ALLIS-CHALMERS

INSTRUCTION BOOK

TDO OIL CIRCUIT BREAKER

TYPE-69-1

JULY 1968

BWX-6725-2

ALLIS-CHALMERS

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OIL CIRCUIT BREAKER
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GENERAL

An Allis-Chalmers Type TDO-69 Power Oil Circuit Breaker is a three phase, single tank, distribution type, outdoor unit for use under the 72.5 maximum design kv rating. It is shipped in final assembled form complete with permanent skid and ready to be mounted on its foundation. Each O.C.B. has been carefully inspected and packed by workmen experienced in the proper handling and packing of electrical equipment.

Upon receipt of the oil circuit breaker, remove all packing traces and examine carefully to see that it has not been damaged in transit. If any injury is discovered, a claim for damages should be filed at once with the transportation company. Then notify the nearest District Office of Allis-Chalmers with a copy of the inspector's report.

LIFTING A TYPE TDO BREAKER

A TDO breaker may be lifted by the use of a sling and chain-and-hooks of proper size. (Check local, state, or underwriter's specifications for regulations on safe chain vs load values.)

CAUTION: DO NOT ALLOW THE CHAINS OR SLINGS TO TOUCH THE BUSHINGS.

STORAGE

Immediately upon receipt of your Allis-Chalmers Oil Circuit Breaker it should be set upon its permanent foundation. If the breaker is not to be connected in service immediately, the tank should be cleaned, dried, and filled with approved insulating oil. When it is not possible to set the breaker on its permanent foundation, the tank should be filled with Allis-Chalmers Universal #3 Insulating Oil to protect the insulating parts of the breaker. If it is not possible to fill the tank with oil, the insulating parts must be kept dry through the use of space heaters or light bulbs which will maintain the inside temperature of the tank above the ambient.

The operating mechanism housing is weatherproof. However, to prevent corrosion due to moisture in the cabinet, the space heaters should be energized within a day or two at the latest, after their receipt, even to the extent of using temporary wiring. Machined parts of the operating mechanism should be coated with a light oil to protect them against corrosion.

Periodic inspection of the breaker while it is in storage is recommended to check for possible corrosion of mechanical parts. If the breaker has

been filled with insulating oil and stored for some time, the oil should be tested and possibly filtered. (Refer to Section on "CARE OF INSULATING OIL".)

If, due to improper storage, moisture occurs in the tank, remove the insulation parts of the interrupting device, lift rods, and guide system and dry them as follows. All impregnated wood parts are to be hung vertically to prevent warpage and dried at 100°F for 8 hours. All other insulation parts are to be dried at 150°F for a like period.

INSTALLATION

A TDO-69 should be mounted in a clean yard and have ample clearance to other apparatus or structures. It is advisable to provide a cement pad into which are imbedded suitable foundation bolts. Sufficient work space should be provided to facilitate inspection and tank removal.

It is important that the breaker be installed in a level position. This is accomplished by setting the breaker on its foundation pad and if necessary, inserting shims between the leg blocks (1-19) and the foundation to bring the breaker to a level position as indicated by levels supported across longitudinal leveling blocks (1-17) on the right hand side of the breaker, and lateral leveling blocks (1-18) at the rear of the breaker. Grout under both leg blocks (1-19) and permanent skids (1-1) and then tighten the hold down means.

Open the control cabinet to remove the shipping ties and/or blocking which hold the breaker in the closed position.

CAUTION: FOR SHIPMENT THE BREAKER IS BLOCKED IN THE CLOSED POSITION, SO CARE MUST BE EXERCISED IN REMOVING THE WEDGES AND OPENING THE BREAKER. NEVER TRIP, OR ALLOW TO TRIP, AN OIL CIRCUIT BREAKER WHILE WORKING ON IT SINCE THE PARTS MOVE SO RAPIDLY THAT ANYONE CAUGHT IN ANY MOVING PART MAY BE SERIOUSLY INJURED.

CAUTION: THE INTERNAL HYDRAULIC SHOCK ABSORBER IS EFFECTIVE ONLY WHEN UNDER OIL. THE OIL CIRCUIT BREAKER SHOULD NOT BE TRIPPED BEFORE THE TANK WITH OIL IS IN PLACE TO AVOID POSSIBILITY OF DAMAGE TO THE APPARATUS.

OPERATION

GENERAL

All adjustments have been made at the factory before shipment and generally no change is required. Therefore, proceed to lower the oil

tank, clean the bushings and examine them carefully for damage. See that all contact surfaces are clean and all current carrying members are in good mechanical condition. Operate the breaker carefully by hand using the means provided (see OPERATOR INSTRUCTION BOOK) to see that the settings are in accord with the adjustment instructions. Do not operate the unit electrically until all adjustments are correct. In particular, check to see that the plungers pass into the center of the hole in the bottom of the Type LC-1 Interrupting devices.

POLE UNIT (Ref. Figure 2)

The essential elements of the TDO-69 pole unit mechanism are a pair of radius arms (2-10) attached at one end to hexagonal main shaft (2-30), each carrying on the opposite end links (2-28) connected to the crosshead (2-24), which actuates movable members (2-1). A mechanism frame (2-20) guides the crosshead (2-24), retains the main shaft bearing (2-21), and holds the lift rods guiding system composed of the two supports (2-25), two rod guides (2-27), and spacers (2-27A). Motion is limited in the closed direction by the lift rods (2-1A) of movable member (2-1) striking the overtravel stops (2-13) on the closing stroke and by the crosshead (2-24) striking the open position stops (2-5) on the shock absorbers (2-4) on the opening stroke. Yoke (2-19) on the end of lift rod (2-1A) provides a #10-32 tapped hole as means for connecting the user's speed analyzer.

OPERATING MECHANISM

The TDO-69 was designed for use with pneumatically actuated operators. For pertinent instructions see the Instruction Book referred to on the Operator Rating Plate.

MANUAL OPERATION FOR MAINTENANCE

The internal hydraulic shock absorber is effective only when under oil therefore, the circuit breaker should not be tripped before the tank with oil is in place to avoid possibility of damage to the apparatus. Therefore, with the tank removed for maintenance inspection, manual operation to slowly open and close the breaker must be employed.

Instructions for use of the maintenance closing device are given in the appropriate operator instruction book.

ADJUSTMENTS

FRONT END LINKAGE (Ref. Figures 2 & 3)

The length of connecting rod assembly (3-8), (3-14), (3-15) must be adjusted to obtain .010 +.031 -.000 clearance between the tops of the lift rod yokes (2-19) of lift rods (2-1A), and the overtravel stops (2-13).

This will give a clearance of 1" +0, -.31 between the cross bars of movable members (2-1) and the bottoms of the LC-1 interrupting devices. The overtravel stop assemblies should be snug but not tight (no initial compression) and the faceplates (2-13) must be in the same horizontal plane in order to obtain the prescribed clearance between the lift rods and stops.

To adjust the connecting rod assembly:

1. Place breaker in open position.

2. Remove retaining ring from the front of pin (3-4).

3. Loosen lock nut (3-14).

4. Rotate yoke (3-15) as required. Shortening the connecting rod assembly will decrease the clearance between the lift rod yokes and overtravel stops.

5. Replace pin (3-4), and fully close the breaker manually as described in the Operator Instruction Book. Carefully watch the overtravel stop clearance as the operator latch position is approached, to be sure that yokes (2-19) do not strike the overtravel stops before the operator latch position is reached.

6. Repeat the preceding sequence as necessary to obtain required clearance.

7. Lock nut (3-14) securely in place and replace the retaining ring.

SHOCK ABSORBER (Ref. Figure 2)

With the breaker in the open position, adjust the height of shock absorber (2-4) by adding or removing shims (2-36) to obtain .06" minimum to .37 maximum clearance between the operator plunger roll and ram cap.

STROKE (Ref. Figure 2)

The breaker stroke is determined by the open and latched positions of the operator and should fall within the limits defined by the 13.0 ± .62" dimension.

OPENING SPRING (Ref. Figure 3)

The opening velocity is determined by the compression of opening spring (3-10). With the breaker in the open position, nut (3-13A) and locknut (3-13B) should be set to achieve 11 to 13 feet/second opening velocity as measured in the first 4" of travel after contact part.

IMPULSE SPRINGS (When Furnished) (Ref. Figure 2A)

The time between initiation of trip coil voltage and start of breaker contact movement to open is reduced by the compression of the two impulse spring assemblies.

These two assemblies are mounted on mechanism frame (20, Figure 2) and are located between the lift rod overtravel stops (13, Figure 2). They are set at the factory to give 1.000" +.062, -.500 of spring compression when the crosshead (24, Figure 2) is in the breaker closed and latched position. If readjustment is required it is accomplished by loosening lock nuts (2-2A) and locating plate guide bolts (4-2A) to provide the required breaker closed and latched compression.

With striker plate (2A-3) against heads of plate guide bolts (2A-4) (breaker open) springs (2A-7) and (2A-8) should be snug against striker plate (2A-3) but should have no initial compression. Spacers (2A-5) and (2A-6) are used for this adjustment.

MAIN SHAFT END-PLAY (Ref. Figure 2)

End play of main shaft (2-30) is determined by adding or removing shims (2-21G) located between housing (2-21A) and plate (2-21E) to obtain .062" $\pm$ .031" of play. CAUTION: Shaft must be free to rotate in all positions.

LC-1 INTERRUPTING DEVICE (Ref. Figures 2 & 4)

INSPECTING STATIONARY CONTACTS

To inspect the stationary contacts without removing the interrupting devices from the breaker, the following procedure should be followed:

1. Remove resistor (4-26).
2. Remove set screw (4-14) at the bottom of the interrupter shell (4-12).
3. Using a 3" spanner wrench, loosen bottom plate (4-13) several turns to relieve the stacking pressure.
4. Remove set screw (4-23) at the top of the interrupter shell.
5. The interrupter shell and its baffles intact within the shell, can now be removed by unscrewing it from contact casting (4-6) using a strap wrench.

The stationary contacts can now be inspected. All fiber parts comprising the interrupter stack can now be removed from the interrupter shell for inspection and replacement as required. If the contacts require removal for dressing or replacement, the interrupter should be removed from the breaker.

TO REASSEMBLE

1. Screw on shell (4-12).

   WARNING: When replacing the shell, please note that it must be oriented so that the exhaust port faces outward and is in line with the lift rod. Rotate shell (4-12) into correct alignment having the top of the thread of the top casting (4-5) line up with the top of the shell within 1/2 turn, and replace set screw (4-23) at the top of the shell.

2. Screw in bottom plate (4-13) to obtain tight stacking and replace set screw (4-14) at the bottom of the shell. There are four (4) tapped holes (one every 90°) in the bottom plate to allow for adjusting the bottom plate within 1/4 turn.

3. Install resistor (4-26). Note that angle (4-27) mounts in a machined slot in the bottom of the shell.

TO CHANGE STATIONARY ARCING CONTACTS

1. Remove interrupting devices (2-3) from the breaker by removing mounting bolts (4-1).

2. Remove interrupter shell (4-12) by following steps 1 through 5 "INSPECTING STATIONARY CONTACTS" above.

3. Remove screw (4-18) from housing (4-21).

4. Pry off tube (4-20).

5. Remove buttons (4-19), compression springs (4-17), housing (4-21), and contact fingers (4-22).

REASSEMBLY AND MOUNTING OF INTERRUPTING DEVICES

1. With the interrupting device upside down, put the eight (8) contact fingers (4-22) in place, and then housing (4-21).

2. Carefully insert a button (4-19) and compression spring (4-17) on each contact finger through the access holes in housing (4-21).

3. Press the tube (4-20) into place over housing (4-21) orienting the tube so that the access hole on the lower end lines up with the tapped hole on the lower end of housing (4-21).

4. Replace screw (4-18) at the bottom of housing (4-21).

5. Replace shell (4-12) and resistor (4-26) as outlined on page 6, "TO REASSEMBLE".

   WARNING: When remounting the interrupters on the breaker, make sure that exhaust ports are facing outward and in line with the lift rods. Refer to Figure 4A for the proper orientation.

For notes on proper alignment of the interrupters, refer to "INTERRUPTER ALIGNMENT", below.

INTERRUPTER ALIGNMENT (Ref. Figures 2, 5, 6)

The interrupting devices are properly aligned only when all 6 movable contact plungers (2-2) freely enter their respective interrupting devices to a depth of approximately five (5) inches (using maintenance closing device) and at this position each movable member (2-1) can be moved freely a small amount in all directions within its guide (2-34).

To accomplish alignment, several adjustments are provided:

1. In the movable members, blocks (5-4) may be moved between bars (5-3) by loosening bolts (5-12) and (5-6).

2. In the adapters (2-32), oversize holes have been provided for mounting bolts (4-1) to provide lateral adjustment of the interrupter, and a leveling ring (4-4) and leveling ring seat in top casting (4-5) have been provided to allow for any leveling required on the interrupter. Loosen bolts (4-1), make necessary adjustment, and then retighten.

MOVABLE CONTACT ADJUSTMENT (Ref. Figures 4, 5, 6)

1. The Type LC-1 Interrupting Device and plungers should require no adjustment. However, for plunger replacement or keeping the present settings, see that all plungers make contact together and slide sufficiently into the stationary contact assembly to make full penetration. This may be done with the shell (4-12) in place by proceeding as follows:

2. Close the breaker with the plungers extending no more than 9" from surface "D". Measure the distances from surface "A" to surface "C", and surface "C" to surface "D".

3. Add dimensions ("A" to "C") and ("C" to "D"), and subtract 2.87" therefrom. Open the breaker and readjust the plunger to this value ± .06, and lock securely with bolts (5-6) and (5-13).

4. Wipe, clean and coat top end of plunger with petroleum jelly.

5. Repeat steps 1 through 4 for each individual plunger setting.

CONTACT CLEANING

In general, before putting the tank in place, wipe all contact surfaces clean with a cloth soaked in a suitable solvent and re-coat with light application of petroleum jelly. After the breaker has been in service for a period of time or after an interruption, a file or sandpaper may be required to dress the arcing contacts. Abrasives, however, **SHOULD NEVER BE USED** on the silver plated contact surfaces of the current carrying parts. Unlike copper, these contact surfaces are good electrical conductors, even when tarnished.

OIL AND GAS SEPARATOR

The oil and gas separator is provided to facilitate escape of gases incident to circuit interruption and to prevent oil throw. It consists of a specially shaped chamber which provides a restricted passage leading from the interior of the insulator support to the atmosphere. The exhaust opening of the gas and oil separator has a standard pipe thread.

During circuit interruption, gases are liberated. These gases rise through the oil to the expansion chamber formed by the insulator support and then escape through the oil and gas separator. Oil particles that may be mixed with the gases are separated, due to the enforced changes in direction of gas flow and are returned to the breaker tank.

TANK

Make sure that the tanks are clean and dry and tank linings are in place, then install on breaker and fill with A-C Universal #3 oil, as shipped with the oil circuit breakers, to the center of the oil gauge. Access to the inside of breaker for oil filling purposes may be had by removing the pipe cap on the fill pipe (2-23).

OIL

Each Allis-Chalmers oil circuit breaker is shipped with sufficient oil to fill tanks to the required level. The oil furnished is of special grade carefully selected for this service, known as A-C Universal #3. It has a high flash point, low freezing point, high resistance to carbonization, and will not readily retain moisture in suspension.

As satisfactory operation of oil circuit breakers depends on the use of a suitable oil, properly maintained, it is advisable to use only oil furnished or recommended by the breaker manufacturer.

The dielectric strength of the oil as shipped is at least 22,000 volts when tested between 1" diameter discs spaced 1/10" apart. If the oil tests less than 22,000 volts, it should be filtered before being placed in the oil circuit breaker tank.

CONTROL WIRING DIAGRAMS

For control wiring diagrams, refer to prints of the particular wiring arrangement furnished with each breaker.

LIST OF CAUTIONS

1. DO NOT ALLOW THE CHAINS OR SLINGS TO TOUCH THE BUSHINGS.

2. FOR SHIPMENT THE BREAKER IS BLOCKED IN THE CLOSED POSITION, SO CARE MUST BE EXERCISED IN REMOVING THE WEDGES AND OPENING THE BREAKER. NEVER TRIP, OR ALLOW TO TRIP, AN OIL CIRCUIT BREAKER WHILE WORKING ON IT SINCE THE PARTS MOVE SO RAPIDLY THAT ANYONE CAUGHT IN ANY MOVING PART MAY BE SERIOUSLY INJURED.

3. THE INTERNAL HYDRAULIC SHOCK ABSORBER IS EFFECTIVE ONLY WHEN UNDER OIL. THE OIL CIRCUIT BREAKER SHOULD NOT BE TRIPPED BEFORE THE TANK WITH OIL IS IN PLACE TO AVOID POSSIBILITY OF DAMAGE TO THE APPARATUS.

CONNECTIONS

Oil circuit breakers of this class may be furnished with up to twelve bushing type current transformers in accordance with service requirements. The standard arrangement and markings of current transformer leads conforms with NEMA Standards. All breakers are wired according to this arrangement unless otherwise specified.

The current transformer ratios and taps are shown on the current transformer nameplates mounted in the operator housing opposite the terminal blocks for the bushing type current transformer leads. All current transformer leads are brought out to a terminal block and the identity of each lead indicated.

The leads pass from the breaker tank to the operator cabinet through a compressible sealing plug (3-40). Each lead passes through an individual hole in the plug and they are sealed by tightening the clamp band (3-39).

Bushing type current transformers have the equivalent of only one primary turn and must, therefore, operate on low values of ampere turns particularly for low values of primary current. Below 200 amperes primary current, they require special consideration of the secondary burdens in their application.

GROUND CONNECTIONS

The frame of the oil circuit breaker should be permanently grounded. A good permanent low resistance ground is essential for adequate protection. A poor ground may be worse than no ground at all. It gives a false feeling of safety to those working around the equipment and may also result in ultimate loss of life or damage to the apparatus.

FINAL INSTALLING INSPECTION

1. Make sure that the oil circuit breaker is properly set up and leveled on its supporting structure.

2. See that all bearing surfaces of the operating mechanism have been lubricated.

3. Inspect all insulated wiring and see that it has not been damaged. Test the wiring for possible grounds or short circuits.

4. Make sure that all current carrying parts outside the oil circuit breaker are correctly insulated in accordance with standard practice.

5. Make sure that all joints are made correctly whether they are soldered joints, clamped joints made with wires or cables, or bolted joints of copper bars.

MAINTENANCE

Upon the proper operation of the oil circuit breaker depends the safety of the users' personnel and the successful functioning of the connected apparatus. It is, therefore, recommended that the breaker be thoroughly inspected, both mechanically and electrically, at least once every three months.

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

Inspect the operating mechanism periodically and lubricate all bearing surfaces of the mechanism with a good low cold test lubricant. Since atmospheric conditions including corrosive gases will affect any grease and shorten its life it should be removed and replaced as necessary.

Keep the bearing surfaces of the rods and levers adequately lubricated and free from grit and other contamination as the mechanism cannot operate properly with sluggish bearings.

The following paragraph, quoted from the definition of interrupting capacity in the AIEE Rule 19A-216, Oil Circuit Breaker Standards, should be observed:

> "After a performance at or near its interrupting rating, it is not to be inferred that the breaker can meet its interrupting rating without inspecting, and if necessary, making repairs."

See that the oil is kept at a proper level in the tank and that the proper dielectric strength of the oil is maintained. Add new oil occasionally to compensate for the slight evaporation.

It is recommended that the oil be changed or filtered and carbon cleaned from bushings and other parts every six months, or more often, depending upon the severity of the service. The oil should be filtered after successive openings under load short circuit, etc. If it shows signs of carbonization, or lowered dielectric strength due to dirt or suspended matter therein, test the oil before replacing it in the tanks. Carbonization is generally indicated by a flaky black precipitate which floats in the oil samples taken from the bottom of the tank. Tests that show less than 16,500 volts per 0.10" gap between 1" diameter discs, requires that the oil be filtered or reconditioned.

TANKLIFTER

For instructions on use of the hydraulic tanklifter, see Instruction Book BWX-6501.

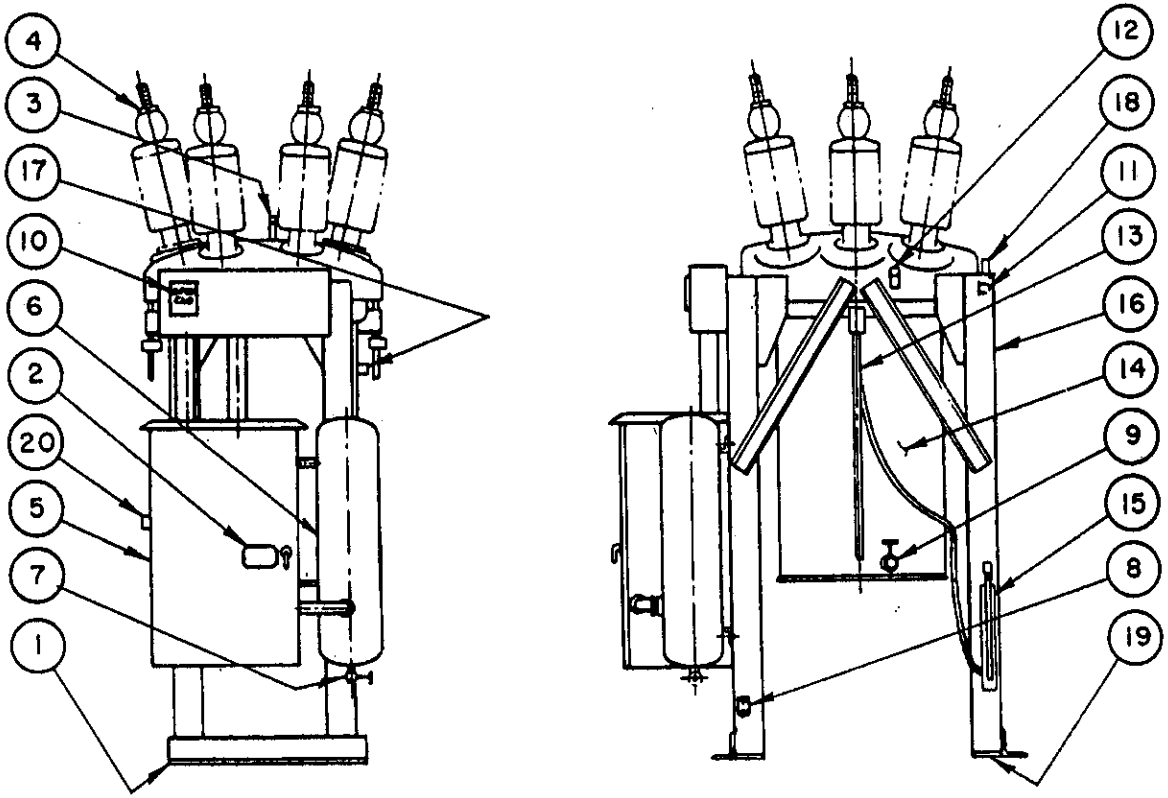
REPAIR PARTS

When ordering supply parts, refer to the figures in this book and then specify quantity, name, figure number, and reference, type, amperage, voltage, and serial number of the breaker on which the parts are to be used. Use the recommended spare parts lists whenever possible.

EXAMPLE: - 6 - Plunger (Ref. #2, Figure 5, Instruction Book BWX-6676-1) for Type TDO-69, 1200 Ampere, 69 kv, Oil Circuit Breaker, S/N 338134

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

A minimum charge will be made on all orders.



1. PERMANENT SKID
2. PRESSURE GAUGE AND OPERATIONS COUNTER
3. OIL GAUGE
4. BUSHING
5. OPERATOR HOUSING
6. AIR TANK - USED ONLY ON PNEUMATIC OPERATED BREAKERS
7. DRAIN VALVE FOR AIR TANK
8. GROUND PAD
9. 1" DRAIN VALVE
10. OPEN-CLOSE INDICATOR
11. 1" FILL PIPE
12. GAS AND OIL SEPARATOR VENT
13. HYDRAULIC TANKLIFTER
14. TANK
15. HAND PUMP FOR TANK LIFTER
16. BREAKER FRAME
17. LONGITUDINAL LEVELING BLOCKS
18. LATERAL LEVELING BLOCKS
19. LEG BLOCKS
20. OUTSIDE MANUAL TRIP

FIG. 1

TYPICAL TDO OIL CIRCUIT BREAKER

SEPTEMBER 18, 1967 72-210-583-401

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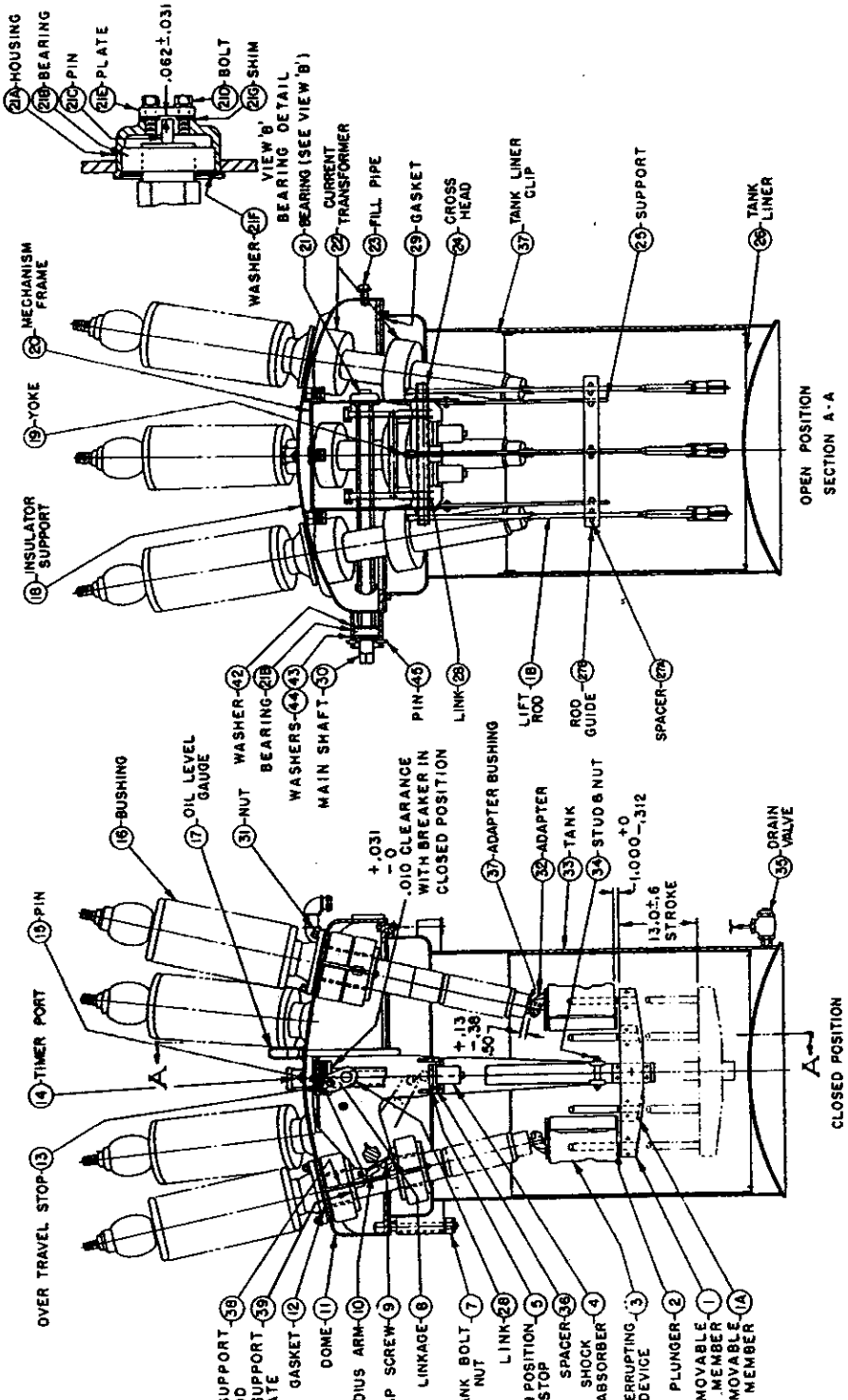

FIG. 2

TYPICAL TDO-69 POLE UNIT

NOV. 2, 1967 72-310-199-401

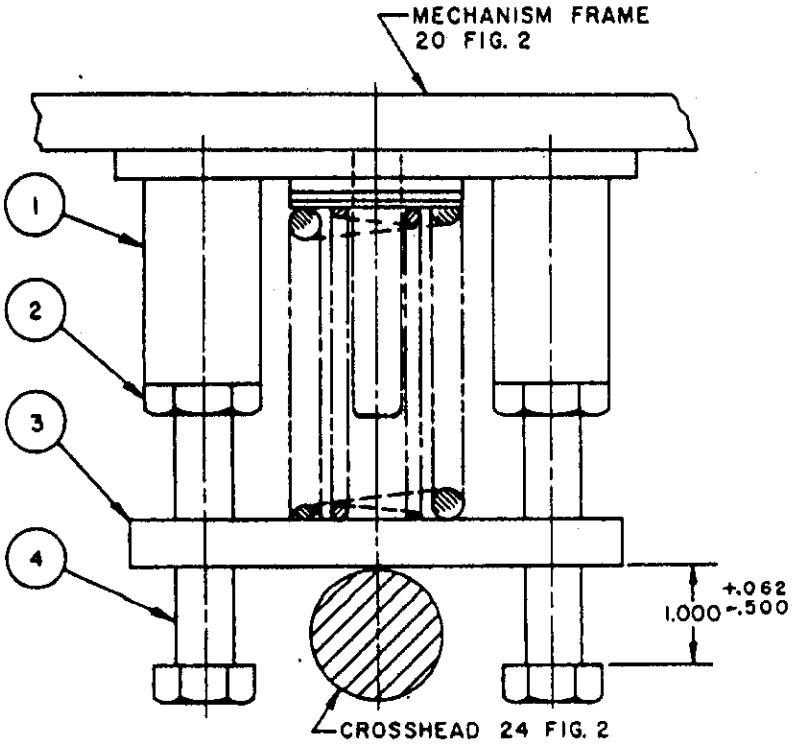

FIG. 2AX

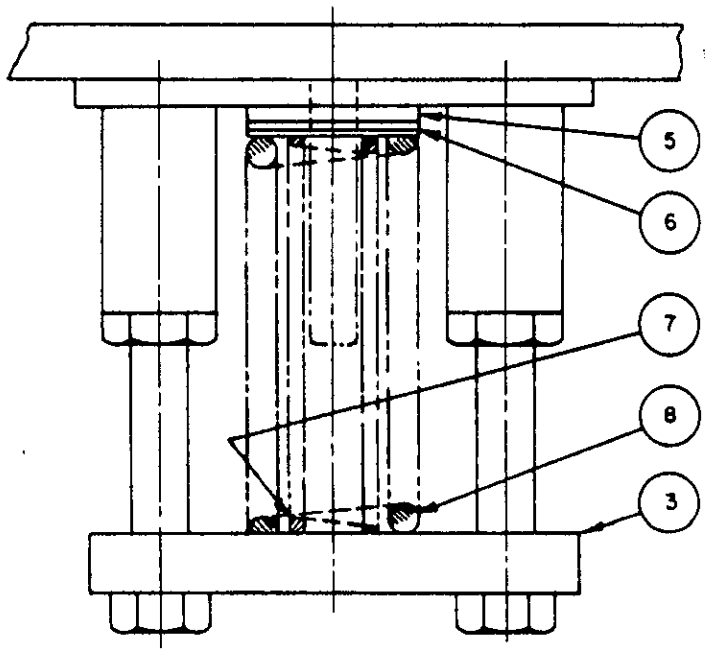

FIG. 2AY

1. SPRING MOUNTING
2. LOCK NUT
3. STRIKER PLATE
4. PLATE GUIDE BOLT
5. SPACER
6. SPACER
7. SPRING, INNER
8. SPRING, OUTER

FIG. 2A

TYPICAL IMPULSE SPRING APPLICATION

SEPT. 5, 1967 72-210-574-401

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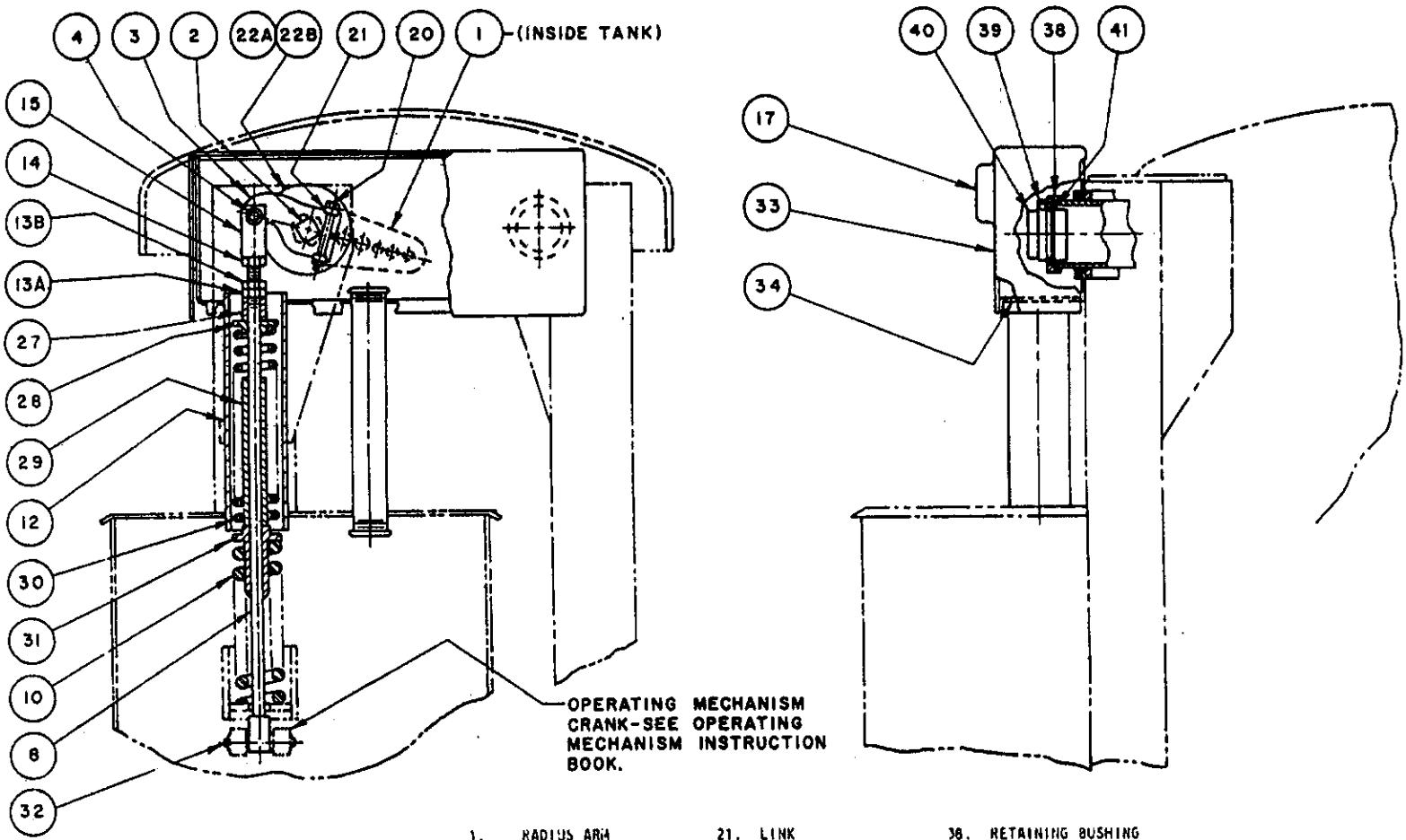

1. RADIUS ARM (INSIDE TANK)
2. MAIN SHAFT
3. MAIN CRANK
4. PIN
8. ADJUSTABLE LINKAGE
10. OPENING SPRING
12. TUBE
13A. NUT
13B. LOCK NUT
14. NUT
15. YOKE
17. INDICATOR HOUSING
20. CAP SCREW
21. LINK
22A. PLATE
22B. GASKET
27. SPACER
28. PLATE GUIDE
29. SLEEVE
30. GUIDE PLATE BIASING SPRING
31. SPRING GUIDE (OPENING SPRING)
32. PIN
33. COVER
34. BOX
38. RETAINING BUSHING
39. CLAMP BAND
40. SEALING PLUG
41. WASHER

FIG. 3

TYPICAL TDO FRONT END LINKAGE

SEPTEMBER 11, 1967 72 192 401

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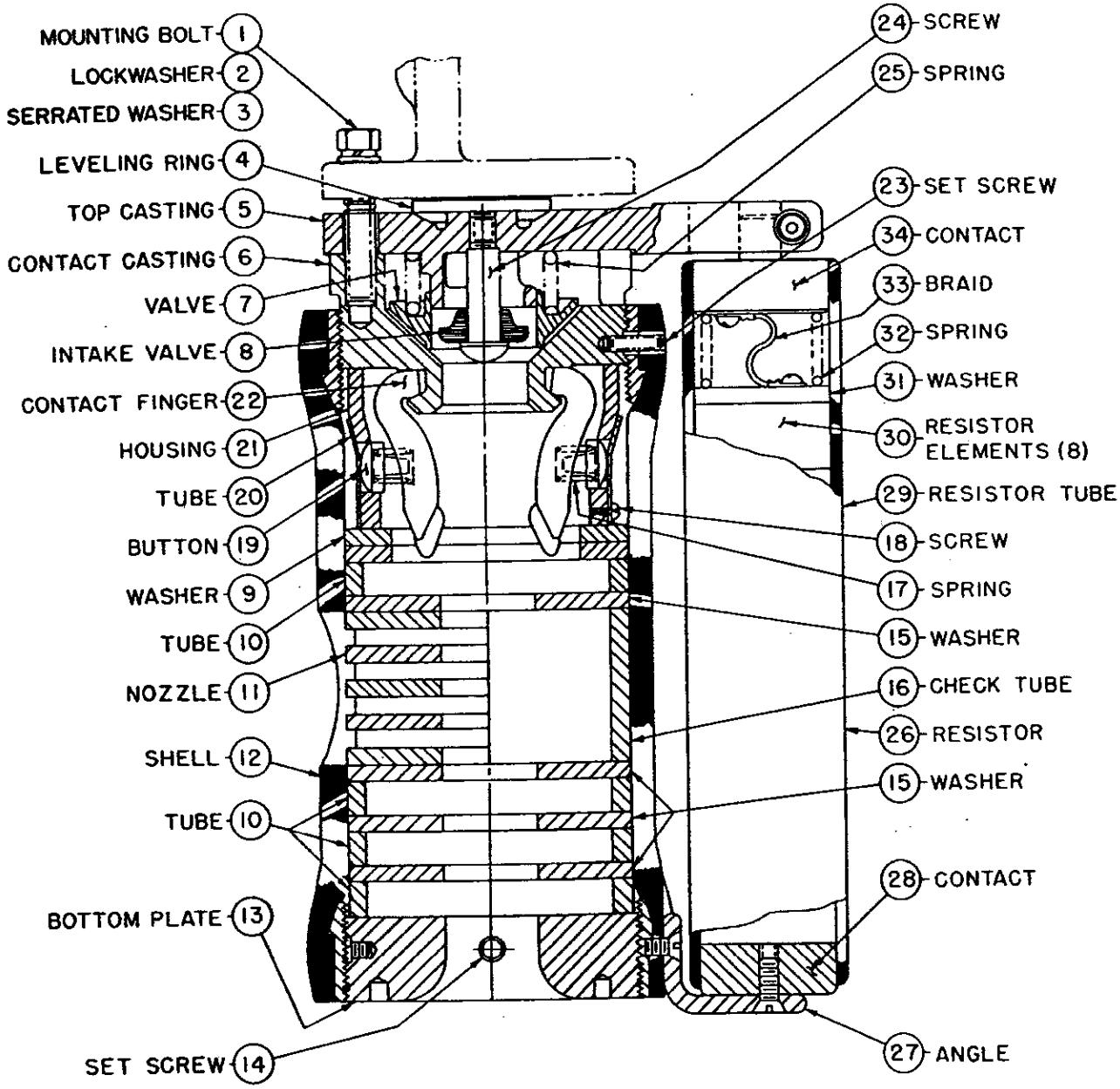

FIG. 4

TYPICAL INTERRUPTOR
APRIL 5, 1966 72-310-044-402

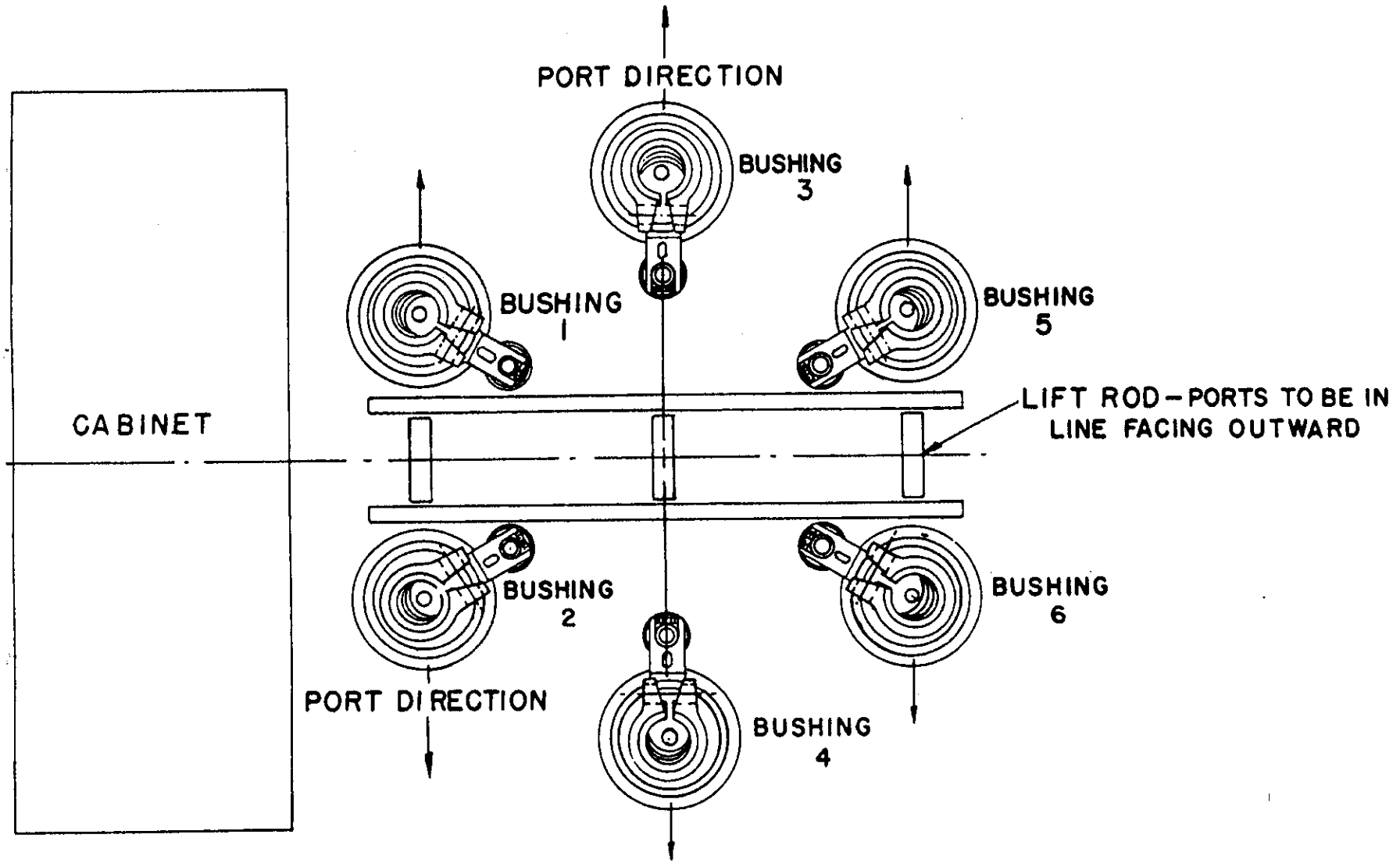

FIG. 4A

PLAN VIEW OF PORT LOCATIONS OF INTERRUPTORS

OCT. 30, 1964 71-(illegible)-665-401

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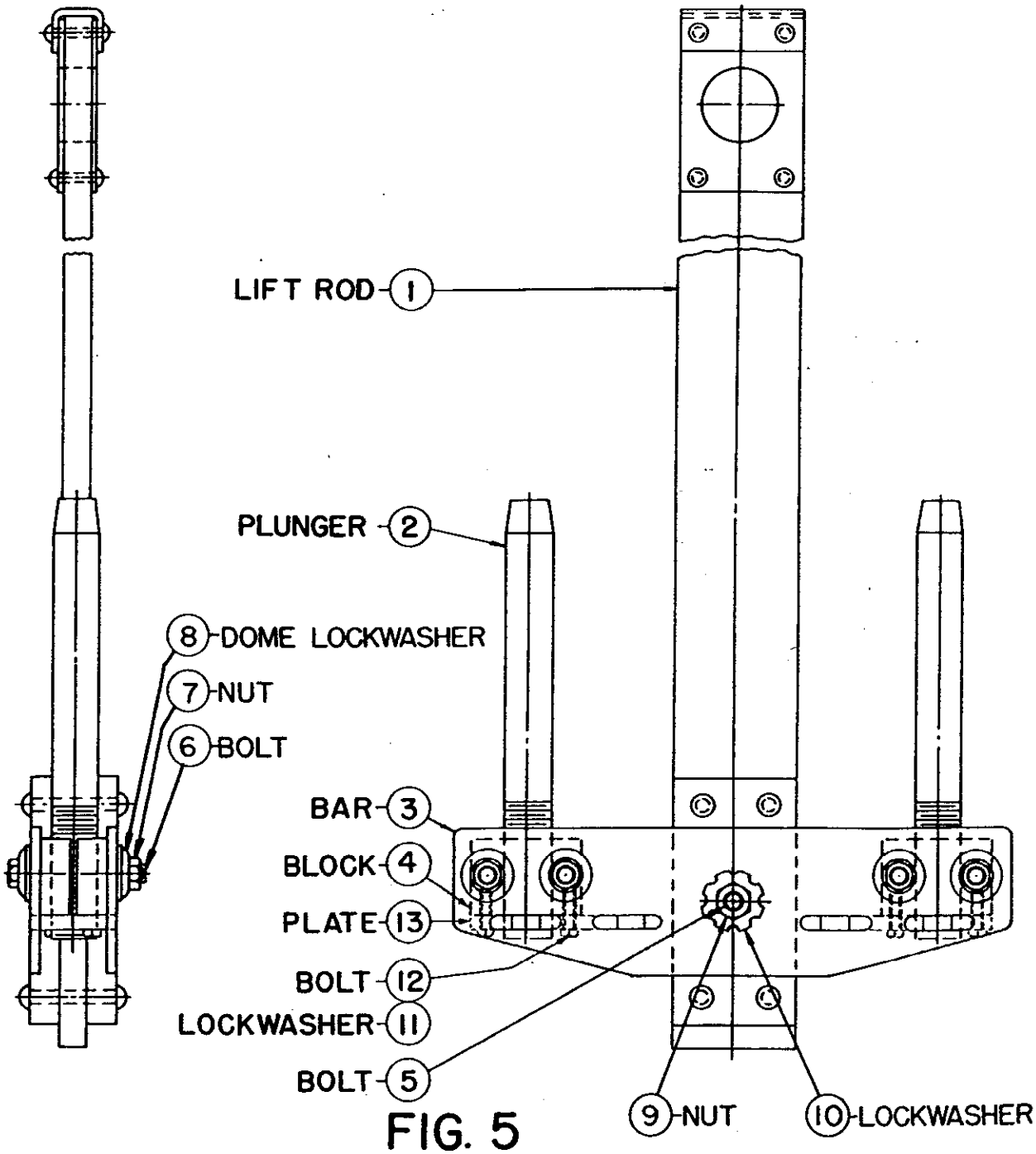

FIG. 5

TYPICAL TDO MOVABLE MEMBER

MARCH 29, 1966 72-310-102-401

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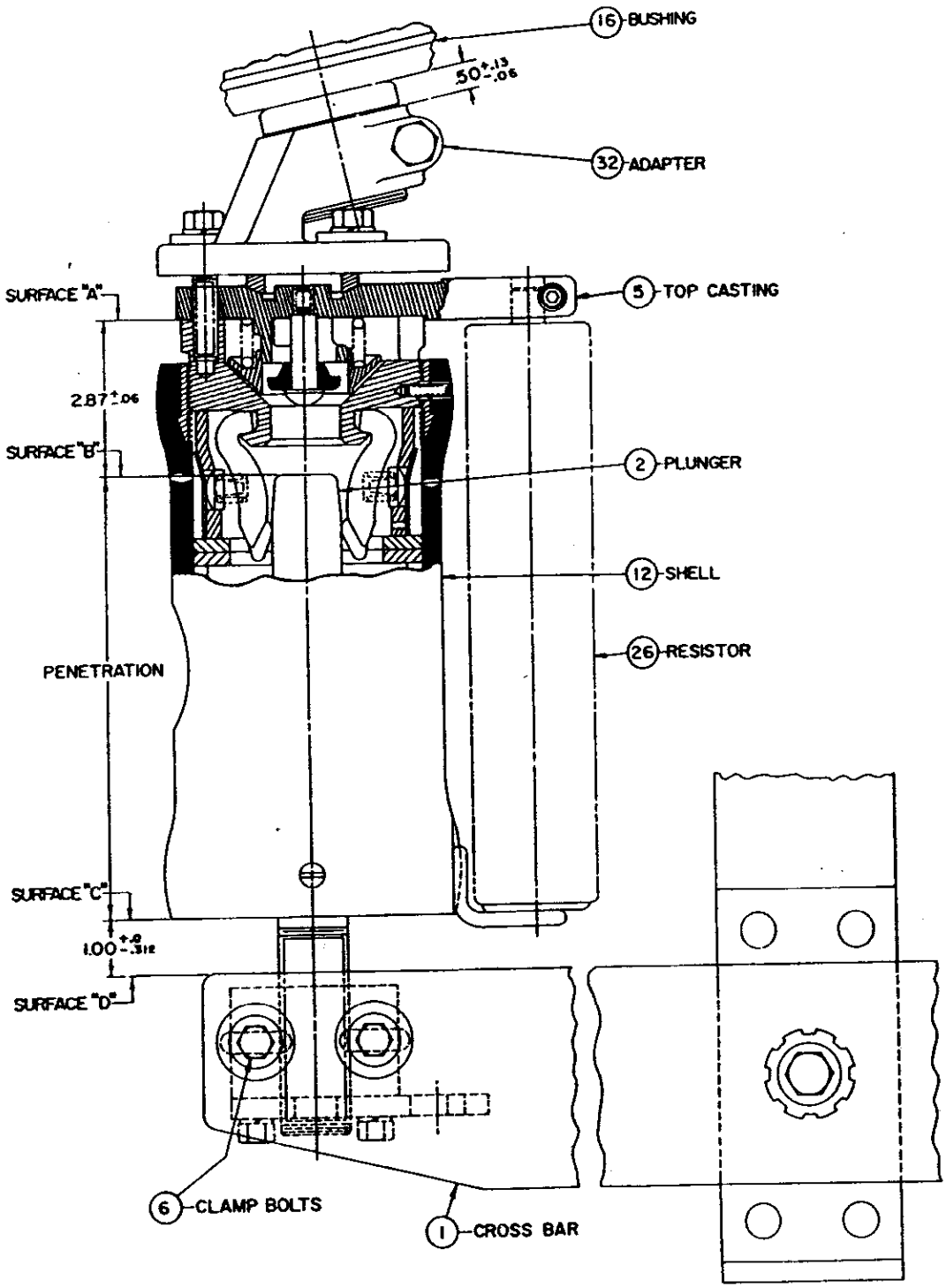

FIG. 6
PLUNGER ADJUSTMENT
(FOR TDO INTERRUPTER)
JUNE 8, 1967 72-410-084-401