INSTRUCTIONS

for

the Installation, Care and Operation of Circuit Breakers and Accessories

6/60

TYPE "F" MOVABLE PORTION
MC-750/1000
RUPTAIR MAGNETIC
POWER CIRCUIT BREAKER
AND AUXILIARY EQUIPMENT

BOOK BMI-6549

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

TABLE OF CONTENTS
FOR
INSTRUCTION BOOK BWX-6549

CONTENTS — SECTION NO.

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ILLUSTRATIONS FOR
MAGNETIC BREAKER AND AUXILIARY EQUIPMENT

FIG. NO.	DESCRIPTION
4	TYPICAL OPERATOR ASSEMBLY
7	TYPICAL SHUNT TRIP ASSEMBLY
10	DASH POT AND OPENING SPRING ASSEMBLY
11	TYPICAL AUXILIARY SWITCH
12	TYPICAL LATCH CHECK SWITCH
13, 14, 15	TYPICAL OPERATOR LINKAGE DIAGRAM
21	TYPICAL MAGNETIC BREAKER ASSEMBLY
22	TYPICAL BASE, OPERATOR AND STUD ASSEMBLY
23	TYPICAL STUD AND SUPPORT ASSEMBLY
24	TYPICAL TOP BUSHING ASSEMBLY
25	TYPICAL LOWER BUSHING ASSEMBLY
26	ARC CHUTE MC-750
26A	ARC CHUTE MC-1000
27	AFTERCOOLER AND MAGNETIC CIRCUIT MC-750
27A	AFTERCOOLER AND MAGNETIC CIRCUIT MC-1000

SECTION - S

CAUTIONS TO BE OBSERVED IN THE INSTALLATION, OPERATION, AND MAINTENANCE OF AIR MAGNETIC CIRCUIT BREAKERS

1. Examine breaker when delivered and report any SHIPPING DAMAGE.
2. Breaker shipped TIED in CLOSED POSITION.
3. Remove SHIPPING BRACES and FASTENINGS.
4. Hoist breaker only with SPREADER - avoid SHORT HITCHES.
5. Barrier stacks are shipped in SEPARATE CONTAINERS.
6. Store to keep breaker and barrier stacks CLEAN and DRY.
7. Operating power LEADS must be large enough to avoid VOLTAGE DROP.
8. Before adjusting or repairing, disconnect breaker from all sources of POWER and see that breaker is OPEN.
9. Unbolt MOVING END ARC RUNNER before raising arc chutes.
10. Barrier stacks require SPECIAL HANDLING to avoid damage.
11. Avoid CLEANING FLUIDS detrimental to insulation or paint.
12. Keep GRAPHITE off insulation under penalty of replacement.
13. Do not dress Silver Contact surfaces.
14. Install barrier stacks before ENERGIZING breaker.
15. Do not close energized breaker with MANUAL CLOSING DEVICE.
16. Reconnect MOVING END ARC RUNNER before ENERGIZING breaker.
17. For breakers equipped with STORED ENERGY CLOSER
    a) Lock closing spring release latch before making adjustments.
    b) Discharge closing springs before making repairs
    c) Unlock closing spring release latch before returning breaker to cubicle.

PART 1 - INTRODUCTION

1.1 GENERAL

Allis-Chalmers power circuit breakers are the products of advanced research and design. They are precision electrical equipment, tested to current ASA, EEI, and NEMA Standards, and manufactured in accordance with highest standards.

1.2 PROPER CARE IS ESSENTIAL TO GOOD SERVICE

The successful operation of this circuit breaker depends on proper installation and maintenance as a complement to quality design and fabrication.

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.

The following numbering system has been adopted for ready reference in this instruction book:

1.2 - Refers to Section #2 of Part 1

4-220 - Refers to item #220 on illustration marked Figure 4

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

1.3 INSPECTION AND SHIPPING

During assembly and when circuit breakers are completed, they are subjected to a series of tests and inspections. Packing is expertly done to assure maximum protection during shipment.

1.4 RECEIPT

Upon receipt of the circuit breaker 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.

1.5 STORAGE

If the breaker cannot be set up immediately in its permanent location, and it is necessary to store the equipment, it should be kept in a clean dry place and protected from dust, the action of corrosive gases, from coal combustion products, etc., and from mechanical injury.

1.6 REMOVE SHIPPING SUPPORTS

This circuit breaker has been shipped locked in the closed position. Packing braces that were installed to hold moving parts stationary in transit, must be removed. Fastenings installed to hold moving components of auxiliaries in closed position during transit must be removed.

1.7 HANDLING

In moving a circuit breaker after shipping crates or supports have been removed, and in handling the breaker with a crane or hoist, hooks should be attached only to special supports provided for the purpose and a spreader used where necessary to prevent distortion of frame members. Avoid short hitches which could place too much strain on parts of the breaker such as bushings, insulating parts, fittings, etc., which are not designed primarily for structural strength.

1.8 PRE-INSTALLATION SERVICE

Circuit breakers are completely set up, adjusted, and tested at the factory. However, since there are possibilities that adjustments or fastenings may have become loosened during shipment, storage, and installation, they should be checked thoroughly and corrected where necessary as described hereinafter before energization. The breaker should be operated several times manually at first, and then electrically, prior to and after installation in position before the breaker is ready for service.

Bushings and other insulating parts should be clean and dry. All contact surfaces should be inspected to see if they are clean and smooth. (Do not dress silver surfaces.)

PART 2 - INSTALLATION

2.1 GENERAL

The Allis-Chalmers RUPTAIR air magnetic circuit 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".

This type of circuit breaker is particularly designed for operation within a fixed cell or metal-clad switchgear cubicle.

2.2 INSTALLATION

Although the circuit breaker was completely set up, adjusted, tested, and packed for maximum protection in transit, it is necessary that adequate steps be taken to prepare the unit for installation.

2.3 REMOVE SHIPPING BRACES

Breaker is shipped locked in closed position and barrier stacks (21-25)* are shipped in separate containers. Remove all shipping bracings and fastenings used to hold trip latch (4-27) and other moving parts of breaker and auxiliaries.

2.4 PREPARE BREAKER FOR INSPECTION

Prepare breaker outside of cubicle for installation inspection and servicing. With the use of arc chute lifting device, furnished with each order, remove phase barriers and raise arc chutes to expose interior of breaker. Prior to raising arc chutes, it is necessary to unbolt connector (21-6) from movable arc runner(26-3). Note that each arc chute pivots on pin (21-7). The arc chutes may be raised for normal inspection purposes or removed if necessary by removing pivot pins (21-7).

CAUTION: BREAKER AND AUXILIARIES SHIPPING BRACES MUST BE REMOVED. BARRIER STACKS (ITEM 21-25) SHIPPED IN SEPARATE CONTAINERS) MUST BE INSTALLED BEFORE BREAKER IS ENERGIZED.

2.5 CHECK AND ADJUST

Check and adjust breaker in accordance with items 1 to 21 inclusive of "Schedule of Checks and Adjustments" Appendix A.

*Numbering system is explained in Section 1.2

2.5 CHECK AND ADJUST (Continued)

Operate breaker several times manually and then electrically to observe lubrication and smooth operation of all moving parts. A device for manual closing circuit breaker is furnished with each order of our air magnetic circuit breakers.

CAUTION: MANUAL CLOSE DEVICE IS NOT SUITABLE FOR ACTUATING THE BREAKER ON AN ENERGIZED CIRCUIT.

2.6 INSTALL BARRIER STACKS

Lower arc chutes using arc chute lifting device. Remove magnetic circuit, (21-24), aftercoolers (21-28) and (21-29), and tube assemblies (26-18). Install barrier stacks (see sections 2.3 and 6.3b). Replace tube assemblies, aftercoolers, magnetic circuit, and phase barriers.

2.7 CLEAN BREAKER AND CUBICLE

Make sure that breaker and cubicle are both entirely free of moisture, dirt, and other foreign matter. Insulation in both breaker and cubicle should be checked for dielectric strength.

2.8 INSERTION MECHANISM

The breaker insertion mechanism should be checked and lubricated if necessary for proper operation to prevent jamming during insertion. The two front wheels on the breaker carriage swivel and the two rear wheels are fixed. The breaker should be moved into position so that it can be rolled straight into the cubicle with a minimum of friction on the wheels and guides in the cubicle.

2.9 GROUNDING CONTACTS

Check to see that grounding fingers (21-12) on bottom of breaker will make proper contact with stationary ground bar in cubicle. Check for proper grounding contact when breaker is moved into cubicle.

2.10 MECHANICAL INERLOCKS

Test mechanical interlock plunger (21-18) and make sure that it operates freely and has no binds or interference.

2.11 POSITIONS IN CUBICLE

Move the breaker into each of its three positions in the cubicle; disconnected position, test position, and operating position. Test to make sure that breaker can be closed electrically only in its test position and in its operating position. When a switchboard has more than one of this type of the same size and rating of circuit breaker, each circuit breaker should be tried in each of the three positions in several cubicles to assure interchangeability.

2.12 OPERATE IN TEST POSITION

The breaker should be operated several times electrically in its test position to see that all parts work correctly in final preparation for its operating position. Make sure that secondary contacts of breaker are in alignment with secondary contacts in the cubicle.

Move the breaker slowly to its operating position. Check alignment of all six breaker primary contacts for proper engagement with the cubicle primary studs. The alignment of breaker and cubicle primary contacts should be close enough so that the contact fingers on the breaker will mesh with the studs in the cubicle without jamming. In the operating position in its cubicle, the Allis-Chalmers RUPTAIR air magnetic circuit breaker is ready for energization and operation within its rating.

PART 6 - REPLACEMENT PARTS

6.1 HOW TO ORDER

When ordering replacement parts, it is very important to give complete information. This information should include:

(1) Breaker serial number

(2) Number of pieces required

(3) Reference number

(4) Instruction book number

(5) Description of part (Use instruction book descriptions where possible)

(6) Rated voltage of all motors, relays and coils ordered

(7) Rated amperes of all motors, relays and coils ordered

(8) Rated voltage of breaker

(9) Rated amperes of breaker

The breaker serial number is necessary to determine the correct identity of a part; without this serial number, Allis-Chalmers Mfg. Co. cannot be sure of the correct identity of the desired parts.

If any doubt exists as to the instruction book reference or the description a dimensional sketch of the desired part will help to properly identify it.

6.2 RECOMMENDED SPARE PARTS LIST (BWX-6549)

It is recommended that sufficient parts be carried in stock to enable operators of circuit breakers to replace without delay any worn, broken, or damaged parts. A list of recommended spare parts follows and is arranged to facilitate choosing the correct parts for the breakers involved. Two columns on this list give the quantities recommended for an installation of one to five breakers and for an installation of five or more breakers.

Ref. No.	Description		Drawing No.	Recommend for Stock 1-5 Breakers	5 or more Breakers
21-3	Contact Finger Assembly (Primary)	1200 Amps.	71-201-738-501	2	6
		2000 Amps.	71-201-458-501	2	6
		3000 Amps.	71-240-442-502	2	6
21-21	Relay (X, Y)	125V. DC	71-206-872-501	1	1
		250V. DC	71-206-872-502	1	1
		230V. AC	71-301-080-501	1	1
4-8	Closing Coil	125V. DC	71-207-740-501	1	1
		250V. DC	71-207-740-503	1	1
	(AC Close)-	200V. DC	71-207-740-502	1	1
7-21	Coil (Trip)	125V. DC	71-200-745-501	1	2
		250V. DC	71-200-745-502	1	2
		48V. DC	71-200-745-503	1	2
		24V. DC	71-200-745-504	1	2
	Silicon Rectifier Assembly (for AC Close)		71-111-264-501	1	1
	Capacitor (for AC Close)		W-663-104	1	1
21-25	Barrier Stack	MC-750	71-302-237-501	2	6
		MC-1000	71-302-481-501	2	6
24-3	Contact Finger (Stationary)	MC-750	71-111-458-501	-	24
		MC-1000	71-111-458-501	-	30
24-4	Arcing Contact (Stationary)		71-111-462-501	9	9
25-3	Contact (Moving)	MC-750	71-207-476-501	3	3
		MC-1000	71-207-476-503	3	3
25-6	Washer	1200A	71-111-446-001	2	6
		2000A	71-111-446-001	2	6
		3000A	71-111-446-001	4	12
26-5	Transfer Stack		71-207-489-502	3	3

PART 5 - MAINTENANCE

5.1 GENERAL

Safety of the operator and continuity of electric service of loads connected to circuit breakers are dependent upon proper operation of the breakers. In order to keep circuit breakers in proper order, it is recommended that 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.

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.

5.2 CONTACTS

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.

5.3 BARRIER STACKS

The barrier stacks are fragile and should be handled carefully. The barrier stacks should be inspected for erosion of the plates in the areas of the slots. The stacks should be replaced when a milky glaze is observed on the full length of the edges of most of the slots. They should be likewise replaced if plates are broken or cracked. When cleaning the breaker and cubicle, inspect for pieces of barrier stack refractory material which would obviously indicate breakage.

5.4 BREAKER TIMING

Check the contact adjustment and breaker timing, 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 when the breaker was new will immediately indicate a condition of maladjustment or friction should the timing vary more than 1/2 cycles on opening or 2 cycles on closing with the same coils. A hole is provided in the movable contact arm (25-14) for the purpose of attaching a speed analyzer connection.

5.5 LUBRICATION

Lubrication is of the utmost importance and a special effort should be made to assure that all moving parts are kept clean and properly lubricated at all times. The disconnect hinge joint and the solenoid armature are lubricated with microfine dry graphite. Graphite should be rubbed in well and all excess carefully removed.

CAUTION: GRAPHITE MUST BE KEPT OFF INSULATION UNDER PENALTY OF REPLACEMENT, AS IT CANNOT BE SATISFACTORILY REMOVED.

Bearing Pins and other moving parts should be lightly lubricated with a light film of "Aero Lubriplate" or equal. Needle Bearings will in general not require frequent lubrication, but care should be taken to prevent entrance of dirt and foreign material during maintenance work. Mating surfaces of main and arcing contacts should not be lubricated.

5.6 MAINTENANCE GUIDE

Refer to the attached "Schedule of Checks and Adjustments", Appendix A, for a digest of pertinent instruction book information, a guide to simple and convenient maintenance procedures. Make adjustments to values tabulated in "Circuit Breaker Adjustment Values", Appendix B attached.

4.13 ADJUSTMENT FOR STROKE

This adjustment is accomplished by lengthening or shortening link (22-5) between operator mechanism and interrupter moving blade to bring dimension c, View "AA", Figure 23, to (see Appendix B-15). Open breaker, remove pin (22-15), loosen checknut, and adjust the length of link (22-5) by screwing rod end in or out as required to bring this dimension to within tolerance in all four measurements in the phase. Make up checknut, replace pin (22-15), insert and spread cotter pin. The stroke should be adjusted in each phase individually.

4.14 CONTACT LEAD (Fig. 23)

Contact lead is adjusted on breakers in the factory and should normally not require further adjustment. It should, however, be checked on each phase separately and only with contact alignment on the phase in correct adjustment.

In order to prepare breaker for contact lead check and adjusting, be sure that breaker is open and disconnect the movable contact from operator link (22-5) by removing pin (22-20) and two spacers (22-28). Bring movable arcing contact (25-3) so that it just touches the stationary arcing contact (24-4) as shown in Fig. 23, View "AA", (Arcing Contacts Engaging). Measure dimension a, Figure 23, the shortest gap between the two tertiary contacts, and dimension b (View "AA", Figure 23), the shortest gap between the main contacts. Dimension a should be (see Appendix B-16) and dimension b should be (see Appendix B-17).

If the dimensions a and b are found to be different than (see Appendix B-16 and B-17), remove one roll pin from each plate (24-10), loosen eight screws (24-22). Insert a spacer as thick as correct dimension a (see Appendix B-16) between the tertiary contacts, and apply a C-clamp bearing on rear of block (24-8) and front of movable contact (25-3). Tighten C-clamp to obtain dimensions b (see Appendix B-17). With contacts held in this position, move two plates (24-10) back so that pins (24-16) are touching leading end of plate slots. Tighten eight screws (24-22) drill and insert pin to retain adjustment. Remove spacer, remove C-clamp, and reconnect movable contact to link (22-5).

4.10 DASHPOT (Fig. 10)

The two dashpots in the breaker are carefully adjusted in the factory with the use of a speed analyzer. In proper adjustment the opening curve of a speed analyzer chart should indicate minimum contact bounce with no perceptable flattening along the slope of the curve. Normally no further adjustment of the dashpots should be required. This adjustment is made if necessary by loosening band (10-25), rotating this band around tube (10-3) to vary the dashpot opening. The openings on the two dashpots in a breaker should be approximately of equal size. If a speed analyzer is not available, adjust the bands (10-25) to (see Appendix B-14), wide opening.

4.11 CONTACT ALIGNMENT AND STROKE

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 normally be necessary. Check for proper contact alignment and, at the same time, for moving contact stroke by checking dimension c, View "AA", Fig. 23, between contact finger (24-3) and plate (24-10), on each side of bushing, top and bottom of each phase separately. It is not necessary that contacts touch simultaneously on all three phases.

When this dimension is found to be (See Appendix B-15) at all four points in a phase, both the alignment of the contacts and the stroke of the moving contact of that phase are correct.

If this dimension is found to be different than (see Appendix B-15) but all four in any phase measure within 1/32 of each other, it is necessary to adjust the stroke of the moving contact of that phase (see Section 4.13). If this dimension is not within tolerance, and there is a difference of over 1/32 among the four measurements in a phase, it is necessary to first adjust the contact alignment (see Section 4.12), and then the stroke of the moving contact (see Section 4.13).

4.12 ADJUSTMENT FOR CONTACT ALIGNMENT

To adjust contact alignment, close and latch breaker. Loosen two screws (24-24) and two screws (24-25). Move top block (24-8) and bottom block (24-13) sidewise until dimension c, View "AA", Figure 23, is (see Appendix B-15). Refasten screws (24-24) and (24-25). Both the contact alignment and stroke will be in proper adjustment.

In the event that this exact dimension and tolerance cannot be obtained, move blocks (24-8) and (24-13) so that all four dimensions c in a phase are within 1/32 of each other. Contact alignment in this phase will then be in proper adjustment.

Care must be exercised in adjusting contact alignment to retain block (24-8) firmly against stop on top of stud.

4.9 TRIPPING UNIT (Fig. 7)

The shunt trip application as shown in Fig. 7 is factory set and should need no further adjustment. In proper adjustment, trip pin (7-14) should float freely on its spring and not have any binds. The travel of the trip armature should be such that slow manual actuation of the trip pin (7-14) will trip the breaker and have (see Appendix B-12) aftertravel. Adjustments are made by use of spacer (7-22). Particular attention should be given this adjustment since latch stop screw (7-4) will be affected and require compensation any time that a spacer (7-22) is added or removed. Trip pin adjusting screw (7-17) should be set to provide (see Appendix B-13) clearance between latch and end of trip pin.

PART 4 - ADJUSTMENTS

4.1 GENERAL

The breaker has been completely set up, adjusted and tested at the factory. However, adjustments or fastenings may be changed or become loosened during shipment, storage or installation and should be checked and corrected, if necessary, before breaker is operated electrically. Manual operation (use maintenance closing device) of breaker should be used for preliminary operation to see that all parts are free and work smoothly. The bushings and other insulating parts should be clean and dry. All contact surfaces should be inspected to see that they are clean and smooth. (Do not dress silver surfaces.) Removal of all phase barriers and removal or raising of arc chute assemblies gives access to breaker for checking adjustments.

CAUTION: NOTE THAT THE MAINTENANCE CLOSING DEVICE IS NOT SUITABLE FOR ACTUATING THE BREAKER ON ENERGIZED CIRCUIT.

The paragraphs immediately following give the proper adjustments and methods of making same on the Allis-Chalmers RUPTAIR Air Magnetic Power Circuit Breaker. Adjustment values are all listed in Appendix B attached. Note reference method - Appendix B-1 indicates item #1 in Appendix B.

4.2 OPENING SPRINGS (Fig. 10)

The opening springs (10-4) 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 the opening velocity (see Appendix B-1) in the first three inches of movement measured at the radius of the arcing contact "touch" point. Changes in adjustment are not necessary and no provision is made for changing spring reaction.

4.3 TOGGLE SETTING (Fig. 4)

With the breaker closed and armature (4-4) held with maintenance closing device against pole head (4-72), the armature must push the toggle roll (4-15) to a point which will provide a clearance (see Appendix B-2) with the prop latch (4-97), and (see Appendix B-3) clearance to stop (4-59).

4.4 OPERATOR MECHANISM MAIN LATCH AND PROP LATCH (Fig. 4)

The main operator latch (4-27) is in proper adjustment when the latch roll (4-15-A) engages it at a point (see Appendix B-4) from the bottom edge of the latch face (4-27). Changes in adjustment are made by positioning stop screw (7-4). The latch roll stop screw (4-75) should be positioned such that the latch roll will have a clearance (see Appendix B-5) between the latch roll and the latch face. The prop latch (4-97) is normally adjusted such that it engages the toggle roll (4-15) at a point (see Appendix B-6) from the bottom edge of the latch. Adjustment is made by using spacers (4-99). Latch adjustments, once properly made, are permanent in nature and will not normally require readjustment in service.

4.5 AUXILIARY SWITCH (Fig. 11)

The auxiliary switch, located at the rear of the breaker, has been adjusted at the factory and should not normally require further adjustment. However, before the breaker is placed in service a check should be made to see that the crank arm (11-10) throws approximately equal distances on either side of a vertical center line. The adjustment for throw of crank arm is made by positioning the clevis on the auxiliary switch connecting rod. After correct adjustment is made, make sure all fastenings and locknuts are secure. Each rotor (11-3) can be adjusted individually in steps of 15 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. Any changes made on this switch should be done carefully.

4.6 LIMIT SWITCH (Fig. 4)

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 breaker open and actuating lever (4-41) against the roll pin (4-56), (Appendix B-7), overtravel of limit switch plunger after "bb" contact make. Adjustments are made by use of screw (4-51). With the breaker closed the "aa" contacts will be closed and no adjustment is necessary.

4.7 LATCH CHECK SWITCH (Fig. 12)

The latch check switch (12-175) is mounted on the right side of operator frame together with switch operating arm (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 (see Appendix B-8) with operating arm (12-171). Adjustments are made by use of spacer (12-173).

4.8 INTERLOCK PLUNGER (Fig. 21)

The foot lever (21-20) operates the interlock plunger (21-18) as well as the trip latch. Depressing the lever trips the breaker and raises plunger (21-18) sufficiently to release the breaker allowing it to be moved in the cubicle. The interlock is in proper adjustment when the plunger (21-18) is positioned to (see Appendix B-9) above the floor line, and causes tripping of breaker contacts when it is raised to a level not more than (see Appendix B-10) above the floor line. The latch tripping rod associated with the foot lever should be clear of the trip latch (4-27) by (see Appendix B-11).

Although the arc chute can be disassembled, contact parts are more readily accessible by raising the arc chutes with the special lifting device supplied.

3.9 CONTACTS (Figs. 24 & 25)

The stationary contact structure of each phase is made up of three sets of contacts; main current carrying, tertiary, and arcing, which are mounted on the upper bushing stud. 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 contact surfaces are of silver-tungsten alloy. The main current carrying contacts are finger type and engage with a wiping action. The tertiary and arcing contacts are butt type. All contacts are backed by steel springs giving positive contact pressure when engaged.

3.10 ARC CHUTE ASSEMBLY (Fig. 26 & 27)

Each arc chute assembly consists of a three section assembly of flame retardant material which provides phase isolation for interruption and venting of the by-product gases of interruption. The lowest section of the arc chute contains:

(a) The stationary end runner (26-4) which is connected to the moving end blowout coil (27-31) through connectors (27-32) and (27-33), and thence to the stationary end blowout coil through connector (27-34). The stationary end blowout coil, in turn, is connected to the top bushing (Fig. 24) thru connector (26-15) and contact (26-6). Springs (26-16) and (26-17) maintain positive contact pressure with block (24-7) when the arc chute is in place.

(b) The moving end runner (26-3) which is connected to the lower bushing (23-2) through connector (21-6).

(c) The transfer stack (26-5) which is made of refractory plates. It aids in the transfer of the arc from the stationary end arcing contacts to the stationary end runner (26-4) by extinguishing the arc which exists between these points during arc transfer period.

(d) Refractory lining on the inside of the inner side plates (26-1) and (26-2) in the region of arcing.

Resting on side plates (26-1) and (26-2) are two barrier stacks. Each barrier stack consists of a number of refractory plates with "Vee-shaped" slots cemented together.

Tube (26-18) encloses the barrier stacks and runners, and supports the aftercooler (21-28) for outside phases, or aftercooler (21-29) for the center phase.

There is one blowout coil (27-31) at each end of the tube (21-18). The two coils are connected in series with the stationary end runner (26-4) and the top bushing (23-1) as described in (a) and (b) above. The blowout coils establish a magnetic field through the magnetic circuit (27-30) during arc interruption.

The aftercooler (21-28) or (21-29) completes the cooling and deionizing of the arc products.

3.6 AUXILIARY EQUIPMENT

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

3.7 BREAKER MECHANISM

The breaker mechanism consists essentially of movable contact arms and insulating links which connect the contact arms to the operator mechanism.

3.8 PHASE BARRIERS

Full size barriers of high dielectric flame retardant material isolate each phase.

3.3 OPERATOR (Fig. 4)

A solenoid operator is an integral part of this type of breaker unit. (For breakers equipped with the stored energy closer, see separate instruction book.) It is mounted in the lower section of breaker and is contained within the breaker frame. The operator is furnished with a mechanically trip-free mechanism consisting of a toggle linkage so designed as to provide quick and positive tripping at any position of the closing stroke. The operator mechanism is of low inertia, capable of quick acceleration, and it 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.

3.4 CLOSING (Fig. 13)

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.

The closing force is applied at the toggle roll (D) by means of armature (12). The toggle linkage (4) and (5) moves towards the on center or in line position, thus rotating crank arms (2) and (3) counterclockwise about center "B". Movement of crank arm (2) closes the breaker and compresses the breaker opening springs (7). When links (4) and (5) reach their final position, prop latch (10) drops behind center "D" to lock the mechanism in the closed position as shown in Fig. 14. After closing the breaker, armature (12) returns to its normal position. Manual closing is as described except that armature (12) is actuated manually through the manual closing device.

3.5 OPENING (Fig. 15)

Opening of the breaker is accomplished either manually or electrically. Manually, the breaker is tripped by pushing on the trip button which in turn causes trip pin (13) to move downward, thus rotating trip latch (9) in a clockwise direction. Temporarily fixed center "E" is thereby released, enabling link (6) to rotate clockwise about center "F". Since the restraining force on opening springs (7) is now released, they act to rapidly open the breaker contacts. Reset spring (8) then acts to return the mechanism to the normal open position shown in Fig. 13. Electrical Tripping is as above except that trip pin (13) is actuated by trip coil (14).

The tripping action described above can take place at any time during a closing operation, either manual or electrical, and regardless of whether or not the armature is energized. Thus the mechanism is electrically and mechanically trip-free in any position.

PART 3 - DESCRIPTION

3.1 GENERAL

The Allis-Chalmers RUPTAIR movable portion consists of a 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 maintenance closing device. THIS DEVICE IS NOT SUITABLE FOR ACTUATING THE BREAKER ON AN ENERGIZED CIRCUIT.

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 arc interruption. 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 the breaker frame and are well shielded. The horizontal terminal studs, which are insulated with flame retardant phenolic tubing, extend through the breaker bracket 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.

3.2 METHOD OF ARC INTERRUPTION

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 assembly separates from the stationary contact assembly, the current transfers very quickly from the main contacts to the arcing contacts, thus keeping main contact erosion to a minimum. (For breakers equipped with tertiary contacts, the current transfers from the mains, to the tertiary and then to the arcing contacts.) As the movable contact assembly continues its stroke, the arcing contacts part, drawing a power arc, which is transferred first to the stationary end arc runner then to the moving end arc runner. The transfer 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, the configuration of the current carrying circuit, etc., tend to force the arc upward into the barrier stack. The cool surfaces of the barrier stack 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 to minimize metal vaporization. To facilitate interruption of low currents, a puffer assembly 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.

6.3 REPLACING PARTS

Before removing any part, observe its function and adjustment. By so doing, it is usually possible to avoid any appreciable amount of adjustment work after the installation of the replacement part.

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.

6.3a PHASE BARRIERS (Fig. 21)

Remove bars (21-26) and (21-27) and then withdraw phase barriers (21-5). On replacing the barriers, make certain that they are fully seated in their respective locating slots. Replace bars (21-26) and (21-27).

6.3b BARRIER STACK

To replace a barrier stack it is first necessary to remove the two phase barriers adjacent to the particular phase involved. (See 6.3a)Next, remove the aftercooler (21-28) or (21-29). Note that the aftercoolers differ in that plate (27-24) is wider on the center phase than on the outside phases. On the MC-1000 it is necessary to remove one screw which passes through the center of bars (27A-23) and the tube (26A-18) before removing after-cooler.

Remove the tube (26-18) being careful to slip it up straight so as to not damage the barrier stacks.

The barrier stacks (26-23) can next be removed. Care must be exercised as a slotted refractoryplate fits between each guide (26-7) and each arc runner (26-3) and (26-4).

On installation make certain the "Vee" slots of the barrier stack are downward and that the slotted refractory plate slips between the arc runner and its guide.

On replacing tube avoid any twisting which could damage parts of the barrier stack. Replace aftercooler and be certain that on MC-1000 breakers the screw through bars (27A-23) and tube (26A-18) is replaced.

Replace phase barriers as described in Section 6.3a.

APPENDIX A

SCHEDULE OF CHECKS AND ADJUSTMENTS

This tabulation is intended to serve as a ready reference for servicing of this equipment. Other items may be added as experience dictates. For a thorough understanding of the breaker, it is recommended that the instruction book be studied.

1 - Breaker should be prepared for servicing outside of its cubicle. Breaker must be in the open position and disconnected from electric power. Remove phase barriers (Section 6.3a) and raise arc chutes to expose breaker interior. Unbolt connector (21-6) from moving end arc runner (26-3) prior to raising arc chutes.

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 Section 5.4.

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

6 - Check operating mechanism toggle adjustment per Section 4.3.

7 - Check trip latch (4-27) adjustment per Section 4.4.

8 - Check latch roll stop screw (4-75) adjustment per Section 4.4.

9 - Check prop latch (4-97) adjustment per Section 4.4.

10 - Check trip pin (7-14) clearance per Section 4.9.

11 - Check trip pin (7-14) aftertravel per Section 4.9.

12 - Check latch check switch (12-175) adjustment per Section 4.7. Check freedom of movement, lubricate arm.

13 - Check limit switch (Fig. 4) adjustment per Section 4.6. Operate manually and electrically. Inspect to see that contacts are clean and make properly.

14 - Check auxiliary switch adjustment per Section 4.5.

15 - Check control relay for proper action.

16 - Operation counter is actuated by a spring which should be adjusted for minimum force by positioning of the counter arm. Record counter reading.

17 - Check trip interlock plunger (21-18) per Section 4.8.

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

19 - Check all hardware for tightness. 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.

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

21 - If breaker is rectifier operated, refer to BWX-6494 for rectifier instructions.

22 - Remove disconnect arms as a unit by removing screw (25-5), nut (25-10) and spring (25-12). Refer to Figure 25. Carefully inspect all contact surfaces in hinge joint. Silver washer (25-6) and adjacent surfaces should be clean and free of roughness or galling. Lubricate silver washer and mating surfaces by rubbing in microfine dry graphite used sparingly. Reassemble hinge joint replacing same number of silver washers that were removed.

23 - Inspect condition of auxiliary switch contacts.

24 - Inspect condition of control relay contacts.

25 - Check alignment and stroke of contacts per Section 4.11.

26 - Check lead of contacts per Section 4.14.

27 - Check for barrier stack erosion per Section 5.3.

28 - Check condition of contacts.

29 - Reassemble breaker. Be sure moving end arc runner (26-3) is secured to connector (21-6).

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

31 GENERAL

The above points will provide a quick reference for maintenance procedures. Other items may be added as experience dictates. For a thorough understanding of the equipment, the instruction book should be studied. Refer to Part 5 for general comments on maintenance and lubrication.

APPENDIX B

CIRCUIT BREAKER ADJUSTMENT VALUES

Item No.	Breaker Component	Reference Section No.	Illustration No.	Adjustment Values
1	Opening springs	4.2	10-4	10 to 14 ft./sec.
2	Clearance between toggle roll and prop latch	4.3	4-15 4-97	1/32 ± 1/64
3	Clearance between toggle roll and stop	4.3	4-15 4-59	1/16 ± 1/32
4	Point of engagement latch roll and latch face	4.4	4-15-A 4-27	3/16 + 0, -1/16
5	Clearance of latch roll and latch face	4.4	4-15-A 4-27	1/32 ± 1/64
6	Point of engagement prop latch and toggle roll	4.4	4-97 4-15	1/8 to 3/16
7	Limit switch overtravel	4.6	4-18	1/16 to 1/8
8	Latch check switch plunger	4.7	12-175	1/32 to 1/16
9	Interlock plunger above floor line	4.8	21-18	1-3/4 ± 1/16
10	Max. clearance plunger above floor line - to trip breaker	4.8	21-18	2-1/16
11	Clearance latch trip rod and trip latch	4.8	21-20 4-27	1/32 to 1/16
12	Trip pin aftertravel	4.9	7-14	1/16 to 3/32
13	Clearance - latch to end of trip pin	4.9	7-14 7-20	1/16 to 3/32
14	Dash pot	4.10	10-25 10-3	

Item No.	Breaker Component	Reference Section No.	Illustration No.	Adjustment Values
15	Contact stroke, Dimension c, View "AA"	4.11	23--	1/16 ± 1/64
16	Contact Lead - tertiary contacts Dimension a	4.14	23--	5/32 + 0, -1/32
17	Contact Lead main contacts Dimension b, View "AA"	4.14	23--	5/16 + 1/16, -1/32

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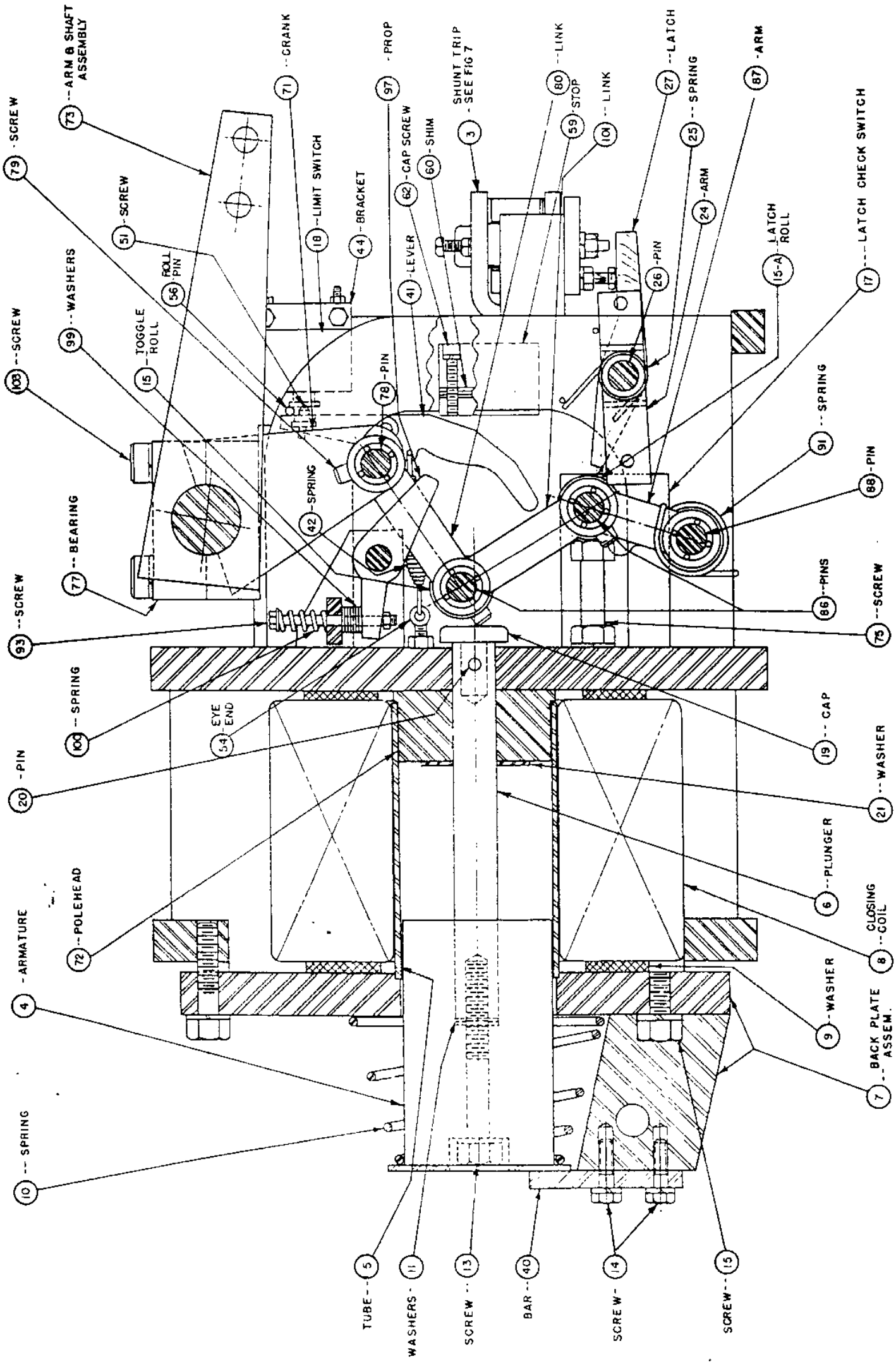


FIG. 4
TYPICAL OPERATOR ASSEMBLY
71-500-163
JUNE 11, 1958

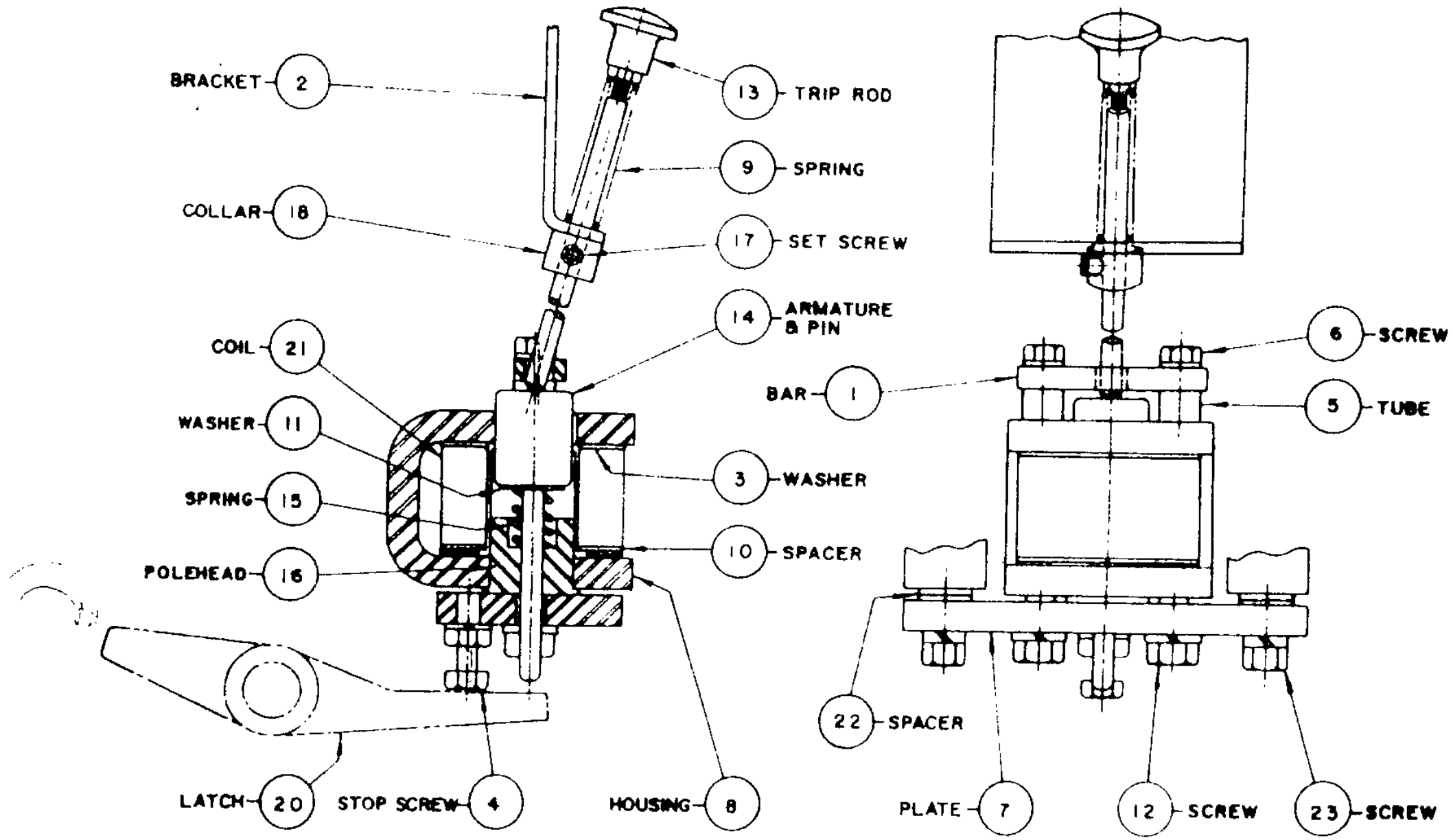


FIG. 7

TYPICAL SHUNT TRIP ASSEMBLY

JUNE 24, 1960

71-302-533

ALLIS-CHALMERS MANUFACTURING COMPANY

ALLIS-CHALMERS MANUFACTURING COMPANY

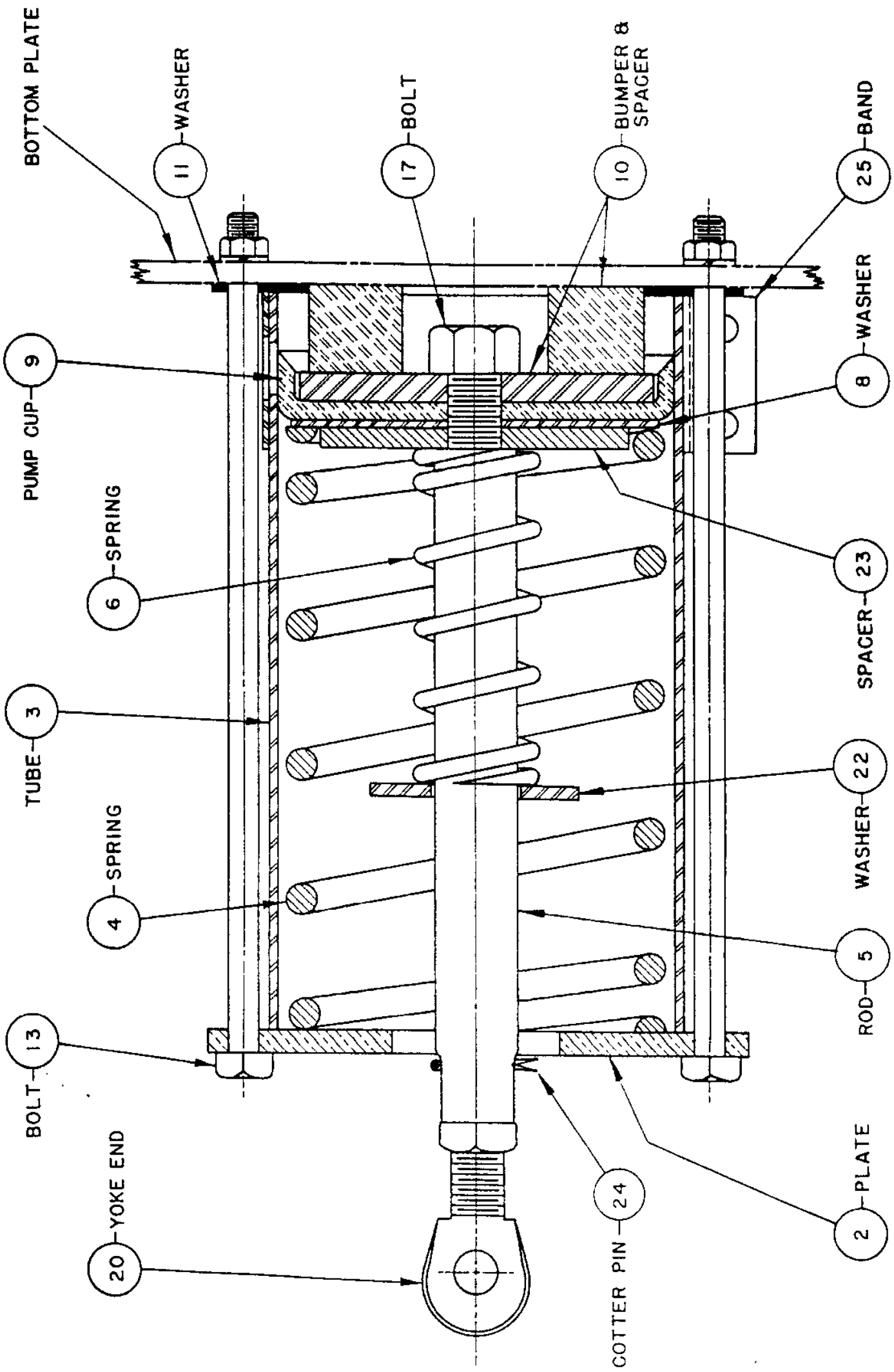


FIG. 10

DASH POT AND OPENING SPRING ASSEMBLY

APRIL 26, 1960

71-302-461

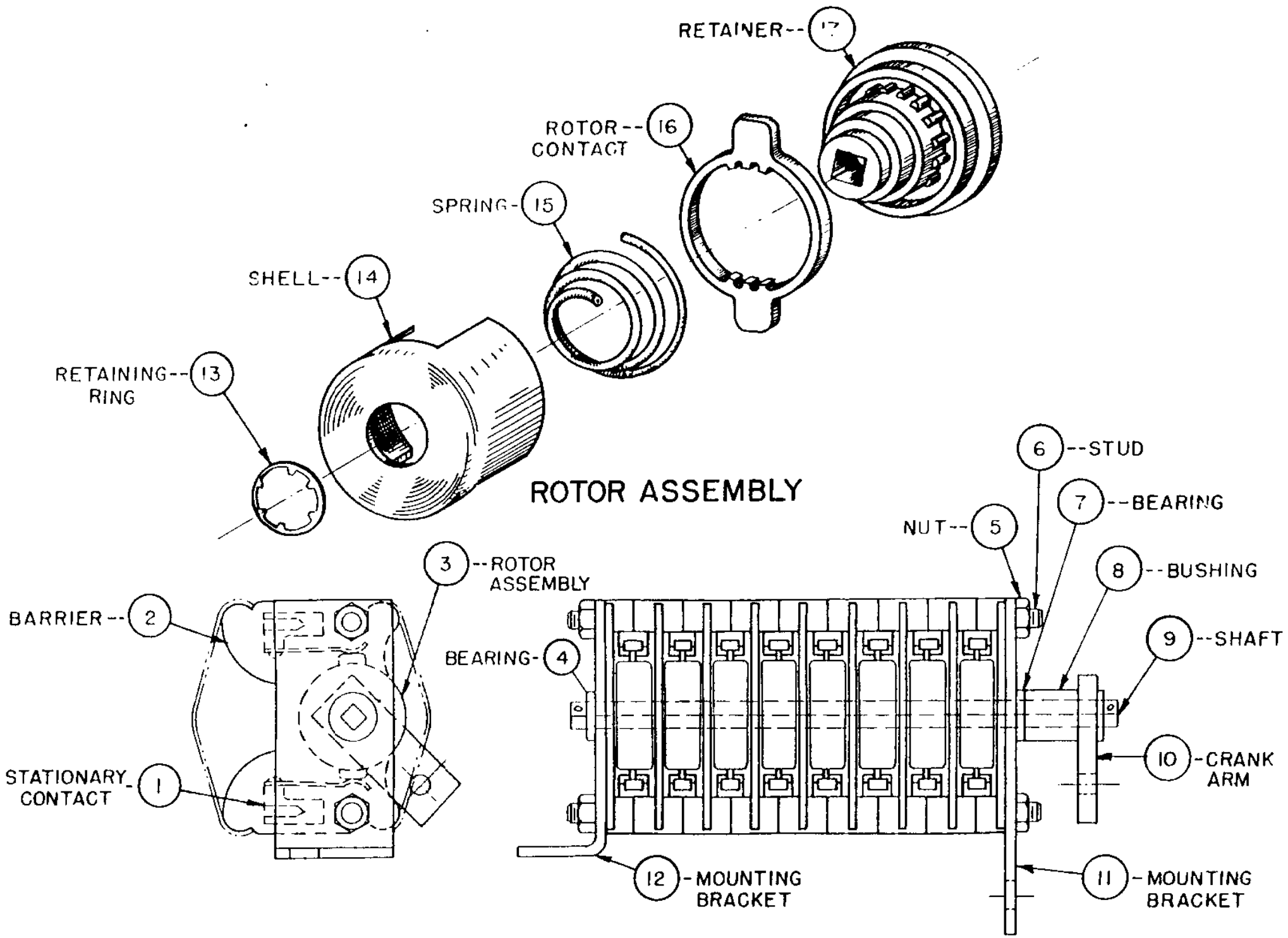


FIG. 11

TYPICAL AUXILIARY SWITCH

JULY 16, 1958 71-301-758

ALLIS-CHALMERS MANUFACTURING COMPANY

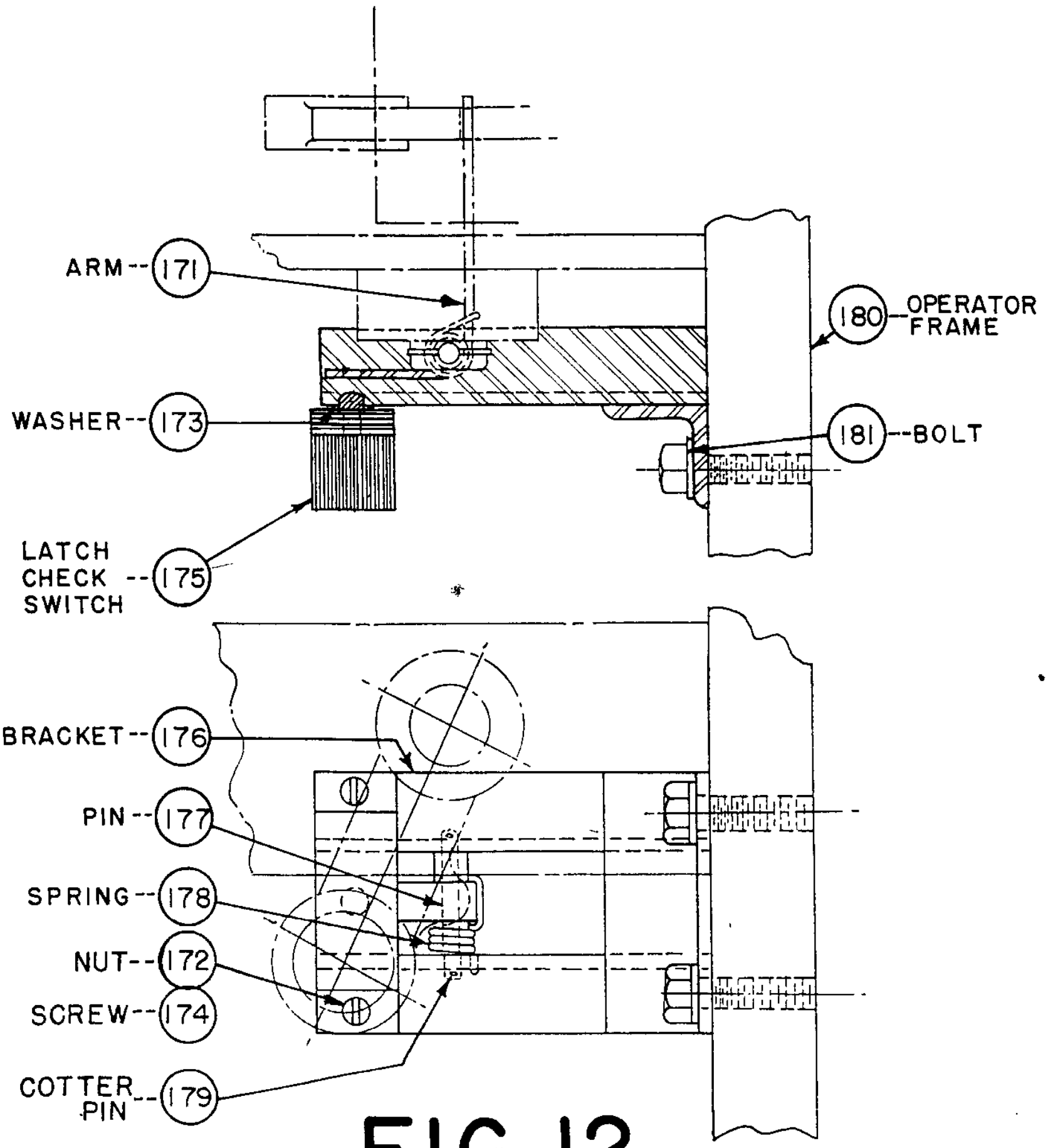


FIG. 12

TYPICAL LATCH CHECK SWITCH

TYPE SO-35

JUNE 16, 1953

71-201-023

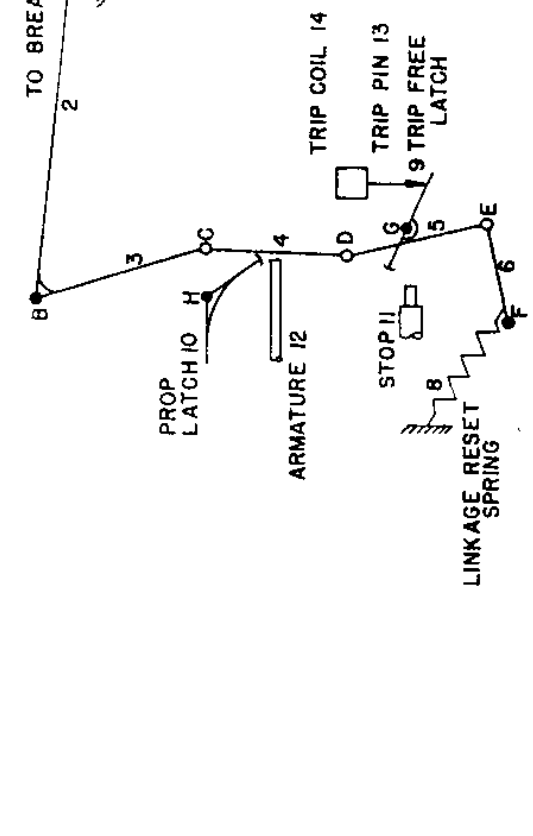
ALLIS-CHALMERS MANUFACTURING COMPANY

OPEN

FIG. 13

CLOSED

FIG. 14



TRIP FREE

FIG. 15

TYPICAL OPERATOR LINKAGE DIAGRAM

SEPTEMBER 9, 1953

71-400-246

ALLIS-CHALMERS MANUFACTURING COMPANY

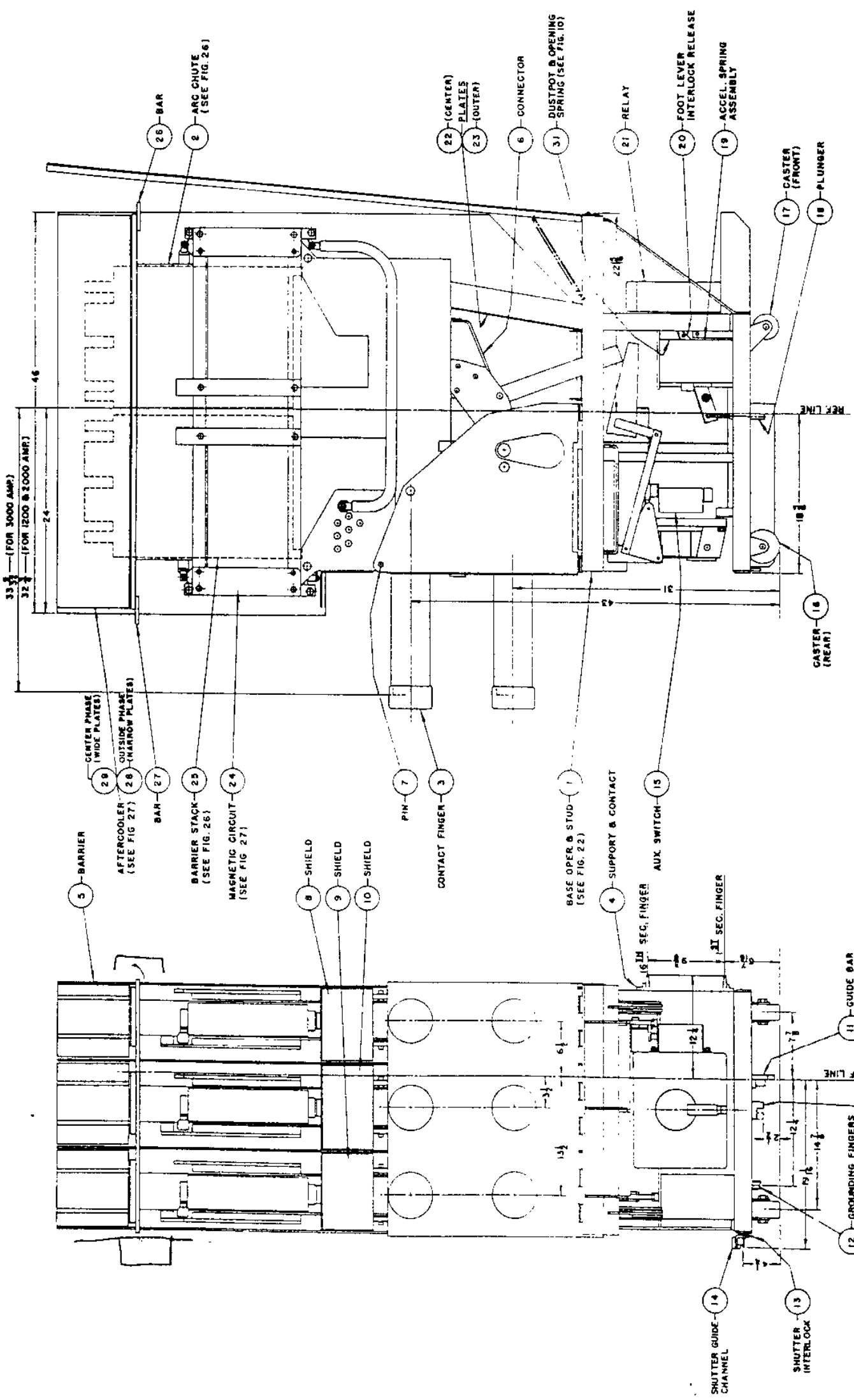


FIG. 21

TYPICAL MAGNETIC BREAKER ASSEMBLY

JUNE 1, 1960

71-600-334

ALLIS-CHALMERS MANUFACTURING COMPANY

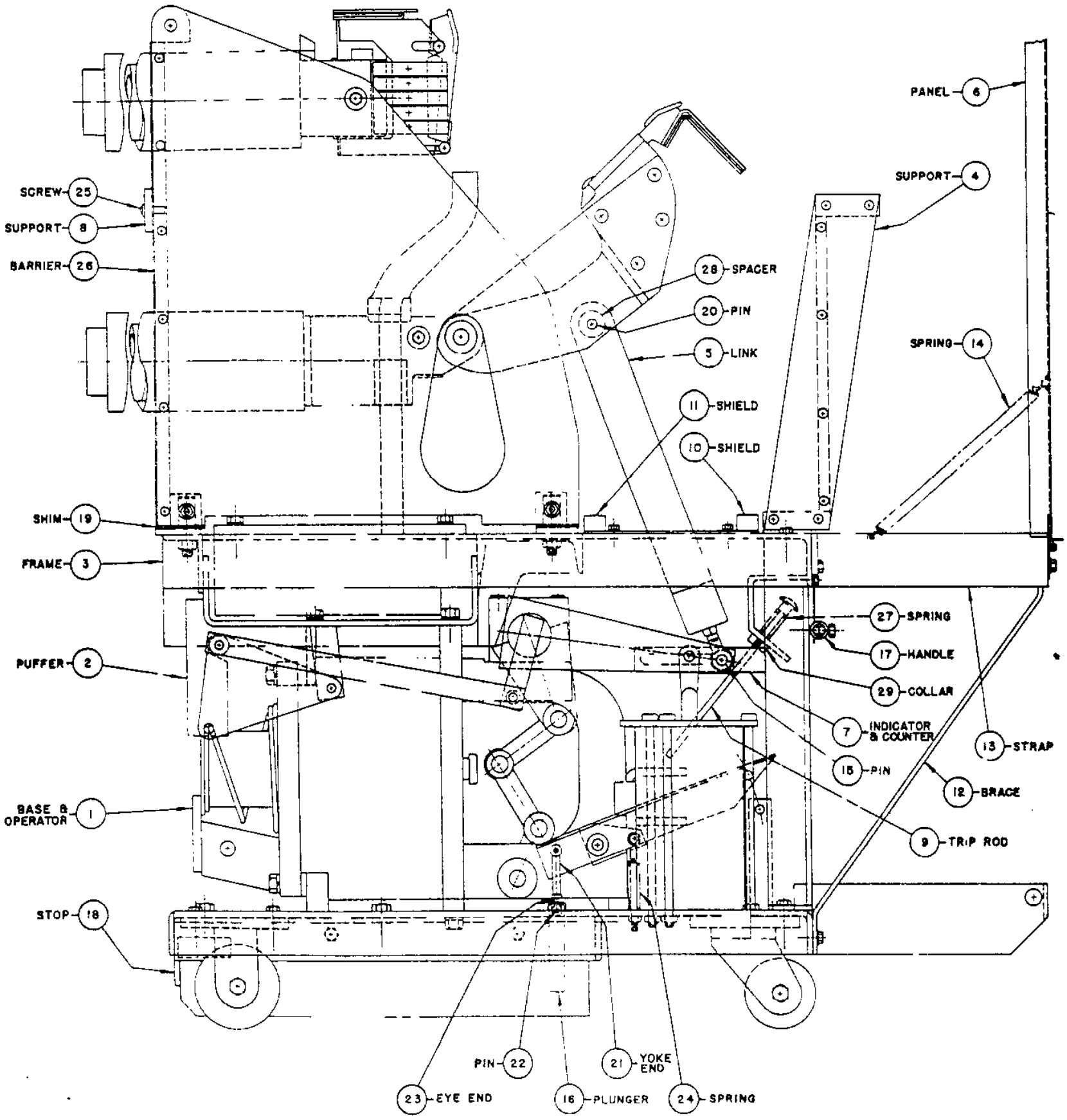


FIG. 22

TYPICAL BASE, OPERATOR AND STUD ASSEMBLY

MAY 13, 1960

71-500-327

ALLIS-CHALMERS MANUFACTURING COMPANY

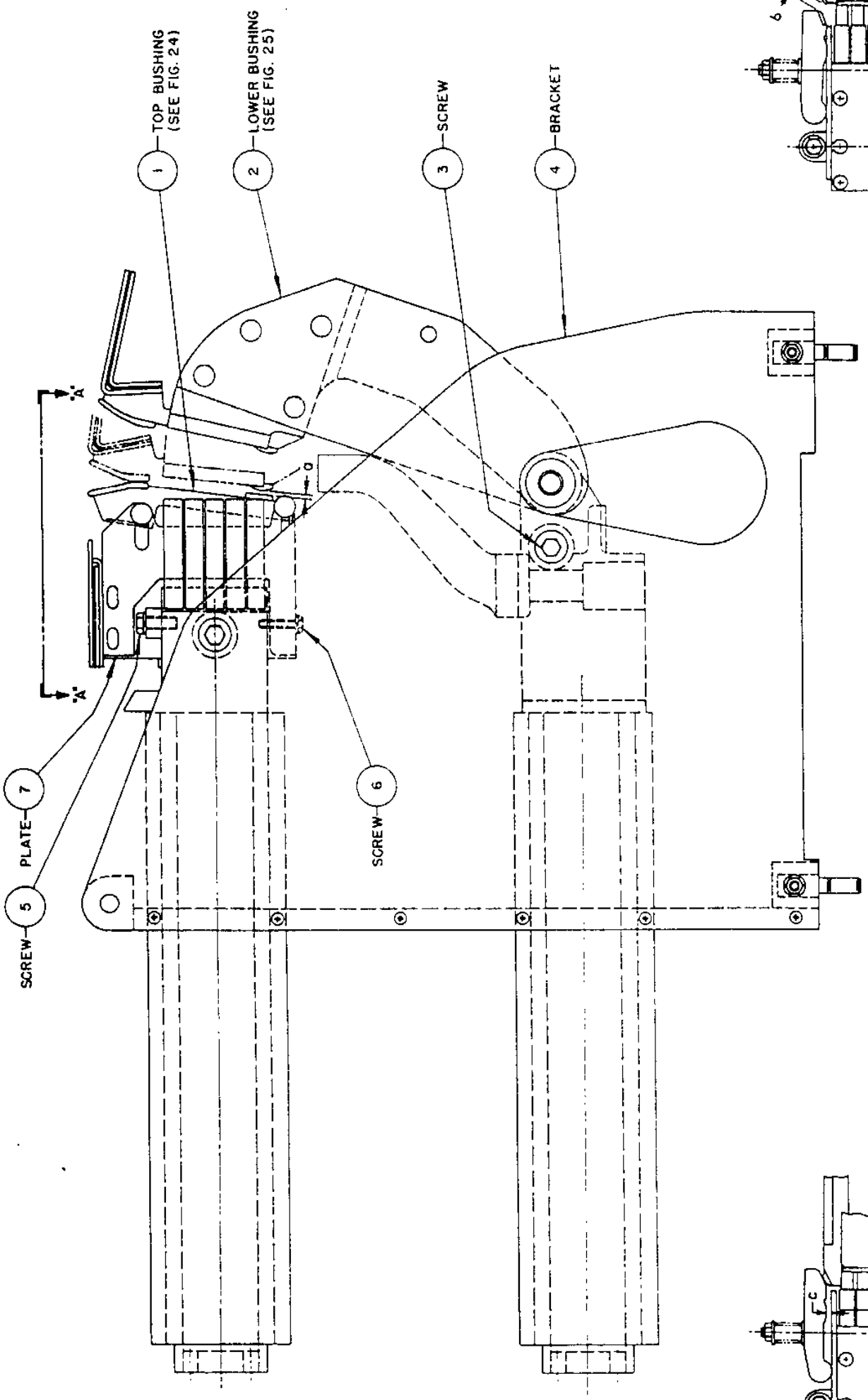


FIG. 23

TYPICAL STUD & SUPPORT ASSEMBLY

MAY 9, 1960

71-401-259

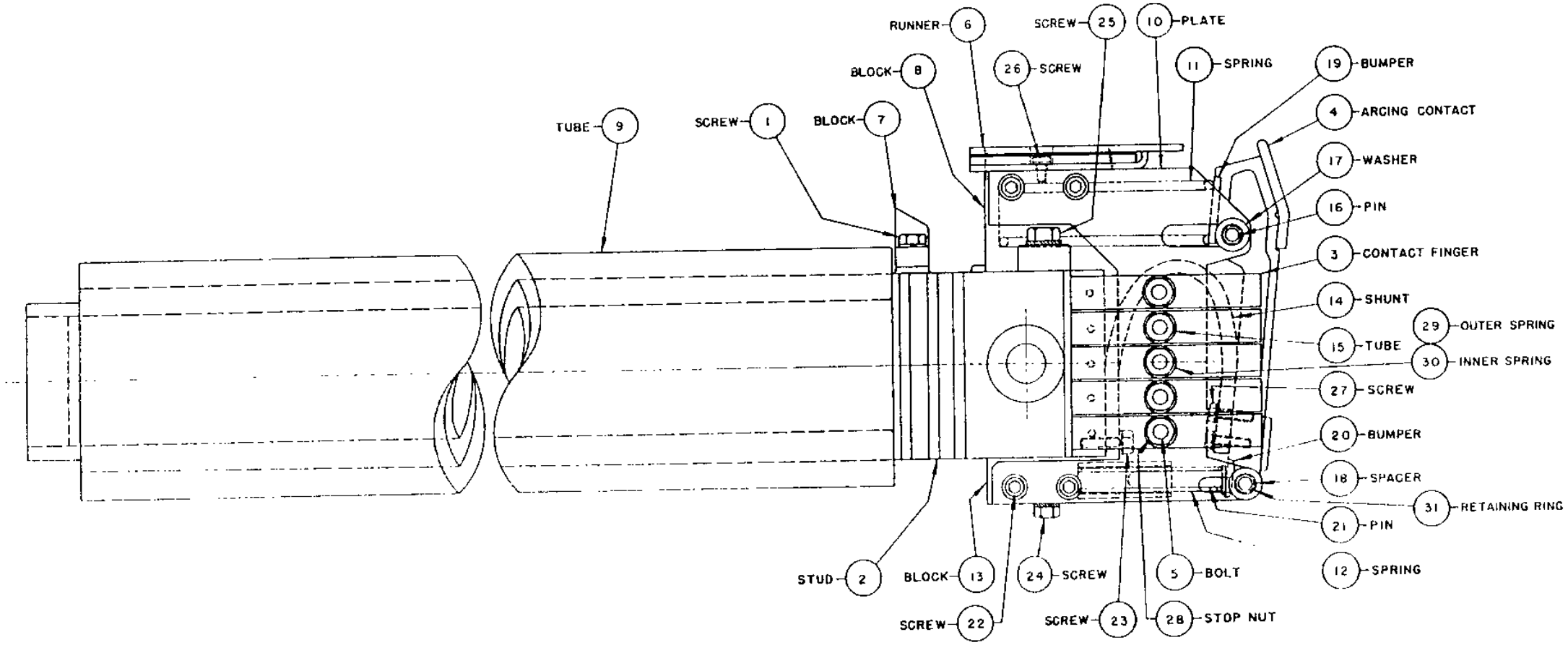


FIG. 24

TYPICAL TOP BUSHING ASSEMBLY

APRIL 28, 1960

71-401-252

ALLIS-CHALMERS MANUFACTURING COMPANY

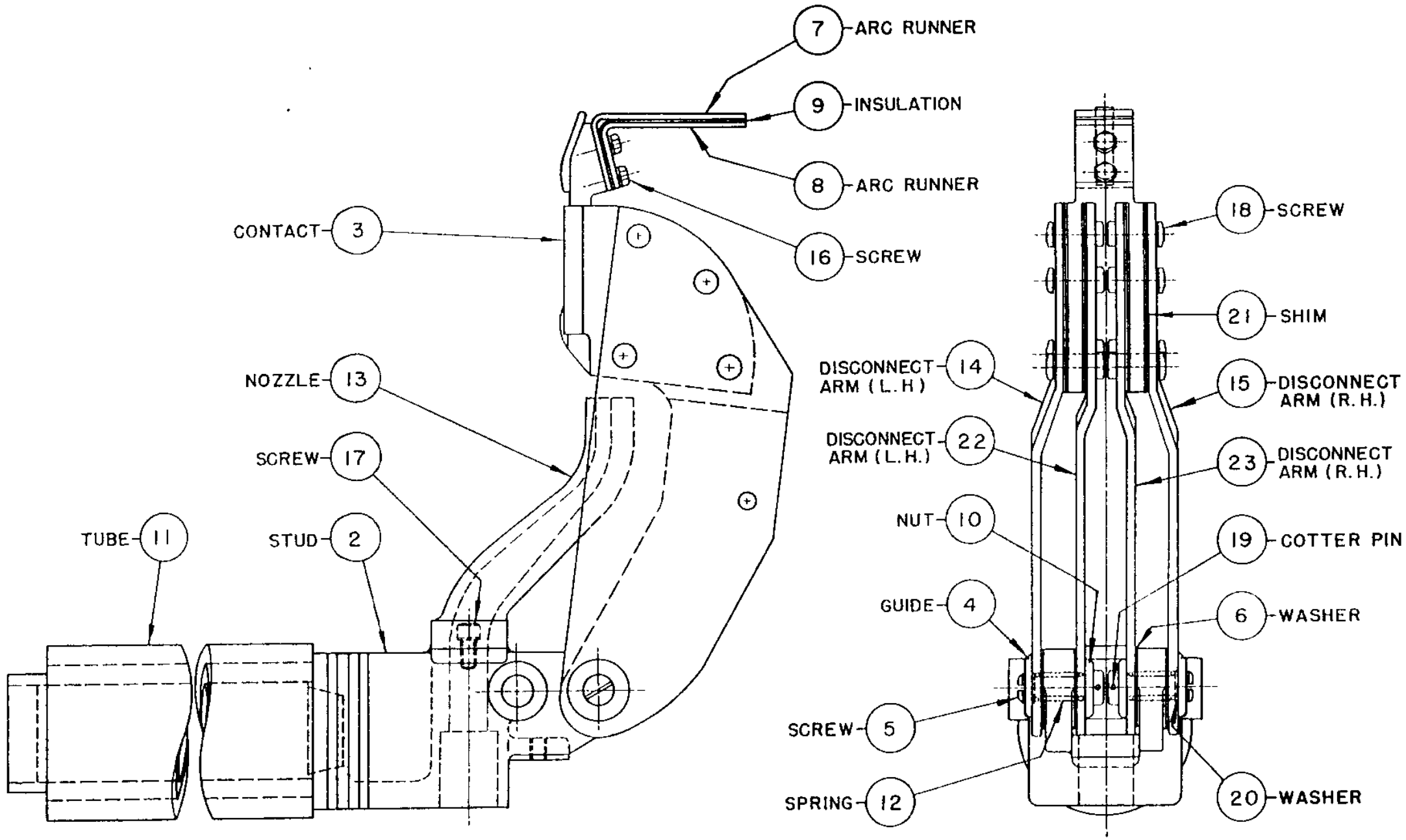


FIG. 25

TYPICAL LOWER BUSHING ASSEMBLY

APRIL 29, 1960

71-302-468

ALLIS-CHALMERS MANUFACTURING COMPANY

ALLIS-CHALMERS MANUFACTURING COMPANY

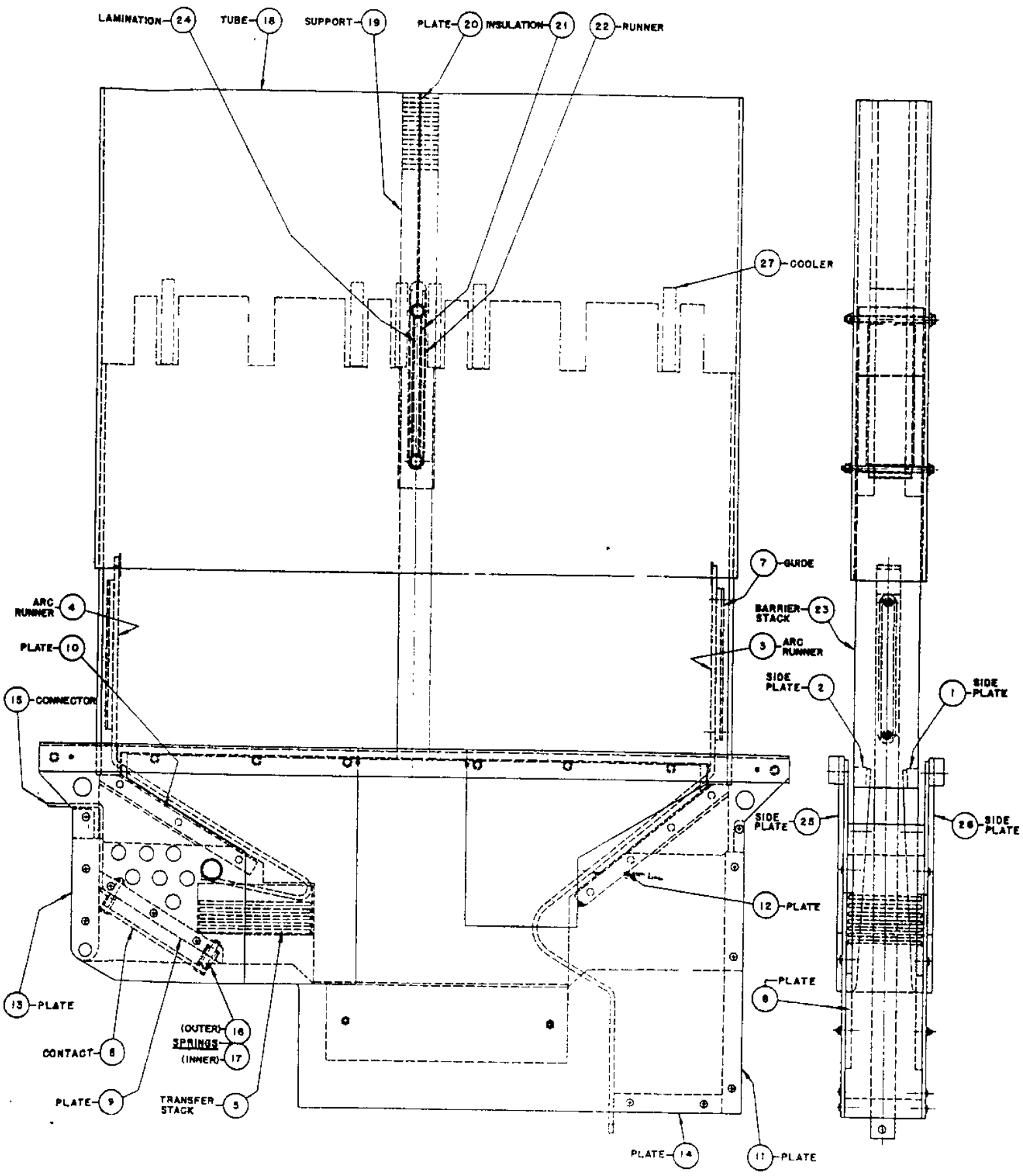


FIG. 26

TYPICAL ARC CHUTE

MAY 25, 1960 71-500-331

MC-750

ALLIS-CHALMERS MANUFACTURING COMPANY

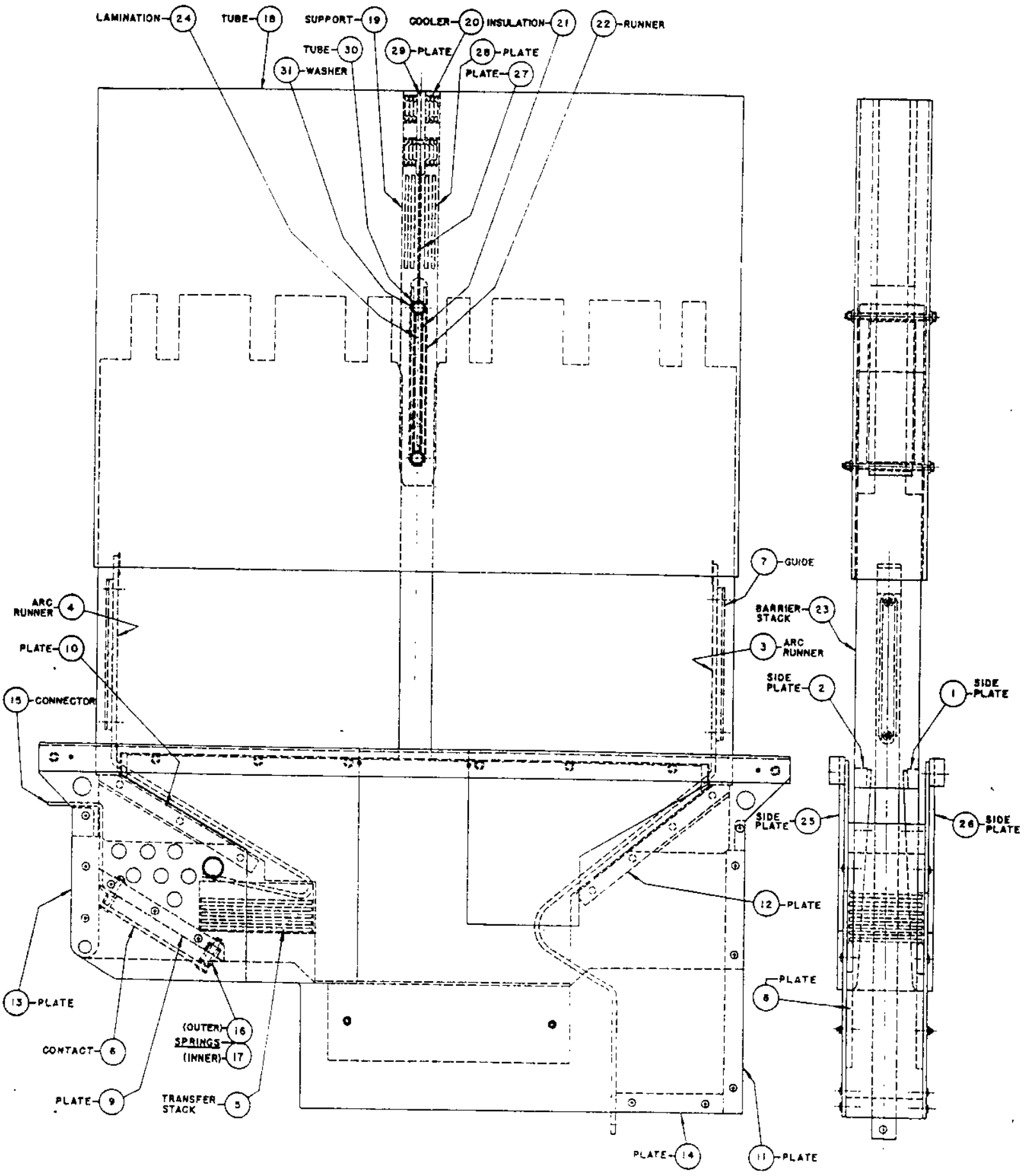


FIG. 26A

TYPICAL ARC CHUTE

JUNE 14, 1960 71-500-337

MC-1000

ALLIS-CHALMERS MANUFACTURING COMPANY

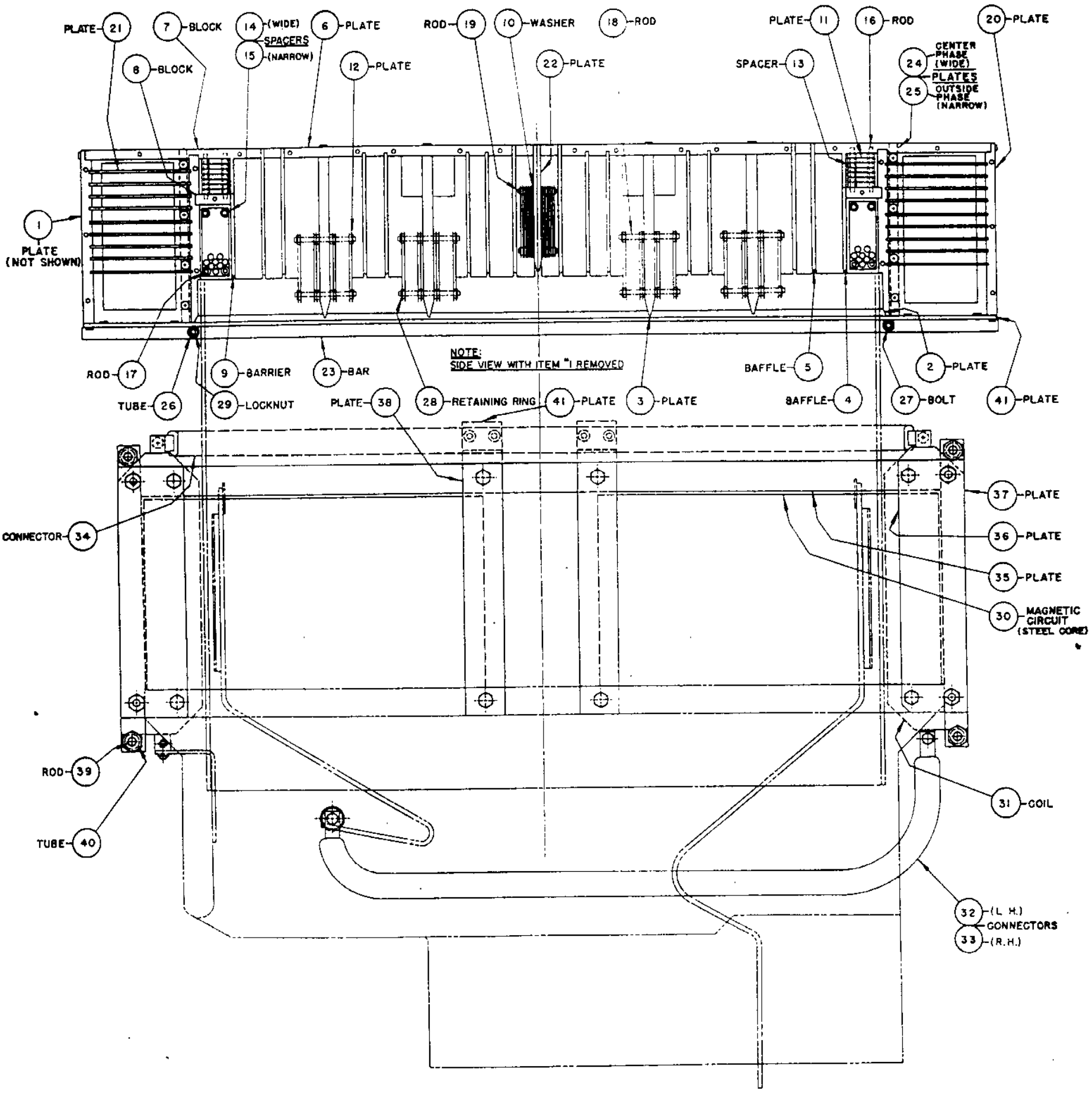


FIG. 27

TYPICAL AFTERCOOLER AND MAGNETIC CIRCUIT

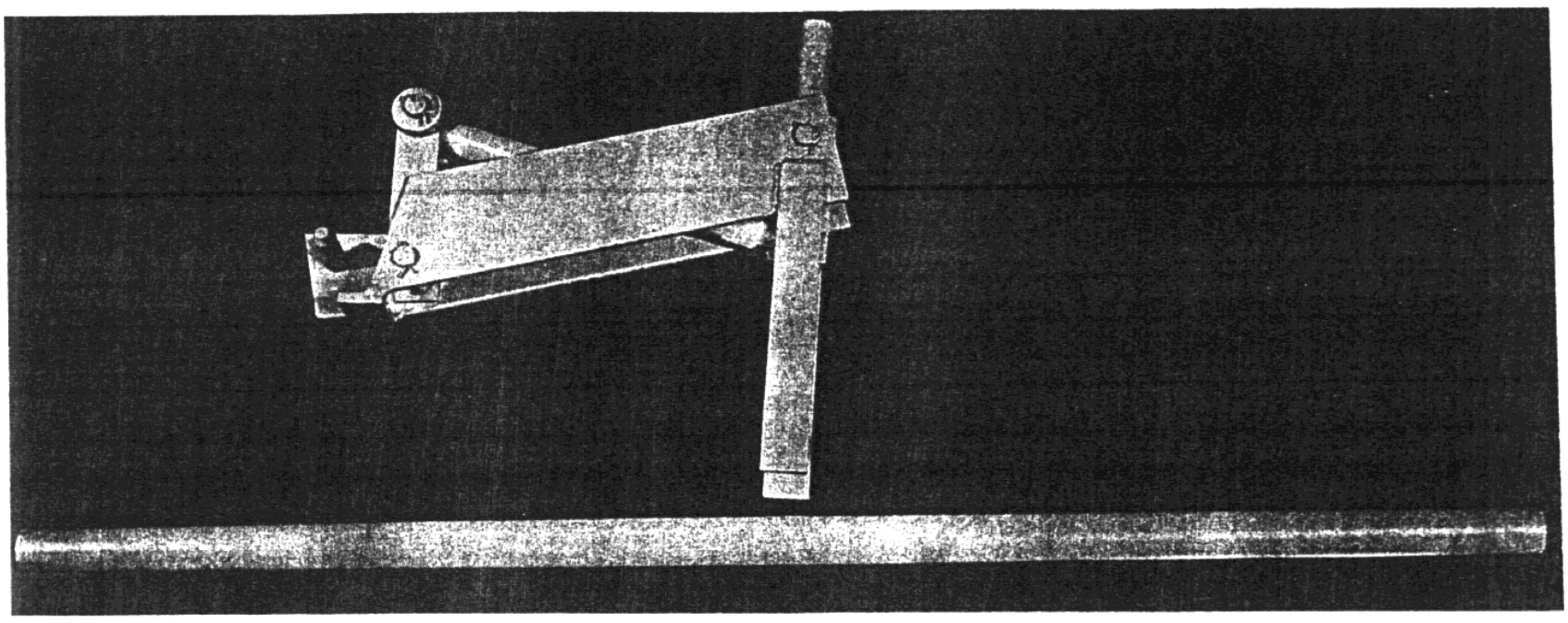
MAY 20, 1960

71-500-330

MC-750

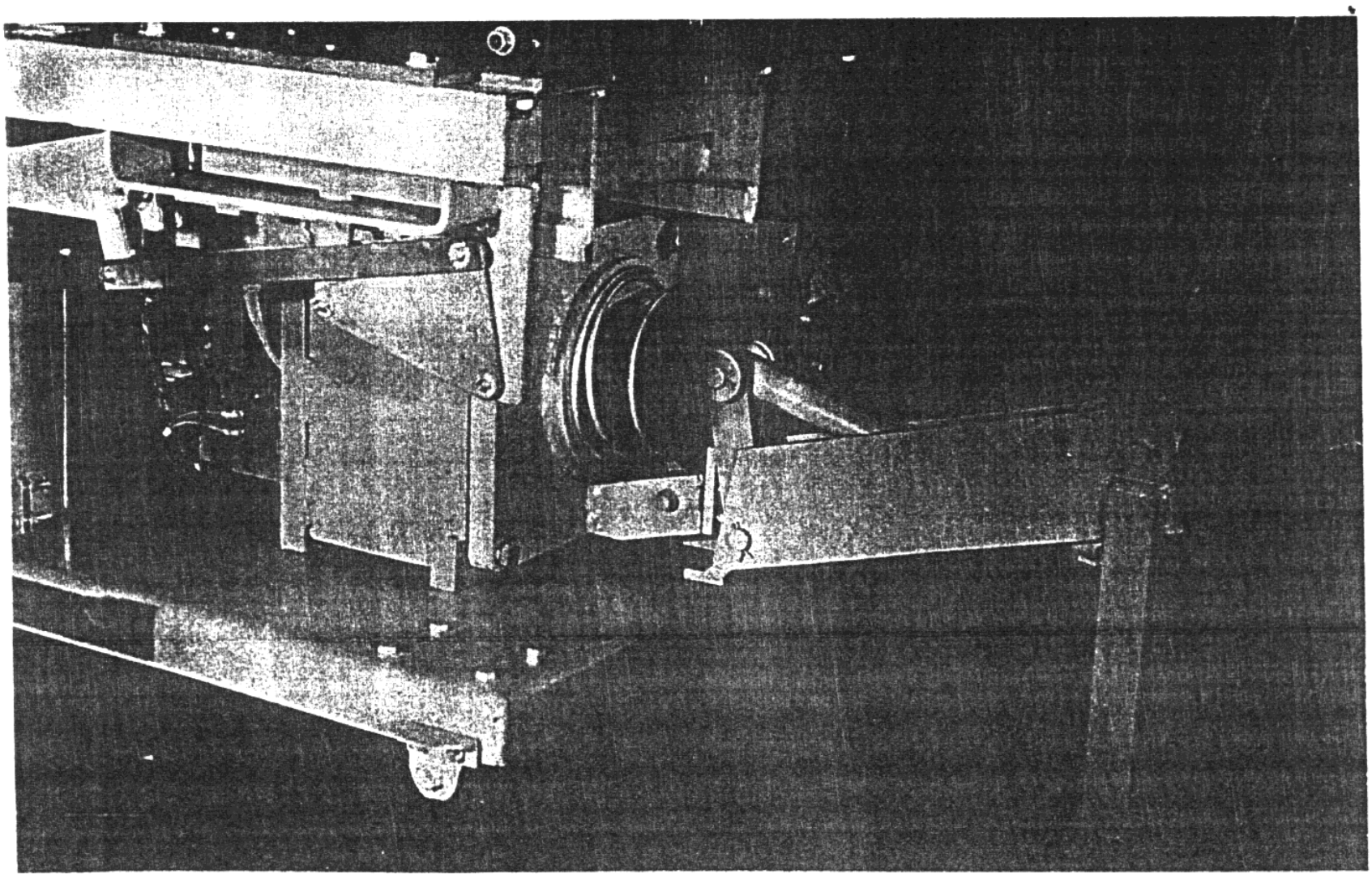
ALLIS-CHALMERS MANUFACTURING COMPANY

APPLICATION OF MAINTENANCE CLOSING DEVICE



Closing Device Parts

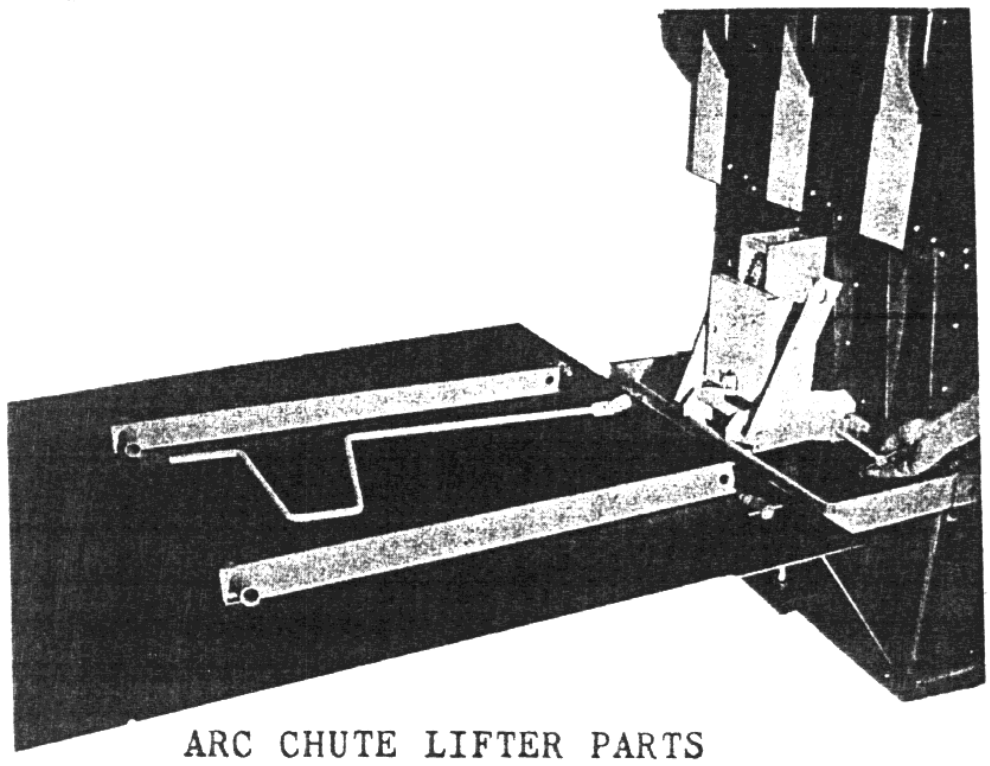
Illust. #205049



Pull Handle Down To Close Breaker

Illust. #205050

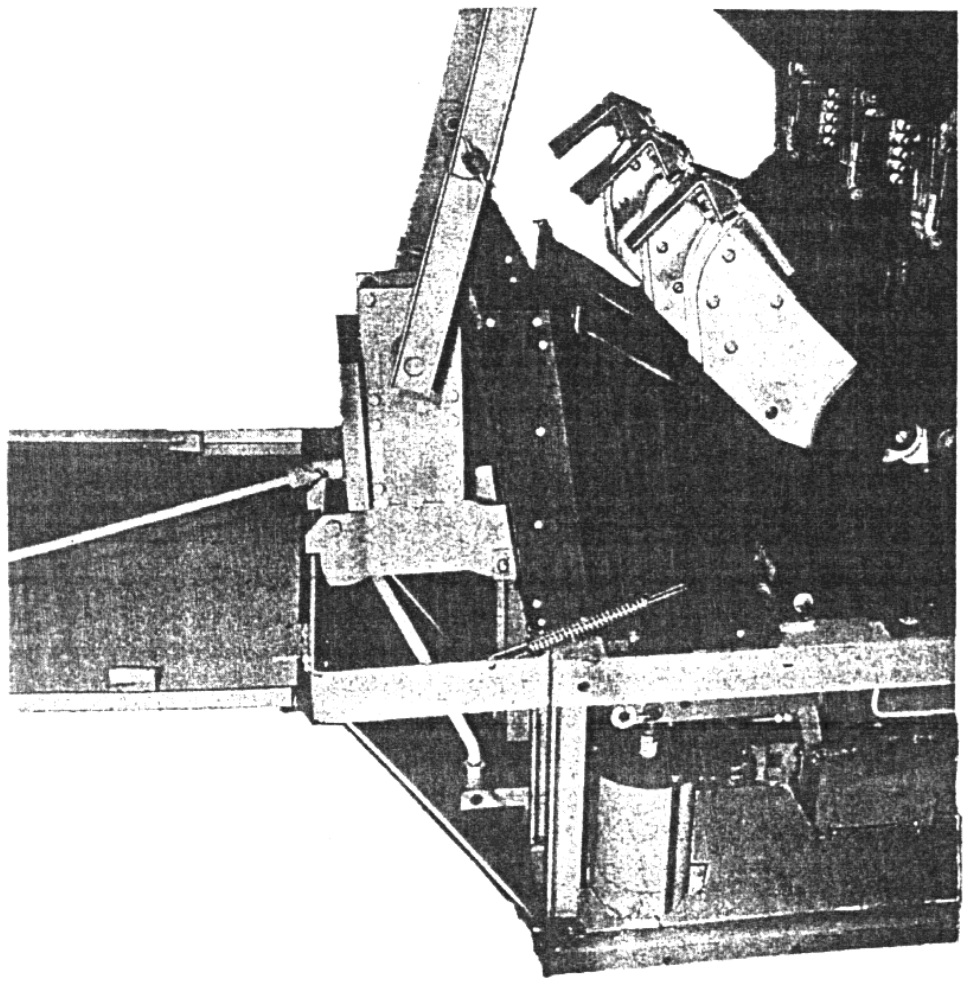
ALLIS-CHALMERS MANUFACTURING COMPANY



Illust. #205063

ARC CHUTE LIFTER PARTS

Unfasten panel springs and remove barriers before mounting chute lifter.



Illust.#205064

ARC CHUTE LIFTER ON
SOLENOID OPERATED BREAKER.

ALLIS-CHALMERS MANUFACTURING COMPANY

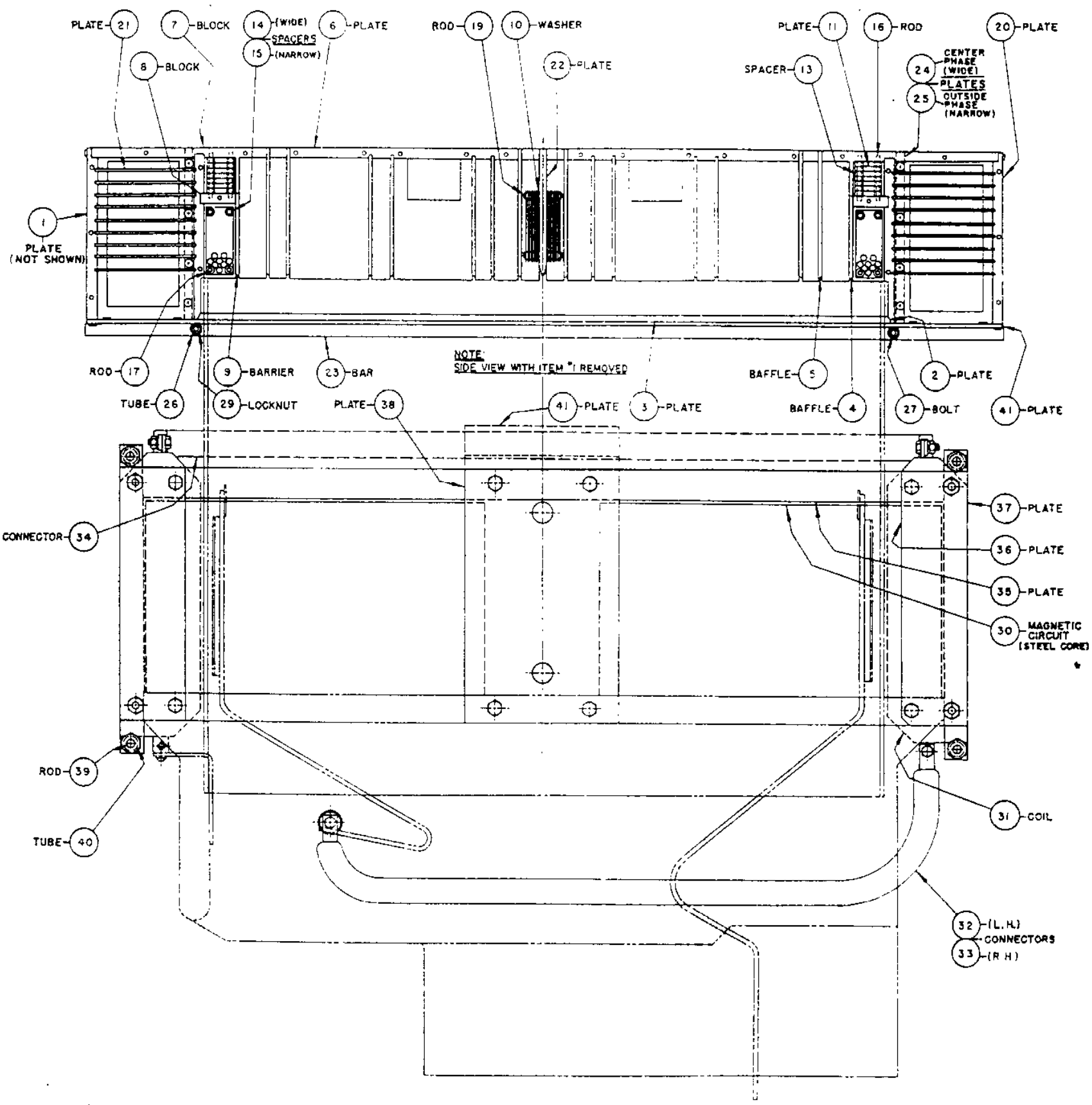


FIG. 27A

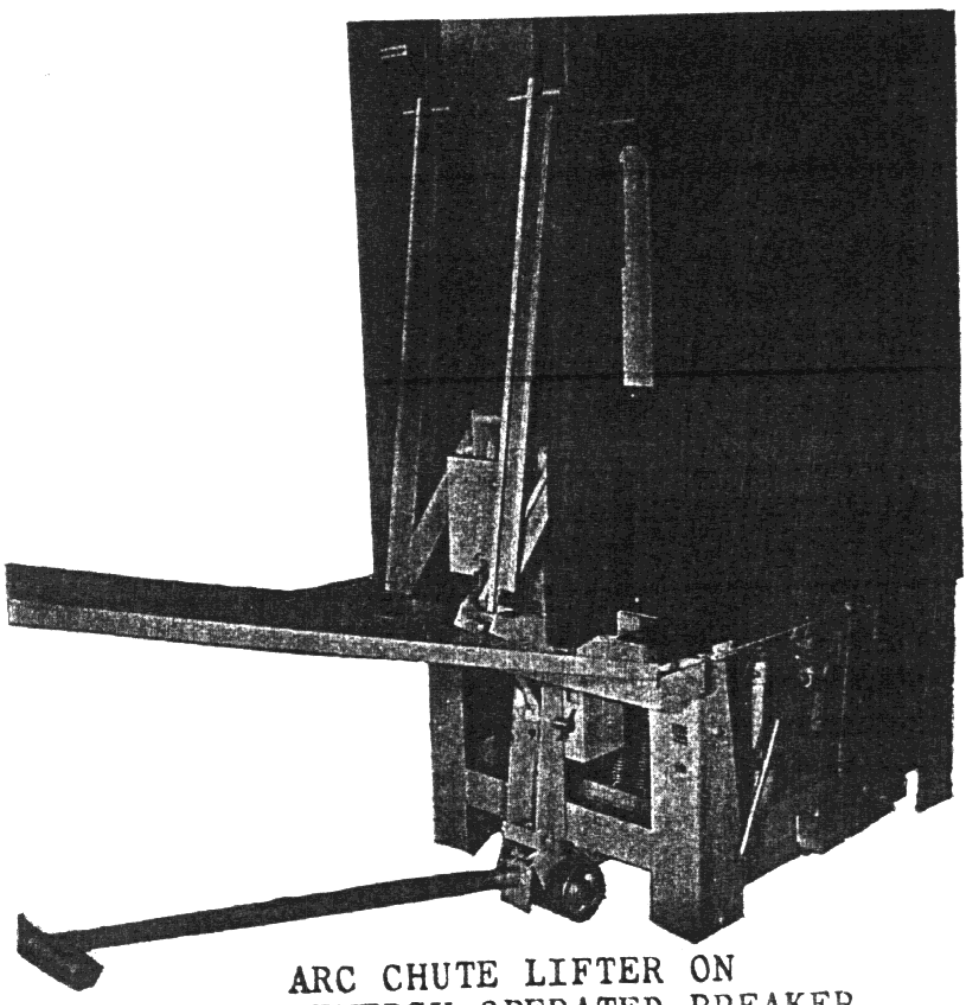
TYPICAL AFTERCOOLER AND MAGNETIC CIRCUIT

JUNE 14, 1960

71-500-336

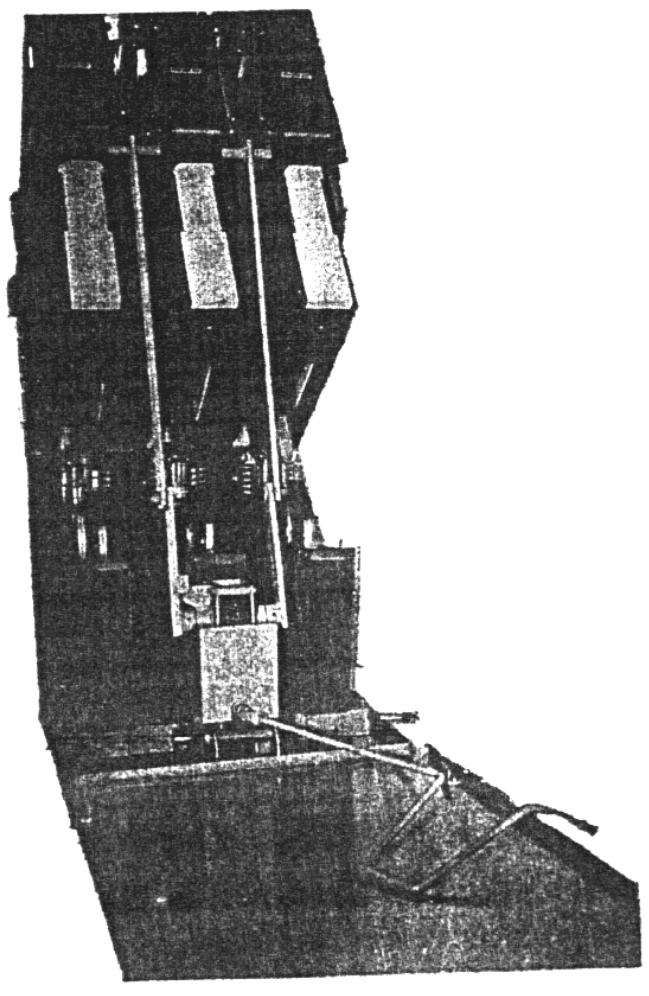
MC-1000

ALLIS-CHALMERS MANUFACTURING COMPANY



Illust. #205065

ARC CHUTE LIFTER ON
STORED ENERGY OPERATED BREAKER.



Illust. #205066

ARC CHUTE TILTED BACK