# United States Patent [19]

**Frink et al.**

[11] **3,875,355**

[45] **Apr. 1, 1975**


[54] **DISCONNECT SWITCH**


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[73] Assignee: **Westinghouse Electric Corporation**, Pittsburgh, Pa.



[22] Filed: **Sept. 11, 1973**

[21] Appl. No.: **396,163**

[52] **U.S. Cl.** ..... **200/48 A**

[51] **Int. Cl.** ..... **H01h 31/00**

[58] **Field of Search** ..... 200/48 R, 48 PI, 48 A, 200/48 KB, 48 CB, 48 V, 48 SB



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,830,144 | 4/1958 | Fjellstedt | 200/48 A |
| 3,299,240 | 1/1967 | Foti | 200/48 A |
| 3,566,056 | 2/1971 | Joseph et al. | 200/48 R P |



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*Assistant Examiner*—M. Ginsburg
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[57] **ABSTRACT**

A high voltage disconnect switch in which the hinged member pivotally supporting the switch blade is composed of aluminum alloy, the sleeve for rotating the blade is composed of copper alloy with copper alloy conductors on opposite sides of the contact surface of the sleeve, and the circuit through the switch passing through the sleeve and conductors rather than through the hinged member.


**8 Claims, 6 Drawing Figures**

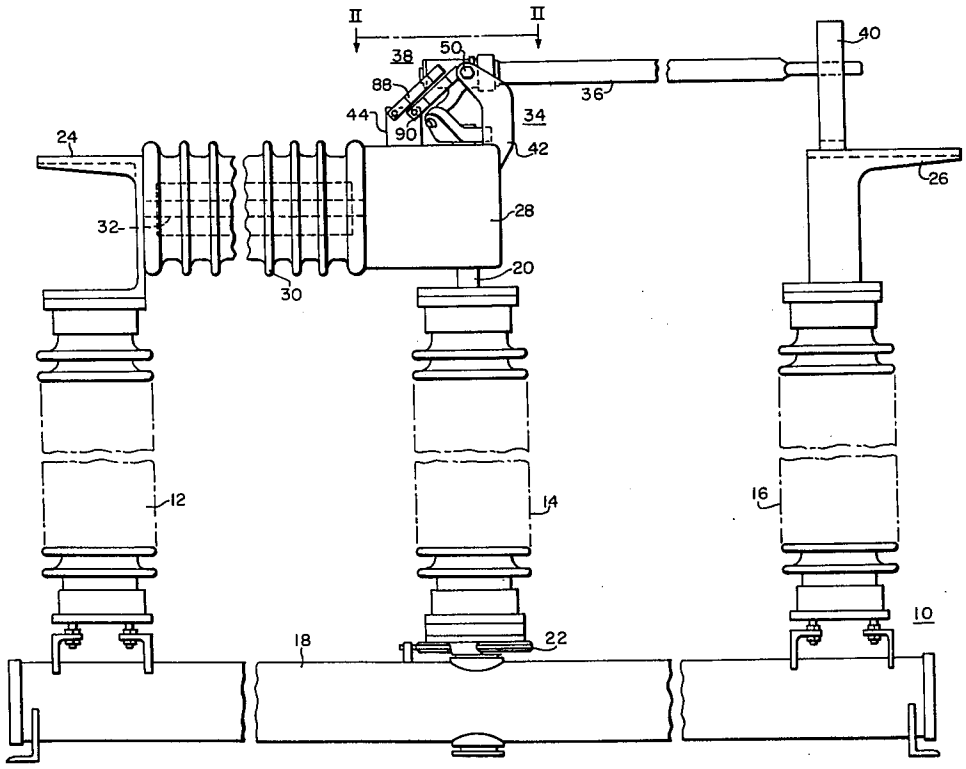
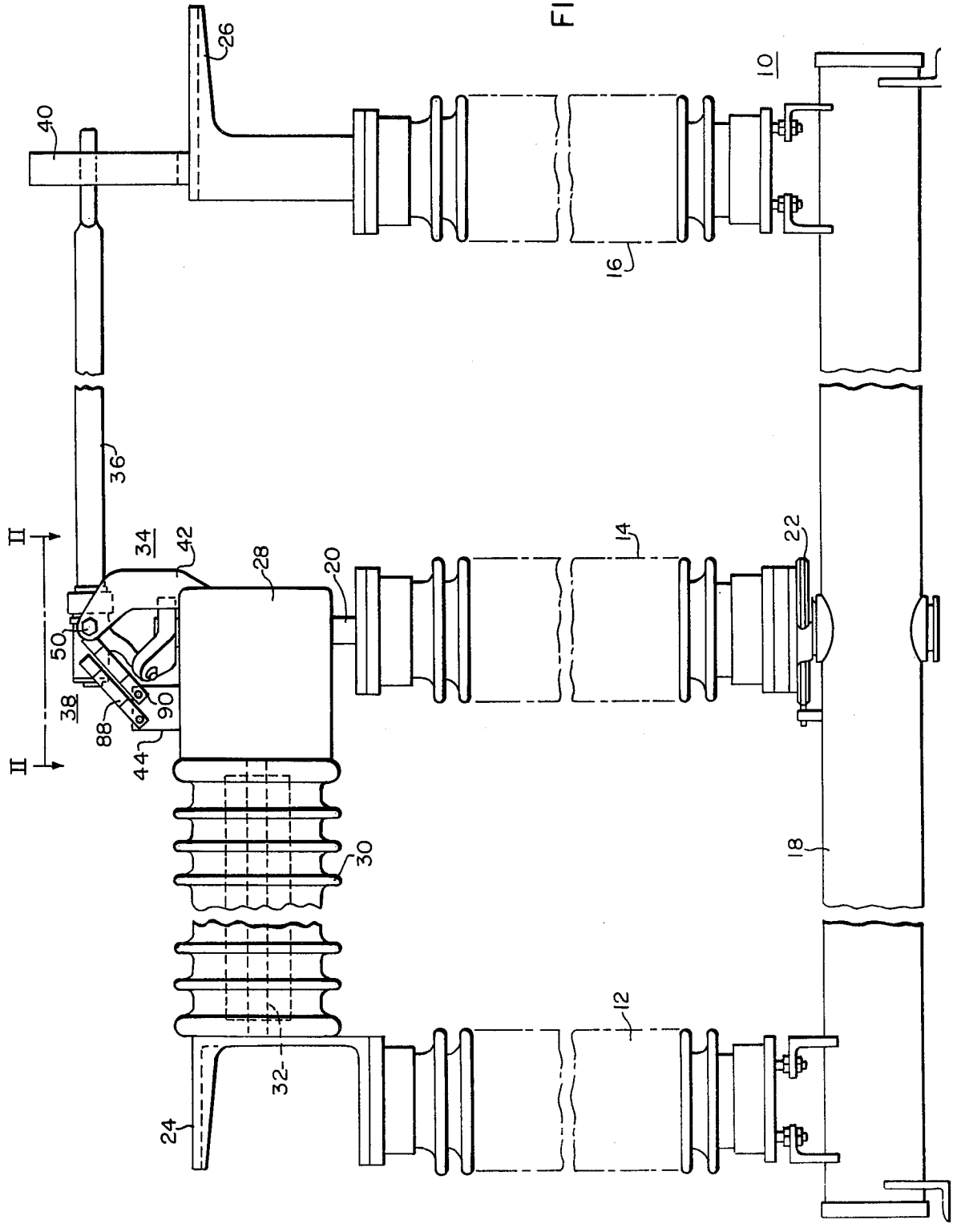


FIG. 1



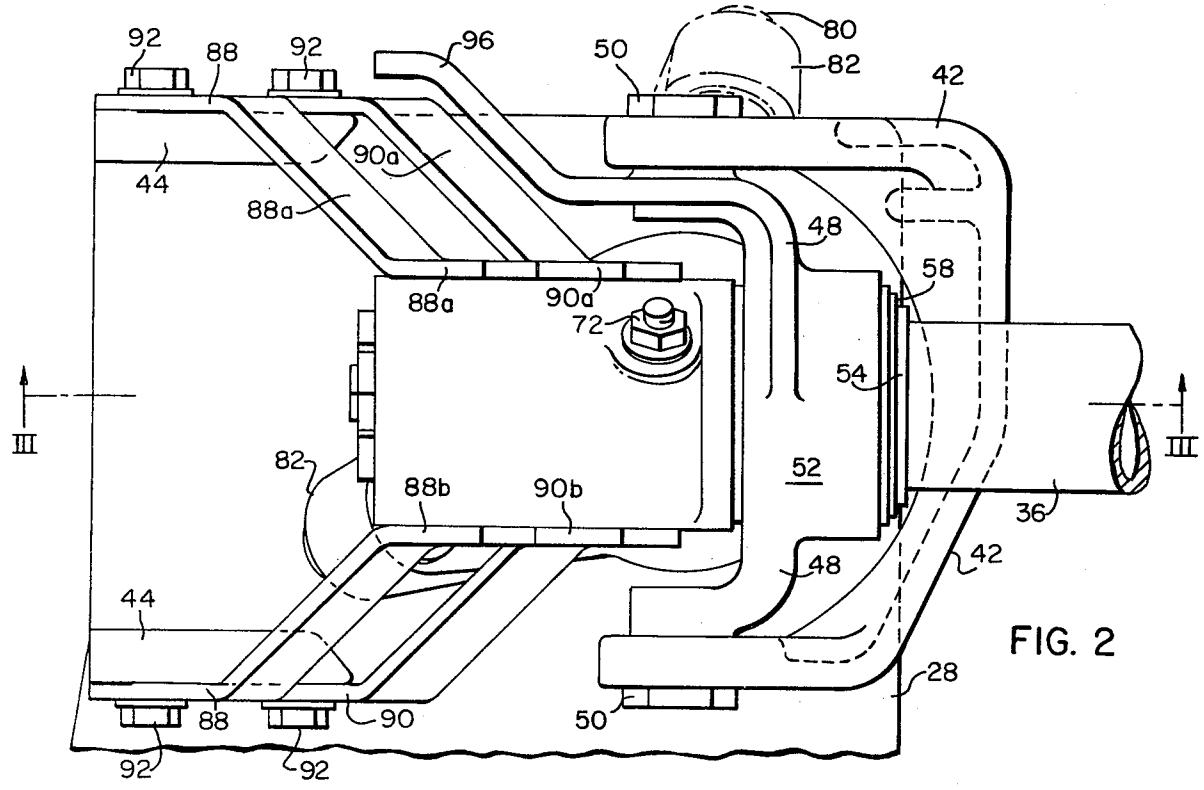

92
88
92
96
50
80
82
42
44
90a
88a
48
58
88a
90a
72
54
III
III
82
88b
90b
52
36
48
42
44
28
88
90
50
92
92

FIG. 2

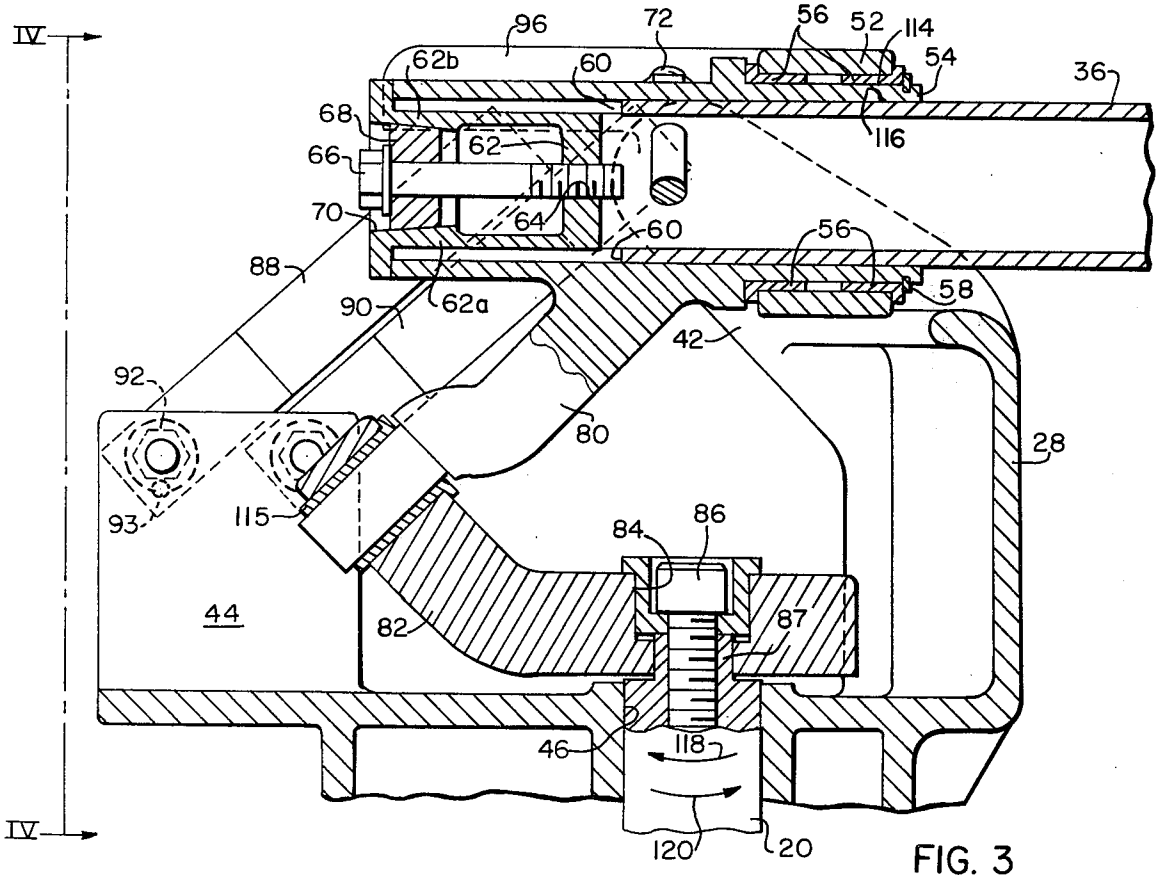

IV
96
72
56
52
114
62b
60
54
36
68
62
116
66
70
64
60
56
88
90
62a
58
42
92
80
28
93
115
84
86
44
82
87
46
118
120
20
IV

FIG. 3

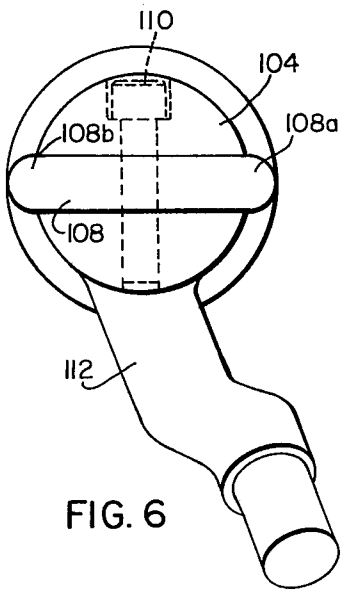



FIG. 6

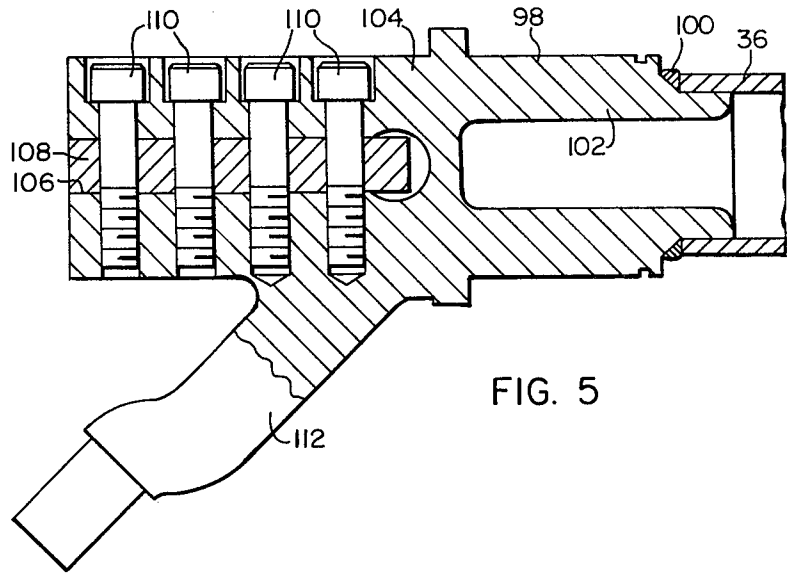



FIG. 5

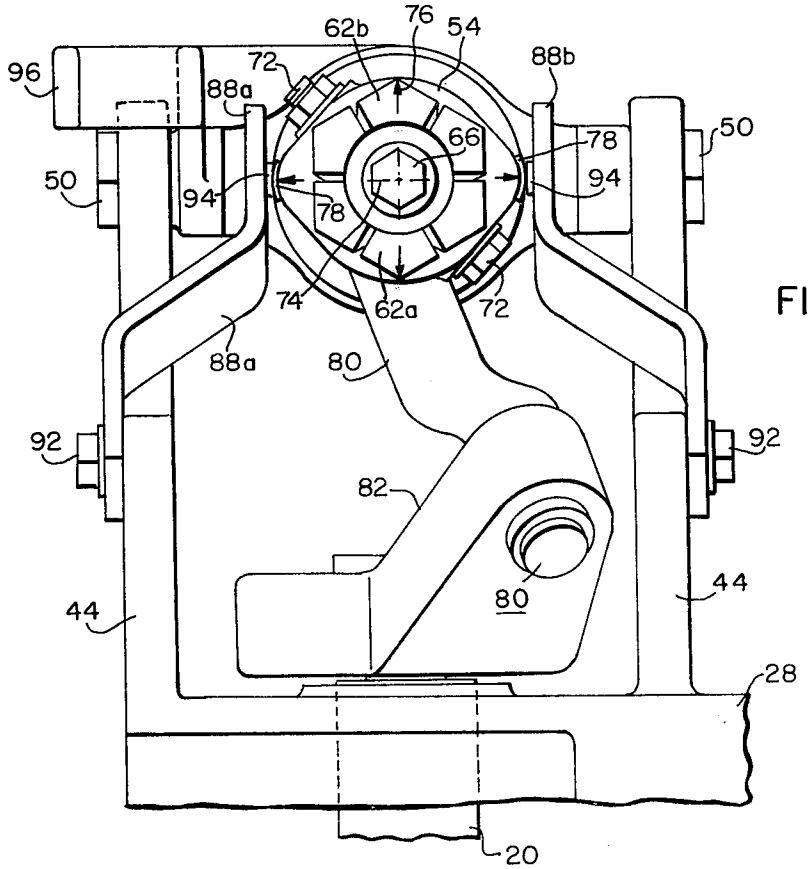



FIG. 4

# DISCONNECT SWITCH

## CROSS REFERENCE TO RELATED APPLICATIONS

This invention is related to those disclosed in the applications of Russell E. Frink and Stanislaw A. Milianowicz, Ser. No. 469,586, filed May 13, 1974, Ser. No. 469,931, filed May 14, 1974, and Ser. No. 468,332, filed May 8, 1974.

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to disconnecting switches and, more particularly, to rotating conducting structures which form part of such switches.

2. Description of the Prior Art

Disconnect switches of various types are disclosed in U.S. Pat. Nos. 3,201,535, 3,240,887, 3,243,561, 3,366,753, and 3,544,742. A disadvantage of most disconnect switches is that they are fabricated from copper alloys which are costly and relatively heavy. As shown in Patent No. 3,544,742, disconnect switches are currently being fabricated with copper and aluminum parts, because aluminum is less costly and lighter than copper. However, other problems have been incurred with aluminum. That is particularly true where the disconnect switch is used outdoors and subject to varying weather conditions. Ordinarily, aluminum oxidizes readily in air; but in wet weather, it enters into electrolytic action with copper. Thus, there has been a problem of corrosion and therefore of deterioration of electrical contact at joints between copper and aluminum parts.

## SUMMARY OF THE INVENTION

It has been found that the foregoing problem may be overcome by providing a disconnect switch comprising a pair of stationary contacts at spaced locations, a switch blade pivotally movable between open and closed positions with one of the stationary contacts, means for pivotally mounting the switch blade at a location spaced from one of the stationary contacts and comprising a stationary frame, the other stationary contact being electrically connected to the stationary frame, the stationary frame supporting a movable sleeve in which the blade is rotatably mounted, means rotating the blade in the sleeve when the blade is pivotally moved between the open and closed positions, conductors mounted on the stationary frame and positioned with respect to the movable sleeve for engagement and disengagement with the mounting sleeve when the blade is in the closed and open positions, respectively.

The advantage of the device of this invention is that electric current is not conducted through a hinge joint as in disconnect switches of prior construction, but rather the current is transmitted through moving copper contacts on which the contacting areas are plated or clad with silver to provide satisfactory contacting surfaces.

## DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of one pole of a three-pole disconnecting switch structure;

FIG. 2 is an enlarged plan view taken on the line II—II of FIG. 1;



FIG. 3 is a vertical sectional view taken on the line III—III of FIG. 2;

FIG. 4 is an end elevational view taken on the line IV—IV of FIG. 3;

FIG. 5 is a vertical sectional view of another embodiment of the invention, and

FIG. 6 is an end elevational view of the device shown in FIG. 5.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. 1 a disconnect switch is generally indicated at **10** and it comprises three spaced insulator stacks **12**, 14 and **16** mounted upon a common base support **18**. Each of the insulator stacks **12, 14, 16** comprises a plurality of insulators which are preferably formed from porcelain or a similar material. A shaft **20** is secured to the upper end of the insulator stack **14** and the assembly of the shaft and stack are rotated by an external operating mechanism (not shown) through a crank member or operating lever **22**.

At the upper end of the insulator stack **12** a terminal pad or stationary terminal contact **24** is provided. Likewise, a terminal pad or stationary terminal contact **26** is provided at the upper end of the insulator stack **16**. As shown in FIG. **1**, a stationary frame **28** is mounted at the upper end of the insulator stack **14** and the frame is spaced from the stationary contact **24** by an insulator **30**. The insulator **30** houses an interrupter unit **32** which is not a part of this invention.

The disconnecting switch **10** comprises a switch structure **34** which includes a boom or blade **36** and a hinge structure **38**. As viewed in FIG. **1**, the right end of the blade **36** is in a closed position with respect to a contact jaw **40** which is an integral part of, or connected to, the stationary contact **26**.

As shown more particularly in FIGS. **2**, **3** and **4**, the frame **28** comprises a yoke **42**, a pair of upturned flanges **44**, and an aperture **46**. The yoke **42** provides means for pivotal mounting for a second or rotatable yoke **48** which is secured in the yoke **42** by pivot bolts **50**. The second yoke **48** comprises a sleeve **52** in which a clamping or mounting sleeve **54** is rotatably mounted, for which purpose bushings **56** are provided and retained in place by a snap ring **58**. The bushings **56** may be of either conducting or insulating material.

As shown in FIG. **3**, the left end portion of the boom or blade **36** is seated within the mounting sleeve **54**. The left end portion of the blade **36** includes a plurality of spaced radial slots **60** and an expander **62** is located within the left open end thereof. The expander **62** includes a threaded aperture **64**, a bolt **66**, and a tapered plug **68**. An inner surface portion **70** is tapered so that upon tightening of the bolt **66** within the aperture **64** the tapered plug **68** expands a plurality of split portions, such as portions **62***a*, **62***b* outwardly against the left end portion of the blade **36** and against the surrounding clamping or mounting sleeve **54**. To help prevent rotational slipping of the cylindrical blade **36** within the cylindrical sleeve **54**, a nut and bolt assembly **72** is provided therein.

As shown more particularly in FIG. **4**, the outer surface of the left end portion of the clamping or mounting sleeve **54** has a substantially oval or elliptical cross-section with a horizontal axis, as indicated by the arrow **74**, that is greater than the vertical axis, as indicated by the arrow **76**. The arcuate surface portions of the sur-

face at the ends of the longer axis **74** are covered with similar claddings **78** of silver.

In addition, the sleeve **54** comprises an arm **80** which extends from the lower side thereof at an angle, such as about 45°, and the lower end of the arm is rotatably mounted on the end of a rotator **82** through the bushing **115** which may be composed of electrically insulating or conducting material. Rotator **82** extends at a right angle from the arm **80** and at an angle of substantially 45° from a horizontal plane. A horizontal portion of the rotator **82** has an aperture **84** and the rotator is secured by a screw **86** to the upper end of the shaft **20** to which it is keyed at **87**, whereby upon rotation of the lever **22** (FIG. **1**), the rotator **82** is turned.

As shown in FIGS. **2, 3** and **4**, conductor means, such as a pair of conductors **88** and **90**, are mounted on each flange **44** and extend upwardly and at an angle to positions on opposite sides of the clamping or mounting sleeve **54**. The conductors **88** and **90** have inturned portions **88***a* and **90***a* (FIGS. **2** and **4**) as well as upturned portions **88***b* and **90***b*. Each conductor **88** and **90** is secured firmly on the corresponding flange **44** by a bolt **92** and a dowel pin **93** and is thereby held in position for engagement with the portions of the sleeve **54** covered by the silver cladings **78**. The contacting areas of the conductors **88** and **90** are also covered with similar claddings **94** of silver, where they contact the sleeve **54**, and their ends which contact the aluminum flanges **44** are coated with tin to lessen the tendency for galvanic corrosion. By providing the silver claddings **78** and **94**, good electrical contact is maintained between the sleeve **54** and the conductors **88** and **90**. For that purpose, the conductors **88** and **90** are spring-biased inwardly so that they engage the elongated axial portion of the sleeve **54**, but do not engage the shorter axial portion when the boom or blade **36** is rotated.

In addition, to facilitate lowering and rotation of the boom or blade **36**, a lever **96** (FIG. **2**) is provided in conjunction with the second yoke **48**. As shown in FIG. **2** when the arm **80** is moved from the broken line position (corresponding to the erect position of the boom **36**) to the solid line position, the arm touches and moves the lever **96** in the clockwise direction whereby lowering of the boom or blade **36** is facilitated at least in the initial stage of movement and not left entirely dependent upon the rotation of the shaft **20**.

The several parts of the device shown in FIGS. **1–4** which are composed of an aluminum base alloy include the boom or blade **36**, the frame **28**, and the rotator **82**. Those parts which are composed of a copper base alloy include the clamping or mounting sleeve **54** including the arm **80**, as well as the oval or elliptical contact surface, and the conductors **88** and **90**.

Another embodiment of the invention is that shown in FIGS. **5** and **6** in which similar reference numbers refer to similar parts as previously set forth above, such as the boom or blade **36**, which is composed of aluminum. This embodiment differs from that described above in that a rod **98** provides for the mounting of the blade **36** on the right end portion thereof by a peripheral weld **100**. The rod **98** includes a shank portion **102**, which is seated in the sleeve **52** where it is mounted with bushings and snap ring **58** in a similar manner. The left end portion **104** of the sleeve includes a longitudinal slot **106** in which a contact **108** is seated with opposite end portions **108***a* and **108***b* extending beyond the periphery of the portion **104**. A plurality of spaced bolts **110** are provided in the portion **104** for holding the contact **108** securely in place. The rod **98** also includes an arm **112** by which the rod and the attached blade **36** are rotated and lifted in a manner similar to that of the embodiment disclosed in FIG. **3**. The rod **98**, including the portion **104** and the arm **112**, is composed of aluminum-base alloy and the contact **108** is composed of a copper-base alloy. Like the end portions of the oval or elliptical contact surface of the sleeve **54**, the opposite end portions **108***a* and **108***b* of the contact **108** are covered with silver claddings similar to the silver claddings **78** as shown in FIG. **4**. Accordingly, the contact **108**, like the mounting sleeve **54**, is adapted for opening and closing a circuit between terminal contacts **24** and **26** when the rod **98** is rotated.

As shown best in FIG. **3** for both embodiments of the invention, a lubricant is preferably provided at the joint **114** between the sleeve **54** and the bushings **56** in order to expedite rotation of the assembly within the sleeve **52**. In addition, an electrical conducting grease is located in a joint **116** between the sleeve **54** and the boom or blade **36** as well as at the joints between the flanges **44** and the conductors **88** and **90**. The oxide inhibiting grease has the purpose of maintaining good electrical contact between the aluminum blade **36** and the copper sleeve **54** by preventing the aluminum blade surface from being oxidized due to exposure to the atmosphere. Hence, a satisfactory electrical path between the sleeve **54** and the blade **36** is maintained.

In operation, the boom or blade **36** is raised or lowered between open and closed positions with respect to the contact jaw **40** primarily by rotation of the shaft **20**. Upon clockwise rotation, as indicated by the arrow **118** (FIG. **3**) the rotator **82** moves the arm **80** in a clockwise direction, and the force applied thereby causes the assembly of the sleeve **54** and the blade **36** to rise about the pivot bolts **50** in the yoke **42**. The rotator **82** continues to move to the left as viewed in FIG. **4** until it occupies the position shown by the broken line in FIG. **2**, whereupon the blade **36** is elevated to the open position with respect to the contact jaw **40**, which position is substantially vertical. Conversely, rotation of the shaft **20** in the counterclockwise direction of the arrow **120** (FIG. **3**) will cause the blade **36** to rotate and lower to the closed position with respect to the contact jaw **40**, whereupon the rotator **82** is again located in the position shown in FIG. **4**, namely, adjacent to the right-hand flange **44**.

In the closed position of the blade with respect to the jaw, a circuit between the stationary contacts **24** and **26** includes the conductor **32**, the frame **28**, the conductors **88** and **90**, the elliptical or oval contact portion of the sleeve **54**, the blade **36**, and the contact jaw **40**. As was set forth above, when the sleeve **54** is rotated clockwise by the arm **80**, the surface portions of the sleeve **54** at the extremities of the longer axis **74** are rotated out of contact with the contactors **88***a* and **90***a* as the smaller portion of the sleeve is rotated into position between those conductor extremities.

Accordingly, the device of this invention provides solutions to prior existing problems occurring due to the transition from an all copper disconnect switch to switches having combinations of copper and aluminum, and avoids the problems occurring between moving parts of copper and aluminum.

What is claimed is:

1. A disconnect switch comprising a pair of stationary contacts at spaced locations, a switch blade pivotally movable between open and closed positions with one of the stationary contacts, means for pivotally mounting the switch blade at a location spaced from one of the stationary contacts and comprising a stationary frame, the other stationary contact being electrically connected to the stationary frame, the stationary frame supporting a movable sleeve in which the blade is rotatably mounted, rotating means rotating the blade in the sleeve when the blade is pivotally moved between the open and closed positions, the rotating means comprising a rotatable sleeve in which the switch blade is disposed and which is rotatably mounted in the movable sleeve, a clamping sleeve within the switch blade for holding the switch blade in tight electrical contact with the rotatable sleeve, the outer surface of the rotatable sleeve having an oval cross-section, and conductor means mounted on the stationary frame and positioned externally of the clamping sleeve for engagement and disengagement with said oval cross-section of the rotatable sleeve when the blade is in the closed and open positions, respectively.

2. The disconnect switch of claim 1 in which the rotatable sleeve comprises a rotatable contact rotatable on the axis of the blade, the contact having long and short axis in a plane that is substantially normal to the blade, and the long axis engaging the conductor means when the blade is in the closed position with said one stationary contact.

3. The disconnect switch of claim 2 in which the conductor means comprises conductors disposed on opposite sides of the rotatable contact and engageable with the peripheral portions at the long axis of the contact and non-engageable with the peripheral portions at the short axis of the contact when the blade is in the open position with said one stationary contact.

4. The disconnect switch of claim 3 in which the peripheral portions of the rotatable contact are covered with a cladding of silver and in which the portions of the conductor structures engageable with the rotatable contact are covered with a cladding of silver.

5. The disconnect switch of claim 1, in which the stationary frame comprises a first yoke, a second yoke rotatably mounted in the first yoke and comprising said movable sleeve, and the blade being rotatable in the sleeve on an axis substantially normal to the axis of rotation of the second yoke.

6. The disconnect switch of claim 5 in which the conductor means comprises conductors disposed on opposite sides of the rotatable sleeve, and the conductors and rotatable sleeve being composed of copper.

7. The disconnect switch of claim 6 in which the contacting areas of the rotatable sleeve and conductors means are covered with silver cladding.

8. The disconnect switch of claim 6 in which the joint between the engaging surfaces of the rotatable sleeve and the blade is coated with a conducting grease, and in which the rotatable sleeve is composed of a copper alloy and the blade is composed of an aluminum alloy.

* * * * *