371-03 BELL SUB

PGEI 1200B

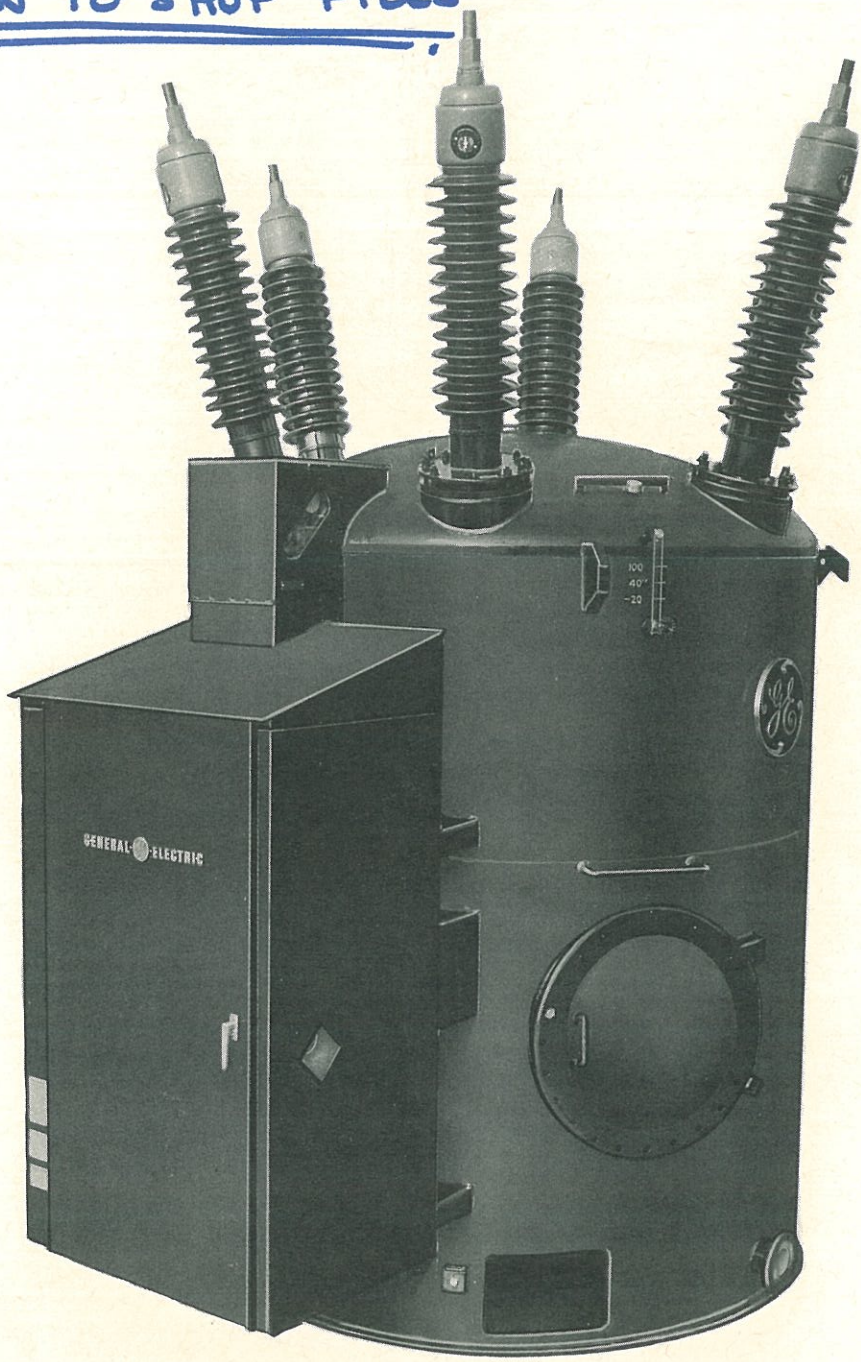
SWITCHGEAR

INSTRUCTIONS

OIL-BLAST CIRCUIT BREAKERS

TYPES KSO 115 KV TO KSO 138 KV

PLS. RETURN TO SHOP FILES



CANADIAN GENERAL ELECTRIC COMPANY LIMITED

CONTENTS

GENERAL INFORMATION

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

These breakers are of the most modern design, incorporating the oil-blast principle of arc interruption. The fast breaker interrupting time means less system disturbance because of quicker clearing of the fault. The short arc lengths mean lower maintenance because of reduced contact burning and deterioration.

These instructions apply to outdoor breakers rated 115,000 and 138,000 volts and with an interrupting rating from 1,500 to 10,000 MVA as designated on the nameplate. They may be used at any altitude up to 10,000 feet if the proper bushings are selected. The operating mechanism is installed in a weatherproof housing attached to the circuit breaker tank.

An oil circuit breaker is a very important unit in the modern transmission system, being depended upon for protection and flexibility of control. It should not be installed in places where it will be called upon to operate at voltages or currents greater than those given on the nameplate. The short circuit conditions to be imposed on the breaker must not exceed the breaker rating.

Proper installation and maintenance are necessary to insure continued satisfactory operation of the breaker. Section 19 of the Standard of American Institute of Electrical Engineers and the N.E.M.A. Switchgear Standards published by the National Electrical Manufacturer's Association, in addition to these instructions, are recommended for reference on the installation and care of oil circuit breakers.

SHIPMENT:

All breakers are assembled and tested at the factory. They are shipped assembled in as complete units as handling and transportation facilities will permit. Each breaker is carefully inspected and packed by workmen experienced in the proper handling and packing of electrical equipment. Immediately upon receipt of a breaker, an examination should be made for any damage sustained during shipment. If injury or rough handling is evident, a damage claim should be filed at once with the transportation company, and the nearest Canadian General Electrical Sales Office notified promptly.

UNPACKING:

For shipment to certain locations it will be necessary to remove the bushings and interrupters.

When unpacking, the crating or boxing must be removed carefully. The porcelains of the bushings and other parts are sometimes broken by driving the wrecking bar into crates or boxes carelessly.

STORAGE:

When the breaker can be set up immediately in its permanent location and filled with oil, it is advisable to do so, even though it will not be placed in service for some time. The oil tanks should be cleaned and dried before they are filled with oil. Even if the tank units must be stored in some location other than the permanent one, the tank should be filled with oil to protect the lift rods and guides.

The multi-break interrupters should be stored in a dry room. If they must be left outdoors for a short time, they should be thoroughly covered to protect them from the weather. Under extreme conditions of humidity, or if the only indoor storage space is damp, they should be kept in containers filled with G.E. #10-C oil.

Renewal parts, especially lift rods, guides, and other parts made of insulating material, which may accompany the breaker shipment, should be stored in a dry room. It may also be advisable to hang the lift rods and guides in a vertical position to minimize the possibility of warping, if a level storage surface is not available.

The space heater in the operating mechanism housing should be energized as soon as possible in order to prevent corrosion due to moisture condensation inside the housing.

For instruction on bushing storage see Instruction Book GGEI-770.

INSTALLATION

The installation of the breaker will be facilitated by a study of these instructions and a review of the approved drawings which supplement these instructions. The drawings show the general arrangement, dimensions, location of foundation bolts, provision for conduit connections, electrical connections and other information necessary for the proper installation of the breaker. The approved drawings consist of the requisition summary, outline of the breaker and the connection diagram.

LOCATION

The breaker should be located so that it will be readily accessible for cleaning and inspection. Where flood conditions exist, the mechanism housing should be above high water level.

MOUNTING

The total weight of the breaker with oil is given on the outline drawing and on the nameplate. This information will serve as a guide to the strength of the lifting means required for handling the breaker. It may be lifted by hooking into the lifting brackets at the top of the tank. When using the cable slings, do not allow the slings to strike the bushings as any strain on these may cause them to crack or to break.

After the circuit breaker has been moved into location on the foundation it should be levelled by dropping a plumb from the vertical punched line on one of the lifting angles provided at the top of the tank to a prick point punched on the flange at the bottom of the tank. For use under windy conditions, a similar arrangement is provided inside the breaker. By removing the cap on the fill pipe in the dome over the manhole, a plumb line may be hung through the pipe and over the notch on its inside end. A reference mark is punched on the bottom of the tank.

With the circuit breaker in place, the weatherproofing covers and the supports holding the interrupters and moving contact members in place during shipping should be removed.

If it has been necessary to remove the bushings for shipment, they can now be removed from the shipping crates and installed in the breakers. Bushing instructions or Instruction Book GGEI-770 should be reviewed before starting this work. Recommendations for unpacking, handling and installation should be followed.

The multibreak interrupters should be assembled on the lower end of the bushings. The procedure to be followed is described under Contacts.

When the bushings and interrupters are removed, they are marked for their respective locations, reassembly will be made easier by following these markings (refer to Fig. 16).

The dashpots should be checked to see that they are filled, to the correct level. See Fig. 7 or 8.

HEATERS

Thermostatically controlled heaters are provided in the oil tank and the operating mechanism housing. The cartridge type tank heaters are energized at 0°F. The strip type heaters in the housing are energized at 60°F. The tank heaters can be removed from the tanks without removing the oil. Before draining the oil from the tank the heaters should be de-energized.

CONNECTIONS

After the breaker has been located, electrical connections can be made. Before making these, every precaution must be taken to see that all the leads to be connected to the breaker are dead.

Primary Connections

Leads should be brought down from above if possible. Ample electrical clearance must be provided between these leads and parts of the station, such as walls, channels, and framework. Leads should be properly supported so that the breaker bushings are not subjected to unnecessary strains. The bushings should not carry cable or bus strains. To avoid overheating, the connecting leads must be of a current carrying capacity at least equal to the maximum operating current of the circuit, which should not exceed the breaker rating.

Connections to the breaker are made by bolted connectors fastened to the ends of the bushings. The bolts on the terminal connectors must be securely tightened to obtain good contact. All joints must be clean, bright and free from dents or burrs.

Control and Secondary Wiring

All control wires should be run in conduit in so far as it is practicable. Control wires must be run separately and remote from high tension leads. Control Wiring of adequate size should be used so that with full operating current flowing to the operating mechanism, the voltage across the terminals of the mechanism will be within the limits specified as standards for the range of control voltage. It is recommended that all conduits entering the mechanism housing be sealed at their entrance to the housing.

Ground Connections

The tank of each breaker should be permanently grounded. The usual practice is to connect a heavy cable to the tank and to the ground. Two grounding terminals are provided on each tank to which this cable can be attached. The cable should be able to carry 25% of the current rating of the breaker but not smaller than #4/0.

A good, permanent, low-resistance ground is essential for adequate protection. A poor ground may be worse than no ground at all, since it gives a false feeling of safety to those working around the equipment and also may result in ultimate loss of life or damage to the apparatus.

ADJUSTMENTS

Although in most cases the breaker will be shipped assembled and has been set up, adjusted and tested at the factory, it is advisable to review all adjustments to see that no change has occurred during shipment and installation. Manual operation should be used for all preliminary inspections. The breaker should be operated by hand to see that is is smooth throughout the closing and opening stroke of the breaker, that no binding occurs and that no excessive play is noticeable between parts. Electrical operation should only be attempted after it is certain all adjustments are made correctly.

The adjustments of the operating mechanism are not included and instructions for the particular operating mechanism used, should be referred to for details.

Note: Before making any changes or adjustments to the breaker, read carefully the factory mechanical and electrical inspection sheets pertaining by serial number to the particular breaker in question. These inspection sheets record the final factory adjustments and correct operation of the breaker will result if these adjustments are maintained.

Breaker Mechanism

FOR BREAKER RATINGS 1500 MVA TO 3500 MVA AT 115 KV
1500 MVA TO 5000 MVA AT 138 KV

Check the following Adjustments:

1. Opening spring Figure 5 Part 7.
2. Toggle adjustment—this has a nominal value of 1 7/8" ±1/4" —See Fig. 3—dimension "A".
3. Clearance between strike pin and lift rod — this has a nominal value of one inch — see Figure 3.
4. Point at which dashpot cam (Pt. 5 Figure 6) strikes roller (Pt. 6 Figure 6). This occurs approximately 8 3/4 inches from the fully closed position.

FOR BREAKER RATINGS 5000 MVA TO 10000 MVA

Check the follow Adjustments:

1. Opening spring Figure 5 Part 7.
2. Toggle adjustment — this has a nominal value of 1" — See Figure 3 — dimension "A".
3. Clearance between strike pin and lift rod — This has a nominal value of one inch — See Figure 3.

Mounting and Alignment of Interrupters:

The interrupters should be hung on the bottom of the bushings with the exhaust ports located as shown in Figure 16. By use of a spirit level, these interrupters can be brought to within 1/16" tolerance of plumb within the length of the interrupter. It may be necessary to change the angle of the bushing in plumbing the interrupter. This can be done by loosening the bolts between the bushing and the flange on the current transformer pocket and moving the bushing as required. (refer to Figure 9).

Contacts

FOR BREAKERS RATED 1500 MVA TO 3500 MVA AT 115KV
1500 MVA TO 5000 MVA AT 138KV

The length of the lower porcelain of the bushing varies and this is compensated for by adjustable contact buttons on the cross bar. Shims are provided between the contact tips and cross bar so that they can be removed to lower the top or added to raise it. The contact buttons should be adjusted so that they make contact with both interrupters as near together as possible. When this has been done, measure the contact compression, that is the distance the contact cap is raised above the point at which the circuit is completed through the internal interrupter contacts. The amount of contact compression should agree within 1/32" with the values given on the mechanical inspection sheets. If the contact compression is not within these limits, the cross bar which is threaded and keyed to the lift rod can be adjusted to obtain the correct compression.

The contact buttons of the three phases on the moving crossarms should make and break at approximately the same time. Practically some difference will exist, but they should be within 3/8" of each other.

FOR BREAKERS RATED 5000 MVA TO 10000 MVA

The length of the lower porcelain of the bushing varies and this is compensated for by adjustable contact tips on the interrupters. Refer to Fully Closed Adjustments for details.

The adjustment of the contact tips can be obtained by use of shims, see Fig. 13 Pt. 35. Addition of, or removal of these adjustment shims, will allows for the make and break of the contact tips to be approximately simultaneous.

Stroke:

The oil dashpots, Figures 7 & 8, should be checked for oil level and filled with G.E. #10C breaker oil if necessary. The correct level is shown on the diagram. This check should be made with the stem up, that is, with the breaker in the partially closed position so that the breaker is not contacting the dashpot stem. A check should be made to see that the breaker mechanism linkage comes to rest on the dashpot caps in all phases at approximately the same time. The stroke should be adjusted to agree within 1/8" with the value given on the mechanical inspection sheet. The dashpots are threaded and can be adjusted up or down to obtain the desired stroke.

OIL

With all adjustments completed, the tanks should be filled with oil for a final test of operation before putting the breaker into service. The normal oil level is the centre of the gauge glass and in no case should the oil level be allowed to get beyond the ***Visible*** portion of the glass.

Before filling with oil, all accessories such as valves and gauges must be assembled on the breaker and made oil tight. The threads should be filled with Glyptal or equivalent before putting into place. Pipe plugs are furnished in the outlet side of the drain valves for shipment and may be used in service for additional insurance.

G.E. #10C oil is used in these circuit breakers.

While the oil is shipped in sealed containers, careless handling during shipment or storage may result in absorption of moisture by the oil. All new oil should be tested before being placed in the oil circuit breaker. The dielectric strength of the oil when shipped is at least 22,000 volts when tested in a standard gap, with 1" disc terminals 0.1" apart. New oil of less than standard dielectric strength (22,000 volts) should not be put in the breaker tank until its insulating value has been brought up to the above standard (by filtering or otherwise).

In filling, care must be taken so that moisture will not be absorbed by the oil during the filling process. When cold drums of oil are brought into a warm place, they should be allowed to stand before opening until there is no condensation on the outside and until they are thoroughly dry. If the installation is outdoors, the preparation and filling should be done on a clear, dry day or adequate protection of some kind provided against moisture being absorbed. The presence of one tenth of 1 per cent moisture may reduce the puncturing resistance of the oil by 50 per cent.

Metal or oil-proof rubber hose must be used because oil dissolves the sulphur in ordinary rubber hose which may cause trouble, as sulphur attacks copper.

Oil Level Gauge

The tank oil level gauge, see Fig. 1, part 11, is provided with temperature reference marks, since the oil level will be influenced by the oil temperature. The tank should be filled to the point indicated by the actual oil temperature in the breaker tank, and not the outside air temperature.

AIR OPERATOR CHECK

A visual inspection of the mechanism should be made to see that all cotter pins are in place, all nuts and terminal connections tight, no binding present, and that it is properly lubricated in accordance with the mechanism instruction book.

While the tank is being filled with oil, checks can be made on the operating mechanism. The compressor oil level should be checked and the air receiver pumped up. The settings of all pressure switches and cut-off switches must be checked. Reference should be made to the mechanism instruction book and inspection sheets for these adjustments.

FINAL INSPECTION

After the breaker has been installed with all mechanical and electrical connections completed, the following inspections and tests should be made.

1. See that the breaker is properly set up and levelled on its foundation.
2. Operate the breaker slowly by hand and check the following points:
   (a) Opening spring adjustment (see inspection Sheet).
   (b) Interrupter alignment.
   (c) Contact compression (see inspection sheet).
   (d) Stroke (see inspection sheet).
   (e) Clearance for all moving parts, connecting rods, etc.
3. See that all nuts, washers, bolts and cotter pins and terminal connections are in place and tightened.
4. Inspect all insulated wiring to see that no damage has resulted during installation and test for possible grounds and short circuits.
5. See that all bearing surfaces of the operating and breaker mechanisms have been lubricated.
6. See that the dashpots are filled with G.E. #10C breaker oil.
7. See that the manhole cover is bolted up properly.
8. See that the tank and bushings are filled with oil to the proper level.
9. Operate the breaker electrically and check the following points (Refer Analyser Chart Fig. 11)
   (a) Operating times: Closing, Opening, Reclosing, Trip-Free. (See inspection data chart for limits.)
   (b) Contact opening speed;
   (c) Contact opening on reclosing; minimum of one half of moving contact stroke.
   (d) Overtravel: maximum of 7/16" for Breakers rated 5000 MVA to 10,000 MVA; 5/8" for Breakers rated 1500 MVA to 3500 MVA at 115 KV and 1500 MVA to 5000 MVA at 138 KV.
   (e) Rebound on Closing: 3/8" maximum
   (f) Rebound on Opening: Nil.
10. See that the current parts connected to the bushings are correctly installed in accordance with the standard practice and that all joints, whether bolted joints of copper bars, or clamped joints made with cables, are made correctly.
11. See that all covers and bolted connections are securely tightened and that all pipe plugs for inspection openings are properly installed and tightened to prevent the entrance of moisture.

SPEED ADJUSTMENT

After the breaker has been adjusted, and the bearing surfaces of the breaker mechanism properly lubricated, the tanks filled with oil, and the air operating mechanism checked and pumped up, the breaker may be operated. A travel Analyzer should be attached to the breaker to obtain an accurate travel record of breaker performance. A #10-24 tapped hole is located in the top of the lift rod of the centre phase for the rod used with the Travel Analyzer. Access to this hole is through a pipe plug in the top frame directly above the lift rod. (see Fig. 2).

Representative travel curves of opening, closing, and reclosing operations are illustrated on the accompanying typical Analyzer Chart, Fig. 11. On most occasions it will not be necessary to make any adjustments to come within the limits given on this chart. If necessary, the opening speed can be adjusted by means of the opening spring Figure 5, Part 7; if there is excessive overtravel or rebound the nearest Canadian General Electric Sales Office should be consulted.

12. See that all points where the surface of the paint has been damaged during installation are repainted immediately, using touch-up paint supplied.

OPERATION AND MAINTENANCE

The safety and successful functioning of connected apparatus depend upon proper and reliable operation of the oil circuit breaker. To obtain this the oil circuit breaker must have regular systematic inspections during which every part is looked over carefully. The frequency of the inspections should be determined by each operating company on the basis of the number of operations (including switching), the magnitude of the current interrupted and any unusual operations which occasionally occur. Operating experience will soon establish a maintenance schedule which will give an assurance of proper breaker condition. The following paragraphs list the main points to be included in an inspection and a number of general recommendations.

1. Be sure the breaker and its mechanism is disconnected from all electric power, both high voltage and operating, before inspecting or repairing. After the breaker has been disconnected from power lines, grounding leads should be properly attached before coming in contact with any of the breaker parts.
2. Be sure the breaker tank is well grounded.
3. At regular inspections:

(a) (I) For Breakers Rated 1500 MVA to 3500 MVA at 115 KV and 1500 MVA to 5000 MVA at 138 KV the contacts should be checked. See that they are aligned and the contact surfaces bear with firm, uniform pressure. The current carrying capacity of high pressure line or point contacts as provided by the butt type oil-blast contacts is practically independent of the condition of the contact surface. With sufficient contact pressure, the area of contact is not important. Therefore, with these contacts, where arcing and current carrying functions are performed by the same contacts, it is not necessary to maintain the surface of the contacts.

(II) For Breakers Rated 5000 MVA to 10000 MVA the contacts should be checked. See that they are aligned and the contact surfaces bear with firm, uniform pressure. The current carrying capacity of high pressure line or point contacts as provided by the tulip-type contacts is practically independent of the condition of the contact surface. With sufficient contact pressure, the area of contact is not important. Therefore, with these contacts, where arcing and current carrying functions are performed by the same contact, it is not necessary to maintain the surface of the contacts.

(b) The oil should be checked. Oil in service should be tested at frequent intervals. Three month periods are recommended. If the dielectric strength of the oil tests less than 16,500 volts, it should be filtered.

When sampling oil, the sample container should be a large mouthed glass bottle. The bottle should be cleaned, dried with benzine and free from moisture before it is used. A dry cork stopper should be used. The sample of oil should be at least 1 pint.

Test samples should be taken only after the oil has settled for some time. Samples should be taken from the sampling valve at the bottom of the tank and sufficient oil drawn off to make sure that the sample represents oil from the tank proper and not that stored in the drain pipe. A glass receptacle is desirable so that if water is present it may be readily observed. If water is found, investigation of the cause should be made and a remedy applied. Excessive water is indicative of leakage somewhere in the breaker structure.

(c) All insulation parts should be thoroughly cleaned to remove all traces of carbon which may remain after the oil has been drained from the tank. It is recommended that the oil be removed and the tank cleaned at regular intervals because filtering the oil does not remove the carbon which adheres to the inside of the tank.

(d) The operating and breaker mechanisms should be thoroughly checked. All bearing surfaces should be lubricated.

(e) The dashpot oil level should be checked and replenished with G.E. #10-C breaker oil where necessary. The dashpot pistons should be examined to see that they work freely so that the dashpots, function properly.

(f) All bolts, nuts, washers, cotter pins, and terminal connections should be in place and properly tightened. The gland nuts on all valves and oil gauges should be checked to see that they are sufficiently tight to prevent leakage. In tightening the gland nuts, precautions should be taken to prevent damaging the packing through excessive pressure.

(g) Operate the breaker slowly by hand and check the points listed under Final Inspection, Paragraph 2.

(h) Operate the breaker electrically and check the points listed under Final Inspection, paragraph 9.

4. Inspect the bushing supports as the vibration due to the operation of the breaker may cause the bushings to move slightly and result in misalignment of contacts.

5. Clean the bushings at regular intervals where abnormal conditions prevail such as salt deposits, cement dust or acid fumes, to avoid flashover as a result of accumulation of foreign substances on their surfaces.

6. See that the oil is kept at the proper level in the tanks and bushings.

7. Use the maintenance closing device to assist in making adjustments. This is the primary purpose of the device because it permits slow closing and opening. ***It must not be used for closing the breaker on load.***

8. After making adjustments operate apparatus by hand before attempting operation.

9. ***Preparation for Gasket and Gasket Surfaces*** (for Cork, Neoprene, Vellumoid, Rubber and similar material.)

   All gasket surfaces shall be thoroughly cleaned to remove all oil, grease, or foreign material which will prevent proper adhesion of the gaskets, or sealing of the joints. They shall be allowed to become thoroughly dry before proceeding with treatment.

   All surfaces where gaskets (except rubber gaskets) are to be permanently assembled shall be given a full unbroken coat of #1201 glyptal compound. All gaskets (except rubber gaskets) for such joints shall be given a similar coat. This shall be done at such time in the assembly cycle that the compound will be allowed to dry at least one-half-hour before final assembly. A longer time up to 24 hours is not detrimental. In making up permanent joints, both the gasket and gasket surfaces are again coated with glyptal and the part bolted up before the glyptal sets.

   For joints such as covers, manholes, or places where the joint has to be opened, do not coat the gasket surface of the removable part or install this part until the compound on the gasket is perfectly dry. The side of the gasket to be assembled against the uncoated surfaces can be greased to prevent sticking.

   Rubber gaskets, due to their composition do not require coating with compound or greasing as outlined above for gaskets of other material.

THE MULTI BREAK INTERRUPTERS

FOR BREAKERS RATED 1500 MVA TO 3500 MVA AT 115 KV AND 1500 MVA TO 5000 MVA AT 138 KV (TYPE 401)

Description

The contacts consist of stationary multi-break interrupters mounted on the lower ends of the bushing and moving contacts operated by the breaker mechanism.

The interrupter (Fig. 15) consists of a tube made from insulation material enclosing the upper, intermediate and lower stationary contacts and a removable contact assembly having two moving bridging type contacts. The stationary and bridging contacts together form four series breaks consisting of two pressure generating breaks and two interrupting breaks. The tube has two port openings to allow the proper flow of oil across the interrupting contacts during fault operations.

Contact pressure is obtained by individual contact springs. The opening speed of the interrupter contacts is initiated by the inner spring on the lower end of the rod assembly. This spring operates to push down on top of the lower external contact which is electrically connected to the lower adapter of the interrupter with two copper braids. The opening speed of the contacts is determined by the speed of the cross bar which is fastened to the lift rod of the breaker.

Overtravel on closing is limited by means of the outer spring on the lower end of the interrupter which has no compression in the normally closed position but absorbs the closing energy when moving beyond this position. The opening energy of the interrupter is absorbed upon completion of the opening stroke by rubber buffers assembled on the interrupter operating rod just above the lower adapter.

On a fault operation the contacts part, drawing four simultaneous arcs. Each of the bridging contacts will form two arcs, one of which is at the pressure break, the other at the interrupting break. Arcing plates are attached to the stationary contacts at the pressure generating breaks. Transfer of the arc from the slotted contacts to the arcing plates gives essentially constant arc lengths throughout the arcing zone and thus allows excellent pressure control. The port openings in the tube are located adjacent to the interrupting breaks. Vaporization of the oil at the pressure generating break forces fresh oil across the interrupting break and out of the tube through the port opening until the fault is cleared. The flow of oil across the interrupting break also carries the arc products away from the contacts and out of the tube through the port openings. Each port opening in the wall of the tube is a single round hole, but

inside the tube a port block is fastened over the hole which divides it into an upper and lower section. The port block also serves as a guide for the moving contacts.

Inspection

The contacts may be inspected without disturbing the resistor unit or removing the interrupter from the bushing. The static shield must be removed to gain access to the bolts supporting the movable contact assembly. When these bolts are unfastened, the complete movable contact assembly can be lowered and removed as a unit, see Figure 15. As this unit is lowered, it must be rotated 90 degrees to clear the lower stationary contact and port block. An indication of when to make this turn without interference may be determined by the feel of the unit as the bridging contacts clear the port block guides.

A look up the inside of the interrupter tube Part 17, Figure 15, will show the condition of the stationary contacts. However, for a more detailed inspection, these contacts are easily removable by unscrewing the insulating bolts which hold them in position.

Assembly of Movable Contacts

To assemble the movable contacts (Figure 10) of the interrupter the operating rod (1) which supports the bridging contacts is placed in an inverted position with the threaded end up. Slide spacer (2) over the end of the rod and then slide over the threaded end of the rod in the following order, tube (3) washers (4) and bridging contact (5). This places in position the upper movable contact. Next in order should come spring (19) spring retainer (6) shims (7) (approx. 1/16" thick) to obtain dimensions 8.312" plus or minus .005" tube (8) washer (9) and bridging contact (10) The lower contact is then in position.

Next in order on the rod should come the lower contact spring (21) spacer (11) disc (12) and the threaded sleeve (13) which should be screwed on the threaded end of the rod until the assembly is tight against the shoulder at the square section of the rod. At this point, check accurately the dimension between the upper and lower contacts which should be 12.312 plus or minus .005". This dimension can be obtained by adding or subtracting shims (7). Finally add the buffer (23) plate (14) springs (15 and 16) and contact disc. (17) which should be screwed into the threaded end of the sleeve until it is tight against the end. The threaded sleeve (13) and the contact disc (17) are held in place by set screws. Fasten the flexible braid to the contact disc (17) and to the plate (14) by means of the screws and locking plates provided.

To facilitate the proper location of the openings in the static shields and the positioning of the flexible braids, the interrupter on the outer phases are provided with intermediate rings and plates. Figure 16 shows the correct location of the static shields and flexible braids on each interrupter and also the interrupter port openings.

Assembly of Stationary Contacts

To assemble the stationary contacts of the interrupter (Fig. 15) first assemble the tube, adapter and ring. Place the ring (16) inside the lower end of the tube and similarly secure in place with studs. Care should be taken to line up the holes in the ring with those in the tube before putting the ring in place.

On the lower side of the adapter, mount the upper contact (29) by means of bolts and lockwashers. Directly below the contact mount the upper port block opposite the large upper hole in the tube, securing with the insulated bolt and washer. Next on the inside of the tube mount the intermediate contact (12) after the insulating lining (10) and arcing plates (8) are first fastened to the contact. Follow by installing the lower port block in the same manner as given above for the upper port block. Insulated bolts and washers are used here also to hold the intermediate contact and lower port block. The lower contact, with its arcing plates and insulating lining is finally mounted using an insulated bolt at the top. The bottom of this contact is held firmly against the ring by recessed hollow head screws and lockwashers to insure a good electrical connection.

Complete Assembly of Interrupter

To complete the assembly of the interrupter, Fig. 15, arrange the bridging contacts properly so that when inserted into the tube the solid edge of the contacts will be towards ports and split sides toward arcing plates. Then insert the movable contact assembly in the tube, with the contacts 90° from the correct position. This is done so that the movable contacts will pass by the stationary contacts and port blocks. When the contacts are in position where they can be rotated without interference turn the assembly back through 90° and insert the rest of the way to the final position. A good indication of when the contacts can be turned is the position where the upper end of the operating rod (1) is just entering the hole in the adapter (2). At this point the movable contact assembly can be rotated. (This method and position of rotating the movable contact 90° from the final position applies also when these contacts are being removed.) Before putting the breaker into service a check should be made on the position of all the bridging contacts. The end of the bridging contacts which is visible through the port openings should be solid. The U-shaped end of the bridging contacts (31) should match with the arcing plates (8) on the contact blocks which are located

180° from the port openings. Fix the internal assembly in position by securing the plates to the ring by means of screws and lockwashers supplied. At this point try closing the interrupter by manual means to test for correct adjustment and alignment of the moving contacts. These can be observed through the port openings.

Shunting Resistor

The shunting resistor is first assembled as a unit, to assemble the resistor unit, first wind the resistor helix on the resistor board and secure the ends of the resistor helix between the washer and flared end of the copper tubes forming grommets located at the upper right hand and lower left hand diagonal corners. Two other grommets are installed in the opposite diagonal corners. Insulating nuts with shoulders, extending through the front cover and the resistor board and flat headscrews extending through the back cover are used to complete the assembly of the resistor unit.

The completely assembled resistor unit is next assembled to the outside of the insulation tube of the interrupter by four screws which pass through holes in the front and back covers and through the grommets in the resistor board assembly. The two upper screws extend into the adapter and the two lower screws extend into the ring. The upper right hand screw and the lower left hand screw complete the resistor circuit between the adapter at the top and the ring and plate at the bottom of the interrupter contact.

FOR BREAKERS RATED 5000 MVA TO 10,000 MVA (TYPE 201)

Description

The type 201 interrupter, shown in figures 12, and 13, consists of two sets of contacts connected in series, and mounted inside a tube of insulating material. This arrangement provides a total of four breaks in series per pole of the breaker.

The two sets of fixed contacts are of the tulip type, faced with arc-resistant Elkonite. Each set consists of a cluster of eight contacts arranged in a ring, each contact being provided with its own pressure spring.

The two moving contacts are of the rod type, tipped with Elkonite, which are forced into the open end of the circular cluster formed by the fixed contacts, forcing them outwards against their pressure springs. Both moving contact rods are operated simultaneously by the breaker contact blade.

Referring to Figure 13, the current flows from the adapter (4), through the upper fixed contacts (10) to the upper moving contact rod (13). The lower end of this rod is insulated by a wood section (20), which forces the current to flow to the fixed transfer fingers (14), through the fixed support plate (16), through the lower fixed contacts (18) and thence to the lower moving contact rod (21). This connects directly to the lower crosshead (34), and from there the current passes through contact tip (38) to the contact cluster on contact blade, shown in Figure 14.

In operation, the dropping of the contact blade allows the interrupter opening springs (24) to drive both the contact rods out of engagement with fixed contacts simultaneously, striking an arc. The contact assembly is guided in its travel by two guide cylinders (27), which are attached to the lower crosshead (34), and travel between a pair of textolite bushings (31) on the outside, and a pair of fixed guide rods (26) on the inside of the cylinders. The upper ends of the guide cylinders (27) are joined by a crosshead which comes to rest against a nest of textolite buffer plates (30) when the interrupter reaches the open position.

Each of the two fixed contacts is located adjacent to a pair of arc ports in the side of the interrupter tube. Gas pressures generated by the action of the arc on the oil within the interrupter are relieved by venting through these ports.

Of the eight fingers in each fixed contact cluster, the two which are immediately adjacent to the two slot-shaped openings of the arc port are equipped with an extended arcing tip, the purpose of which is to stabilize the location of the arc during interruption.

The baffle stacks, (12) and (19), which surround the contacts, are so shaped and arranged as to force the resulting gas and oil flow across the arc, and at the same time, splitting the flow into a number of parallel layers of flow. This cross-blasting and splitting action cools, elongates, and deionizes the arc, and thus extinguishes it, interrupting the current.

In closing, the contact cluster, Figure 14, engages the contact tip (38) at the bottom of the interrupter, and exerts closing force on the moving assembly through the guide (51), which engages the textolite buffer (37) surrounding the contact tip (38). The contact fingers (50) in the blade cluster are of the tulip type, similar to the fixed contacts in the interrupter.

Overtravel of the contact rod assembly is limited by the overtravel spring (39), which engages the lower crosshead (34) through the retainer ring (33), when the crosshead travels beyond the fully-closed position.

Inspection

In order to inspect the contacts, a preliminary dismantling is required, consisting of the removal of the moving contact rod assembly, Figure 17. If inspection of the contact rods indicates the need of inspection of the fixed contacts, a further dismantling is necessary.

Dismantling and Inspection

In order to remove the moving contact assembly, Figure 17 for inspection, the following order of dismantling is used. (Refer figure 14).

(a) Remove mounting bolt (28) and lower static shield (29).

(b) Remove set screw (42) and buffer bolt (43). Remove buffer (37).

(c) Remove contact tip bolt (36), contact tip (38) and adjustment shims (35). Keep shims together with the interrupter, so as to maintain all settings.

(d) Remove guide cylinder nut (32).

(e) Remove crosshead (34) and contact rods (13), (20) and (21) as one assembly, as shown in figure 17. Springs (4) and washer (6), figure 17, will accompany the assembly. If the assembly does not come loose readily, tap downward firmly with a soft-nosed hammer on the crosshead (34).

If the burning of the contact rods is not excessive, further inspection of the stationary contacts is not necessary. If, however, replacement of the rods is deemed necessary, it is desirable to dismantle further.

To remove the lower fixed contact and baffle stack assembly, figure 19, the following order of dismantling is used:

(a) Remove resistor mounting screws and resistor, shown in Fig. 12.

(b) Remove cotter pins and nuts from lower tie studs shown in Figure 12.

(c) Remove lower housing (25), figure 13, complete baffle stack assembly, figure 18, and fibre adjustment shims between the two parts.

(d) Remove nuts from the three wood studs that hold baffle stack assembly together, thus allowing dismantling of the parts.

(e) Remove the upper static shield. Remove cotter pins and nuts from upper tie studs (figure 12), and remove interrupter tube, exposing upper fixed contact cluster for inspection.

Since this dismantling procedure does not disturb the setting of the mounting adapter on the bushing, no re-adjustment of the interrupter alignment is necessary after reassembly of the parts.

Replacement of Parts

MOVING CONTACT RODS

Normally, the arc erosion of the contact rods will not be uniform around the end, but will be concentrated on that side adjacent to the arc port. If the burning is confined to the end rather than the circumference of the tip, and is not severe (i.e. no more than 1/16" has been burned off) the rod may be considered as still serviceable.

However, if more than 1/16" of burning is found, and the circumference has been eroded, filing to try to duplicate the original contours of the tip should not be attempted, since the reduced diameter of the rod will cause a reduction of contact pressure. The contact rods should be replaced.

Normally, the wood rod carrying the upper contact rod should require no replacement. The upper rod may be replaced by loosening the set screw at its lower end and screwing it off the wood rod. In fitting the new contact rod, care should be taken that it is screwed tightly against the shoulder, with no sign of looseness or shake, and that the set screw is replaced firmly. Care must be taken not to damage the surface of the contact rod or the wood rod.

The lower contact rod is replaced by loosening the clamp bolt in the crosshead and unscrewing the rod from the latter.

FIXED CONTACTS

To replace the fixed contact fingers, first detach them from their flexible leads by removing the holding screws, and slide the contact cluster off its mounting boss. Then remove the three screws which hold the spring retaining ring to the fibre cage, and pry the ring off.

In order to replace the contact fingers, a special tool is used to facilitate the insertion of the pressure springs. This is shown in Figure 18. Two tools are furnished; the one shown is for the arcing fingers; a slightly larger size is used for the current transfer fingers. Procedure is as follows:

Step 1. Place the base (4) on the bench and insert the contact fingers (8), Elkonite tip upwards, in the circular groove. Place the fibre spring cage (5) around the contact cluster and insert the pressure springs (7) in the cage holes, making sure they are seated in the finger recesses.

Step 2. Place the brass retaining ring (6) and the extra ring (2) used as a spacer, in the straight-bored end end of the cylinder (1).

Step 3. Place the taper-bored end of the cylinder down over the finger and spring cluster, making sure that the springs slide squarely into the cylinder.

Step 4. Holding the retainer and spacer rings in place in the end of the cylinder, invert the latter and push the base and finger assembly to the other end of the cylinder.

Step 5. Remove the cylinder, spacer ring, and base, leaving fingers, springs, retaining cage and retaining ring assembled. Replace the three screws holding the cage and retaining ring together, and the cluster is ready for reassembly in the interrupter.

When placing the cluster on its mounting boss, the assembly tool base (4) is used to apply even pressure to all fingers. The proper location of the arcing tips for the upper and lower contacts is shown in Figure 23.

The assembly procedure for the current transfer contacts is the same as for the arcing contacts, except that the larger assembly tool is used.

Reassembly

When reassembling the interrupter, the reverse of the dismantling procedure is followed. ***Care must be taken that the arc ports on the interrupter tube are in the same locations as shown in figure 16.*** Otherwise a danger of flashover between adjacent interrupters exists.

When installing the baffle stack assembly Figure 19, in the tube, sufficient fibre spacer discs should be added between it and the lower housing so that there is a space of 1/16" between the end of the interrupter tube and the lower housing prior to tightening the tie studs. That is, when the studs are tightened, the baffle stack assembly will be pre-compressed by 1/16". This is essential to ensure that any swelling of the baffle stacks is taken by the interrupter tube, rather than by the baffle stack assembly studs.

Adjustment of Moving Contact Rods

The 201 Interrupter is so designed that, when the breaker is fully closed, the lower crosshead (34), Figure 13, just touches the overtravel spring retaining ring (33). In this position, the contact wipe must be 1/2" plus 0" minus 1/16".

To readily check this, Wipe Checking Gauge T.L. #138657 is used, as shown in Figures 20, 21, and 22. Procedure is as follows:

(a) With the moving contact rod assembly, Figure 17 removed from the interrupter, insert the small end of the gauge rod in the end of the interrupter in place of the contact rod, and, with the slider unclamped, push the rod in until it rests firmly against the face of the contact mounting boss, as shown in figure 20.

(b) Run the slider up until its stepped ring rests against the overtravel spring retainer ring, Fig. 13 Pt. 33 and lock in place with the clamp screw, as shown in figure 20.

(c) Remove the gauge from the interrupters, and stand it along side the contact rod with the tip of the gauge resting on the step on the crosshead, as shown in Figure 21.

(d) Check length of contact rod against gauge slider, as shown in Figure 22. The end of the contact rod should touch either the upper or lower step on the bottom face of the slider, or else should lie between these faces.

(e) If the length of the rod is incorrect, loosen the clamp bolt on the crosshead and screw the rod in or out of the crosshead to correctly match the gauge. Re-tighten the clamp bolt.
This must be done for both contact rods, and when adjustments are complete, care must be taken to replace the contact rod assembly in the same interrupter against which it was checked.
The distances between these faces and the stepped ring on the slider assures that the contact wipe is 1/2", plus 0", minus 1/16", as described.

Fully Closed Adjustments

With the interrupters, less lower static shields, mounted on the bushings and adjusted for plumb, it is necessary to check the fully-closed setting of the interrupters. As mentioned under Reassembly and Adjustments of Contacts, the lower crosshead (34) of the interrupter Figure 13, must just touch the overtravel spring retaining ring (33) when the breaker is fully closed under power. When closed by means of the hydraulic jack, the crosshead should be about 1/16" below this ring. Adjustment shims (35) are provided to adjust for this setting. Procedure is as follows:

1. Jack the breaker closed, carefully watching all interrupters. If any interrupters go more than 3/16" past fully closed (i.e. retaining ring (33) is lifted more than 3/16" off its stop ring) before the breaker latches closed, open the breaker and remove sufficient shims (35) to reduce this before jacking further, See 3 below.
2. With the breaker latched closed, measure, on each interrupter, the distance between crosshead (34) and retainer ring (33) or between retainer ring (33) and its stop ring, as the case may be. Record these measurements for each interrupter.

3. Add or remove shims (35) to obtain a distance of 1/16" between crosshead (34) and retainer ring (33). Procedure is as follows:
   (a) Open breaker.
   (b) Remove set screw (42), bolt (43), and buffer (37).
   (c) Remove contact tip bolt (36) and contact tip (38). Shims (35) will come off with contact tips.
   (d) Add or remove required shims, as determined in 2., and reassemble.
4. Recheck 1/16" dimension between crosshead (34) and retaining ring (33), by closing the breaker manually.
5. See that Final Inspection 1. to 6. has been made, and then close breaker electrically at normal pressure.
6. Recheck all interrupters. Crosshead (34) should now just touch retaining ring (33), without lifting latter from its stop ring. If not, a readjustment must be made, by adding or removing additional shims.
7. Check to see that all-bolts and setscrews are properly tightened, and replace static shields, noting positions of shield openings as shown in figure 16. The lower portion of the shields may be rotated on the upper portion by removal of the flat-head screws holding the two parts together.

Shunting Resistor

The shunting resistor is first assembled as a unit. To assemble the resistor unit, first wind the resistor helix on the resistor board and secure the ends of the resistor helix between the washer and flared end of the copper tubes forming grommets located at the upper right hand and lower left hand diagonal corners. Two other grommets are installed in the opposite diagonal corners. Insulating nuts with shoulders, extending through the front cover and the resistor board and flathead screws extending through the back cover are used to complete the assembly of the resistor unit.

The completely assembled resistor unit is next assembled to the outside of the insulation tube of the interrupter by four screws which pass through holes in the front and back covers and through the grommets on the resistor board assembly.

The two upper screws extend into a metal bracket which mounts on the upper adapter. The two lower screws extend through into the lower housing. The upper right-hand screw and the lower left-hand screw complete the resistor circuit between the top adapter and the lower housing, thus shunting the interrupter contacts.

With the resistor mounted, the resistor value should be checked by a bridge or suitable ohmmeter between the upper adapter and lower housing. For breakers supplied with 401 interrupters, the resistance should be 1350 ohms ± 10%. For breakers supplied with 201 interrupters, the resistance should be 1620 ohms ± 10%.

The resistance may be checked after the breaker has been tanked, by jacking the breaker closed until the contact blades engage the contact tips of the interrupters, and connecting the bridge between the top bushing terminals and connecting the bridge between the top bushing terminals of each phase in turn. The resistance reading should be 2650 ohms ± 10% for the 401 interrupter and 3240 ohms ± 10% for the 201 interrupters.

MOVING CONTACT MEMBERS

FOR BREAKERS RATED 1500 MVA TO 3500 MVA AT 115 KV AND 1500 MVA TO 5000 MVA AT 138 KV

The moving contact member consists of a cross bar clamped to the lower end of the lift rod and supporting adjustable contact tips with shims at each end. The contact tips are removable and may be renewed when necessary. The tips are mounted on to the ends of the cross bar and are held in place with a nut, lockwasher and set screw.

FOR BREAKERS RATED 5000 MVA TO 10,000 MVA

The contact blade assembly consists of a cross bar clamped to the lower end of the lift rod and carrying a contact cluster at each end, as shown in Figure 14. These contacts are held in place by a clamp bolt and nut (56), the removal of which permits the demounting of the contact cluster as a complete unit.

If replacement of the fingers is necessary, the set screw (58) is loosened, and retaining bolt (59) and nut (57) removed, permitting the removal of the base (53), and dismantling of the fingers (50), guide (51) springs (52), and mounting bolt. The reverse procedure is followed for reassembly.

BUSHINGS

Little or no maintenance is required of the bushings other than a periodic checking of the oil level gauge and cleaning of the porcelains. In locations where abnormal conditions prevail such as salt deposits, cement dust, etc. It should be recognized that a special hazard exists and the bushings should be cleaned regularly to avoid accumulations on the external surfaces which might cause a flashover.

DASHPOTS

Oil filled dashpots (Figure 3 part 14 and Fig. 7, Fig. 8, using the same kind of oil as in the breaker tank, absorb the energy of the moving parts at the end of the opening stroke. They are self-contained and will operate properly whether the oil tanks are filled with oil or not. Since very little oil is

lost during breaker operation, they will require only periodic inspection. The oil level can be checked by removing the cap on the outer end of the fill pipe leading to the inside of the dashpot cylinder. The fill pipe is located at the correct oil level. Oil can be added to the cylinder through this fitting.

(See figure 7 and 8).

VENTING

Gases generated during circuit interruption are separated from the oil and vented to the outside by means of a gravel filled chamber which is located in the top frame (refer to Figure 4). There are no adjustments, and no maintenance is required unless the gravel becomes dirty and the vent clogged. Then the gravel should be removed and cleaned. The fittings over the outer end of the chamber are removable for this purpose.

RENEWAL PARTS

These instructions should be used to identify 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. It will be readily appreciated that a stock of such parts minimizes service interruptions caused by breakdowns and saves time and expense.

The following is a list of parts most subject to wear in ordinary operation, and to damage or breakage due to possible abnormal conditions. The recommended stock is given only as a guide. 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.

	Ref. Fig.	Part No.	No. per Brk.	Recomm. Stock 1 Brk.	5 Brks.
Bushing	1	1	6	1	3
Bushing Gasket	1	2	6	2	4
Lift Rod	1	8	3	1	2
Moving Contact Clusters or Tips	1 or 14		6	6	12
Oil Gauge Glass	1	11	1	0	1
Opening Dash Pot	3	14	3	0	1
201 Multibreak Interrupter	12 & 13	—	6	0	2
Fixed Contact Cluster	18	3, 5, 6, 7, 8	12	12	24
Transfer Contact Cluster	18	3, 5, 6, 7, 8	6	0	6
Upper Moving Contact Rod	13	13	6	6	12
Lower Contact Rod	13	21	6	6	12
Wood Contact Rod Support	13	20	6	3	6
Contact Tip	13	38	6	6	12
Contact Tip Adjustment Shims	13	35	24	6	12
Buffer	13	37	6	0	3
401 Multi-Break Interrupter-	10 & 15	—	6	0	2
Upper Contact	15	29	6	6	12
Intermediate Contact Lining	15	12 & 10	6	6	12
Lower Contact & Lining	15	39 & 37	6	6	12
Bridging Contacts	15	31	12	12	24
Flexible Leads	15	43	12	3	6
Operating Rod	10	1	6	1	3
Contact Disc	10	17	6	6	12

ORDERING INSTRUCTIONS

When ordering Renewal Parts, address the nearest Sales Office of the Canadian General Electric Company; specify the name of the part, giving the name shown on the illustration in this book, and the quantity of each part required. The complete nameplate data of the breaker, including the serial number, and if possible the number of the requisition on which the breaker was furnished must be supplied for complete identification of part ordered.

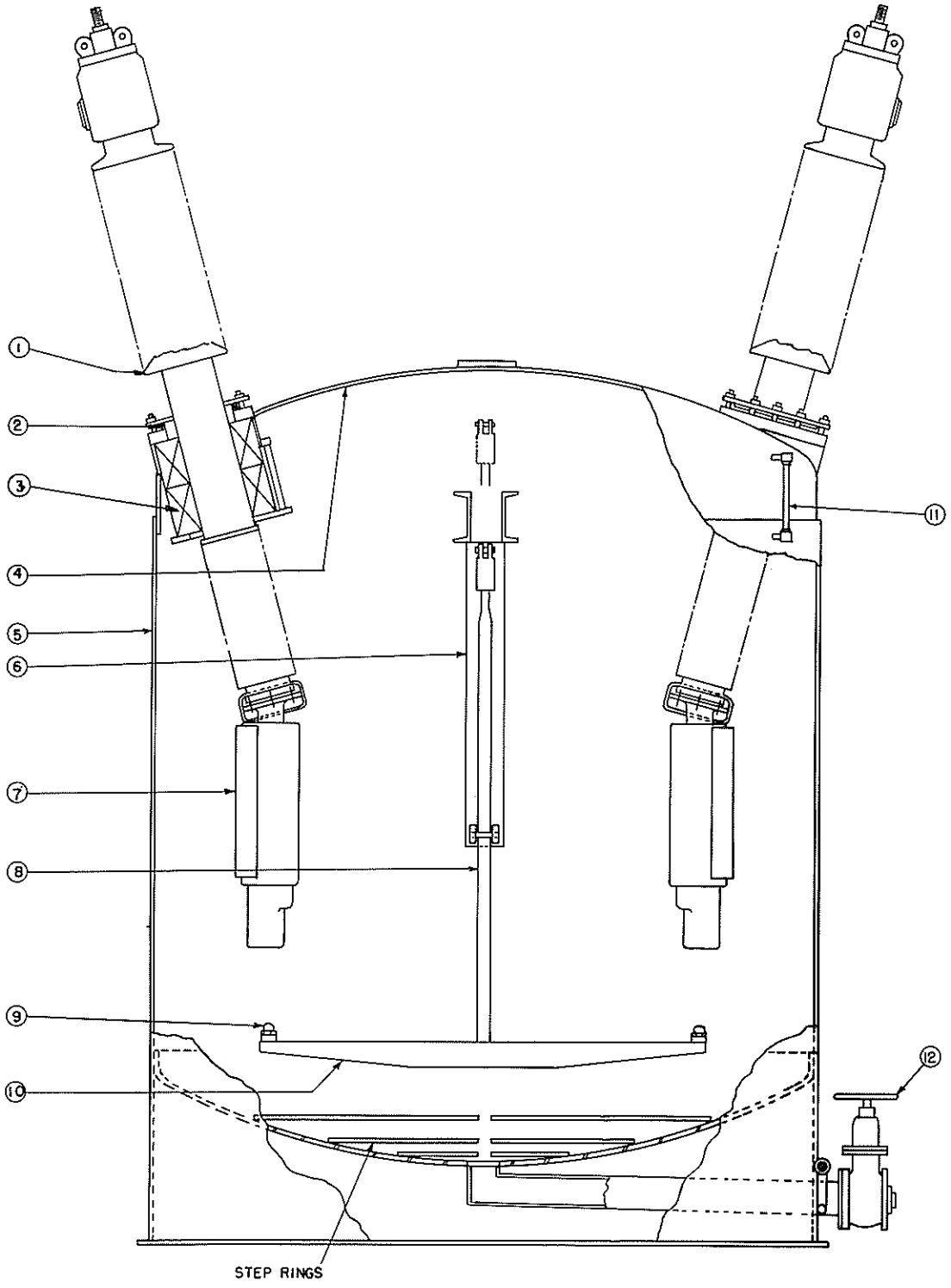


Fig. 1

TYPICAL SECTIONAL VIEW THROUGH CENTRE PHASE

1. BUSHING
2. BUSHING GASKET
3. BUSHING CURRENT TRANS.
4. TOP FRAME
5. OIL TANK
6. LIFT ROD GUIDES
7. MULTIBREAK INTERRUPTER
8. LIFT ROD
9. CONTACT
10. CONTACT BLADE
11. OIL GAUGE
12. DRAIN & SAMPLING VALVE

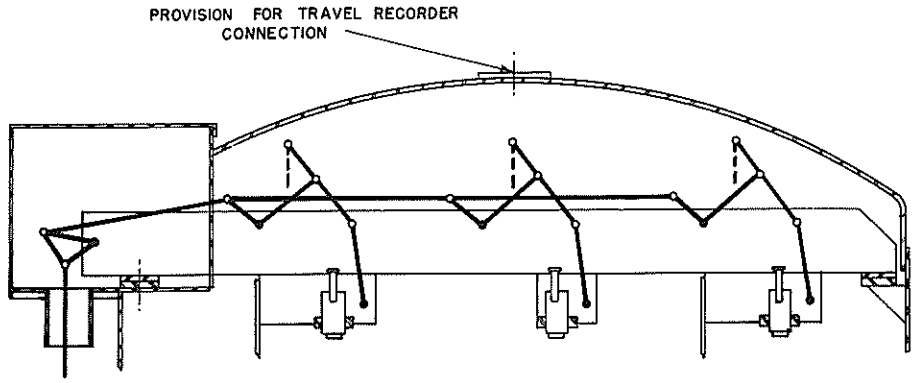
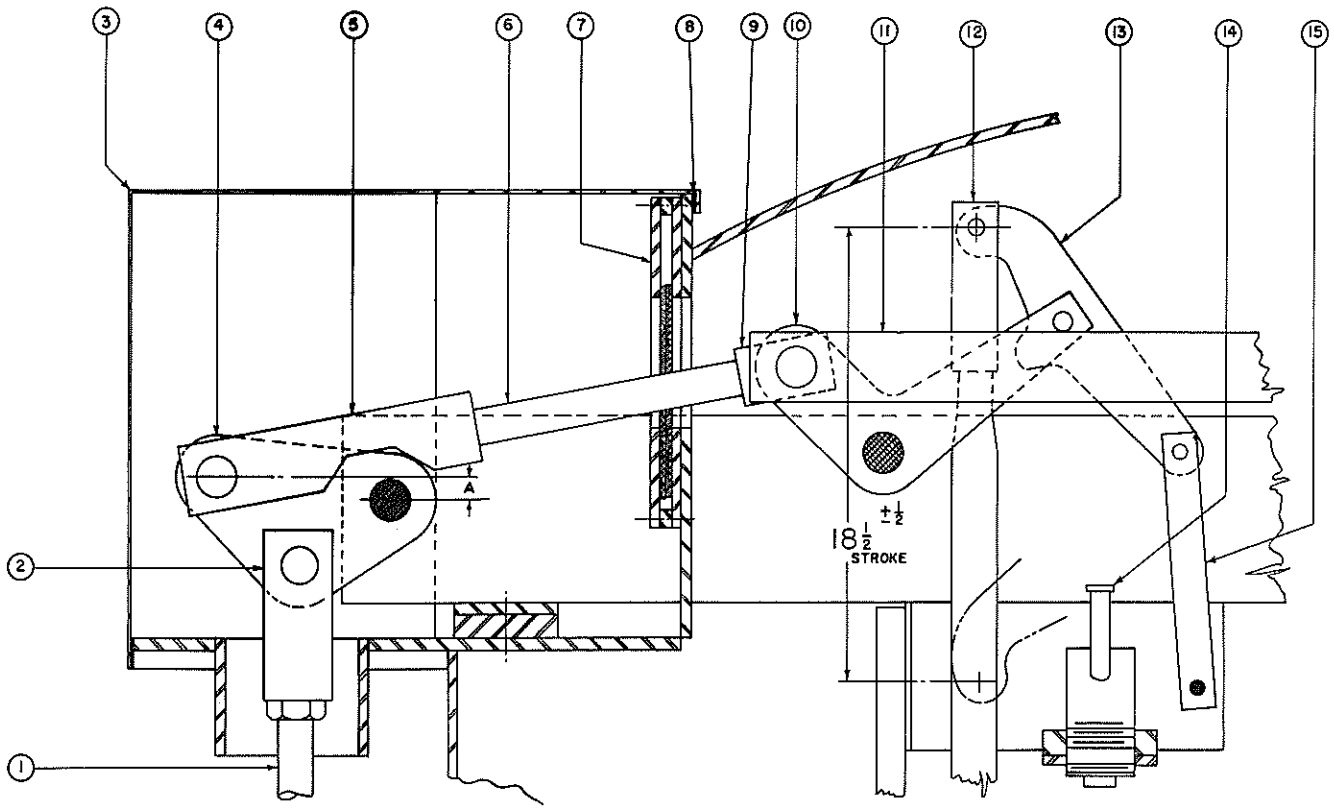


Fig. 2



"A" DIMENSION FOR 1500 MVA TO 3500/5000 MVA = 1 7/16" ± ¼
5000 MVA TO 10,000 MVA = 1" ± ⅛

Fig. 3

BREAKER MECHANISM

1. OPERATING ROD
2. COUPLING
3. FRONT CRANK COVER
4. CRANK
5. COUPLING
6. CONNECTING ROD
7. GAS SEAL
8. GASKET
9. COUPLING
10. BEAM
11. CONNECTING LINK
12. LIFT ROD
13. LEVER
14. DASH POT
15. ROCKER ARM

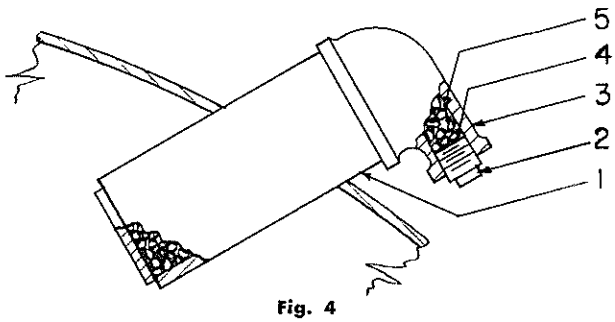


Fig. 4

SEPARATING VENT

1. PIPE
2. PIPE LUG
3. ELBOW
4. SCREEN
5. PEBBLES

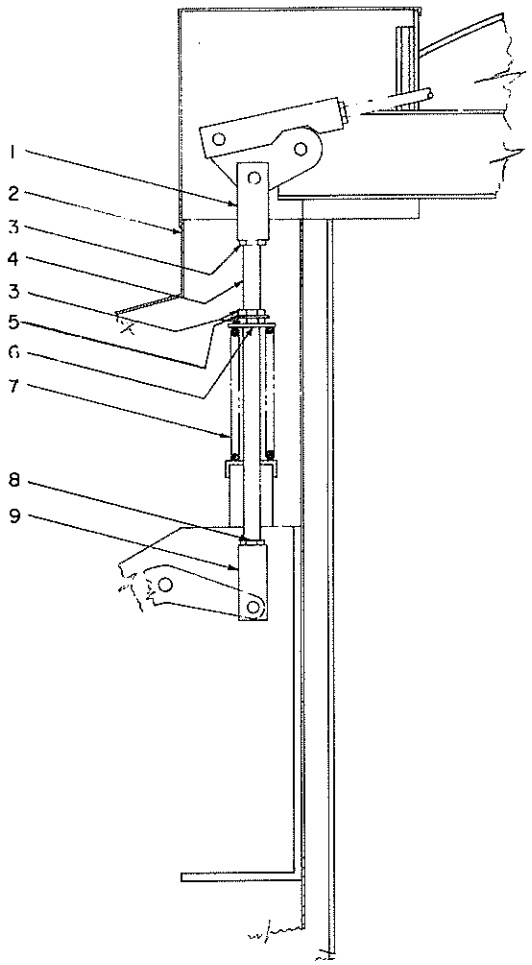


Fig. 5

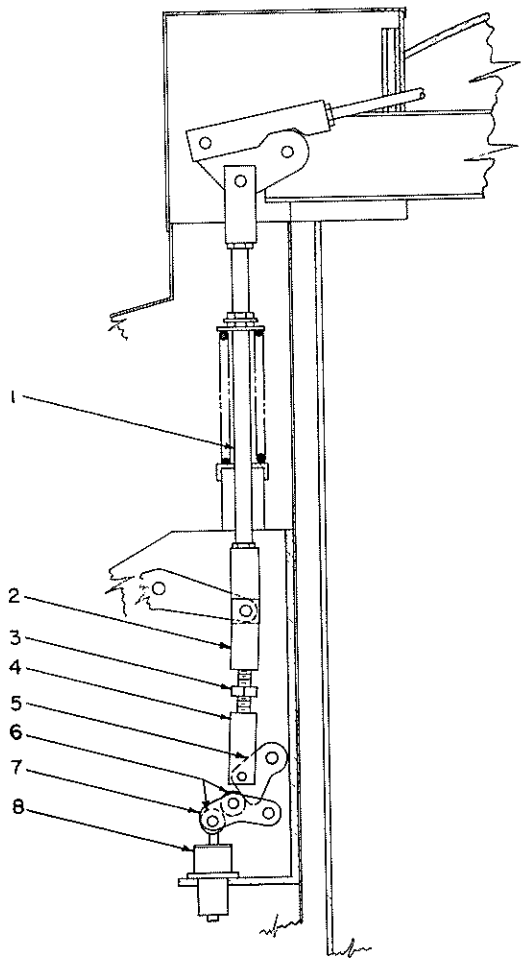


Fig. 6

OPENING SPRING ASSEMBLY

1. COUPLING
2. MECHANISM HOUSE
3. L.H. LOCKNUT
4. OPERATING ROD
5. LOCKING PLATE
6. WASHER
7. SPRING
8. R.H. LOCKNUT
9. COUPLING

OPENING SPRING ASSEMBLY & CLOSING DASH POT

1. OPENING SPRING ASS'Y, SEE FIG. 5
2. COUPLING
3. ADJUSTING SCREW
4. COUPLING
5. CAM
6. ROLLER
7. CRANK
8. DASH POT, SEE FIG. 7

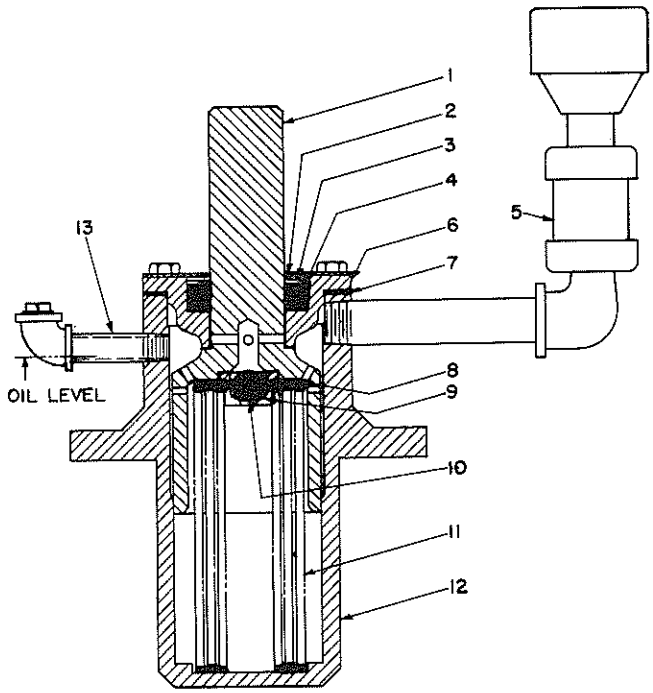


Fig. 7

CLOSING DASH POT ASSEMBLY

1. PISTON
2. COVER PLATE
3. WASHER
4. OIL SEAL
5. RESERVOIR
6. COVER
7. GASKET
8. WASHER
9. CUP
10. BALL
11. SPRINGS
12. CYLINDER
13. FILL PIPE

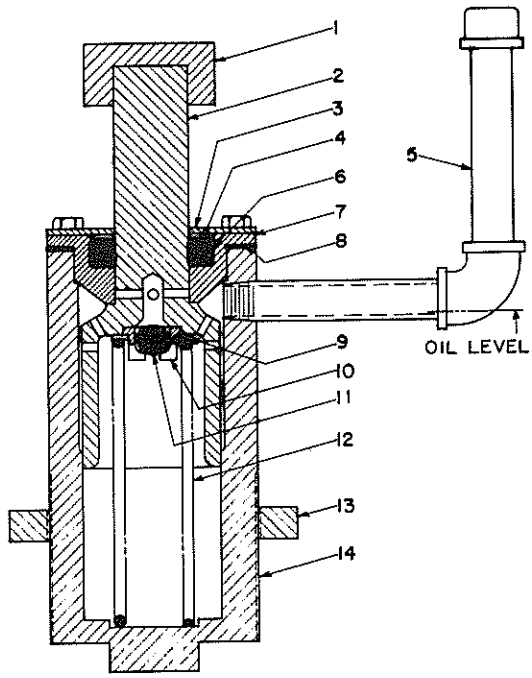


Fig. 8

OPENING DASH POT ASSEMBLY

1. CAP
2. PISTON
3. COVER
4. WASHERS
5. FILL PIPE
6. OIL SEAL
7. COVER
8. GASKET
9. WASHER
10. CUP
11. BALL
12. SPRING
13. LOCKING PLATE
14. CYLINDER

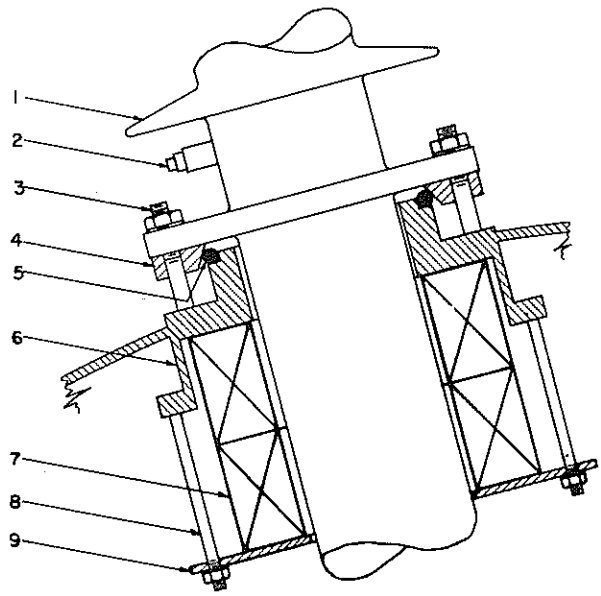


Fig. 9

DETAILS OF BUSHING MOUNTING

1. BUSHING
2. CAPACITANCE OUTLET
3. STUD
4. CLAMP RING
5. RING GASKET
6. BUSHING POCKET
7. BUSHING CURRENT TRANSFORMER
8. STUD
9. TRANSFORMER SUPPORT

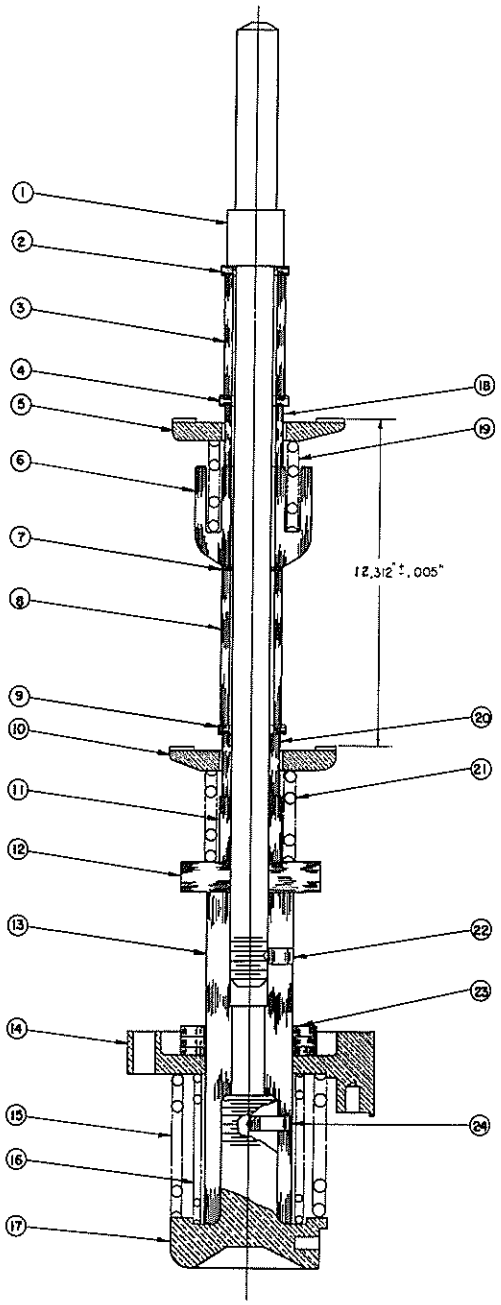


Fig. 10

MOVABLE CONTACT ASSEMBLY

1. OPERATING ROD
2. SPACER
3. TUBE
4. WASHER
5. BRIDGING CONTACT
6. SPRING RETAINER
7. SHIM
8. TUBE
9. WASHER
10. BRIDGING CONTACT
11. SPACER
12. DISC.
13. SLEEVE
14. PLATE
15. SPRING
16. SPRING
17. CONTACT DISC.
18. SPACER
19. SPRING
20. SPACER
21. SPRING
22. SET SCREW
23. BUFFER
24. SET SCREW

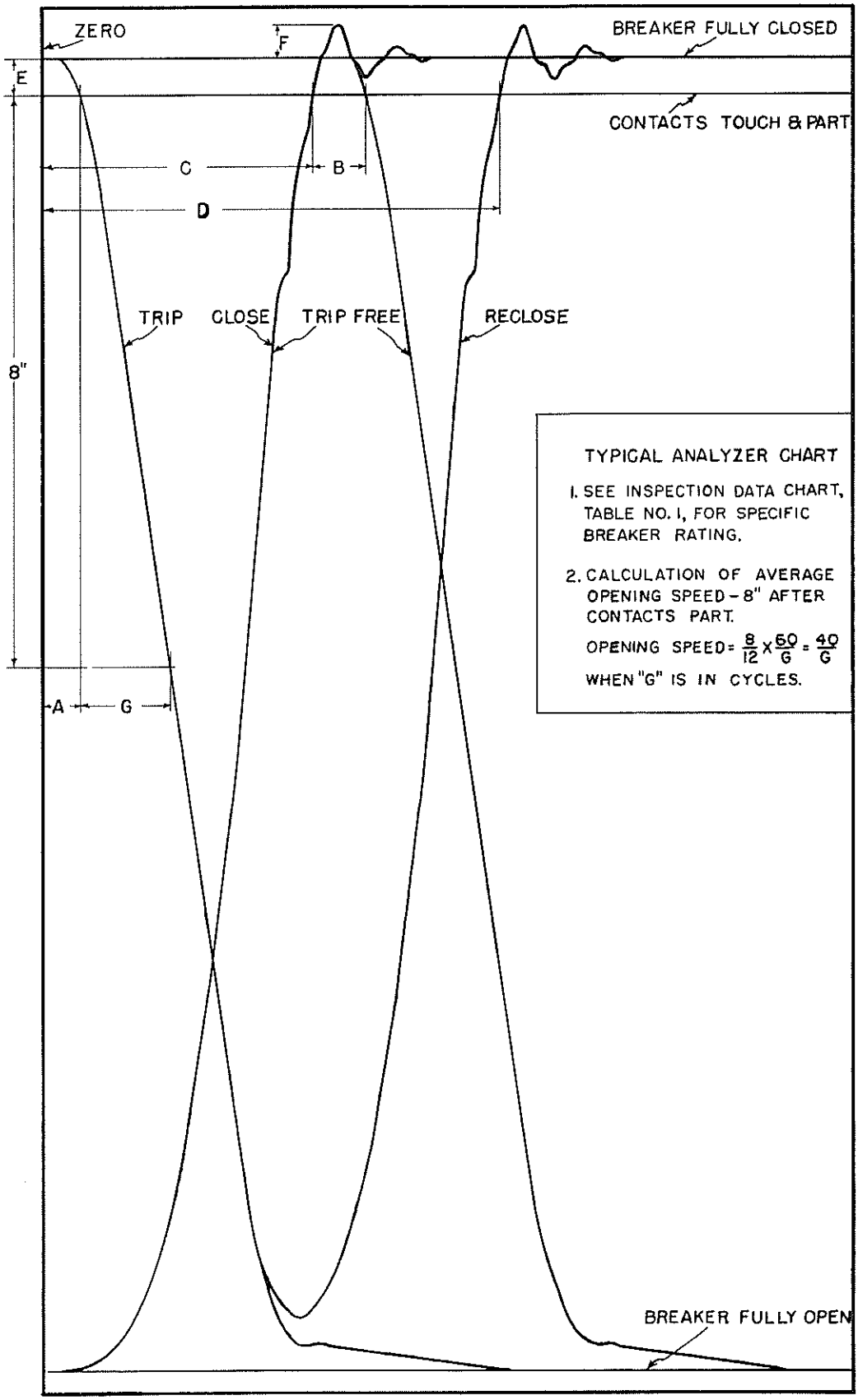

ZERO
F
BREAKER FULLY CLOSED
E
CONTACTS TOUCH & PART
C
B
D
TRIP
CLOSE
TRIP FREE
RECLOSE
8"
TYPICAL ANALYZER CHART
1. SEE INSPECTION DATA CHART, TABLE NO. 1, FOR SPECIFIC BREAKER RATING.
2. CALCULATION OF AVERAGE OPENING SPEED - 8" AFTER CONTACTS PART.
OPENING SPEED = 8/12 X 60/G = 40/G
WHEN "G" IS IN CYCLES.
A
G
BREAKER FULLY OPEN

Fig. 11

INSPECTION DATA CHART

BREAKER RATING			MECHANISM TYPE	"E" CONTACT WIPE (INCHES) +.00 TOL-.06	OPENING SPEED (FT./SEC)	DISTANCE FOR OPENING SPEED CALCULATION (INCHES)	"A" CONTACT PART-TIME (CYCLES) (MAX.)	"B" TRIP-FREE TIME (CYCLES) (MAX.)	"C" CLOSE TIME (CYCLES) (MAX.)	"D" RECLOSE TIME (CYCLES) (MAX.)	"F" OVER-TRAVEL (INCHES) (MAX.)
KV	MVA	CURRENT									
115	1500	800/1200	MAP-15	.375	7.0 - 9.0	8	2.5	3.5	20	20	.625
	2500										
	3500										
	5000	800/1200/1600		.437	7.5 - 9.5						.500
	5000		MAP-15A				1.5	2.5			
	7500			.500	10.5 - 11.5						
	10000										
138	1500	800/1200	MAP-15	.375	7.0 - 9.0	8	2.5	3.5	20	20	
	2500										
	3500										
	5000										
	7500	800/1200/1600	MAP-15A	.500	10.5 - 11.5		1.5	2.5			.500
	10000										
161	1500	1200	MAP-15	.375	7.0 - 9.0	8	2.5	3.5	20	20	.625
	2500										
	3500										
	5000										

TABLE NO. 1

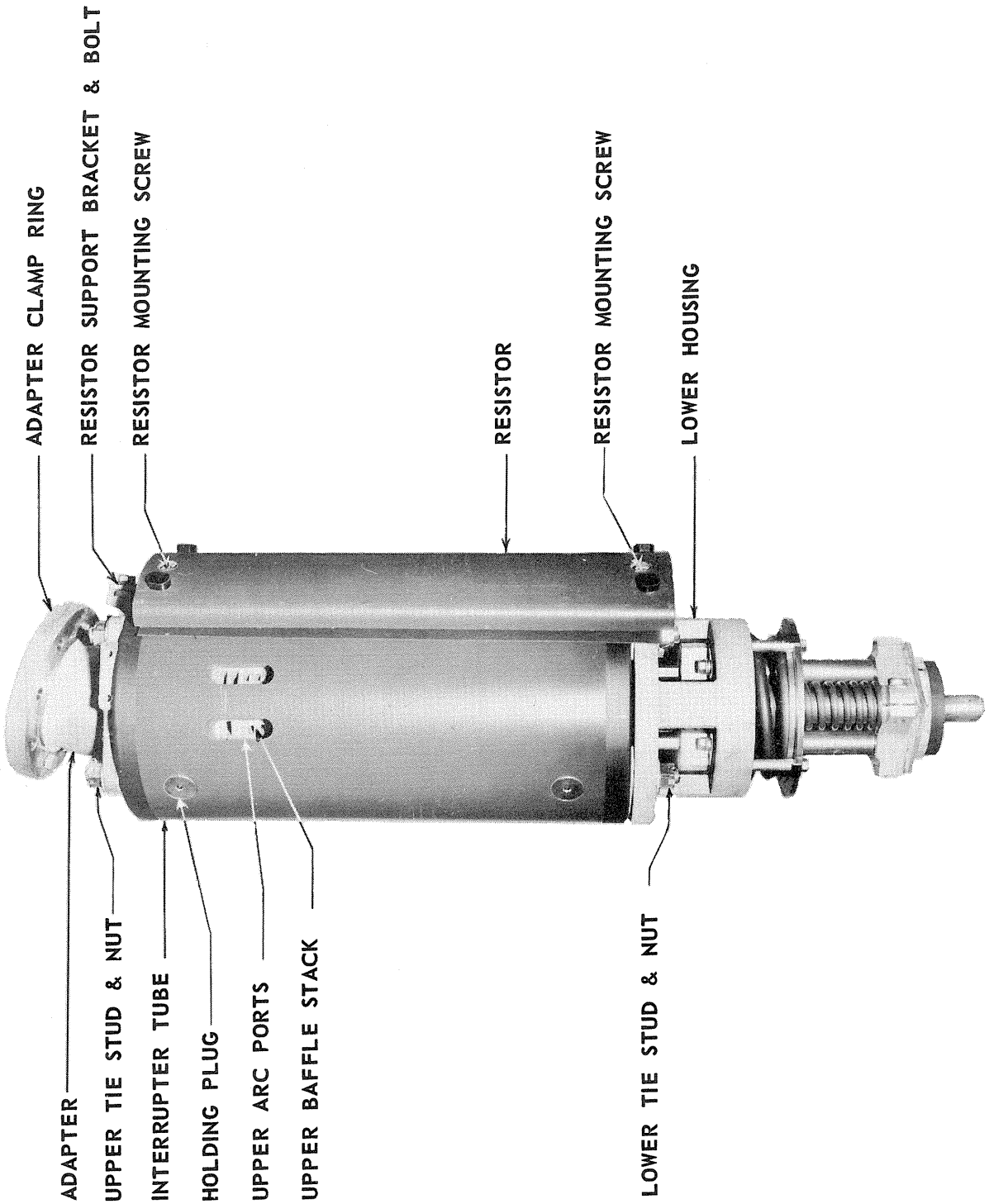


Fig. 12

201 INTERRUPTER LESS STATIC SHIELDS

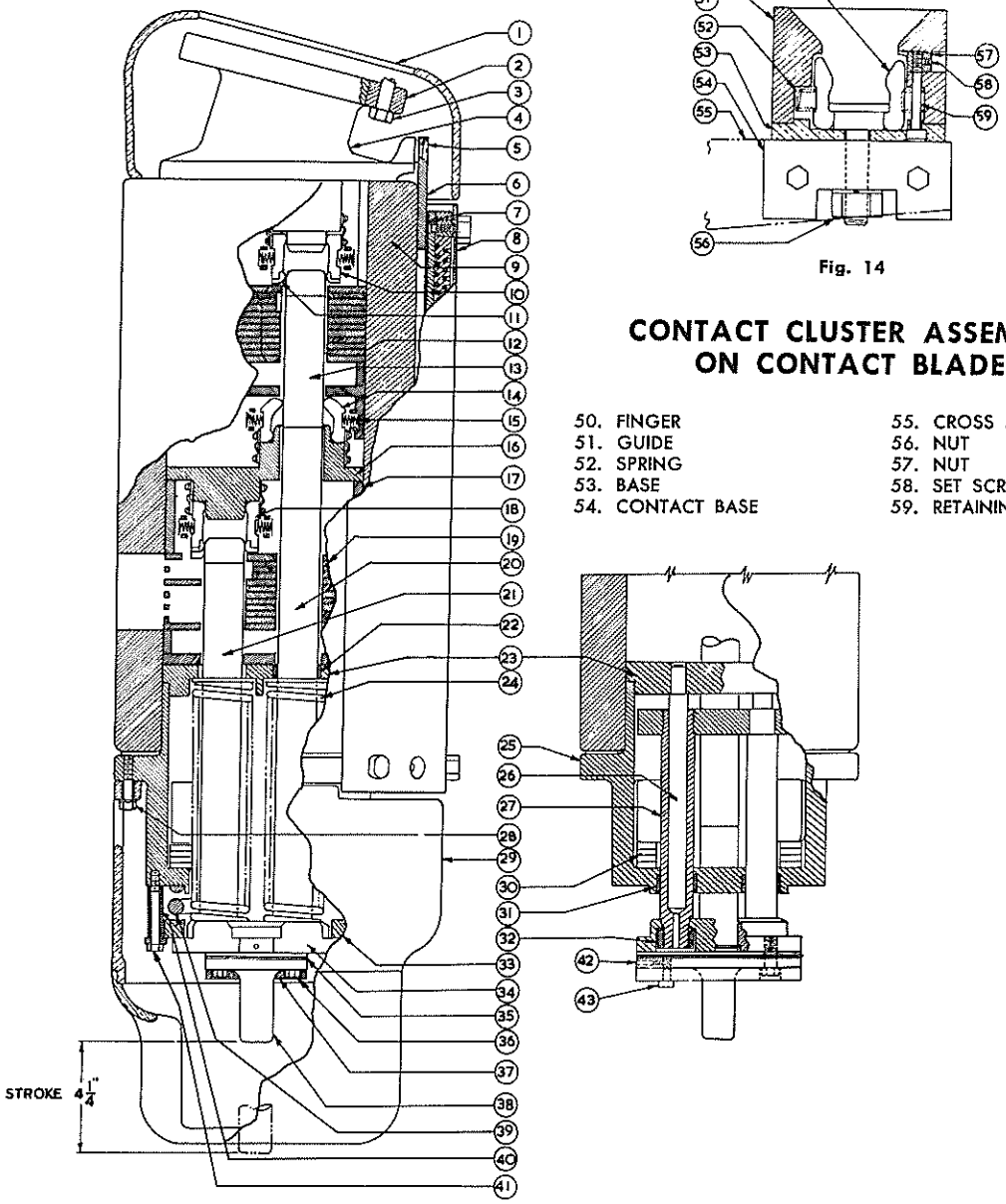


Fig. 13

201
MULTI BREAK INTERRUPTER

1. UPPER STATIC SHIELD
2. ADAPTER CLAMPING RING
3. ADAPTER RING BOLT
4. ADAPTER
5. SCREW
6. RESISTOR SUPPORT
7. INSULATION
8. RESISTOR
9. INTERRUPTER TUBE
10. UPPER CONTACT FINGER
11. UPPER CONTACT FINGER WITH ARCING TIP
12. UPPER BAFFLE STACK
13. UPPER CONTACT ROD
14. CURRENT TRANSFER FINGER
15. SPRING RETAINER
16. CONTACT FINGER SUPPORT
17. SPACER TUBE
18. LOWER CONTACT FINGER
19. LOWER BAFFLE STACK
20. WOOD ROD
21. LOWER CONTACT ROD
22. TEXTOLITE BUSHING
23. BOTTOM SUPPORT
24. INTERRUPTER SPRING
25. LOWER HOUSING
26. GUIDE ROD
27. GUIDE CYLINDER
28. MOUNTING BOLT
29. LOWER STATIC SHIELD
30. BUFFER
31. TEXTOLITE BUSHING
32. GUIDE CYLINDER NUT
33. BUFFER O/T SPRING RETAINER
34. CROSS HEAD
35. ADJUSTMENT SHIMS
36. CONTACT TIP BOLT
37. BUFFER
38. CONTACT TIP
39. BUFFER SPRING
40. SPACER
41. BOLT
42. SET SCREW
43. BUFFER BOLT

Fig. 14

CONTACT CLUSTER ASSEMBLY ON CONTACT BLADE

50. FINGER
51. GUIDE
52. SPRING
53. BASE
54. CONTACT BASE
55. CROSS ARM
56. NUT
57. NUT
58. SET SCREW
59. RETAINING BOLT

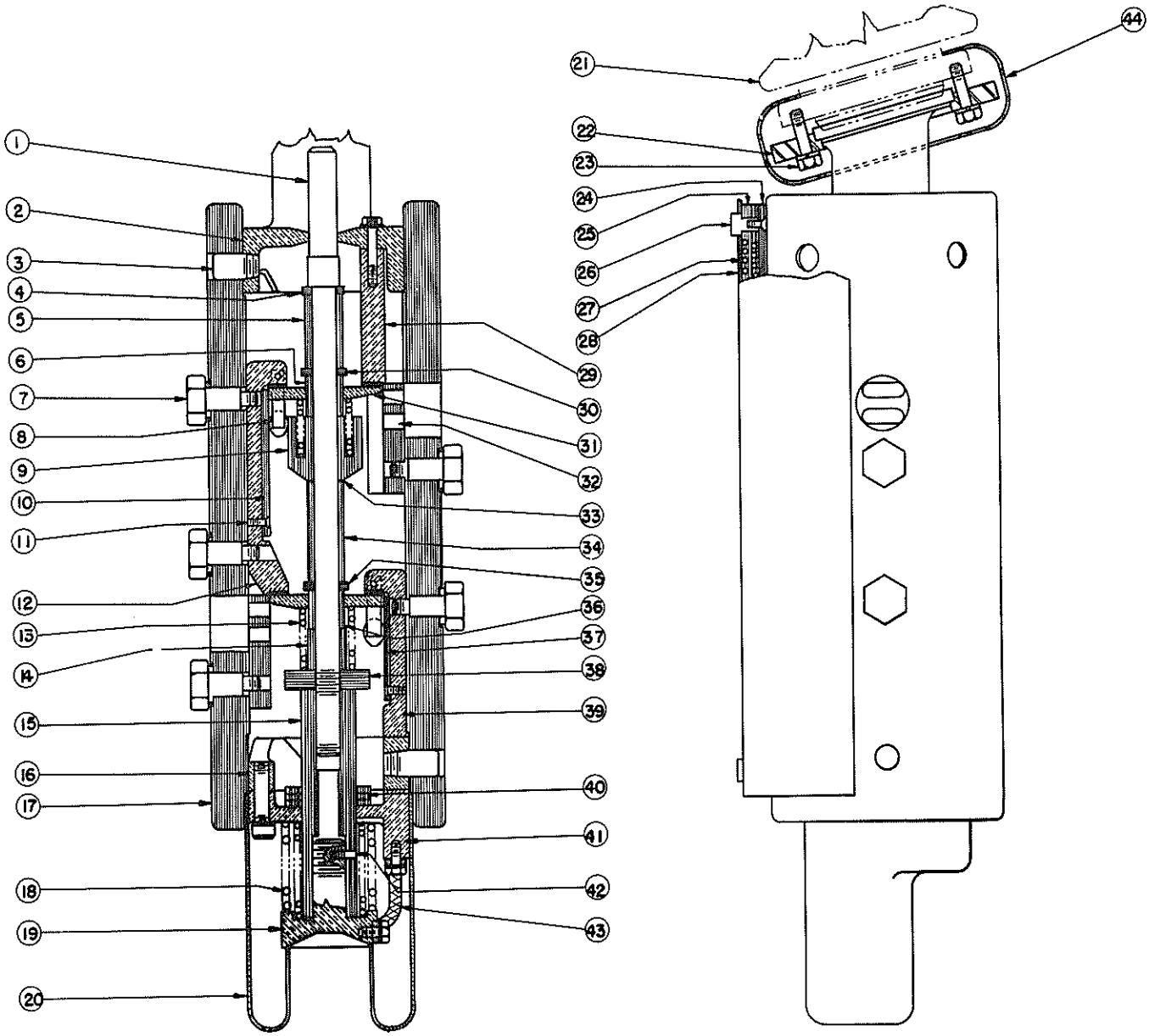


Fig. 15

401

MULTI BREAK INTERRUPTER

1. OPERATING ROD
2. ADAPTER
3. PIN
4. SPACER
5. TUBE
6. SPACER
7. INSULATED BOLT
8. ARCHING PLATE
9. SPRING RETAINER
10. INSULATION LINING
11. SCREW
12. INTERMEDIATE CONTACT
13. SPRING
14. SPACER
15. SLEEVE
16. RING
17. TUBE
18. SPRING
19. CONTACT DISC.
20. STATIC SHIELD
21. BUSHING
22. CLAMPING RING
23. CAP SCREW
24. BACK COVER
25. RESISTOR BOARD
26. INSULATING NUT
27. RESISTOR HELIX
28. FRONT COVER
29. UPPER CONTACT
30. WASHER
31. BRIDGING CONTACT
32. PORT BLOCK
33. SHIM
34. TUBE
35. WASHER
36. SPACER
37. INSULATING LINING
38. DISC
39. LOWER CONTACT
40. BUFFER
41. PLATE
42. SET SCREW
43. FLEXIBLE LEAD
44. STATIC SHIELD

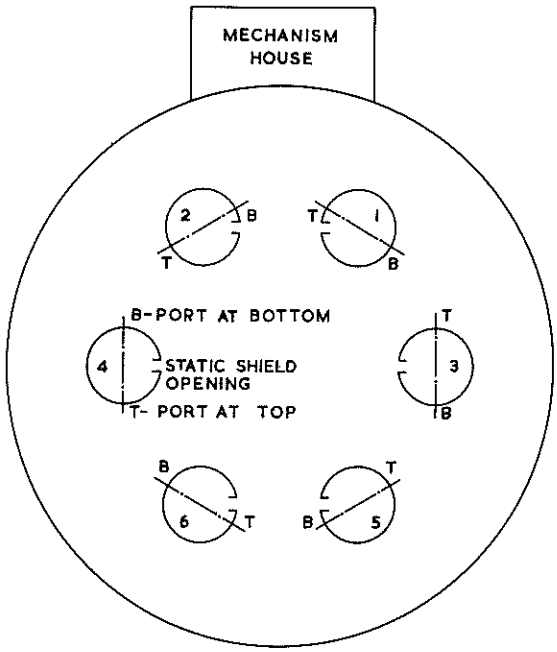


Fig. 16

MULTI BREAK INTERRUPTER LOCATION

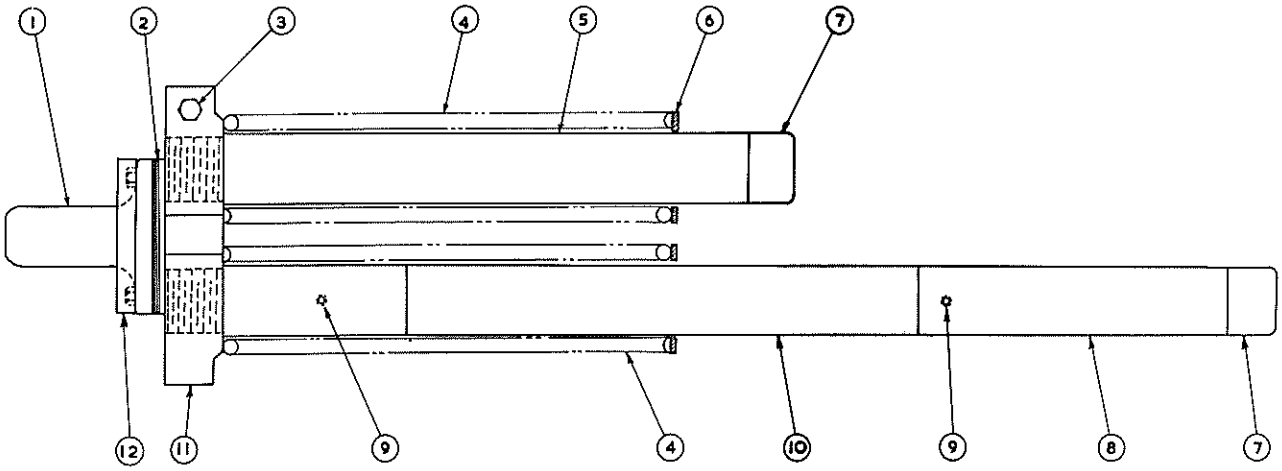
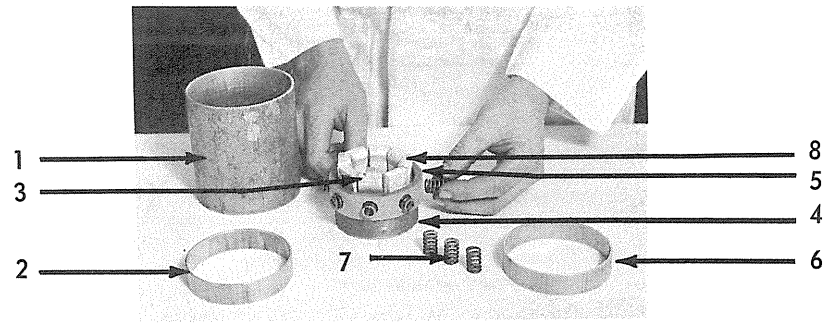


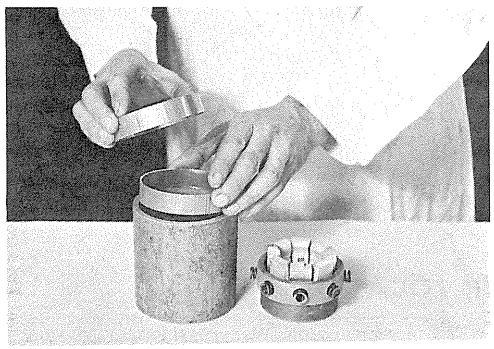
Fig. 17

MOVABLE CONTACT ASSEMBLY

1. CONTACT TIP
2. ADJUSTMENT SHIMS
3. CONTACT ROD ADJUSTMENT CLAMP NUT
4. INTERRUPTER SPRING
5. LOWER CONTACT ROD
6. WASHER
7. ELKONITE TIP
8. UPPER CONTACT ROD
9. SET SCREW
10. WOOD ROD
11. CROSS ARM
12. BUFFER



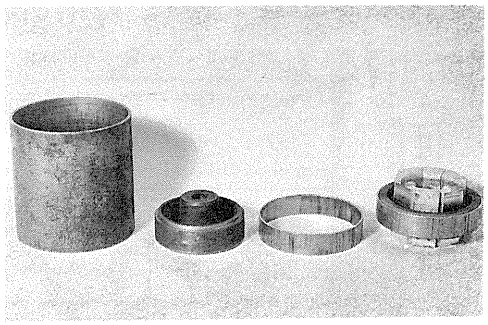
Step 1



Step 2

Step 3

Step 4



Step 5

Fig. 18

FIXED CONTACT CLUSTER ASSEMBLY SEQUENCE USING ASSEMBLY TOOL

1. TAPERED CYLINDER
2. RETAINING RING
3. ARCING CONTACT FINGER
4. CONTACT ALIGNMENT BLOCK
5. SPRING GUIDE
6. RETAINING RING
7. CONTACT SPRINGS
8. MAIN CONTACT FINGERS

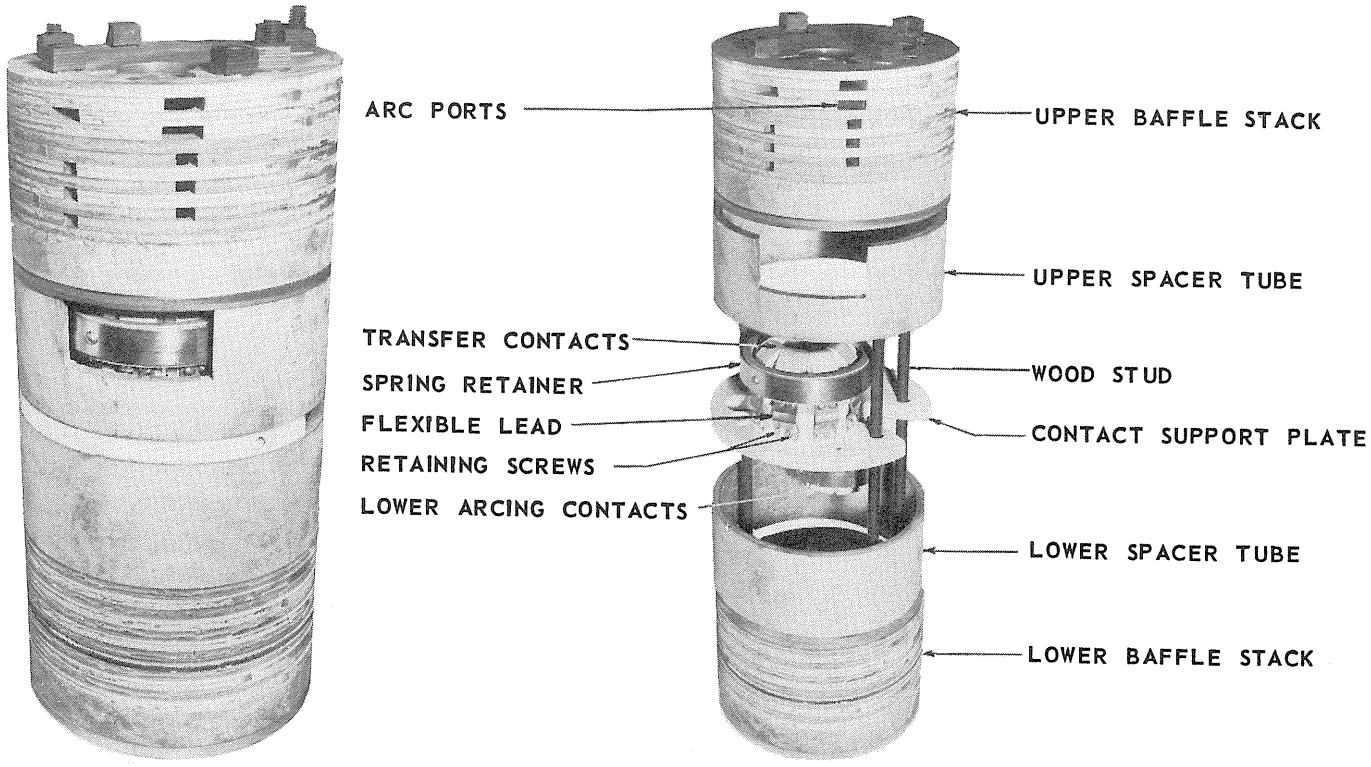


Fig. 19

BAFFLE STACK AND CONTACT ASSEMBLY

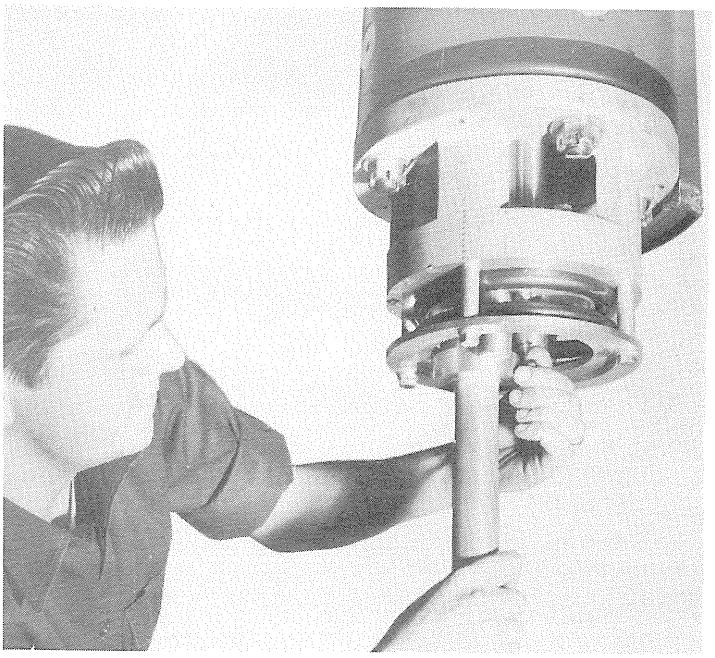


Fig. 20 INSERTING WIPE CHECKING GAUGE IN END OF INTERRUPTER IN PLACE OF CONTACT ROD.

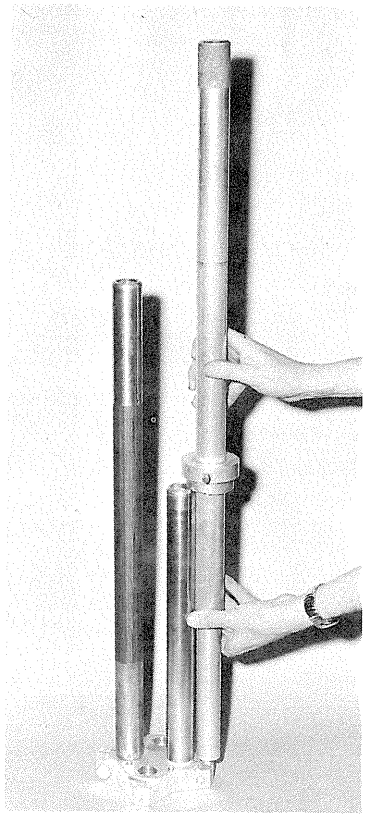


Fig. 21 CHECKING GAUGE IN PLACE ON CONTACT ROD ASSEMBLY

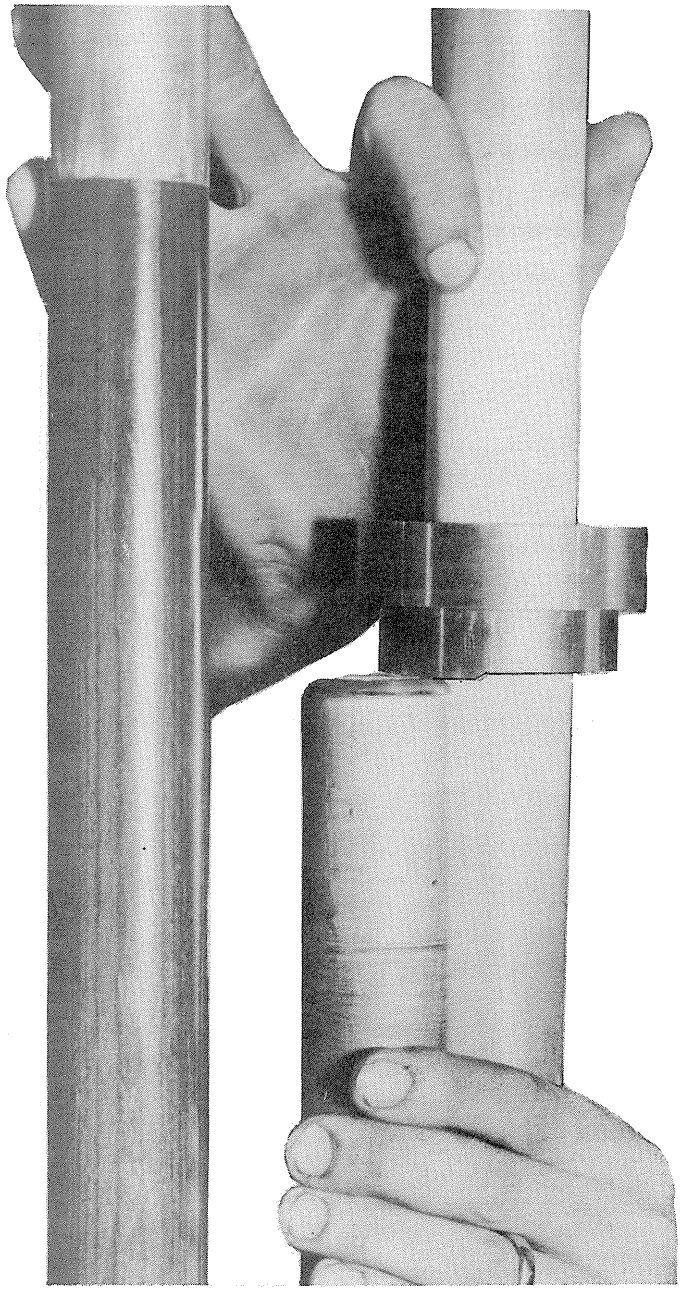


Fig. 22 STEPPED SLIDER BEING USED TO CHECK MAXIMUM AND MINIMUM ROD LENGTH

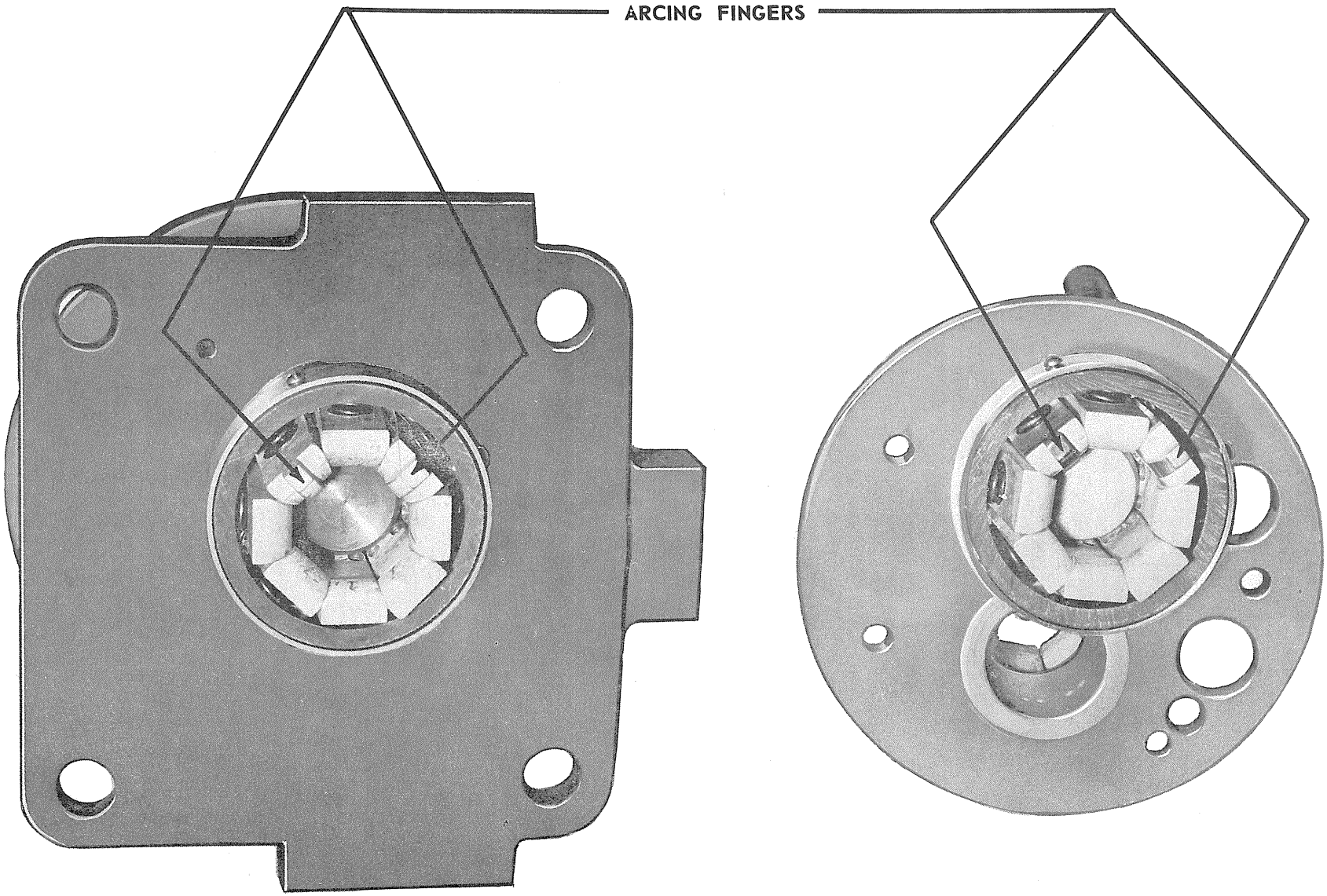


Fig. 23

LOCATION OF ARCING FINGERS

INDUSTRIAL APPARATUS
DEPARTMENT
PETERBOROUGH — ONTARIO

CANADIAN GENERAL ELECTRIC

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