DESCRIPTION • INSTALLATION • ADJUSTMENT

INSTRUCTIONS

One-, Two-, And Three-Pole

DISCONNECTING SWITCH

Type V

600—1200 Amperes

69,000—230,000 Volts

WESTINGHOUSE ELECTRIC CORPORATION

SWITCHGEAR DIVISION

EAST PITTSBURGH PLANT • **EAST PITTSBURGH, PA.**

SUPESEDES I.B. 36-160-1

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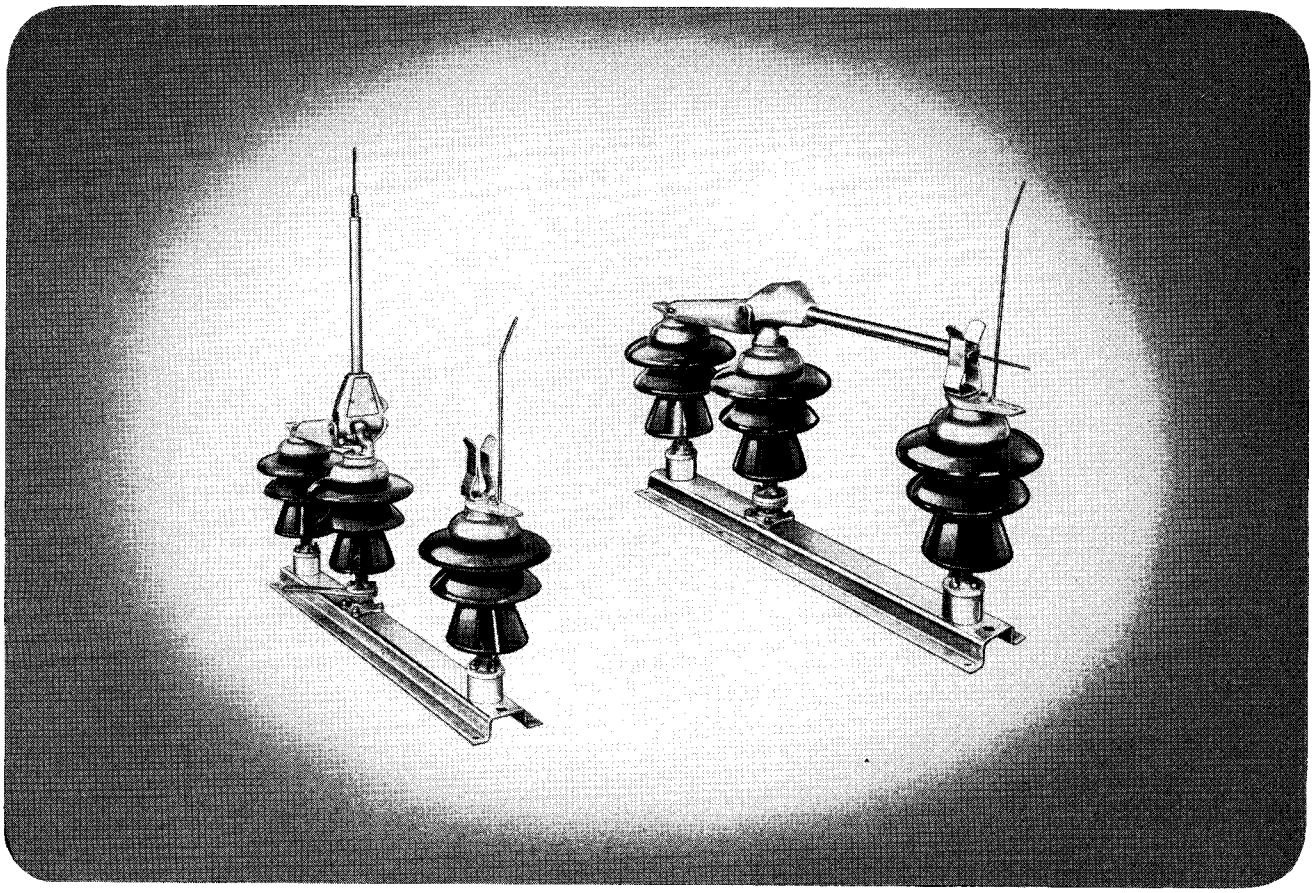
DISCONNECTING SWITCH
Type V



The Type V Disconnecting Switch is an outdoor air switch suitable for all applications. It has only three moving parts, all totally enclosed for protection from weather and corrosion, insuring easy operation under even the most severe conditions. Oilite bearings provide permanent lubrication of live parts.

The Type V Switch is arranged as a gang-operated remote-controlled device. The type of operating mechanism supplied with the switch is determined by the structure on which it is to be mounted.

Important: Proper installation and maintenance are necessary to insure continued satisfactory operation of the disconnecting switch. It should not be called upon to operate at voltages or currents greater than those given on the nameplate. The short circuit currents which the switch might have to withstand must not exceed those specified in NEMA standards.

DESCRIPTION

The Type V Disconnecting Switch is an outdoor air switch of the gang-operated vertical-break type. It is designed for all outdoor switching applications such as the isolation of circuit breakers, transformer banks, lightning arresters, and line sectionalizing. Horizontal upright-mounted switches are equipped with arcing horns and may be used to interrupt small currents such as line-charging or transformer-magnetizing currents. Vertically-mounted or underhung switches should not be called upon to interrupt any current because of the danger of the arc involving the switch base to create a system fault.

Type V switches may be either manually or motor operated. Either torsional or reciprocating mechanisms are available to suit any structural requirements. In general torsional pipe mechanisms (TP) are best suited for horizontal switches, and reciprocating pipe (RP) mechanisms are best suited for vertical switches.

All ratings of switches conform to AIEE and NEMA standards for power switching equipment. Switches are available in all the standard ratings. It is the purpose of this instruction book to assist in the proper installation, operation, and maintenance of switches rated 69,000 volts (heavy duty) and above.

APPLICATION

Insulation Levels. The impulse withstand values of the standard switch insulators are shown in Table No. 1. Switches should always be applied so that their impulse withstand rating (BIL) is equal or exceeds the impulse insulation level of the system to which they are connected. For example, if on a 133 kv circuit the insulation level of the line insulators, transformer bushings, and circuit breaker bushings is 650 kv, a 161 kv switch having a 750 kv BIL should be used.

For additional safety to personnel these switches are designed to have an open gap which will withstand a voltage at least ten percent in excess of the withstand rating of the insulator columns.

Momentary Current Ratings. The momentary current ratings of the standard Type V switches 69 kv and above are shown in Table No. 2. These switches should always be applied so that their continuous current rating is not exceeded by the load current, and their momentary current rating is not exceeded by the maximum available fault current.

Table No. 1. INSULATOR DATA

VOLTAGE RATING KV	B.I.L. IMPULSE WITHSTAND 1.5 x 40 MS CREST KV	NEMA INSULATION TECHNICAL REFERENCE NUMBER		WESTINGHOUSE INSULATOR UNIT STYLE	
		STD. STRENGTH	HIGH STRENGTH*	STD. STRENGTH	HIGH STRENGTH
69	350	16	56	1176 190 (2)	968 758 (2)
115	550	19	..	968 758 (3)	.....
161	750	25	26**	968 758 (4)	968 758 (3) 1409 412 (1)
196	900	27	..	1409 412 (5)	.....
230	1050	28	..	1409 412 (6)	.....

* High strength stacks are standard for switches rated 2000 amperes and above
** TR26 is high strength stack for vertical base switches.

Table No. 2. SHORT TIME CURRENT DATA

VOLTAGE RATING KV	TIME RATING	CURRENT RATING OF SWITCH IN AMPERES		
		600	1200	2000
		SHORT TIME RATING IN THOUSANDS OF AMPERES		
69	Momentary	20	40	60
	4-Second	12.5	25	37.5
115	Momentary	20	40	..
	4-Second	12.5	25	..
161	Momentary	20	40	..
	4-Second	12.5	25	..
196	Momentary	..	30	..
	4-Second	..	18.8	..
230	Momentary	..	30	..
	4-Second	..	18.8	..

INSTALLATION

HANDLING AND STORAGE

Disconnecting switches rated 69 kv and above are shipped with live parts bolted to the pole unit bases, and the insulator units are shipped separately. These insulators are packed in shock-resistant cartons; however, they should be handled carefully to avoid breakage of the porcelain.

When the equipment is received it should be examined carefully to determine any loss or damage in shipment. The carrier should be notified immediately of any claims. In unpacking the insulators be sure to retain the small bag of hardware shipped with each unit.

Since these are outdoor switches they may be stored either indoors or outdoors. ***If switches are to be stored outdoors, however all components should be removed from the packing.*** It is particularly injurious to the insulators if they are left for long periods in cartons which have been saturated with water from rain or snow.

ERECTION

Pole Units. Before the pole units are mounted onto the supporting structure they should be fitted with the required number of insulator units. The proper number of units for each column can be determined from Table No. 1.

Important. Before the live parts are unbolted from the bearing and insulator supports, make sure the switch pole unit blade is in a position to release the pressure of the counter-balancing springs. On horizontal upright switches, the springs are released when the blades are in the open position. On vertical-base and underhung switches the springs are released when the blades are in the closed position.

After the live parts have been removed from the base the bottom insulator unit of each column should be assembled to the insulator pedestals using the galvanized hardware provided in a bag attached to the pole unit. The additional units may then be added using the bolts provided with each insulator. Finally the live parts are assembled to the tops of the insulators using the copper-alloy hardware provided with each pole. If arcing horns are to be used these should not be assembled until the switch is mounted on the structure. With the switch closed

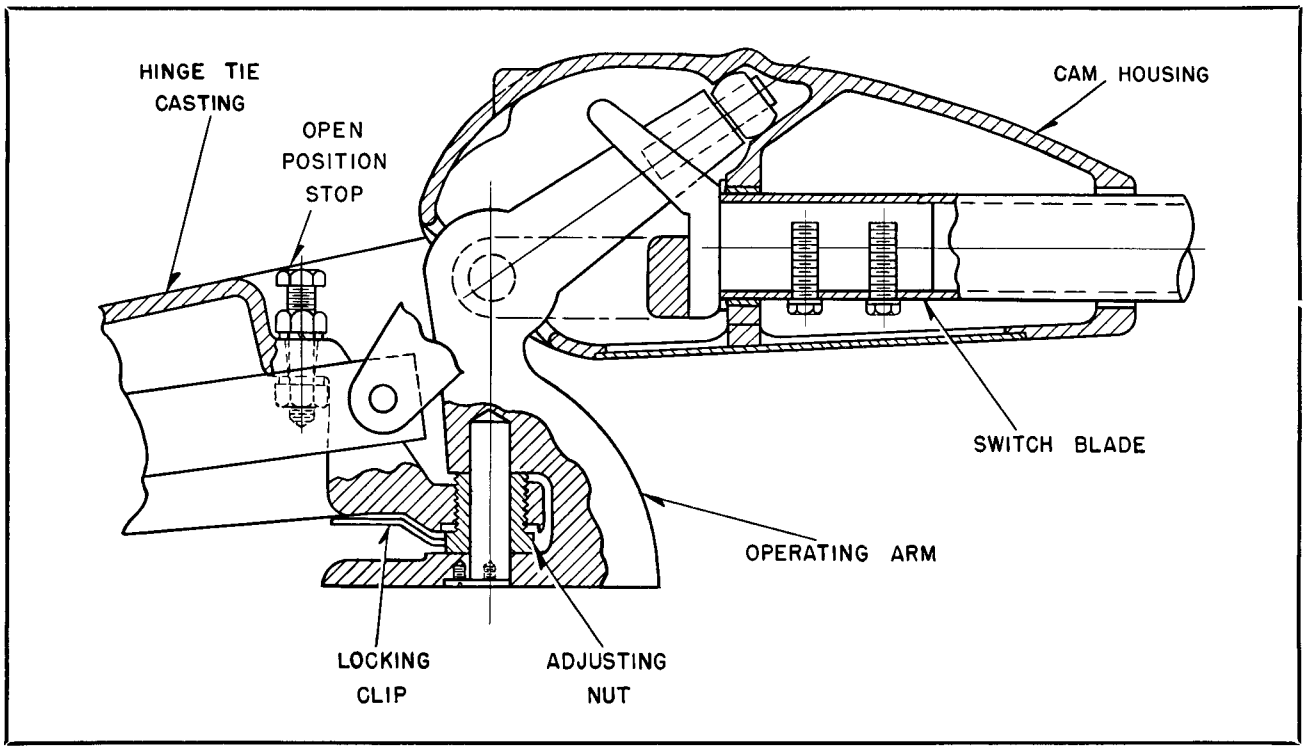


FIG. 1. Cross Section of Hinge and Cam Housing

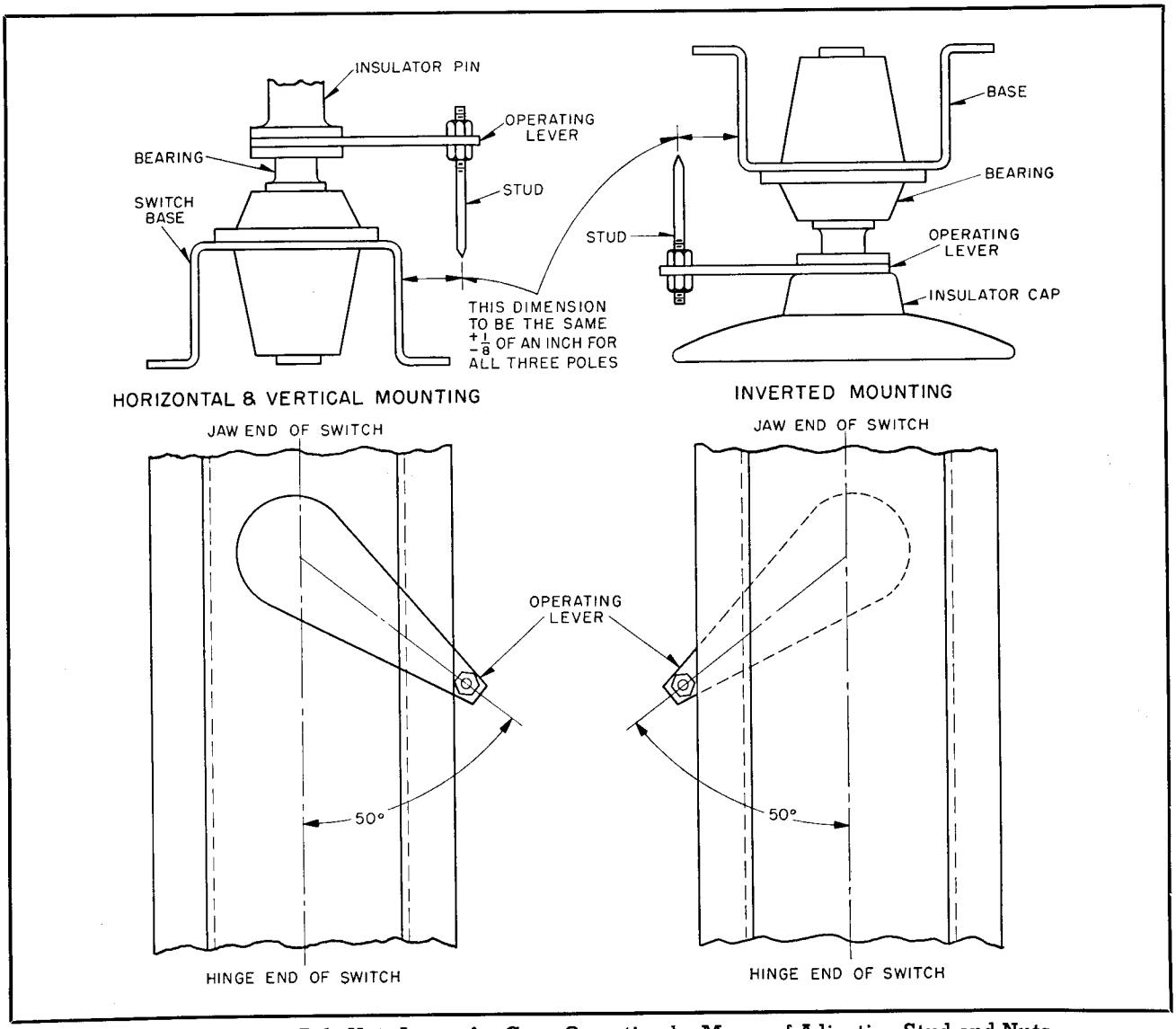


FIG. 2. Aligning Pole Unit Levers for Gang Operation by Means of Adjusting Stud and Nuts

tighten the bolts which support the break jaw so that the jaw is properly aligned with the blade.

After each pole unit has been assembled on the insulators it may be operated by means of the lever at the base of the rotating insulator column. This lever should be in a position which is 50 degrees from the centerline of the switch base when the switch is closed, and should swing to a symmetrical position 50 degrees on the other side of the centerline when the switch is open. It is important that this lever swing to form equal angles on either side of the base. If the lever is not properly placed and its relation to the operating arm (See Fig. 1) is not correct, the pole units will not track properly during ganged operation. For best results, the relation of the operating arm and operating lever should be established after the pole units are mounted on the structure.

To effect this relation, all three pole units should be *opened* and the open position stop (Fig. 1) adjusted, if necessary, to align the blades in the "open" position. This alignment may be checked by sighting along the three blades. With the blades in the *full open* position, the pole unit levers may be set with the aid of the special stud and nuts as illustrated in Fig. 2. On each pole unit, assemble the stud as shown and measure the distance from the tip of the stud to the side of the switch base. All three lever settings should give measurements within one fourth of an inch. If more variation is observed the bolts in the insulator stack should be loosened and the lever shifted until it is properly aligned. Re-tighten the bolts being careful not to disturb the established relation between the operating lever and the switch live parts. The pole units should then be closed and the break jaw contact

inspected to be certain that the blade and jaw alignment has not been disturbed.

In the closed position of the switch the blade should come to rest approximately in the center of the jaw. If the vertical position of the blade is not as desired it may be adjusted by turning the adjusting nut at the top of the rotating insulator as shown in Fig. 1. Remove the locking clip and turn the nut clockwise viewed from the top to lower the blade; turn it counterclockwise to raise the blade.

After vertical blade motion has stopped when closing the switch, the blade rotates to make high pressure contact engagement with the stationary jaws. The blade tip is machined to form a section of a cylinder so that full contact pressure is maintained with the blade tip as much as 15 degrees from a horizontal position in either direction. Therefore it is not necessary to adjust the switch so the blade tip is exactly horizontal in the closed position. If it is desired to adjust the blade rotation this may be accomplished by removing the cover plate on the mechanism housing and loosening the two bolts which hold the blade as shown in Fig. 1. Clearance holes in the blade allow some angular adjustment of the blade position about its axis.

If the switch is to be operated from a Type TP mechanism, one of the poles may be fitted with a special double lever at the base of the rotating insulator column. This lever allows connection of the interphase rod and outboard driving rod at the optimum angles for ease of operation. Make certain that the pole unit which is fitted with this lever is assembled in the proper position with respect to the outboard bearing as shown on the three pole outline drawing identified for the job. Care should be taken to avoid warping of the switch base during mounting. If the mounting surface is uneven shims should be used to level the base.

In making electrical connections to the switch, avoid placing excessive stress on the insulators. Use strain insulators or bus supports where necessary.

OPERATING MECHANISMS

The mechanisms for gang operation of Type V switches transmit the motion required to operate the switch from some convenient handle location. These mechanisms are individually designed to suit the switch mounting position, and the supporting structure for the switch and handle. In general they are either of the torsional type or the reciprocating type. The torsional type, known as the Type TP, is usually used when the switch bases are horizontal. The reciprocating type, known as the Type RP, is better suited to switches with the bases vertical. Either of these mechanisms may be equipped with a motor operator when required. For instructions on proper installation and operation of motor mechanisms refer to I.B. 36-164-1.

The operating mechanism on a particular switch should be assembled in accordance with the three pole outline drawing which is identified with the Style Number given on the switch pole unit nameplates. Figures 6 (TP), 7 (RP), and 8 (Geared TP) show typical mechanism arrangements.

Caution: Do not drill operating pipe for attachment of handle mechanism until switch has been adjusted as described under "Adjustments" on page 15.

GROUNDING BLADES

When Type V switches are equipped with grounding blades these units are assembled on the pole unit bases at the factory. When the insulators are assembled on the pole unit the grounding jaw is assembled on the break jaw supporting insulator. The grounding blade can then be operated using the lever at the base. The blade should enter the jaw and rotate into contact engagement in the same manner as the main switch. If the grounding blade does not enter the center of the jaw, the alignment can be adjusted by means of adjusting bushings under the two bottom mounting bolts of the grounding switch hinge on the switch base. To make this adjustment, loosen the nuts on the mounting bolts and then rotate the bushings until proper adjustment is made. After the adjustment is complete tighten the nuts to lock the position of the grounding switch.

An additional adjustment on the depth to which the blade enters the jaw is available because the jaw mounting bracket is provided with slots for mounting. By loosening the mounting bolts for this bracket the position of the jaw can be varied as required.

Operating mechanisms for grounding switches are of the same general form as the main switches and should be assembled in accordance with the three-pole drawing identified for the particular switch. Mechanical interlocks are furnished with switches equipped with grounding blades and should be assembled as shown on the drawing to prevent the main switch and the grounding switch from being closed simultaneously. Fig. 9 shows a typical assembly of a 69 HD, 115, or 161 kv switch with grounding blades.

KEY INTERLOCKS

Key interlocks may be provided with the operating mechanism to prevent improper switching sequence. When such locks are provided with Type TP mechanisms they are assembled on a separate mounting bracket which is mounted above the operating handle as shown in Fig. 3. An interlock disc is provided with notches to cooperate with the bolt extension on the interlock. After the mechanism is assembled and adjusted for proper operation the vertical pipe should be drilled to pin this disc in such a position that the notches in the disc allow extension of the interlock bolt with the switch in the position in which it is to be locked.

When key interlocks are provided with geared TP mechanisms, or with RP reciprocating mechanisms, the interlocks are assembled on the handle mechanisms in the factory and no further adjustment is required in the field.

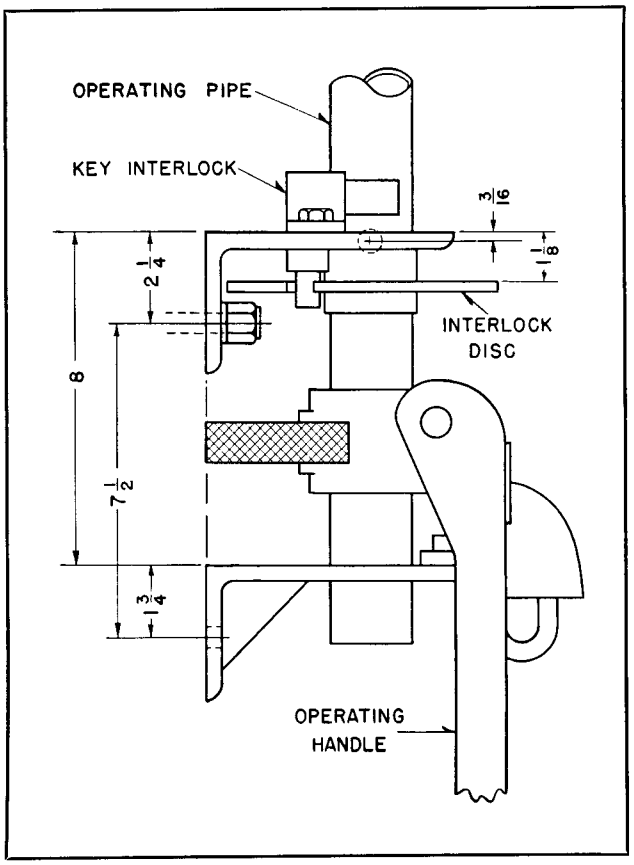


FIG. 3. Key Interlock Mechanisms

AUXILIARY SWITCHES

Auxiliary switches are available for connection to the operating mechanism of any Type V switch. Figs. 10 and 11 show the assemblies for Type TP and Type RP mechanisms. These units should be mounted on the structure along the vertical operating shaft at any convenient location. They are usually mounted just above the manual operating handle. The final connection of auxiliary operating linkage to the vertical pipe should not be made until the main switch is completely adjusted for proper operation.

When auxiliary switches are supplied with geared Type TP mechanisms, such as shown in Fig. 8, they are assembled at the factory onto the handwheel mounting bracket and require no field assembly or adjustment.

LEAD GUIDES

Lead guides may be supplied with these switches to support cables leaving the switch terminals for an adequate distance to insure that cable sag does not reduce the striking distance across the insulators. Fig. 4 shows the method of assembly of one of these guides on a pole unit. This assembly should be made after the pole unit is mounted on the structure.

ARCING HORNS

When arcing horns are provided with these switches they should be assembled after the switch is installed on the structure. The moving horn is attached to the blade at the factory; however, the stationary horn is shipped separately. A clamp is provided on the break-jaw support to hold the bottom of the stationary horn. This assembly is shown in Fig. 5.

The arcing horns may be adjusted by bending them slightly. It is important that these horns make light rubbing contact during switch operation. This will prevent pitting of the main contacts as they separate during an operation when opening charging currents or magnetizing currents. The horns are designed to maintain a sliding electrical contact without increasing switch operating effort.

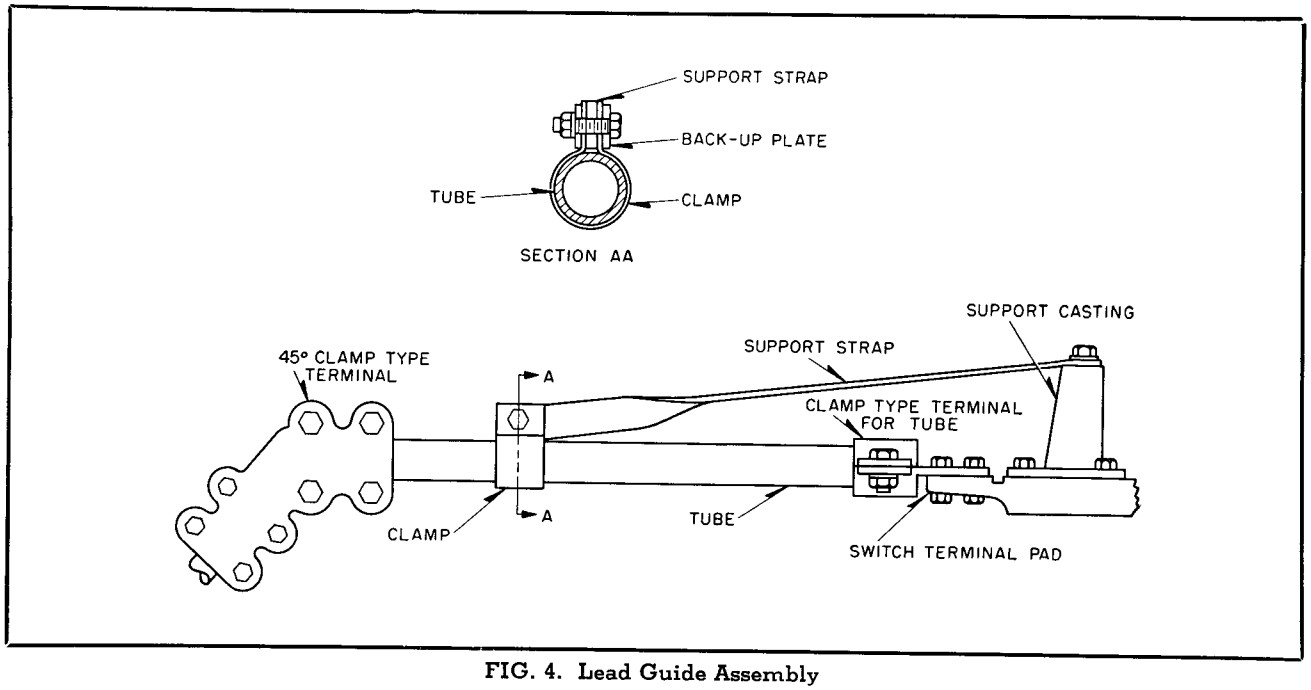


FIG. 4. Lead Guide Assembly

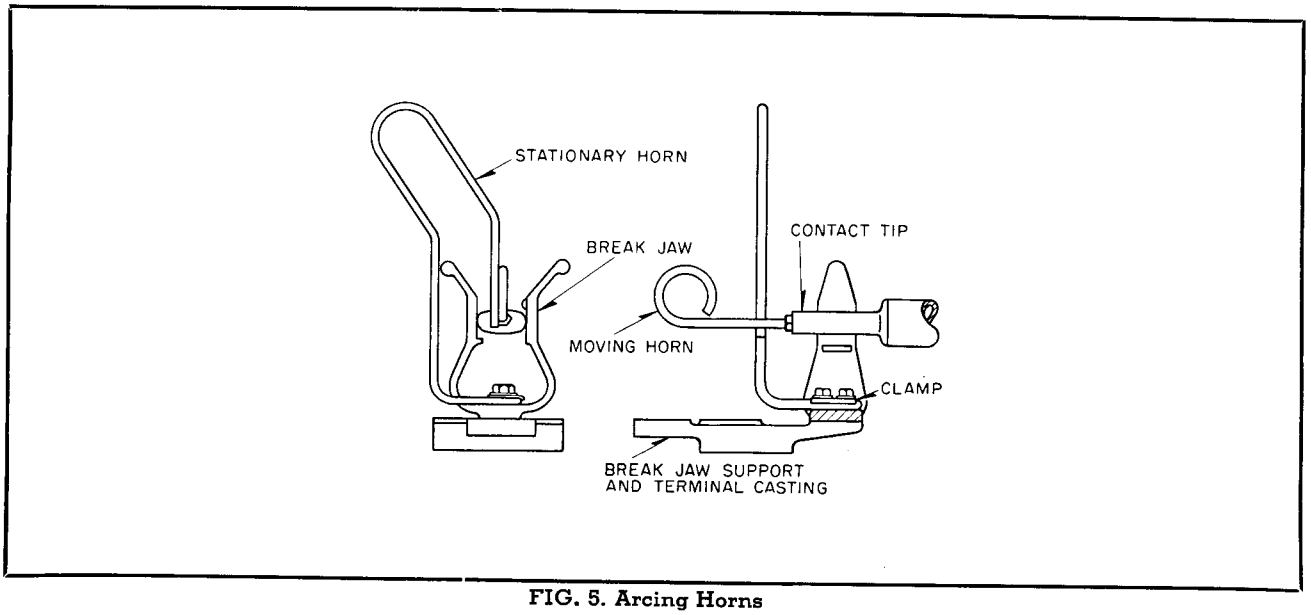


FIG. 5. Arcing Horns

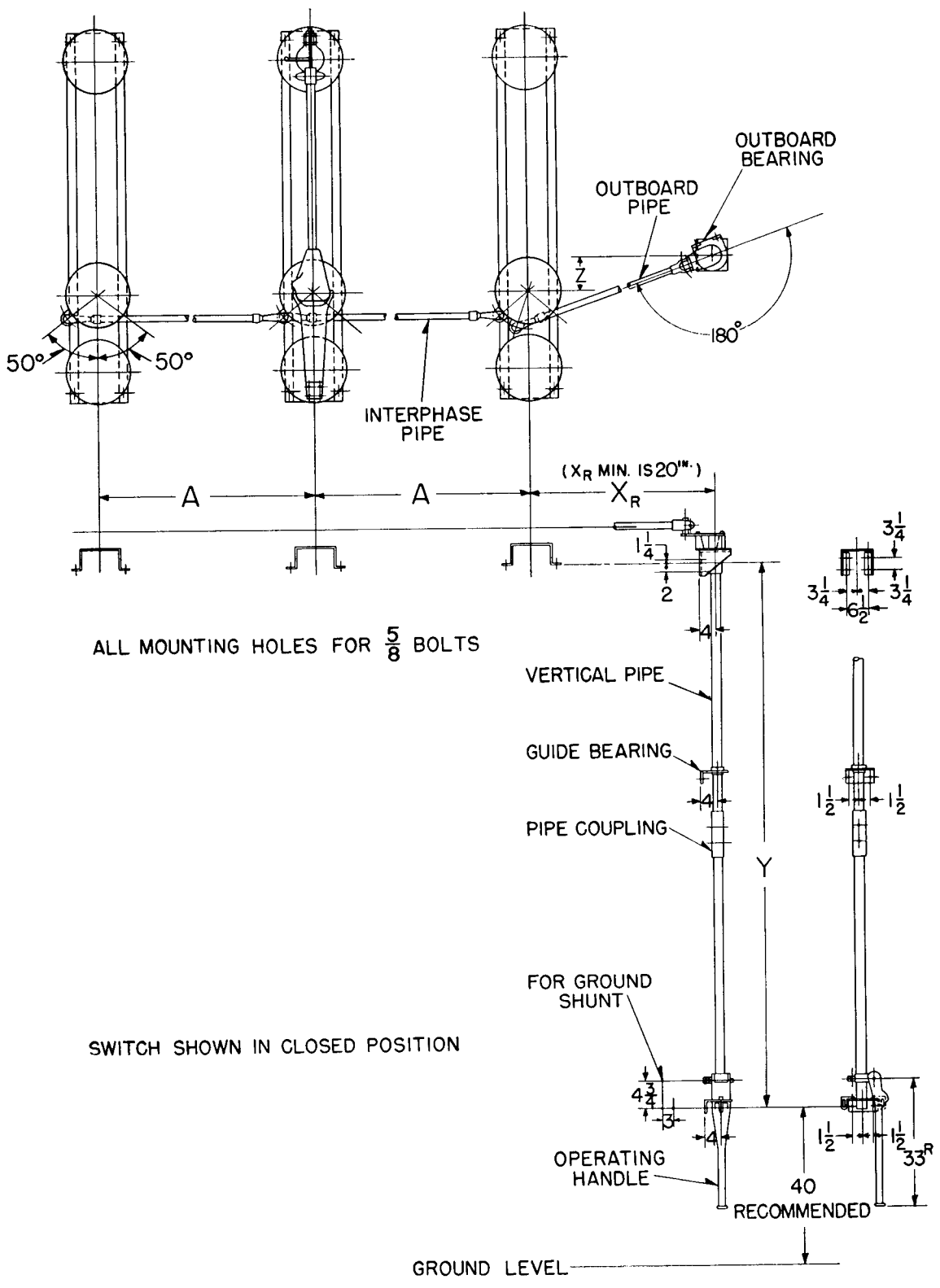


FIG. 6. Horizontally Mounted, 69 kv H.D. to 161 kv, 600-1200A Type V Switch with Double Offset "TP" Operating Mechanism

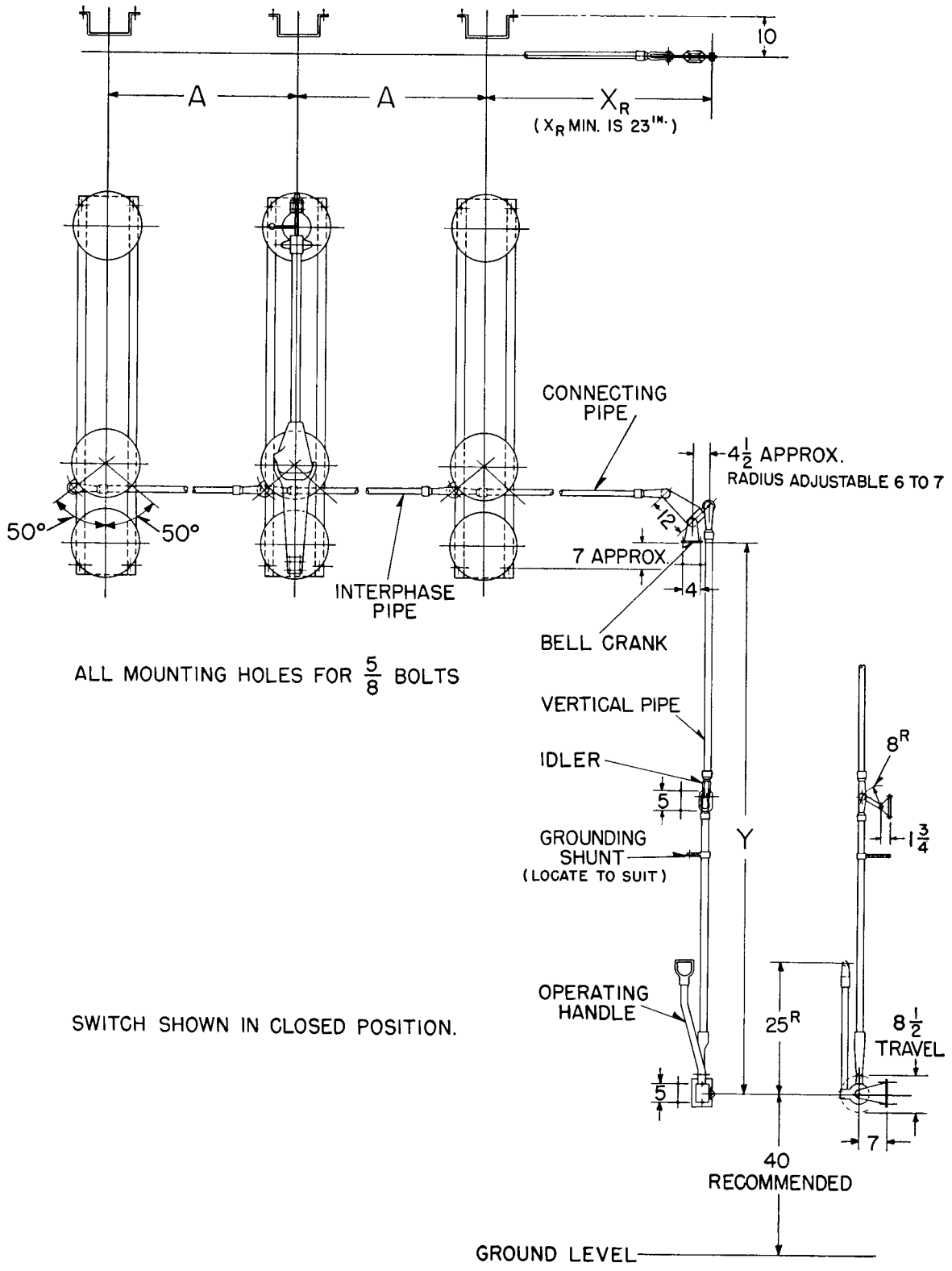


FIG. 7. Vertically Mounted, 69 kv H.D. to 161 kv, 600-1200A Type V Switch with Offset "RP" Operating Mechanism

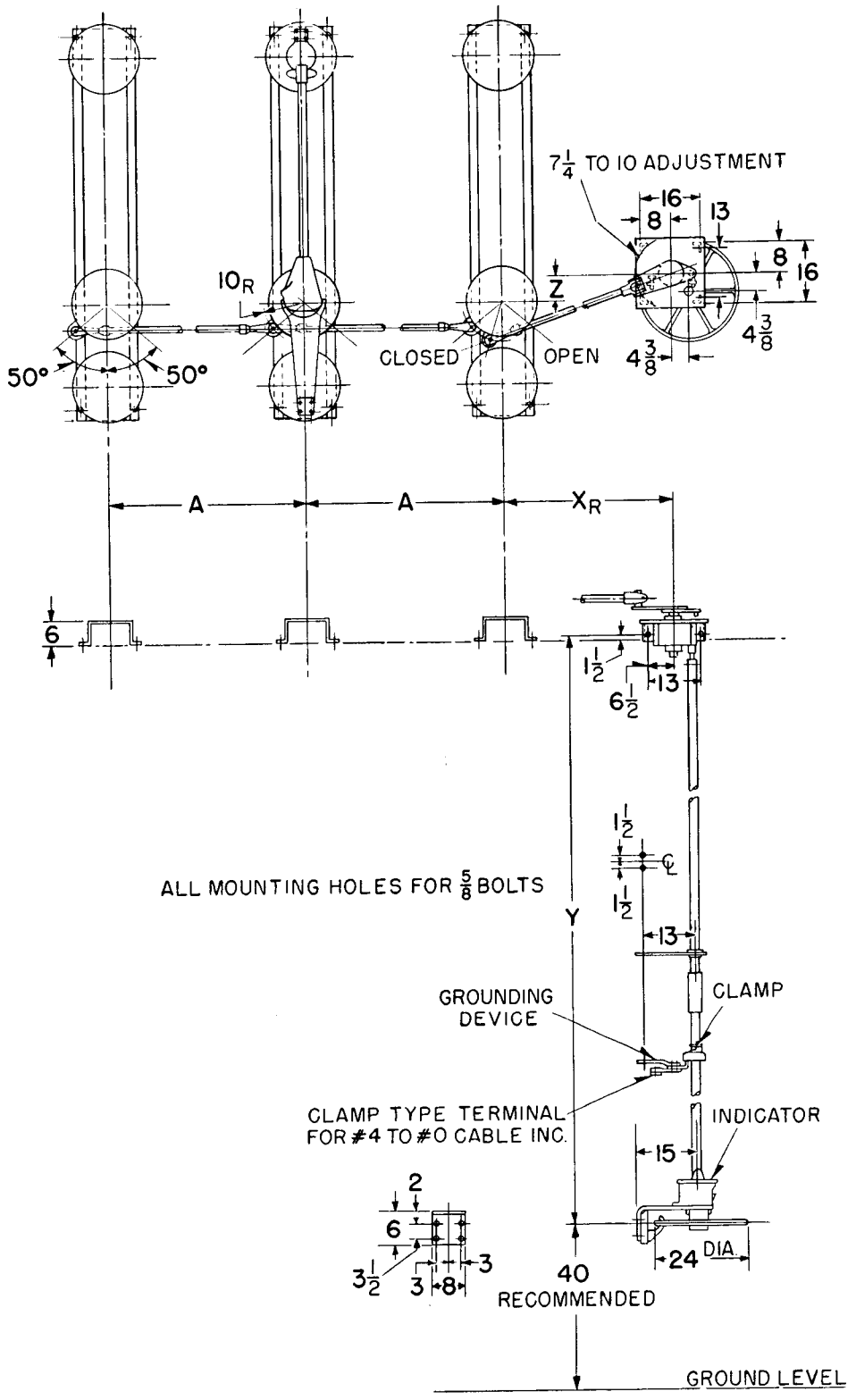
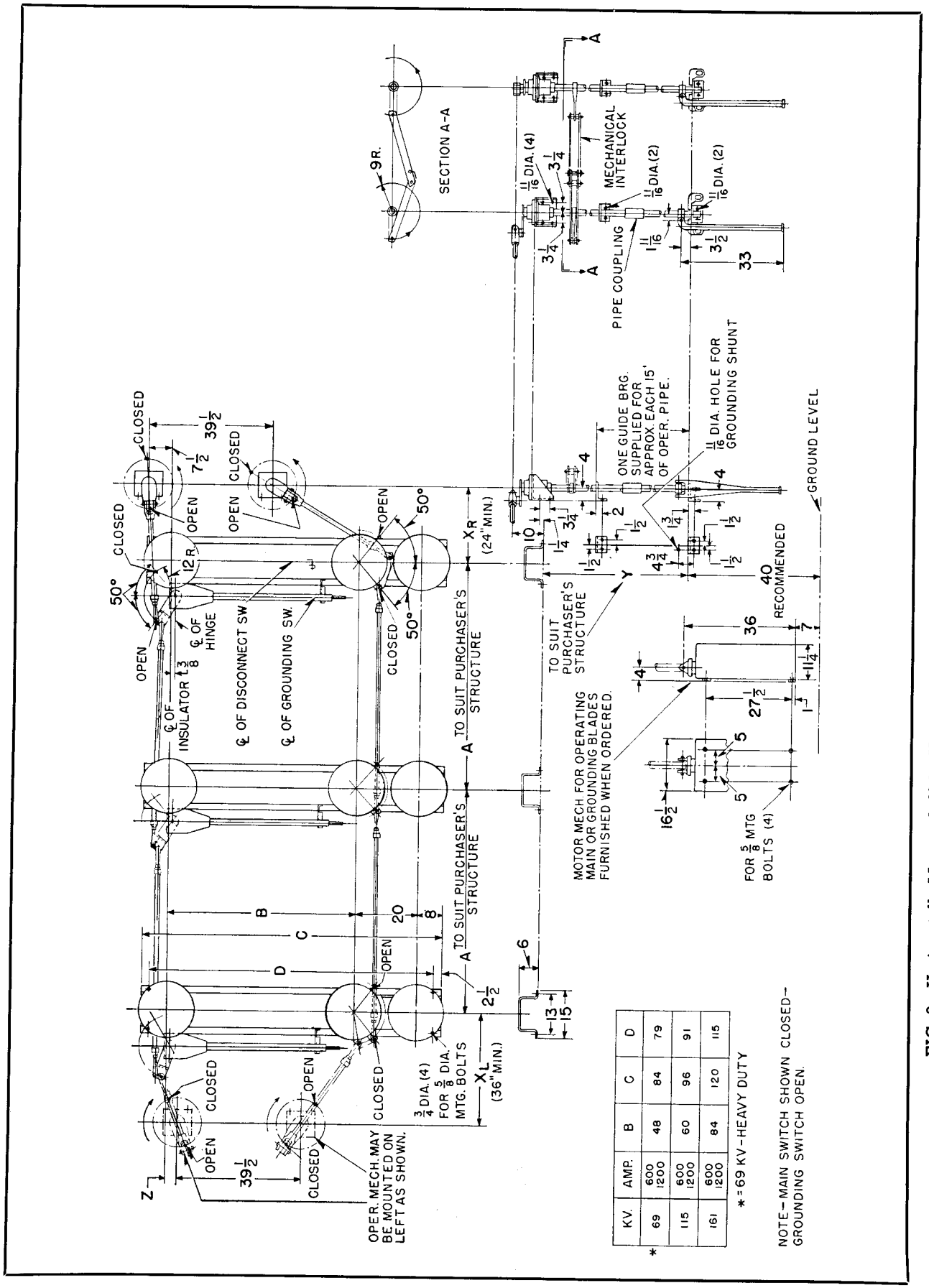


FIG. 8. Horizontally Mounted, 196 and 230 kv, 1200A Type V Switch with Gearbox and Handwheel Operating Mechanism



KV.	AMP.	B	C	D
69	600 1200	48	84	79
115	600 1200	60	96	91
161	600 1200	84	120	115

* = 69 KV-HEAVY DUTY

NOTE-MAIN SWITCH SHOWN CLOSED-GROUNDING SWITCH OPEN.

FIG. 9. Horizontally Mounted, 69 kv H.D. to 161 kv, 600-1200A Type V Switch with Grounding Blades

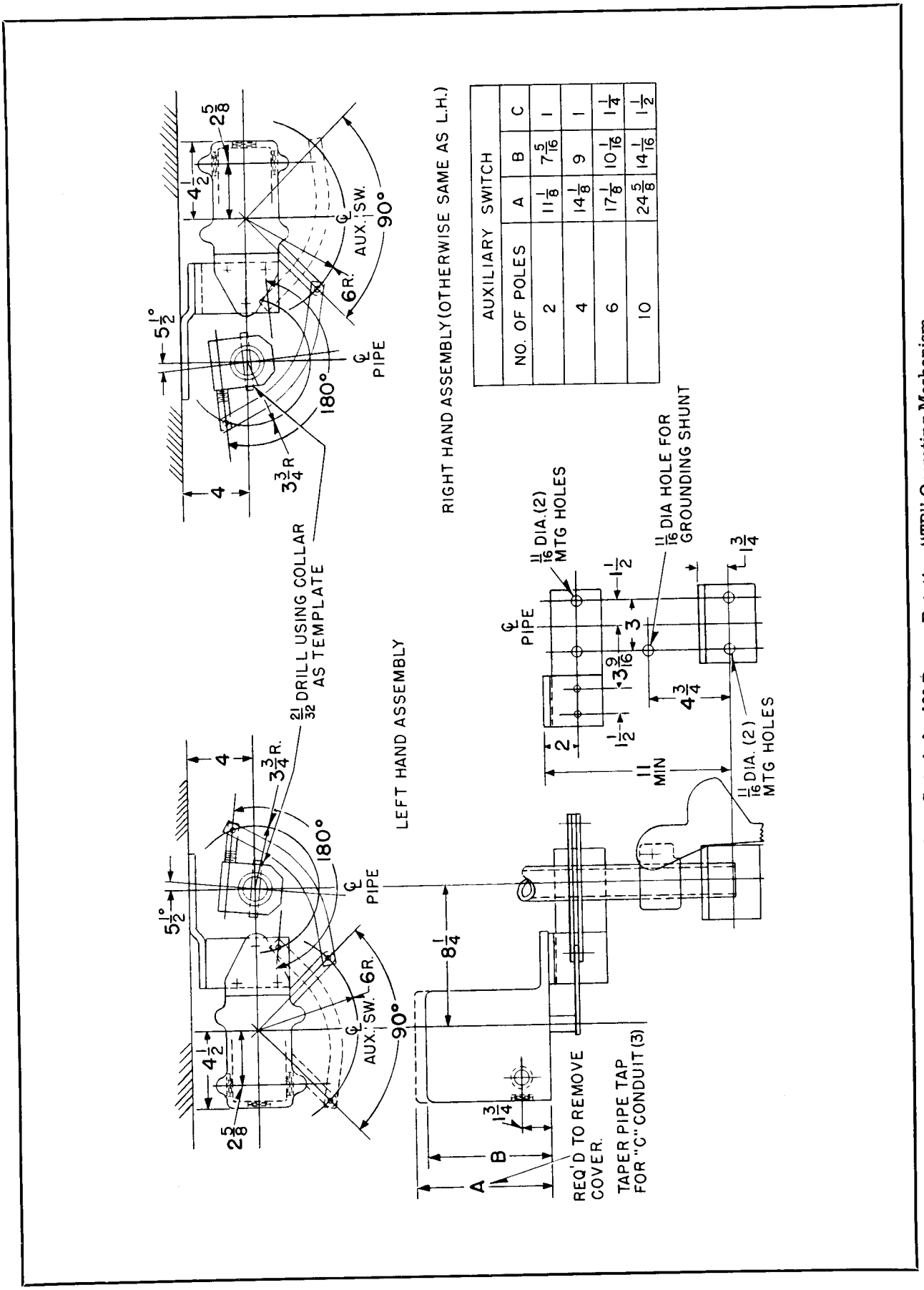


FIG. 10. Auxiliary Switch for 180 Degree Rotation "TP" Operating Mechanism

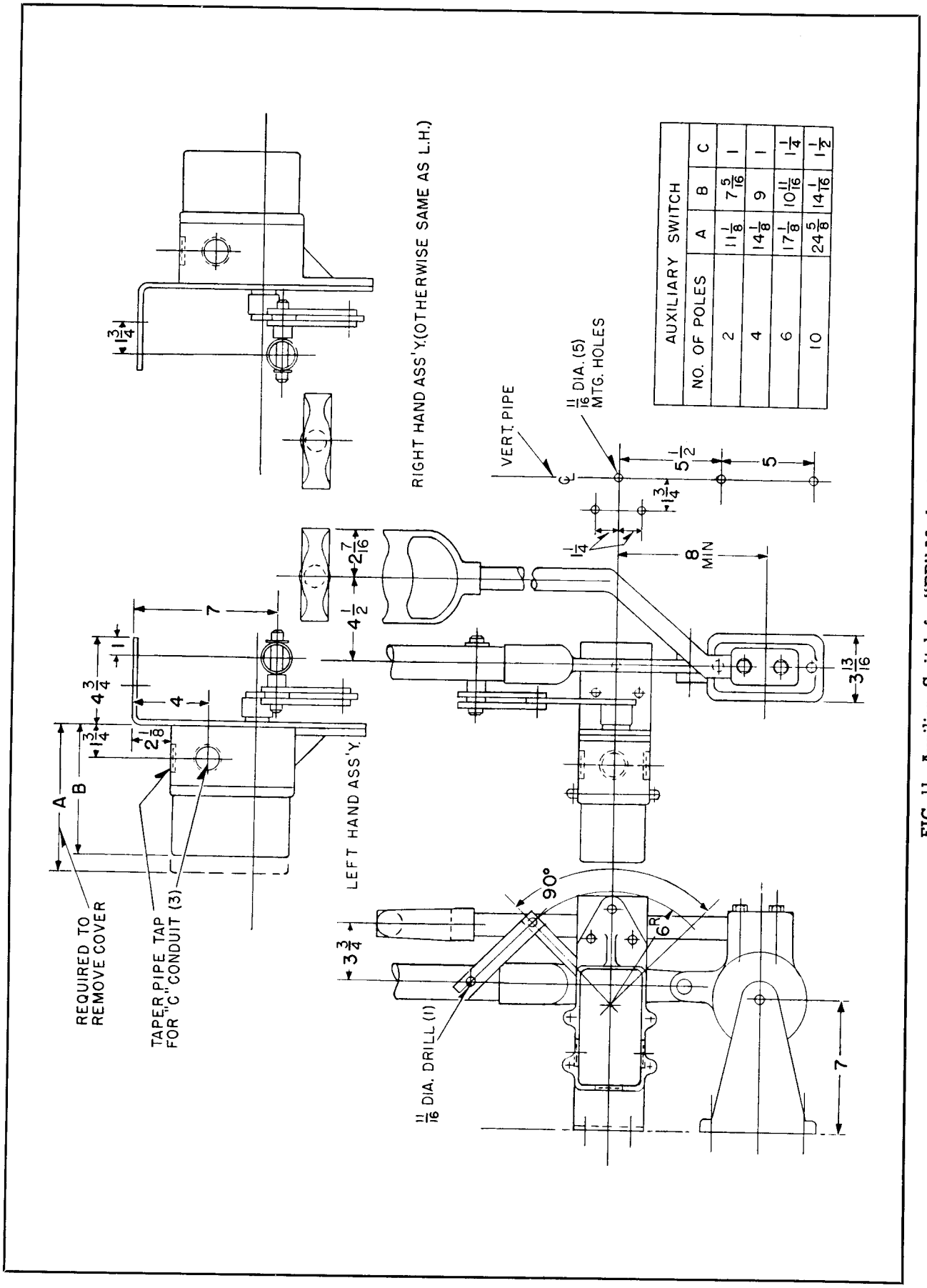


FIG. 11. Auxiliary Switch for "RP" Mechanism

ADJUSTMENT

TYPE TP MECHANISM

To adjust a Type V switch having a torsional type mechanism for proper operation proceed as follows:

1. Check individual pole unit adjustment to make certain these operate as described under "Pole Units" beginning on page 4 of this book.

2. Set the driven pole in the "*open*" position.

3. Adjust the radius of the outboard lever to be approximately 7¾ inches (except for horizontally mounted ground switch where the outboard lever radius should be approximately 9⅛ inches). Set the outboard lever in a position where it points either directly toward or directly away from the pole unit lever connection whichever is indicated for the "open" position on the erection drawing. In this position when the pipe connecting the outboard lever with the first pole unit is installed, it will be exactly in line or in toggle with the outboard lever. Adjust the stop bolts of the gear box or outboard bearing to coordinate with the toggle positions of the outboard lever.

4. Adjust the clevis on the outboard connecting pipe to the proper length so that the pipe will fit between the driven pole unit lever and the outboard lever while both are in the "open" position as set above. Make this pipe connection and the first pole unit can now be operated by turning the outboard lever.

5. Close the first pole and observe the position of the outboard lever. The pole unit should reach the fully closed position just as the outboard lever reaches a position in line or in toggle with the connecting pipe. If the lever reaches the in-toggle position before the switch is fully closed the radius of the lever should be increased slightly. If the switch closes fully before the lever reaches the toggle position the radius of the lever should be shortened. Small adjustments should be made of the radius of the lever and the length of the connecting pipe until the outboard lever is in toggle in both the fully open and fully closed position.

6. Open all poles and assemble the interphase pipes.

7. When the switch is now operated by turning the outboard lever all poles should close properly.

8. Finally the vertical pipe may be drilled to pin the operating handle, and the "open" and "closed" indicators assembled on the handle bracket in the proper positions.

9. If the mechanism is equipped with a gear box and handwheel the "open" and "closed" position indicators are assembled at the factory. These should be checked by rotating the handwheel in the direction opposite to that specified for the gear box lever on the 3-pole outline drawing representing the installation. If the indicators read improperly they can be interchanged after removing the front cover.

10. If a worm gear operating mechanism is used and it is desired to change direction of rotation of the handle and vertical pipe, this may be accomplished by simple changes noted on the instruction sheet 26-B-4821 which accompanies each mechanism.

TYPE RP MECHANISM

To adjust a Type RP mechanism for proper operation proceed as follows:

1. Check individual pole unit adjustment to make certain these operate as described under "Pole Units" on pages 4, 5 and 6 of this book.

2. Set the driven pole in the "closed" position.

3. Assemble and adjust the length of the outboard connecting pipe until the edges of the bell crank are 45 degrees from horizontal when the switch is closed.

4. Adjust the adjustable arm of the bell crank to have a 6½-inch radius.

5. Adjust the lengths of vertical pipe so that they can be connected to the bell crank and idler arms set 30 degrees above horizontal.

6. With the switch closed and the handle in the up position, cut and pin the vertical pipe to the handle mechanism.

7. Open the switch with the operating handle and observe the handle position as the switch comes fully open. If the handle is not in the fully down position when the switch is open the radius of the bell crank arm should be increased. If the switch has not opened fully when the handle is down the radius of the bell crank arm should be decreased. The clevis on the upper section of vertical pipe should be adjusted to accommodate any change.

8. When the bell crank has been adjusted so that full handle travel results in full travel of the driven pole, this pole should be opened.

9. Open the other two poles and assemble the interphase pipes. All poles should then track together.