

Instruction Manual

for

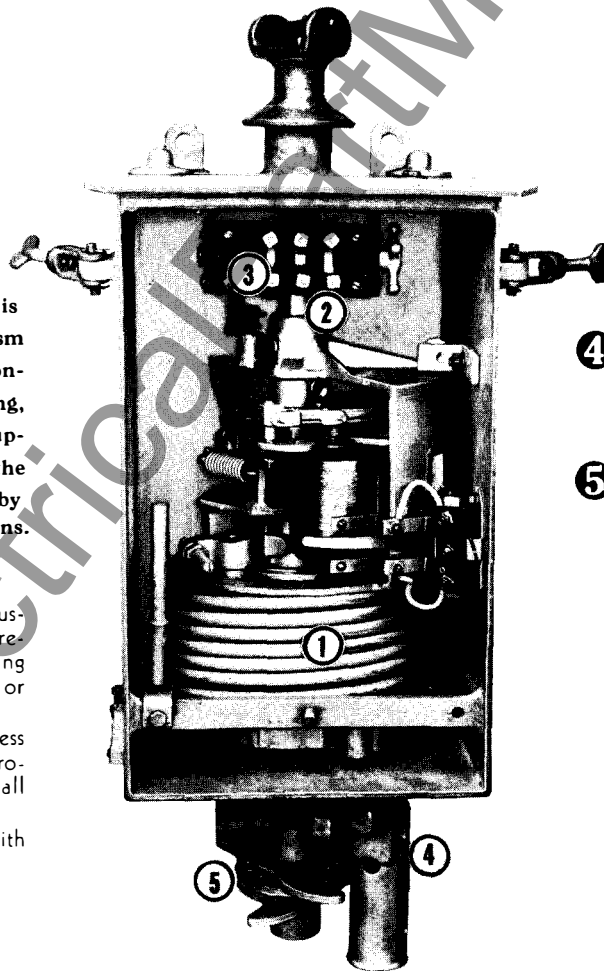
Type SO-2
Spring driven

SWITCH OPERATING MECHANISM

The Type SO-2 is a Spring Mechanism for the automatic operation of disconnecting switches. A torsional spring, either manually or motor wound, supplies the required stored energy for the operation which may be initiated by relays, remote control, or other means.

RELIABILITY

- ① The main operating spring, with adjustable torque to suit operating requirements, encloses a "kick off" spring which provides extra torque for ice or unusual conditions.
- ② Chromium plated shafts with oilless bearings eliminates maintenance and provides positive operation under all weather conditions.
- ③ Silver contact auxiliary switches with adjustable segments:



SAFETY

- ④ Trip free manual handle for rewinding spring or operating switch, eliminates any possibility of injury to operator should the switch be automatically tripped during manual operation.
- ⑤ Adjustable lock plates with provision for locking handle in either Open or Closed position.

CONVENIENCE

- ◆ Individually hand adjustable auxiliary switch.
- ◆ Torque of operating spring is adjustable.
- ◆ All parts readily accessible by removal of one piece cover.
- ◆ Switch can be manually operated at all times.
- ◆ Can be operated from any supply source including dry or B batteries.
- ◆ Furnished with two 1¼" conduit openings for control circuits. See page 2.



I-T-E CIRCUIT BREAKER COMPANY

Instruction Manual FOR

Type SO-2 Spring Driven, Switch Operating Mechanism

General Description

The Type SO-2 operating mechanism consists of the following main components:

1. Housing
2. Operating shaft assembly
3. Hand shaft assembly
4. Operating springs
5. Latch and trip assembly
6. Trip-magnet
7. Auxiliary switch.

DIRECTION OF ROTATION OF SHAFTS

The following must be constantly borne in mind:

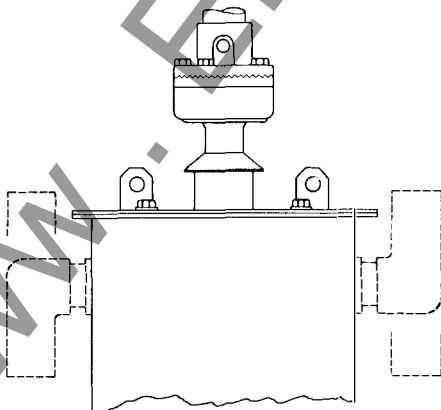
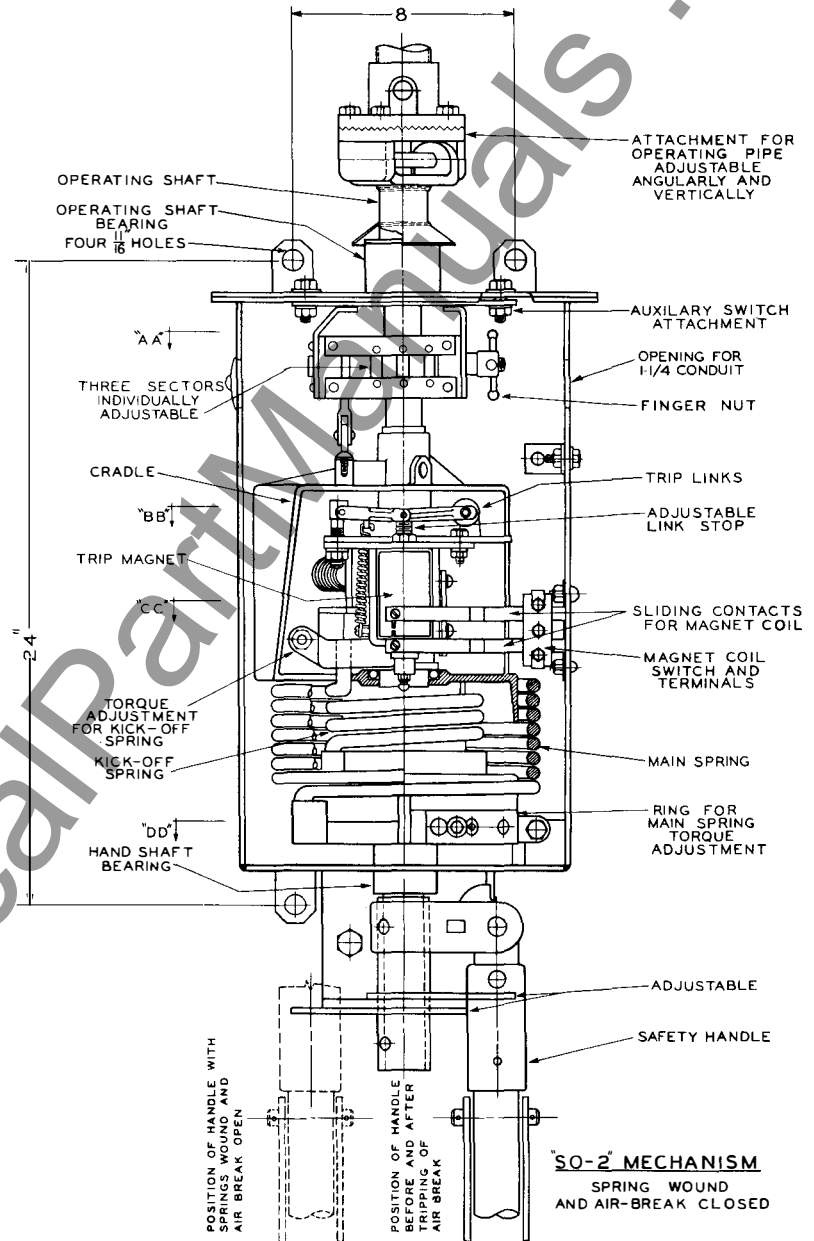
A-In tripping, only the operating shaft turns clockwise.

B-In rewinding of the springs, only the hand shaft turns clockwise.

C-In closing of the air break, both shafts turn counter-clockwise.

D-In opening of the air break manually, both shafts turn clockwise.

NOTE: The air break can not be closed unless the operating springs are wound.



CONDUIT ENTRANCE

Detail of suggested use of Crouse-Hinds conduit, Cat. No. LB-997 for conduit entrance.

Instruction Manual FOR

Mounting and Operating

Type SO-2

IT IS IMPORTANT TO FOLLOW THESE
INSTRUCTIONS CAREFULLY

1. Mount the mechanism and wind the springs with operating handle clockwise (looking from top) until latched. Do NOT TRIP the mechanism before all adjustments are made as instructed below.

2. Adjust stop bolt "SB" (bottom right hand) as follows: (Fig. 1)

operating angle see control dwg.	90°	100°	110°	120°
length "x"	2-5/8"	2-1/4"	1-3/4"	1-1/4"

WHEN MECHANISM OPERATES TO TRIP THE AIR-BREAK SWITCH OPEN, PROCEED AS IN PARAGRAPHS 3a AND 4a.

WHEN MECHANISM OPERATES TO TRIP THE AIR-BREAK SWITCH CLOSED, PROCEED AS IN PARAGRAPH 3b.

PARAGRAPHS 5 to 10 REFER TO BOTH CASES.

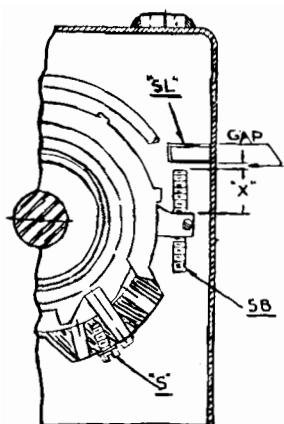


FIG. 1

3a. Operate mechanism with handle until stop bolt "SB" (Fig. 1) is about 1/2" away from stationary stop "SL". Leave it in this position. Close the air-break switch properly by operating directly at base of rotating insulator stacks; set stops on switch bases and connect the torsional operating pipe, first to switch rotor and then to angularly adjustable coupling at mechanism shaft.

3b. Operate mechanism with handle until stop bolt "SB" (Fig. 1) is about 1/4" away from stationary stop "SL" and leave it in this position. Open the air-break switch properly by operating directly at base of rotating insulator stacks. Set the stops at switch bases and connect the torsional operating pipe, first to switch rotor and then to angularly adjustable coupling at mechanism shaft.

4. Open air-break switch by means of operating handle at mechanism and then close again. If stop bolt "SB" interferes with proper closing of the air-break switch -- that is, if the stop bolt does not permit sufficient winding of the operating pipe - proceed as follows:

Open switch again and disconnect couples at lower end of operating pipe from mate at mechanism shaft. Then close the switch a few degrees by operating directly at base of rotating insulator, and reconnect coupling. Repeat this procedure until the gap (Fig. 1) is about 1/4" with air-break switch properly closed. THE DIMENSION "X" MUST REMAIN AS SET IN PARAGRAPH 2.

5. Operate air-break switch by hand several times and notice whether there is any binding in the bearings due to distortion in mountings of the mechanism. Correct by shimming the mounting lugs.

6. Adjust JAWS OF LOCK PLATE so as to be able to lock the handle in open and closed positions of the switch.

7. Attach BATTERY LEADS to the two binding posts marked "+" and "-", close the switch (if the switch is automatic opening) or open the switch (if it is automatic closing), lock handle to lock-plate, and operate by completing the circuit.

8. There are TWO OPERATING SPRINGS, one inside of the other. The mechanism is shipped with both springs PARTLY WOUND. The inner spring acts only through a maximum of 30 degrees and its purpose is to help to break ice or to overcome stiffness due to cold weather. TO WIND THE INNER SPRING, TRIP THE MECHANISM and screw stud "K" (Fig. 2) in crank to which the upper end of the spring is attached. Lock with lock nut.

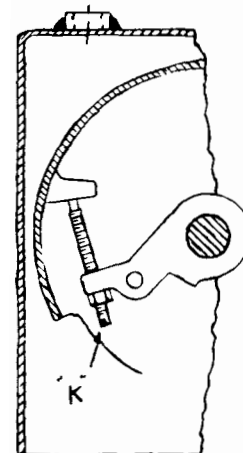


FIG. 2

TO WIND THE OUTER (MAIN) SPRING, TRIP

THE MECHANISM, take out cap screw "S" (at bottom of mechanism - Fig. 1) which holds the locking pin in place, insert the spring winding rod, which is held loosely in socket at left-hand lower corner (see paragraph 11) into one of the vacant holes, and wind clockwise (looking from top) at the same time applying a light pressure to the end of

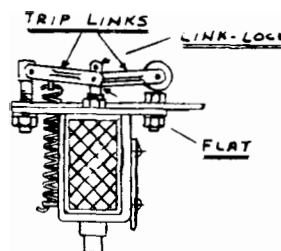


FIG. 3

Instruction Manual FOR

Mounting and Operating

Type SO-2

the locking pin with finger. The pin will thus drop into position when the next locking notch is reached. Four notches are provided and they can be seen from underneath the rotating drum.

9. Above the magnet coil and directly in front of the mechanism (when it is in position ready to trip) there are two broken-down bronze TRIP LINKS. The middle point of these links rests on a stud through the coil, which is so adjusted that the middle point is about 1/16" lower than the ends of the links. If it is desired to have the mechanism work at a voltage lower than that for which it is set, TRIP THE MECHANISM, loosen lock nut on top of stud supporting the links, screw up the stud, and lock with lock nut. There is a flat on the end of the stud for a wrench. The links must always be broken down sufficiently to prevent tripping by vibration.

10. To adjust the AUXILIARY SWITCH rotating contacts, unloosen finger nut and turn contacts to the desired position. Each contact can be adjusted individually without disturbing the others. TIGHTEN back finger nut with fingers.

11. To prevent mechanism from tripping accidentally while work is being done on it or on the line, remove "spring winding rod" from socket at left hand lower corner and insert short end of it into hole just behind the center of the broken-down trip links until the conical section of the rod comes in contact with the links. The cover cannot be replaced as long as the rod is in this position.

Application of Type SO-2 Spring Actuated Switch Operating Mechanism to an automatic sectionalizing installation.

In this operating scheme the air switch is normally closed. When the oil circuit breaker trips, the loss of voltage



at the potential transformer causes the air switch to open. The stored energy of the Type SO-2 Mechanism is sufficient to open the switch, but it is closed manually, thereby resetting the spring mechanism.

Note that the SO-2 Mechanism and relay cabinet may be mounted adjacent to each other on the pole.

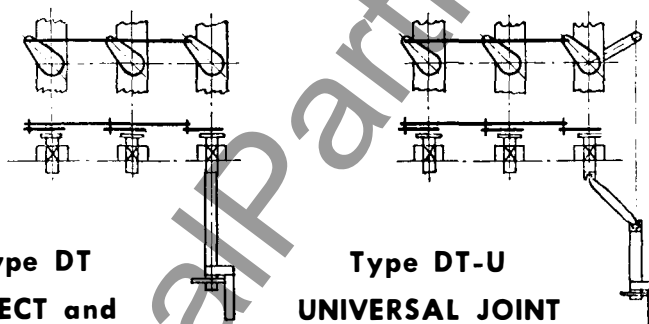


I-T-E CIRCUIT BREAKER COMPANY

Instruction Manual
for
INSTALLATION and OPERATION

**STANDARD
DIRECT-TORSION
SWITCHES and OPERATING MECHANISM**

“The Standard Stock Plan”



Type DT
DIRECT and

Type DT-U
UNIVERSAL JOINT

Switch Mountings—Horizontal Upright
7,500 and 15,000 Volts—Style No. 36339
23,000 to 69,000 Volts—Style No. 36340
400, 600 and 1200 Amperes



ITE Imperial Corporation

ERECTION CREWS- FIELD MEN-

Here's a new way to-

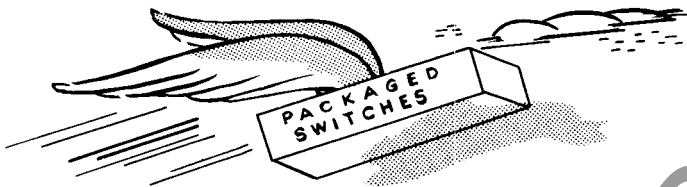
• GET SERVICE TO CUSTOMERS -

Sooner

• BRING IN SERVICE REVENUE -

Quicker

STANDARD STOCK PLAN - a New Service for-



1 Faster Deliveries, Switches and Mechanisms

Can be applied to any type structure

Especially applicable to wood pole structures, existing steel structures and new purchaser-designed structures

2



3 Permits on-the-site tailor-fitting by Experienced Field Crew

In addition to the above plan which assures you of fast deliveries for field application - I-T-E will continue to supply the long established Custom Designed Operating Mechanism, fully detailed with complete erection information - where time permits and data is available.



4 Provides field control of all details of installation

Stock Plan has double advantage

A. Order from I-T-E Greensburg Factory with prompt delivery

5

B. Order and stock in your own warehouse for instant use



6 Helps meet construction schedules

This service is always available when a complete substation is fabricated by I-T-E, or when complete structure details are furnished. The new Standard Stock Plan is advantageous when it is desirable and convenient for the field construction men to take standard sizes of parts, and fit them to available mounting structure.

Type DT and DT-U

Manual Operating Mechanism connected direct to switch rotor of Types TTR, TTL switches.

Torsion type operation.

UNPACKING INSPECTION

The bill of material and installation drawings, shown in this Manual should be checked against the total shipment of switch pole units, operating links, and mechanisms for completeness, and to aid the installation procedure. Any damages or shortages should be reported immediately to the carrier and proper claim entered. All type TTR 49 and TTL 49 pole units up to and including 46 Kv are normally shipped completely assembled and adjusted, except for arcing horns, and are ready for installation.

DESCRIPTION

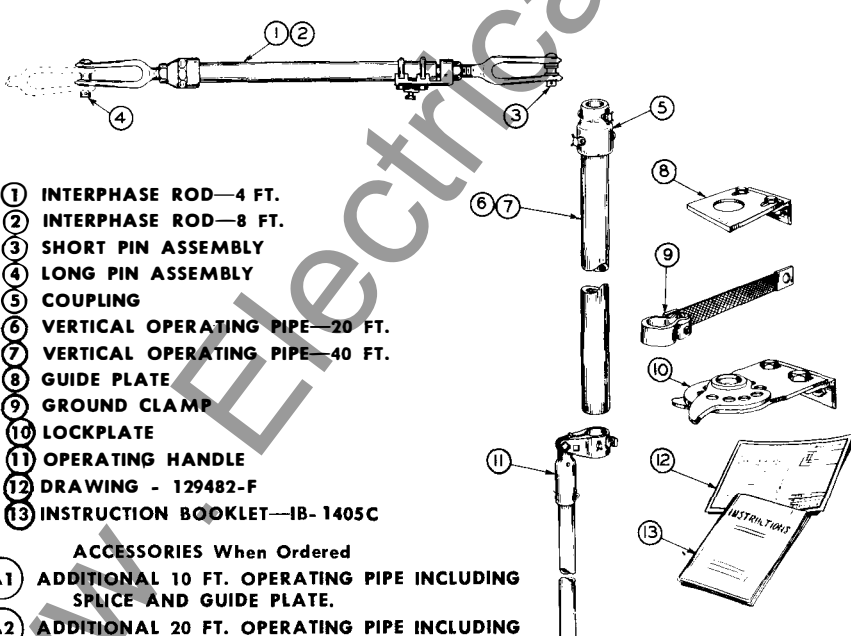
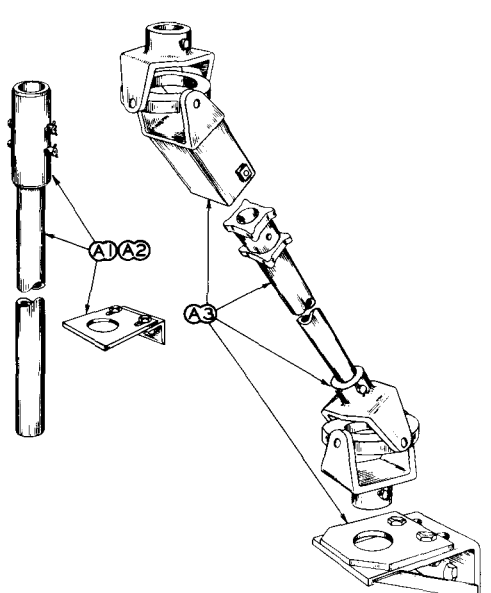
Operating pipe can be attached to any one of the three pole bearing rotors and attached to wood pole, or structure, — and down to ground level operating

position. If the position of the operating handle is not directly below the driven switch rotor, universal joints should be used. They are considered an accessory to the standard mechanism. A standard hinged pipe handle, when raised, is horizontally moved in an arc of 90° to operate switches. A vernier lock plate stops rotation in open and closed position and can be padlocked. Interphase connections are adjustable. When more than one standard length of vertical pipe is required, a coupling is supplied with the extra length. Guide plates are supplied to keep vertical pipe in alignment.

SWITCH ADJUSTMENT

A complete detailed instruction manual covering switch adjustment and maintenance is supplied with each three-pole switch.

BILL OF MATERIAL

STANDARD MECHANISM PARTS	UNIVERSAL JOINT ACCESSORY When Ordered
	
<ul style="list-style-type: none">① INTERPHASE ROD—4 FT.② INTERPHASE ROD—8 FT.③ SHORT PIN ASSEMBLY④ LONG PIN ASSEMBLY⑤ COUPLING⑥ VERTICAL OPERATING PIPE—20 FT.⑦ VERTICAL OPERATING PIPE—40 FT.⑧ GUIDE PLATE⑨ GROUND CLAMP⑩ LOCKPLATE⑪ OPERATING HANDLE⑫ DRAWING - 129482-F⑬ INSTRUCTION BOOKLET—IB- 1405C	<ul style="list-style-type: none">A1 ADDITIONAL 10 FT. OPERATING PIPE INCLUDING SPLICE AND GUIDE PLATE.A2 ADDITIONAL 20 FT. OPERATING PIPE INCLUDING SPLICE AND GUIDE PLATE.A3 ADDITIONAL 10 FT. OPERATING PIPE COMPLETE WITH UNIVERSAL JOINTS AND GUIDE PLATE.

INSTALLATION OF OPERATING MECHANISM

INTERCONNECTING RODS

With switches in fully closed position (cranks against closed position base stops), install phase interconnecting rods beginning with the switch pole to which the vertical operating pipe is to be attached. Each Interphase Rod is supplied with one U-bolt clamp, with piercing screw. The length of the rod, center to center of the extreme clevis holes, is found by determining the phase spacing of the switch voltage rating. Cut the pipe so that the "L" dimension

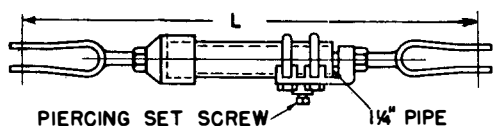


Fig. 1

(Figure 1) will equal the interphase distance. With the U-bolt clamped in position, drive the piercing set screw through the pipe. Lengthen or shorten the rods to adjust switch operation by turning clevis (Item 3, page 6). One-half turn of clevis equals 1/16 inch. Then, lock jam nut and install cotter pins.

VERTICAL PIPE ASSEMBLY

When the operating mechanism is coupled to one of the pole units as illustrated on page 5, attach pipe coupling (Item 5), and the first section of operating pipe to the switch rotor. Each part is numbered and its location clearly shown on drawings, page 6.

GUIDE PLATE AND COUPLINGS

If more than one section of pipe is necessary, a guide plate (Item 8) is furnished which should be slipped over the pipe. When additional pipe lengths are being used, a pipe splice is furnished and should be slipped over the pipe. After the operating pipe and handle have been completely installed, the guide plates should be mounted to hold the pipe in alignment. On wood poles, it may be necessary to block out from the pole, or gain the pole properly to support the pipe.

OPERATING HANDLE AND LOCK PLATE

As illustrated on page 6, slide handle clamp and lock plate (Item 10) over the lower end of the pipe and fasten the lock plate in position at the height desired. Recommended height is approximately 3'-6" from the ground level. With switches in fully closed

position, set the torsion type handle clamp with its centerline 3 1/2" above the lock plate and with the handle 45 degrees to the right of the lock plate center as you face the plate. Temporarily fasten the handle to the pipe with the set screw (Note "X"). Operate the switch and adjust the stops of the vernier type lock plate until they exert pressure against the handle in both the open and closed position of the switch. The vertical operating pipe should be free to rotate when all guide plates are in alignment.

There should be some "wind-up" in the vertical operating pipe in both the open and closed position of the switches. This is accomplished by the proper adjustment of the handle locking plate stops. The rotor crank stops on the bases of the individual switch pole units should engage before the handle is in the locked position.

GROUND CONNECTIONS

A flexible ground connection (item 9) should be installed to suit the installation. The ground clamp should be connected to the vertical operating pipe above the handle, and the other end bolted to the supporting structure. An electrical connection should be made between the fixed end of the clamp and the station ground grid.

In the case of a wood pole structure, the connection should be made to a grounded metal platform or other suitable grounding means.

OPERATION

Switches will now operate freely with moderate effort applied to the operating handle. All blades should operate together to the fully closed position. It may be necessary to slightly adjust one or more "open position" stop bolts (C) Figure 2, to obtain proper open position of blades. Operate several times to check adjustments. Be sure all blades operate to the fully closed position when the handle is locked closed. Finally, drill 5/8" hole for pin and permanently secure the handle to the vertical operating pipe.

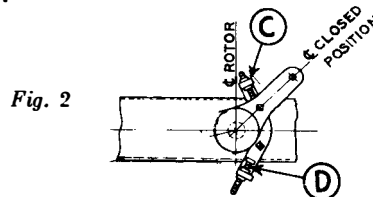


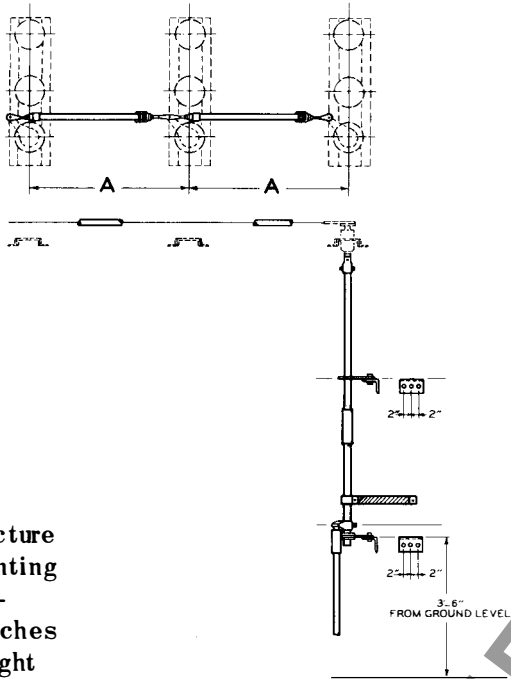
Fig. 2

TYPICAL ASSEMBLIES

Standard - Direct Connected Mechanisms

TYPE DT

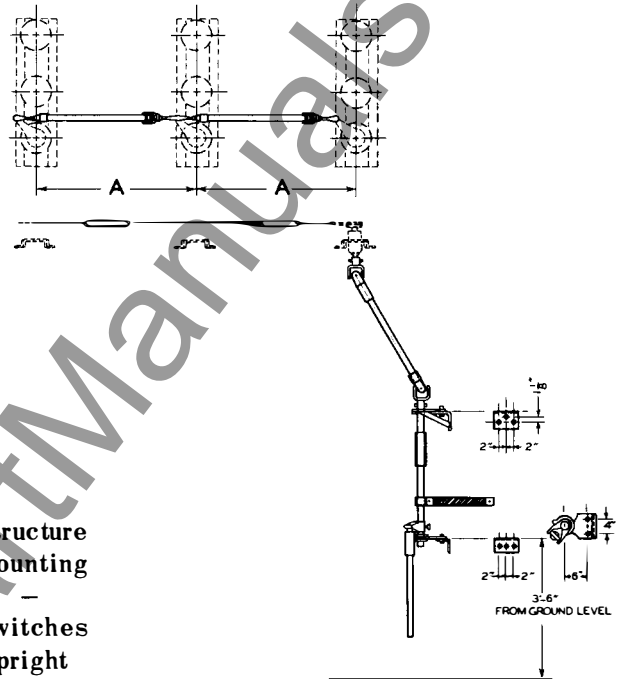
Operating Handle directly below driven switch rotor.



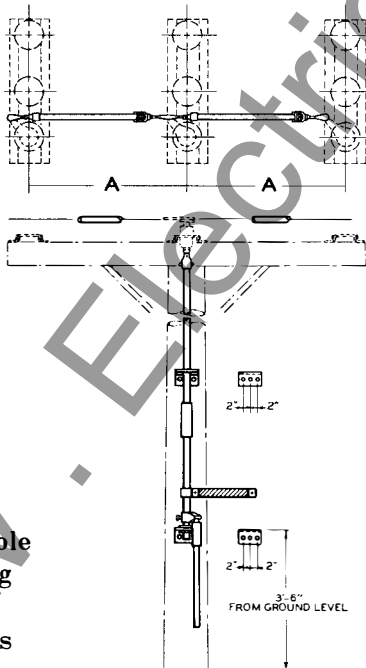
Structure Mounting
—
Switches Upright

Type DT-U, Accessory

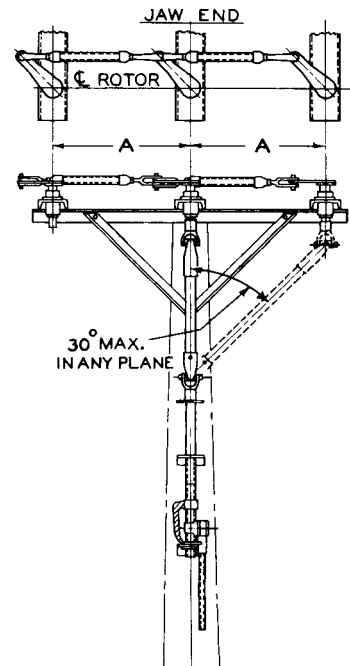
Operating Handle not directly below driven switch rotor.



Structure Mounting
—
Switches Upright

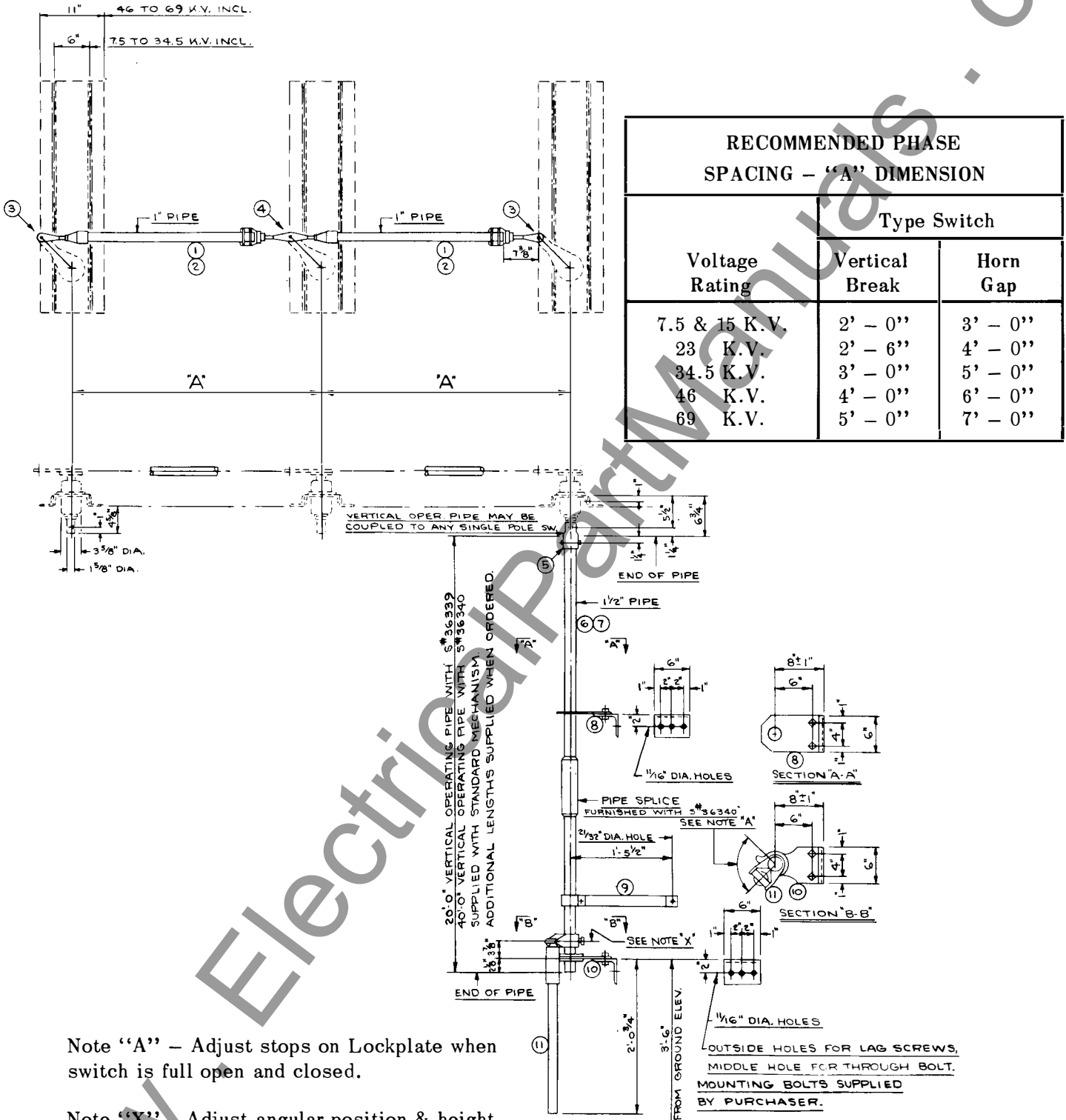


Wood Pole Mounting
—
Switches Upright



Wood Pole Mounting
—
Switches Upright

DETAILS FOR ERECTING MANUAL TORSION TYPE - ATTACHES DIRECT TO SWITCH ROTOR OF TYPE



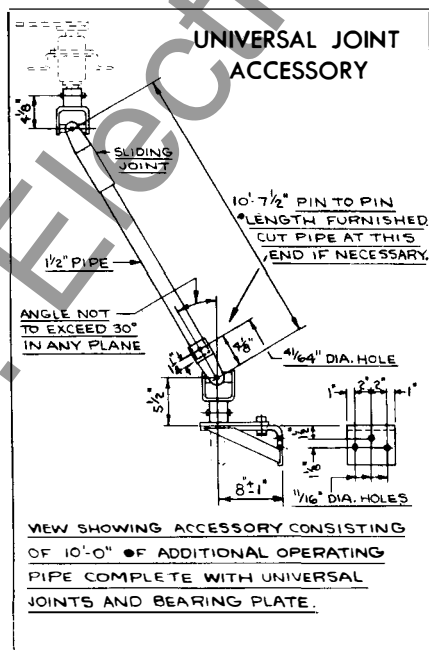
Note "A" - Adjust stops on Lockplate when switch is full open and closed.

Note "X" - Adjust angular position & height of handle. Then lock to pipe by forcing tool steel set screw until head touches casting. Drill a 5/8" Dia. hole through pipe for a 5/8" Dia. Pin.

SWITCH OPERATING MECHANISM

TTR49 OR TYPE TTL49 SWITCHES, 400, 600, 1200 AMPERE

BILL OF MATERIAL		STYLE NUMBERS	
		No. 36339	No. 36340
for TTR 49 and TTL 49 switches		7.5 and 15 Kv	23 to 69 Kv
ITEM	PART	REQUIRED	REQUIRED
1	Interphase Rod (4 feet)	2	—
2	Interphase Rod (8 feet)	—	2
3	Short Clevis Pin Assembly	2	2
4	Long Clevis Pin Assembly	1	1
5	Coupling, to bearing	1	1
6	Vertical Oper. Pipe (20 feet)	1	—
7	Vertical Oper. Pipe (40 feet) (2 pieces – 20 ft. long)	—	1
8	Bearing plate	—	1
9	Ground Clamp with flex	1	1
10	Lock plate	1	1
11	Operating Handle	1	1
12	Instruction Drawing – 129482-F	1	1
13	Instruction Booklet – IB-1405C	1	1
ACCESSORIES		WHEN ORDERED	
A1	Additional 10 ft. Oper. Pipe with splice & Guide	No. 36351	
A2	Additional 20 ft. Oper. Pipe with splice & Guide	No. 36352	
A3	Additional 10 ft. Oper. Pipe Complete with Universal Joints and Bearing Plate	No. 36353	



A larger size print of the details shown here is supplied with the "Standard Stock Plan" Mechanism when shipped. For additional copies – refer to drawing number below.

129482-F

www.ElectricalPartManuals.com



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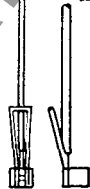
Instruction Manual
for
INSTALLATION and OPERATION

**STANDARD
 RECIPROCATING
 SWITCHES and OPERATING MECHANISM**

“The Standard Stock Plan”



Type RO
 FOURTH BEARING



Switch Mounting—Bases Vertical

7,500 and 15,000 Volts—Style No. 36337

23,000 to 69,000 Volts—Style No. 36338

400, 600 and 1200 Amperes



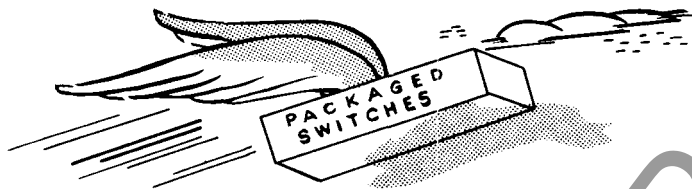
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ERECTION CREWS- FIELD MEN -

Here's a new way to -

- GET SERVICE TO CUSTOMERS - **Sooner**
- BRING IN SERVICE REVENUE - **Quicker**

STANDARD STOCK PLAN - a New Service for -

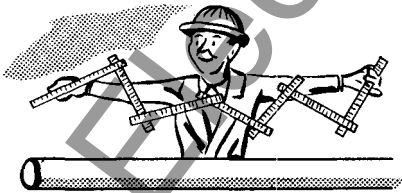


1 Faster Deliveries, Switches and Mechanisms

Can be applied to any type structure

Especially applicable to wood pole structures, existing steel structures and new purchaser-designed structures

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Stock Plan has double advantage

A. Order from I-T-E Greensburg Factory with prompt delivery

5

B. Order and stock in your own warehouse for instant use



6 Helps meet construction schedules

This service is always available when a complete substation is fabricated by I-T-E, or when complete structure details are furnished. The new Standard Stock Plan is advantageous when it is desirable and convenient for the field construction men to take standard sizes of parts, and fit them to available mounting structure.

Type RO

Manual Operating Mechanism connected direct or with offset bearing.

Type TTR or Type A Switches (400, 600 and 1200 amperes.)

Reciprocating type operation.

UNPACKING INSPECTION

The bill of material and installation drawings, shown in this Manual and attached to the Operating Mechanism parts should be checked against the total shipment of switch pole units, operating links, and mechanisms for completeness, and to aid the installation procedure. Any damages or shortages should be reported immediately to the carrier and proper claim entered. All type TTR 49 and type A6 pole units up to and including 46 Kv are normally shipped completely assembled and adjusted, except for arcing horns, and are ready for installation.

DESCRIPTION

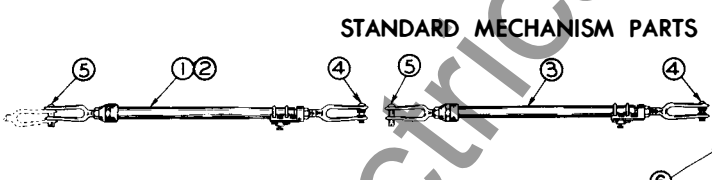
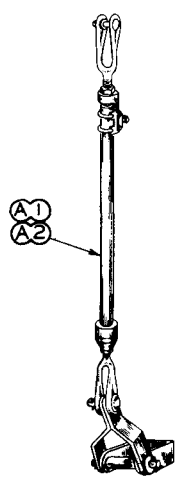
Type RO Switch Operating Mechanism has a reciprocating vertical pipe, designed for use with switches mounted with bases vertical. Operating pipe is attached to the outboard, or fourth bearing by means of an adjustable bell crank.

pipe extends from adjustable bell crank to operating mechanism at ground level. A pump type handle when raised or lowered, is moved in an arc of 180° to operate switches. A latching stop limits the switch operation in open and closed position and can be padlocked in either position. Interphase connections are adjustable and are made of pipe, with an adjustable clevis at one end and a U-bolt clamp with piercing set screw at the other end. When more than one standard length of vertical pipe is required, an intermediate bearing is supplied with the extra length.

SWITCH ADJUSTMENT

A complete detailed instruction manual covering switch adjustment and maintenance is supplied with each three-pole switch.

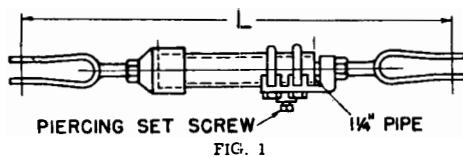
BILL OF MATERIAL

STANDARD MECHANISM PARTS	PIPE AND BEARING ACCESSORY
 <ul style="list-style-type: none"> ① INTERPHASE ROD—4 FT. ② INTERPHASE ROD—8 FT. ③ OFFSET LINK—8 FT. ④ SHORT PIN ASSEMBLY ⑤ LONG PIN ASSEMBLY ⑥ OUTBOARD BEARING—7½" CRANK ⑦ OUTBOARD BEARING—10" CRANK ⑧ VERTICAL OPERATING PIPE—21'-9" ⑨ GROUND CLAMP AND FLEX ⑩ OPERATING HANDLE ⑪ INSTRUCTION DRAWING—129481-F ⑫ INSTRUCTION BOOKLET—IB- 1405D 	 <ul style="list-style-type: none"> Ⓐ1 ADDITIONAL 10 FT. OPERATING PIPE WITH INTERMEDIATE BEARING Ⓐ2 ADDITIONAL 20 FT. OPERATING PIPE WITH INTERMEDIATE BEARING
<p style="text-align: center;">ACCESSORIES</p> <ul style="list-style-type: none"> Ⓐ1 ADDITIONAL 10 FT. OPERATING PIPE WITH INTERMEDIATE BEARING Ⓐ2 ADDITIONAL 20 FT. OPERATING PIPE WITH INTERMEDIATE BEARING 	

INSTALLATION OF OPERATING MECHANISMS for 3-inch Bolt Circle Switches

Interphase Rods

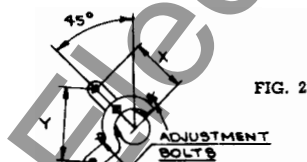
Begin with the switch pole nearest the outboard bearing and, with switches in fully closed position (cranks against closed position base stops), install phase interconnecting rods. Each Interphase Rod is supplied with one U-bolt clamp, with piercing screw. The length of the rod, center to center of the extreme clevis holes, is found by determining the phase spacing of the switch voltage rating. Cut the



pipe so that the "L" dimension (Fig. 1) will equal the interphase distance. With the U-bolt clamped in position, drive the piercing set screw through the pipe. Lengthen or shorten the rods to adjust switch operation by turning clevis, Item 3, on page 6. One-half turn of clevis equals 1/16 inch. Then, lock jam nut (1) and install cotter pins.

Outboard Bearing

When the outboard bearing is located and the connecting link fastened, adjust "Y" dimension, Figure 2, to suit crank length "X", which corresponds to switch crank length. See "adjustable crank length", page 6. The length of the connecting link is found by measuring the center to center distance between the outboard bearing and the switch rotor to be connected.



Vertical Pipe and Operating Handle Assembly

When the outboard, fourth bearing is located, connect the vertical pipe as shown on drawing 129481-F. With the hinge point of the operating handle located at least 3 ft. above ground, and handle in up position and with the fourth bearing crank in the closed position of the switch, then cut the vertical length of pipe to the required length so that the upper, or clevis end with the U-bolt clamp connects as shown.

Bolt the Operating Handle at a convenient height, usually 3 ft., or 3 ft. 6 in. above ground. The handle should be in toggle, in both the open and closed position. Beam clamps are sometimes used, but drilling and bolting is recommended for better anchorage of the Handle mounting.

Tighten the U-bolt clamp at the top of the operating pipe and operate the switch once to assure the full travel of the open and closed position of the switch. When switches operate satisfactorily, drive the set screw in the top U-bolt clamp until it pierces the pipe.

Intermediate Bearing

When additional lengths of pipe are to be used, an intermediate bearing is required and is supplied. The additional length of vertical pipe is also equipped with a U-bolt clamp and piercing screw. Attach the two lengths of pipe to the intermediate bearing as shown on drawing No. 129481-F, and cut the pipe to required length as described previously under "Vertical Pipe." Be sure, — when both lengths of pipe have been cut to required length and U-bolts tightened — to drive both set screws through pipe for solid connection. Caution — when intermediate bearing is used, upper pipe length should be at least 10 ft., pin to pin.

If the location of the intermediate bearing is critical, bolt it down first and cut both pipe sections to suit. Follow details shown on drawing 129481-F.

Ground Connections

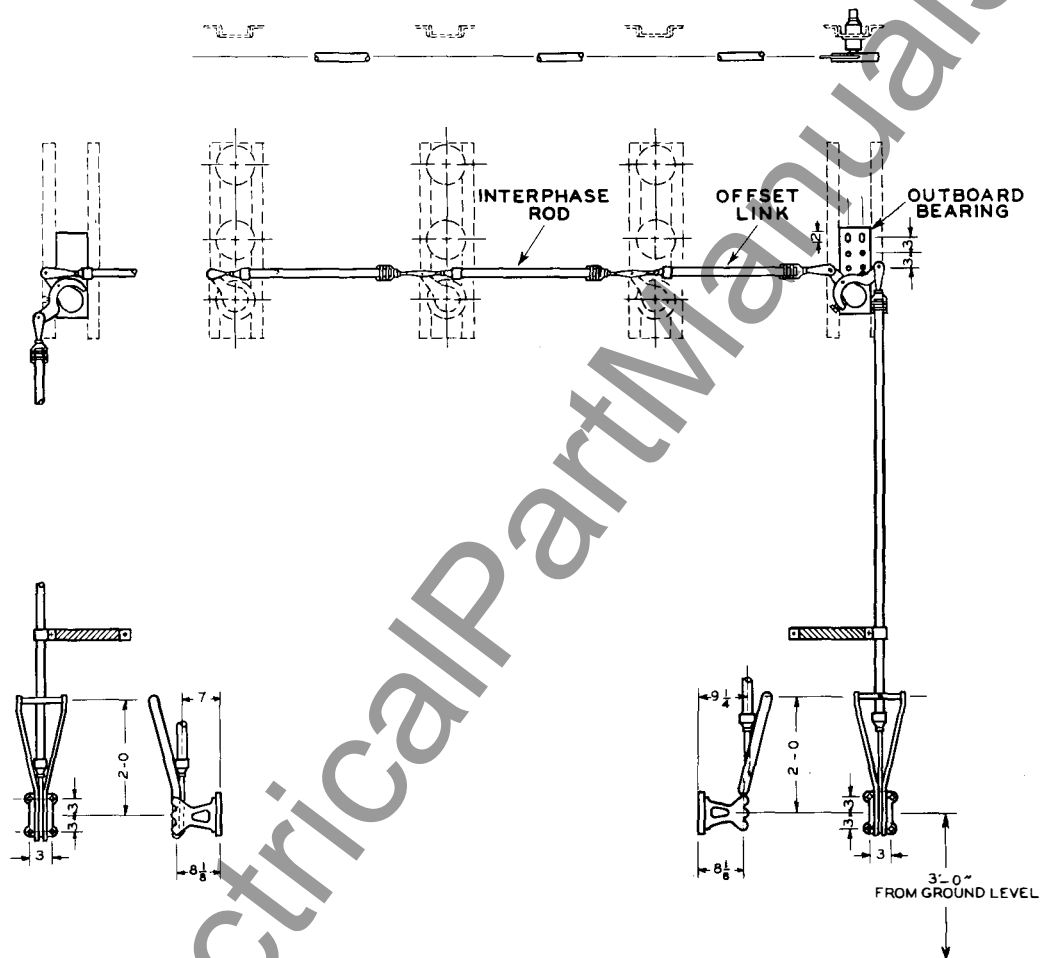
A flexible ground connection (item 9) should be installed to suit the installation. The ground clamp should be connected to the vertical operating pipe above the handle, and the other end bolted to the supporting structure. An electrical connection should be made between the fixed end of the clamp and the station ground grid.

In the case of a wood pole structure, the connection should be made to a grounded metal platform or other suitable grounding means.

TYPICAL ASSEMBLIES of Reciprocating Type Mechanisms

Type RO

Switches mounted with bases vertical - Manual handle connected to outboard bearing.



See details on pages 6 and 7

Operation

Switches will now operate freely with moderate effort applied to the operating handle. All blades should operate together to the fully closed position. It may be necessary to slightly adjust one or more "open position" stop bolts (C) Figure 3, to obtain proper open position of blades. Operate several times to check adjustments. Be sure all blades operate to the fully closed position when the handle is locked closed.

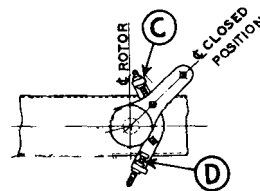
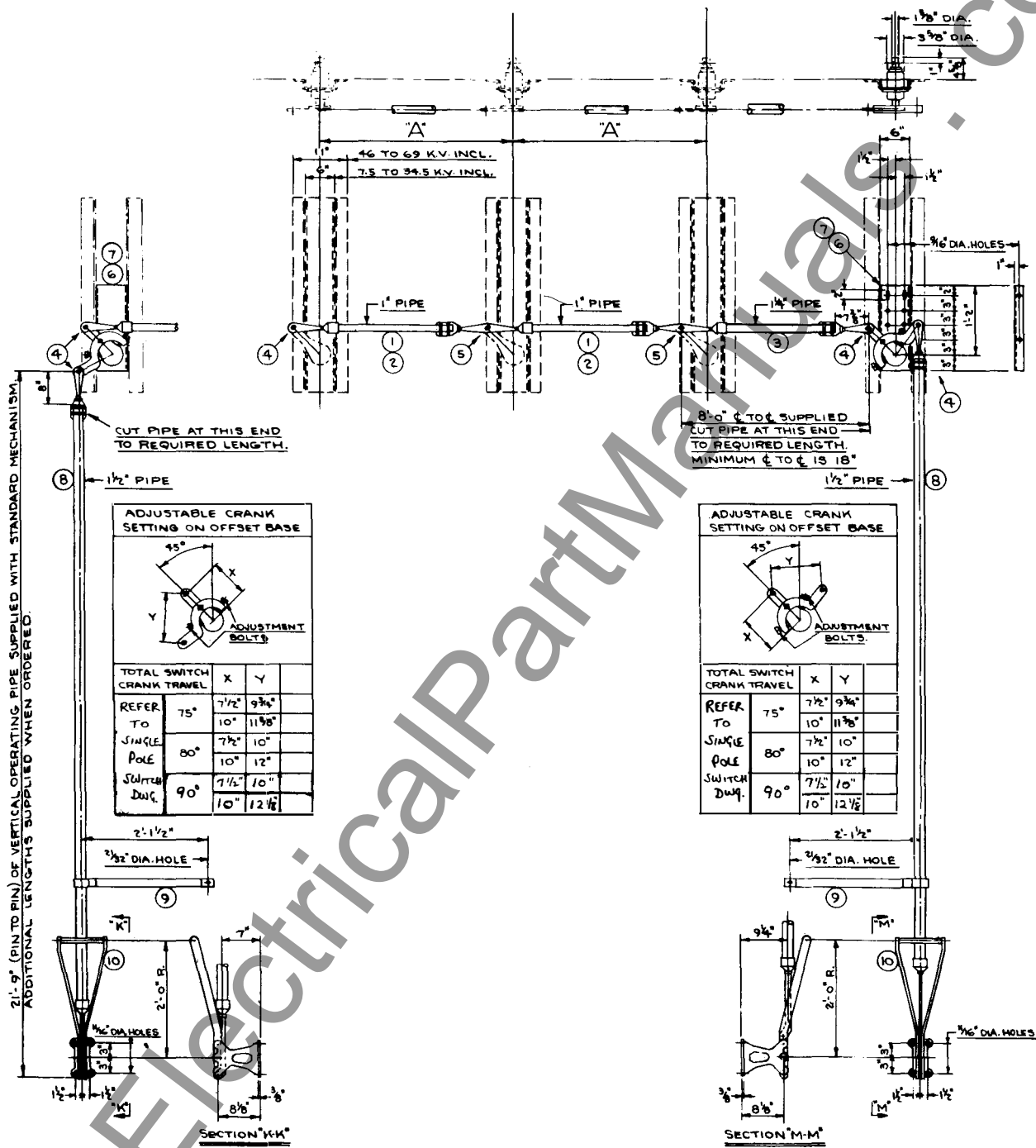


FIG. 3

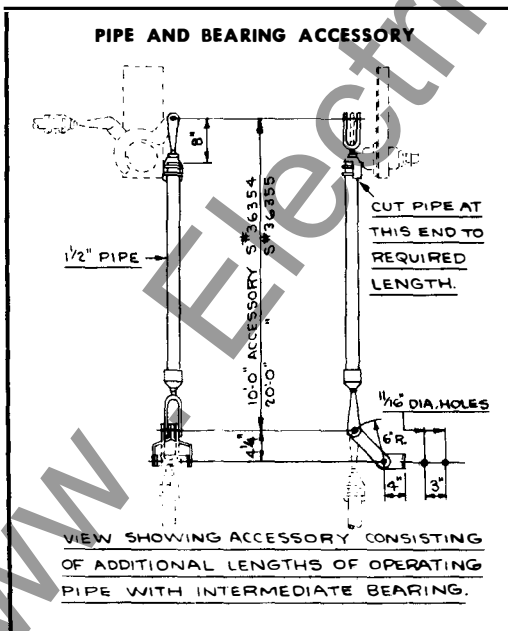
DETAILS FOR ERECTING RECIPROCATING



RECOMMENDED PHASE SPACING "A" DIMENSION			
VOLTAGE RATING	TYPE SWITCH		
	Vertical Break	Side Break	Horn Gap
7,500 and 15,000	2' - 0"	2' - 6"	3' - 0"
23,000	2' - 6"	3' - 0"	4' - 0"
34,500	3' - 0"	4' - 0"	5' - 0"
46,000	4' - 0"	5' - 0"	6' - 0"
69,000	5' - 0"	6' - 0"	7' - 0"

SWITCH OPERATING MECHANISM

BILL OF MATERIAL		STYLE NUMBERS	
		No. 36337	No. 36338
<ul style="list-style-type: none"> • for side opening switches • for vertical opening switches 		7.5 to 23 Kv. 7.5 and 15 Kv.	34.5 to 69 Kv. 23 to 69 Kv.
ITEM	PART	REQUIRED	REQUIRED
1	Interphase Rod (4 feet)	2	—
2	Interphase Rod (8 feet)	—	2
3	Offset link (8 feet)	1	1
4	Short clevis pin assembly	3	3
5	Long clevis pin assembly	2	2
6	Outboard bearing (7½" R. crank)	1	—
7	Outboard bearing (10" R. crank)	—	1
8	Vertical operating pipe (21'-9")	1	1
9	Ground clamp, with flex	1	1
10	Operating handle	1	1
11	Instruction Drawing — 129481-F	1	1
12	Instruction Booklet — IB-1405D	1	1
ACCESSORIES		WHEN ORDERED	
A1	Add. 10 feet operating pipe with intermediate bearing	No. 36354	
A2	Add. 20 feet operating pipe with intermediate bearing	No. 36355	



A larger print of the details shown here is supplied with the "Standard Stock Plan" mechanism when shipped. For additional copies, refer to drawing number.

129481-F

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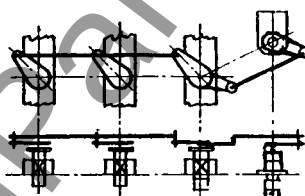


ITE Imperial Corporation

Instruction Manual
for
INSTALLATION and OPERATION

**STANDARD
OFFSET-TORSION
SWITCHES and OPERATING MECHANISM**

“The Standard Stock Plan”



**TYPE OT
FOURTH BEARING**
with Multi-Angle Crank

Switch Mounting—Upright and Inverted

Vertical Break 7.5 & 15 Kv,	} Style No. 36335
Side Break 7.5 to 23 KV	
Vertical Break 23 to 69 Kv	} Style No. 36336
Side Break, 34.5 and 69 Kv	



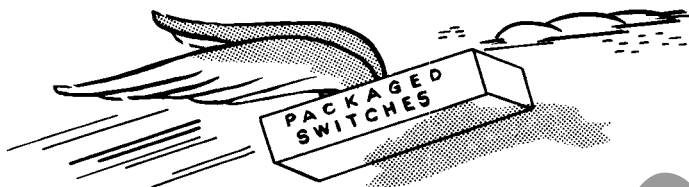
ITE Imperial Corporation

ERECTION CREWS- FIELD MEN -

Here's a new way to -

- GET SERVICE TO CUSTOMERS - **Sooner**
- BRING IN SERVICE REVENUE - **Quicker**

STANDARD STOCK PLAN - a New Service for -



1 Faster Deliveries, Switches and Mechanisms

Can be applied to any type structure

Especially applicable to wood pole structures, existing steel structures and new purchaser-designed structures

2



3 Permits on-the-site tailor-fitting by Experienced Field Crew

In addition to the above plan which assures you of fast deliveries for field application — I-T-E will continue to supply the long established Custom Designed Operating Mechanism, fully detailed with complete erection information — where time permits and data is available.



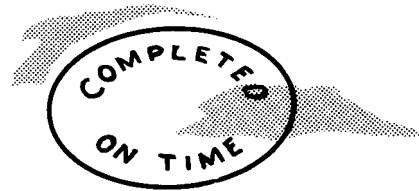
4 Provides field control of all details of installation

Stock Plan has double advantage

A. Order from I-T-E Factory with prompt delivery

5

B. Order and stock in your own warehouse for instant use



6 Helps meet construction schedules

This service is always available when a complete substation is fabricated by I-T-E, or when complete structure details are furnished. The new Standard Stock Plan is advantageous when it is desirable and convenient for the field construction men to take standard sizes of parts, and fit them to available mounting structure.

Type OT

Manual Operating Mechanism connected with universal multi-angle crank and a fourth bearing to -

Type TTR, TTL and Type A Switches

Torsion type operation.

UNPACKING INSPECTION

The bill of material and installation drawings, shown in this Manual, should be checked against the total shipment of switch pole units, operating links, and mechanisms for completeness and to aid the installation procedure. Any damage or shortages should be reported immediately to the carrier and proper claim entered. All type TTR 49 and TTL 49 pole units up to and including 46 Kv are normally shipped completely assembled and adjusted, except for arcing horns, and are ready for installation.

DESCRIPTION

When a vertical operating pipe cannot be dropped directly down from one of the three switch rotors, a fourth or offset bearing must be used. An advantage of this fourth bearing mechanism is the universally adjustable multi-angle crank used on the switch rotor to which the fourth bearing is connected. It

permits the fourth bearing to be mounted in any angular position to, and in the same plane as, the driven rotor. The vertical operating pipe is connected to the fourth or offset bearing, and terminates at a ground level operating position. A standard hinged pipe handle, when raised, is moved horizontally in an arc of 90° to operate switches. A vernier lock plate stops rotation in open and closed position, and can be padlocked in either position. Interphase connections are adjustable, having a U-bolt, piercing screw adjustment. When more than one standard length of vertical pipe is required, a coupling is supplied with the extra length. Guide plates are supplied to keep vertical pipe in alignment.

SWITCH ADJUSTMENT

A complete detailed instruction manual covering switch adjustment and maintenance is supplied with each three-pole switch.

BILL OF MATERIAL

STANDARD MECHANISM PARTS		PIPE ACCESSORY
<ol style="list-style-type: none"> ① INTERPHASE ROD—4 FT. ② INTERPHASE ROD—8 FT. ③ OFFSET LINK—8 FT. ④ SHORT PIN ASSEMBLY ⑤ LONG PIN ASSEMBLY ⑥ MULT-ANGLE CRANK—7½" R ⑦ MULT-ANGLE CRANK—10" R ⑧ OUTBOARD BEARING ⑨ OUTBOARD BEARING ⑩ COUPLING ⑪ VERTICAL OPERATING PIPE—20 FT. ⑫ VERTICAL OPERATING PIPE—40 FT. ⑬ GUIDE PLATE ⑭ GROUND CLAMP ⑮ LOCKPLATE ⑯ OPERATING HANDLE ⑰ INSTRUCTION DRAWING—129104-F ⑱ INSTRUCTION BOOKLET—IB-1405E 	<ol style="list-style-type: none"> A1 ADDITIONAL 10 FT. OPERATING PIPE INCLUDING SPLICE AND GUIDE PLATE. A2 ADDITIONAL 20 FT. OPERATING PIPE INCLUDING SPLICE AND GUIDE PLATE. 	
<p style="text-align: center;">ACCESSORIES</p>		

INSTALLATION OF OPERATING MECHANISMS for 3-inch Bolt Circle Switches

INTERCONNECTIONS

With switches in fully closed position (operating crank against closed position base stop), install phase interconnecting rods and offset connecting link, beginning at the outboard bearing.

OUTBOARD BEARING

Mount the outboard bearing with its structural steel support, in a location suitable for an operating position for the handle and vertical operating pipe. (See Figure 4). Additional reinforcing steel may be required in order to provide a rigid fourth bearing in the same plane as the switch rotors.

MULTI-ANGLE CRANK and ADAPTER

On the switch pole nearest the location of the outboard bearing, assemble the Multi-Angle Crank and Adapter (figures 7 and 8) as shown in figures 5 and 6. First mount the adapter plate underneath the flange of the switch rotor, Fig. 6. Replace the three bolts indicated with attachment bolts which are supplied with crank parts. When post type insulator units are being used, double end bolts are also supplied. One end of each of three bolts is screwed into tapped holes of insulator base caps and the insulator is placed in position to fasten the adapter plate (figure 6) with nuts supplied. The adjustable crank, figure 7, can now be attached at an angle of about 45° to center line of connecting link as shown in figure 3. After adjustment, it should be permanently fastened with a minimum of three bolts and nuts as shown.

CONNECTING LINK

The length of the offset connecting link is found by measuring the center distance between the outboard bearing and the switch rotor to be connected.

Cut the pipe of the connecting link so that the total pin to pin length, when U-bolt is clamped, equals that distance just measured. Drive home the piercing set screw to secure the clamp.

Attach the offset link to the multi-angle switch crank and rotate the multi-angle crank around its adapter plate on the switch rotor until, with the switch fully closed, the offset link can be attached to the offset crank. Next, fasten the multi-angle crank to its adapter plate in such a position that the offset crank and link are as nearly as possible

in toggle. In some positions the stop bolt may have to be removed from the switch crank. Stop bolts on the other two switches will be adequate.

INTERCONNECTING RODS

With switches in fully closed position (cranks against closed position base stops), install phase interconnecting rods beginning with the switch pole

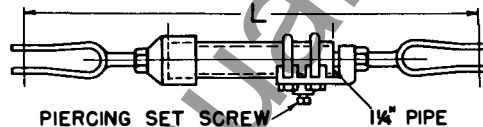


FIG. 1

nearest the fourth bearing. Each Interphase Rod is supplied with one U-bolt clamp, with piercing screw. The length of the rod, center to center of the extreme clevis holes, is found by determining the phase spacing of the switch voltage rating. Cut the pipe so that the "L" dimension (Figure 1) will equal the interphase distance. With the U-bolt clamp in position, drive the piercing set screw through the pipe. Lengthen or shorten the rods to adjust switch operation by turning clevis (Item 3, page 6). One-half turn of clevis equals 1/16 inch. Then, lock jam nut and install cotter pins.

VERTICAL PIPE ASSEMBLY

Attach the top section of operating pipe to the bottom of the fourth bearing rotor. Each part is numbered and its location clearly shown on drawings, page 6. Next cut off the bottom end of the lower section of vertical operating pipe to the required length and fasten it to the upper section by means of the coupling provided.

GUIDE PLATE AND COUPLINGS

If more than one section of pipe is necessary, a guide plate (Item 8) is furnished which should be slipped over the pipe. When additional pipe lengths are being used, a pipe splice is furnished and should be installed as shown on drawing 129482-F, page 6. If additional guide plates are furnished, they should be slipped over the pipe. After the operating pipe and handle have been completely installed, the guide plates should be mounted to hold the pipe in alignment, on wood poles, it may be necessary to block out from the pole, or gain the pole properly to support the pipe.

(continued on page 5)

OPERATING HANDLE AND LOCK PLATE

As illustrated on page 6, slide handle clamp and lock plate (Item 10) over the lower end of the pipe and fasten the lock plate in position at the height desired. Recommended height is approximately 3'-6" from the ground level. With switches in fully closed position, set the torsion type handle clamp with its centerline 3 1/2" above the lock plate and with the handle 45 degrees to the right of the lock plate center as you face the plate. Temporarily fasten the handle to the pipe with the set screw (Note "X", page 7). Operate the switch and adjust the stops of the vernier type lock plate until they exert pressure against the handle in both the open and closed position of the switch. The vertical operating pipe should be free to rotate when all guide plates are in alignment.

There should be some "wind-up" in the vertical operating pipe in both the open and closed position of the switches. This is accomplished by the proper adjustment of the handle locking plate stops. The rotor crank stops on the bases of the individual switch pole units should engage before the handle is in the locked position.

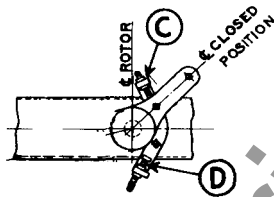


FIG. 2

Schematic views showing various locations of fourth bearing and multi-angle crank - also recommended direction of opening.

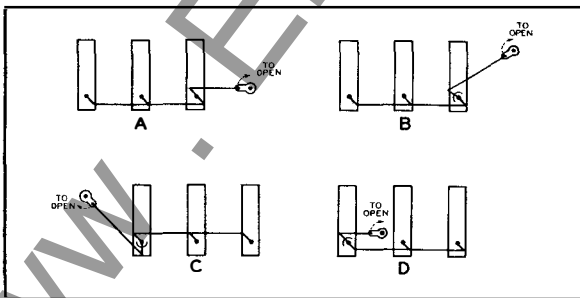


FIG. 4

GROUND CONNECTIONS

A flexible ground connection (item 9) should be installed to suit the installation. The ground clamp should be connected to the vertical operating pipe above the handle, and the other end bolted to the supporting structure. An electrical connection should be made between the fixed end of the clamp and the station ground grid.

In the case of a wood pole structure, the connection should be made to a grounded metal platform or other suitable grounding means.

OPERATION

Switches will now operate freely with moderate effort applied to the operating handle. All blades should operate together to the fully closed position. It may be necessary to slightly adjust one or more "open position" stop bolts (C) Figure 2, to obtain proper open position of blades. Operate several times to check adjustments. Be sure all blades operate to the fully closed position when the handle is locked closed. Finally, drill 5/8" hole for pin and permanently secure the handle to the vertical operating pipe.

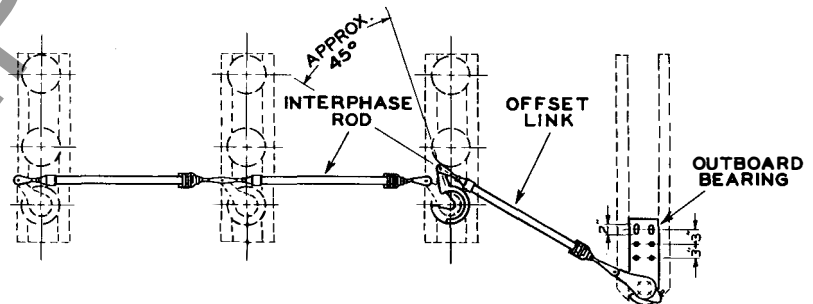


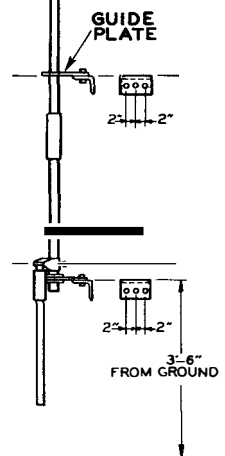
FIG. 3

TYPICAL ASSEMBLY

Offset - Torsional -

Switches and Operating Mechanism

TYPE OT - with fourth bearing



DETAILS OF MULTI-ANGLE CRANK on the Driven Switch Rotor

Angular Adjustment of Crank

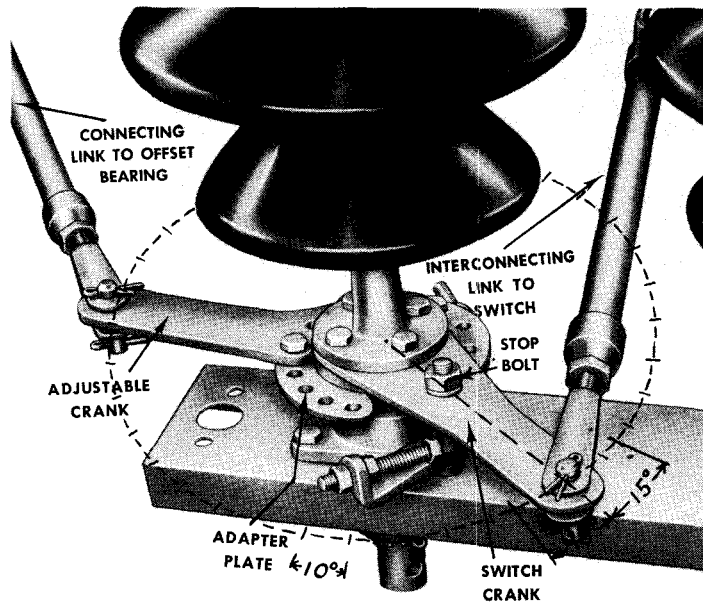


FIG. 5—Angular position of adjustable crank is limited only by the switch crank and interconnecting clevis. The dotted line indicates the 15 degree possible limits on either side of pin in the switch crank clevis. A—Interconnection to other switch. B—Connection to fourth bearing.

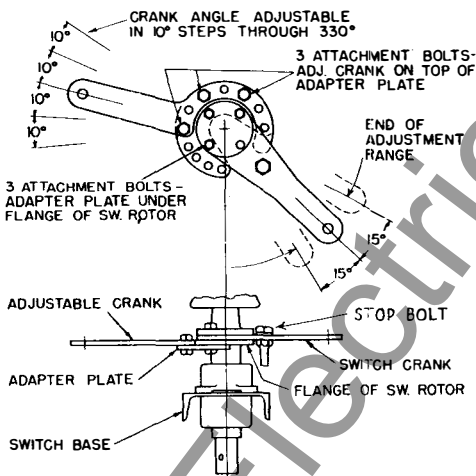


FIG. 6—Assembly detail of FIG. 5

Note—15° limit shown is as close as the adjustable crank can be placed to the switch crank regardless of position. This is the required clearance for the clevis connections.

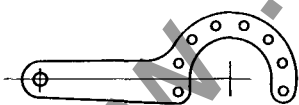


FIG. 7—Adjustable Crank

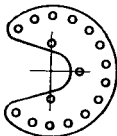


FIG. 8—Adapter Plate

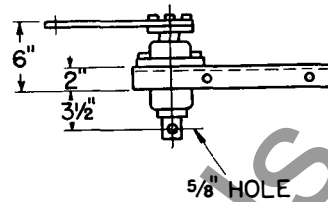


FIG. 9—Fourth Bearing.

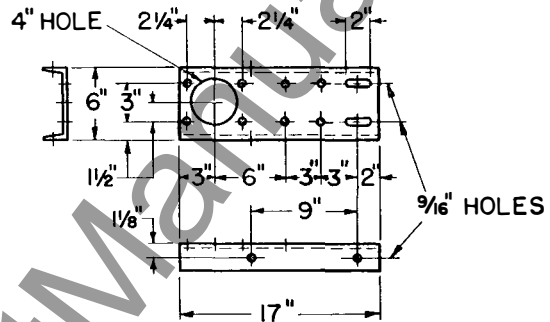


FIG. 10—Details of 4th Bearing Support.

BILL OF MATERIAL		STYLE NUMBERS	
		No. 36335	No. 36336
• for vertical opening switches		7.5 & 15 Kv	23 to 69 Kv
• for side opening switches		7.5 to 23 Kv	34.5 to 69 Kv
ITEM	PART	REQUIRED	REQUIRED
1	Interphase Rod (4 feet)	2	—
2	Interphase Rod (8 feet)	—	2
3	Offset Link (8 feet)	1	1
4	Short Clevis Pin Assembly	4	4
5	Long Clevis Pin Assembly	1	1
6	Multi-angle crank (7½" R.)	1	—
7	Multi-angle crank (10" R.)	—	1
8	Outboard bearing (7½" R. crank)	1	—
9	Outboard bearing (10" R. crank)	—	1
10	Coupling (to bearing)	1	1
11	Vertical operating pipe (20 feet)	1	—
12	Vertical operating pipe (40 feet) (2 pcs. 20 feet long)	—	1
13	Guide plate	—	1
14	Ground clamp, with flex	1	1
15	Lock plate	1	1
16	Operating handle	1	1
17	Instruction Drawing - 129104-F	1	1
18	Instruction Booklet - IB-1405E	1	1
ACCESSORIES		WHEN ORDERED	
A1	Add. 10 feet oper. pipe with splice and guide plate	No. 36351	
A2	Add. 20 feet oper. pipe with splice and guide plate	No. 36352	
A3	Add. 10 feet oper. pipe with universal joints and guide plate	No. 36353	

DETAILS FOR ERECTION of Torsional, Fourth Bearing Operating Mechanism

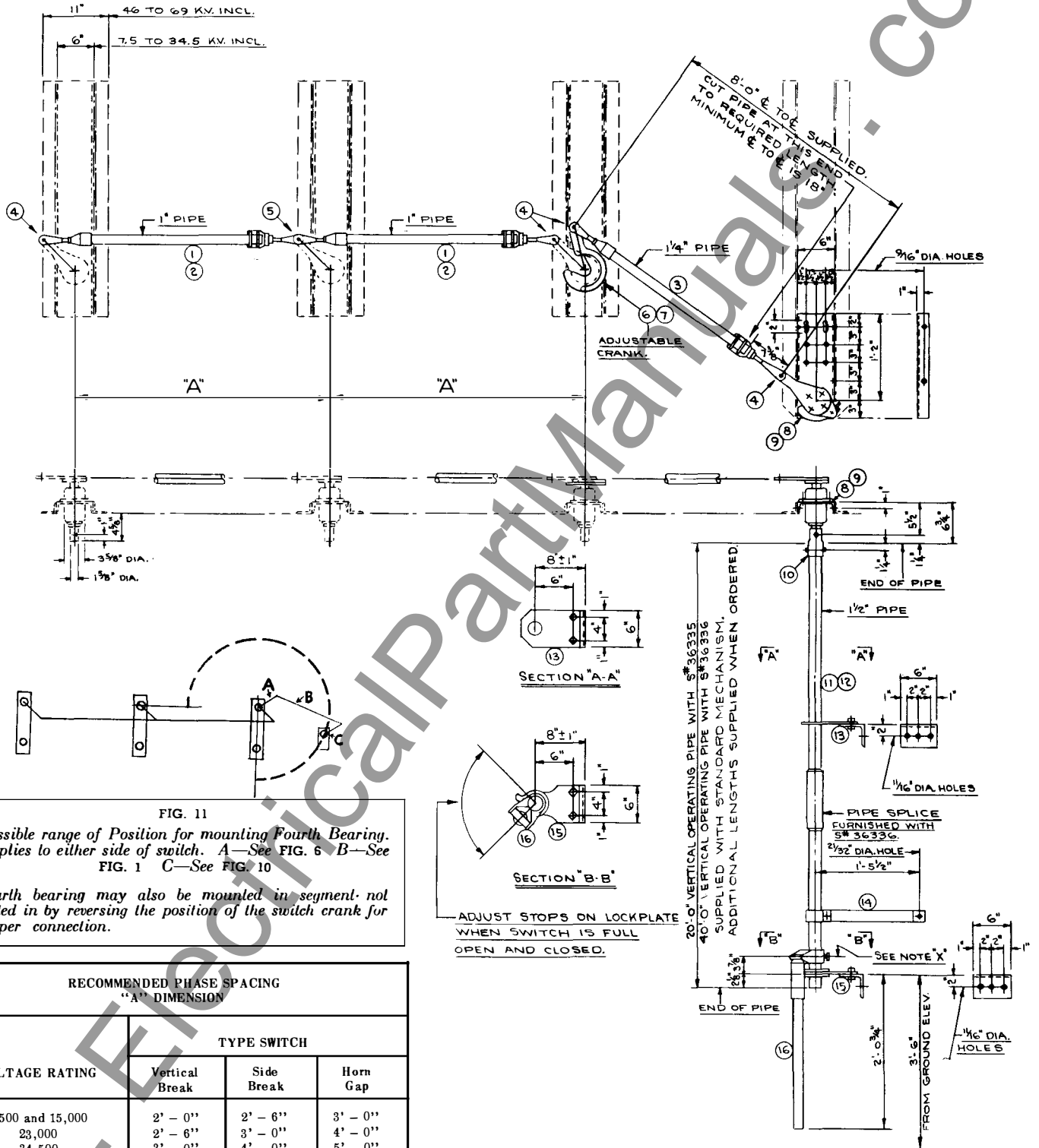


FIG. 11
Possible range of Position for mounting Fourth Bearing. Applies to either side of switch. A—See FIG. 6 B—See FIG. 1 C—See FIG. 10
Fourth bearing may also be mounted in segment not dotted in by reversing the position of the switch crank for proper connection.

RECOMMENDED PHASE SPACING "A" DIMENSION			
VOLTAGE RATING	TYPE SWITCH		
	Vertical Break	Side Break	Horn Gap
7,500 and 15,000	2' - 0"	2' - 6"	3' - 0"
23,000	2' - 6"	3' - 0"	4' - 0"
34,500	3' - 0"	4' - 0"	5' - 0"
46,000	4' - 0"	5' - 0"	6' - 0"
69,000	5' - 0"	6' - 0"	7' - 0"

Note "X" - Adjust angular position & height of handle. Then lock to pipe by forcing tool steel set screw until head touches casting. Drill a 5/8" diameter hole through pipe for a 5/8" pin.

A larger print of the details shown here is supplied with the "Standard Stock Plan" mechanism when shipped. For additional copies - refer to drawing number below.

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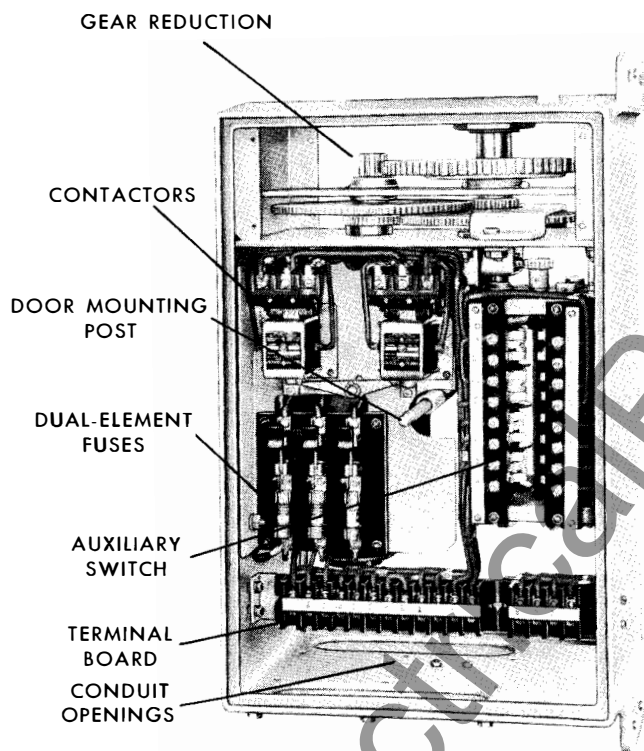


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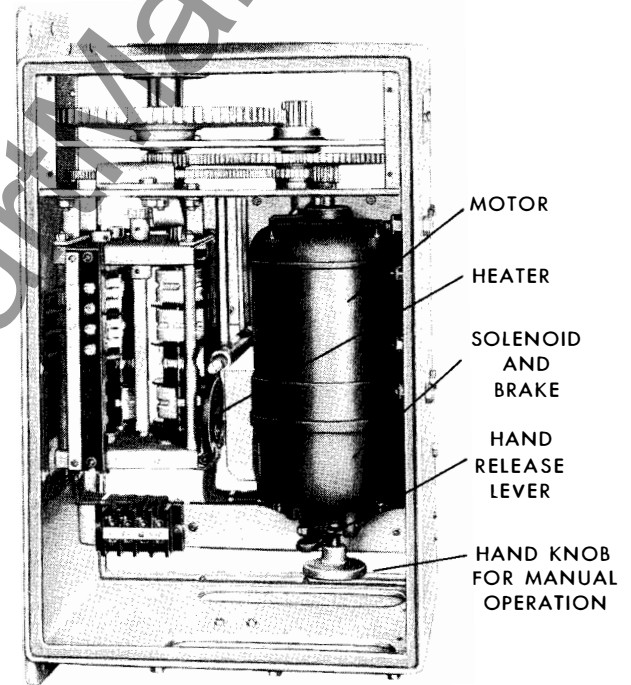
SWITCH OPERATING MECHANISMS

INSTRUCTIONS

MO-9 MOTOR DRIVEN ACTUATORS



3780A



3780B

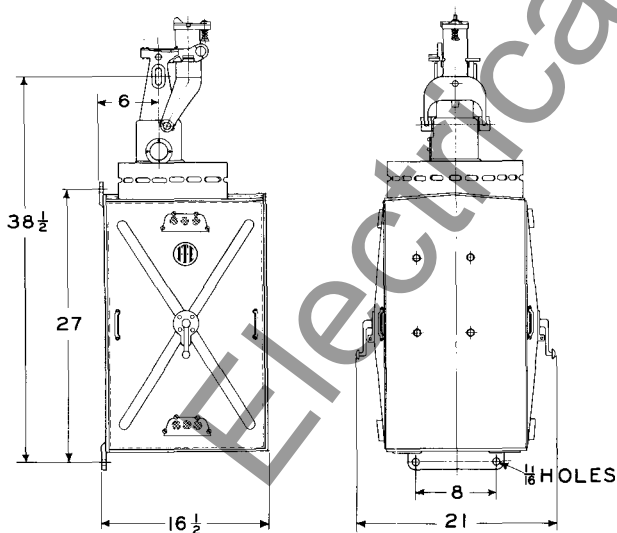


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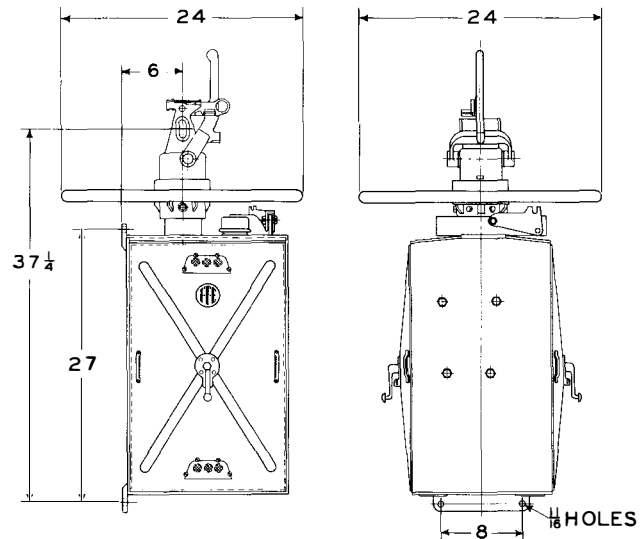
Motor Driven SWITCH OPERATING MECHANISM

Types of Mechanisms and Operating Characteristics

Type	Type of Operation	Used with external gear reduction of ratio	Limit and aux. switch always coupled with	Approx. Time of one operation in seconds	Emergency torque lb. inch at rated voltage	Operating crank
MO-9-3A	torsional	.....	motor	3	10,000	.....
MO-9-3B	torsional	.....	op. pipe	3	10,000	.....
MO-9-2A	torsional	9 to 1	motor	3-5	25,000	.....
MO-9-2B	torsional	9 to 1	op. pipe	3-5	25,000	.....
MO-9-3AL	push-pull	.....	motor	4	7,000	at left
MO-9-3AR	push-pull	.....	motor	4	7,000	at right
MO-9-3BL	push-pull	.....	op. pipe	4	7,000	at left
MO-9-3BR	push-pull	.....	op. pipe	4	7,000	at right
MO-9-H	torsional	as required	as desired	-----	as spec'ed	.....



MO9-3



MO9-2

For full details of Type MO9 Mechanisms consult Bulletin 1450.

Instruction Manual

GENERAL CONSTRUCTION of Type M09

MOUNTING: Four 11/16" holes are provided for mounting of the mechanism. The mounting dimensions are 8" x 27"



2515

HOUSING: The housing is of all welded construction and galvanized. Two removable covers which can be individually padlocked, are provided. Each cover is made tight against a water-proofing gasket by means of a single central screw.

BEARINGS: All main bearings are equipped with Oilite bushings. The shafts are chromium-plated. No lubrication is required in the mechanism.

GEARS: The gears are all cut of high-carbon steel plates, cadmium-plated, and adequately keyed to the shafts.

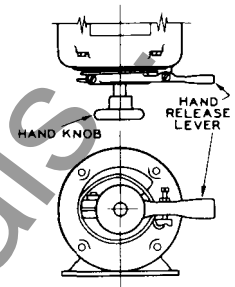
MOTOR: The motor is of electrically reversible type, high starting torque, ball bearing equipped. It requires no lubrication.

CONTACTORS: The contactors are of solenoid type, 25 ampere capacity and are mechanically interlocked. They require no adjustment.

PANEL: The panel in the standard mechanisms has a two-pole knife switch with Fusetrons controlling all circuits and a separate switch with standard fuse for control of the heater.

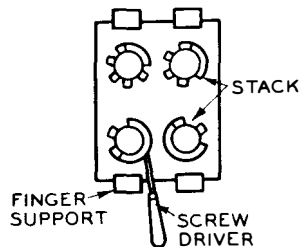
HEATER: The heater is a Chromalox 70-140 Watt two element disc type heater operable on either 115 or 230 volts A.C. A thermostatic control can be supplied if desired at extra cost.

BRAKE: The brake is of double action solenoid type and consists of a movable disc, with brake lining on both sides compressed between two stationary aluminum discs by means of compression springs. The brake can be released manually by rotating the brake - release lever. An aluminum hand knob is provided to permit hand operation (see "Coupling and Uncoupling.") The brake is oil and grease proof.



TERMINALS AND CONDUITS: All connections are brought to terminals properly marked and placed near the conduit openings. Two removable plates 1/8" thick permit drilling for a total of six 1-1/2" conduits.

LIMIT AND AUXILIARY SWITCH: The switch consists of 3 or 4 stacks of rotating adjustable contacts, with a total of 6 to 16 separate circuits. Standard Motor Mechanisms are equipped with a 10-circuit auxiliary switch, including limits. Each circuit can be made either "a" or "b". All stacks are geared to the operating shaft. Each adjustable contact is provided with a series of ribs placed between the two contact bands to facilitate adjustment.



To adjust the contacts, loosen up the finger nut under the corresponding stack and move each contact to the desired position. This is done by placing a screw-driver against the ribs which are accessible between the 2 finger supports on each side of the mechanism.

The proper setting of the limit and light contacts is shown on the print pasted inside of the mechanism. All adjustment must be made with the knife switch open.

Care must be taken not to have the "red" and "green" light contacts making contact at the same time as a short will result. The finger nuts must be securely tightened after each adjustment. The contact bands and the finger contacts are silver lined.



INDIVIDUAL CONTACT

Instruction Manual

For ADJUSTING and OPERATING Type M09-3A

COUPLING AND UNCOUPLING: The operating handle is placed on top of the mechanism. When the handle is latched in vertical position, the operating pipe is coupled to the mechanism. The handle can be padlocked in this position to prevent dropping out.

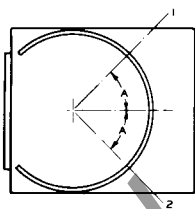
Placing the handle into horizontal position uncouples the pipe from the mechanism and permits operation of the air switch by hand, either to open or to close without affecting the mechanism or the position of the limit and the auxiliary switch contacts.

Also, with the handle in horizontal position, the mechanism can be operated in any direction without affecting the position of the air switch. Recoupling can be done only when the position of the limit switch corresponds to the actual position of the air switch. This is recognized when a red spot painted on the operating shaft appears in front of the glass window. This spot can be brought into visibility either by operating the air switch with the handle or by operating the mechanism by hand.

To operate the mechanism by hand, release the brake by rotating the brake-release lever and revolving the aluminum hand knob.

ATTACHMENT OF OPERATING PIPE: Adjust control so as to have all 3 poles of the air switch properly closed. Attach upper end of the vertical operating pipe to the rotor bearing. Place operating handle horizontally in a position corresponding to the closed position of the air switch. (See sketch under "ADJUSTMENT"). Drill the holes in the lower end of the operating pipe (5/8" drill) using coupling as jig and attach to coupling. The weight of the pipe should be supported by the upper end.

ADJUSTMENT: Set closing lock stop so as to be able to lock the handle with the air switch closed. In setting the lock stop, put sufficient torsion in the operating pipe to take up all lost motion and springiness in the pipe which may lead to backing out of the air switch. Lock the handle.



- 1-Position of handle for clockwise opening.
- 2-Position of handle for counter-clockwise opening.
- A-Half of total operating angle.

Bring red spot in front of the window by releasing the brake and rotating the brake disc with fingers. Set limit and light contacts as per diagram pasted inside.

Open air switch by hand and set opening lock stop so as to be able to lock the handle in open position with sufficient torsion in the pipe.

Again bring red spot in front of window by rotating the brake disc in the direction of the rotation of the operating pipe to open, and check positions of the limit and light contacts with diagram. Correct if necessary.

Put handle in vertical position. Operate electrically and, if necessary, make final corrections in lockstop positions, and also limit and light contact settings.

There is a difference between summer and winter operations. In summer the operation is easier, and the mechanism drifts farther after the current is cut off by the limit contacts.

In winter the operation is harder and the operating pipe is twisted more in closing. Therefore, it is sometimes necessary to reset the limits with a change in season.

There is also a difference in lock-stop settings for hand operation and for motor operation, as the motor is capable of winding the pipe more than a man can. Therefore, the final determination of the positions of the lock-stops must be left to the operator's judgment. These positions may also be affected by the seasons.

TESTING: To test the mechanism, uncouple it from the operating pipe by placing the operating handle in the horizontal position and operate either by means of the control switch or by actuating one of the contactors momentarily with a finger. When push buttons are supplied for testing purposes, press the desired push button momentarily and release.

The mechanism is highly efficient and the motor speed is very high when running idle. For this reason the mechanism, when tested with the operating pipe uncoupled, drifts considerably farther than it does when operating the air switch. Therefore, at the end of the test the operating shaft may stop in a position in which recoupling is impossible. To make recoupling possible, proceed as follows:

Bring mechanism electrically into a position corresponding to the position of the air switch. That is, if the air switch is closed, operate the mechanism to close, and vice versa. If at the end of this last operation the red spot cannot be seen in the window, operate the mechanism with the aluminum hand knob on the motor shaft in a direction opposite to the one of the last operation. That is, if in the last operation the knob ran counter-clockwise (the knob and the operating handle always operate in the same direction) then rotate it by hand in a clockwise direction until the red spot appears in the window.

IMPORTANT: Always check the setting of the limit and auxiliary switch contacts after recoupling.

Instruction Manual

For ADJUSTING and OPERATING

Type M09-3B

COUPLING AND UNCOUPLING: The operating handle is placed on top of the mechanism. When the handle is latched in vertical position, the operating pipe is coupled to the mechanism. The handle can be padlocked in this position to prevent dropping out.

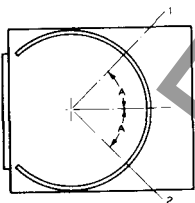
To uncouple the operating pipe from the mechanism simply move operating handle socket into horizontal position. Before doing this, it is advisable to open the mechanism and depress the brake-release arm (below the motor and brake) in order to relieve the torsional twist on the operating pipe, which may make the uncoupling operation difficult, particularly in warm weather.

With the handle in horizontal position it is possible to operate the air switch by hand, either to open or to close without affecting the mechanism.

The limit and the auxiliary switch contacts move with the operating pipe. Also, with the handle in horizontal position, the mechanism can be operated in any direction without affecting the position of the air switch or of the limit and auxiliary switch.

Recoupling can be done with the air switch in any position simply by returning the handle into the vertical position. If this operation seems to be difficult, give the handle a slight jerk sideways (one or two degrees).

ATTACHMENT OF OPERATING PIPE: Adjust control so as to have all 3 poles of the air switch properly closed. Attach upper end of the vertical operating pipe to the rotor bearing. Place operating handle horizontally in a position corresponding to the closed position of the air switch. (See sketch under "ADJUSTMENT".) Drill the holes in the lower end of the operating pipe (5/8" drill) using coupling as jig and attach to coupling. The weight of the pipe should be supported by the upper end.



- 1-Position of handle for clockwise opening
- 2-Position of handle for counter-clockwise opening
- A-Half of total operating angle.

ADJUSTMENT: Set closing lock stop so as to be able to lock the handle with the air switch closed. In setting the lock stop, put sufficient torsion in the operating pipe to take up all lost motion and springiness in the pipe which may lead to backing out of the air switch. Lock the handle

Set limit and light contacts as per diagram pasted inside.

Open air switch by hand and set opening lock stop so as to be able to lock the handle in open position with sufficient torsion in the pipe.

Check positions of the limit and light contacts with diagram. Correct if necessary. Put handle in vertical position. Operate electrically and, if necessary, make final corrections in lock stop positions, and also limit and light contact settings.

There is a difference between summer and winter operations. In summer the operation is easier and the mechanism drifts farther after the current is cut off by the limit contacts. In the winter the operation is harder and the operating pipe is twisted more in closing. Therefore, it is sometimes necessary to reset the limits with a change in season.

There is also a difference in lock-stop settings for hand operation and for motor operation, as the motor is capable of winding the pipe more than a man can. Therefore, the final determination of the positions of the lock-stops must be left to the operator's judgment. These positions may also be affected by the seasons.

TESTING OF MECHANISM: To test the mechanism uncouple it from the operating pipe by placing the operating handle in the horizontal position and operate by actuating one of the contactors with a finger. When push buttons are supplied for testing purposes, press the desired push button.

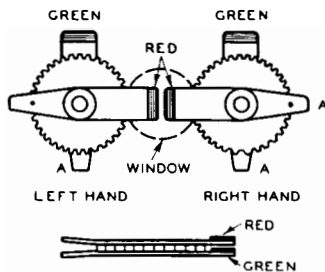
As the limit switch does not operate when the mechanism is tested with the operating pipe uncoupled, one of the contactors will drop out as soon as finger is removed and the other can be released only by pulling out the knife switch on the panel. For the same reason recoupling is possible in any position of the motor and gears.

Instruction Manual

For ADJUSTING and OPERATING

Type M09-2-A

POSITION INDICATION: Since the limit and auxiliary switch does not operate when the air switch is operated by hand with hand wheel, it is necessary to have a position indicator for the air switch and a separate one for the limit and auxiliary switch.

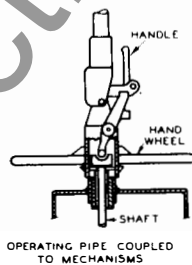


The indications of both indicators can be observed through the glass window in front of the mechanism. The right-hand indication is that of the position of the air switch, and the left-hand indicates the position of the limit switch.

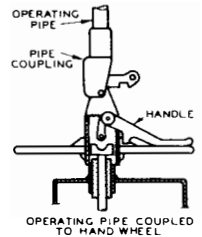
Each indicator consists of a gear and two markers which are free on the gear shaft and are locked in the gear teeth. Each marker is set to the proper position by pulling end "A" of the marker slightly away from the locking gear and turning the marker to the desired position. When end "A" is released, the marker becomes locked in the set position.

COUPLING AND UNCOUPLING: The hand-wheel is placed on top of the mechanism and is idle when the operating pipe is coupled to the mechanism. A short handle directly above the hand-wheel can be placed in either vertical or horizontal position. When this handle is in vertical position, the operating pipe is coupled to the mechanism and the hand-wheel is idle. The handle can be padlocked in this position.

To uncouple the operating pipe from the mechanism, simply move handle into horizontal position. Before doing this it is advisable to open the mechanism and rotate the brake-release lever (below the motor and brake) in order to relieve the torsional twist of the operating pipe, which may make the uncoupling difficult, particularly in warm weather.



With the handle in horizontal position it is possible to operate the air switch by hand either to open or to close without affecting the mechanism or the position of the limit and auxiliary switch contacts. The handle can also be padlocked to the hand-wheel to prevent recoupling of the mechanism to the pipe.



The hand-wheel, in turn, can be padlocked to the mechanism housing with the air switch either closed or open. The hand-wheel lock is adjustable at the pivot for the nearest spoke.

Also, with the handle in horizontal position and the hand-wheel padlocked or not, the mechanism can be operated in any direction without affecting the position of the air switch.

Recoupling of the operating pipe to the mechanism must be done only when the position of the limit switch corresponds to the actual position of the air switch, that is, when the two indicators both indicate either "green" or "red" in line.

The indicators can be made to register either by operating the air switch to bring it into correspondence with the limit switch position, or by releasing the brake (see "Brake") and operating the mechanism through the hand knob.

To recouple move handle to vertical position. If it is impossible to do this turn handle one way not over 30 degrees, then the other way through the same angle, all the time pressing handle upwards until the point is found where the handle will snap into vertical position.

ATTACHMENT OF OPERATING PIPE: The mechanism is shipped with the operating coupling coupled to the mechanism shaft (handle in vertical position) and the hand-wheel idle but secured to the mechanism housing. Do not change the position of handle until the operating pipe is properly attached.

In case the handle is moved to horizontal position before the operating pipe is attached and it is impossible to bring it back to the vertical position on account of displacement of the operating-pipe coupling, proceed as follows: Press handle gently upwards and at the same time rotate it on the vertical operating shaft.

Instruction Manual
For ADJUSTING and OPERATING
Type MO9-2-A

(Continued)

To attach operating pipe, adjust control to have all 3 poles of the air switch properly closed. Mount the mechanism. Attach the upper end of the pipe to the crank gear shaft.

If the lower end of the pipe is predrilled, release the brake with brake release lever and turn the aluminum hand knob until the holes in the pipe coupling are in line with the holes in the pipe. Then insert coupling pins.

If the lower end of the pipe is not predrilled drill holes using coupling as a jig and couple. The weight of the pipe should be supported from the upper end.

ADJUSTMENT: With the air switch still closed, set red marker of the right-hand indicator in horizontal position, to be seen in window. Then uncouple the operating pipe from the mechanism by moving the handle into horizontal position and operate the air switch with hand-wheel until fully opened. Set green marker to the right-hand indicator in horizontal position to be seen in the window. In doing this make sure not to disturb the marker indicating red. Again close air switch with hand-wheel and check indicator.

Recouple operating pipe to mechanism by moving handle to vertical position. If it is impossible to do so, press handle gently upwards and at the same time rotate it on the vertical operation shaft. Set red marker of left-hand indicator to indicate "red".

Set limit and light contacts as instructed in pasted-in print. Release brake and turn aluminum hand knob at bottom of motor shaft by hand until the air switch is fully open, that is until the right-hand indicator indicates "green".

The direction of rotation of the hand knob in this operation is the same as the direction of rotation of the hand-wheel to open. This direction is shown by an arrow attached to the hand-wheel spokes. The operation of opening the air switch with brake requires about 180 revolutions of the disc.

Set green marker to left-hand indicator to indicate "green" and check setting of limit and light contacts with print. Operate electrically, and, if necessary, make final corrections in position indication and also of limit and light contact settings.

TESTING OF MECHANISM: To test the mechanism uncouple it from the operating pipe (see "Coupling and Uncoupling") and operate either by means of the control switch or by actuating one of the contractors momentarily with a finger. When push buttons are supplied, for testing purposes, press the desired push button momentarily and release.

The mechanism is highly efficient and the motor speed is very high when running idle. For this reason the mechanism, when tested with the operating pipe uncoupled, drifts considerably farther than it does when operating the air switch. Therefore, at the end of the test the operating shaft may stop in a position in which recoupling is impossible. To make recoupling possible, proceed as follows:

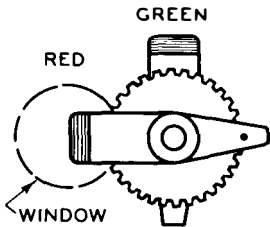
Bring mechanism electrically into a position corresponding to the position of the air switch. That is, if the air switch is closed, operate the mechanism to close and vice versa. If, at the end of this last operation the left-hand marker cannot be seen in the window, operate the mechanism with the aluminum hand knob in a direction opposite to the one of the last operation. That is, if, in the last operation, the hand knob ran counter-clockwise (the hand knob and the hand wheel always operate in the same direction), then rotate it by hand in a clock-wise direction until the left-hand marker appears in the window. Then if both markers check, the mechanism can be recoupled.

IMPORTANT: Always check the setting of the limit and auxiliary switch contacts after recoupling.

Instruction Manual

For ADJUSTING and OPERATING Type M09-2-B MOTOR MECHANISM

POSITION INDICATION: Since the auxiliary switch is always coupled to the operating pipe, one indicator for switch position indication is sufficient. The indicator consists of 2 metal strips, individually adjustable and placed inside of the gear compartment. One end of one strip is painted red to indicate "closed" and one end of the other strip is painted green to indicate "open". The indication is observed through a glass window.



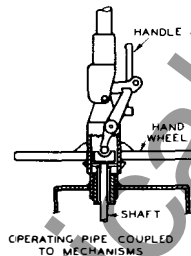
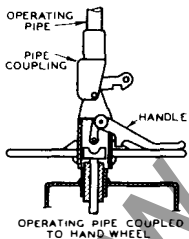
To adjust an indication take a hold of the unpainted end with fingers, bend it away slightly from the small gear against which this end is pressed, move to the desired position, and release. The indications are self-locking.

COUPLING AND UNCOUPLING: The hand-wheel is placed on top of the mechanism and is idle when the operating pipe is coupled to the mechanism. A short handle directly above the hand-wheel can be placed in either vertical or horizontal position.

When this handle is in vertical position, the operating pipe is coupled to the mechanism and the hand-wheel is idle. The handle can be padlocked in this position.

To uncouple the operating pipe from the mechanism simply move handle into horizontal position. Before doing this, it is advisable to open the mechanism and rotate the brake release lever (below the motor and brake) in order to relieve the torsional twist of the operating pipe which may make the uncoupling operation difficult, particularly in warm weather.

With the handle in horizontal position it is possible to operate the air switch by hand either to open or to close without affecting the mechanism. The handle can also be padlocked to the hand-wheel to prevent recoupling of the mechanism to the pipe. The hand-wheel, in turn, can be padlocked to the mechanism housing with the air switch either closed or open. The hand-wheel lock is adjustable at the pivot for the nearest spoke.



Also, with the handle in horizontal position and the hand-wheel padlocked or not, the mechanism can be operated in any direction without affecting the position of the air switch or that of the limit and auxiliary switch.

Recoupling can be done with the air switch in any position simply by returning the handle into the vertical position. If this operation seems to be difficult, give the handle a slight jerk sideways (one or two degrees).

ATTACHMENT OF OPERATING PIPE: To attach operating pipe, adjust control to have all 3 poles of the air switch properly closed, Mount the mechanism. Attach the upper end of the pipe to the crank gear shaft.

If the lower end of the pipe is predrilled, couple pipe to hand-wheel (handle in horizontal position) and work hand-wheel until the holes in the pipe coupling are in line with the holes in the pipe. Then insert coupling pins.

If the lower end of the pipe is not predrilled, drill holes using coupling as a jig and couple. The weight of the pipe should be supported from the upper end.

ADJUSTMENT: Close air switch by hand, set red indicator in horizontal position with red mark to be seen in window. Set limit and light contacts as per diagram pasted inside.

Open air switch by hand, set green indicator in horizontal position with green mark to be seen in window. Check contact setting with diagram and correct, if necessary. Recouple operating pipe to mechanism by placing handle into vertical position and operate electrically. Correct setting, if necessary.

TESTING OF MECHANISM: To test the mechanism, uncouple it from the operating pipe by placing handle in horizontal position and operate by actuating one of the contactors with a finger. When push buttons are supplied for testing purposes, press the desired push button.

As the limit switch does not operate when the mechanism is tested with the operating pipe uncoupled, one of the contactors will drop out as soon as finger is removed and the other can be released only by pulling out the knife switch on the panel. For the same reason recoupling is possible in any position of the motor and gears.

Instruction Manual

For ADJUSTING and OPERATING Type M09-3AL or AR

COUPLING AND UNCOUPLING: The operating handle is placed on top of the mechanism. When the handle is in vertical position, the operating pipe is coupled to the mechanism. The handle can be padlocked in this position.

Placing of the handle into horizontal position uncouples the pipe from the mechanism and permits operation of the air switch by hand, either to open or to close without affecting the mechanism or the position of the limit and the auxiliary switch contacts.

Also, with the handle in horizontal position, the mechanism can be operated in any direction without affecting the position of the air switch. Recoupling can be done only when the position of the limit switch corresponds to the actual position of the air switch. This is recognized when a red spot painted on the operating shaft appears in front of the glass window. This spot can be brought into visibility either by operating the air switch with handle or by operating the mechanism by hand. To operate the mechanism by hand, release the brake, and rotate the aluminum hand knob by hand.

ATTACHMENT OF OPERATING PIPE: Adjust control so as to have all 3 poles of the air switch properly closed.

Put operating handle into the horizontal position and rotate it until the operating crank of the side of the mechanism is in the position shown on the switch control drawing.

Adjust the closing lock stop on the circular band to lock the handle in this position and adjust length of operating crank as instructed on control drawing.

Adjust properly length of operating pipe and attach it to the operating crank.

ADJUSTMENT: Bring red spot in front of the window by releasing the brake and rotating the hand knob by hand. Set limit and light contacts as per diagram pasted inside.

Open air switch by hand and set opening lock stop so as to be able to lock the handle in open position.

NOTE: If the switch does not open properly, change length of crank and operating pipe until proper operation is obtained.

Again bring red spot in front of window by rotating the hand knob in the direction of the rotation of the operating pipe to open, and check positions of the limit and light contacts with diagram. Correct if necessary. Put handle in vertical position. Operate electrically and if necessary, make final corrections in lock stop positions, and also limit and light contact settings.

TESTING: To test the mechanism, uncouple it from the operating pipe by placing the operating handle in the horizontal position and operate either by means of the control switch or by actuating one of the contactors momentarily with a finger. When push buttons are supplied for testing purposes, press the desired push button momentarily and release.

The mechanism is highly efficient and the motor speed is very high when running idle. For this reason the mechanism, when tested with the operating pipe uncoupled, drifts considerable farther than it does when operating the air switch. Therefore, at the end of the test the mechanism may stop in a position in which recoupling is impossible. To make recoupling possible, proceed as follows.

Bring mechanism electrically into a position corresponding to the position of the air switch. That is, if the air switch is closed, operate the mechanism to close, and vice versa.

If at the end of this last operation the red spot cannot be seen in the window, operate the mechanism with the aluminum hand knob in a direction opposite to the one of the last operation. That is, if in the last operation the hand knob ran counter-clockwise (the hand knob and the operating handle always operate in the same direction) then rotate it by hand in a clockwise direction until the red spot appears in the window.

IMPORTANT: Always check the setting of the limit and auxiliary switch contacts after recoupling.

Instruction Manual

For ADJUSTING and OPERATING Type MO9-3BL or BR

COUPLING AND UNCOUPLING: The operating handle is placed on top of the mechanism. When the handle is in the vertical position, the operating pipe is coupled to the mechanism. The handle can be padlocked in this position to prevent dropping out.

To uncouple the operating pipe from the mechanism simply move operating handle socket into the horizontal position. With the handle in the horizontal position it is possible to operate the air switch by hand, either to open or to close without affecting the mechanism. The limit and the auxiliary switch contacts move with the operating pipe.

Also, with the handle in the horizontal position, the mechanism can be operated in any direction without affecting the position of the air switch or of the limit and auxiliary switch.

Recoupling can be done with the air switch in any position simply by returning the handle to the vertical position. If this operation seems to be difficult, give the handle a slight jerk sideways (one or two degrees).

ATTACHMENT OF OPERATING PIPE: Adjust control so as to have all three poles of the air switch properly closed. Put operating handle into the horizontal position and rotate it until the operating crank on the side of the mechanism is in the position shown on the switch control drawing.

Adjust the closing lock stop on the circular band to lock the handle in this position and adjust length of operating crank as instructed on control drawing.

Adjust properly length of operating pipe and attach it to the operating crank.

ADJUSTMENT: Set limit and light contacts as per diagram pasted inside.

Open air switch by hand and set opening lock stop so as to be able to lock the handle in open position.

NOTE: If the switch does not open properly, change length of crank and operating pipe until proper operation is obtained.

Again check positions of the limit and light contacts with diagram. Correct if necessary. Put handle in vertical position. Operate electrically and, if necessary, make final corrections in lock stop positions, and also limit and light contact settings.

TESTING OF MECHANISM: To test the mechanism uncouple it from the operating pipe by placing the operating handle in the horizontal position and operate by actuating one of the contactors with a finger. When push buttons are supplied for testing purposes, press the desired push button.

As the limit switch does not operate when the mechanism is tested with the operating pipe uncoupled, one of the contactors will drop out as soon as finger is removed and the other can be released only by pulling out the knife switch on the panel. For the same reason, recoupling is possible in any position of the motor and gears.

Instruction Manual

For ADJUSTING Type MO9-3 (Motor) and SO-2 (Spring) MECHANISM WHEN USED TOGETHER

IT IS IMPORTANT TO FOLLOW THESE INSTRUCTIONS CAREFULLY AND IN EXACT ORDER.

NOTE: Paragraphs marked "AB" apply to both MO-9-3A and MO-9-3B mechanisms. Paragraphs marked "A" apply to MO-9-3A only and paragraphs marked "B" apply to MO-9-3B only.

IMPORTANT: Do not trip until all adjustments as per paragraphs 1 to 9 are made.

1-AB: Mount the SO-2 mechanism and remove coupling "C" by removing pin "A". (Fig. 1)

2-AB: Mount the MO-9 mechanism as shown. (Fig. 1)

3-AB: Unlatch handle socket "B" of the MO-9 and swing it into horizontal position. Insert safety handle and rotate sideways until it becomes possible to uncouple both mechanisms with coupling "C".

Instruction Manual

For ADJUSTING Type MO9-3 (Motor) and SO-2 (Spring) MECHANISMS WHEN USED TOGETHER

(Continued)

4-AB: Wind the springs of the SO-2 with handle clockwise looking from top, until latched. (Fig. 2)

5-AB: Adjust stop bolt "SB" in Fig. 3 as follows:

Operating Angle	90°	100°	110°	120°
Length of bolt	2-5/8"	2-1/4"	1-3/4"	1-1/4"

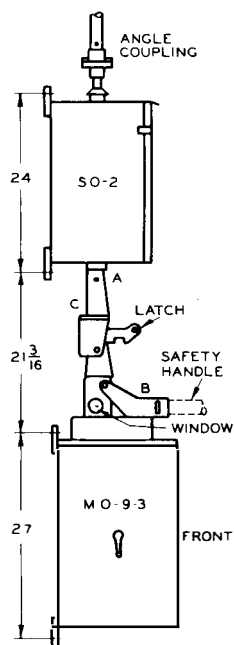


Fig. 1

The operating angle is found on the control drawing. The stop bolt can be made accessible by rotating the mechanism with operating handle.

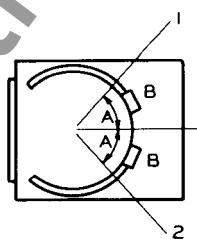
6-AB: Attach operating pipe to mechanism by means of angle adjusting coupling (Fig. 1) and adjust the angle so as to be able to close the switch by hand (or open it, if the switch is automatic closing) properly without stop bolt "SB" touching stop in the back of the mechanism. (The gap should be about 1/4".) Do not change the length of the stop bolt to obtain this gap.

7-AB: Operate air switch with handle several times back and forth to make sure that it operates properly.

8-AB: Adjust lockstop on top of MO-9 (Fig. 2) so as to be able to lock the handle in either open or closed position of the air switch.

9-AB: Close the air switch (open it if it is automatic closing), lock handle socket to lock-stop, take out handle, connect battery leads to the binding posts marked + and - (Fig. 3) and trip by completing the circuit.

10-AB: There are two operating springs, one inside of the other. The mechanism is shipped with



1. Position of handle ready to wind spring of SO-2 after tripping.
 2. Position of handle with springs of SO-2 wound and air-switch open.
- A is approximately one half of the total operating angle of air-switch.
B lock stops on MO-9.

Fig. 2

both springs partly wound. The inner spring acts only through a maximum of 30° and its purpose is to help to break ice or to overcome stiffness due to cold weather.

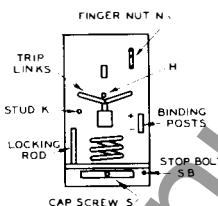


Fig. 3

To wind the inner spring, trip the mechanism and screw in stud "K" (Fig. 3) in crank to which the upper end of the spring is attached. Lock with Lock nut.

To wind the outer (main) spring, trip the mechanism, remove screw "S", remove locking rod (Fig. 3) from its seat, insert it into one of the vacant holes adjacent to screw "S" and wind clockwise (looking from top), at the same time applying a light pressure to the end of the locking pin with finger. The pin will thus drop into position when the next locking notch is reached. Four notches are provided and they can be seen from underneath the rotating drum (Fig. 3).

11-AB: Above the magnet coil and directly in front of the mechanism (when it is in a position ready to trip) there are two broken-down bronze trip-links. The middle point of these links rests on a stud through the coil, which is so adjusted that the middle point is about 1/16" lower than the ends of the links.

If it is desired to have the mechanism work at a voltage lower than that for which it is set, trip the mechanism, loosen lock nut on top of stud supporting the links, screw up the stud, and lock with lock nut. There is a flat on end of stud for a wrench. The links must always be broken down sufficiently to prevent tripping by vibration. (Fig. 3)

12-AB: The auxiliary switch in the standard SO-2 mechanisms has three independent single pole, single throw circuits, each adjustable through 360° by loosening the finger nut "N". (Fig. 3) The auxiliary switch is operated from the air switch operating shaft.

Instructions for setting of the rotating contacts are given on the wiring diagram. Be sure to tighten finger nut securely (without wrench) after contact setting is completed.

13-AB: To lock the mechanism so as to prevent tripping due to any cause (overload, vibration, etc.) take off front cover, remove locking rod from its seat (left-hand lower corner), and insert it into hole "H" directly in back and above the center of the bronze trip links. The rod is long enough so as to prevent replacement of the cover while the links are locked. (Fig. 3)

Instruction Manual

For ADJUSTING Type MO9-3 (Motor) and SO-2 (Spring) MECHANISMS WHEN USED TOGETHER

(Continued)

ADJUSTING OF MO-9-3 MECHANISM

IMPORTANT: Do not operate electrically until all adjustments as per paragraphs 14 to 21 are made.

14-AB: Remove both covers of the MO-9 by unscrewing the crank in the center of each cover, and pull out the double knife switch on panel.

15-AB: Wind the SO-2 and latch it. Then close air switch with handle and lock it in this position (open air switch if it is automatic closing).

16-A: Release brake by rotating the lever under brake (Fig. 4) and rotate the hand knob until a red spot appears in the window on top of the MO-9 (Fig. 1) directly underneath the pin.

17-AB: Set the limit and light contacts as shown on photostat pasted inside of the mechanism. To do this unscrew finger nuts under the two front stacks of contacts and move

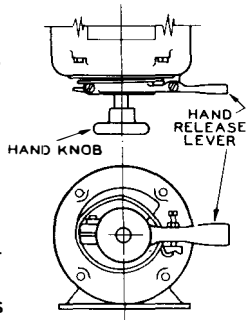


Fig. 4

each contact to the desired position by pressing a screw driver against the fins between the two contact surfaces (Fig. 6). The fins are accessible from between the finger panels (Fig. 5). Care must be taken not to have the "red" and "green" light contacts marked L1-R and L2-G making contact at the same time, as a short will result. In this position the closing limit (L1-C) must be off.

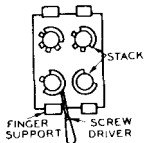


Fig. 5

18-A: Open the air switch with handle (or close it, if it is automatic closing) and rotate brake disc again until the red spot appears in front of the window directly underneath the pin. Check the limit settings. In this position the opening limit (L1-T) must be off.



Fig. 6

19-AB: Take out handle and swing handle socket into vertical position until latched (Fig. 1). The MO-9 thus becomes coupled to the SO-2.

20-AB: Set the rest of the auxiliary switch contacts in both the SO-2 and MO-9 as indicated in the general wiring diagram, when it is furnished.

21-AB: Test installation as follows: Close air switch through MO-9 electrically. Trip air switch through SO-2 electrically. Wind springs through MO-9 electrically.

During this test it may be found that the limit and auxiliary switch setting have to be corrected.

IMPORTANT: The limit L1-T must be so set as to permit latching of the springs when wound. The limit L1-C must be so set as not to allow excessive winding of the operating pipe in closing.

22-A: To test the MO-9 only, uncouple it from the SO-2 by swinging the handle socket into horizontal position. Lock it to lock-stop. Operate by actuating contactors with finger. When push buttons are supplied, press required button momentarily and release. Recoupling of the SO-2 is only possible when red spot is seen in the window.

22-B: To test the MO-9 only, uncouple it from the SO-2 by swinging the handle socket into horizontal position. Lock it to lock-stop. Operate by actuating contactors with finger. When push buttons are supplied, press required button momentarily and release.

NOTE: No lubrication is required in either of the mechanisms.



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