INSTRUCTIONS

GEI-88768 C

Supersedes GEI-88768 B

GROUND AND TEST DEVICE

TYPES

GM-4.16-250-1	GM-13.8-500-1
GM-4.16-350-1	GM-13.8-750-1
GM-7.2 -500-1	GM-13.8-1000-1

With ML-13 Stored Energy Mechanism

GENERAL ELECTRIC

GROUND AND TEST DEVICE

GM-4.16-250-1 GM-13.8-500-1
GM-4.16-350-1 GM-13.8-750-1
GM-7.2 -500-1 GM-13.8-1000-1

With ML-13 Stored Energy Mechanism

INTRODUCTION

The Ground and Test Device, an auxiliary device for use with vertical lift metal-clad switchgear equipment, is designed for use during both the initial installation and at normal maintenance periods. The primary function of the device is to solidly ground the equipment as well as permit various types of tests.

A GM-4.16, GM-7.2 and GM-13.8 type Ground and Test Device is available for each rating of its corresponding magne-blast circuit breaker. A single device can be used for either a 1200 or 2000 ampere unit by using the proper size primary contact on the upper end of the bushing. A separate device is required in the case of a 3000 ampere unit. Even though the device has no interrupting capacity, it is capable of successfully closing and latching against short circuit currents equivalent to the full momentary current rating of the equipment.

Various interlock arrangements are included within the device in order to insure proper operation. Several specific devices are outlined in these instructions, each having different interlocks to accomplish a specific sequence of operation. Interlocking the device with other types of equipment such as test units may be accomplished by the correct selection of key interlocks.

Proper installation and maintenance are necessary to insure continued satisfactory operation of the device. The following instructions will provide information for placing the device in service and for maintaining satisfactory operation. Since a clear conception of the function of all parts is helpful in understanding the operation and during installation and maintenance periods, a brief description of the design and operating principles is also given.

4. Remove test coupler, if applicable, attach mechanism cover and replace barriers.

5. If Ground and Test Device has been stored for a long period of time, it is recommended that the insulation be checked with the standard 60 cycle high potential test -- see INSULATION TEST (page 12).

6. Lubricate the silver portion of the primary disconnect studs by rubbing a small amount of contact lubricant D50H47 to form a thin coating on the ball contact.

7. Refer to instruction book GEH-1802 for final instructions before inserting the Ground and Test Device into the metal-clad unit.

GENERAL DESCRIPTION AND OPERATION

The Ground and Test Device is composed of two major parts, the grounding, switching, and testing element and the operating mechanism. The grounding, switching, and testing element comprises three similar pole units in which the specific features may vary in the different type devices. For a detailed description, reference should be made to the specific device involved. A general description of this element may be seen in the cross-sectional view of Fig. 10. Grounding of the equipment is accomplished through a set of grounding contacts (10 & 11) operated by the closing mechanism (4). The support for the movable connect is connected to a common bus within the device which engages the ground bus of the metal-clad equipment. The selector switch used on certain design permits grounding of either the bus or line side of the equipment.

A set of test receptacles (23 & 25), Fig. 10 accessible from the front of the device, are provided for permitting various types of tests. The receptacles are electrically connected to the primary bushings in various ways on different type devices in order to permit the particular functions of that type device. Connection between the receptacles and primary bushings is made through bus bars of sufficient size to withstand the full momentary current rating of the equipment. The test receptacles are designed for use with equipment such as a Kenotron set or a Murry Loop test set.

The type ML-13 operating mechanism shown in Figures 1 to 6 is of the stored energy type designed to provide the high contact speed and forces necessary to successfully close and latch short circuit currents. Since the Ground and Test Device has no interrupting capacity, the mechanism is of the non-trip free type (cannot be tripped open during the closing operation). This feature prevents accidental reopening of the grounding contacts if the device is closed on an energized circuit. The mechanism will operate on a-c or d-c voltage as indicated on the device nameplate. Closing and opening operations are initiated electrically by either a control switch on the metal-clad door or from a remote control station. A control transfer switch mounted on the front of the device must be correctly set before the mechanism can be operated.

Manual tripping may be accomplished through the use of a manual trip button. Manual closing can be done only when the device is withdrawn from the metal-clad unit.

The spring charging mechanism consists of a high speed gear motor that compresses a set of closing springs through the action of a simple eccentric, ratchet, and pawl assembly. The rotary action of the motor (5) Fig. 4 is converted to a short straight stroke pumping action through the eccentric (6) and a lever that carries a spring loaded driving pawl (3). The pawl advances the ratchet wheel (6) Fig. 3 only a few degrees each stroke where it is held in position by the latching pawls (3). When the ratchet wheel has been rotated approximately 180 degrees the closing springs (10) will be fully compressed. As the ratchet wheel continues to rotate, the spring load will shift over center and attempt to discharge. After only a few degrees of rotation, the closing roller (8) Fig. 1 will engage the closing latch (10) and the compressed springs will be held in repose until the release latch is withdrawn by operation of the closing solenoid. During the last few degrees of the ratchet wheel rotation the motor and interlock switches (9) are released and the driving pawl is raised from the ratchet wheel surface. This allows the motor and driving mechanism to coast to a natural stop expending all residual energy.

When the Ground and Test Device is removed from the metal-clad unit, the closing springs may be charged manually. A 5/8" ratchet wrench can be used to rotate the eccentric in a counter clockwise direction until the indicator reads "CHARGED" and the driving pawl no longer engages the ratchet wheel.

A positive interlock (14) Fig.11 and interlock switch (4) Fig. 1 are provided between the Ground and Test Device and the metal-clad unit to prevent raising or lowering of the device in the unit while the grounding contacts are in a closed position and also to prevent a closing operation when the device is not in either the fully raised or lowered position. Should the closing springs be in the charged position when the device is inserted in the metal-clad unit, a linkage directly connected to the closing release latch and the trip latch discharges the closing springs before the device can be raised.

Ground and Test Devices used interchangeably with the MS-13 solenoid operated breakers have fuses mounted on the device to protect the motor circuit.

For a more detailed description of a specific device, refer to that particular device listed under PRINCIPLES OF OPERATION.

Closing Operation

The charging of the closing springs and the closing operation of the

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If adjustment is required for either pawl the springs must first be fully charged and blocked. Loosen seven motor support bolts (1) Fig. 7 and move entire motor assembly to the rear if the clearance is under the minimum at the latching pawls, and to the front if the clearance is under the minimum at the driving pawl. Move the motor assembly approximately twice the dimensional increase required at the pawl. Be certain the motor assembly is moved straight forward or rearward and tighten the one bolt on the right side of the mounting frame first to assure proper alignment. After tightening the remaining bolts, the springs should be released and the clearance again checked as described above.

Tripping Stop Adjustment

With the control transfer switch (4) Fig. 11 in the "TRIP" position, the clearance between the tripping stop (3) Fig. 8 and the blocking cam (6) should be 1/16" to 1/4". To adjust for this clearance loosen the nuts at the turn-buckle (12) in the control transfer switch connecting rod (9) and change the length of the connecting rod. Lengthening the rod will reduce the clearance and shortening the rod will increase the clearance.

With the control transfer switch in the "Off" position, the clearance between the tripping stop and the blocking cam should be 1/32" to 3/32". This clearance is set at the factory and no adjustment is provided.

Positive Interlock Prop Adjustment

With the grounding contacts in the closed position, the clearance between the positive interlock prop (1) Fig. 8 and the pin (2) through the mechanism output crank should be 1/32" to 1/16". To adjust this clearance, loosen the nuts at the turnbuckle (10) in the positive interlock connecting rod (8) and change the length of the connecting rod. Lengthening the rod will increase the clearance and shortening the rod will decrease the clearance.

With the grounding contacts in the open position, the clearance between the positive interlock prop and the pin should be at least 1/32" when the positive interlock crank (1) is rotated forward.

Manual Trip Adjustment

The clearance between the pin on the manual trip crank (5) Fig. 8 and the cut-out in the blocking cam (6) should be 1/32" to 1/16". To adjust this clearance, loosen the nuts at the turn-buckle (11) in the manual trip connecting rod (7) and change the length of the connecting

Auxiliary Fuses

Refer to Fig. 2. On certain Ground and Test Devices, a set of protecting fuses (11) are mounted on the lower part of the closing mechanism. These fuses will be the primary protection devices for the closing control circuits, and in some instances, the tripping circuit on those devices that are used in metal-clad units designed for solenoid operated breakers.

FINAL INSPECTION AND TEST

1. For ease in reviewing the adjustments, the following are recapitulated:

   A. Ground contact wipe: 1/4" to 5/16"
   B. Ground contact gap: 3 5/16" to 3 1/2" on 4.16KV device.
      5-1/8" to 5-9/16" on 7.2KV & 13.8KV device.
   C. Trip latch wipe: 3/16" to 1/4" with the trip latch resting against the stop pin.
   D. Trip latch clearance: 1/32" to 1/16".
   E. Prop Clearance: 1/16" to 5/32".
   F. Release latch wipe: 3/16" to 1/4".
   G. Release latch monitoring switch: maximum clearance 1/32".
   H. Motor and power switches: Maximum clearance 1/32".
   I. Interlock switch wipe: Maximum clearance 1/32".
   J. Auxiliary switch "a" contacts close when the grounding contact gap is 1" or greater.
   K. Driving and latching pawl: Minimum clearance to ratchet teeth 0.015".
   L. Tripping stop adjustment: 1/16" to 1/4".
   M. Positive interlock prop adjustment: 1/32" to 1/16".
   N. Manual trip adjustment: 1/32" to 1/16".

2. Check all nuts, washers, bolts, retaining rings, cotter pins, and terminal connections for tightness.

3. Inspect all wiring to make sure that no damage has occurred during installation, and test for possible grounds or short circuits.

4. See that all bearing surfaces of the mechanism have been lubricated. Refer to the section on LUBRICATION.

5. Operate the device slowly with the manual charging wrench and note that there is no excessive binding or friction and that the device can be moved to the fully opened and fully closed positions.

6. See that any place where the surface of the paint has been damaged during installation is repainted immediately.

7. Check the trip coil plunger and the release coil plunger to see that they move freely.

Insulation Test

If the device has been stored for a long period of time, it is recommended that the insulation be checked before the device is placed in service. A standard 60 cycle high potential test at 14,000 volts RMS on the 4.16 KV device or 27,000 volts RMS on the 7.2KV & 13.8KV device will normally indicate whether the device is satisfactory for service. With the ground contacts in the fully opened position, apply the high potential test to each terminal of the device individually for one minute with all other terminals and the device frame grounded. After high potential tests are made on organic insulation materials, these materials should be inspected for visible leakage current paths, and necessary action must be taken to replace insulation which may have been affected by moisture absorption.

NOTE: Before applying a high potential to devices type 102, 104, 120, or similar, disconnect the potential transformer by opening the PT switch.

Voltage Relay

On devices equipped with an auxiliary relay connected to the potential transformer check for correct electrical operation of the relay. The relay should operate satisfactorily at 80% of the nominal operating voltage.

Control Power Check

After the grounding contacts have been closed and opened slowly several times with the maintenance closing wrench and the mechanism adjustments are checked as described, the operating voltages should be checked at the release coil, trip coil, and motor terminals. For electrical operation of the mechanism, the control power may be either an alternating or direct current source. The operating ranges for the closing and tripping voltages are given on the device nameplate. The following ranges are standard:

Nominal Voltage	Closing Range			Tripping Range		
	Min.		Max.	Min.		Max.
48v d-c	34	-	50v d-c	28	-	60v d-c
110v d-c	80	-	115v d-c	60	-	125v d-c
125v d-c	90	-	130v d-c	70	-	140v d-c
220v d-c	160	-	230v d-c	120	-	250v d-c
250v d-c	180	-	260v d-c	140	-	280v d-c
115v a-c	95	-	125v a-c	95	-	125v a-c
230v a-c	190	-	250v a-c	190	-	250v a-c

If the closed circuit voltage at the terminals of the coils or motor does not fall within the specified range, steps should be taken to correct the power supply.

Electrical closing or tripping is accomplished by energizing the respective circuit. The device cannot be operated unless the interlocks are set correctly. It is also possible to trip the device manually by pressing the manual trip button.

When all the foregoing inspection details have been checked, the device may be safely placed in service. Before the device is finally raised into position in the metal-clad unit, rub a small amount of G.E. Lubricant D50H47 on the silvered portion of the bushing studs to form a thin coating for contacting purposes.

NOTE: THIS DEVICE IS DESIGNED ONLY FOR ELECTRICAL CLOSING WHEN IN USE. NEVER ATTEMPT MANUAL CLOSING WITH THE DEVICE IN SERVICE.

MAINTENANCE

Dependable safety of grounded equipment is based on the unfailing performance of the Ground and Test Device. To maintain such performance, it is recommended that a definite inspection and maintenance schedule be set up and followed. A periodic lubrication of parts subject to wear is also vitally important for successful operation.

CAUTION: BEFORE ANY MAINTENANCE WORK IS PERFORMED, MAKE CERTAIN THAT ALL CONTROL CIRCUITS ARE OPENED AND THAT THE DEVICE IS REMOVED FROM THE METAL-CLAD UNIT. DO NOT WORK ON THE DEVICE OR MECHANISM WHILE IN THE CLOSED POSITION UNLESS THE PROP AND TRIP LATCH HAVE BEEN SECURELY WIRED OR BLOCKED TO PREVENT ACCIDENTAL TRIPPING. DO NOT WORK ON THE DEVICE OR MECHANISM WHILE THE SPRINGS ARE CHARGED UNLESS THEY ARE SECURED IN THAT POSITION BY THE MAINTENANCE SPRING BLOCKING DEVICE.

Periodic Inspection

The frequency of the periodic inspection is dependent upon the operating conditions of the particular installation. In the case of highly repetitive operation, the first periodic inspection should be made after not more than 500 operations. The interval between successive periodic inspections may be determined by experience. A thorough inspection should be made however in any case where the device is closed on an energized circuit.

Grounding Contacts

By removing or sliding the outside and inter phase barriers the movable and stationary grounding contacts can be inspected. If the contacts are burned or pitted, they should be made smooth with a fine file.

After completing inspection of the contacts, check the contact adjustments as specified under ADJUSTMENTS.

Mechanism

A careful inspection should be made to check for loose nuts or bolts and broken retaining rings. All cam, roller, and latch surfaces should be inspected for any evidence of damage or excessive wear. Lubricate the mechanism as outlined below, then, using the manual charging wrench, open and close the grounding contacts several times to make certain that the mechanism operates freely throughout its entire stroke. Check the mechanism adjustments as specified under ADJUSTMENTS. Check all terminal connections.

Bushings and Insulation

The surface of the bushings should be kept clean and unmarred to prevent moisture absorption. If the insulation surface should become damaged, it should be sanded and cleaned, and should be refinished with either clear varnish or clear resin. Allow to dry smooth and hard.

All other insulation parts on the device should be kept clean and dry. Smoke or dust collected between inspection periods should be wiped off, and if dampness is apparent, heaters should be installed to insure dryness.

LUBRICATION

In order to maintain reliable operation, it is important that the device be properly lubricated at all times. Most of the bearings and rolling surfaces utilize a new type of dry lubrication that will require no maintenance and will last the life of the equipment. Only few bearings and surfaces listed in the chart require lubrication. These have been properly lubricated, during assembly at the factory, using the finest grades of lubricants available. However, even the finest oils and greases have a tendency to oxidize with age, as evidenced by hardening and darkening in color. Elimination of the hardened lubricant is essential for proper operation. Also frequent operation of the device causes the lubricant to be forced out from between the bearing surfaces. A simple lubrication will often clear up minor disturbances which might be mistaken for more serious trouble.

A definite lubrication schedule should be set up taking into consideration the frequency of operation and local conditions. Until such a schedule is worked out, the device should be lubricated at each periodic inspection and also whenever it is overhauled, in accordance with the lubrication chart. It is also recommended that the device be operated at regular intervals to insure the user that the equipment is operating freely.

The lubrication chart is divided into two methods of lubrication. The first method outlines the maintenance lubrication which should be performed at the time of periodic maintenance, and requires no disassembly. The second method outlines a lubrication procedure similar to that performed at the factory, but should be used only in case of a general overhaul or disassembly for other reasons, or if the operation becomes slower.

eneral Electric Lubricants D50H15 and D50H47 are available in 1/4# collapible tubes. It is so packaged to insure cleanliness and to prevent oxidation.

PART	LUBRICATION AT MAINTENANCE PERIOD	ALTERNATE LUBRICATION (REQUIRES DISASSEMBLY)
Sleeve Bearings - links, trip shaft, etc. (Teflon coated bearings)	No lubrication required.	No lubrication required.
Sleeve Bearings - main crank shaft, driving pawl lever. (Bronze or cast iron)	Light application of machine oil SAE 20 or SAE 30.	Remove bearings or links clean per instructions and apply D50H15 lubricant liberally.
Contact Arm Hinge Assembly Cup bearing Loose rings between bushing and contact arm.	No lubrication required.	Wipe clean and apply D50H47.
Roller and Needle Bearings	Light application of machine oil SAE 20 or SAE 30.	Clean per instructions and repack with D50H15 lubricant.
Ground surfaces such as cams, ratchet teeth, etc. (Surfaces coated with M_oS_2)	No lubrication required.	No lubrication required.
Ground surfaces such as latches, rollers, prop, etc.	Wipe clean and apply D50H15 lubricant.	Wipe clean and apply D50H15 lubricant.
Grounding contact surfaces, silver plated contacts, and primary disconnect studs.	Wipe clean and apply D50H47.	Wipe clean and apply D50H47.

LUBRICATION CHART

Method of Cleaning Bearings

Whenever cleaning is required, as indicated in the in the lubrication chart, the following procedures are recommended:

Sleeve Bearings

The sleeve bearings used throughout the linkage utilize Teflon surfaces and do not require lubrication. After a number of operations, the surface will acquire a thin black film. Do not remove this film unless there is evidence of outside contaminates, such as dry or hardened grease. If contaminants are present they should be removed by immersing the link and bearing in clean petroleum solvent or similar cleaner and using a stiff brush. Do not remove the bearings from the links. DO NOT USE CARBON TETRACHLORIDE.

The hinge of the grounding contact arm (12) Fig. 10 should be disassembled, cleaned, and lubricated with G-E D50H47 lubricant at general overhaul periods.

The main shaft bearings (24) Fig. 5 and the driving pawl lever bearing should be removed, cleaned, and lubricated with G-E D50H15 lubricant at general overhaul periods.

Roller & Needle Bearings

The cam follower bearings (6) Fig. 5, latch roller bearing (9), and cam shaft bearings (25) should be first removed from the mechanism and the inter race disassembled. They should then be placed in a container of clean petroleum solvent or similar cleaner. DO NOT USE CARBON TETRACHLORIDE. If the grease in the bearings has become badly oxidized, it may be necessary to use alcohol (type used for thinning shellac) to remove it. Ordinarily, by agitating the bearings in the cleaning solution, and using a stiff brush to remove the solid particles, the bearings can be satisfactorily cleaned. Do not handle the bearings with bare hands as deposits from the skin onto the bearings are inductive to corrosion. If the bearings are touched, the contamination can be removed by washing in alcohol. After the bearings have been thoroughly cleaned, spin them in clean new light machine oil until the cleaner or solvent is entirely removed. Allow this oil to drain off and then repack them immediately with G-E lubricant D50H15 being sure all metal parts are greased. The removable seals should then be replaced.

NOTE: If it becomes necessary to clean the bearings in alcohol (Shellac thinner), be sure the alcohol is perfectly clean, and do not allow the bearings to remain in the alcohol for more than a few hours. If it is desirable to leave the bearings in the alcohol for a longer time, an inhibited alcohol such as is used for anti-freeze should be used. Even then the bearings should be removed from the alcohol within twenty-four hours. Esso Anti-Freeze and Du Pont Zerone are satisfactory for this purpose. Precautions against the toxic effects of the alcohol must be

exercised by wearing rubber gloves and by using the alcohol in a well ventilated room; excessive exposure to the fumes is sometimes unpleasant to personnel. Washing the bearings in the light oil and draining should follow immediately, then apply the lubricant.

Bearings that are pressed into the frame or other members such as the eccentric drive bearings (6) Fig. 4 should not be removed. After removing the shaft and inner race the bearing can usually be cleaned satisfactorily with petroleum solvent or a similar cleaner and a stiff brush. Follow the procedure outlined above using a light machine oil and G-E lubricant D50H15 before reassembling the inner race and shaft.

Rolling Surfaces

A number of rolling and rubbing surfaces in the mechanism have been lubricated with a baked-on, dry, molybdenum disulfide coating. This requires no maintenance and should last the life of the device.

TROUBLE SHOOTING

Failure of a device to operate properly will generally fall within several general classes; failure to trip, failure to close or latch closed, and closing springs will not charge. The following is a brief outline showing particular types of distress that might be encountered, together with suggestions for remedying the trouble:

Failure to Trip

1. Mechanism binding or sticking caused by lack of lubrication.
   REMEDY: Lubricate complete mechanism.

2. Mechanism binding or sticking caused by being out of adjustment.
   REMEDY: Check all mechanism adjustments, latches, stops, auxiliary devices, etc., in accordance with section on ADJUSTMENTS. Examine latch and roller surfaces for corrosion.

3. Damaged trip coil.
   REMEDY: Replace damaged coil.

4. Blown fuse in trip circuit.
   REMEDY: Replace blown fuse after determining cause of failure.

5. Faulty connections in trip circuit.
   REMEDY: Repair broken or loose wires and see that all binding screws are tight.

6. Damaged or dirty contacts in trip circuit.
   REMEDY: Recondition or replace contacts.

Failure to Close or Latch Closed

1. Mechanism binding or sticking caused by lack of lubrication.
   REMEDY: Lubricate complete mechanism.

2. Mechanism binding or sticking caused by being out of adjustment.
   REMEDY: Check all mechanism adjustments, latches, stops, auxiliary devices, etc., in accordance with section on ADJUSTMENTS. Examine latch and roller surfaces for corrosion.

3. Damaged or dirty contacts in control circuit including control relay.
   REMEDY: Recondition or replace contacts.

4. Damaged spring release coil.
   REMEDY: Replace damaged coil.

5. Defective motor limit switch or interlock switch.
   REMEDY: Replace defective switch.

6. Blown fuse in closing circuit.
   REMEDY: Replace blown fuse after determining cause of failure.

7. Faulty connections in closing circuit.
   REMEDY: Repair broken or loose wires and see that all binding screws are tight.

8. Insufficient control voltage caused by excessive drop in leads.
   REMEDY: Install larger wires and improve electrical contact at connections.

9. Insufficient control voltage caused by poor regulation (a-c control).
   REMEDY: Install larger control transformer.

Failure to Charge Springs

1. Defective motor cut-off switch, interlock switch, or closing latch monitoring switch.
   REMEDY: Replace switch.

2. Damaged or dirty contacts in control circuit.
   REMEDY: Recondition or replace contacts.

3. Blown fuse in closing circuit.
   REMEDY: Replace blown fuse after determining cause of failure.

4. Faulty connection in charging circuit.
   REMEDY: Repair broken or loose wires and see that all binding screws are tight.

REPAIR AND REPLACEMENT

The following information covers in detail the proper method of removing various parts of the device in order to make any necessary repairs. This section includes only those repairs that can be made at the installation on parts of the device that are most subject to damage or wear.

IMPORTANT: UPON COMPLETION OF ANY REPAIR WORK, ALL ADJUSTMENTS MUST BE CHECKED. Refer to the section on INSTALLATION, paying particular attention to ADJUSTMENTS and FINAL INSPECTION.

Stationary Grounding Contacts

Removal and replacement of the contact fingers (9) Fig. 9 requires the use of a spring compressor suitable for use on the contact spring. Using this tool, remove fingers as follows:

1. Compress the contact spring (6).
2. Remove spring and spring guide (1).
3. Raise the contact finger to clear the contact stop plate (8) and lift the finger out of contact support (7). Remove one contact finger at a time.

To replace the Stationary Grounding Contacts:

1. Apply a thin coating of D50H47 grease on the hinged edge of the finger (9) then place it on the contact support (7) so that it is retained by stop plate (8).

   NOTE: When replacing fingers, make certain that the two fingers having arc resistant material on the contact surface (unsilvered) are positioned to correspond with the one movable contact having a similar contact surface (where applicable).

2. Open spring compressor (3) and assemble spring guide, spring and spring compressor (Fig. 9A).
3. Turn nut (2) in clockwise direction to compress contact spring (Fig. 9B). Hold spring firmly in yoke on spring compressor to prevent spring from slipping out of the compressor.
4. Place washer (not shown) on guide on top of spring, place top of guide into hole in spring retainer (4) and the round end of spring guide in cutout in primary finger (Fig. 9C).
5. Hold spring assembly firmly in place and remove spring compressor.

Movable Grounding Contacts

Removal and replacement of the movable grounding contact (11) Fig. 10 is easily accomplished by removing the assembly bolts on the contact blades (12).

NOTE: When replacing the contacts make certain that the one contact having arc resistant material on the contact surface (unsilvered) is positioned to correspond with the two contact fingers having similar contact surfaces (where applicable).

Contact Blade Assembly (12) Fig. 10

1. Remove pin connecting contact blade to operating rod (9).

2. Remove cup bearing assembly at the pivot of the contact blade.

3. The blade assembly can be removed as soon as the mounting bolts for the hinge support are loosened.

4. Reassemble in the reverse order taking care that the hinge support is positioned for correct alignment of the contacts as well as to prevent binding with the blade.

Bushings (2 and 17) Fig. 10

IMPORTANT: DO NOT REMOVE ALL SIX BUSHINGS AT ONCE. The bushings have been carefully aligned with the frame, during assembly at the factory, and it is important that this alignment be maintained to facilitate installation of the device in the metal-clad unit. It is therefore recommended that the bushings be removed and reassembled one at a time. Also before removing any one bushing, measure the distance from that particular bushing to adjacent bushings in both directions, so that it may be re-installed in the same location.

It is also possible to remove and reassemble three bushings at one time. If this is preferred, alignment of the bushings may be accomplished by placing the device in a de-energized spare metal-clad unit before tightening the bushing mounting bolts.

To replace the bushing:

1. Rotate selector switch to the opposite bushing.

2. Remove horizontal barrier and disconnect test receptacle connection bar from bushing.

3. Remove the four bolts at the mounting flange and lower bushing.

4. Reassemble in the reverse order taking care to position the bushing for correct alignment of the selector switch as well as correct location of the ball end.

Selector Switch or PT Switch (26) Fig. 10 or 27 Fig. 12 - To remove the blade assembly, remove the pin connecting the blade to the operating rod and remove the hinge bolt. When replacing the blade, tighten the hinge with sufficient pressure to insure good contact.

Interlock Switch

To remove the interlock switch (4) Fig. 1 remove the two mounting screws and disconnect the lead wires. Reassemble in the reverse order and check the switch adjustments as explained under ADJUSTMENTS.

Motor and Power Switches

The three switches are mounted in tandem as shown in Fig. 6.

1. Remove (2) mounting bolts (3) from switch bracket (4).
2. Remove the (2) mounting screws of the lower switch.
3. Remove the (2) mounting screws of the center switch.
4. Remove the (2) mounting screws of the upper switch.
5. Disconnect the lead wires of switch to be replaced.
6. Reassemble in the reverse order and check switch adjustment as explained under ADJUSTMENTS.

Motor Support

1. To remove motor support (7) Fig. 7 first remove the latch spring (12) Fig. 6.
2. Remove the retaining ring (4) Fig. 7 and link (6).
3. Remove motor leads from the terminal board.
4. Remove six 3/8" bolts (1) Fig. 7 on bottom and one 3/8" bolt on the right side (not shown).
5. Remove four mounting bolts from motor (not shown).
6. Remove the retaining ring (8) from the eccentric (3) Fig. 7.
7. Reassemble all parts of the motor support in the reverse order and re-align it properly as described under DRIVING PAWL ADJUSTMENTS.

Trip Coil

To replace the potential trip coil (2) Fig. 2 proceed as follows:

1. With the device in the open position, remove the two mounting bolts.
2. Remove upper support and spacers.
3. Cut wires at the butt connectors and remove coil.

4. When replacing the coil be sure to assemble the correct fiber spacers at the ends before bolting support.

5. Adjust coil location to allow approximately 1/4" of armature travel before latch starts to move.

6. Butt connect wires and check operation of solenoid electrically and mechanically.

Spring Release Coil

To remove the spring release coil (16) Fig. 6 proceed as follows:

1. Block the closing springs as described in INSTALLATION.

2. Remove the left hand closing spring as described in CLOSING SPRING below.

3. Remove two mounting bolts (11), coil support (17), and spacers.

4. Cut wires at the butt connectors and remove coil.

5. Replace the coil and the correct number of fiber spacers before bolting support.

6. Butt connect wires and check that the armature is not binding. Check coil for electrical operation.

Closing Springs

The closing springs (10) Fig. 3 can be removed as follows:

1. Charge the springs with the manual charging wrench and apply the spring blocking device as described in INSTALLATION.

2. Discharge springs by pushing manual close button (9) Fig. 2.

3. Rotate cam shaft (5) Fig. 3 by using the manual charging wrench until the gap between the spring (10) and the bearing block (7) is 2 inches or more.

4. Lift both springs until they clear the lower supports, then pull forward and down until the top supports are free.

5. Block the opening springs with a suitable blocking device, or with the control transfer switch in the "TRIP" position, discharge the opening springs by pushing the manual trip lever.

Opening Springs

To remove the opening springs (4) Fig. 3 proceed as follows:

1. Charge and block the closing springs as described under INSTALLATION.
2. Push manual trip lever (8) Fig. 2 to be sure the opening springs are fully discharged. The control transfer switch must be in the "TRIP" position.
3. Remove upper pin (2) Fig. 3 and lower pin (8).
4. After reassembling springs check the contact gap as described under GROUNDING CONTACT GAP.

OPERATION OF SPECIFIC DEVICES

GM-4.16-250-101 GM-13.8-500-101
GM-4.16-350-101 GM-13.8-750-101
GM-7.2 -500-101 GM-13.8-1000-101

Description

Test Receptacles - Six test receptacles, available from the front of the device, are included each connecting to its corresponding primary bushing. Two sliding doors, one covering the upper receptacles, and one covering the lower receptacles, are included to isolate the test receptacles while not in use.

Method of Control - The device is electrically controlled from a push button station located on the end of a 50 ft. removable cable. Power to operate the device is supplied through the same secondary coupler used by the power circuit breaker. A control transfer switch mounted on the front of the deviee must be properly set in order to operate the device.

Selector Switch - A group operated selector switch is furnished on each pole of the device for connecting the desired primary bushing to the grounding contacts. The switch cannot be operated when the device is in the metal-clad unit.

Grounding Contacts - A set of grounding contacts are included for use in grounding the equipment. The contacts are operated by a stored energy type mechanism mounted on the rear of the device.

Interlocks

1. Control Transfer Switch (4) Fig. 11. The control transfer switch completes the closing circuit to the mechanism only when in the "CLOSE" position and completes the tripping circuit only when in the "TRIP" position. Linkages connected to the switch mechanically block the device from tripping when in the "CLOSE" or "OFF" positions. BEFORE RAISING DEVICE IN THE METAL-CLAD UNIT, THIS SWITCH MUST BE PLACED IN THE "TRIP" POSITION WHICH WILL UNBLOCK THE TRIP LATCH AND ALLOW THE CLOSING SPRINGS TO DISCHARGE WITHOUT OPERATING THE GROUNDING CONTACTS.

2. Selector Switch (26) Fig. 10. The selector switch is designed so that it must be fully engaged in either the "BUS" or "LINE" position and the handle removed in order to place the device in the metal-clad unit. It cannot be operated when the device is within the unit.

3. Interlock Crank (14) Fig. 11. An interlock crank is furnished to insure that the device cannot be raised into or lowered from the operating position with the grounding contacts closed. The crank also prevents closing (both electrically and mechanically) the grounding contacts when the device is not in either the fully raised or lowered position within the metal-clad unit. Also a link connected to this interlock crank rotates the mechanism trip latch and operates the closing spring release latch to discharge the closing springs, leaving the grounding contacts in the open position. (The control transfer switch must be in the "TRIP" position to unblock the trip latch.)

4. Mechanism Lock (13) Fig. 11. A Kirk type lock (A) is furnished for locking the grounding contacts closed. When operated the device is blocked both electrically and mechanically from tripping and cannot be raised or lowered in the metal-clad unit. The lock cannot be operated unless the grounding contacts are closed and the control transfer switch is in the "OFF" position. The key is released only when the grounding contacts are locked closed.

5. Test Receptacle Door Locks (5 and 10) Fig. 11. Individual Kirk type locks (C and F) are furnished for locking the test receptacle doors. The keys to these locks are released only when the doors are locked closed.

Operating Sequence

Before elevating the device in metal-clad unit check that the size of the primary bushing ball contacts correspond to the ampere rating of the equipment. Two thousand-amp adapters are for use with 2000-amp metal-clad units only.

Grounding

1. Rotate selector switch to desired position.
2. Set the control transfer switch to "TRIP" position and elevate device in metal-clad unit. Return control transfer switch to "OFF" position.
3. Check to insure that the "LINE" or "BUS" to be grounded has been deenergized. This can be done by the use of a suitable test plug in the upper test receptacles for the line bushings and the lower test receptacles for the bus bushings.
4. Rotate the control transfer switch to "CLOSE".
5. Insert control lead and close grounding contacts by operating push button on end of control lead.
6. Return control transfer switch to "OFF" position.
7. Lock grounding contacts closed by operating trip mechanism lock (A) and removing key.
8. To open grounding contacts, unlock mechanism lock (A) rotate control transfer switch to "TRIP" and operate push button on control lead or manual trip button.

Testing

After elevating the device in the metal-clad unit, testing can be accomplished by the use of suitable test plugs in the receptacles. Testing of the line side of the metal-clad can be done through the upper test receptacles while the bus side can be tested through the lower receptacles.

Phasing

After elevating the device in the metal-clad unit, phasing can be accomplished by the use of suitable test plugs in the upper and lower test receptacles.

GM-4.16-250-102	GM-13.8-500-102
GM-4.16-350-102	GM-13.8-750-102
GM-7.2 -500-102	GM-13.8-1000-102

Description

Test Receptacles - Three test receptacles, available from the front of the device, are included, each connecting to the center location of its corresponding selector link. A sliding door covering the receptacles is included to isolate the test receptacles while not in use. The sliding door is arranged so that the test probes may be locked in place.

Method of Control - The device is electrically controlled from a switching station located elsewhere in the metal-clad line-up. Power and control to operate the device is fed through a special secondary coupler similar to the one used by the circuit breaker.

Potential Transformer - A three-phase, wye-connected potential transformer is furnished for phasing or checking for feed-back. The high voltage side of the transformer is connected to its corresponding selector link through a disconnecting switch. The secondary of the transformer is brought out through the secondary coupler used for control power.

PT Switch - A group-operated PT disconnecting switch is furnished on each pole of the device for isolating the transformer from the bushings. The switch may be operated when the device is within the metal-clad unit. Auxiliary contacts operated by the switch are in the control circuits and insure that the switch is in the proper position in order to operate the grounding contacts. To close the grounding contacts the PT switch must be closed. To open the grounding contacts the PT switch must be open.

Selector Link - Provisions are furnished for selecting either the "BUS" or "LINE" to be grounded or tested. Changing of the selector link requires disassembly of the device side covers and barriers.

Indicating Lamps - A set of three indicating lamps, visible from the front of the device is included for checking for feed back. The lamps are connected directly to the secondary of the transformer.

Grounding Contacts - A set of grounding contacts are included for use in grounding the equipment. The contacts are operated by a stored energy type mechanism mounted on the rear of the device.

Interlocks

1. Control Transfer Switch (2) Fig. 13 - The control transfer switch completes the closing circuit to the mechanism only when in the "CLOSE" position and completes the tripping circuit only when in the "TRIP" position. Linkages connected to the switch mechanically block the device from tripping when in the "CLOSE" or "OFF" positions. BEFORE RAISING DEVICE IN THE METAL-CLAD UNIT THIS SWITCH MUST BE PLACED IN THE "TRIP" POSITION WHICH WILL UNBLOCK THE TRIP LATCH AND ALLOW THE CLOSING SPRINGS TO DISCHARGE WITHOUT OPERATING THE GROUNDING CONTACTS.

2. Interlock Crank (12) Fig. 13 - An interlock crank is furnished to insure that the device cannot be raised into or lowered from the operating position with the grounding contacts closed. The crank also prevents closing (both electrically and mechanically) the grounding contacts when the device is not in either the fully raised or lowered position within the metal-clad unit. Also a link connected to this

interlock crank rotates the mechanism trip latch and operates the closing spring release latch to discharge the closing springs leaving the grounding contacts in the open position. (The control transfer switch must be in the "TRIP" position to unblock the trip latch.)

3. Mechanism Lock (11) Fig. 13 - A Kirk type lock (A) is furnished for locking the grounding contacts closed. When operated the device is blocked both electrically and mechanically from tripping and cannot be raised or lowered in the metal-clad unit. The lock cannot be operated unless the grounding contacts are closed, and the control transfer switch is in the "OFF" position. The key is released only when the grounding contacts are locked closed. The key is interlocked with the test receptacle door lock (C).

4. Elevating Lock (13) Fig. 13 - A Kirk type lock (B) is furnished for locking the device in the operating position within the metal-clad unit. The key is released only when the device is locked in the elevated position. The key is interlocked with the test receptacle door lock (D).

5. Test Receptacle Door Locks (4 and 3) Fig. 13 - Two Kirk type locks (C & D) are furnished for locking the test receptacle door closed. One (C) is also used for locking the test probes in position. Lock (C) is interlocked with the mechanism lock (A) while lock (D) is interlocked with the elevating lock (B). In order to open the door, the grounding contacts must be closed, and the device locked in the elevated position. The grounding contacts may be opened by locking the test probes in place, but the device remains locked in the elevating position.

Operating Sequence

Before elevating the device in the metal-clad unit check that the size of the primary bushing ball contacts correspond to the ampere rating of the equipment. Two thousand-amp adapters are for use with 2000-amp metal-clad units only.

Grounding

1. Connect the selector link to either the "BUS" or "LINE" to be grounded.

2. Set the control transfer switch to "TRIP" position and elevate device in metal-clad unit. Return control transfer switch to "OFF" position.

3. Rotate PT switch to "CLOSE" and check that the "LINE" or "BUS" to be grounded has been de-energized. This can be done through the use of the potential transformer and indicating lamps.

4. Rotate the control transfer switch to "CLOSE".

5. Close Grounding Contacts by using control switches located elsewhere in metal-clad line-up.

6. Lock Grounding Contacts closed by operating mechanism lock (A) and removing key.

7. To open grounding contacts, unlock mechanism lock (A), rotate control transfer switch to "TRIP", open PT switch and operate opening control switch or manual trip button.

Phasing

1. Elevate device as for grounding.

2. Rotate PT switch to the closed position.

3. Phasing or checking for feed back can now be accomplished.

Testing

1. Elevate device and close grounding contacts as per instructions for grounding.

2. Lock device closed (A) and lock in elevated position (B) and remove keys.

3. Using these keys in (C) & (D) unlock test receptacle door.

4. Open door and insert test probes.

5. Lock probes in place by locking (C) & unlocking grounding contacts (A)

6. Open PT switch and open grounding contacts.

7. Testing of the equipment may be accomplished as soon as the grounding contacts are opened.

8. To remove test probes or lower device from the unit the reverse order must be followed.

NOTE: The PT switch must be closed before the closing mechanism will operate.

GM-4.16-250-103	GM-13.8-500-103
GM-4.16-350-103	GM-13.8-750-103
GM-7.2 -500-103	GM-13.8-1000-103

Description

Test Receptacles - Six test receptacles, available from the front of the device are included. The upper three receptacles are connected to their corresponding "BUS" side bushings while the lower receptacles are connected to the hinge of the selector switch. Two sliding doors, one covering the upper receptacles and one covering the lower receptacles, are included to isolate the test receptacles while not in use.

Method of Control - The device is electrically controlled from a control box located elsewhere in the station. Power to operate the device is supplied through a permanently attached cable at least 50 feet long. A control transfer switch mounted on the front of the device must be properly set in order to operate the device.

Selector Switch - A group operated selector switch is furnished on each pole of the device for connecting the desired primary bushing to the grounding contacts. The selector switch can be locked in the "LINE" position.

Grounding Contacts - A set of grounding contacts are included for use in grounding the equipment. The contacts are operated by a stored energy type mechanism mounted on the rear of the device.

INTERLOCKS

1. Control Transfer Switch - (3) Fig. 23. The control transfer switch completes the closing circuit to the mechanism only when in the "CLOSE" position. Linkages connected to the switch mechanically blocks the device from tripping when in the "CLOSE" or "OFF" positions.

   BEFORE RAISING DEVICE IN THE METAL-CLAD UNIT, THIS SWITCH MUST BE PLACED IN THE "TRIP" POSITION WHICH WILL UNBLOCK THE TRIP LATCH AND ALLOW THE CLOSING SPRINGS TO DISCHARGE WITHOUT OPERATING THE GROUNDING CONTACTS.

2. Selector Switch - (25) Fig. 22. The selector switch is designed so that it must be fully engaged in either the "BUS" or "LINE" position and the handle removed in order to place the device in the metal-clad unit. It cannot be operated when the device is within the unit. A Kirk type lock (E) is provided for locking the switch in the "LINE" position. The key to this lock is released only when the switch is locked in the "LINE" position. The key is interlocked with the upper ("BUS") test receptacle door lock (C). Auxiliary contacts operated by the lock, open the closing control circuit when the key is released. The lock cannot be operated when the device is inserted in the metal-clad unit.

3. Interlock Crank - (15) Fig. 23. An interlock crank is furnished to insure that the device cannot be raised into or lowered from the operating position with the grounding contacts closed. The crank also prevents closing the grounding contacts when the device is not in either the fully raised or lowered position within the metal-clad unit. Also a link connected to this interlock crank rotates the mechanism trip latch and operates the closing spring release latch to discharge the closing springs, leaving the grounding contacts in the open position. (The control transfer switch must be in the "TRIP" position to unblock the trip latch.)

4. Mechanism Lock - (13) Fig. 23. A Kirk type lock (A) is furnished for locking the grounding contacts closed. When operated the device is blocked both electrically and mechanically from tripping and cannot be raised or lowered in the metal-clad unit. The lock

cannot be operated unless the grounding contacts are closed and the control transfer switch is in the "OFF" position. The key is released only when the grounding contacts are locked closed.

5. Tripping Lock - (14) Fig. 23. A Kirk type lock (B) is furnished for locking the grounding contacts open. To operate the lock the manual trip button must be held in the trip position and the device in either the fully raised or lowered position. The key in this lock is released only when the grounding contacts are locked open. **The key is interlocked with the upper ("BUS") test receptacle door lock (D).**

6. Test Receptacle Door Locks - (4 & 5) Fig. 23. Two Kirk type locks are furnished on the upper ("BUS") test receptacle door. These locks are interlocked with the manual trip lock (B) and selector switch lock (E). To open the door, the grounding contacts must be open and the selector switch in the "LINE" position. An individual Kirk type lock (F) is furnished on the lower ("HINGE") test receptacle door.

Operating Sequence

Before elevating the device in the metal-clad unit, check that the size of the primary bushing ball contacts correspond to the ampere rating of the equipment. Two thousand-amp adapters are for use with 2000-amp metal-clad units only.

Grounding

1. Rotate selector switch to desired position. Do not operate switch lock (E).
2. Set the control transfer switch to "TRIP" position and elevate device in metal-clad unit. Return control transfer switch to "OFF" position.
3. Check to insure that the "LINE" or "BUS" to be grounded has been de-energized. This can be done by the use of a suitable test plug in the lower test receptacle.
4. Rotate the control transfer switch to "CLOSE".
5. Insert control lead and close grounding contacts by operating push button on control box.
6. Lock grounding contacts closed by operating mechanism lock (A) and removing key.
7. To open grounding contacts, unlock mechanism lock (A), rotate control transfer switch to "TRIP" and operate manual trip button.

Testing

1. Elevate the device in the metal-clad unit in accordance with steps 1 & 2 for grounding.
2. Testing can be accomplished by using suitable test plugs in the lower test receptacles.

Phasing

1. Rotate selector switch to "LINE" position and operate selector switch lock (E) and remove key.
2. Set the control transfer switch to "TRIP" position and elevate device in metal-clad unit.
3. Depress manual trip button, operate tripping lock (B), and remove key.
4. Using keys from tripping lock (B) and selector switch lock (E), open upper test receptacle door.
5. Phasing can be accomplished by using suitable test plugs in the upper and lower test receptacles.

GM-4.16-250-105	GM-13.8-500-105
GM-4.16-350-105	GM-13.8-750-105
GM-7.2 -500-105	GM-13.8-1000-105

Description

The design and interlock arrangement is the same as on the Type 101 device except for the test receptacle connections. On this device, the upper reeeptacles are connected to the corresponding hinge of the selector switch while the lower three receptacles are connected to the bus bushings. For detailed description of the component parts and interlocks, refer to the section on the Types 101 device.

Operating Sequence

Before elevating the device in the metal-clad unit, check that the size of the primary bushing ball contacts correspond to the ampere rating of the equipment. Two thousand-amp adapters are for use with 2000-amp metal-clad units only.

Grounding

1. Rotate selector switch to desired position.
2. Set the control transfer switch to "TRIP" position and elevate device in metal-clad unit. Return control transfer switch to "OFF" position.
3. Check to insure that the "LINE" or "BUS" to be grounded has been de-energized. This can be done by the use of a suitable test plug in the upper test receptacles.
4. Rotate the control transfer switch to "CLOSE".
5. Insert control lead and close grounding contacts by operating push button on end of control lead.
6. Return control transfer switch to "OFF" position.
7. Lock grounding contacts closed by operating trip mechanism lock (A) and removing key.
8. To open grounding contacts, unlock mechanism lock (A), rotate control transfer switch to "TRIP" and operate push button on control lead or manual trip button.

Testing

1. Rotate selector switch to desired position.
2. Elevate device in metal-clad unit.
3. Testing may be accomplished using suitable test plugs in the upper test receptacles.

Phasing

1. Rotate selector to the "LINE" position.
2. Elevate device in metal-clad unit.
3. Phasing may now be accomplished by the use of suitable test plugs in the upper and lower test receptacles.

GM-4.16-250-106	GM-13.8-500-106
GM-4.16-350-106	GM-13.8-750-106
GM-7.2 -500-106	GM-13.8-1000-106

Description

Test Receptacles - Six test receptacles, available from the front of the device, are included each connecting to its corresponding primary bushing. Two sliding doors, one covering the upper receptacles and one covering the lower receptacles, are included to isolate the test receptacles while not in use.

Method of Control - The device is electrically controlled by the same local and remote switches used to operate the power circuit breaker. Power to operate and control the device is fed through the same secondary coupler used by the breaker. A control transfer switch mounted on the front of the device must be properly set in order to operate the device. A knife switch connected in the closing circuit is provided on the front of the unit.

Selector Switch - A group operated selector switch is furnished on each pole of the device for connecting the desired primary bushing to the grounding contacts. The switch cannot be operated when the device is in the metal-clad unit.

Grounding Contacts - A set of grounding contacts are included for use in grounding the equipment. The contacts are operated by a stored energy type mechanism mounted on the rear of the device. A ground clip is furnished at the front of the device for customers auxiliary connections.

Interlocks

1. Control Transfer Switch - (4) Fig. 25. The control transfer switch completes the closing circuit to the mechanism only when in the "CLOSE" position. Linkages connected to the switch mechanically blocks the device from tripping when in the "CLOSE" or "OFF" positions. BEFORE RAISING DEVICE IN THE METAL-CLAD UNIT, THIS SWITCH MUST BE PLACED IN THE "TRIP" POSITION WHICH WILL UNBLOCK THE TRIP LATCH AND ALLOW THE CLOSING SPRINGS TO DISCHARGE WITHOUT OPERATING THE GROUNDING CONTACTS.

2. Selector Switch - (26) Fig. 24. The selector switch is designed so that it must be fully engaged in either the "BUS" or "LINE" position and the handle removed in order to place the device in the metal-clad unit. It cannot be operated when the device is within the unit.

3. Interlock Crank - (14) Fig. 25. An interlock crank is furnished to insure that the device cannot be raised into or lowered from the operating position with the grounding contacts closed. The crank also prevents closing the grounding contacts when the device is not in either the fully raised or lowered position within the metal-clad unit. Provisions are furnished to padlock the grounding contacts open. Also a link connected to this interlock crank rotates the mechanism trip latch and operates the closing spring release latch to discharge the closing springs, leaving the grounding contacts in the open position. (The control transfer switch must be in the "TRIP" position to unblock the trip latch.)

4. Tripping Mechanism Lock - (15) Fig. 25. A sliding bolt with provisions for two padlocks is furnished for locking the grounding contacts closed. When operated the device is blocked both electrically and mechanically from tripping and cannot be raised or lowered in the metal-clad unit. The sliding bolt cannot be operated unless the grounding contacts are closed. When the bolt blocks the grounding contacts in the closed position, the padlocks can be installed.

5. Test Receptacle Door Locks - (5 and10) Fig. 25. Provision for a padlock is furnished to lock each test receptacle door in the closed position.

Operating Sequence

Before elevating the device in metal-clad unit check that the size of the primary bushing ball contacts correspond to the ampere rating of the equipment. Two thousand-amp adapters are for use with 2000-amp metal-clad units only.

Grounding

1. Rotate the selector switch to desired position.
2. Set the control transfer switch to "TRIP" position and elevate device in metal-clad unit. Return control transfer switch to "OFF" position.
3. Check to insure that the "LINE" or "BUS" to be grounded has been de-energized. This can be done by the use of a suitable test plug in the upper test receptacles for the line bushings and the lower test receptacles for the Bus bushings.
4. Rotate the control transfer switch to "CLOSE" and close the knife switch.
5. Close grounding contacts by using the same control switches that are used to operate the circuit breaker.
6. Return control transfer switch to "OFF" position.
7. Lock grounding contacts closed by operating sliding bolt on trip mechanism and installing padlocks.

Testing

After elevating the device in the metal-clad unit, testing can be accomplished by the use of suitable test plugs in the receptacles. Testing of the Line side of the metal-clad can be done through the upper test receptacles while the Bus side can be tested through the lower receptacles.

Phasing

After elevating the device in the metal-clad unit, phasing can be accomplished by the use of suitable test plugs in the upper and lower test receptacles.

GM-4.16-250-118	GM-13.8-500-118
GM-4.16-350-118	GM-13.8-750-118
GM-7.2 -500-118	GM-13.8-1000-118

Description

Test Receptacles - Three test receptacles, available from the front of the device, are included, each connecting to its corresponding primary bushing. A sliding door covering the receptacles is included to isolate the test receptacles while not in use. The sliding door is arranged so that the test probes may be locked in place.

Method of Control - The device is electrically controlled by the switches mounted on the metal-clad equipment that is used to operate the power circuit breaker. Power to operate the device is fed through the same secondary coupler used by the breaker.

Grounding Contacts - A set of grounding contacts are included for use in grounding the equipment. The contacts are operated by a stored energy type mechanism mounted on the rear of the device.

Interlocks

1. Control Transfer Switch - (3) Fig. 17. The control transfer switch completes the closing circuit to the mechanism only when in the "CLOSE" position and completes the tripping circuit only when in the "TRIP" position. Linkages connected to the switch mechanically block the device from tripping when in the "CLOSE" or "OFF" position. BEFORE RAISING DEVICE IN THE METAL-CLAD UNIT THIS SWITCH MUST BE PLACED IN THE "TRIP" POSITION WHICH WILL UNBLOCK THE TRIP LATCH AND ALLOW THE CLOSING SPRINGS TO DISCHARGE WITHOUT OPERATING THE GROUNDING CONTACTS.

2. Interlock Crank - (10) Fig. 17. An interlock crank is furnished to insure that the device cannot be raised into or lowered from the operating position with the grounding contacts closed. The crank also prevents closing the grounding contacts when the device is not in either the fully raised or lowered position within the metal-clad unit. Also a link connected to this interlock crank rotates the mechanism trip latch and operates the closing spring release latch to discharge the closing springs, leaving the grounding contacts in the open position. (The control transfer switch must be in the "TRIP" position to unblock the trip latch.)

3. Mechanism Lock - (9) Fig. 17. A Kirk type lock (A) is furnished for locking the grounding contacts closed. When operated the sevice is blocked both electrically and mechanically from tripping and cannot be raised or lowered in the metal-clad unit. The lock cannot be operated unless the grounding contacts are closed and the control transfer switch is in the "OFF" position. The key is released only when the grounding contacts are locked closed and is interlocked with the test receptacle door lock (C).

4. Elevating Lock - (11) Fig. 17. A Kirk type lock (B) is furnished for locking the device in the operating position within the metal-clad unit. The key is released only when the device is locked in the elevated position and is interlocked with the test receptacle door lock (D).

5. Test Receptacle Door Locks - (4 & 5) Fig. 17. Two Kirk type locks (C & D) are furnished for locking the test receptacle door closed. One (C) is also used for locking the test probes in position. Lock (C) is interlocked with the mechanism lock (A) while lock (D) is interlocked with the elevating lock (B). In order to open the door, the grounding contacts must be closed and the device locked in the elevated position. The grounding contacts may be opened by locking the test probes in place.

Operating Sequence

Before elevating the device in the metal-clad unit, check that the size of the primary bushing ball contacts correspond to the ampere rating of the equipment. Two thousand-amp adapters are for use with 2000-amp metal-clad units only.

Grounding

1. Set the control transfer switch to "TRIP" position and elevate device in metal-clad unit. Return control transfer switch to "OFF" position.

2. Rotate the control transfer switch to "CLOSE".

3. Close grounding contacts by using control switches used to operate circuit breaker.

4. Return control transfer switch to "OFF" position.

5. Lock grounding contacts closed by operating mechanism lock (A) and removing key.

6. To open grounding contacts, unlock mechanism lock (A), rotate control transfer switch to "TRIP" and operate control switch or manual trip button.

Testing

1. Elevate device and close grounding contacts per instructions for grounding.

2. Lock device closed and in elevated position and remove keys from locks (A) & (B).

3. Using these keys unlock test receptacle door locks (C) & (D).

4. Open door and insert test probes.

5. Lock probes in place by closing door and unlocking door lock (C) and returning key to mechanism lock (A).

6. Testing of the line may be accomplished as soon as lock (A) is released and the grounding contacts are open.

7. To remove the test probes or lower the device from the unit, the reverse order must be followed.

GM-4.16-250-119	GM-13.8-500-119
GM-4.16-350-119	GM-13.8-750-119
GM-7.2 -500-119	GM-13.8-1000-119

Description

Test Receptacles - Three test receptacles, available from the front of the device, are included, each connecting to its corresponding primary bushing. A sliding door covering the receptacles is included to isolate the test receptacles while not in use.

Method of Control - The device is electrically controlled from a remote station located on the end of a removable cable. Power to operate the device is supplied through the same secondary coupler used by the power circuit breaker. A control transfer switch mounted on the front of the device must be properly set in order to operate the device.

Grounding Contacts - A set of grounding contacts are included for use in grounding the equipment. The contacts are operated by a stored energy type mechanism mounted on the rear of the device.

Interlocks

1. Control Transfer Switch - (4) Fig. 19. The control transfer switch completes the closing circuit to the mechanism only when in the "CLOSE" position and completes the tripping circuit only when in the "TRIP" position. Linkages connected to the switch mechanically block the device from tripping when in the "CLOSE " or "OFF" positions. BEFORE RAISING DEVICE IN THE METAL-CLAD UNIT THIS SWITCH MUST BE PLACED IN THE "TRIP" POSITION WHICH WILL UNBLOCK THE TRIP LATCH AND ALLOW THE CLOSING SPRINGS TO DISCHARGE WITHOUT OPERATING THE GROUNDING CONTACTS.

2. Interlock Crank - (10) Fig. 19. An interlock crank is furnished to insure that the device cannot be raised into or lowered from the operating position with the grounding contacts closed. The crank also prevents closing (both electrically and mechanically) the grounding contacts when the device is not in either the fully raised or lowered position within the metal-clad unit. Also a link connected to this

interlock crank rotates the mechanism trip latch and operates the closing spring release latch to discharge the closing springs, leaving the grounding contacts in the open position. (The control transfer switch must be in the "TRIP" position to unblock the trip latch.)

3. Mechanism Lock - (9) Fig. 19. A Kirk type lock (A) is furnished for locking the grounding contacts closed. When operated the device is blocked both electrically and mechanically from tripping and cannot be raised or lowered in the metal-clad unit. The lock cannot be operated unless the grounding contacts are closed and the control transfer switch is in the "OFF" position. The key is released only when the grounding contacts are locked closed.

4. Test Receptacle Door Lock - A Kirk lock (C) is furnished for locking the test receptacle door closed. The key to this lock is released only when the door is locked closed.

Operating Sequence

Before elevating the device in the metal-clad unit check that the size of the primary bushing ball contacts correspond to the ampere rating of the equipment. Two thousand-amp adapters are for use with 2000-amp metal-clad units only.

Grounding

1. Set the control transfer switch to "TRIP" position and elevate device in metal-clad unit. Return control transfer switch to "OFF" position.

2. Check to insure that the "LINE" to be grounded has been de-energized. This can be done by the use of suitable test plugs in the test receptacles.

3. Rotate the control transfer switch to "CLOSE".

4. Insert control lead into receptacle on front of frame and close grounding contacts by operating contacts at remote station.

5. Return control transfer switch to "OFF" position.

6. Lock grounding contacts closed by operating mechanism lock (A) and removing key.

7. To open grounding contacts, unlock mechanism lock (A), rotate control transfer switch to "TRIP" and operate contacts at remote station or depress manual trip button.

Testing

After elevating the device in the metal-clad unit, testing can be accomplished by use of suitable test plugs in the test receptacles.

GM-4.16-250-120	GM-13.8-500-120
GM-4.16-350-120	GM-13.8-750-120
GM-7.2 -500-120	GM-13.8-1000-120

Description

The design and interlock arrangement for this type device is the same as on the type 102 devices except for the "Method of Control" and terminal locations for the secondary of the potential transformer. For detailed description of the component parts and interlocks, refer to the section on the type 102 devices.

Method of Control - The device is electrically controlled from a remote control station. Power and control to operate the device is supplied through a removable cable.

Potential Transformer - A three-phase, wye-connected potential transformer is furnished for phasing or checking for feed-back. The high voltage side of the transformer is connected to its corresponding selector link through a disconnecting switch. The secondary of the transformer is brought out through a plug connector on the front of the device.

Operating Sequence

Before elevating the device in the metal-clad unit check that the size of the primary bushing ball contacts correspond to the ampere rating of the equipment. Two thousand-amp adapters are for use with 2000-amp metal-clad units only.

Grounding

1. Connect the selector link to either the "BUS" or "LINE" to be grounded.
2. Set the control transfer switch to "TRIP" position and elevate device in metal-clad unit. Return control transfer switch to "OFF" position.
3. Rotate PT switch to "CLOSE" and check that the "LINE" or "BUS" to be grounded has been de-energized. This can be done through the use of the potential transformer and indicating lamps.
4. Insert plug for control cable and rotate the control transfer switch to "CLOSE".
5. Close grounding contacts by control switch or push-button located remote to device.
6. Lock grounding contacts closed by operating mechanism lock (A) and removing key.
7. To open grounding contacts, unlock mechanism lock (A), rotate control transfer switch to "TRIP", open PT switch and operate opening control switch or manual trip button.

Phasing

1. Elevate device as for grounding and insert plug for PT secondary leads.
2. Rotate PT switch to the closed position.
3. Phasing or checking for feed back can now be accomplished.

Testing

1. Elevate device and close grounding contacts as per instructions for grounding.
2. Lock device closed (A) and lcok in elevated position (B) and remove keys.
3. Using these keys in (C) & (D) unlock test receptacle door.
4. Open door and insert test probes.
5. Lock probes in place by locking (C) and unlocking grounding contacts (A).
6. Open PT switch and open grounding contacts.
7. Testing of the equipment may be accomplished as soon as the grounding contacts are opened.
8. To remove test probes or lower device from the unit the reverse order must be followed.

NOTE: The PT switch must be closed before the closing mechanism will operate.

GM-4.16-250-121	GM-13.8-500-121
GM-4.16-350-121	GM-13.8-750-121
GM-7.2 -500-121	GM-13.8-1000-121

Description

The design and interlock arrangement for this type device is the same as on the type 103 device except that two keys are furnished on the tripping lock (B). These two keys function in the same manner except that the second key is interlocked with the lower (hinge) test receptacle door lock (F). To open the lower door the ground contacts must be locked open. For further detail description of the component parts and interlocks, refer to the section on the type 103 device.

Operating Sequence

Before elevating the device in the metal-clad unit check that the size of the primary bushing ball contacts correspond to the ampere rating of the equipment. Two thousand-amp adapters are for use with 2000-amp metal-clad units only.

Grounding

1. Rotate selector switch to desired position. Do not operate selector switch lock (E).

2. Set the control transfer switch to "TRIP" position and elevate device in metal-clad unit. Return control transfer switch to "OFF" position.

3. Check to insure that the "LINE" or "BUS" to be grounded has been de-energized. This can be done by the use of a suitable test plug in the lower test receptacle.

4. Rotate the control transfer switch to "CLOSE".

5. Insert control lead and close grounding contacts by operating push button on control box.

6. Lock grounding contacts closed by operating mechanism lock (A) and removing key.

7. To open grounding contacts, unlock mechanism lock (A), rotate control transfer switch to "TRIP" and operate manual trip button.

Testing

1. Elevate the device in the metal-clad unit in accordance with steps 1 & 2 for grounding.

2. Depress manual trip button, operate tripping lock (B), and remove key #2.

3. Using Key #2 from the tripping lock (B), open the lower test receptacle door.

4. Testing can be accomplished by using suitable test plugs in the lower test receptacles.

Phasing

1. Rotate selector switch to "LINE" position and operate selector switch lock (E) and remove key.

2. Set the control transfer switch to "TRIP" position and elevate device in metal-clad unit.

3. Depress manual trip button, operate tripping lock (B), and remove both keys.

4. Using keys from tripping lock (B1) and selector switch lock (E), open upper test receptacle door.

5. Using the key from tripping lock (B2), open the lower test receptacle door.

6. Phasing can be accomplished by using suitable test plugs in the upper and lower test receptacles.

RENEWAL PARTS

It is recommended that sufficient renewal parts be carried in stock to enable the prompt replacement of any worn, broken, or damaged parts. A stock of such parts minimize service interruptions caused by breakdowns, and saves time and expense. When continuous operation is a primary consideration, more renewal parts should be carried, the amount depending upon the severity of the service and the time required to secure replacements.

Renewal parts which are furnished may not be identical to the original parts, since improvements are made from time to time. The parts which are furnished, however, will be interchangeable.

NOTE: The listed terms "Right" and "Left" apply when facing front of the Ground and Test Device. The test receptacles are in the front and the operating mechanism is on the rear of the device.

ORDERING INSTRUCTIONS

1. Always specify the complete nameplate information as listed on the Ground and Test Device.

2. Specify the quantity, catalog number (if listed), reference number (if listed), and description of each part ordered, and this bulletin number.

3. Standard hardware, such as screws, bolts, nuts, washers, etc., is not listed in this bulletin. Such items should be purchased locally.

4. For prices, refer to the nearest office of the General Electric Company.

PARTS RECOMMENDED FOR NORMAL MAINTENANCE

In the tabulation below are listed the parts of the devices which are most subject to damage or wear and are usually recommended for stock for normal maintenance. All parts (except standard hardware) are, however, available and may be ordered by description rather than catalog number.

FIG. NO.	REF. NO.	DESCRIPTION	CATALOG NUMBER	NO. PER DEVICE									
				GM-4.16-250	GM-4.16-350-1200A	GM-4.16-350-3000A	GM-7.2-500	GM-7.2-500B	GM-13.8-500	GM-13.8-500B	GM-13.8-750	GM-13.8-750B	GM-13.8-1000
10	10	Stationary Contact Finger	0108B5513 G-001	18	24	24	24	24	24	24	24	24	24
10	11	Contact Finger Spring	006509787 P-001 0414A0180 P-001 0121A5964 P-001	18	24	24	24	24	24	24	24	24	24
10	11	Contact Finger Spring Spacer	006176109 P-006		24	24		24				24	24
9	6	Movable Grounding Contact	0114C5474 G-006 0114C5474 P-011 0802B0726 G-010 0802B0726 G-009 0114C5474 P-016 0802B0726 G-010 0802B0726 G-009	3 1	6 5 1	6 6	6 6	6 6	6 6	6 6	6 6	6 6	6 6
10	9	Operating Rod	0114C5474 G-001 0114C5369 G-002 0269C0801 G-001	3	3	3	3	3	3	3	3	3	3
6	15	Spring Charging Motor 48 V-dc 110 & 125 V-dc & 115 V-ac 220 & 250 V-dc & 230 V-ac	0105C9393 P-001 0105C9393 P-002 0105C9393 P-003	Quan. 1/Device									
6	19	Relay - 48 V-dc 110 & 125 V-dc 220 & 250 V-dc 115 V-ac 230 V-ac	0137A7575 P-004 0137A7575 P-001 0108B1978 G-003 0137A7575 P-005 0137A7575 P-002	Quan. 1/Device									
2	2	Trip Coil - 24 V-dc 48 V-dc 110 & 125 V-dc 220 V-dc 250 V-dc 115 V-ac 230 V-ac	006275070 G-001 006174582 G-034 006174582 G-001 006174582 G-015 006174582 G-002 006174582 G-013 006174582 G-032	Quan. 1/Device									
6	16	Spring Release Coil 48 V-dc 110 & 125 V-dc 220 V-dc 250 V-dc 115 V-ac 230 V-ac	006174582 G-034 006174582 G-001 006174582 G-015 006174582 G-002 006174582 G-010 006174582 G-014	Quan. 1/Device									
6	7	Switch-Normally Open	0456A0866 P-005	Quan. 5/Device									
6	7	Switch-Normally Closed	0456A0866 P-006	Quan. 1/Device									
2	3	Auxiliary Switch	0137A9192 G-003	Quan. 1/Device									
4	3	Driving Pawl Spring	0161A4241 P-001	Quan. 1/Device									
3	3	Latching Pawl Spring	0161A5909 P-001	Quan. 2/Device									

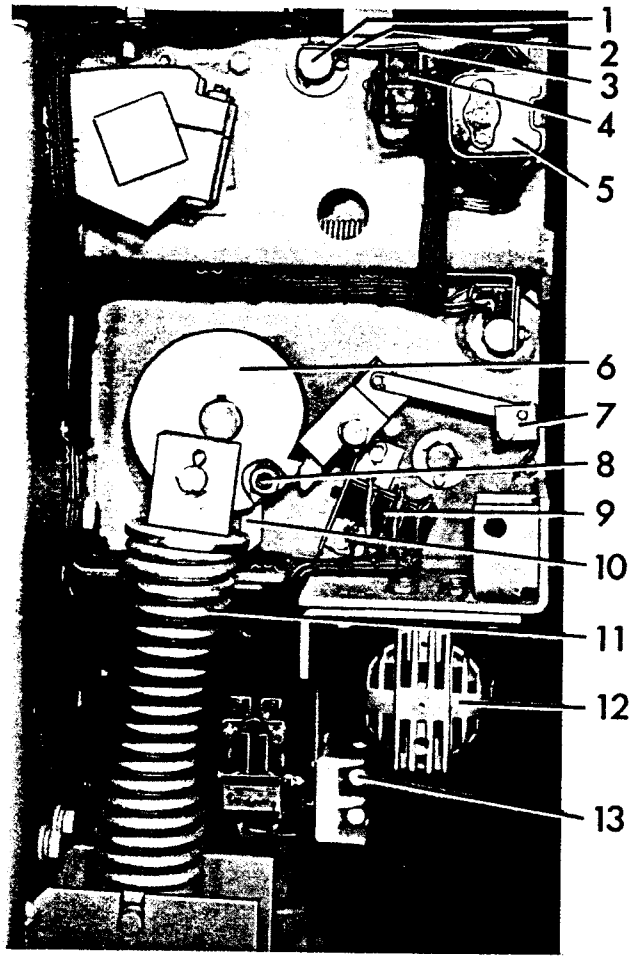


Fig. 1 Side View ML-13
Operating Mechanism

1. Positive Interlock Shaft
2. Switch Arm
3. Switch Support
4. Interlock Switches
5. Auxiliary Switch
6. Switch Cam
7. Charge-Discharge Indicator
8. Closing Latch Roller
9. Power Switches
10. Closing Latch
11. Closing Springs
12. Motor
13. Fuses

Fig. 1 8034473

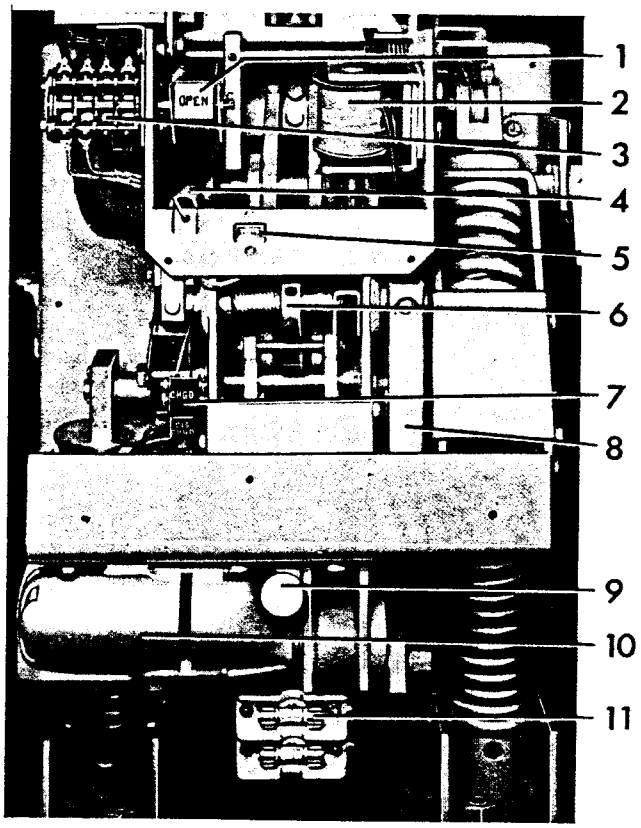


Fig. 2 Front View ML-13
Operating Mechanism

1. Open - Close Indicator
2. Trip Coil
3. Auxiliary Switch
4. Prop Spring
5. Counter
6. Trip Latch
7. Charge-Discharge Indicator
8. Trip Lever
9. Close Button
10. Motor
11. Fuse

Fig. 2 8034471

Fig. 3 8034463

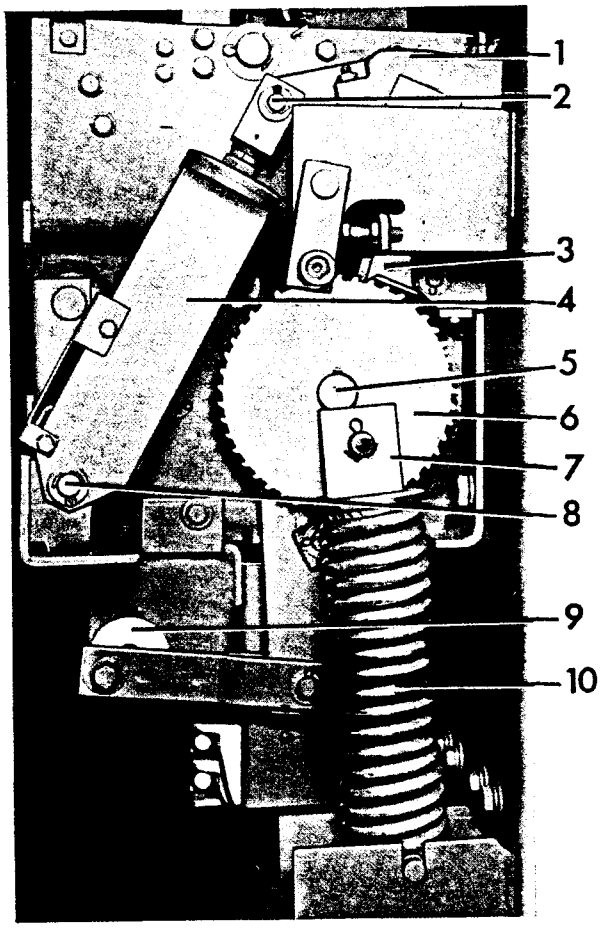


Fig. 3 Side View ML-13 Operating Mechanism

1. Main Shaft Bearing
2. Upper Spring Pin
3. Latching Pawls
4. Opening Spring
5. Cam Shaft
6. Ratchet Wheel
7. Guide Block
8. Lower Spring Pin
9. Eccentric
10. Closing Spring

Fig. 4 8034475

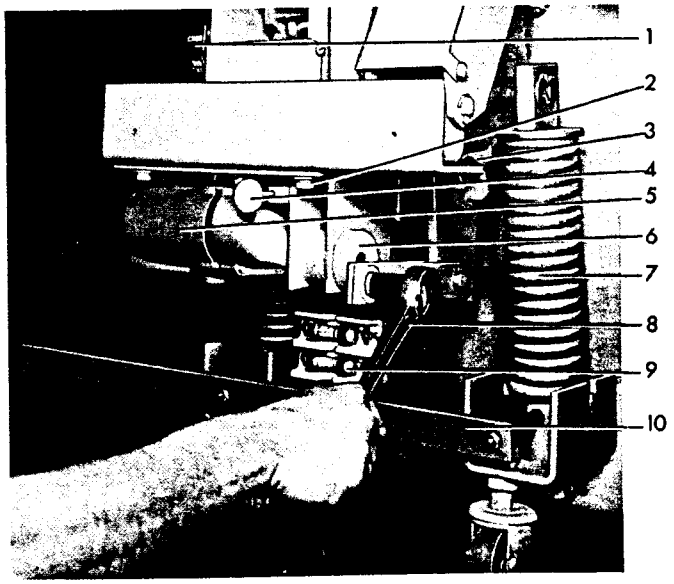


Fig. 4 Spring Blocking Device

1. Charge-Discharge Indicator
2. Support Bolts
3. Driving Pawl
4. Close Button
5. Motor
6. Eccentric
7. Closing Spring
8. Manual Charging Wrench
9. Fuse
10. Spring Blocking Device

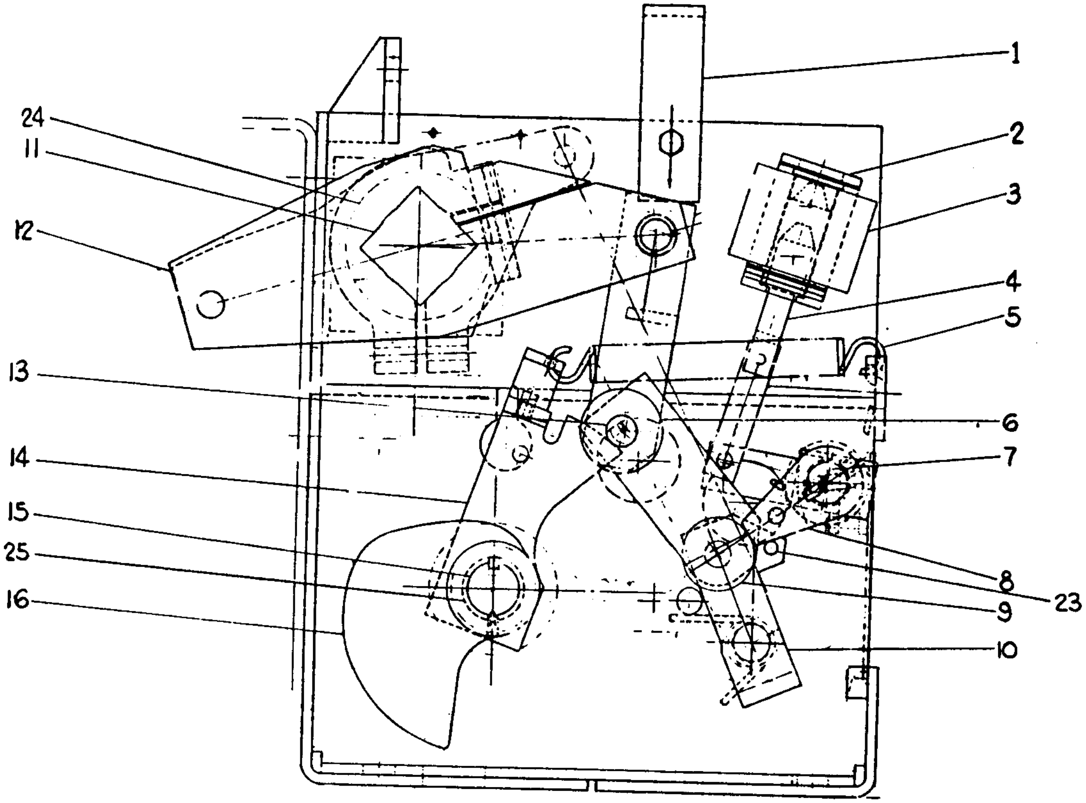
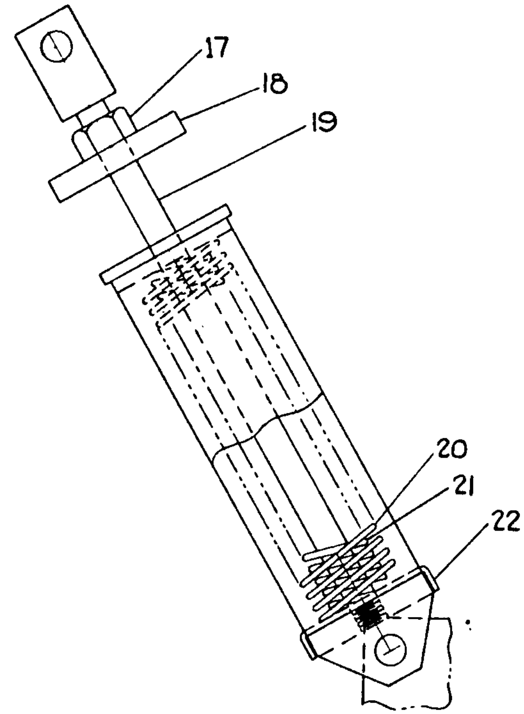


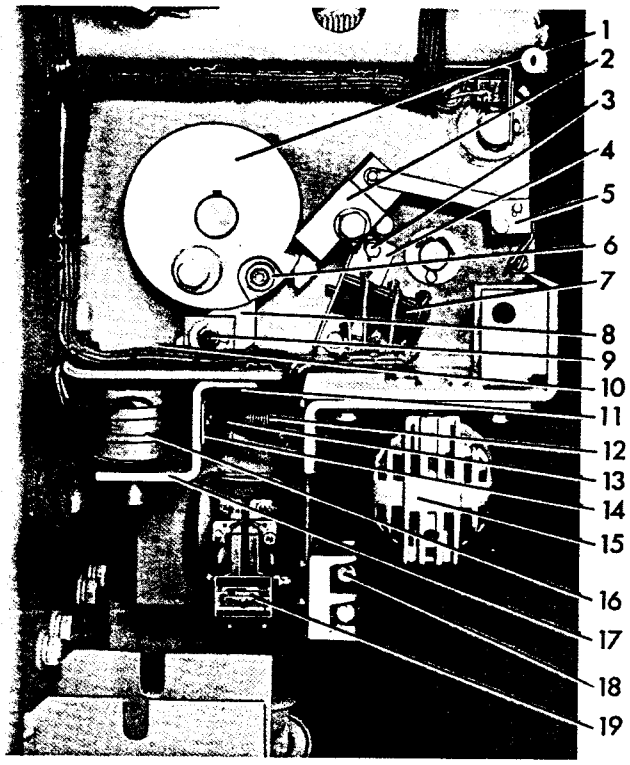
Fig. 5 Sectional Side View of Mechanism



Opening Spring

1. Handle
2. Trip Coil Support
3. Trip Coil
4. Trip Armature
5. Prop Reset Spring
6. Cam Follower Roller
7. Trip Shaft
8. Trip Latch
9. Trip Latch Roller
10. Trip Latch Roller Support
11. Crank Shaft
12. Cranks
13. Prop Pin
14. Prop
15. Drive Shaft
16. Cam
17. Check Nut
18. Stop Plate
19. Spring Rod
20. Spring
21. Spring
22. Guide
23. Stop Pin
24. Main Shaft Bearing
25. Cam Shaft Bearing

114C5320



1. Switch Cam
2. Switch Striker
3. Switch Support Bolts
4. Switch Support
5. Charge-Discharge Indicator
6. Closing Latch Roller
7. Power Switches
8. Closing Latch
9. Closing Latch Shaft
10. Latch Adjusting Screw
11. Release Coil Bolts
12. Closing Latch Spring
13. Latch Monitoring Switch
14. Switch Mounting Bracket
15. Motor
16. Spring Release Solenoid
17. Release Coil Support
18. Fuse
19. Control Relay

Fig. 6 Control Mechanism

Fig. 6 8034467

1. Mounting Bolts
2. Manual Close Button
3. Eccentric
4. Retaining Ring
5. Hex Charging Stud
6. Driving Link
7. Motor Support
8. Retaining Ring
9. Motor
10. Fuse

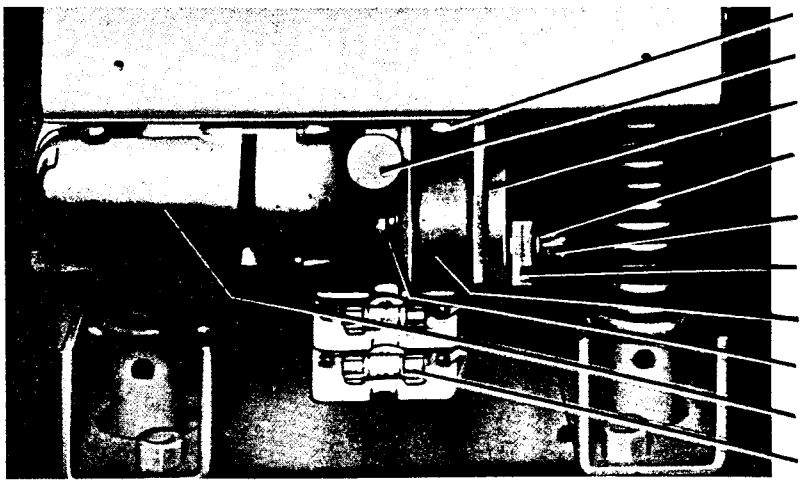


Fig. 7 Driving Elements

Fig. 7 8034471

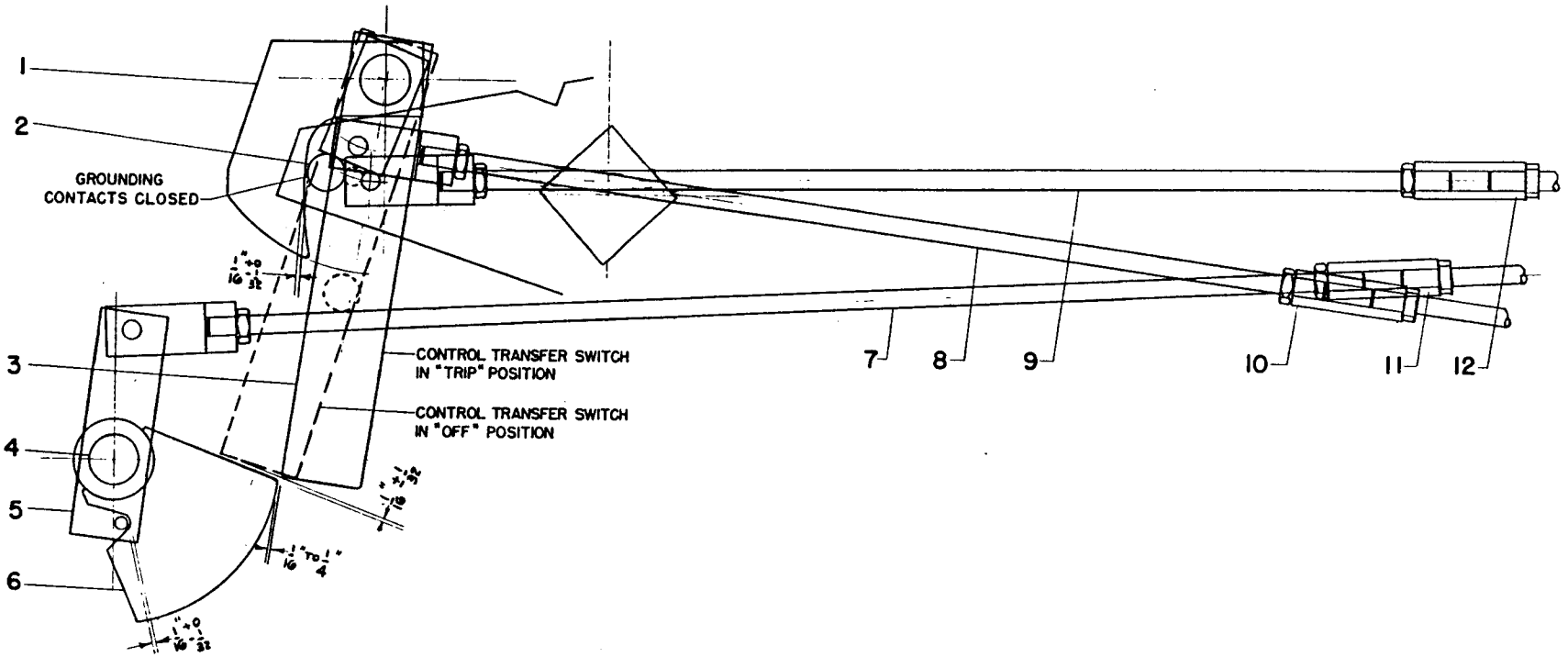


Fig. 8 Mechanism Interlocks and Blocking Adjustments

1. Positive Interlock Prop
2. Mechanism Pin
3. Tripping Stop
4. Trip Latch Shaft
5. Manual Trip Crank
6. Blocking Cam
7. Connecting Rod to Manual Trip
8. Connecting Rod to Positive Interlock
9. Connecting Rod to Control Transfer Switch
10. Turnbuckle
11. Turnbuckle
12. Turnbuckle

FIG. 8 0844D093

Fig. 9D 8034468

Fig. 9C 8034469

Fig. 9B 8034465

Fig. 9A 8034466

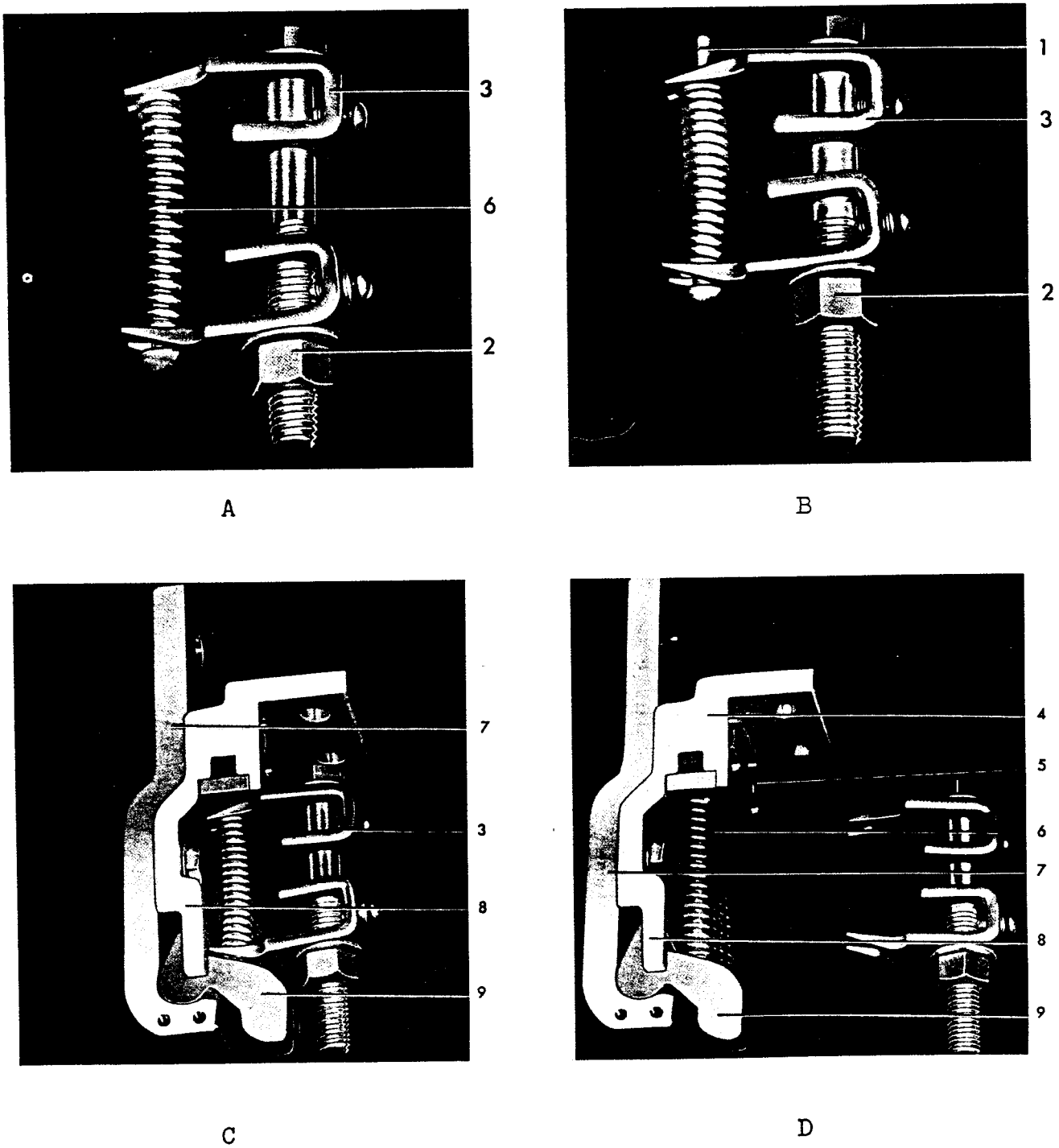


Fig. 9 Method of Installing Primary Contact Springs Using a Spring Compressor

1. Spring Guide
2. Compressor Nut
3. Spring Compressor
4. Spring Retainer
5. Assembly Bolts
6. Spring
7. Contact Support
8. Stop Plate
9. Stationary Primary Finger

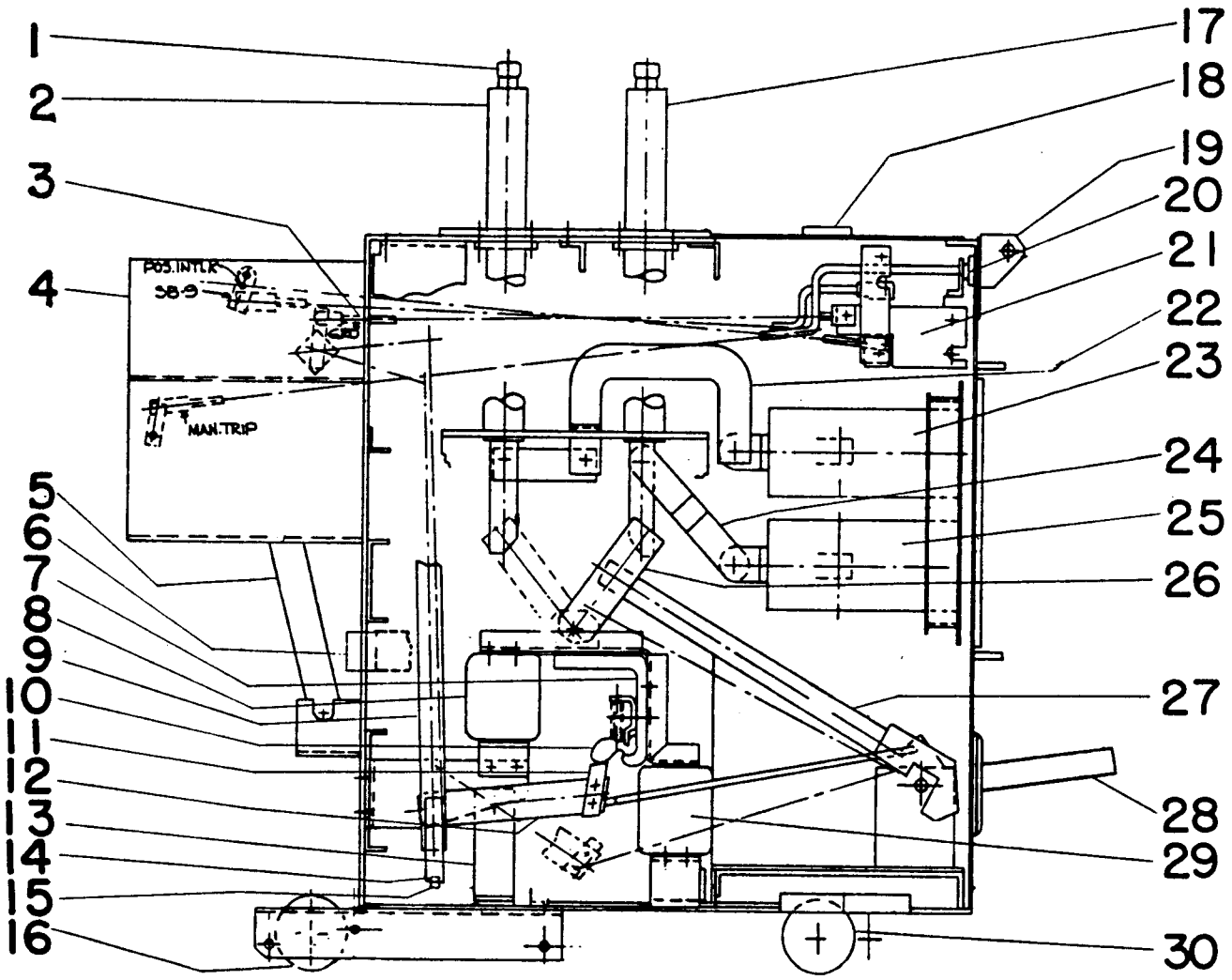
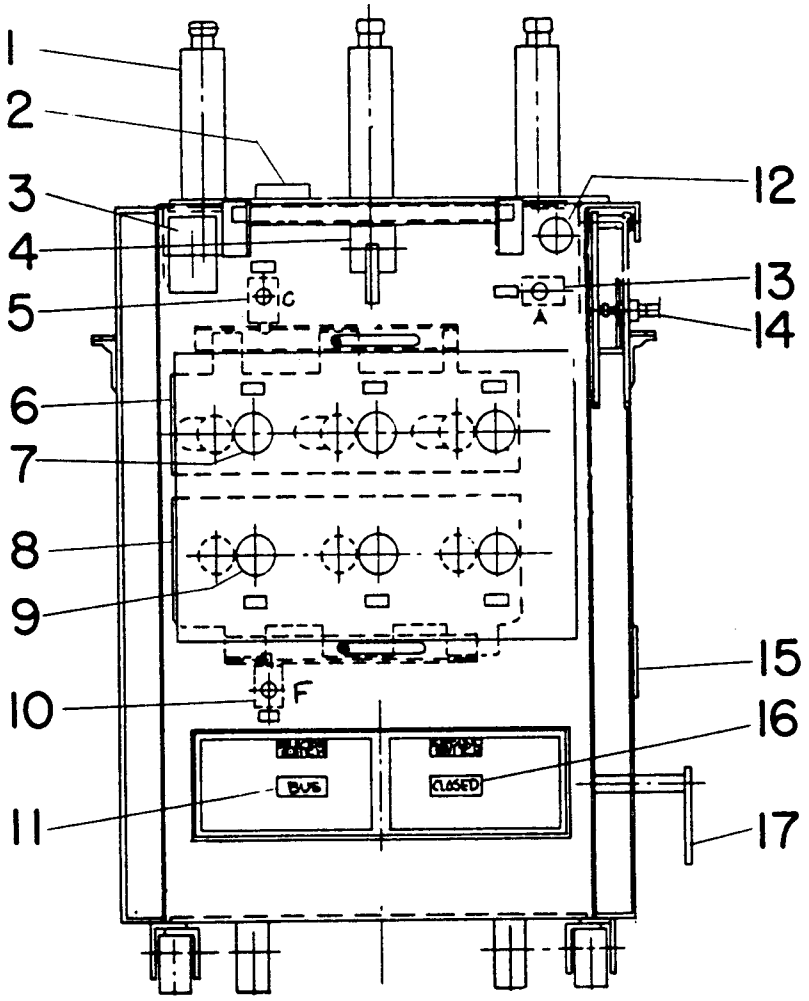


Fig. 10 0844D0927

1. Ball Contact
2. Bushing
3. Interlock Rods
4. Operating Mechanism
5. Closing Springs
6. Ground Shoe
7. Contact Support
8. Insulator
9. Operating Rod
10. Stationary Contact Finger
11. Movable Contact
12. Contact Blade
13. Hinge Support
14. Adjusting Nut
15. Check Nut
16. Wheel
17. Bushing
18. Coupler
19. Handle
20. Manual Trip Button
21. Slider Assembly
22. Connection Bus
23. Test Receptacle
24. Connection Bus
25. Test Receptacle
26. Selector Switch Blade
27. Selector Switch Operating Rod
28. Selector Switch Operating Handle
29. Insulator
30. Wheel

Fig. 10 Cross-Sectional View of Ground and Test Device - Type 101

Fig. 11 0844D0927



1. Bushing
2. Coupler
3. Control Circuit Receptacle
4. Control Transfer Switch
5. Key Interlock
6. Sliding Door
7. Line Test Receptacle
8. Sliding Door
9. Bus Test Receptacle
10. Key Interlock
11. Selector Switch Position Indicator
12. Manual Trip Button
13. Key Interlock
14. Interlock Crank
15. Ground Shoe
16. Ground Switch Position Indicator
17. Selector Switch Operating Handle

Fig. 11 Front View of Ground and Test Device - Type 101

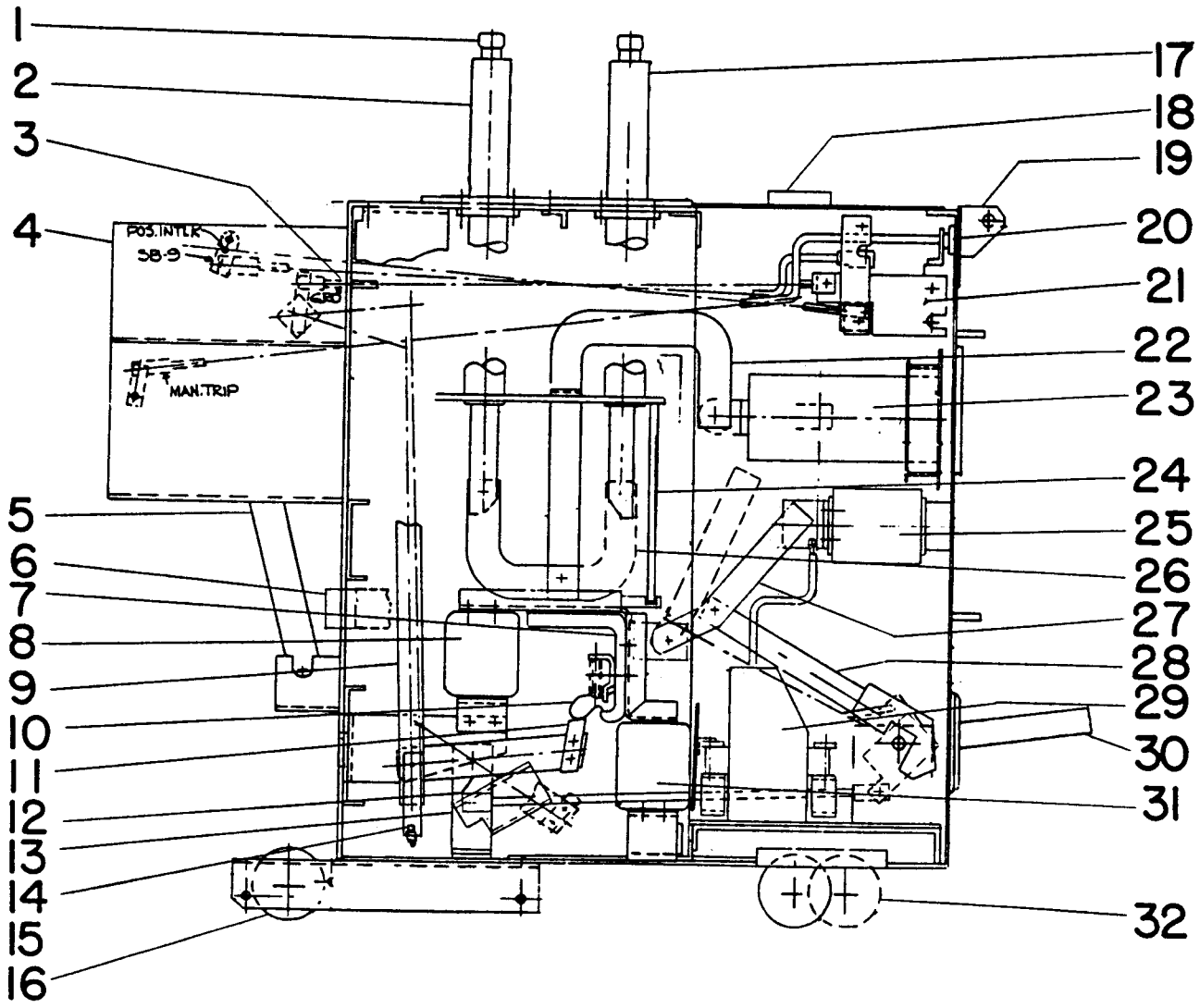
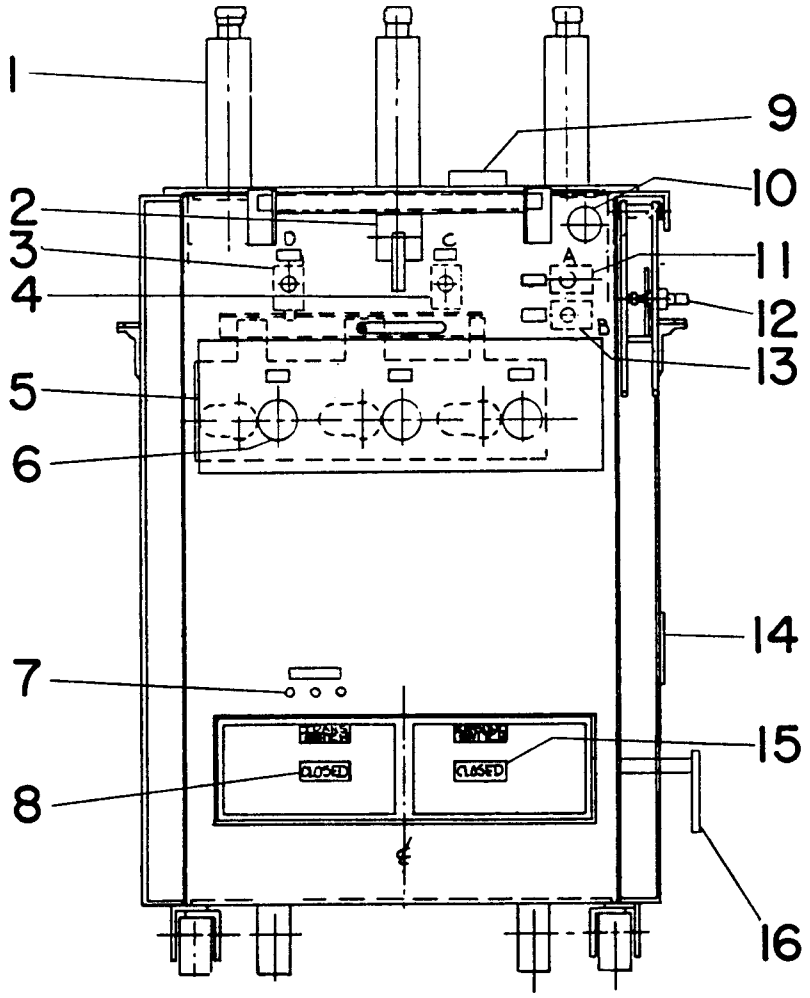


Fig. 12 0844D0929

1. Ball Contact
2. Bushing
3. Interlock Rods
4. Operating Mechanism
5. Closing Springs
6. Ground Shoe
7. Contact Support
8. Insulator
9. Operating Rod
10. Stationary Contact Finger
11. Movable Contact
12. Contact Blade
13. Hinge Support
14. Adjusting Nut
15. Check Nut
16. Wheel
17. Bushing
18. Coupler
19. Handle
20. Manual Trip Button
21. Slider Assembly
22. Connection Bus
23. Test Receptacle
24. Barrier
25. Insulator
26. Selector Link
27. PT Switch Blade
28. PT Switch Operating Rod
29. Potential Transformer
30. PT Switch Operating Handle
31. Insulator
32. Wheel

Fig. 12 Cross-Sectional View of Ground and Test Device - Type 102

Fig. 13 0844D0929



1. Bushing
2. Control Transfer Switch
3. Key Interlock
4. Key Interlock
5. Sliding Door
6. Test Receptacle
7. PT Secondary Indicating Lamps
8. PT Switch Position Indicator
9. Coupler
10. Manual Trip Button
11. Key Interlock
12. Interlock Crank
13. Key Interlock
14. Ground Shoe
15. Ground Switch Position Indicator
16. PT Switch Operating Handle

Fig. 13 Front View of Ground and Test Device - Type 102

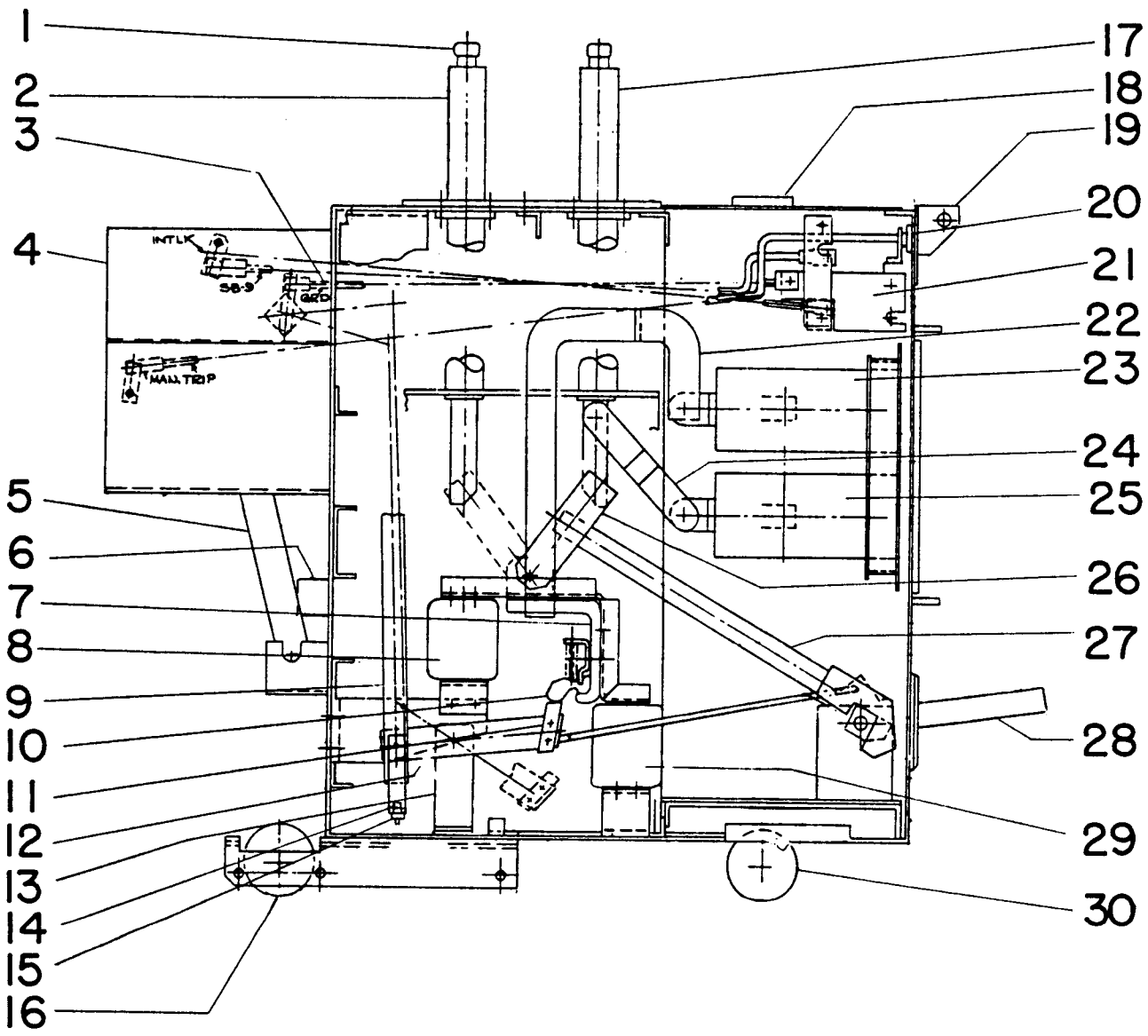


Fig. 14 084D0925

1. Ball Contact
2. Bushing
3. Interlock Rods
4. Operating Mechanism
5. Closing Springs
6. Ground Shoe
7. Contact Support
8. Insulator
9. Operating Rod
10. Stationary Contact Finger
11. Movable Contact
12. Contact Blade
13. Hinge Support
14. Adjusting Nut
15. Check Nut
16. Wheel
17. Bushing
18. Coupler
19. Handle
20. Manual Trip Button
21. Slider Assembly
22. Connection Bus
23. Test Receptacle
24. Connection Bus
25. Test Receptacle
26. Selector Switch Blade
27. Selector Switch Operating Rod
28. Selector Switch Operating Handle
29. Insulator
30. Wheel

Fig. 14 Cross-Section View of Ground and Test Device - Type 105

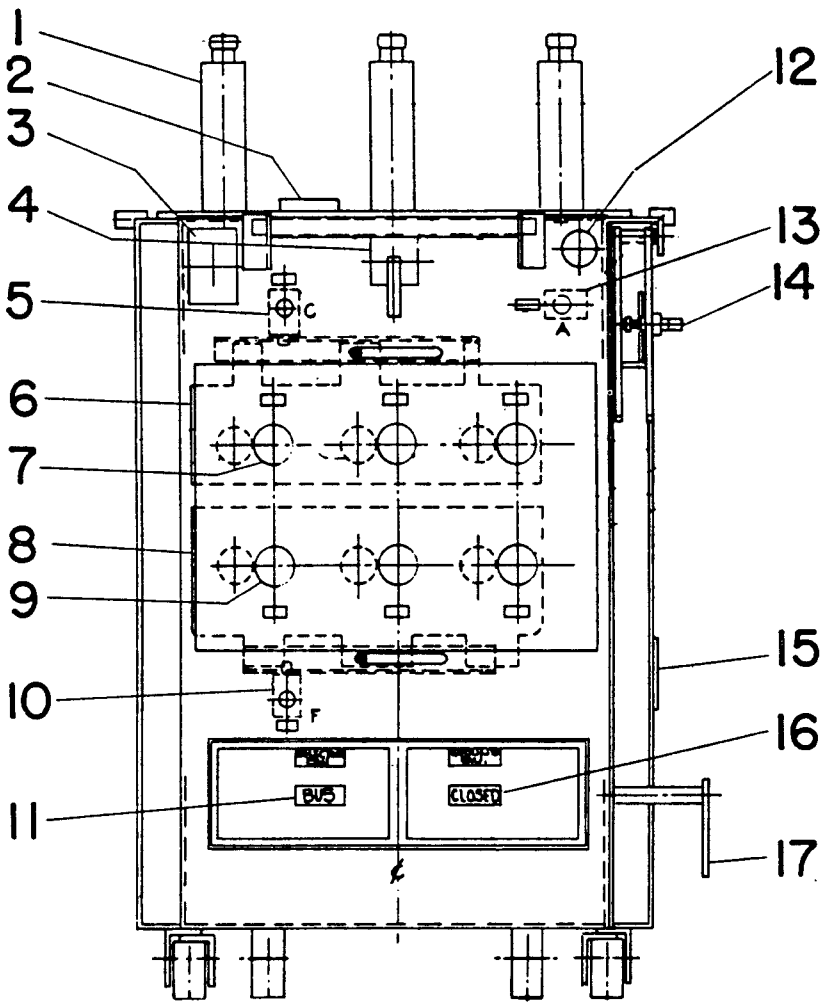


Fig. 15 0844D0925

1. Bushing
2. Coupler
3. Control Circuit Receptacle
4. Control Transfer Switch
5. Key Interlock
6. Sliding Door
7. Hinge Test Receptacle
8. Sliding Door
9. Bus Test Receptacle
10. Key Interlock
11. Selector Switch Position Indicator
12. Manual Trip Button
13. Key Interlock
14. Interlock Crank
15. Ground Shoe
16. Ground Switch Position Indicator
17. Selector Switch Operating Handle

Fig. 15 Front View of Ground and Test Device - Type 105

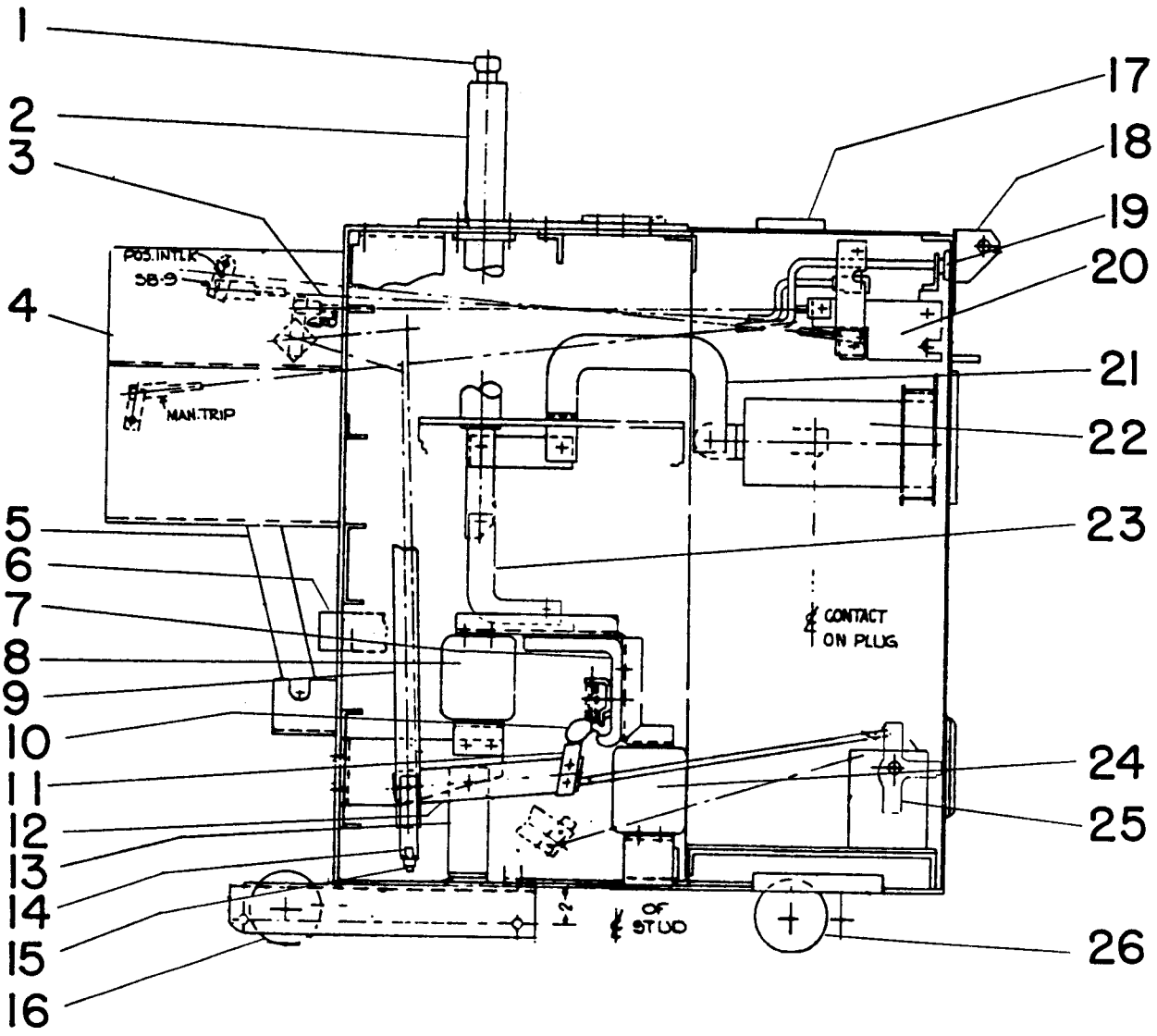


Fig. 16 0844D0926

1. Ball Contact
2. Bushing
3. Interlock Rods
4. Operating Mechanism
5. Closing Springs
6. Ground Shoe
7. Contact Support
8. Insulator
9. Operating Rod
10. Stationary Contact Finger
11. Movable Contact
12. Contact Blade
13. Hinge Support
14. Adjusting Nut
15. Check Nut
16. Wheel
17. Coupler
18. Handle
19. Manual Trip Button
20. Slider Assembly
21. Connection Bus
22. Test Receptacle
23. Connection Bus
24. Insulator
25. Position Indicator
26. Wheel

Fig. 16 Cross-Section View of Ground and Test Device - Type 118

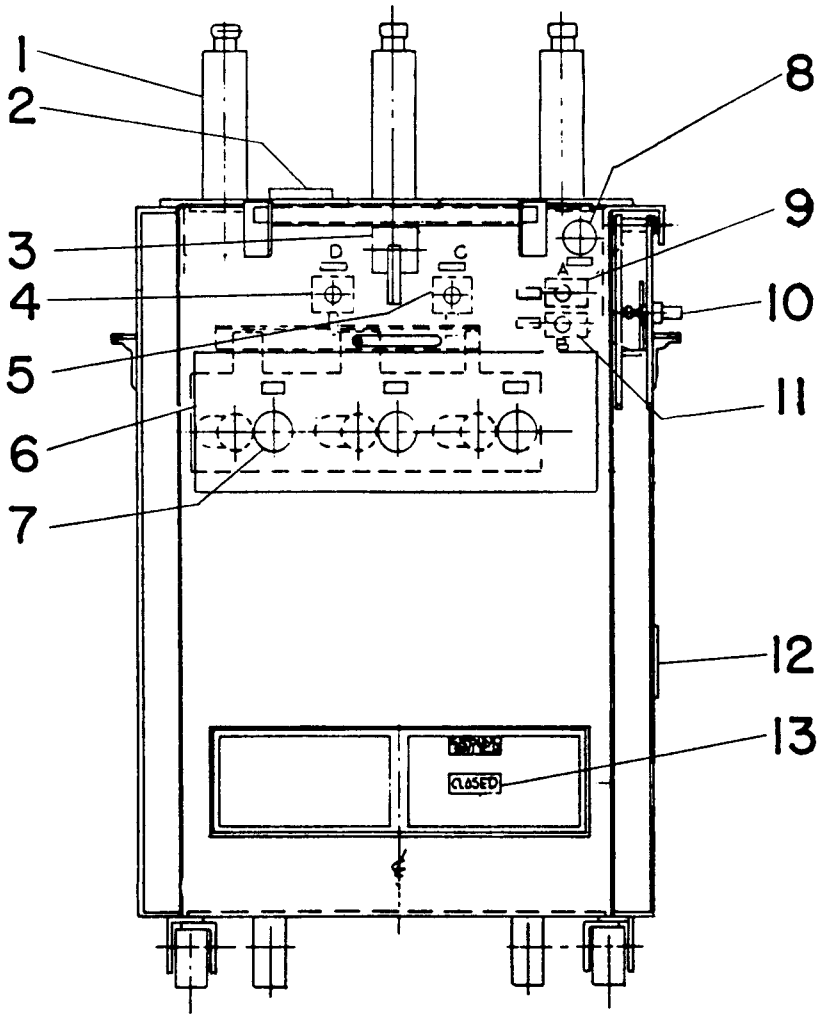


Fig. 17 0844D0926

1. Bushing
2. Coupler
3. Control Transfer Switch
4. Key Interlock
5. Key Interlock
6. Sliding Door
7. Line Test Receptacle
8. Manual Trip Button
9. Key Interlock
10. Interlock Crank
11. Key Interlock
12. Ground Shoe
13. Ground Switch Position Indicator

Fig. 17 Front View of Ground and Test Device - Type 118

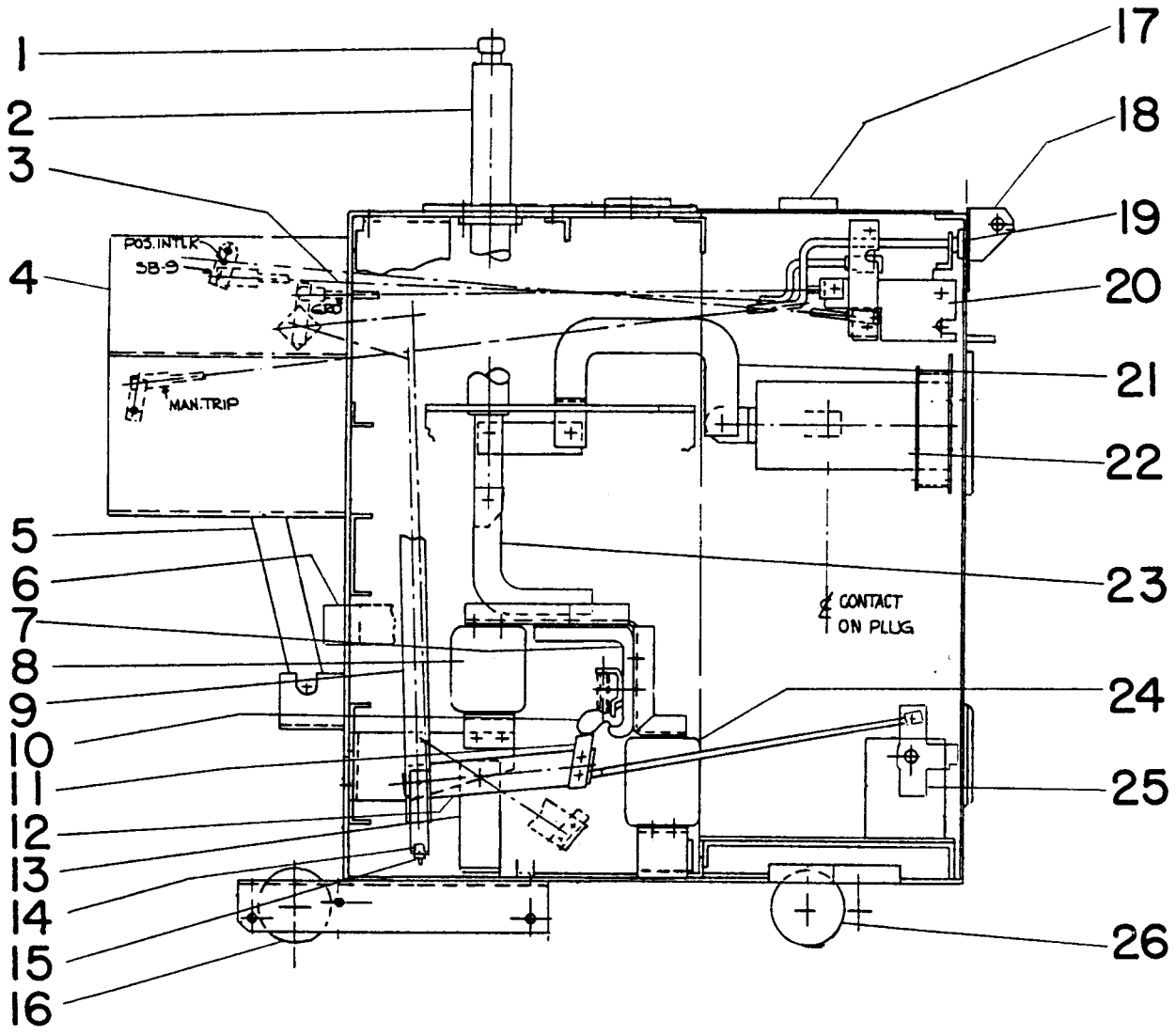
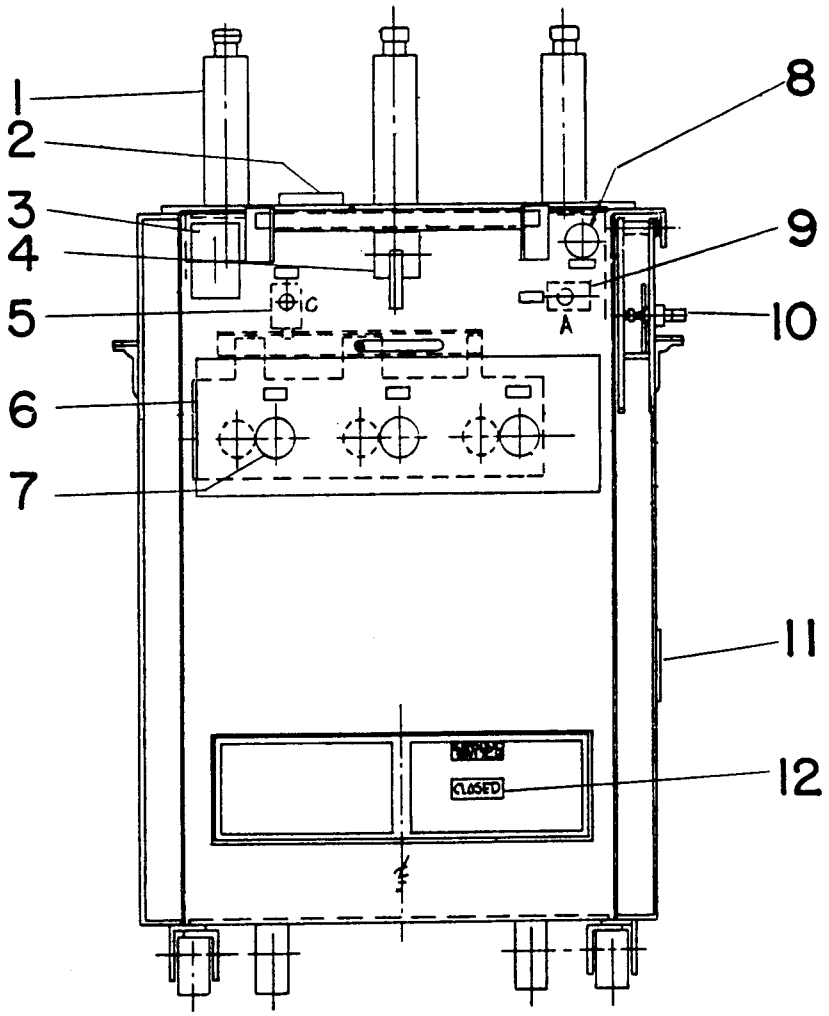


Fig. 18 0844D928

1. Ball Contact
2. Bushing
3. Interlock Rods
4. Operating Mechanism
5. Closing Springs
6. Ground Shoe
7. Contact Support
8. Insulator
9. Operating Rod
10. Stationary Contact Finger
11. Movable Contact
12. Contact Blade
13. Hinge Support
14. Adjusting Nut
15. Check Nut
16. Wheel
17. Coupler
18. Handle
19. Manual Trip Button
20. Slider Assembly
21. Connection Bus
22. Test Receptacle
23. Connection Bar
24. Insulator
25. Position Indicator
26. Wheel

Fig. 18 Cross-Sectional View of Ground and Test Device - Type 119

Fig. 19 0844D0928



1. Bushing
2. Coupler
3. Control Circuit Receptacle
4. Control Transfer Switch
5. Key Interlock
6. Sliding Door
7. Line Test Receptacle
8. Manual Trip Button
9. Key Interlock
10. Interlock Crank
11. Ground Shoe
12. Ground Switch Position Indicator

Fig. 19 Front View of Ground and Test Device - Type 119

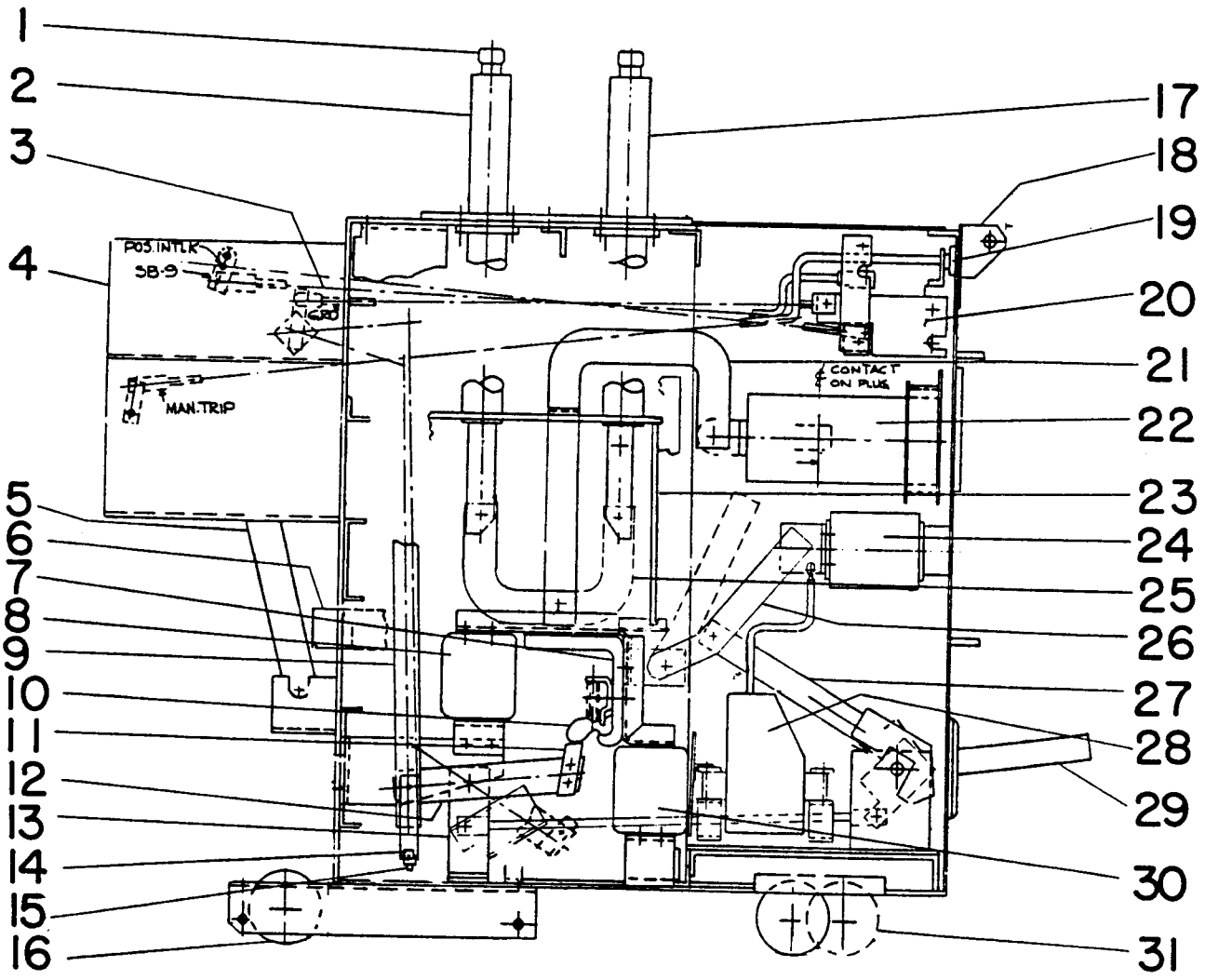
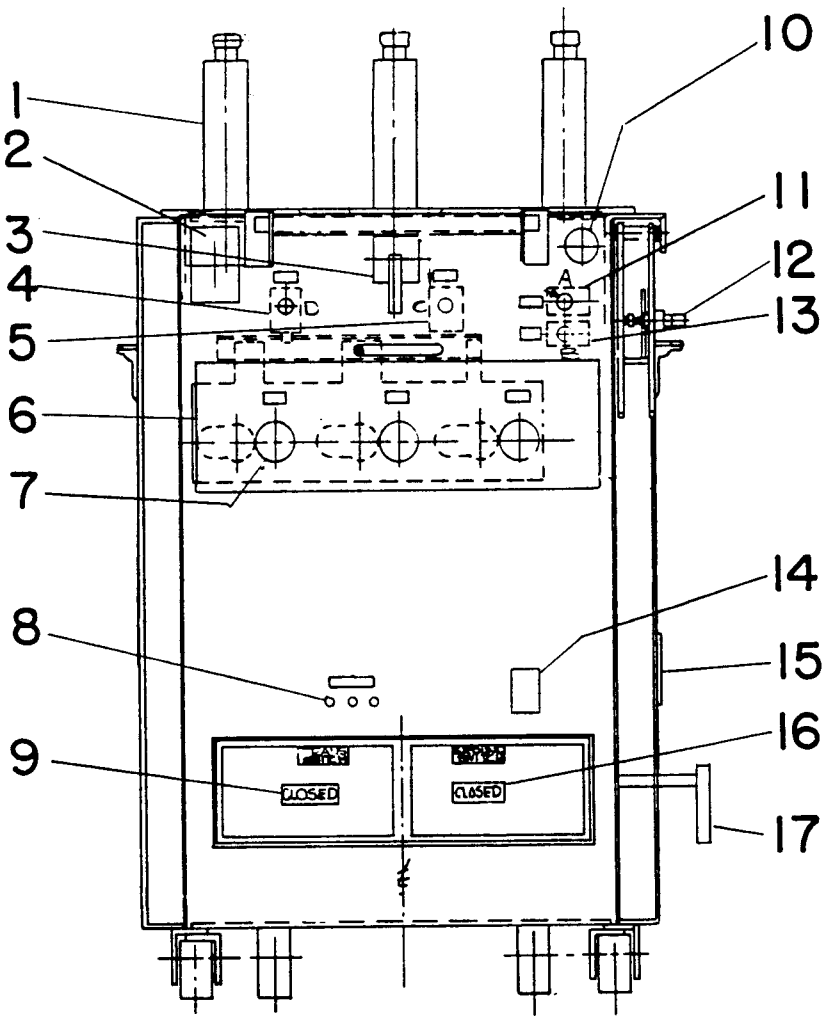


Fig. 20 0844D0930

1. Ball Contact
2. Bushing
3. Interlock Rods
4. Operating Mechanism
5. Closing Springs
6. Ground Shoe
7. Contact Support
8. Insulator
9. Operating Rod
10. Stationary Contact Finger
11. Movable Contact
12. Contact Blade
13. Hinge Support
14. Adjusting Nut
15. Check Nut
16. Wheel
17. Bushing
18. Handle
19. Manual Trip Button
20. Slider Assembly
21. Connection Bus
22. Test Receptacle
23. Barrier
24. Insulator
25. Selector Link
26. PT Switch Blade
27. PT Switch Operating Rod
28. Potential Transformer
29. PT Switch Operating Handle
30. Insulator
31. Wheel

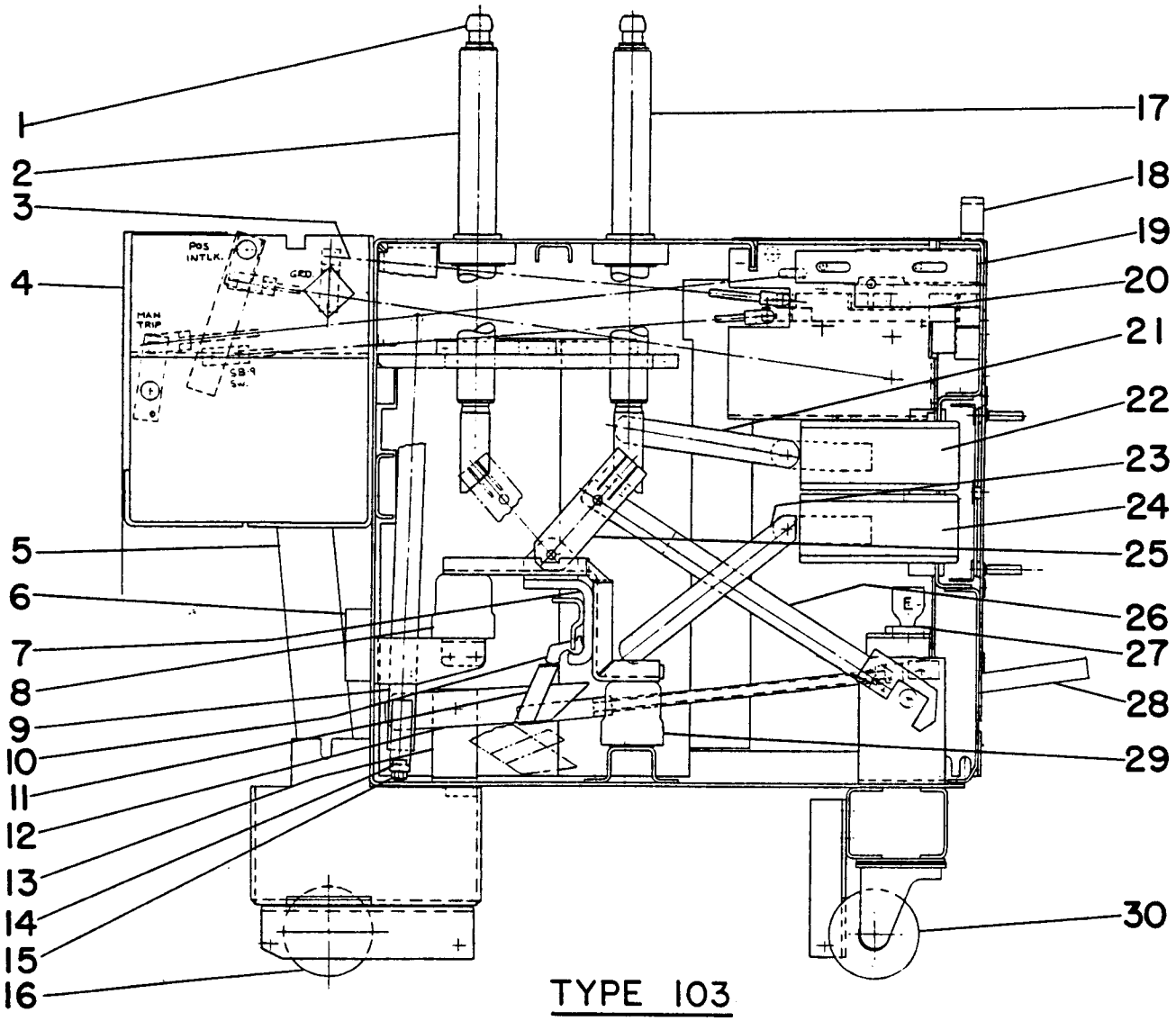
Fig. 20 Cross-Sectional View of Ground and Test Device - Type 120

Fig. 21 0844D0930



1. Bushing
2. Control Circuit Receptacle
3. Control Transfer Switch
4. Key Interlock
5. Key Interlock
6. Sliding Door
7. Test Receptacle
8. PT Secondary Indicating Lamps
9. PT Switch Position Indicator
10. Manual Trip Button
11. Key Interlock
12. Interlock Crank
13. Key Interlock
14. PT Secondary Receptacle
15. Ground Shoe
16. Ground Switch Position Indicator
17. PT Switch Operating Handle

Fig. 21 Front View of Ground and Test Device - Type 120

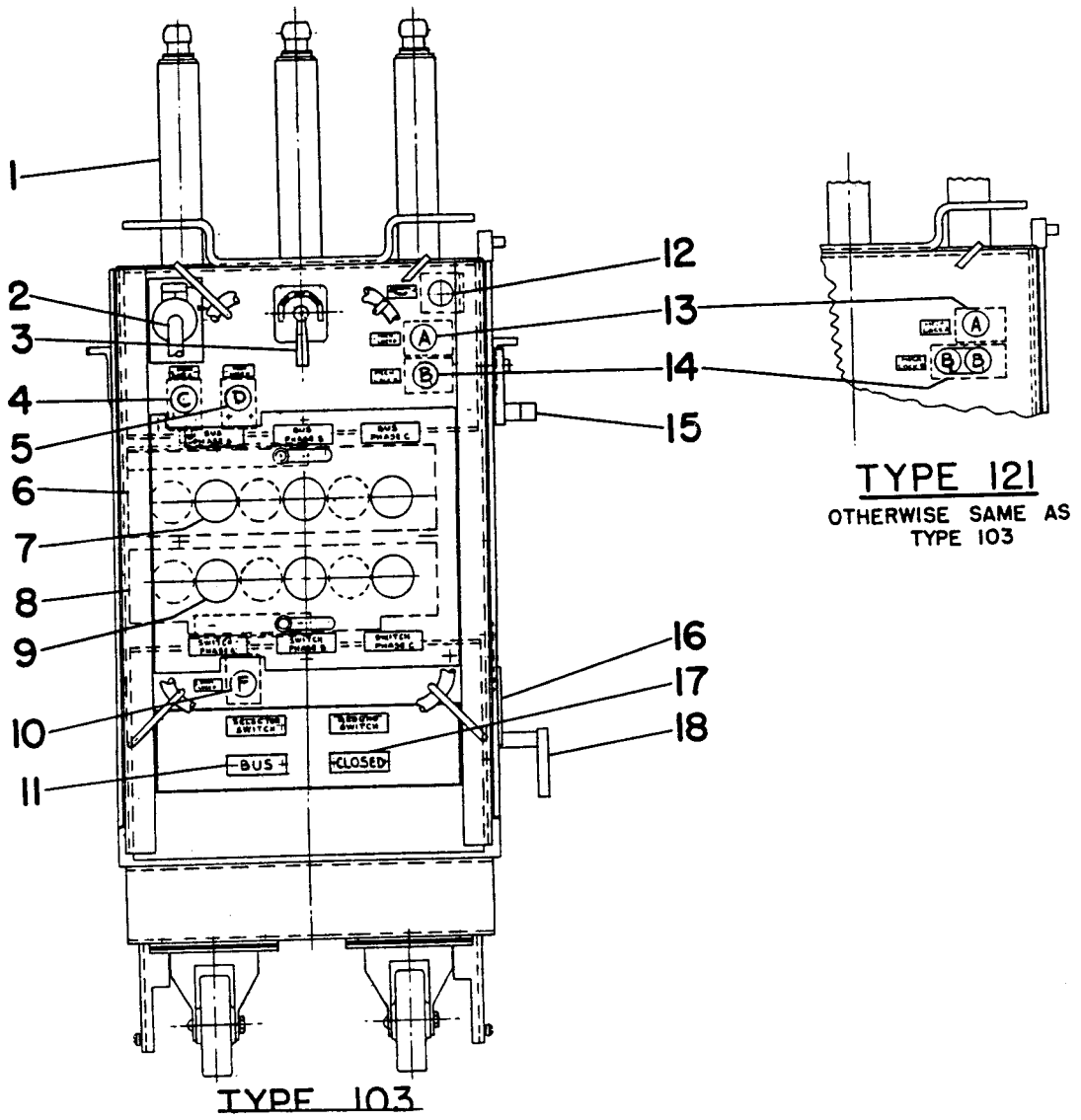


1. Ball Contact
2. Bushing
3. Interlock Rods
4. Operating Mechanism
5. Closing Springs
6. Ground Shoe
7. Contact Support
8. Insulator
9. Operating Rod
10. Stationary Contact Finger
11. Movable Contact
12. Contact Blade
13. Hinge Support
14. Adjusting Nut
15. Check Nut
16. Wheel
17. Bushing
18. Handle
19. Manual Trip Button
20. Slider Assembly
21. Connection Bus
22. Test Receptacle
23. Connection Bus
24. Test Receptacle
25. Selector Switch Blade
26. Selector Switch Operating Rod
27. Key Interlock
28. Selector Switch Operating Handle
29. Insulator
30. Wheel

Fig. 22 Cross-Section View of Ground and Test Device - Type 103

Fig. 22 0844D0962

Fig. 23 0844D0962



1. Bushing
2. Control Cable
3. Control Transfer Switch
4. Key Interlock
5. Key Interlock
6. Sliding Door
7. Bus Test Receptacle
8. Sliding Door
9. Hinge Test Receptacle
10. Key Interlock
11. Selector Switch Position Indicator
12. Manual Trip Button
13. Key Interlocks
14. Key Interlocks
15. Interlock Crank
16. Ground Shoe
17. Ground Switch Position Indicator
18. Selector Switch Operating Handle

Fig. 23 Front View of Ground and Test Device - Type 103 and 121

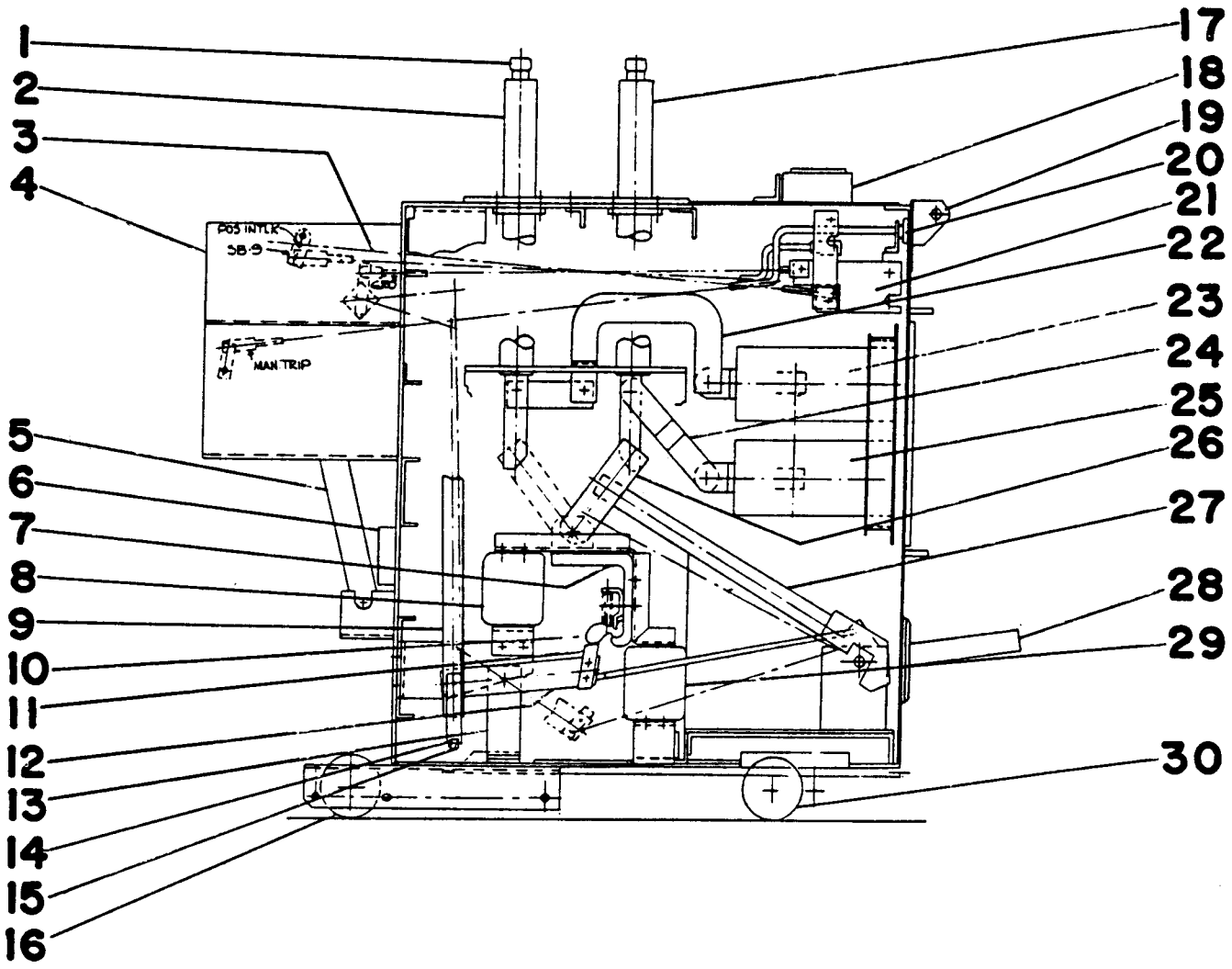


Fig. 24 0114C5427

1. Ball Contact
2. Bushing
3. Interlock Rods
4. Operating Mechanism
5. Closing Springs
6. Ground Shoe
7. Contact Support
8. Insulator
9. Operating Rod
10. Stationary Contact Finger
11. Movable Contact
12. Contact Blade
13. Hinge Support
14. Adjusting Nut
15. Check Nut
16. Wheel
17. Bushing
18. Coupler
19. Handle
20. Manual Trip Button
21. Slider Assembly
22. Connection Bus
23. Test Receptacle
24. Connection Bus
25. Test Receptacle
26. Selector Switch Blade
27. Selector Switch Operating Rod
28. Selector Switch Operating Handle
29. Insulator
30. Wheel

Fig. 24 Cross-Sectional View of Ground and Test Device - Type 106

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