ALLIS-CHALMERS

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TYPE SDO-15 AND 23
OIL CIRCUIT BREAKER

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INSTRUCTIONS FOR INSTALLATION AND OPERATION

GENERAL

An Allis-Chalmers Type SDO Power Oil Circuit Breaker is a three phase single tank, distribution type, outdoor unit for use under the 15.5 or the 25.8 maximum design KV rating. It is shipped in assembled form, with only the diagonal braces removed to permit economical shipment with the lowest possible clearance.

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 SDO BREAKER

An SDO 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).

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 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 TC-2 interrupting device.

POLE UNIT (Refer to Fig. 2)

The essential elements of the SDO pole unit mechanism are a pair of radius arms 2-7 attached at one end to hexagonal main shaft 2-30, each carrying on the opposite end a link 2-28 connected to the crosshead 2-20 which drives movable member 2-1. A mechanism frame 2-15 guides the crosshead 2-20, retains the main shaft bearing 2-16 and holds the lift rod guiding system composed of two supports 2-21 and two rods guides 2-26. Bar 2-6 between the two radius arms 2-7 serves as the mechanical element which limits crosshead travel by coming against overtravel stop 2-9 on the close stroke and by striking the open position stop 2-5 of shock absorber 2-4 on the opening stroke. Yoke 2-14, mounted on the crosshead 2-20, provides a #10-32 tapped hole as means for connecting the user's speed analyzer.

OPERATING MECHANISM (Refer to Figs. 1, 3, & 4)

The type SDO breaker is equipped with a type SO-35C solenoid operator. The armature of the solenoid operator, acting through a toggle linkage, simultaneously closes the breaker and compresses the springs used to impart the opening velocity.

Refer to Figure 1 and note that the design and suspension of the SO-35C is unique in that it is mounted directly on the hexagonal main shaft which operates, and passes into, the pole unit without need for complex cabinet seals. In addition, it is so balanced with the pole unit mechanism that the only fastening needed for stability is a bracket at the bottom of the operator to attach it to the control housing.

MANUAL MAINTENANCE CLOSING

For manual slow closing for maintenance purposes, engage end of closing lever (5-66) in the slot in fulcrum hook (5-39) and rotate downward.

CAUTION: NEVER MANUALLY CLOSE THE BREAKER ON ENERGIZED LINES.

ADJUSTMENTS - OPERATOR AND POLE UNIT

BREAKER TRIPPING SYSTEM (Refer to Figs. 4, 5)

1. With the breaker open, adjust stop screw (5-29) to provide 1/64" plus 1/64" minus 0 clearance between trip latch (5-24) and latch roll (5-25).

2. With the breaker open, adjust stop screw (5-52) to make the right edge of latch (5-24) come 5/32" ± 1/32" to the right of the line of centers between pin (5-23) and latch roll (5-25).

3. With the breaker open, set trip latch (5-24) in the release position by placing armature (4-65) against pole head (4-62), and adding or subtracting shims (4-60) to set the right edge of trip latch (5-24) approximately 1/16" to the left of the line of centers between pin (5-23) and latch roll (5-25).

4. The de-energized position of armature (5-65) is adjusted by bending armature stop (5-55) to position armature (5-65) to have a clearance of at least 1/8" between trip pin (5-61) and arm (5-21).

BREAKER ACTUATING TOGGLE (Refer to Figs. 3 & 5)

1. With the breaker closed and the armature (3-1) raised against pole head (3-6) by the maintenance closing lever (5-66), the cap (5-33) should push the toggle roll (5-32) high enough to give 1/32" ± 1/64 clearance between prop latch (5-13) and toggle roll (5-32). This adjustment is made by inserting the proper number of washers (small) (3-36) between the armature and plunger. To add or subtract washers (3-36), remove pin (3-35) at the top of the plunger (3-2) which allows armature (3-1) and plunger (3-2) to drop out of the operator. Then, plunger (3-2) may be held in a rise to remove nut (3-67).

2. With the breaker closed, the toggle roll (5-32) should engage the face of the prop latch (5-13) at a point 5/32" ± 1/32 from the right edge of the latch. This adjustment is made by inserting the proper quantity of washers (5-12) between the tail of prop latch (5-13) and its supporting member.

3. With the breaker closed, and toggle roll (5-32) resting on prop latch (5-13), there should be a clearance of 3/32 ± 1/64 between toggle roll (5-32) and stop (5-18). This adjustment is made by inserting the proper number of shims (5-19) behind stop (5-18).

OPEN POSITION STOP (Refer to Figs. 2 & 5)

1. With the breaker open, adjust if necessary the open position stop (2-5) to create in the SO-35C operator the following three conditions:

LIMIT SWITCH (Refer to Fig. 4)

The limit, or "aa" switch (4-54) is located on the right side of the operator frame. It should be checked to make sure it is closed when the breaker is closed. For the adjustment procedure, see "Auxiliary Switch". Any changes made on this switch should be done with reasonable care to avoid damaging the switch insulation.

LATCH CHECK SWITCH (Refer to Fig. 5)

The latch check switch (5-49) should be adjusted to obtain a minimum of 1/16" overtravel after actuation by arm (5-21). This adjustment is made by inserting the proper number of washers (5-50) between latch check switch (5-49) and bracket (5-51).

3. Power close breaker with plungers (8-3) extending no more than 5" from top surface of cross bar (8-4) and measure distance from bottom plate (6-8) to top of cross bar (8-4), dimension 9-b.

4. Add dimensions 9-a and 9-b and subtract 5/16" therefrom. Readjust plunger (8-3) to this value, ± 1/16", and lock securely with clamp bolts (8-7).

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

6. Repeat Steps 2 through 5 for each individual plunger setting.

TC-2 INTERRUPTING DEVICE (Refer to Fig. 6)

The shell of the TC-2 interrupting device must be oriented so that the exhaust port faces outward, and in line with the lift rod. The proper position is maintained by a clip (6-14) which keys the contact block (6-2) to the shell (6-3) via a slot in the contact block, and a choice of 3 slots in the shell.

To change the position of the exhaust port, the following procedure is recommended:

1. Loosen clip (6-14) and set screw (6-15).

2. Using a 2-1/4" spanner wrench, loosen the bottom plate (6-8).

3. Rotate the contact block in the shell into correct alignment, having the top of the thread in the contact block 1/2 to 1 turn above the top of the shell within 1/2 turn.

4. Install clip (6-14).

5. Using a 2-1/4" spanner wrench, run in bottom plate (6-8) to provide a tight stacking, and tighten set screw (6-15).

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.

2. FOR SHIPMENT THE BREAKER IS BLOCKED IN THE CLOSED POSITION, SO CARE MUST BE EXERCISED IN REMOVING THE WEDGES TO AVOID INJURY TO PERSONNEL. 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. AFTER REMOVING THE BLOCKING, THE BREAKER IS READY TO BE OPERATED. BEFORE DOING SO, MAKE SURE THAT ALL PERSONNEL ARE IN SAFE POSITIONS.

3. THE INTERNAL HYDRAULIC SHOCK ABSORBER IS EFFECTIVE ONLY WHEN UNDER OIL. THE OIL CIRCUIT BREAKER SHOULD BE TRIPPED AS LITTLE AS POSSIBLE BEFORE THE TANK WITH OIL IS IN PLACE TO AVOID THE POSSIBILITY OF DAMAGE TO THE APPARATUS.

CONNECTIONS

Oil circuit breakers of this class may be furnished with up to nine bushing type current transformers in accordace with service requirements. The standard arrangement and markings of current transformer leads conform 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.

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 levelled 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.

TANKLIFTER

In use of the tanklifter proceed with equal lengths of loop end unwound from the drum so that the tank will be let down and/or elevated in a horizontal manner. Feed the cables onto and off the drum so that they lay smooth without consecutive turns crossing each other.

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. #3, Fig. 8, Instruction Book BWX-6752) for Type SDO-15, 600 Ampere, 15 KV Oil Circuit Breakers, S/N 338134.

EXAMPLE Assume that on an SDO the triangle ABC is constructed. Time (CB) by measurement is found to be 2.0 cycles and travel (AC) is 3", then Speed equals 3" divided by 2.0 cycles. To convert this to feet per second -

$$\frac{\text{3" divided by 12}}{\text{2.0 cycles divided by 60}} = \frac{3}{12} \times \frac{60}{2.0} = \frac{15}{2.0} = 7.5 \text{ Feet per Second}$$

It can be seen that if the travel (AC) is a constant (which in our case is 3") then the breaker contact speed is expressed by the simple equation $\frac{15}{T}$ where T is the time (CB) in cycles.

The Cincinnati Analyzer is a dual speed device and the chart paper supplied by the manufacturer has two measurement scales. On the high drum speed scale 3/4" (horizontal measurement) equals one electrical cycle. On the low drum speed scale 3/8" equals one electrical cycle.

Care should be taken to construct the triangle as carefully as possible. A small drafting triangle is an excellent aid in constructing the velocity triangle.

SUMMARY OF MEASUREMENTS

Contact Part Time	2.0-2.5 cycles	for	5 cycle breakers
	1.5-1.6 cycles	for	3 cycle breakers
Opening Velocity	7 1/2-8 1/2 F.P.S.	for	both 3 cycle and 5 cycle breakers
Closing Velocity	5.5 F.P.S.		minimum for stored energy operators
	4.5 F.P.S.		minimum for solenoid operators at nominal rated voltage.
Closing Time	6-8 cycles		typical for stored energy operators.
	14-20 cycles		typical for solenoid operators at nominal voltage

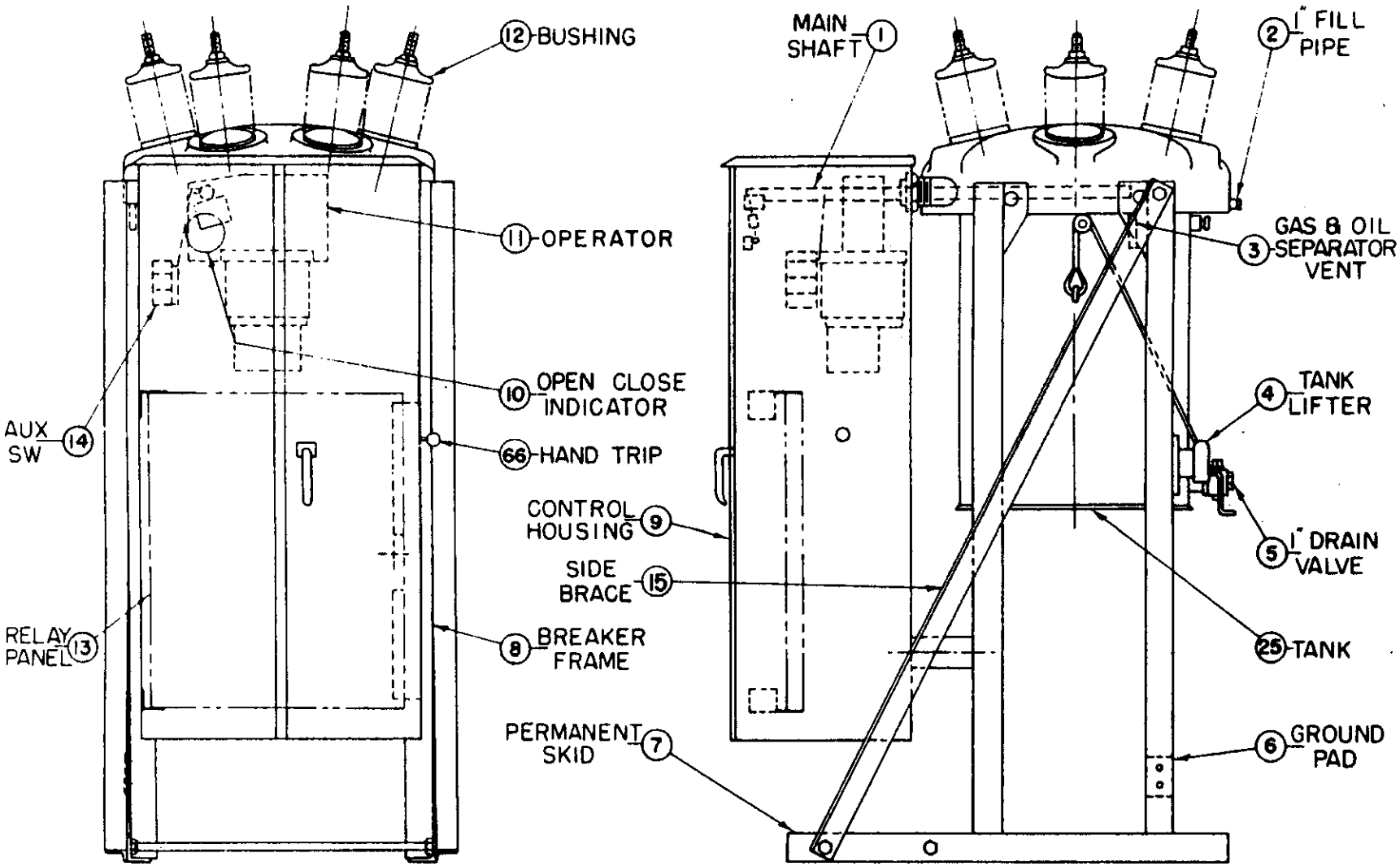

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FIG. 1

TYPICAL SDO-15 OIL CIRCUIT BREAKER

SEPT. 26, 1969

72-310-054-402

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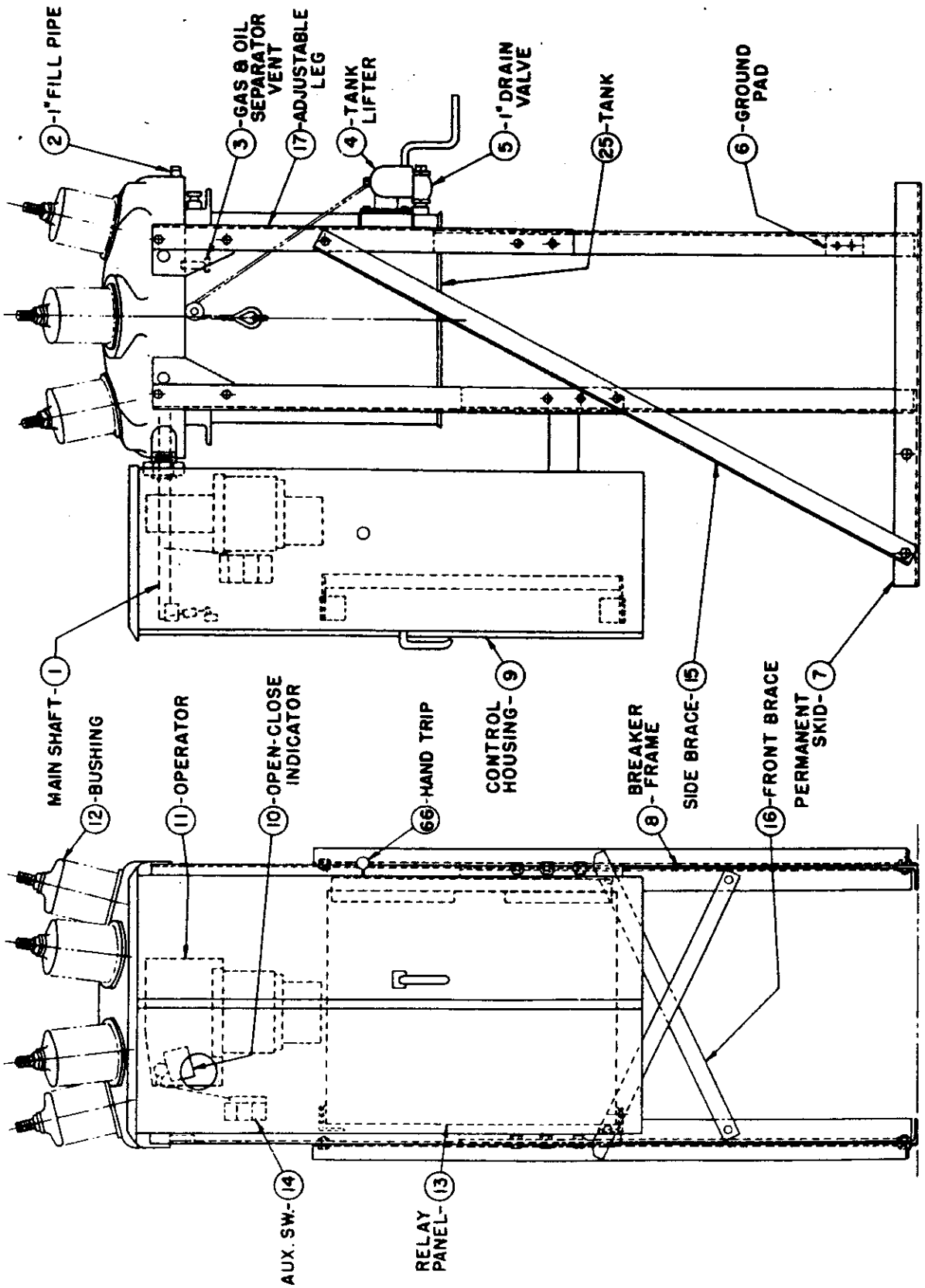

FIG. 1A

TYPICAL SDO-15 OIL CIRCUIT BREAKER

SEPT. 26, 1969

72-310-053-402

ALLIS-CHALMERS

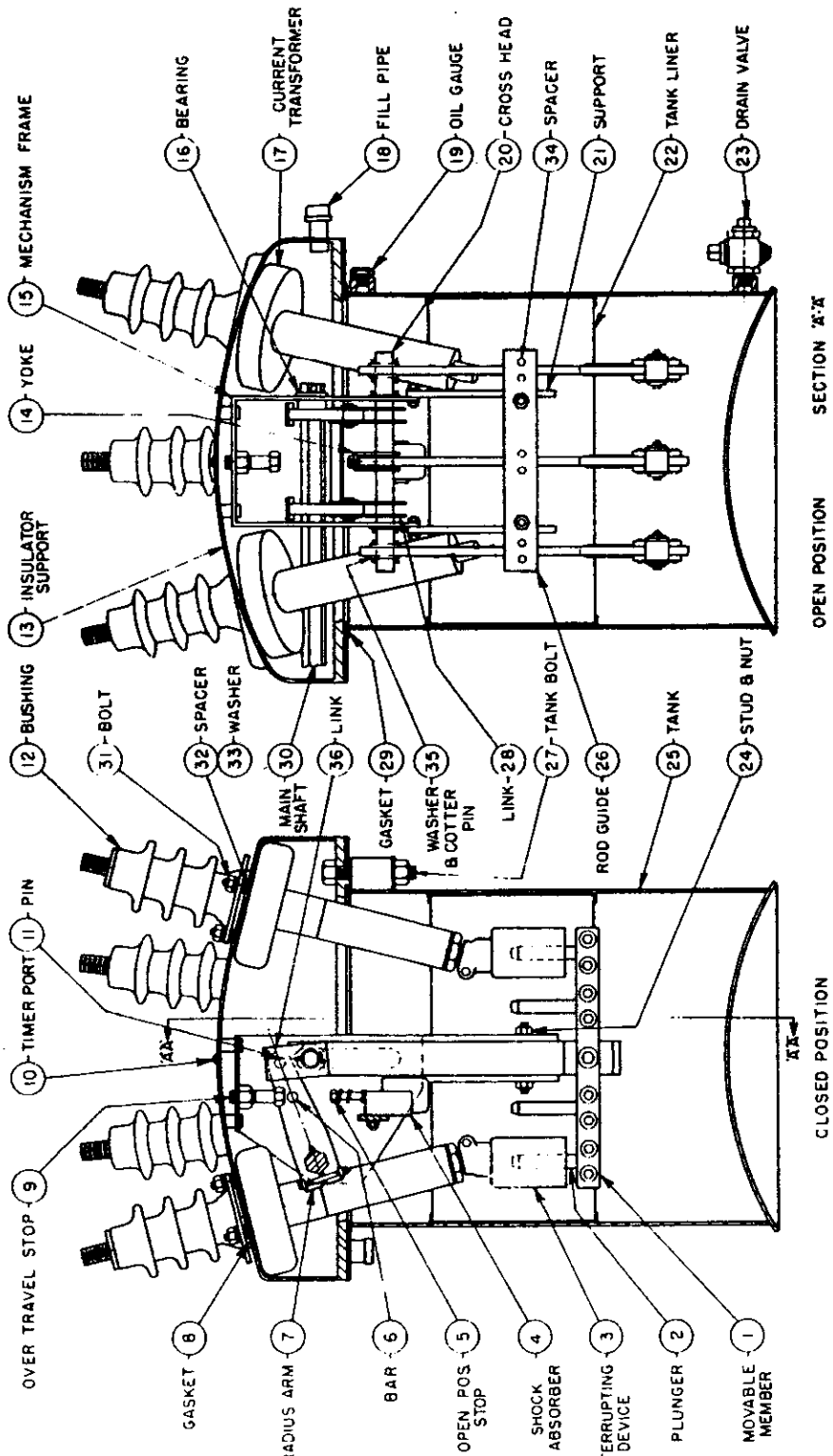

FIG. 2

TYPICAL SDO-15 POLE UNIT

SEPT. 12, 1963

71-401-668-401

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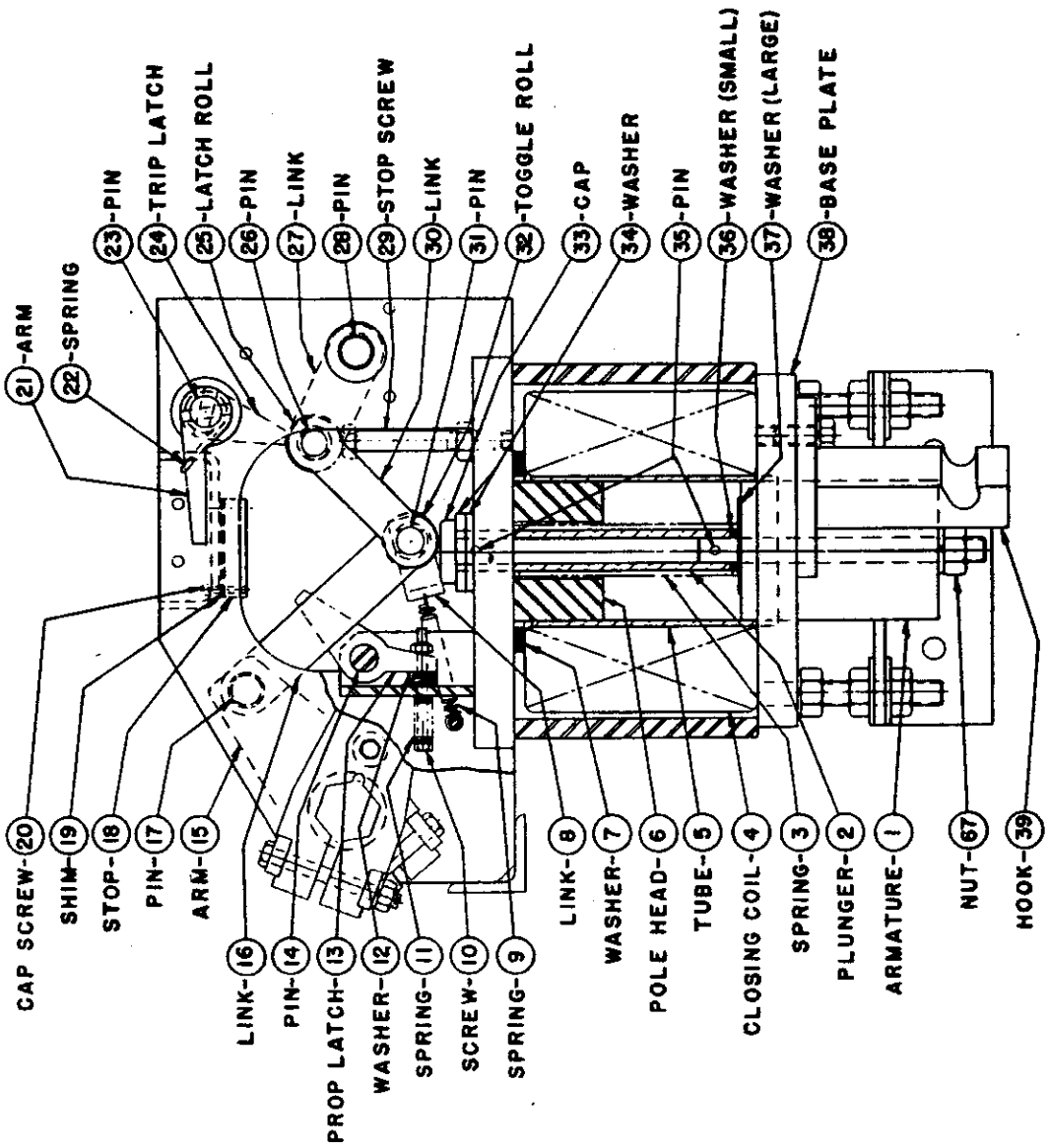

FIG. 3

TYPICAL SO-35C OPERATOR

NOVEMBER 16, 1965 72-310-055-401

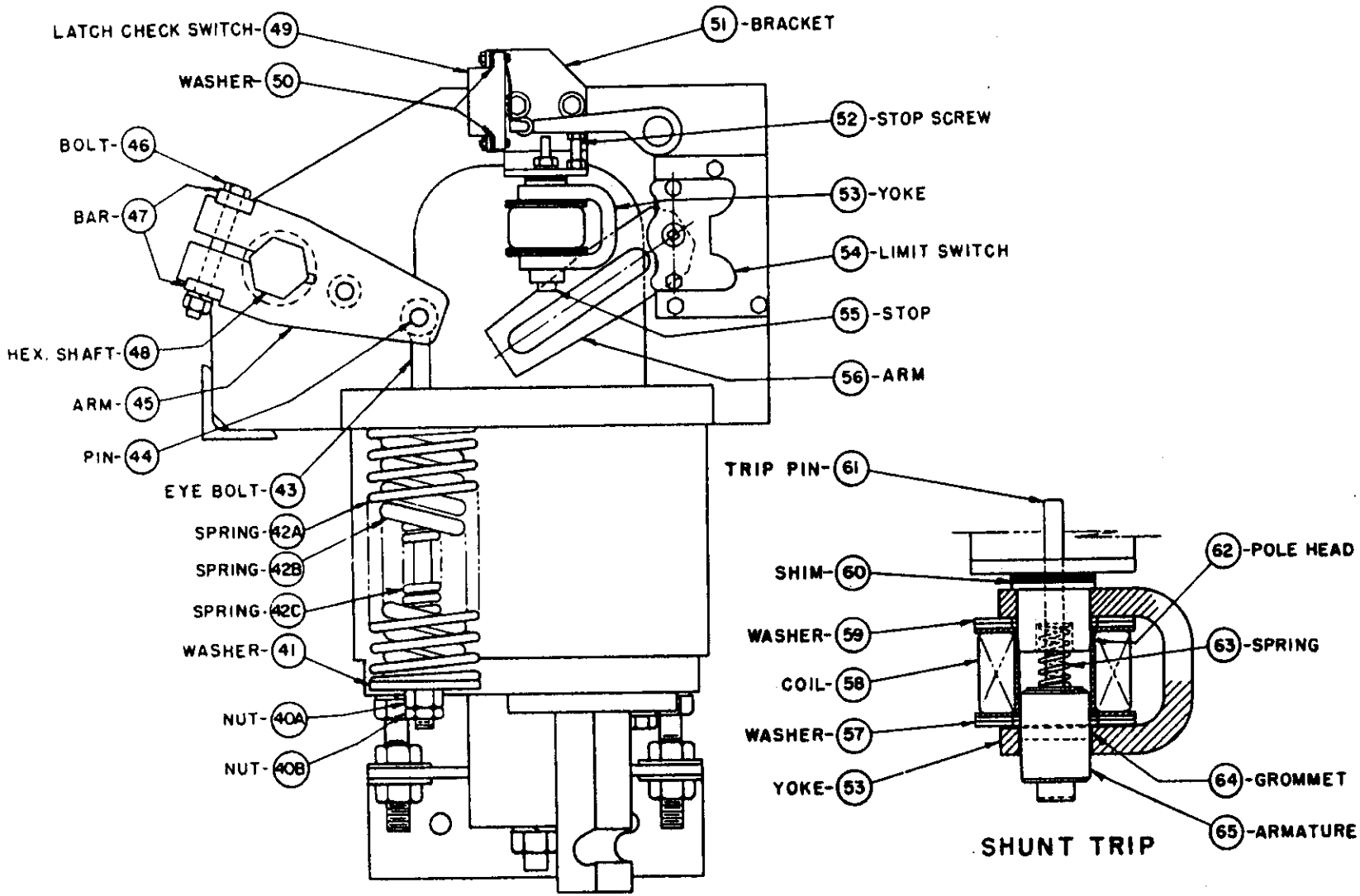

FIG. 4

TYPICAL SO-35-C OPERATOR

NOVEMBER 10, 1965 72-310-051-401

ALLIS-CHALMERS

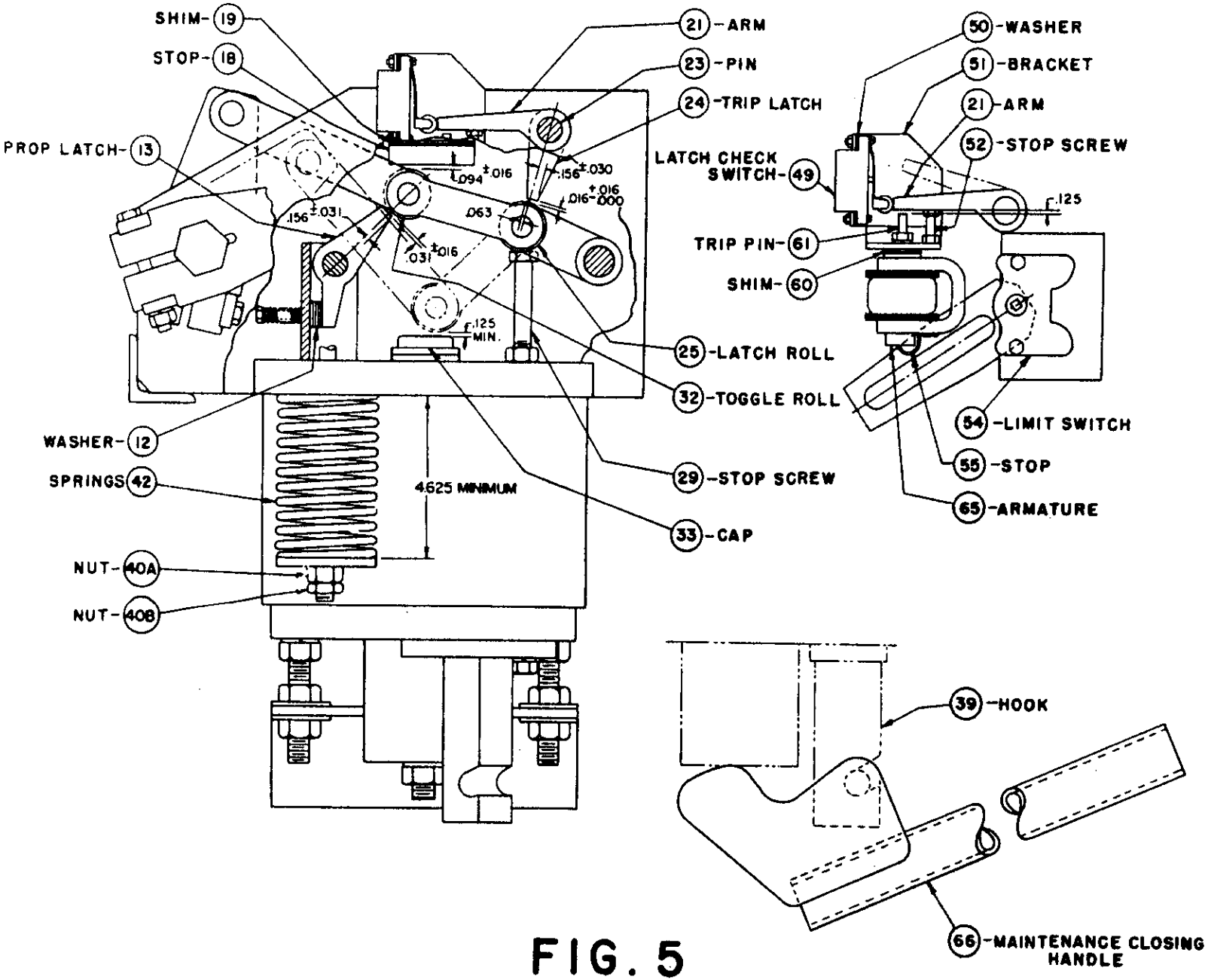

FIG. 5

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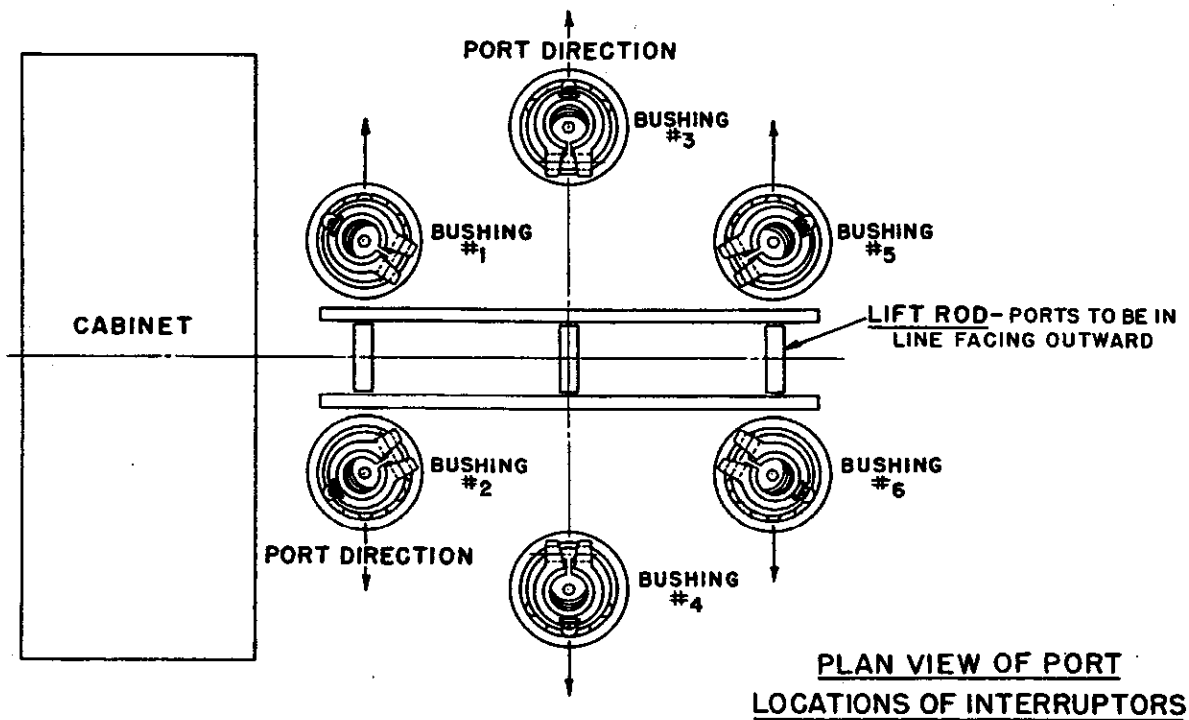

PLAN VIEW OF PORT LOCATIONS OF INTERRUPTORS

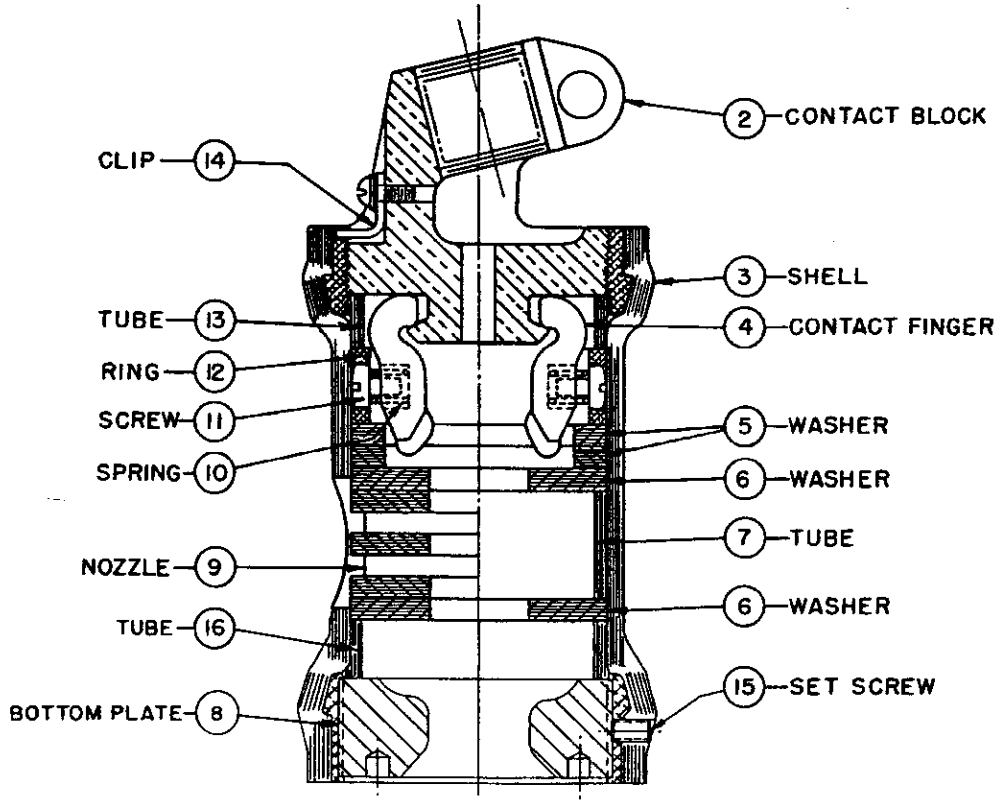

FIG. 6
TYPICAL TC-2 INTERRUPTER
OCT. 20, 1970 72-310-361-401

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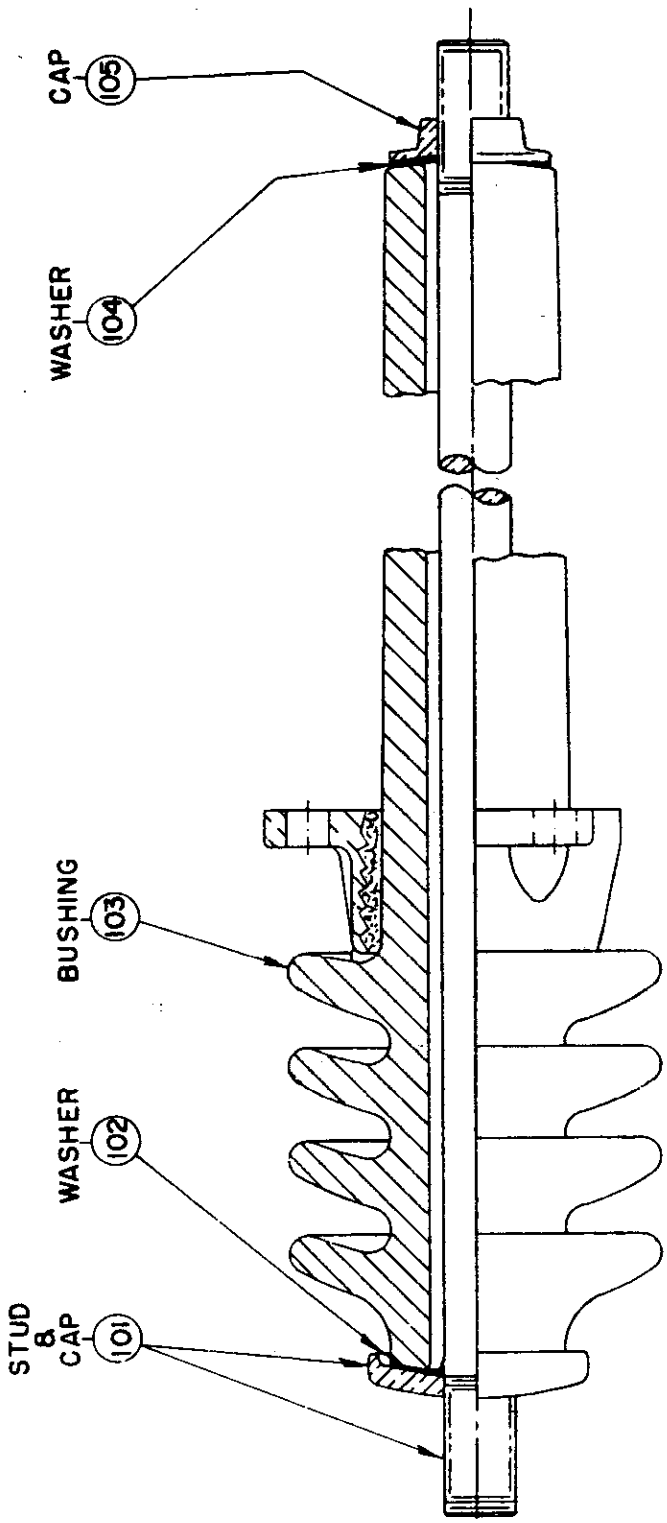

FIG. 7

TYPICAL 14.4 K.V. BUSHING

71-210-179-402

SEPT. 26, 1969

ALLIS-CHALMERS

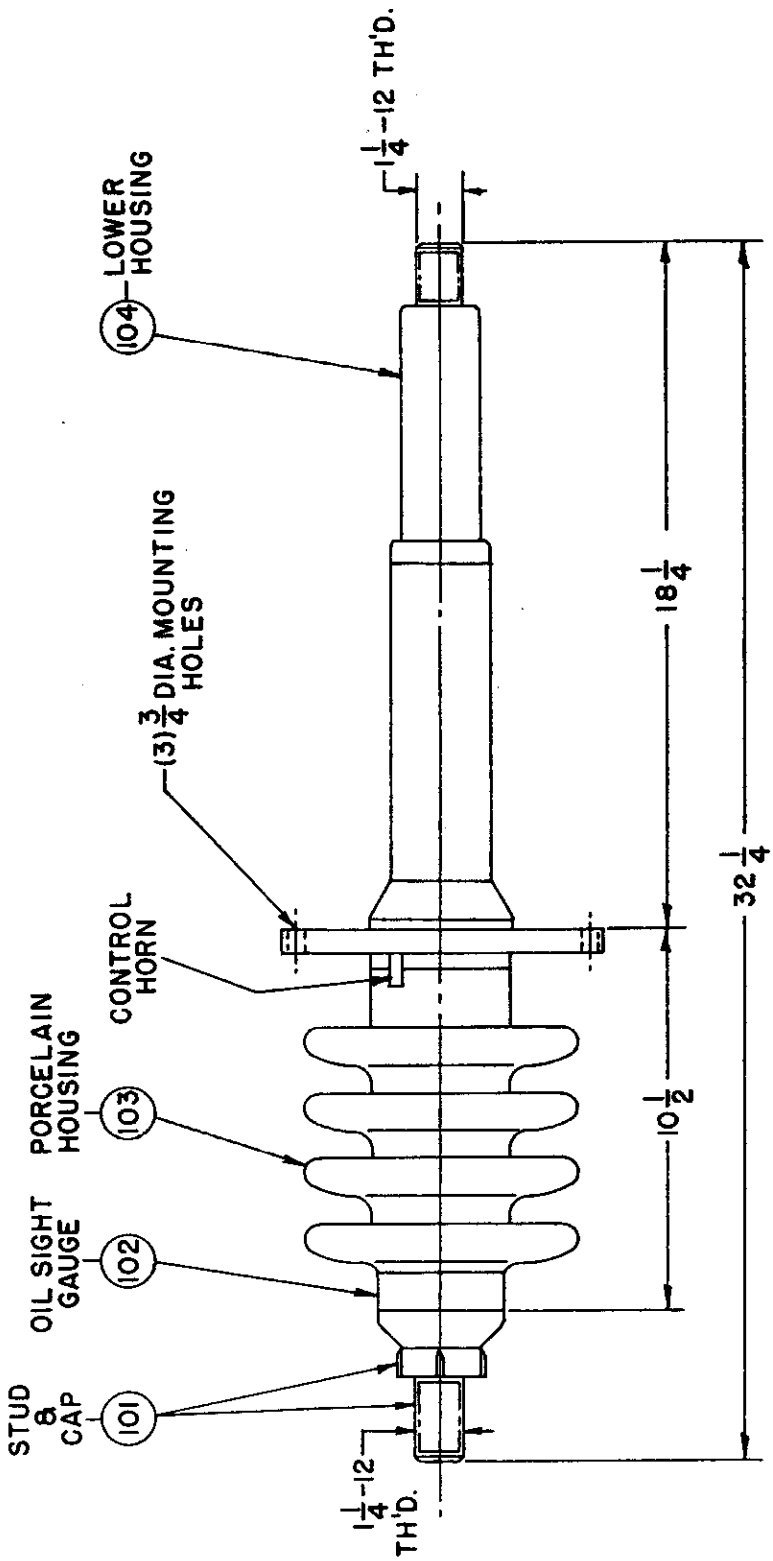

FIG. 7A

TYPICAL 23KV BUSHING

OCT. 20, 1970 72-211-109-401

ALLIS-CHALMERS

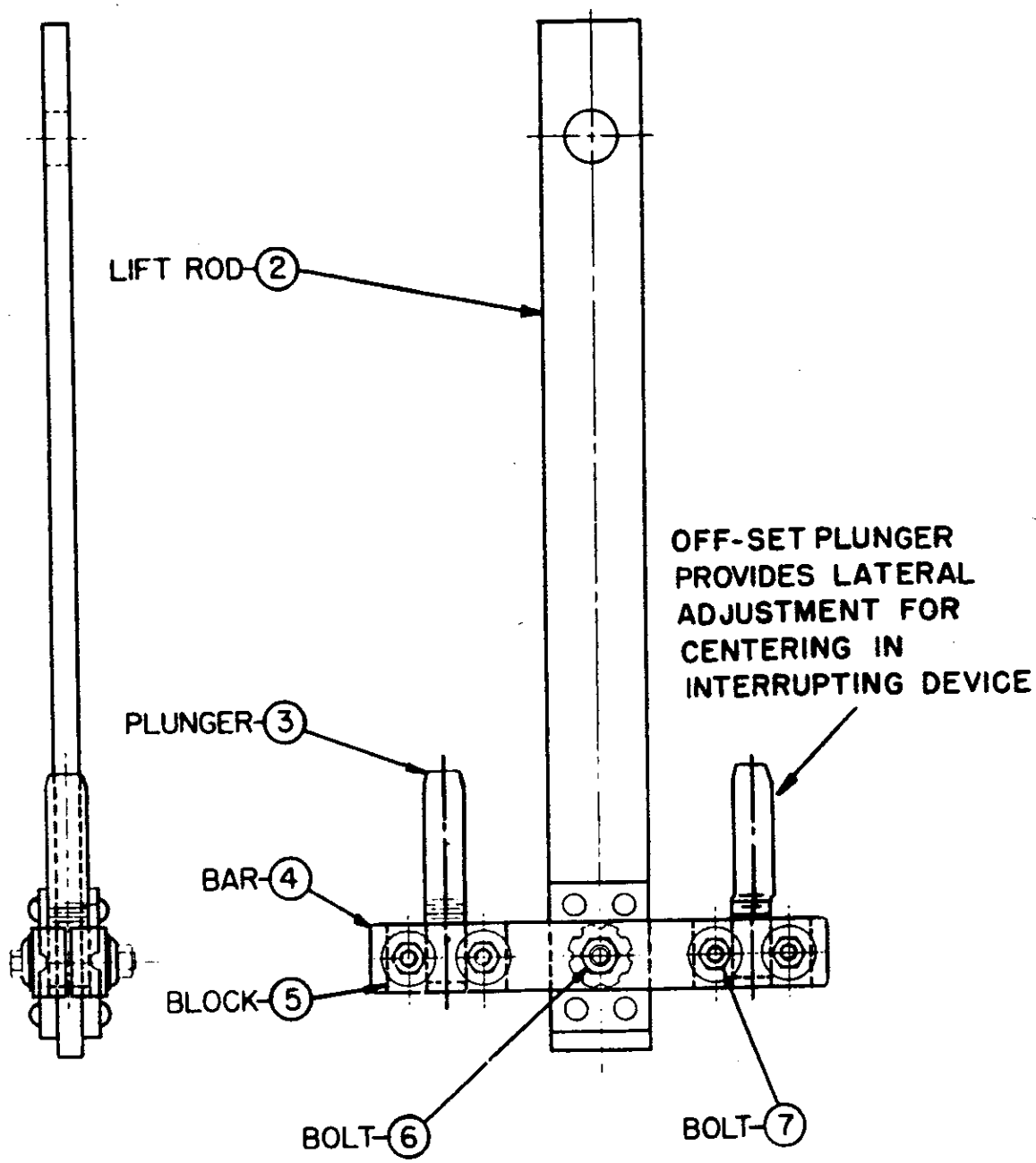

FIG. 8

TYPICAL SDO-15 MOVABLE MEMBER

JUNE 20,1968 72-111-168-401

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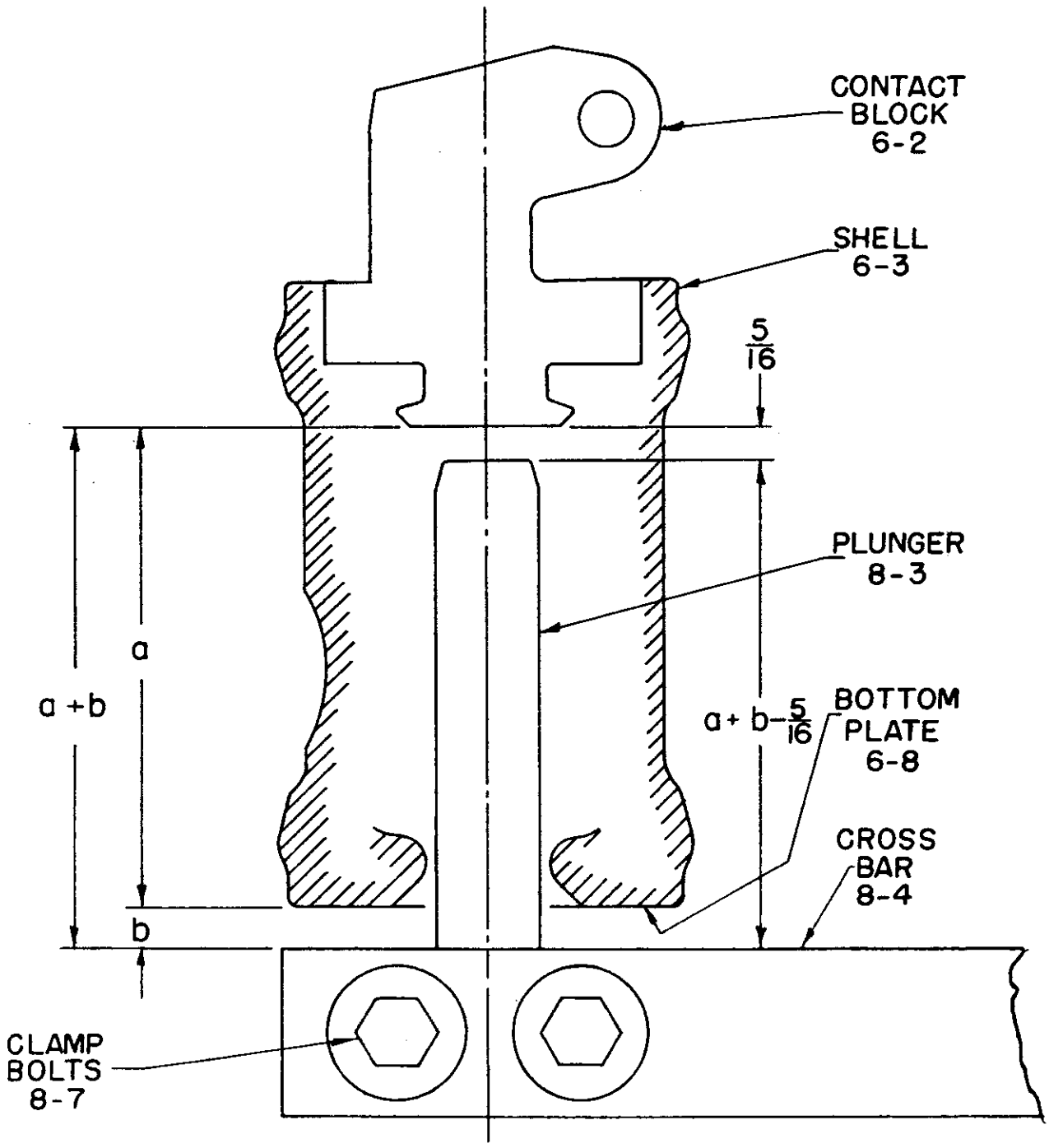

FIG. 9

PLUNGER ADJUSTMENT
(FOR TC-2 INTERRUPTOR)

OCT. 19, 1970 72-211-108-401

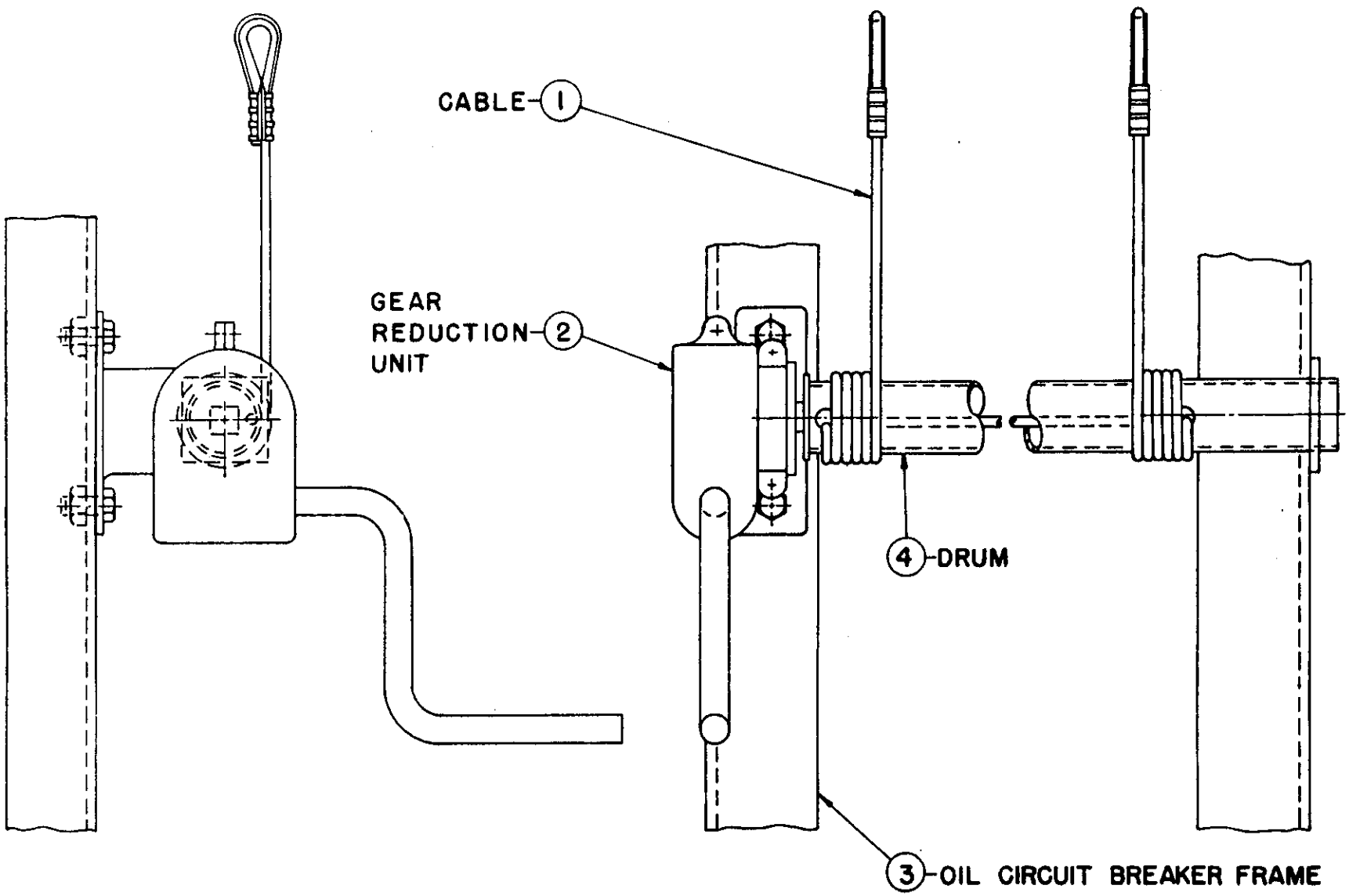

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FIG. 10

TYPICAL TANK LIFTER

OCTOBER 3, 1963 71-303-342-401

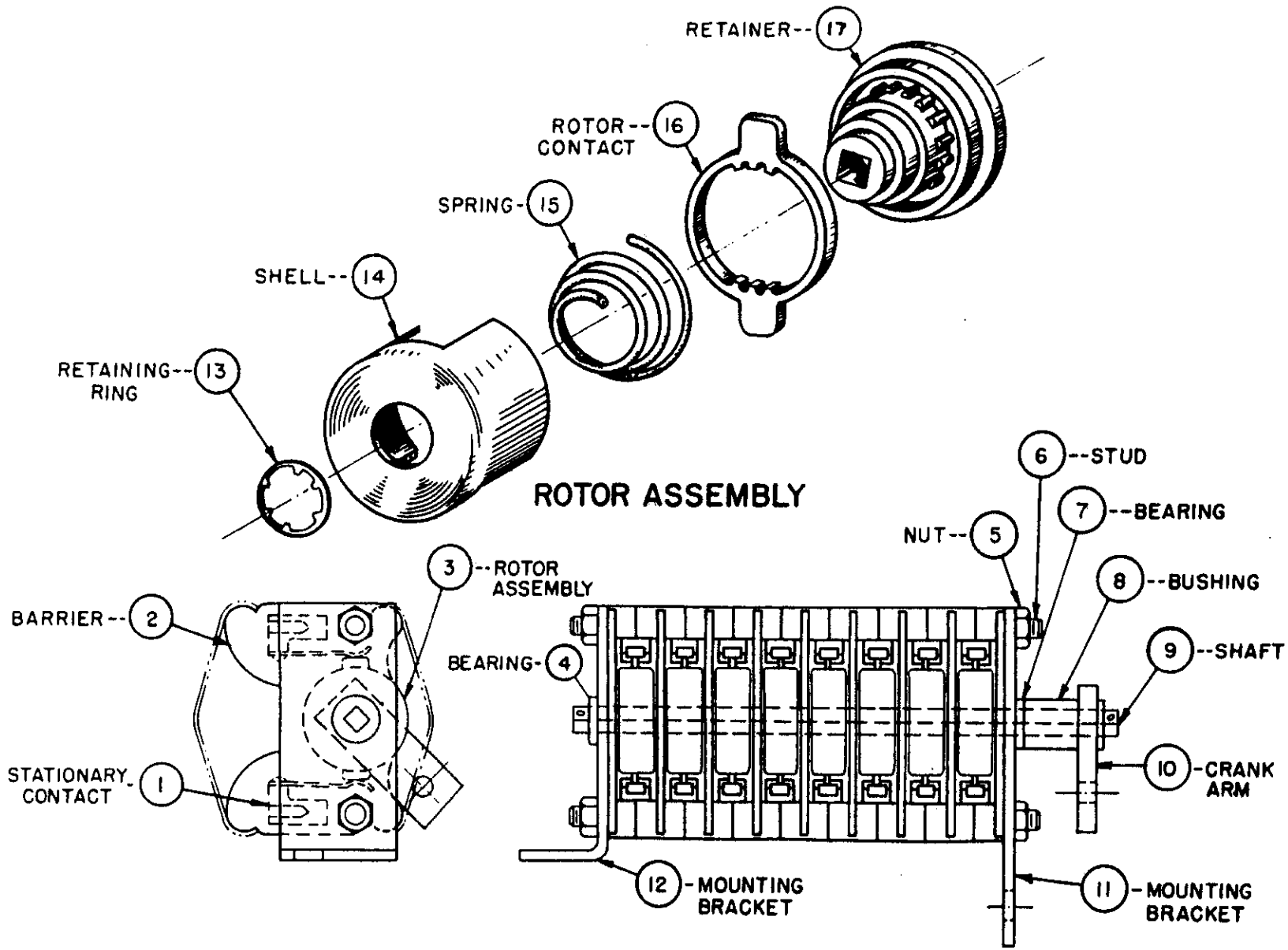

FIG. 11

TYPICAL AUXILIARY SWITCH

JULY 16, 1958

71-301-758

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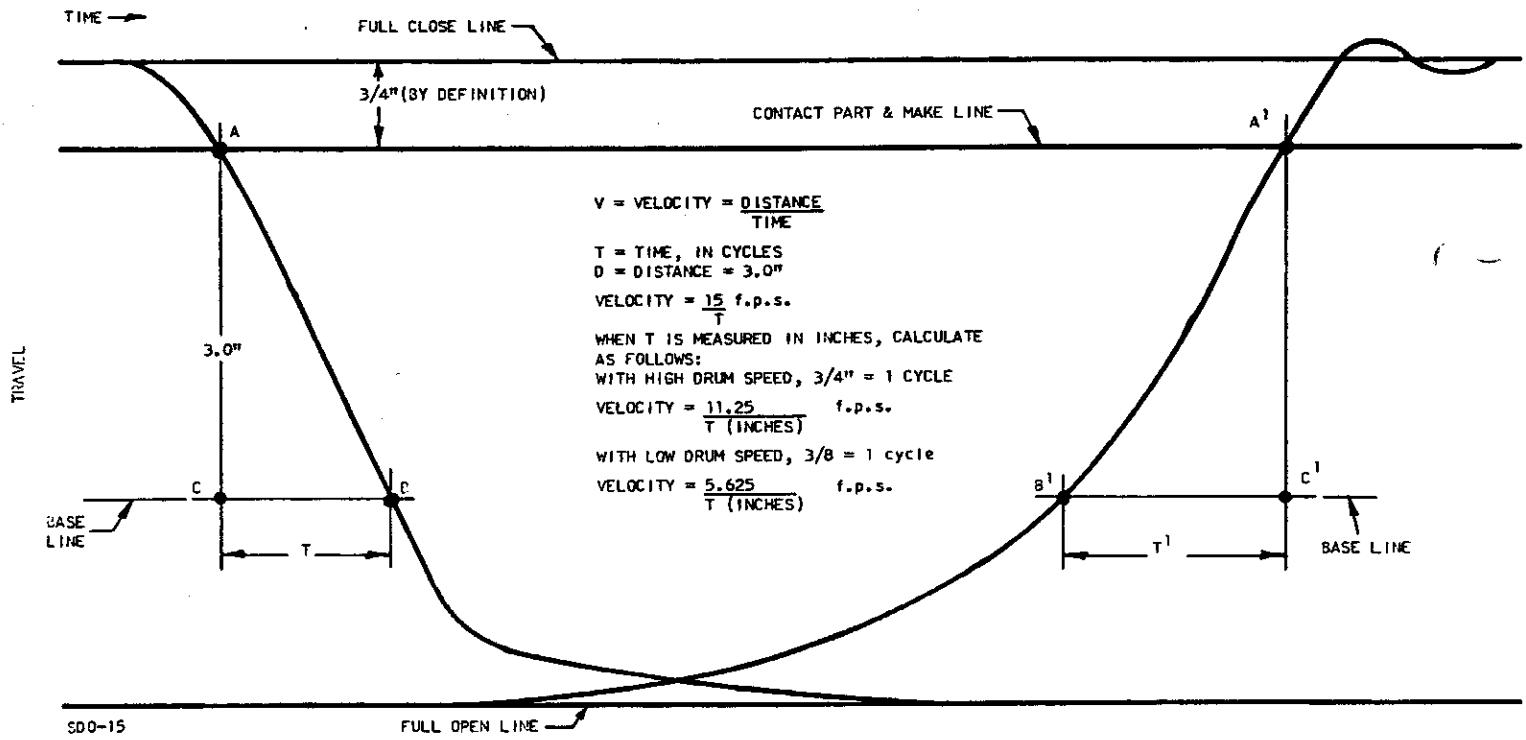

FIG. 12

TYPICAL SPEED GRAPH

SDO WITH SO-35C SOLENOID OPERATOR

OCT. 20, 1970 72-211-110-402