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INDEX FOR
MAGNETIC BREAKER AND AUXILIARY EQUIPMENT

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ILLUSTRATIONS FOR
MAGNETIC BREAKER AND AUXILIARY EQUIPMENT

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INSTRUCTIONS
FOR THE INSTALLATION AND OPERATION
OF
ALLIS-CHALMERS RUPTAIR
MAGNETIC BREAKER AND
AUXILIARY EQUIPMENT

GENERAL

PROPER CARE IS ESSENTIAL TO GOOD SERVICE

1. The Allis-Chalmers Ruptair Magnetic Breaker is an integral unit consisting of a power circuit breaker complete with relays, auxiliary switches and equipment necessary for its operation and control. When supplied with primary and secondary disconnecting contacts, it becomes the complete movable portion for Allis-Chalmers switchgear and is usually referred to as the "Movable Portion".

2. The successful operation of this unit depends on proper installation and maintenance, as well as proper design and manufacture.

3. The information and instructions included in this book are to aid you in installing and maintaining these units so that you will obtain the highly satisfactory service of which they are capable.

4. Please pass this information along to your engineers and erection and servicemen who will then be better able to aid you in realizing the best service from this equipment.

INSPECTION

5. Before leaving the factory, each movable portion has been carefully inspected and packed by workmen experienced in the proper handling of electrical equipment.

RECEIPT

6. Upon receipt of the movable portion remove all packing traces and examine the breaker and auxiliary equipment carefully to see that no damage has occurred during transit. If any injury is disclosed, a claim for damages should be filed at once with the transportation company and the Allis-Chalmers Manufacturing Company notified.

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for the first time make sure that the guide wheels on breaker frame engage properly with the mating parts on cubicle. As breaker is then moved into position, check to see that the grounding contacts under breaker make properly with the stationary contacts in cubicle, and that primary and secondary contacts are in alignment for proper contact engagement.

DESCRIPTION

GENERAL

11. The Allis-Chalmers Ruptair movable portion shown in Fig. 1 consists of magnetic circuit breaker for metal-clad switchgear application, with auxiliary equipment suitably arranged for best function and easy installation. As part of standard equipment, each order is furnished with one combination maintenance operating device and transfer handle. THIS DEVICE IS NOT SUITABLE FOR ACTUATING THE BREAKER ON AN ENERGIZED CIRCUIT.

12. The Ruptair magnetic circuit breaker differs essentially from oil breakers and air-blast breakers in that it does not depend on any stored medium such as oil or compressed air for interruption. Referring to Figure 1, the component parts of the breaker are mounted in a structural steel frame. The operator, the operating shaft and connecting links are mounted on the lower section of breaker frame and are well shielded. The horizontal terminal studs, which are insulated with shielded bakelite tubing, extend through the breaker frame and support the other parts of the electrical circuit. Interruption occurs within the arc chute assemblies which are mounted at the top over the contact structures.

CONTACTS (Figs. 3 & 6)

13. The stationary contact structure of each phase is made up of two sets of contacts, namely; main current carrying, and arcing, which are mounted on the upper bushing terminal. The movable contacts are attached to contact arms that pivot from the end of the lower bushing stud. Transfer areas of current carrying contacts are silver plated, and arcing contact surfaces are of a silver-tungsten alloy. The main current carrying contacts and arcing contacts are finger type. All contacts are backed by steel springs giving positive contact pressure when engages.

ARC-CHUTE ASSEMBLY (Fig. 8)

14. Each arc-chute assembly consists of a two section tube of arc resistant material which provides phase isolation for interruption, and venting of the by-product gases of interruption. The lower half of the arc-chute contains:

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stroke. The mechanism is of low inertia, capable of quick acceleration and is equipped with a low energy trip device and opening coil, designed to provide high speed release of the trip mechanism upon energization of the trip coil.

AUXILIARY EQUIPMENT (Fig. 1)

18. The auxiliary equipment consists of a secondary transfer device, control relay, and closing rectifier as required. These are mounted on the lower portion of the breaker. The secondary transfer device houses the auxiliary switch, which is wired to the finger contacts such that when movable portion is moved into operating position in the cubicle the finger contacts engage the stationary contacts to complete the control circuit for operation of the breaker.

METHOD OF ARC INTERRUPTION

19. The Ruptair magnetic circuit breaker does not depend on any prestored medium, such as oil or compressed air, for arc interruption. Interruption is accomplished in air at atmospheric pressure, with the aid of a self induced magnetic blowout field and air draft. At the time the trip coil is energized, current is being carried through the main contacts. As the movable contact blade separates from the main contact, the current is transferred to the arcing contact to protect the main current carrying surfaces. As the arcing contacts part a power arc is drawn which is transferred first to the head and then the tail arc runners as the moving contact passes close to them on its opening stroke. The tranferral of the arc to the arc runners establishes the full flow of current through the blowout coils, setting up the magnetic field, which in accompaniment with natural thermal effects of the heated arc, configuration of the current carrying circuit, etc., tend to force the arc upward into the barrier stack. The cool surfaces of the barrier stack tend to cool and deionize the arc while the "Vee" slots in the stack reduce its cross section and elongate it. The arc runners are made of wide, heavy material for maximum heat dissipation and help to minimize metal vaporization. To facilitate interruption of low currents, a puffer assembly (Fig. 10) provides a movement of air through the contact area to aid the magnetic field in moving the arc into the barrier stack. All of the above effects work together to increase the resistance of the arc and enable it to be extinguished at an early current zero.

CLOSING - (Fig. 13)

20. Figure 13 shows the mechanism of the operator in the open position. Points "B", "F", "G", and "H" are fixed centers about which crank arms (2) and (3), link (6), trip latch (9), and prop latch (10) rotate respectively. Center "E" is a temporarily fixed center, being restrained by stop (11) and latch (9) as long as latch (9) is in position.

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CONTACT ALIGNMENT

26. The contacts are an integral part of the bushing assemblies and are carefully aligned with the upper and lower bushings before shipment and no further adjustment should be necessary. All that is required for proper contact alignment is that the moving contact operate in a plane relatively parallel to the fixed stationary contacts and that all the stationary fingers are engaged.

OPENING SPRINGS (Fig. 10)

27. The Opening Springs (10-39) (10-41) are fixed in adjustment such that with the breaker in the fully closed position the springs will be compressed to a length which will provide an opening velocity of 14-17 feet per second in the first three inches of movement, measured at the radius of the arcing contact "make" point. Changes in adjustment are not necessary and no provision is made for changing spring reaction.

STROKE OF MAIN CONTACT (Fig. 1 & 7)

28. The stroke of the main contact (3-53) is controlled through adjustment of operating arm (1-244). Proper adjustment is obtained when, with the breaker closed, the arcing contact (7-113) bumper service is not binding tightly on the bumper (6-84) and the main contacts (7-115-118) has the maximum possible positive wiping action on the main contact fingers (6-91). Note that the main contacts engage in a "heel and toe" action, first touching at the bottom and then coming to final position at the top, while the bottom initial contact points separate. The described adjustment will provide a separation of the initial contact points of at least 1/64", usually more, up to approximately 3/64". Adjustment is obtained by removing pin (1-253) loosening checknut and adjusting the length of connecting rod by screwing the rod end in or out until the closing of the breaker, the above conditions of adjustment exist on all three phases. After proper adjustment make sure that the checknut is made up tight and that cotter pins are properly spread.

CONTACT ADJUSTMENT (Figs. 6 & 7)

29. The contacts are carefully adjusted before shipment and no further adjustments should be necessary. However, it would be well to check the adjustment of the arcing and main contacts before installation and periodically thereafter to insure continuous good service. The arcing and main contacts are adjusted as follows: With the stroke set per Par. 28 adjust the stationary arcing contacts (6-79) so that it engages the moving arcing contact (7-113) at the point in the stroke where there is 1/4" plus .000" minus 1/16" air gap between the main contact fingers (6-91) and the moving contact (7-115-118). In general, this gap (arcing contact lead) will decrease slightly with successive adjustments as the arcing contacts wear in service and should not be permitted to become less than 3/16". The adjustment should be made individually on each phase, the 1/4" plus .000" minus 1/16" setting being obtained for

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exercised in making any changes. However, before the breaker is placed in service a check should be made to see that the crank arm (5-14) throws approximately equal distances on either side of a horizontal centerline. The adjustment for throw of lever is made by positioning clevis (2-305) on connecting rod (2-300). After correct adjustment is made, make sure all fastenings and locknuts are secure. Each rotor (5-1) can be adjusted individually in steps of $22\frac{1}{2}$ degrees merely by pressing the contact to one side against the spring and rotating it within its insulated rotor housing until it snaps into the desired position.

LIMIT SWITCH (Fig. 11)

34. The limit switch is located on the front of the operator frame and contains both the "a-a" and "b-b" stages of limit switch contacts. The switch has been adjusted correctly before leaving the factory. However, a check should be made to see that with the solenoid de-energized and actuating arm (11-163) against the stop in bracket (11-156), there is 1/32" to 1/16" overtravel of the limit switch plunger after "bb" contact make. Adjustments are made by use of spacer (11-160). With the breaker closed, the "aa" contacts will be closed, and no adjustment is necessary.

LATCH CHECK SWITCH (Fig. 12)

35. The latch check switch (12-175) is mounted on the right side of operator frame together with switch operating crank (12-171). Proper adjustment has been made prior to shipment. However, a check should be made to see that plunger on the latch check switch (12-175) has a clearance of 1/32" to 1/16" with operating arm (12-171). Adjustments are made by use of spacer (12-173).

INTERLOCK CRANK (Fig. 2)

36. The mechanical interlock (2-322) is located under the breaker base plate. It acts on the trip latch in such a manner that the breaker is rendered trip free between the test position and the fully inserted position. It is actuated by a cam mounted on the floor of the cubicle. The interlock is in proper adjustment when the roll (2-325) is positioned such that the breaker can trip within 5/16" movement from the fully inserted position. When the breaker is fully inserted, roll (2-325) should have a min. 1/16 clearance. Note that interlock rod (2-304) acts to prevent removal of the breaker if it is in the closed position.

TRIPPING UNIT (Fig. 9)

37. The shunt trip application as shown in Fig. 9 is factory set and should need no further adjustment. In proper adjustment, trip

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can be easily inserted to its final position in cubicle. Check to see if breaker can be closed only in either its test position or in its final position.

OPERATION IN TEST POSITION

45. The breaker should be operated several times in the test position to see that all parts are working smoothly before it is placed in service.

FASTENINGS

46. Check to make sure that all fastenings are secure.

MAINTENANCE

GENERAL

47. Upon the proper operation of the circuit breaker depends the safety of the operators and the successful functioning of the connected apparatus, therefore, the breaker should have regular systematic, thorough, understanding inspection and maintenance. Be sure that the breaker and its mechanism is disconnected from all electric power and that the breaker is in the open position before any maintenance is attempted. Inspect the breaker and auxiliary equipment mechanically and electrically at least once every six months, or more often if service is particularly severe.

CONTACTS

48. Inspect all contacts frequently, depending on severity of service. Replace badly pitted or burned contacts before they are damaged to such an extent as to cause improper operation of the breaker.

BARRIER STACKS

49. The arc-chute barrier stacks are fragile and should be handled carefully. The barrier stacks (8-254) should be inspected for erosion of the plates in the areas of the slots. Stacks should be replaced when erosion progresses to a point such that the slots of the shortest plates have been extended to the lowest hole through the plate above the slot. They should be likewise replaced if plates are broken or cracked.

BREAKER TIMING

50. Check the contact adjustment and breaker timing occasionally, also check adjustments of auxiliary equipment and see that it functions properly. A comparison of breaker timing at any period of maintenance with that taken new will immediately indicate a condition of maladjustment or friction should the timing vary more than 1/2 cycle on opening or 2 cycles on closing with the same coils. A convenient place to attach the speed analyzer link may

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CAUTION: BEFORE REMOVING ANY PART, MAKE SURE THAT THE BREAKER AND ITS OPERATING MECHANISM IS DISCONNECTED FROM ALL ELECTRIC POWER AND THAT THIS BREAKER IS IN THE OPEN POSITION.

PHASE BARRIERS (Fig. 1)

56. The outside and inter-phase barriers (1-350) can be removed by simply withdrawing them from the top of the breaker. On replacement make sure that the barriers are fully inserted and set in their respective locating slots.

ARC-CHUTE ASSEMBLY (Fig. 8)

57. When removing an arc-chute assembly, remove the phase barriers adjacent to that particular phase, lift off top section of arc-chute tube, remove barrier stack, disconnect blowout coil leads from front and rear bushings, and then lift out lower section of arc-chute tube.

CAUTION: ON INSTALLING MAKE SURE BLOWOUT COIL LEADS ARE FASTENED SECURELY.

BARRIER STACK (Fig. 8)

58. For replacing an arc-chute barrier stack remove top section of arc chute tube as outlined in Paragraph 57 and lift out barrier stack. On installation make sure that the barrier stack is inserted with the "Vee" shaped slots toward the bottom of the chute.

FRONT AND REAR ARC RUNNERS AND BLOWOUT COILS (Fig.8)

59. Should it be found necessary to replace an arc runner, remove the top section of the arc chute tube and barrier stack as outlined in Paragraphs 57 and 58. Then after the blowout coil leads have been disconnected from the bushings lift out the lower section of the arc chute tube, remove side plate (8-287) and remove screws holding arc runners (8-272) in place, remove blowout core (8-293), then remove coil and connected arc runner. To reassemble reverse procedure.

FLASH PLATES (Fig. 8)

60. Should it be found necessary to replace a flash plate (8-289), remove top section of arc chute tube, barrier stack, lower section of arc chute tube, blowout coils and arc runners as described in Paragraphs 57-59 and the desired side of the lower arc chute tube. The flash plate may then be unfastened from the support plate. To reassemble reverse procedure.

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67. After bushings have been properly aligned and secured the movable portion should be moved slowly into position in cubicle and the centering of finger contacts in stationary tubes checked. If misalignment is noted, the movable portion should be removed from cubicle, bushing alignment checked, and corrections made.

BUSHING STUD REMOVAL (Fig. 3)

68. When it is found necessary to replace a bushing stud remove the phase barriers and arc-chute assemblies (refer to Paragraphs 56 and 57) from all phases for ease of access.

CAUTION: WHEN REMOVING A BUSHING STUD DO NOT DISTURB THE OTHER BUSHINGS AS THEY MUST BE HELD IN CORRECT POSITION FOR REFERENCE SEE PARAGRAPH 65.

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SUGGESTED MAINTENANCE CHECK LIST
FOR
TYPES MB-250, MC-150, MC-250, MC-500
AIR MAGNETIC CIRCUIT BREAKERS

(REFERENCES ARE TO INSTRUCTION BOOKS BWX-6375, 6376, 6380, 6381)

The following list is intended to serve as an easy to use guide for the purpose of insuring complete and adaquate servicing of the equipment at the regularly scheduled maintenance intervals.

A routine service inspection should be made at six month or 2000 operation intervals, whichever comes first. The actual service interval and the amount of servicing required will usually be determined by the particular conditions at the installation and will be influenced by such things as the number of operations, number of fault interruptions, cleanliness of the equipment, and past experience with the equipment.

Servicing is usually intended to cover adjusting, cleaning, lubricating, tightening, inspection, test etc. A permanent record is usually desirable and should list for each serial number the date, operation counter reading, general condition of equipment, and work done by serviceman.

For new equipment not yet in service, refer to paragraph 1 through 10 of the instruction book.

1. Prepare breaker for servicing by removing phase barriers, arc chute top section, barrier stack, blowout side plates and arc chute lower section. All parts lift off easily without removing hardware, except for arc chute lower section which requires the blowout coil terminals to be loosened. Refer to Fig. 8.

2. Operate breaker with maintenance closing device to check general operation and freedom of movement.

3. Visually inspect all parts during all phases of servicing.

4. If a travel recording device is available, it will furnish an excellent indication of the mechanical operation of the breaker. Refer to paragraph 50.

5. Clean all parts of breaker. An air blower is useful in removing dust from generally inaccessible places.

6. Remove disconnect arms as a unit by removing bolt 7-109. Refer to Fig. 7. Carefully inspect all contact surfaces in hinge joint. Contact washer 7-105 and adjacent surfaces should be clean and free of roughness

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or galling. Clean parts thoroughly and lightly brush off the felt sealing washer. Lubricate contact washer and mating surfaces by rubbing in micro-fine dry graphite used sparingly. Reassemble hinge joint and adjust hinge contact pressure per paragraph 30. (Note - older instruction books may state 8 to 12 pounds pull - 6 to 10 is adaquate).

7. Check operating mechanism toggle adjustment per paragraph 31. Adjustment is by spacer 4-226.

8. Check trip latch (4-141) adjustment per paragraph 32.

9. Check latch roll stop screw (4-224) adjustment per paragraph 32.

10. Check prop latch (4-198) adjustment per paragraph 32.

11. Check trip pin (9-131) clearance per paragraph 37.

12. Check trip pin (9-131) aftertravel per paragraph 37.

13. Check latch check switch (12-175) adjustment per paragraph 35. Check freedom of movement, lubricate arm.

14. Check limit switch (Fig. 11) adjustment per paragraph 34. Operate manually and electrically. Inspect to see that contacts are clean and make properly.

15. Check stroke of main contact per paragraph 28.

16. Check adjustment of main contact per paragraph 29.

17. Check auxliary switch adjustment per paragraph 33. Inspect condition of contacts.

18. Check control relay for proper action, check condition of contacts.

19. Manual trip rod should be such that end of rod is within 1/16" of the trip armature, but not in contact with it hard enough to change the armature position. Adjustment is by positioning collar on rod.

20. Position indicator should have full travel. Slack in operating wire may be taken up by putting a kink in the wire.

21. Operation counter is actuated by a spring which should be adjusted for minimum force by positioning of the counter arm.

22. Mechanical trip interlock (2-322) should be adjusted to trip the breaker within 5/16 movement when removing breaker from fully inserted position in cubicle. The rod that engages the latch should clear the latch by 1/32 to 1/16 and the trip roller should clear the cam on the cubicle floor by at least 1/16 when breaker is fully inserted.

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23. Check all wiring for frayed or broken wires, tighten all terminals.

24. Check all hardware for tightness (see special instructions for hinge joint hardware, item 6 above). Note that Stover locknuts are used in many places. These nuts may be identified by the slightly egg-shaped hole on one end and the parallel grooves on the corresponding face of the nut.

25. Operate breaker manually and electrically. Check operation at minimum close and trip voltage if possible.

26. If breaker is rectifier operated, refer to BWX-6389-1 for rectifier instructions.

27. Reassemble breaker - Be sure blowout coil terminals are properly fastened.

28. Check breaker in cubicle. Check general fit and line-up. Check operation of trip interlock in test position and fully inserted position. Check secondary wiring fingers for good contact. Check grounding contacts for good contact.

29. General. The above points will provide a quick reference for maintenance procedures. Other items may be added as experience dictates. For a more thorough understanding of the equipment, the instruction book should be studied. Refer to paragraphs 47 through 51 for general comments on maintenance and lubrication.

May 1, 1957

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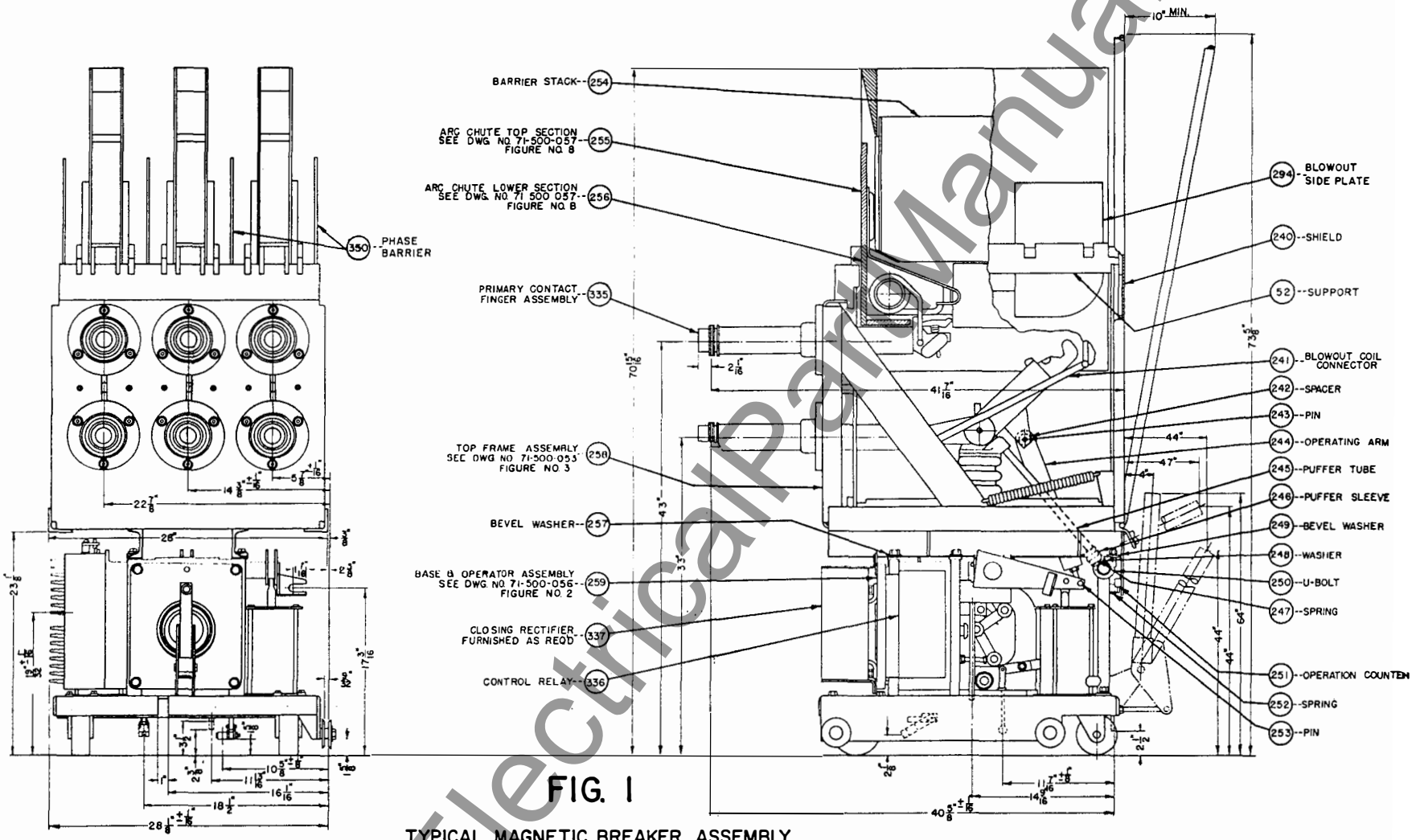

FIG. 1

TYPICAL MAGNETIC BREAKER ASSEMBLY

SEPTEMBER 16, 1953

71-500-077

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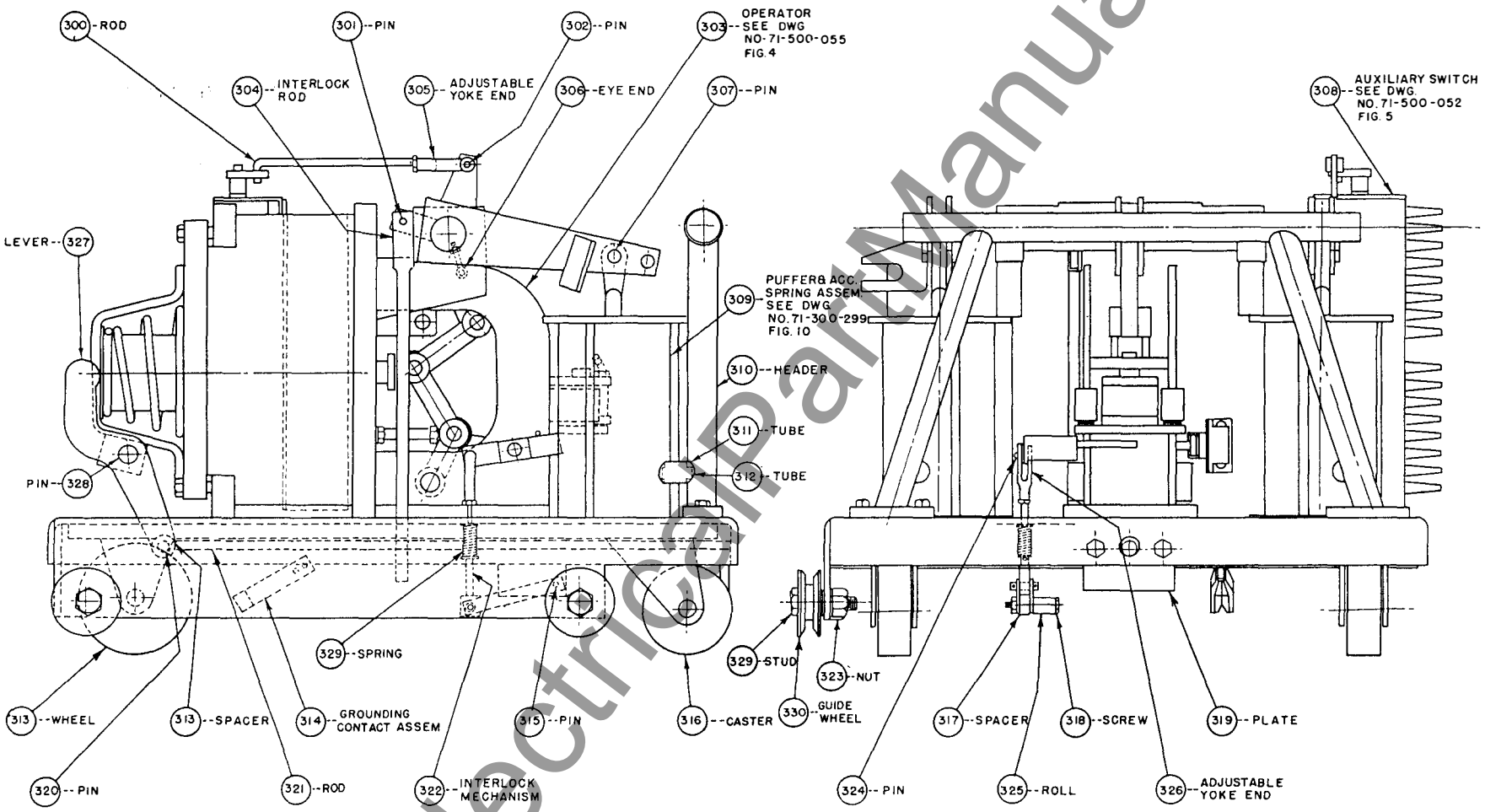

FIG. 2
TYPICAL BASE AND
OPERATOR ASSEMBLY

JULY 6, 1953 71-500-056

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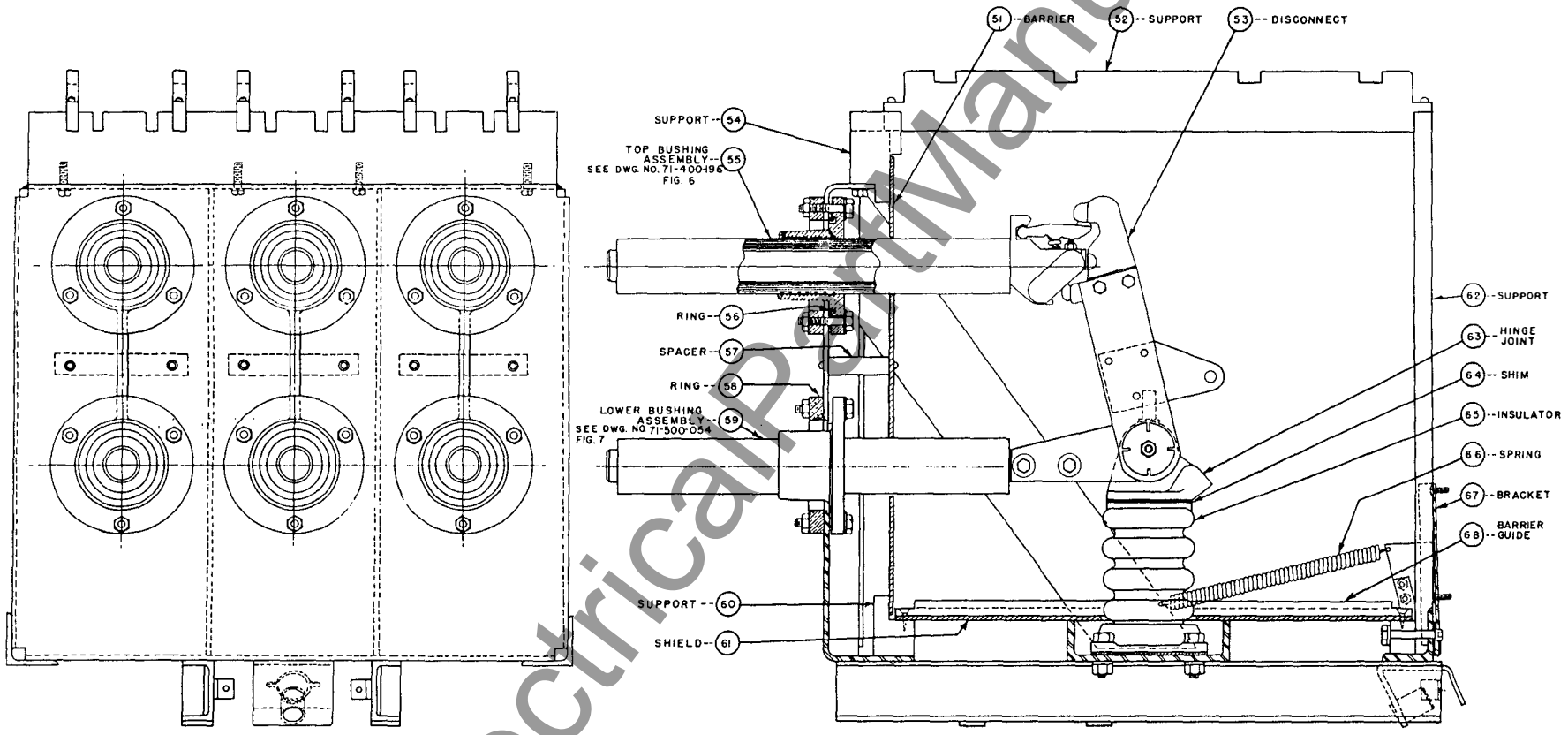

FIG. 3

TYPICAL TOP FRAME ASSEMBLY

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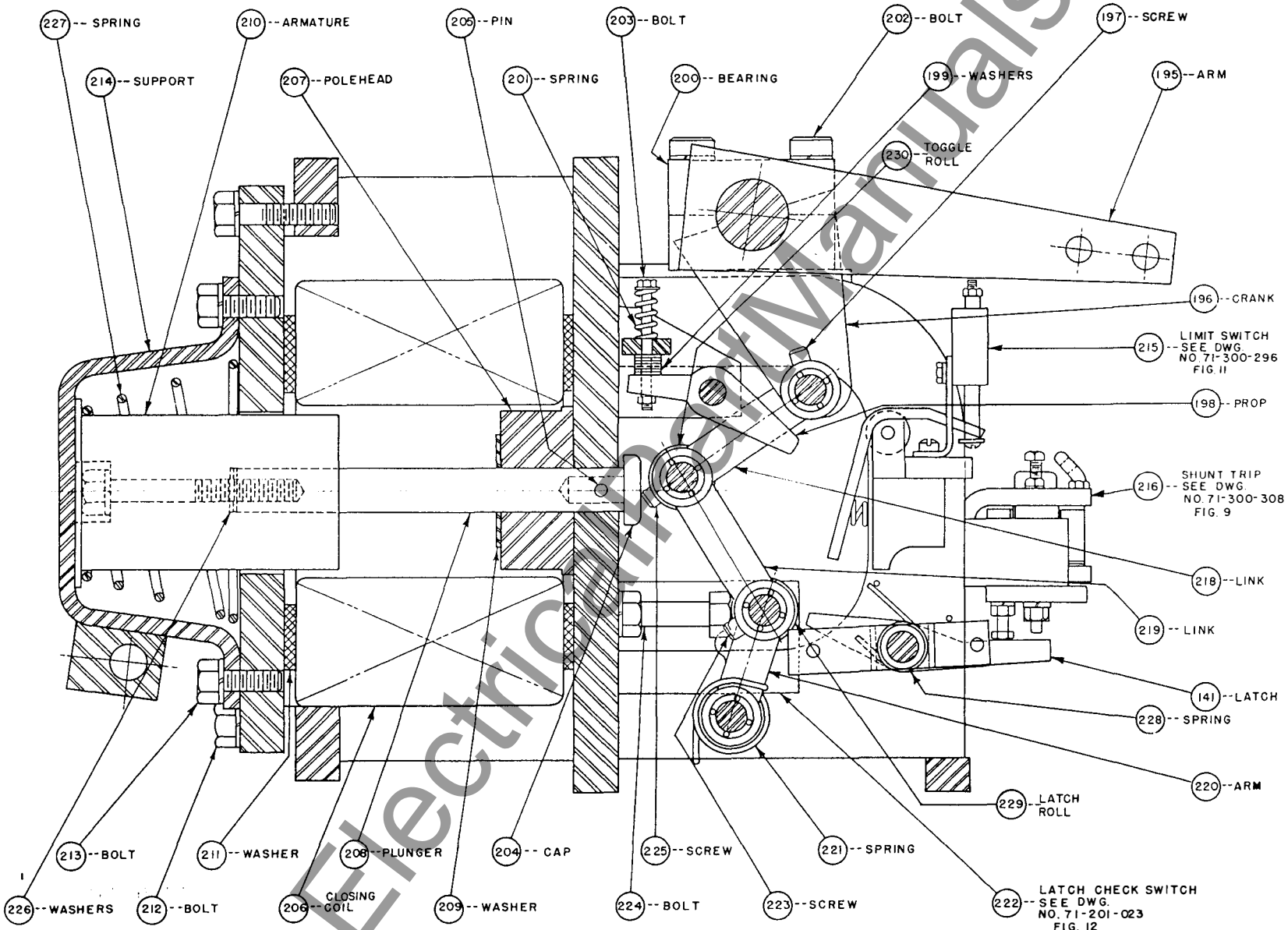

FIG. 4
TYPICAL OPERATOR ASSEMBLY

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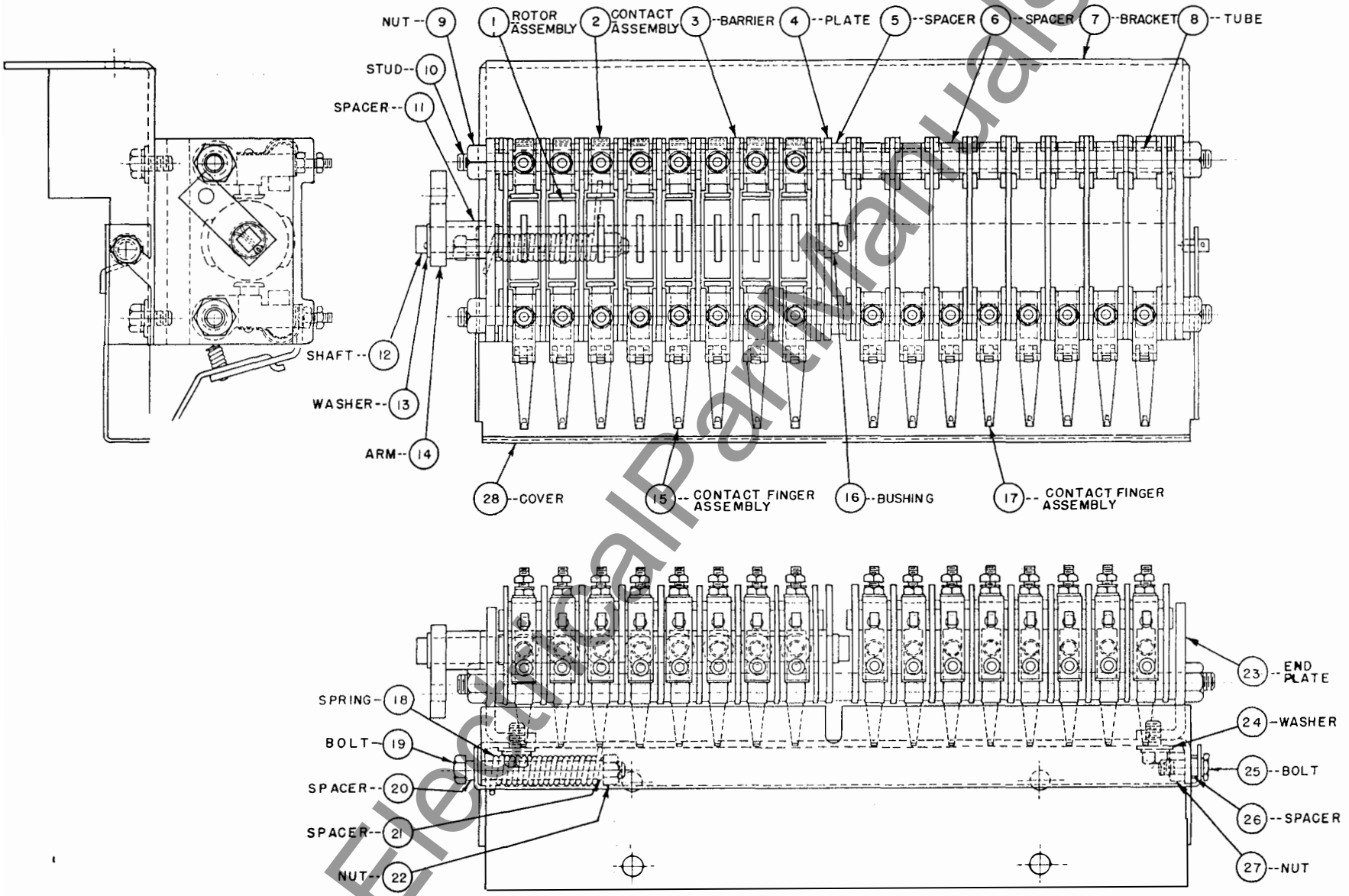

FIG. 5

TYPICAL AUXILIARY SWITCH

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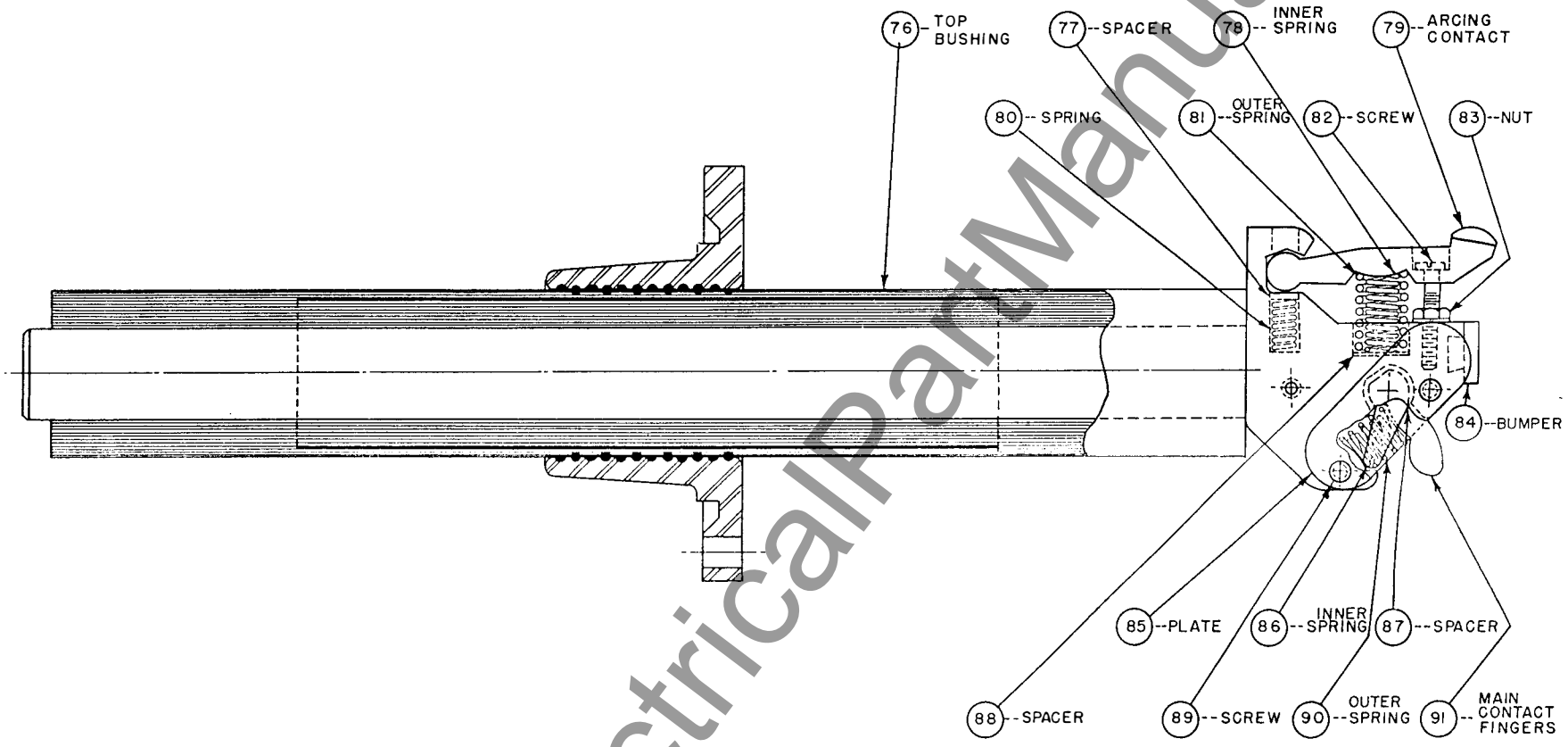

FIG. 6

TYPICAL TOP BUSHING ASSEMBLY

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71-400-196

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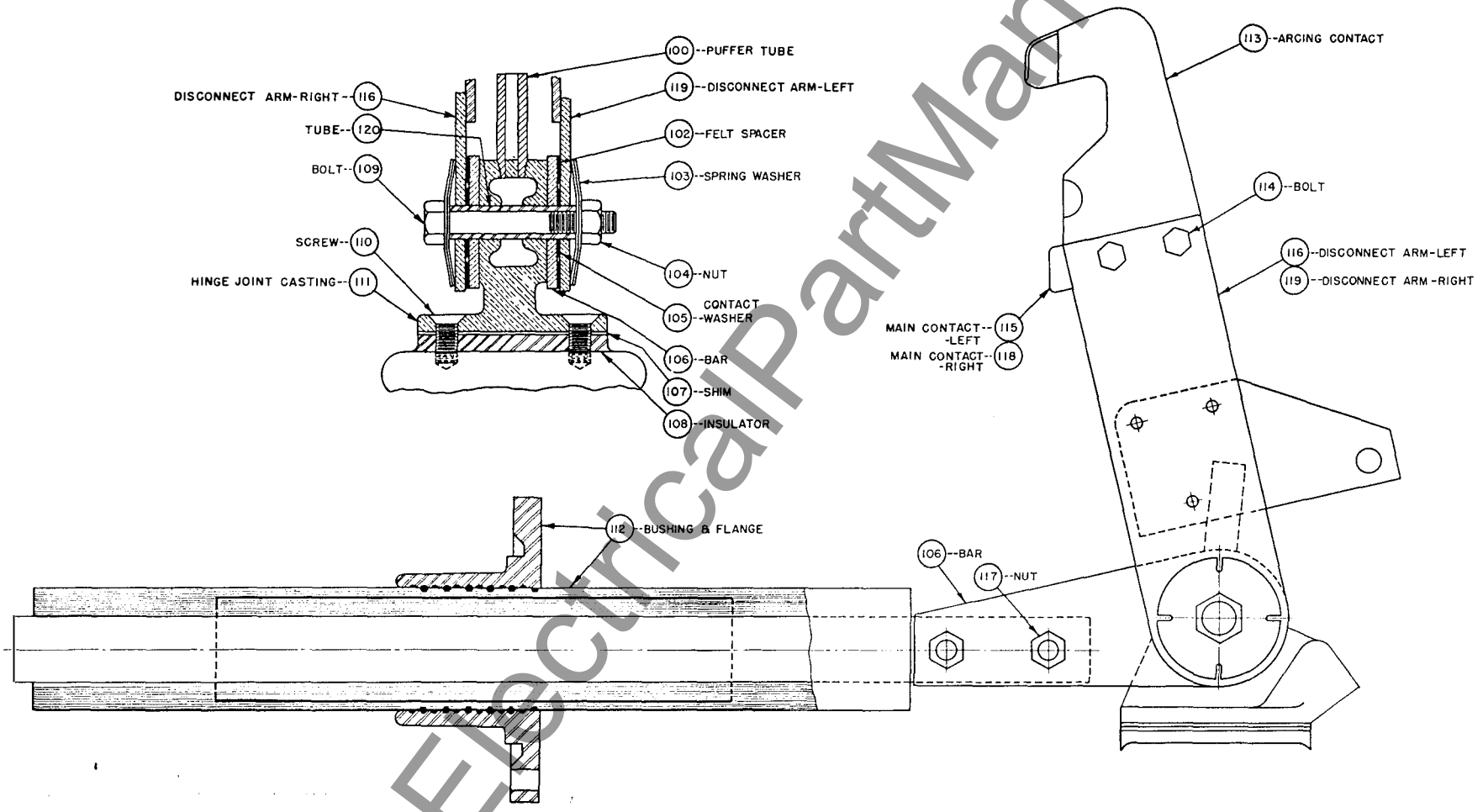

FIG. 7

TYPICAL LOWER BUSHING ASSEMBLY

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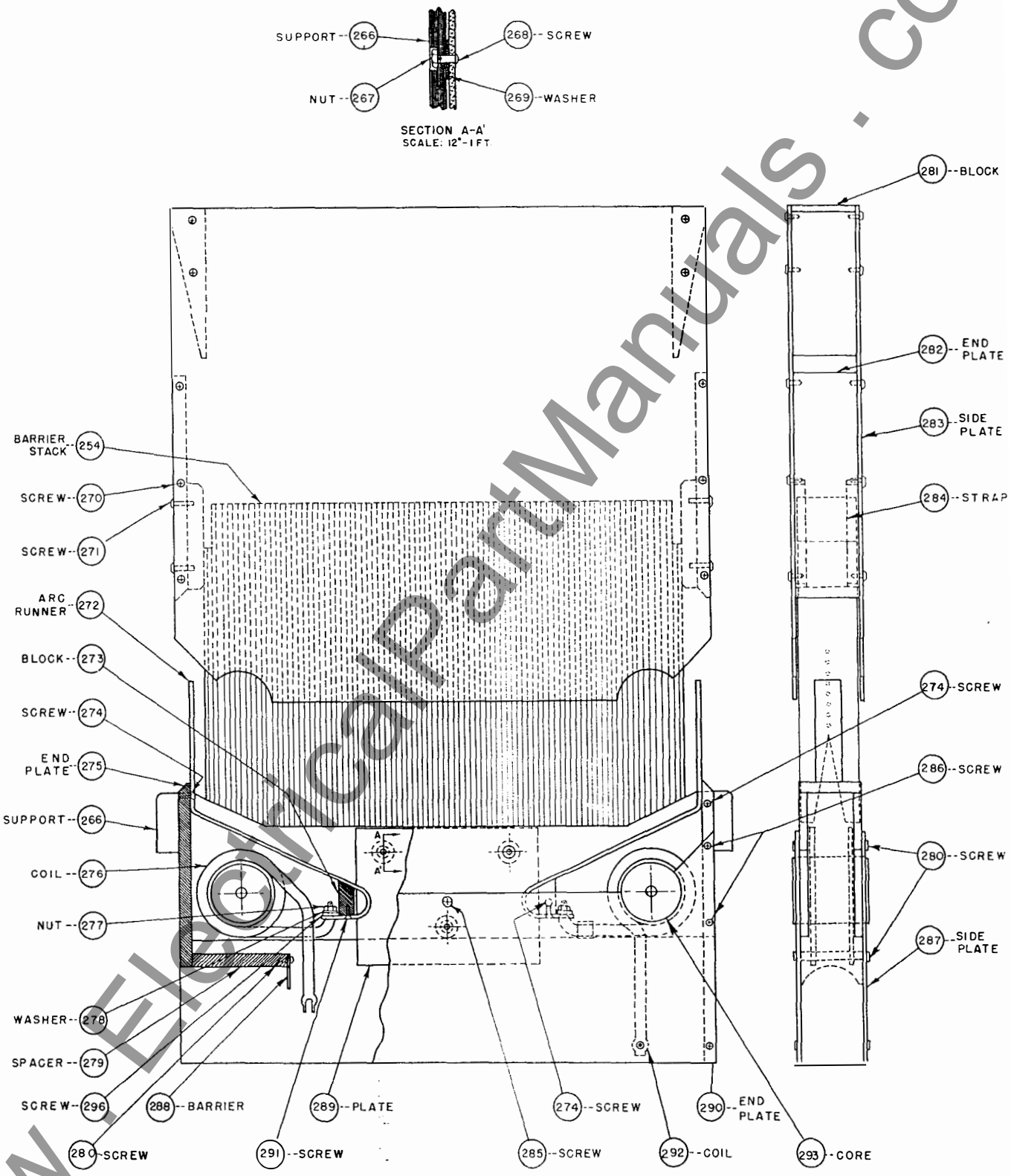

FIG. 8
TYPICAL ARC CHUTE
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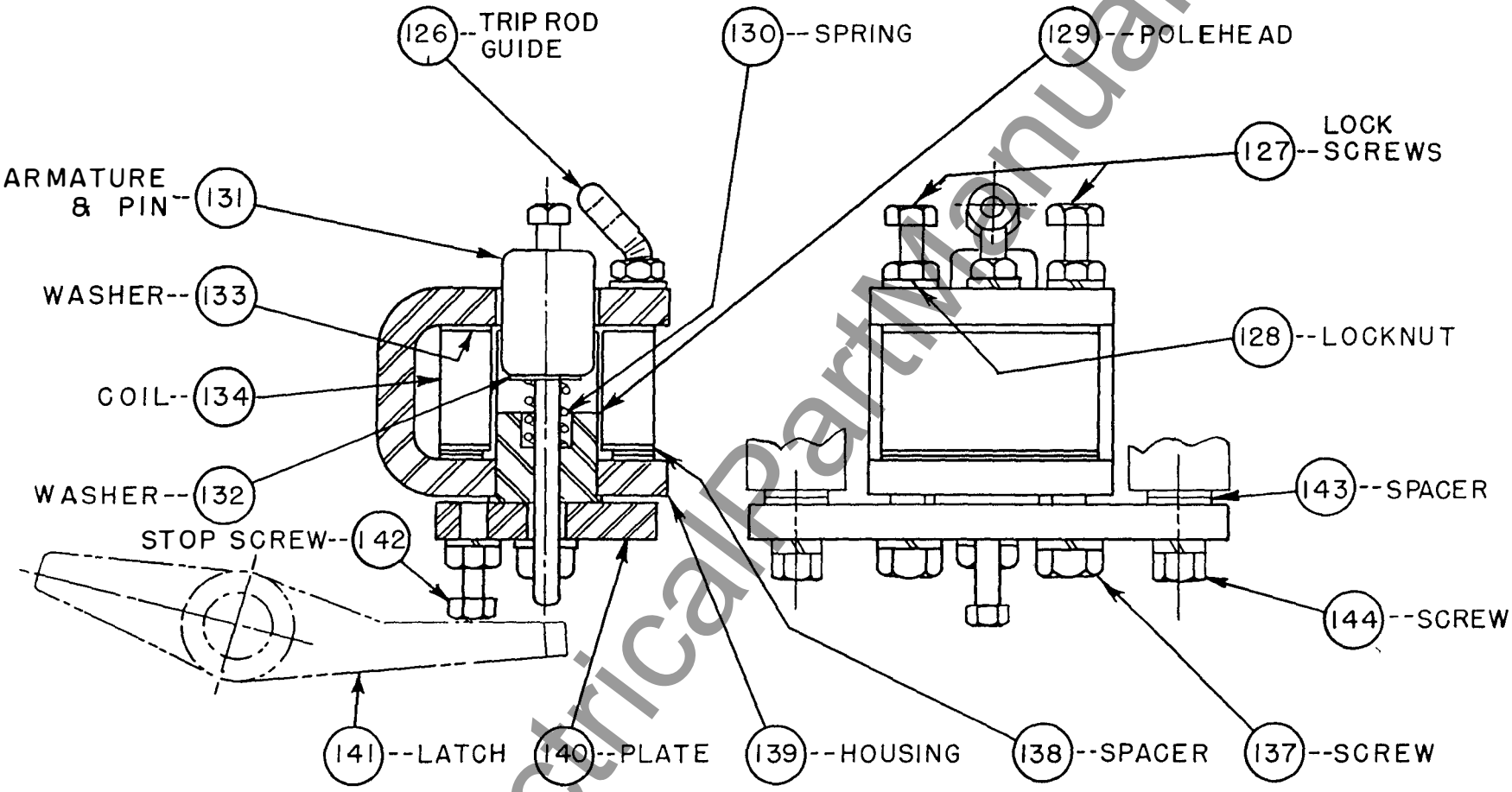

FIG. 9

TYPICAL SHUNT TRIP ASSEMBLY

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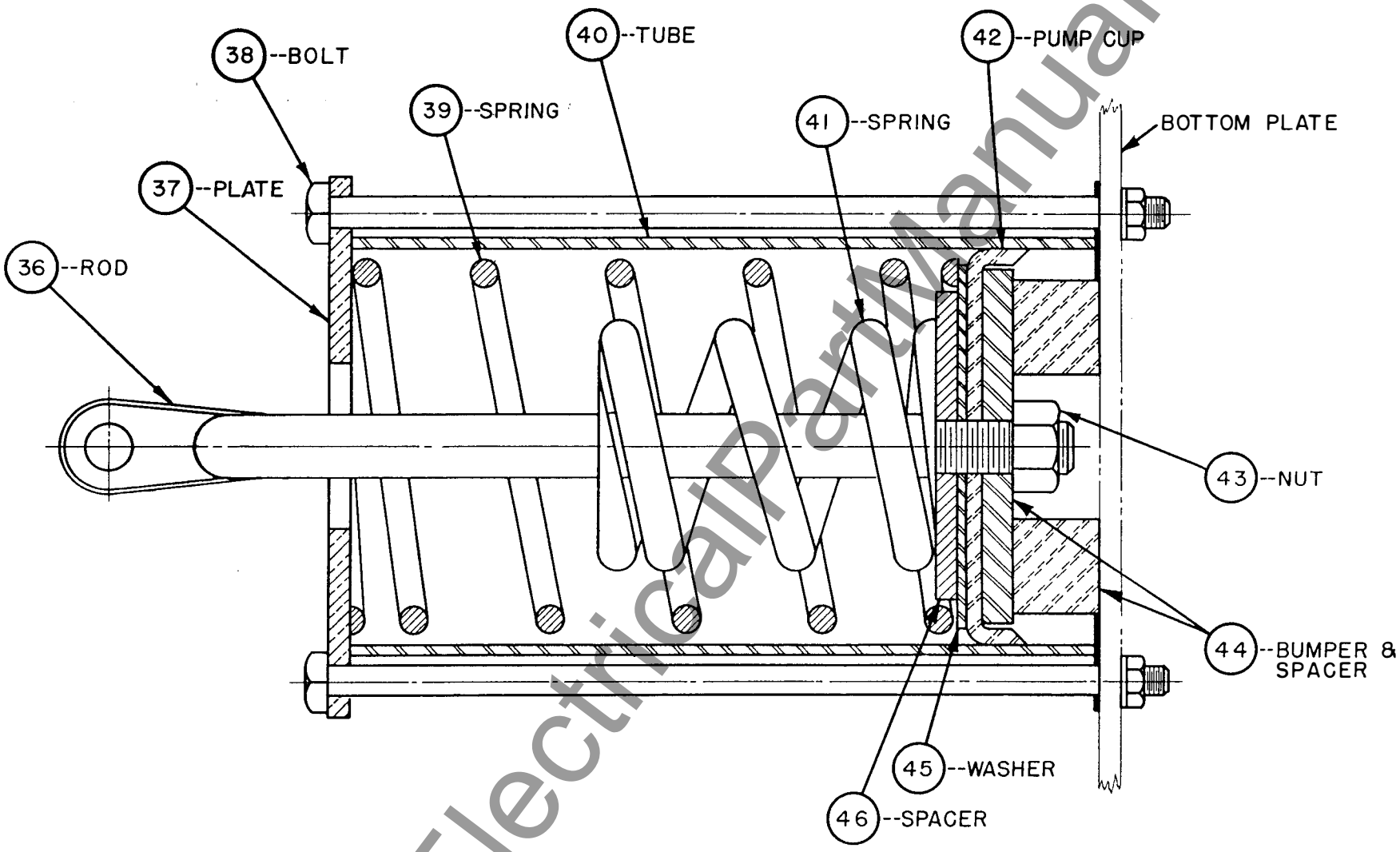

FIG. 10

PUFFER AND ACCELERATING SPRING ASSEMBLY

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71-300-299

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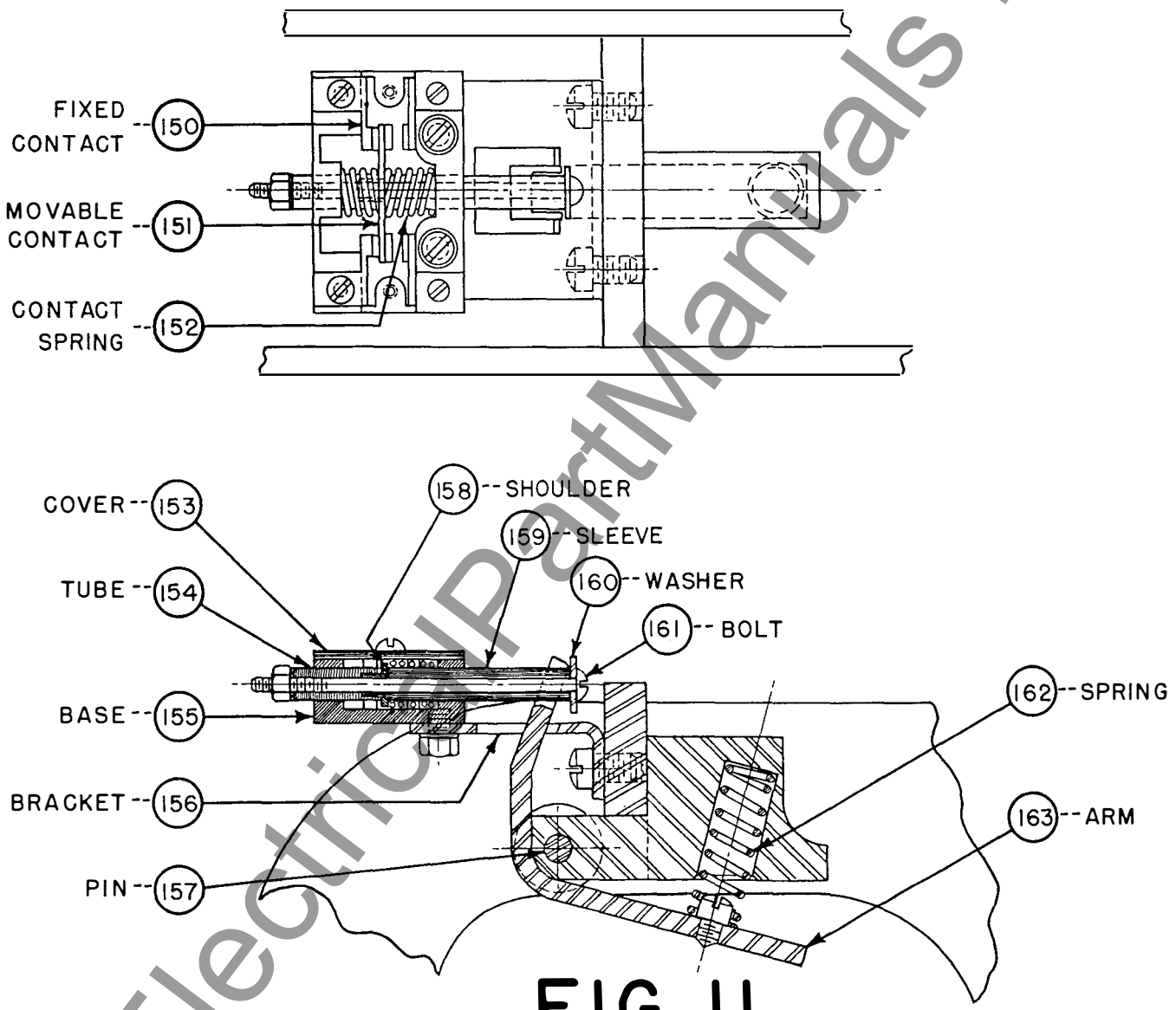

FIG. 11
TYPICAL LIMIT SWITCH

TYPE SO-35

JUNE 12, 1953 71-300-296

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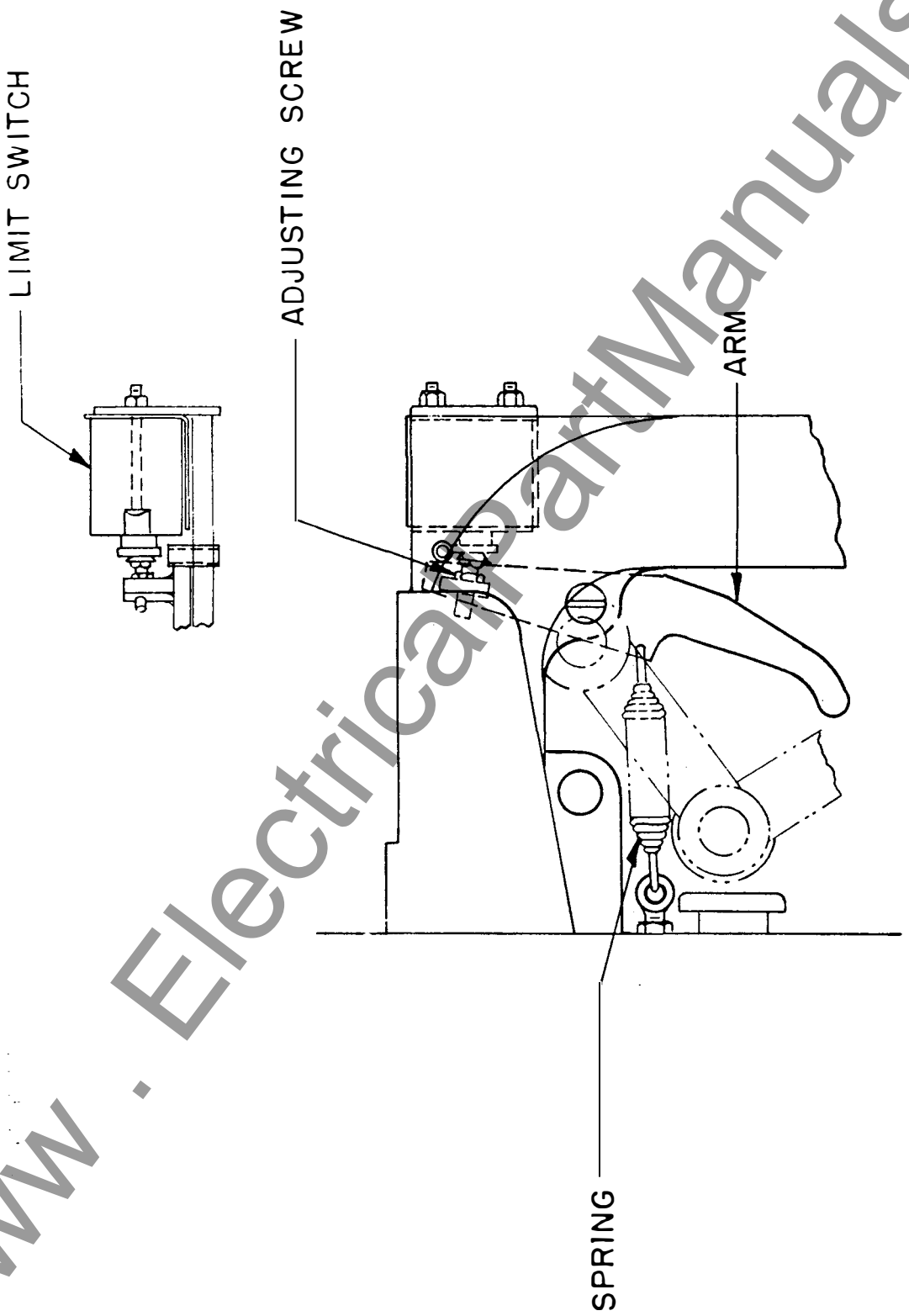

FIG. IIA

TYPICAL LIMIT SWITCH

71-206-850

9-26-1958

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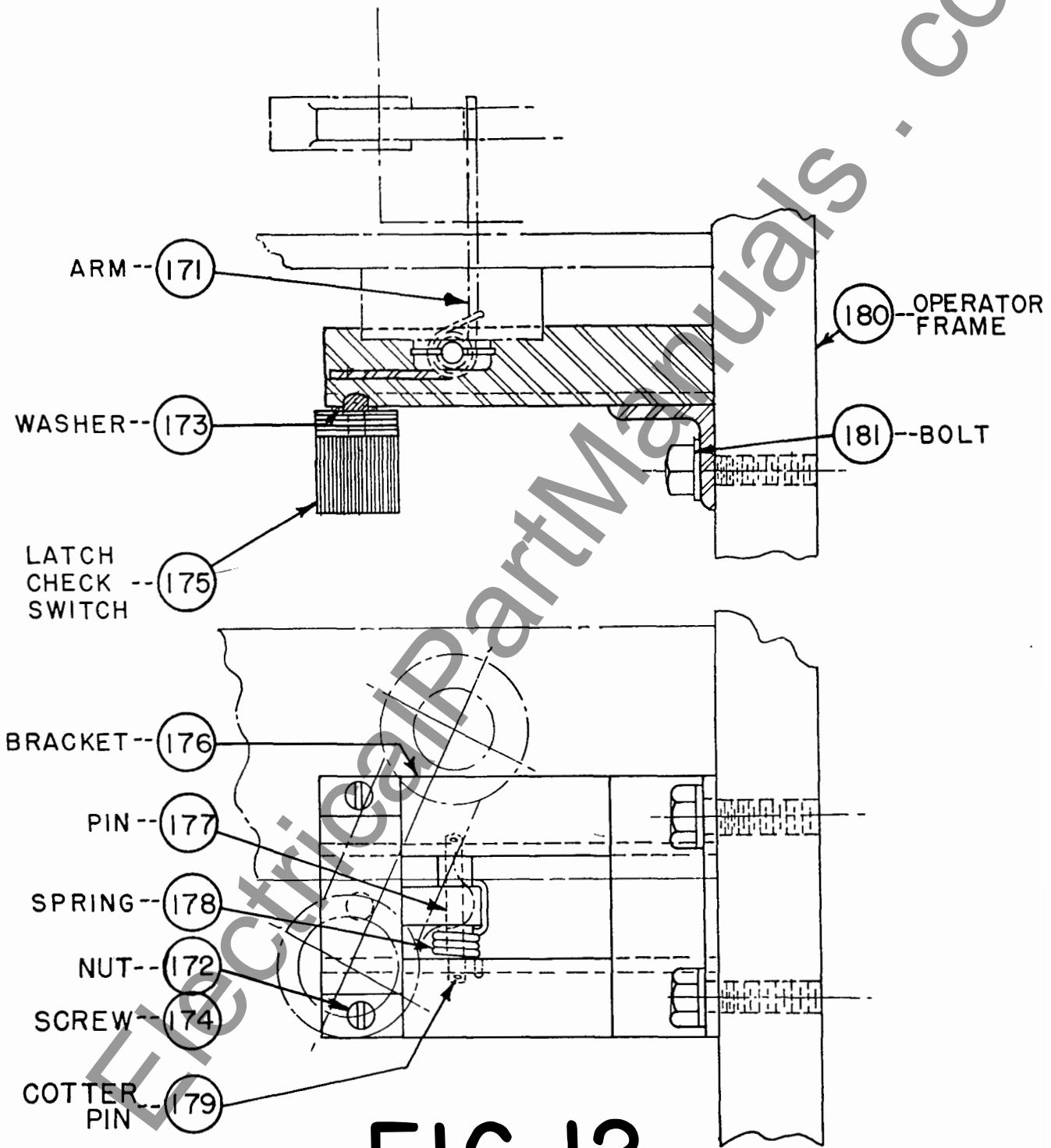

FIG. 12

TYPICAL LATCH CHECK SWITCH

TYPE SO-35

JUNE 16, 1953

71-201-023

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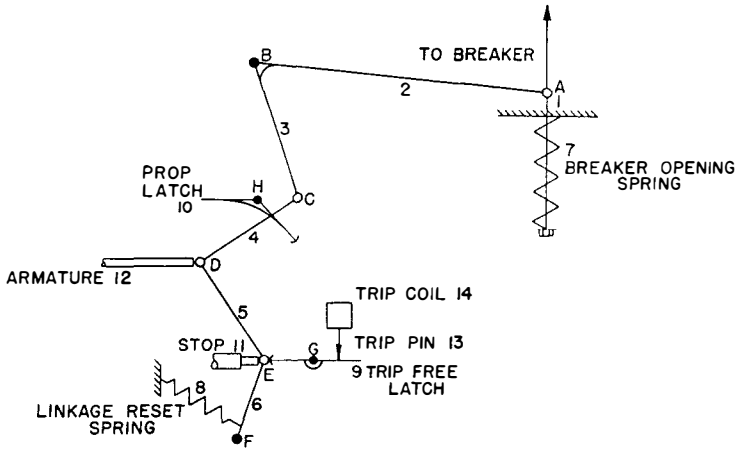
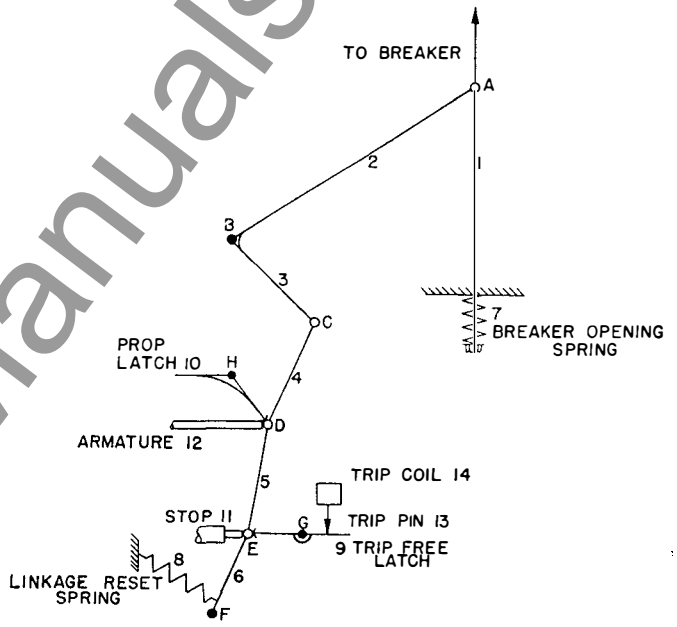


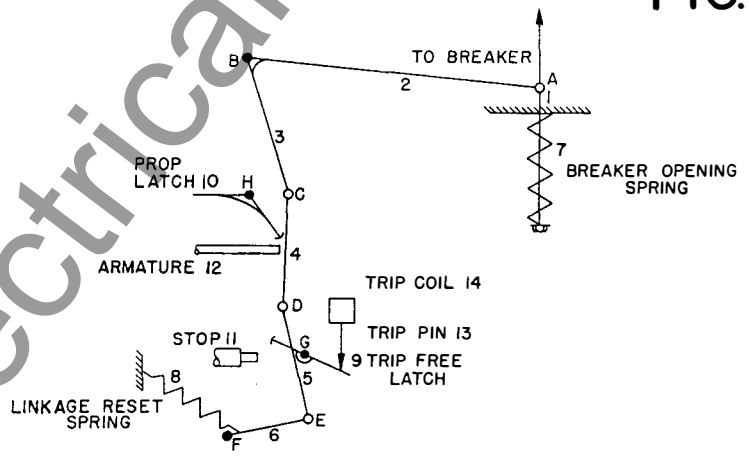
OPEN

FIG. 13



CLOSED

FIG. 14



TRIP FREE

FIG. 15

TYPICAL OPERATOR LINKAGE DIAGRAM

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