

June 2, 1959

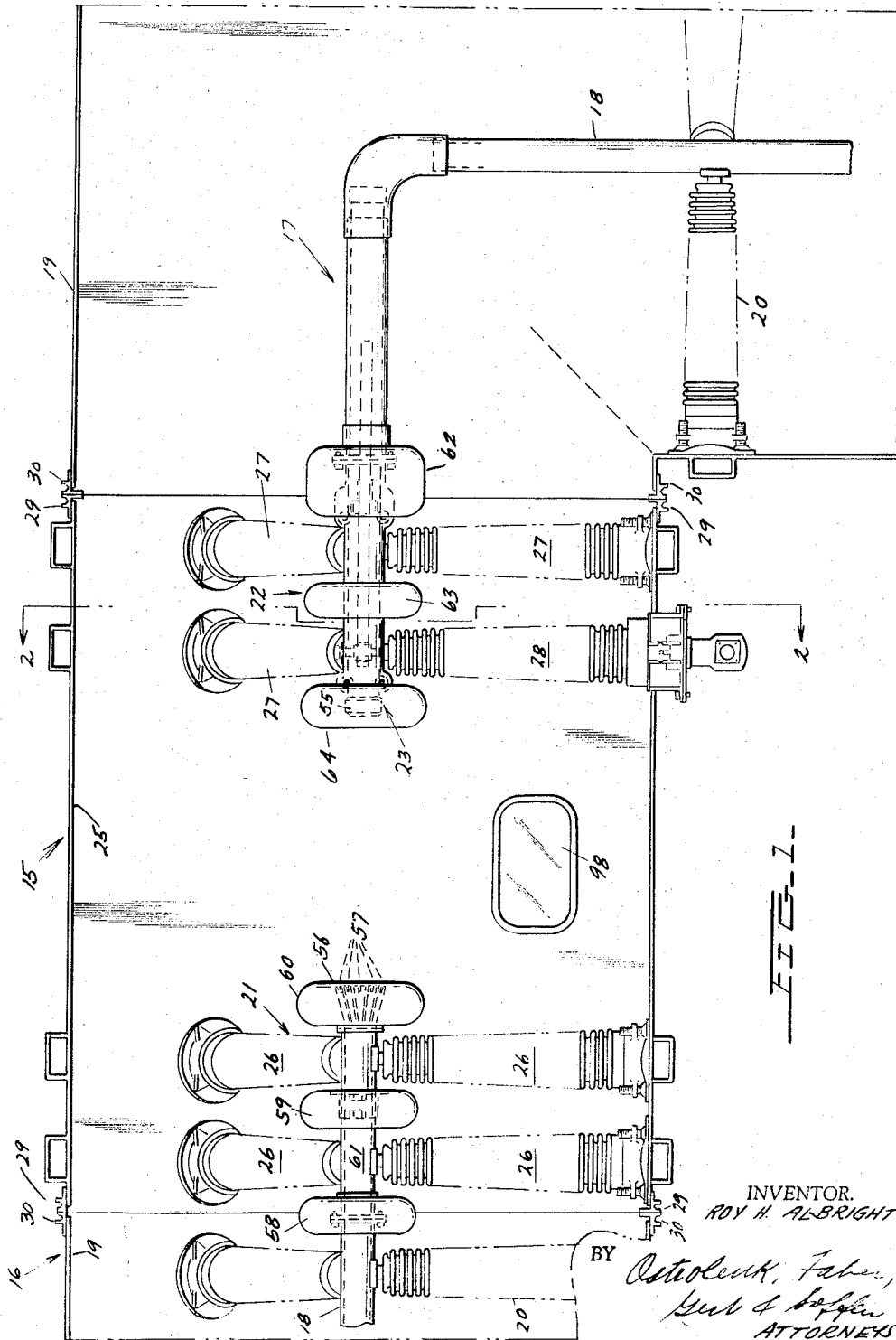
R. H. ALBRIGHT

2,889,436

TELESCOPING BLADE SWITCH IN A CIRCULAR HOUSING

Filed Dec. 26, 1957

6 Sheets-Sheet 1



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TELESCOPING BLADE SWITCH IN A CIRCULAR HOUSING

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6 Sheets-Sheet 2

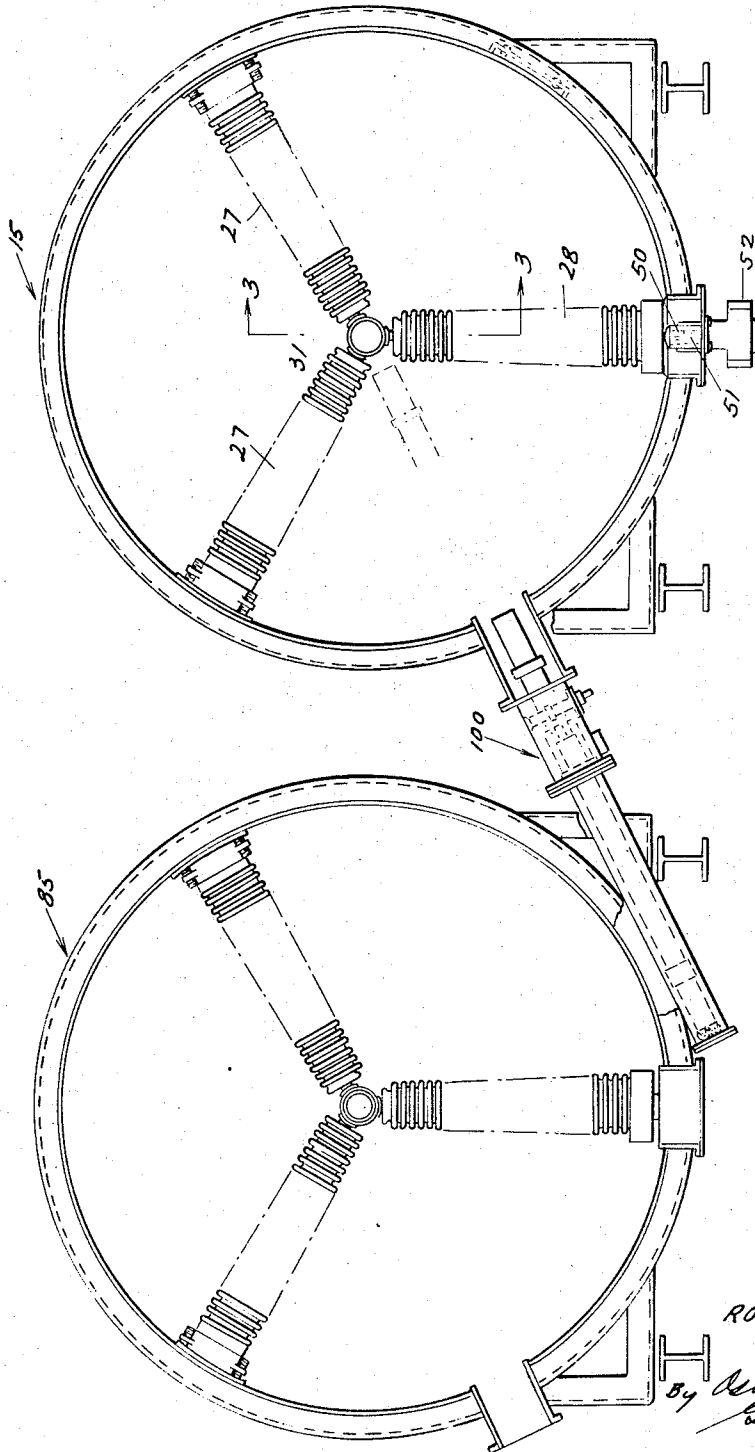


FIG. 2.

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6 Sheets-Sheet 3

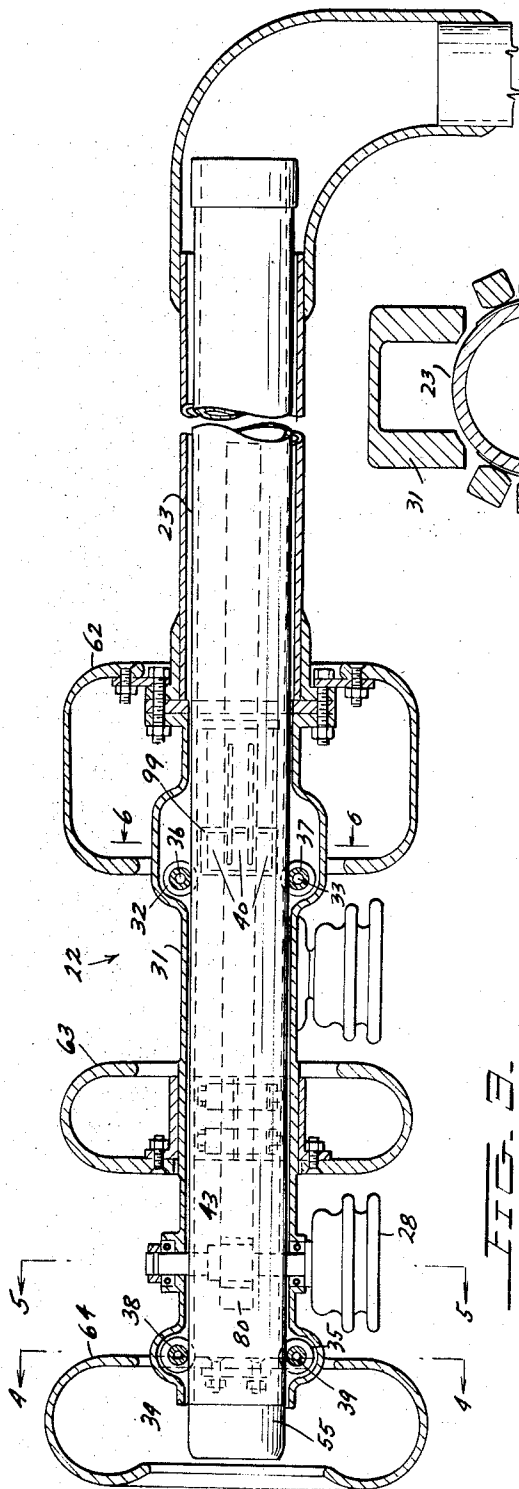


FIG. 3.

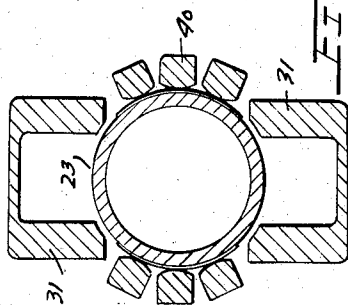


FIG. 6.

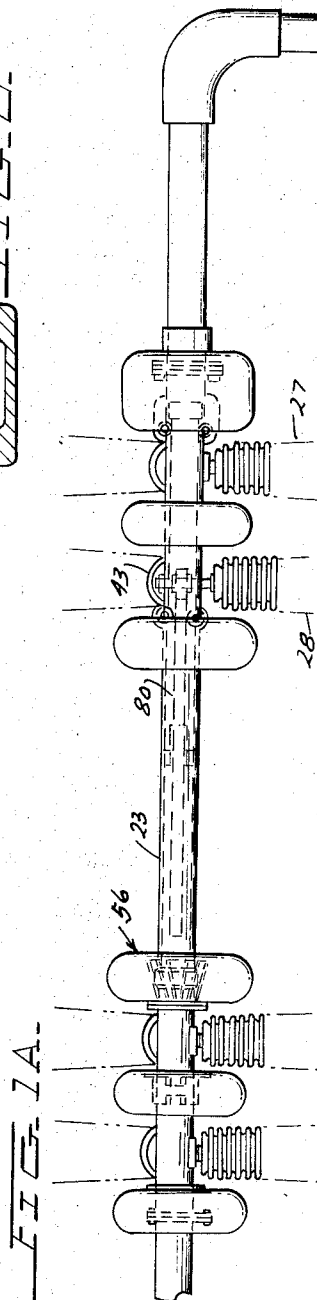


FIG. 1A.

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TELESCOPING BLADE SWITCH IN A CIRCULAR HOUSING

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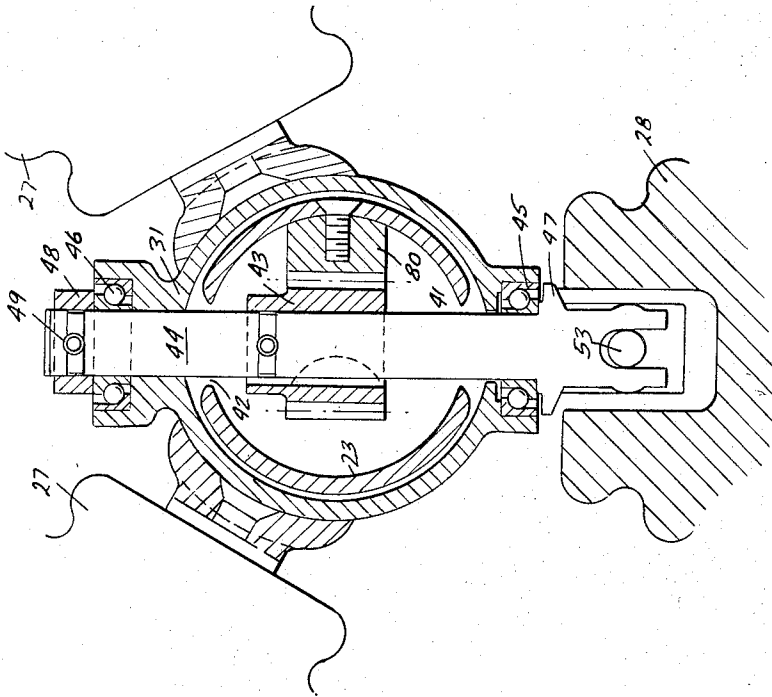


FIG. 5-

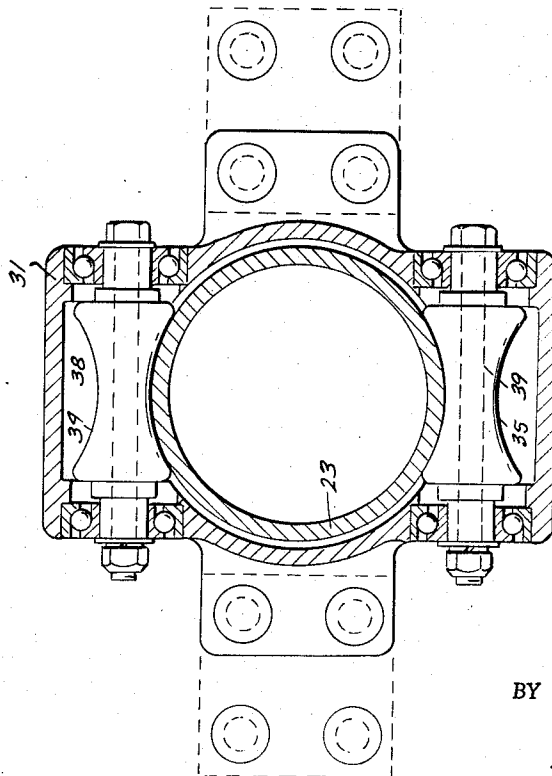


FIG. 4-

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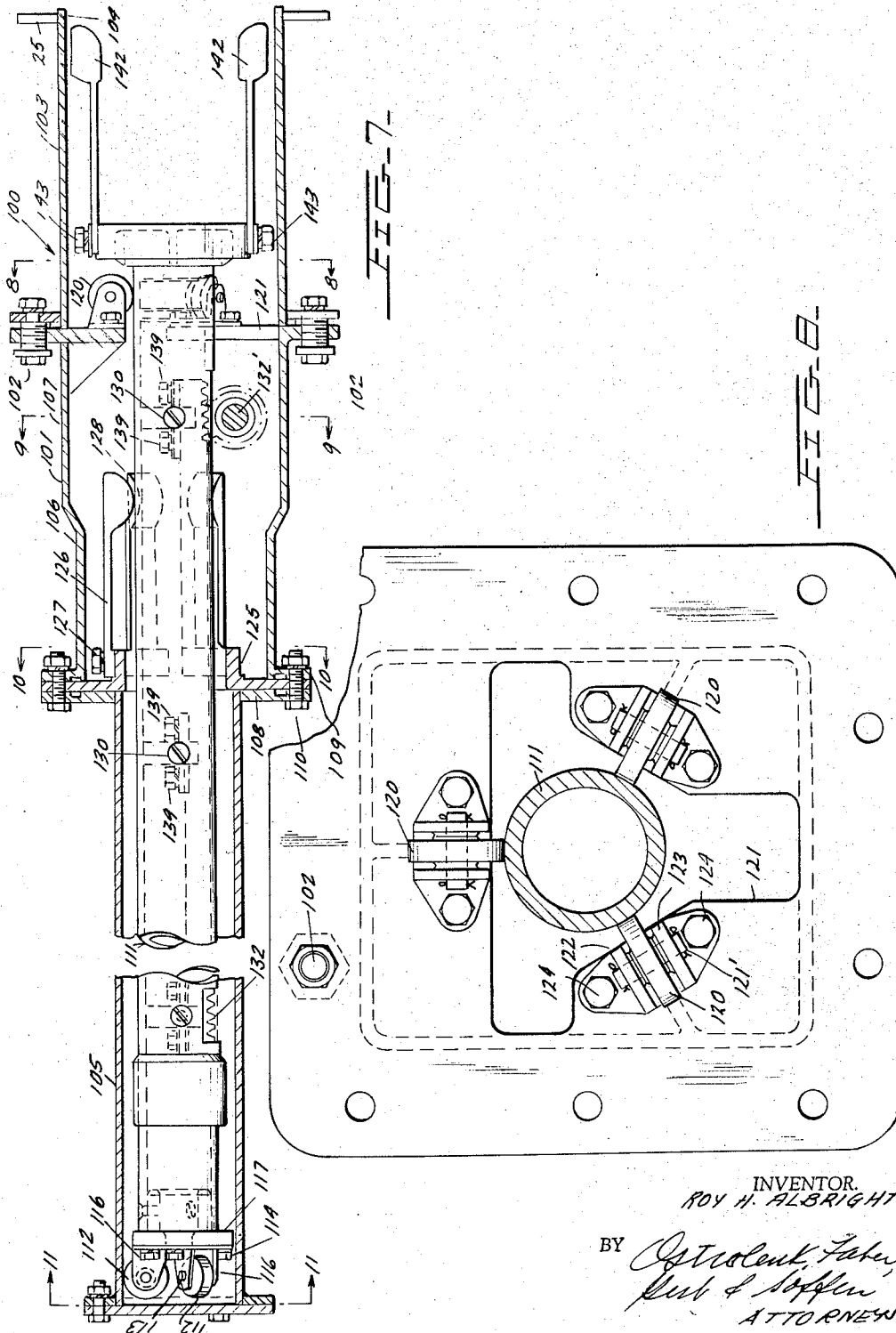
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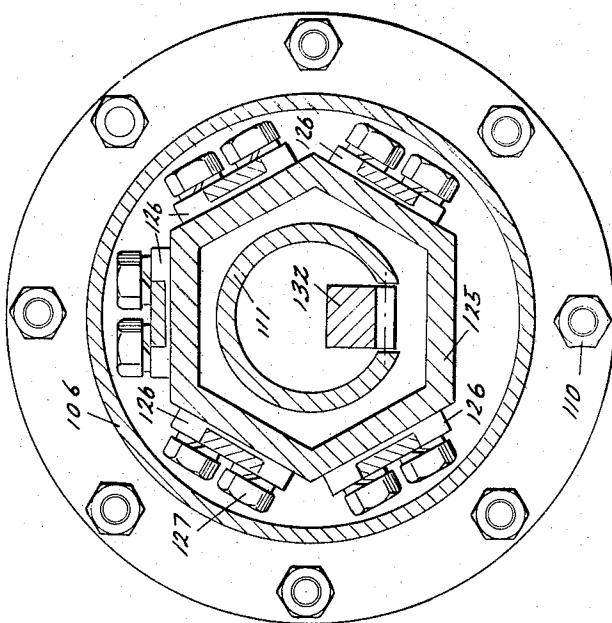


FIG. 10.

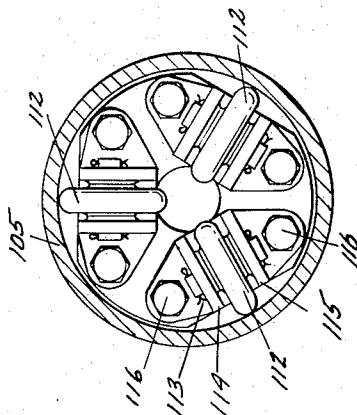


FIG. 11.

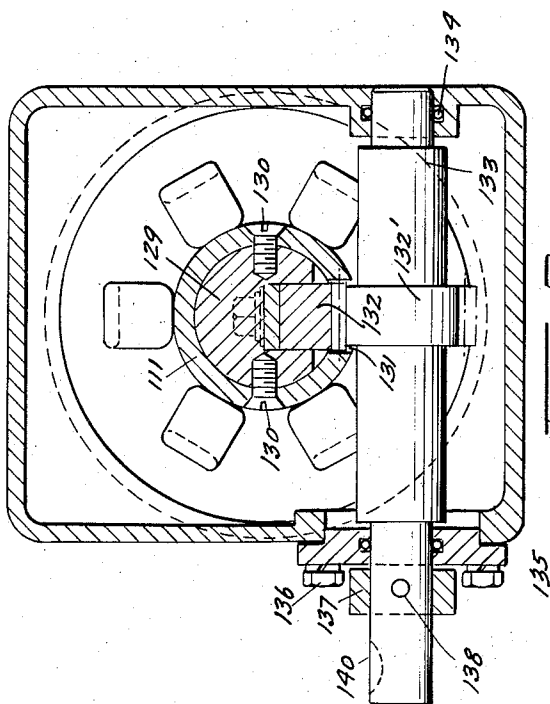


FIG. 9.

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TELESCOPING BLADE SWITCH IN A CIRCULAR HOUSING

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Application December 26, 1957, Serial No. 705,269

4 Claims. (Cl. 200—163)

This invention relates to electric switches used in high current and high voltage applications and more particularly to an electric switch having a telescoping blade adapted for use as a disconnect switch for isolated phase bus wherein the bus housing is circular and the switch housing is also circular to appear as a continuation of the bus housing. A grounding switch utilizing the telescoping blade principle is also provided for the isolated phase bus.

Heretofore, the disconnect switches for use with isolated phase bus comprised a pivoted blade or a blade that was moved transverse to its own axis to produce a double break. With these arrangements the switch housings were constructed having rectangular cross-sections to provide large unoccupied spaces through which the switch blades would travel during operation of the switches.

In the instant invention a telescoping blade switch of the type disclosed in copending application Ser. No. 660,920, filed May 22, 1957, and assigned to the assignee of the instant invention, is utilized as a disconnect switch for a run of isolated phase bus. In the telescoping blade switch, the blade thereof is moved along its longitudinal axis to telescope within one of the terminating conductors of the isolated phase bus thereby achieving a large saving in space. The telescoping blade switch lends itself to high current applications as it permits the use of more highly efficient tubular conducting members for blades than the conventional switches using bar type blades. The telescoping blades also permit the use of multiple contacts on the outer surface of the blades to provide a uniform and effective current distribution. Inasmuch as the blade may have essentially the same contour as the conductors, the blade will have an equalized current distribution.

Furthermore, a telescoping blade switch is readily adaptable for high voltage applications since the parts thereof can be effectively shielded to approach a uniform electrostatic field which is essential for high dielectric characteristics. Corona shields may also be conveniently included with the switch.

My telescoping blade switch is enclosed in a housing having a circular cross-section of the same diameter as the diameter of the isolated phase bus housing. Because the switch and bus housings are of the same cross-sectional dimensions the special joining means formerly employed in connecting the switch and bus housings is no longer required. Further, in the design of isolated phase bus the housing is constructed to be as small as possible consistent with the size of the conductors as well as cooling and dielectric requirements. Thus a switch housing of substantially the same size and shape as the bus housing will be of a minimum size for the particular application.

Movement is imparted to the switch blade by means of an operating mechanism comprising a pinion gear which is in operative engagement with a rack secured to the blade. A rotatable insulator of substantially the

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same size and shape as the insulators centering the bus within the housing is interposed between the pinion gear and the switch actuating means which may be hand or power operated.

Operational force requirements are very low which reduces the stresses on the rotatable insulator. Furthermore, the insulator is not subjected to a cantilever load but rather to a torsional load which it is better able to withstand.

The rack and pinion require very little space with both being mounted inside the hollow bus conductors and the entire switch being mounted inside an enclosure of the same dimensions as the bus housing. With the rack and pinion both mounted within the switch blade, the centerline of the rotatable insulator intersects the longitudinal axis of the bus thereby achieving a maximum saving in space.

The instant invention also includes a grounding switch having a telescoping blade which is movable by rack and pinion means along a line perpendicular to the axis of the isolated phase bus. Since the blade of the grounding switch is considerably smaller than the blade of the disconnect switch the rack is either mounted on or cut into the outer surface of the switch blade.

Accordingly, a primary object of this invention is to provide an electric switch for isolated phase bus in which the switch housing is of the same size and shape as the bus housing.

Another object is to provide a disconnect switch, for isolated phase bus having a telescoping blade operated by means of a rack and pinion wherein the pinion is driven through a rotatable insulator whose axis is perpendicular to and intersects the longitudinal axis of the bus.

Still another object is to provide an isolated phase bus structure including a disconnect switch and a grounding switch both having telescoping blades with the blade of the grounding switch being movable along a line extending radially from the longitudinal axis of the bus.

Yet another object is to provide an isolated phase bus having a telescoping blade switch wherein the blade is operated by means of a rack and pinion both mounted inside the blade and the pinion is driven by a rotatable insulator positioned between the bus housing and hollow bus bar.

These objects and other objects will readily become apparent after reading the following description of the accompanying drawings in which:

Figure 1 is a longitudinal cross-section of an isolated phase bus run disconnect switch built in accordance with the instant invention with the disconnect switch in the open circuit position.

Figure 1A is a fragmentary view of Figure 1 with the disconnect switch in the closed circuit position.

Figure 2 is a cross-section taken through line 2—2 of Figure 1 looking in the direction of arrows 2—2.

Figure 3 is a cross-section taken through line 3—3 of Figure 2 looking in the direction of arrows 3—3.

Figures 4, 5 and 6 are cross-sections taken through lines 4—4, 5—5, 6—6 respectively of Figure 3 looking in the direction of arrows 4—4, 5—5, and 6—6 respectively.

Figure 7 is a longitudinal cross-section of the grounding switch of Figure 2.

Figures 8, 9, 10 and 11 are cross-sections taken through lines 8—8, 9—9, 10—10, and 11—11 respectively of Figure 7 looking in the direction of arrows 8—8, 9—9, 10—10 and 11—11 respectively.

Referring to the figures, disconnect switch 15 is shown in Figures 1 and 1A as being interposed between sections 16 and 17 of isolated phase bus. Each isolated phase bus section 16, 17 is of the conventional type fully

described in U.S. Patent #2,469,445 and comprises a hollow bus bar 18 centered in metallic housing 19 of circular cross-section by means of three insulators 20. Bus section 17 is an elbow while bus section 16 is straight.

Disconnect switch 15 comprises a jaw structure 21 mounted on the hollow bus bar 18 of bus section 16, a contact structure 22 mounted on the hollow bus bar 18 of bus section 17, and a movable blade 23 which is slidably mounted to contact structure 22 for telescoping therewith. Jaw structure 21 and contact structure 22 are positioned in axial alignment with a gap therebetween which is bridged by blade 23 when disconnect switch 15 is in the closed position of Figure 1A.

Jaw structure 21 is positioned within disconnect switch housing 25 by means of a plurality of radially projecting fixed insulators 26 while contact structure is positioned within housing 25 by means of a plurality of radially projecting fixed insulators 27 and a single rotatable insulator 28, the purpose of which shall be hereinafter explained. Switch housing 25 is of circular cross-section and of the same diameter as the housing 19 of the isolated phase bus run with which disconnect switch 15 is associated.

Notched flange members 29 are welded or otherwise secured to switch housing 25 at each end thereof and butt against similarly notched flange members 30 welded or otherwise secured to the bus housing 19. A suitable ring clamp (not shown) is utilized to secure the bus and switch housings 19, 25 to one another.

Contact structure 22 includes an elongated housing 31 inside of which concave rollers 32—35 are rotatably mounted on shafts 36—39. Rollers 32—35 are provided since the great weight of blade 23 makes a sliding bearing contact impractical. Secured to housing 31, externally thereof, are resilient contact fingers 40 which extend through openings 99 into wiping contact with blade 23.

A rack 89 is secured to the inside of blade 23 between longitudinal slots 41, 42. Pinion 43 is mounted on shaft 44 which is journaled in ball bearings 45, 46 of contact structure housing 31 and retained therein by shaft shoulder 47 and ring 48 secured to shaft 44 by set screw 49. Pin 53 couples shaft 44 to rotatable insulator 28, which extends from contact structure housing 31 to disconnect switch housing 25. Rotatable insulator 28 is of substantially the same shape as the insulators 20 of the isolated phase bus. A stub shaft 50 extends axially from the housing end of rotatable insulator 23 and is connected to the output shaft 51 of gear box 52 through which driving power is transmitted to disconnect switch 15.

Rotation of insulator 28 will cause rotation of pinion 43. Since pinion 43 is meshed with rack 80 and shaft 44 is journaled in stationary bearings 45, 46 rotation of pinion 43 brings about movement of switch blade 23, which is secured to rack 40, along its longitudinal axis. Slots 41, 42 provide clearance for shaft 44 as blade 23 travels between the circuit open position of Figure 1 and the circuit closed position of Figure 1A.

In the circuit closed position of Figure 1A the end 55 of switch blade 23 is engaged by the plurality of circularly arranged contacts 57 which form jaw 56. Contacts 57 are biased radially inward when they engage the outer surface of blade 23 either because they are resilient members or because of a separate biasing means such as a garter spring (not shown).

Corona shields 58—60, of C-shaped cross-section, are secured to hollow member 61 of jaw structure 21 at strategic locations thereof while corona shields 62—64, each of C-shaped cross-section, are secured to contact structure housing 31. Window 99 in switch housing 25 is located opposite the gap between contact structure 17 and jaw structure 16 so that the position of blade 23 may be readily ascertained.

Referring more particularly to Figures 2 and 7—11, 75

grounding switch 100 includes housing 101 extending radially outward from disconnect switch housing 25 and being secured by means of fasteners 102 to flanged extension 103 surrounding opening 104 in housing 25. Grounding switch housing 101 is comprised of a round section 105 and another section which is rounded at 106 and rectangular at 107. The housing sections are in axial alignment and joined at flanges 108, 109 by fastening means 110.

Hollow grounding blade 111 is slidably disposed to telescope within housing 101 when grounding switch 100 is open, Figure 7, and to project from housing 101 into engagement with contact structure housing 31, disconnect switch blade 23, or jaw structure 16 when grounding switch 100 is closed, depending on the longitudinal position of opening 104.

Three circularly arranged guide wheels 112 engage the inside surface of housing section 105 to support blade 111 in spaced relationship with respect thereto. Each guide wheel 112 is mounted to a shaft 113 journaled by openings in a pair of brackets 114, 115 mounted by bolts 116 to end piece 117 secured to the rear end of blade 111. Another set of three guide wheels 120 is secured to an inwardly extending flange 121' at the forward end of rectangular housing section 107. Each guide wheel 120 is mounted to a shaft 121 journaled by openings in a pair of brackets 122, 123 mounted by bolts 124 to flange 121. Guide wheels 120 are circularly arranged in contact with the outer surface of blade 111.

Extending forward from round portion 105 of housing 101 and secured by fasteners 110 is a hexagonal mounting member 125. An individual contact member 126 is secured by fasteners 127 to five of the six outer faces of mounting member 125 and is positioned to extend forward thereof. Contact fingers 128, at the free ends of contact members 126, engage blade 111 in wiping contact on the outer surface thereof.

A stiffening member 129 is positioned within blade 111 secured thereto by screws 130 to prevent the collapse of blade 111 in the region of longitudinal slit 131 due to the pressure of contact fingers 128 which is directed radially inward. Rack 132 is mounted to stiffening member 129 by fasteners 139 and is aligned with slit 131. Pinion 132', keyed to operating shaft 133 extends through slit 131 into operative engagement with rack 132.

One end of shaft 133 is journaled by housing bearing 134 while the other end is journaled by bearing members 135 secured to housing 107 by fasteners 136. Ring 137, held by set screw 138, maintains shaft 133 in proper longitudinal position. Suitable driving means (not shown) may be keyed at 140 to shaft 133 for rotation thereof.

Rotation of operating shaft 133 in the appropriate direction will cause grounding switch blade 111 to move along its longitudinal axis from its open position of Figure 7 to its closed position wherein the plurality of grounding fingers 142 are projected radially inward to engage disconnect switch 15. Grounding fingers 142 extend forward from the front end of blade 111 being secured thereto by means of fasteners 143.

Thus I have provided a disconnect switch 15 and a grounding switch 100 for isolated phase bus both of which operate on the telescoping blade principle set forth in my aforesaid copending application Serial No. 660,920. The disconnect switch is enclosed in a housing 25 of the same size and shape as the bus housing 19 which is of a minimum size considering the voltage and current ratings of the bus. A rotatable insulator 28 is used to transmit actuating power to a pinion 43 which is positioned internally of switch blade 23 and is meshed with rack 80 secured to blade 23 internally thereof. Insulator 28 is rotatable about an axis which

intersects the longitudinal axis of blade 23 at right angles.

Grounding switch 100 is arranged so that the blade 111 thereof travels along a path which also intersects the longitudinal axis of disconnect switch blade 23 at right angles. In a multiphase distribution system with an individual disconnect and grounding switch for each phase of the isolated phase bus run, the grounding switch arrangement hereinafter described enables the grounding switch 100 to be conveniently positioned in the formerly unused space between adjacent disconnect switches 15, 85 (Figure 2).

It should be apparent to those skilled in the art that the operation of the disconnect switch 15 and grounding switch 100 may be coordinated so that opening of disconnect switch 15 will result in the closing of grounding switch 100. Further, interlock provisions may be included to prevent entrance into the bus 19 or switch 25 housings while grounding switch 100 is not closed.

Although the present invention has been described with an exemplary form, it is to be understood that variations may be made within the broader spirit and scope of the invention, and it is not intended to be limited except as set forth in the following claims.

I claim:

1. A disconnect switch having a telescoping blade and a grounding switch having a telescoping blade operable along a path extending radially from the longitudinal axis of said disconnect switch telescoping blade.

2. The combination comprised of a disconnect switch, a first and a second section of isolated phase bus; each of said first and second sections comprising a hollow conductor and a circular housing surrounding said conductor and coaxial therewith; said first and said second sections being in axial alignment; said disconnect switch being interposed between said first and said second sections; said disconnect switch comprising a contact structure, a jaw structure and a blade; said contact structure being secured to the conductor of said first section and extending therefrom in a first direction; said jaw structure being secured to the conductor of said second section and extending therefrom in a second direction opposite to said first direction; said jaw structure being spaced from said contact structure to form a gap therebetween; said blade having a first position wherein it is telescoped wherein said blade bridges said gap; said disconnect switch also including a circular housing of the same diameter as the housing of said first and said second sections to appear as a continuation thereof; a grounding switch including a blade movable along its own axis which is positioned on a line extending radially from the longitudinal axis of the blade of said disconnect switch.

3. The combination comprised of a disconnect switch, a first and second section of isolated phase bus; each of said first and second sections comprising a hollow conductor and a circular housing surrounding said conductor and coaxial therewith; said first and said second sections being in axial alignment; said disconnect switch being interposed between said first and said second sections; said disconnect switch comprising a contact structure, a jaw structure and a blade; said contact structure

being secured to the conductor of said first section and extending therefrom in a first direction; said jaw structure being secured to the conductor of said second section and extending therefrom in a second direction opposite to said first direction; said jaw structure being spaced from said contact structure to form a gap therebetween; said blade having a first position wherein it is telescoped wherein said blade bridges said gap; said disconnect switch also including a circular housing of the same diameter as the housing of said first and said second sections to appear as a continuation thereof; a grounding switch including a blade movable along its own axis which is positioned on a line extending radially from the longitudinal axis of the blade of said disconnect switch; said blade of said grounding switch having a first position wherein it is positioned outwardly of said disconnect switch housing and a second position wherein said blade extends from said disconnect switch housing into electrical contact with said conductor of one of said first and said second sections.

4. The combination comprised of a disconnect switch, a first and a second section of isolated phase bus; each of said first and second sections comprising a hollow conductor and a circular housing surrounding said conductor being coaxial and concentric therewith; said first and said second sections being in axial alignment; said disconnect switch being interposed between said first and said second sections; said disconnect switch comprising a contact structure, a jaw structure and a blade; said contact structure being secured to the conductor of said first section and extending therefrom in a first direction; said jaw structure being secured to the conductor of said second section and extending therefrom in a second direction opposite to said first direction; said jaw structure being spaced from said contact structure to form a gap therebetween; said blade having a first position wherein it is telescoped within said contact structure and a second position wherein said blade bridges said gap; said disconnect switch also including a circular housing of the same diameter as said circular housing of said first and said second sections to appear as a continuation thereof; said disconnect switch circular housing and said circular housing of said first and second sections being of uniform diameter throughout the lengths thereof; said disconnect switch also including an insulator rotatable about an axis extending radially from the longitudinal axis of said blade; a first gear means being directly secured to said blade; a second gear means being secured to said insulator at one end thereof and rotatable in unison with said insulator upon rotation thereof; said first and said second gear means being in operative engagement whereby rotation of said insulator is effective to cause movement of said blade between said first and said second positions.

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