LOW VOLTAGE POWER SWITCHGEAR

INSTRUCTIONS

TYPE MT CIRCUIT BREAKERS

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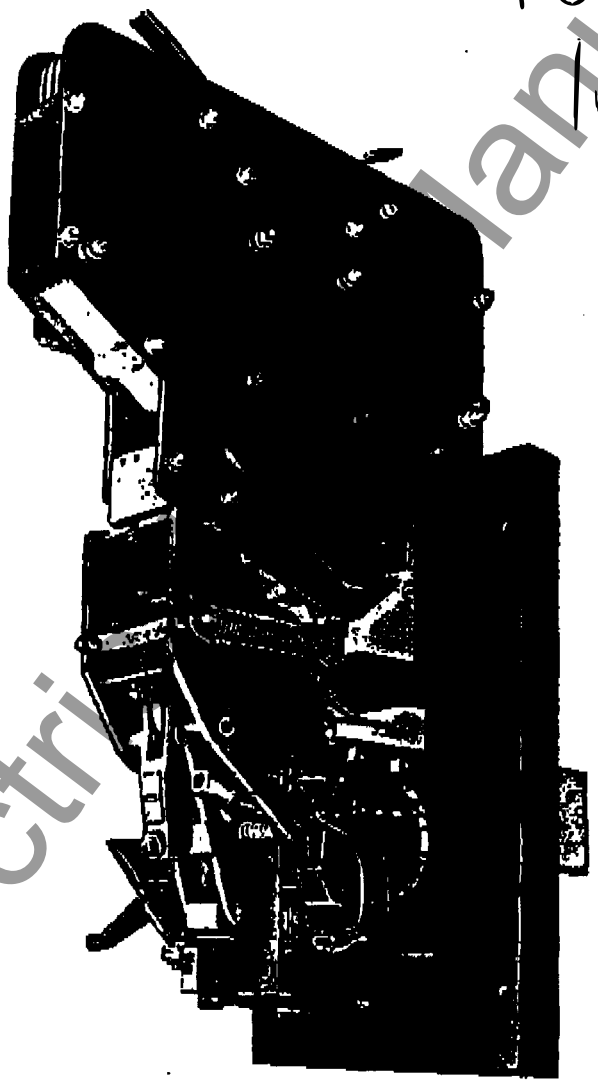

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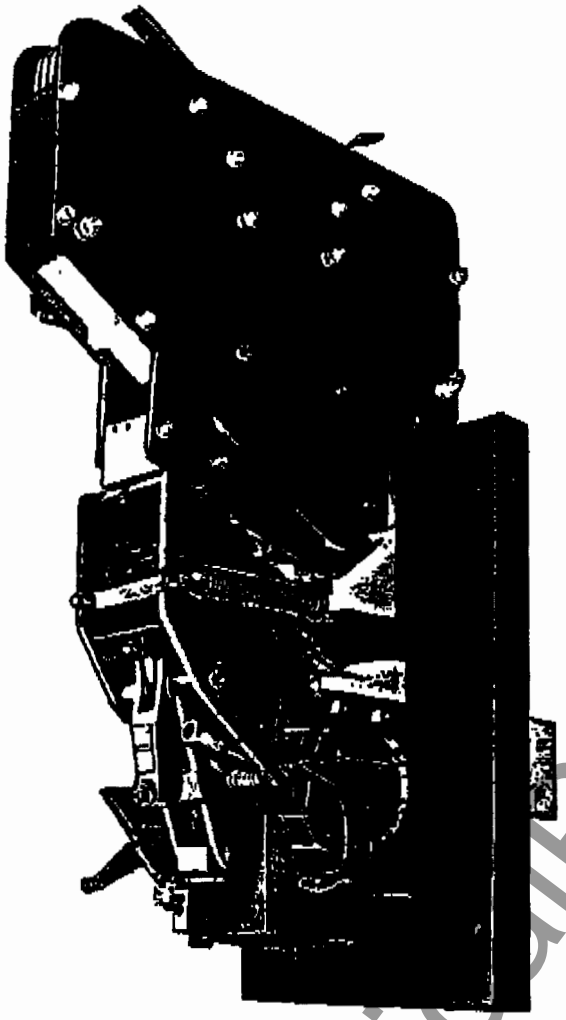

Cover Photo 20466-R

Fig. 1—Type MT Single-Pole Circuit Breaker Electrically Operated for Panel Mounting

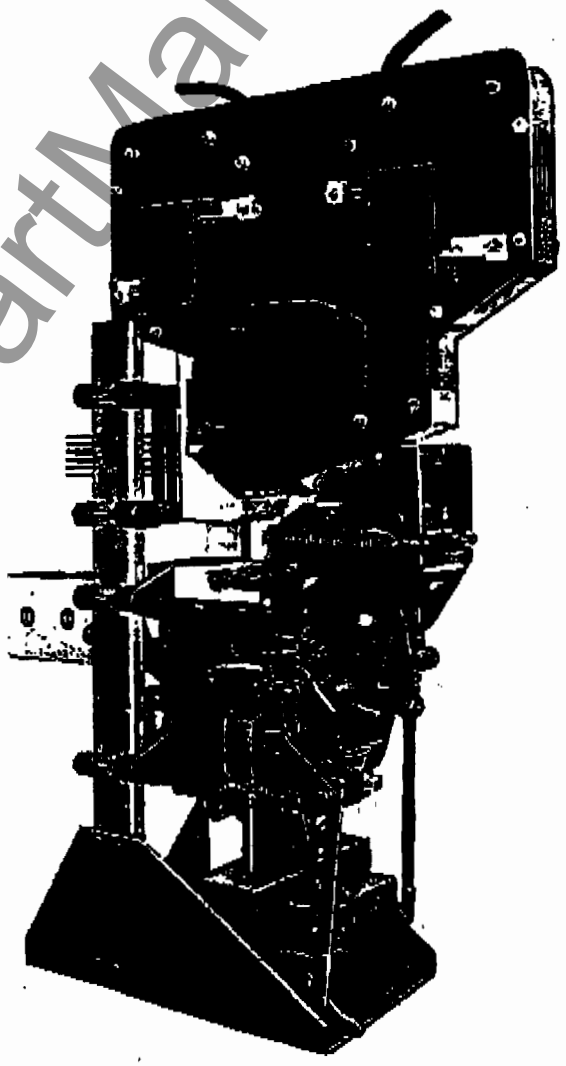

Photo 20466-R

Photo 6283-R

Fig. 2—Type MT Single-Pole Circuit Breaker Electrically Operated for Pedestal Mounting

INSTRUCTIONS FOR TYPE MT CIRCUIT BREAKERS

INTRODUCTION

This instruction bulletin should be read and its contents followed for the installation, operation and maintenance of the type MT circuit breakers. File this bulletin in a convenient place together with all information and drawings relative to the switchgear. By following these instructions the operator can prolong the life and usefulness of the equipment.

GENERAL CONSTRUCTION

Type MT circuit breakers are designed for mounting in several types of switchboard construction, and for individual mounting.

PANEL MOUNTED

The panel mounted breaker, Fig. 1, is designed for open type switchboard construction employing an angle iron framework, dead front stationary switchboards, and drawout truck type switchboards.

PEDESTAL MOUNTED

The pedestal mounted type breaker, Fig. 2, is designed for base mounting. Two vertical insulated posts support the entire breaker. The base can be supported at any height on top of a cubicle or pedestal of convenient design.

The type MT circuit breaker is constructed as a single pole breaker only. The entire mechanism is supported by the housings and by the upper terminal, which in turn are fastened to the support posts. There is no insulation between the housing, operating mechanism and the lower terminal, which makes all of these parts alive to the lower terminal polarity.

The arc chute is a complete and separate unit which prevents the arc from spreading in a horizontal direction but requires considerable space above the arc chute for expansion of incandescent gases.

The standard overcurrent trip is surrounded by the housing and the lower terminal. All other protective devices are mounted external to the breaker housing or on the back of the terminal. The solenoid is an integral part of the housing and uses the housing side plates for part of the magnetic circuit.

The circuit breakers are mechanically trip free from the operating handle and from the solenoid.

GENERAL MOUNTING CONSTRUCTION

PEDESTAL MOUNTED

Pedestal mounted circuit breakers as shown in Fig. 2 are attached to insulated vertical steel posts attached to a steel base which is to be bolted on the pedestal.

SWITCHBOARD MOUNTED

Switchboard mounted circuit breakers as shown in Fig. 1 are built on a bevel-edged heavy slate base. The drawout type breaker is mounted on a truck which permits the breaker to be moved to or from the connected position while the switchgear is energized, without the necessity of interrupting the services on the main bus. The stationary open panel type breakers are also built on a slate base, but are not provided with a truck.

An alternate arrangement makes use of the pedestal mounted breaker frame as a truck carriage for draw-out switchboard construction.

RECEIVING, HANDLING, AND STORAGE

Each circuit breaker, before leaving the I-T-E Circuit Breaker Company, is carefully inspected and tested for proper operation and then crated by workmen who are experienced in the proper handling and packing of electrical equipment. Each crate is plainly marked at convenient places with the crate number, weight, and handling position.

TRANSPORTATION DAMAGE

Immediately upon receipt of the circuit breaker, examine the crates to determine if any damage or loss was sustained during transit. If injury or rough handling is evident, file a damage claim at once with the carrier and promptly notify the I-T-E Circuit Breaker Company. The I-T-E Circuit Breaker Company is not responsible for damage to goods after delivery to the carrier. However, the company will lend assistance in securing any adjustment, if notified of such claims.

HANDLING

Unpack the circuit breaker as soon as possible after receipt. If unpacking is delayed, difficulty may be experienced in making a claim for damages not evident upon receipt.

Use care in unpacking in order to avoid damaging any of the circuit breaker parts. Check the contents of each package against the packing list before discarding any packing material. If any shortage of material is discovered, promptly notify the nearest representative of the I-T-E Circuit Breaker Company. Information specifying the purchase number, crate number, and part numbers of the damaged parts should accompany the claim.

Considerable time can be saved in unpacking if a crane is available to use in removing the breaker

from the crate. Before lifting the breaker it is advisable to remove the arc chute.

To remove the arc chute, loosen one screw at upper front housing, and remove one nut each side of the blowout core. Remove two rear upper screws located above the blowout core.

As the arc chute is heavy, provide means of lifting by crane or hoist. Lifting should be done by passing a rope sling under the two upper resistor support studs located on each side of the arc chute. The arc chute free of its attaching screws and nuts can now be lifted away from the breaker.

CAUTION: WHEN ATTACHING ROPE SLING, SEE THAT IT HOLDS THE ARC CHUTE SECURELY.

When lifting the circuit breaker place the rope sling under the upper terminal, close the breaker and block the bridge closed.

STORAGE

When a circuit breaker can be installed immediately in its permanent location, it is advisable to do so even though it will not be placed in service for some time.

If the circuit breaker can not be installed in its permanent location, the following precautions should be taken:

1. Uncrate the circuit breaker as described under HANDLING.

2. Cover with heavy wrapping paper to prevent dirt or foreign substances from settling on the movable parts and electrical contact surfaces.

3. Store in a clean, dry place with moderate temperatures.

DESCRIPTION

The circuit breakers are electrically operated against heavy springs located back of the contacts and in the operating mechanism and linkage. During inspection and maintenance periods, the circuit breaker may be closed manually by a removable maintenance closing handle. The circuit breaker contacts are opened by the opening springs when the trip latch is released either by pushing the manual trip button or automatically by any trip device with which the circuit breaker is equipped.

The circuit breakers are "trip free" from the closing mechanism, which assures that the breaker contacts can not be closed as long as any trip device is functioning.

MAIN CONTACTS

The main moving contacts as shown in Figure 3 are machined from hard-drawn copper. Silver composition inserts are brazed to the upper and lower ends of the contacts with the upper contact inserts on the vertical face of the contact bar and the lower insert on the lower horizontal end of the contact bar. Main contact pressure is secured from the main contact springs in the bridge arm assembly.

The main contacts are entirely supported by the bridge arm. Just above the center of the bridges, a hole elongated vertically, supports the bridges on the bridge arm and opening toggle pin. The slot allows free vertical travel so that the contact springs can exert pressure on the lower horizontal contact face.

ARCING CONTACTS

There are two sets of arcing contacts, the arcing contacts and the intermediate contacts. Contacts connected to the upper terminal are called "stationary" and those connected to the moving contact arm are called "moving." The stationary arcing contact is pivotally mounted on the arcing horn in such a way as to permit contact motion. Normal arcing contact pressure is supplied by a spring mounted behind the contact insert. The spring is housed in the upper terminal casting. The moving arcing contact is mounted directly on the bridge arm casting by means of socket head screws.

The stationary intermediate contact is mounted directly on the upper terminal casting. The moving intermediate contact is mounted on a contact lever pivoted on the moving arcing contact support. The spring for the moving intermediate contact is supported by the bridge arm casting. Both the moving intermediate contact and the stationary arcing contact are connected to their respective supporting members by means of flexible copper conductors. All arcing and intermediate arcing contacts are faced with special non-welding silver composition inserts.

The sequence of contact "make" and "break" should be as described in section CONTACTS under ADJUSTMENTS.

OPERATING MECHANISM

The operating mechanism is supported entirely by means of pins through the side housings. The operating mechanism consists of two simple toggle arrangements and a latching system.

The breaker, Fig. 3, is closed by means of closing lever (1) acting against the adjusting screw at the lower end of closing lever (2) to force the opening toggle (1) toward the closed contact position against the force of the opening spring and the bridge springs. Both closing lever (1) and closing lever (2) rotate clockwise (facing right hand side) about the same pivot pin which passes through the housing side frame. During the closing motion, opening toggle (1) and (2) are close to an on-center position which is maintained by the link, the trigger, and latch arm.

When the breaker has reached the fully closed position, holding toggle (1) and holding toggle (2) are forced downward into an over-center position to maintain the closing lever (1) in the closed breaker position. A spring assembled over a tube

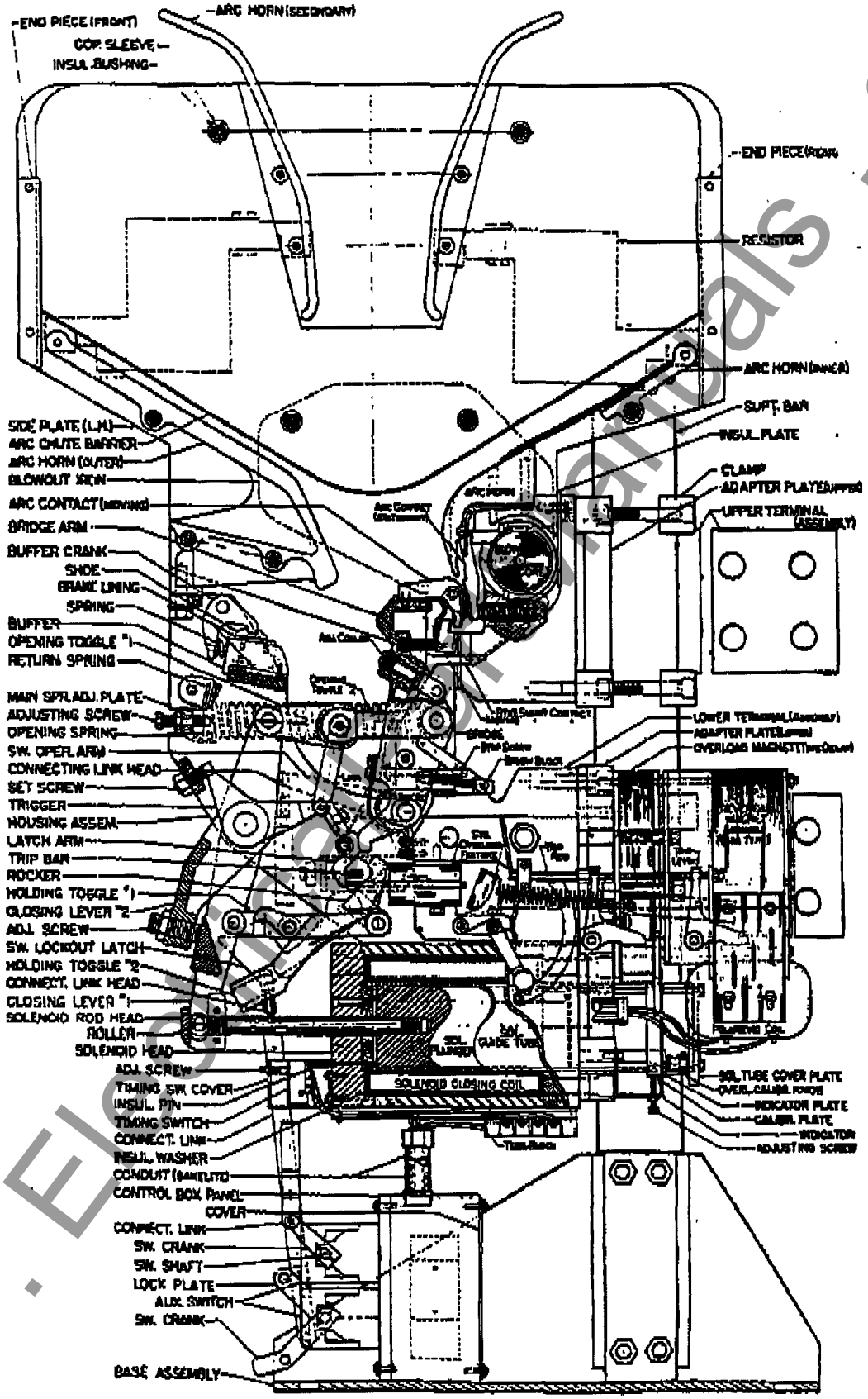

Fig. 3—Type MT Circuit Breaker for Pedestal Mounting

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acts on an auxiliary casting to force the holding toggles into place.

At any time during the closing stroke or when the breaker is completely closed, the latch bar may be rotated clockwise facing the right-hand side of the breaker to release the link and trigger in such a way that opening toggles (1) and (2) may break downward and allow the bridge arm to be pulled to the full open contact position by means of the heavy opening spring.

As the bridge arm reaches the open contact position, the projection on the lower end strikes a lever which breaks holding toggle (1) and (2). The breaking of holding toggle (1) and (2) permits a closing lever (1) to assume an open breaker position by means of the return spring acting on closing lever (2).

Manual closing is accomplished by means of a pole type handle inserted in holding toggle (2).

BRIDGE ARM

The bridge arm is pivoted at its lower end on a pin through the housing side frames. It is forced toward the closed contact position by means of opening toggle (2) and the bridge toggle pin. It is moved toward the open position by the opening springs. The bridge arm is a copper alloy casting of high strength and high conductivity. At the upper end it carries the moving arcing and intermediate contacts. On the upper rear surface a projection serves as a striking face which engages the self-energizing buffer to absorb the shock of opening. The main contact bridges are pivoted on a pin in the bridge arm a short distance above the bridge center. Bridges are held in place by means of the pivot pin, the stop screws which are below the bridge pivot pin and by the bridge spring link which bears against the bridge spring. The lower end of the bridge arm, connected to the lower terminal by means of a flexible conductor, is fastened to the same point as the flexible conductors which conduct current to the lower terminals during arcing period of the upper contacts.

BUFFER MECHANISM

The buffer mechanism, Fig. 3, is arranged so as to absorb the kinetic energy of the bridge arm and bridge as it reaches the open position. The mechanism consists of a buffer with pieces of brake lining on its upper and lower surfaces, and a crank that acts on a brake shoe. The force on the brake shoe is derived from the spring which is compressed by the impact from the bridge arm assembly.

ARC CHUTE

The arc chute combines several principles of arc interruption. It is fastened to the upper front end of the breaker housing, and to blowout core by means of a through bolt. During the opening of a breaker, the current transfers from the main bridges to the intermediate contact without passing through the blowout coil. In transferring from the intermediate contacts to the arcing contacts, the current transfers its path through the blowout coils setting up a strong magnetic field in the blowout coil core and the iron side plates which are fastened to the sides of the arc chute. As the breaker approaches the full open position, the arc transfers from the moving arcing contact to the front outer horn which is attached to the lower terminal of the breaker through the housing. The arc rises along both of the arc chute horns and is cooled by contact with the arc splitters. As it rises higher in the arc chute, the arc is broken into several sections as the secondary arc horns come into play. The secondary arc horns as shown in Fig. 3 are connected in series with the primary arc horns with resistors in the circuit. These resistors are mounted on the side of the arc chute. Part of the energy of interruption is absorbed in the arc chute resistor and the arc is completely extinguished as it approaches the top of the arc chute.

CLOSING SOLENOID

The closing solenoid is mounted in the lower portion of the circuit breaker mechanism housing assembly and uses the side plates as a part of the magnetic circuit. The plunger operates in a horizontal direction and is returned to the open air gap position by means of the pressure of the solenoid rod. The energy of returning the solenoid plunger to the open air gap position is obtained from the return springs and is transmitted to the closing levers (1) and (2).

In closing, the plunger reaches the closed air gap position to bring the breaker into the closed contact position. Simultaneously, a switch rod in the head of the solenoid engages the cut-off switch which operates to de-energize the closing relay. This switch must be properly adjusted to open at the end of the closing stroke.

STANDARD OVERCURRENT TRIP

The lower terminal houses an instantaneous magnet and armature and is so arranged that part of the current passes through the winding of the instantaneous trip magnet and part of the current by-passes the magnet completely. Under some arrangements, the division current is of no consequence in the arrangement of the tripping. The standard instantaneous armature is restrained by means of a spring. Adjustment of pickup current value is obtained by means of adjusting the air gap as indicated on the calibration plate.

As the standard instantaneous armature moves toward the closed air gap position, it strikes a push rod which rotates the latch arm and disengages the latch roller to allow the breaker to open.

ACCESSORIES

A maintenance manual closing handle is furnished for manually operating the circuit breaker during test and maintenance periods.

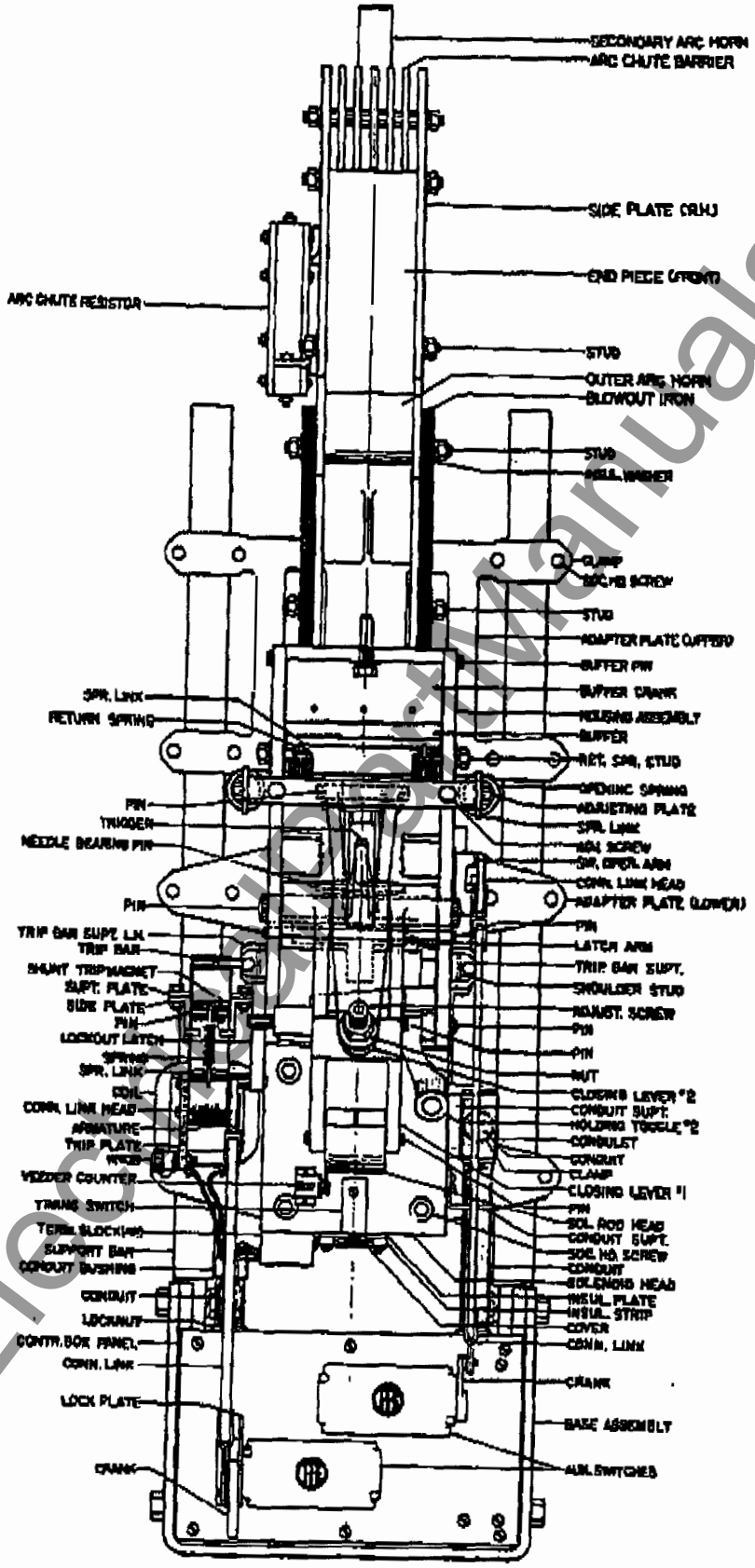

Fig. 4—Type MT Circuit Breaker for Pedestal Mounting

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ATTACHMENTS

Standard Instantaneous Trip

The standard instantaneous trip device is mounted within the lower terminal of the breaker and may be calibrated as a standard arrangement from 100 to 200 percent. The pickup of the instantaneous trip is adjustable in the field by means of a calibrated scale.

Because of the location of the standard overcurrent magnet in the lower terminal, it is possible for the inductance of the magnet to drive some of the current into the other leg of the terminal during a rapid rate of rise current. Since the division of current in the lower terminal is maintained for some distance along the lower current studs, a certain amount of iron is inserted along the upper current path to compensate for the inductance of the overcurrent magnet.

Shunt Trip

The shunt trip is a standard clapper type magnet mounted on the side of the breaker mechanism housing and so arranged that motion of the armature strikes the trip bar in order to rotate the latch arm and disengage the latch. A shunt trip coil is well insulated to permit tripping power and breaker voltage to be derived from different sources.

The magnet and armature of the shunt trip are laminated which provide for high speed operation.

As the breaker opens, the shunt trip coil is disconnected from the control source by means of an auxiliary switch connected to the operating mechanism of the breaker.

Auxiliary Switches

The MT breaker is equipped with a rotary type auxiliary switch so arranged that it is operated by the circuit breaker bridge arm to which it is attached by means of a lever and insulating link. The auxiliary switch is mounted on the main breaker panel or on a sub-panel in the case of breakers built for pedestal mounting. The contacts in the auxiliary switch are completely reversible "a" or "b" and their position relative to the motion of the contact arm may be adjusted by changing their position on the contact shaft.

INSTALLATION

Before attempting any installation, consult all drawings furnished by the I-T-E Circuit Breaker Company for the particular order. These drawings consist of dimensional front and side views and secondary wiring. When installing panel mounted breakers, prepare in accordance with the drawing furnished with the circuit breaker.

WIRING

The wiring of the main circuits should be in exact accordance with the diagram accompanying the device. Care should be taken to see that the line cables are connected to the upper studs.

In addition to the main wiring mentioned above the control circuits must be installed in exact accordance with the diagram. Adequate size wires should be used in the control circuits to insure proper operation.

MAINTENANCE

The circuit breaker parts are designed and constructed so as to require a minimum of maintenance. However, it is recommended that a maintenance program be established that will provide for an inspection of the circuit breaker at least once every six months and immediately after operating to interrupt a fault.

An inspection should be made to determine the condition of the contacts, arc chute, and electrical connections.

All mounting screws, fastening assemblies such as the operating mechanism and operating accessories, should be tight against their supporting members.

The main, intermediate, and arcing contacts can be exposed for inspection by removing arc chute.

ARC CHUTE

To remove the arc chute, proceed as described in section HANDLING under RECEIVING, HANDLING, AND STORAGE.

The contact between the front arc horn and the cross bar on the mechanism housing should be kept free of rust and corrosion and should have good electrical contact. If the arc chute splitters or any portion of the arcing horns and arcing contacts show signs of excessive burning and erosion, those parts should be replaced and some study of the operating conditions made to determine whether the frequency of operation under severe interrupting duty is a normal part of the installation.

The arc chute must be removed in order to inspect, maintain, or replace the contacts.

CONTACTS

Dirt or grease on the contacts should be removed by wiping them with a clean cloth saturated with carbon tetrachloride. Discoloration of the contact surface is not harmful.

All flexible conductors should be inspected for broken or pinched laminations. Flexible conductors in such condition should be replaced.

Main Contacts

A slight amount of pitting is to be expected on the main contacts. If the contacts are badly pitted or eroded, the contacts should be replaced before other parts of the circuit bre ker become damaged. Excessive pitting may be caused by badly burned arcing contacts, or the circuit breaker may be interrupting currents beyond its interrupting rating.

Arcing and Intermediate Contacts

A moderate amount of pitting is to be expected and will not interfere with the operation of the arcing and intermediate contacts. Occasionally it may be necessary to "dress-up" the contacts by removing small burrs with several light wipes of a fine file. Always follow the contour of the contacts and do not attempt to entirely eliminate the pitting. Prevent any filings from falling into the mechanism by covering it with a clean cloth. After filing the contacts, carefully remove the cloth and blow out any dust or particles that may have fallen into the mechanism with low-pressure dry air.

If the contacts are severely pitted or eroded, the contacts should be replaced.

The moving arcing and moving intermediate arcing contacts may be removed by removing the screws at the top of the bridge arm. The stationary arcing contact is removed by removing the screws holding the arcing horn in place and by removing the arcing horn.

ADJUSTMENTS

The circuit breakers are adjusted, inspected, and tested before leaving the factory. However, it is possible that rough handling during transit or abnormal usage after installation may cause a change in some of the adjustments. The circuit breaker should be checked and if adjustments are required, they should be made in accordance with the following sections.

NOTE: WITH THE EXCEPTION OF THE SOLENOID OVERTRAVEL ADJUSTMENT, ALL ADJUSTMENTS ON THE BREAKER AFFECT THE CONTACT TRAVEL AND PRESSURE.

CONTACTS–INITIAL

To make the initial contact adjustment on the main contacts, loosen the right angle set screw and turn the contact spring collar counter clockwise. Adjust the bridge stop screw (the stop screw is screwed into the bridge by means of a lock nut) until the main upper contacts are in line and show 1/8 inch space when the intermediate contacts touch. This may be determined by closing the breaker slowly by hand until the intermediate contacts touch.

During the initial closing of the breaker, it should be noted that the intermediate contacts should show a separation of approximately 3/16 inch as the arcing contacts touch. Therefore, the sequence of the contacts requires that there be 3/16 inch break on the intermediate contacts as the arcing contacts touch and 1/8 inch break on the main contacts as the intermediate contacts touch.

CONTACTS–FINAL

NOTE: THE CLOSING LEVER ADJUSTMENT MUST BE MADE BEFORE PROCEEDING WITH THE FINAL CONTACT ADJUSTMENT.

Make additional adjustment on the bridge stop screws so that the outer contacts will be 0.025 inch behind the inner contacts. The outer contacts so adjusted are, on 3 and 5 bridge units—1 contact on each side; and on 8 bridge units—2 contacts on each side. This adjustment, of course, reduces the wipe or travel on the lower contacts.

Tighten locking nuts on bridge stop screws. Close breaker. Turn each contact spring adjusting collar clockwise until the springs are fully compressed, then back off *one full turn* and tighten locking screw at right angle to the adjusting collar.

The above adjustments should result in a pull of not less than 50 lbs. required to part the main contact at the upper contact face.

MECHANISM

Closing Lever

The adjusting screw at the lower end of closing lever (2) adjusts the relation between closing lever (1) and closing lever (2) and determines the position of the bridge arm when holding toggle (1) and (2) fall into the overcenter position. This screw must be adjusted so that the contacts have the proper overtravel and wipe when the breaker is in the closed position.

Back off the adjusting nut and screw at the lower end of closing lever (2). Close breaker slowly by hand until upper main contacts just touch. Mark position of lower main contacts with scribe mark so that motion along horizontal surface can be measured, after breaker has been closed. Continue closing motion so that the wipe of the lower main contacts may be noted. Adjust screw at lower end of closing lever (2) so that the wipe or travel of the lower main contacts is 1/8 to 5/32 inch between first make of upper contacts and position reached when holding toggles (1) and (2) drop over center. Lock closing lever adjusting screw by lock nut, and check travel of lower contact by opening and reclosing breaker.

Trigger

The trigger set screw determines the position of the latch roller against the latch bar. It is important that the trigger set screw be so adjusted that the roller is in the proper position to insure latching of the breaker.

With the breaker fully closed, the trigger should lift off of the trigger adjusting screw 1/32 to 1/16 inch. If the latch fails to fall into place under the roller so that the opening toggles (1) and (2) are not held in place by the link, shorten the trigger adjusting screw. After closing the breaker adjust the trigger set screw until the clearance between the screw head and trigger is approximately 1/16 inch. Tighten lock nut.

Solenoid Rod (Overtravel)

The stroke of the solenoid may be adjusted by rotating the solenoid rod. The length of the solenoid