15 KV FSP LOAD INTERRUPTER SWITCH

INSTRUCTION BOOK

I.B. 32-251-12

SWITCHGEAR DIVISION

WESTINGHOUSE ELECTRIC CORPORATION

EAST PITTSBURGH, PENNA.

(c) Pull switch toward front of cell until rail latch engages slot in rail. Switch is then secured in disconnect position.

(d) To withdraw switch completely from cell place tip of your shoe under latch marked "LIFT TO UNLATCH" and tilt or lift your shoe to unlatch and pull switch slightly to move switch out of the cell and beyond the disconnect position. (See Fig. 6)

(e) Pull switch completely out of cell.

SWITCH DETAILS

DOLLY BRACKET (See Fig. 8)

The combination of the dolly and dolly bracket enables the interrupter switch to be readily maneuvered and readily transported outside of the cell providing the floor is relatively smooth. The dolly should not be used to insert or remove the switch from the cell as interlocks may be defeated.

The switch dolly handling bracket is located in the center of the bottom, front cross brace. When not in use, it is pushed backward within the confines of the switch and out-of-the-way. In use, pull this bracket forward as far as it will come. Place the vertical pin of the portable dolly in the hole in the dolly bracket by tilting the dolly handle sharply toward the switch. Pull the dolly handle downward until the front wheelsof the switch lift off the floor. The switch can now be steered by horizontal movements of the dolly handle.

PADLOCKS

SWITCH POSITION PADLOCK - (See Fig. 9) The switch can be padlocked in the closed or open position. This is accomplished by padlocking the handle casting to suitable lugs on the front panel.

PADLOCK IN CONNECTED POSITION - (See Fig. 7) Placing the padlock through the hole in the protruding levering-in shaft prevents engagement of the shaft by the levering-in crank and effectively locks the switch in the connected position within the cell.

INTERLOCKS

FLOOR INTERLOCK - This interlock prevents closing the switch while it is levered into or out of the connected position. (See Fig. 10) In operation, the rear end of the switch shutter operator is pushed upward by the cell floor cam when the switch is moved toward the connected position or moved from the connected position. The lifting of this switch shutter operator, through its connected linkage, lifts the switch shutter upward such that its (red painted) surface covers the handle casting to prevent insertion of the operating handle. The floor cam and linkage holds it in this position as long as the switch is not at one of its limits of travel. When the switch is completely within the cell in its connected position or when out of the cell at its disconnect position or beyond, the switch shutter operator drops off the cell floor cam and the switch shutter drops, exposing the handle casting for insertion of the operating handle.

SWITCH INTERLOCK - This levering interlock is designed to prevent moving the switch into or out of the connected position if the switch contacts are in the closed position. The switch operating shaft which controls the switch position (closed or open) is interlocked with the levering-in shaft which controls the movement of the switch into or out of the connected position. (See Fig. 11)

When the switch is closed, the linkage connecting these two shafts allows a spring biased locking key to firmly press on the surface of the levering-in shaft. This shaft contains a slot or keyway such that when the shaft is rotated, this slot becomes aligned with the locking key which then is spring forced into the slot and effectively prevents further turning of the shaft and the switch is immobile. The levering-in shaft may be left in any position so that the keyway may not line up with the key. However, since the key is pressing against the shaft, it will snap into the keyway

on the first rotation of the shaft as the keyway comes into line with the key. Thus, the levering-in shaft cannot be rotated any further and no more movement of the switch can occur as long as it is in the closed position.

If you try to turn the levering-in shaft as hard as possible while the switch is closed, the spring biased locking key may distort or break.

If the key is broken or distorted, it should be clear that the switch must be opened before it is withdrawn and the damaged key must be replaced.

LEVERING DEVICE

The main parts of the device are:

1. The nut.
2. The guide tube.
3. The levering shaft.
4. The levering interlock.

These are a part of the switch assembly. The nut is fastened securely to the guide tube and is housed in a casting fastened to the extreme rear of the switch.

The basic operation is for the nut to turn onto the screw which is mounted on the rear wall of the cell. Since the nut is securely fastened to the switch, it pulls the breaker into the fully connected position.

The levering device guide tube is slotted lengthwise for a distance about equal to the travel of the switch. The levering shaft has 2 rectangular hardened keys welded to it which slide in the guide tube slot. Thus, as the levering shaft is rotated, the guide tube and nut are also rotated. As the nut consequently moves on the screw, BY CLOCKWISE ROTATION, the screw extends farther toward the front of the switch, pushing the levering shaft with it. Consequently the levering shaft stands still relative to the screw and other cell parts, including the door. Thus, the end

of the levering shaft is always the same distance behind the door, whether the switch is in the disconnect or connected position, or in between.

As the switch continues to be levered in, the keys on the levering shaft move toward the end of the guide tube slot. As the rear key comes out of the slot, the levering shaft turns freely and the switch moves no further. The end of the guide tube is shaped like a steep-pitch one-turn screw thread so that when the levering shaft is rotated counterclockwise, the rear key will catch and enter the slot, and rotate the guide tube and nut, and the switch will be withdrawn.

CODING PLATES - (See Fig. 12)

The Type FSP Interrupter Switch is available in many ratings and must be coordinated with a specific metal clad cell in a switchgear line-up. Consequently, the interrupter switch is keyed to assure that it is installed in its proper cell. If an attempt is made to install a switch in the wrong cell, an interference occurs between the switch code key and the cell code plate that prevents further entrance of the switch into the cell.

RAIL LATCH - (See Fig. 6)

The purpose of the rail latch is as follows:

1. The rail latch prevents accidental damage to the cell levering-in device screw or the nut on the switch. Without this rail latch, the screw and possibly the nut would be damaged if the switch were pushed into the cell so as to bump the nut hard against the end of the screw.
2. The rail latch holds the switch in the disconnect position.

The rail latch has two catching dogs, one on each side of the pivot, which can engage notches on the guide rail. A spring normally holds the front dog down against the rail so that as the switch is pushed into the cell, the front dog will drop into the rear notch and prevent further movement.

When it is desired to lever the switch into the connected position, the rail latch is disengaged by upward pressure of your toe against the LIFT-TO-UNLATCH lever and the switch is pushed 1/4 to 3/8 inch so as to get the levering device nut against the screw.

When levering the switch out, it should be pulled slightly forward after the nut has run off the screw, to engage the rail latch. The rail latch must be released to withdraw the switch from the cell.

HATCHET LEVER ASSEMBLY

Mounted in front of the primary main contact supports (in the cell) are molded polyester stationary barriers and a vertically moving polyester cell shutter that prevents access to the cell studs when the switch is withdrawn. A hatchet shaped operating lever is pivoted to the side of the cell and linked to the cell shutter. A roller on the switch engages against the cam surface of the hatchet lever when the switch is levered into the connected position. The associated linkage causes the shutter to rise vertically to expose the cell studs which are now ready to receive the finger clusters of the levered-in switch.

When the switch is levered out of the connected position the shutter drops by gravity and prevents access to the cell studs. The barrier and shutter (when closed) provide a physical barrier to the main contacts which may be "ALIVE".

Removing the shutter exposes the molded polyester barriers and contacts. DO NOT REMOVE OR MANUALLY LIFT THE SHUTTER UNLESS THE MAIN CONTACTS ARE DEAD.

The interrupter switch cell has a distinctively designed hatchet lever and the circuit breaker cell has its own distinctively designed hatchet lever. The interrupter switch cannot be levered into the circuit breaker cell and the circuit breaker cannot be levered into a switch cell.

GROUND CONTACT

Connected to the rear of the switch is a heavy-duty finger type contact that clamps to the ground contact in the cell. This effectively grounds the frame and covers of the switch. (See Fig. 1)

HANDLE STORAGE (See Figure 13)

The operating handle is required whenever the switch is closed or opened. It is also used during the maintenance procedure. For ready access, this handle can be stored in the special mounting area located at the bottom of the front panel.

DETAILED SWITCH OPERATION

BASIC SWITCH DESCRIPTION

The following basic components make up the 15 KV Type FSP Interrupter Switch.

FRAME - The switch is assembled as a single mobile unit having four integral wheels that engage with guide rails in the stationary metal clad cell. This frame supports porcelain post insulators which in turn support the blade assembly of each phase. The frame further supports the operating mechanism, the trip mechanism, the interlock safety system, the fuse system with their porcelain post insulators, the levering-in device, the dolly bracket and the isolating barriers. All are integrated to provide easy access for switch inspection and fuse replacement.

MAIN BLADES AND JAWS - The switch blades, main contacts, hinges and break jaws are all constructed from hard drawn copper. To protect against erosion from the heat of the arc during possible fault closing, the stationary break jaws are provided with a copper-tungsten arcing tip and the moving blades are provided with copper-tungsten arc buttons. The contact surface areas of all current carrying components are silver plated.

LOAD INTERRUPTER - A spring-loaded flicker blade and engaging stationary, tungsten-tipped, contact fingers located inside a "De-ion" arc chute comprise the load interrupter function of the switch. The main blades open first and the current shunts through the still closed, spring-loaded flicker blades. Further travel of the main blades causes the flicker blades to snap out of their stationary fingers. The subsequent current arc is drawn within the confines of the "De-ion" arc chute.

Positive load current arc interruption is accomplished by the de-ionizing action of the arc chutes in combination with the high speed opening of the spring loaded flicker blades.

OPERATING MECHANISM - Porcelain drive rods connect and insulate the main contact blades to the switch shaft. Partial rotation of this shaft imparts an equal push motion to the three porcelain drive rods to close the switch or imparts a pull motion to these rods to open the switch. The source of power to rotate the operating shaft comes from a compressed spring which acts on a driving rod connected to the spring lever which in turn is rigidly connected to the operating shaft.

QUICK-MAKE,QUICK BREAK - To initiate the closing action, a removable handle is inserted into the handle casting which is then rotated upward through an angle of 120°. This charges the heavy duty compression spring and as the spring lever snaps over toggle the stored energy of the spring is immediately transferred to the shaft which slams the switch closed. This quick-make mechanism has sufficient power to overcome the blowout forces which occur when the switch is closed against a fault condition. The forces from the short-circuit as well as from the mechanical forces of normal operation are not transmitted to the operating handle as it is not rigidly connected to the moving contact blade mechanism. Therefore, it is SAFE to close the switch under short circuit conditions within its rating. When the switch is not closed against a fault, the excessive closing force of the mechanism is not transmitted to the stationary contacts and supporting insulators but is absorbed by an adjustable stop mechanism (See Fig. 3)

Similar conditions prevail when initiating the opening action. The handle is rotated downward through 120°, the spring charges, goes

over toggle, and the switch snaps open.

NOTE: After the switch has closed (or opened), the operating handle must be removed from the handle casting and replaced in its storage area below the front panel, (See Fig. 13)

"DE-ION" ARC QUENCHING

Fig.14a - The flicker blade is connected to the side and parallel to the main blade. When the switch is closed, practically all the current flows through the main blade.

Fig.14b - As the main blade separates from the main break contact, the current is transferred to the flicker blade which is restrained in the arc chute by the high pressure contacts within the arc chute. Once the maximum angular movement between the flicker blade and main blade has been reached, the flicker blade starts to move out of the arc chute contacts within the arc chute.

Fig.14c - The combined pull of the torsional spring on the flicker blade assembly and the main blade operating mechanism snaps the blade into an open position at high speed. The heat of the arc releases a blast of deionizing gas from the gas generating material of the arc chute chambers. This combination of quick-break and De-ion action quickley extinguishes the arc and the circuit is safely de-energized.

NOTE: The position of the switch can be viewed through the high impact safety window mounted in the top front cover. Do not observe the current arc interruption through this window.

MAINTENANCE

NOTE: The interrupter switch must be removed from the cell for inspection and maintenance. Access to the switch parts is prevented by the two front panels which can only be removed when the switch is outside the cell.

INSPECTION SCHEDULE

It is recommended that each switch be inspected after 24 months of service or after approximately 100 rated current interruptions, whichever occurs first. When the current interrupted is smaller than rated, the duty is proportionally lighter and more operations may be allowed before inspection. After the switch has been closed against a fault current, it should be inspected at the first opportunity at which it can be de-energized and removed from the cell. Inspections should be conducted as listed below.

(a) Check main blade contact pieces and the edges of the flicker blades for arc erosion.

(b) Check the engagement of the flicker blades - first, place handle in the handle casting and close the switch. Now, insert the handle in the blade alignment (maintenance) lug (See Fig. 3) on the shaft and slowly open the switch. The flicker blades should remain engaged in their contact fingers while the main blades open. When the main blades clear the break jaws, they will hit the stop on the flicker blade support brackets and start the flicker blades out of the station arm contact fingers. The flicker blades will then snap open from the forces in their charged torsional coil springs. Slowly release the pressure on the handle and the switch will return to the closed position. Do not release your hold on the handle until the switch is closed.

(c) Check barriers for carbon or metallic deposits. Replace the barriers if deposits appear excessive.

(d) Inspect arc chute sides and replace them if they are damaged.

(e) Replace worn or damaged parts of the flicker blade assembly.

(f) Arc chute must be dismantled in order to examine condition of arc chute.

(g) After a fault closing operation it may be necessary to clean up the arcing contacts. This may be done with a few light strokes of a fine file. It is only necessary to remove sharp and high points; no attempts should be made to file out the pit marks. DO NOT USE abrasive material for cleaning.

(h) CLOSE AND OPEN THE DE-ENERGIZED SWITCH AT LEAST THREE (3) TIMES TO CHECK THE PERFORMANCE OF THE OPERATING MECHANISM.

NOTE: The main current carrying contacts should not be filed. Opening and closing of the switch will clean the contacts. However, if there is evidence of excessive burning, the main blade and hinge assembly together with the break jaw should be replaced.

MAIN BLADE ALIGNMENT (See Fig. 4)

Method #1 - Loosen the four bolts holding the hinge terminal to the porcelain post insulator. Loosen the two bolts holding the jaw terminal on the insulator. Insert the operating handle in the blade alignment maintenance lug on the shaft and close the switch. For safety purposes, the switch will not fully close and will revert to the open position if the pressure on the handle is released. Do not release your hold on the handle until the switch is returned to the open position. Hold the switch in the closed position and check that the upper spacer of the main blades are approximately 3/16 inch

above the bottom of the break jaw blade stop. If not, the jaw blade can be moved vertically by loosening the bolts supporting the rear of the post insulator. This insulator and jaw can be adjusted vertically to obtain this 3/16 inch distance. When obtained, tighten the four bolts. Then check that the main blade closes symmetrically and is centered on the jaw break terminal. First, move the jaw left or right until the fit is correct and tighten the jaw terminal bolts. Second, adjust the main blade parallel to the jaw break terminal by loosening the four bolts on the pedestal supporting the blade assembly (See Fig. 4) and slightly rotate the pedestal to achieve proper alignment. Recheck and realign until satisfactory.

Method #2 - Remove the porcelain operating rod from the associated shaft arm by loosening and removing the bolt and the lock-and-slip-proof spacers. Each pole can now be separately aligned by closing and opening the blade with the operating drive rod. The upper spacer of the main blades can be set to 3/16 inch gap and the blade-jaw alignment can be set as described in Method #1 above.

FLICKER BLADE AND ARC CHUTE ALIGNMENT - (See Fig. 4)

Loosen the two arc chute mounting bolts. Adjust the arc chute so that the arc chute opening is parallel to the main blade. Lightly tighten the arc chute mounting bolts. Using one of the procedures described above, slowly close the switch and check that the flicker blade is in line with the arc chute opening. If necessary, move the arc chute left or right until the flicker blade and arc chute line up. Tighten the arc chute mounting bolts and re-check the alignment. Repeat till aligned.

OVER OR UNDER TRAVEL OF MAIN BLADES - (See Fig. 4)

Close the switch using the operating handle or close each pole individually (Method 2). Check that the upper spacers of the main blades are approximately 3/16 inch above the bottom of the break jaw blade stop, adjust accordingly as explained previously in MAIN BLADE ALIGNMENT.

The blades should surround the break jaw such that the distance from the forward edge of the blade to the back surface of the jaw blade is 3.5 to 3.62 inches. (See Fig. 4). This can be adjusted by loosening the bolt holding the porcelain operating rod to the shaft arm. The blade can now be adjusted to the required distance by pushing or pulling on the blade.

NOTE: WHEN THE PROPER SETTING IS OBTAINED, TIGHTEN THE NUT ON THE OPERATING ROD ATTACHED TO THE SHAFT ARM. TIGHTEN TO 35 FOOT POUNDS. THIS "SETS" THE LOCK-AND-SLIP-PROOF SPACER AND PREVENTS FUTURE MOTION.

MAIN LEVER STOP ADJUSTMENT (See Fig. 3)

The top stop adjustment bolt (and lock nut) adjusts the open position and the bottom stop adjustment bolt (and lock nut) adjusts the close position. In the closed position the shaft arms should be slightly over toggle (5°), i.e., the toggle position would be the straight line position of the shaft arm and porcelain operating arm. In the open position the air gap clearance between the edge of the main blade and the break jaw should be 6-5/8 $\pm$ 1/8 inch.

FLICKER BLADE REPLACEMENT

To change a flicker blade, remove the two bolts holding the flicker blade to the flicker blade bracket. The switch must be in the open position. Remove the worn blade and replace with a new blade. Replace the two bolts and tighten the nuts.

To change a complete flicker blade assembly, remove the elastic stop nut from the bolt holding the assembly to the main blade. Using a box wrench or similar tool, hook the hole in the wrench over the torsion spring end and pull slightly forward and to the left until the spring end clears the stop post. Remove the wrench and pull out the bolt. The flicker blade assembly is now free. To install a new assembly, reverse the procedure. Don't forget to reinstall the nylon spacer. Be sure the brass spacer between the two copper bars making up the main blade is still there. Tighten the stop nut only enough to eliminate any wobbling of the assembly. Before the torsion spring is placed behind the stop post, a sideward movement of 1/16" should be present. Too much tightening will decrease this movement and cause friction which will slow down the action of the flicker blade. Using the same procedure for releasing the torsion spring end, put the spring end on the other side of the stop post.

MAIN CLOSING SPRING

To dis-engage the main closing spring, located along the right side, first remove the barriers. Take a 5/16-18 threaded rod 4" long and screw it into the rear end of the spring rod. Make a spacer 1.5" long from a pipe or tube with a 1.0" I.D. Put this over the 5/16" rod. Take a washer with an O.D. as large or larger than the O.D. of the spacer and with a clearance hole for the 5/16" rod and place this on the rod. Run a 5/16-18 nut down the rod and center the spacer. Tighten the nut until the tension on the pin at the front of the spring lever is released. Remove the washers holding the pin and remove the pin. The main spring assembly is now free from the shaft. To completely remove the spring assembly, remove the two bolts holding the L-shaped bracket to the side of the frame. To re-install the assembly, or to re-engage the spring rod, reverse the procedure.

MAIN BLADE, JAW AND HINGE ASSEMBLY

Disconnect the porcelain operating drive rod from the shaft arm as instructed in MAIN BLADE ALIGNMENT. Remove the four bolts holding the hinge assembly and terminal pad to the top of the insulator. The hinge, main blade and flicker blade are now free. Remove the two bolts holding the jaw to the insulator, replace with a new jaw, and replace and finger-tighten the two bolts. If the new hinge and blade assembly is equipped with a flicker blade assembly, mount the hinge end on top of the terminal pad and install the four bolts finger tight. Remount the used flicker blade assembly if the new hinge and blade assembly is not so equipped. Tighten the lock nut on the spring washer on the jaw end of the blade. When it is tight (using standard tools) back the nut off 1/4 turn. Set the main blade to an open position of approximately 45°. The weight of the blade should let the blade fall slowly open. If the blade fails to fall open, loosen the lock nut on the hinge spring washer until the blade slowly falls open. If the blade falls too fast, tighten the lock nut. Align and adjust as per MAIN BLADE ALIGNMENT AND FLICKER BLADE AND ARC CHUTE ALIGNMENT.

NOTE: After completing any alignment, the switch should be operated thru at least three "close-open" operations to insure proper performance of the operating mechanism.

MAINTENANCE CLOSING AND OPENING

The operating handle is also the maintenance handle and fits into the maintenance lug on the shaft (See Fig. 3) for hand closing and opening the switch. This operation is solely for the purpose of inspecting and adjusting the contacts or other working parts of the switch when slow motion is required. The

maintenance handle always operates to compress the heavy duty operating spring. Consequently, there is always an opposing force on the handle - ALWAYS RELEASE THE HANDLE SLOWLY BACK TO ITS ORIGINAL POSITION as the switch will not remain closed if it is closed with the maintenance handle nor will it remain open if it is opened with the maintenance handle.

CAUTION

THE MAINTENANCE LUG IS ACCESSIBLE ONLY WHEN THE FRONT PANELS ARE REMOVED. THE SWITCH MUST BE REMOVED FROM THE CELL. DON'T EVER ATTEMPT TO CLOSE THE SWITCH BY HAND AGAINST A LIVE CIRCUIT. PROPER CLOSING REQUIRES MORE SPEED AND POWER THAN CAN BE SUPPLIED BY HAND POWER. THE FRONT COVERS MUST BE MOUNTED PRIOR TO ENTRANCE INTO THE CELL.

AUXILIARY CLOSING SPRING

The auxiliary closing spring, located on the left side of the switch, remains charged (compressed) when the switch is open. As the switch slams closed, the stored energy of the auxiliary spring adds to that of the main spring. To disengage this auxiliary spring, close the switch and remove the pin that joins the auxiliary spring rod to the switch shaft (See Fig. 15)

SHAFT BEARING REPLACEMENT

(a) Remove barriers, front panel, operating mechanism safety pan.

(b) Disengage the main spring rod per STORED ENERGY SPRING.

(c) Disengage the operating drive rods from the shaft. Be sure to retain the lock-and-slip-proof spacers for reuse.

(d) Disengage the interlock linkages attached to the shaft.

(e) Disengage the auxiliary spring per AUXILIARY CLOSING SPRING.

(f) Remove the four bolts on the right side panel and the two bolts on the left side panel. These bolts support the shaft.

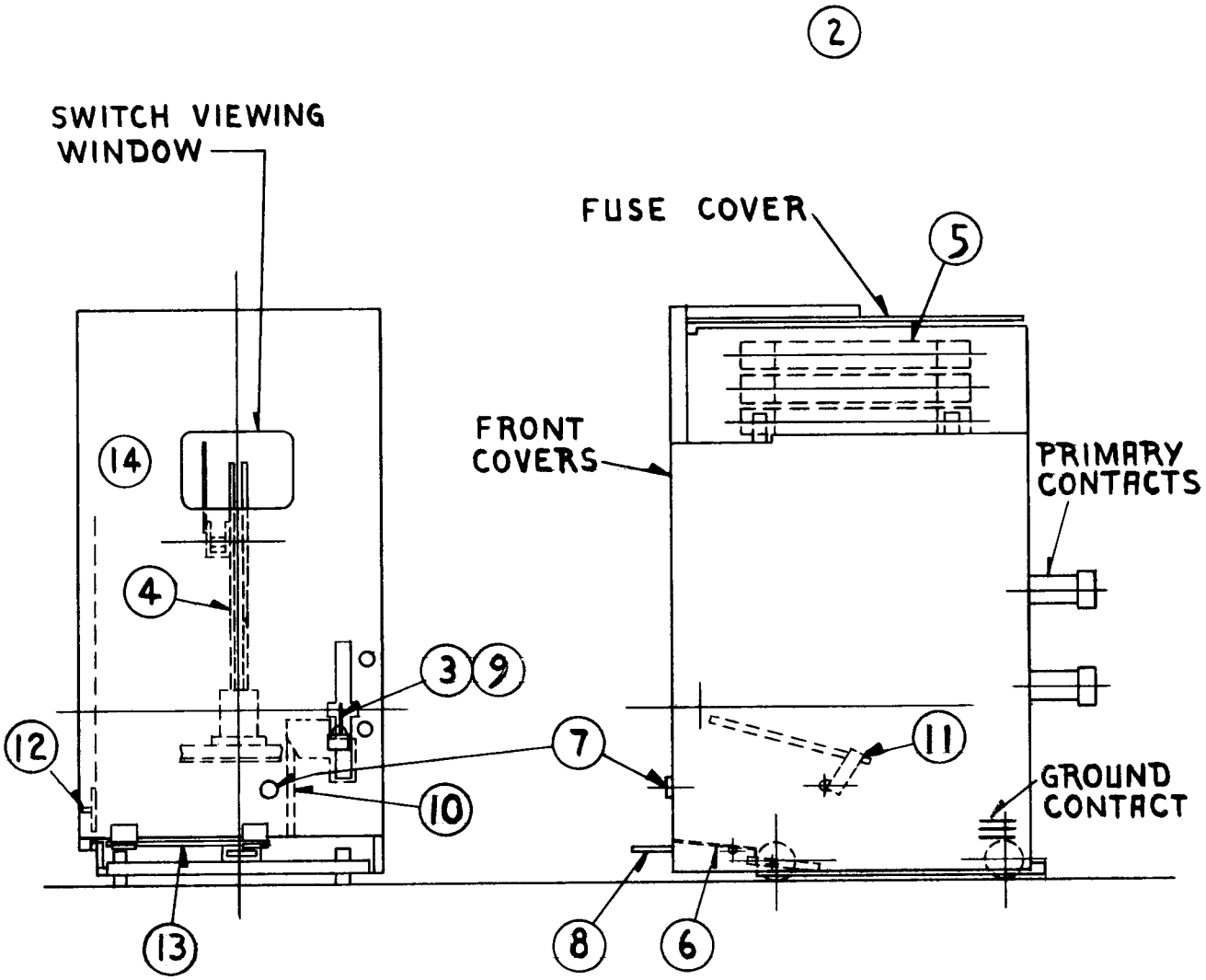
(g) Loosen the bolts holding the reinforcing tie bars.

(h) Slide the shaft and end brackets forward and out.

(i) Remove and replace bearings.

(j) To replace the shaft, slide the shaft and end brackets back into the frame. Install the four bolts on the right side and the two bolts on the left side. Tighten all bolts. Reconnect the linkage systems, springs, and other items initially removed. Check switch alignment and operation as discussed previously.

NOTE: After completing any alignment, the switch should be operated through at least three "close-open" operations to insure proper performance of the operating mechanism.



○ INDICATES FIGURE

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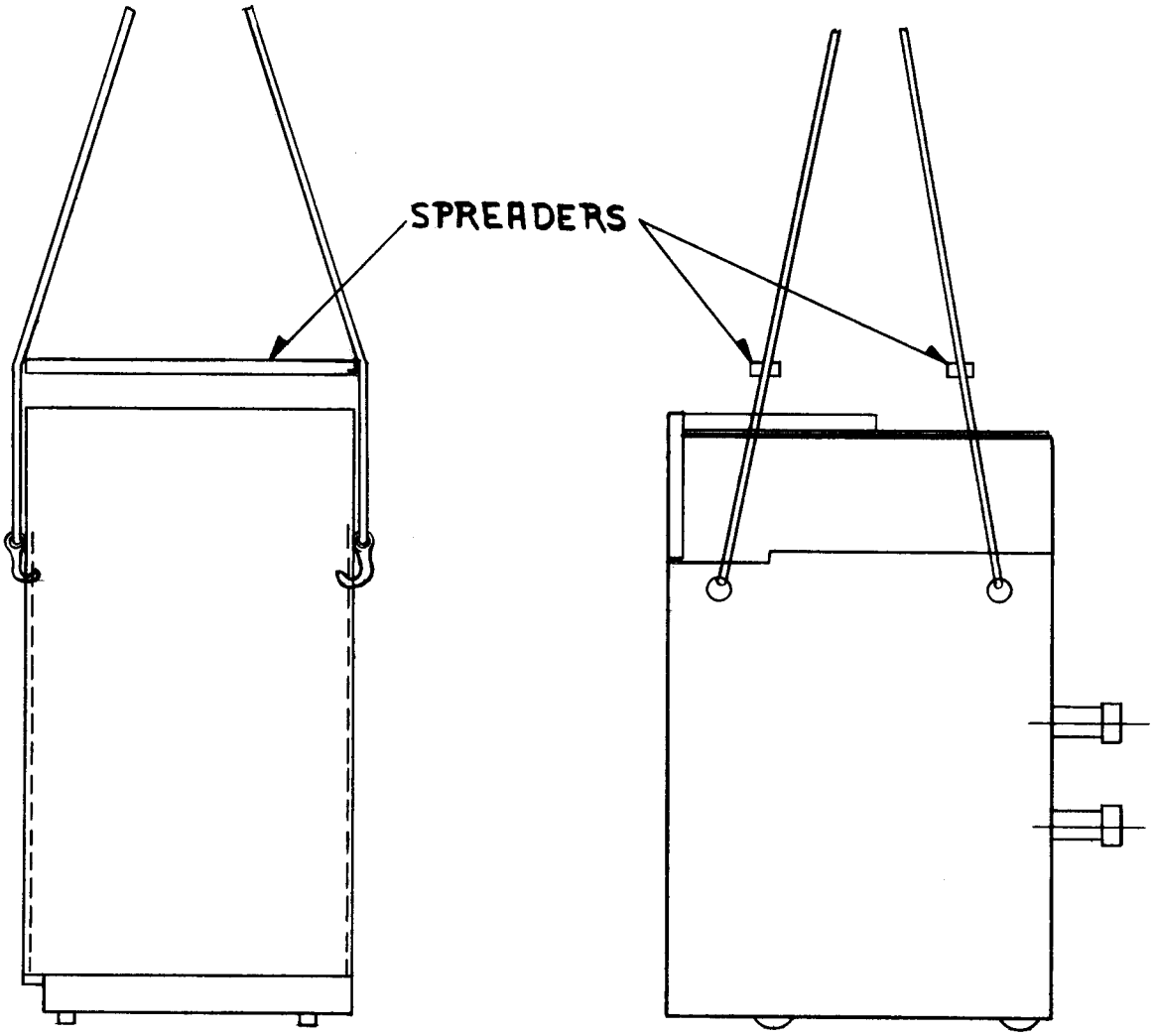
TITLE OUTLINE 15 KV FSP

DRAWOUT FUSED SWITCH

DIVISION

PLANT LOCATION

FIG. 1



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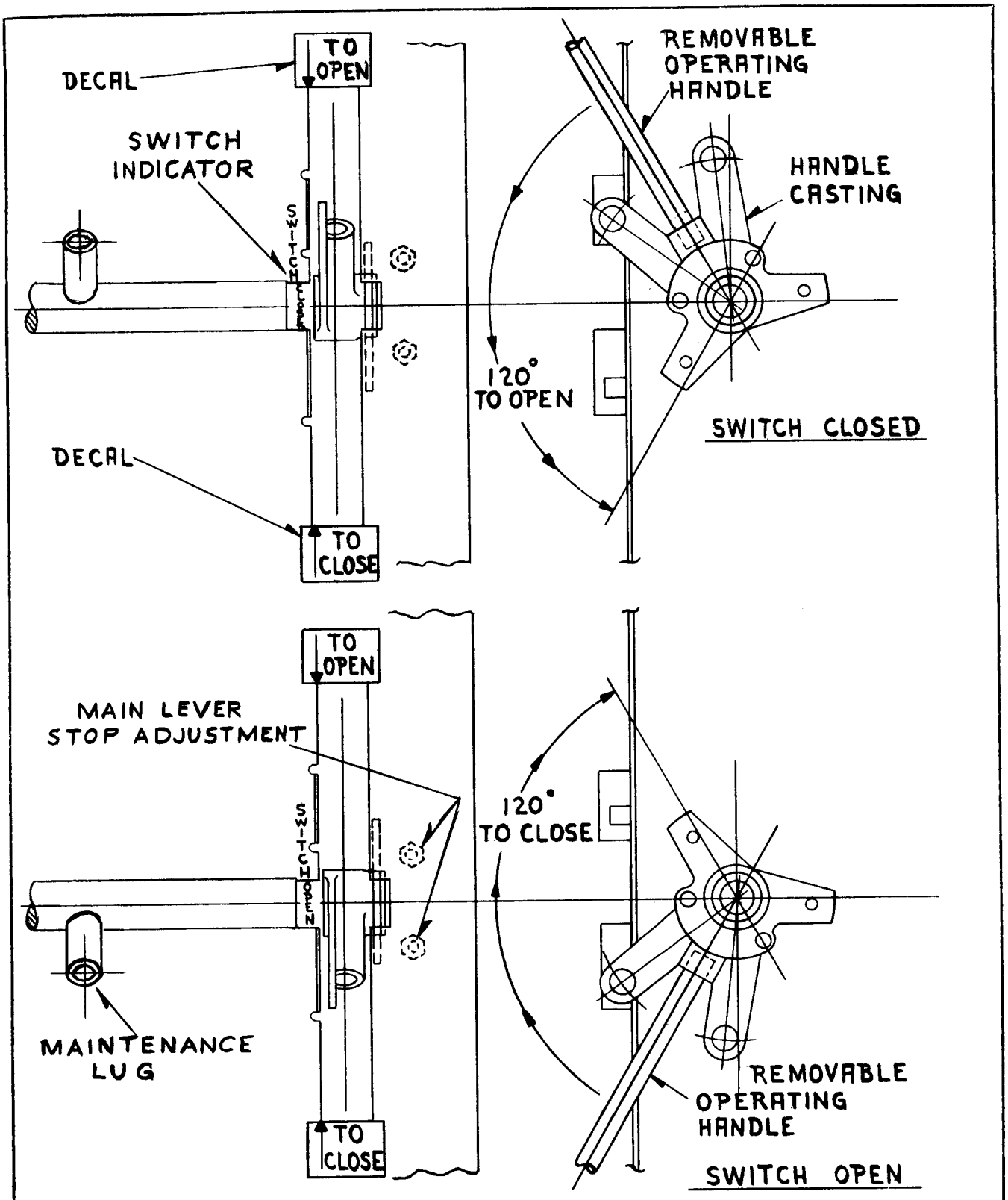
TITLE LIFTING INSTRUCTIONS

FIG. 2

DIVISION _____ PLANT LOCATION _____



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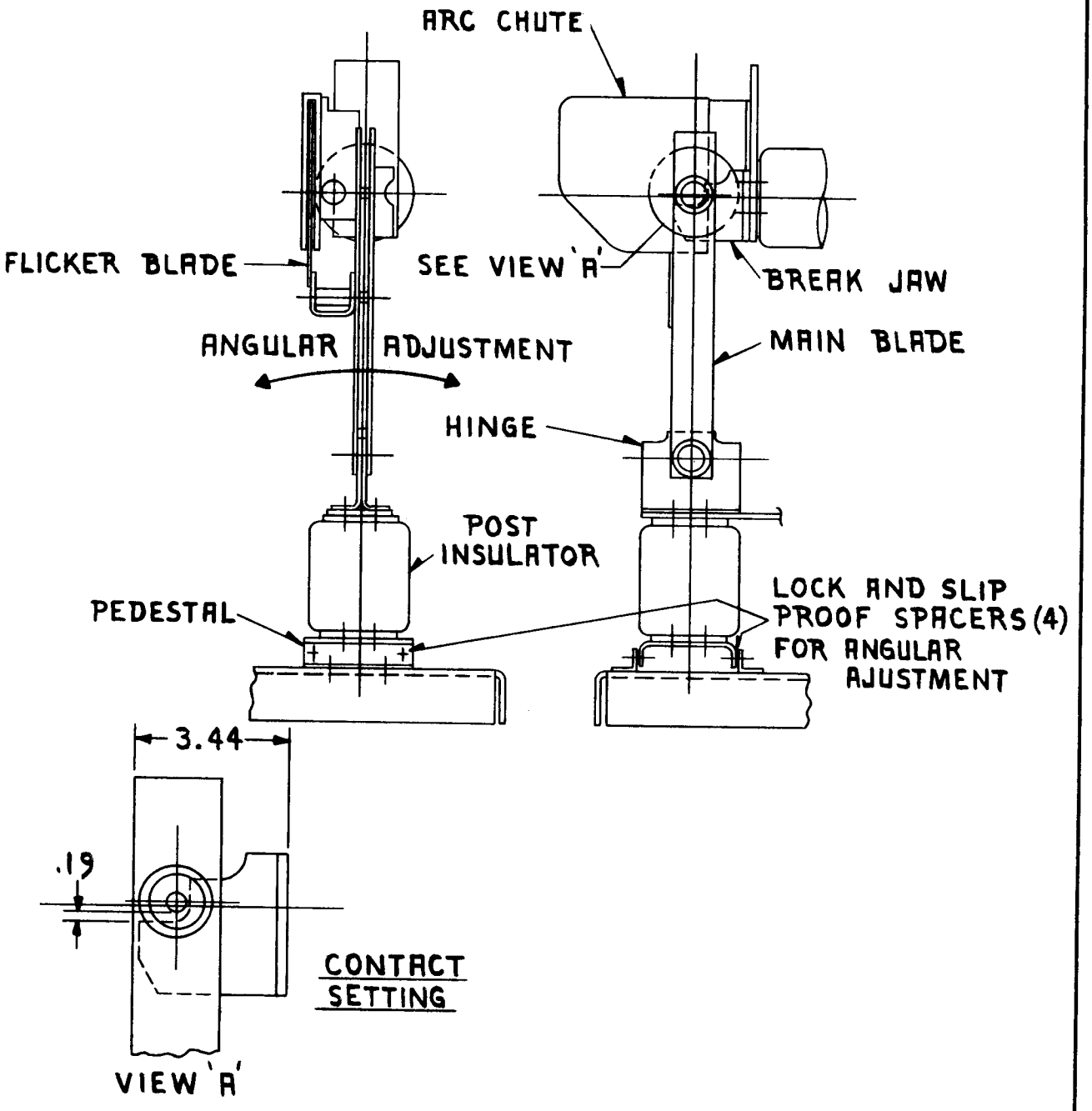
TITLE SWITCH OPERATION & DECAL LOCATION

FIG. 3

DIVISION _____ PLANT LOCATION _____



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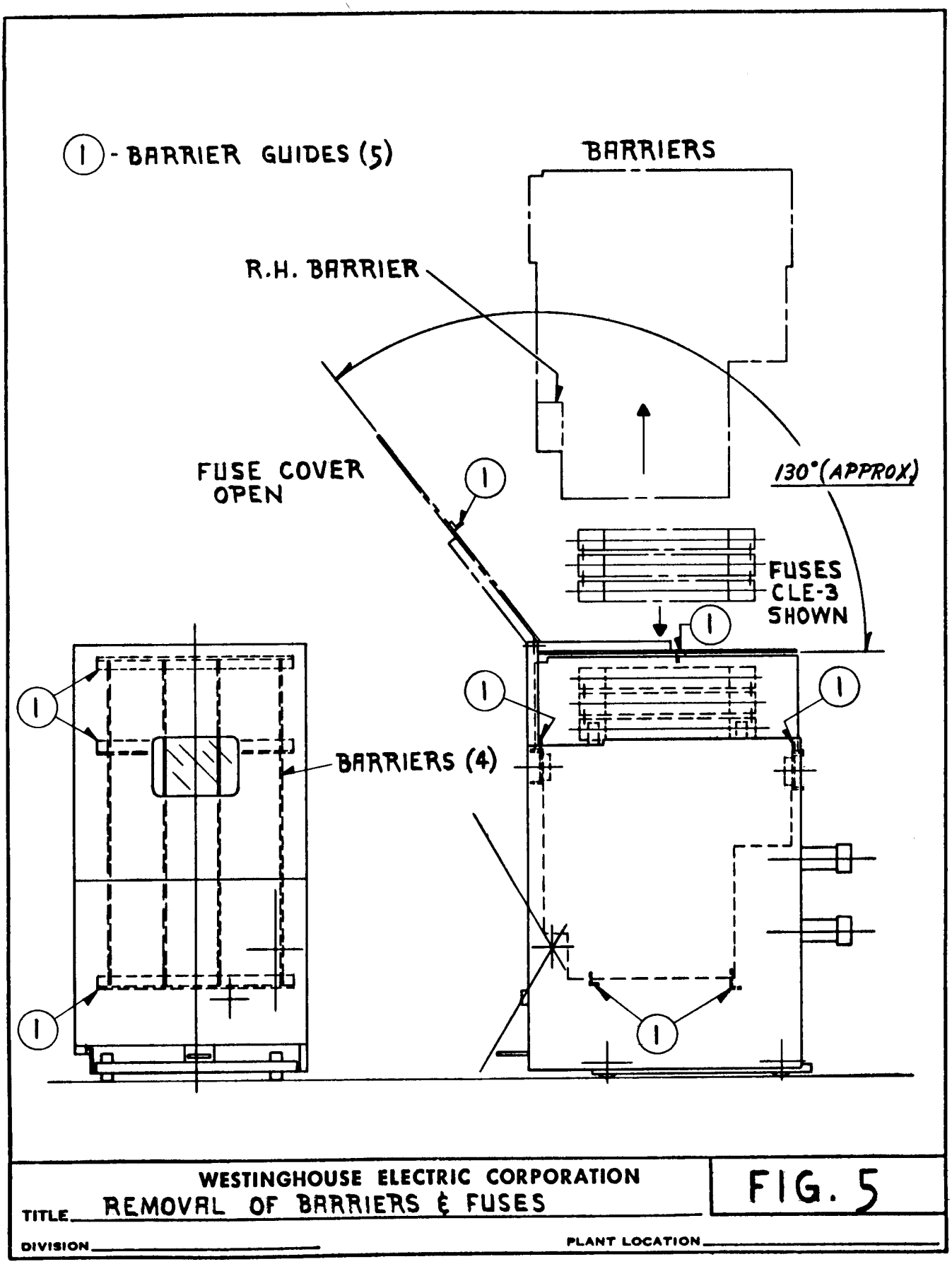
TITLE SWITCH ADJUSTMENT

FIG. 4

DIVISION

PLANT LOCATION



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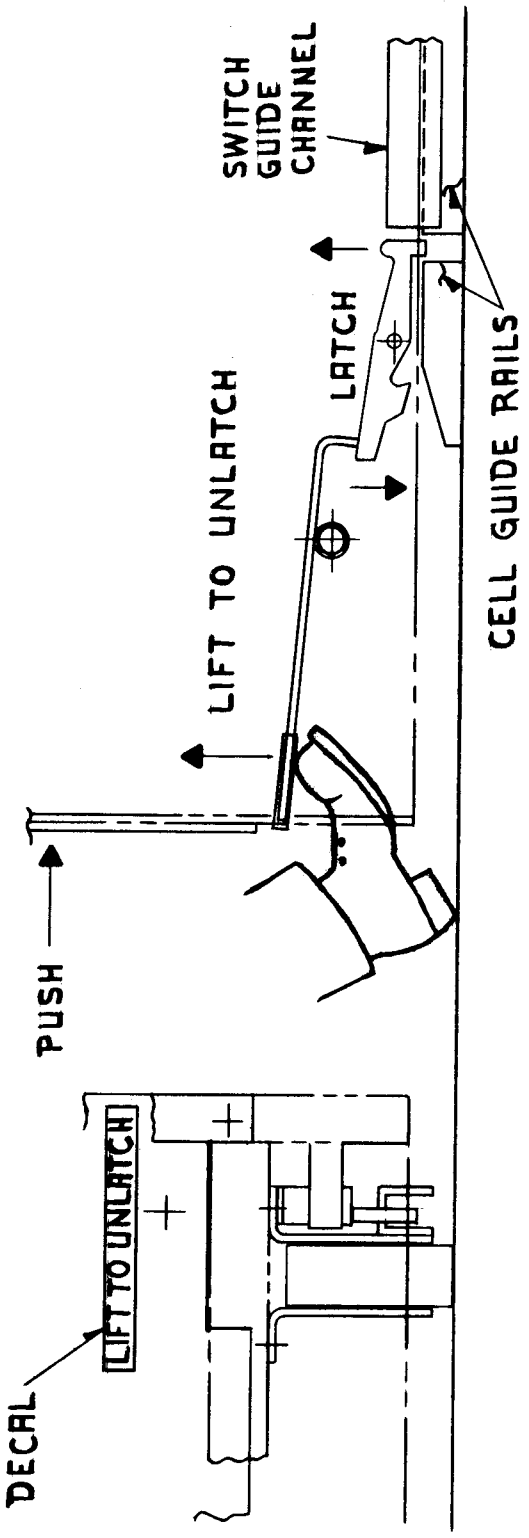
TITLE REMOVAL OF BARRIERS & FUSES

FIG. 5

DIVISION

PLANT LOCATION



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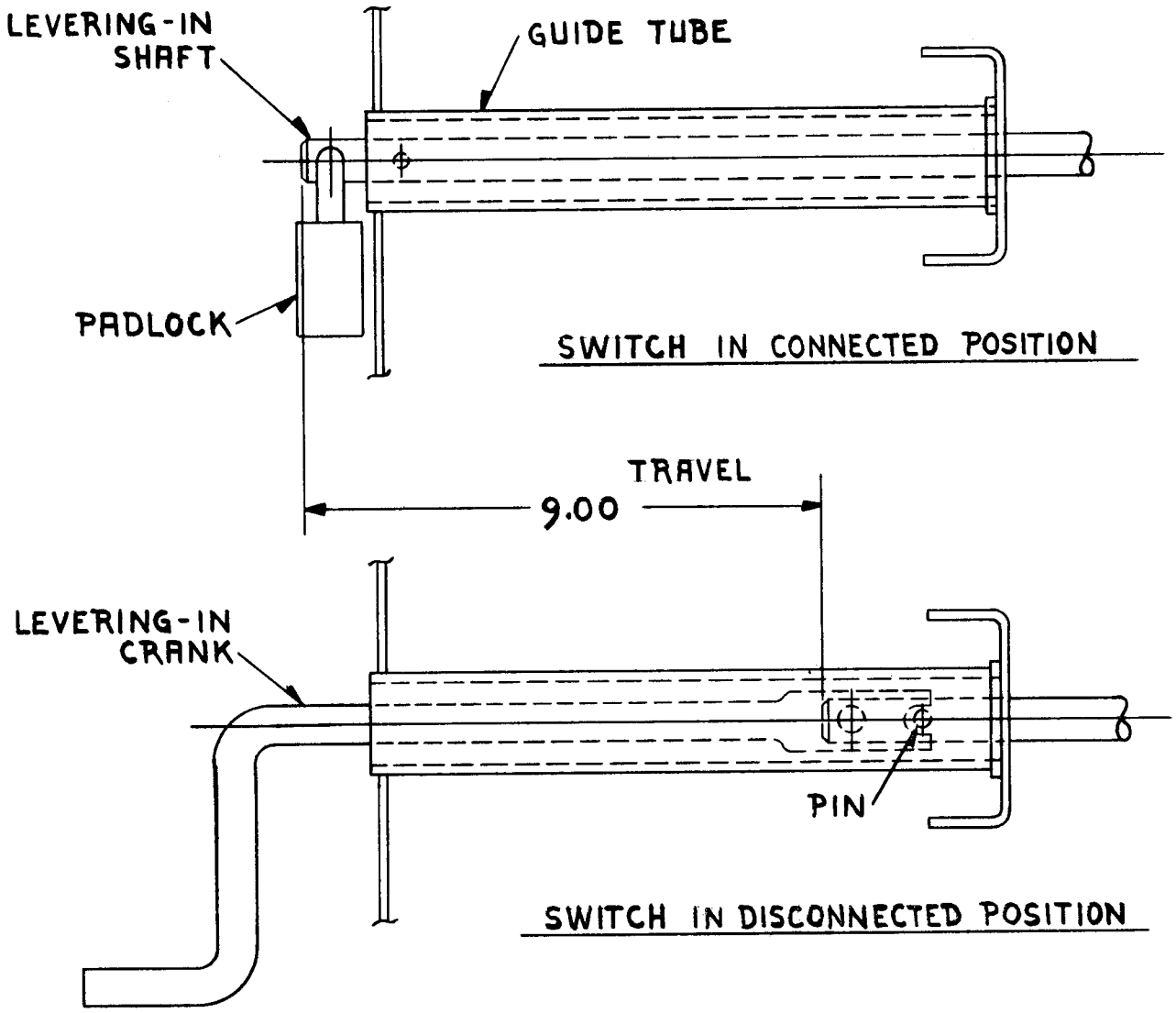
TITLE DISCONNECT POSITION LATCH

FIG. 6

DIVISION

PLANT LOCATION



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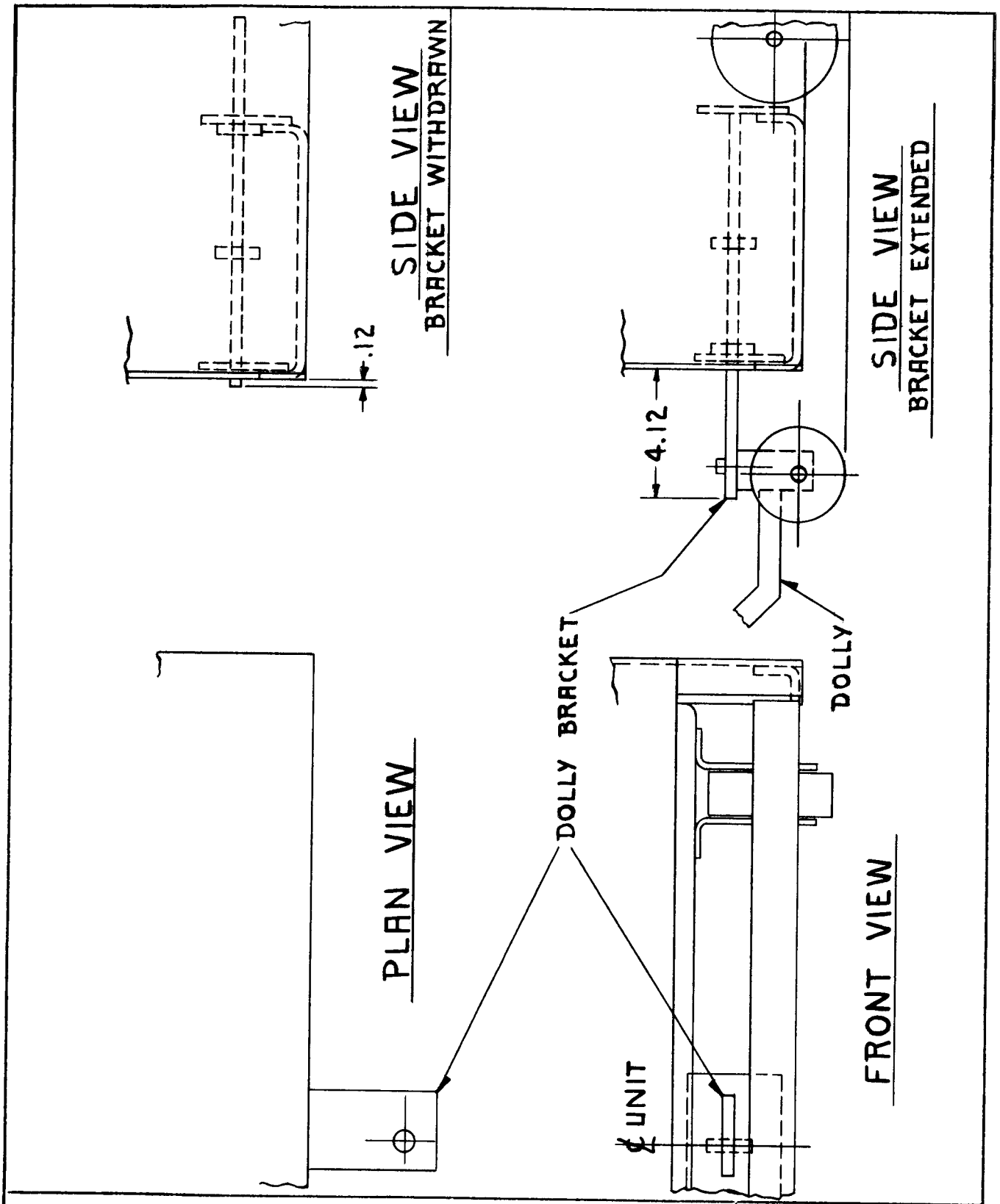
TITLE LEVERING-IN DEVICE

FIG. 7

DIVISION

PLANT LOCATION



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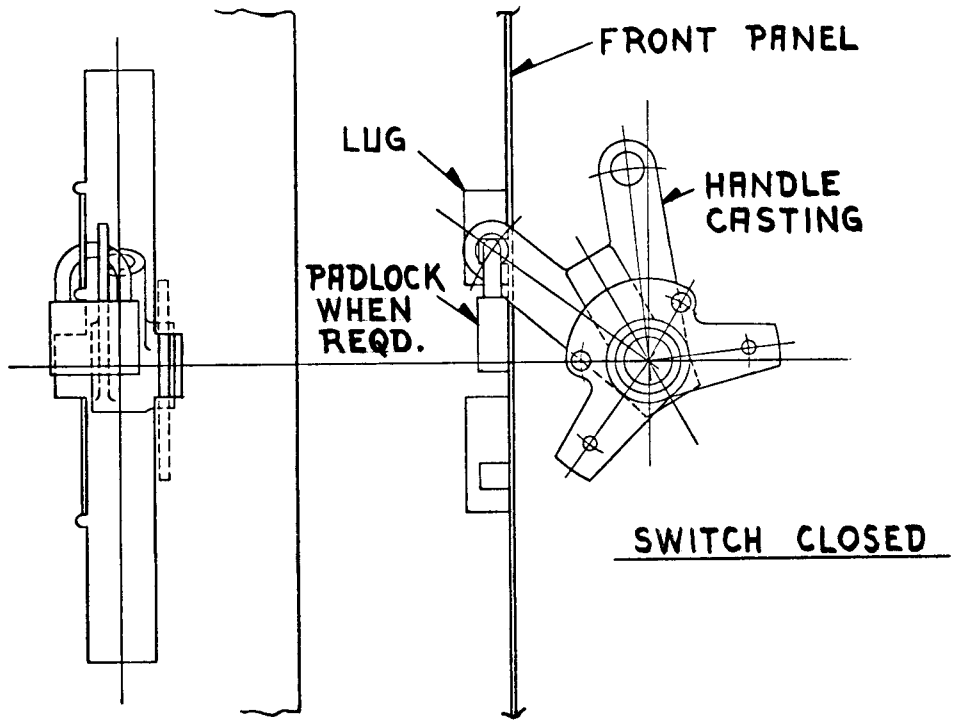
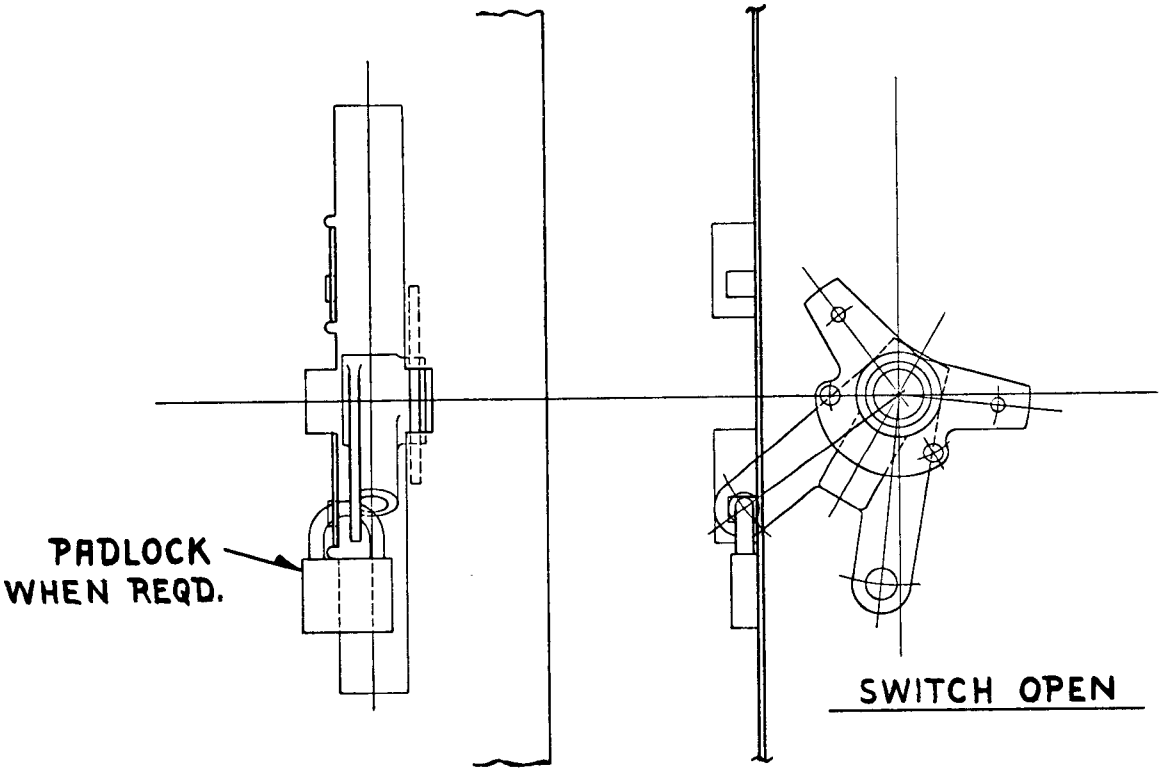
TITLE DOLLY BRACKET

FIG. 8

DIVISION

PLANT LOCATION





WESTINGHOUSE ELECTRIC CORPORATION

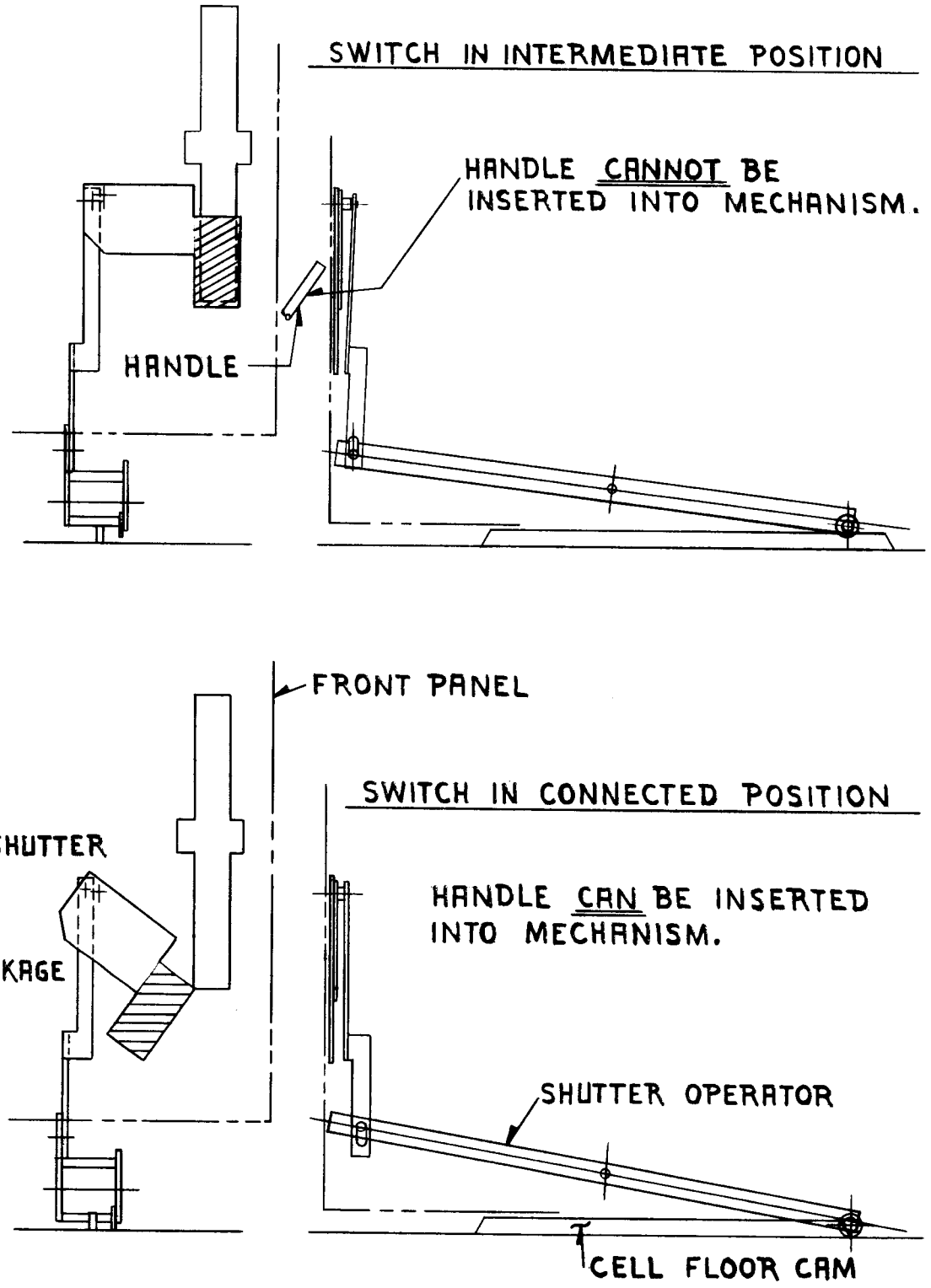
TITLE SWITCH POSITION PADLOCK

FIG. 9

DIVISION

PLANT LOCATION

S.O.	SUB.
D.	1



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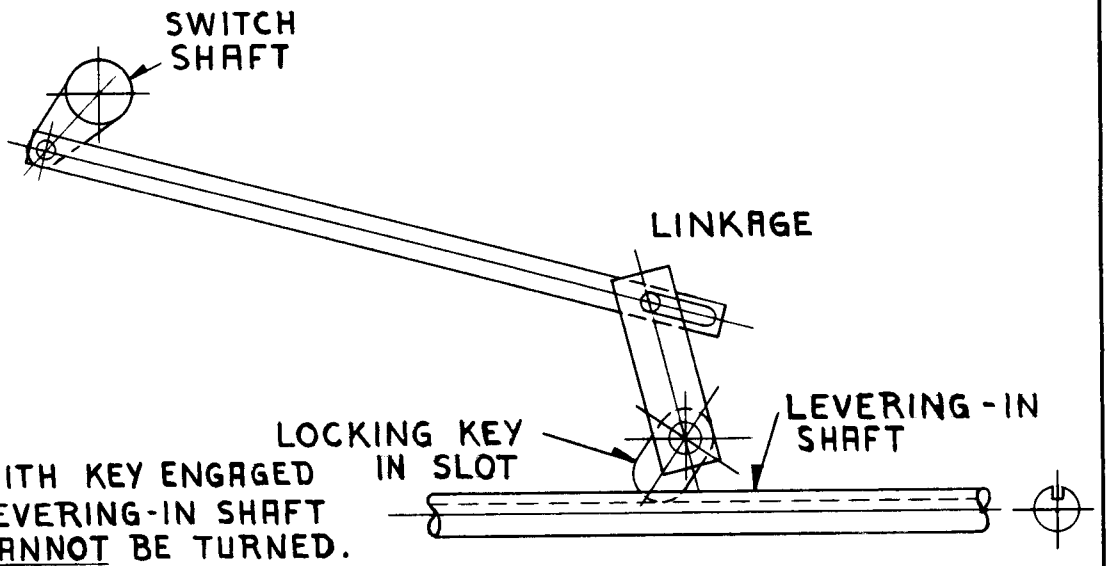
TITLE FLOOR INTERLOCK

FIG. 10

DIVISION

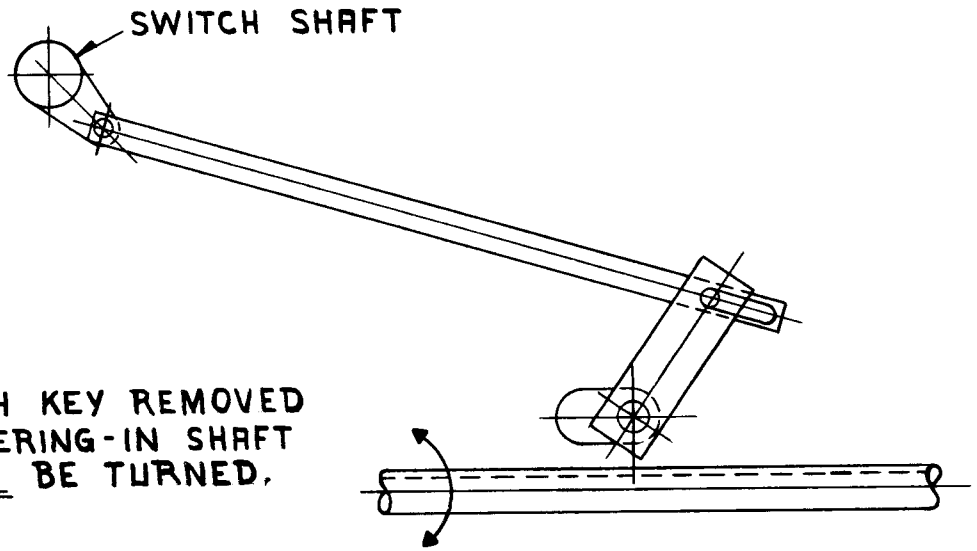
PLANT LOCATION

S.O.	SUB.
D.	1



WITH KEY ENGAGED LEVERING-IN SHAFT CANNOT BE TURNED.

LOCKED POSITION
SWITCH CLOSED



WITH KEY REMOVED LEVERING-IN SHAFT CAN BE TURNED.

UNLOCKED POSITION
SWITCH OPEN

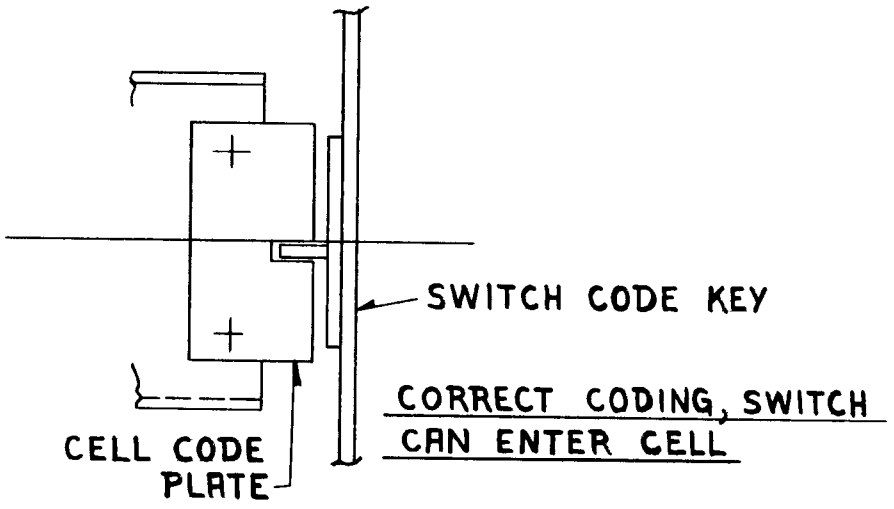
WESTINGHOUSE ELECTRIC CORPORATION

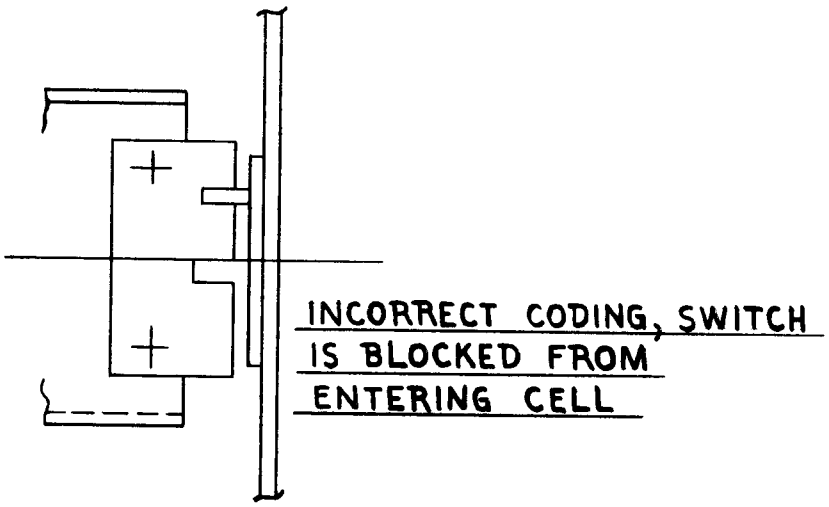
TITLE SWITCH INTERLOCK

FIG. 11

DIVISION

PLANT LOCATION





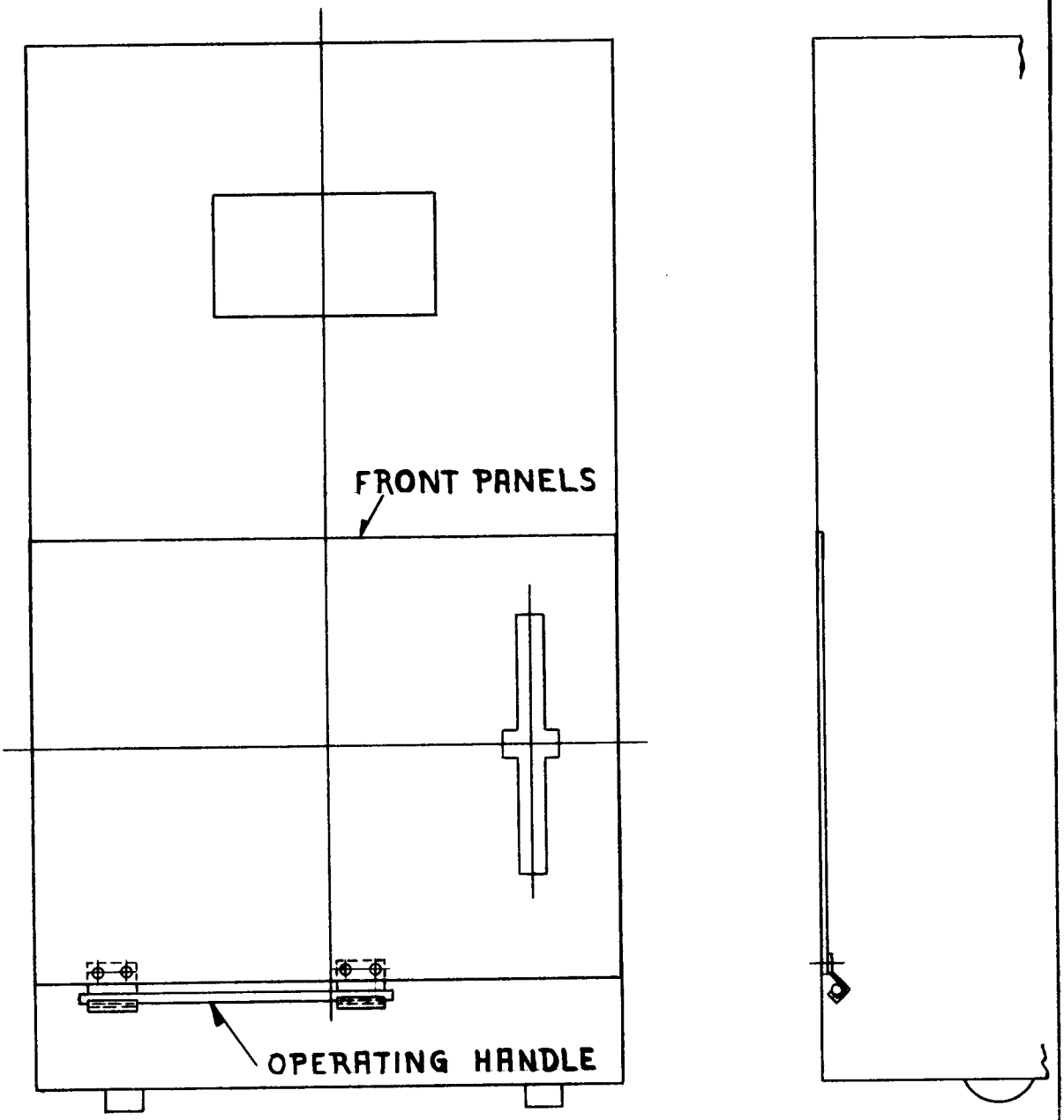
WESTINGHOUSE ELECTRIC CORPORATION

TITLE CODING PLATES

FIG. 12

DIVISION

PLANT LOCATION



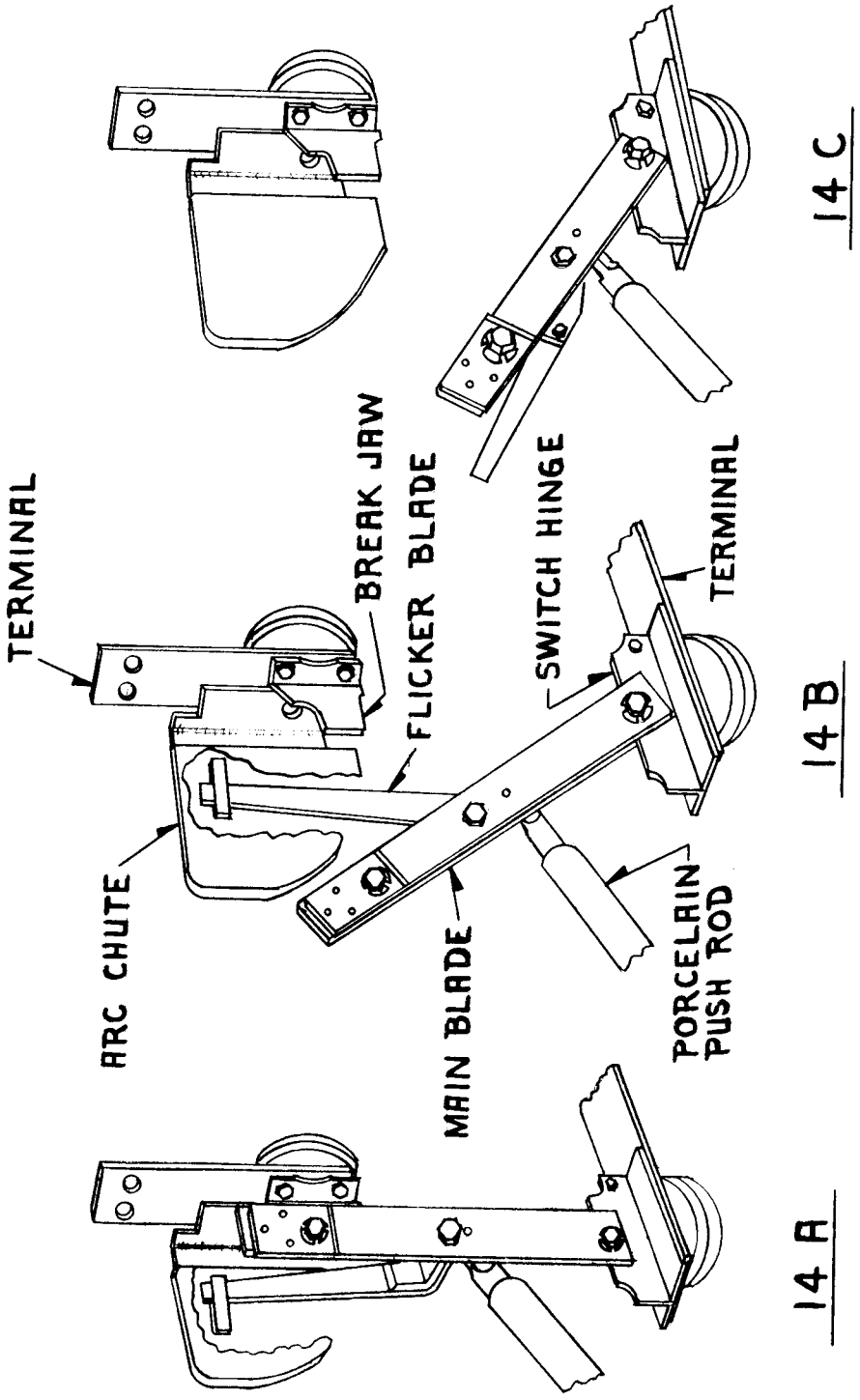
WESTINGHOUSE ELECTRIC CORPORATION

TITLE STORAGE OF OPERATING HANDLE

FIG. 13

DIVISION

PLANT LOCATION



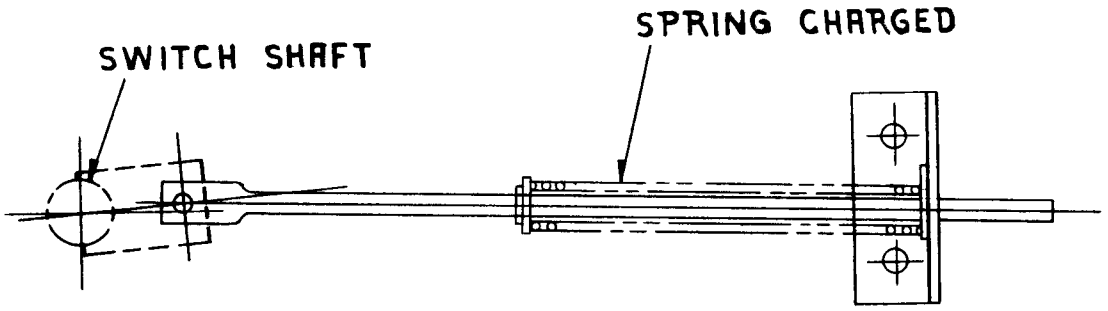
WESTINGHOUSE ELECTRIC CORPORATION

TITLE 'DE-ION' QUICK BREAK OPERATION

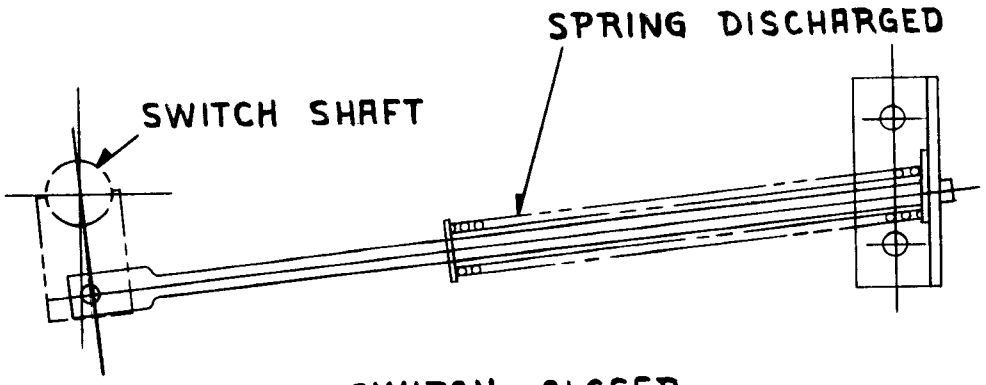
FIG. 14

DIVISION

PLANT LOCATION



SWITCH OPEN



SWITCH CLOSED

WESTINGHOUSE ELECTRIC CORPORATION

TITLE AUX. SPRING L.H. SIDE

FIG. 15

DIVISION

PLANT LOCATION