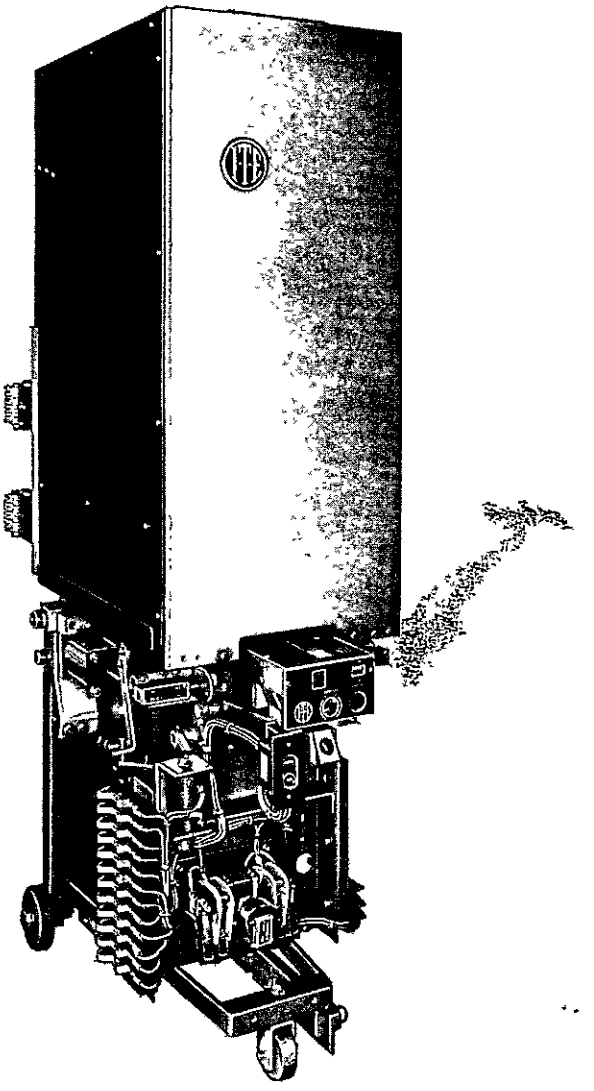
# METAL-CLAD SWITCHGEAR

# INSTRUCTIONS

## HV CIRCUIT BREAKERS

## TYPE 5HV-50, 600 AND 1200 AMPERES

MODELS A4, B4, A5 AND B5



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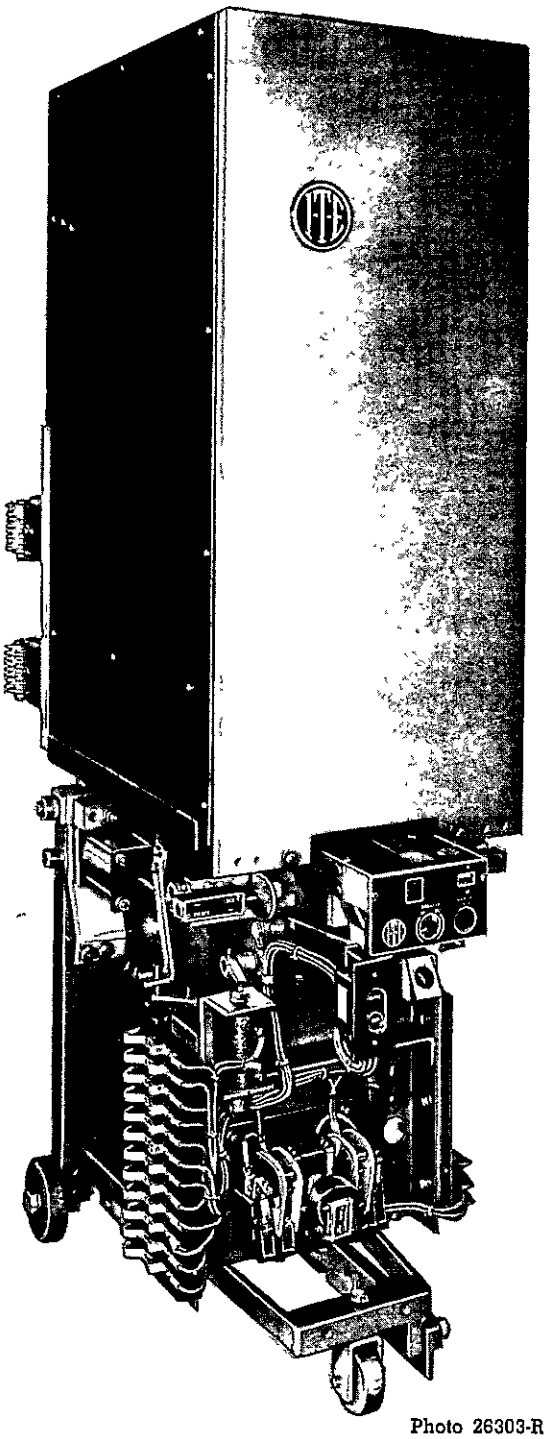
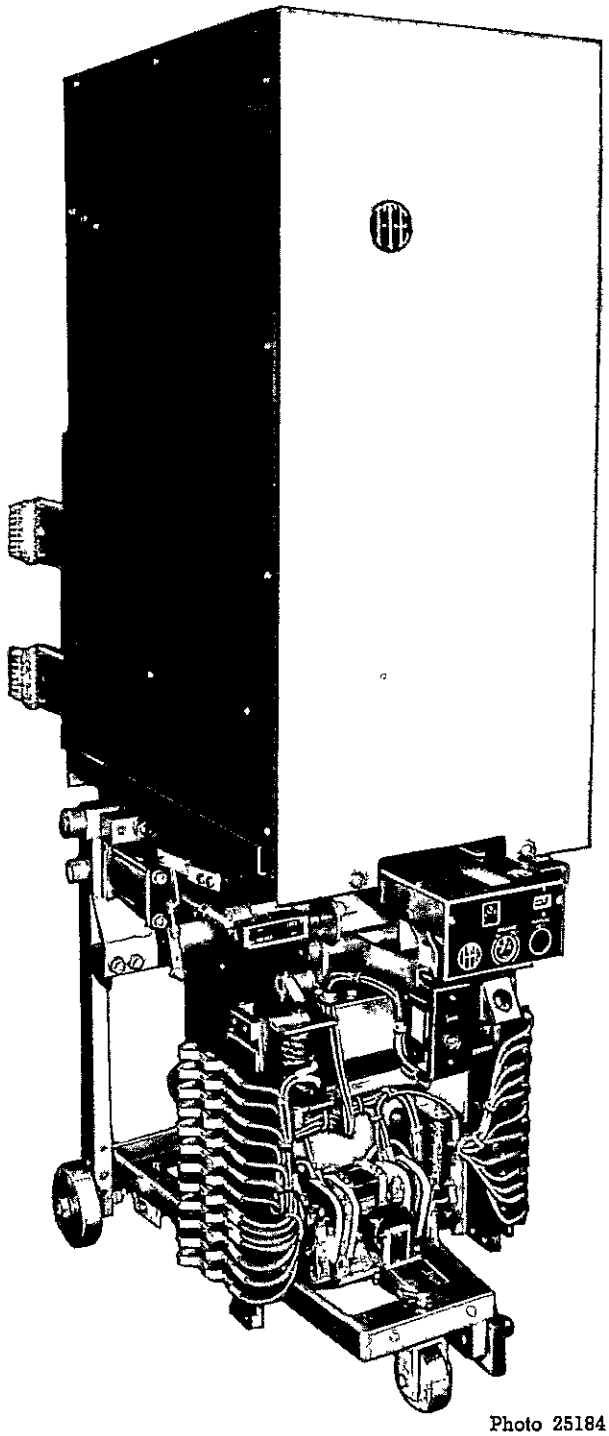


Photo 26303-R

*(A) Model A5 or B5*



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*(B) Model A4 or B4*

***Fig. 1—Type 5HV-50 Circuit Breakers***

# INSTRUCTIONS FOR

# TYPE 5HV-50 CIRCUIT BREAKERS, MODELS A4, B4, A5 AND B5

# 600 AND 1200 AMPERES

## INTRODUCTION

These instructions apply to the circuit breaker types and models listed in Table I. The circuit breaker model is designated by the serial number suffix as stamped on the nameplate.

TABLE I

| Type | Current Rating Amperes | Model |
|---|---|---|
| 5HV-50 | 600 | A 4 |
| 5HV-50 | 1200 | B 4 |
| 5HV-50 | 600 | A 5 |
| 5HV-50 | 1200 | B 5 |

Read these instructions thoroughly and carefully before installing or attempting to operate the Type 5HV-50 power circuit breaker. The operator can prolong the life and usefulness of this equipment by following these instructions.

The circuit breakers, as shown in Fig. 1, are three-pole, electrically operated circuit breakers designed for use in drawout switchboard installations. Each circuit breaker consists of a control panel, operating mechanism and solenoid assembly, upper and lower terminals, blowout structure, arc chute, racking and visual assembly, and necessary supporting structure.

## RATINGS

The Type 5HV-50 circuit breakers are available in current ratings of 600 and 1200 amperes, and are designed for application on a-c voltages from 2300 minimum to 4760 maximum. They have an interrupting rating of 50 MVA at 2300 volts and 4160 volts. The rating of each circuit breaker is stamped on a nameplate which is attached to the top of the racking and indicator assembly.

## 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.

## 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, unless conditions of high humidity prevail and it is not possible to energize space heaters or equivalent.

If the circuit breaker can not be installed in its permanent location, or the high humidity condition listed above prevails, the following precautions should be taken:

1. Uncrate the circuit breaker as described under HANDLING.

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

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

## DESCRIPTION

The Type 5HV-50 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, with the circuit breaker in the test position, the circuit breaker may be closed manually by a removable maintenance closing handle. The circuit breaker contacts are opened

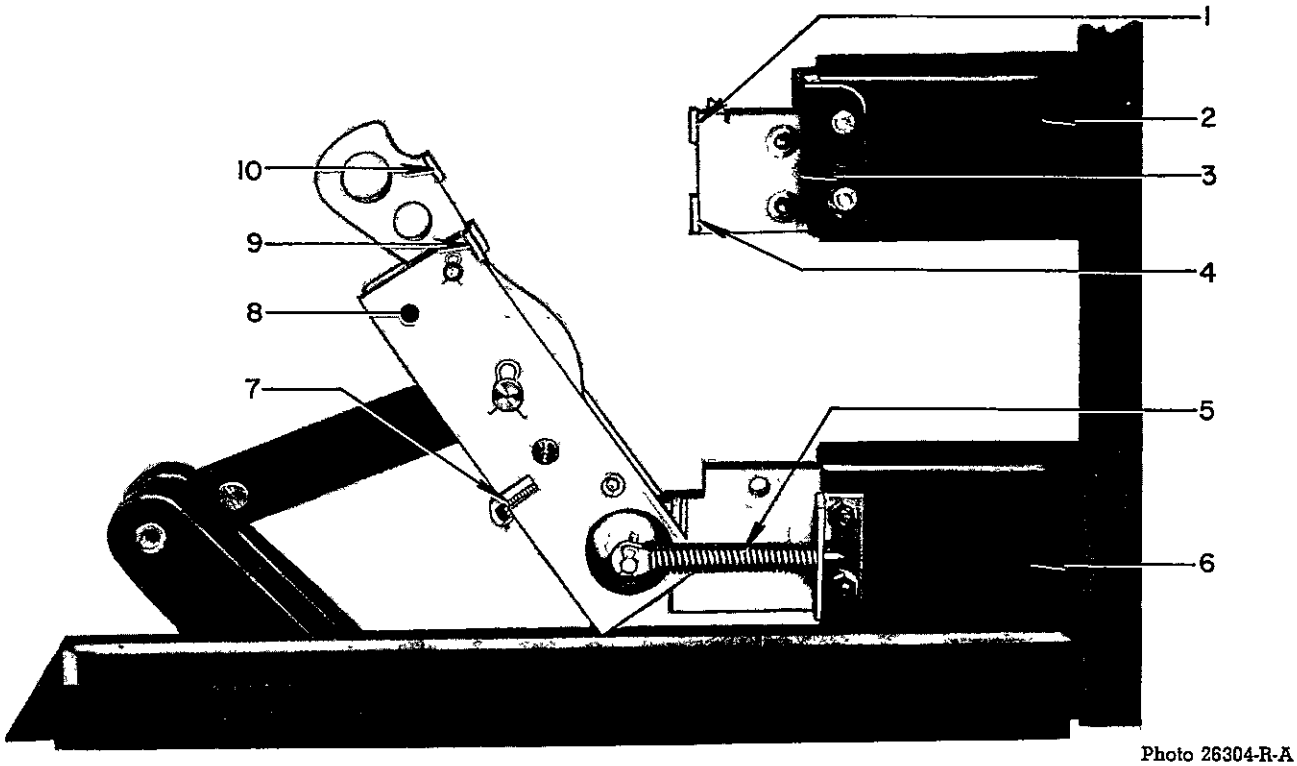



Photo 26304-R-A

1 Stationary Arcing Contact
2 Upper Terminal
3 Terminal Block
4 Stationary Main Contact
5 Spring (Bridge)
6 Lower Terminal
7 Spring
8 Movable Bridge Assembly
9 Movable Main Contact
10 Movable Arcing Contact

*Fig. 2—Partial View of Type 5HV-50 Circuit Breaker Showing Contact Assembly (1200 Ampere)*

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.

The current path of the circuit breaker is through the upper terminals, stationary contacts, movable contact bridge assemblies, and the lower terminals. When the circuit breaker opens, the main contacts open first, which shunts the current through the arcing contacts. When the arcing contacts open, a magnetic field is produced by the blowout coil which causes the arc to rise into the arc chutes where it is extinguished.

## TERMINALS

The upper and lower terminals (2 and 6, Fig. 2) are constructed of bar copper which is pressed into a rectangular, insulating, bakelite tube having a conductive inner surface liner.

## CONTACTS

The correct contact closing sequence is as follows: (1) the arcing contacts close, and (2) the main contacts close. The contacts open in the reverse order, but the opening sequence can not be observed due to the speed with which the contacts operate.

All contact surfaces are silver-alloy blocks which are brazed to the stationary and movable contact parts. No flexible connectors are used to conduct the current between contact pivot points. These pivot points are silver to silver held under a fixed pressure by spring washers.

### Main Contacts

The stationary main contacts (4, Fig. 2) are brazed onto the lower front face of the terminal blocks in a position so as to line up and make contact with the movable main contacts when the circuit breaker closes.

The movable main contacts (9, Fig. 2) are brazed on the upper corners of the two bridge bars, one right-hand and one left-hand bar. The complete bridge assembly (8, Fig. 2) pivots on a stud supported by the lower terminal.

Contact pressure is provided by the springs (5, Fig. 2) which force the lower end of the bridge forward when the contacts are open. As the contacts approach the fully closed position, the force applied by the closing arm overcomes the spring pressure at the pivot point and forces the pivot stud to move up an inclined slot toward the rear of the lower terminals. This movement produces the necessary contact pressure and also provides for contact wipe.

### Arcing Contacts

The stationary arcing contacts (1, Fig. 2) are brazed to the upper front faces of the terminal blocks in a position so as to line up and make contact with the movable arcing contacts when the circuit breaker closes.

The movable arcing contacts (10, Fig. 2) are brazed on the upper end of the arcing contact arms. The lower end of this assembly is connected to two links which ride on a flat sided pin capable of following their angular motion while supported by the bridge bars. A spring (7, Fig. 2) provides the necessary contact pressure between contact parts, as well as the arcing contact pressure. The insulated pivot point of the arcing contact arm is so positioned that the current path below the pivot pin is approximately twice that of the current path above the pin. This difference in current path makes a corresponding difference in magnetic forces, producing a blow-on contact.

## ARC CHUTE AND BLOWOUT STRUCTURE

The blowout coil and iron circuit are built into and form an integral part of the arc chute (22, Fig. 3). This assembly is pivotally supported on an insulated pivot point making it possible, after first unbolting the lower lead connection (21, Fig. 3), to swing the complete assembly back 90 degrees for inspection and maintenance purposes.

The arc chutes consist of a one piece front and side shell, and a series of arcing plates mounted in spaced relation transverse to the arc path.

When the circuit breaker opens, the main contacts separate first, followed by the arcing contacts which draw an arc. As the contact bridges move toward their open position, the arc, forced upward by its own magnetic field, impinges on the rear arc runner, thereby inserting the blowout coil in the circuit. The current in the blowout coil sets up a strong magnetic field which drives the arc up into the arc chute. As the contacts approach the open position, the arc transfers from the movable arcing contact to the front arc runner, which is connected to the lower terminal. The arc, as it rises along the front and rear arc runners, increases in length and at the same time is brought into contact with larger surfaces of the arcing plates. The arc is interrupted by the cooling, lengthening, and squeezing of the arc in many points along its path.

## INTERPHASE BARRIER

The interphase barrier assembly (1, Fig. 4) provides the necessary isolation between phases of the circuit breaker. The barrier assembly has a front metal plate which is grounded to the circuit breaker frame. The barrier is removed as a complete unit and can be handled by one man.

## OPERATING MECHANISM

The operating mechanism (Fig. 7) is located below the contact structure. The mechanism is conventional, having the usual toggle system and linkage for transmitting the force of the solenoid or manual closing handle to the contact bridges.

The mechanism is designed so that little force is required to trip the circuit breaker. This is necessary for fast tripping and for circuit breakers using transformer trip units which require the use of an auxiliary tripping device.

The circuit breakers are trip free over the full range of the closing stroke. When the contacts make under "fault" conditions, the tripping device will operate the trip shaft, release the tripping toggles, and allow the opening springs to return the contacts to the "OPEN" position.

## SOLENOID

The solenoid (Fig. 7) is mounted directly below the operating mechanism. The solenoid consists of four corner posts, a top and bottom plate, guide tube end, guide tube, plunger, push rod, and closing coil. The closing coil is centered by the guide tube which also guides the plunger.

When the closing coil is energized, the upward motion of the plunger and push rod is applied to the operating mechanism toggle system, which in turn transmits the force to close the contacts. A "bb" switch opens the pick-up coil circuit of the control relay near the end of the solenoid closing stroke. "Pumping" or repetition of the closing stroke is prevented by a "non-repeat" feature on the control relay.

## CONTROL PANEL

The control panel (9, Fig. 3) serves as a shelf on which the various trip units can be mounted. The shunt trip device is mounted on the upper left-hand corner of the control panel. A transformer trip assembly can also be supplied and mounted on this panel.

The Type R14 "trip-free" closing relay (12, Fig. 3) is mounted on the front of the control panel. The relay prevents "pumping" or repetition of the solenoid closing stroke and protects the closing coil which is not designed for continuous service. The instruction bulletin number for the Type R14 control relay is listed in the bibliography at the back of this bulletin. Copies of this bulletin will be furnished on request.

1 Blowout Iron
2 Arc Chute Support
3 Movable Arcing Contact
4 Main Separable Contact
5 Terminal Block
6 Movable Bridge Assembly
7 Locking Bolt
8 Auxiliary Switch
9 Control Panel
10 Control Separable Contact
11 Guide Bar
12 Control Relay
13 Locking Device Handle
14 Shunt Trip Device
15 Manual Closing Lever
16 Test Switch
17 Manual Trip Button
18 Nameplate
19 Closing Arm
20 Closing Link
21 Lower Lead Connection
22 Arc Chute

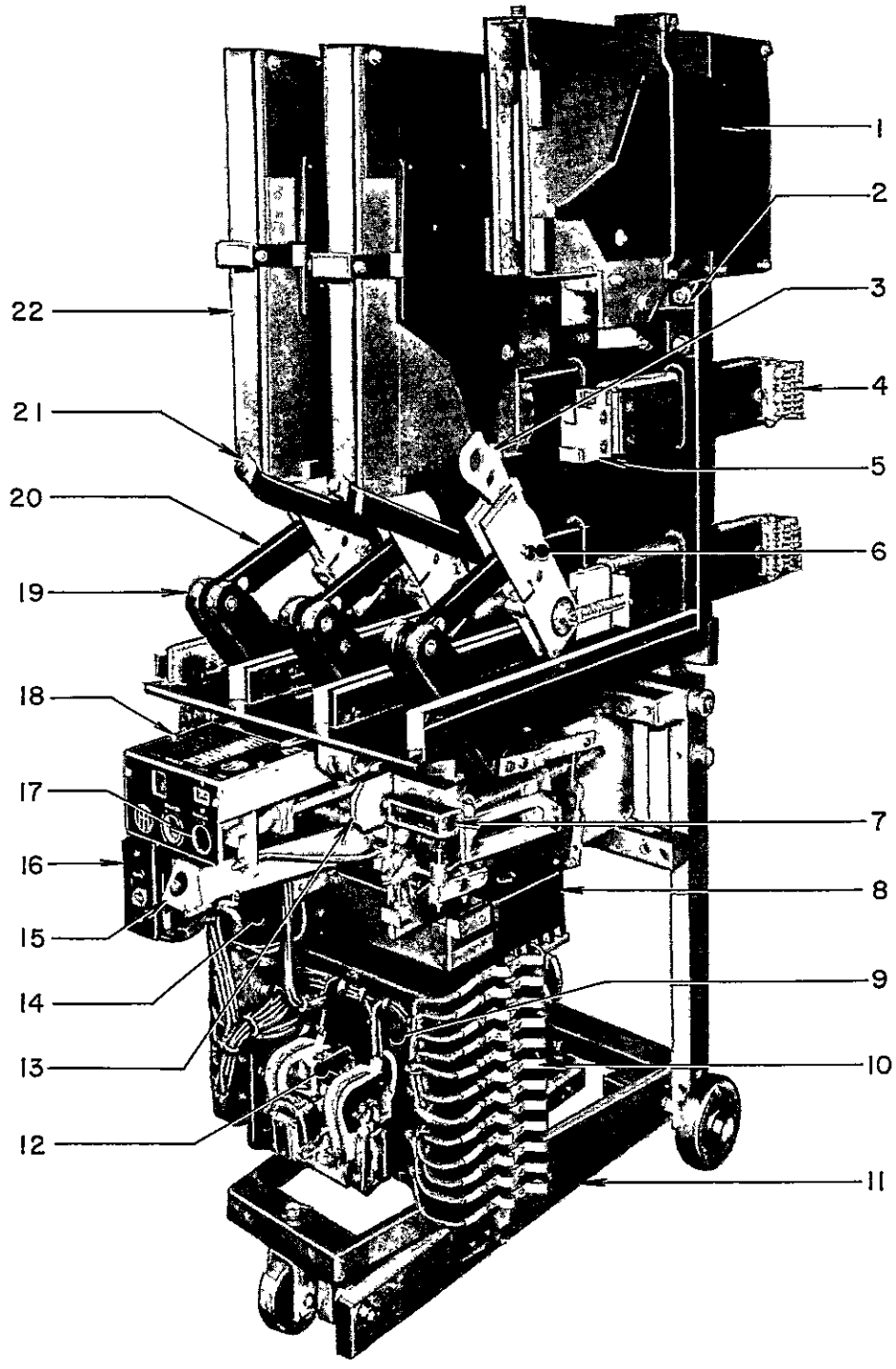



Photo 25181-A

*Fig. 3—Type 5HV-50 Circuit Breaker with Interphase Barrier Removed and One Arc Chute in the Tilted Position*

A six contact auxiliary switch is mounted on the left-hand side of the circuit breaker. An additional auxiliary switch (8, Fig. 3) can be added on the right-hand side, if required.

Two types of auxiliary switches have been furnished; the Type L back-connected auxiliary switch (14, Fig. 5) on circuit breaker models A4 and B4, and the Type L2 front-connected auxiliary switch (14, Fig. 4) on circuit breaker models A5 and B5. The instruction bulletin numbers for these auxiliary switches are listed in the bibliography at the back of this bulletin. Copies will be furnished on request.

The control separable contacts (16, Fig. 4) are mounted at each side of the control panel. A total of 24 contacts can be furnished on each circuit breaker.

In addition to the above units, a latch-checking switch can be furnished for use with reclosing relays.

Ninety percent of all wiring required is done on the panel. Any of the above mentioned devices can be added to the circuit breaker in the field without additional drilling since all holes necessary for mounting these devices are drilled at the factory.

## RACKING AND INDICATOR ASSEMBLY

The racking and visual indicator assembly (13, Fig. 4) is located at the front of the circuit breaker directly above the control panel. A visual indicator plate fastens to the supporting bracket and contains the openings for the visual indicator, operation counter, racking handle, and manual trip button. Whenever the circuit breaker is in the "CLOSED" position, the racking opening is closed automatically by a shutter to prevent racking the circuit breaker from one position to another without first tripping it.

Nameplates on each end of the racking bar indicate the direction to move the sliding bolts to lock or unlock for racking or removal.

The push button station (16, Fig. 3), located below the indicator plate, is used to operate the circuit breaker electrically in the "TEST" position. These push buttons will not operate the circuit breaker when it is in the "OPERATING" position.

The circuit breaker nameplate is attached to the top of the racking and indicator assembly, and is stamped with the necessary information concerning voltage, current, interrupting ratings, serial number, type, etc. The position indicator is a part of this nameplate and a pointer indicates either the "TEST" or "OPERATING" position of the circuit breaker.

Racking the circuit breaker from the "OPERATING" to the "TEST" position moves it forward four inches. In the "TEST" position, the circuit breaker is disconnected from the primary bus. However, the ground and control contacts are still engaged which permits electrical operation of the circuit breaker for test purposes.

## BUFFER ASSEMBLY

The air buffer assembly (22, Fig. 4) is arranged so as to absorb the kinetic energy of the movable contact bridges and mechanism as they reach the open position. The buffer assembly is mounted at the left-hand side of the mechanism and consists of a cylinder containing a piston, piston rings, and an adjustable connecting rod. As the circuit breaker approaches its open position, the force of the buffer arm forces the piston rod and piston toward the rear of the circuit breaker which compresses the air in the cylinder. The buffer is adjusted at the factory to hold the rebound of the contact bridges to approximately 15 per cent of their opening stroke. This adjustment is critical and must not be changed.

## INTERLOCKS

Interlocks are provided to prevent moving the circuit breaker to or from the "OPERATING" position while the contacts are closed.

These interlocks serve two functions. One prevents the insertion of the racking handle unless the circuit breaker is in the "OPEN" position. The second holds the trip latch disengaged at all positions of the circuit breaker between the connected "OPERATING" and disconnected "TEST" positions which prevents "making" or "breaking" current on the main separable contacts.

Key interlocks can be furnished for customer's special requirements.

## MAIN SEPARABLE CONTACTS

The main separable contacts (23, Fig. 4) provide separable electrical connections between the circuit breaker terminals and the male contacts on the primary bus. The current carrying capacity and conductivity of the contact is maintained under severe current and temperature conditions.

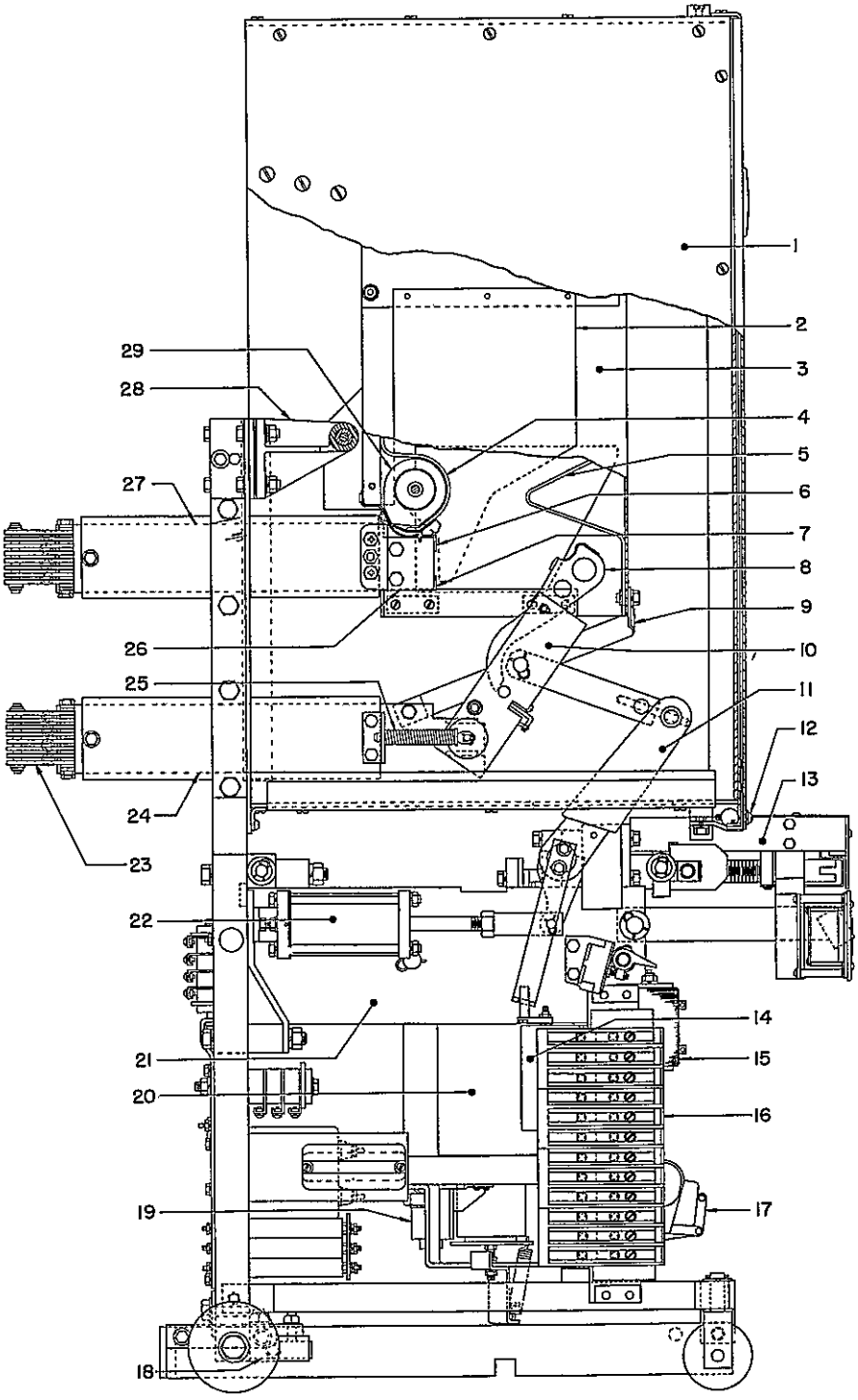
## GROUND CONNECTION

The ground bus contact (18, Fig. 4) is mounted on the bottom rear cross frame bracing. The contacts engage the ground bus before the circuit breaker reaches the "TEST" position and remains engaged from the "TEST" to the "OPERATING" position.

## ACCESSORIES

A steering handle is furnished to facilitate moving truck type circuit breakers in and out of switchboards, as well as any other moving which may be required during the installation and maintenance of the circuit breaker.

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




1 Interphase Barrier
2 Blowout Iron
3 Arc Chutes
4 Rear Arc Runner
5 Front Arc Runner
6 Stationary Arcing Contact
7 Stationary Main Contact
8 Movable Arcing Contact
9 Lower Lead Connection
10 Movable Bridge Assembly
11 Closing Arm Assembly
12 Mounting Screw (Interphase Barrier)
13 Racking and Indicator Assembly
14 Auxiliary Switch
15 Shunt Trip Device
16 Control Separable Contacts
17 Control Relay
18 Ground Contact
19 "bb" Switch
20 Solenoid Assembly
21 Operating Mechanism
22 Air Buffer Assembly
23 Main Separable Contacts
24 Lower Terminal
25 Spring (Bridge)
26 Terminal Block
27 Upper Terminal
28 Arc Chute Support
29 Blowout Coil

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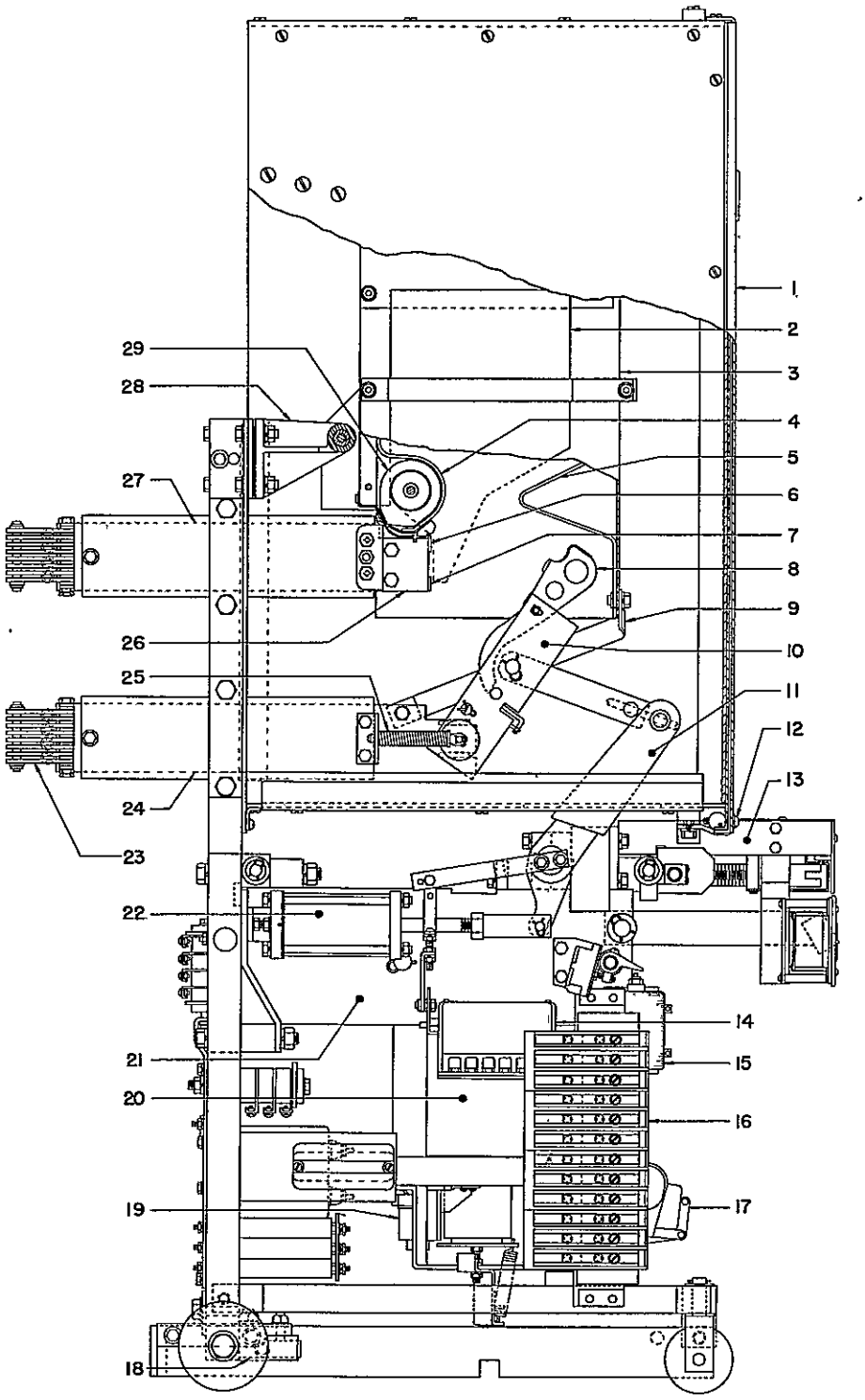
*Fig. 4—Type 5HV-50 Circuit Breaker, Side Section View*
*Models A5 and B5*




1 Interphase Barrier
2 Blowout Iron
3 Arc Chutes
4 Rear Arc Runner
5 Front Arc Runner
6 Stationary Arcing Contact
7 Stationary Main Contact
8 Movable Arcing Contact
9 Lower Lead Connection
10 Movable Bridge Assembly
11 Closing Arm Assembly
12 Mounting Screw (Interphase Barrier)
13 Racking and Indicator Assembly
14 Auxiliary Switch
15 Shunt Trip Device
16 Control Separable Contacts
17 Control Relay
18 Ground Contact
19 "bb" Switch
20 Solenoid Assembly
21 Operating Mechanism
22 Air Buffer Assembly
23 Main Separable Contacts
24 Lower Terminal
25 Spring (Bridge)
26 Terminal Block
27 Upper Terminal
28 Arc Chute Support
29 Blowout Coil

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***Fig. 5—Type 5HV-50 Circuit Breaker, Side Section View Models A4 and B4***

A racking crank is furnished for racking the circuit breaker to either of its two positions within the switchboard.

## INSTALLATION

The switchboard and all associated equipment should be completely installed, inspected, and tested before installing the circuit breakers.

Circuit breakers that have been in storage during the installation of the switchboard and associated equipment should be unwrapped and thoroughly cleaned.

Close and trip the circuit breaker manually before inserting it into the switchboard. If a test station is available, also check the electrical close and trip operations.

CAUTION: DE-ENERGIZE THE PRIMARY AND CONTROL CIRCUITS BEFORE INSERTING THE CIRCUIT BREAKER INTO THE SWITCHBOARD.

### INSERTING CIRCUIT BREAKER

The procedure described below should be followed when inserting the circuit breaker into the switchboard:

1. The circuit breaker should be in the "OPEN" position, the position indicator at the "TEST" position, and the locking bolts in the "UNLOCK" position.
2. By use of the steering handle, align the sides of the circuit breaker with the switchboard frame.
3. Back the circuit breaker into the switchboard, so that the guide bar at the bottom of the breaker enters the guide slot on the switchboard compartment floor, until a definite stop is reached.
4. Slide the two locking bolts to the "LOCK" position and remove the steering handle. The circuit breaker is now in the "TEST" position.
5. ENERGIZE the control circuit and electrically close and trip the circuit breaker from the push button station on its front panel.
6. With the circuit breaker in the "TEST" position, insert the racking crank and turn it clockwise as far as possible. The circuit breaker is now in the "OPERATING" position as indicated by the position indicator.
7. Close all switchboard doors, ENERGIZE the primary circuits and the switchgear is ready to be put into service.

### REMOVING THE CIRCUIT BREAKER

The procedure described below should be followed when removing the circuit breaker from the switchboard:

1. Trip the circuit breaker by means of the control switch on the front of the switchboard.
2. Open switchboard door, insert racking crank, and rack circuit breaker to the "TEST" position.

If it is desired to remove the circuit breaker from the switchboard, continue as follows:

3. Slide the two locking devices to the "UNLOCK" position.
4. Insert steering handle and withdraw the circuit breaker from the switchboard.

## OPERATION

The Type 5HV-50 circuit breakers can be electrically operated when in the "TEST" or "OPERATING" position. With the circuit breaker in the "TEST" position, it can be operated from either the push button station mounted on the racking mechanism or from the main control switch mounted remotely from the breaker. However, when the circuit breaker is in the "OPERATING" position, it can be operated only from the remote mounted main control switch.

The circuit breaker can be manually operated in either the "TEST" position or when completely withdrawn from the switchboard as described under sections MANUAL CLOSING and MANUAL TRIPPING.

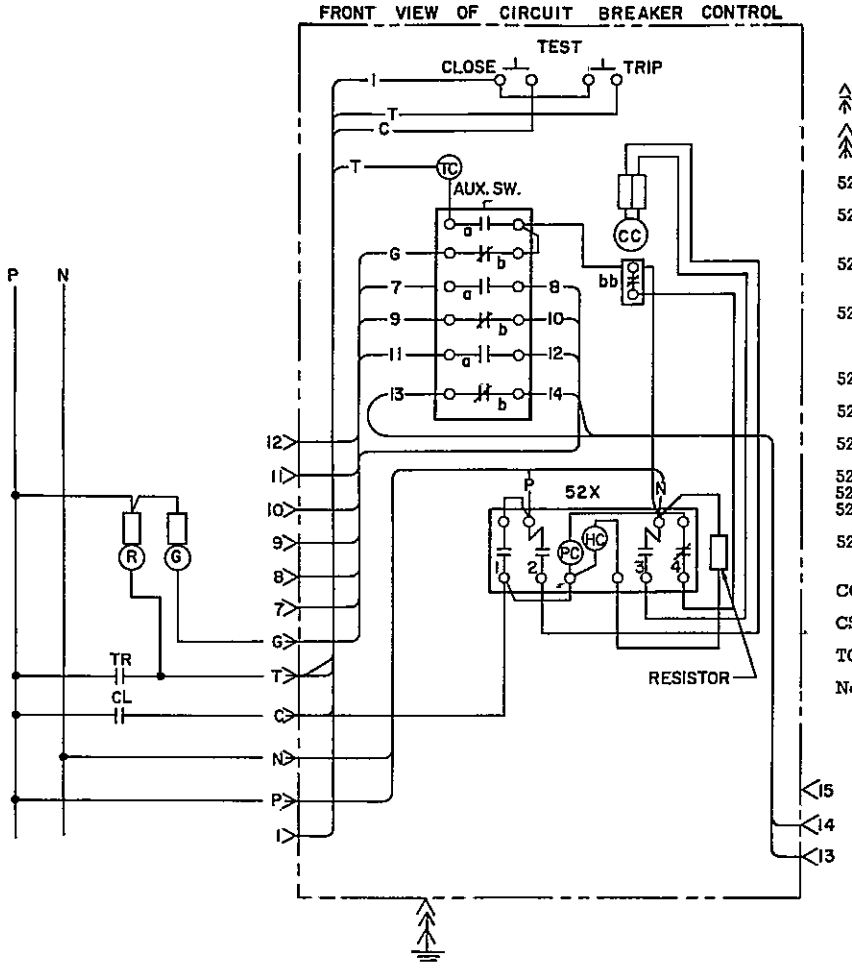
Refer to the schematic diagram (Fig. 6) when following the electrical closing and tripping procedures described below.

### ELECTRICAL CLOSING

The Type 5HV-50 circuit breakers are electrically closed by the operation of a control switch mounted on the front of the switchboard or at some remote point as follows:

Turn the control switch to the "CLOSE" position. This energizes simultaneously the pick-up coil (PC) and holding coil (HC) on the control relay. The stronger of the two coils, the pick-up coil, attracts the relay armature and closes contacts 52X-1, 52X-2, and 52X-3. (NOTE: Contact 52X-4 is closed when the relay is de-energized and remains closed when the relay armature is attracted to the pick-up coil magnet.) This energizes the solenoid closing coil (CC) and the solenoid plungers upward movement actuates the circuit breaker closing mechanism. At the end of its travel, the plunger rod causes the 52-bb switch contacts to open, thus de-energizing the pick-up coil (PC). The relay armature is then attracted by the magnet of the weaker or holding coil (HC) and opens all the 52X contacts. The opening of contacts 52X-2 and 52X-3 de-energizes the closing coil (CC).

If the control switch has a maintaining contact in the closing circuit, or if a momentary contact is held closed, the circuit breaker will not attempt to reclose if it trips on the first attempt due to some fault. The reason for this failure to reclose, even though the control switch is in the "CLOSE" position, is that the relay armature remains attracted to the magnet of the holding coil, thus preventing the 52X contacts from closing. Therefore, a second attempt to close the circuit breaker




LEGEND

| | |
|---|---|
| ⩝ | Disconnecting contact device closed when circuit breaker is in test position only. |
| ⩝⩝ | Disconnecting contact device closed when circuit breaker is in test or operating position. |
| 52 | Air circuit breaker Type HV. |
| 52a | Auxiliary switch contact closed when circuit breaker is closed, open when circuit breaker is open. |
| 52b | Auxiliary switch contact closed when circuit breaker is open, open when circuit breaker is closed. |
| 52bb | Contact closed when circuit breaker operating mechanism is in non-operated position. Opens at end of solenoid closing stroke. |
| 52X | Circuit breaker closing relay Type R14—trip free. |
| 52X-HC | Closing relay holding coil. |
| 52X-PC | Closing relay pickup coil. |
| 52X-1, 52X-2, 52X-3 | Closing relay contacts closed when pickup coil is energized. |
| 52X-4 | Closing relay contact closed except when holding coil is energized and pickup coil is de-energized. |
| CC | Solenoid closing coil. |
| CS | Control switch. |
| TC | Shunt trip coil. |

Note: For 125 volt dc resistors are 1000 ohms.
For 250 volt dc resistors are 2000 ohms.

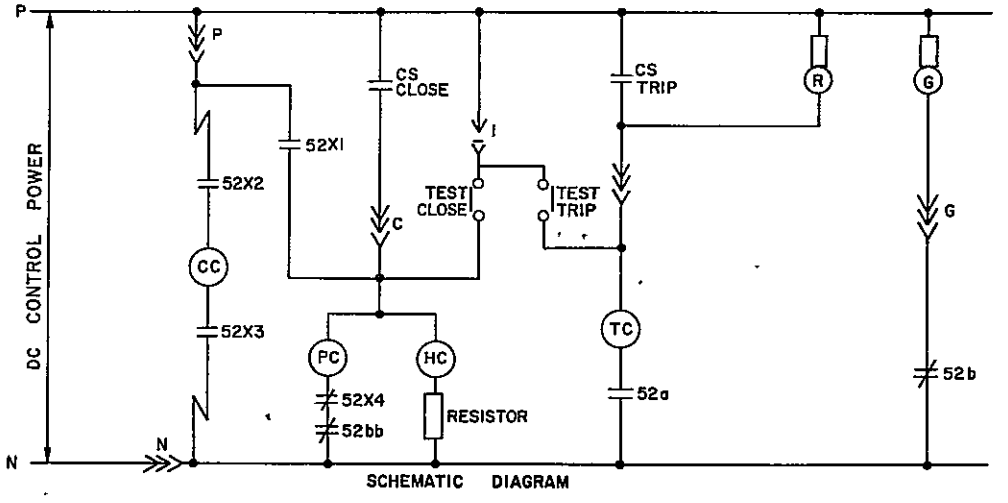



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*Fig. 6—Typical Diagram of Connection for Type 5HV-50 Circuit Breakers*

can not be made until the control switch is turned to the "OFF" position which de-energizes the holding coil and closes the 52X-4 contact.

The control relay is now in its normal de-energized position and will function to close the circuit breaker when the control switch is again turned to the "CLOSE" position. This non-repeat feature of the control relay prevents cyclic reclosing of the circuit breaker and assures that the momentarily rated pick-up coil receives only intermittent service.

### ELECTRICAL TRIPPING

The circuit breaker can be electrically tripped by either pushing the "TRIP" push button on the circuit breaker or turning the control switch to the "TRIP" position. Either of the above means energizes the shunt trip coil (TC). The movement of the shunt trip armature rotates the trip lever and shaft enough to release the trip latch, resulting in consequent tripping of the circuit breaker.

The circuit breaker is electrically tripped in a similar manner by any other tripping device with which it may be equipped.

### MANUAL CLOSING

CAUTION: NEVER CLOSE THE CIRCUIT BREAKER MANUALLY WHILE IT IS IN THE "OPERATING" POSITION IF THE BUS IS ENERGIZED.

The circuit breaker may be closed manually by inserting the manual closing handle into the socket of the manual closing lever (3, Fig. 8) and bearing down on it until the circuit breaker latches closed. The circuit breaker should be racked to the "TEST" position or withdrawn from the switchboard before operating it manually for test or maintenance purposes.

### MANUAL TRIPPING

The manual trip button (2, Fig. 8) is located on the visual indicator plate. To trip the circuit breaker, push the trip button which actuates a rod which in turn rotates the trip lever and shaft enough to release the trip latch resulting in consequent tripping of the circuit breaker.

## MAINTENANCE

The Type 5HV-50 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 chutes, and electrical connections. This inspection can be made by measuring the voltage drop across the terminals of each pole. To obtain accurate readings, pointed terminals and a low, direct-current voltage should be used. The measured d-c drop between the ends of the terminals, at the rear of the circuit breaker, should be less than 40 millivolts at rated current.

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

The main and arcing contacts can be exposed for inspection by removing the interphase barrier and tilting the arc chutes.

### INTERPHASE BARRIER

To remove the interphase barrier, loosen two screws (12, Fig. 4) enough to allow them to be pushed down and out of engagement with the front of the interphase barrier. Then, lift the front and rear of the barrier slightly and slide it forward until the barrier is free of the circuit breaker.

### ARC CHUTE AND BLOWOUT ASSEMBLY

The arc chute and blowout assembly (3, Fig. 4) may be tilted backward 90 degrees by removing the screw fastening the lower lead connection (9, Fig. 4) to the arc chute. In this position, the interior of the arc chute is easily inspected. Discoloration or slight eroding of the interior does no harm. But, if the arc runners or arcing plates show signs of serious burning, or if the arcing plates, arc chute sides, or ends are cracked or broken, the arc chute should be replaced as a complete unit.

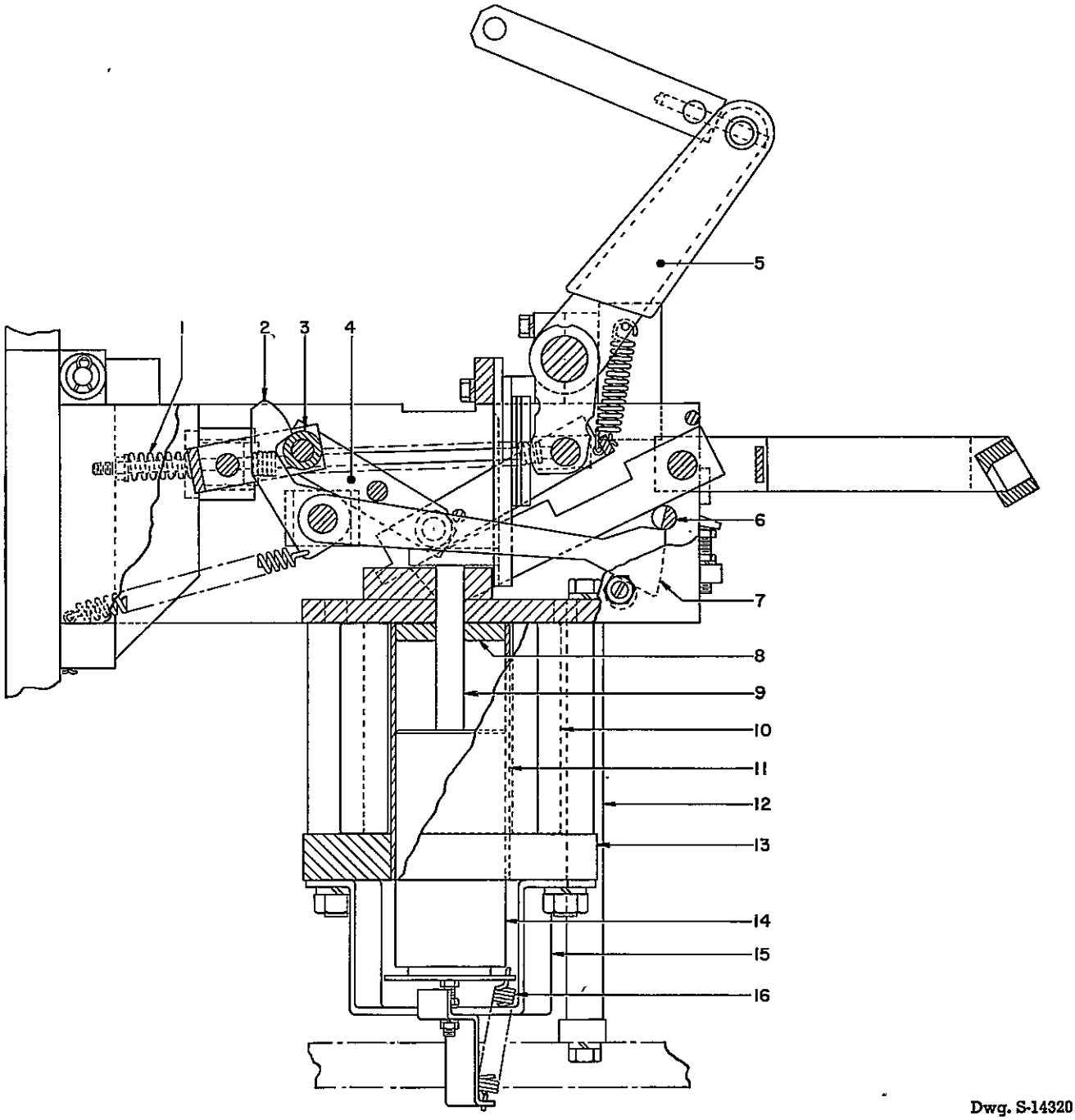
To remove the arc chute (3, Fig. 4), remove pivot stud in arc chute support (28, Fig. 4).

CAUTION: WHEN REMOVING THE ARC CHUTE AND BLOWOUT ASSEMBLY FROM THE CIRCUIT BREAKER, HANDLE WITH CARE, DO NOT DROP.

### CONTACTS

In general, any 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.

The main contacts should not be filed or cleaned by using abrasives. Generally, the cleaning can be accomplished by closing and opening the contacts under no load conditions. The wiping action of the contacts dislodges any dirt or film. The above procedure also applies to the lower inner surfaces of the contact bridges where they bear against the lower terminals.




Dwg. S-14320

1 Opening Spring
2 Main Latch Hook
3 Main Latch Roller
4 Toggle Assembly
5 Closing Arm Assembly
6 Tripper Bar
7 Main Latch
8 Guide Tube End
9 Push Rod
10 Closing Coil
11 Guide Tube
12 Mechanism Front Support
13 Bottom Plate
14 Plunger
15 Plunger Stop
16 Spring (Solenoid Return)

***Fig. 7—Operating Mechanism and Solenoid Assembly for Type 5HV-50 Circuit Breakers Shown in the Open Position***

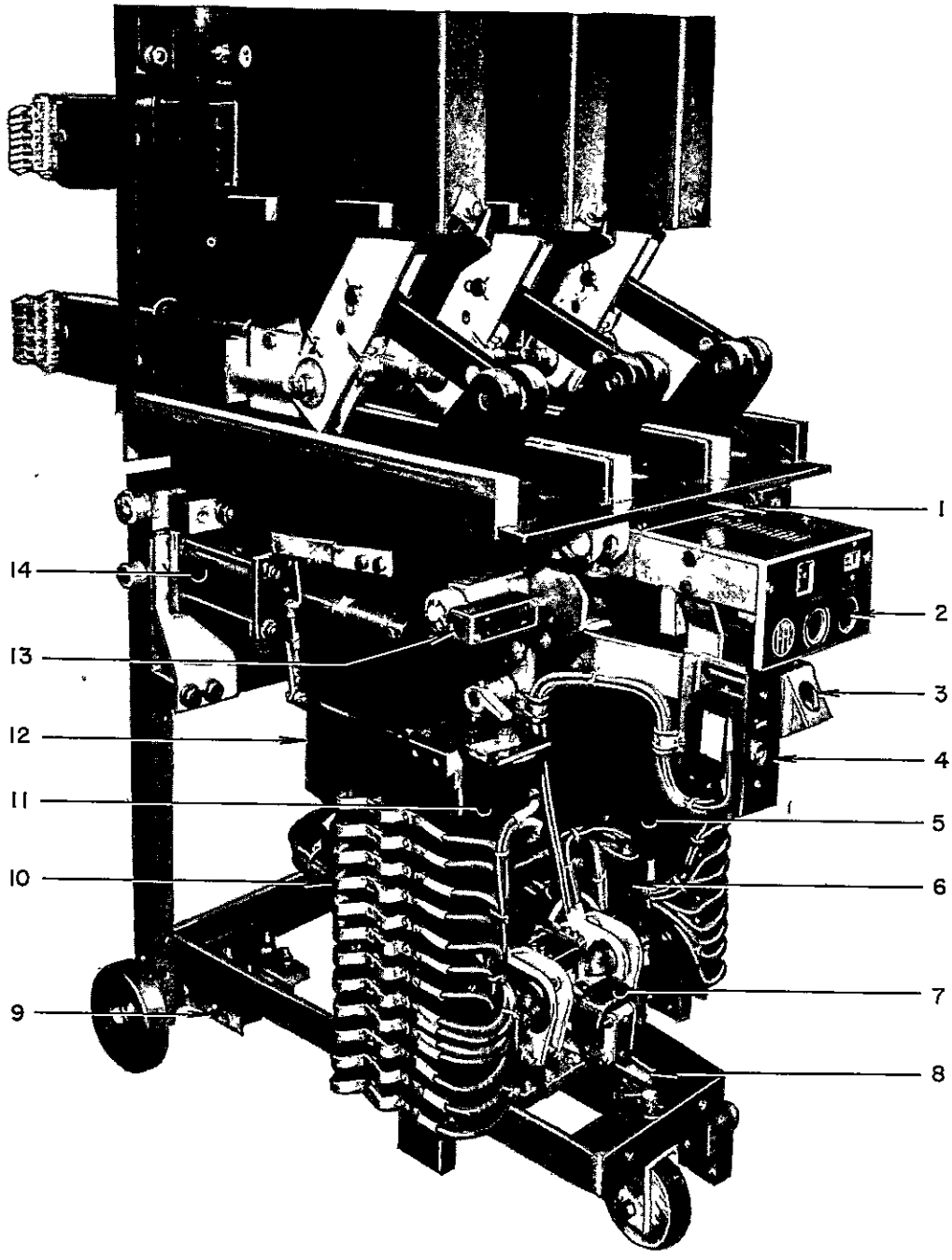



Photo 25183-A

| | | | |
|---|---|---|---|
| 1 | Position Indicator | 8 | Guide Bar |
| 2 | Manual Trip Button | 9 | Ground Contact |
| 3 | Manual Closing Lever | 10 | Control Separable Contact |
| 4 | Test Switch | 11 | Shunt Trip Device |
| 5 | Control Panel | 12 | Auxiliary Switch |
| 6 | Resistor | 13 | Locking Bolt |
| 7 | Control Relay | 14 | Air Buffer Assembly |

*Fig. 8—Control Panel and Racking and Indicator Assembly for Type 5HV-50 Circuit Breakers*

A moderate amount of pitting will not interfere with the operation of the arcing contacts. Occasionally, it may be necessary to remove 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 and particles that may have fallen into the mechanism with low pressure, dry air.

## ADJUSTMENTS AND TESTS

The Type 5HV-50 circuit breakers are adjusted, tested, and inspected before leaving the factory. Rough handling during transit or abnormal usage after installation may cause a change in some adjustments.

In making the adjustments and tests during maintenance periods, follow the sequence in which the adjustments and tests are listed in the following sections.

The adjusting and testing procedures described in the following sections apply only to the circuit breaker and its accessories. It is recommended that circuit breakers already installed in switchboards be removed and moved to a suitable test area.

### REMOVING CIRCUIT BREAKER

The procedure for removing the circuit breaker from the switchboard is described under REMOVING CIRCUIT BREAKER in section INSTALLATION.

### INTERPHASE BARRIER

The interphase barrier must be removed before making adjustments or tests. To remove the interphase barrier, proceed as described under INTERPHASE BARRIER in section MAINTENANCE.

### ARC CHUTE AND BLOWOUT ASSEMBLY

The arc chute and blowout assembly must be placed in the tilted position in order to inspect, maintain, or replace the contacts. To tilt the arc chute and blowout assembly, proceed as described under ARC CHUTE AND BLOWOUT ASSEMBLY in section MAINTENANCE.

### MECHANICAL ADJUSTMENTS AND TESTS

#### Contact Sequence

Slowly close the circuit breaker by using the manual closing handle and observe the position of the movable contacts relative to the stationary contacts.

The movable arcing contacts should touch the stationary arcing contacts within 1/32 inch of each other. With the arcing contacts just touching, the main contacts should have a gap of 3/16 inch, plus 1/32 inch or minus 0, at "A", Fig. 9 (C).

The adjustment can be made by turning the adjusting screw, shown in Fig. 9 (C), in the required direction.

#### Main Contact Pressure

The lower end of the movable bridge, Fig. 9 (C), should skid 3/16 inch, plus or minus 1/32 inch, from the time the main contacts just touch until the circuit breaker latches closed. This measurement is made at "B", Fig. 9 (C).

To check this adjustment, manually close the circuit breaker until the main contacts just touch. Hold the contacts in this position, and scribe a line on the lower terminal adjacent to the rear edge of the bridge. Continue the closing operation until the circuit breaker latches closed and then scribe a second line. Trip the circuit breaker and measure the travel between the two lines at "B", Fig. 9 (C).

If adjustment is required, loosen the set screw for the adjusting stud shown in Fig. 9 (C). Turn the stud in the required direction and again check the travel at "B", Fig. 9 (C). Tighten the set screw when the adjustment is correct.

#### Bridge Side Pressure

The side pressure at the pivot point of the contact bridges is a fixed pressure maintained by spring washers as shown in Fig. 9 (C).

To check the side pressure, proceed as follows:

1. Disconnect closing link from bridge by removing hair pin cotter and bridge pin for each pole.

2. Place the bridge in the closed position, with arcing contacts touching, and by use of a spring scale positioned as shown in Fig. 9 (C), measure the pull necessary to move the contact bridge.

The pull necessary to move the bridge should be between 2 and 3 pounds. If adjustment is required, proceed as follows:

1. Loosen set screw in adjusting nut, Fig. 9 (C).

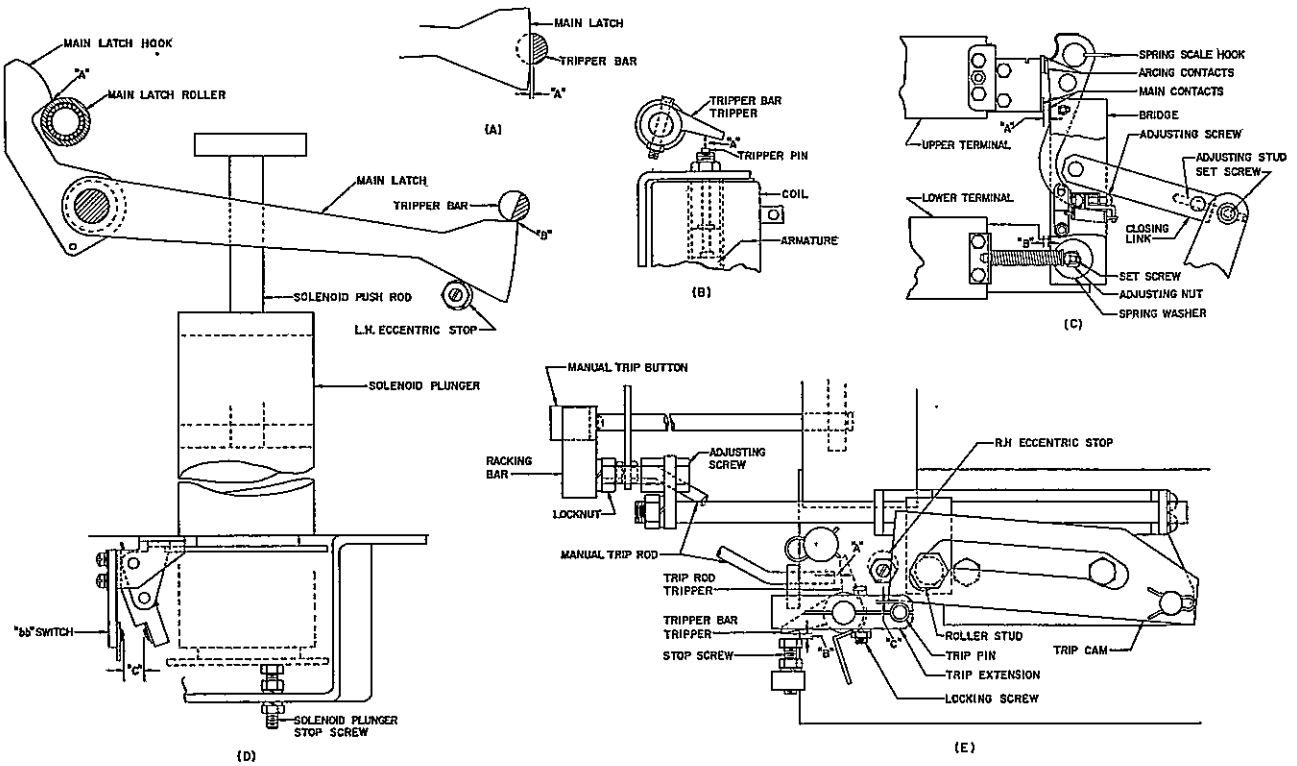
2. Turn adjusting nuts in direction to increase or decrease the pull as required and again check for correct pull with the spring scale. Tighten the set screws in the adjusting nuts when the adjustment is correct.

#### Tripper Bar

Inspect the tripper bar and associated parts for the following:

1. The tripper bar should have a slight amount of side play, but not more than 1/32 inch.

2. Some clearance must be maintained between the shunt trip tripper pin and tripper bar tripper at "A", Fig. 9 (B).




Dwg. S-14325

***Fig. 9—Mechanical Schematic of Adjustments for Type 5HV-50 Circuit Breakers***

3. Some clearance must be maintained between the manual trip rod and trip rod tripper at "A", Fig. 9 (E). Check for this clearance by holding the tripper bar tripper down and then pushing the manual trip button. It should be possible to feel a slight inward movement of the trip button, approximately 3/32 inch.

### Tripper Bar Overtravel

The tripper bar overtravel, after it reaches the tripping point, should be between 0.002 inch (minimum) and 0.008 inch (maximum). With the circuit breaker in the "OPEN" position, check for correct overtravel by holding the tripper bar in the fully tripped position while the main latch is held as shown in Fig. 9 (A).

If adjustment is required, turn the right-hand eccentric, Fig. 9 (E), until the required clearance is obtained between the tripper bar face and the main latch at "A", Fig. 9 (A). Be sure and tighten the locknut on the right-hand eccentric after making any adjustment.

### Tripper Bar Latch Bite

The tripper bar latch bite adjustment is accurately made at the factory. However, if adjustment is necessary, proceed as follows:

1. Turn stop screw, Fig. 9 (E), down to insure sufficient latch bite to close the circuit breaker.
2. Close the circuit breaker.
3. Turn stop screw up slowly with backward pressure on the tripper bar until the circuit breaker trips.
4. Turn stop screw down 3 full turns and tighten locknut.

A check test, for correct adjustment, can be made by placing a 0.150 inch feeler gauge between the stop screw and tripper bar tripper at "B", Fig. 9 (E). Hold the tripper bar tripper against the feeler gauge and manually close the circuit breaker. The circuit breaker should remain closed when the tripper bar tripper is released. If the circuit breaker trips, adjust the stop screw as described above.

### Main Latch

The gap at "A", Fig. 9 (D), between the main latch hook and main latch roller, should be 0.020 inch to 0.030 inch with the circuit breaker in the "OPEN" position. The plunger stop screw at the bottom of the solenoid can be adjusted to produce the given dimension. Lowering the stop screw will increase the gap at "A", Fig. 9 (D) and vice versa. When the adjustment is correct, the stop screw must be locked securely, with its locknut.

### Main Latch Reset Stop

The solenoid should be in its normal reset position. The reset stop point of the main latch is adjusted by turning the eccentric stop on the left-hand side of the mechanism housing as shown in Fig. 9 (D). When the stop is adjusted correctly, there will be a clearance of 0.002 to 0.005 inch between the tripper bar tripper and the main latch at "B", Fig. 9 (D). Any amount in excess of this measurement will cause unnecessary hammering of the latch against the latch surface of the tripper bar. If any change is made in the adjustment, be sure and tighten the locknut on the eccentric.

### "bb" Switch

The "bb" switch is connected in series with the operating coil of the control relay. The "bb" switch contacts open and de-energize the relay operating coil the instant the solenoid plunger reaches the end of its closing stroke.

The "bb" switch should have approximately a 3/8 inch break at "C", Fig. 9 (D) when the solenoid plunger is at the top of its stroke.

### Auxiliary Switch Contacts

A circuit-continuity indicating means should be used to test the circuits of the auxiliary switch contacts at the point where they are wired to the control separable contacts. (Refer to the wiring diagram furnished with each installation.)

Manually close the circuit breaker and test for electrical continuity through the normally open "a" contacts.

Open the circuit breaker and test for electrical continuity through the normally closed "b" contacts.

### Shunt Trip Tripper Travel

With the shunt trip armature, Fig. 9 (B), held all the way up, there should be a clearance between the tripper bar stop screw and the tripper bar tripper of not less than 0.222 inch and not more than 0.284 inch at "B", Fig. 9 (E).

The tripper bar travel on circuit breakers having capacitor trip (shunt trip) is adjusted as described above.

### Capacitor Trip

The capacitor should be tested for normal a-c trip. At normal voltage, the capacitor should have sufficient charge to trip the circuit breaker after the control voltage has been disconnected for 60 seconds.

### Racking Trip Cam

CAUTION: DE-ENERGIZE THE PRIMARY CIRCUIT BEFORE CHECKING THE RACKING TRIP CAM ADJUSTMENT.

A check test for correct racking trip cam adjustment can be made with the circuit breaker in the switchboard compartment as follows:

With the circuit breaker in the "TEST" position and the contacts closed, slowly rack the circuit breaker toward the "OPERATING" position. The circuit breaker should trip with 5 turns (maximum) of the racking crank. Rack the circuit breaker to the "OPERATING" position and count the number of turns necessary to trip the circuit breaker while slowly racking it toward the "TEST" position. The circuit breaker should trip between 3 and 5 turns of the racking crank.

If the circuit breaker does not trip with the recommended number of turns described above, remove the circuit breaker from the switchboard and adjust the racking trip cam as follows:

Check the gap as "C", Fig. 9 (E) with the racking bar first racked against its stop in the "OUT" position and again when the bar is racked against its stop in the "IN" position. In both extreme positions of the racking bar, the gap at "C", Fig. 9 (E) should be approximately 1/8 inch. Adjustment to this dimension is made by loosening the locknut on the adjusting screw, Fig. 9 (C), and turning it in the direction required to produce the given dimension. Be sure and tighten the locknut after making any adjustments.

After the gap at "C" is adjusted, rack the bar to the half-way position which is identified by the roller stud being in the center of the slot in the trip cam. With the roller stud and trip cam so positioned, insert a 1/32 inch gauge between the trip cam and the trip pin. Adjustment is made by loosening the locking screw and turning the trip extension in the direction required to produce the 1/32 inch free motion. Be sure and tighten the locking screw after making any adjustment.

## APPLYING CONTROL POWER

The circuit breaker is now ready for electrical tests. Provide an adequate source of supply for the test station, as a current load equivalent to 25 amperes at 125 volts a-c or d-c will be drawn by the circuit breaker closing coil during the closing cycle.

Move the circuit breaker so that it is within easy reach of the test station jack. Check to make sure that the control switch in the test station is in the "OFF" position. Remove the test jack from the test station compartment and install the test jack on the control separable contacts at the left-hand side of the circuit breaker. Make sure the marked contacts of the test jack meet the marked control separable contacts on the circuit breaker in direct relationship.

Energize the test station and proceed to close and trip the circuit breaker by means of either the test switch (4, Fig. 8) or the test station control switch.

### Control Relay

The control relay operates to close the circuit breaker as described in section ELECTRICAL CLOSING. For test purposes, check the control relay for correct sequence of operation as follows:

Depress and hold the "CLOSE" button of the test switch (4, Fig. 8). The relay should pickup immediately and remain attracted to the magnet of the pick-up coil until the solenoid reaches the end of its closing stroke. At this point of the closing stroke, the pick-up coil is de-energized and the relay armature is attracted to the magnet of the holding coil. The armature will remain attracted to the magnet of the holding coil and all the 52X contacts will remain open until the "CLOSE" button is released. Upon release of the "CLOSE" button, the armature will return to its normal de-energized position and the 52X-4 contact will close.

If the control relay fails to interrupt the closing coil circuit upon completion of the closing stroke, or if the relay fails to operate when energized, recheck the "bb" switch adjustment.

## REMOVING CONTROL POWER

This completes the electrical tests of the circuit breaker. De-energize the test station and place the control switch in the "OFF" position. Disconnect the test jack from the control separable contacts and replace the test jack in the test station compartment.

## RE-INSTALLING CIRCUIT BREAKER

Before inserting the circuit breaker in the switchboard, place the arc chutes in their normal position, connect the lower lead connections, and replace the interphase barrier assembly. The arc chutes and interphase barrier are replaced by following the reverse of the procedure described under ARC CHUTES and INTERPHASE BARRIER in section MAINTENANCE.

Replace the circuit breaker in the switchboard as described under INSERTING CIRCUIT BREAKER in section INSTALLATION.

## RENEWAL PARTS

It is recommended that sufficient renewal parts be stocked to facilitate proper maintenance and replacement of parts. The quantity of parts and items carried in stock should be based on the number of circuit breakers in service and previous operating experience.

When ordering renewal parts, address the nearest Sales Office of the I-T-E Circuit Breaker Company. Specify the type and serial number of the circuit breaker, description of part, and quantity required.

***These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the I-T-E Circuit Breaker Company.***

## BIBLIOGRAPHY


| *Title* | *Bulletin No.* |
|---|---|
| Type L Auxiliary Switches | IB-1003-AUX |
| Type L2 Auxiliary Switch | IB-5504 |
| Type R-14 Control Relay | IB-5412 |


The above listed instruction bulletins can be obtained by requesting copies from the nearest Sales Office of the I-T-E Circuit Breaker Company.

## Consult Our Sales Offices

The I-T-E Circuit Breaker Company is represented in all principal cities of the United States and Canada. These representatives are experienced and are competent to make correct applications, as well as give complete information and prices. We suggest you consult the representative nearest you.

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