NAVSHIPS 362-2191

SWITCHBOARD
Technical Manual

PART 2

CIRCUIT BREAKERS

CHAPTER 4

NAVY TYPE ACB-3200HR

WESTINGHOUSE TYPE DBN-1032

3200-AMPERE FRAME SIZE

CHAPTER 5

NAVY TYPE ACB-4000HR

WESTINGHOUSE TYPE DBN-1040

4000 AMPERE FRAME SIZE

REMOVABLE ASSEMBLIES OF STANDARDIZED DIMENSIONS

WESTINGHOUSE ELECTRIC CORPORATION
EAST PITTSBURGH, PA., U.S.A.

TECHNICAL MANUAL 32-855-4C1

BUREAU OF SHIPS • NAVY DEPARTMENT • FEBRUARY, 1960

PRELIMINARY DATA

INTERCHANGEABILITY OF CIRCUIT BREAKERS

This manual covers both type ACB-3200HR and ACB-4000HR circuit breakers since they are both fully interchangeable in performance or as a complete removable assembly. The type ACB-300HR is furnished with overcurrent coils 2000, 2400, 2800 and 3200 amperes. The type ACB-4000HR is furnished with 4000 ampere overcurrent coils. Internal difference between the units is only in the overcurrent trip devices.

PURPOSE

A circuit breaker has two fundamental purposes: First, to perform normal switching operations to isolate a circuit, and second, to isolate a circuit under fault conditions.

CAUTION - WARNING - THE CIRCUIT BREAKER SHOULD BE IN THE OPEN POSITION AND THE SWITCHBOARD DE-ENERGIZED BEFORE INSTALLING, ADJUSTING, INSPECTING, REPLACING PARTS, OR REMOVING THE CIRCUIT BREAKER. IF THE BUS CANNOT BE DE-ENERGIZED, USE INSULATED HANDLE TOOLS, RUBBER GLOVES, AND A RUBBER FLOOR MAT.

INSTALLATION

The movable component must be removed before stationary component can be bolted in switchboard. Normal care in handling the stationary component is sufficient.

After securing the stationary component the movable component should be lifted by hooks in the "lifting holes".

When installing the circuit breaker, care should be taken to see that the supporting surface is even and vertical, and that all leads to be connected to the circuit breaker are de-energized. Protect the circuit breaker from dirt and possible damage.

The connections to the circuit breaker studs should be cleaned, flat and free of burrs to assure full contact area, and firmly clamped or bolted in place to prevent excessive heating. The connecting cables should be supported so that the circuit breaker studs will not be subjected to unnecessary strain.

At no time should the circuit breaker be allowed to rest upon or be supported by the current studs. This will result in unnecessary damage and stress to the studs and the insulated moldings.

Any discoloration or pitting of the circuit breaker contacts in evidence when the circuit breaker is received from the manufacturer is caused by calibrating the breaker and will in no way interfere with proper functioning of the circuit breaker.

MAINTENANCE

Periodic inspection of the breaker is recommended. An inspection should always be made after it is known that the breaker has opened on a severe short circuit. When a circuit breaker is not operated for long periods of time, a high resistance oxide or sulfide may form on the contact surfaces which results in overheating. To burn off this high resistance film, operate the circuit breaker several times under normal load at regular inspection periods.

Be sure the breaker is disconnected from all sources of power before inspecting or repairing.

If excessive heating occurs, look for loose or corroded contacts or connections.

When inspecting the breaker, examine the contacts to see if there has been any severe pittings or burning of the contact surfaces which will prevent proper contact wipe. Rough or high spots should be removed with a very fine clean file or fine clean sandpaper.

LUBRICATION

In general, the breaker mechanism requires very little lubrication which should be applied sparingly. Any excessive amount of oil on the breaker parts is apt to collect dust and is to be avoided.

The lubrication applied during manufacture should be sufficient for the life of the breaker.

REPLACING PARTS

Before replacing any part, the operator should note the position of each part before removing.

When removing or replacing tension springs with hooks, the work may be facilitated by pulling on the hooks with a cord or a wire.

TABLE OF CONTENTS

Description	Page
CHAPTER 1 - GENERAL INFORMATION	1-1
SECTION 0 - GENERAL DATA	1-1
CIRCUIT BREAKER CHARACTERISTICS	1-1
Rating of Components	1-1
Auxiliary Switch	1-2
SECTION 1 - INTRODUCTION	1-2
GENERAL	1-2
SECTION 2 - DETAILED DESCRIPTION	1-5
CIRCUIT BREAKER	1-5
General	1-5
Movable Component	1-5
Pole Unit	1-5
Arc Chute	1-7
Operating Mechanism	1-7
Closing Relay	1-9
Closing Solenoid	1-9
Shunt Trip Device	1-12
Anti-Shock-Close Device	1-13
Anti-Shock-Open Device	1-13
Series Overcurrent Trip Unit	1-14
Auxiliary Switch	1-19
Main Disconnects	1-19
Secondary Disconnects	1-19
Indicator Lights	1-20
Silicon Rectifier	1-20
Cell Interlock	1-21
Levering-in Device	1-21
Stop	1-22
Extension Rails	1-22
CHAPTER 2 - PRINCIPLES OF OPERATION	2-1
SECTION 1 - GENERAL PRINCIPLES	2-1
GENERAL	2-1
Description	2-1
Closing	2-1
Tripping	2-3
Electrical Operation	2-3
CHAPTER 3 - OPERATING INSTRUCTIONS	3-1
SECTION 1 - PRECAUTIONS	3-1
SAFETY PRECAUTIONS	3-1

TABLE OF CONTENTS (Cont'd)

Description	Page
CHAPTER 4 - INSTALLATION	4-1
SECTION 1 - INSTALLATION INSTRUCTIONS	4-1
GENERAL	4-1
CHAPTER 5 - MAINTENANCE	5-1
SECTION 1 - PREVENTIVE MAINTENANCE	5-1
PERIODIC PROCEDURES	5-1
General	5-1
SECTION 2 - CORRECTIVE MAINTENANCE	5-1
GENERAL INSTRUCTIONS	5-1
General	5-1
Movable Component	5-1
Pole Units	5-1
Arc Chute	5-2
Operating Mechanism	5-2
Closing Relay	5-3
Closing Solenoid	5-4
Shunt Trip Device	5-4
Anti-Shock-Close Device	5-4
Anti-Shock-Open Device	5-4
Overcurrent Trip Device	5-4
Auxiliary Switch	5-5
Main Disconnect	5-5
Secondary Disconnects	5-5
Indicator Lights	5-5
Silicon Rectifier	5-6
Cell Interlock	5-6
Levering-in Device	5-6
Stop	5-6
Extension Rails	5-6
CHAPTER 6 - PARTS LIST	6-1
SECTION 1 - PARTS LIST INTRODUCTION	6-1
PARTS IDENTIFICATION	6-1
Circuit Breaker	6-1
Repair Part Ordering	6-1
SECTION 2 - REPAIR PARTS TABULATION	6-1
REPAIR PARTS TABULATION	6-1
Repair Parts	6-1
CHAPTER 7 - DRAWINGS	7-1
SECTION 1 - GENERAL	7-1

LIST OF ILLUSTRATIONS

CHAPTER 1 - GENERAL INFORMATION

SECTION 1 - INTRODUCTION

Figure		Page
1-1-1	Removable Assembly and Stationary Component	1-3
1-1-2	Movable Component	1-4

SECTION 2 - DETAILED DESCRIPTION

1-2-1	Circuit Breaker Movable Component	1-5
1-2-2	Arc Chute and Pole Unit Assembly	1-6
1-2-3	Operating Mechanism with Position Indicator	1-8
1-2-4	Closing Relay	1-10
1-2-5	Closing Solenoid and Relay Trip Assembly - Electrically Closed Breakers	1-11
1-2-6	Shunt Trip Device	1-12
1-2-7	Anti-Shock-Close Device	1-13
1-2-8	Anti-Shock-Open Device	1-14
1-2-9	Typical Time Current Curves	1-15
1-2-10	Overcurrent Trip Device	1-16
1-2-11	Auxiliary Switch	1-18
1-2-12	Main and Secondary Disconnects	1-19
1-2-13	Indicator Light	1-21
1-2-14	Silicon Rectifier	1-21
1-2-15	Cell Interlock	1-22
1-2-16	Levering-in Device and Stop Assembly	1-23

CHAPTER 2 - PRINCIPLES OF OPERATION

SECTION 1 - GENERAL PRINCIPLES

2-1-1	Wiring Diagram	2-2
2-1-2	Schematic Symbols	2-3

CHAPTER 5 - MAINTENANCE

SECTION 2 - CORRECTION MAINTENANCE

5-2-1	Relay Contact Adjustment	5-3

CHAPTER 7 - DRAWINGS

SECTION 1 - GENERAL

7-1-1	Air Circuit Breaker Removable Assembly, DBN-1032	7-3,7-4
7-1-2	Air Circuit Breaker Stationary Assembly, DBN-1032	7-5,7-6
7-1-3	Air Circuit Breaker Removable Assembly, DBN-1040	7-7,7-8
7-1-4	Air Circuit Breaker Stationary Assembly, DBN-1040	7-9,7-10

LIST OF TABLES

CHAPTER 1 - GENERAL INFORMATION

SECTION 0 - GENERAL DATA

Table		Page
1-0-1	Circuit Breaker Classification Data	1-1
1-0-2	Current Rating of Components	1-1
1-0-3	Voltage Rating of Components	1-2
1-0-4	Auxiliary Switch	1-2

CHAPTER 1
GENERAL INFORMATION
Section 0—General Data

1-0-1 CIRCUIT BREAKER CHARACTERISTICS

The circuit breaker classification data is listed in Table 1-0-1.

TABLE 1-0-1—CIRCUIT BREAKER CLASSIFICATION DATA

Types	Navy Type ACB-3200HR; WE Corp. DBN-1032 ACB-4000HR; WE Corp. DBN-1040
Frame Sizes (continuous rating)	Type ACB-3200HR 3200 Amps. ACB-4000HR 4000 Amps.
Voltage	500 Volts
Current	A-C
Frequency	60 Cycles
Poles	3
Continuous Current Rating (Trip Coil)	ACB-300HR-2000, 2400, 2800, 3200 Amps. ACB-4000HR 4000 Amps.
Interrupting Capacity	100,000 (RMS) Amperes
Short Time Rating	100,000 (RMS) Amperes
Short Time Duration	35 Cycles
Means of Closing	Electrical and Emergency, Manual
Auxiliary Switch	12
Mounting	Removable Assembly-Dead Front
Connections	Back
Insulation Class	B
Shock Classification	Class HI
Ambient Temperature	50°C
Protective Functions	Overcurrent Long Delay Tripping Short Delay Tripping (Bands 2, 3 & 4) Instantaneous Tripping Shunt Trip
Master Drawings	3200HR - Westinghouse 900J233 (2 Sheets) 4000HR - Buships 3313912 Westinghouse 900J065 (2 Sheets)
Navy Test Approval	N. Y. Lab. 5419-23 of 29 May 1958
Weights	
Complete Removable Assembly	890 lbs
Movable Component Only	570 lbs
Stationary Component Only	320 lbs
Overcurrent Device	12 lbs

1-0-1-1 Rating of Components

The rating of the components are listed in Table 1-0-2 and 1-0-3.

TABLE 1-0-2—CURRENT RATING OF COMPONENTS

COMPONENTS	DUTY (AMPERES)	LOAD DURATION (SECONDS)	ALLOWABLE OPERATIONS PER MINUTE
115V. Closing Relay	4 Intermittent	1/5	10
450V. Closing Relay	1 Intermittent	1/5	10
115V. Closing Magnet	80 Intermittent	1/10	10
450V. Closing Magnet	20 Intermittent	1/10	10
115V. Shunt Trip	4 Intermittent	1/10	10
450V. Shunt Trip	1 Intermittent	1/10	10
Auxiliary Switch	15 Intermittent	(For interrupting ratings see table)	
Secondary Disconnects	15 Intermittent	(No interrupting rating)	
Wiring to Aux. Switch	10 Intermittent	(Unless contract specifies more)	

TABLE 1-0-3—VOLTAGE RATING OF COMPONENTS

COMPONENTS	NOMINAL RATING (VOLTS)	VOLTAGE RANGE (VOLTS)
Closing Relay and Magnet	115	90-130
	450	360-500
Shunt Trip	115	80-130
	450	360-500

1-0-1-2 Auxiliary Switch

The interrupting capacities of the auxiliary switch contacts are listed in Table 1-0-4.

TABLE 1-0-4—AUXILIARY SWITCH

VOLTS	NON-INDUCTIVE CIRCUIT	INDUCTIVE CIRCUIT
115 a-c	75 amps.	15.0 amps.
450 a-c	25 amps.	5.0 amps.

Section 1—Introduction

1-1-1 GENERAL

This manual describes the Navy Types ACB-3200HR and 4000HR (Westinghouse Types DBN-1032 and 1040) 3200 and 4000 ampere frame size air circuit breakers, meeting the requirements of Specification MIL-C-17587 for Naval Shipboard service.

Each circuit breaker is supplied as a complete, removable switchboard assembly consisting of circuit breaker, separable disconnects and associated control wiring and drawout mechanism and assembly structural supports and back plate including stationary main bus connections and stationary terminals for connection of the necessary external control wiring.

The complete, removable assembly consists of two major components, the stationary component that is bolted into the switchboard frame, and the movable component which is the operating mechanism of the circuit breaker and may be drawn out for inspection, maintenance or isolation from the shipboard electrical system.

The general arrangement of this equipment is shown in Figures 1-1-1 and 1-1-2.

This manual describes both the Navy Type ACB-3200HR air circuit breaker and the Navy Type ACB-4000HR air circuit breaker, since they are fully interchangeable as to installation and operation except for overcurrent trip ratings.

The DBN-1032 or 1040 circuit breaker is a complete, removable assembly for installation within a switchboard cubicle.

The circuit breaker is designed as an assembly including the drawout mechanism. These assemblies incorporate disconnect features for both main current connections and secondary current connections. This mounting allows easy removal and installation of the movable component when maintenance operations are required.

The circuit breaker is closed electrically from a local or remote control switch. It may be tripped from the control switch or may be tripped by depressing the "push-to-trip" button which protrudes through the face plate.

For maintenance, an emergency closing handle provides manual closing by inserting the operating handle through the face plate into the socket provided in the operating mechanism and pulling the operating handle down (down approximately 45 degrees) until the breaker latches.

The DBN-1032 and 1040 air circuit breakers are especially designed so that the stationary component which is secured inside the cell of a switchboard functions through special devices to allow withdrawal or insertion of the moving component. The special devices include the extension rails, rollers, and levering device. These units incorporate quick disconnect features for both main current connections and secondary current connections. This special mounting allows easy removal and installation when maintenance operations are required.

The moving component of the breaker consists of a rigid metal chassis to which are bolted various sub-assemblies. Each sub-assembly is a complete unit and is readily interchangeable between breakers. In addition, each sub-assembly may be removed intact and easily replaced for minimum outage time.

The sub-assemblies required in all breakers are the mechanism, pole units, arc chutes, aux-

iliary switch, secondary disconnects, anti-shock-closed, anti-shock-open closing relay and closing magnet. The remaining sub-assemblies that may be included are overcurrent trip devices and shunt trip device.

The circuit breaker for three phase a-c service is normally provided with series overcurrent trip devices in the two outer poles, otherwise the three poles are identical.

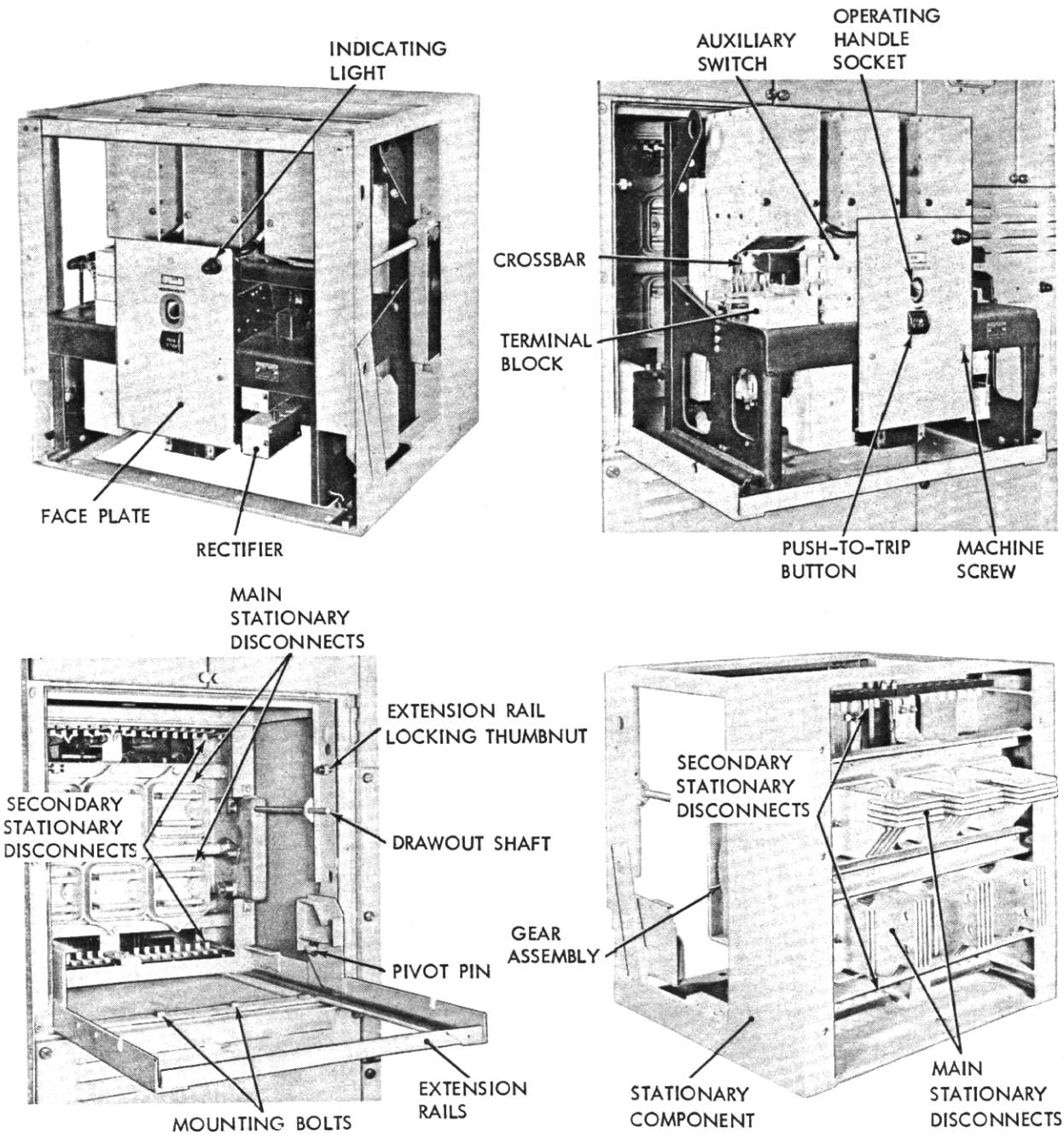
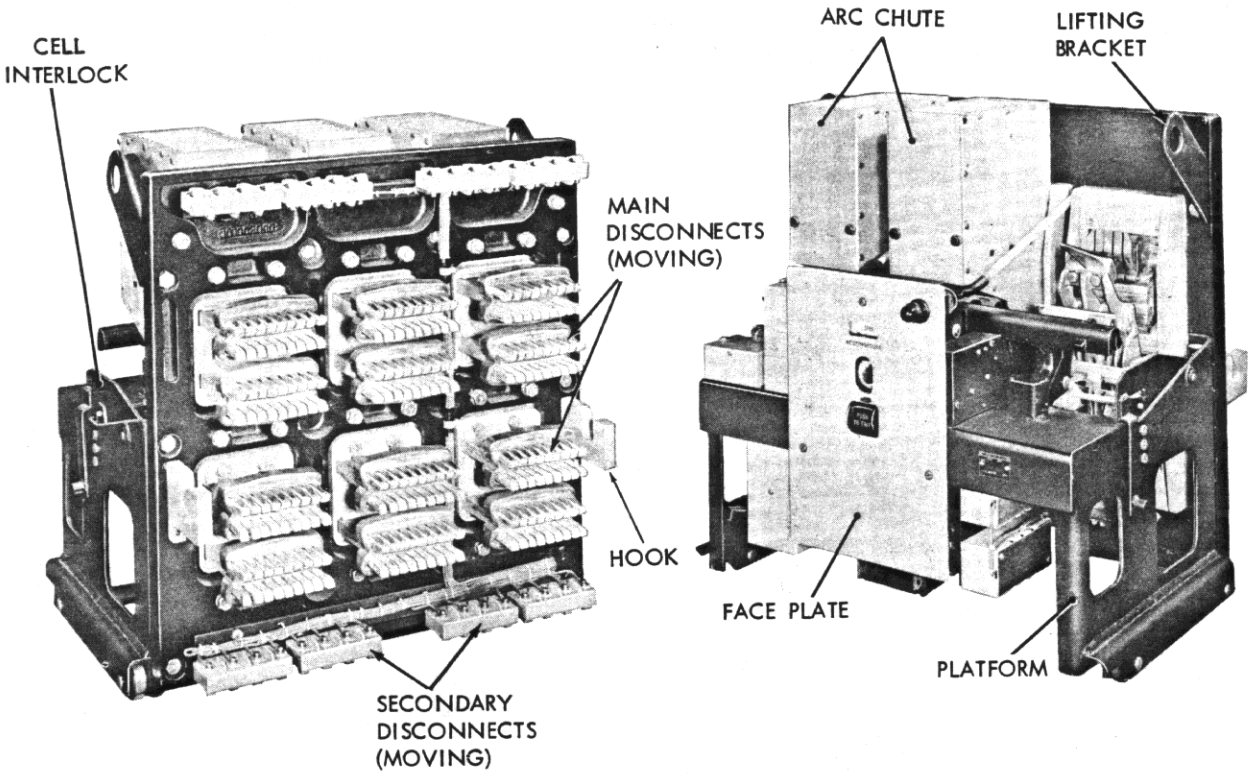


FIGURE 1-1-1 — Removable Assembly and Stationary Component



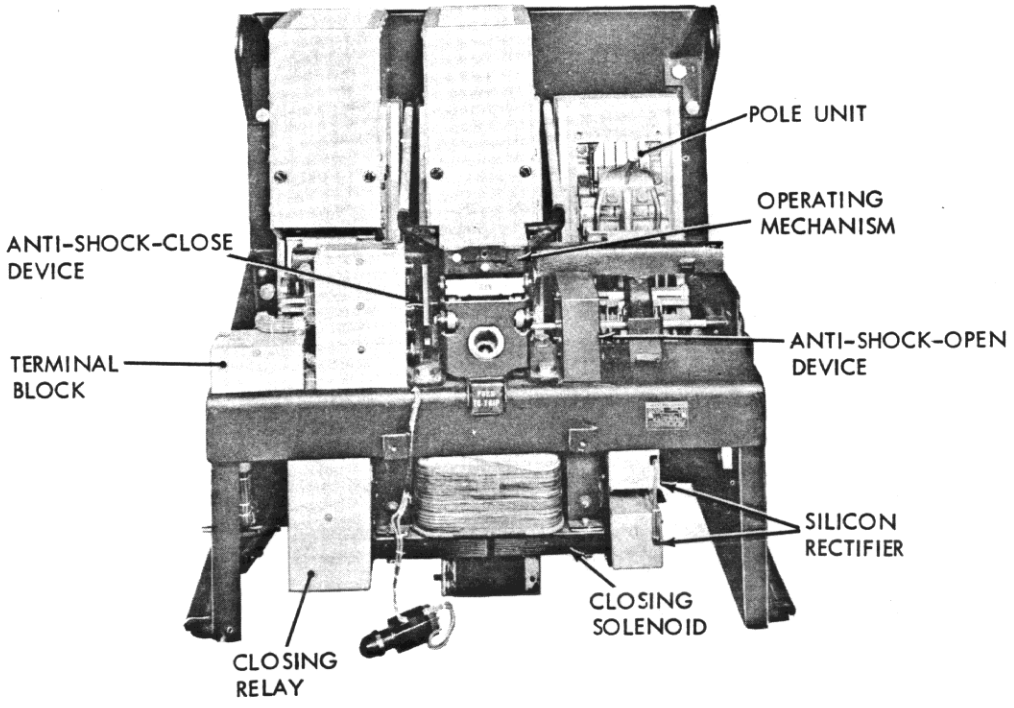


FIGURE 1-1-2 — Movable Component

Section 2—Detailed Description

1-2-1 CIRCUIT BREAKER

1-2-1-1 General

Paragraph 1-1-1 describes the general detail and subsequent paragraphs describe various sub-assemblies in detail.

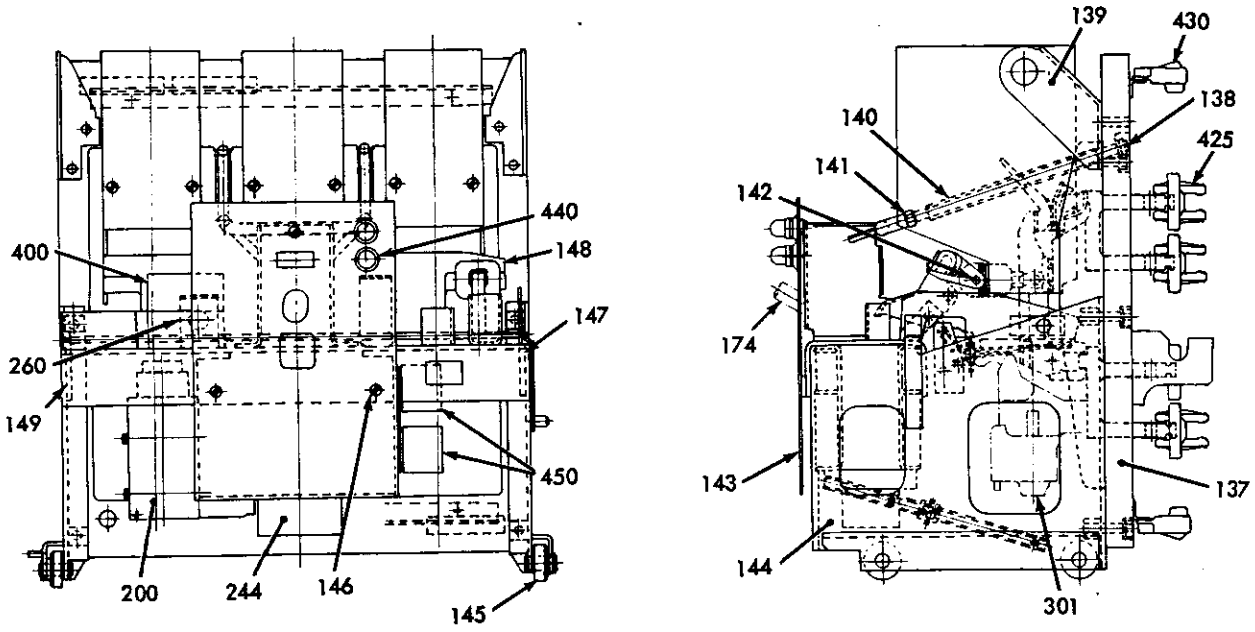
1-2-1-2 Movable Component—(See Figure 1-2-1)

The assembly consists of a rigid aluminum panel (137) and platform (144) with integral shelf. The platform is bolted to the front of the aluminum panel. Roll out wheels (145) are attached on the bottom of the platform on each side. Two lifting brackets are secured, one on each side, on the aluminum panel.

1-2-1-3 Pole Unit—(See Figure 1-2-2)

Three separate pole units are bolted to the front of the aluminum panel, one for each of the three phases. Each pole unit consists generally of a base, a stationary contact assembly and a moving contact assembly. The base is molded from Navy Type MAJ-60 insulating material and isolates the stationary and moving contacts from the chassis.

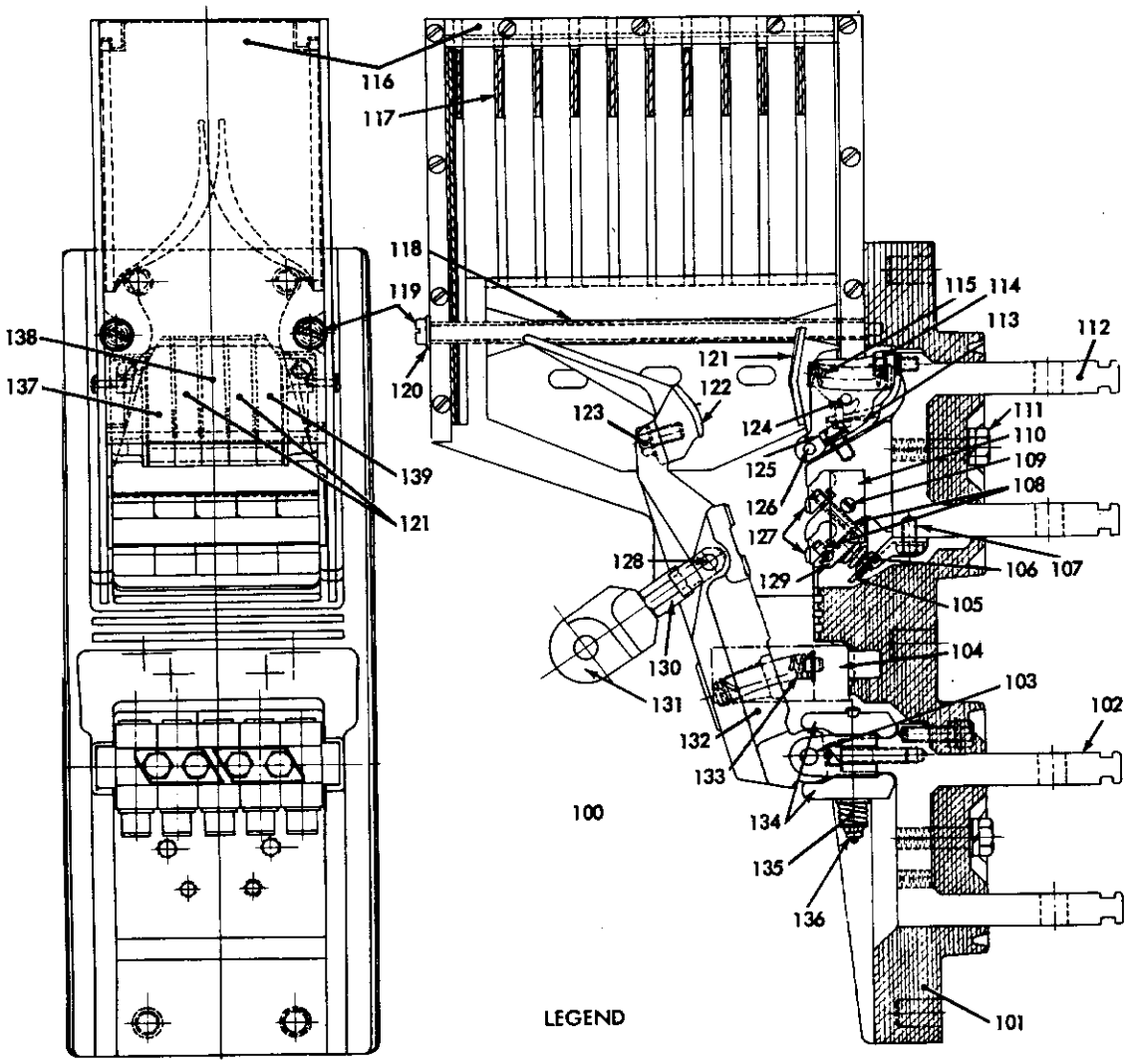
The stationary contact assembly consists of the upper stud (112), the main contact fingers (127), pins (108), pressure plate (129), main contact spring (106), arcing contacts (121), (137), (138) and (139), the arcing contact spring (115), pin (126) and shunt (113). The main stationary



LEGEND

137	PANEL
138	TIE STUD
139	LIFTING BRACKET
140	TUBE
141	NUT
142	PIN
143	FACE PLATE
144	PLATFORM
145	ROLLOUT WHEELS
146	SCREW
147	BRACKET
148	CROSS BAR
149	BRACKET
174	OPERATING HANDLE
200	CLOSING RELAY
244	CLOSING SOLENOID
260	SHUNT TRIP DEVICE
301	OVERCURRENT TRIP DEVICE
400	AUXILIARY SWITCH
425	MAIN DISCONNECT
430	SECONDARY DISCONNECT
440	INDICATING LIGHT
450	SILICON RECTIFIER

FIGURE 1-2-1 — Circuit Breaker Movable Component



LEGEND

100	POLE UNIT
101	BASE
102	LOWER STUD
103	PIN
104	OVERCURRENT STATIONARY YOKE
105	SPRING SUPPORT
*106	SPRING, MAIN CONTACT
107	SCREW
108	PIN
109	SCREW
110	PLATE
111	BOLT
112	UPPER STUD
113	SHUNT
114	BOLT
*115	SPRING, STATIONARY ARCING CONTACT
116	ARC CHUTE
117	PLATE
118	INSULATING TUBE
119	SCREW
120	WASHER
*121	STATIONARY ARCING CONTACT
*122	MOVING ARCING CONTACT
123	BOLT
124	STOP PIN
125	BOLT
126	PIVOT PIN
127	MAIN CONTACT FINGER
128	PIN
129	PRESSURE PLATE
130	TURNBUCKLE
131	INSULATING LINK
132	MOVING CONTACT ARM
*133	SPRING, ACCELERATING
134	AUXILIARY CONTACT
*135	SPRING, AUXILIARY CONTACT
136	STOP NUT
*137	STATIONARY ARCING CONTACT, L.H.
*138	STATIONARY ARCING CONTACT, LEADING
*139	STATIONARY ARCING CONTACT, R.H.

*REPAIR PARTS

FIGURE 1-2-2 — Arc Chute and Pole Unit Assembly

contact is bolted to the base (101) and the arcing contact is pivoted on pin (126). The main and arcing contacts are connected electrically by means of shunt (113).

The main stationary contact fingers (127) are inserts which pivot in sockets. Main contact pressure is equalized by the main contact spring (106) through pressure plate (129) and pressure pins (108).

Limited rotation about pin (126) provides for arcing contact overtravel while the arcing contact spring (115) maintains the required contact pressure. The arcing contact closes first and is the last to part thus protecting the main contacts. The contact surfaces of the arcing contacts are special arc resistant alloy inserts.

The moving contact assembly consists of a contact arm (132) of copper to which is fastened arcing contact (122) by two bolts (123) which are secured by locking clips. The main contacts are an integral part of the moving contact arm and the contact tips are silver brazed in position. The auxiliary contacts (134) carry the current from the moving contact assembly to the lower stud. Spring (135) provides the required contact finger pressure between the moving contact assembly and the lower stud.

1-2-1-4 Arc Chute—(See Figure 1-2-2)

The arc chute (116) mounted above and surrounding the contact assembly of each pole, stretches and cools the arc drawn between the separating contacts so that the arc may be extinguished and the circuit opened in the least possible time. The arc chutes are an extremely important part of the circuit breaker and a breaker should never be energized without their being mounted in place.

Each arc chute consists of a number of asbestos plates (117) supported in a laminated case and held in place by clamping plate, insulating tubes (118) and two screws (119) through the insulating tubes to the molded base (101). When the arc is drawn by the separating contacts, it moves up into the chute by magnetic and thermal action where it is quickly de-ionized and extinguished.

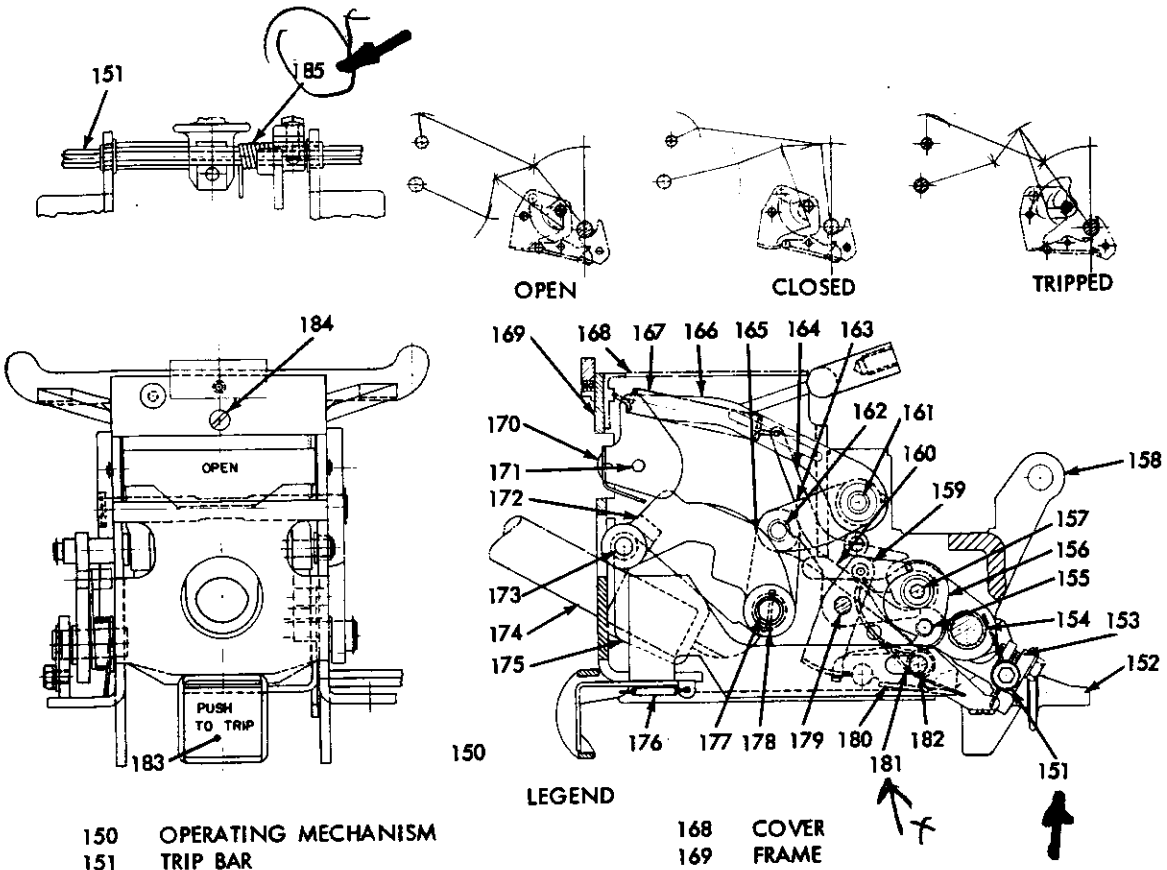
1-2-1-5 Operating Mechanism—(See Figure 1-2-3)

The operating mechanism opens and closes the circuit breaker by moving the crossbar (148) (Figure 1-2-1) to which the moving contact assemblies are attached. It is mounted on the top of the shelf at the center of the circuit breaker.

The operating mechanism consists of a group of toggle links, and latches attached to the operating mechanism frame (169) on fixed pins (154), (157), (171), (173), (179), and (182). The cross bar is held by the closing lever (158). Lowering the operating handle (174) moves the mechanism linkage from the open position shown in Figure 1-2-3 to the closed position shown. This is accomplished when the fork-type handle socket (175) forces the first toggle link (172) upward pushing second toggle link (165), third toggle link (163) and closing lever (158) ahead of it. The motion of the toggle linkages is directed by link (160) which is pivoted at its lower end on pin (155) in latch (156). Latch (156) in turn is restrained from moving by roller latch (159) which is pivoted on pin (179) and engages trigger (180) which is held by latch (153) on the trip bar. The linkage is held in the closed position by pawl (164) which latches under pin (162). In electrical operation, the plunger rod of the closing solenoid bears on pin (177) thus engaging linkage and closing the breaker.

The mechanism is opened by rotating trip bar (151) counterclockwise. This is accomplished either by pushing the PUSH-TO-TRIP button; in which case the pushbutton rotates latch (153), or by causing the tripping attachments to strike trip finger (152). In either case the counterclockwise rotation of the trip bar (151) moves trigger (180) out of engagement with the lower end of the roller latch (159), which in turn permits the roller latch to rotate counterclockwise out of engagement with latch (156). Latch (156) is then free to rotate in response to the pull of the latch link (160) so that the mechanism assumes the trip free position shown in Figure 1-2-3 in which the contacts are open but part of the mechanism levers are in the closed position. In this position, pawl (164) is disengaged permitting the linkage to collapse to the open position.

Position indicator (170) is an integral part of the mechanism, formed from sheet metal and pivoted on pin (171). It is visible from the front of the circuit breaker through a window in the faceplate and mechanism frame. With the circuit breaker in the open position shown in Figure 1-2-3, the yellow face of the indicator shows through the window. The word "OPEN" is stamped on this yellow face. When the breaker closes, pin (161) of the closing lever (158) pulls indicator link (166) to the right, thus rotating the other face of the indicator up into a position visible through the window. This face is painted blue and is stamped with the word "CLOSED". The position indicator



LEGEND

150	OPERATING MECHANISM	168	COVER
151	TRIP BAR	169	FRAME
152	TRIP FINGER	170	POSITION INDICATOR
153	LATCH	171	PIN
154	PIN	172	FIRST TOGGLE LINK
155	PIN	173	PIN
156	LATCH	174	OPERATING HANDLE (EMERGENCY)
157	PIN	175	HANDLE SOCKET (EMERGENCY)
158	CLOSING LEVER	*176	SPRING, TRIP BUTTON
159	ROLLER LATCH	177	PIN
160	LINK	178	COTTER PIN
161	PIN	179	PIN
162	PIN	180	TRIGGER
163	THIRD TOGGLE LINK	*181	SPRING, LATCH
164	PAWL	182	PIN
165	SECOND TOGGLE LINK	183	TRIP BUTTON
166	INDICATOR LINK	184	SCREW
*167	SPRING PAWL	*185	SPRING, TRIP BAR

*REPAIR PARTS

FIGURE 1-2-3 — Operating Mechanism with Position Indicator

NAVSHIPS 362-2191

provides a positive visual indication of the operating condition of the circuit breaker.

1-2-1-6 Closing Relay—(See Figure 1-2-4)

The closing relay is used on electrically operated breaker only and is mounted on the left side of the closing solenoid. This relay closes and opens the closing coil circuit of the solenoid, in electrical operation. The relay provides a means of closing the circuit breaker electrically from a remote point through a control switch.

The relay base (238) is molded from insulating material. The contact assemblies, coil assembly and other parts are attached to the base. Frame (203) holds the coil in place and serves as part of the magnetic circuit of coil (206). The frame or yoke is secured to the molded base by three screws (208). The coil (206) is held in place by guide tube (207). The relay is enclosed by molded cover (211) which is secured by screw (239).

The moving core (204) is free to slide up and down in the guide tube (207). In moving up in response to the magnetic pull from the stationary core when the coil is energized, the moving core pulls up latch (229) which is fastened with pin (227) to the moving core. When the coil (206) is energized, spring (225) bearing against latch (229) holds the latch in such a position that it is hooked under latch pin (230), causing moving contact arm assembly to rotate counterclockwise around contact arm pin (232), thereby compressing spring (235). The moving contacts (236) are thus pulled against the stationary contacts (237) completing the circuit.

As the pin (230) is moved upward toggle links (228) and (224) are raised. Toggle link (224) pivots on pin (223) and toggle link (228) is attached to the moving contact arm (234) which pivots on pin (232). As the toggle links move upward, the contact arm is rotated counterclockwise and the relay contacts are closed. When the relay contacts close, current starts flowing through the coil (250) (Figure 1-2-5) of the closing solenoid. The moving core (245) of the solenoid moves up closing the circuit breaker. Trip bracket (257) fastened to the moving core of the solenoid forces the first trip lever (225) of the relay trip assembly up; increased spring tension rotates second trip lever (253) which strikes the relay trip pin (201) (Figure 1-2-4) forcing it upward. The trip pin rotates the trip crank (220) which engages the latch (229) and rotates it clockwise against the torque exerted by torsion spring (225). The rotation of latch (229) disengages latch pin (230), the toggle links (224) and (228) collapse and spring (235) rotates the moving contact arm (234) clockwise to snap the moving contacts (236) away from the stationary contacts (237).

The main moving contacts (236) are fastened to the contact arm (234) which is molded from insulating material. Silver alloy contact tips are brazed on the contact legs.

The main stationary contacts are made from spring material and are "U" shaped. They are secured to the base by screws (240). The "U" shape arrangement causes a slight rolling and wiping action on the spherically shaped contact surfaces, as they meet, which helps to insure a positive electrical connection.

With the circuit breaker in the closed position, the trip pin (201) of the relay is held in the trip position. Therefore, even though the relay coil may be inadvertently energized when the circuit breaker is latched, the relay contacts will not close and no current can flow through the circuit breaker closing coil.

Two blow out coils (216) and (217) and two arc chambers are provided so that the arc drawn by the separating contacts may be extinguished and the circuit open in the least possible time. The blow out coils are held in place by two iron plates and secured by screws (218). The blow out magnet coil is connected in series with the contacts, which causes flux to flow through the magnetic circuit and the air gap of the blow out magnet assembly. The magnetic circuit is positioned so its air gap is across the arc chamber and the arc. At the time the contacts part and draw an arc, the arc is deflected by the magnetic force down into the arc chamber where it is extinguished due to the stretching and cooling process. This arrangement makes possible a small and efficient relay.

The relay is provided with a "seal-in" feature through the auxiliary contact (244) which can be connected in parallel with the control switch in the relay coil circuit. If this connection is made, once energized the relay will remain closed until breaker closing solenoid completes its stroke.

1-2-1-7 Closing Solenoid—(See Figure 1-2-5)

The closing solenoid is used to close the circuit breaker electrically and is mounted directly below the mechanism and under the platform of the circuit breaker. It is secured to the platform by the same four bolts that hold the mechanism in place.

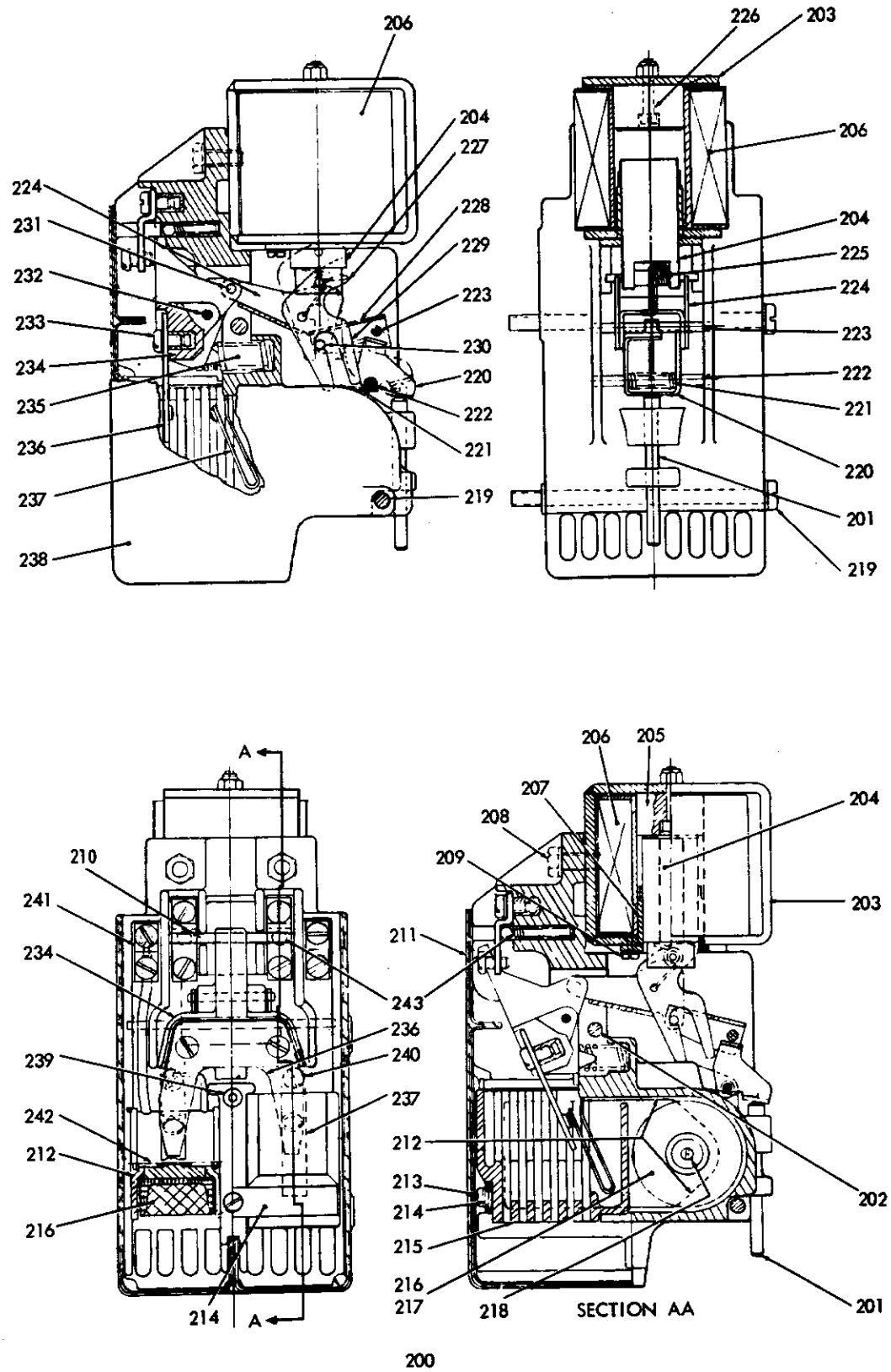
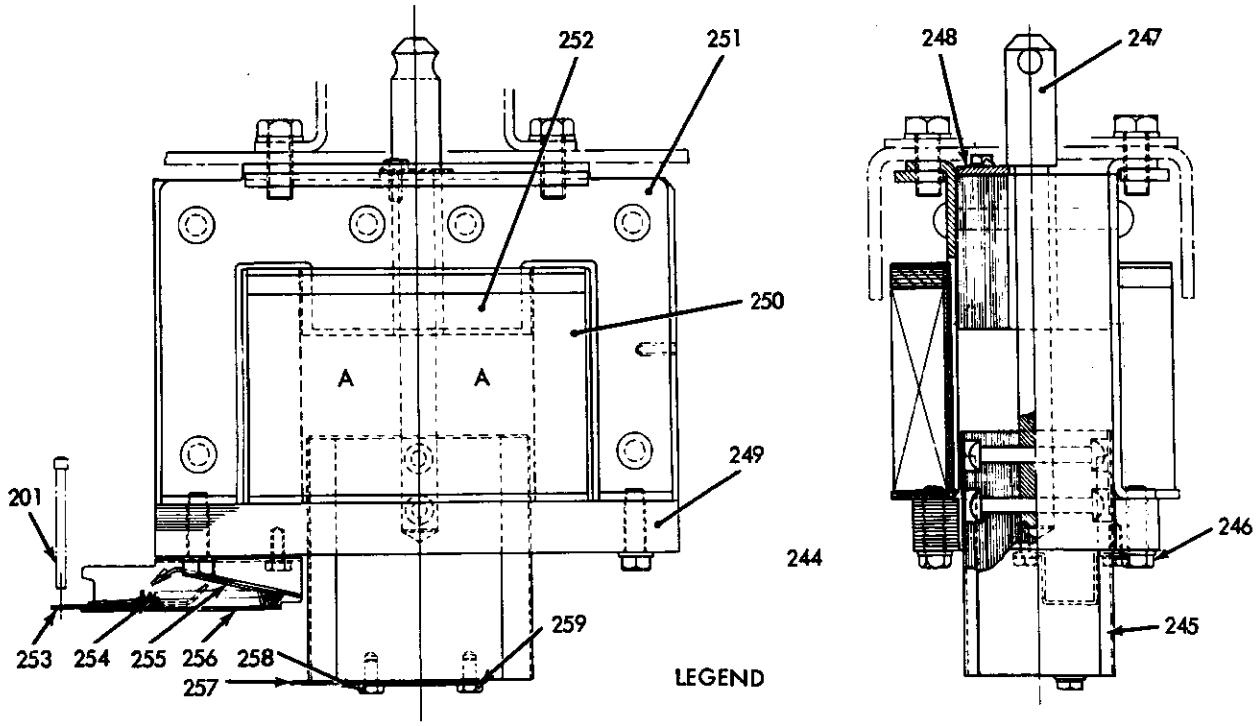


FIGURE 1-2-4 — Closing Relay for Solenoid

200 Closing Relay
201 Trip Pin
202 Pin
203 Coil Frame
204 Movable Core
205 Stationary Core
*206 Control Coil
207 Bushing
208 Mounting Screw
209 Bushing Screw
210 Contact, Auxiliary
211 Cover
212 Side Plate
213 Screw
214 Arcing Chamber Retaining Strip
215 Arcing Chamber
*216 Blow-out Coil-left Hand
*217 Blow-out Coil-right Hand
218 Side Plate Screw
219 Relay Mounting Screw
220 Trip Crank
*221 Spring, Trip
222 Trip Crank Pin
223 Pin
224 Second Toggle Link
*225 Spring, Latch
226 Stationary Core Mounting Bolt
227 Drive Pin
228 First Toggle Link
229 Latch
230 Pin
231 Pin
232 Pin
233 Movable Contact Screw
234 Movable Contact Arm
*235 Contact Arm Spring
*236 Movable Contact
*237 Stationary Contact
238 Base
239 Cover Screw
240 Stationary Contact Screw
241 Main Circuit Terminal
242 Magnetic Core
*243 Spring, Auxiliary Contact

*Repair Parts

FIGURE 1-2-4 — Closing Relay for Solenoid



LEGEND

244 CLOSING SOLENOID (D-C)
245 MOVING CORE
246 BOLT
247 OPERATING ROD
248 STOP
249 BOTTOM PLATE
* 250 COIL
251 FRAME
252 STATIONARY CORE
253 SECOND TRIP LEVER
* 254 SPRING, RELAY TRIP
255 FIRST TRIP LEVER
256 RELAY TRIP BRACKET
257 TRIP BRACKET
258 BOLT
259 LOCKPLATE
201 RELAY TRIP PIN

*REPAIR PARTS

FIGURE 1-2-5 — Closing Solenoid and Relay Trip Assembly— Electrically Closed Breakers

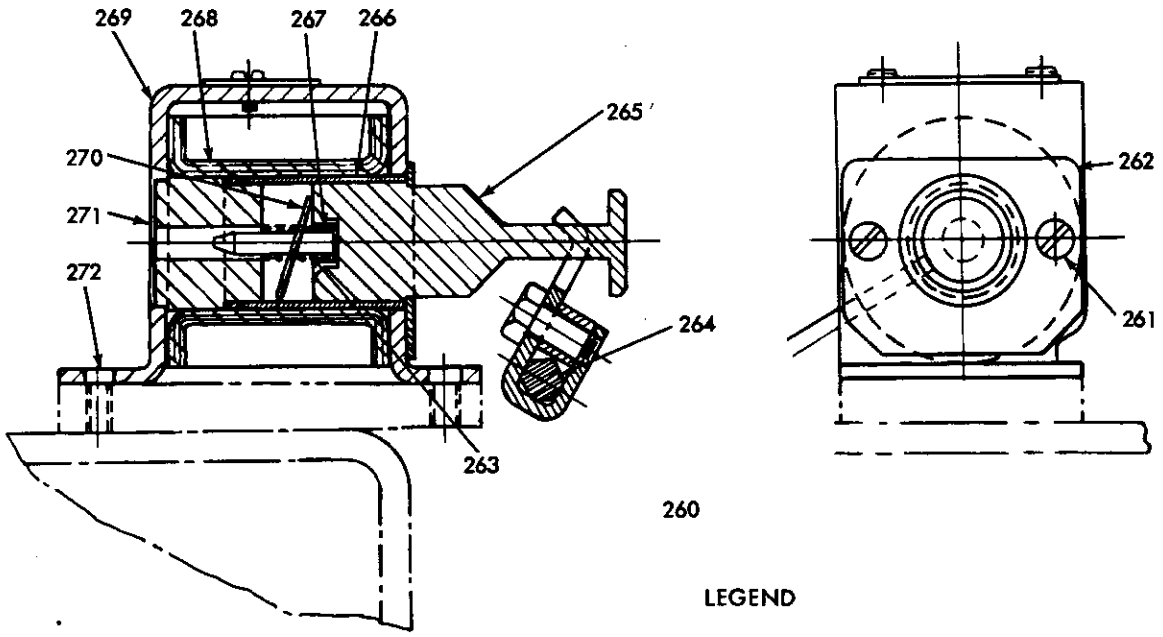
The closing solenoid consists of an iron frame or yoke (251) which is bolted to the circuit breaker shelf, a plunger or moving core, an operating rod (247), a stationary core (252) and a coil (250).

The operating rod (247) connects the moving core (245) to pin (177) (Figure 1-2-3) of the mechanism. When coil (250) is energized through the contact of the closing coil (Refer to Paragraph 1-2-1-6), the moving core (245) moves upward in response to the magnetic attraction between the stationary and moving cores across air gap "A". About one-tenth of a second is required for the solenoid to close and latch the circuit breaker. The moving core is provided with a trip bracket (257) and when the moving core moves into the "breaker closed" or "closed gap" position, trip bracket (257) engages the first trip lever (255) of the relay trip assembly. As the first trip lever (255) is forced upward, increased tension on spring (254) rotates second trip lever (253) which engages the relay trip pin (201) (Figure 1-2-4) of the closing relay to trip the relay, the relay contacts open, de-energizing the closing solenoid. The coil of the closing solenoid is momentarily rated and serious damage will result if potential is allowed to remain on its terminals through improper adjustment of the relay trip pin (201) so that the relay does not trip and interrupt the closing coil circuit (Refer to Paragraph 1-2-1-6). When the moving core and operating arm have pushed the mechanism linkage to the closed and latched position, pin (177) (Figure 1-2-3) of the operating mechanism holds the moving core in the "closed gap" position. When the mechanism (150) is tripped, pin (177) falls allowing the operating arm and the moving core to fall to the "open gap" position.

1-2-1-8 Shunt Trip Device—(See Figure 1-2-6)

The shunt trip device is used on electrically operated breakers and is mounted behind the auxiliary switches on the breaker shelf.

The shunt trip device consists of a frame (269), stationary core (271), moving core (265) and the trip coil (268). Energizing the trip coil (268) sets up a magnetic attraction between stationary core (271) and moving core (265). The



LEGEND

260	SHUNT TRIP DEVICE	266	SLEEVE
261	SCREW	* 267	SPRING
262	PLATE	* 268	COIL
263	PIN	269	FRAME
264	TRIP BAR	270	NON-MAGNETIC WASHER
265	MOVING CORE	271	STATIONARY CORE
		272	BOLT

*REPAIR PARTS

FIGURE 1-2-6 — Shunt Trip Device

moving core moves to the left which rotates trip bar (264) to trip the circuit breaker. The opening of the circuit breaker de-energizes the shunt trip coil through a normally open auxiliary switch contact. Spring (267) then returns the moving core (265) to its normal position. Non-magnetic washer (270) prevents residual magnetism from holding the cores together when the coil is de-energized.

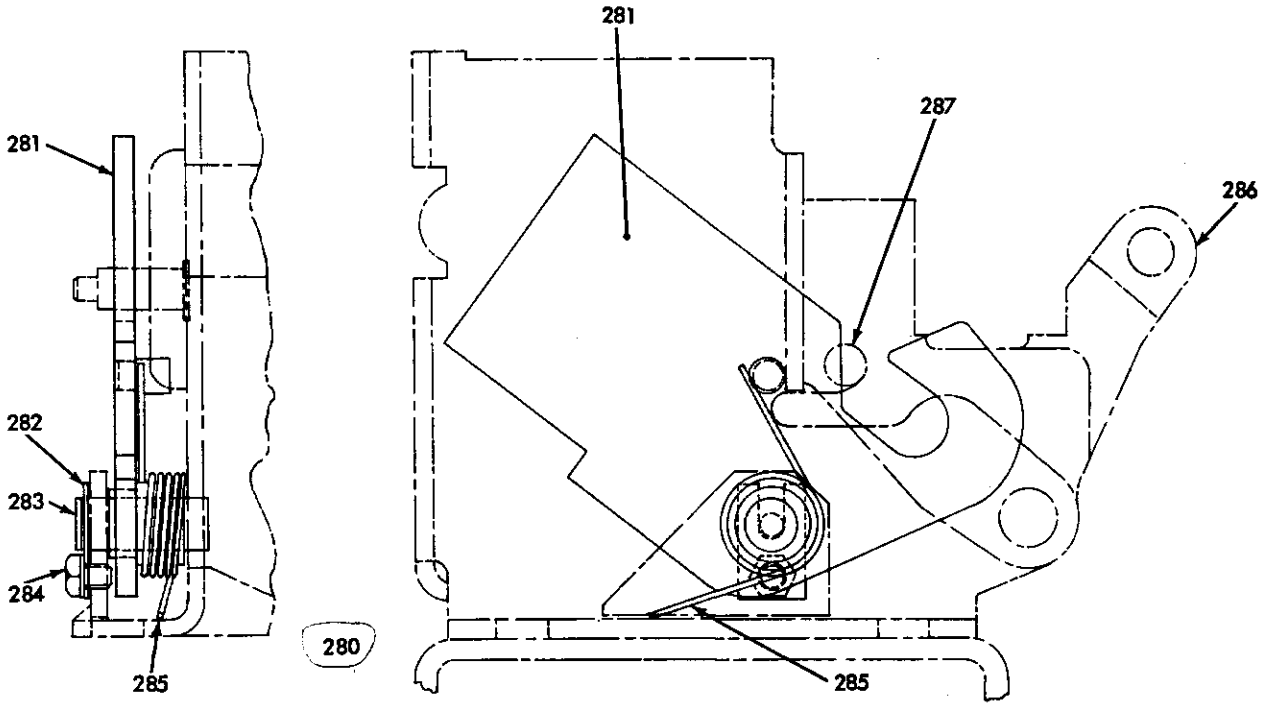
1-2-1-9 Anti-Shock-Close Device—(See Figure 1-2-7)

The anti-shock-close device (280) is mounted on the side of the operating mechanism. This device prevents the circuit breaker contacts from closing from shock when the breaker is in the open position. This device also, functions as an anti-bounce latch.

The anti-shock-close latch (281) is pivoted on the side of the mechanism. The plate is so shaped that the impact of shock rotates the device, and the hook engages pin (287) of the auxiliary switch to momentarily hold the breaker open. The anti-shock-close device also serves as an anti-bounce latch to prevent the closing lever (286) from bouncing off its stops and reclosing the circuit when the circuit breaker interrupts maximum short circuit currents. Under these conditions, the crossbar knocks the latch up, causing the latch to engage the crossbar pin to momentarily hold the breaker open. Return spring (285) returns the latch to its original position when conditions are normal.

1-2-1-10 Anti-Shock-Open Device—(See Figure 1-2-8)

The anti-shock-open device prevents tripping of the circuit breaker due to rotation of the trip lever caused by shock when breaker is



LEGEND

280	ANTI-SHOCK-CLOSE DEVICE
281	LATCH
282	CLIP
283	PIN
284	BOLT
*285	SPRING, RETURN
286	CLOSING LEVER
287	PIN

* REPAIR PARTS

FIGURE 1-2-7 — Anti-Shock-Close Device

in the closed position and is mounted on the circuit breaker shelf to the right of the operating mechanism frame.

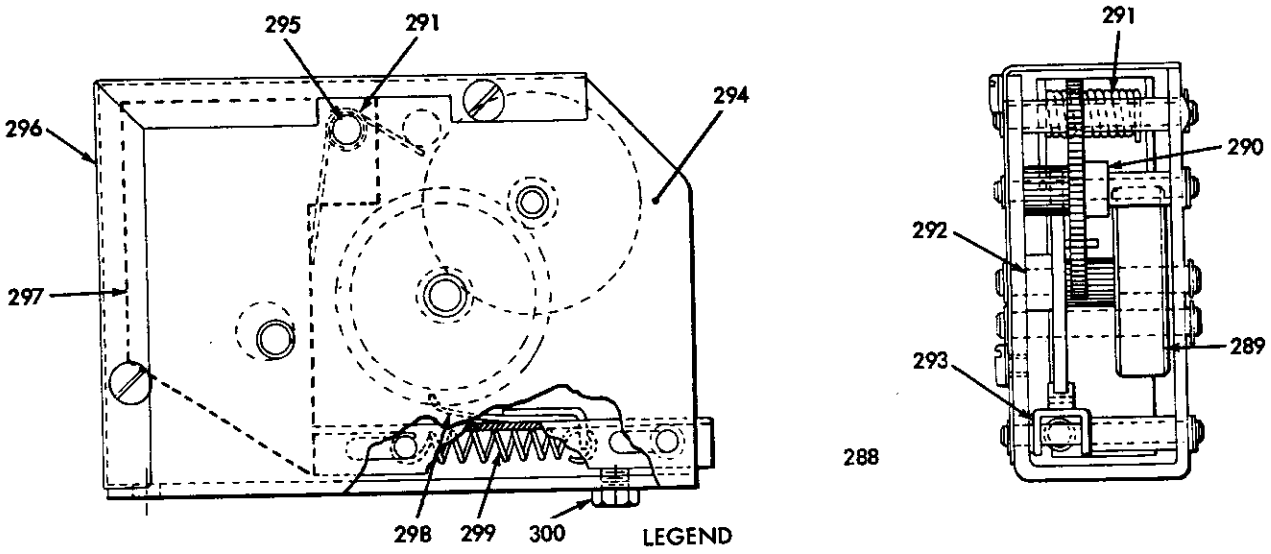
The anti-shock-open device consists of a frame (294), cover (296), weight (297), lever (293), spring clip (298), lever spring (299), weight spring (291) and a gear train. The gear train is composed of two torque reducing gears (290) and (292) and a round unit of rotating mass (289). Under shock conditions, the weight (297) is rotated about pin (295). As the weight rotates, it forces the lever (293) outward to block the trip bar and prevent breaker tripping. During the outward movement of the lever, spring clip (298) acts as a ratchet on gear (292) allowing the lever to move without rotation of the gear train. Weight spring (291) returns the weight to its original position. When lever spring (299) starts to return the lever to the original position, the spring clip (298) engages the teeth of gear (292) causing rotation of the gear train. The rotation of the gear train causes a time delay in the return direction. This time delay holds the trip bar for the duration of the shock.

1-2-1-11 Series Overcurrent Trip Unit—
(See Figures 1-2-9 and 1-2-10)

The series overcurrent trip unit provides for selective protection under three distinct conditions of overcurrent: First, low overcurrents will trip breaker after LONG DELAY; second, moderate overcurrents will trip breaker after a SHORT DELAY; and third, high overcurrents will trip breaker INSTANTLY.

Two calibrated long delay pickup settings are marked on scaleplate (329) in amperes (at approximately 150 and 200 of coil rating). The long delay time is factory set per figure 1-2-9. By turning dial (323) the long delay time can be approximately halved or doubled; but is locked to prevent excessive adjustment.

The short delay pickup, short delay time, and instantaneous pickup are all factory set and



LEGEND

288	ANTI-SHOCK-OPEN DEVICE	295	PIN
289	ROTATING MASS	296	COVER
290	GEAR	297	WEIGHT
* 291	SPRING, WEIGHT	298	SPRING CLIP
292	GEAR	* 299	SPRING, LEVER
293	LEVER	300	BOLT
294	FRAME		

*REPAIR PARTS

FIGURE 1-2-8 — Anti-Shock-Open Device

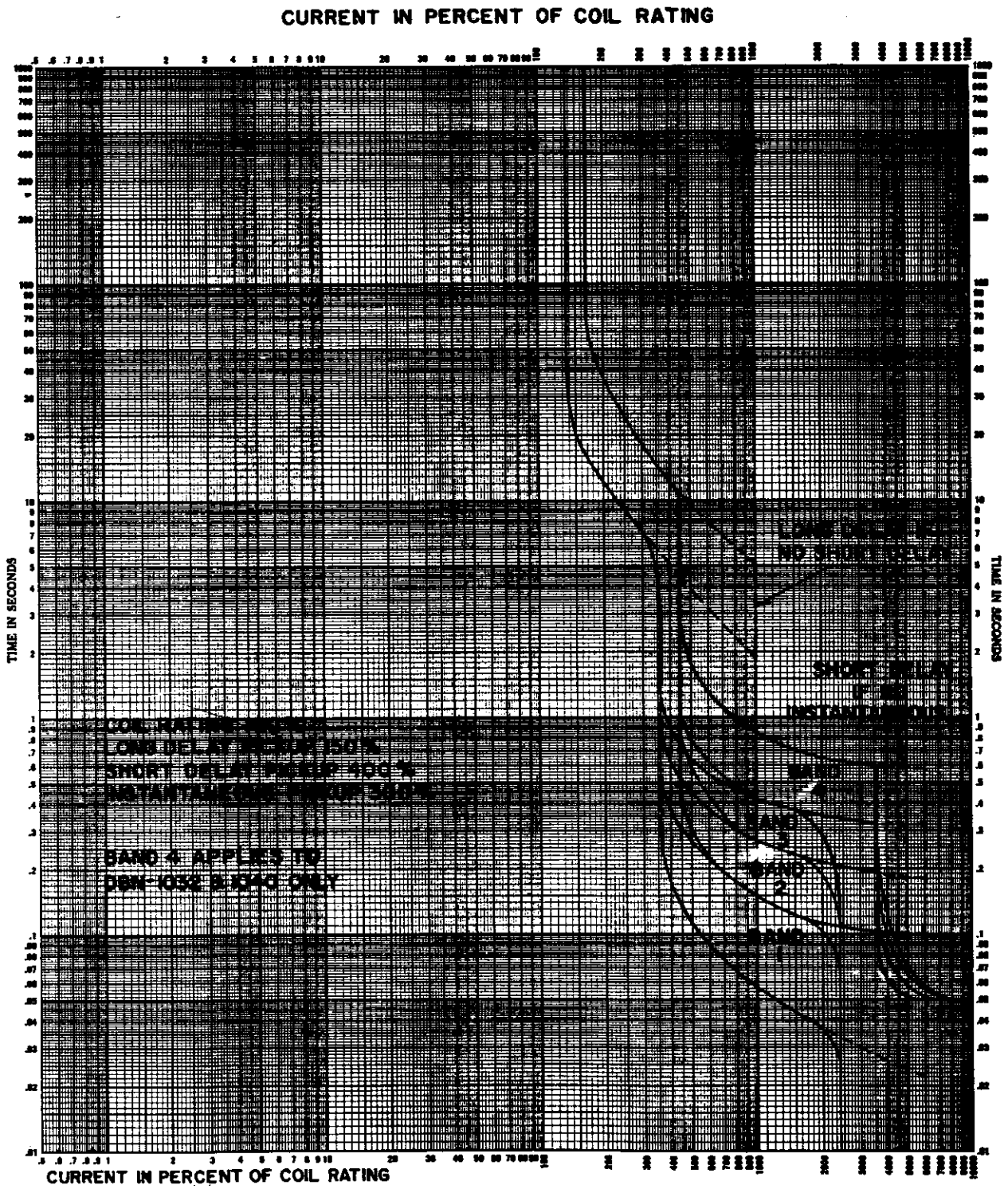


FIGURE 1-2-9 — Typical Time Current Curves

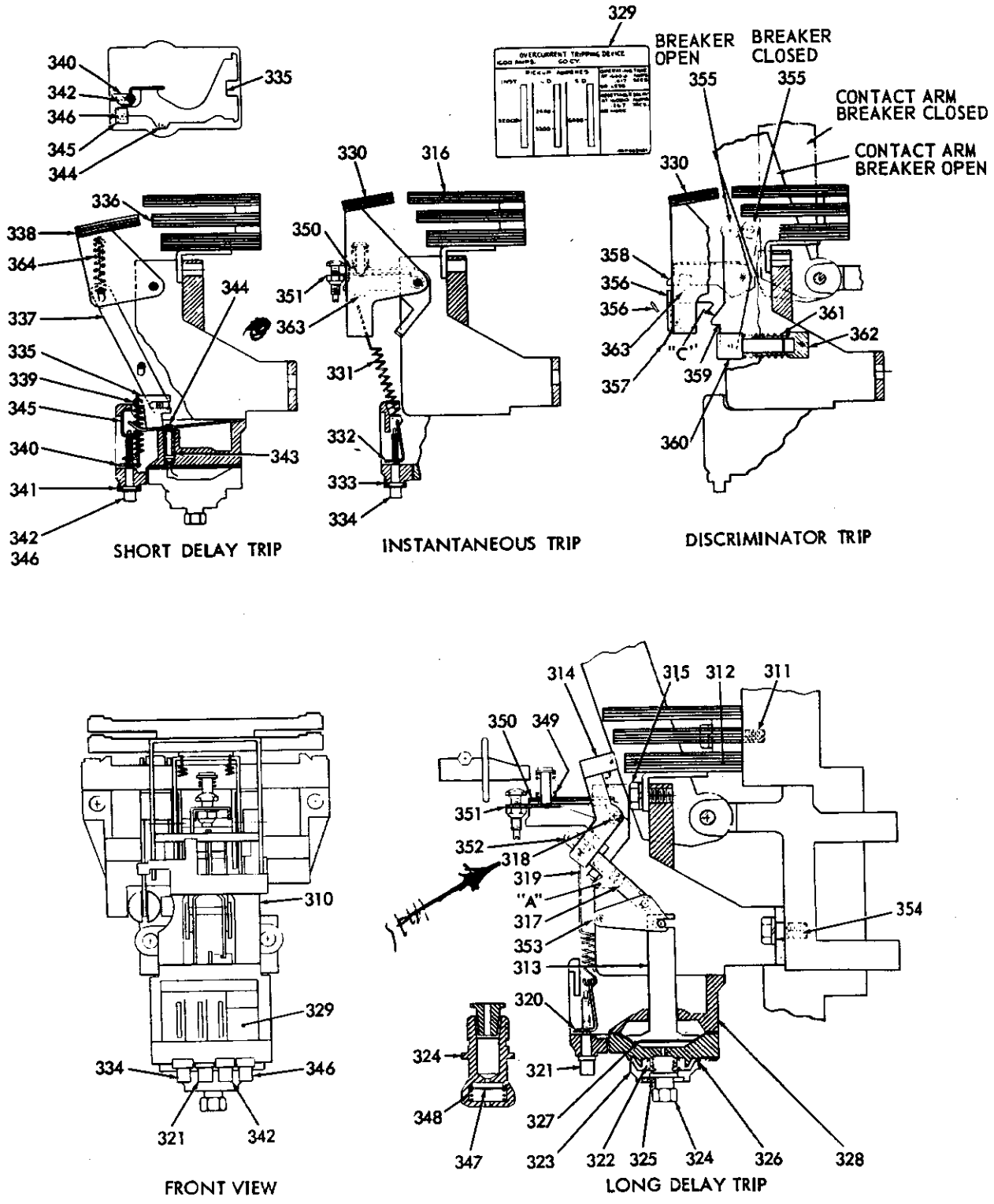


FIGURE 1-2-10 — Overcurrent Trip Device

CIRCUIT BREAKER - NAVY TYPE ACB-4000HZ
4000 AMPERE FRAME SIZE

310 Overcurrent Trip Unit
311 Yoke Mounting Bolt
312 Stationary Yoke
313 Stem Assembly
314 Lower Armature
315 Upper Mounting Bolt
316 Stationary Yoke
*317 Spring, Limit
318 Pin
*319 Spring (L.D. Pickup)
320 Pointer (L.D. Pickup)
321 Screw (L.D. Pickup)
*322 Spring (L.D. Dial)
323 Dial (L.D.)
324 Valve (L.D. Time)
325 Screw
326 Clip
327 Diaphragm (Part of 313)
328 Moulded Case
329 Scaleplate
330 Upper Armature
*331 Spring (Instantaneous)
332 Pointer (Instantaneous)
333 Clip
334 Screw (Instantaneous)
335 Lever
336 Stationary Yoke
337 Line
338 Center Armature
*339 Spring (S.D. Pickup)
340 Pointer (S.D. Pickup)
341 Clip
342 Screw (S.D. Pickup)
*343 Spring (S.D. Valve)
344 Valve (S.D.)
345 Bracket
346 Screw (S.D. Time)
347 Disc (Reset)
*348 Spring (Disc)
*349 Spring (Trip)
350 Crank
351 Trip Crank
352 Link
353 Lever
354 Lower Mounting Bolt
355 Roller
356 Latch
*357 Spring, Latch
358 Crank
359 Lever
360 Piston
*361 Spring Piston
362 Cylinder
363 Pin
*364 Spring, Follow

*Repair Parts

FIGURE 1-2-10 — Overcurrent Trip Device

sealed. The pickup currents and time delay are marked on scaleplate.

Figure 1-2-9 shows a typical "Time-current Curve". The upper line of a given band shows the MAXIMUM time for breaker to clear the circuit for any given overcurrent. The lower line shows the MINIMUM time an overcurrent can exist before returning to normal without tripping breaker.

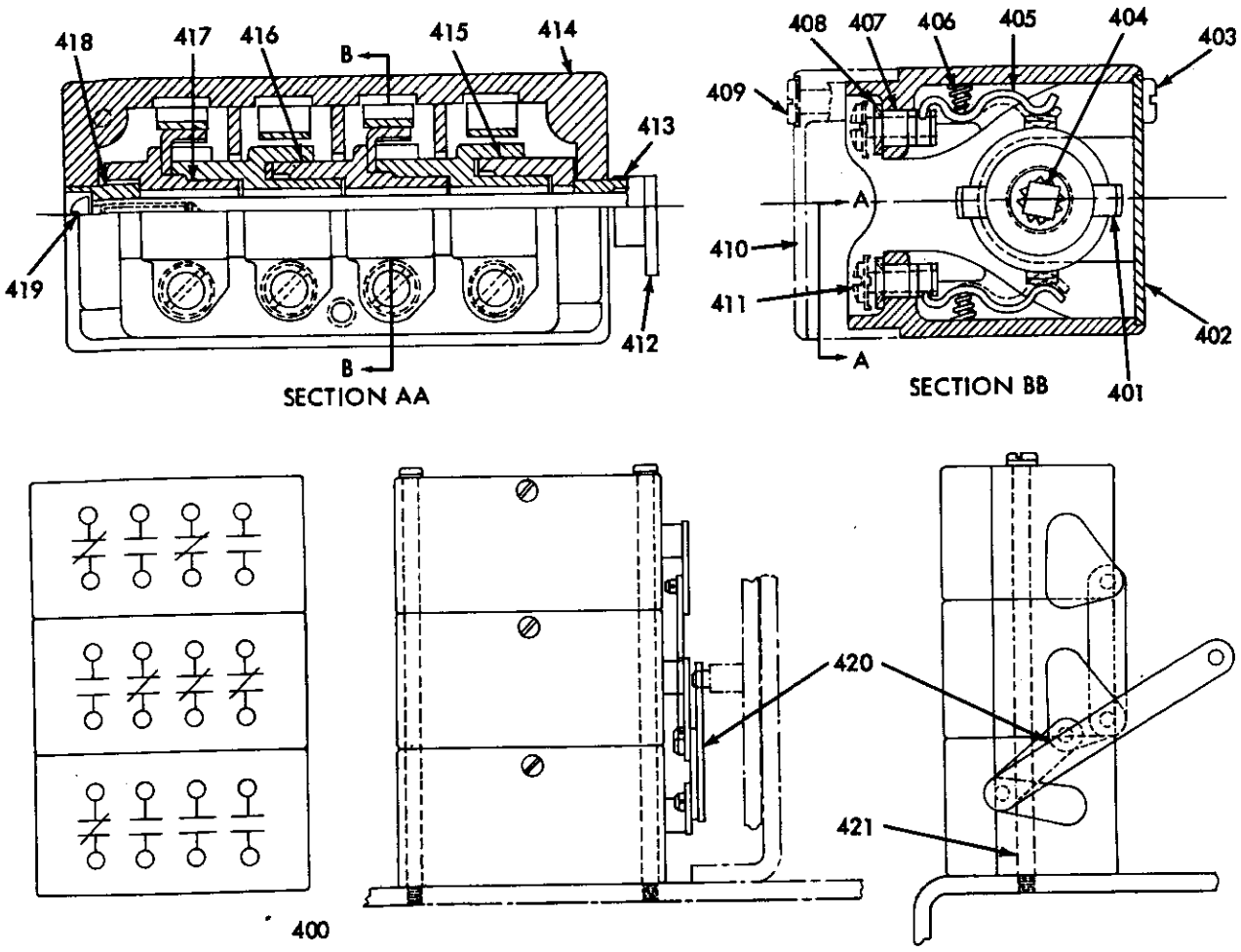
The overcurrent trip device is mounted by bolts (311), (315), and (354) to the pole units. The stationary yokes (312), (316), and (336) and the moving armatures (314), (330), and (338), form a laminated iron loop around the breaker moving contact arm. Current flow in contact arm creates a magnetic force between stationary yokes and the moving armatures in the direction to pivot armatures clockwise about pin (318).

When armature (314) rotates, spring (317) transmits force via lever (353) to stem assembly (313). As stem assembly (313) moves, projections (A) on link (352) rotates crank (350) clockwise. Crank (350) via spring (349) and rivet pin will rotate trip crank (351) to actuate breaker trip bar, spring (349) limits force applied to breaker trip system.

The long delay pickup is adjusted by turning screw (321) which moves pointer (320) and lower end of springs (319). Spring (319) holds down armature (314) unless overcurrent exceeds calibrated pickup. The rate at which the stem will rise depends on the vacuum drag on the diaphragm (327). The diaphragm is part of stem assembly (313). Valve (324) controls the amount of air which can flow into the vacuum chamber. Turning dial (323) clockwise closes the tapered long delay orifice. Spring (322) and clip (326) prevent accidental change in adjustment and screw (325) prevents excessive intentional adjustment.

The instantaneous pickup is factory set by turning screw (334) which moves pointer (332) and lower end of spring (331). Spring (331) will hold armature (330) until magnetic attraction of yoke (316) lifts armature. When the armature rises, pin (363) will lift crank (350) to trip breaker instantly. Clip (333) is cemented to screw (334) to protect factory setting.

The short delay pickup is factory set by turning screw (342) which moves pointer (340) and lower end of spring (339). Spring (339) will hold down lever (335), link (337) and armature (338) until magnetic attraction of yoke (336) lifts armature. When the armature rises, lever (335) will lift valve (344) and allow a controlled amount of air to flow thru port to vacuum chamber. This controlled air flow will allow long delay tripping parts to react for short delay tripping. Turning screw (346) moves bracket (345) which limits motion of lever (335). This adjustment controls air flow around valve (344) and predetermined short delay time required to trip breaker. Two clips (341) are cemented to screws (342) and (346) to protect factory setting.



LEGEND

* 400	AUXILIARY SWITCH	411	TERMINAL SCREW
401	CONTACT	412	ARM
402	BOTTOM COVER	413	SPACER
403	SCREW	414	CASE
404	SHAFT	415	ROTOR END
405	CONTACT FINGER	416	ROTOR SECTION
406	CONTACT SPRING	417	ROTOR END
407	STEM	418	BUSHING
408	COLLAR	419	MACHINE SCREW
409	MACHINE SCREW	420	CONNECTION LINK
410	COVER	421	MACHINE BOLT

*REPAIR PARTS

FIGURE 1-2-11 — Auxiliary Switch

These overcurrent trip units have a quick reset valve. If a unit has partially or completely reacted to an overcurrent condition and then the current subsides to zero or normal, a quick reset is desirable. As stem assembly (313) comes down, air is expelled thru port to bottom of long delay valve (324). Pressure moves disc (347) down providing a large opening for the expelled air. Spring (348) returns the disc to the sealed position after reset is completed.

When selective coordination requires that instantaneous tripping be omitted, a discriminator trip is supplied. The discriminator will NOT trip a breaker that is closed, but will instantaneously trip a breaker that is closing if the inrush current is above 40,000 amperes. The discriminator trip operates similar to an instantaneous trip except additional parts are required and slot (E) is added to crank (358).

If breaker is closed, spring (361) forces projection (C) on lever (359) to rotate latch (356) away from projection (D) on crank (358). Although high fault currents will rotate armature (330) NEITHER pin (363) nor latch (356) can engage crank (358) and breaker will not trip unless fault current duration allows short delay tripping.

If breaker is open, contact arm movement of roller (355) will rotate lever (359) away from latch (356). Spring (357) places latch (356) into position to engage crank projection (D). Piston (360) and cylinder (362) create a small time delay so that latch (356) will not rotate on closing stroke of breaker until breaker is completely closed. If on the closing stroke, a fault current of 40,000 amperes or more appears then armature (330) will carry latch (356) with it and rotate crank (358) and cause breaker to trip.

1-2-1-12 Auxiliary Switch—(See Figure 1-2-11)

The auxiliary switch is mounted on top of the circuit breaker shelf to the left of the operating mechanism.

The twelve pole auxiliary switch (400) consists of three four-pole switches; one mounted over the other. A fourth switch case, which contains a terminal block (Figure 1-1-1), is mounted next to the switches.

Each auxiliary switch is a shaft-operated, four pole, rotary type containing both normally open or normally closed contacts or a combination of normally open and normally closed contacts. The normally open or "a" contacts are open when the circuit breaker is in the open position and the normally closed contacts or "b" contacts are closed when the circuit breaker is open.

The rotor assembly consists of a square shaft (404), rotor ends (415) and (417), three rotor sections (416), moving contacts (401), arm (412), bushing (418) and screw (419) which clamps together the rotor assembly.

Each contact finger (405) backed by spring (406), is secured by a rivet and is attached to stem (407), which is secured to the case by collar (408). Screws (411) and a crimp washer provide the terminal connections.

Link (420) is attached to the breaker lever of the operating mechanism. As the link is rotated by the action of the operation mechanism, arm (412) rotates the shaft (404) to re-position the moving contacts.

The moving contacts are set 90 degrees apart for a 90 degree rotation of the shaft. The contacts can be converted in the field to either normally open or normally closed by rotating the appropriate rotor section 90 degrees on the shaft.

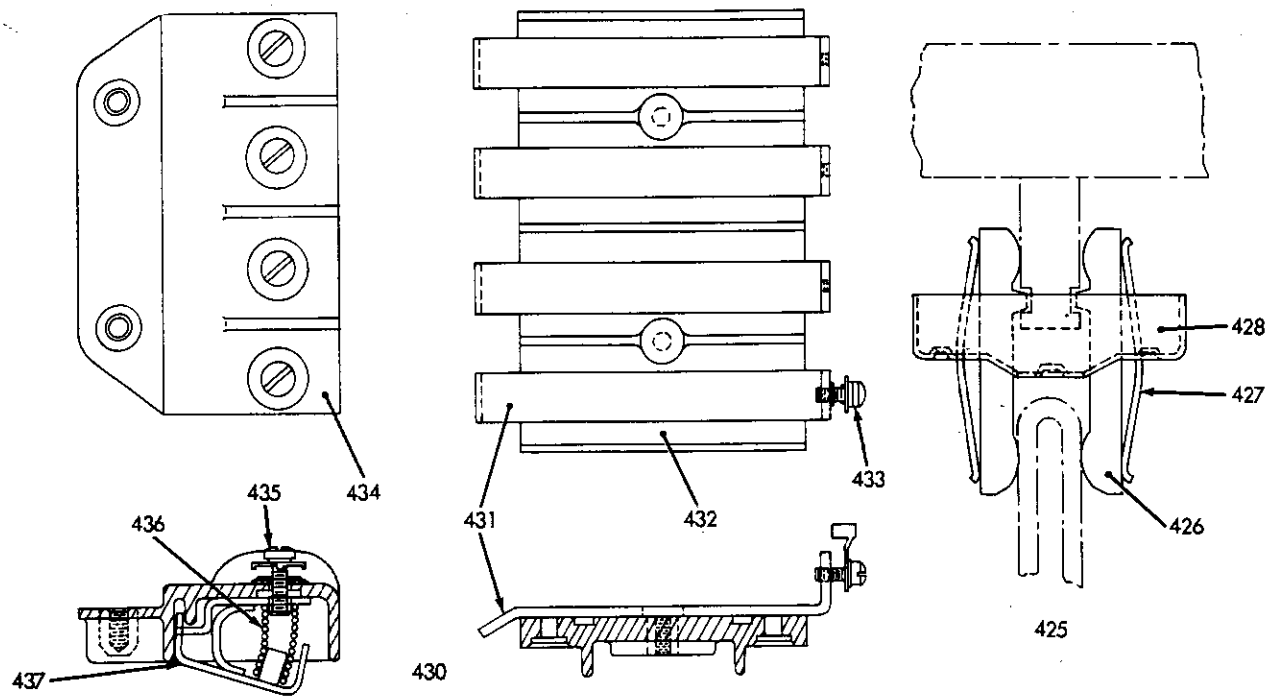
1-2-1-13 Main Disconnects—(See Figure 1-2-12)

The main disconnects are mounted on the studs of the moving component of the circuit breaker, one on each of the six breaker studs.

Each main disconnect consists of a finger retainer (428), the finger cluster (426) and two finger springs (427). The assembly is held on the studs by a protrusion on the finger cluster which fits in a slot in the stud. The finger cluster is held captive by a leaf type spring which is partially compressed in its normal position. When the mating studs of the stationary component enter the contact assembly, the fingers are forced open for additional spring compressing which exerts a double acting force on the contact fingers. The assembly, although secure on the studs is free to move up and down to rectify any slight misalignment of the two components.

1-2-1-14 Secondary Disconnects—(See Figure 1-2-12)

The secondary disconnects consist of two assemblies; the moving assembly, which is mounted on the breaker panel and the stationary assembly, which is mounted within the stationary component. The secondary contacts provide a means of connecting the breaker control circuit to the bus.



LEGEND

* 425	MAIN DISCONNECT	432	STATIONARY BASE
426	FINGER CLUSTER	433	TERMINAL CONNECTION
427	FINGER SPRING	434	MOVING BASE
428	FINGER RETAINER	435	TERMINAL CONNECTION
* 430	SECONDARY DISCONNECT	436	SPRING
431	STATIONARY FINGER ASSEMBLY	437	MOVING FINGER ASSEMBLY

* REPAIR PARTS

FIGURE 1-2-12 — Main and Secondary Disconnects

The moving assembly consists of a base (434) on which are mounted four separate but identical contacts. Each contact consists of moving finger assembly (437) which is riveted to the base. Spring (436) forces the moving finger against the stationary finger assembly (431) when the breaker is in place.

The stationary assembly consists of a stationary base (432) and four separate but identical stationary finger assemblies. Each finger assembly is provided with a terminal (433) for the wiring connection.

1-2-1-15 Indicator Lights—(See Figure 1-2-13)

The a-c indicator lights when specified are mounted on the face plate and are used to indicate the operating state of the circuit breaker. The white indicating lamp is lighted whenever control power is available and the blue indicator light is lighted whenever the circuit breaker is closed.

Each indicator light consists of a transformer assembly (441) and two lamps (Type TS-159, 2.5 volts). The lamps are connected in parallel as a safety precaution to insure visual indication of the signaled condition in the event of a lamp failure.

Two types of indicator lights are available. One is used in 450 volt, 60 cycle circuits; the other is used in 117 volt, 60 cycle circuits. The indicator lights are type B-27A or B27B as covered by Navy standard drawing #9000-S6202-F-73907.

1-2-1-16 Silicon Rectifier (See Figure 1-2-14)

The silicon rectifier assembly converts alternating current (a-c) to direct current (d-c) for energizing the dc electric closing solenoid.

All breakers are supplied with silicon rectifiers mounted on right side of closing solenoid.

The rectifier is composed of two units. Each consists of case (451) and cover (452) which encloses eight rectifier elements (453). The rectifier units are wired in a bridge type arrangement as shown in Figure 1-2-14.

1-2-1-17 Cell Interlock (See Figure 1-2-15)

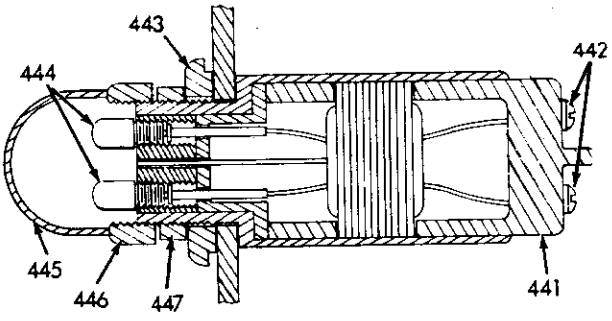
The cell interlock assembly prevents removal or installation of the breaker while it is in the close position and is located on the right side of the movable component.

The cell interlock consists of a lever assembly (459) which is pivoted about pin (458). When the lever assembly (459) is moved upward through action of the cam (456) on the extension rails, the circuit breaker trip bar (461) is rotated and the breaker tripped. If the moving component is out on the rails and an attempt is made to insert it in the stationary component while closed, a small cam (456) on the right rail causes the interlock lever to be pushed up thus tripping the movable component and making it trip free until it is in the connected position and the extension rails are in the vertical position. This same action takes place when the movable component is being withdrawn from the stationary component. Upon lowering of the rails, the cam (456) is rotated and pushes up on the interlock to trip the movable component. When the moving component is in the stationary component with the rails up in normal position, stop (457) holds the interlock lever down to prevent the interlock from moving upward and tripping the breaker on shock.

1-2-1-18 Levering-in Device (See Figure 1-2-16)

In order to install the movable component in the stationary component a levering-in device is needed to assist in the engaging of the main disconnects. This device is a hook-type design. The hook is mounted securely on the rear of the movable component, and the mechanism and moving parts of the device mounted in the stationary component.

When installing the movable component, it is first positioned in the stationary component



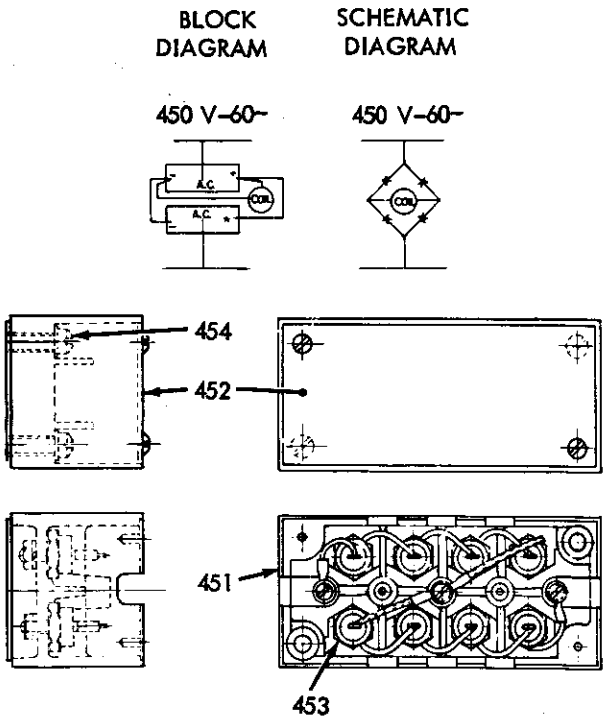
440

LEGEND

*	440	INDICATOR LIGHT ASSEMBLY
	441	TRANSFORMER ASSEMBLY
	442	TERMINAL SCREW
	443	TRIM PLATE
	444	LAMP
	445	GLOBE
	446	KNURLED RING
	447	LOCK NUT

* REPAIR PARTS

FIGURE 1-2-13 — Indicator Light



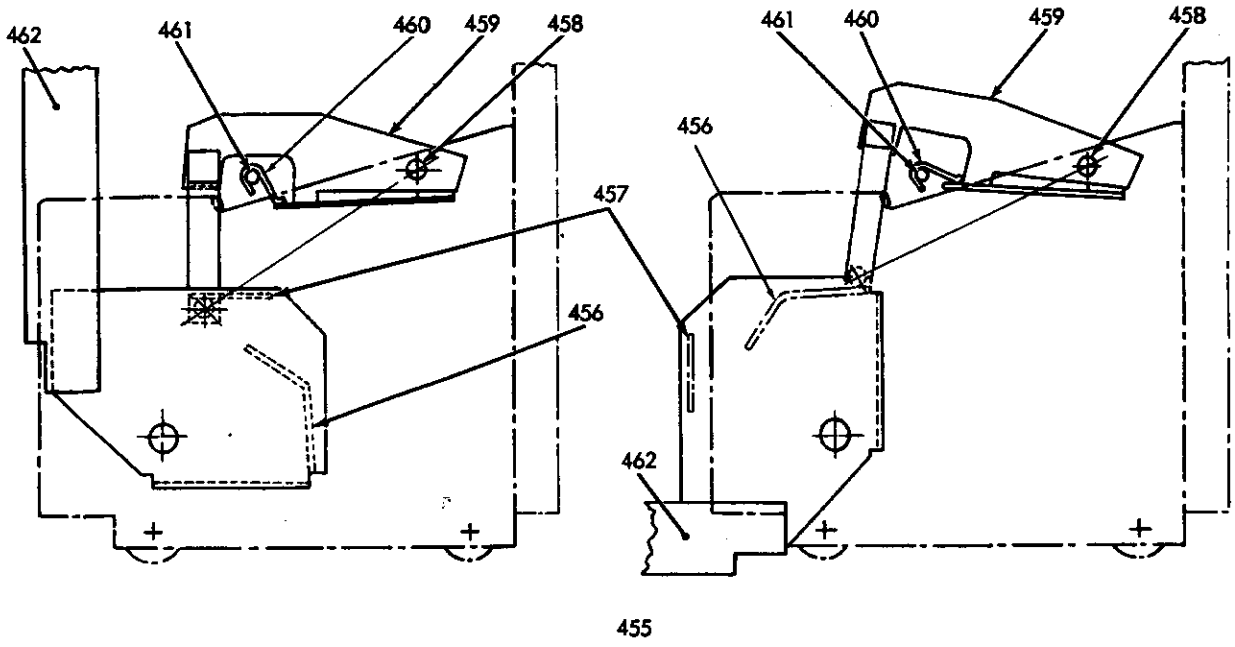
450

LEGEND

*	450	SILICON RECTIFIER
	451	CASE
	452	COVER
	453	RECTIFIER ELEMENT
	454	MOUNTING SCREWS

* REPAIR PARTS

FIGURE 1-2-14 — Silicon Rectifier



455	CELL INTERLOCK	459	LEVER ASSEMBLY
456	CAM	460	TRIP BAR CLAMP
457	STOP	461	TRIP BAR
458	PIN	462	EXTENSION RAIL

FIGURE 1-2-15 — Drawout Interlock

and inserted until the pointer lines up with the "DISC" mark on the position indicator, then the crank (475) is placed on the operating shaft (471) and turned clockwise until the pointer lines up with the "CONN" mark on the position indicator. As the shaft (471) is turned, the worm (470), which is pinned to the shaft, rotates worm gear (472) which is keyed to shaft (474). This latter shaft (474) has two lever arms (469), which rotate into and pull on the hook (468) which is mounted on the movable component, thereby pulling the movable component into the connected position.

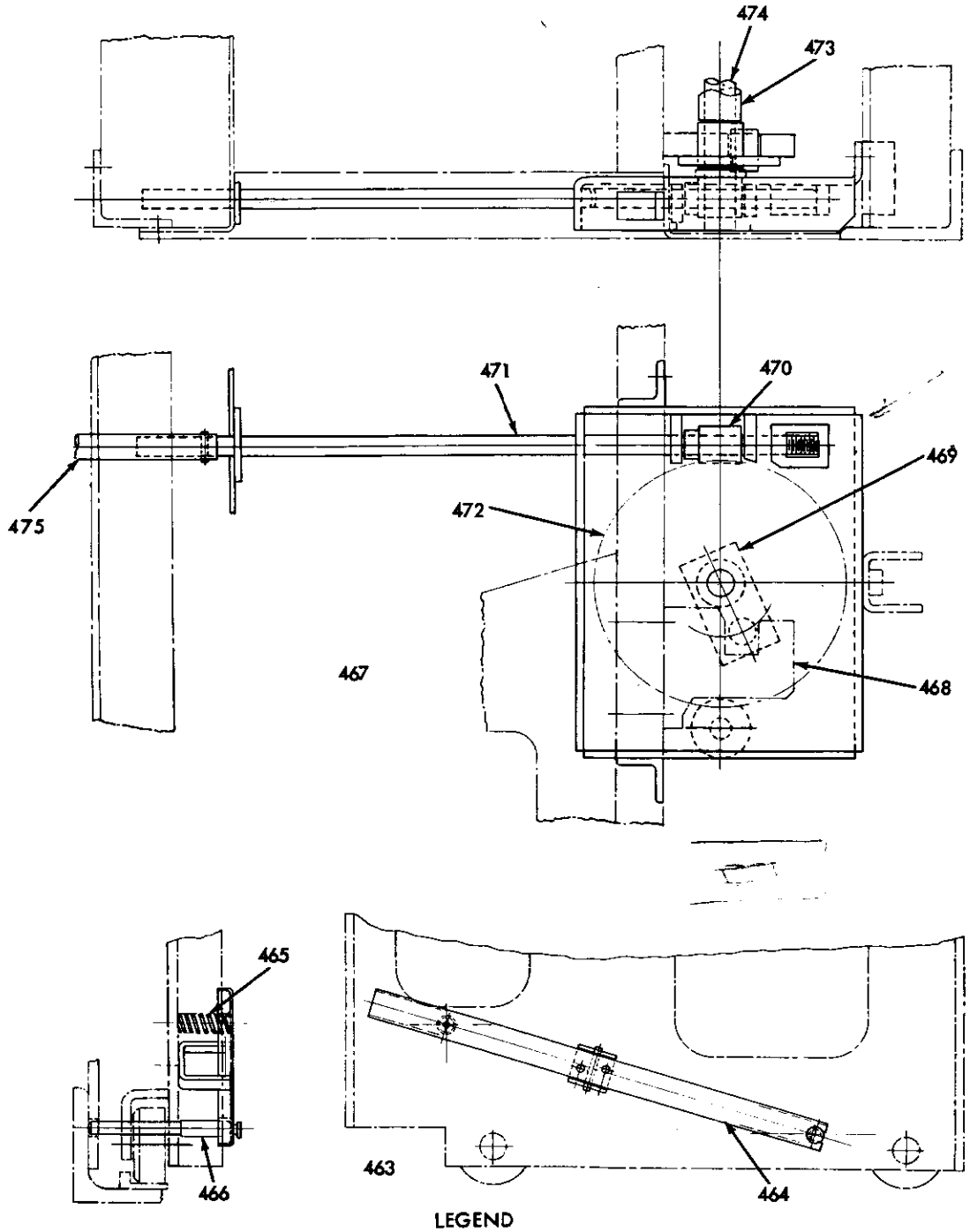
1-2-1-19 Stop (See Figure 1-2-16)

The stop (463) prevents the movable component from rolling when on the rails of the stationary component. This assembly is mounted on the inside of the lower leg of the platform.

The stop assembly consists of a spring (465) and stop lever (464) which moves the pin (466) out of position when it is pressed against the side of the platform. The stop positions the movable component by means of the spring (465) which returns the lever (464) to normal position and causes the pin (466) to fall into the holes provided in the left hand rail. The stop lever should be pushed toward the platform side whenever removing the movable component from or installing it on the rails.

1-2-1-20 Extension Rails (See Figure 1-1-1)

The extension rails are an integral part of the stationary component on which the movable component rolls in and out of position. The rails are pivoted on the pivot pin and may be lowered by loosening the thumbscrew and pulling the rails down.



LEGEND

463	STOP	470	WORM
464	STOP LEVER	X 471	SHAFT
* 465	SPRING	X 472	WORM GEAR
466	STOP PIN	473	INSULATING TUBE
467	LEVERING-IN DEVICE	474	DRIVEN SHAFT
X 468	BRACKET	475	CRANK HANDLE
X 469	LEVER ARM		

*REPAIR PARTS

FIGURE 1-2-16 — Leveling-In Device and Stop Assembly

CHAPTER 2
PRINCIPLES OF OPERATION

Section 1—General Principles

2-1-1 GENERAL

2-1-1-1 Description

The circuit breaker is a device for interrupting in air, a circuit between separable contacts under infrequent, normal and abnormal conditions. The types ACB 3200HR and ACB 4000HR circuit breakers have interrupting and continuous current rating as follows:

INTERRUPTING RATING . . . . . 500 V
60 Cycles A.C.
R.M.S. Amperes A.C., 100,000

CONTINUOUS CURRENT RATING:
Circuit Breaker Copper
Rating . . . . . Amperes
3200 (DBN 1032)
4000 (DBN 1040)

Overcurrent Trip Coil
Rating . . . . . Amperes

DBN-1032	DBN-4000
2000	4000
2400	
2800	
3200	

The breakers are furnished with 3 pole construction for removable assembly type mounting. Each pole unit is mounted on individual insulated moldings. These moldings isolate the main current carrying from the metal supporting base of the circuit breaker. The main power circuit consists of the upper stud, stationary contact, moving contact assembly and lower stud, all connected in series in the order named.

The operating mechanism simultaneously actuates the moving contact of all poles. It is a complete, removable unit in which are housed the closing toggles and latches.

The closing force is transmitted through the toggles and links to the contact bar on which the moving contact assemblies are bolted. At the end of the closing sequence, the mechanism latches and holds the contacts closed. The closing solenoid supplies the closing force. The closing relay regulates the amount of current drawn by the solenoid closing coil. A manual operating handle is also provided for test purposes or for emergency use.

The moving contacts make or break a main circuit by moving in or out from the stationary contacts. The contacts are quick break, under all conditions of operation. Arc chutes are installed to split, lengthen, cool, and extinguish the arc that is drawn when the contacts open.

The circuit breaker is mechanically trip free, that is, the tripping mechanism can trip even though:

1. The emergency handle is held in closed position or

2. The closing control circuit is energized. The closing mechanism will not reclose it after tripping until the closing control switch is opened and again closed.

The shunt trip device provides an electrical means for tripping the breaker without regard to the load conditions in the circuit. An auxiliary switch is incorporated to open or close contacts for use in protective and control circuits. Shunt trip and indicating lamp circuits are connected through the auxiliary switch. Manual tripping may be accomplished by depressing button on face plate.

The overcurrent device is a calibrated unit which offers protection to the equipment in the circuit when the current reaches limits in excess of the predetermined settings. It will cause the breaker to open by direct action on the trip bar.

2-1-1-2 Closing

Manual closing is accomplished by rotating the operating handle downward. The closing motion should be smooth and quick. After closing the circuit breaker, remove the operating handle.

The closing solenoid provides the normal means for closing the circuit breaker. To close the breaker electrically, turn the control switch

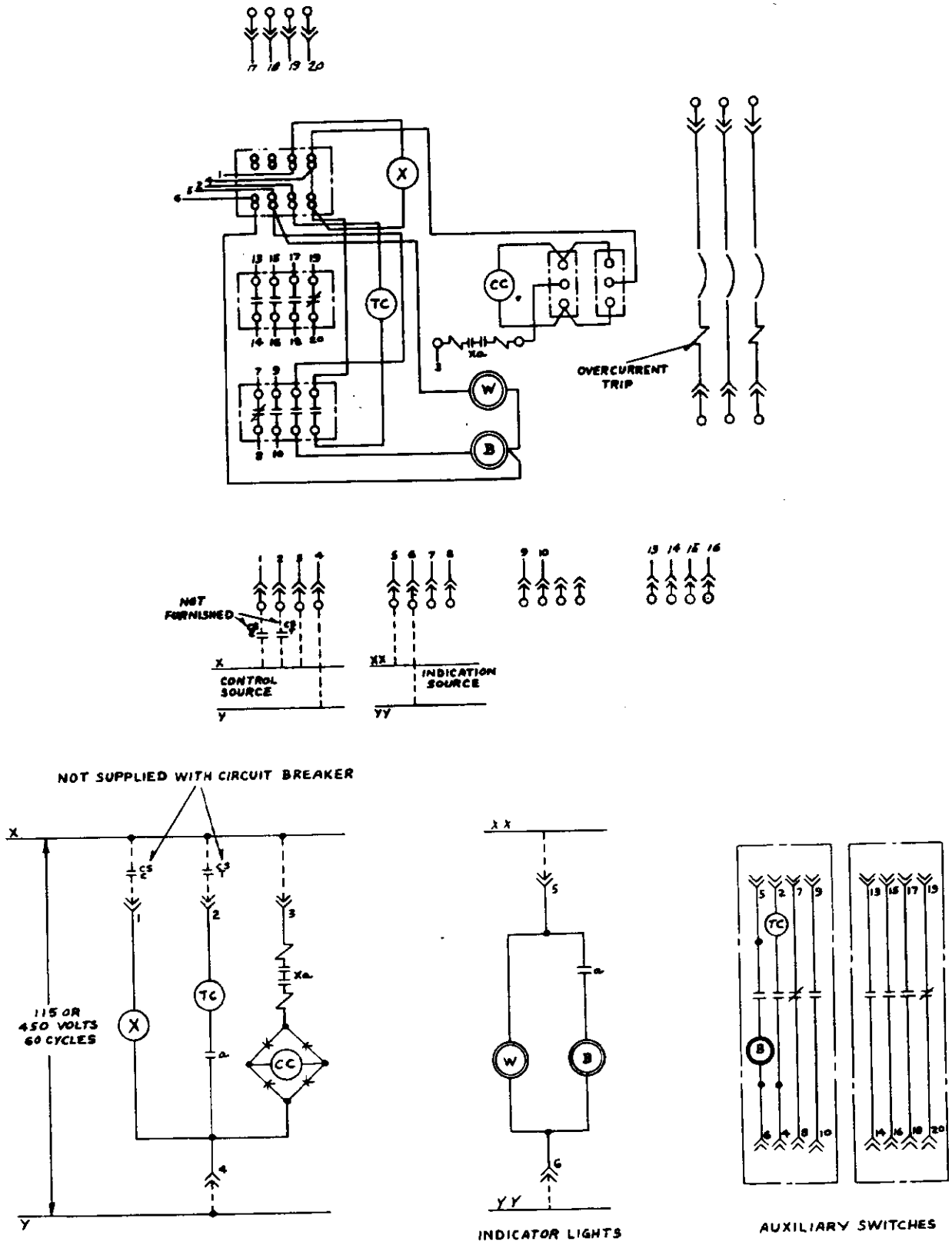


FIGURE 2-1-1 — Wiring Diagram

to the "CLOSE" position to energize the pickup coil of the closing relay.

This closing relay controls the supply of current necessary to energize the solenoid closing coil. When the closing coil is energized the plunger push rod in the closing solenoid rises to close the circuit breaker.

2-1-1-3 Tripping

Tripping of the circuit breaker can be accomplished by means of the manual button, the shunt trip device, or the overcurrent trip unit.

To trip the circuit breaker manually, depress button as indicated on the face plate. When released, the button will return to its normal position.

To trip the circuit breaker electrically, turn the control switch, which is remotely located, to the "TRIP" position in order to energize the shunt trip coil. With this trip coil circuit closed, the shunt trip device will operate to rotate the trip bar and trip the circuit breaker.

The overcurrent trip unit will also cause the circuit breaker to open by direct action on the trip bar whenever the current exceeds the designated pickup values.

2-1-1-4 Electrical Operation

Figure 2-1-1 shows the wiring diagram and the schematic diagram for an electrically operated circuit breaker. When the close switch (CSC) is closed, the closing relay is actuated which closes contacts Xa to energize the closing solenoid.

The closing solenoid closes the breaker as described in Chapter 1, Section 2. When the breaker is closed the normally open circuit breaker contact "a" closes to set up the shunt trip circuit. Closing the circuit breaker trip switch (CST) energizes the trip coil to trip the circuit breaker as described in Chapter 1, Section 2.

This figure also includes a schematic diagram of the indicating light circuit. The white lamp is energized whenever control power is available. When the circuit breaker is closed, auxiliary contact "a" closes to energize the blue indicating lamp. These indicating lamps provide a convenient means of observing the operating state of the circuit breaker.

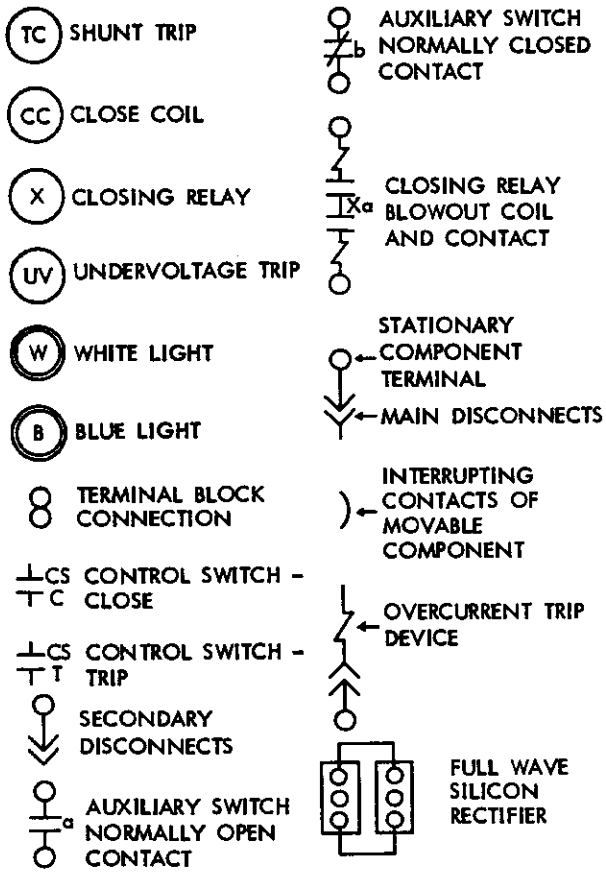


FIGURE 2-1-2 — Schematic Symbols

CHAPTER 3
OPERATING INSTRUCTIONS

Section 1—Precautions

3-1-1 SAFETY PRECAUTIONS

3-1-1-1 When operating or working on the circuit breaker at any time, the following safety precautions are to be adhered to:

(a) Never attempt any maintenance operation unless breaker is open and in a withdrawn position.

(b) Never use kerosene, gasoline or other combustible solvents to clean the circuit breaker as their use is dangerous and may result in an explosion.

(c) Never clean or dress contacts with emery cloth since the abrasive dust is a good conductor and may cause trouble if allowed to settle on insulating surfaces. Rough or high spots should be removed with a fine file or sandpaper.

CHAPTER 4
INSTALLATION
Section 1—Installation Instructions

4-1-1 GENERAL

4-1-1-1 For information in regard to unpacking and handling see preliminary data on page iii. Refer to figures 7-1-1 and 7-1-2 for outline and mounting dimensions.

4-1-1-2 To install the stationary component:

(a) If the movable component is in the stationary component, remove it following instructions in paragraph 4-1-1-3 part (a), and paragraph 4-1-1-4 part (b), depress the stop lever and move the movable component to the end of the rail extensions, then lift the movable component off the rail extensions.

CAUTION

Care must be taken so the complete removable assembly is placed on a surface large enough to support the extension rails when lowered to a horizontal position. If such a surface is not available care must be taken so the assembly does not tilt forward when removing the removable component.

(b) Insert the stationary component into the switchboard compartment making certain that it moves all the way in so that it is tight against the structural members at the rear of the compartment.

(c) Secure the stationary component to the switchboard structure by means of: (1) six 1/2-13 hex-head bolts inserted from the rear of the switchboard through holes in the vertical members at the rear of the compartment and into the tapped holes in the rear of the stationary component, and (2) four 3/4-10 hex-head bolts inserted through four holes in the lower front edge of the stationary component and into the tapped hole in the switchboard structural member.

NOTE

If the stationary component is to be mounted in the bottom compartment of the switchboard, the bolts used for securing the switchboard to its foundation must first go through the lower front edge of the stationary component, then through the base member of the switchboard and into the switchboard foundation structure or channels.

(d) Make the necessary control wiring connections to the stationary secondary disconnect fingers.

(e) Connect the switchboard bus work to the primary breaker studs following Navy accepted practices.

4-1-1-3 To install the movable component into the stationary component:

(a) Turn the two thumb nuts that secure the rail extensions in a vertical position counterclockwise until the spring is fully compressed, and lower the extension rails to a horizontal position.

NOTE

The two thumb nuts are located near the top end of the extension rails when in a vertical position, and directly behind the front flange of the extension rails. The springs prevent the nuts from loosening under vibration.

(b) Using the crank provided turn the drawout shaft counterclockwise until it stops to make sure the mechanism is in the proper position to rack in the movable component, then remove the crank.

(c) Lift the movable component by means of suitable hooks placed in the lifting brackets, and place it on the rail extension. During this operation the stop lever must be depressed so the stop pin clears the vertical flange of the left extension rail.

NOTE

After the wheels of the movable component rest on the extension rail the movable component can be moved to any de-

sired position on the extension rails and held in place by the stop pin which engages in one of the holes in the left extension rails when the stop lever is released.

(d) Depress the stop lever and push the movable component into the stationary component until the pointer on the right hand side of the stationary component lines up with the "DISC" mark on the position indicator on the right hand side of the movable component.

(e) Using the crank provided turn the drawout shaft clockwise until the pointer lines up with the "CONN." mark on the position indicator.

CAUTION

Do not turn drawout shaft so pointer moves beyond "CONN." position as this may damage the mechanism.

(f) Remove the crank, raise the extension rails to the vertical position and turn the two thumb nuts clockwise until tight. These thumb nuts prevent the rail extensions from dropping to the horizontal position when the switchboard panel or cover is open.

(g) The movable component is now in the operating position.

4-1-1-4 To withdraw the movable component:

(a) Perform step in paragraph 4-1-1-3 (a).

(b) Using the crank provided turn the drawout shaft counterclockwise until the pointer lines up with the "DISC." mark on the position indicator.

CAUTION

Do not turn drawout shaft so pointer moves beyond "DISC." position as this may damage mechanism.

(c) In this position both the primary and secondary disconnect fingers are disconnected and the movable component is trip free and cannot be closed manually.

(d) To operate the movable component with the maintenance handle, it must be pulled out to the first stop or any other position between the first stop and the end of the extension rails.

4-1-1-5 To insert the movable component follow the instructions in paragraph 4-1-1-3 parts (d), (e), (f) and (g).

4-1-1-6 To install replacement movable component:

(a) Follow instructions in paragraph 4-1-1-3 parts (b), (c), (d) and (e). If the pointer does not line up properly with the "DISC." mark on the position indicator loosen the two screws that secure the position indicator onto the movable component and line up the "DISC." mark with the pointer, then tighten the two screws securely.

(b) Proceed with instructions in paragraph 4-1-1-3 parts (f) and (g).

CHAPTER 5
MAINTENANCE

Section 1—Preventive Maintenance

5-1-1 PERIODIC PROCEDURES

5-1-1-1 General

The ACB 3200HR and ACB 4000HR air circuit breakers should be completely inspected as a preventive maintenance procedure at least once a year. However, any circuit breaker that has opened under a heavy short-circuit current should be inspected as soon as possible.

When inspecting a circuit breaker, examine the contact surfaces; rough or high spots should be removed. Refer to corrective maintenance procedure. Arc chutes that are badly burned or corroded should be cleaned or replaced.

If excessive heating not caused by overcurrent is observed, look for loose or corroded contacts or connections. Examine the internal wiring for damage or breaks and make the necessary repairs.

Keep the components clean and free of dust, dirt, oil and foreign matter. If allowed to accumulate it could contaminate the insulation and would lead to circuit breakdown. Accumulated dirt and dust should be removed. Vacuum cleaning or hand dusting is satisfactory. If used, compressed air must be clean and free of condensation.

Section 2—Corrective Maintenance

5-2-1 GENERAL INSTRUCTIONS

5-2-1-1 General

The need for corrective maintenance can be considerably reduced by performing the preventive maintenance procedure. Should any of the sub-assemblies require repair or replacement, refer to the appropriate paragraph in this section for detailed instructions. Do not perform any maintenance work or extensive inspection on the breaker while it is in the cell.

5-2-1-2 Movable Component

Refer to Paragraph 1-2-1-2 for description of the movable component of the air circuit breaker. The movable component will require no maintenance other than keeping it clean, free of dirt, dust and other foreign matter.

5-2-1-3 Pole Units—(See Figure 1-2-2)

Refer to Paragraph 1-2-1-3 for description and operation of the pole units. The correct pressure of the circuit breakers is obtained when there is a positive deflection of 0.005 inch of the main contact fingers as measured above and below the main contact stops. A convenient method for measuring this deflection is to take a measurement with a feeler gauge above and below the main contact stops when the circuit breaker is open and comparing this with another measurement taken when the breaker is closed. Remove the screws (119) and washers (120) securing the arc chute (116) for the measurement and adjust if necessary. This deflection may be adjusted by means of the turnbuckle (130). To increase the deflection, rotate the turnbuckle counterclockwise. If the deflection must be decreased, rotate the turnbuckle clockwise. Repeat this adjustment until required deflection is obtained. Replace the air chute after adjusting.

The arcing contacts should be replaced if they are severely pitted or when they are excessively worn. To replace a moving arcing contact (122), remove the screws (119) and the arc chute (116). Bend down the locking clips at the bolts (123) and remove the two bolts. Remove arcing contact and replace with new arcing contact. Reassemble in reverse order of disassembly, making sure to relock bolts by bending up locking clips. To replace stationary arcing contact (121) remove arc chute (116). Remove bolts (114) and (125) which make shunt (113), stop pin (124) and pivot pin (126) free of arcing contact and arcing con-

tact free of upper stud. Reassemble stop and pivot pins on new stationary arcing contact. Place new arcing contact in position with shunt and secure them with the bolts (114) and (125). Replace arc chute and secure with washers (120) and screws (119). To replace the spring (115), carry out procedure above, use new spring and reassemble.

To replace the auxiliary contact spring (135), first remove the overcurrent trip device (see Paragraph 5-2-1-11). Remove the stop nut (136) and replace the spring with a new one. Install stop nut to secure spring. The proper auxiliary contact pressure is obtained by tightening the nut until the spring is solid and then backing the nut off one full turn. Install overcurrent trip (see Paragraph 5-2-1-11). Adjust main contact pressure as outlined in the beginning of this paragraph if necessary.

Sluggish or slow operation of the moving contact assembly will result in excessive arcing and rapid deterioration of the arcing contacts. This condition may be caused by a broken or defective accelerating spring (133). In order to replace this spring (133), remove the arc chute. Remove pin (128) that holds the insulating link (131) to the cross bar. Move the moving contact arm (132) back to its limit. Compress the spring (133) slightly and slide the spring out of position. To reassemble, replace the spring and use the reverse procedure of that outlined for removal. Make sure end of spring is centered on the projection on the moving contact arm.

To replace the main contact spring (106), remove pin (128). Remove screws (119) (Figure 1-2-2) and then remove arc chute (116). Loosen nut (136) to decrease the pressure applied by the auxiliary contacts on the contact arm (132). Remove snap ring on pin (103) and drive out the pin. Remove contact arm (132) and accelerating spring (133). Remove two bolts (111) securing upper stud (112) and main contact to the base (101). Remove main contact spring (106) from main contact assembly by removing spring support (105). Make sure pressure plate (129) and pins (108) remain in position. Reassemble in reverse order to disassembly procedure. Make sure to readjust the auxiliary contact pressure as described below.

To replace main contact fingers, remove main contact spring as described above. With the main contact spring removed, allow the pressure plate (129) and pins (108) to fall out of position. Remove screw (109) securing lock plate (110) in position and slide the main contact fingers out of position. Reassemble in reverse order to disassembly instructions. Make sure to readjust the auxiliary contact pressure as described above.

5-2-1-4 Arc Chute—(See Figure 1-2-2)

Refer to aragraph 1-2-1-4 for description of the arc chute. The arc chute requires no maintenance other than keeping clean and free of foreign matter. When inspection shows that the plates of the arc chute are badly burned, it should be replaced.

To replace the arc chute, remove screws (119) and washers (120) and lift arc chute free of breaker. Place new arc chute in position and replace washers and screws.

5-2-1-5 Operating Mechanism—(See Figure 1-2-3)

Refer to Paragraph 1-2-1-5 for description and operation of the operating mechanism. The only maintenance required other than keeping the operating mechanism clean and free of foreign material will be the replacement or a broken or defective spring.

To replace trip bar spring (185), remove two outboard bearings of trip bar (151) from the supporting platform. Carefully note each position of the trip finger (152) and attachment and remove them. Loosen latch (153) and slide trip bar from mechanism leaving spring free to be replaced. Reassemble with replacement spring by following the reverse of the disassembly procedure.

To replace pawl spring (167), first remove face plate and mechanism cover. Slide hook end of spring from pawl (164) and remove spring. Install new spring on pawl and reassemble mechanism cover and face plate.

To replace the trip button or latch springs, the operating mechanism must be removed from the breaker. Block up the solenoid (244) (Figure 1-2-1) to prevent its moving or falling. Remove the arc chutes. Remove the nuts (141) at both ends of the tie studs (138) and remove the tie studs, tubes (140) and lockwashers. Remove the cross bar (148) and end brackets (147) and (149). Remove the cotter pin (178) (Figure 1-2-3) and with the operating handle in place lower it until the pin (177) is in position to be driven out through the hole in the side of the mechanism. Remove the four bolts securing the operating mechanism and remove it.

To replace the trip button spring (176) unhook it at both ends and install a new one. In order to replace the latch spring (182), remove the pin (183) and spring and install a new one. Install the operating mechanism in the reverse order given for removal.

5-2-1-6 Closing Relay—(See Figure 1-2-4)

Refer to Paragraph 1-2-1-6 for description and operation of the closing relay. The required maintenance will consist of replacing a broken or defective spring and repairing or replacing the contacts.

Remove the closing relay (200) from the circuit breaker before attempting any disassembly. To remove the closing relay from the circuit breaker, remove the cover screw (239) and lift off molded cover (211) to expose the terminal connections. Tag, then remove the terminal connections by loosening the terminal screws (210). Remove the cover of the terminal block and disconnect relay coil leads. Remove the two screws (219) securing the closing relay in position. Remove relay from circuit breaker.

To replace a defective relay coil (206), remove screws (208) securing coil frame (203) and the coil to molded base (238) and remove frame and coil assembly base. Remove screw (209) and slide out bushing (207). Remove bolt (226) to remove stationary core (205). Slide coil sideways to remove from frame. Reassemble, using new coil in reverse order to disassembly procedure.

To replace a defective or broken latch spring (225), remove screw (208) securing coil frame (203) and coil to molded base (238) and remove frame and coil assembly from base. Lift movable core (204) and latch assembly out of base. Pull pin (227) out far enough to allow spring (225) to drop out. Replace spring and reposition pin (227). Lower movable core (204) and latch assembly into base making sure latch (229) slides over pin (230). Reassemble in reverse order to disassembly procedure.

To replace a defective or broken trip spring (221), remove ring from the end of the trip crank pin (222). Push out trip crank pin with soft rod and lift out trip spring. Reassemble in reverse order to disassembly procedure.

To replace moving contact arm spring (235), remove arcing chamber retaining strip (214) and both arcing chambers (215) by removing screw (213). Remove contact (236) by removing screw (233). Depress movable contact arm (234) at the upper end and hold. Compress spring with screw driver and remove. Reassemble in reverse order to disassembly procedure.

To replace blow out magnet coil (216) or (217), remove arcing chamber retaining strip (214) and both arcing chambers (215) by removing screw (213). Remove contact (236) by removing screw (233). Remove stationary contacts (237) by removing stationary contact screw (240). The assembly consisting of coil (216) and (217), core (242), screw (218) and side plates (212) can be lifted out. Remove side plate screw (218) to detach side plates from core and side coil off core. Reassemble in reverse order to disassembly procedure.

To replace stationary contact, remove arcing chamber contact strip (214) and both arcing chambers (215) by removing screw (213). Remove moving contact (236) by removing screw (233). Remove stationary contact (237) by removing stationary contact screw (240). Reassemble in reverse order to disassembly procedure.

After replacing the stationary contact, check the contact for proper adjustment. Figure 5-2-1 shows an enlarged view of the relay contacts and clearly indicates the proper measurements. Measure distance "A" with the contacts open, measure the distance "B" with contacts closed. The difference between "A" and "B" is distance "D". If this dimension is greater than required bend the longer arm slightly in and then, bend the short arm slightly forward. Bending the

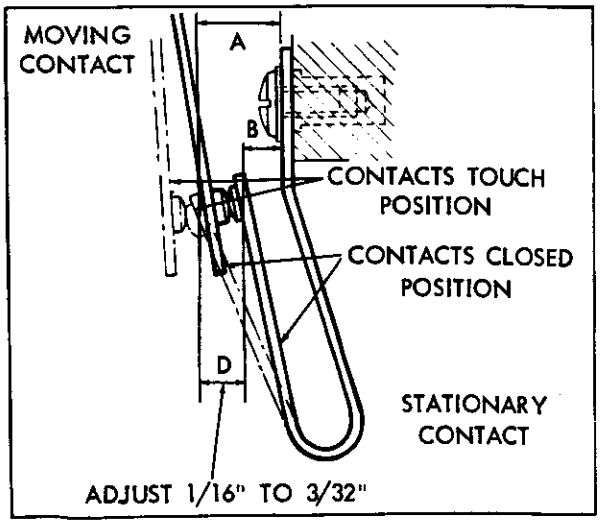


FIGURE 5-2-1 — Relay Contact Adjustment

arms in the opposite direction will decrease dimensions "D". Repeat this procedure until satisfactory adjustment is obtained.

5-2-1-7 Closing Solenoid—(See Figure 1-2-5)

Refer to Paragraph 1-2-1-7 for description and operation of the closing solenoid (244). The solenoid closing coil or the relay trip spring (254) are the only parts which may require replacement.

To replace a defective closing coil (250), first tag, then remove wire connections from indicating light (440) (Figure 1-2-13) terminals. Remove face plate (143) (Figure 1-2-1) by removing the three screws (146). Remove relay trip bracket (257) (Figure 1-2-5) by removing two bolts (258). Tag, then disconnect the closing coil leads from the silicon rectifier. Retract the moving core (245) into the stationary core (252) by closing and latching the circuit breaker. Remove bottom plate (249) by removing screws (246) and allow coil to slide out. Reassemble in reverse order to disassembly procedure, making sure that the relay trip assembly is functioning as described in paragraph 1-2-1-7.

To replace relay trip spring (254), remove face plate as described above. Remove relay trip bracket (256) by removing two bolts. Slide the trip levers (253) and (255) off their hinges and unhook spring (254). Reassemble in reverse order to disassembly procedure.

5-2-1-8 Shunt Trip Device—(See Figure 1-2-6)

Refer to Paragraph 1-2-1-8 for description and operation of the shunt trip device (260). The shunt trip device requires no maintenance other than the cleaning procedures. If a trip coil or spring becomes defective, it must be replaced.

To replace a defective coil (268), disconnect the shunt trip coil leads from the auxiliary switch. Remove two bolts (272) and remove shunt trip device from shelf. Remove plate (262) by removing two screws (261). Slide out the moving core (265), stationary core (271), spring (267), pin (263), washer (270), and sleeve (266). Lift out coil (268). Reassemble the shunt trip device with new or serviceable coil in reverse order to disassembly procedure.

To replace a defective or broken reset spring (267), follow above disassembly instructions until spring is removed. Replace spring and reassemble in reverse order to disassembly instructions.

5-2-1-9 Anti-Shock-Close Device—(See Figure 1-2-7)

Refer to Paragraph 1-2-1-9 for description and operation of the anti-shock-close device. Maintenance procedures consist of replacing a broken or defective return spring.

Replacement of a defective return spring (285) requires the removal of the operating mechanism from the circuit breaker. Refer to Paragraph 5-2-1-5. With the operating mechanism removed from the circuit breaker, remove bolt (284) and clip (282) from end of pin (283) and slide off latch plate (281) and return spring (285). Renew spring and reassemble in reverse order to disassembly instructions making sure spring ends are properly located.

5-2-1-10 Anti-Shock-Open Device—(See Figure 1-2-8)

Refer to Paragraph 1-2-1-10 for description and operation of the anti-shock-open device. Maintenance procedure consists of replacement of a broken weight spring (291) or lever spring (299).

Replacement of either spring requires prior removal of the anti-shock-open device from the circuit breaker. To remove the anti-shock-open device from the circuit breaker, remove cover (296) by removing four cover screws. Remove two bolts (300) securing the frame to the breaker platform and lift device free of circuit breaker.

To replace a defective weight spring, remove truarc ring and pin (295). Lift out spring. Reassemble in reverse order to disassembly instructions.

To replace lever spring (299), unhook spring ends from pin and lever (293) through opening in bottom of frame. Reassemble by hooking spring ends on lever and pin.

5-2-1-11 Overcurrent Trip Device—(See Figure 1-2-10)

Refer to Paragraph 1-2-1-11 for description and operation of the overcurrent trip device. No corrective maintenance should be attempted on the overcurrent trip device, since the proper operation of this unit is dependent not only on the characteristics of a replaced part but also is related to the combined characteristics of all associated springs or valves. If the overcurrent trip device fails to function properly or should it be accidentally damaged, the unit must be returned to the manufacturer for repairs and recalibration.

The long time delay pick up adjustment is the only field adjustment that should be made.

To change the pick-up current setting of the long time delay unit, turn the adjusting screw (321) until the indicator points at the desired setting. Adjusting screws (334), (342), and (346) are sealed so they cannot be turned accidentally.

Repair springs are included with on board repair parts, however they should be used only under supervision of manufacturer's representative.

To remove overcurrent trip, unscrew bolts (315) and (354). The breaker in this condition will function properly except overload protection is lost. Bolt (311) and stationary yoke (312), (316) and (336) need not be removed unless they are damaged.

5-2-1-12 Auxiliary Switch—(See Figure 1-2-11)

Refer to Paragraph 1-2-1-12 for description and operation of the auxiliary switch. At least once each year, the auxiliary switch should be inspected and cleaned. Any parts showing obvious wear or damage should be replaced.

The auxiliary switch is not adjustable. However, the contacts can be converted to either normally open or normally closed by rotating the appropriate rotor section 90 degrees on the shaft. To convert a normally open or normally closed contact; tag, then remove the terminal connections. Disconnect link (420) from closing lever. Remove the two mounting bolts (421) and remove switch from breaker. For identical reassembly, note the exact position of the rotating contacts with respect to the stationary contacts with the exception of the contact that is to be converted. Remove screw (419) and bushing (418), withdraw shaft (404) completely. Lift the rotor assembly out of case. Pull the rotor apart slightly at the contact to be changed to disengage positioning lugs. Rotate the contact 90 degrees clockwise to convert a normally open contact to a normally closed contact when affected contact is in the lower switch and counterclockwise to convert a normally open contact to a normally closed contact when the affected contact is in the two top switches. Reverse this procedure when converting a normally closed contact to a normally open contact. Push the rotor assembly together to lock in place. Reassemble in reverse order to disassembly instructions making certain the rotor assembly is in its identical original position. This precaution is required since it is possible to insert shaft with the rotor rotated 30 degrees either direction.

To replace an auxiliary switch; tag, then remove the terminal connections. Disconnect link (420) from closing lever and disconnect arm (412) from link of switch to be replaced. Remove two mounting bolts (421) and remove switch. Tag and disconnect terminal connections between terminal block and auxiliary switch to be replaced. Replace with new switch making sure that contacts of new switch are positioned identical with contacts of switch being replaced. Refer above for instructions regarding positioning of contacts. Reassemble auxiliary switch in reverse order of disassembly procedure.

5-2-1-13 Main Discounts—(See Figure 1-2-12)

Refer to paragraph 1-2-1-13 for description and operation of the main disconnects. The main disconnects require no maintenance except to keep the contacts clean. If the contacts become badly pitted or worn, the entire assembly must be replaced.

To remove a finger cluster, depress both leaf type finger springs (427) and slide retainer off. Reassemble, using new assembly in reverse order to disassembly procedure.

5-2-1-14 Secondary Contacts—(See Figure 1-2-12)

Refer to paragraph 1-2-1-14 for description and operation of the secondary disconnects.

The disconnect contacts should be inspected and cleaned occasionally. Note that stationary contacts may be energized even though breaker is withdrawn.

Since these are not interrupting contacts, corrective maintenance will be required only if moving contact assemblies are damaged by handling. In this case complete moving contact assembly must be replaced.

To replace the secondary disconnect assemblies; tag, then remove all wiring at the terminal connections. Remove the two mounting screws from each assembly and remove the assembly. Replace new assembly in reverse order to disassembly procedures.

5-2-1-15 Indicator Lights—(See Figure 1-2-13)

Refer to paragraph 1-2-1-15 for description and operation of the indicating lights. Maintenance procedure consists of replacing a defective lamp.

To replace a defective lamp, remove globe (445) by turning knurled ring (446) counterclockwise and turn defective lamp out. Reassemble in reverse order to disassembly procedure.

5-2-1-16 Silicon Rectifier (See Figure 1-2-14)

Refer to paragraph 1-2-1-16 for description and operation of the silicon rectifier. The rectifier requires no maintenance other than the normal cleaning procedures and checking of connections. If the silicon rectifier becomes defective, it must be replaced.

To replace a rectifier, first remove the front cover (452) of each case by removing the screws. Tag and disconnect the incoming leads. Remove the screws (454) securing the rectifier to the mounting plate on the closing solenoid. To install the replacement rectifier, use the reverse of the removal procedure.

5-2-1-17 Cell Interlock (See Figure 1-2-15)

Refer to Paragraph 1-2-1-17 for description and operation of the cell interlock. The lever assembly of the cell interlock is mounted on the side panels of the platform of the moving component.

To remove a defective lever assembly, remove pin (458) securing the assembly to the platform. To install the lever assembly (459), position the assembly on the side panel of the platform and secure it with pin (458). Make certain that lever is positioned correctly relative to the trip bar clamp (460). The cam (456) and stop (457) which hold the interlock lever are an integral part of the cam rails.

5-2-1-18 Levering-in Device (See Figure 1-2-16)

Refer to Paragraph 1-2-1-18 for description and operation of the levering-in device. The levering-in device requires no maintenance other than the normal cleaning procedures.

5-2-1-19 Stop (See Figure 1-2-16)

Refer to Paragraph 1-2-1-19 for description and operation of the stop.

To replace a defective spring, compress the spring (465) with a screwdriver and slide it out of the lever (464). When installing the replacement spring, make certain it is positioned correctly between the lever and platform side.

5-2-1-20 Extension Rails (See Figure 1-1-1)

Refer to Paragraph 1-2-1-20 for description and operation of the extension rails. The extension rails require no maintenance other than the normal cleaning procedures.

CHAPTER 6
PARTS LIST

Section 1—Repair Parts List Introduction

6-1-1 REPAIR PARTS IDENTIFICATION

6-1-1-1 Circuit Breaker

Each sub-assembly of the movable component is a complete unit which is readily replaceable. Certain types of parts within the various sub-assemblies have been shown by years of Naval experience to be the most subject to wear and breakage. Repair parts are normally provided for these in accordance with Navy specifications.

The sub-assemblies, as well as the replaceable parts within the various sub-assemblies, are listed in Section 2, Spare Parts Tabulation. This repair parts list provides the manufacturer's service part number, part name and indicates the figure number of the drawing on which it is identified.

Refer to the ship's allowance list or to the certification data to determine the actual number of repair parts for a specific installation.

6-1-1-2 Repair Part Ordering

When ordering a part not identified by manufacturer's part number, be sure to state S.O. (shop order) number that appears on front of breaker platform on "Breaker Identification Plate".

Section 2—Repair Parts Tabulation

6-2-1 REPAIR PARTS TABULATION

6-2-1-1 Repair Parts

See Paragraph 6-1-1-1 for explanation of the following tabulation.

Identified on Figure No.	Repair Part No.	Name of Repair Part	Mfr. Part No.	No. of Spares Supplied Per Breaker
1-2-2	100	POLE UNIT	403D075G11	-
1-2-2	122	Contact, moving arcing	201B184G01	3
1-2-2	121	Contact, stationary arcing	200B598G02	3
1-2-2	115	Spring, stationary arcing contact	30D9774H09	5
1-2-2	135	Spring, auxiliary contact	1802356	5
1-2-2	133	Spring, accelerating	1802343	2
1-2-2	106	Spring, main contact	1802345	5
1-2-2	137	Contact, stationary arcing - L.H.	200B598G03	3
1-2-2	138	Contact, stationary arcing - leading	200B598G04	3
1-2-2	139	Contact, stationary arcing - R.H.	200B598G01	3
1-2-3	150	OPERATING MECHANISM	405D220G11	-
1-2-3	167	Spring, pawl	125A163H15	1
1-2-3	176	Spring, trip button	300P049H01	1
1-2-3	181	Spring, latch	1809525	1
1-2-3	185	Spring, trip bar	1799969	1

Identified on Figure No.	Repair Part No.	Name of Repair Part	Mfr. Part No.	No. of Spares Supplied Per Breaker
1-2-4	200	CLOSING RELAY		0
1-2-4	221	Spring, trip	1802923	1
1-2-4	235	Spring, contact arm	30D9774H12	1
1-2-4	206	Coil	*	1
1-2-4	225	Spring, latch	1802924	1
1-2-4	236	Contact, movable	1802917	1
1-2-4	237	Contact, stationary	1802916	2
1-2-4	217	Coil, blowout (R.H.)	300P275G01	1
1-2-4	216	Coil, blowout (L.H.)	300P274G01	1
1-2-4	243	Spring, auxiliary contact	1802939	1
1-2-5	244	CLOSING SOLENOID	-	0
1-2-5	250	Coil, closing	*	1
1-2-5	254	Spring, relay trip	1802968	1
1-2-6	260	SHUNT TRIP	-	0
1-2-6	267	Spring	1802869	1
1-2-6	268	Coil	*	1
1-2-7	280	ANTI-SHOCK-CLOSE DEVICE	-	0
1-2-7	285	Spring, return	126A172H01	1
1-2-8	288	ANTI-SHOCK-OPEN DEVICE	-	0
1-2-8	291	Spring, weight	126A804H01	1
1-2-8	299	Spring, lever	126A604H02	1
1-2-10	310	OVERCURRENT TRIP UNIT	-	0
	317	Spring, limit	*	1
	319	Spring, L D pickup	*	1
	322	Spring, L D dial	*	1
	331	Spring, instantaneous	*	1
	339	Spring, S D pickup	*	1
	343	Spring, S D value	*	1
	348	Spring, disc	*	1
	349	Spring, trip	*	1
	357	Spring, latch	*	1
	361	Spring, piston	*	1
	364	Spring, follow	*	1
1-2-11	400	AUXILIARY SWITCH	*	1
1-2-12	425	Main disconnects	29B8671G02	2
1-2-12	430	Secondary disconnect	18B1225G05	2
1-2-13	440	INDICATOR LIGHT	*	1
1-2-13	441	Transformer	-	0
1-2-13	444	Lamp (2.5V)	Type TS-159	0
1-2-13	445	Globe	-	0
1-2-14	450	SILICON RECTIFIER	*	1
1-2-16	465	Spring, drawout-stop	13D8370H07	1
		Truarc kit	*	1

* See certification data sheet for correct Mfr. Part No.

CHAPTER 7
DRAWINGS

Section 1—General

Figure 7-1-1. Air Circuit Breaker Removable Assembly (Westinghouse Drawing 900-J-233 Sheet 1) . . Page 7-3,7-4

Figure 7-1-2. Air Circuit Breaker Stationary Assembly (Westinghouse Drawing 900-J-233 Sheet 2) . . Page 7-5,7-6

Figure 7-1-3. Air Circuit Breaker Removable Assembly (Westinghouse Drawing 900-J-065 Sheet 1) . . Page 7-7,7-8

Figure 7-1-4. Air Circuit Breaker Stationary Assembly (Westinghouse Drawing 900-J-065 Sheet 2) . . Page 7-9,7-10