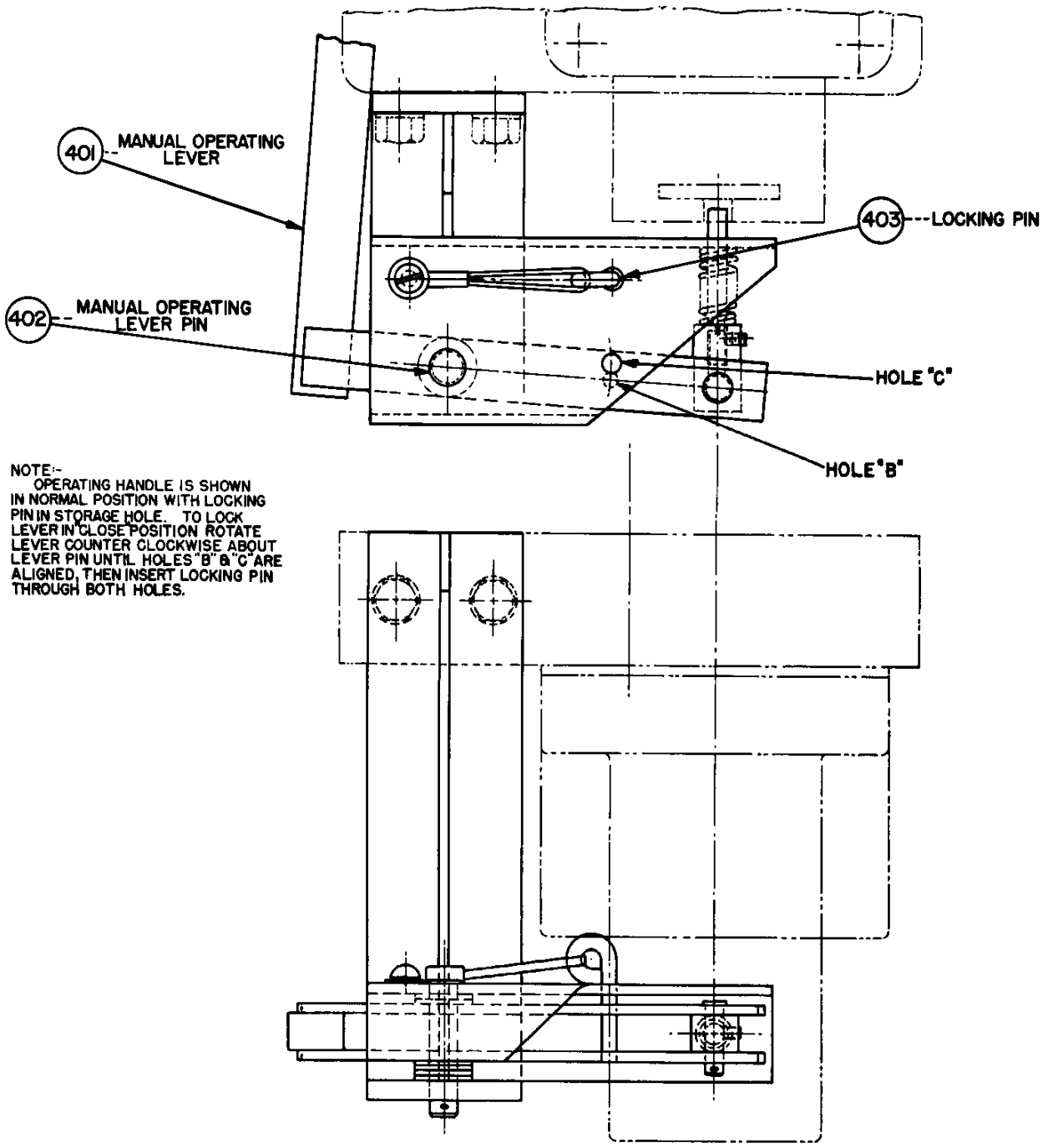


FIG.4

TYPICAL HYDRAULIC VALVE HAND OPERATOR

JANUARY 30, 1956

71-301-175

ALLIS-CHALMERS MANUFACTURING COMPANY

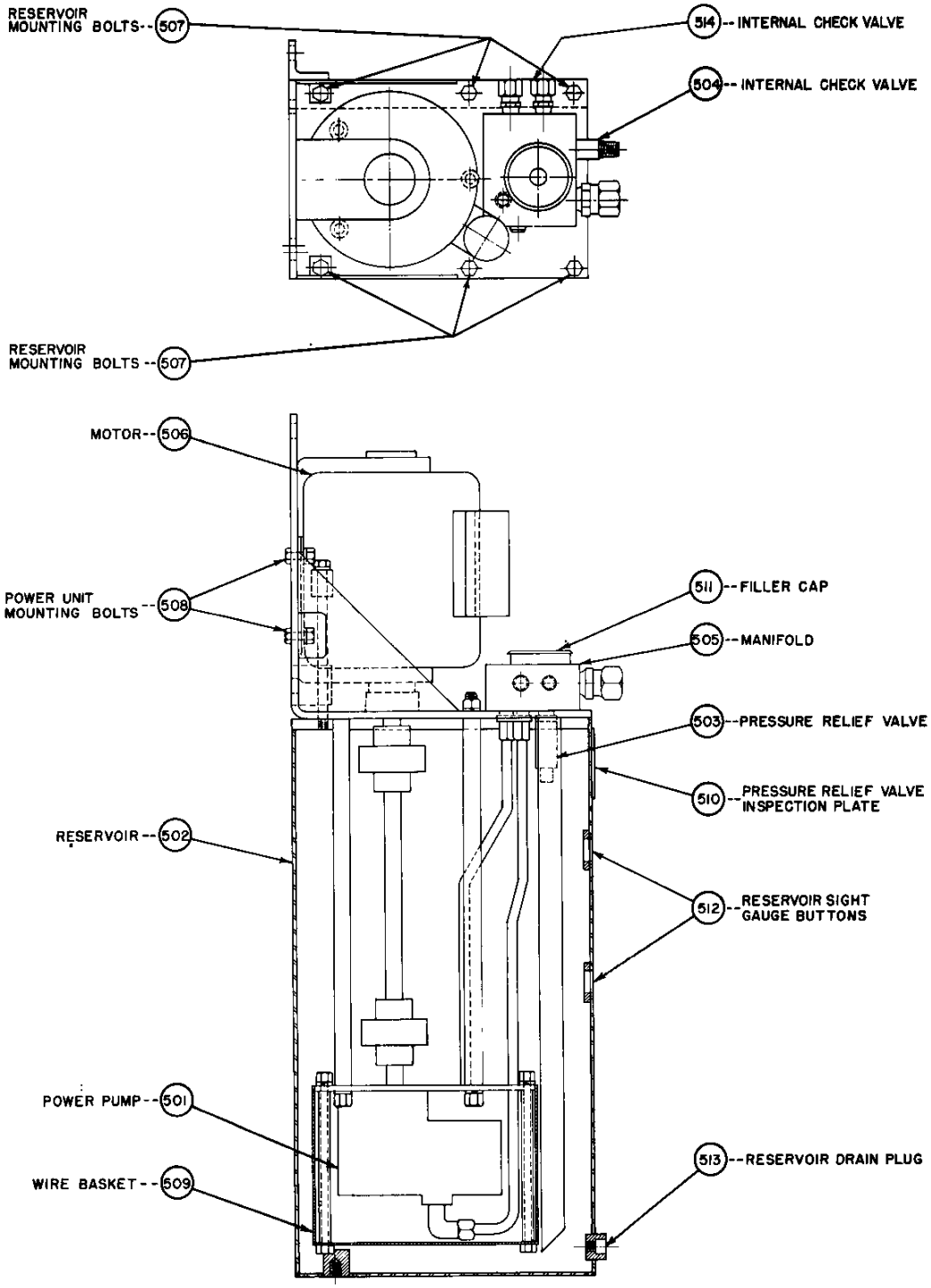
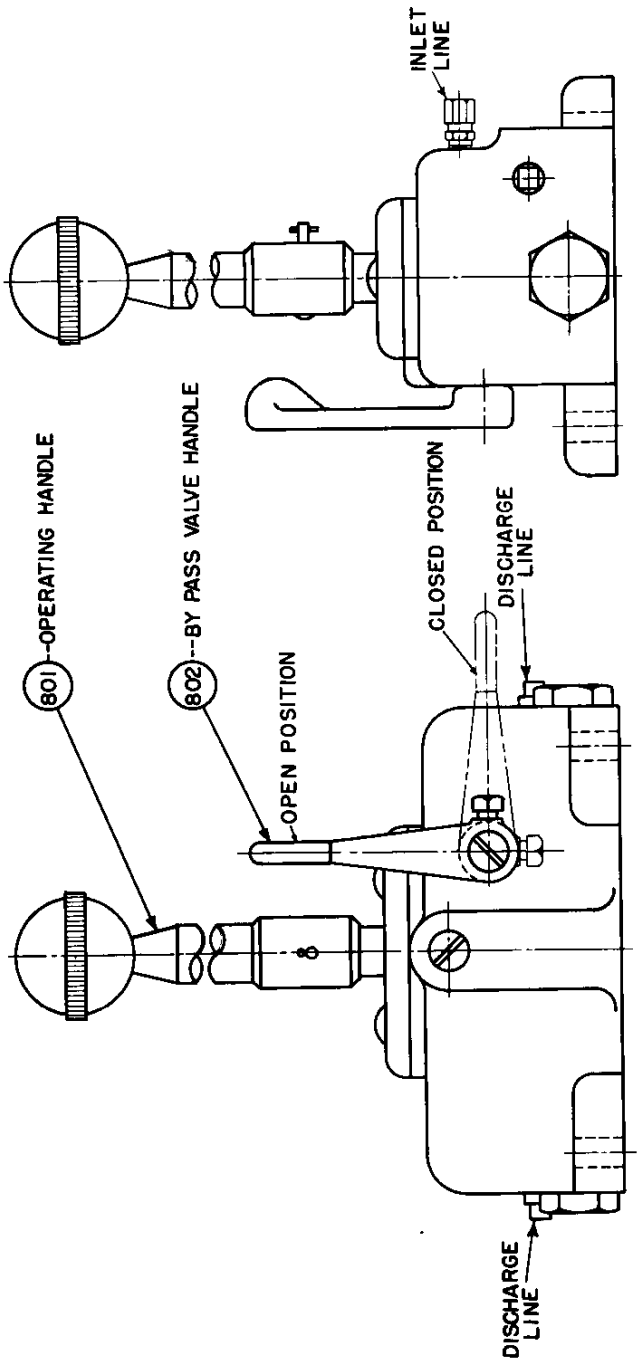


FIG.5

TYPICAL HYDRAULIC POWER UNIT

JANUARY 25, 1956

71-400-747



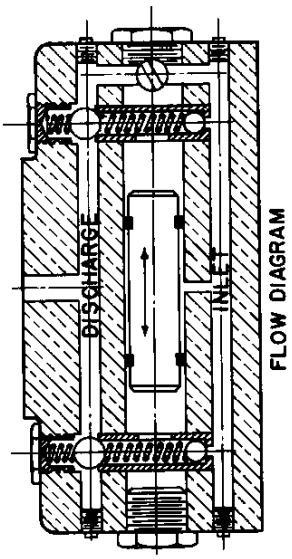


FIG. 6

TYPICAL MANUAL PUMP

JANUARY 27, 1956

71-301-172

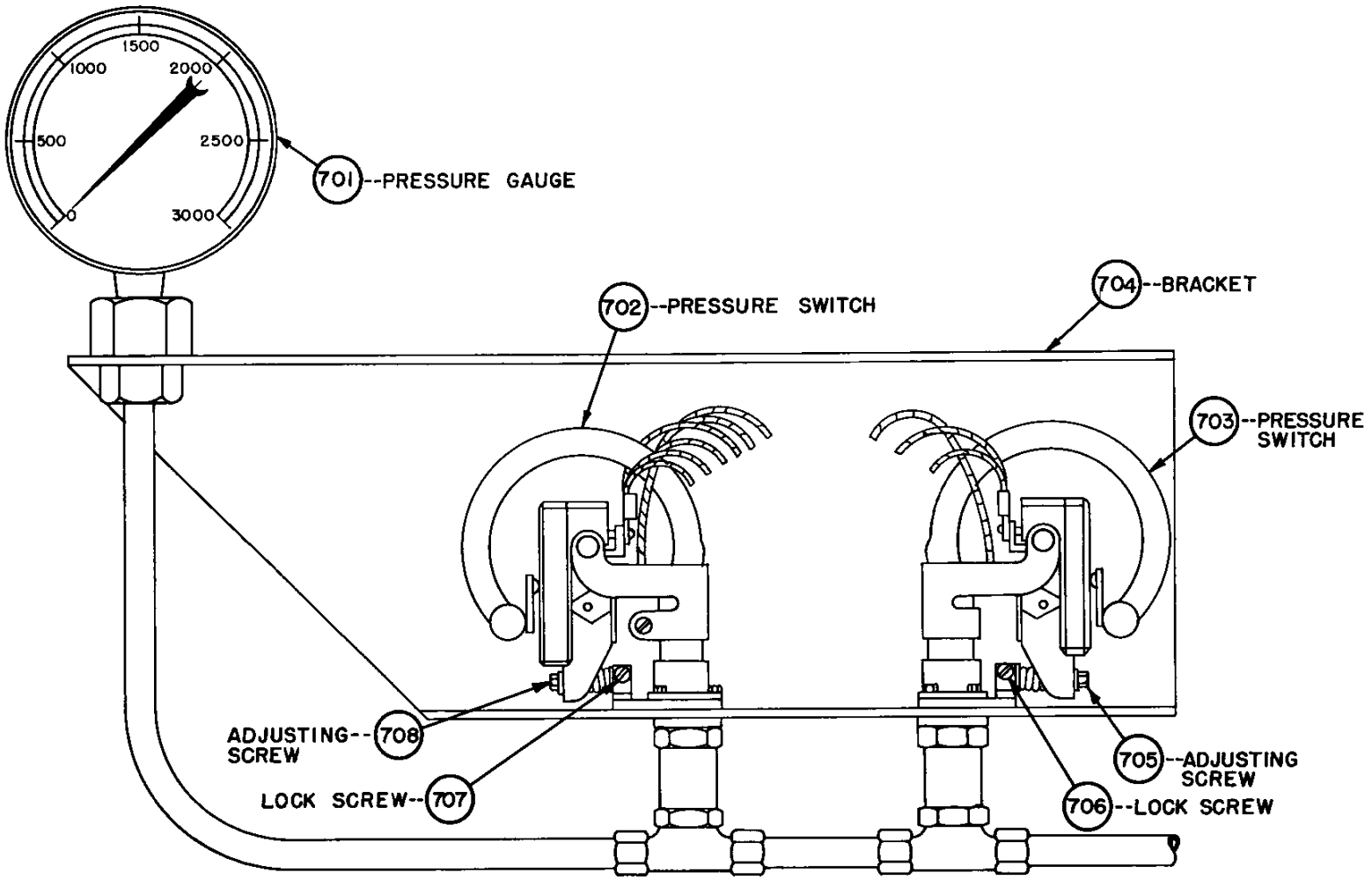


FIG.7

TYPICAL PRESSURE SWITCH AND GAUGE ASSEMBLY

OCTOBER 14, 1955

71-301-088

ALLIS-CHALMERS MANUFACTURING COMPANY

ALLIS-CHALMERS MANUFACTURING COMPANY

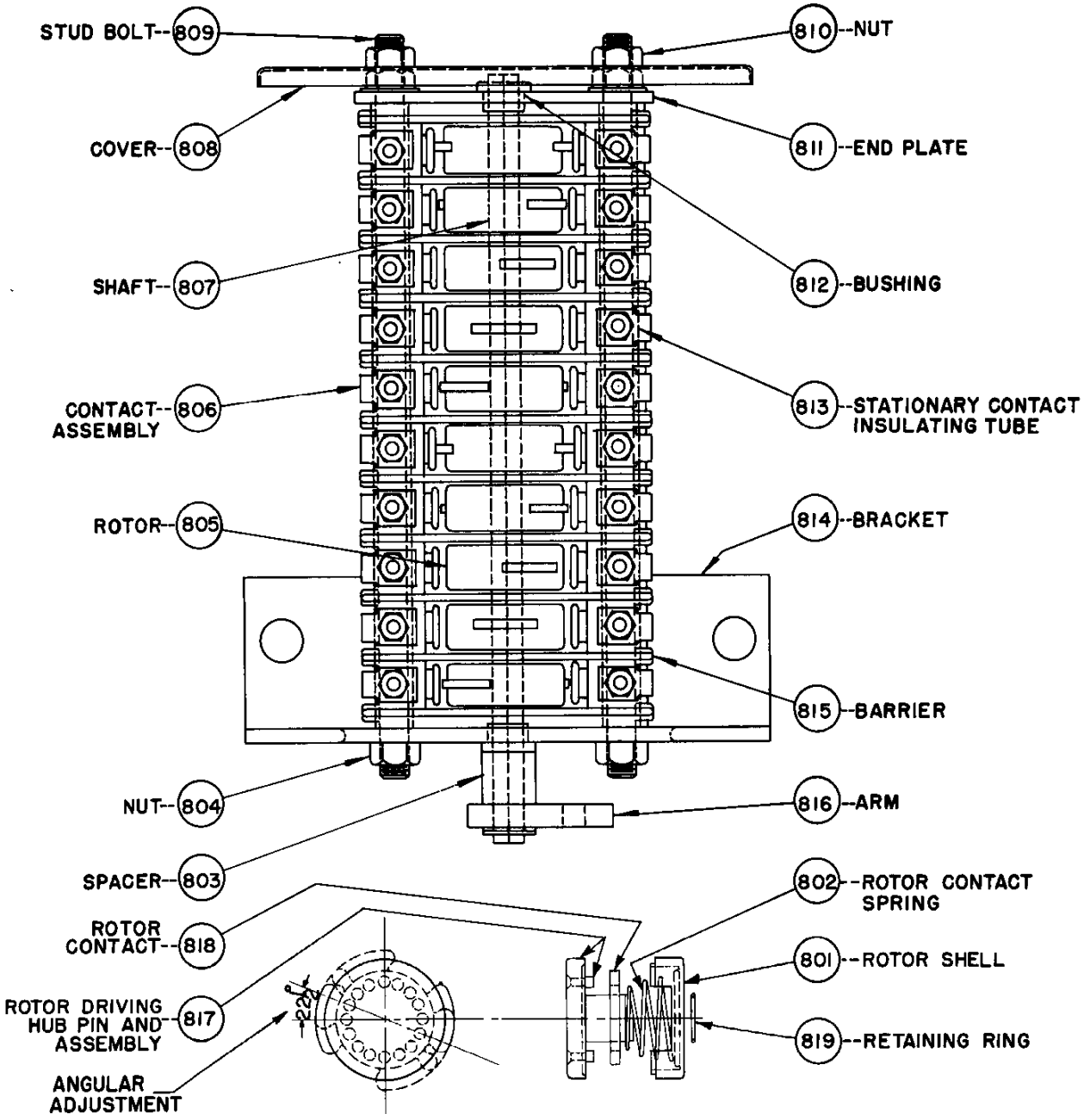


FIG. 8

TYPICAL AUXILIARY SWITCH

JANUARY 30, 1956 71-301-078

ALLIS-CHALMERS MANUFACTURING COMPANY

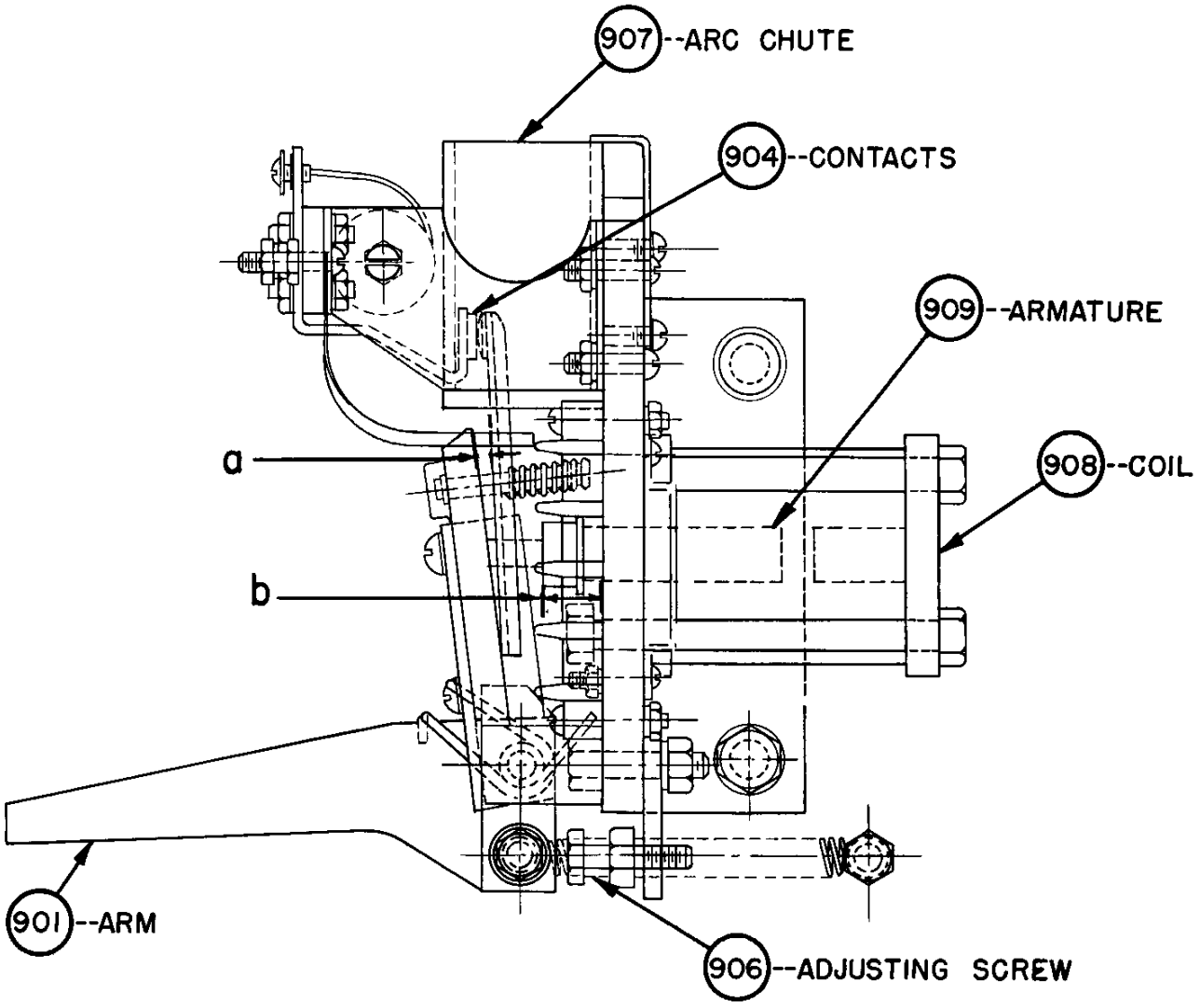


FIG.9

TYPICAL LIMIT SWITCH APPLICATION

FEBRUARY 3,1956

71-301-152

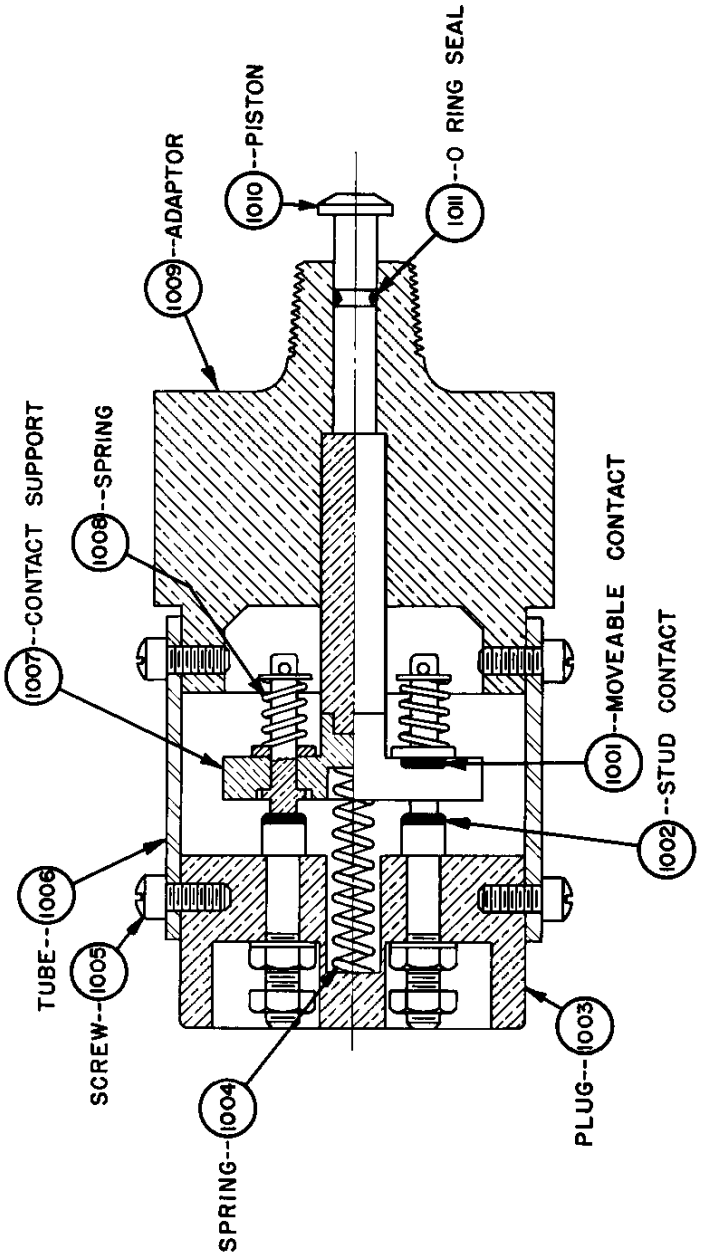


FIG. 10

TYPICAL HYDRAULIC SEAL-IN SWITCH
71-301-094
OCTOBER 21, 1955

"63S"

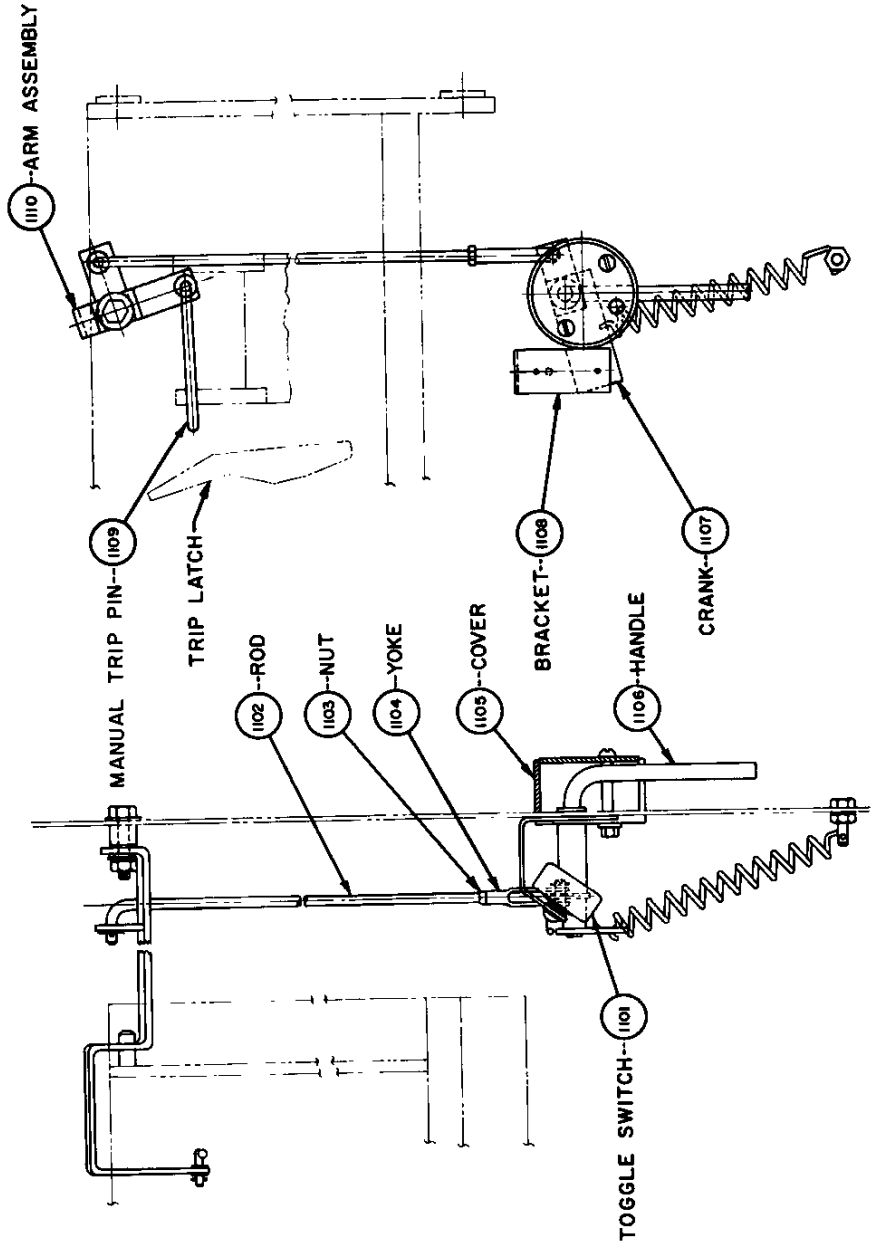


FIG. 11

TYPICAL OUTSIDE TRIP APPLICATION

71-400-752

JANUARY 27, 1956

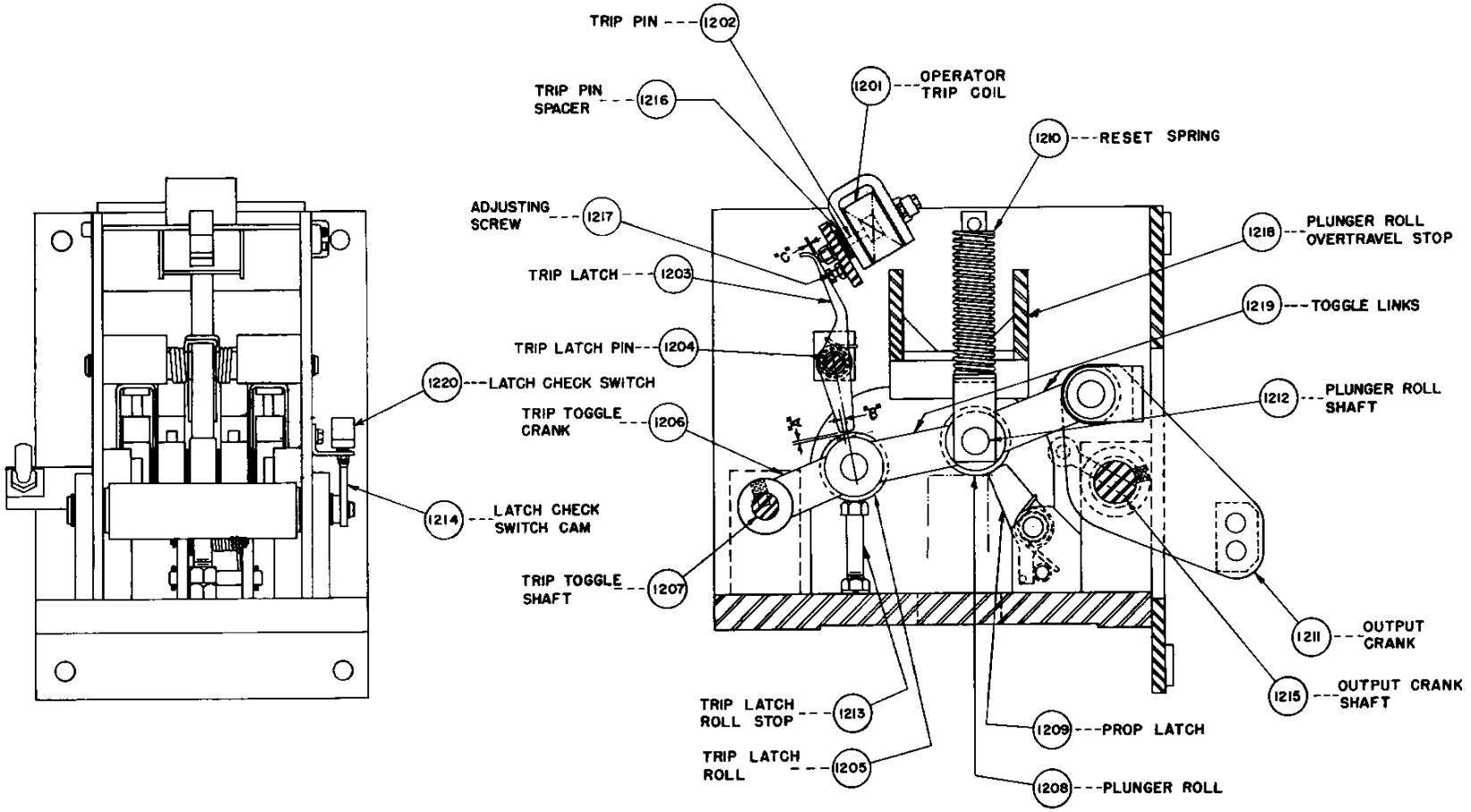


FIG. 12

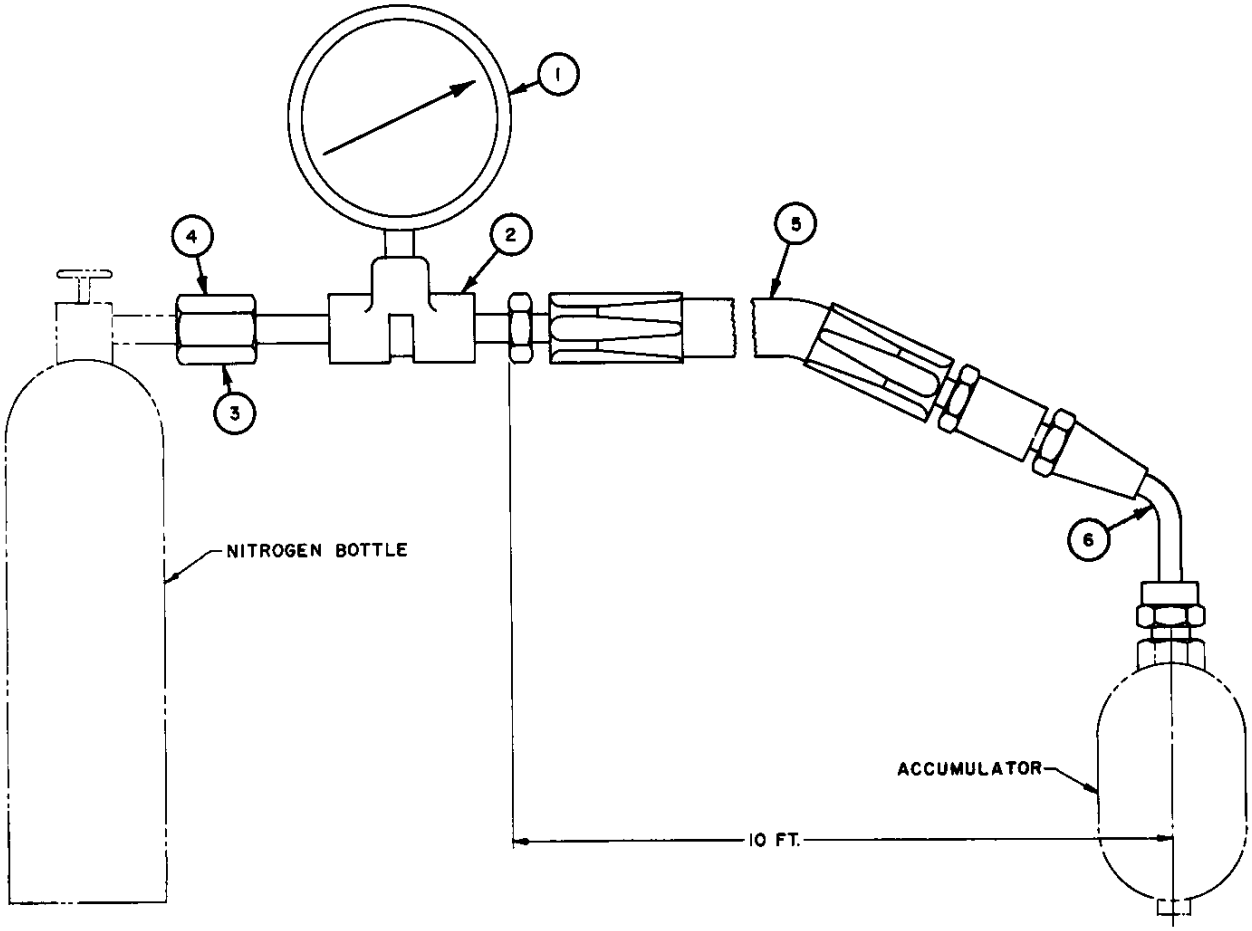
TYPICAL TYPE "C" OPERATOR MECHANISM

JANUARY 27, 1956

71-400-751

ALLIS-CHALMERS MANUFACTURING COMPANY

ALLIS-CHALMERS MANUFACTURING COMPANY



"*PNEU-DRAULIC*" OPERATORS ARE SUPPLIED WITH A CHARGING HOSE ASSEMBLY CONSISTING OF A PRESSURE GAGE ①, A 1/4" TEE ②, A GLAND ③, A GLAND NUT ④, A HOSE ASSEMBLY ⑤, AND A SWIVEL CONNECTOR ⑥ THE RECOMMENDED GAS IS "OIL PUMPED, OR DRY NITROGEN." DO NOT USE OXYGEN

PRECHARGING METHOD

1. MOUNT GLAND NUT ④ ON THE NITROGEN BOTTLE (LEFT HAND THREAD)
2. MOUNT SWIVEL CONNECTOR ⑥ ON THE ACCUMULATOR VALVE. HAND TIGHTEN SUFFICIENTLY TO COMPRESS GASKET IN SWIVEL CONNECTOR IN ORDER TO PREVENT LEAKAGE.
3. PROCEED TO INFLATE ACCUMULATOR TO PREDETERMINED PRESSURE BY OPENING VALVE ON NITROGEN BOTTLE SLOWLY, CLOSING IT OCCASIONALLY TO ALLOW NEEDLE ON GAGE ① TO SETTLE IN POSITION, THUS GIVING THE CORRECT PRESSURE IN THE ACCUMULATOR.
4. CLOSE VALVE ON NITROGEN BOTTLE SECURELY AND REMOVE CHARGING HOSE QUICKLY. A SLIGHT RELEASE OF PRESSURE WILL BE PRESENT WHEN HOSE IS REMOVED. THIS IS CAUSED BY THE NITROGEN WHICH WAS TRAPPED IN THE HOSE ASSEMBLY AND DOES NOT EFFECT ACCUMULATOR PRECHARGE.
5. CHECK FOR LEAKAGE BY PLACING A FEW DROPS OF OIL IN ACCUMULATOR VALVE AND INSTALL CAP.
6. CAREFULLY TEST ACCUMULATOR CONNECTIONS FOR LEAKAGE USING SOAP SUDS WHEN PRECHARGING IS COMPLETE

FIG. 13

ACCUMULATOR CHARGING HOSE ASSEMBLY

MAY 17, 1955

71-300-960

ALLIS-CHALMERS MANUFACTURING COMPANY

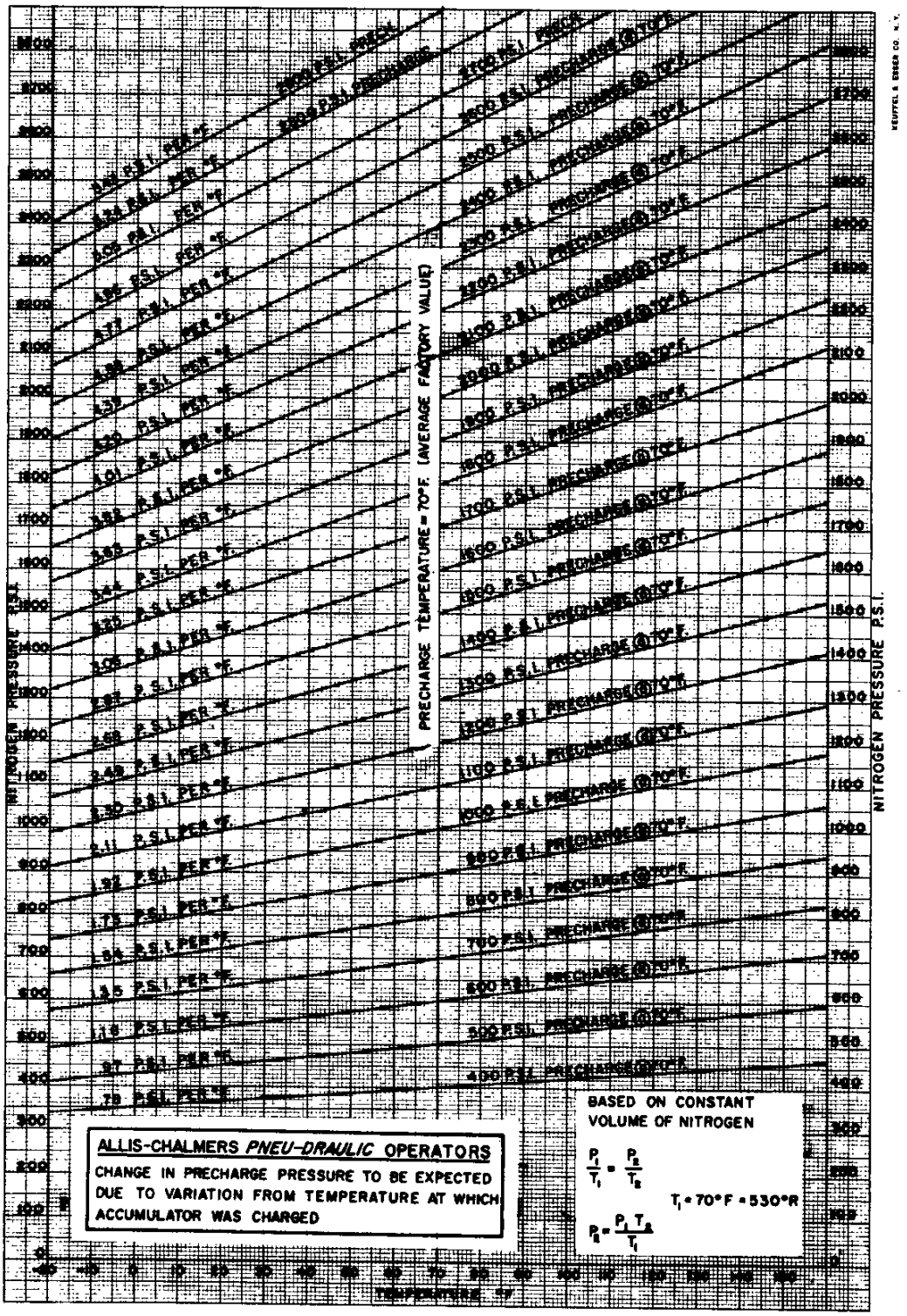
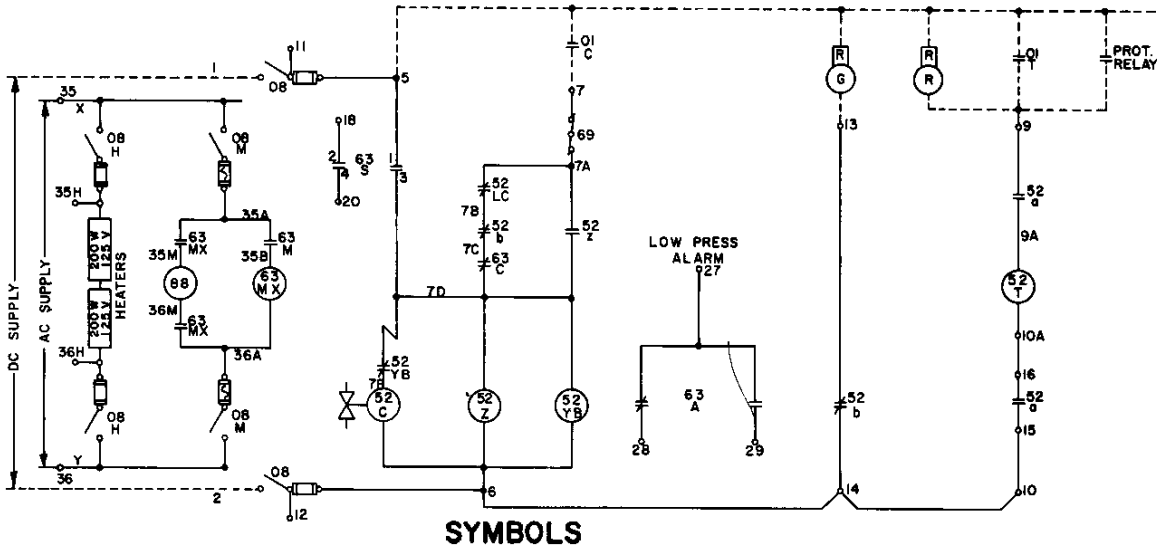


FIG.14

FEBRUARY 2, 1956

71-300-972

ALLIS-CHALMERS MANUFACTURING COMPANY



SYMBOLS

COIL, MOTOR OR LAMP AS MARKED
CONTACT, OPEN WITH DEVICE DE-ENERGIZED
CONTACT, CLOSED WITH DEVICE DE-ENERGIZED
SOLENOID OPERATED VALVE
FUSE TIME LAG FUSE
TERMINAL AT O.C.B. FOR EXTERNAL WIRES

DEVICES

01	CIRCUIT BREAKER CONTROL SWITCH
08	CONTROL POWER SWITCH OR AIR CIRCUIT BREAKER
08M	COMPRESSOR MOTOR POWER SWITCH OR AIR CIRCUIT BREAKER
08H	HEATER POWER SWITCH OR AIR CIRCUIT BREAKER
52	OIL CIRCUIT BREAKER (O.C.B.)
52a	O.C.B. AUX. SW. - OPEN WHEN BREAKER IS OPEN
52b	O.C.B AUX. SW. - CLOSED WHEN BREAKER IS OPEN
52C	OPERATING SOLENOID FOR CONTROL VALVE - SEE NOTE 2
52LC	LATCH CHECK SWITCH - CLOSED ONLY WHEN O.C.B. IS LATCHED TO OPERATOR
52T	TRIP COIL OF O.C.B.
52YB	MECHANICALLY OPERATED CUT-OFF AND ANTI-PUMP DEVICE - SEE NOTE 3
52Z	AUXILIARY RELAY
63A	PRESSURE SWITCH-LOW PRESSURE ALARM
63C	PRESSURE SWITCH-LOCKOUT-PREVENTS OPERATION AT LOW PRESSURE
63M	PRESSURE SWITCH-ACTS AS PRESSURE REGULATOR
63MX	AUX. RELAY FOR 63M
63S	HYDRAULICALLY OPERATED SEAL IN SWITCH
69	RECLOSER CUTOFF SWITCH-OPENED BY HAND TRIP LEVER, MANUALLY RESET
88	AUX. MOTOR OR MOTOR GENERATOR

NOTES

1. ALL EQUIPMENT SHOWN WITH O.C.B. OPEN, COILS DE-ENERGIZED, AND ACCUMULATOR AT NORMAL OPERATING PRESSURE.
2. WHEN 52C IS DE-ENERGIZED, VALVE IS POSITIONED CONNECTING TOP OF PISTON TO HIGH PRESSURE IN ACCUMULATOR AND BOTTOM OF PISTON TO ATMOSPHERE IN RESERVOIR. ENERGIZING 52C POSITIONS VALVE TO REVERSE PRESSURE IN CYLINDER AND CLOSE BREAKER.
3. CONTACT OF 52YB IS MECHANICALLY OPERATED, ELECTRICALLY HELD. IT IS OPENED LATE IN CLOSING STROKE MECHANICALLY AND HELD OPEN MAGNETICALLY AS LONG AS COIL OF 52YB IS ENERGIZED TO PREVENT PUMPING, BUT CONTACT CANNOT BE OPENED BY ENERGIZING COIL.
4. EQUIPMENT FURNISHED BY ALLIS-CHALMERS WILL BE SPECIFIED ON ORDER OR CONTRACT AND DOES NOT NECESSARILY INCLUDE ALL DEVICES SHOWN HERE TO MAKE DIAGRAM COMPLETE.
5. ALL GROUNDS BY PURCHASER.

FIG.15

TYPICAL ELEMENTARY WIRING DIAGRAM

OCTOBER 19, 1955

71-400-709