Westinghouse

TYPE U "DE-ION" AIR CIRCUIT-BREAKER

600 and 1200 Amperes, 2500-7500 Volts, 60 Cycles

INSTRUCTION BOOK

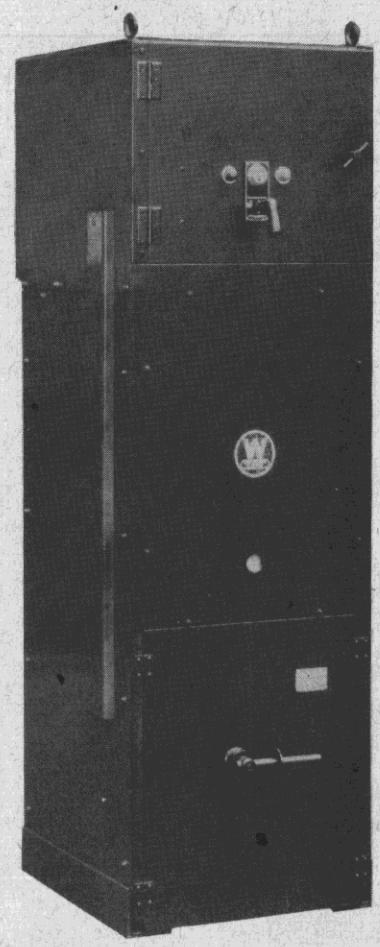

Fig. 1 - Type "U" De-Ion Air Circuit-Breaker, Three Poles 600 and 1200 Amperes, 2500 to 7500 Volts

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

Reprinted in U.S.A. (4-38)

I. B.-5709-2

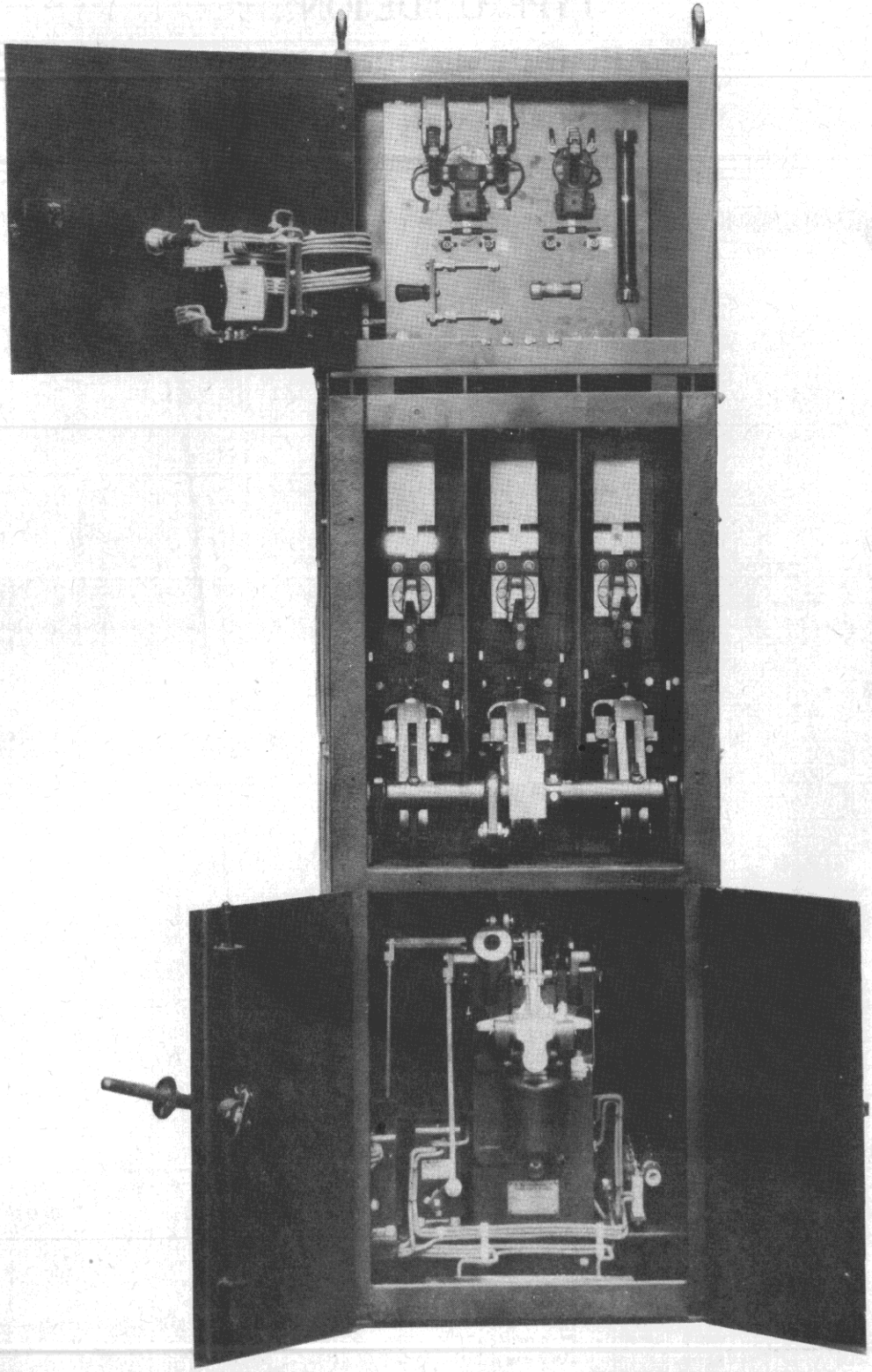

Fig. 2 - Breaker with De-Ionizing Chamber Removed

Westinghouse

TYPE U "DE-ION"
AIR CIRCUIT-BREAKER

600 and 1200 Amperes, 2500-7500 Volts, 60 Cycles

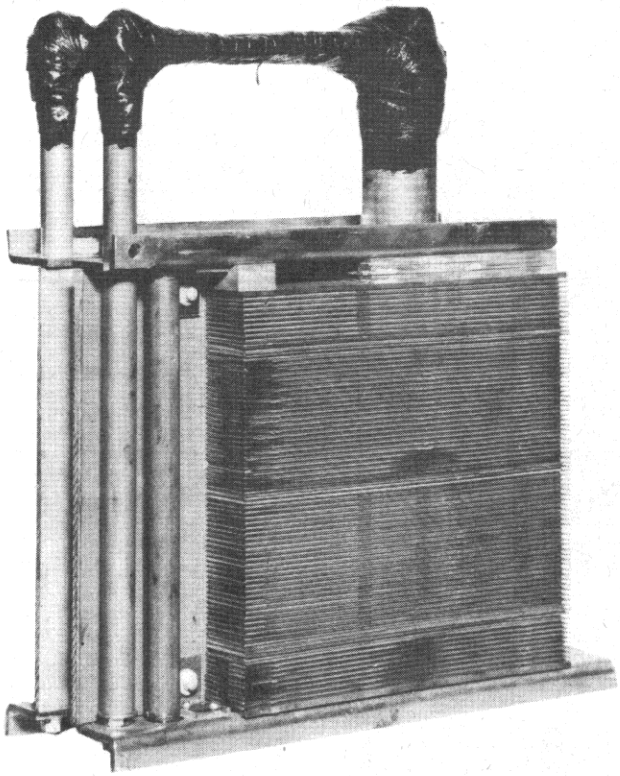

Fig. 3 - De-Ionizing Chamber

APPLICATION

The "De-ion" Air Circuit-Breakers described below are designed for operating voltages of from 2500 to 7500 volts and for continuous current ratings of 600 and 1200 amperes at 60 cycles. These breakers are 3-pole units, electrically operated and they may be completely enclosed in a sheet steel housing which may be grounded.

DESCRIPTION AND OPERATION

The complete breaker unit with solenoid operating mechanism is shown in Fig. 1. The circuit-breaker frame, of welded structural steel, also forms the housing frame. The housing is divided into two parts which are separated by a steel barrier, The type SA-3 solenoid mechanism, control panel and auxiliary switches being mounted in the lower compartment and the circuit-breaker proper being mounted in the upper compartment. Access to the mechanism compartment for hand closing, etc. is by means of swinging doors which may be padlocked. The sides, top and upper half of the front are bolted on and are removable for access to all parts of the breaker. The top of the breaker housing is of 1/2-inch thick Micarta plate.

Fig. 2 shows a breaker unit with the sides removed from the frame showing the frame, pole units and operating members. The pole units are separated by insulating barriers, barriers are also provided for insulating between live parts and the interior of the housing. Each pole contains a de-ionizing chamber or arc chute mounted above the contacts. The movable contacts, with arc-resisting tips, are bolted to copper levers which are actuated by wood base Micarta toggle members which in turn are operated by levers on a main operating shaft running completely across the breaker, this shaft being operated by a pull rod from the solenoid mechanism. The copper levers are slotted at the bottom and provided with compression springs so as to cause initial contact to be made at the arc-resisting tips and final contact to be made at the bottom or "heel" of the contact blocks. In this manner severe arcing is confined to the tips and the bottom of the contact remains suitable for carrying continuous load currents. These springs, together with gravity, also provide acceleration for the opening of the contacts.

The movable contact arm and lower casting are supported by a porcelain bushing passing through the frame. The stationary contact and de-ionizing chambers are supported by post type porcelain insulators.

DE-IONIZING CHAMBER

The de-ionizing chamber, in which the circuit is interrupted, consists essentially of a

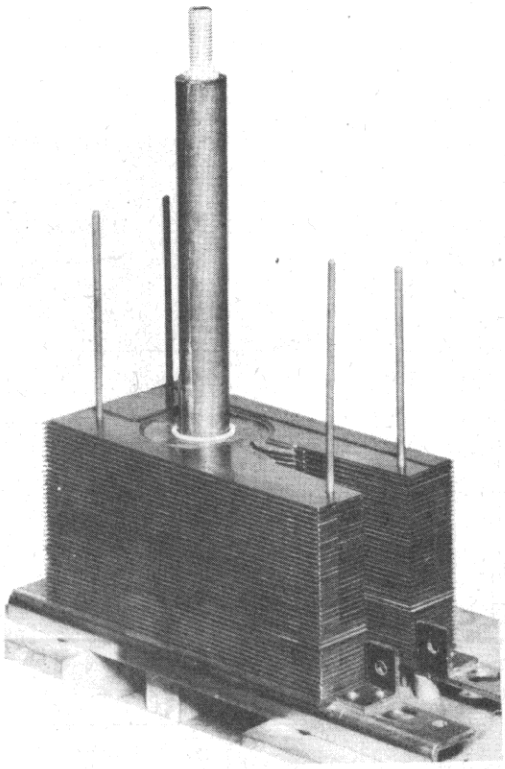

Fig. 4 - De-Ionizing Chamber Showing Spacers

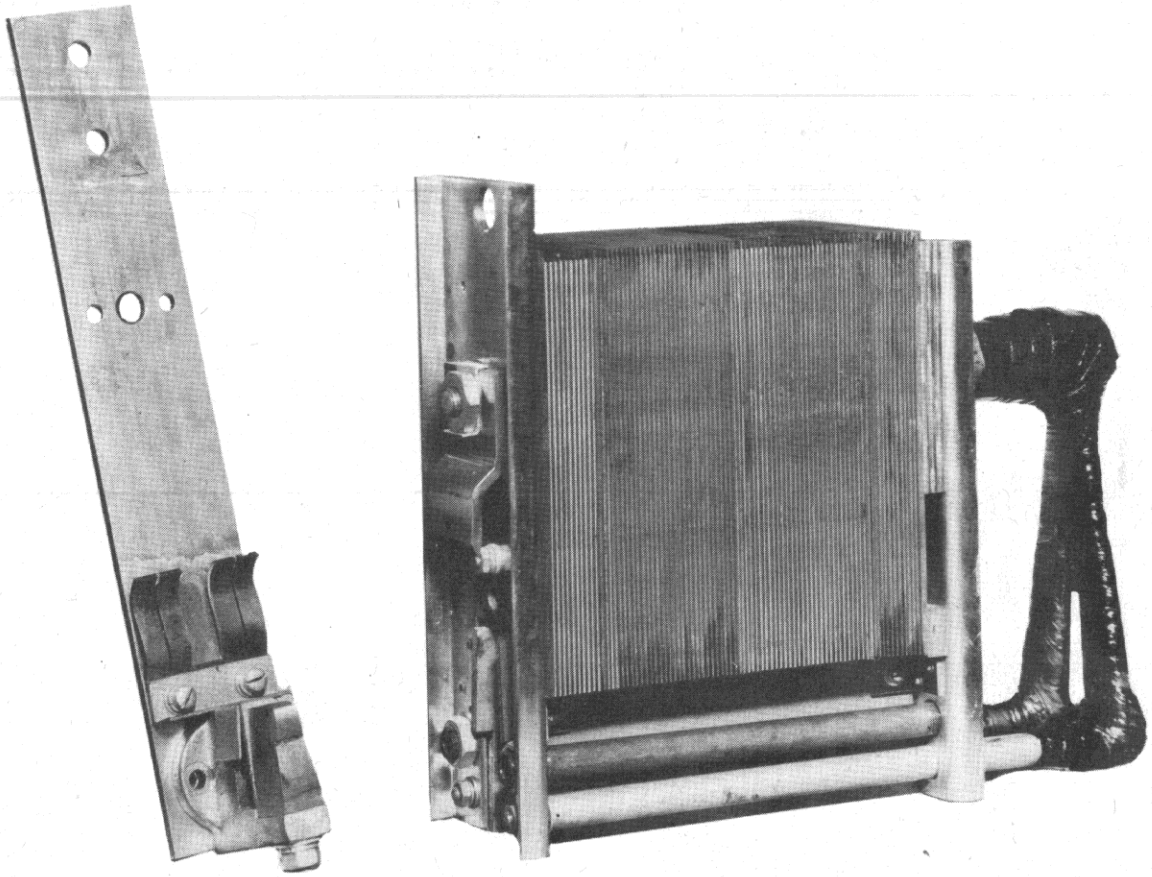

Fig. 5 - De-Ionizing Chamber and Rear Terminal

series of pairs of copper and steel plates, the pairs of plates being insulated from each other so as to form a series of gaps. A complete chamber is shown in Fig. 3. Each copper plate has a tapered slot at the lower end so that the stack of plates form a tapered throat, into which the arc is moved, as shown in Fig. 4. As the arc attaches itself to the plates it is broken into a series of short arcs, one in each gap between plates. As shown in Fig. 5, the insulating spacers between plates are shaped so as to form a circular raceway for each short arc. Three flat spiral coils, spaced at intervals through the stack, supply a magnetic field essentially radial to this raceway when energized by the line current, which drives the short arcs about the raceways at such speed that the copper plates are not damaged, until a zero point occurs in the current wave, when the current is interrupted. An arc box, consisting of fibre plates with arc-resisting inserts, extends from the contacts to the copper plates. These are shown fastened in the de-ionizing chamber in Fig. 4. The fibre has the characteristic of remaining clean under the action of the arc which leaves the insulation unimpaired. A single-turn coil, represented in Fig. 3 by the single upper insulated stud and the two lower insulated studs connected at the front by taped copper straps, supplies the magnetic field for moving the arc from the contacts to the de-ionizing plates. One end of this coil is connected solidly to the line by the wedge and bronze spring contacts shown in Fig. 6. The other end of this coil terminates in an arc horn immediately above the stationary contact but insulated from it. In operation, as the arc impinges on the arc horn the one-turn coil is introduced into the circuit. The de-ionizing chamber may be removed as a unit for inspection or maintenance of contacts, arc box, etc.

HANDLING AND INSTALLATION

The frame of the breaker is provided with four eye nuts at the top by which it may be lifted. The breaker is a self-contained unit and, with covers and doors, requires no cell or cubicle. It merely needs to be placed in position and bolted to the floor. Line connections may be made in the ordinary manner with the usual precautions to prevent contact with live leads. Fig. 10 shows the outline dimensions of the breaker unit.

To guard against damage in shipment, the de-ionizing chambers are shipped separately from the breaker. To install the chambers, first remove the 5/8-inch bolt with insulating bushing from the top insulator of the pole unit. In setting the chamber in position, insert the wedge contact behind the bronze spring contact and press down until the top hole in the end plate lines up with the hole in the insulator. The 5/8-inch bolt, with insulating bushing, may then be inserted and tightened. Be sure to install the copper connector from the front stack end plate to the lower casting. Serious damage may result if this is omitted. In assembling the de-ionizing chambers on the breaker it may be desirable to remove the top and barriers. To do this, unscrew the four eye nuts and the top can be lifted off. Remove the small bolts holding the barriers at the front and they may then be lifted out of the top of the breaker.

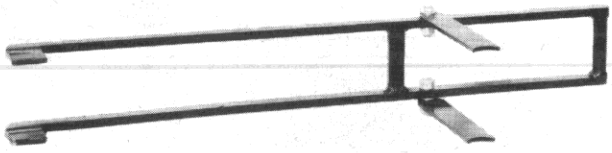

Fig. 6 - Lifter for De-Ionizing Chamber

REMOVAL AND INSTALLATION OF DE-IONIZING CHAMBER

Figure 6 shows a lifter which is provided for use in removing or installing the de-ionizing chamber. To remove the chamber, first fold the two short legs parallel to the rails of the lifter and insert it so that the two end lugs rest on the rear angle of the breaker frame, as shown in Fig. 7. Remove the top chamber supporting bolt disconnect the two front connecting straps from the chamber. As shown in Fig. 8, raise the front of the lifter so as to break the wedge and spring contact, shown in Figure 5. Pull the stack forward slightly and lower the lifter legs to rest on the breaker shaft. Referring to Fig. 9, slide the chamber straight forward on the two rails of the lifter and remove it from the breaker.

To install the chamber, place the lifter in position with the legs on the shaft. Place the stack on the rails and push to the rear. Raise the front of the lifter so as to permit the wedge contact to enter the spring contact and work the chamber down to final position. Install the upper supporting bolt and the two side connectors and the chamber is ready for service.

INSPECTION AND MAINTENANCE

Although "De-ion" circuit-breakers will operate for long periods of time with little maintenance, they should be given periodic inspections comparable to other switching apparatus of similar rating. In general the frequency of these inspections should be determined by the severity of the duty to which the breaker is subjected.

CAUTION

Parts of the circuit-breaker itself are at line potential and therefore the breaker should be isolated from the circuit by disconnecting switches before being handled, in line with standard practice for conventional circuit-breakers. It is to be understood that, in the case of a totally enclosed breaker as shown in Fig. 1, the housing may be grounded but in no instance should breaker compartment sides or top be removed before opening disconnecting switches.

HEATER

A heater is provided for the protection of insulation of the breaker against atmospheric moisture. It is important that the heater should be used at all times when conditions are favorable to the condensation of moisture and under conditions of excessive humidity. The breaker should be kept dry under the most extreme conditions of atmospheric moisture or humidity.

INSULATION

All insulating parts should be kept clean and free from any accumulation of dirt or dust.

ARC BOX

The arc box may be given a rough inspection by viewing from below with a flash light or other suitable light. If there are indications of severe burning or excessive deposits of carbon, etc., the arc box may be cleaned with a file and sandpaper. To do this conveniently the de-ionizing chamber may be removed as a unit.

DE-IONIZING CHAMBER

1. Insulation of Gaps. Each gap between pairs of copper and steel plates may be "lighted" or "rung" out with a light or bell ringer at not more than 250 volts per gap. Each gap should be open but in case of extremely severe duty, some may become short-circuited by particles being blown from the arc box or contacts. Loose particles may be removed by blowing out the chamber thoroughly with dry compressed air. If this does not remove the particles, pass 100 to 200 amperes at not more than 125 volts a-c. through the shorted gaps. This may be applied by thin copper straps inserted between the copper plates on each side of the shorted gaps. This should burn the gaps clean instantly but any short-circuits not removed by this treatment can be left until such time as the stack is disassembled. In an emergency a chamber may be used with as many as 15 per cent of the gaps short-circuited but it is recommended that any chambers having shorted gaps which do not clean up with the above treatment be disassembled and any damaged parts be replaced.

CONTACTS

See that the bolts holding the contacts in place are tight. Under normal conditions the contacts should be good for a large number of operations at the rated rupturing capacity of the breaker. A moderate amount of burning on the main contact surfaces will not impair their current carrying ability on account of the high contact pressure used. However, if the contacts show signs of excessive burning, they should be checked as follows:

With the hand closing lever move the contacts toward the closed position until they just touch. In this position the clearance between the lower or main contact surfaces should be approximately 1/8 inch. In the latched or completely closed position of the breaker the clearance between the arc tips should be approximately 1/8 inch.

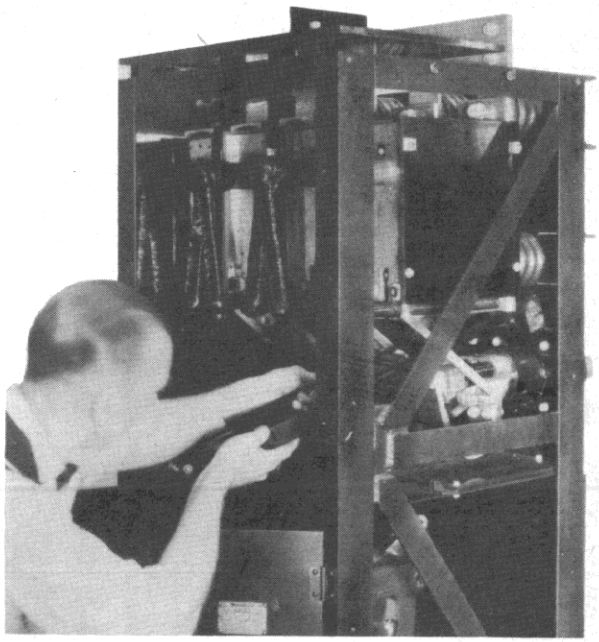

Fig. 7 - Placing Lifter for De-Ionizing Chamber, In Position

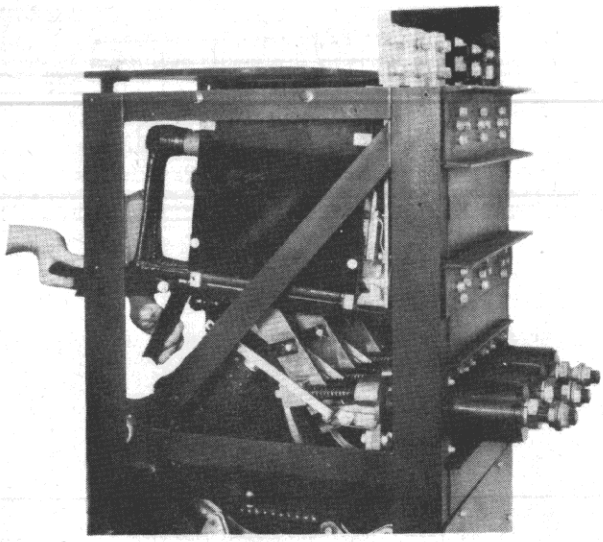

Fig. 8 - Disconnecting De-Ionizing Chamber Contacts

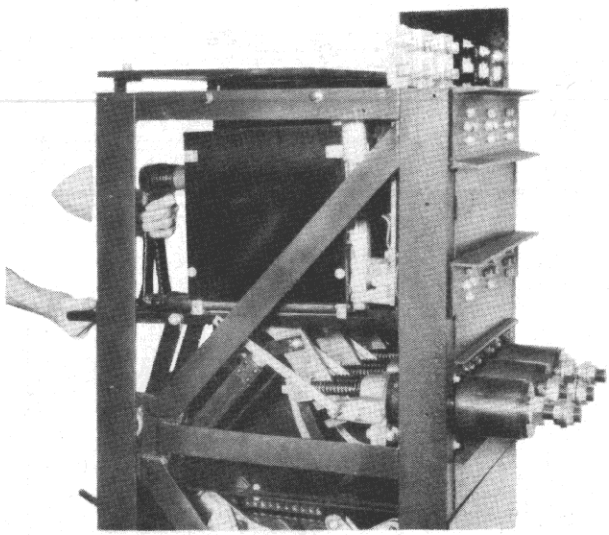

Fig. 9 - Removing De-Ionizing Chamber from Breaker

OPERATING PARTS

Inspect the breaker structure in general and see that all bolts, nuts, set screws, etc., are tight; that all spring cotters, etc., are in place. Note evidence of excessive wear or other improper operation of the various parts.

In the fully closed position of the breaker, the clearance between the toggle stop levers and set screw stops at each end of the main shaft should be approximately 1/16 inch.

In operating the breaker by hand there should be no binding or excessive friction. In opening the breaker slowly by hand the bumper levers at each end of the main shaft should come to rest securely against the bumpers. In the fully open position of the breaker the electric mechanism stop on the mechanism main lever should have a clearance of approximately 5/16 inch.

AUXILIARY SWITCH

To prevent excessive shock on electrical closing, the closing coil is energized in two steps. The initial step is of low power and is energized by the control relay in the ordinary manner. When the breaker is almost closed, the auxiliary switch operated by the solenoid core closes the circuit through an additional section of the coil which increases its power to completely close the breaker. A wide switch segment, closing when the breaker closes, is used for this purpose.

Check to see that the second-step contact on the auxiliary switch begins to make contact when the breaker contacts are approximately 1-1/4 inches apart.

ELECTRIC CLOSING MECHANISM

The closing mechanism is the solenoid type SA-3 and instructions for it are given in W.E. & M. Co. Instruction Book No. 5567.

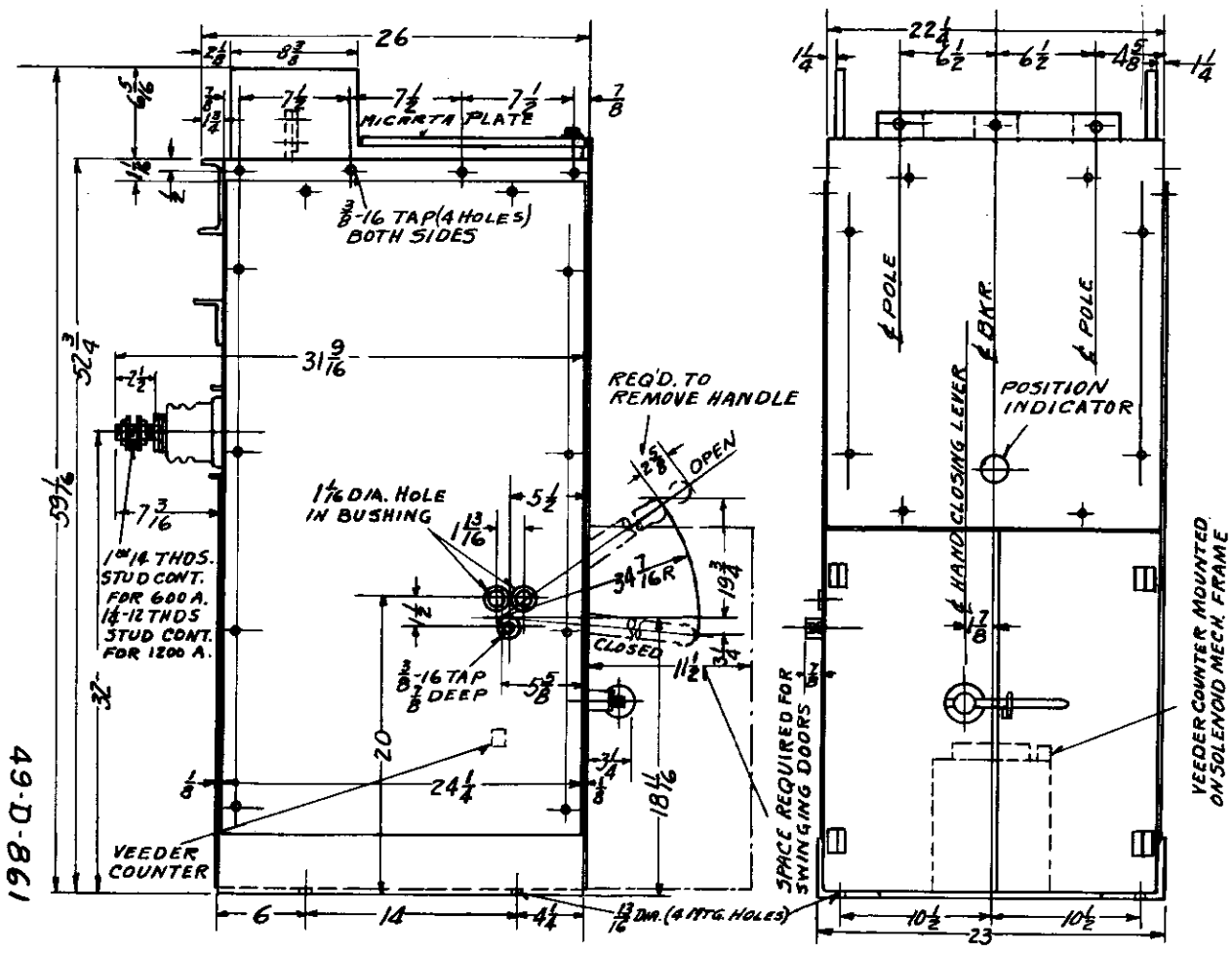

Fig. 10 - Outline Drawing