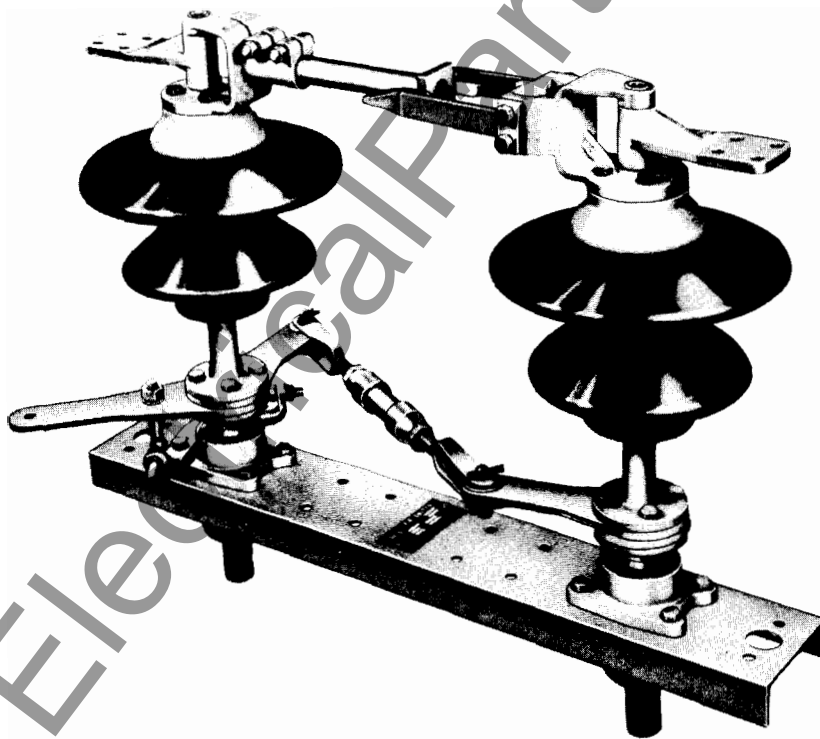


# *Instruction Manual*

*for*

**INSTALLATION, INSPECTION AND MAINTENANCE**

## **Type DR Group Operated Outdoor Air Switches**



***ITE Imperial Corporation***

# INSTALLATION, INSPECTION and MAINTENANCE

## TYPE DR

### GROUP OPERATED OUTDOOR AIR SWITCHES

#### GENERAL

This manual embraces five main sections; namely Mechanical Parts, Instructions for Installation, Contacts, Switch Maintenance and Terminal Surfaces.

This description provides instructions for the installation, inspection and maintenance of the R&IE Equipment Division Type DR Switches.

Switches described in this manual are outdoor type, suitable for gang-operation, single throw, single break, horizontal opening, two insulator stacks per pole, with both insulator stacks rotating. Switches included enter into the following classifications:

- (1) 3" Bolt Circle DR-5, 400 Amps., 7.5 Kv to 34.5 Kv. inclusive.
- (2) 3" Bolt Circle DR-5, 600 Amps., 7.5 Kv to 69 Kv. inclusive.
- (3) 5" Bolt Circle DR-5, 600, and 1200 Amps., 69 Kv to 161 Kv. inclusive.

The basic design features of subject switches are such that maintenance is kept to an absolute minimum. The rotor bearings are maintenance-free; they are weather-sealed and are unaffected by soot, dirt or smoke contamination, or the hazards of corrosion.

Likewise, the Sealed Pressure Hinge Contacts are maintenance-free. These hinge contacts are weather-sealed; are in constant engagement and are unaffected by air contamination or corrosion.

In most cases, only the make-and-break contacts and mechanical adjustments will require attention. However, instructions are being included to cover even the more remote conditions which may occur in isolated cases.

#### SECTION 1 MECHANICAL PARTS

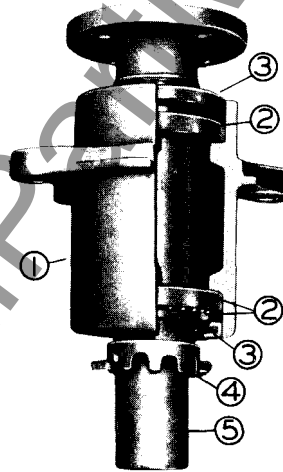
**Live or Current Carrying Parts** -- Features have been incorporated in the design of the DR switches, which reduce maintenance and repair of live mechanical parts to an absolute minimum.

These switches are mechanically sound and ruggedly built to perform their mechanical and electrical duties satisfactorily. However, if a live mechanical part should ever require replacement, it is recommended that the replacement part be obtained from the factory.

**Bearings** -- The switch base bearing on which the insulators rotate are weather-sealed, greaseless rotor bearings with stainless steel balls running in special bearing bronze races.

These bearings have synthetic rubber seals which function on either copper-alloy or aluminum surfaces, excluding dirt and moisture from the internal ball bearing races. They should not be disassembled for maintenance.

If bearings are ever found defective, it is recommended that they be returned to the factory for replacement.



#### BEARINGS

Require no lubrication. A weather seal, not affected by low temperatures, excludes all moisture and foreign matter.

1. One-piece housing.
2. Stationary and take-up ball races.
3. Weather seal, rubber-impregnated felt, tipped outwardly and metal reinforced.
4. Adjusting and takeup nut.
5. Galvanized forged steel rotor.

Fig. 1

**Bases** -- On older switches, bases should be painted or re-galvanized before reassembly of parts. Rotor crank stops, located near rotor crank at the switch base, should be straightened and aligned to engage the rotor crank stop properly.

**Stops** -- For the purpose of identifying the various "stops" they will be referred to as follows:

a -- **Rotor Crank Stop** -- This is the stop arrangement found on the switch base, located near rotor crank. Plan views of this stop arrangement may be seen in Figures 3 and 4. This stop limits the travel of the rotating insulator, stopping the drive crank and consequently the rotating insulator stack in both the switch open and switch closed position.

Adjusting bolts (D) which limit the rotor crank travel are secured solidly to switch base, and a projection (E) fastened to rotor crank strikes these adjusting bolts in the switch open and switch closed positions.

b -- Handle Locking Plate Stop -- This so-called "stop" arrangement is found at the bottom of a vertical operating pipe, (10) of Fig. 5. It consists of two galvanized steel stampings mounted on a pipe guide plate and can be adjusted in an arc to give a required rotation of the vertical torsional operating pipe.

In reality, it is not a stop, but a lock for the manual operating handle to prevent rotation of the vertical operating pipe until the manual operating handle is raised from its locked position.

## OPERATING PARTS

Operating parts consist of operating pipes, rods, and handles. In general, these parts require little maintenance after installation; such as, cleaning for any corrosion and re-aligning for wear or sag.

## SECTION 2 INSTRUCTIONS FOR INSTALLATION

### UNPACKING INSPECTION

Type DR switches up to and including 46 Kv are normally shipped completely assembled and adjusted, except for arcing horns, and are ready for installation.

The bill of material and installation drawings, contained in an envelope 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.

### ADJUSTMENT

Mount single pole switches on supporting members, level and parallel to each other. On 3" Bolt circle switches 7.5 to 34.5 Kv Inclusive, shimming may be necessary to compensate for irregularities of the supporting members.

For the higher voltage switches, the increased spacing and height of parts require a ready adjustment to the inequalities and deflections of mounting surfaces. Shims, shim plates and other less accurate adjustments are difficult and sometimes impossible to handle on the installation.

An important feature shown here, and not found on any other switch bearing, is the LEVELING SCREW.

It is used to provide a high degree of accuracy, without the use of shims, to align the insulator stacks of the complete switch. The fine thread, individual screw adjustment regulates this accuracy to a fraction of a degree. When adjustment is completed, a locking nut is tightened against bearing or mounting flange for permanent setting. See Fig. 2.

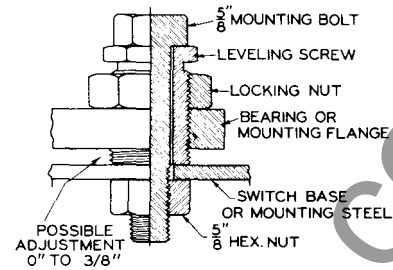


Fig. 2

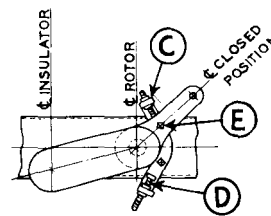
Variations in heights of insulator stacks, or their angle to the mounting surface can be easily and quickly corrected.

Switches may be either clockwise or counter-clockwise rotating and are normally operated from the blade end of the switch. However, it may be operated from the jaw end without any noticeable difference.

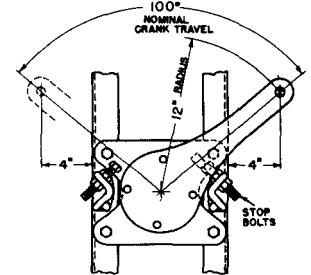
In setting the switch, the blade clamp bolts are loosened before the switch is closed to permit the blade to rotate about its axis when closing into the jaw. This rotation should be slight and only enough to give aligned setting of the moving contact on the contact fingers of the jaw.

The moving contact of the blade should come to rest mid way on the silver portion of the jaw contact fingers.

Should the blade contact fail to do this, move the blade out or into its clamp casting enough to centralize it. The blade clamping bolts are then tightened.



3 inch Bolt Circle  
Fig. 3



5 inch Bolt Circle  
Fig. 4

Next the closed position stop is to be set. This stop is located on the blade rotor bearing (See Fig. 3 and 4).

The stop bolt Item C Fig. 3 is adjusted to set against the crank stop Item E Fig. 3 with the switch in the closed position.

The open stop bolt Item D Fig. 3 is set in the same manner after the switch has been moved to the proper open position. In the open position the blades axis is perpendicular to the switch base.

## ARCING HORNS, INSPECTION AND ADJUSTMENT

When arcing horns are used on switches, they should be installed and adjusted after mounting switches on the structure.

Arcing horns are furnished on DR switches only when horn gap switches are ordered.

The arcing horns of the 3" Bolt circle switch are attached in the following manner.

Attach blade arcing horn to the blade tube with the clamps provided. The jaw arcing horn is attached to the jaw base casting by means of a bolt and clamp.

The 5" Bolt circle arcing horns are both attached to the blade tube. One on the blade side and one on the jaw side.

Arcing horns are adjusted by turning or bending slightly by hand until they make light contact for the full length of their engagement.

## SECTION 2 INSTALLATION OF OPERATING MECHANISM

### Mounting 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.

For fourth bearing mechanisms, begin with the pole nearest the fourth bearing. Lengthen or shorten the rods to suit phase spacing by turning clevis (3) of Figure 5. One-half turn of clevis equals 1/16 inch. Then, lock jam nut (1) and install cotter pins.

**Vertical Pipe Assembly** -- If the operating mechanism is "Direct" (coupled to one of the pole units as illustrated in Figure 5, attach pipe coupling (4), and the first section of the operating pipe to the switch rotor.

If the operating mechanism is "Offset" (with a fourth bearing), a complete drawing showing the assembly arrangement is furnished for each installation, and should be followed in erection.

For offset mechanisms each part is numbered and its location clearly shown on the drawings. Where adjustable multi-angle crank operating mechanisms are used, an instruction manual is furnished.

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.

On reciprocating mechanisms, it is well to have the adjustment so that switches are similarly held in the open and closed position with the operating handle in its corresponding position. This is best accomplished by adjusting the length of interphase connecting rods to take out all "slack" at the extreme limits of travel by forcing the switch rotor cranks against their limit stops.

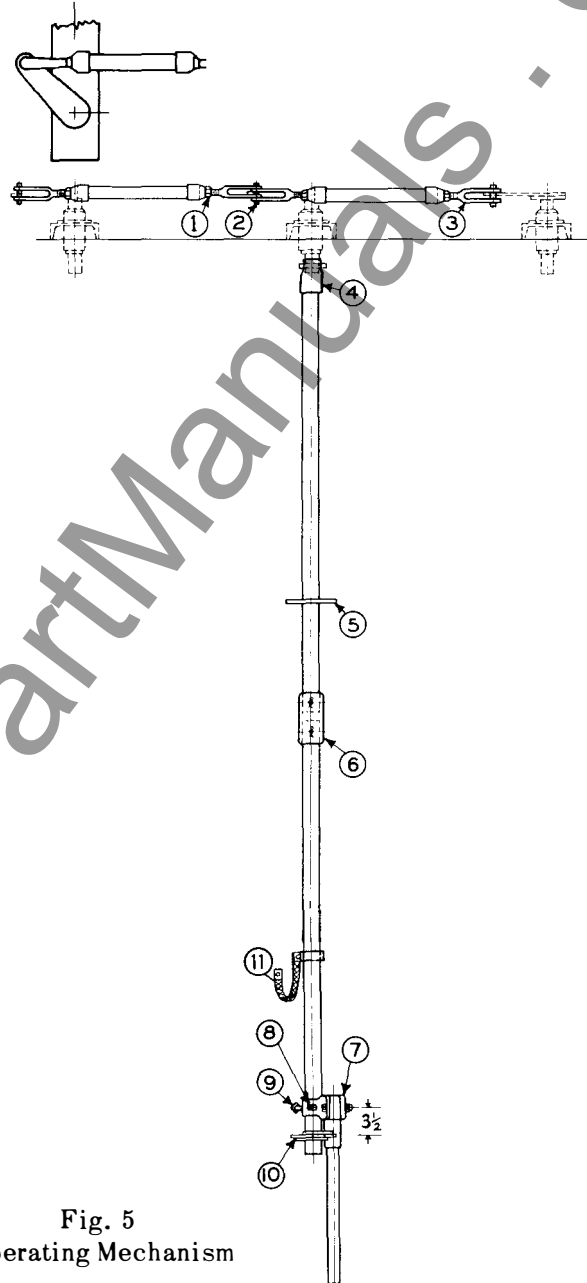


Fig. 5  
Operating Mechanism

**Guide Plate and Couplings** -- If more than one section of pipe is necessary, a guide plate (5), Figure 5, is furnished which should be slipped over the pipe. The pipe splice (6), should be put in place to couple the pipe sections. 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.

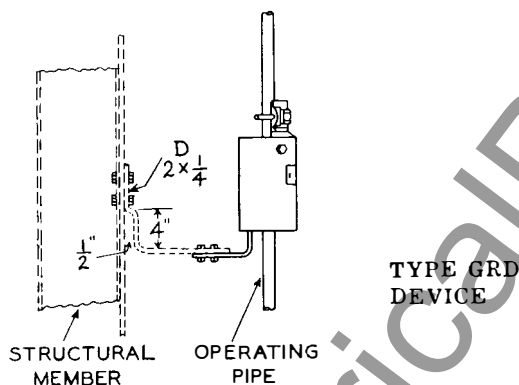
On reciprocating mechanisms, an intermediate bearing is used in place of the guide plates. On wood poles, it may be necessary to block out from the pole, or gain the pole properly to support the pipe.

**Operating Handle and Lock Plate** -- As illustrated in Figure 5 slide handle clamp (7) and lock plate (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  $3\frac{1}{2}$ " 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 (9).

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.

If a reciprocating type mechanism is used, install operating handle as shown on mechanism drawing. All up and down adjustments can be made by turning, in or out, the clevis that connects the vertical pipe to the handle.

**Ground Connections** -- A flexible ground connection (11) Fig. 5, should be installed to suit the installation. For multi-revolution mechanisms, the type GRD grounding device is supplied. See Fig. 6.



D—Rigid ground connection.

*Mounted to prevent rotation of stator, but flexible to minor pipe eccentricity.*

Fig. 6

**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, Figures 3 and 4 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 (8) of Figure 5, and permanently secure the handle to the vertical operating pipe.

## SECTION 3 CONTACTS

The word "contact" as used in this manual will signify a current interchange surface between two or more current conducting members.

The duties of a contact are to carry normal rated current without overheating, -- to carry heavy overloads on short circuit currents in accordance with NEMA specifications for short periods of time, -- to make or break light charging or load currents without damage, -- to establish a renewed contact surface with each engagement of switch blade and jaw, and to break, and if possible, remove ice and contamination.

Contact surface materials throughout this new line of switches have been selected with extreme care and the factory processing of switch parts is carefully controlled in an effort to secure the optimum contacts insofar as electrical and thermal conductivity, thermal capacity, proper hardness, best resistance to abrasion, and best resistance to galling are concerned.

Contacts on the DR switch are mainly five:

- (1) The jaw end terminal surface.
- (2) The sealed pressure jaw hinge contact at the current interchange between jaw terminal casting and jaw hinge casting.
- (3) The make and break contact between blade moving contact and jaw contact fingers.
- (4) The sealed pressure blade hinge contact at the current interchange between the blade hinge and blade terminal castings.
- (5) The blade terminal surface.

### Contact Pressure and Wear

The high pressure contact is designed to give a gas-tight seal at the contact surface to prevent oxidation. The copper to silver contacts of the TTR 49 and TTL 49 switches have been thoroughly tested and proved to be the best type for electrical and thermal conductivity, wear, and corrosion-resistance.

Under constant usage, contacts may wear so that they may require replacement. In general, experience has shown that most switches this will not be necessary until after fifteen to twenty years operation. In the worst cases, contact replacement may be necessary as early as seven to ten years.

Where switches are used frequently, or under severe contamination or grit conditions, contacts may have to be cleaned frequently. If the contacts can be frequently maintained, they will not abrade so severely and a longer contact life may be expected.

The contact pressure on the switch jaws is provided by beryllium cobalt copper jaw uprights. These spring members provide adequate pressure for the contact duty if the contact surfaces are in reasonably good condition.

As the contacts wear, or should they become burned, the deflection of the jaws will decrease and a point may be reached where inadequate pressure is applied to the contact surfaces.

Even with contact wear, if the contact surfaces have been smoothed and cleaned, and provided there is at least 1/8" deflection in the contacts, the switch contacts should be adequate for placing back in service. This 1/8" is measured by calipering the jaw contact with the blade out of the jaw, calipering at the point of engagement with the beavertail, and comparing that reading with the width of the beavertail. The beavertail width for 400 and 600 ampere, 3" B.C. switches is nominally 2 1/2" and a new jaw is nominally 2 5/16" when manufactured, giving a total contact deflection of 3/16", or 3/32" deflection for each jaw upright with the switch closed.

For the high voltage 5" B.C. switches, the beavertail width is nominally 3" the total contact deflection is nominally 3/16" and the deflection for each jaw upright with the switch closed is 3/32". On a switch that is being maintained, if this deflection in the contacts is 1/8" or more, the contacts are entirely adequate.

The above recommendation is made on the expectancy of carrying normal currents and short circuit capacity. If a switch is in service and the contact deflection is slightly under 1/8", say 1/10", the switch will still be usable but may overheat when subjected to full load currents and short circuits.

The Sealed Pressure Hinge Contact is superior to the jaw contact in that it normally will require no maintenance or repair. All parts of the SPHC (Sealed Pressure Hinge Contact) are properly assembled and adjusted at the factory and require no further adjustments.

There is no need to inspect, maintain or repair the internal SPHC, unless the switch has been subjected to a line fault of such severity that the main jaw make-and-break contacts were damaged by the fault.

The SPHC is completely enclosed, weather-sealed, lubricated for the life of the switch, and its contacts are of the high-pressure, high-thermal capacity, silver to copper type, which remain in constant engagement.

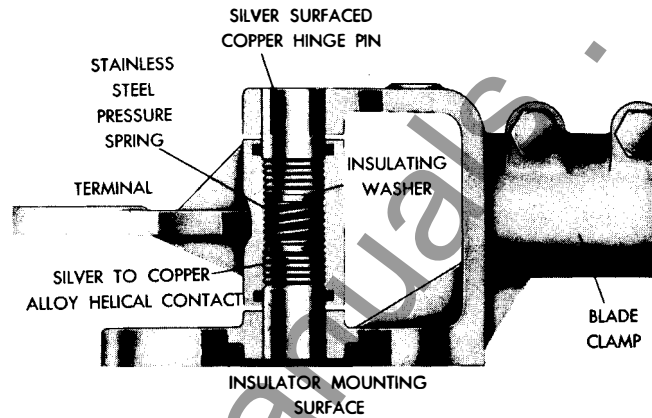
Constant contact pressure is supplied to the hinge contact pins by means of non-magnetic, stainless steel springs which are insulated from the current carrying pins. Fig. 7.

The internal contacts of the SPHC have been designed with a factor of safety and meet NEMA standards. The 400, 600, and 1200 ampere switches all utilize the 1200 ampere hinge pin, so that in the lower ratings there is a decided margin of safety in those contacts. Repeated short circuit tests have proved adequacy of all these contacts.

However, if a line fault occurs, where a breaker and/or relaying fails, which burns up considerable equipment and is on for a long period of time, it would be a wise precaution to examine the switch if the jaw make-and-break contacts have been damaged.

There is no need of ever examining the internal contacts unless a fault occurs of such severity that it damages the make-and-break contacts. Then, if

there is any question about the internal contacts or if it becomes necessary to inspect the hinge pin contacts, this can be done by removing the stainless steel socket head bolts with a standard Allen wrench. The hinge pins may then be removed by unscrewing them from hinge casting, using a large screw driver.



Sectional detailed view of hinge

Fig. 7

#### SECTION 4 SWITCH MAINTENANCE

Although our policy has been to produce outdoor switch equipment requiring a minimum of maintenance, a certain amount of care and inspection is required. Recognition of this fact is general in the industry and we are including the NEMA recommendations.

#### NEMA RECOMMENDATIONS FOR CARE OF OUTDOOR AIR SWITCHES

An air switch is not equipped with isolating switches to allow it to be serviced at frequent intervals. This does not indicate, however, that an air switch needs no care and inspection. The frequency of inspection will necessarily be a function of the atmospheric conditions at a given switch location, frequency of operation, etc., because of the switches' complete exposure to the elements and contamination in the air.

In non-corrosive atmospheres, a switch may operate satisfactorily for many years without care, while in a severe atmosphere such as encountered at power plants and industrial sites, maintenance may be required in a matter of months. This service interval must be determined by the user.

The following points require special attention:

1. Be sure that the switch is disconnected from all electric power before servicing.
2. After power has been disconnected from the switch, ground leads or their equivalent should be attached to both sides of the switch.
3. Clean the insulators where abnormal conditions, such as salt deposits, cement dust or acid fumes prevail, to avoid flashover as a result of the accumulation of foreign substances on their surfaces.
4. Examine the contacts. Check that they are aligned and that contact surfaces bear with a firm uniform pressure. Check contact surfaces.

If it is known that the switch carried a heavy short-circuit current, special efforts should be made to inspect the switch at the earliest possible time. This is especially important if the switch contacts are badly corroded since the ability of the switch to carry rated short-circuit currents is seriously impaired if the contacts are not properly maintained. Replace any pitted or burned contacts. If pitting is of a minor nature, smooth down with clean fine sandpaper (not emery) or as the manufacturer recommends.

5. See that bolts, nuts, washers, cotter pins and terminal connections are in place and tight. If the switch is gang operated, interphase linkages, line operating parts, rods, levers, bearings, etc., should be cleaned and lubricated as required according to manufacturer's directions; check for simultaneous closing of all blades and for complete contact in closed position.

6. When the switch cannot be disconnected from power, hot stick servicing may be used to as great an extent as possible.

7. Where periodic maintenance of any kind cannot be made, it should be recognized that the life of the switch contacts may be affected. In these cases, when a switch operation is made, it is recommended that the switch be opened and closed several times instead of just once in order to clean the contacts more effectively.

#### MAINTENANCE OF EXPOSED JAW CONTACTS

Contact maintenance will vary considerably, dependent upon the type of atmosphere to which the contacts are exposed. For heavy industrial areas, particularly near coke ovens where tarry products are in the atmosphere, contacts tend to become coated with a heavy flint-like film.

Where contacts are subjected to chemical or cement plant dust and the like, a hard coating may be deposited which is insulating in characteristic and which cannot be removed in the usual course of switch operation.

For the more normal application, the operation of the switch once every three months should be sufficient to keep its contacts in good condition when combined with an annual maintenance program. In many cases, two or three operations per year may prove adequate; and in some cases, users report only one operation per year. The user can best judge his maintenance procedure after gaining experience in operating switches under the prevailing conditions.

The periodic maintenance should consist of cleaning the contact surfaces thoroughly by carefully scraping off any contamination or deposit and sanding the surface to a smooth finish with clean fine sandpaper, being careful to wipe off all evidence of sand.

With the contact surfaces entirely clean, a coating of lubricant should be applied. The lubricant may be either NO-OX-ID (Grade XX) or Dow Corning DC-44 medium consistency silicone grease.\*

It is recommended that parts be returned to the factory for repairing major damages. If the jaw contact is burned or worn sufficiently that it should be repaired, it is recommended that the jaw contact members be replaced with new ones. Each jaw member or finger is bolted to the jaw base. Removing the bolts will permit removal of jaw members making them readily replaceable with new ones.

In general, contacts in good condition, coated with a lubricant as described above, improve with frequent operation although the lubricant should be renewed at regular intervals, preferably yearly.

#### MAINTENANCE OF OPERATING MECHANISM LINKAGES

In general, operating mechanism linkages require no maintenance. Bearings at vital points are weather-sealed and greaseless, requiring no lubrication.

Exposed bearings; such as the pinned connection of the rotor crank to the interphase connecting rods and the vertical operating pipe guide plates, should receive special attention particularly in areas where atmospheric contamination is abnormally great or where operation under sleet conditions is common.

Any number of lubricants might be suitable for application at these points. Dow Corning DC-4 silicone compound is recommended. This compound is practically inert, very durable even when exposed to the elements, and retains its viscosity over a very wide temperature range.

#### SECTION 5 TERMINAL SURFACES

Both the jaw and hinge end terminals employ four  $\frac{1}{2}$ " bolts on  $1\frac{3}{4}$ " x  $1\frac{3}{4}$ " centers which permit NEMA standard 600 or 1200 ampere clamping and the R&IE Type "UC" universal terminal clamp.

Where  $\frac{1}{2}$ " bolts are used, the clamping pressure is sufficient to keep the contact area adjacent to the bolts entirely clean. To recondition or maintain such terminal surfaces, all that is required is light abrading with steel wool.

All terminal areas should have bright metallic surfaces after cleaning and preferably should be coated with NO-OX-ID, Grade A-Special, in making the new connection.

This special grade of NO-OX-ID is a soft, greasy type, designed for brush application, and does not require heating the surfaces upon application. Bolts should be drawn up tightly to insure adequate contact pressure. These special precautions will be well justified by added years of trouble-free service.

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\*NO-OX-ID greases can be purchased from the Dearborn Chemical Company, 310 South Michigan Avenue, Chicago, Illinois. The silicone compounds and greases can be purchased from Dow Corning, 592 Saginaw Road, Midland, Michigan.



**ITE Imperial Corporation**

# Instruction Manual

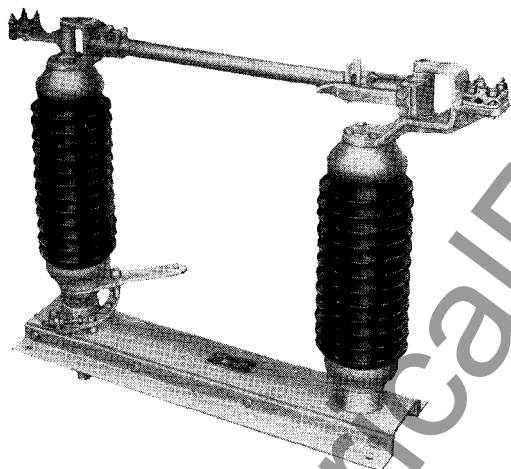
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INSTALLATION, INSPECTION AND MAINTENANCE

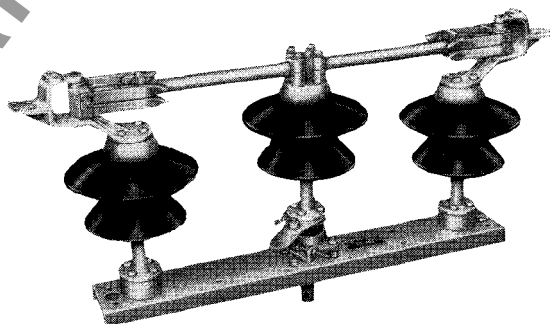
of

TYPES A6 and AT6

GROUP OPERATED, OUTDOOR AIR SWITCHES



Type A6  
7.5 to 161 Kv  
400, 600 and 1200 Amps.



Type AT6  
23 and 34.5 Kv  
400, 600 and 1200 Amps.

BULLETIN IB-1344B

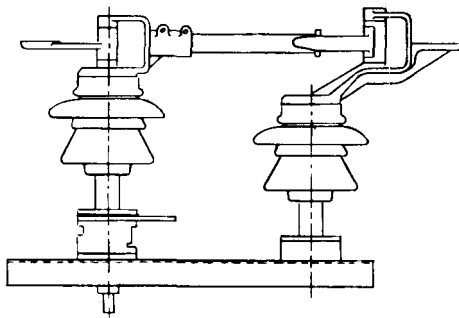
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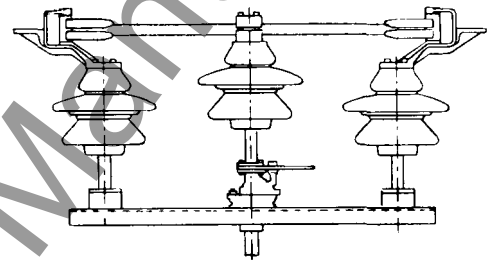
I-T-E CIRCUIT BREAKER COMPANY

This manual was compiled specifically for the type A6, or single break, horizontal opening switch. However, application of Lodrupter units to horizontal opening switches also requires the use of a double break, or type AT6 switch for 23 and 34.5 Kv service.

Therefore, the material contained in this manual is equally applicable to the double break, type AT6 switch insofar as design features, installation, maintenance and inspection are concerned.



Type A6



Type AT6

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# Installation, Inspection and Maintenance

## — TYPES A6 and AT6 —

### Group Operated, Outdoor Air Switches

#### General

This manual provides instructions for the installation, inspection and maintenance of Types A6 and AT6 switches.

It consists of five main sections: Mechanical Parts, Instructions for Installation, Contacts, Switch Maintenance and Terminal Surfaces.

Switches described in this manual are of the outdoor type, suitable for gang-operation, single throw, single break, horizontal opening, two and three insulator stacks per pole, with one insulator stack rotating. Switches included are classified as follows:

- (1) 3-inch Bolt Circle Type A6, 400 Amps., 7.5 to 34.5 Kv, inclusive.
- (2) 3-inch Bolt Circle Type A6, 600 and 1200 Amps., 7.5 to 69 Kv, inclusive.
- (3) 5-inch Bolt Circle Type A6, 600 and 1200 Amps., 69 to 161 Kv.
- (4) 3-inch Bolt Circle Type AT6, 400, 600 and 1200 Amps., 23 and 34.5 Kv.

#### Design Features

The basic design features of these switches are such that need for maintenance is kept to an absolute minimum. The rotor bearings are maintenance-free; they are weather-sealed and are unaffected by soot, dirt, smoke contamination, or the hazards of corrosion. Likewise, the Sealed Pressure Hinge Contacts are maintenance-free. These hinge contacts are weather-sealed; are in constant engagement and are unaffected by air contamination or corrosion. In most cases, only the make-and-break contacts and mechanical adjustments will require attention. However, instructions are being included to cover even the more remote conditions which may occur in isolated cases.

### SECTION I. MECHANICAL PARTS

**Live or Current Carrying Parts . . Features** have been incorporated in the design of the switches which reduce maintenance and repair of live mechanical parts to an absolute minimum. These switches are mechanically sound and ruggedly built to perform their mechanical and electrical duties satisfactorily. However, if a live mechanical part should ever require replacement, it is recommended that the replacement part be obtained from the factory.

**Bearings . .** The switch base bearing on which the drive insulator rotates is a weather-sealed, greaseless rotor bearing with stainless steel balls running in special bearing bronze races. These bearings have synthetic rubber seals which function on either copper-alloy or aluminum

surfaces, excluding dirt and moisture from the internal ball bearing races. They should not be disassembled for maintenance. If bearings are ever found defective, it is recommended that they be returned to the factory for replacement.

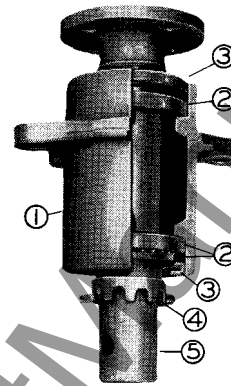


Fig. 1

Bearings require no lubrication. A weather seal, not affected by low temperatures, excludes all moisture and foreign matter.

1. One-piece housing.
2. Stationary and take-up bearing races.
3. Weather seal, rubber-impregnated felt, tipped outwardly and metal reinforced.
4. Adjusting and take-up nut.
5. Forged steel rotor, galvanized.

**Bases . .** On older switches, bases should be painted or re-galvanized before reassembly of parts. Rotor crank stops, located near rotor crank at the switch base, should be straightened and aligned to engage the rotor crank stop properly.

**Stops . .** For the purpose of identifying the various "stops" they will be referred to as follows:

(a) **Rotor Crank Stop . .** This is the stop arrangement found on the switch base, located near rotor crank. Plan views of this stop arrangement may be seen in Figures 4 and 5, page 5. This stop limits the travel of the rotating insulator, stopping the drive crank and consequently the rotating insulator stack in both the switch open and closed position. Adjusting bolts (C) and (D) which limit the rotor crank travel are secured solidly to switch base, and a projection (E) fastened to rotor crank strikes these adjusting bolts in the switch open and switch closed positions.

(b) **Handle Locking Plate Stop . .** This so-called "stop" arrangement is found at the bottom of a vertical operating pipe, (10) of Fig. 8, page 6. It consists of two galvanized steel stampings mounted on a pipe guide plate and can be adjusted in an arc to give a required rotation of the vertical torsional operative pipe. In reality, it is not a stop, but a lock for the manual operating handle to prevent rotation of the vertical operating pipe until the manual operating handle is raised from its locked position.

#### Operating Parts

Operating parts consist of operating pipes, rods, and handles. In general, these parts require little maintenance after installation; such as, cleaning for any corrosion and realigning for wear or sag.

## SECTION II. INSTRUCTIONS FOR INSTALLATION

### Unpacking Inspection

Switches up to and including 46 Kv are normally shipped completely assembled and adjusted, except for arcing horns, and are ready for installation.

The bill of material and installation drawings, contained in an envelope, 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.

Switches rated higher than 46 Kv are shipped un-assembled (with insulators, bases and current carrying parts packed separately). These switch parts must be assembled and adjusted on the job site.

### Installation and Adjustment

Mount single pole switches, or switch bases on cross arms or supporting structure, level and parallel to each other. The parts of the switches are then assembled on the bases.

The next step in installation is to check each single pole switch unit for proper alignment and to set the open and closed stop bolts found on the single pole rotor bearings.

On the 46 Kv and higher voltage switches, the increased spacing and height of parts require a ready adjustment to the inequalities and deflections of mounting surfaces. Shims, shim plates and other less accurate adjustments are difficult and sometimes impossible to handle on the installation.

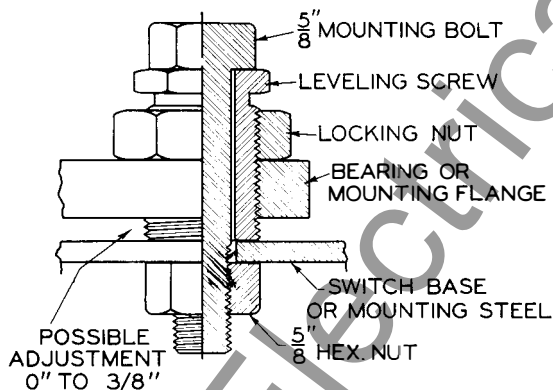


Fig. 2 Leveling Screw detail 5" B.C.

Leveling screws are an important feature of the 5-inch bolt circle Type A6 Switch. They are used to provide a high degree of accuracy, without the use of shims, to align the insulator stacks of the complete switch.

The fine thread individual screw adjustment regulates this accuracy to a fraction of a degree. When adjustment is complete, a locking nut is tightened against the bearing or mounting flange for a permanent set as shown in Figure 2. Variation in height of insulator stacks or their angle to the mounting surface can be easily and quickly corrected.

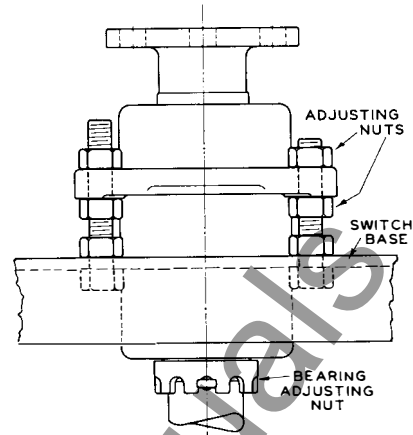


Fig. 3 Leveling Screw detail 3" B. C.

On 3-inch bolt circle, 69 Kv switches, a similar means of aligning the rotor insulator stack is used. The rotating insulator stack is aligned by using two nuts on each of the four mounting bolts of the rotor bearing. By manipulation of these two nuts between the rotor flange and switch base, the same accuracy of alignment can be attained as that of the 5-inch bolt circle switches, see Figure 2.

Having aligned the insulator stacks as described above, the switches may be closed and examined to see that the blade moving contact is engaging properly with the switch jaw contacts. Proper contact must meet the following conditions:

1. The blade moving contact must come to rest midway on the silver contact surfaces of the jaw contacts.
2. The blade moving contact surfaces must be parallel to jaw contact surfaces so as to cause line contact engagement, and equal deflection of jaw contact springs in case of multi-fingered jaws.

Should the switch contacts not make proper engagement as described, a ready means of adjustment is possible and can be found on the blade at the rotating insulator column. At this point the two bolts in the two-bolt clamp that secures the blade can be loosened. This allows the blade to be rotated, shortened or lengthened as deemed necessary to make proper contact.

**Caution:** Bolts are to be securely tightened after the proper adjustment is attained.

Stop bolts of the jaw are properly adjusted at the factory and should require no field adjustment. However, should adjustment be necessary, proceed as follows: (See Figure 7, page 5)

#### A. ADJUSTMENT OF "OPEN POSITION" STOP.

1. To open jaw Farther —  
Loosen lock nut B  
Turn set screw A OUT a few turns to suit.
2. To open jaw Less —  
Loosen lock nut B  
Turn set screw A IN a few turns to suit.

## B. ADJUSTMENT OF "CLOSED POSITION" STOP.

1. To close jaw Farther, (past center line of blade) —  
Loosen lock nut C  
Turn set screw D OUT a few turns to suit.
2. To close jaw Less —  
Loosen lock nut C  
Turn set screw D IN a few turns to suit.

On a counterclockwise opening, the adjustment of the open and closed stop positions would be reversed.

The final step in single pole switch adjustment is setting of the stop bolts which are on the switch rotor bearing. The closed position bolt of the rotor crank stop at the switch base should be adjusted so that it engages the mating projection on the rotor crank when the switch is in the fully closed position. See Figures 4 and 5.

To set the open position stop, the blade is moved to the full open position which is with the blade axis at 75 degrees with respect to the base axis, and again set the rotor open stop bolt in the same manner as the closed stop bolt. See Figures 4 and 5.

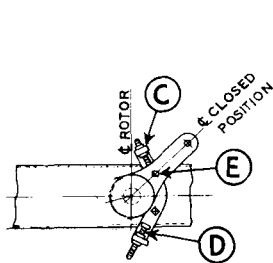


Fig. 4  
3-inch Bolt Circle.

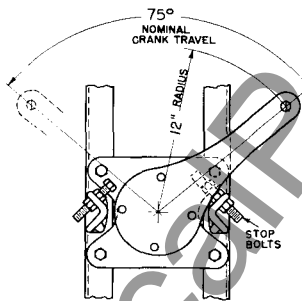


Fig. 5  
5-inch Bolt Circle.

## Arcing Horns

Arcing horns are shipped with the single pole units only when horn gap switches are specified. When arcing horns are used, they should be installed and adjusted after switches are mounted on structures as follows:

On 3-inch bolt circle switches, the stationary horn clamps under the two bolts which mount the jaw base to the insulator. See Figure 18, page 15.

On 5-inch bolt circle switches, the stationary horn is assembled to the side of the jaw base on the side opposite that from which the blade enters. Two tapped holes are provided.

On all Type A6 switches, the movable horn clamps to the blade and is adjusted by sliding it along the length of blade so as to make contact with the stationary horn. Adjust horns to make contact LIGHTLY throughout their travel. (Figure 17, page 14).

## Field Reversal of Switches

One of the distinct advantages to be found on the Types A6 and AT6 Switches is field conversion of the direction of opening.

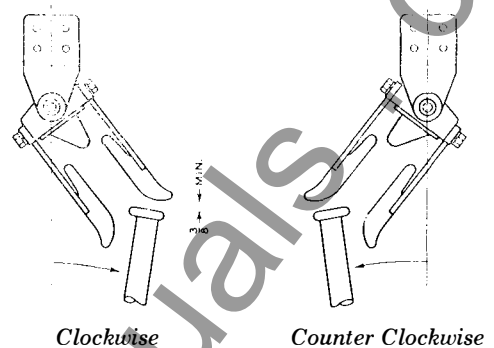


Fig. 6 Showing direction of opening.

Switches should be ordered specifying clockwise or counterclockwise opening as viewed from above, looking down on the switch. Field conversion to clockwise or counterclockwise switch blade motion can be accomplished simply if warranted at some future time, as follows:

To change opening motion of the jaw it is necessary to perform two operations on the jaw assembly. First move the jaw to the open position. In this position the four bolts that retain the bias spring housing (See Figures 7 below, and 15, page 12) are removed allowing the housing to move forward enough to be turned 180 degrees. The four bolts are then replaced.

The next operation is to interchange set screws A and D and adjust to get the 35° open position and dead center at closed positions. (See Figure 7 below).

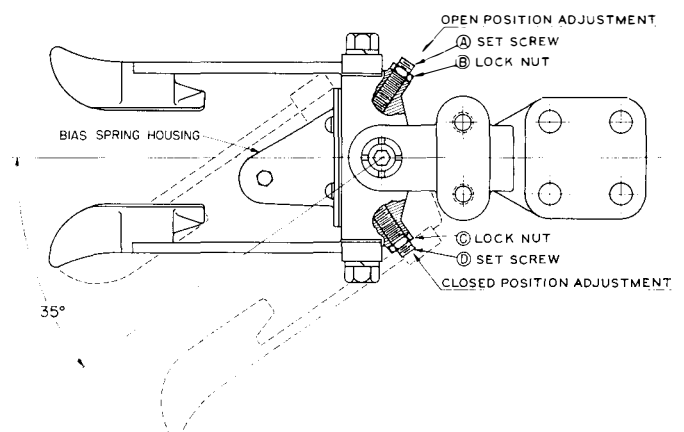
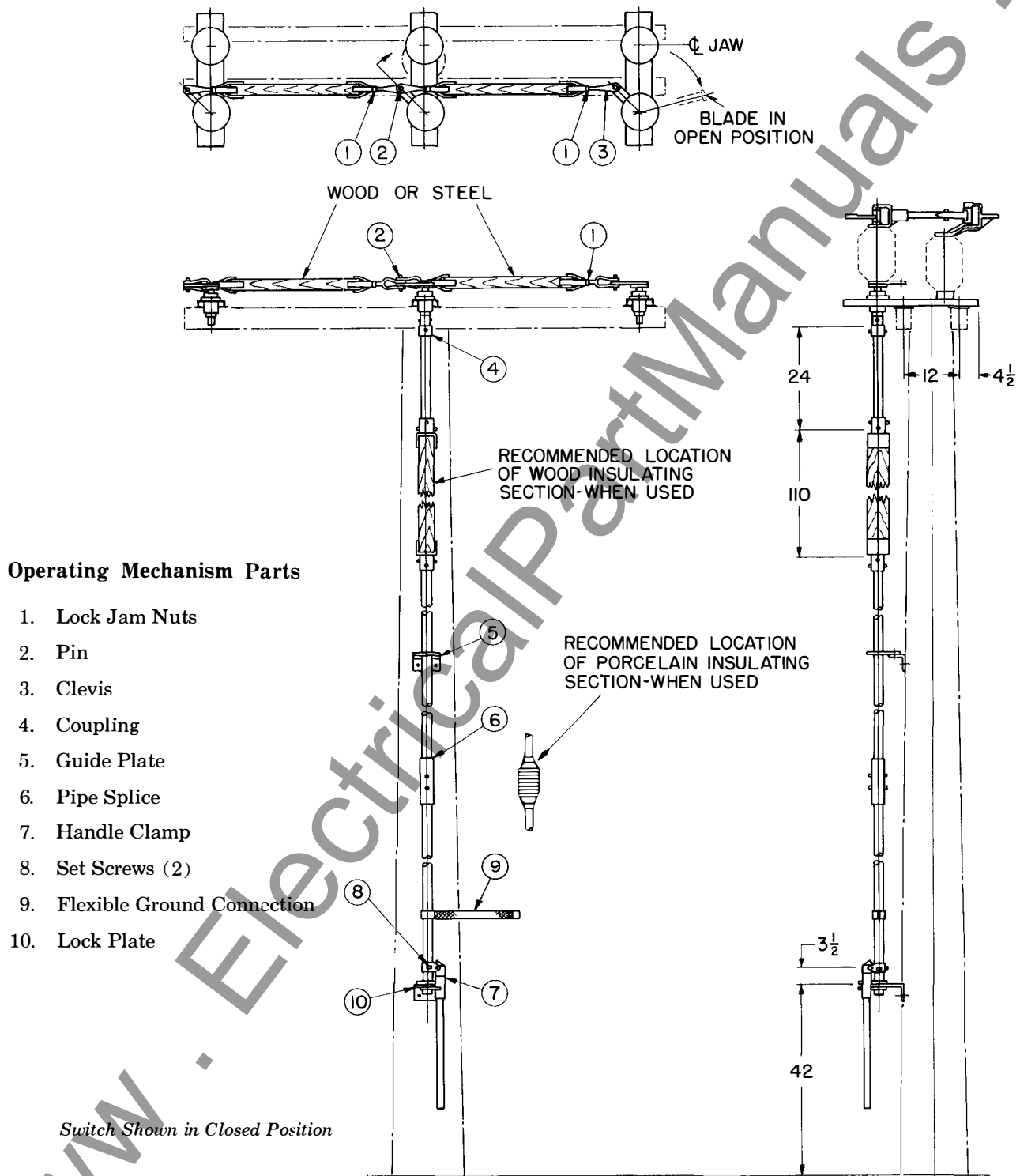


Fig. 7  
Jaw detail showing provision for stop adjustment.

To complete the changeover of current carrying parts it is necessary to loosen the blade clamping bolts at the swivel end and rotate the blade 180 degrees about its longitudinal axis. This places the blade moving contact so the longer side is moving to the closed position, see (A), Figure 13, page 11.

## Installation of Operating Mechanism

It is recommended that an "offset" bearing (a fourth bearing) be used wherever possible on the operating mechanism for Types A6 and AT6 switches. The operating linkage from the offset bearing to the drive switch should be set slightly past dead center when the switch is in the closed position. Figures 8, 10, 11 and 12 illustrate some typical installations.



### Operating Mechanism Parts

1. Lock Jam Nuts
2. Pin
3. Clevis
4. Coupling
5. Guide Plate
6. Pipe Splice
7. Handle Clamp
8. Set Screws (2)
9. Flexible Ground Connection
10. Lock Plate

Figure 8. A "direct" (coupled to one of the single pole units) operating mechanism mounted on single wooden pole. This installation can be used with the A6 switch up to and including 34.5 kv switches. A "direct" operating mechanism should not be used on AT6 switches.

## Mounting 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. For fourth bearing mechanisms, begin with the pole nearest the fourth bearing. Lengthen or shorten the rods to suit phase spacing by turning clevis, (3) of Figure 8. One-half turn of clevis equals 1/16 inch. Then, lock jam nut (1) and install cotter pins.

**Vertical Pipe Assembly** . . If the operating mechanism is "Direct" (coupled to one of the pole units as illustrated in Figure 8) attach pipe coupling (4), and the first section of operating pipe to the switch rotor. If the operating mechanism is "Offset" (with a fourth bearing), a complete drawing showing the assembly arrangement is furnished for each installation, and should be followed in erection. For Offset mechanisms each part is numbered and its location clearly shown on the drawings. Where adjustable multi-angle crank operating mechanisms are used, an instruction manual is furnished.

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.

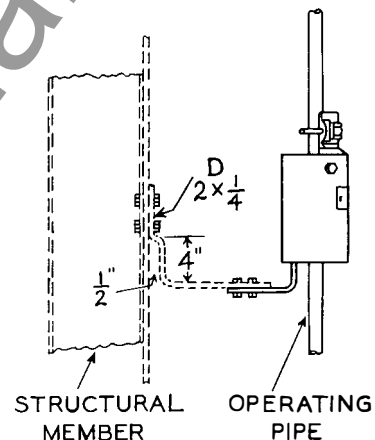
On reciprocating mechanisms, it is well to have the adjustment so that switches are similarly held in the open and closed position with the operating handle in its corresponding position. This is best accomplished by adjusting the length of interphase connecting rods to take out all "slack" at the extreme limits of travel by forcing the switch rotor cranks against their limit stops.

**Guide Plate and Couplings** . . If more than one section of pipe is necessary, a guide plate (5), Figure 8, is furnished which should be slipped over the pipe. The pipe splice (6), should be put in place to couple the pipe sections. 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 reciprocating mechanisms, an intermediate bearing is used in place of the guide plates. On wood poles, it may be necessary to block out from the pole, or the pole properly gained to support the pipe.

**Operating Handle and Lock Plate** . . As illustrated in Figure 8, slide handle clamp (7) and lock plate (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 screws (8). 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. If a reciprocating type mechanism is used, install operating handle as shown on mechanism drawing.

**Ground Connections** . . A flexible ground connection (9) Fig. 8, should be installed to suit the installation. For multi-revolution mechanisms, the type GRD grounding device is supplied, Fig. 9.



*D—Rigid ground connection.*

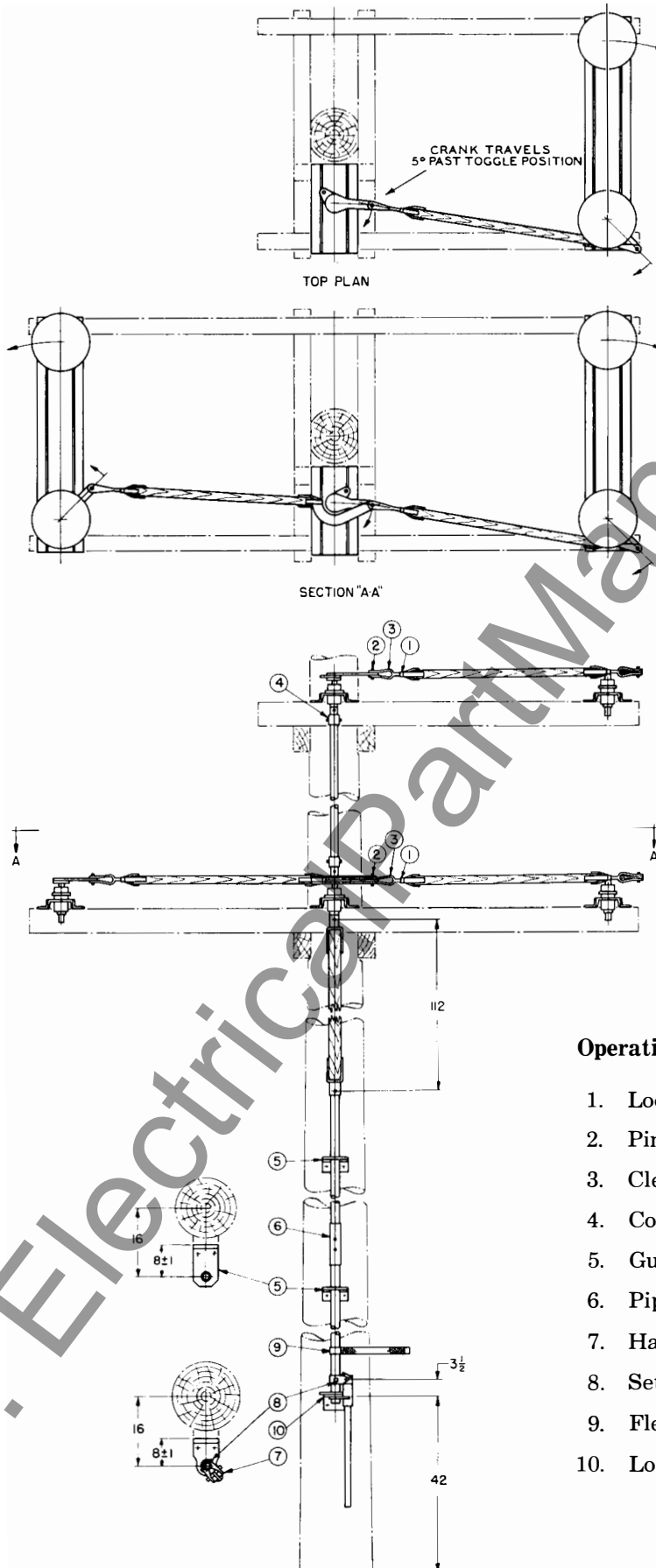
*Fig. 9*

*Mounted to prevent rotation of stator, but flexible to minor pipe eccentricity.*

**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, Figures 4 and 5, page 5, 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, tighten the two stainless steel set screws, (8) of Figure 8, until their dog points pierce the pipe. This will permanently secure the handle to the vertical operating pipe.

REFER ALSO TO FIGURES 10, 11 AND 12.

Operating mechanism for one wood pole, triangular switch configurating.



Operating Mechanism Parts

1. Lock Jam Nuts
2. Pin
3. Clevis
4. Coupling
5. Guide Plate
6. Pipe Splice
7. Handle Clamp
8. Set Screws (2)
9. Flexible Ground Connection
10. Lock Plate

Switch Shown in Closed Position

Figure 10. This is a triangular mounted switch on a single wooden pole. By using the triangular operating mechanism it is possible to "lock" the switch closed by setting the rotor crank arm on the "offset" bearing slightly past center in the closed position of the switch. This installation can be used with switches up to and including 69 kv.

Operating mechanism for two wood poles, with fourth bearing.

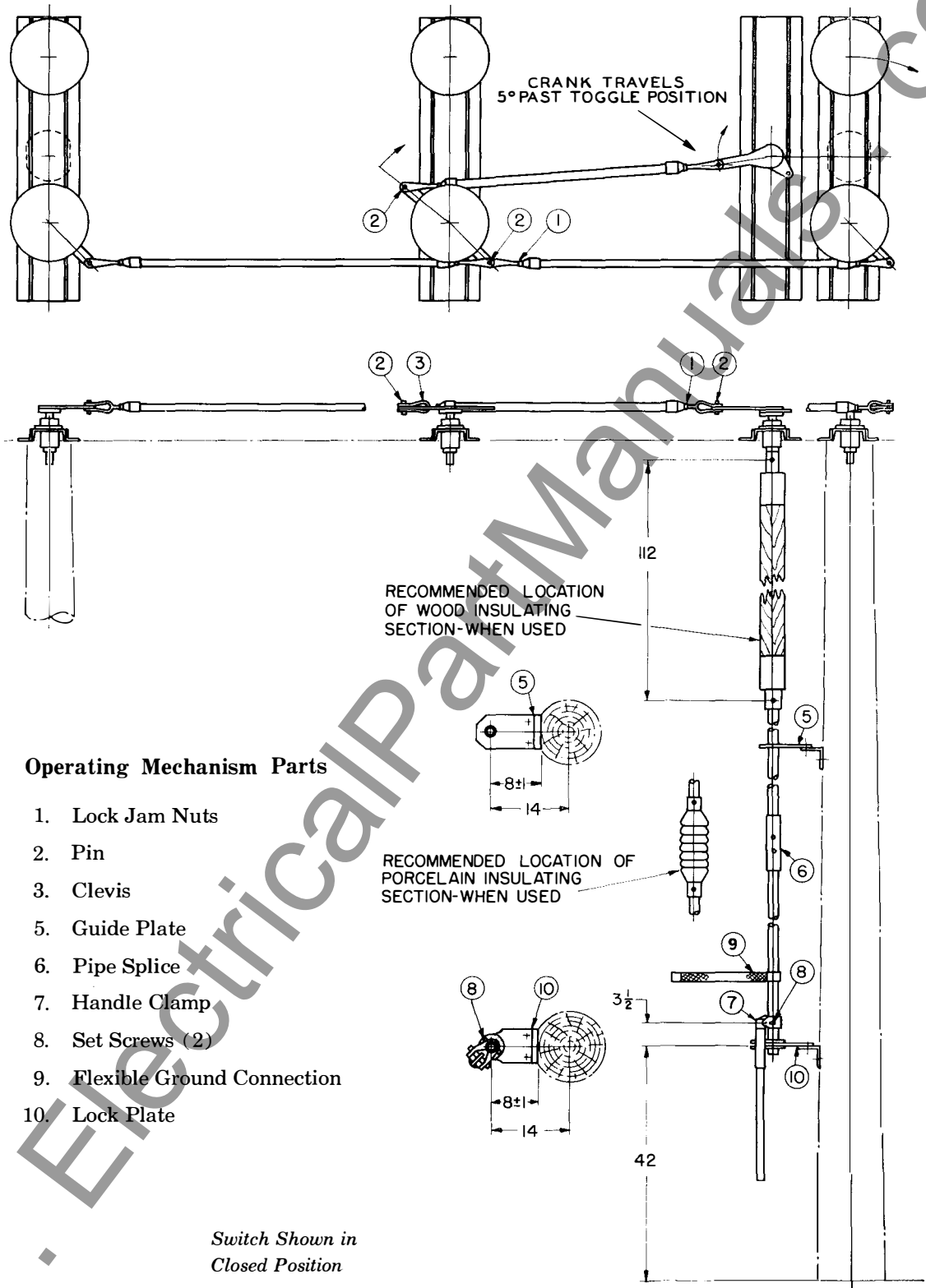


Figure 11. This is a typical installation where two wooden poles are used to mount the switch. Again an "offset" bearing or fourth base is used which allows the switch to be "locked" in the closed position by toggling the rotor arm of the "offset" bearing over center. This is a standard installation for 46 and 69 kv switches.

Operating mechanism for structural mounting, with offset bearing.

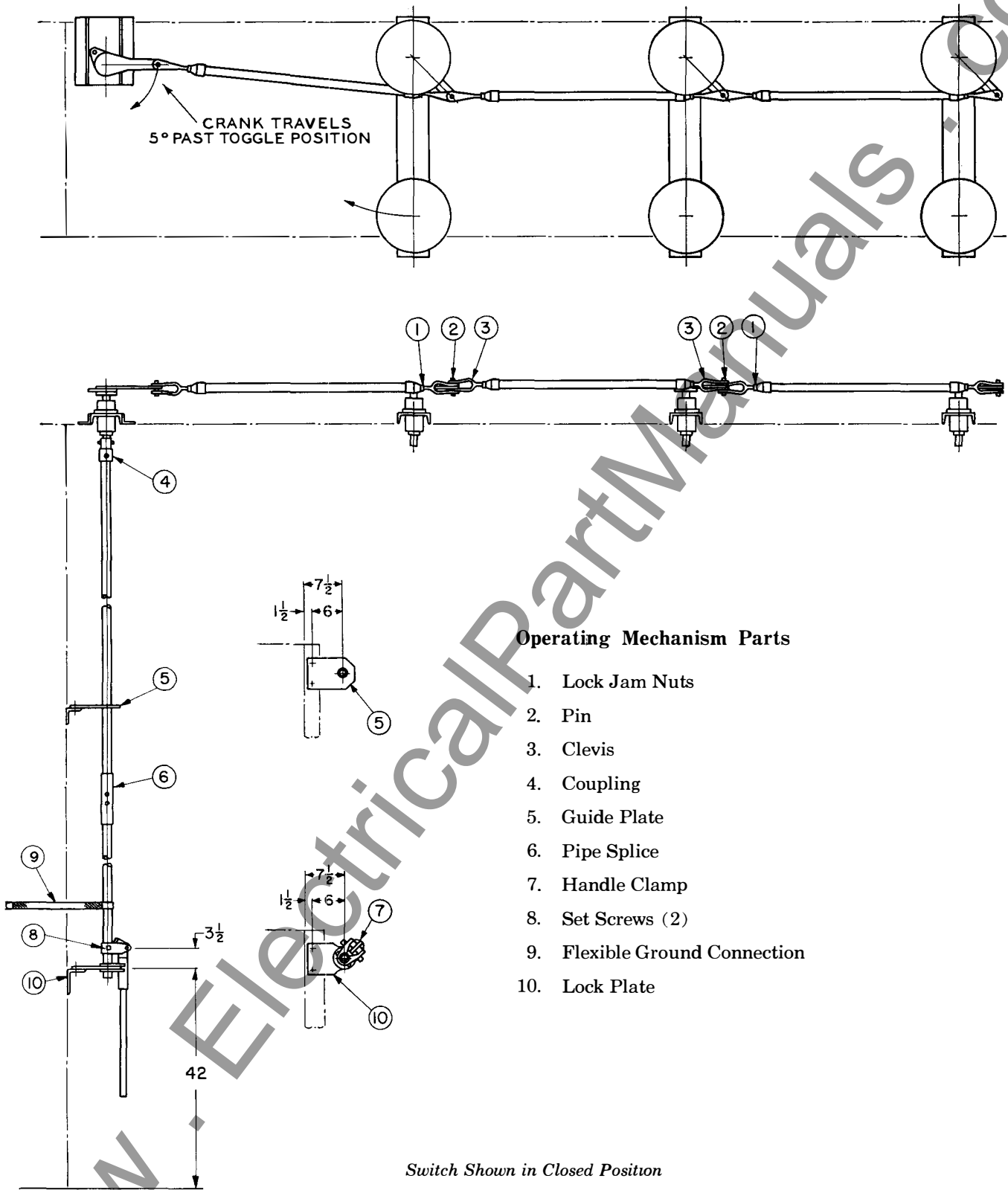


Figure 12. Shows a switch installation mounted on a steel structure. Again notice the crank arm on the "offset" base is toggled over center when the switch is closed. Can be used on all standard voltage ratings.

### SECTION III. CONTACTS

The word "contact" as used in this manual will signify a current interchange surface between two or more current conducting members. The duties of a contact are to carry normal rated current without overheating,—to carry heavy overloads on short circuit currents in accordance with NEMA specifications for short periods of time,—to make or break light charging or load currents without damage,—to establish a renewed contact surface with each engagement of switch blade and jaw, and to break, and if possible, remove ice and contamination. Contacts on a Type A6 Switch are mainly five:

1. The jaw terminal surface.
2. The Sealed Pressure Hinge Contact at the current interchange between the jaw and the jaw terminal casting.
3. The make and break contact between blade and jaw.
4. Sealed Pressure Hinge Contact at the current interchange between the blade and blade terminal casting. (Terminal swivel)
5. The blade terminal surface.

Remarks concerning the jaw and hinge terminal surfaces will be found in Section V, page 14, titled "Terminal Surfaces."

Contact surface materials throughout this line of switches have been selected with extreme care and the factory processing of switch parts is carefully controlled in an effort to secure the optimum contacts insofar as electrical and thermal conductivity, thermal capacity, proper hardness, best resistance to abrasion, and best resistance to galling are concerned.

The high pressure contact of the jaw-rotating type as developed at the make-and-break contact of these switches fulfills the duties of a "contact" as outlined previously in the most satisfactory manner and with minimum maintenance and repair. The blade-end contact is a mechanical press fit and is swaged on the hard drawn, high conductivity, tubular copper blade. The jaw contacts are high thermal capacity, silver-surfaced copper fingers backed up with beryllium cobalt copper spring members—copper for its good electrical and thermal conductivity and the beryllium cobalt copper for its strength

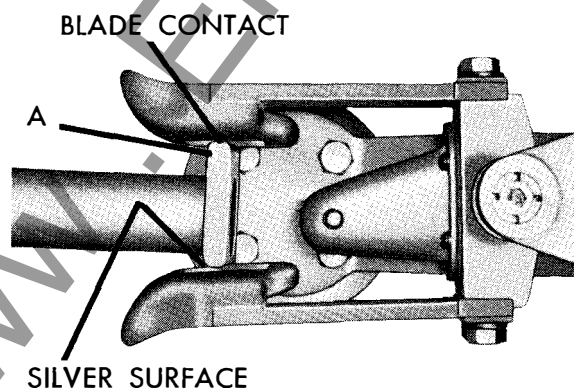


Fig. 13 Showing blade in closed position.

and resilience. Upon closing a switch, the copper blade contact of the blade slides into the silver-surfaced jaw contacts, deflecting the beryllium cobalt copper jaw members apart and wiping into engagement, thus accomplishing a high pressure line contact, see Fig. 13. Experience has proven silver-to-copper contact surfaces best for wear resistance.

The Sealed Pressure Hinge Contact is superior to the jaw contact in that it normally will require no maintenance or repair. All parts of the SPHC (Sealed Pressure Hinge Contact) are properly assembled and adjusted at the factory and require no further adjustments. There is no need to inspect, maintain or repair the internal SPHC, unless the switch has been subjected to a line fault of such severity that the main jaw make-and-break contacts were damaged by the fault. The SPHC is completely enclosed, weather-sealed, lubricated for the life of the switch, and its contacts are of the high-pressure, high-thermal capacity, silver-to-copper type, which remains in constant engagement. Constant contact pressure is supplied to the hinge contact pins by means of non-magnetic, stainless steel springs, Fig. 14. These springs are insulated from the path of current by insulating washers.

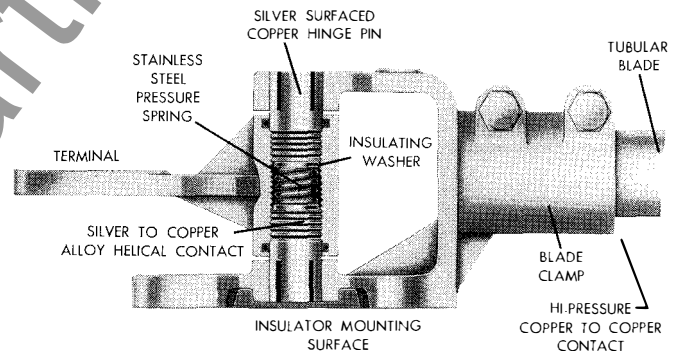


Fig. 14 Sectional detailed view of Hinge.

The internal contacts of the SPHC have been designed with a factor of safety and meet NEMA standards. The 400, 600, and 1200 ampere switches all utilize the 1200 ampere hinge pin, so that in the lower ratings there is a decided margin of safety in those contacts. Repeated short circuit tests have proved adequacy of all these contacts.

However, if a line fault occurs, where a breaker and/or relaying fails, which burns up considerable equipment and is on for a long period of time, it would be a wise precaution to examine the switch if the jaw make-and-break contacts have been damaged.

As stated above, there is no need of ever examining the internal contacts unless a fault occurs of such severity that it damages the make-and-break contacts. Then, if there is any question about the internal contacts, they may be inspected by removing the stainless steel socket head bolts with a standard Allen wrench. The hinge pins may then be removed by unscrewing them from the terminal casting, using a large screw driver.

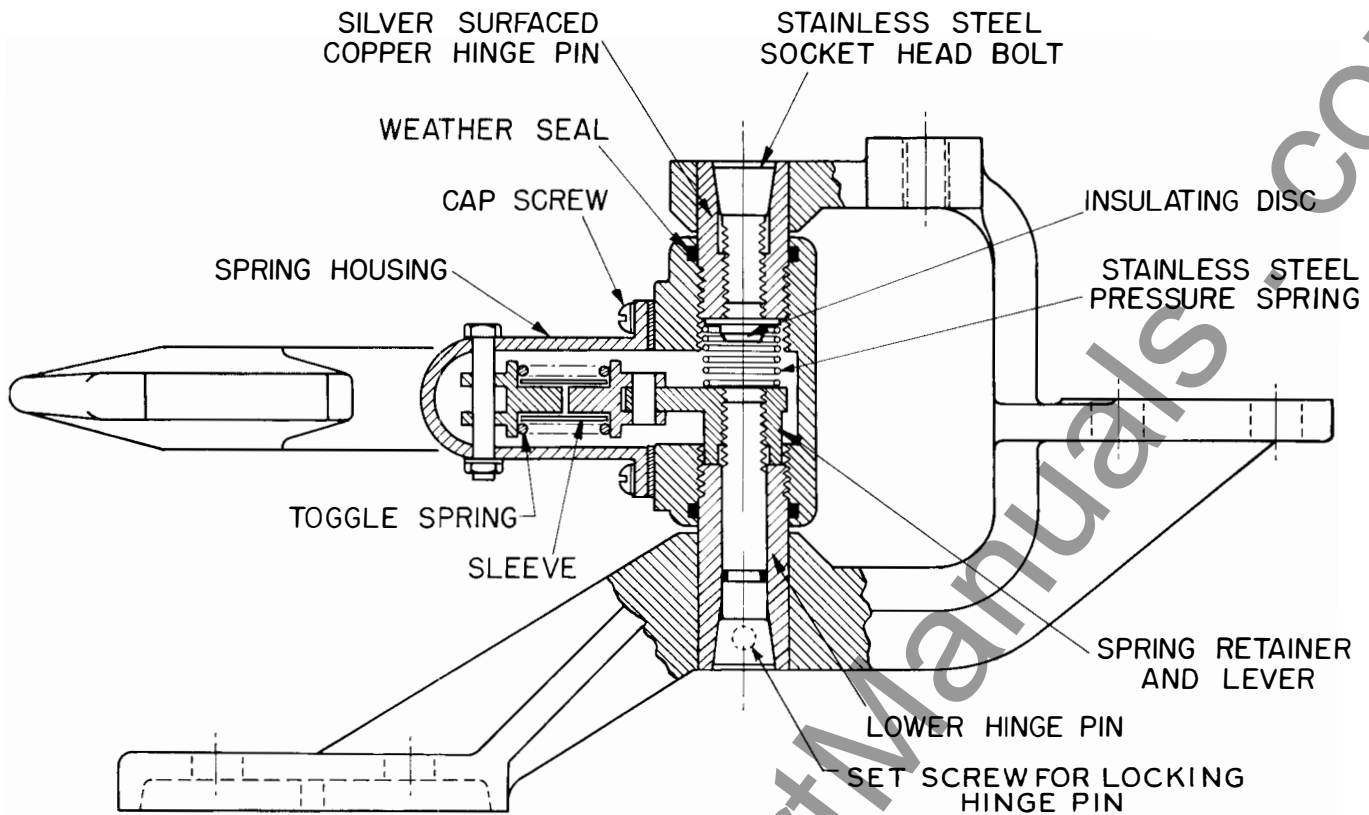


Fig. 15 Showing sectional detailed view of Jaw.

The internal contacts of the jaw assembly may be inspected in the following manner:

Remove the spring housing by removing four cap screws, Fig. 15. The spring and sleeve will then be free. Remove the top and bottom stainless steel socket head bolts with a standard Allen wrench. Remove the top hinge pin, seal plug and spring. Disengage the spring retainer and lever, which has a key section and fits into the keyway of the lower hinge pin, by lifting. Remove the lower hinge pin by first removing the two set screws from the jaw support casting. These set screws prevent the lower hinge pin from rotating. Then by using a large screw driver, remove the lower hinge pin.

When reassembling, the lower hinge pin should be flush with the bottom of the opening for the spring lever. The spring lever should be positioned parallel to the jaw fingers in the normal closed position. It should be held in this position until the set screws that prevent the hinge pin from turning, and the bottom socket head bolt, have been tightened.

Next, install the stainless steel pressure spring, insulating disc and top hinge pin. The assembly can then be completed by assembling the toggle spring, sleeve and spring housing.

### Contact Pressure and Wear

The high pressure contact is designed to give a wiping action at the contact surface to improve the life and service of the contact. The copper to silver contacts of the switches have been thoroughly tested and proved to be the best type for electrical and thermal conductivity, wear and corrosion-resistance.

Under constant usage, contacts may wear so that they may require replacement. In general, experience has shown that on most switches this will not be necessary until after fifteen to twenty years operation. In the worst cases, contact replacement may be necessary as early as seven to ten years.

Where switches are used frequently, or under severe contamination or grit conditions, contacts may have to be cleaned frequently. If the contacts can be frequently maintained, they will not abrade so severely and a longer contact life may be expected. See contact maintenance, page 13.

The contact pressure on the switch jaws is provided by beryllium cobalt copper jaw members. These spring members provide adequate pressure for the contact duty if the contact surfaces are in reasonably good condition. As the contacts wear, or should they become burned, the deflection of the jaws will decrease and a point may be reached where inadequate pressure is applied to the contact surfaces.

Even with contact wear, if the contact surfaces have been smoothed and cleaned, and provided there is at least  $\frac{1}{8}$ " deflection in the contacts, the switch contacts should be adequate for placing back in service. This  $\frac{1}{8}$ " is measured by calipering the jaw contact with the blade out of the jaw, calipering at the point of engagement with the blade contact, and comparing that reading with the width of the blade contact. The blade contact width for 400 and 600 ampere, 3" B. C. switches is nominally  $2\frac{1}{2}$ " and a new jaw is nominally  $2\frac{5}{16}$ " when manufactured, giving a total contact deflection of  $\frac{3}{16}$ ", or  $\frac{3}{32}$ " deflection for each jaw finger with the switch closed. For 1200

ampere, 3" B. C. and for the high voltage 5" B. C. switches, the blade contact width is nominally 3½", the total contact deflection is nominally 3/16" and the deflection for each jaw finger with the switch closed is 3/32". On a switch that is being maintained, if the total contact deflection is 1/8" or more, the contacts are entirely adequate.

The previous recommendations are made on the expectancy of carrying normal currents and short circuit capacity. If a switch is in service and the total contact deflection is slightly under 1/8", say 1/10", the switch will still be usable but may overheat when subjected to full load current and short circuits.

## SECTION IV. SWITCH MAINTENANCE

Although our policy has been to produce outdoor switch equipment requiring a minimum of maintenance, a certain amount of care and inspection is required. Recognition of this fact is general in the industry and we are including the NEMA recommendations.

### NEMA Recommendations For Care of Outdoor Air Switches

"An air switch is not equipped with isolating switches to allow it to be serviced at frequent intervals. This does not indicate, however, that an air switch needs no care and inspection. The frequency of inspection will necessarily be a function of the atmospheric conditions at a given switch location and the frequency of operation. In non-corrosive atmospheres, a switch may operate satisfactorily for many years without care, while in a severe atmosphere such as is encountered at power plants and industrial sites, maintenance may be required in a matter of months. This service interval must be determined by the user.

"The following points require special attention:

1. Be sure that the switch is disconnected from all electric power before it is serviced.
2. After power has been disconnected from the switch, ground leads or their equivalent should be attached to both sides of the switch.
3. Where abnormal conditions, such as salt deposits, cement dust or acid fumes prevail, clean the insulators in order to avoid flashover which might result from the accumulation of foreign substances.
4. Examine the contacts. Check to determine that they are aligned and that contact surfaces bear with a firm uniform pressure. Check contact surfaces. If it is known that the switch carried a heavy short-circuit current, special effort should be made to inspect the switch at the earliest possible time. This is especially important if the switch contacts are badly corroded since the ability of the switch to carry rated short-circuit currents is seriously impaired if the contacts are not properly maintained. Replace any pitted or burned contacts. If pitting is of a minor nature, smooth down the surface of

the contacts with clean, fine sandpaper (not emery) or in accordance with the manufacturer's recommendations.

5. See that bolts, nuts, washers, cotter pins and terminal connections are in place and tight. If the switch is group operated, interphase linkages, line operating parts, rods, levers, bearings, etc., should be cleaned and lubricated as required according to the manufacturer's directions; check for the simultaneous closing of all blades and for complete contact in the closed position.

6. When the switch cannot be disconnected from power, hot stick servicing should be used to as great an extent as possible.

7. Where periodic maintenance of any kind cannot be made, it should be recognized that the life of the switch contacts may be affected. In these cases, when the switch operation is made, it is recommended that the switch be opened and closed several times instead of just once in order to clean the contacts more effectively."

(NEMA Pub. SG6-1954, Part 9, page 3)

### Maintenance Of Exposed Jaw Contacts

Contact maintenance will vary considerably, dependent upon the type of atmosphere to which the contacts are exposed. For heavy industrial areas, particularly near coke ovens where tarry products are in the atmosphere, contacts tend to become coated with a heavy flint-like film.

Where contacts are subjected to chemical or cement plant dust and the like, a hard coating may be deposited which is insulating in characteristic and which cannot be removed in the usual course of switch operation.

For the more normal application, the operation of the switch once every three months should be sufficient to keep its contacts in good condition when combined with an annual maintenance program.

In many cases, two or three operations per year may prove adequate; and in some cases, users report only one operation per year. The user can best judge his maintenance procedure after gaining experience in operating switches under the prevailing conditions.

The periodic maintenance should consist of cleaning the contact surfaces thoroughly by carefully scraping off any contamination or deposit and sanding the surface to a smooth finish with clean, fine sandpaper, being careful to wipe off all evidence of sand. With the contact surface entirely clean, a coating of lubricant should be applied. The lubricant may be either NO-OX-ID (Grade XX) or Dow Corning DC-44 medium consistency silicone grease.\*

It is recommended that parts be returned to the factory for repairing major damages. If the jaw contact is burned or worn sufficiently that it should be repaired, it is recommended that the jaw contact members be replaced with new ones. Each jaw member or finger is bolted to the

\*No-ox-id greases can be purchased from the Dearborn Chemical Co., 310 South Michigan Avenue, Chicago, Ill., and silicone compounds and greases from Dow-Corning, 592 Saginaw Rd., Midland, Mich.

jaw base. Removing the bolts will permit removal of jaw members, making them readily replaceable with new ones.

In ordering parts or in correspondence regarding this switch, please state the voltage and current rating and the serial number. This data is indicated on the name plate.

In general, contacts in good condition, coated with a lubricant as described before, improve with frequent operation, although the lubricant should be renewed at regular intervals, preferably yearly.

### Maintenance Of Operating Mechanism Linkages

In general, operating mechanism linkages require no maintenance. Bearings at vital points are weather-sealed and greaseless, requiring no lubrication. Exposed bearings, such as the pinned connection of the rotor crank to the interphase connecting rods and the vertical operating pipe guide plates, should receive special attention particularly in areas where atmospheric contamination is abnormally great or where operation under sleet conditions is common. Any number of lubricants might be suitable for application at these points. Dow Corning DC-4 sili-

cone compound is recommended. This compound is practically inert, very durable even when exposed to the elements, and retains its viscosity over a very wide temperature range.

### SECTION V. TERMINAL SURFACES

Both the jaw and hinge end terminals employ four  $\frac{1}{2}$ " bolts on  $1\frac{3}{4}$ " x  $1\frac{3}{4}$ " centers which permit NEMA standard 600 or 1200 ampere clamping and the Type "UC" universal terminal clamp. Where  $\frac{1}{2}$ " bolts are used, the clamping pressure is sufficient to keep the contact area adjacent to the bolts entirely clean. To recondition or maintain such terminal surfaces, all that is required is light abrading with steel wool.

All terminal areas should have bright metallic surfaces after cleaning and preferably should be coated with NO-OX-ID, Grade A Special, in making the new connection. This special grade of NO-OX-ID is a soft, greasy type, designed for brush application, and does not require heating the surfaces upon application. Bolts should be drawn up tightly to insure adequate contact pressure. These special precautions will be well justified by added years of trouble-free service.

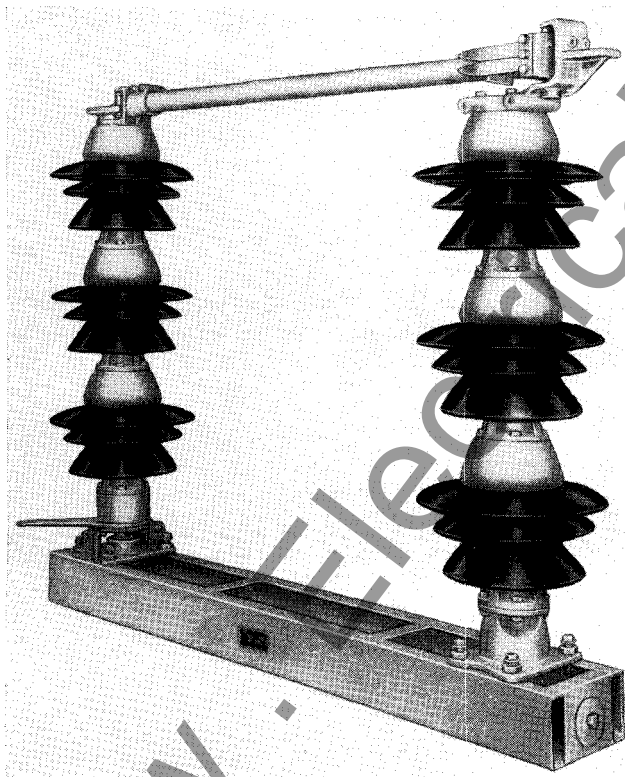


Fig. 16  
Type A6, 5" Bolt Circle Switch

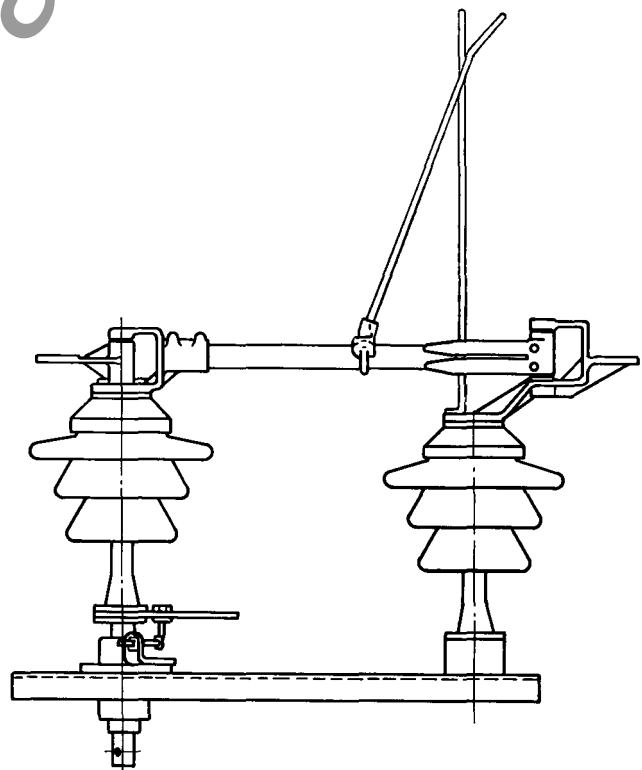


Fig. 17  
Type A6 Switch equipped with Arcing Horns.

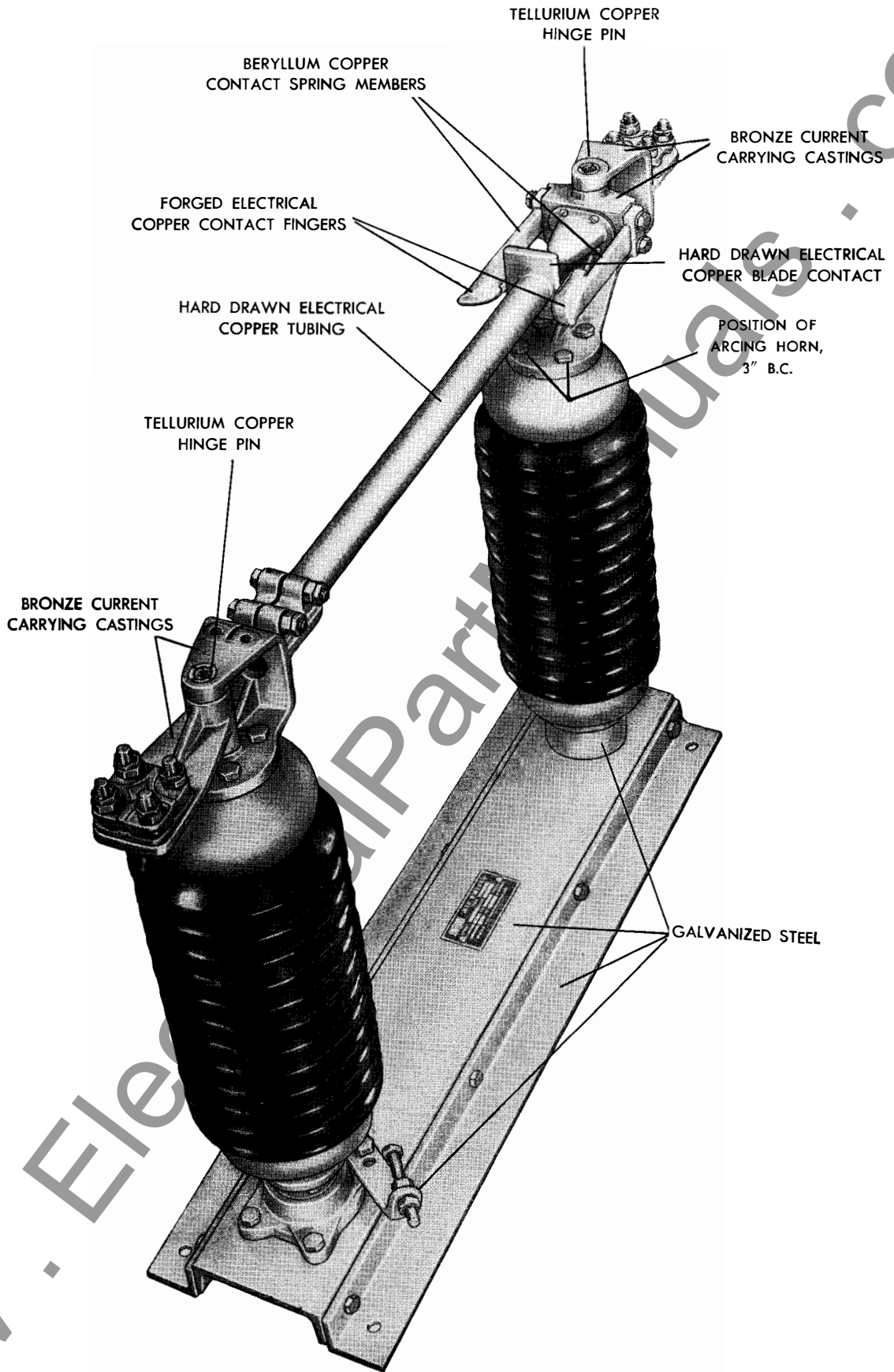


Fig. 18

Description of Non-Ferrous Metals used in current-carrying parts.

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