May 16, 1967 J. R. CALDWELL ETAL 3,320,376

ELECTRIC SWITCH

Filed May 24, 1965 3 Sheets-Sheet 1

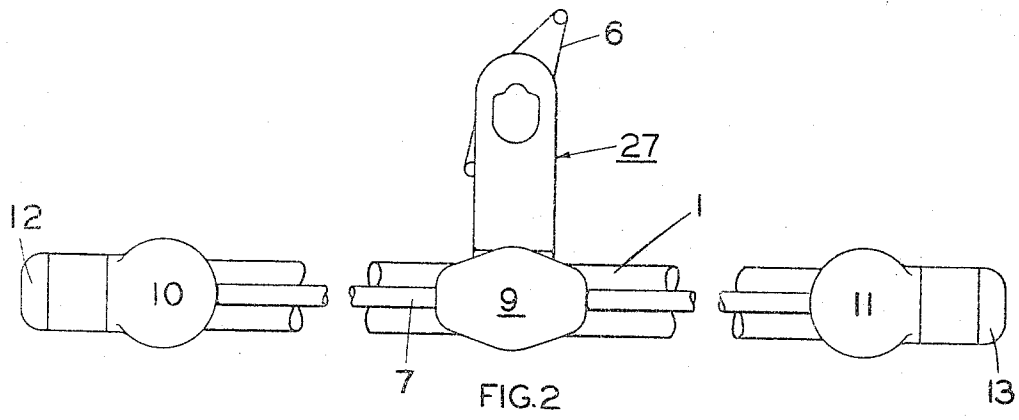

FIG. 2

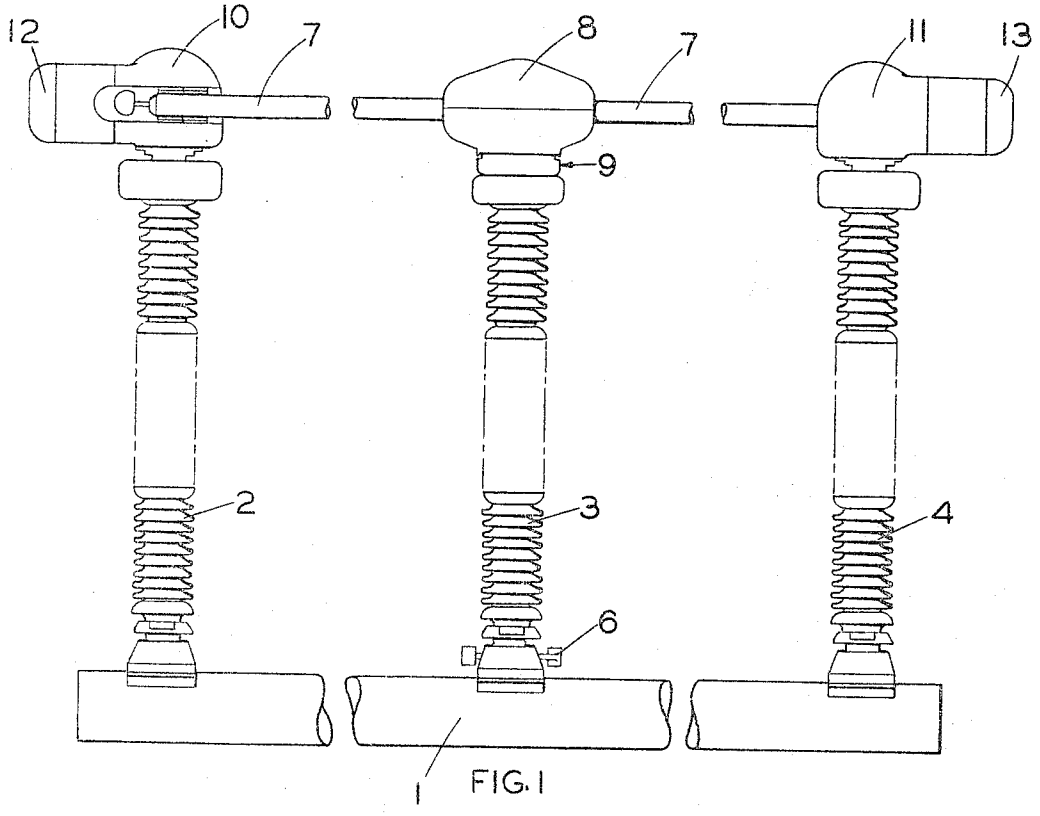

FIG. 1

INVENTORS
JOHN R. CALDWELL
PAYTON C. MAYO
BY Walter M. Rodgers
ATTORNEY

May 16, 1967 J. R. CALDWELL ET AL 3,320,376

ELECTRIC SWITCH

Filed May 24, 1965 3 Sheets-Sheet 2

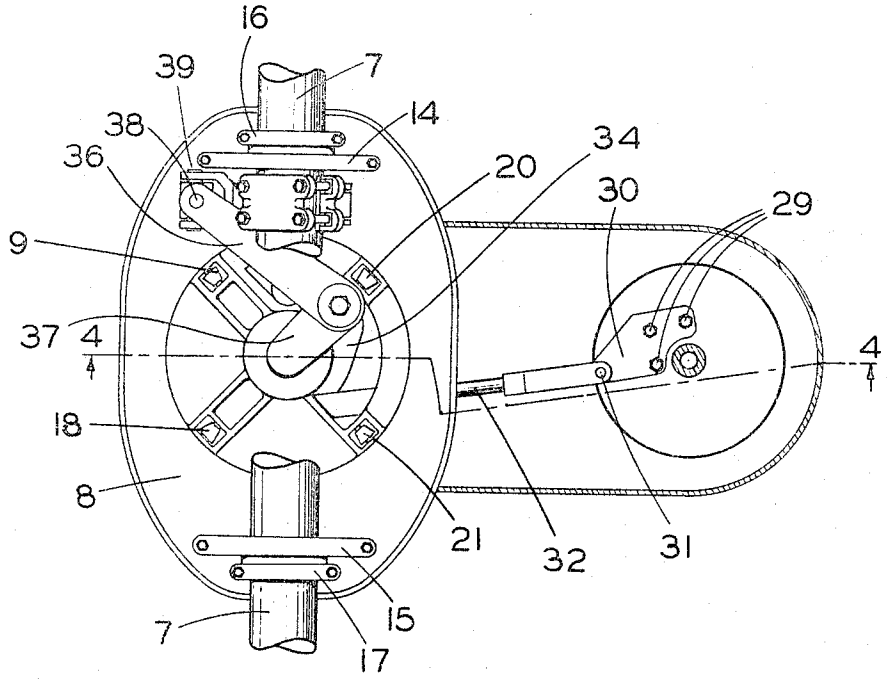

FIG. 3

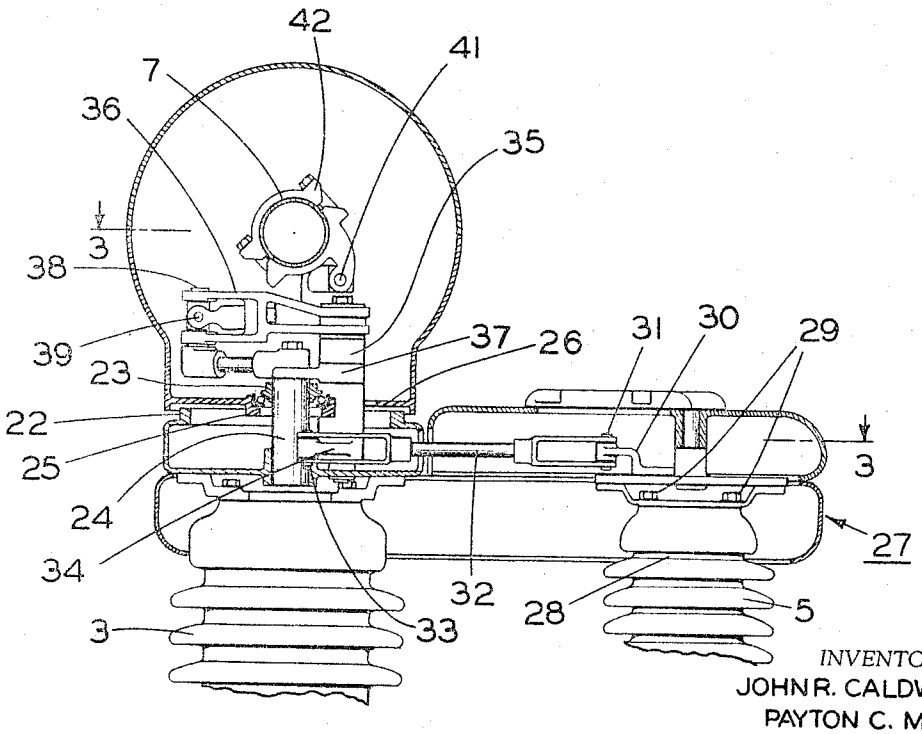

FIG. 4

INVENTORS
JOHN R. CALDWELL
PAYTON C. MAYO
BY Walter M. Rodgers
ATTORNEY

May 16, 1967 J. R. CALDWELL ETAL 3,320,376

ELECTRIC SWITCH

Filed May 24, 1965 3 Sheets-Sheet 3

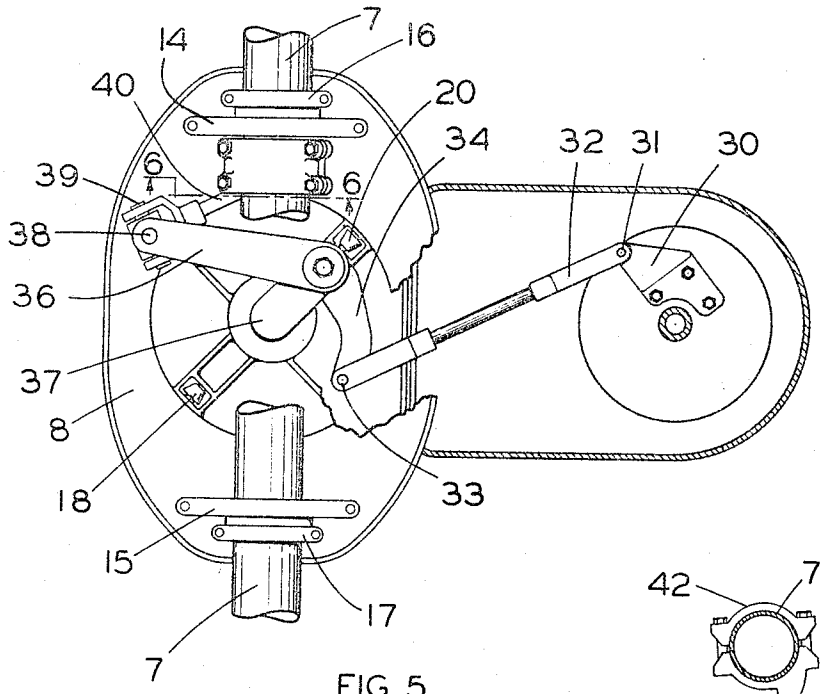

FIG. 5

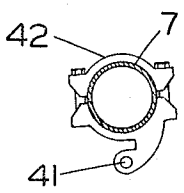

FIG. 6

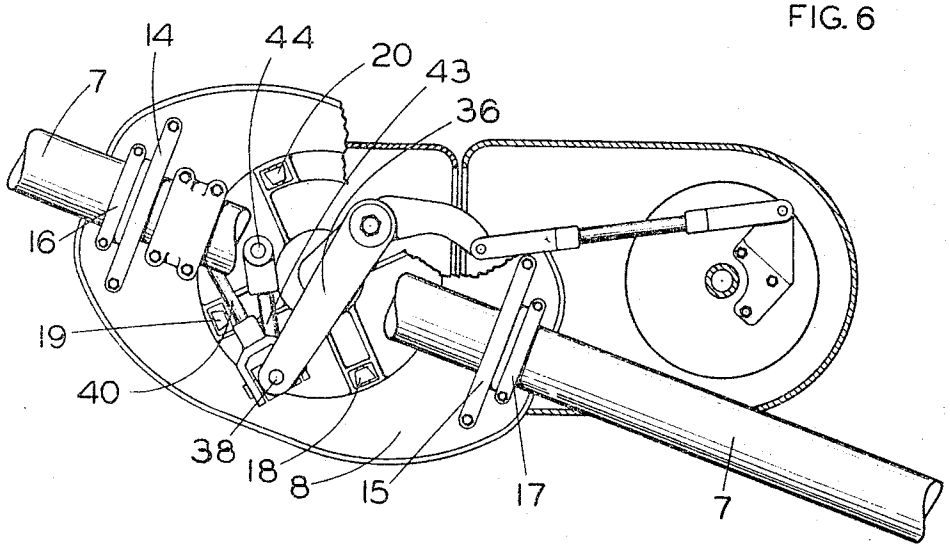

FIG. 7

INVENTORS
JOHN R. CALDWELL
PAYTON C. MAYO
BY Walter M. Rodgers
ATTORNEY

United States Patent Office

3,320,376

Patented May 16, 1967

3,320,376

ELECTRIC SWITCH

John R. Caldwell, Hampton, and Payton C. Mayo, Atlanta, Ga., assignors to Southern States, Inc., a corporation of Georgia

Filed May 24, 1965, Ser. No. 458,105

4 Claims. (Cl. 200—48)

ABSTRACT OF THE DISCLOSURE

The switch as disclosed herein comprises fixed contacts **10** and **11** fixedly mounted on insulators **2** and **4** and a swingable switch blade **7** mounted atop fixed insulator **3** and disposed within rotatable support housing element **8** which is rotatable about insulator **3**. Operating movement is imparted to the switch by rotatable insulator **5** and suitable linkage including link **32** connected therewith. Link **32** is operably connected to rocker **34**, **35** and **36** which in turn is pivotally connected to twist link **40** and to swing link **43**, twist link **40** being pivotally connected to blade **7** which is rotatable about its major axis and swing link **43** being pivotally connected at **44** to the support housing **8**.

This invention relates to electric switches and more particularly to high voltage switches of the air break type wherein a movable switch blade is arranged for rotation about its major axis and which also is arranged for bodily swinging movement relative to fixed jaw contacts. The invention is particularly concerned with a mechanism whereby switch operating movement is imparted to the switch blade.

In switches of the high voltage air break type, it is necessary to increase the size and weight of the switch components as transmission voltages are increased.

Heretofore, it has been the practice to construct switches of the high voltage air break type in such a way that a substantial mechanical advantage was inherent in the switch so that premature rotation of the blade about its major axis during a switch closing operation could not take place. In this way, control of the blade is effected so that the blade tip enters the space between the fixed jaw contacts before rotation of the blade about its major axis occurs. One switch of this type is disclosed in U.S. Patent 2,818,799 issued Oct. 22, 1957 and assigned to the assignee of this invention.

When switches are constructed for transmission voltages of the order of five hundred kilovolts and above, the switch parts and associated operating mechanism become so massive as to necessitate a positive and sure control of each increment of blade movement throughout both switch opening and switch closing operations.

A principal object of this invention is to provide an improved air break switch which is specially constructed for use in conjunction with very high transmission voltages and which is arranged so that positive and sure control of the switch movement is effected throughout opening and closing operations of the switch.

Another object of this invention is the provision of an improved operating mechanism for switches of the high voltage air break type.

The invention in one form as applied to an electric switch comprises a vertically disposed supporting insulator, a movable support in the form of housing structure mounted on said supporting insulator and rotatable about an axis which is substantially coaxial therewith, a blade mounted on the support and rotatable thereon about its own axis and arranged to swing with the support upon rotation thereof in a plane transverse to the axis of the supporting insulator, a fixed pivot supported by the supporting insulator and disposed within the housing structure, a rocker arm pivotally mounted on the fixed pivot, operating means for imparting swinging movement to the rocker arm about the fixed pivot, a twist element pivotally connected to the switch blade and to the rocker arm, and a swing element pivotally mounted on the movable support and pivotally connected to the rocker arm, the parts being arranged so as to effect rotation of the switch blade through the agency of the twist element in the initial phases of an opening operation and so as to impart swinging movement to the blade during subsequent stages of an opening operation of the switch through the agency of the swing element and associated parts.

For a better understanding of the invention, reference may be had to the following detailed description, taken in conjunction with the accompanying drawings in which FIG. 1 is a side view of one pole of a two break switch of the air brake type and which embodies the invention; FIG. 2 is a top view of the arrangement depicted in FIG. 1; FIG. 3 is a plan view of certain essential parts of the invention in their switch closed positions with parts of the supporting housing structure either removed or broken away and taken generally along the line **3—3** as indicated in FIG. 4; FIG. 4 is a cross sectional view of the structure depicted in FIG. 3 and taken along the line **4—4** as indicated in FIG. 3; FIG. 5 is a view similar to FIG. 3 but showing the parts in the positions which they occupy during a switch opening operation after the switch blade has been rotated about its major axis but before substantial swinging movement of the blade has taken place; FIG. 6 is a cross sectional view taken on the line designated **6—6** in FIG. 5; and in which FIG. 7 is a view corresponding to FIGS. 3 and 5 and depicting the switch in the fully open position.

With reference to FIG. 1, the numeral **1** denotes a mounting base of conventional construction. Numerals **2**, **3** and **4** designate vertical insulator stacks mounted on the base **1**. A fourth insulator stack is shown in FIG. 4 and is designated by the numeral **5**. Insulator stack **5** is rotatably supported in conventional fashion and rotating movement is imparted thereto by the crank designated by the numeral **6** and shown for example in FIGS. 1 and 2.

For the purpose of supporting the switch blade **7** for swinging movement about the fixed insulator **3**, a movable support **8** is rotatably mounted atop insulator stack **3** by suitable bearing structure generally designated by the numeral **9**. The blade **7** swings into and out of engagement with the fixed contacts mounted atop the insulator stacks **2** and **4** and designated by the numerals **10** and **11**, respectively. Of course, the associated circuit is connected with the switch depicted in FIGS. 1 and 2 by way of terminals **12** and **13** which are electrically connected with the contacts **10** and **11**, respectively.

In FIGS. 3, 5 and 7 the switch blade **7** is shown as a discontinuous structure. It will be understood that this procedure has been followed simply to expose the elements of the invention and that the blade **7** is in fact a continuous tubular conductor.

With reference to FIGS. 3–7, inclusive, a pair of bearings **14** and **15** of conventional construction are affixed to the movable support **8** and serve rotatably to support the switch blade **7**. As shown in FIGS. 3, 5 and 7 a pair of collars **16** and **17** are used to secure the blade **7** against axial movement relative to bearings **14** and **15**. These collars and bearings are of conventional construction and it is by this means that the blade **7** is rotatably supported on the support element **8** for rotation about its major axis.

Movable support **8** is provided with a plurality of low friction roller elements **18**, **19**, **20** and **21** as best shown in FIGS. 3, 5 and 7. These rollers are disposed so as to ride on the upper surface of the horizontal circular rim

designated by the numeral **22** and best shown in FIG. 4. Rim **22** is substantially coaxial with insulator **3**. Movable support **8** is centered on the insulator stack **3** by means of bearing structure **23** which is mounted about stud **24** which in turn is securely affixed in centered coaxial relation to the insulator stack **3**. Bearing structure **23** cooperates with the circular opening **25** formed in the base **26** of the support structure **8**. Thus support structure **8** is free to rotate about stud **24** and the axis of insulator stack **3** as a center. Of course, rotation of movable support **8** is accompanied by swinging movement of blade **7** as is well understood.

Operating movement is imparted to the operating parts by the rotatable insulator stack **5** which is immediately behind insulator stack **3** as viewed in FIG. 2. As is well understood, this insulator stack is rotated by a suitable linkage or other mechanism which engages the crank **6**. Securely affixed to the upper end of rotatable insulator stack **5** is enclosing structure designated by the numeral **27**. The stack **5** in effect is journaled as indicated at **28** within an opening in the bottom of enclosing structure **27**. Affixed atop the insulator stack **5** by suitable bolts **29** is an operating crank **30** which swings in an arcuate path when insulator stack **5** is rotated. Pivotally connected at **31** to crank **30** is an operating link **32**. Link **32** is connected by the pivot pin **33** to an operating linkage.

For example, and as is best shown in FIGS. 4, 5 and 7, link **32** is connected at pin **33** to one end **34** of a rocker arm having a vertical part **35** securely affixed to the horizontal end **34** and to another horizontal end portion **36**. The central portion **35** of the rocker **34**, **35** and **36** is journally supported for rotation on fixed radial pivot arm **37** secured to stud **24**. The outer end of rocker end portion **36** is connected by a universal joint having pins **38** and **39** to a suitable twist element **40**. Twist element **40** is connected by pivot **41** and collar **42** to switch blade **7**.

Operation of the initial part of a switch opening movement is effected when clockwise rotation is imparted to the insulator stack **5** as viewed from above. Such operation causes the parts to move from their switch closed positions depicted in FIGS. 3 and 4 to the positions depicted in FIG. 5. During this movement link **32** moves bodily generally toward the right and the rocker arm comprising parts **34**, **35** and **36** swings in a counter-clockwise direction about the vertical element **35** which as explained is held against sidewise movement by the fixed pivot arm **37**. This counter-clockwise movement of rocker **34**, **35** and **36** about the vertical portion **35** thereof causes the twist link **40** to move generally toward the left as viewed in FIG. 5. This movement causes the switch blade **7** to rotate in a clockwise direction about its major axis as viewed for example in FIGS. 4 and 6.

For the purpose of swinging the switch blade **7** from the position depicted, for example, in FIG. 5 to the open position depicted in FIG. 7, a swing link **43** is provided. Swing link **43** as is best shown in FIG. 7 is affixed at one end to the movable support **8** by a pivot **44** and at its other end to the outer end of rocker arm **36** by the pin **38**.

Thus as the insulator **5** continues to rotate in a clockwise direction as viewed in FIG. 5, the rocker arm **36** imposes tension on the swing link **43** which causes the movable support **8** to swing bodily from the position depicted in FIG. 5 to that depicted in FIG. 7. Of course, the switch is then in its fully opened position.

In order to close the switch, the above described operation is reversed. For example, the rotatable insulator stack **5** is rotated in a counter-clockwise direction as viewed for example in FIGS. 3, 5 and 7 and the above described operation is simply reversed. During closing, the blade is swung bodily from the position depicted in FIG. 7 to that depicted in FIG. 5. Thereafter, continued counter-clockwise rotation of rotatable insulator stack **5** causes the linkage to move from the position depicted in FIG. 5 to that depicted for example in FIGS. 3 and 4 and such movement rotates the blade **7** about its major axis and imparts a suitable contact pressure between the contact tips (not shown) and the jaw contacts comprising the fixed structure **10** and **11**.

From the above description, it is apparent that sure and positive control of both the rotating movement of the blade **7** about its own axis and bodily swinging movement of the blade is effected throughout both the closing and opening operations. Furthermore, it is apparent that this positive and sure control of every phase of the operation of the switch affords protection against premature rotation of the blade **7** about its own axis during a closing operation such as might prevent full and complete closing of the switch.

While a particular embodiment of the invention has been shown and described, it will be understood that the invention is not limited thereto and that certain changes and modifications may be made in the invention without departing from the true spirit and scope thereof.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An electric switch comprising a fixed vertically disposed supporting insulator having a substantially horizontal circular rim mounted thereon, a movable support having low friction means arranged to ride on said circular rim whereby said support is rotatable about an axis which is substantially coaxially arranged relative to said supporting insulator, a switch blade mounted on said support and rotatable about its own axis, said blade being arranged for swinging movement bodily in a plane transverse to the axis of said supporting insulator, a fixed pivot supported by said supporting insulator, a rocker arm pivotally mounted intermediate its ends on said fixed pivot and arranged to swing in a plane transverse to the axis of said supporting insulator, operating means for imparting swinging movement to said rocker arm about said fixed pivot, a twist element pivotally connected to said switch blade and to said rocker arm, and a swing element pivotally mounted on said movable support and pivotally connected to said rocker arm, said rocker arm and said twist element being arranged to impart rotating movement to said switch blade about its axis at the beginning of a switch opening operation and said rocker arm and said swing element being arranged to impart bodily swinging movement to said movable support and to said switch blade during succeeding stages of a switch opening operation.

2. A switch according to claim **1** wherein said movable support comprises a housing structure symmetrically disposed relative to said supporting insulator inside of which said rocker arm, twist element, and swing element are mounted.

3. A switch according to claim **2** wherein said fixed pivot is disposed within and movable with respect to said movable support housing structure.

4. A switch according to claim **1** wherein said rocker arm comprises a pair of horizontal links at different levels and integrally connected at their adjacent ends by a vertically disposed tubular element pivotally mounted on said fixed pivot and wherein said operating means comprises a rotatable insulator disposed alongside said fixed supporting insulator and operating linkage disposed at substantially the same level as the lower one of said operating links, and wherein fixed enclosing structure is journally related to said rotatable insulator at the upper end thereof.

References Cited by the Examiner

UNITED STATES PATENTS

2,575,707	11/1951	Gilliland et al.	200—48
2,710,322	6/1955	Price	200—48 X

ROBERT K. SCHAEFER, *Primary Examiner.*

H. HOHAUSER, *Assistant Examiner.*