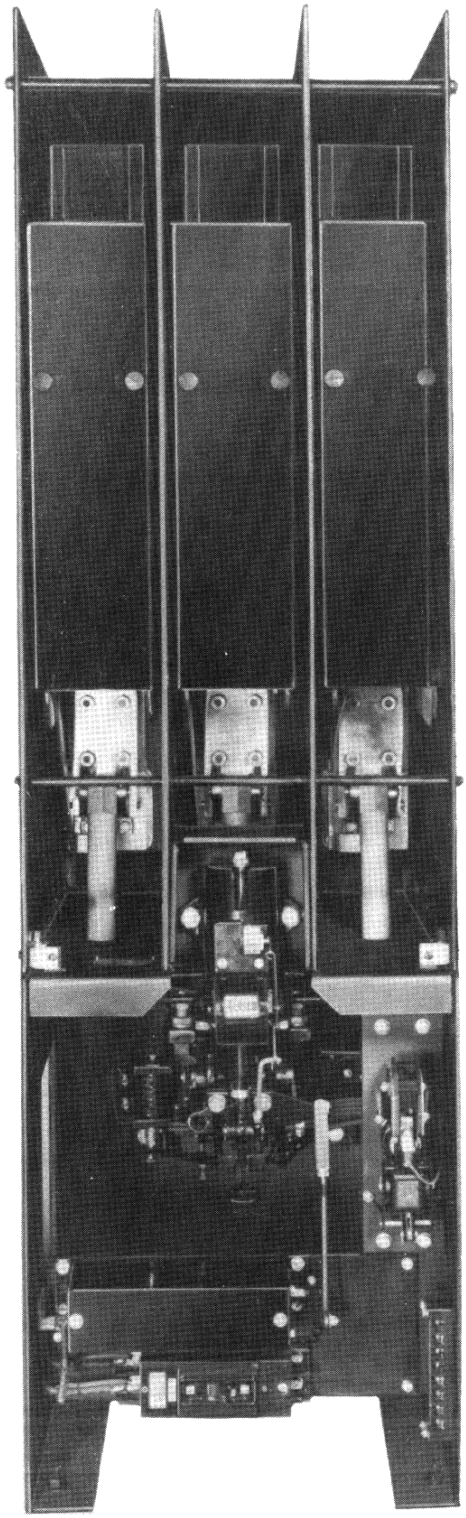

Type 50-DH—100, 2000 Amperes, 3 Pole, Frame Mounted Air Circuit Breaker

Type "DH" "De-ion" Air Circuit Breakers

Rating: AMPERES—600, 1200, 2000
VOLTS—2500 TO 5000

INDEX

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

LIST OF ILLUSTRATIONS

GENERAL INSTRUCTIONS

APPLICATION

The "DH De-ion" Air Circuit Breaker is designed to function in a normal atmosphere and is not dependent on the maintenance of any stored medium, such as air or liquid dielectric. Its performance is dependable, clean-cut and free from uncertainty.

The breakers described herein are designed for indoor operating service at a-c. voltages of from 2300 to 5000, for normal current loads of 600, 1200 and 2000 amperes, and for interrupting duty of 100,000, 150,000 and 250,000 Kv-a. at frequencies of 25 and 60 cycles. They may be used in general applications where an air circuit breaker is desired. They are characterized by long life and moderate maintenance requirements under severe duty.

SHIPMENT AND STORAGE

These breakers are completely assembled and tested at the factory before shipment. The arcing chambers are generally shipped separately from the breaker to guard against damage due to rough handling and for more secure protection against moisture. Assembly of these chambers on the breaker is a simple operation and instructions for the work are given under installation.

Immediately upon receipt of a circuit breaker, an examination should be made for any damage sustained while enroute. If injury is evident or indication of rough handling is visible, a claim for damage should be filed at once with the carrier (Transportation Company) and the nearest Westinghouse Sales Office notified promptly.

The breaker is designed for indoor service and should be put in a clean, dry place immediately upon arrival.

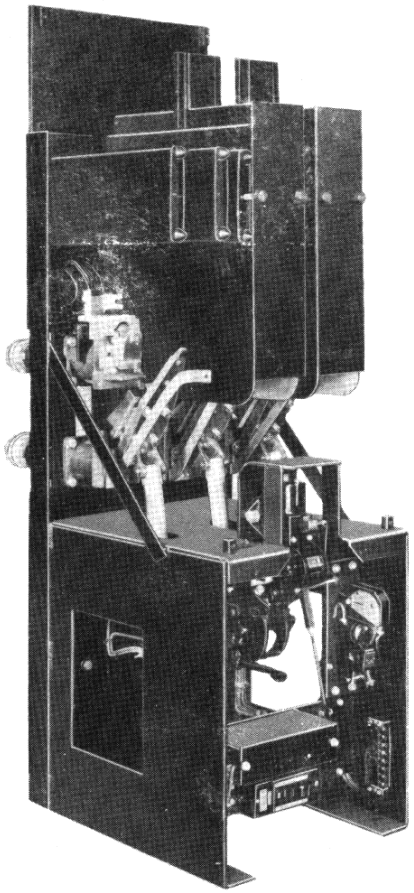

Figure 1 - Type 50-DH-100, 2000 Ampere, 3 pole, Frame Mounted Air Circuit Breaker Interphase Barrier and one arc chamber removed.

DESCRIPTION

The frontispiece shows a 2000 ampere, 5000 volt, Type 50-DH-100 air circuit breaker equipped with a solenoid operating mechanism. The breaker consists essentially of a mounting frame on which are mounted three individual pole units, each with its own contacts and arcing chamber, operated by a single electric mechanism. The control relay auxiliary switch and thermal breaker is provided in the control circuit. This is one of several mounting arrangements to which this breaker is adaptable.

Figure 1 shows a side view of the breaker with the barrier and one arc chamber removed. Figure 3 shows a cross section view of a breaker to illustrate the functions of the various parts. The operating mechanism with all the low voltage control parts is arranged in an enclosed compartment at the

the contacts, arc chambers, and all the live parts which are at high potential.

The electrical operating mechanism supplied with DH breakers is of the direct-current solenoid type. It is mounted so that the moving core, operating in a horizontal plane, acts through a toggle linkage and insulating rod arrangement to open and close the breaker contacts. The necessary tripping devices form a part of the mechanism. Auxiliary switches with contacts of from six to twenty in number are mounted on the breaker and mechanically connected to the linkage which operates with the breaker contacts. A cut-off switch, operating with the solenoid core, is supplied to energize a control relay for interruption of the closing coil current. If desired, this control relay may be supplied with the breaker together with fuses and a knife switch or an AB breaker for disconnecting the breaker control circuit from the control bus; if so ordered, all this equipment may be mounted on a separate panel. In any event, the equivalent of this equipment should be installed in the control circuit. For applications where rapid reclosing duty is required, a latch-checking switch may be supplied. Terminal blocks for collecting all the circuit breaker control wiring at some convenient point, may also be provided if desired.

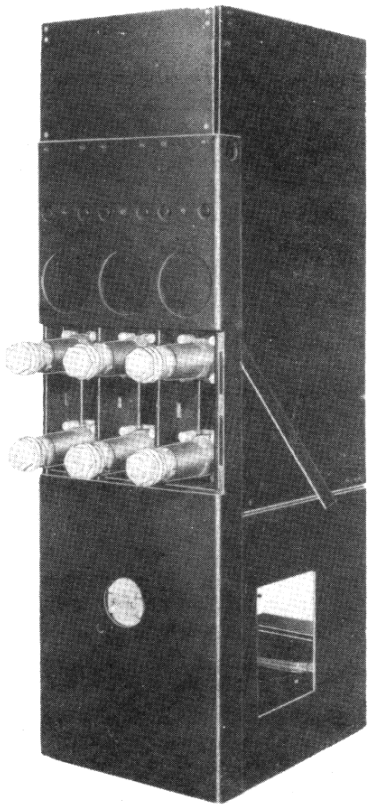

Figure 2 - Type 50-DH-100, 2000 Ampere, 3 pole, Frame Mounted Air Circuit Breaker, Rear View

The breaker contact assembly must be capable of carrying normal load currents and of drawing the current during the interrupting periods in a manner that after circuit interruptions the contacts will be in such condition that the load current can be carried without undue temperature rise. The moving main contacts are self-aligning bridge members to which bars of silver-nickle composition are brazed to the studs to form the stationary main contacts. In the closed position the silver bars engage to complete the main current path through the breaker.

On opening, the main contact bridge, attached to the moving contact arm, parts from the stationary elements first. The lower part of the main contact is protected from arcing by a parallel shunt and the upper part is protected by secondary and arcing contacts located above the mains. During the early part of the opening movement a horizontal barrier system isolates the main contacts from gases thrown downward by the arc. The stationary portion of the protective contacts are arranged on a spring-mounted platform which follows up the opening contact arm for a short distance. At the lower edge of this platform is the secondary contact surface which continues contact with the secondary contacts on the moving arm until the main contact surfaces are separated a safe distance. Stops then operate to stop the follow-up movement of the lower portion of the platform, thus acting to separate the secondary contact surfaces while the arc-drawing members are still permitted to remain in contact. The arcing contacts part last, consequently the arc is drawn at the extreme upper end of the contact structure

The arc chambers are located immediately above the arcing contacts of each pole unit; the insulating sides of the chamber extend downward past the upper contact members to insure a positive transfer of the arc into the chamber. The chamber consists of laterally spaced ceramic plates having V-shaped slots and held together with a moisture and heat resisting cement.

At each end of the chamber is provided an arcing horn. The series of V-shaped slots in these plates forms a vented groove or slot extending the full length of the chamber into which the arc is drawn and extinguished, thus interrupting the circuit.

A multi-turn coil, located immediately behind the arc-chamber and above the upper stationary contact is inserted into the electrical circuit by the transfer of the arc terminal from the arcing contact to the arcing horn which is immediately above it. This coil then generates a magnetic flux which is directed across the arc path by magnetic pole faces that are along the sides of the arc chamber. The flux across the gap between the pole faces and through the chamber forces the arc upward into the interrupting slot.

The following paragraph may be more clearly understood by referring to Fig. 4 wherein is shown the typical arrangement of the component parts of the type DH circuit breaker.

The arcing contacts are so arranged that at the instant of parting they form a sharp loop in the current path through the breaker. The magnetic effect of this loop extends the arc upward very rapidly as the contacts open. Due to this upward looping effect, the arc almost immediately impinges against the fixed horn in the chambers and immediately above the stationary arcing contact so that one terminal of the arc transfers to this horn, the other terminal remaining on the moving arcing contact momentarily. Transfer of the arc to the horn alters the current path through the breaker to include the multi-turn coil mentioned in a preceding paragraph, as this coil is not energized when the breaker is in the closed position. Energizing this coil produces a magnetic circuit which moves the arc upward into the chamber and the second arc terminal from the moving arcing contact to the arcing horn at the front end of the arc chamber. A shunt path connects this horn to the lower breaker terminal, thus relieving the contacts of the current carrying duty.

Insulating interphase barriers, including barriers on the outside of the outer pole units, all built into a single unit, serve to enclose the high tension parts of the breaker as well as insulation between phases. Truck mounted breakers have main barriers which are arranged to engage lugs on the sides of the breakers and then rotate into place, while the barriers of the frame mounted breakers slide horizontally into position, fastening there with bolts.

INSTALLATION

With the exception of the arcing chambers and barriers, these breakers are shipped completely assembled and adjusted. No change in adjustments should be required and none should be made unless it is obvious that they have been disturbed. However, before attempting to operate a breaker electrically it should be closed carefully by hand to make certain that all parts are functioning properly.

As the breakers are more easily handled with the arc chambers removed, it is advisable not to mount the arc chambers on the pole units until the breaker has been installed in its permanent location and securely bolted to the floor, or in the case of truck mounted breakers, until the metal clad cells are ready to receive the trucks. The stacks may then be assembled by resting their supporting strips on the pole faces of the magnetic circuit and sliding them into position, using the pole faces as a guide, these surfaces are lubricated with a small amount of paraffin.

Check to see that the contact jaw on the stack has engaged the lead to the blow-in coil.

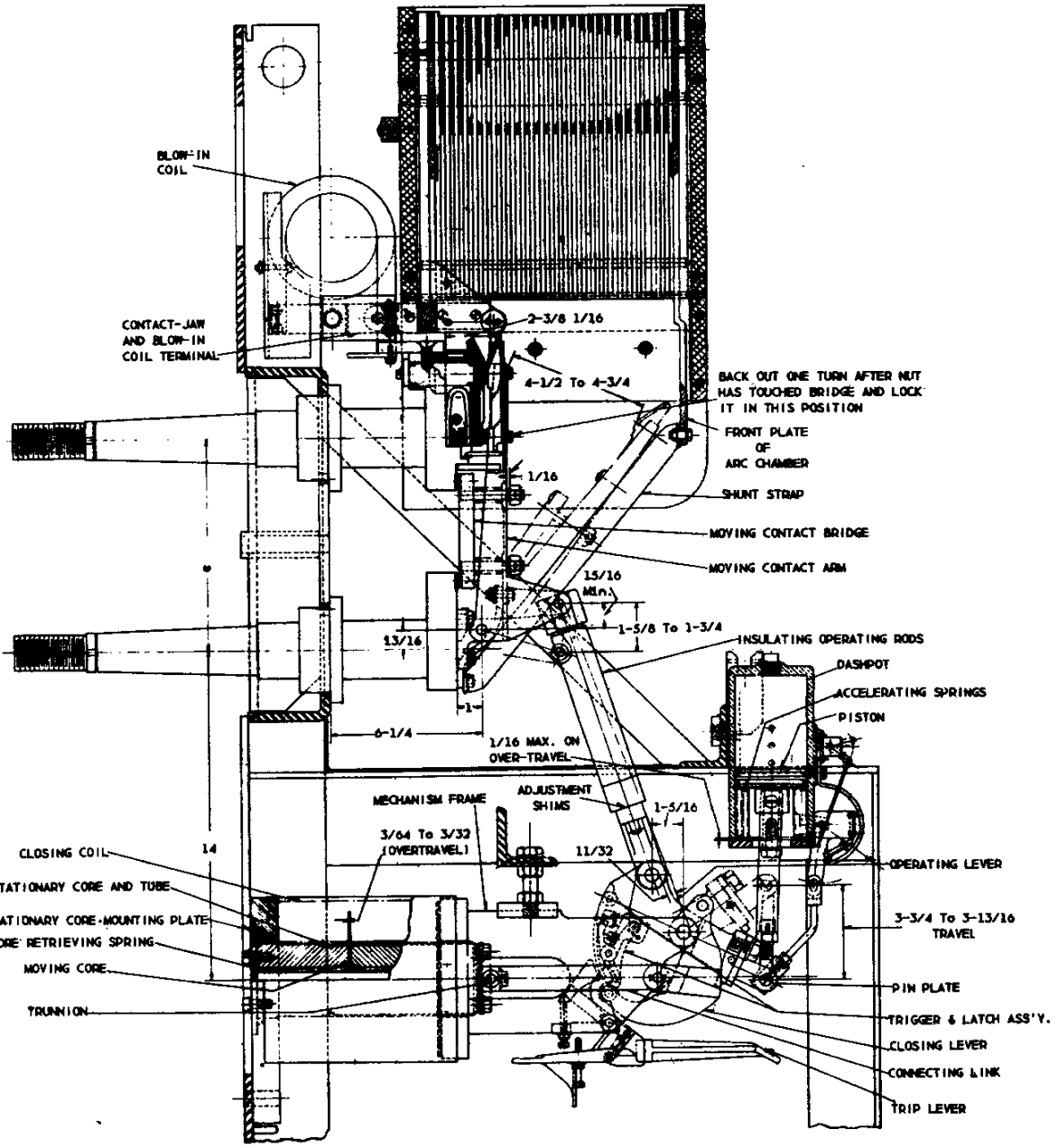

Figure 3 - Type DH Breaker, Cross Section View

Connect the shunt strap to the front plate of the arc chamber. The cover plates of each pole unit may then be placed in position, securing them with the insulated head bolts which are supplied for that purpose. The interphase barrier may then be placed in position.

If the breaker is enclosed within a metal enclosure, care should be taken that minimum clearances for the rated voltage are maintained between live parts and ground. The same check should be made between phases if barriers other than those supplied with the breaker are used.

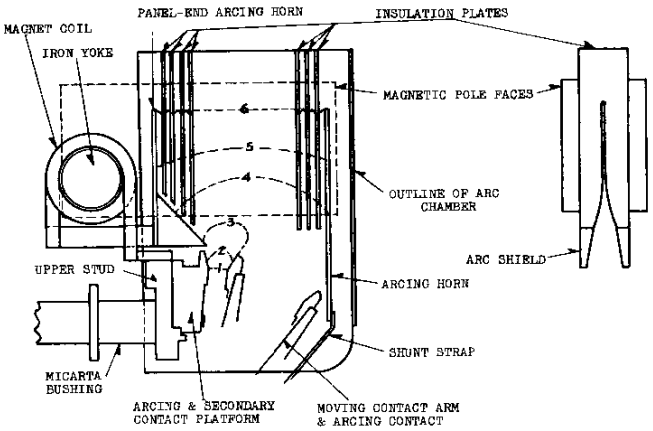

Figure 4 - Typical Arrangement of Component Parts

INSPECTION AND MAINTENANCE

FREQUENCY OF INSPECTION

The frequency of inspection, cleaning, etc. will depend upon the activity and duty to which the breaker is subjected and upon the cleanliness of the atmosphere and surroundings of the breaker. For normal applications of the breakers described herein it is recommended that a preliminary or visual inspection be made every three months. A complete inspection, including removal of the stack for cleaning, should be made every twelve months.

When breaker activity is high or where atmospheric conditions are dirty, inspections should be made more frequently. The following table is recommended as a guide for intervals between inspections until such time as the accumulated experience for any particular application shall indicate that the periods may be lengthened, or should perhaps be shortened.

INSPECTION DETAIL	FREQUENCY OF OPERATING DUTY			
	Normal 5 Oper. Dy.	Moderate 15 Oper. Dy.	Repetitive 30 Oper. Dy.	Highly Repetitive 60 Oper. Upward.
Clean External Surfaces	3 Mos	3 Mos.	2 Mos.	Every 5000 Oper.
Blow out Arcing Chamber	6 Mos.	3 Mos.	2 Mos.	" " "
Remove and Clean Arcing Chamber	12 Mos.	6 Mos.	4 Mos.	" " "
Inspect Contacts	6 Mos.	6 Mos.	4 Mos.	" " "
Inspect Mechanical Parts	12 Mos.	6 Mos.	4 Mos.	" " "

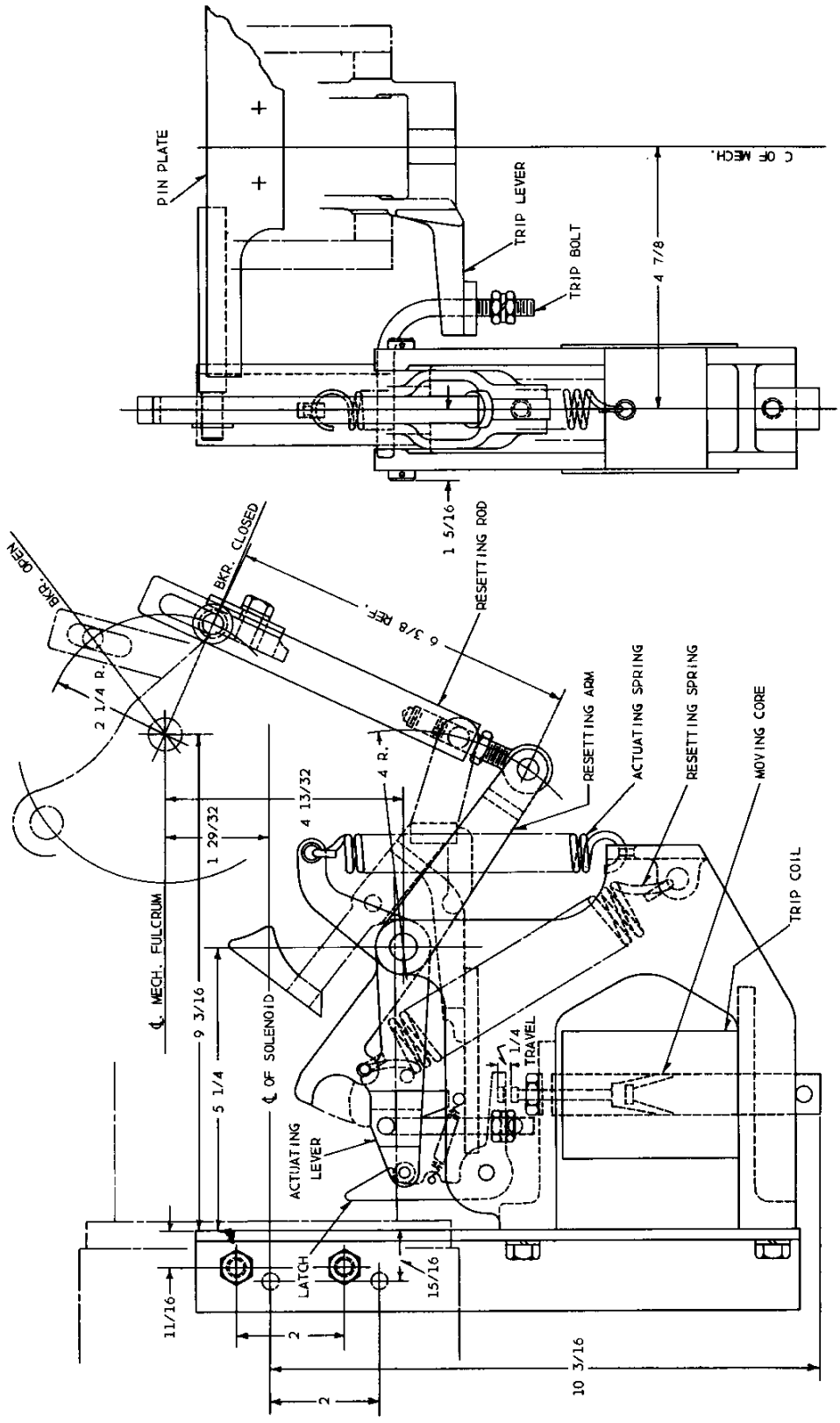

Figure 5 - Type DH Air Circuit Breaker, Capacitor Shunt Trip, (Low Energy Trip) Assembly

Caution

Parts of the circuit breaker itself in the high voltage compartment of the housing are at line potential and the breaker should be isolated from the circuit by disconnecting switches, in line with standard practice for conventional circuit breakers, before the pole unit barriers are removed. As a safety measure the moving contact arms should be in the open position whenever possible while work is being done on the breaker.

GENERAL

Inspect the breaker structure in general and see that all bolts, nuts, etc. are tight and that all cotter pins, locking clips, etc. are in place. Note evidences of excessive wear or other improper operation of the various parts.

Clean off any accumulation of dust and dirt from the external surfaces. Dry compressed air is best suited to this purpose. Waste the air for a few seconds to insure that any residue of water accumulated in the air line will not be sprayed over insulating surfaces. Direct the air stream thoroughly into all joints and crevices. If compressed air is not available, this cleaning may be done with a clean dry cloth. Steam waste is not recommended for this purpose due to its tendency to leave a residue of lint on insulating surfaces.

ARCING CHAMBERS

It should be borne in mind that the insulating parts of the arcing chamber remain in position across the contacts at all times. While the contacts are in the open position these insulating parts are subjected to full potential across the breaker. Ability to withstand this potential will depend upon the care given to insulation in the arcing chamber.

On general inspections the chamber should be blown out with compressed air by directing the air stream upward from the contact area and out through the stack. Play the air stream thoroughly over the arc box sides (boxlike compartment in which the arc is drawn) and through each space between adjoining plates of the stack.

The arcing chamber should be removed periodically and thoroughly inspected. Any residue of dirt or arc combustion should be removed by a vigorous brushing. A stiff wire brush is not recommended for this purpose due to the possibility of scratching or roughening the insulating surfaces and inviting increased deposits of dirt in future service. Inspect the stack plates for metallic deposits, breakage or evidence of undue deterioration.

Caution

Caution should be taken that after the arc chamber is replaced in position to see that the contact jaw on the stack has engaged the lead to the blow-in coil and that the shunt strap from the lower terminal is bolted to the front arcing horn.

CONTACTS

The contacts should be inspected periodically for wear and for evidences of undue burning. Under normal conditions the contacts should be good for a large number of operations within the rated rupturing capacity of the breaker. A moderate amount of burning on the main contact surfaces will not impair their current carrying ability because of the liberal surface and high contact pressure used. Any roughness on the main surfaces may be removed with a fine file or sand paper. Never use emery cloth.

The breaker should be opened slowly by hand to determine whether the several contact surfaces part in proper sequence. The sequence on opening should be as follows: (1) main contacts part; (2) secondary contacts part; (3) arcing contacts part. When contacts become worn to the point of changing this sequence of parting they should be replaced. This condition should not appear until the breaker has had a large number of operations.

In operating the contacts by hand there should be no binding or excessive friction. When opening the breaker slowly by hand, see that the contact arm passes to the full-open position with the dashpot piston at the end of its stroke.

Contact Adjustment

These breakers are fully adjusted and tested at the factory and no readjustment should be necessary unless it is evident that something has been changed. If it becomes necessary to renew the contacts, or if for any reason the breaker has been disassembled, refer to Fig. 3 and proceed with the contact adjustment as follows:

Adjustment of Moving Contact Arms

The linkage between the moving contact arms of a multi-pole breaker and the closing mechanism assembly is through insulating push rods and the crossbar. The crossbar is omitted in building the single pole breaker. This linkage should be adjusted by shims located at the lower end of the insulating push rods so that when the mechanism is in the latched-closed position the distance between the upper forward surface of the top-stud block and the inner surface at the top of the moving contact arm is 2-3/8 inches plus or minus 1/16 inch.

Adjustment and Care of Main Contact Bridges

The main contacts are held in position by studs which pass through the main contact springs and the moving contact arm and are held against the force of the contact springs, when the breaker is in the open position, by pinned nuts. Adjustment of the main contact is made with the breaker in the latched-closed position by setting these nuts so that there is then approximately 1/16 inch clearance between the adjusting nut and the surface of the contact arm.

On the opening stroke, the stationary element of the arcing contact should follow the moving arcing contact approximately 3/4 inch before parting. On the closing stroke, the arcing contacts should engage at approximately the same time.

ELECTRICAL OPERATING MECHANISM

The electrical operating mechanism contains a number of moving joints and operating parts all of which are subject to wear or sticking if not kept in proper condition. The mechanism should be inspected at regular intervals, making a number of operations both electrically and by hand to be assured that it is in good operating condition. It is desirable to apply a light lubricating oil to the various pin joints but not to the extent of causing them to become gummed or sticky. Moving parts, particularly the trigger and switches, should be kept free from dirt and foreign matter.

When shipped from the factory the mechanism has been adjusted and tested and no changes should be necessary. If for any reason reassembly in service becomes necessary, certain relations must be obtained.

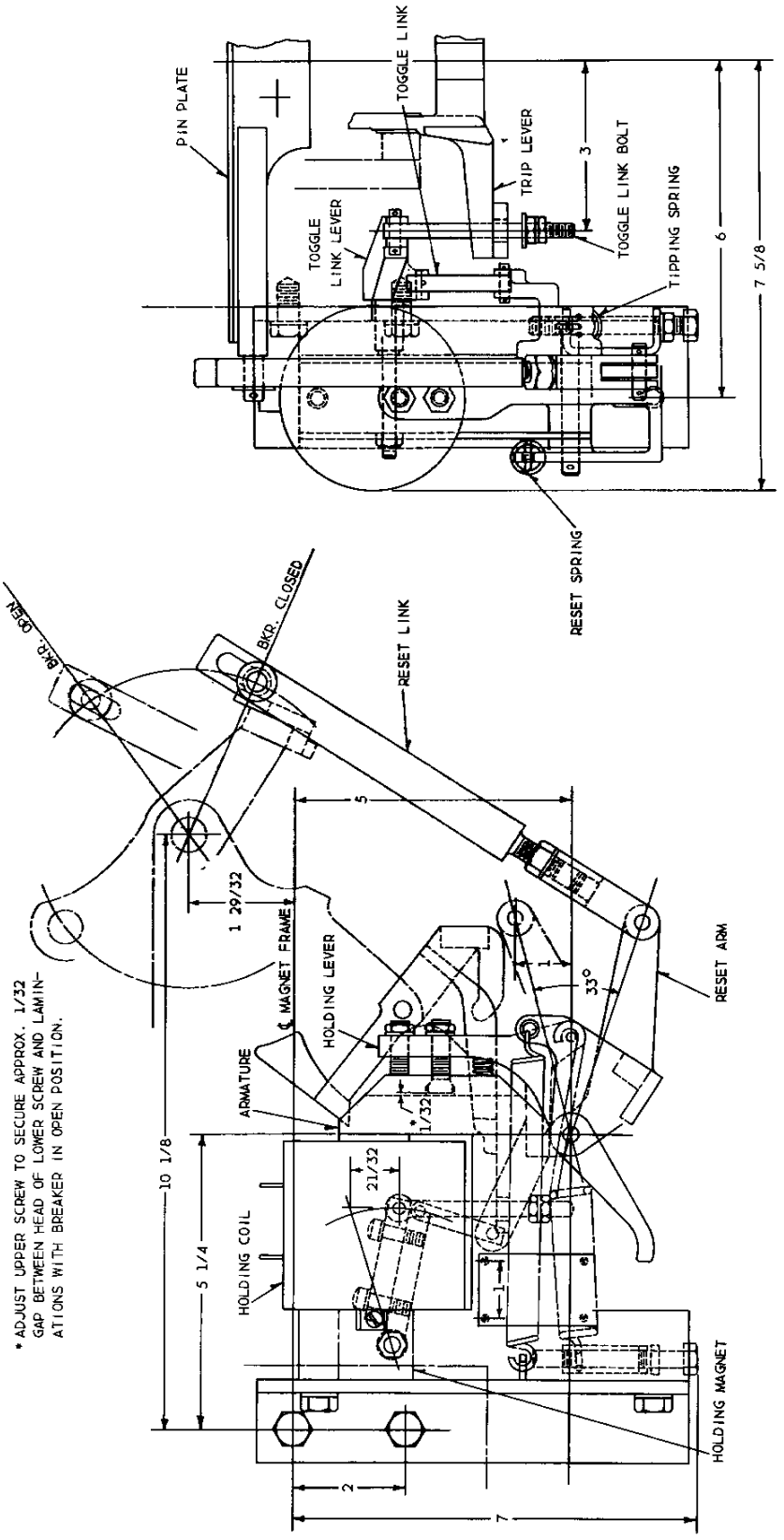

Figure 6 - Type DH Air Circuit Breaker, Undervoltage Release Assembly

The closing mechanism consists essentially of the mechanism frame, coil, stationary core and knurled tube, moving core, core retrieving spring, moving core trunnion, closing lever, connecting links, operating lever, trigger and latch assembly, pawl, and the trip lever.

The closing coil may be removed from the mechanism by first removing the two bolts holding the stationary core to its mounting plate, then, with the breaker in the open position, remove the four bolts that attach this plate to the mechanism frame. This plate acts to restrain the retrieving spring and should be removed with care. The two bolts that hold the trunnion to the moving core can then be removed and the stationary core and knurled tube assembly, together with the moving core slid out through the back frame. The coil can then be removed. The coil can then be replaced by reversing the process taking care that the coil is securely blocked in position and that the shims between the trunnion are in place. These shims are used to get approximately 1/16 inch overtravel, as measured by core movement, from the latched-in position when the closing coil is energized momentarily. The surfaces which form the stops between the closing lever and mechanism frame are set so that they just clear when the mechanism is held closed with the closing handle.

The tripping lever normally rests on a screw which is so set as to obtain a clearance of approximately 1/16 inch between the lever and the tail trigger.

Caution: - The breaker should never be tripped when the air dash pots (Bumpers) are disconnected from the operating mechanism.

TRIPPING ATTACHMENTS

SHUNT TRIP

Two shunt trip mountings are available for use with type DH mechanisms; one of these mountings provides for locating the tripping device on the left side of the mechanism frame, the other permits locating the shunt trip in front of and below the mechanism frame. The action of both is the same in that upon energizing a tripping coil a magnetic flux is generated which causes a moving core to operate through a rod or bolt upon a trip lever to trip the breaker. The total travel of the moving core in either device is approximately one inch and the mechanism is adjusted so that the core can move 1/4 inch before engaging the trip lever. When moving the core slowly upward by hand, there should be at least 1/16 inch between the moving and the stationary core faces when the breaker trips.

Shunt trip coils are designed for momentary current carrying service and for that reason the shunt trip circuit should be interrupted by auxiliary contacts immediately after the breaker is tripped. The first and third contact segments as counted from the auxiliary switch operating arm are used for that purpose.

CAPACITOR SHUNT TRIP; LOW ENERGY TRIP

The capacitor shunt trip as applied to the Type DH breaker is a low energy tripping device wherein the actual power for tripping is secured by springs which are extended during the closing stroke of the breaker; on tripping the disengagement of the tripping latch on this device releases the action of the springs which in turn operates on the breaker trip lever.

The detailed operation of the device can best be followed by referring to Figure 5 wherein the capacitor trip mechanism is shown connected to the operating pin plate and to the trip lever of the breaker. The travel of the moving core is approximately 1/4 inch and there should be 1/16 clearance between the latch trigger and the core stem. When the trip coil is energized

the moving core stem strikes the latch arm thus releasing the actuating lever. This lever is then free to move under the influence of the actuating spring and operates through the tripping bolt to move the trip lever of the breaker.

The actuating lever is reset by the resetting spring and through the resetting rod as the breaker opens.

Additional information concerning the capacitor shunt trip and its control circuit is given in the Descriptive Data 33-130.

UNDERVOLTAGE RELEASE TRIP

The undervoltage release is a device for use in automatically tripping the breaker when the supply voltage is lowered to a predetermined value. The mechanism consists of a coil laminated U-shaped holding magnet, its armature and a group of levers and springs as shown by Figure 6. When nominal voltage is applied to the holding coil the magnetic field is of sufficient strength to hold the armature against the force of the tripping spring. When the voltage decreases to approximately 60 per cent of its normal value the magnetic field is no longer strong enough to counteract the force of the tripping spring so that the holding lever is rotated and, through the toggle link, the toggle-link lever and toggle-link bolt, acts to move the breaker trip lever thus causing the breaker to open. As the breaker opens, the reset link permits the reset arm to rotate under the action of the reset spring so that the armature is placed in pickup position.

RENEWAL PARTS

When ordering renewal parts, specify the name of the part desired. Give the breaker Type, Amperes, volts, and Stock Order Number (S.O. No.) as found engraved on the breaker nameplate.


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