INSTRUCTION BOOK

De-ion®

AIR CIRCUIT BREAKER

Type 150-DH-1000

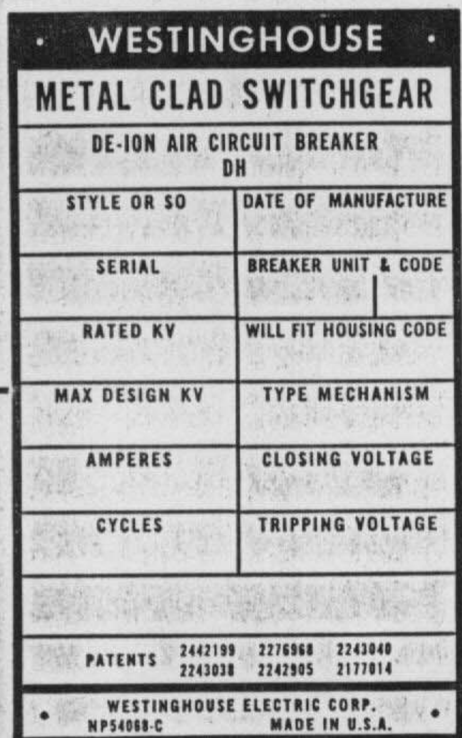
Westinghouse Electric Corporation

I. B. 32-251-6

SPECIAL INQUIRIES

When communicating with Westinghouse regarding the product covered by this Instruction Book, include all data contained on the nameplate attached to the equipment.* Also, to facilitate replies when particular information is desired, be sure to state fully and clearly the problem and attendant conditions.

Address all communications to the nearest Westinghouse representative as listed in the back of this book.



* For a permanent record, it is suggested that all nameplate data be duplicated and retained in a convenient location.

RECEIVING • OPERATION • MAINTENANCE

INSTRUCTIONS

De-ion®

AIR CIRCUIT BREAKER

Type 150-DH-1000

Horizontal Drawout

Indoor and Outdoor Service

AIR CIRCUIT BREAKER TYPE	3-PHASE INTER-RUPTING RATING MVA.	VOLTAGE RATINGS			AMPERES CONTIN-UOUS 60 CYCLES	INTERRUPTING RATINGS—AMPERES	
		Rated KV.	Max. Design KV.	Min. KV. for Rated INT. MVA.		At Rated Voltage	Max. Amperes
150-DH-1000	1000	13.8	15.0	11.5	1200	42,000	50,000
150-DH-1000	1000	13.8	15.0	11.5	3000	42,000	50,000

WESTINGHOUSE ELECTRIC CORPORATION
SWITCHGEAR APPARATUS DEPARTMENTS
EAST PITTSBURGH PLANT • EAST PITTSBURGH, PA.
NEW INFORMATION MAY, 1959
Printed in U.S.A.

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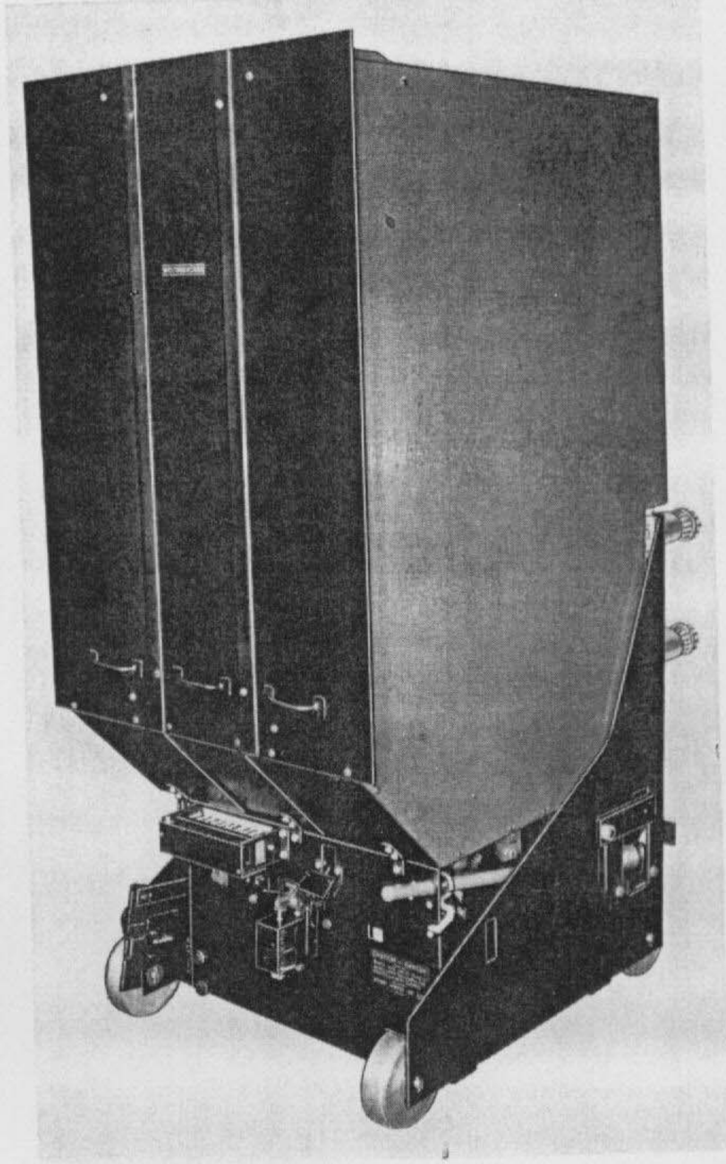


FIG. 1. Type 150-DH-1000, 1200 Amp., Breaker Completely Assembled

One of the outstanding improvements in modern power distribution has been the development of the air circuit breaker by Westinghouse for distribution circuit voltages. On circuits where the duty on breakers is heavy, long life with a minimum of maintenance makes the De-ion air breaker an outstanding performer. In the type DH magnetic De-ion air circuit breakers, Westinghouse offers a complete standard line for circuits from 2.3 to 15 kv., with interrupting ratings from 75 to 1000 MVA.

Each of the type DH air circuit breakers is three-pole, electrically operated, and is built as a complete horizontal drawout unit for metal-clad switchgear. Breaker units of the same rating are interchangeable so that changing breakers is a matter of minutes. Since they are drawn out horizontally, no lowering or lifting is necessary. Steel barriers and automatic interlocks prevent contact with live parts while the breakers are being changed.

As in the case of most high voltage electrical equipment, these breakers should be inspected and maintained at regular intervals in order to obtain the most dependable performance.

DESCRIPTION

The type 150-DH-1000 **AIR CIRCUIT BREAKER** is a three-pole, electrically operated, horizontal drawout unit for use in metal-clad switchgear. The ratings of the breaker are tabulated on page 1.

Figure 1 shows a 150-DH-1000 breaker completely assembled. Figure 2 shows the breaker with the

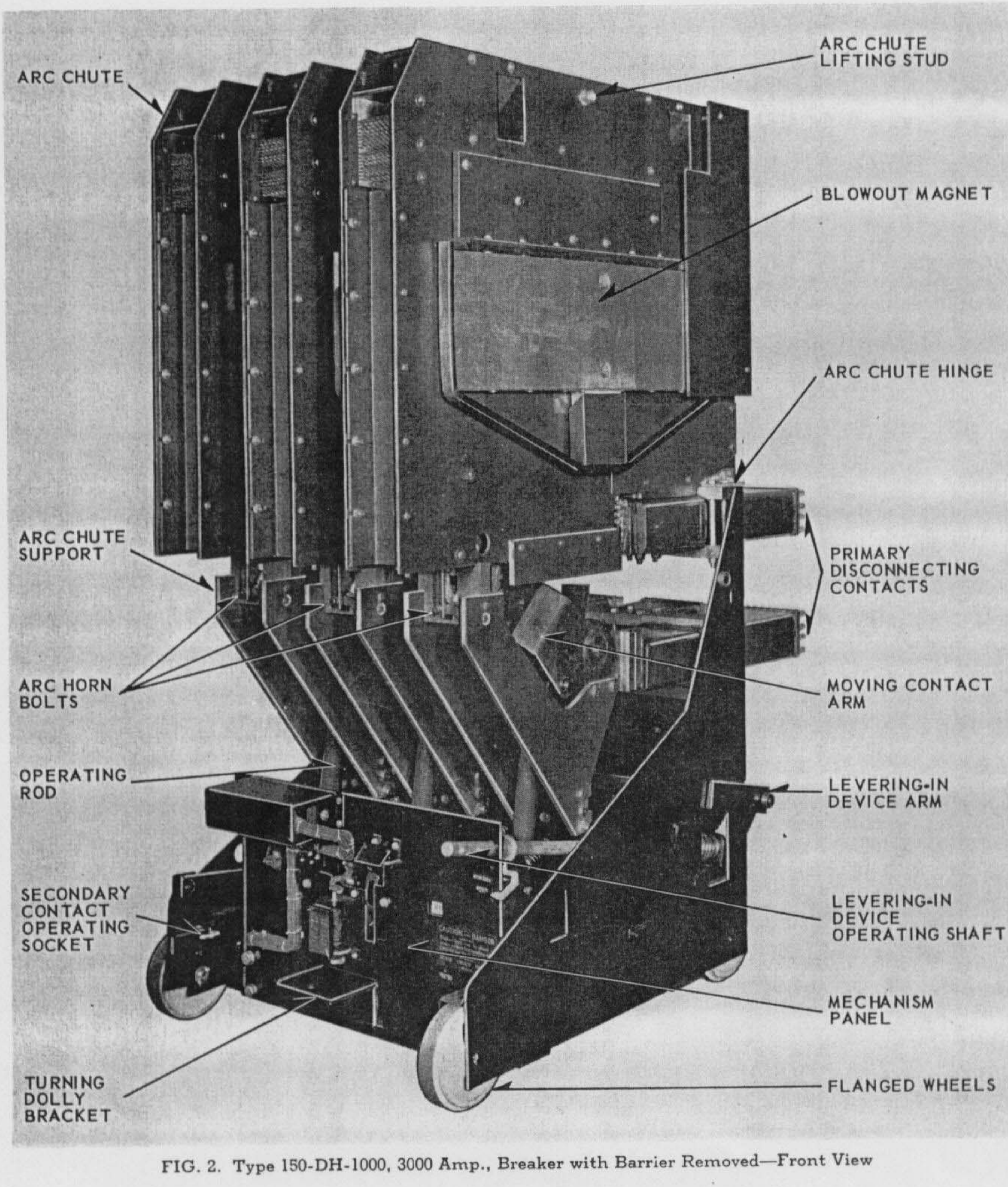


FIG. 2. Type 150-DH-1000, 3000 Amp., Breaker with Barrier Removed—Front View

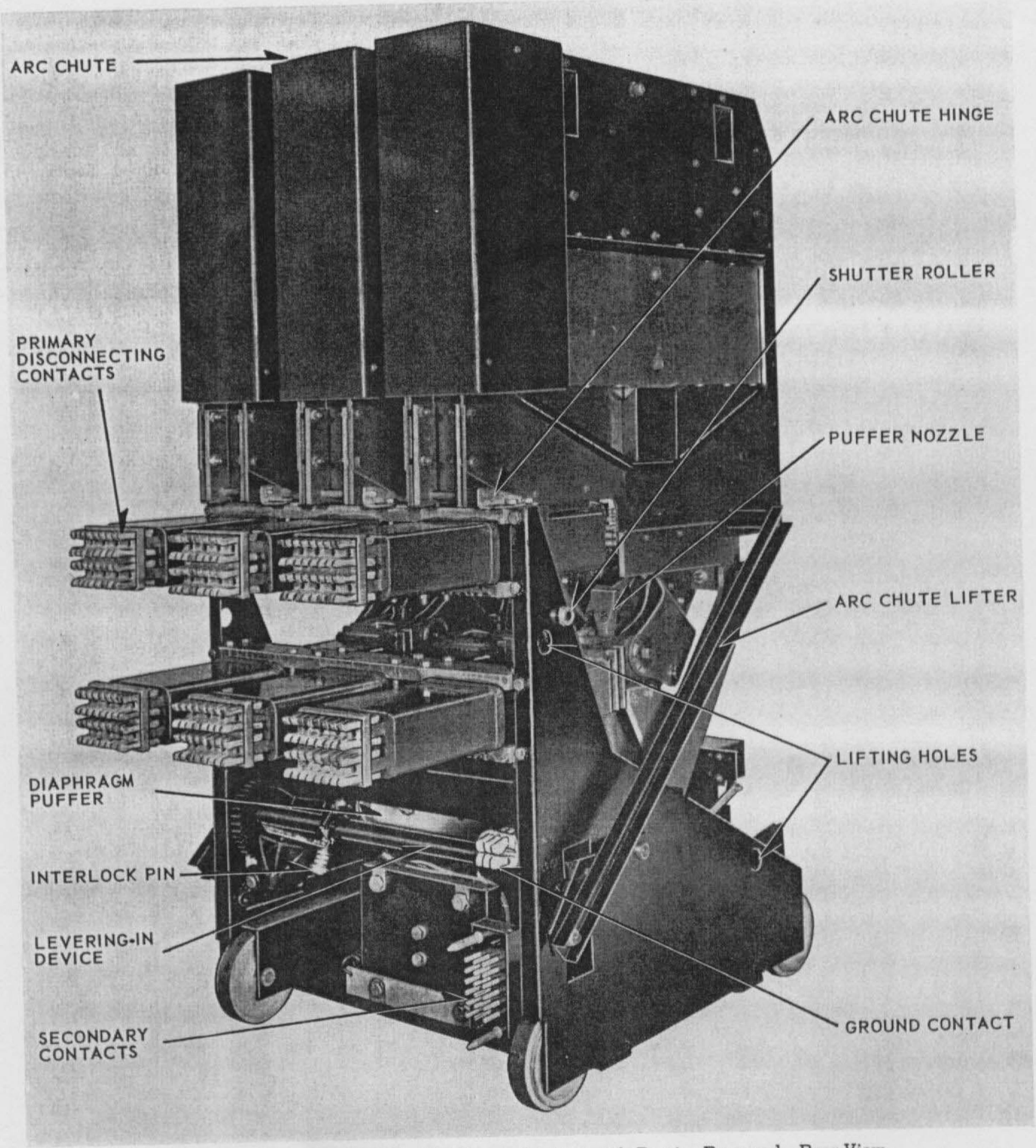


FIG. 3. Type 150-DH-1000, 3000 Amp., Breaker with Barrier Removed—Rear View

main barrier removed, and Fig. 3 is a rear view of the breaker with the stack lifter in place. This shows the arrangement of the center-coil arc chutes, separating contacts, primary disconnecting contacts, insulated operating rods, and the solenoid operating mechanism. These components are supported on a welded steel frame which is mounted on flanged wheels for rolling into the metal-clad cell. Located in the lower part of the frame is the levering-in device for moving the breaker into final contact engagement. It is interlocked with the mechanism to prevent inserting or withdrawing the breaker with the contacts closed. It also prevents closing the contacts unless the breaker is completely in or completely out of the cell. Also located in the lower part of the frame are the secondary contacts, for automatically disconnecting the control wiring when the breaker is in the withdrawn position, the auxiliary switch, shunt trip, cut-off switch, latch checking switch, operation counter, breaker contacts position indicator, and levering-in device position indicator.

The arc chutes on this breaker are of the center-coil design. The magnetic circuit is H-shaped with the cross member of the H passing through the center of the arc chute. The blowout coils are wound around the cross member of the H and lie in the center of the arc chute.

With this arrangement, the magnet core passing through the center of the arc chute, it is impossible to remove the arc chute from the magnet. To provide easy accessibility for contact maintenance and inspection, the arc chutes are hinged at the rear, and a simple tilting device is provided. Figure 4 shows the breaker with the arc chutes tilted back. The levering-in device is used to supply the mechanical advantage for tilting the arc chutes.

A 3-piece barrier assembly, Fig. 4, is placed on the breaker before it is rolled into the cell. The front sheet is of $1/8$ inch steel to form a grounded barrier between personnel and live parts when the unit is in the cell.

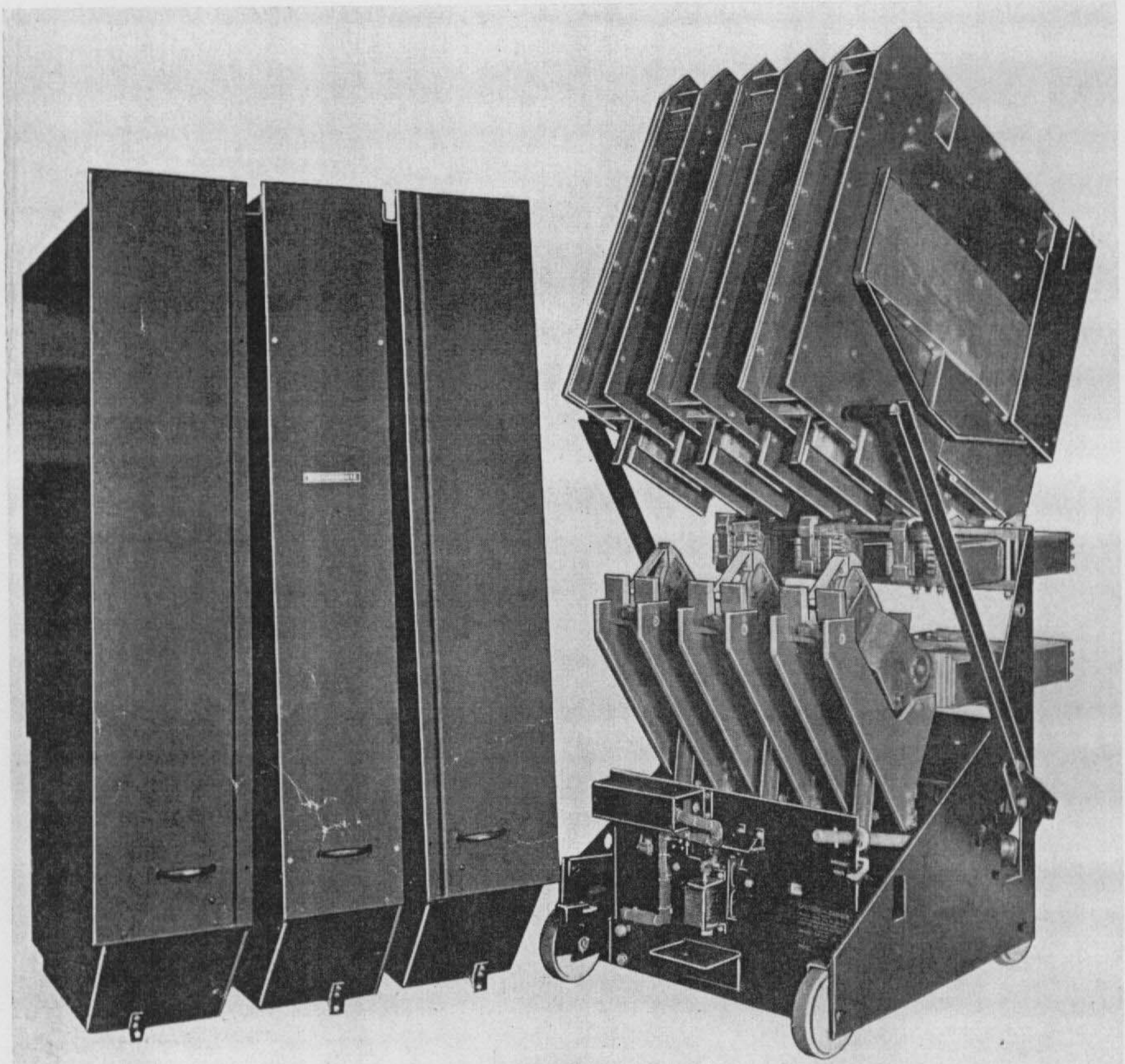


FIG. 4. Breaker with Barriers Removed and Arc Chutes Tilted Back for Inspection

The 150-DH-1000 air circuit breaker is arranged for use in metal-clad equipment from which it is drawn out horizontally. As may be seen in Figs. 2 and 3, all parts are supported on a steel frame which is mounted on roller bearing wheels to facilitate moving the breaker. The wheel flanges engage with the rails to align the breaker in the cell.

The main conductors project horizontally from the rear of the breaker and are supported and insulated by Redarta condenser bushings. On the ends of these main conductors are clusters of finger contacts arranged to engage the primary conductors in the cell.

PART TWO

RECEIVING, HANDLING AND STORING

The type 150-DH-1000 breaker is assembled and given operating tests at the factory. Then it is carefully inspected and prepared for shipment by workmen experienced in the proper handling and packing of electrical equipment. In order to afford maximum protection against damage, the main barrier assembly and the arc chutes are packed separately. For each three-pole breaker there is one 3-piece barrier assembly and three arc chutes.

After the equipment has been unpacked, make a careful inspection for any damage which may have occurred in transit. If the apparatus has been damaged, file a claim immediately with the carrier and notify the nearest Westinghouse Sales Office.

HANDLING

Remove the crating and packing carefully. To avoid damage from negligent handling of crow-bars or other tools, use a nail puller for the uncrating. Care must be used in handling the arc chutes since the splitter plates in them are made of a ceramic material which may break if dropped.

The base of the crate may be used as a skid for moving the breaker, or the breaker may be lifted with slings under the crate. If the breaker is to be lifted with slings, move it while it is still crated. After the breaker is unpacked the best way to move it is by rolling it on its own wheels.

If it is necessary to lift the breaker after it is uncrated, lift it **without the barrier or arc chutes in place.** Slings may be placed under the breaker frame or hooks used in the holes provided in the frame.

STORING

The arcing chambers are shipped in separate containers to guard against damage from rough handling and for better protection from dust and water or liquids. Store them in their shipping containers until ready for use.

Store all components of these breakers in a clean dry place. During the storage period, keep them sufficiently warm to prevent moisture condensation.

The approximate weight of the breaker and the various breaker parts is given below:

Breaker Parts	1,200 Amps.	3,000 Amps.
Breaker without arc chutes and barrier	1,470 pounds	1,800 pounds
Single arc chute	608 pounds	608 pounds
Barrier assembly	284 pounds	284 pounds
Complete breaker	3,578 pounds	3,908 pounds

PART THREE

OPERATION

Before placing the circuit breaker in service, it is advantageous to become familiar with the construction and function of the different parts of the breaker. The following paragraphs describe the operation of the various breaker parts. This material should be studied carefully before placing the breaker in service.

The general arrangement of the breaker components is shown in Figs. 2 and 3. The solenoid coil is built to exert a horizontal force on the mechanically trip free linkage. This linkage, in turn, exerts an upward force on the pole unit operating rods which act on the moving contact arms to open and close the contacts. The breaker has three sets of contacts; main, intermediate, and arcing. On opening, these contacts separate in the order named; on closing, they touch in the reverse order. Above the arcing contacts are located the center-coil arc chutes for extinguishing the arc while the contacts are separating. The breaker is tripped by lifting the primary latch either manually or electrically by means of the trip coil.

MECHANISM

The solenoid operating mechanism with its trip-free linkage is shown in Fig. 5. In this mechanism, the horizontal pull of the solenoid coil is transmitted to the contact operating rods through a system of links which rotate counterclockwise about the operating center. The linkage system consists of four (4) major links: the non-trip free lever, trip free lever, upper trip free link, and lower trip free link. These members are arranged as shown and are held to form a rigid member by the cam link and tripping cam. The tripping cam is held fixed by the tripping latch.

When the solenoid is energized, the moving core pulls on the junction of the non-trip free lever and the lower trip free link. This causes the system to rotate about the operating center as the parts move from the RESET POSITION, Fig. 5C, to the CLOSED POSITION, Fig. 5A. The trip free lever then exerts an upward force on the operating rods to close the breaker. The breaker is held in this position by the closing latch.

The breaker is tripped either electrically or manually by lifting the trigger which disengages the primary latch. This allows the tripping latch to release the tripping cam so that it is free to rotate. Without the restraining force of the cam and cam links, the major linkage collapses under the force of the contact springs, the springs in the air bumpers, the accelerating springs, and the springs over the puffer rods. The junction of the upper and lower trip free links moves to the right, and the trip free lever rotates clockwise opening the breaker. The position of the linkage is then in the TRIP FREE POSITION as shown in Fig. 5B.

In moving to this position, the lower trip free link has disengaged the closing latch. The retrieving springs now pull on the solenoid core which moves the linkage to the RESET POSITION as shown in Fig. 5C. In this position the tripping latch is reset and the breaker may be reclosed.

MECHANISM PANEL

The mechanism panel is mounted on the front of the closing mechanism as shown in Fig. 6. On it are mounted the following auxiliary devices included as standard on all breakers.

Shunt Trip Magnet. The shunt trip magnet is a small electromagnet which is used to trip the breaker electrically. It may be equipped with a coil for direct current, or alternating current, or capacitor tripping. When the shunt trip magnet is energized, the core is drawn up into the magnet yoke. An extension of the core protrudes through the top of the magnet assembly. As the core moves up, this extension moves up against the trip lever directly above it. The force of the solenoid is sufficient to raise the trip lever which disengages the primary latch tripping the breaker. A thin brass washer prevents the moving core from being retained by residual magnetism in the raised position after the coil is de-energized.

Cut-Off Switch. The cut-off switch is an "AA", normally open contact which acts with the breaker control relays to cut-off the closing coil current after the breaker is closed. The switch is operated by an arm attached to the trip free lever in the mechanism.

Contact Position Indicator. The contact position indicator gives a positive indication that the breaker contacts are either open or closed. It operates directly on the trip free lever in the mechanism.

Interlock Position Indicator. The interlock position indicator gives a positive indication of the position of the breaker interlock. It operates from levering-in device shaft. When the indicator points to the word OPERATE, the interlock is free and the breaker may be closed or tripped. When the indicator points to the word INTERLOCKED, the interlock is functioning and the breaker cannot be closed. Since the interlock is operative only when the breaker is in an intermediate position between fully engaged and fully withdrawn, it also serves as a means of indicating when the breaker is all the way in or all the way out of the cell.

Operation Counter. The operation counter records each operation of the breaker. It advances one count of each tripping operation. A link to the trip free lever operates the counter.

Auxiliary Switch. The auxiliary switch is a nine-pole rotary type switch. It is operated by a link from the trip free lever in the mechanism. There are five "a" contacts (closed when the breaker is closed), and four "b" contacts (closed when the breaker is open). These are arranged alternately, starting with an "a" contact nearest the operating lever.

The first and third segments of the rotor are longer than the others and are connected on each side of the shunt trip coil. When the breaker closes, these segments complete the trip coil circuit just as the main contacts touch. The rotor turns approximately

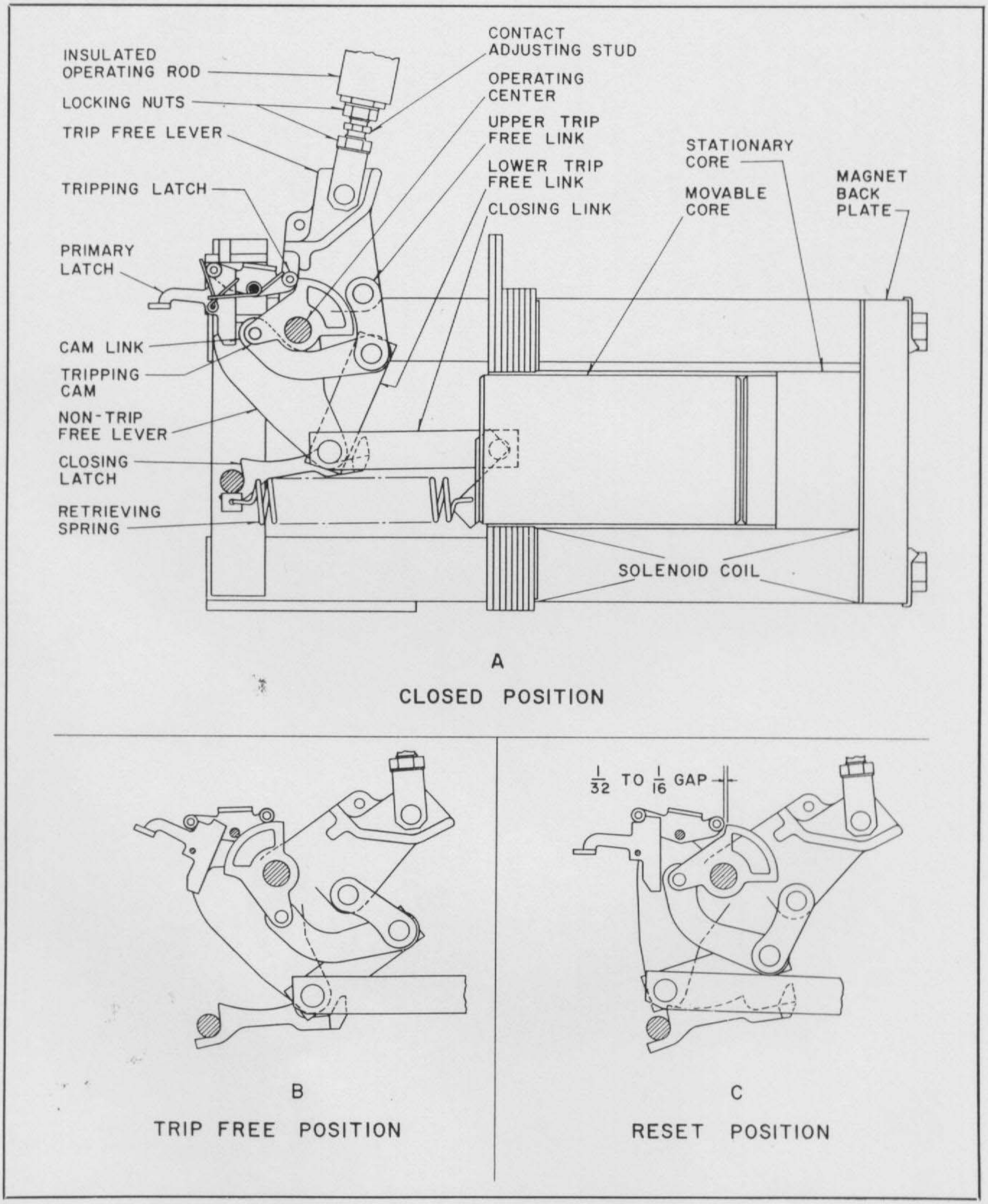


FIG. 5. Solenoid Operating Mechanism

90°, and is adjusted by the serrated operating lever.

Each contact is able to carry 20 amperes continuously, and interrupt the following current.

Voltage	Non-Inductive	Inductive
125 d-c	8.	4.
250 d-c	2.	1.
600 d-c	0.5	0.2
125 a-c	50.	30.
250 a-c	25.	15.
600 a-c	5.	3.

Latch Check Switch. The latch check switch is a small, light force, snap action switch which is operated by the primary latch. When a breaker is to be automatically reclosed after being tripped free, it is necessary to arrange the electrical control scheme so that the closing solenoid will not be energized to start the closing motion until the mechanism has completely reset. See B and C of Fig. 5. For this purpose, the switch is arranged to be closed when the primary latch is reset because the primary latch is the last part to reset in the sequence of linkage motions required to reset the mechanism.

In addition to the above items which are standard on all breakers, the following special devices may also be mounted on the mechanism panel when required.

Undervoltage Trip Attachment. The undervoltage trip attachment shown in Fig. 7, is a magnetically held device which will trip the breaker using the force stored in a spring during the breaker closing stroke when the control voltage drops below a predetermined value. For instantaneous release, the holding magnet coil may be directly connected to a d-c control source, or it may be supplied with low voltage d-c obtained from an a-c control voltage

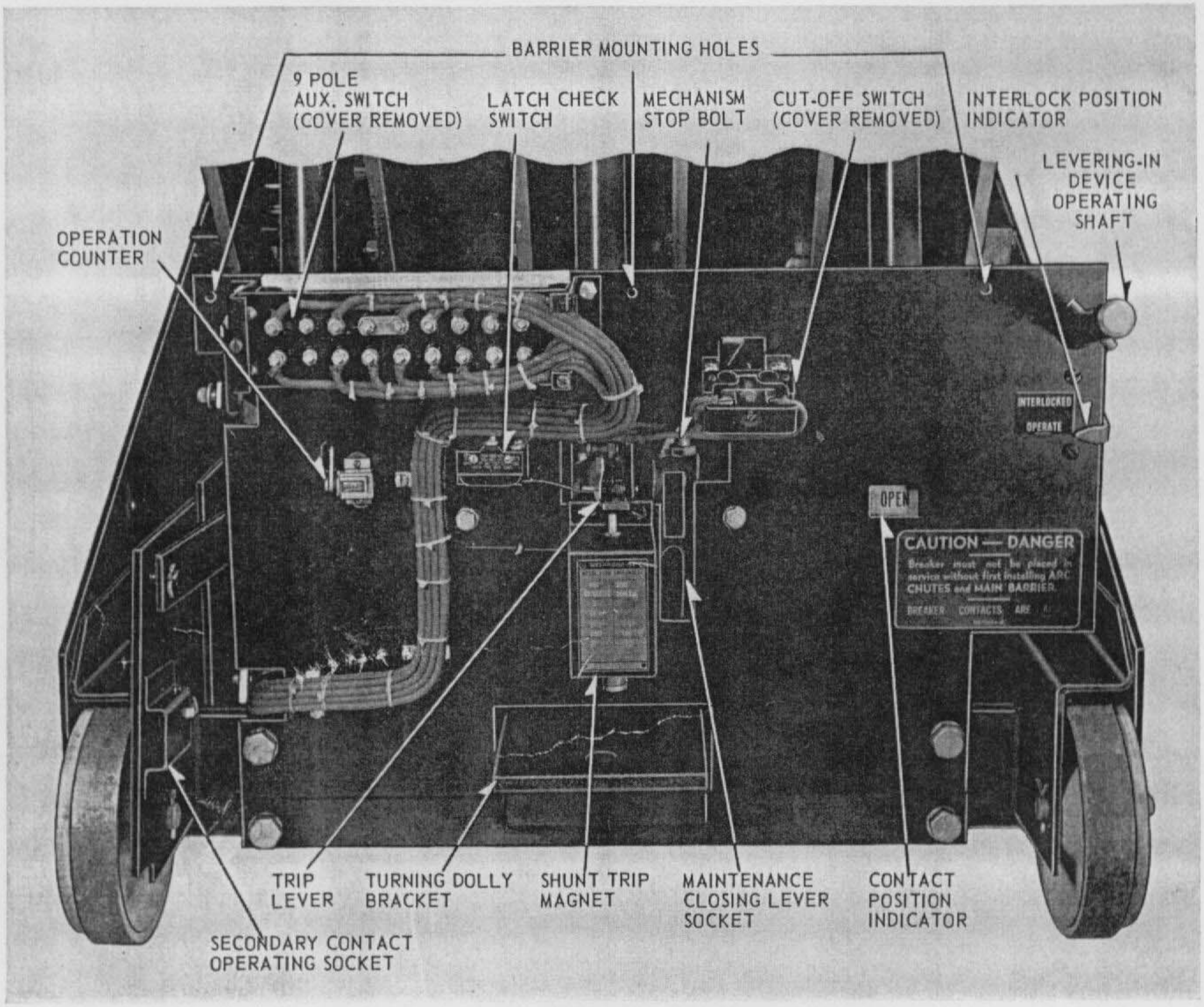


FIG. 6. Mechanism Panel

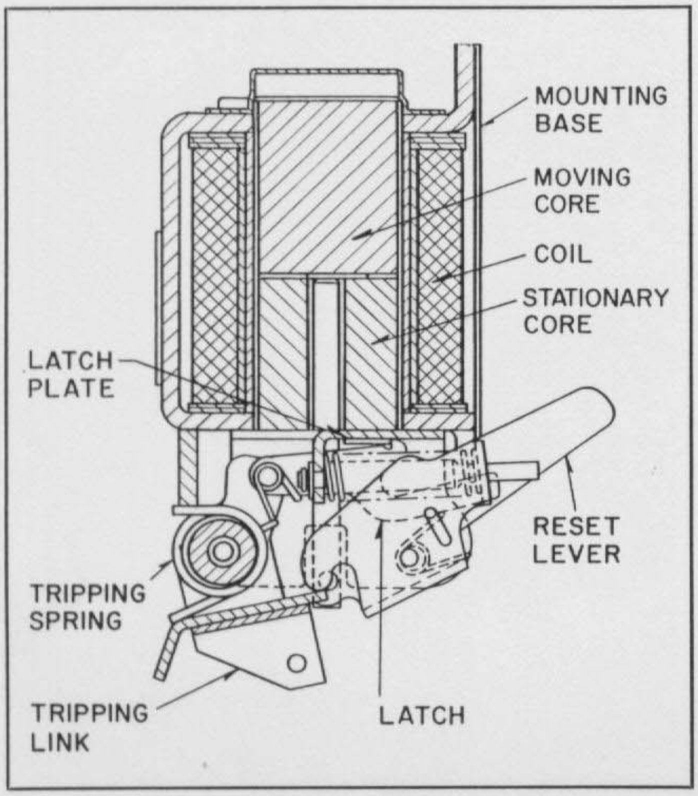


FIG. 7. Undervoltage Trip Unit

through a small transformer and Rectox assembly mounted in the cell structure. Normally the moving core of the device is held magnetically against the stationary core to hold the rod and consequently the reset lever in the reset position. When the coil voltage is reduced sufficiently, the reset lever spring overcomes the magnetic attraction of the cores and rotates the reset lever clockwise. As the reset lever rotates, the pin pushes against the latch to release it from its latch plate. When the latch releases, the trip spring rotates the trip lever to trip the breaker. The linkage is reset by the trip free lever of the mechanism as the breaker opens.

For time delay release on tripping, a very high resistance coil is employed in the holding magnet. It is supplied with about 300 volts d-c from a transformer, Rectox, and capacitor device mounted in the cell. The capacitor is connected across the coil and provides a slowly decaying holding current. The time delay is adjusted by varying the charging voltage to the capacitor by a four step resistor.

Three-Coil Trip Attachment. The three-coil trip attachment, when supplied, mounts on the mechanism panel and is used in addition to the shunt trip magnet. It is designed to accommodate three instantaneous current transformer trip assemblies. The calibration on each of the current trip coils is engraved with the values of current required to trip the breaker.

CONTACTS

The 150-DH-1000 breaker is equipped with 3 sets of contacts; main, intermediate, and arcing. When the breaker is tripped, the contacts separate in the order named above. When the breaker is closed, they make up in the reverse order.

The moving contact is a copper casting to which are brazed the arcing, secondary, and main contact inlays. It is bolted between 4 formed copper blades which hinge on the lower bushing foot and form the moving contact arm. See Fig. 8.

All the contact resiliance is built into the stationary contact assembly. Because of the high momentary rating of the breaker, the contacts have been divided to give a multiplicity of contact surfaces. See Fig. 9.

Three sets of arcing and secondary contacts are brazed to castings which are mounted over pins and biased by springs in the center of the stationary contact assembly. On each side of the arcing and secondary contacts are five main contact fingers. They are held in place and biased by the springs which are over the studs which pass through the fingers.

This arrangement of the contacts, relatively long and narrow, permits all the contacts to be up inside the arc chutes.

ARC CHUTES

The arc chute consists of an H-shaped blow-out magnet, blow-out coils, transfer arc horns, transfer stacks, main interrupter stacks, a front arc horn, and a rear arc horn all assembled in and about a fabricated rectangular Redarta chute jacket. The arc chute is hinged to the breaker; and when it is in the normal position, its lower end completely surrounds the contact structure. Fig. 10 is a schematic cross section of the arc chute showing the component parts.

The blow-out magnet is located so that the core passes through the center of the arc chute. The blow-out coils are wound about the core and lie in windows cut in the chute jacket side sheets. One terminal of each coil connects to a transfer arc horn, and the other terminals are joined together by the shading coil. Two transfer stacks are placed in the space between the transfer arc horns and the shading coil. To either side of the transfer arc horns are the main interrupter stacks which are made up of a series of insulating refractory plates. These plates have inverted V-shaped slots molded into them. The slots are offset so that when the plates are stacked with the slots alternating from one side to the other, the arc must take a serpentine path as it moves up into the arc chute increasing the length of the arc.

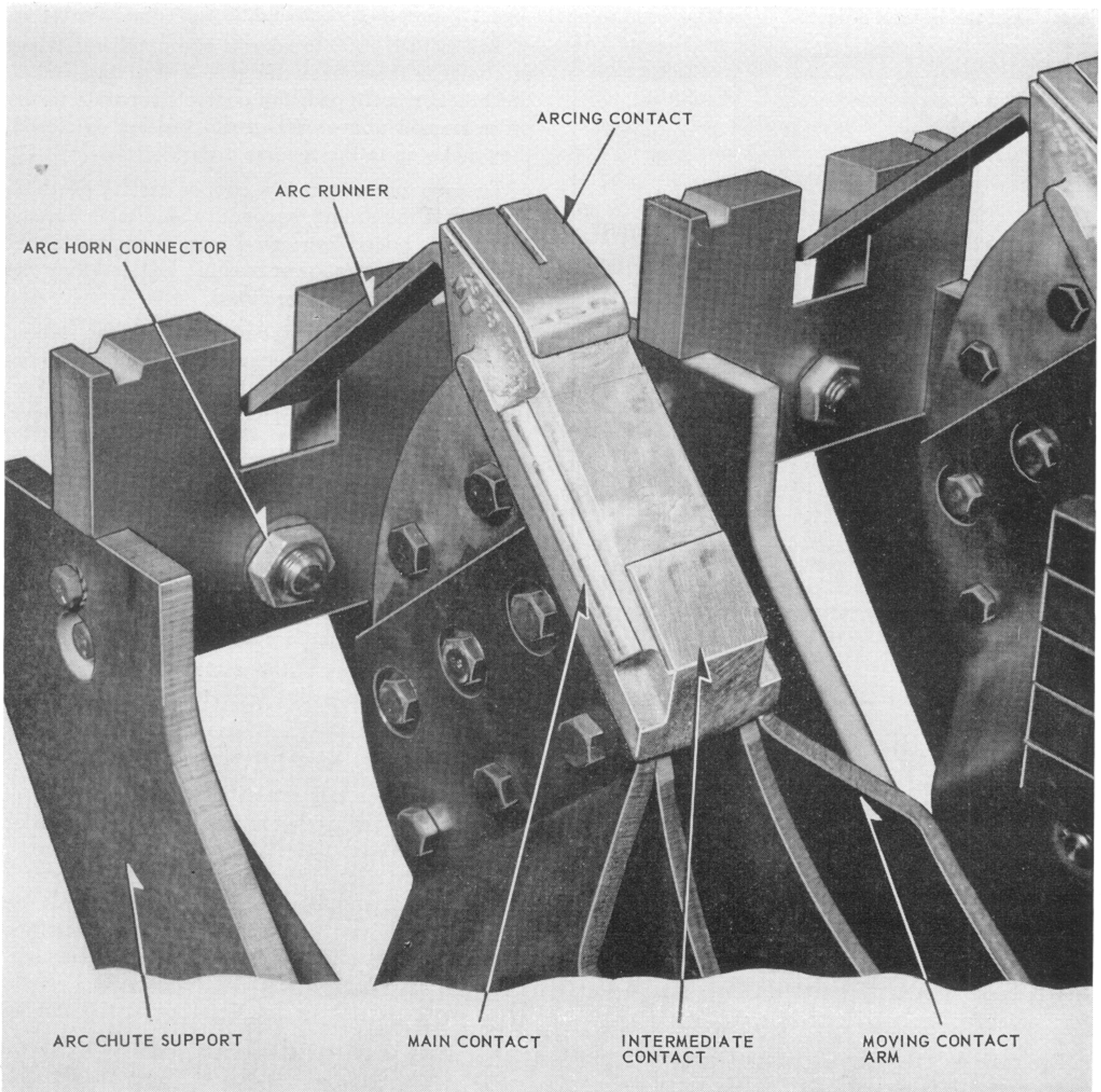


FIG. 8. Moving Contact Assembly

To either side of the main interrupter stacks are two metallic arc horns to which the arc transfers from the arcing contacts. The front arc horn is connected electrically to the moving contact, and the rear arc horn is connected to the stationary contact.

The action of a breaker in interrupting an arc is as follows. Referring to Fig. 10, when the arcing contact parts and an arc is drawn, it loops up and impinges on the lower ends of the two transfer arc horns and the shading coil. The two short segments of the arc, from the transfer arc horns to the shading coil, then move up into the transfer stacks and are quickly interrupted placing the blow-out coil in series with the arc.

When current starts to flow in the blow-out coils, a magnetic field is established and the arc, which by this time is two separate arcs extending from the two end arc horns to the transfer horns, is driven very rapidly into the slots of the refractory plates. As the arc moves to the closed end of the slots, it is restricted, lengthened, cooled, and subject to a strong magnetically induced blast of gas. All of these forces result in rapid deionization of the arc space; and for the arc to maintain itself, it must continuously

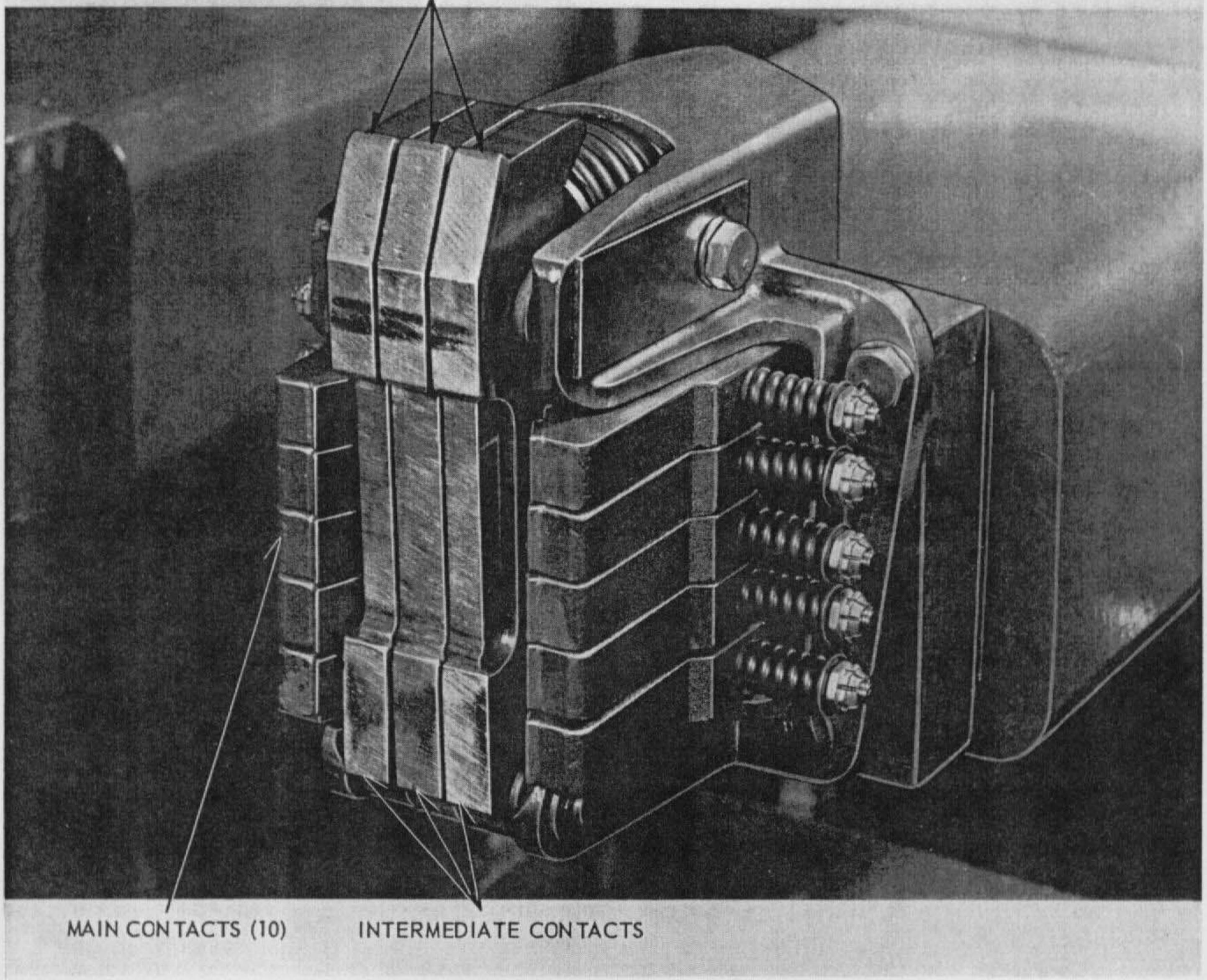


FIG. 9. Stationary Contact Assembly

ionize fresh gas. At current zero the formation of new ionization momentarily ceases, but the de-ionization continues so that dielectric strength is established in the arc space and the circuit is interrupted.

Figures 11 and 12 are photographs of partly assembled arc chutes. Figure 11 shows the cute with the right hand magnet pole piece and side sheet removed. The direction of the viewing is up into the throat of the arc chute. Figure 12 is the same chute looking down into the top.

LEVERING-IN DEVICE

In order to move the breaker in or out of the cell against the resistance of the contact fingers, a levering-in device is provided on each breaker. There is an arm on each side mounted on a common shaft across the back of the breaker. On each arm is a roller which engages a groove in the sidewall of the cell. A removable crank engages another shaft in the right front corner of the breaker which turns the levers through a worm gear arrangement.

Before a breaker is rolled into a cell, the arms, with rollers, at each side of the breaker must point to the rear and slightly downward as shown in Fig. 13. The position of the arms shown in Fig. 14 is that which they take after the breaker is cranked into the operating position. To put the arms in the position shown in Fig. 13, place the crank on the operating shaft at the front right corner of the breaker, push in, and rotate to engage the coupling in the levering-in device. The breaker contacts must be open to engage the coupling. Rotate the crank

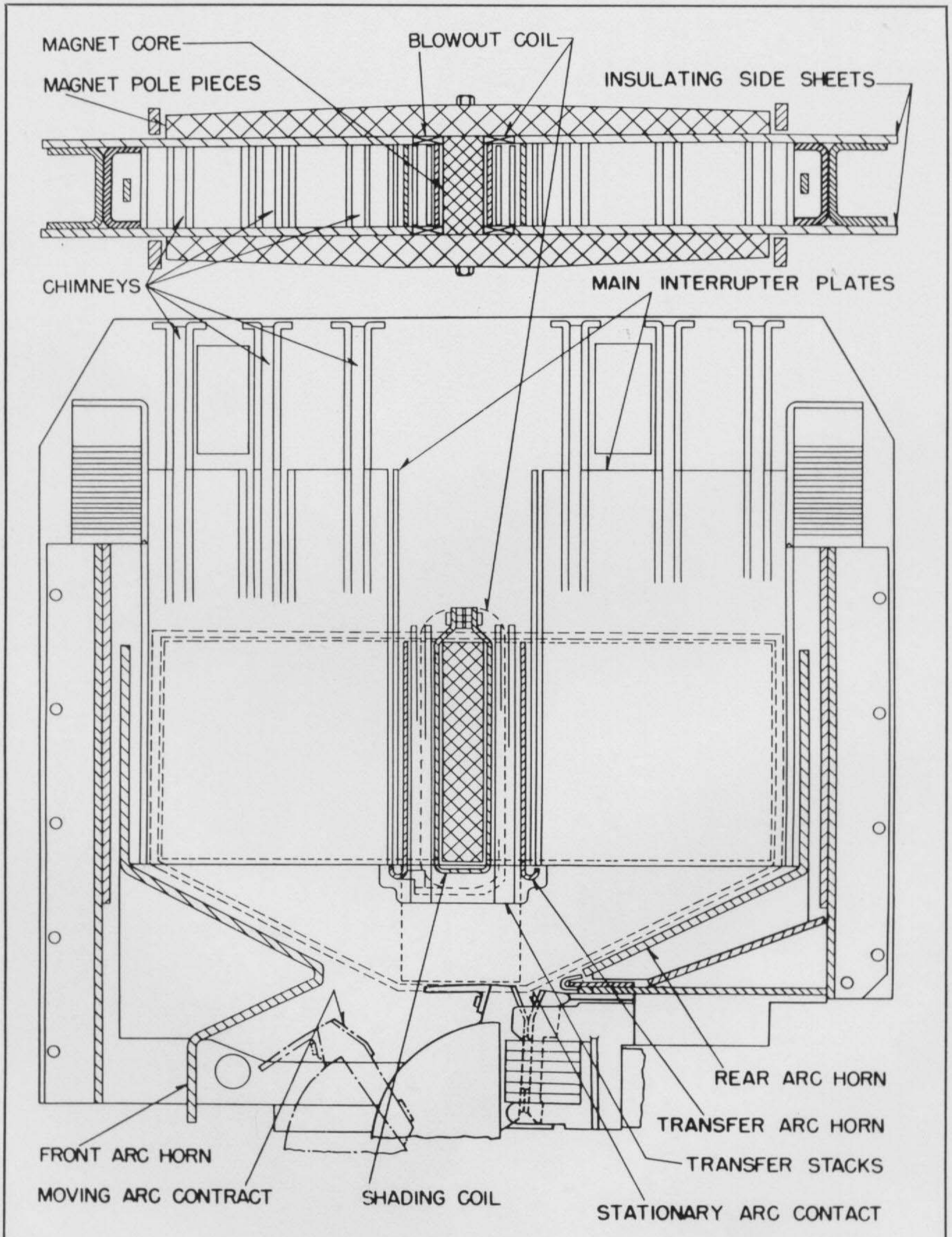


FIG. 10. Arc Chute Arrangement

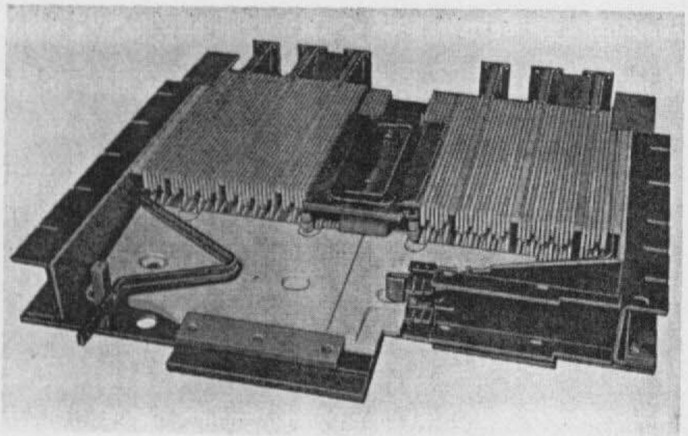


FIG. 11. Partially Assembled Arc Chute Viewed From Bottom

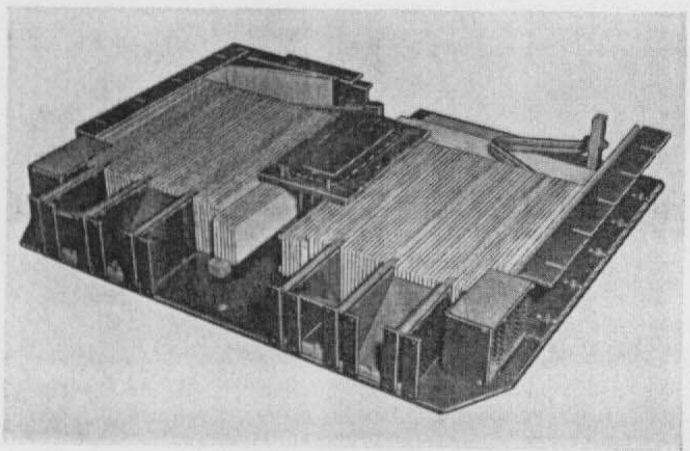


FIG. 12. Partially Assembled Arc Chute Viewed from Top

counterclockwise to the end of the travel. At the end of the travel, the interlock will release, the handle will move back out, and the indicator on the mechanism panel will point to the word OPERATE.

With the arms to the rear and down as shown in Fig. 13, the breaker is ready to be rolled into the cell as far as the test position. As the breaker is rolled into the cell, the rollers on the levers strike vertical angles on the cell wall and stop the breaker at the test position. If the breaker is to be operated at this position, remove the crank and engage the secondary contacts in the manner described in the section under SECONDARY CONTACTS. To move the breaker from the test position to the fully engaged operation position, put the crank on the shaft, push in and rotate to engage the levering-in coupling, and crank clockwise. The torque required will increase slightly when the primary contact fingers engage the studs in the cell. Continue cranking to the end of the travel where the interlock will again fall free pushing the crank back out. Remove the crank. The indicator on the panel will again point to the word OPERATE.

To remove the breaker from the operating position, first check that the breaker is open. The levering-in device can not be engaged unless the breaker contacts are open. Put the crank on the operating shaft, push in and rotate to engage, and turn counterclockwise until the breaker returns to the test position. Remove the crank.

Caution: Never move the breaker into the cell beyond the test position unless the arc chutes and barrier are in position.

TEST POSITION

When the breaker is first moved into the metal clad cell, it moves until the rollers on the levering-in device come up against a pair of vertical angles welded into the cell. This is the test position. In this position, the breaker primary contacts are separated from the energized contacts in the cell, and metal shutter is closed completely isolating all live parts from the breaker. The secondary contacts may be engaged and the breaker operated safely without the arc chutes or barriers.

Caution: The breaker should never be moved beyond the test position without the arc chutes and barriers in place.

OPERATING POSITION

The breaker may be moved from the test to the operating position by engaging the levering-in device and rotating the levering-in crank clockwise. As the breaker travels beyond the Test Position the metal shutter covering the high voltage primary contacts will be automatically opened by the shutter rollers which are located on each side of the breaker frame at the rear. See Fig. 14. At the end of the travel, all the breaker contacts are engaged. This is the operating position.

Caution: When the breaker is in the operating position it should never be closed by the Maintenance Closing Handle.

INTERLOCK

The interlock on the 150-DH-1000 breaker has two functions to perform. First, it prevents the breaker from being moved from the test to the operate position or vice versa with the contacts closed. Second, if the breaker is in some intermediate position between the test and operate position, it prevents the contacts from being closed.

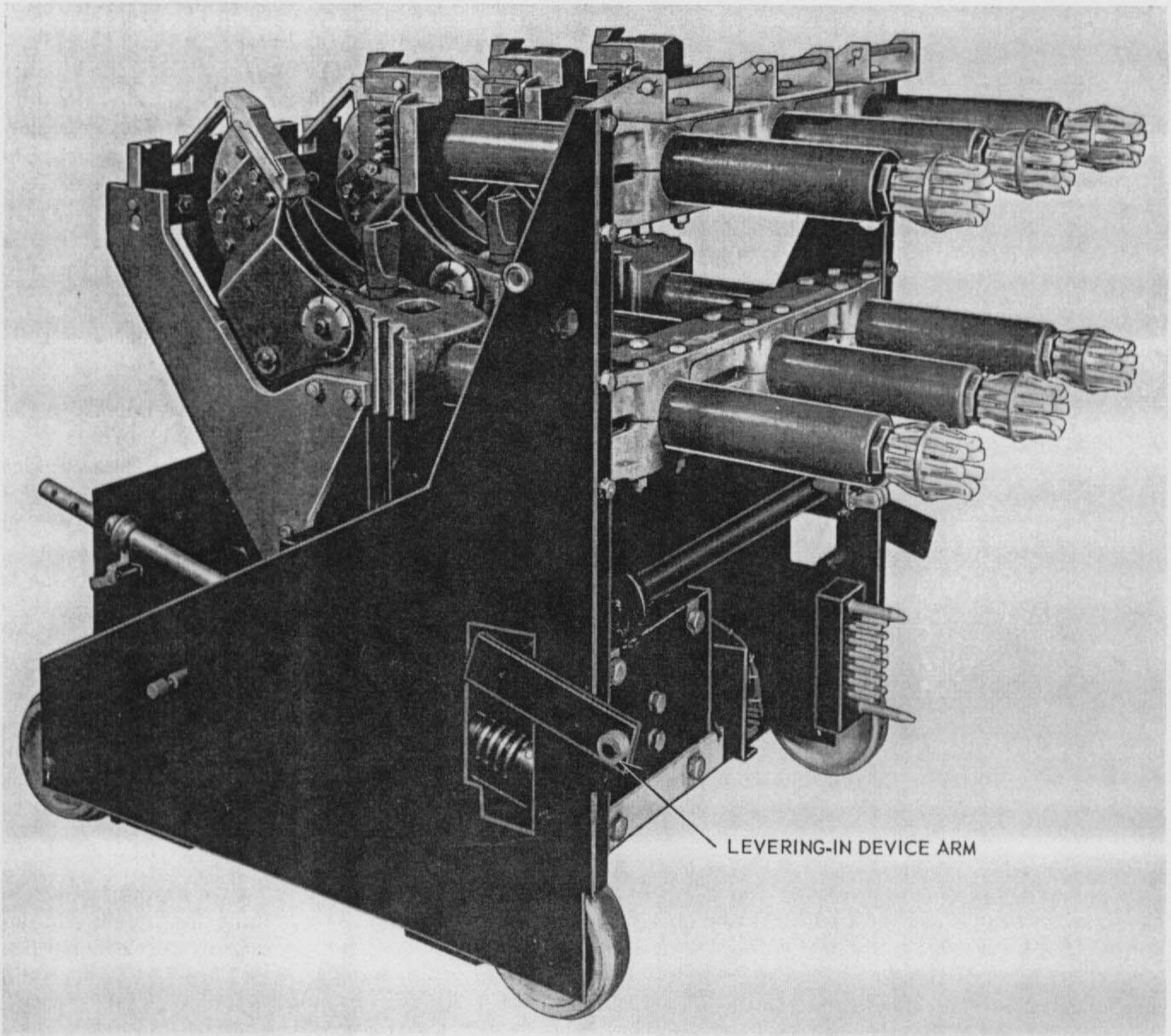


FIG. 13. Levering-In Device in Position for Rolling Breaker into Cell

This interlocking action is accomplished by having two pins, one operated by the breaker mechanism, and one by the levering-in device, operate at right angles to each other. When the breaker is closed, the mechanism pin is extended over the end of the levering-in device pin. This prevents the pin from moving; and if the pin does not move, the coupling cannot be engaged in the levering-in device to move the breaker. When the breaker is in any position between the test and operate position, the pin in the levering-in device is extended blocking the pin from the mechanism. The breaker cannot be closed. See Fig. 15.

SECONDARY CONTACTS

The breaker control wiring is arranged for drawout disconnection by means of an 18-point connector block arranged to plug into a mating block mounted in the cell. The secondary connector block is mounted on a movable bracket on the lower left hand side of the breaker frame. This permits the 18-point connector block to be extended to the rear and make contact with a stationary member so that the control circuits can be made up while the breaker is in the test position.

To engage the secondary contacts while the breaker is in the test position, place the breaker maintenance closing handle in the socket on the

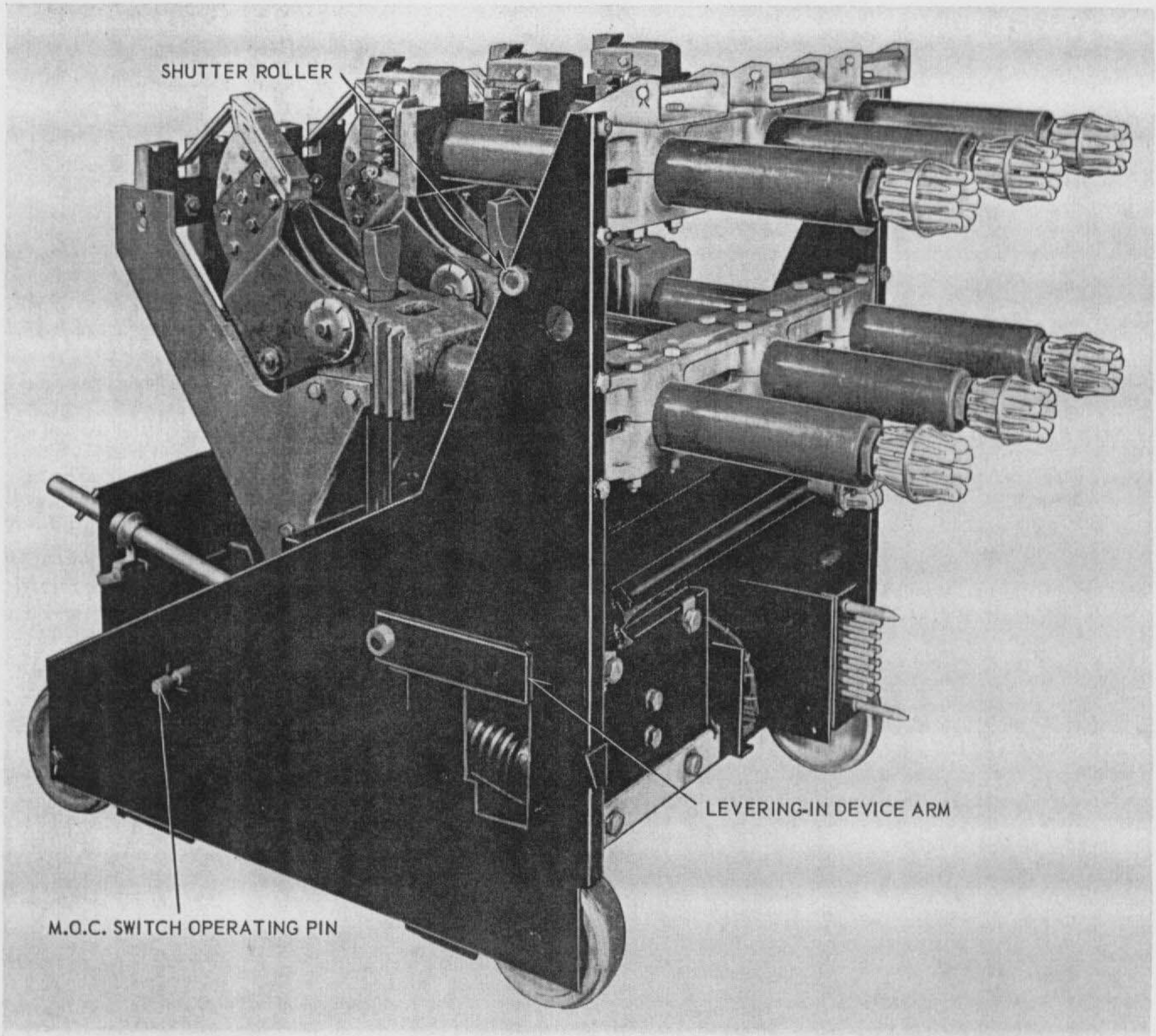


FIG. 14. Levering-In Device in Position taken when Breaker is in Operating Position in Cell

secondary contact slide at the lower left hand side of the breaker, Fig. 6. Push forward slightly to release the latch, then raise up on the handle to the end of the travel. See Fig. 15. To disengage the secondary contacts, the maintenance closing handle is inserted into the socket and lowered. If the breaker is levered into the operating position, the secondary plug and slide will automatically return to the normal position and the latch will hold it in place when the breaker is later moved to the test position.

GROUND CONTACT

A ground contact is located at the left rear of the breaker frame, directly above the 18-point secondary plug. See Fig. 16. Six spring loaded floating contact fingers engage the ground contact at the rear of the cell and insure a low impedance path to ground.

PUFFER ASSEMBLY

Directly behind the mechanism is a puffer arrangement that supplies a jet of air to each of the contacts through the puffer tubes and nozzles. Since the blow-out force of small arcs is very light, the jet of air is released at the instant the breaker is tripped. This facilitates the movement of the arc into the arc chute where it is quickly interrupted. The arrangement is shown in Fig. 16 and 17. The diaphragm is connected to the operating mechanism through the two operating rods. As the breaker trips open, the diaphragm is drawn into the cavity expelling the air which is directed to the contacts by the puffer nozzles. The diaphragm is made of long lasting, wide temperature range material and should never require replacement unless through accidental puncturing.

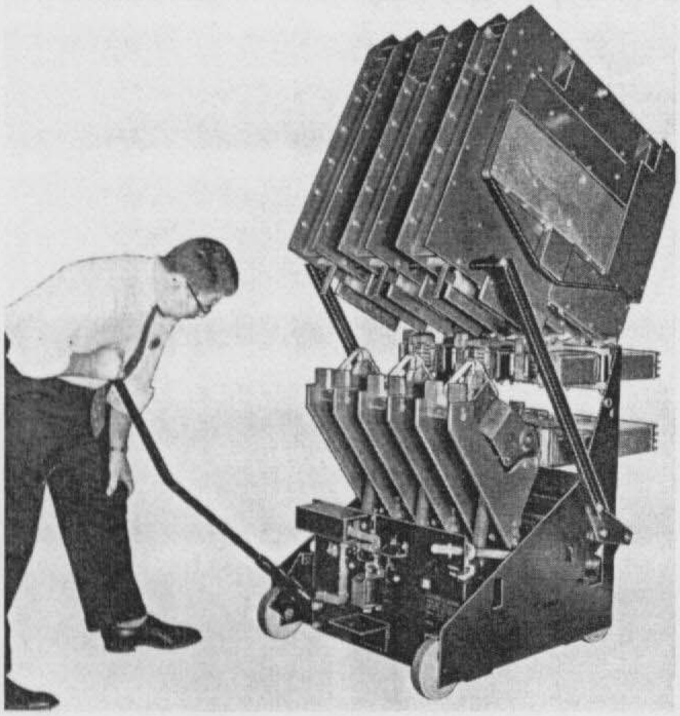


FIG. 15. Method of Operating Secondary Contacts

MECHANISM OPERATED CONTROL SWITCH

Some installations require more auxiliary switch contacts than are available on the nine pole auxiliary switch on the breaker. For this purpose additional rotary switches are mounted in the cell and are mechanically linked to the breaker mechanism.

An operating pin, shown in Fig. 14 extends through the right hand side of the breaker frame. It is an extension of a pin through the trip free lever which moves with the mechanism. The end of the pin engages a link in the cell to operate the additional switches. This link may be arranged for operation of the switches when the breaker is in the operating position only, or both testing and operating positions.

SECONDARY CONTROL WIRING

The low voltage control wiring from the 18-point secondary plug to the various components consists of flexible stranded copper wire having flame retardant, moisture resistance insulation. The standard

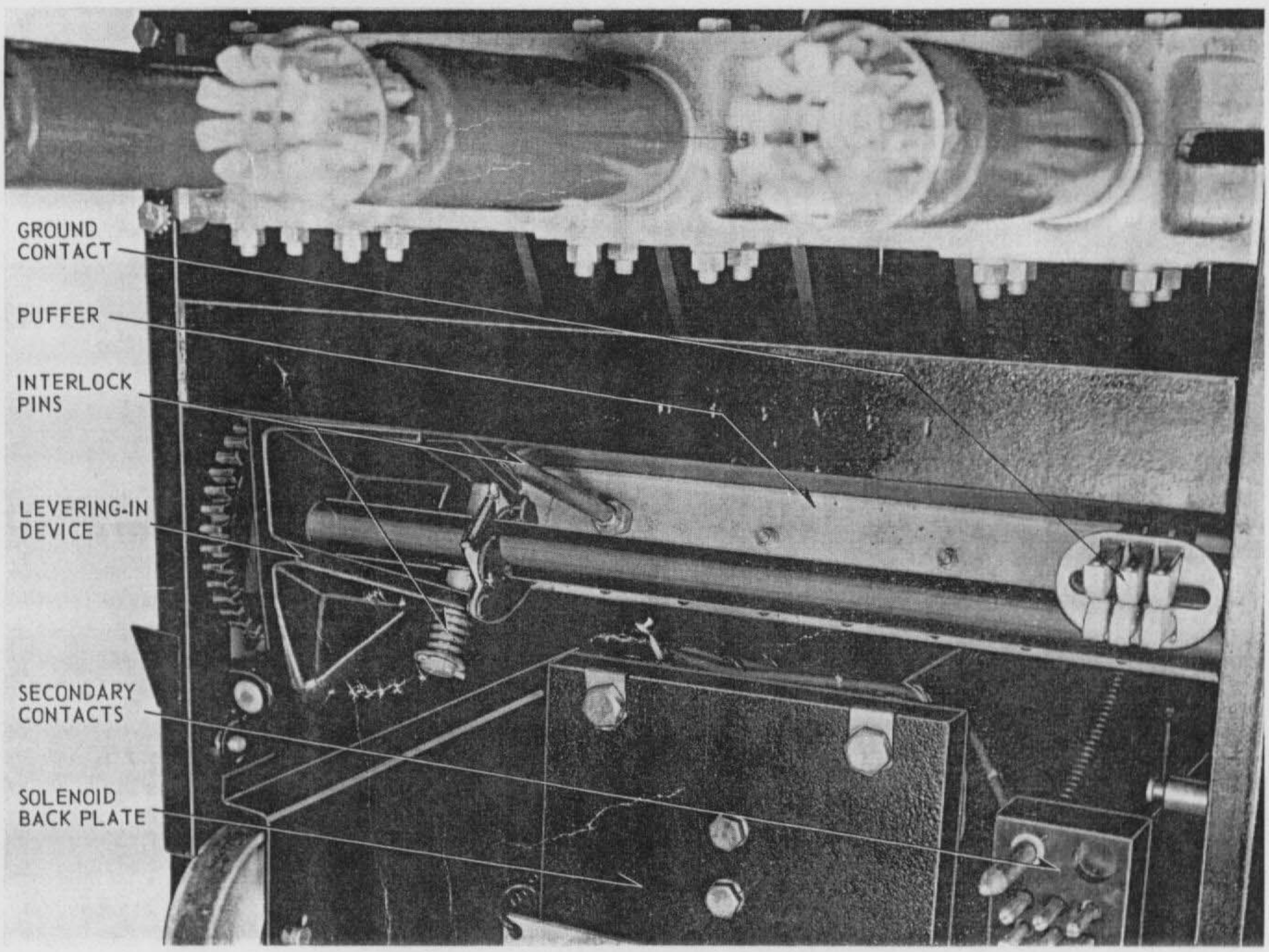


FIG. 16. View of Lower Part of Breaker from Rear

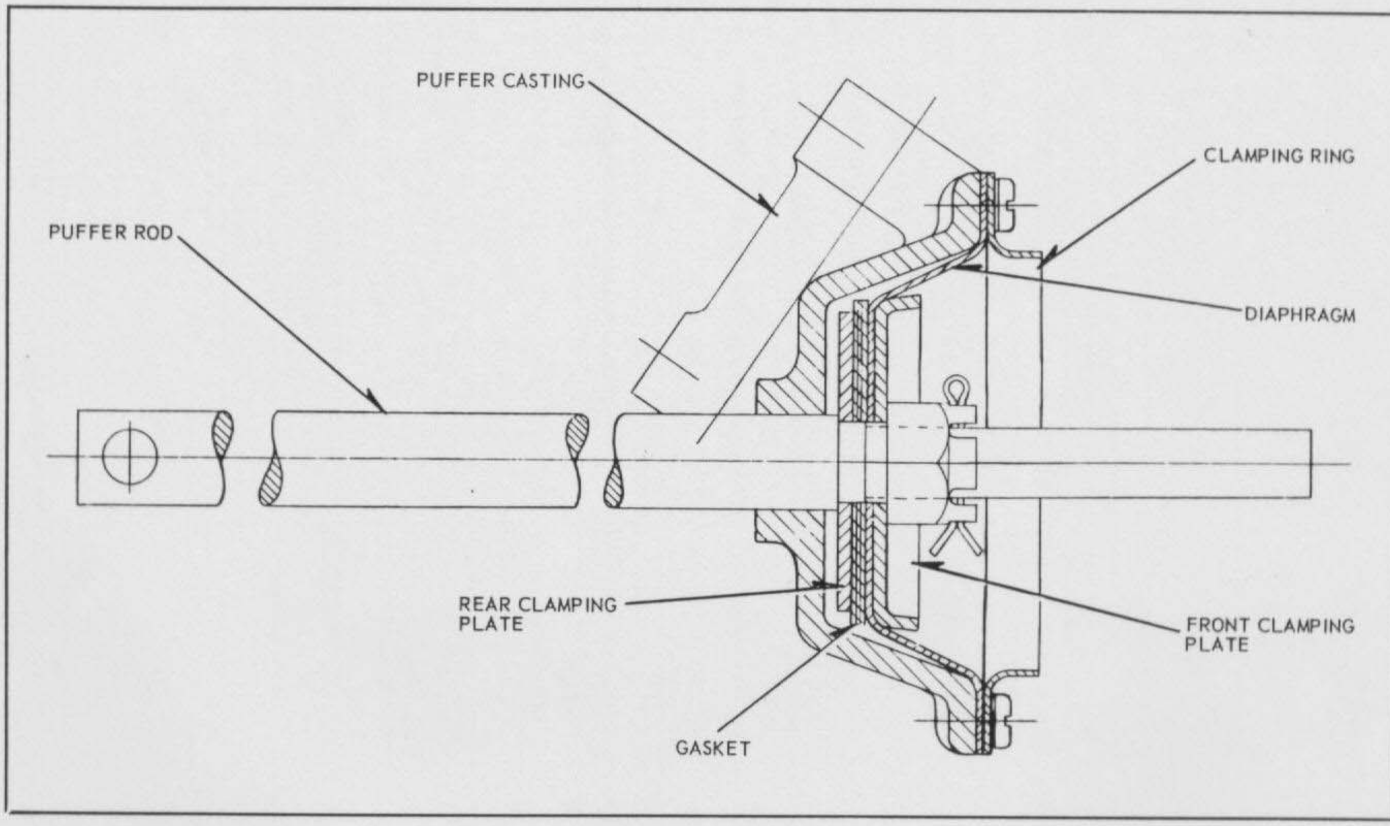


FIG. 17. Puffer Arrangement

breaker internal wiring is shown on Connection Diagram, Fig. 18.

When an undervoltage trip device is used on the breaker, its coil is connected between secondary contacts 15 and 16; and the "a" contact at the end of the auxiliary switch is not wired.

One lead from each of the three current trip coils is connected to secondary contacts 13, 14, and 15 with the common connection from the three coils going to contact 16. This eliminates the connection to the last "a" and "b" contact of the auxiliary switch.

ARC CHUTE LIFTER

In order to raise the arc chutes for contact inspection and maintenance, an arc chute lifter is provided. It consists of a piece of round bar, two lengths of channel, two triangular plates, and the necessary hardware to mount them to the breaker.

With the breaker out of the cell and the barrier removed, the following procedure should be used in raising the arc chutes. Refer to Fig. 19 and proceed as follows:

1. Remove the bolts which connect the front arc horn in the arc chutes to the support.

2. Crank levering-in device around until arms take position they would normally assume when the breaker is in the cell.

3. Mount the triangular plates over the levering-in arms. Place large hole over the roller and bolt

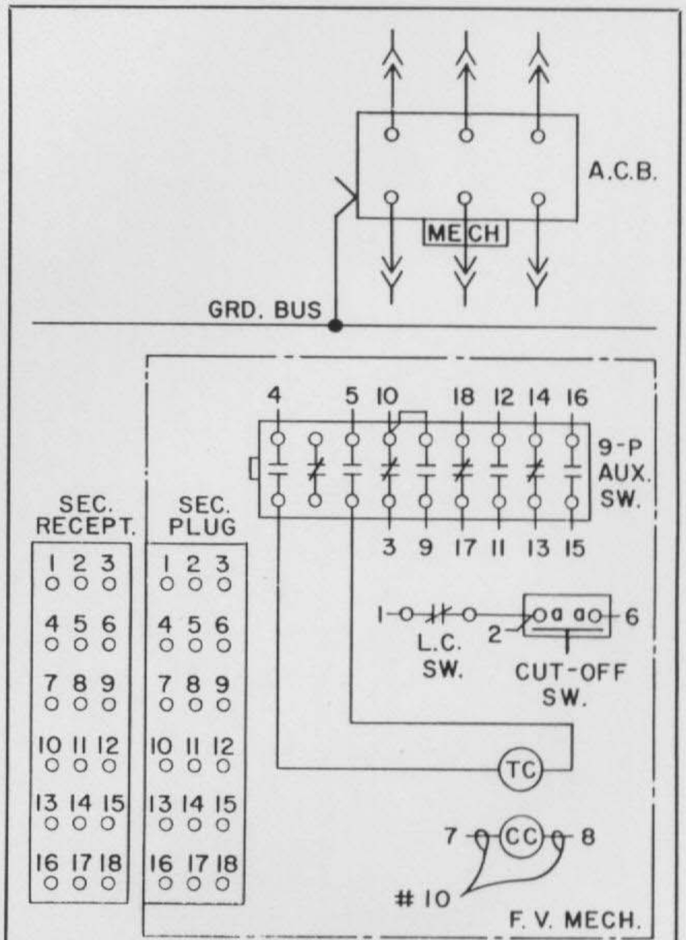


FIG. 18. Diagram of Breaker Internal Wiring

the plate to the shaft with the ½ inch bolts provided. The free end of the plate should be to the rear of the breaker and pointing down.

4. Bolt the channels to the plates with the elastic stop nuts.

5. Place the round bar thru the 1½ inch holes in the arc chutes.

6. Swing the free end into place and bolt to the bar thru the chutes.

7. Operate the levering-in device in the same manner as when moving the breaker out of the cell. (Rotate crank counterclockwise). Use the full travel of the levering-in device in raising the chutes so that the interlock will fall free. The contacts cannot be operated if this is not done.

To lower the arc chutes, follow the same procedure in reverse.

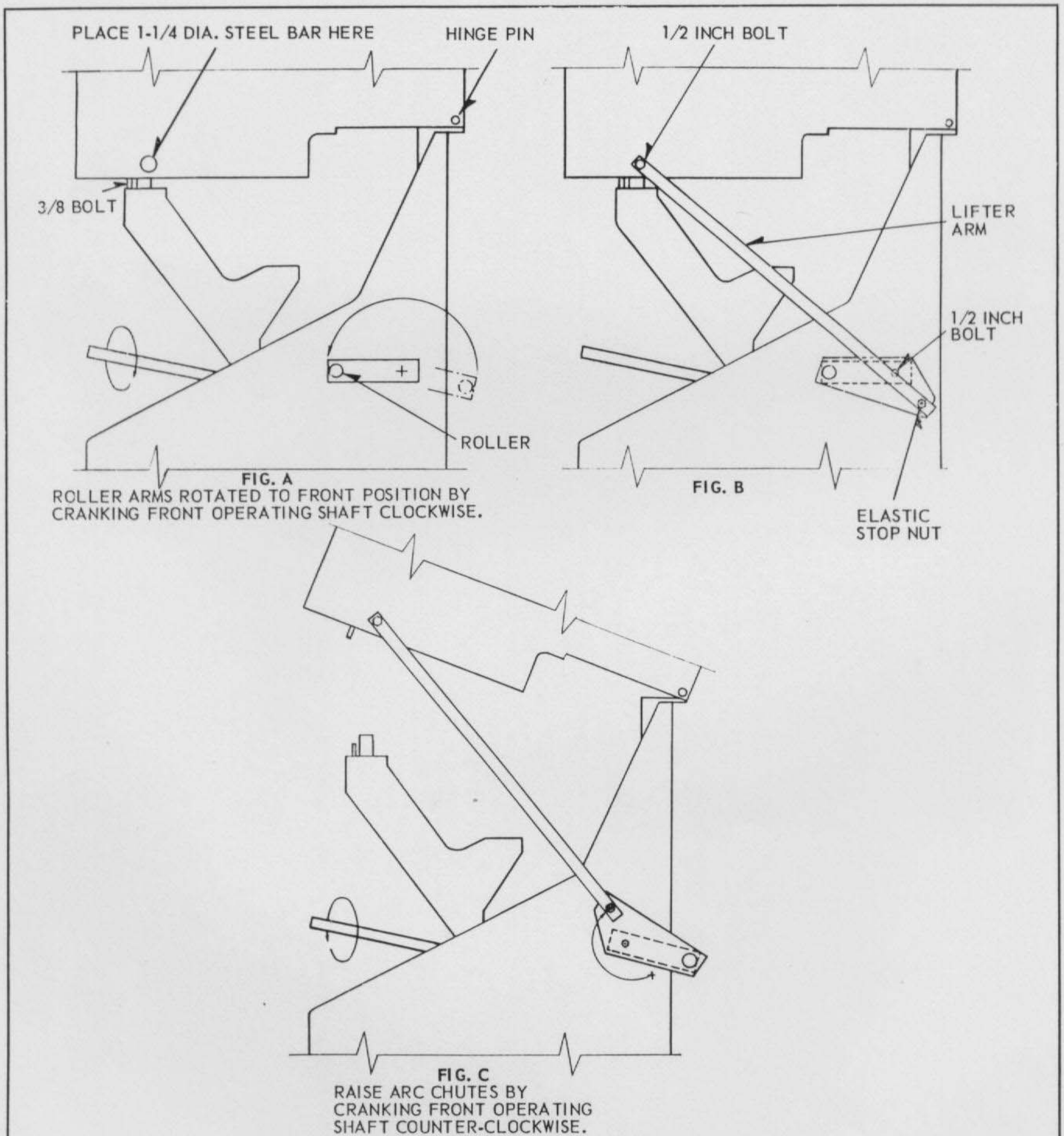


FIG. 19. Arc Chute Lifting Arrangement

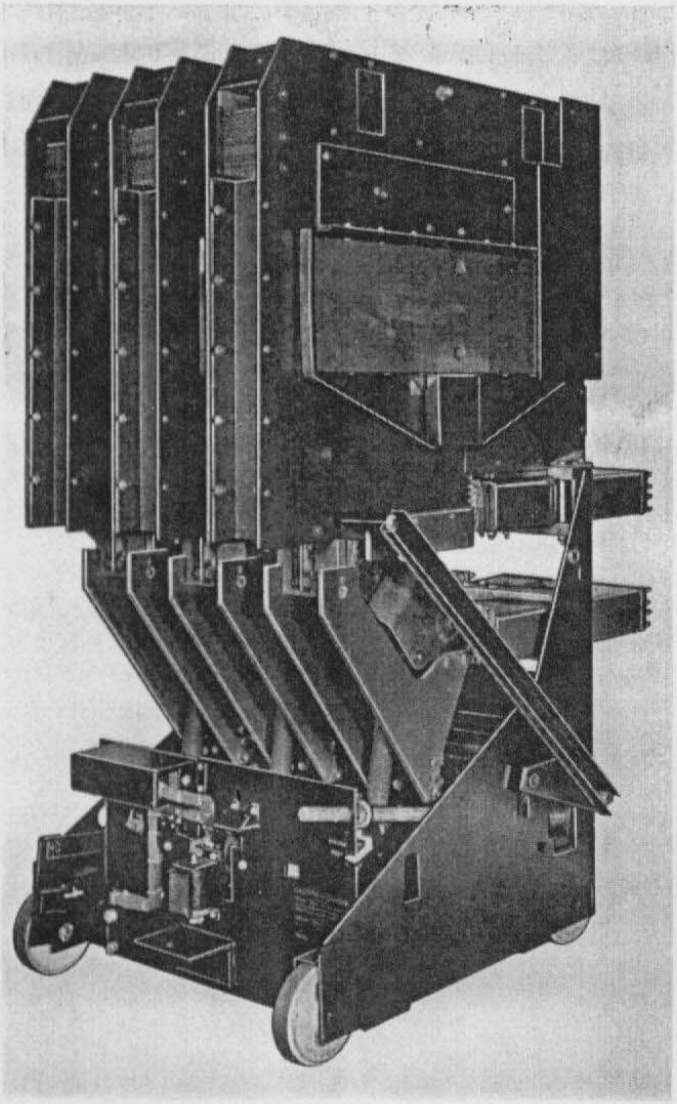


FIG. 20. Arc Chute Lifting Device in Place

Caution: After the arc chutes have been raised for contact inspection and then lowered, be sure to replace the bolt thru the front arc horn to the support.

Figure 20 shows the breaker with the chute lifter in place prior to raising the chutes, and Fig. 21 shows the chutes being raised using the levering-in crank.

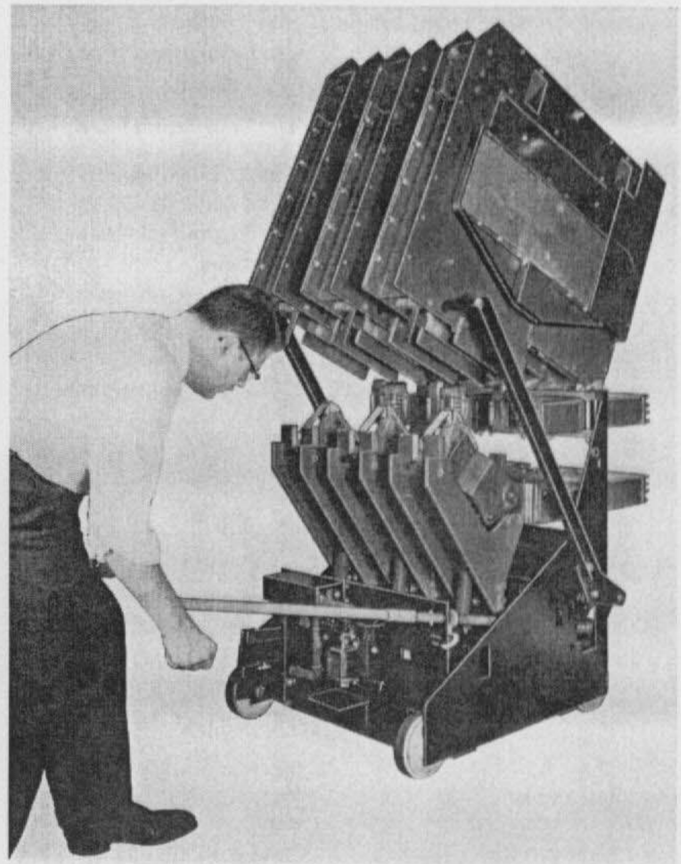


FIG. 21. Raising the Arc Chutes

PART FOUR

INSTALLATION

With the exception of the arcing chambers and barriers, the breakers are shipped completely assembled and adjusted. No adjustment should be required and none should be made unless obviously needed.

Caution: Severe injury may be sustained if any part of the body is struck by the contact arms since they move very rapidly in the opening stroke. Personnel working about the breaker should stay clear of the space in which the contact arms move while the breaker is closed or being closed. Never trip the breaker with the maintenance-closing lever in place.

Place the breaker in a convenient position adjacent the test cabinet or in front of the metal clad cell in which it will go. Then perform the following sequence of operations to place the breaker in service.

1. Remove tie on hand-trip lever. Breakers are shipped with the contacts closed and a tie on the hand-trip lever to prevent tripping. Take off the tie on the trip lever and trip the breaker.

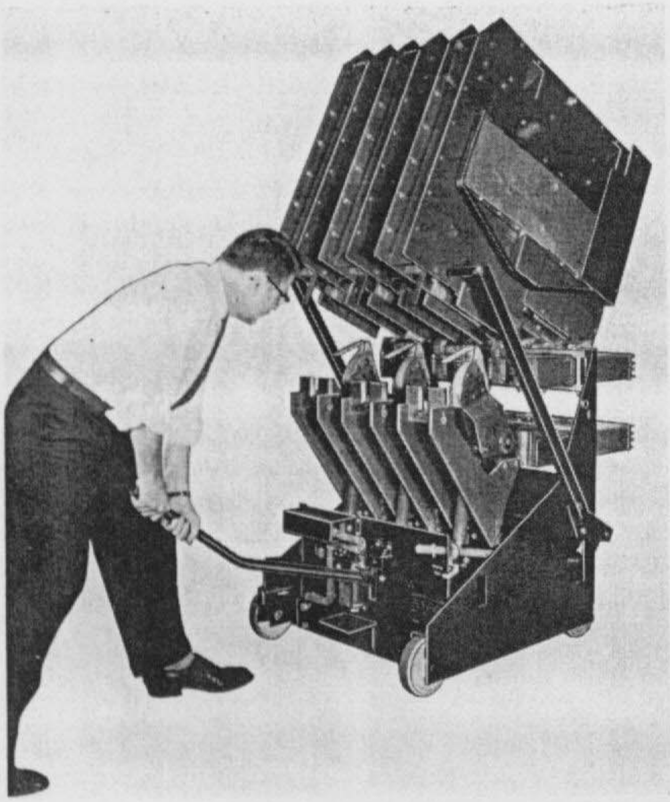


FIG. 22. Closing the Breaker by Hand for Maintenance Purposes

2. Wipe off breaker main and arcing contacts. A light film of grease is applied to the contacts before the breaker is operated. This film is normally removed before shipment. Be sure contacts are free of grease before placing in service.

3. Close breaker by hand. Place the maintenance closing handle in the closing socket in the breaker mechanism and push down to close the breaker. As the contacts close near the end of the stroke, the force necessary to close the breaker increases rapidly. See Fig. 22.

4. Check contact adjustment. The breaker contacts are properly adjusted when the difference between the breaker closed and breaker open position as measured across the outside of the top pair of main contact fingers is $1/8 \pm 1/64$ inch. (See Fig. 23). If adjustment is required, it is made by loosening the two lock nuts on the lower end of the operating rods and turning the adjusting stud to lengthen or shorten the lift rods as required. Be sure to tighten the lock nuts after adjusting the contacts.

5. Trip the breaker. The breaker is tripped both manually and electrically by lifting up on the hand trip assembly on the front of the breaker mechanism panel.

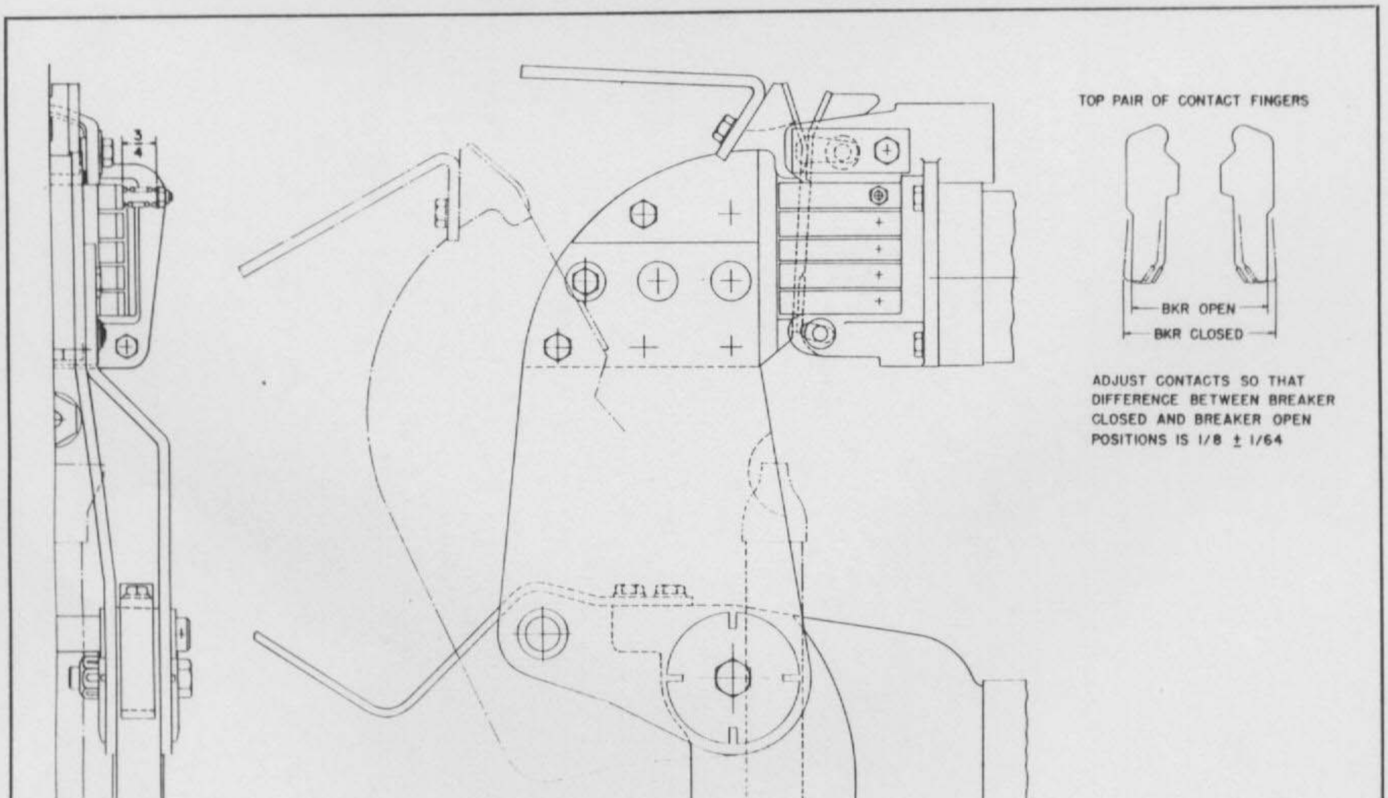


FIG. 23. Type 150-DH-1000 Contact Adjustment

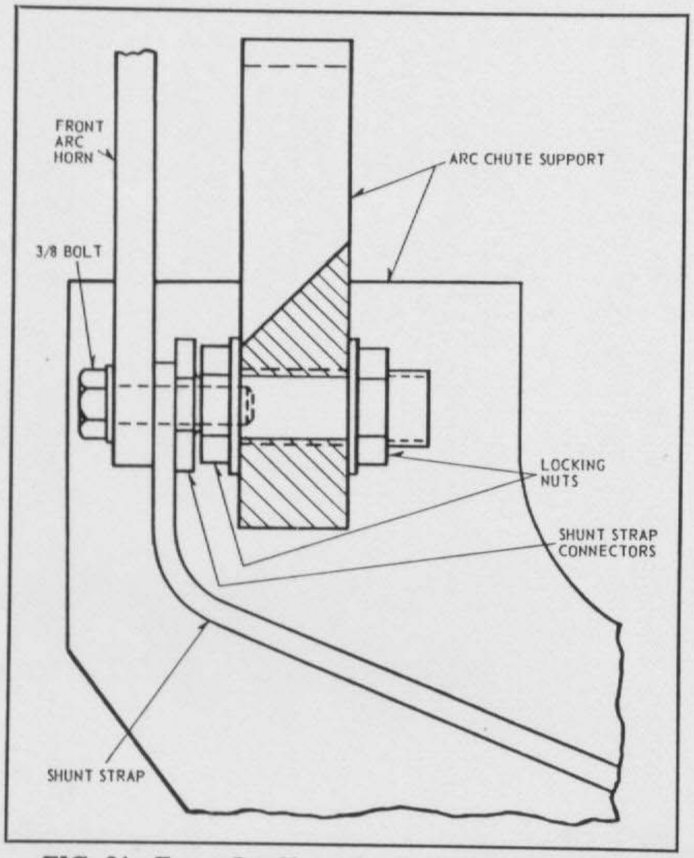


FIG. 24. Front Arc Horn Connector Arrangement

6. Close and trip the breaker. Close and trip the breaker manually several times to be certain that all parts are functioning properly.

7. Connect test jumper. Connect the test jumper from the test cabinet to the breaker secondary contact block and operate the breaker electrically several times. Breaker operation should be quick and positive in both closing and tripping.

8. Inspect arc chute. Before installing the arc chutes, play a stream of dry compressed air through them from each end to remove any dust or foreign matter. Then examine them to make certain the vents and slots are open and free from obstructions.

9. Mount arc chutes. Mount the arc chutes one at a time in the following manner:

(a) Lift the arc chutes by hooking into the 3/4 inch stud passing through the center of the chute near the top.

(b) Remove the hinge pin from the hinge bracket on the bushing support.

(c) Lower arc chute in place so the back end is between hinge bracket on bushing support bar. Use care in aligning the arc chutes so that the rear arc horn clip makes good contact with the upper contact foot. The front of the arc chute will rest in the two grooves in the arc chute support.

(d) Insert hinge pin and put cotter pins in place.

(e) Bolt front arc horn to shunt strap connector. The front arc horn is connected to the lower bushing through the shunt strap connector. Refer to Fig. 24 and proceed as follows:

(1) Loosen locknuts.

(2) Adjust shunt strap connector in or out so that arc horn will not be bent when connection is made.

(3) Bolt arc horn and shunt strap to connector.

(4) Tighten locknuts.

(f) Make final check by operating breakers slowly by hand to see that there is no interference with movement of the contacts.

10. Mount to barrier. Mount the barrier one section at a time as follows:

(a) Place center barrier in place and bolt to mechanism panel.

(b) Place outside barrier section in position being certain that insulating side sheet is inside breaker frame.

(c) Bolt the sections together.

(d) Mount remaining section and bolt together as in b and c above.

(e) Bolt 2 outside sections to mechanism panel.

11. Prepare levering-in device to move breaker into cell. Breakers are shipped with levering-in device in the position shown in Fig. 14. Before placing the breaker in the cell, the levering-in device roller arms must be pointed to the rear of the breaker and slightly downward as shown in Fig. 13. To put the levers in the position just described, place the crank over the shaft extending through the right front corner of the mechanism panel, press in on the crank to engage the levering device, and rotate counterclockwise until the arms come around to the end of the travel against the solid stop. The breaker must be open to engage the levering-in device.

12. Place breaker in test position. Position the breaker in front of the cell and roll it in until it comes up against the solid stop. This is the test position. In moving to this position it may be necessary to shift the barrier assembly a little to the right or left to clear the cell angles. If this is necessary, simply loosen the 3 bolts which hold the barrier assembly to the mechanism panel and shift the barrier as required.

13. Engage secondary contacts. Place the hand closing handle in the secondary contact socket and lift up to engage the secondary contacts. (Figure 15).

14. Operate breaker electrically. Close and trip the breaker several times electrically with the control switch on the front of the cell to check the control wiring in the cell. If the operation is satisfactory, the breaker may now be levered into the operating position.

15. Caution: When the breaker is put into the cell and moved in beyond the test position, the high voltage parts will be energized. If the barrier is completely assembled on the breaker, personnel will be protected from contact with the live parts. If however, the barrier assembly is left off and the breaker rolled into the cell, live parts are exposed. The breaker should *never* be rolled into an energized cell structure beyond the test position without the arc chutes and barrier assembly in place.

16. Level breaker into cell. To move the breaker to the operating position, the contacts must be open. Place the crank on the levering-in device operating shaft, press in to engage the levering-in device, and rotate the crank clockwise to the end of the travel. At the end of the travel, the handle will come back out and the indicator on the breaker mechanism panel will point to "Operate". The breaker must be all the way in for the interlock to release to permit the contacts to close. Remove the levering-in crank.

17. Caution: Do not attempt to close this breaker by hand against an energized circuit. To insure sufficient force and speed, the breaker should be closed electrically from an adequate power source. (See NEMA Standard SG-6-213).

18. Energize the breaker. Close and secure the cell door. Close the breaker electrically with the control switch on the cell door.

If a test cabinet is not available for checking the breaker electrically before placing it in the cell, it can be checked electrically in the test position in the cell. Observe the caution of Step 15 above and do not go beyond the test position unless the arc chutes and barriers are in place.

PART FIVE

ADJUSTMENT

MECHANISM

The mechanism in the 150-DH-1000 air circuit breaker is adjusted at the factory and is designed to give long, trouble free performance. Do not make any adjustment unless faulty operation is observed.

Tripping Latch. If a breaker fails to close contacts although the moving core of the mechanism moves to the closed position, a probable cause is failure to reset. Refer to "C", Fig. 5. The gap indicated between the tripping latch roller and cam is an essential requirement to permit the tripping latch to fall into the cam notch. Watch the trigger handle (with words "lift to trip"), it should return to the horizontal position immediately after the breaker has been opened.

If the trigger is prevented from returning to the full reset position by the primary latch roller above it, the cause may be that the tripping latch roller cannot drop into the cam notch. Remove the barrier from the breaker. This gives easy access to the gap. Using the maintenance closing lever, close the breaker part way, trip it, and then slowly retrieve the moving core. Note whether or not the tripping latch roller drops into the cam notch.

If it is necessary to increase the clearance to get 1/32 inch, loosen the locknut and adjust the stop bolt until the cam to roller clearance is within limits. The stop nut is accessible through the cutout in the mechanism panel next to the shunt trip. See Fig. 6. The maintenance closing handle should be out of the socket during this adjustment.

Cut-Off Switch. Operation of this switch must occur at the proper time in the closing stroke. The contacts must make positively before the end of motion so that the current will always be cut off. In the other direction, cut-off must not occur too early in the stroke or the mechanism might fail to complete its closing stroke. Proper action will be obtained when the switch plunger has from 1/32 to 1/8 inch overtravel. In other words between the position where the contacts touch and the position with the breaker closed and latched at rest, there must be 1/32 to 1/8 inch motion of this switch plunger. Ordinarily no adjustment is required. The resilience provided in the operating arm by the leaf spring prevents damage to the switch on the mechanism overtravel. If it should be necessary to change the switch contact time, bend the switch operating arm to get the proper time.

Latch Check Switch. The action of this switch may be checked as follows. With the breaker open, raise the trigger (lift to trip) arm to end of the travel. Lower it slowly listening for the snap action. Note the position of the arm when the switch snaps closed. The switch should close when the trigger arm is in an interval from 3/8 to 1/8 inch above the normal reset position measuring at the shunt trip plunger centerline. A convenient method of measuring this is to raise and lower the trigger arm by pushing with the trip plunger and making pencil marks on the plunger rod. If the breaker is out of the cell, switch action may be indicated electrically from drawout plugs 1 and 2. If switch action must be made earlier or later, bend the switch arm near the middle of its length.

Contacts. Each time the breaker is operated, a small amount of the contact material is eroded away. In order to maintain proper pressure as the contacts erode, it is necessary to readjust the contacts from time to time to compensate for wear. The contacts are properly adjusted when the difference between the breaker closed and breaker open position as measured across the outside of the top pair of main contact fingers is 1/8 ± 1/64 inch. See Fig. 23.

To make this adjustment, first loosen the two locknuts at the end of the insulated operating rod. Then turn the contact adjusting stud till the proper contact adjustment has been obtained. Always be sure to tighten the locking nuts after adjusting the contacts.

PART SIX

MAINTENANCE

The Westinghouse Type 150-DH-1000 circuit breaker is designed to have a long life with a minimum of maintenance when operating duty is ordinary or average. However, with the many types of applications of these breakers, the operating duty will vary greatly as to frequency of operations and as to size and power factor of current interrupted. Therefore, the frequency of inspection and the amount of maintenance for any particular application must be chosen with the due regard to the kind of duty a breaker is performing. The following remarks are intended as a general guide. Experience on a particular application may show a need for different maintenance practices.

Breakers which operate only a few times per year with light to medium currents being interrupted will require only light routine maintenance. This maintenance should consist of a general inspection and a cleaning of deposited dust and dirt particularly from insulation surfaces and a few exercising operations. When making these exercising operations, observe the mechanical operations to be sure they are quick, snappy, and positive and that there is no tendency for any parts to stick. If there is any stickiness or sluggish motion, operate slowly by hand to locate the place with high friction. See paragraphs on Lubrication. It is recommended that breakers which remain closed continuously without any automatic operations be tried for proper operations at least once a year.

With breakers which operate a moderate number of times, say 100 to 1,000 times per year, mechanical stickiness is unlikely to develop and there will be no need for exercising operations. However, on inspection more attention should be paid to cleanliness of the interrupter especially if there are many fault current interruptions. Large current arcs glaze the ceramic surfaces inside the arc chutes but leave them clean electrically. On the other hand, frequent operation at low or medium currents (about 1,000 amperes or less) tend to cause the accumulation of soot and condensed metal on the parts inside the arc chute, particularly on the ceramic arc shields near the contacts. These deposits may be conducting and may have to be removed as explained later under Arc Chutes. Breakers which have opened large fault currents near the maximum rating, should be inspected as soon as practical. The condition of the contacts surfaces and the contact pressure adjustment should be checked. Also the interior of the arc chutes should be inspected for cleanliness, degree of erosion, etc.

For breakers which operate very frequently more maintenance will be required especially when the breaker opens large fault currents as well as ordinary load currents. Until experience has been acquired on such an application, inspection should be scheduled at least every two months or every 1,000 operations which ever comes sooner. At inspection, such breakers will need close checking of contact and mechanism wear. Also, they may need cleaning in the arc chutes and readjustment of the mechanism.

CONTACTS

In normal operation the arc will make terminal marks all over the contacts and to a lesser extent on nearby metal parts. High current arcs will erode arc contact material more rapidly, but high current arcs move upward very quickly off the contacts. Low current arcs move very slowly and their terminals may hop around the contacts for several cycles. Hence a breaker which has had many operations at low currents may be expected to have numerous small burn spots and pock marks all over the metal parts supporting the arcing contacts. When inspecting arcing contacts, the important condition to be observed is the extent of the erosion of the contact material. When half of the original 1/8 inch thickness is gone, the contact should be replaced. This is because the remaining 1/16 inch thickness will be mechanically weak and might be broken away suddenly.

On high fault current operations there may be occasional slight burning on the main contacts. Also after many operations, the main contacts will sometimes become roughened. A fine flat file should be used lightly on the main contact silvers, removing only enough to take off the high spots. A moderate amount of pitting on the main contacts surfaces will not appreciably impair their current carrying ability because of the high contact pressure.

After the contacts have been worn and dressed off as above, or replaced, contact adjustment should be checked. Refer to the section on Contact Adjustment.

Moving Contact Assembly. The moving contact assembly consists of a copper casting to which are brazed the arcing, intermediate, and main contacts. To change this contact, remove the eight bolts which hold the contact between the blades. There are three different lengths of bolts holding this contact in place. Be sure the longest bolts are in the bottom set of holes and the shortest ones in the top when replacing the contact. Refer to Figs. 8 and 25.

Stationary Main Contact. The stationary main contact is made up of individually sprung fingers arranged in two vertical rows of five each to either side of the stationary arcing contacts. See Figs. 9 and 26. To change the main contacts, remove the nuts from the studs which pass through the main contact fingers. Then remove the washers, springs, and studs. The fingers may now be removed and new ones put in their places. Replace the studs, springs, washers, and nuts. To set the springs for the proper contact pressure, close the breaker and adjust the nuts to the three-quarter inch dimension as shown in Fig. 23.

Stationary Arcing Contacts. Because of the high momentary current rating of this breaker, the stationary arcing contact is divided into three parts: right hand, center, and left hand arcing contacts. To change these contacts, refer to Figs. 9 and 26, and proceed as follows:

1. Remove main contact fingers as described above.

2. Remove two bolts from top of shunt.

3. Remove two side plates from contact cage.

4. Remove Tru-Arc rings from pin at lower ends of contacts.

5. Close breaker by hand just far enough to relieve pressure on upper and lower pins through arcing contacts. CAUTION; Do not latch breaker.

6. Remove two pins being careful to catch the spacers as they drop from between the contacts and the cage casting.

7. Let breaker come slowly open.

8. As the breaker comes open, remove the spring guide and the equalizer from behind the arcing contact.

9. Remove the shunt from the arcing contacts and bolt it to the three new contacts. CAUTION; Be sure a full set of three contacts is used. See Fig. 26.

10. Place the contacts in position against the springs.

11. Close breaker part way compressing the spring.

12. Replace the upper and lower pins and spacers.

13. Place Tru-Arc rings on lower pin.

14. Bolt side plates over upper pin to contact cage casting.

15. Bolt top of shunt to contact foot.

16. Replace main contact fingers.

17. Adjust contacts as described in the section under Contact Adjustment. See Fig. 23.

Moving Contact Arms. Should it ever be necessary to change the moving contact arms, it should be done as follows:

1. Remove pin which holds operating rod to the contact arms.

2. Remove hinge bolts being careful to observe arrangement of spring washers, spacers, etc.

3. Remove 8 bolts holding arms to moving contact assembly.

4. Bolt new blades to moving contact assembly.

5. Replace hinge bolts as removed in 2 above.

6. With the operating rod still disconnected from the moving contact arms, open the arms to approximately 45° from the "contact closed" position. Tighten the castle nut on the hinge bolt sufficiently to barely hold the 45° position.

7. Reconnect the operating rod.

ARC CHUTES

The insulation parts of the arc chute remain in the circuit across the contacts at all times. During the time that the contacts are open, these insulating parts are subjected to the full potential across the breaker. Ability to withstand this potential depends upon the care given the insulation.

On general inspections, blow out the arc chutes with dry compressed air by directing the stream upward from the contact area and out through each of the slots between the arc splitter plates. Also direct the dry air stream throughly over the arc box shields. These are the ceramic liners in the lower end of the chute where the arc is drawn.

The arc chutes should be inspected each time the contacts are inspected. Remove any residue or dirt or arc products with a cloth or by a light sanding. Do not use a wire brush or emery cloth for this purpose because of the possibility of embedding conducting particles in the ceramic material.

When inspecting an arc chute, look for the following:

Broken or Cracked Ceramic Parts. Small pieces broken out of the ceramics, or small cracks are not important. But large breaks and particularly cracks extending from the inverted V slot in the interrupter plates out ot the edge of the plate or to the top may interfere with top performance of the interrupter. Hence if more than one or two broken or badly cracked plates are apparent, renewal of the ceramic stack is indicated.

Erosion of Ceramics. When an arc strikes a ceramic part in the arc chutes, the surface of the ceramic will be melted slightly. When solidified again, the surface will have a glazed whitish appearance. At low and medium current, this effect is very slight. However, large current arcs repeated many times may boil away appreciable amounts of the ceramic. When the width of the slot at its upper or narrow end (originally 1/16 inch) has been eroded to twice its original size, (about 1/8 inch), the ceramic stacked assembly should be replaced.

Dirt in Arc Chute. In service the arc chute assembly will become dirty from three causes. First, dust deposited from the air which can readily be blown out of the chute with a dry compressed air stream. Second, loose soot deposited on the inside surfaces of the arc chute in the lower portions near the contacts which may be removed by wiping with cloths free of grease or metallic particles. Third, some very tightly adhering deposits from the arc gases on the ceramic arc shields near the contacts. These deposits from the metal vapors boiled out of the contacts and arc horn, may accumulate to a harmful amount only in breakers which get many operations at low or medium interrupted currents.

Cleaning Arc Shields. Cleaning methods for the first two types of dirt are obvious as mentioned above. Particular attention should be paid to any dirt on Redarta surfaces exposed to the arc below the ceramic arc shield. Wipe clean if possible. If wiping will not remove the dirt, rub with sand paper and refinish these inside Redarta surfaces with Westinghouse red enamel #672 or equivalent. On breakers which get thousands of operations at low and medium interrupted currents, tightly adhering dirt may accumulate on the ceramic arc shields sufficiently to impair proper interrupting performance. This tightly adhereing dirt can be removed only by rubbing with coarse sand paper or other nonconducting abrasive paper.

The ceramic arc shields may appear dirty and yet have sufficient dielectric strength. The following insulation test may be used as a guide in determining when this complete or major cleaning operation is required. The arc chutes should withstand 28 KV, 60 cycle for one minute between the front and rear arc horns. Also the dirty surface of the ceramic near the contacts should withstand approximately 10 KV per inch when test prods are put directly on to the ceramic surface. When test voltage is applied, there should be no luminus display in the black deposits.

OPERATING MECHANISM

With average conditions, the breaker operating mechanism may be expected to operate 5000 times or more with only routine inspection and lubrication. During inspection the following points should be kept in mind: (1) Remove loose dust and dirt with a compressed air stream. (2) Wipe off latch and roller surfaces. (3) With maintenance closing lever, move mechanism parts slowly closed to point where arcing contacts just touch, and then allow contacts arms to fall slowly to open position, observing for any evidence of stickiness or excessive friction. (4) Holding trigger up, move maintenance closing lever up and down slowly. The core should move freely in the solenoid and the linkage system should reset positively when the weight of the maintenance closing lever is removed slowly.

Lubrication. In general, lubricants are not in wide spread use on circuit breakers. Yet the gains that are to be made from the use of certain choice lubricants only follows principles of good mechanical practice. For many operating parts, lubricants can be avoided. In certain other parts, the use of special lubricants is desirable and beneficial—PROVIDED IT IS DONE CAREFULLY. This means applying it in small quantities to avoid drippings and accumulation. Experience will dictate the amount required. Those breakers having only a few operations per year, will perform best with the moving surfaces of the mechanism clean and only a very light film of lubrication. While those breakers having many operations per day will require more lubrication to prevent excessive wear.

If any excessive friction or binding is discovered on inspection, relieve it either by adding lubricant or if necessary by cleaning old dried lubricant from the bearing surfaces. In general, the addition of a few drops of oil should be sufficient in most cases. In a few cases, after long service, the accumulation of dried or oxidized lubricant may make it necessary to disassemble parts and clean them. Carbon Tetrachloride is a good solvent for this.

Apply a small amount of light oil to the bearing surfaces. Use a stable oil with a low rate of oxidation and with a low pour point. Wemco C is suggested. Avoid putting oil on insulating material surfaces. Also put no oil on the breaker contacts, the auxiliary switch, or the puffer diaphragm. Soft petrolatum may be used on the drawout connectors both primary and secondary.

For the air bumper, which has a bronze piston and rings in a brass cylinder, a small amount of graphite grease (W) 1022-1 is recommended. For the moving core, apply a small quantity all around the core when the breaker is in the open position; and close and open the breaker several times to work the grease in.

The silver plated contact disks on the hinge of the moving contact arms should be lubricated with graphite grease (W) No. 8831-9.

When the stationary main contact fingers are replaced, the knuckle joint between the fingers and the contact foot should have a light film of graphite grease (W) No. 8831-9.

The rollers and pins on the hand trip assembly, Items 2 and 4 in Fig. 28 should receive a very small quantity of a molybdenum lubricant (W) No. 8577-2.

The levering-in device rollers and shutter rollers should also receive molybdenum lubricant (W) No. 8577-2. The levering-in shaft bearings and worm gear should receive (W) Material No. 5435-1.

Any good grade of grease can be used for the breaker wheel bearings.

In dusty, dirty locations, surplus oil may catch and hold grit near bearings and latches and cause faster wear. In such locations, it is recommended that all oil be omitted, and the steel parts in the mechanism be lubricated by rubbing with (W) Molkolube Powder Material No. 8565-e.

Clearances. After a mechanism has operated several thousand times, the following points should be checked as part of routine inspection. With the breaker open and the mechanism reset there should be 1/32 to 1/16 clearance between the tripping latch roller and the cam. See Fig. 5. If readjustment is necessary, see explanation under Mechanism Adjustments.

To permit the closing latch to move up to its holding position, the pin at the lower end of the non-trip free lever must overtravel the latch surface slightly. With the breaker closed, look down into the mechanism with a flashlight at the closing latch and shaft and energize the close coil for one or two seconds several times. The overtravel should be approximately 1/32 minimum to 3/32 maximum. With wear in the link holes and pins, this overtravel may decrease. Adjustment is made with steel shim washers between the magnet back plate and the four large magnetic return studs. This will change the position of the stationary core with respect to the latching points in the mechanism frame.

After about 15,000 operations, replacement of some parts may be required. During routine maintenance, the amount of wear should be observed on latch surfaces, rollers, pins and pin holes. If it becomes impossible to obtain correct adjustments or if latches fail to hold, replacements should be considered.

PUFFER

The puffer diaphragm is made of long lasting, wide temperature range material, and should never require replacement unless through accidental puncturing. If replacement is necessary, remove the clamping ring, which is in 4 sections, and the 2 castelated nuts over the puffer rods. See Figs. 17 and 30. Next remove the pin which connects the long puffer rod to the trip free lever in the mechanism. Pull the puffer rod part way through to the front. The diaphragm and clamping plates may now be removed from the puffer cavity. Remove the 2 bolts which hold the diaphragm between the clamping plates.

Place the new diaphragm in the same position as the one removed and replace the 2 bolts. Do not over tighten the bolts so as to crush the diaphragm. Place the diaphragm assembly in the cavity of the puffer casting and reconnect the puffer rod to the trip free lever. Then replace the 2 castelated nuts. Be sure to secure these nuts with the cotter pins. Replace the clamping ring using moderate pressure on the bolts to not damage the diaphragm.

PUFFER NOZZLE

The puffer nozzle is molded directly to the puffer tube. The tube passes through the lower bushing foot and into the puffer casting. It can be changed by removing the bolt from the clip at the base of the tube where it passes through the breaker frame. When replacing the tube, be sure the clip is in the notch in the tube before tightening the bolt.

Auxiliary Switch. The contact fingers and rotor segments of the nine pole auxiliary switch may be inspected when the breaker main barrier and the insulating angle cover on the switch frame are removed. Refer to Fig. 31.

The rotor moves approximately 90 degrees starting from a position 22½ degrees below the horizontal when the breaker is closed. This is adjusted by loosening the ¼—20 locknut at the end of the operating lever and moving the serrated plate. The "V" tip of the stationary contact finger should be near the center of the contact segment when that stage is closed. Check "a" contacts with the breaker closed, and "b" contacts with the breaker open.

Normal operation is sufficient to keep the contacts clean. If the contacts do require cleaning, crocus cloth should be used; and care taken not to remove more material than necessary.

Any burned segments and contact fingers should be replaced. The rotor is removed from the switch by loosening the operating lever and removing the end plates. The rotor is dismantled by removing the ¼—20 clamping bolt and end clamp. Refer to Fig. 31.

In reassembling, care must be taken that the insulating spacers are placed on the rotor shaft in the correct order. The various widths are given in Fig. 31 with the 7/32 and 15/32 spacers starting at the third position and alternating to the end of the rotor.

ORGANIC INSULATION

Flame retardent, glass polyester insulating materials are used in high voltage air circuit breakers for bushing ties, barriers, braces, arc chutes and similar purpose, where it has been found to be more suitable than porcelain. The material used on Westinghouse breakers is Redarta, which has a long established record for insulating and mechanical dependability.

Insulation maintenance consists primarily in keeping the surfaces of the insulating material clean. This can be done by wiping off the insulating surfaces each time the breaker is removed from the cell for inspection.

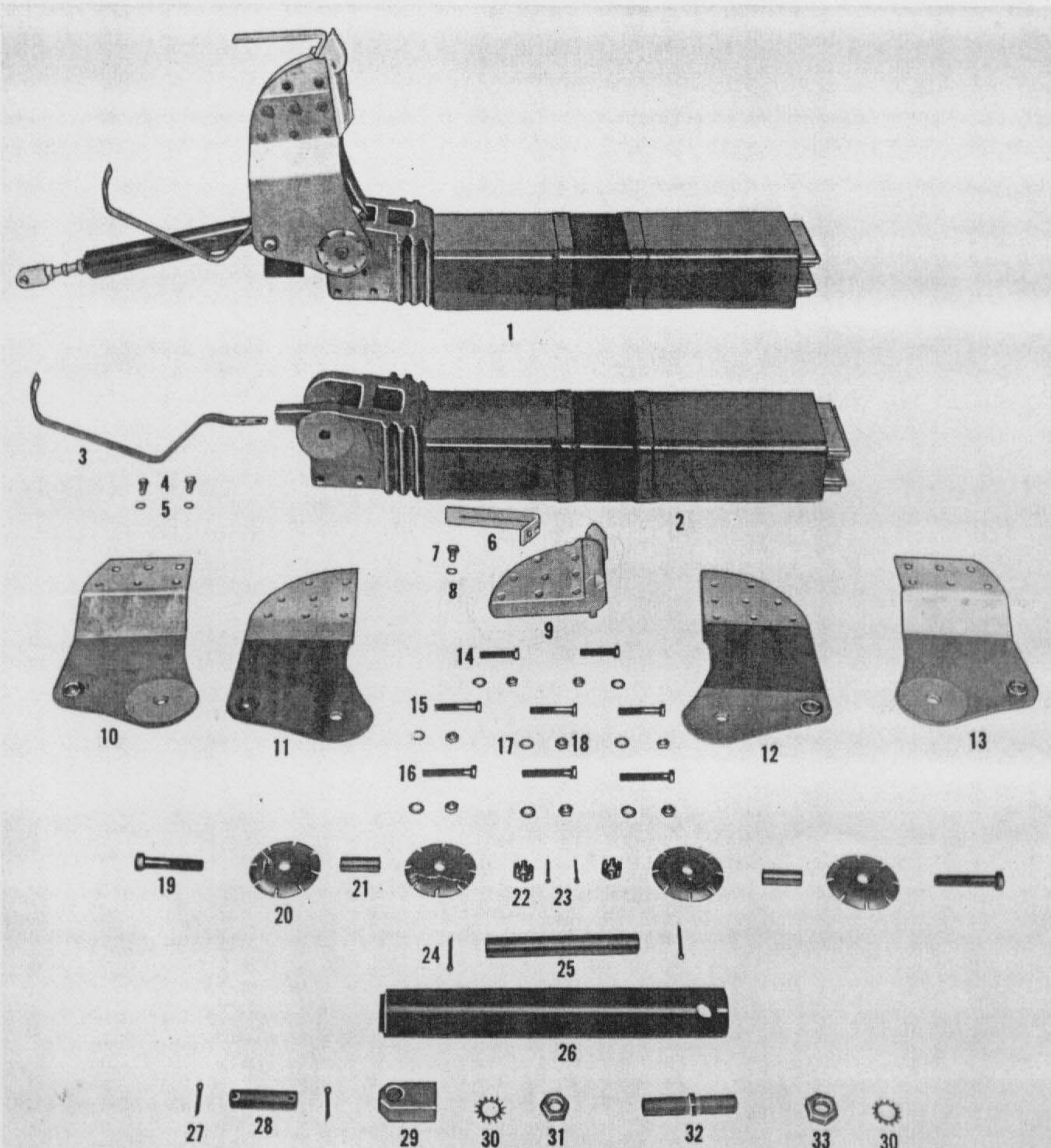
In case there is any tightly adhereing dirt which will not come off by wiping, it can be removed with Westinghouse solvent No. 1609-1 or -2.

PART SEVEN

PARTS IDENTIFICATION

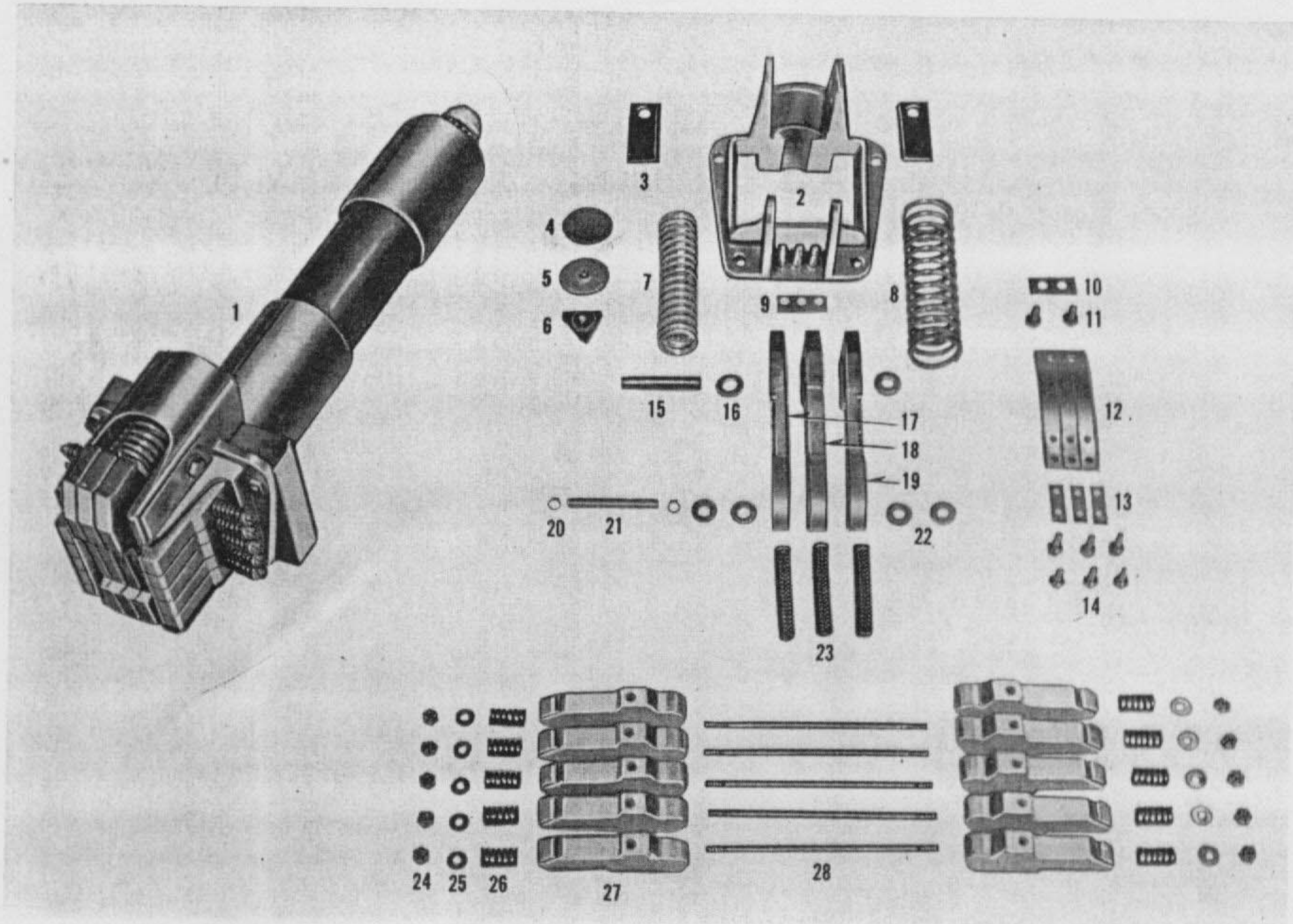
Detailed parts identification for the breaker is shown in the various figures throughout this book. Figure 2 shows the major components of the breaker. Figures 5 and 27 shows the mechanism linkage. The hand trip assembly is shown in Fig. 28, and the air bumper assembly in Fig. 29. Figure 6 shows the various components mounted on the mechansim panel. Figure 25 shows the parts for the moving contact assembly, while Fig. 26 shows the parts for the stationary contact assembly. Figure 30 shows the parts in the puffer assembly. The auxiliary switch assembly is shown in Fig. 31.

Renewal Parts. A list of renewal parts recommended to be kept in stock will be furnished upon request. When ordering renewal parts, always specify the part name and style identification from the renewal parts data. If this is not available, identify the part by name from a particular figure in this instruction book. Also, always supply full nameplate information along with the order.



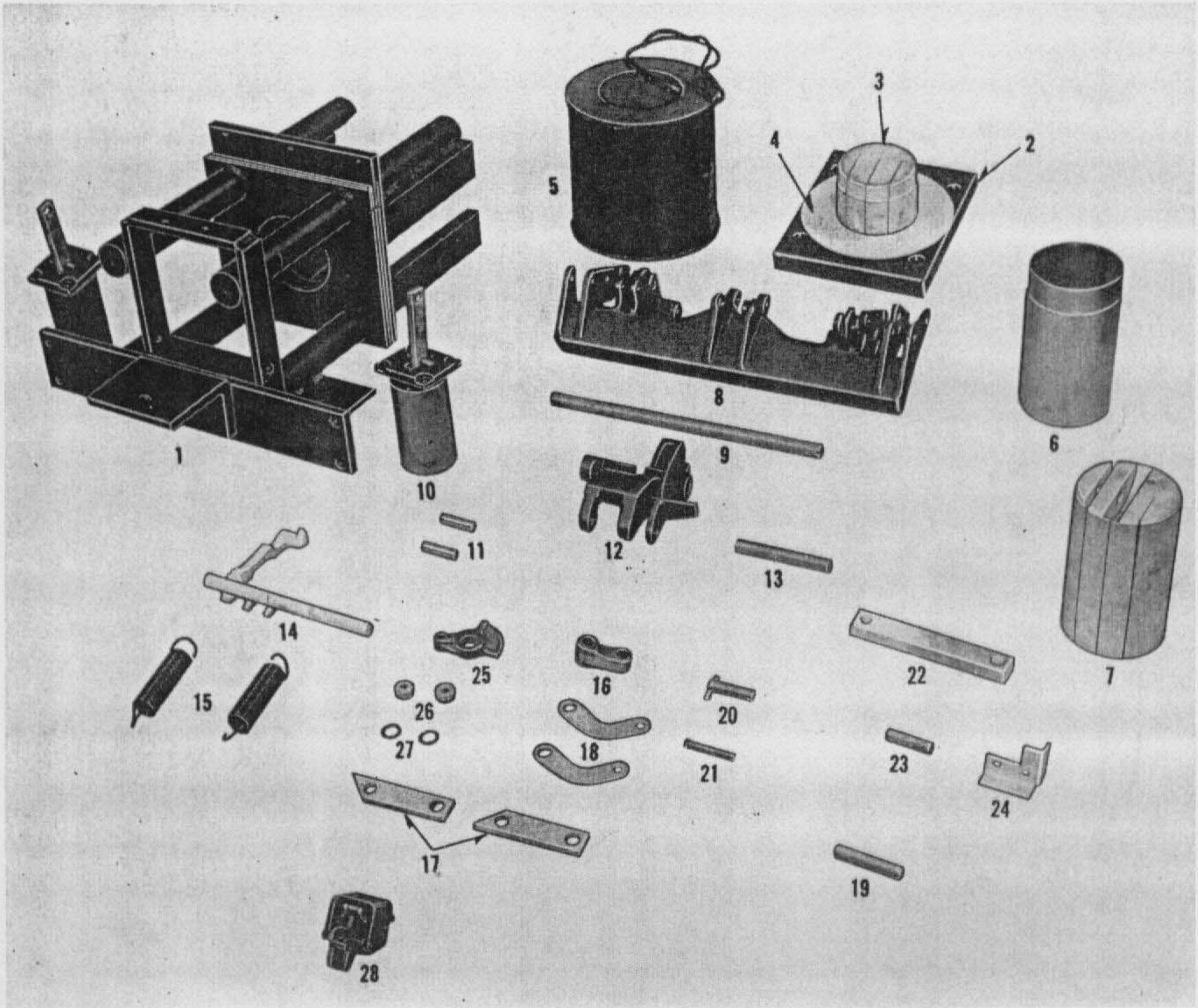
1. Moving Contact Assembly—Complete
2. Lower Stud Assembly
3. Shunt
4. Bolt
5. Lockwasher
6. Arc Runner HORN
7. Bolt
8. Lockwasher
9. Moving Contact Assembly
10. Outer Left Hand Moving Contact Arm
11. Inner Left Hand Moving Contact Arm
12. Inner Right Hand Moving Contact Arm
13. Outer Right Hand Moving Contact Arm
14. Bolt
15. Bolt
16. Bolt
17. Nut
18. Lockwasher
19. Bolt
20. Spring Washer
21. Spacer
22. Castle Nut
23. Cotter Pin
24. Cotter Pin
25. Pin
26. Operating Rod
27. Cotter Pin
28. Pin
29. Rod End
30. Lockwasher
31. Left Hand Thread Nut
32. Adjusting Stud
33. Right Hand Thread Nut

FIG. 25. Moving Contact Assembly



1. Stationary Contact Assembly—Complete
2. Cage Casting
3. Clip
4. Insulating Washer
5. Spring Seat
6. Equalizer
7. Arc Contact Spring-Inner
8. Arc Contact Spring-Outer
9. Insulation
10. Shunt Clip
11. Bolt
12. Shunt
13. Shunt Clip
14. Bolt
15. Pin
16. Washer
17. Left Hand Arcing Contact
18. Center Arcing Contact
19. Right Hand Arcing Contact
20. Tru-Arc Ring
21. Pin
22. Washer
23. Intermediate Contact Spring
24. Lock Nut
25. Washer
26. Main Contact Spring
27. Main Contact Finger
28. Stud

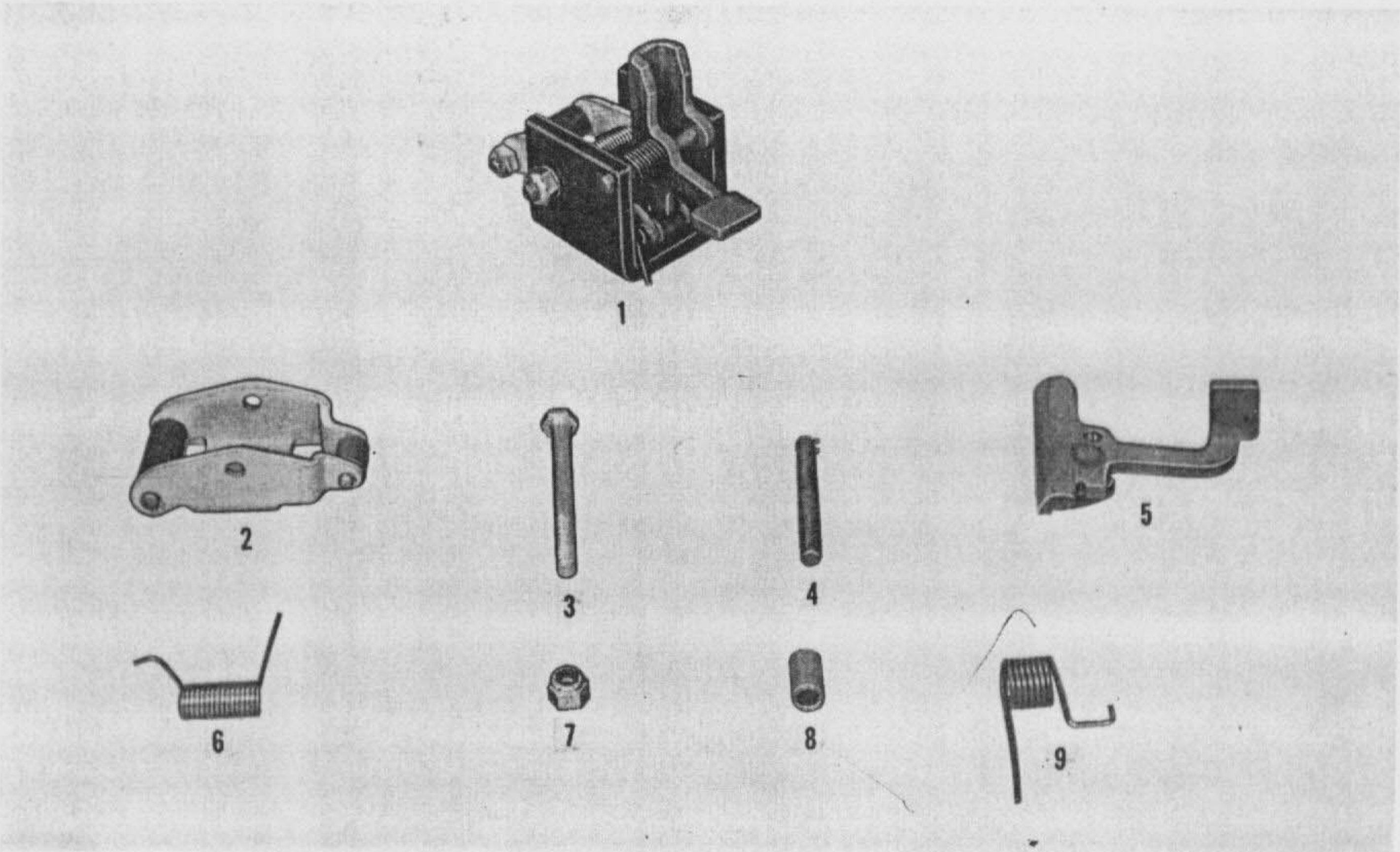
FIG. 26. Stationary Contact Assembly



1. Mechanism Frame
2. Solenoid Back Plate
3. Stationary Core
4. Solenoid Coil Shims
5. Solenoid Coil
6. Core Guide Tube
7. Moving Core
8. Trip Free Lever
9. Operating Center Pin
10. Air Bumper Assembly
11. Air Bumper Pins
12. Non-Trip Free Lever
13. Latching Pin
14. Closing Latch
15. Retrieving Springs
16. Upper Trip Free Link
17. Lower Trip Free Links
18. Cam Links
19. Pin for Upper Trip Free Link to Trip Free Lever
20. Pin Joining Upper & Lower Trip Free Links
21. Pin Joining Cam & Cam Link
22. Closing Link
23. Closing Link Pin
24. Closing Link Pin Keeper & Retrieving Spring Bracket
25. Tripping Cam
26. Cam Stop Rollers
27. Closing Link Spacers
28. Hand Trip Assembly

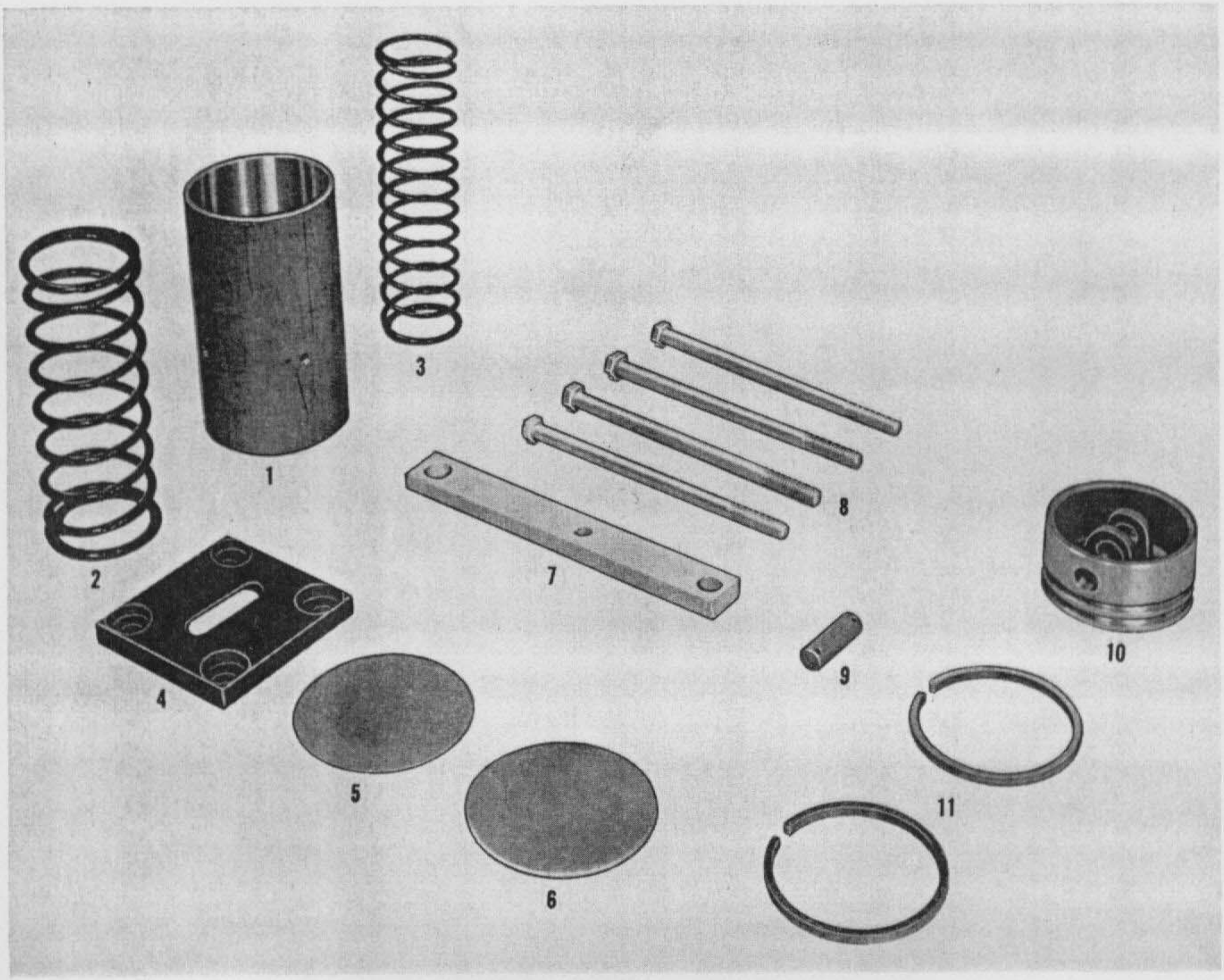
FIG. 27. Mechanism Assembly

SOL.—?



1. Hand Trip Assembly Complete
2. Roller Lever Assembly
3. Bolt
4. Pin and Tru-Arc Rings
5. Trigger
6. Roller Lever Spring
7. Nut
8. Spacer
9. Trigger Spring

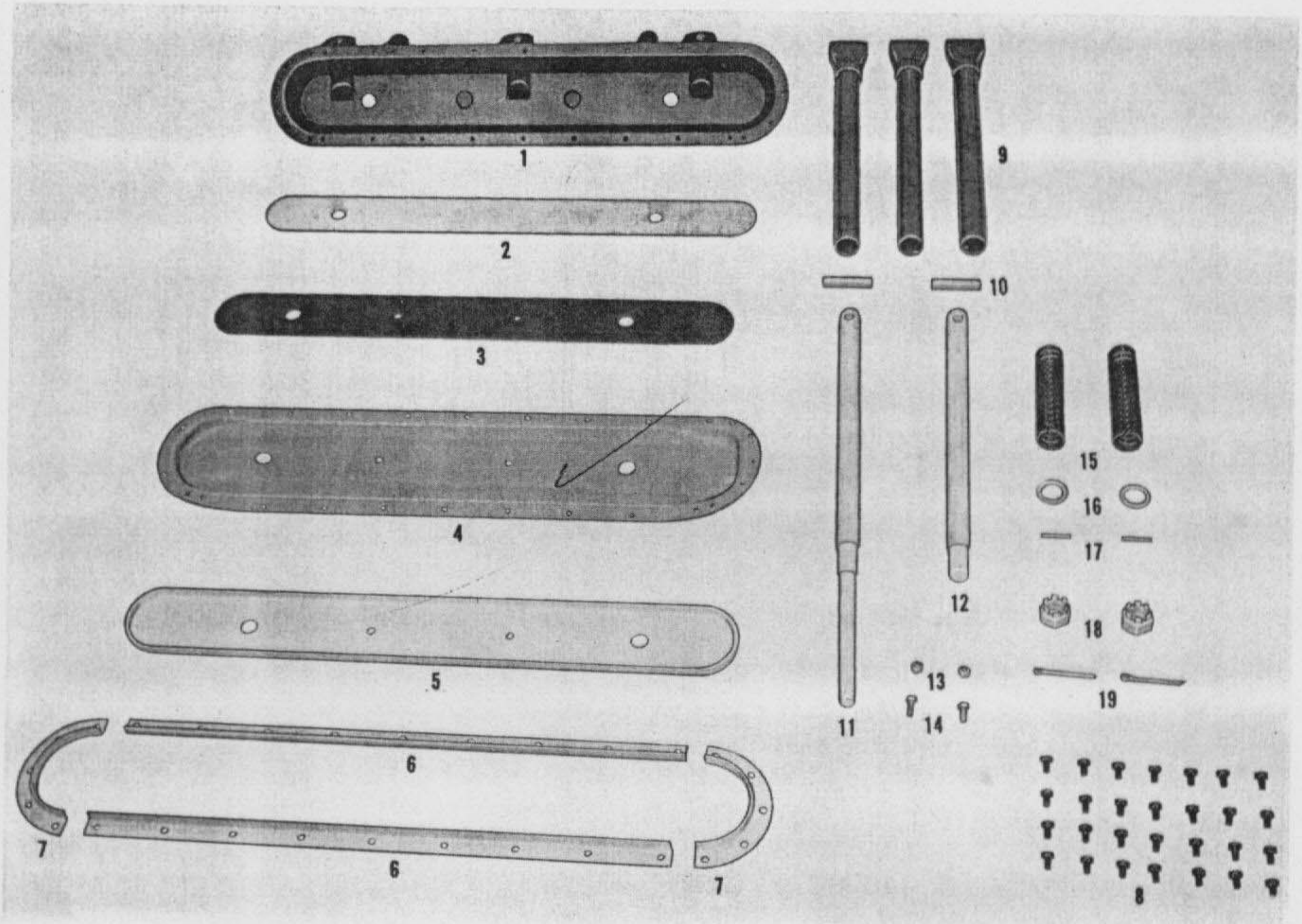
FIG. 28. Hand Trip Assembly



1. Cylinder
2. Outer Spring
3. Inner Spring
4. Top
5. Washer—Thin*
6. Washer—Thick*
7. Link
8. Bolts
9. Pin
10. Piston
11. Piston Rings

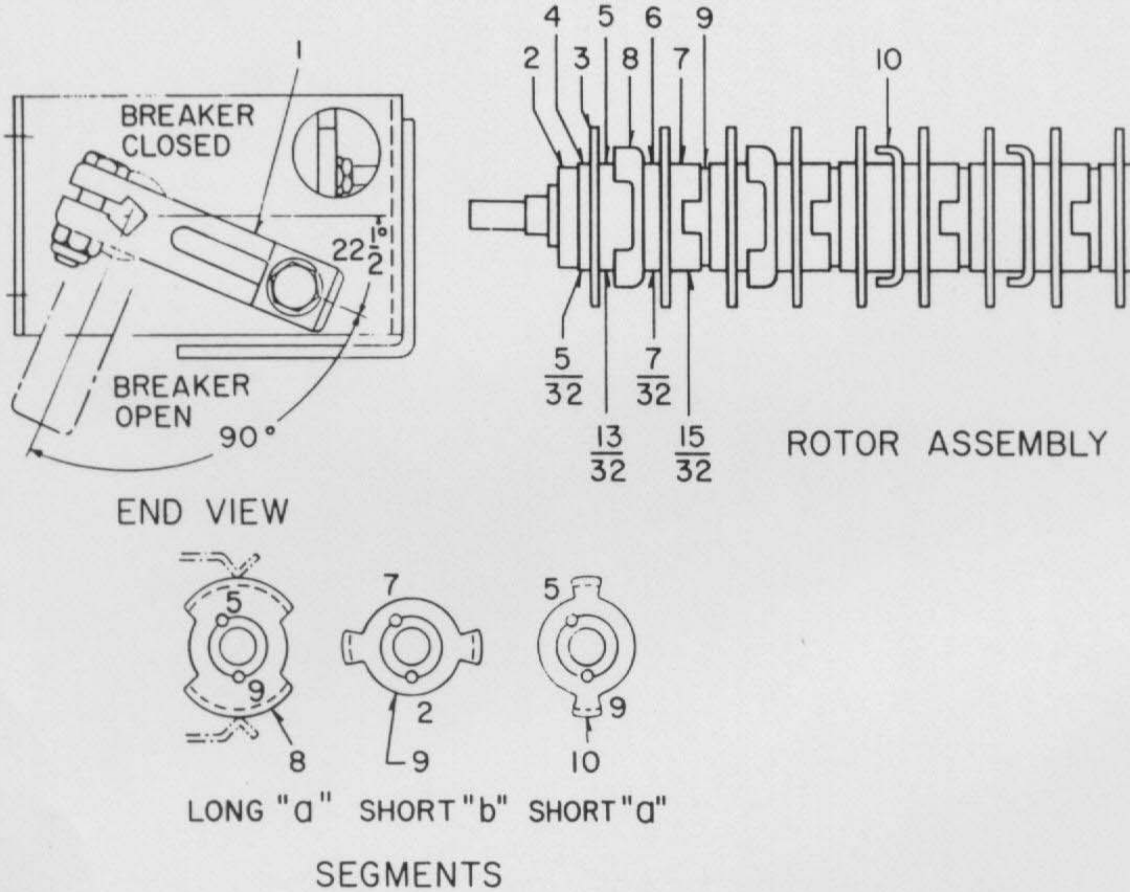
* Used to obtain contact separation in open position. Number will vary from breaker to breaker.

FIG. 29. Air Bumper Assembly



1. Puffer Casting
2. Rear Clamping Plate, Steel
3. Gasket Plate
4. Diaphragm ✓
5. Front Clamping Plate
6. Clamping Ring—Sides
7. Clamp Ring—End Rings
8. Clamping Ring Screws
9. Puffer Tubes & Nozzles
10. Puffer Rod Pins
11. Puffer Rod, Long
12. Puffer Rod, Short
13. Diaphragm Center Clamp Nuts
14. Diaphragm Center Clamp Bolts
15. Puffer Springs, Accellerating
16. Washers
17. Spring Stop Pins
18. Castle nut
19. Cotter Pins

FIG. 30. Puffer Assembly



1. Operating Lever
2. Collar
3. Insulating Barrier
4. Spacer 5/32 Wide
5. Spacer, 13/32 Wide
6. Spacer, 7/32 Wide
7. Spacer, 15/32 Wide
8. Segment, Long, "a"
9. Segment, Short, "b"
10. Segment, Short, "a"
11. End Clamp
12. Clamping Bolt

FIG. 31. Auxiliary Switch Details

WESTINGHOUSE

INSTRUCTION BOOK

De-ion®

AIR CIRCUIT BREAKER

Type 150-DH-1000

Westinghouse Electric Corporation

I. B. 32-251-6