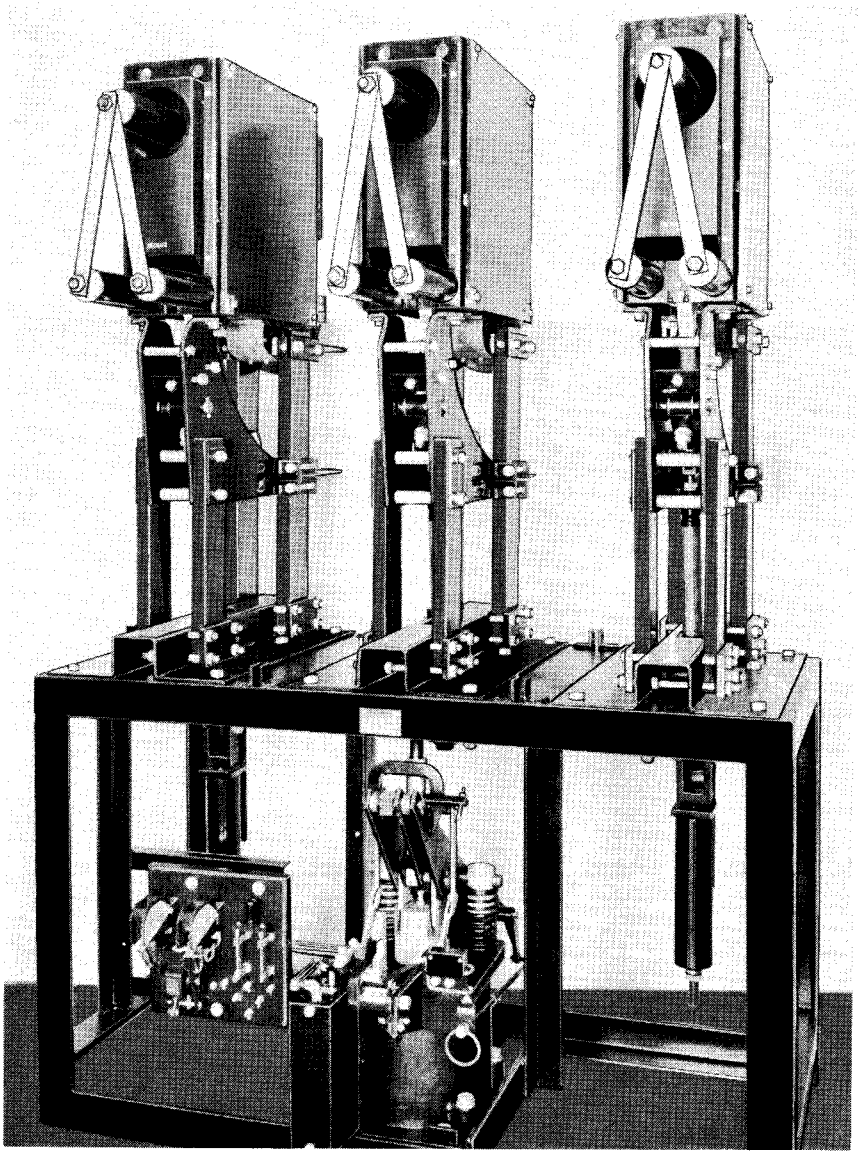
TYPE U "DE-ION" AIR CIRCUIT BREAKERS

600, 1200, 2000 Amperes, 15,000 Volts, 60 Cycles, 3-Pole,
Floor Mounted with 4" SAF Solenoid Mechanism

Types 150-U-12 & 150-U-22



Frontispiece - Figure 1
Front View, Type 150-U-12 "De-ion" Air Circuit Breaker showing Pole Units, Floor Mounting Frame and SAF-4 Mechanism
(Three-pole, 600-Ampere, 15,000-Volt)

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LIST OF ILLUSTRATIONS

GENERAL INSTRUCTIONS - SECTION I

Application

The "De-ion" Air Circuit Breaker is designed to function in a normal atmosphere and is not dependent upon the maintenance of any stored medium, such as air or liquid di-electric. Its performance is dependable, clean-cut and free from uncertainty.

The breakers described herein are designed for operating service at 600 to 2000 amperes and 15,000 volts a-c. They may be used in general applications where an air circuit breaker is desired. They are characterized by long life and low maintenance requirements under severe duty.

Shipment & Storage

These breakers are completely assembled and tested at the factory before shipment. The stacks or de-ionizing chambers are generally shipped separately from the breaker to guard against damage due to rough handling. Detailed instructions for installing the stacks are given below under installation.

Immediately upon receipt of a circuit breaker, an examination should be made for any damage sustained while enroute. If injury is evident or indication of rough handling is visible, a claim for damage should be filed at once with the carrier (Transportation Company) and the nearest Westinghouse Sales Office notified promptly.

The breaker is designed for indoor service and should be put in a clean, dry place immediately upon arrival.

Description

The frontispiece, Figure 1, shows a 600-ampere 15,000 volt Type 150-U-12 "De-ion" air breaker equipped with an "SAF-4" solenoid operating mechanism and arranged for floor mounting. This is one of several possible mounting arrangements. The breaker may also be equipped with an "SA-3" mechanism instead of the "SAF-4" as shown in Figure 1. The breaker consists of a mounting frame, solenoid operating mechanism, and three separate pole units, each with its own de-ionizing chamber.

Figure 2 shows a side view of one pole. Various specific parts of the breaker are labeled. The solenoid mechanism operates a steel shaft, which in turn operates a wood Micarta pull rod on each pole unit. This pull rod is connected to the moving contact arm linkage system which closes or opens the moving contact arm. The moving contact arm is made of flat copper bars plus steel bars for strength.

Figures 3 and 4 show a side view of a pole unit with de-ionizing stack removed to show respectively open and closed positions of contacts. The main current carrying contacts and the arcing contacts are made in a single renewable piece. This piece is interchangeable between moving and stationary positions. Arc resisting material is used on the arcing contact portion of the contact piece.

Figure 5 shows a side view of a pole unit with de-ionizing chamber in place. The static shield is removed to show edges of the assembled laminations of the de-ionizing chamber or stack. The stack consists of steel plates, copper plates, insulating plates and radial field coils. Typical steel and copper plates are shown in Figure 6. The arc box sides, consisting of hard fibre liners with inserts of asbestos composition are shown together with the front and rear arc horns laid in their proper relative positions in Figures 7 & 8.

The tubular insulating shields, the ends of which are visible in Figures 2 & 5, form part of a loop that creates a magnetic field for moving the arc up the arc horns and into the stack or de-ionizing chamber. In the case of the 150-U-12, stack, this is a one-turn loop. In the case of the 150-U-22 stack, this is a two-turn loop.

Theory of Operation

The de-ionizing chamber is built up of copper plates insulated from each other to form a series of gaps as shown in Figures 2 & 5. Each copper plate is partially surrounded by a steel plate of the same thickness. See Figure 6.

Consider first the 150-U-12 stack and refer to Figure 9. As the contacts separate, the arc is drawn between arcing contacts (shown in solid black) and the circuit is completed as indicated by the broken arrows. The arc rises due to the magnetic field of the arc current. One arc terminal transfers from the stationary arcing contact to the arc horn immediately above and current begins to flow through the one-turn loop. The individual steel plates act as a magnetic yoke which, when energized by the one-turn loop, supplies additional magnetic field for moving the arc rapidly upward into the plate structure.

When the arc impinges on the copper plates the radial field coils are introduced into the circuit. These coils supply the field for spinning the arc around the annular path, in the same manner that the armature conductor of a motor is driven in a circular path by the field of the motor. The arc as shown is now broken into a number of short arcs. The spinning action continues until a zero point occurs in the current. At that instant the circuit is interrupted.

Refer now to Figure 10, which shows schematically the circuit arrangement used in the 150-U-22 breaker. In this stack, when the arc rises from the stationary contact and transfers to the main rear arc horn immediately above the stationary contact, the first turn of the two-turn loop is energized. The arc then moves upward rapidly, the arc terminals traveling up the arc horns. When the rear arc terminal reaches the small auxiliary horn above the main horn, the arc transfers to this auxiliary horn and thereby cuts in the second turn of the two-turn loop. With both turns energized, the magnetic blow-in field causes prompt motion of the arc into the plate structure and the consequent separation into a series of short arcs. The remainder of the operation is similar to that of the 150-U-12 stack.

These actions of the arc, while requiring some time to describe, occur in a relatively short time. Complete interruption of the arc - drawing, moving it into the gaps and spinning it - usually require only one-half to one cycle on a 60-cycle wave. The arc may be spun at a rate of 20 revolutions per cycle.

The static shields, mounted on each side of the stack, act to distribute the voltage equally over the series of gaps formed by the insulating spacers. The static shields are made of Micarta plate having sheets of metal foil embedded within them. The foil sheets are so proportioned as to correct the tendency of some of the gaps to become overstressed and of others to become understressed with voltage.

INSTALLATION

With the exception of "De-ion" chambers and barriers, these breakers are shipped completely assembled and adjusted. No change in adjustments should be required and none should be made unless it is obvious that they have been disturbed.

These breakers are much easier to handle with the De-ionizing chambers or stacks removed. Hence, the stacks should not be placed on the breaker pole units until the breaker has been installed in its permanent location and securely bolted to the floor.

If the breaker is placed within a metal enclosure, care should be taken to insure that minimum clearances for the voltage rating are maintained between live parts and ground and between phases.

These breakers are generally equipped with space heaters mounted on the lower frame for use under conditions of high atmospheric moisture. It is important that these heaters be used at all times when atmospheric conditions are favorable to the condensation of moisture on the breaker. This applies particularly to conditions during shutdown periods although the heater might possibly also be required under normal running conditions.

De-ionizing Chamber

Due to the weight of the De-ionizing chambers or stacks, and the fact that they must be removed for contact maintenance, special means are provided for liftin'g them during installation or removal. Refer to Figure 12. The stack lifter consists of a lifter cradle (which fits either the 150-U-12 or 150-U-22 stack), cable and a cable-drum which is hand-operated through a worm gear. The whole is supported on wheels from an I beam which is temporarily hung over each pole unit. To install a stack, place the lifter rail and lifter in position over the pole unit. Attach the lifter cradle as shown in Figures 11 & 12 and hoist the stack several inches above the pole unit. Roll the chute over the pole unit. (For convenience, the barriers between pole units should be removed while installing or removing a chute). The special hand lever for moving the stack backward or forward as shown in Figure 11 should be set in place. The stack should then be carefully lowered, with the arc box centered over the contacts. The stack should be lowered about two inches forward of its final assembled position. While the stack is being lowered the stack lever should be held at the proper angle to engage the front end plate. With the stack resting lightly on the pole unit but still largely supported from the stack lifter for safety, use the stack lever to move the stack to the rear. Be certain that the guide pins and the spring contact fingers at the rear of the stack properly meet and engage the rear upright portion of the stationary contact casting. Lever the stack far enough to the rear to insert

the two fastening bolts up through the pole unit brackets into the corner pads on the bottom of the stack front end plate. Clearance is provided in these bolt holes so that the front end of the stack may be moved laterally before the bolts are tightened. The front end of the stack should be moved to one side or the other, as necessary, to prevent the moving contact from rubbing the arc base sides. The rear end of the stack will be aligned by the guide pins at the rear. After the two stack fastening bolts have been tightened, the stack lifter may be removed. Also, the special hand lever may be removed by taking the pin out of the pole unit brackets.

Note: - During an interruption, there is a momentary passage of current from the stack front end plate to the pole unit brackets. The surfaces (where the stack front end plate sets upon the pole unit bracket,) should be clean and bright.

To remove a stack, set the stack lifter in place and pull the cables taut before loosening the stack fastening bolts. After the two fastening bolts are removed and the stack is lifted slightly by the lifter, it should be pulled forward slightly to disengage the guide pins and contact fingers at the rear. If necessary, the special hand lever may be used to move the stack forward. After the contact fingers and guide pins are clear at the rear, the stack should be lifted straight up far enough to clear the moving contact horn then rolled forward.

INSPECTION AND MAINTENANCE

Frequency of Inspection

The frequency of inspection, cleaning, etc. will depend upon the activity and duty to which the breaker is subjected and upon the cleanliness of the atmosphere and surroundings of the breaker. For breakers of the type described herein, it is recommended that a preliminary or visual inspection be made every 2 or 3 months. A complete inspection, including removal of the stack for inspection and cleaning should be made every 9 to 12 months. When breaker activity is high or where atmospheric conditions are dirty, inspections should be made more frequently. If automatic openings on short-circuit are unusually high, inspections should be made more often.

Caution

Parts of the circuit breaker itself in the high-voltage compartment of the housing are at line potential and the breaker should be isolated from the circuit by disconnecting switches, in line with standard practice for conventional circuit breakers, before the pole unit barriers are removed.

General

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

In operating the breaker by hand there should be no binding or excessive friction. In opening the breaker slowly by hand, bumper arms should come to rest securely against their bumpers and there should be no excessive friction or binding.

Static Shields

The static shields are large flat sheets of Micarta with metal foil embedded within them. They are supported on the stack by four bolts, one at each corner of the shield. Each shield is marked with a small (F) and a small (R) indicating which end of the shield be placed on the (F) FRONT or (R) REAR of the breaker. The markings are on the outside or black side near the top corners of the shield next to copper clips. The front of the stack is considered to be the end from which the tubular insulating shields of the magnetic loop protrude about seven inches, or nearest the cell door in ordinary applications. Shields belonging on one side of a pole unit should not be changed to the other side of the same pole unit.

Tubular Insulating Shields

These shields are Micarta wound upon steel rods (except in the case of the 150-U-22 center shield) with embedded layers of metal foil, the construction being similar to that of a condenser bushing. Copper terminals, soldered under the banding wire, form the connection between the outer foil layer and the end plate of the stack. These shields or bushings, in addition to insulating the conductors of the magnetic loop, serve to hold the stack together. If the breaker is located in an exceptionally dry atmosphere, there may be some shrinkage of the insulating spacers between the stack plates. For this reason, the tightness of the stack should be checked at times when a complete inspection of the breaker, including removal of the stack, is being made. This tightness may be checked as follows. The outer nuts or lock nuts on the rear ends of the bushings should be loosened and backed off. Then the inner nuts should be tightened to a maximum torque of about 25 pounds - foot. Retighten the outer nuts. This tightening must be done at the rear of the stack. The nuts at the front ends of the bushings should not be disturbed unless the stack is held compressed by assembling clamps or auxiliary tie rods.

The center bushing of the 150-U-22 stack is similar to the other bushings except that the micarta is wound upon a copper tube. A steel rod with insulation wound on it is placed inside the copper tube. The steel rod serves as the tension member to hold the stack together. Any tightening on this rod should be done by the nuts at the rear so that the rod will not be moved lengthwise in the tube. The insulation on the rod should extend about one half inch beyond the copper tube at either end.

De-ionizing Chamber

Insulation of Gaps. Each gap between pairs of copper and steel plates may be "lighted" or "rung" out with a lamp 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 directed in both top and bottom. 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 replaced.

Arc Box

The arc box can be best inspected and cleaned when the stack is removed from the breaker and hanging from the stack lifter. If there are indications of severe burning or excessive deposits of soot, etc., on the arc box sides, they may be cleaned with sandpaper or a file. If much cleaning or filing appears necessary, it will be more convenient to remove the arc horns. After the cleaning on the arc box sides is done, the stack should be blown out with clean dry compressed air, blowing down from the top first to prevent dirt being carried up into the plate structure and deposited in the gaps. For the same reason the cleaning should not be done with the stack upside down.

Contacts - 600 Ampere Breaker

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 due to the high pressure used. The contacts should not be kept in service if the arc tips touch in the closed position, as this means that some pressure will be taken from the main contact surfaces. This will cause excessive heating due to current being diverted through the arc tips, which are of relatively high resistance.

In the fully closed position the main contact surfaces should be on firm contact, and the clearance between the arc tips should be 3/32 to 1/8 inch in a new breaker. This clearance may change due to wear on the main contact surfaces. When it decreases to the point where the arc tips are in contact in the fully closed position, the contact should be renewed. This condition should not be reached until the breaker has had a large number of operations.

Adjustments - 600 Ampere Breaker

This breaker is completely adjusted at the factory and individually checked by tests. No change in adjustments should be required and none should be made unless it is obvious that something has been disturbed. In the event of any adjustments, make sure that all three poles make contact at approximately the same time.

The contact opening speed in the early part of the stroke is important for proper interrupting performance. This speed is greatly affected by the length of stationary contact follow. Between closed and open positions of the breaker the arcing tip of the stationary

contact should move not less than approximately seven-eighths of an inch. This travel of the stationary contact is controlled by the setting of the special nut on the spring rod projecting from the rear of the stationary contact casting. The stationary contact follow has been carefully adjusted and checked at the factory and should not need any change on a new breaker.

Heaters

These breakers are generally equipped with space heaters mounted under the high voltage compartment for use under conditions of high atmospheric moisture. It is important that heaters be used at all times when there is any possibility of moisture condensation.

Insulation

All insulating parts should be kept clean and free from accumulations of dirt or dust. Dry compressed air should be used to blow off loose dust. It should be also blown into the de-ionizing chamber to remove any loose particles. In doing this, the air should be directed into the arc box, upward toward the top of the stack and downward through the individual gap vents along the top of the stack. Other parts may be wiped off with a clean dry cloth.

Toggle Stops

The clearance at the pole unit toggle stops should be approximately 1/16 inch.

Electric Closing Mechanism

Some of these breakers are equipped with the type SAF-4 electrically operated mechanism. See Westinghouse Instruction Book No. 5664.

Others of these breakers may be equipped with the type SA-3 mechanism. See Instruction Book No. 5567.

Description

Figure 15 shows a 1200 ampere type 150-U-22 frame mounted breaker in the open position with the de-ionizing chamber assembled on the right hand pole only. The general similarity of construction to the 600 ampere breaker will be noted by comparing Figure 15 with Figure 14. General descriptions and instructions given in Section 1 of this book also apply to the 1200 ampere breaker except where marked to apply specifically to the 600 ampere breaker.

Figure 16 shows the movable and stationary contact assembly of the 1200 ampere breaker in the open position. The arcing contacts are located at the top and the stationary members consist of 2 parallel fingers of high strength copper alloy with arc resisting tips at the outer end, at the last point of contact as the movable contact parts from them. The inner end of each arcing contact finger has a vertical semi-cylindrical surface which makes line contact with the stationary arcing contact block. Compression springs on each side held by a horizontal bolt passing through the assembly, bias the fingers toward each other giving high unit pressure on the contact surfaces. In the closed position, each finger acts as a bridge from the movable arcing contact to the stationary contact block dispensing with flexible shunts.

The movable arcing contact is shaped to form a movable arc horn. The arcing contact proper has an arc resisting tip at the parting surface, rounded so as to give easy entry between fingers.

The stationary main contacts, mounted below arcing contacts so as to be also below the de-ionizing chamber, consist of 2 pairs of parallel fingers having vertical cylindrical surfaces at each end. The fingers in each pair are biased toward each other by a single compression spring held by a bolt passing through the fingers and the stationary main contact block. In the closed position each finger acts as a bridge between the main movable contact block and the stationary finger contact block so that no flexible shunts are necessary.

The movable main contact consists of a low resistivity, high strength copper alloy block, rounded on the end for easy entry between the fingers, bolted to the main movable copper conductors of the movable contact arm. All contact surfaces, both main and arcing are heavily silver plated.

At the lower end of the movable contact arm is a hinge joint between the copper conductors of the movable contact arm and copper conductors extending from the lower line terminal of the breaker. Pressure is maintained on the contact surfaces of this joint by spring washers. This construction eliminates the necessity of a flexible shunt at the hinge point.

INSPECTION AND MAINTENANCE

Instructions for inspection and maintenance given in Section 1 of this book apply to the 1200 ampere breaker except as specifically applied to the 600 ampere rating.

Contacts - 1200 Ampere Breaker

The contacts are adjusted at the factory and checked by test. No change in adjustment should be made unless it is obvious that adjustments have been disturbed.

(1) In the open position, the minimum break distance between stationary and movable contact parts should be approximately 6-1/8 inches.

(2) When the breaker is closed by hand until the arcing contacts just touch, it should be possible to slip a 5/16 diameter pin between the main contact fingers and the moving main contact at either side.

The arc tips should make first contact near the upper tips of fingers and movable contact.

(3) As the breaker is opened slowly by hand the stationary contact fingers should snap firmly against the stationary contact block stopping surfaces, located near the outer end of the fingers.

(4) Cotter pins locking the contact spring retaining units should be in place.

(5) The contacts are good for a large number of operations. The arc tips will gradually burn away with the interruption of currents near the rating of the breaker. They should be replaced when the clearance given in (2) decreases to approximately 3/16 inch.

(6) The main contacts may bead slightly from interruption of current, this being more pronounced at the higher values. On account of the high unit pressure, this will not disturb the current carrying ability of the contacts. Any pronounced beads on the rubbing surfaces of the contacts should be removed by a fine file or fine emery cloth as repeated mechanical operation may result in galling of the contact surfaces.

(7) The adjustment of the spring washers at the movable contact arm hinge joint should not be disturbed unless definite signs of overheating or other improper operation are evident. If for any reason, it is necessary to readjust this hinge joint, loosen the lock nut on one side and take out the set screw on that one side. Back off the internally threaded steel sleeve until the brass spacer next to the cup washer is just free. Then tighten sleeve one complete turn. Tighten the locknut.

Drill a 1/4 diameter hole approx. 1/8 deep in the steel sleeve for the flat pivot point set screw. Replace and lock the set screw. If for any reason the hinge joint is disassembled, the following points should be noted when re-assembling. The current carrying surfaces should be clean and smooth. If necessary they may be rubbed lightly with fine emery cloth. After cleaning the surfaces should be completely covered with a light coat of good grade graphite grease such as W. E. & M. Co. Mat #1022-2. When reassembling, set the pressure on the cup washers as explained above. Before replacing the set screws, check the lateral position of the moving contact arm to see that the moving contacts properly meet the stationary contacts. If necessary, tap the horizontal hinge stud and sleeves to one side or other. Redrill for the set screws if necessary and replace and lock the set screws.

SPECIAL INSTRUCTIONS FOR TYPE 150-U-12F

The type 150-U-12F "De-ion" air circuit breaker is designed for highly repetitive duty such as is required in arc furnace of other industrial applications, in which a large proportion of the operation will be on load switching or relatively light overloads. The mechanical parts of this breaker are designed for long life. The de-ionizing chamber is designed for operation over relatively long periods without requiring major maintenance.

It is not to be inferred however, that this breaker can be expected to operate indefinitely in any type of service whatever without maintenance. Like any electrical or mechanical device it is subject to some deterioration both electrically and mechanically. Therefore, to get the maximum service and satisfaction which it is designed to give it should be inspected periodically and maintained in good mechanical and electrical condition by persons familiar with and competent to work on equipment of this kind.

For detailed description of this breaker refer to "General Instructions" in the forepart of this book. The pole unit of this breaker is similar in construction to that of the type 150-U-12 and 150-U-22 breakers shown in Figs. 2, 3, 4 and 5 except that the mechanical operating parts are made of specially hardened material for long wear and are equipped for lubrication where needed.

The de-ionizing chamber of the 150-U-12F breaker is similar to that of the type 150-U-22 shown in Fig. 5 using the 150-U-22 de-ionizing plate shown at the left in Fig. 6. The arc box of the 150-U-12F is similar to that of the 150-U-12 shown in Fig. 7 except that its surface is ribbed and the arc horns are equipped with refractory guards to reduce the deterioration of the surface resistance when operating large numbers of times on small currents. The radial field coils of the 150-U-12F, see Fig. 9, are stronger than on the standard central station breaker, to reduce the tendency of the de-ionizing plates to form beads on low-current repetitive operations.

INSPECTION AND MAINTENANCE TYPE 150-U-12F

When first installed the breaker should be inspected after the first two or three weeks of service. Subsequent inspection and maintenance may then be made at as high as every 10,000 operations or every two months. In determining the frequency of inspection and maintenance, proper judgment should be used relative to the severity of the duty. The following factors should be considered. Many interruptions of low currents only, of the order of one to five hundred amperes, tend to dirty the arc box sides and lower the surface resistance. If the breaker occasionally interrupts medium currents of the order of two to five thousand amperes, much of the soot and dirt may be burned away leaving the fibre surfaces relatively clean. The breaker should be inspected after any interruptions of short circuit currents at or near its maximum rating. The amount of cleaning needed on the breaker will, of course, be affected by the atmospheric surroundings. If considerable dust or dirt is likely to be deposited on the breaker, more frequent cleaning and blowing out with dry compressed air will be needed.

De-ionizing Chamber

In addition to the following instructions refer also to page 9 under "Caution", "General", "Static Shields", "Tubular Insulating Shields", and pages 10, 11 and 12.

In inspecting the de-ionizing chamber, the condition of the insulation is of primary importance. The insulating surfaces of the arc box, adjacent to the contacts and arc horns will be subject to some deterioration which will tend to be cumulative with the number of operations of the breaker. The insulating condition of the insulating spacers between the de-ionizing plates will vary to some extent with atmosphere moisture conditions and number of breaker operations. Ordinary atmospheric conditions have only a small effect in the average indoor installation. If the de-ionizing chambers are ever subject to such conditions as to cause actual condensation of moisture on the insulation it is obvious that they should be dried before placing in service. In drying, they should not be subjected to more than 70°C. See "Heaters" page 11.

Instruments of the "Megger" type are useful in checking the insulating condition of the de-ionizing chamber assembly. The highest voltage instrument available should be used. However, it should be used in this case only for indicating broad limits of insulation resistance. Generally speaking, approximately 100 megohms should be regarded as a lower limit for keeping a chamber in service except for a limited time.

In checking the de-ionizing chamber with the "Megger", check the overall resistance by measuring across the two metal end plates. Then, with the arc box sides in a clean condition measure across each group of plates between radial field coils, which are

indicated by small insulating barriers along the top of the chamber assembly. Individual groups of plates may be operated safely at less than 100 megohms but if several groups in a stack indicate a resistance of less than approximately 20 megohms, for 2 consecutive inspections, the cause should be investigated. If convenient, the chamber may be baked for approximately 8 hours at 60° to 70°C. If not, the stack should be dismantled and the cause of the low resistance determined by inspection.

It is to be understood that megger readings will vary over a wide range, and unless the readings are excessively low, an individual reading may be disregarded unless, on the next inspection, it is still low.

Arc Box. A brief partial inspection of the condition of the arc box surfaces and the contacts may be made by looking up into the arc box with a flashlight. However, a much more satisfactory inspection of both arc box and contacts can be made by removing the de-ionizing chamber or stack from the pole unit. If any maintenance work is to be done, it will be necessary to remove the stack.

When inspecting the arc box sides, notice should be taken of the amount of carbon soot and other arc products deposited upon the arc box sides. If there is any appreciable soot or blackening it should be wiped out with a cloth. If any of the black material adheres to the arc box sides, it should be cleaned off by using sandpaper, or a wire brush. This cleaning can be done more easily and more efficiently if the arc horns are removed and the stack is laid on its side on a table. First, one arc box side should be cleaned, then the stack laid on the other side and the other arc box side cleaned. Care should be taken not to break off the fibre ribs on the arc box sides while cleaning. After the cleaning, the stack should be thoroughly blown out with dry compressed air.

At the same time that the stack has been removed from the breaker for arc box cleaning, the insulation of the gaps in the stack should be checked as indicated on page 10. When reassembling the arc horns into the stack, care should be taken not to damage the asbestos plate guards on the horns. Also, the horns should be centered in the arc box space. Details at the ends of the stacks should be carefully replaced as they were.

After several cleanings by the above method, a more thorough cleaning of the arc box sides may be considered advisable. If for this or some other reason it is desired to remove the arc box sides from the stack, the following procedure should be used. Remove the static shields. Remove the small bolts on the sides of the lower half of the stack, which hold the arc box in place. It will next be necessary to remove the two lower bushings or tubular insulating shields but before this is attempted the following ideas should be thoroughly understood. Refer to the section on "Tubular Insulating Shields" beginning on page 9. The center bushing of the 150-U-12F stack is the same as the center bushing of the

150-U-22. Note that when the laminations of the stack are held compressed, the steel rods in the bushings are in tension. The tapered portion of the wound Micarta extending from the front of the stack is normally in compression, but if the nuts at the front end of the bushings are loosened or removed while the stack is still held in compression, this tapered portion of the wound Micarta will be stressed in shear and may telescope, ruining the bushing. Therefore, it is essential that nuts at the rear be loosened first and tightened last. This applies to both center and bottom bushings. When taking out the lower bushings to permit removal of the arc box sides, either of two methods may be used. One is to set the stack up on blocks with rear end plate down. Loosen the nuts on all three bushings to take pressure off the stack. Remove connecting straps at front end. Remove small screw holding foil grounding connection to front end plate. Proceed to remove two lower bushings and the arc box sides. An alternate method, which may be found more convenient in case much work of this kind is to be done, is to prepare two pairs of clamping rods and bars to hold the stack of laminations in compression while the bushings and other details are removed. Make four rods 1/2 or 3/4 inch diameter, about two feet long and threaded several inches at either end, four bars about one by two by eleven inches with a hole at either end for the rods. Assemble one pair of rods and clamps near the top of the stack and the other pair near the bottom just above the lower bushings. The clamping bars are, of course, assembled outside the end plates so as to press the end plates toward each other. The thin sheet metal cover on the front end plate can be loosened and moved out of the way. Tighten the clamping rods until they, rather than the bushings, hold the stack in compression. The bushings can then be removed without any danger of damaging them. Also, the stack can be put in any desired position, because the clamping rods will hold the laminations together.

When reassembling the arc box sides, it will be found helpful to adjust the pressure on the lower end of the stack until the strips on the back of the arc box side slip into place between the laminations. After the arc boxes are in place, adjust the clamping rods to get 18 and 5/16 inches plus or minus 1/16 between inside surfaces of the end plates. Insert the bushings. Draw the nuts up snug, both front and rear. Remove the clamping bars. Take particular care to replace all connecting details at either end exactly as they were. The interrupter will not function if the two turn magnetic loop is incorrectly connected. The small screws on the outside of the lower half of the stack, holding the arc box sides in place are threaded into strips of insulating material on the back of the arc box sides. When tightening these screws, use care to avoid stripping the threads in the insulating material. Note that static shields are right and left hand. Assemble with black side out, letter F to front and R to rear. When reassembling stack on breaker see that stack is centered so that moving contact does not strike horns or arc box sides.

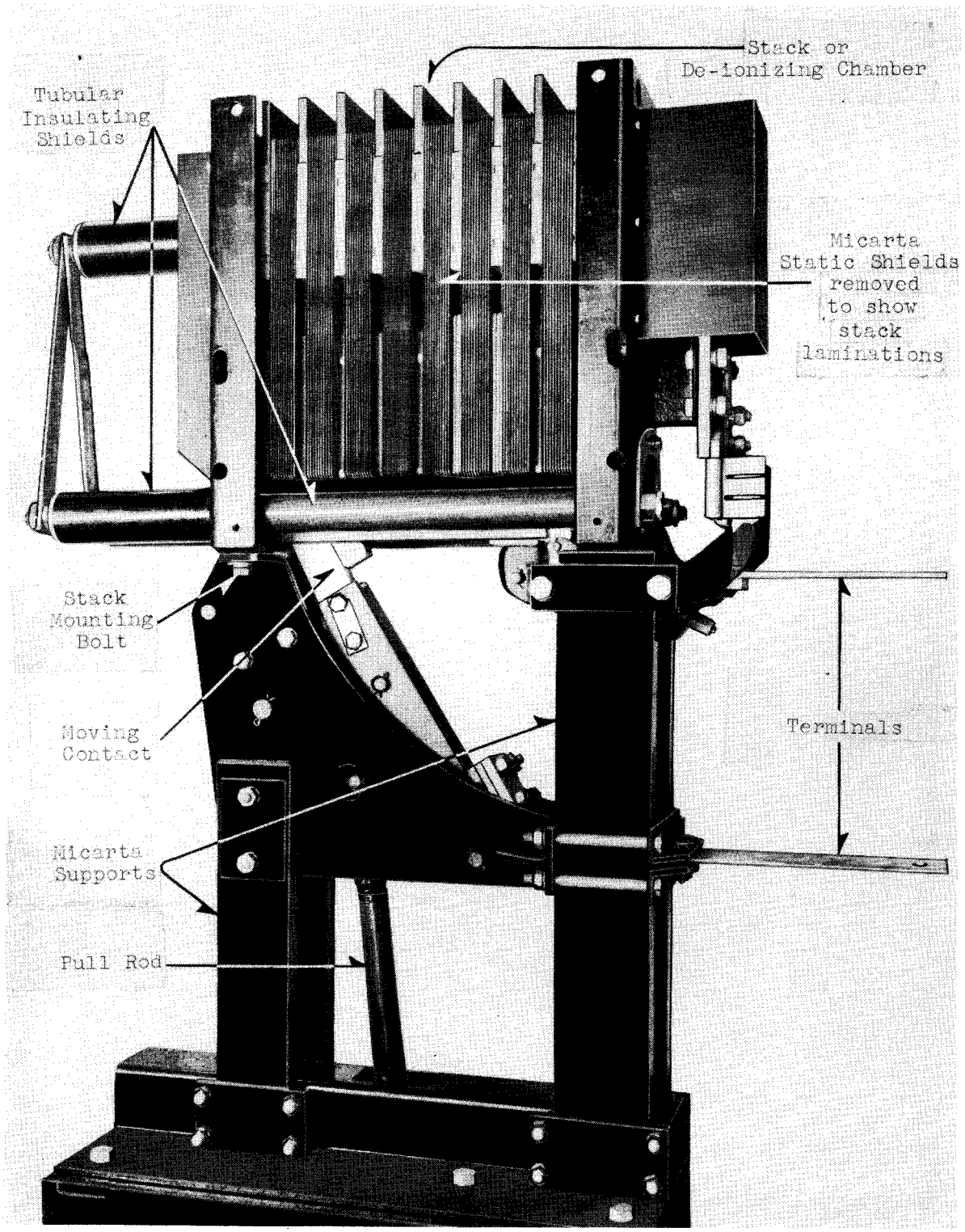

Figure 2
Side View, Single-Pole Unit, Type 150-U-12 "De-Ion" Air Circuit Breaker
(Static Shield Removed to Show Edges of Stack Laminations)

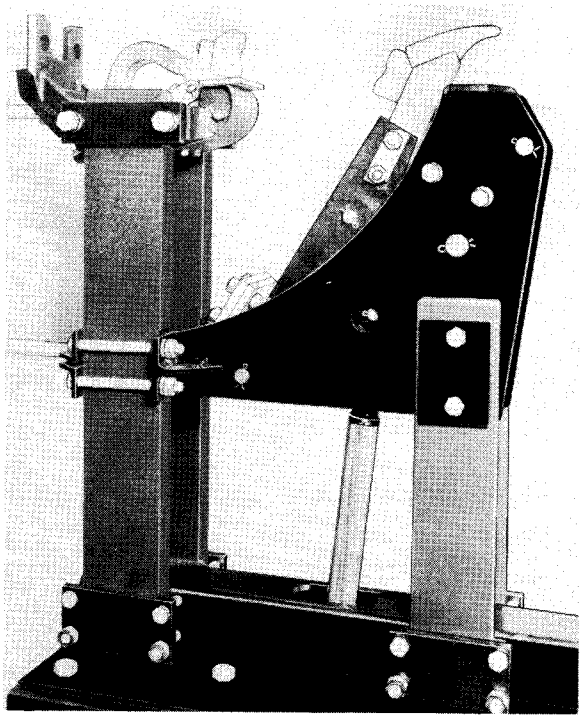

Figure 3
Side View, Single-Pole Unit,
Types 150-U-12 & 150-U-22 "De-Ion" Air Circuit Breakers
"De-Ion" Chamber Removed, Showing Contacts in "Open" Position

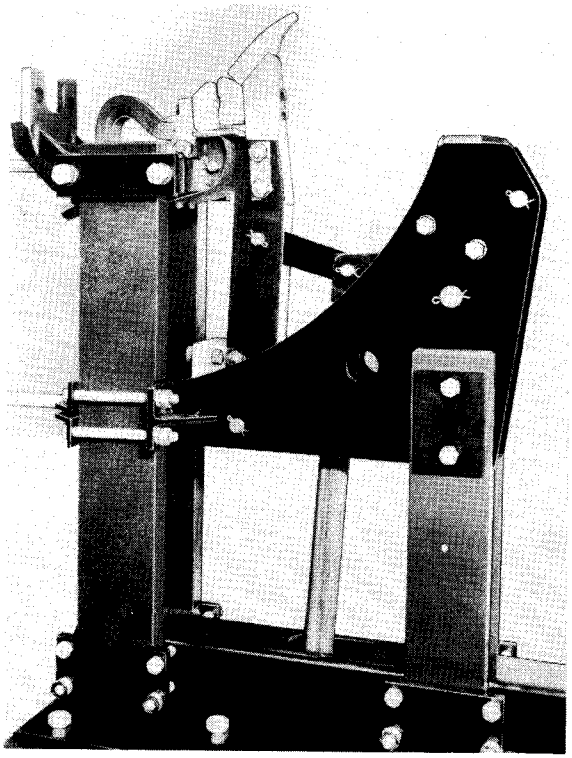

Figure 4
Side View, Single-Pole Unit,
Types 150-U-12 & 150-U-22 "De-Ion" Air Circuit Breakers
"De-Ion" Chamber Removed, Showing Contacts in "Closed" Position

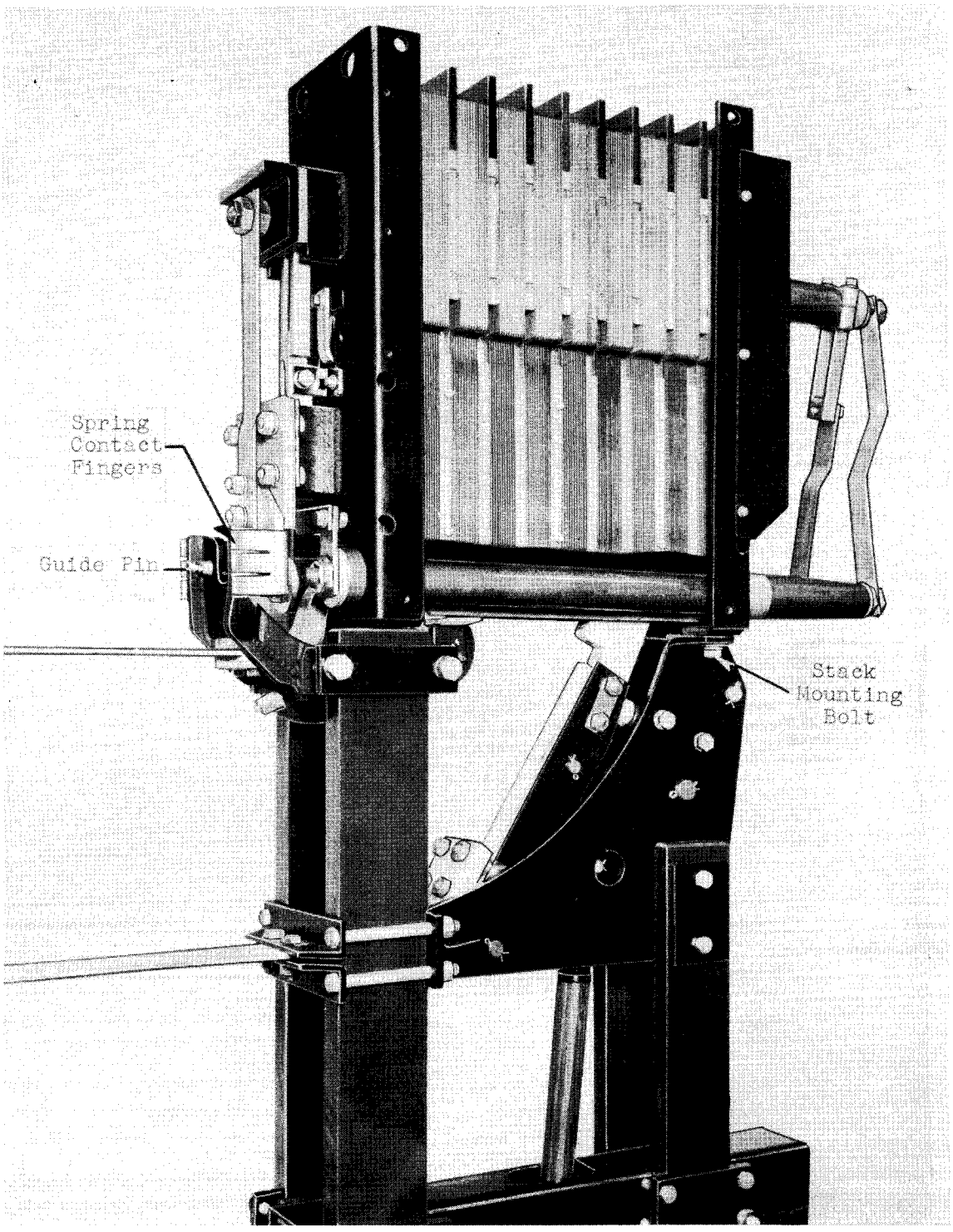

Figure 5
Side View, Single-Pole Unit, Type 150-U-22 "De-Ion" Air Circuit Breaker
Static Shield Removed - Showing Guide Pins and Spring Contact Fingers
in Engagement with Stationary Contact Casting

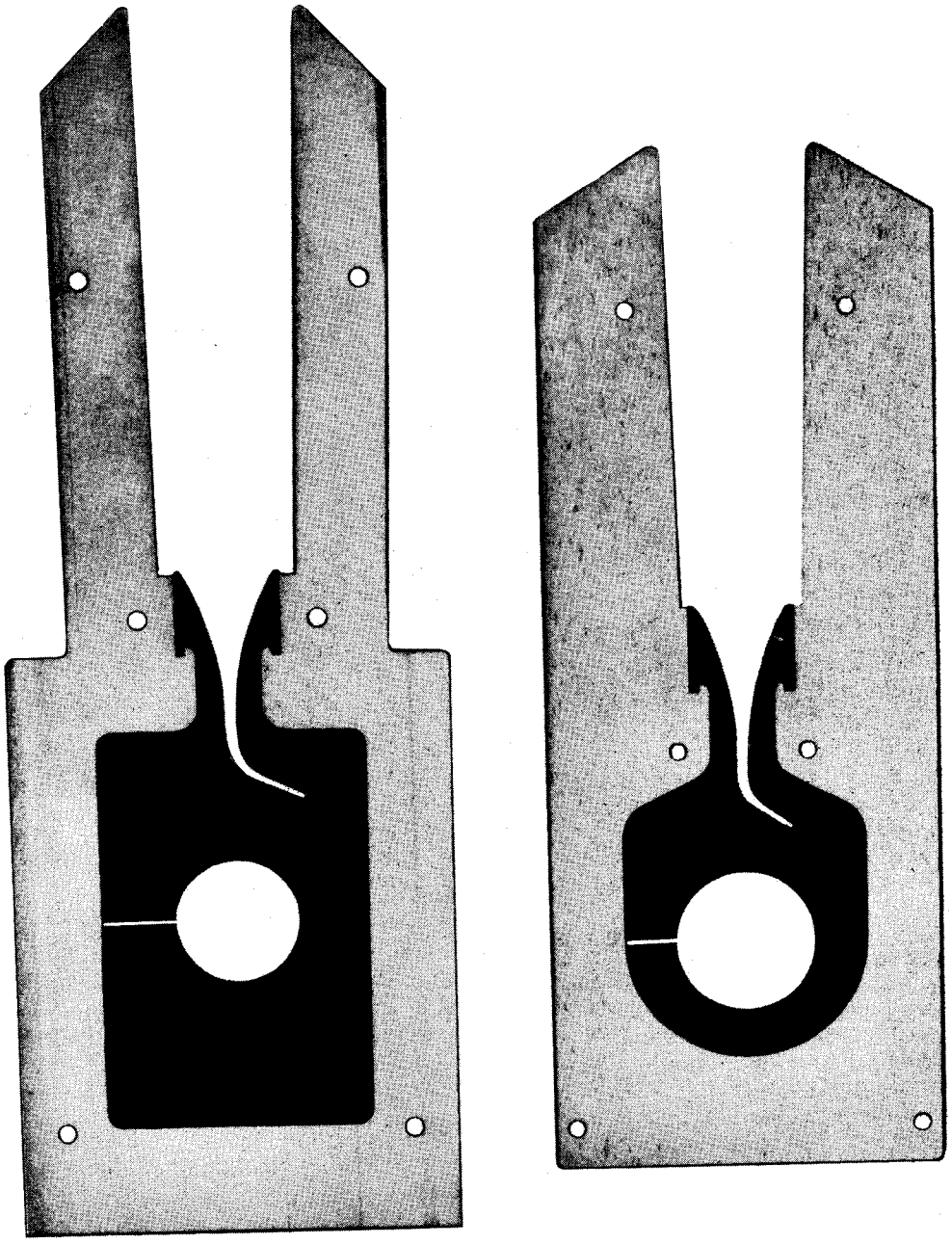

Figure 6
Copper and Steel Plate Laminations
Types 150-U-12 & 150-U-22 "De-Ion" Air Circuit Breakers

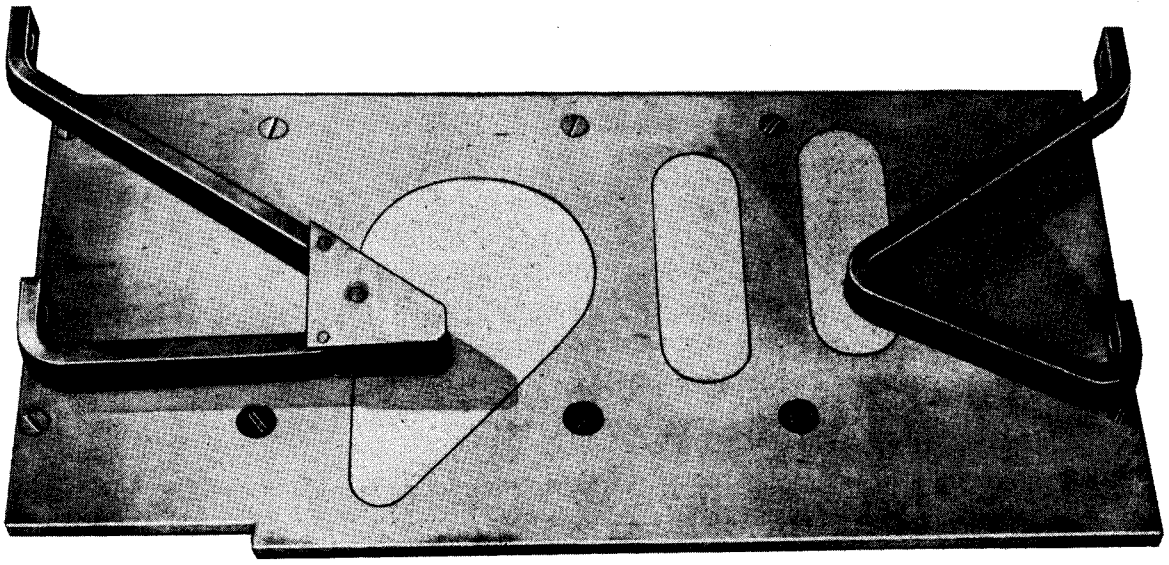

Figure 7
View of Single Arc Box Side from Type 150-U-12 "De-Ion" Air Circuit Breaker Stack with Front Arc Horn (Right) and Rear Arc Horn (Left)

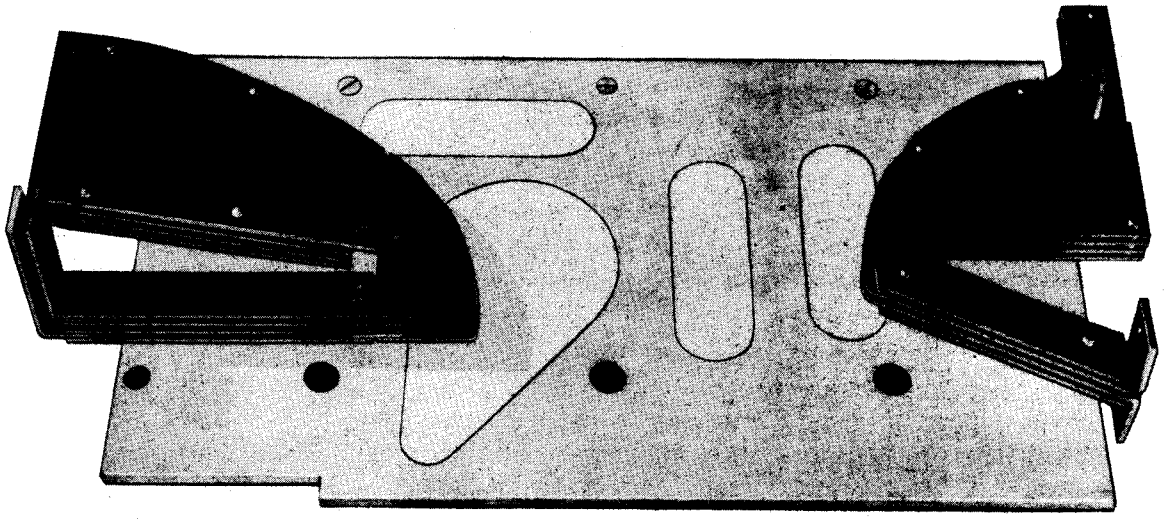

Figure 8
View of Single Arc Box Side from Type 150-U-22 "De-Ion" Air Circuit Breaker Stack with Front Arc Horn (Right) and Rear Arc Horn (Left)

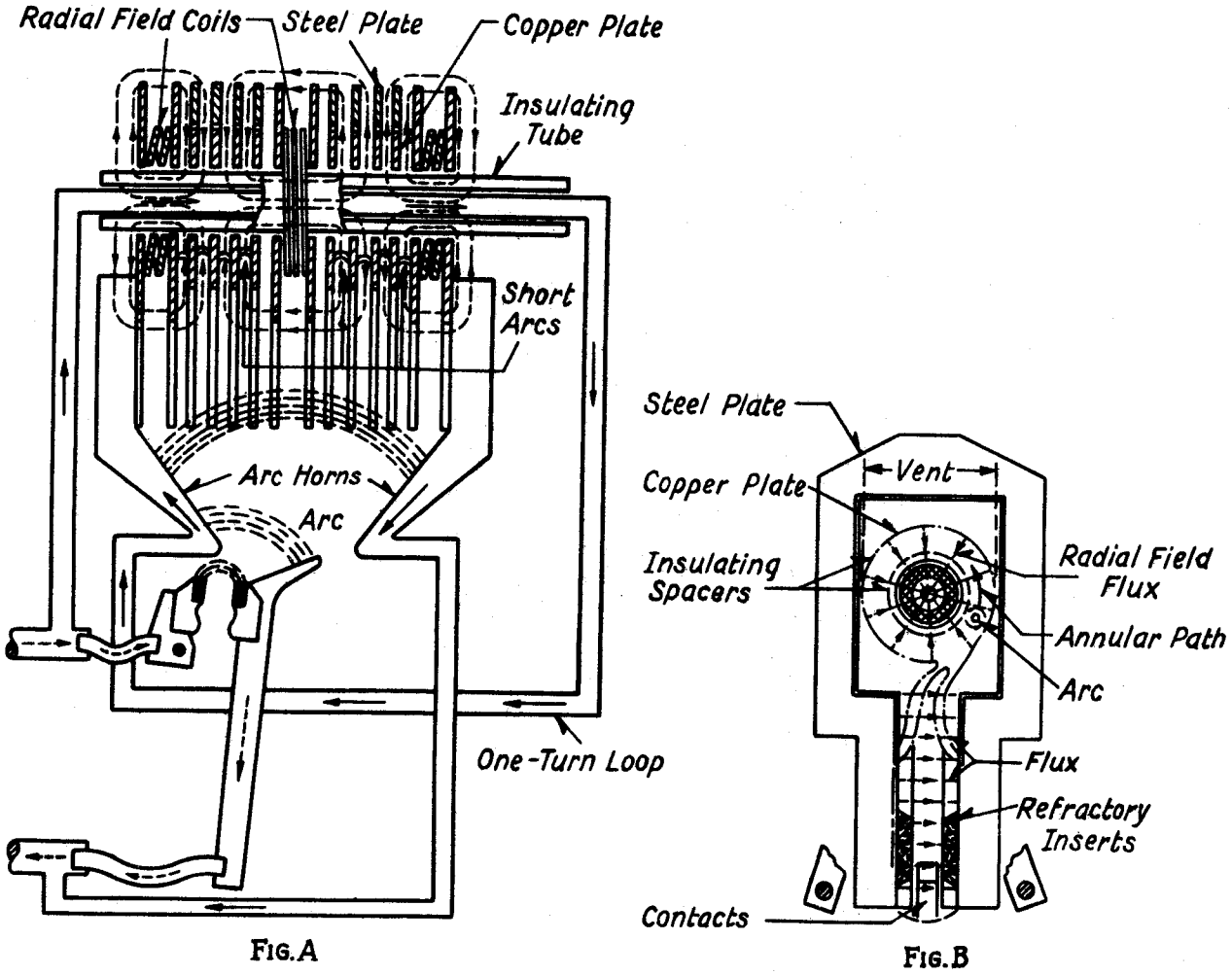

Figure 9
Schematic Diagram of Pole Unit Type 150-U-12 "De-Ion" Air Circuit Breaker

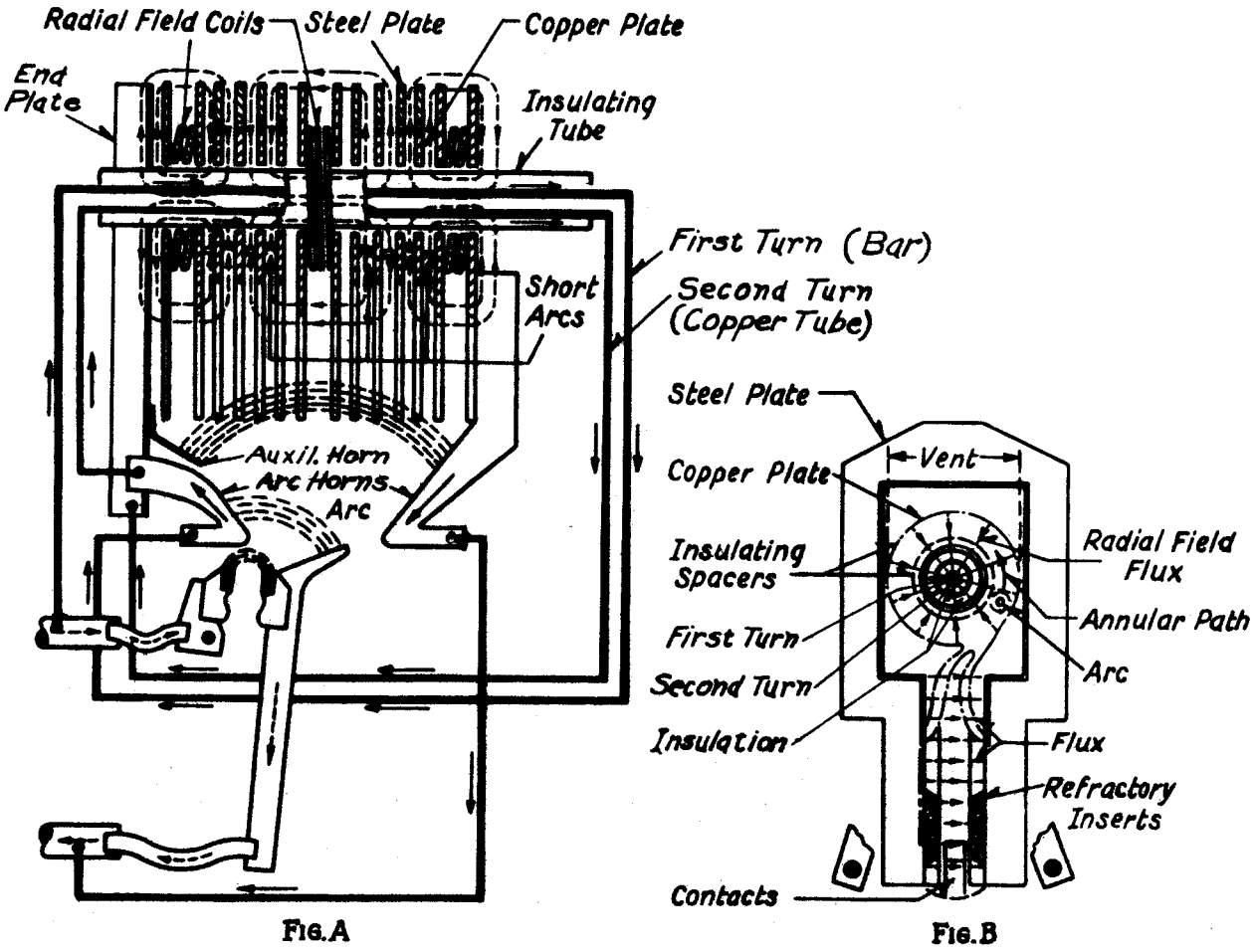

Figure 10
Schematic Diagram of Pole Unit Type 150-U-22 "De-Ion" Air Circuit Breaker

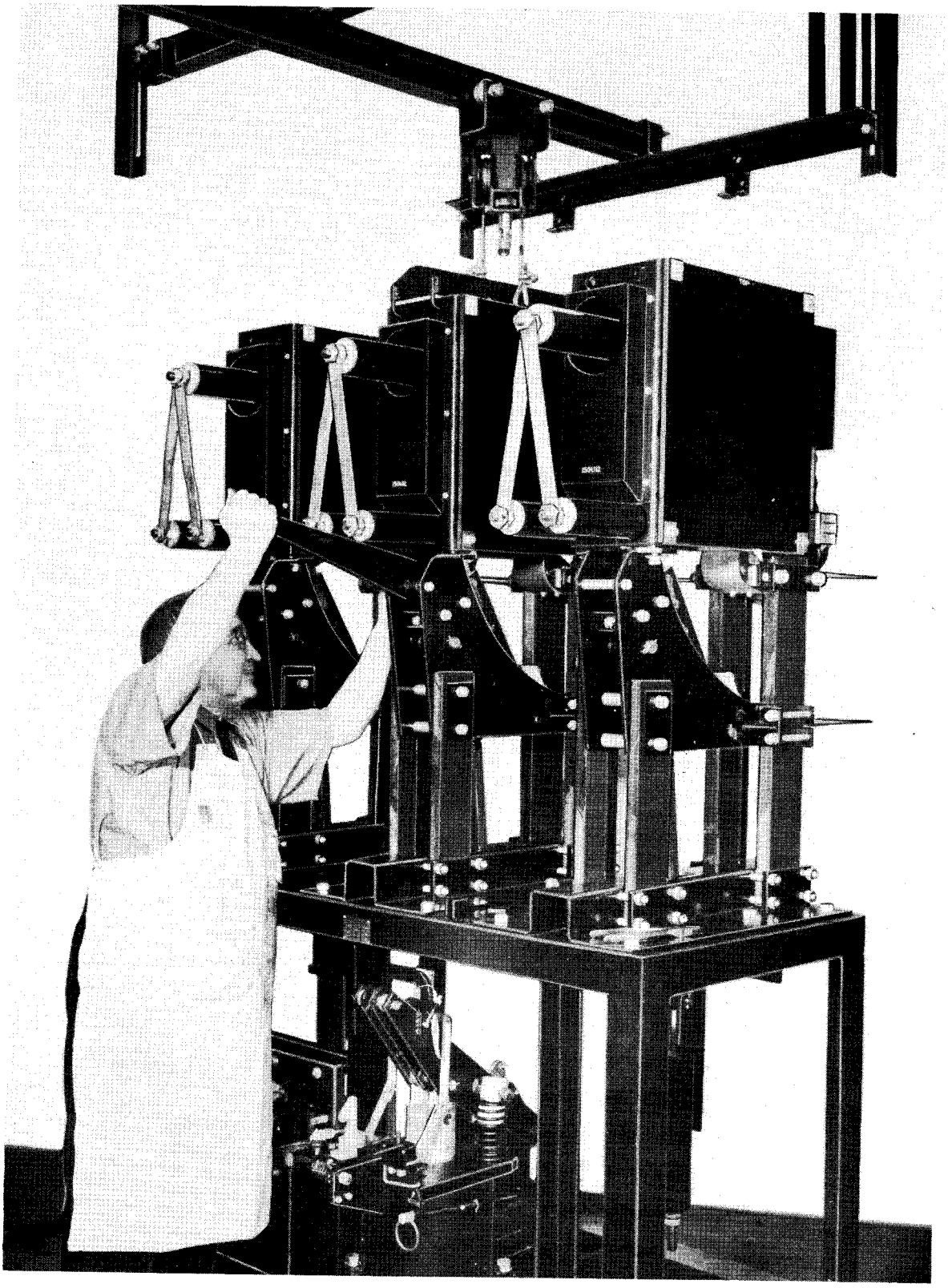

Figure 11
Use of Stack Lever Device When Installing or Removing Stack
Types 150-U-12 & 150-U-22 "De-Ion" Air Circuit Breakers

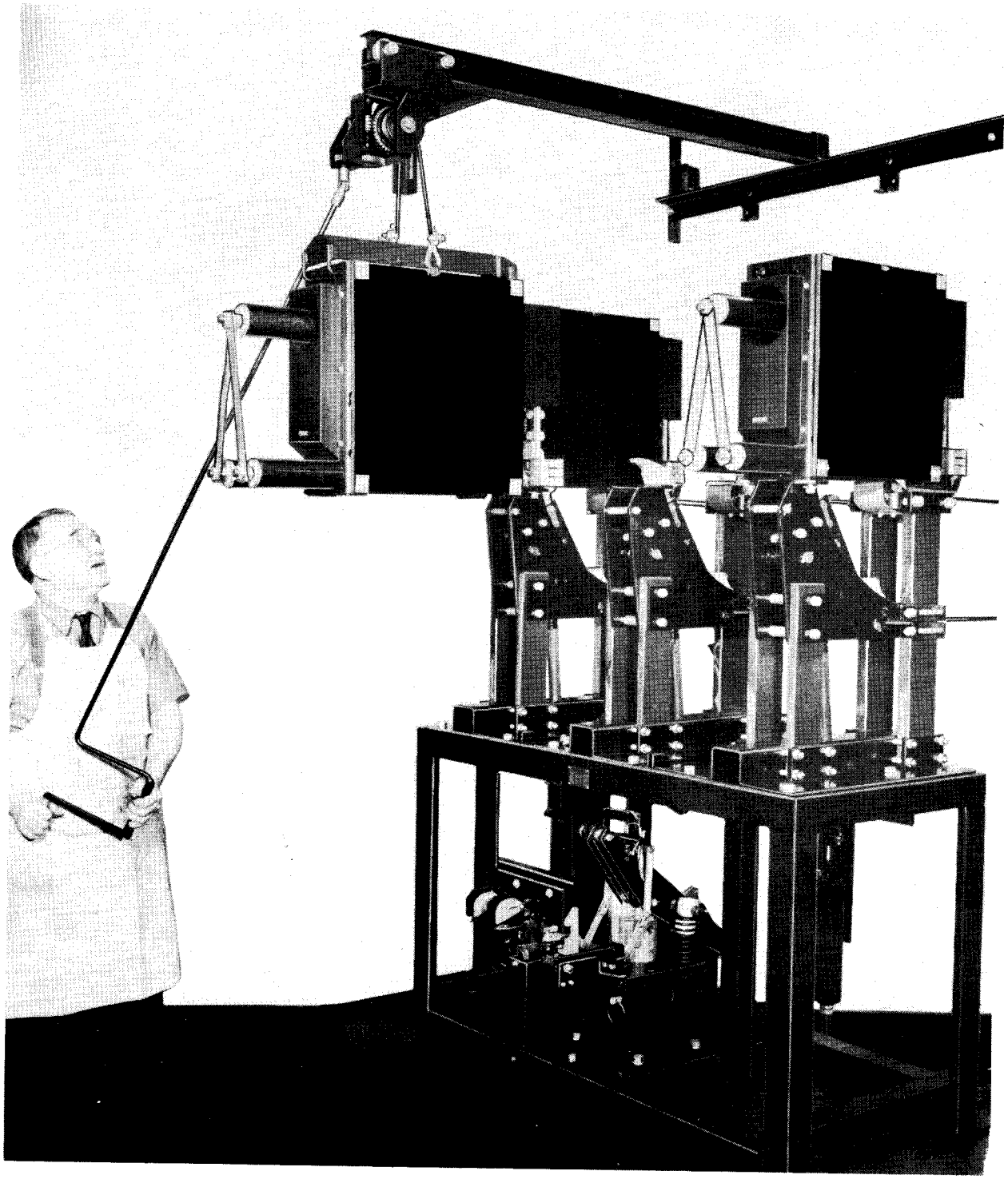

Figure 12
Use of Stack Lifter When Installing or Removing Stack
Types 150-U-12 & 150-U-22 "De-Ion" Air Circuit Breakers

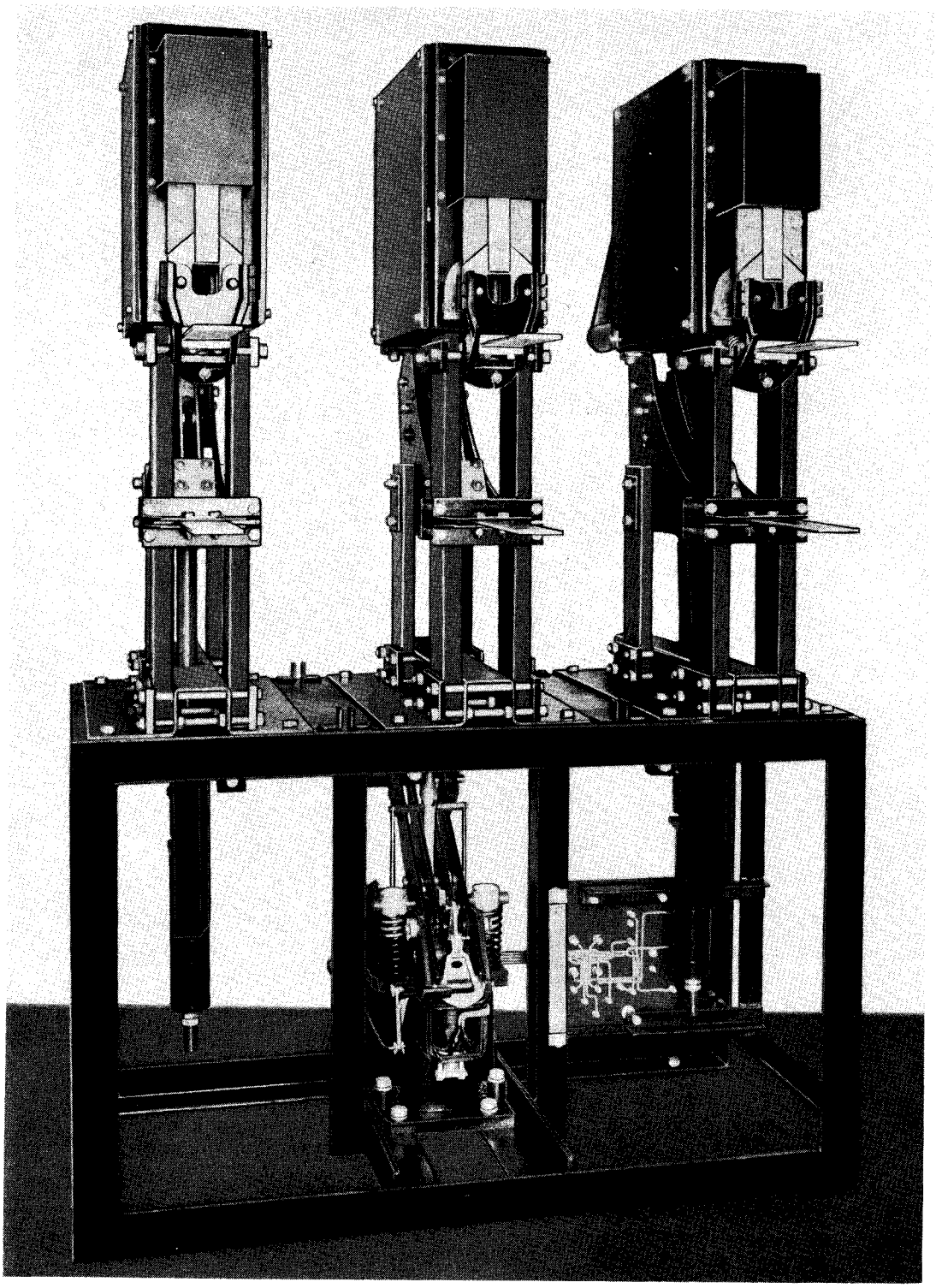

Figure 13
Type 150-U-12 "De-Ion" Three Pole Air Circuit Breaker
(Rear View)

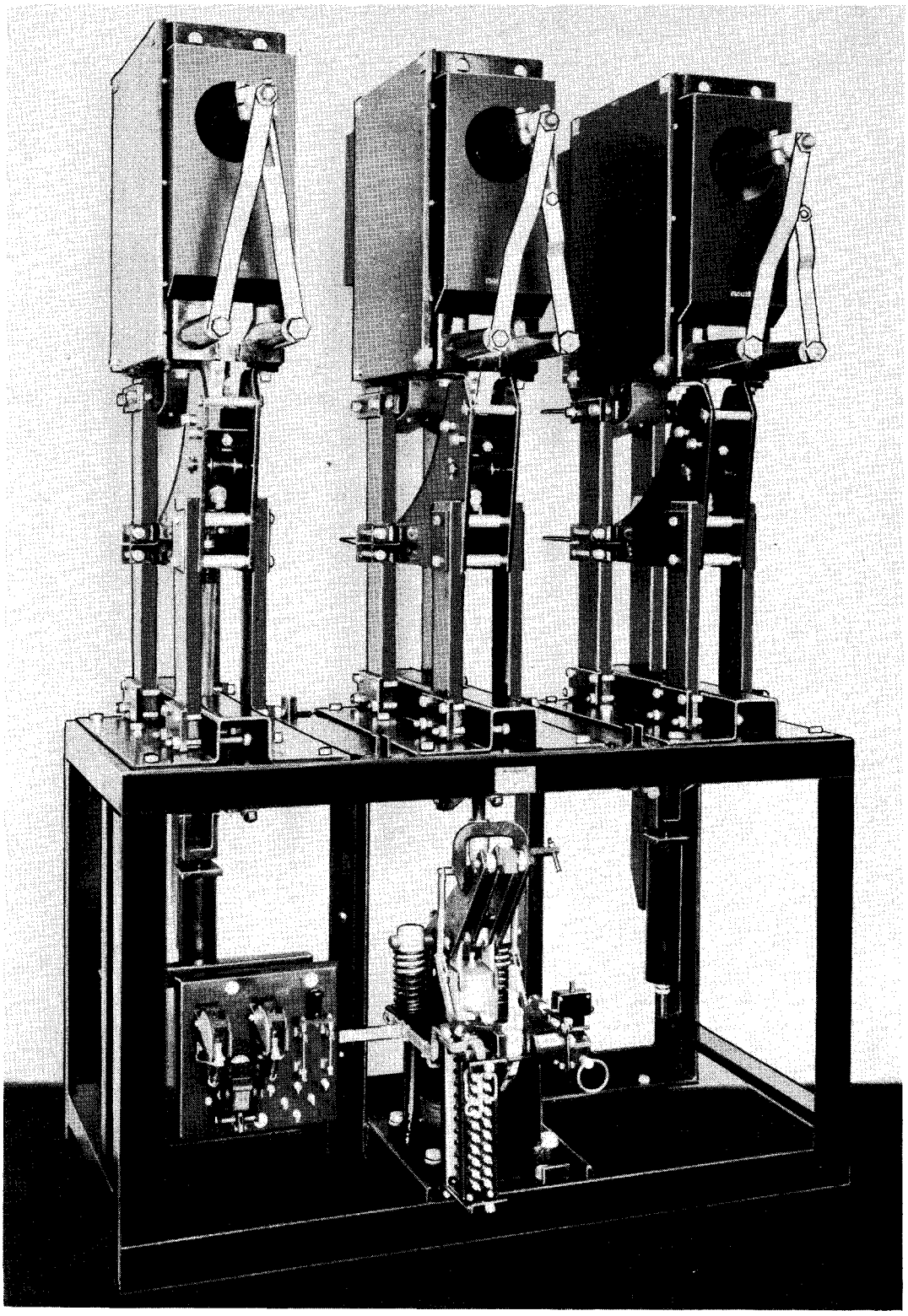

Figure 14
Type 150-U-22 "De-Ion" Air Circuit Breaker
(Front View, with SAF-4 Mechanism)

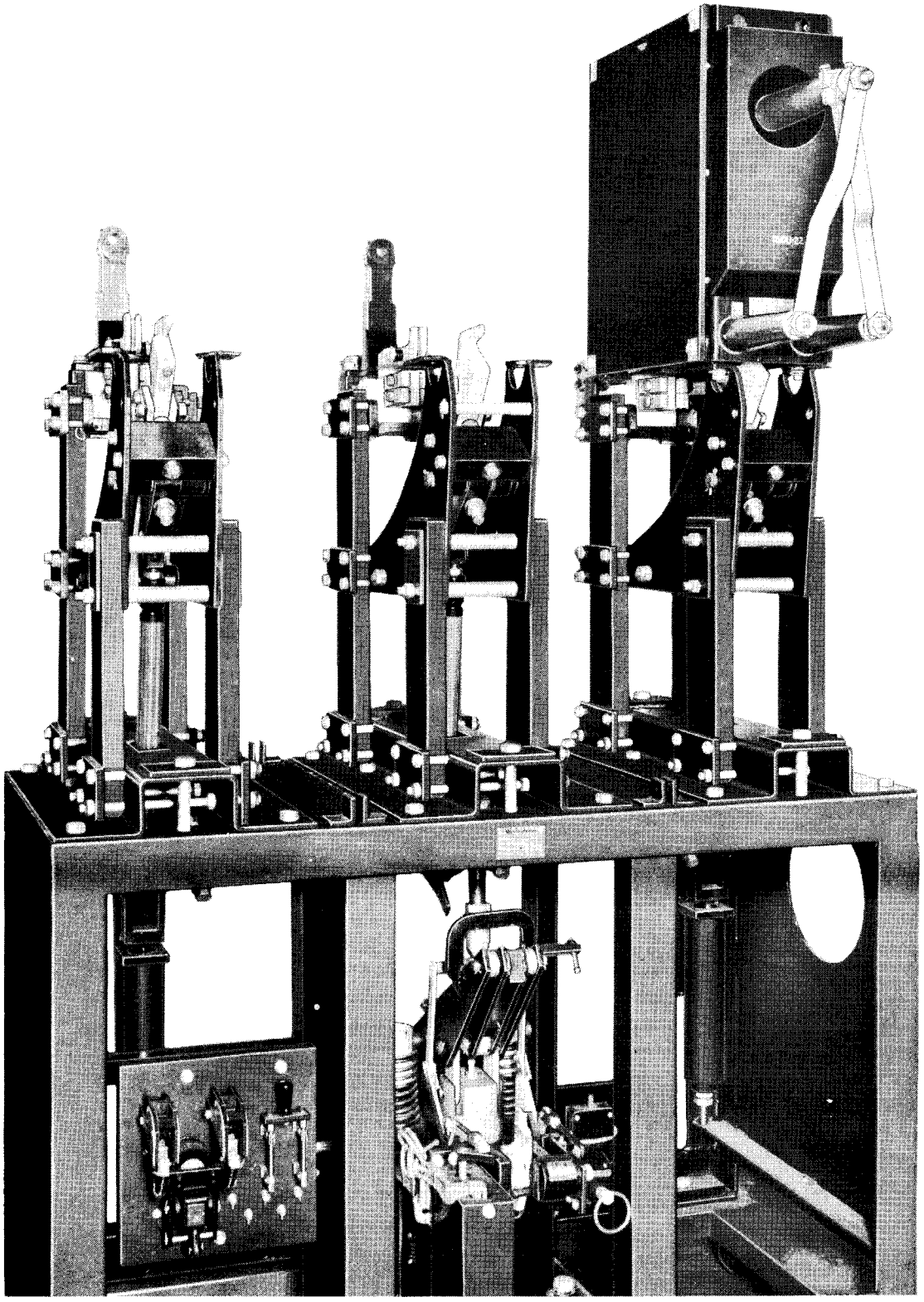

Figure 15
Type 150-U-22 Air Circuit Breaker
(Front View, Two Arc Chutes Removed)

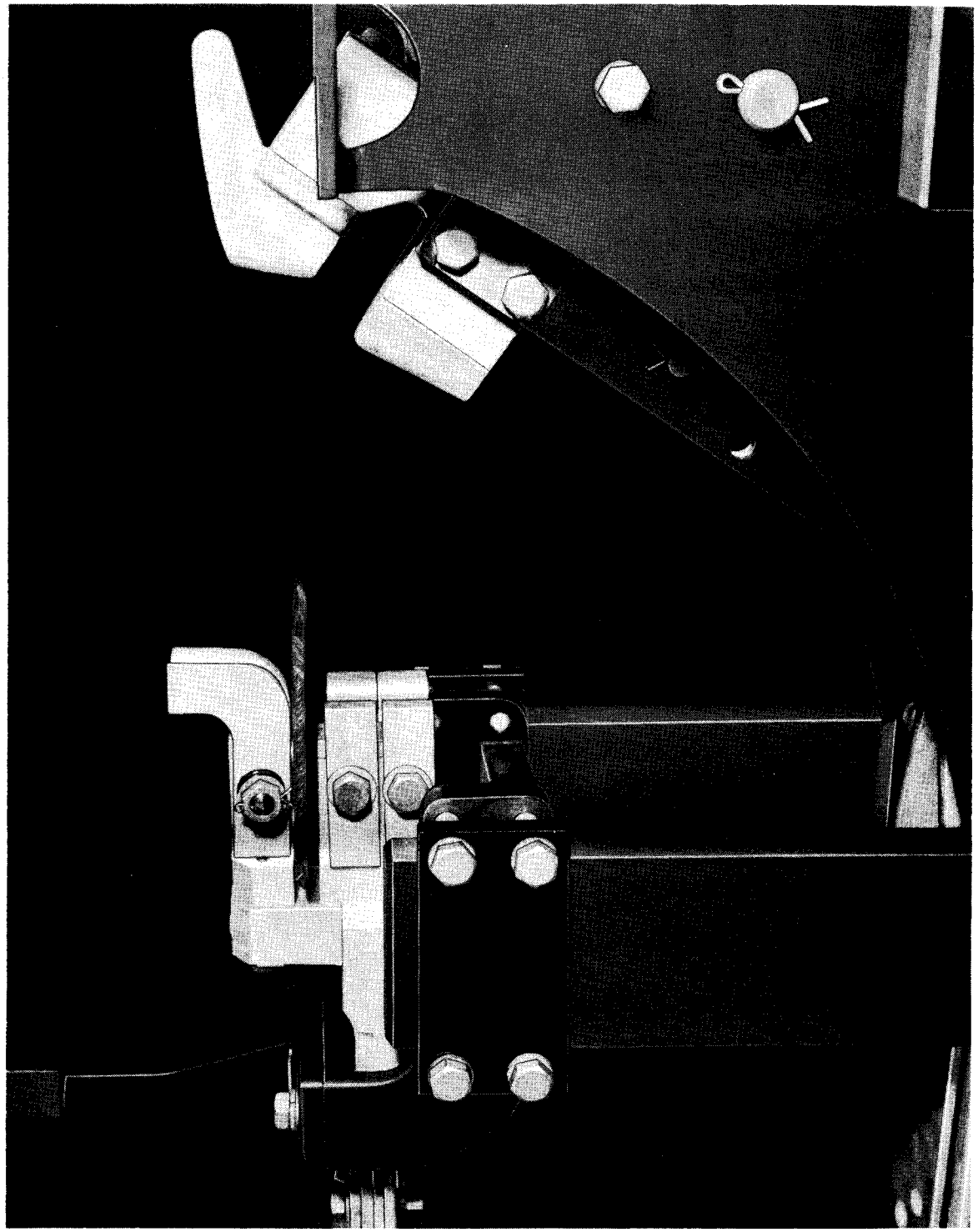

Figure 16
Side View, 1200 Ampere Contacts-Arc Chute Removed