

March 30, 1954

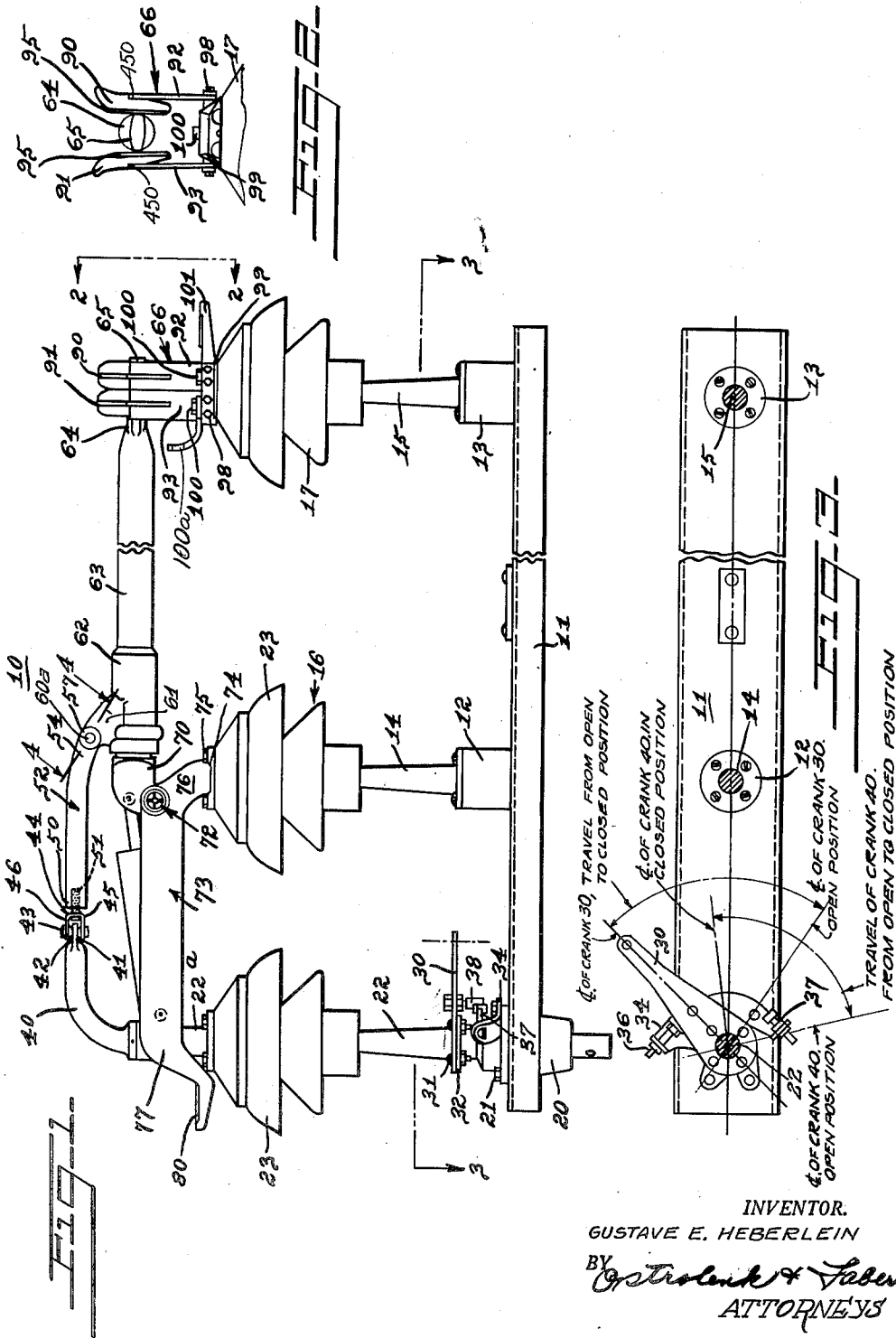
G. E. HEBERLEIN

2,673,902

DISCONNECT SWITCH

Filed Feb. 21, 1950

7 Sheets-Sheet 1



March 30, 1954

G. E. HEBERLEIN

2,673,902

DISCONNECT SWITCH

Filed Feb. 21, 1950

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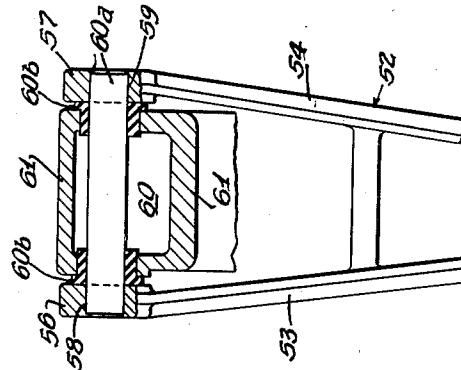
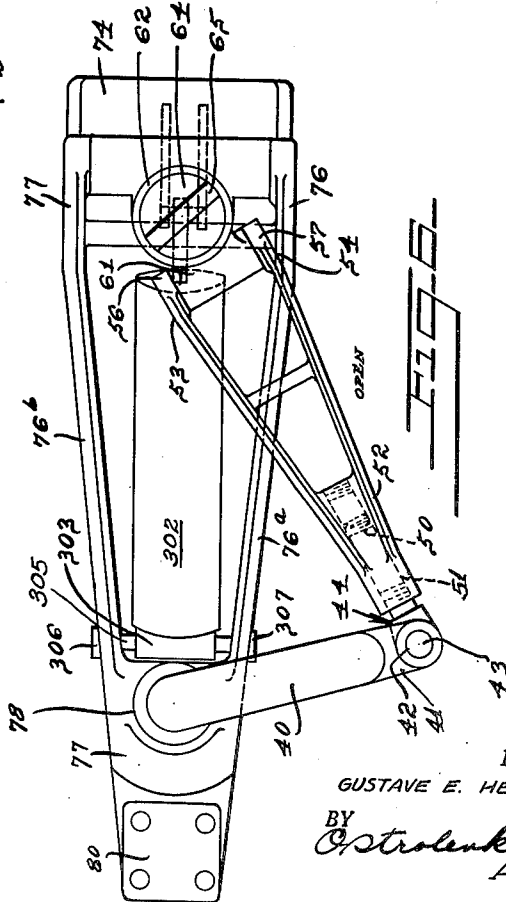
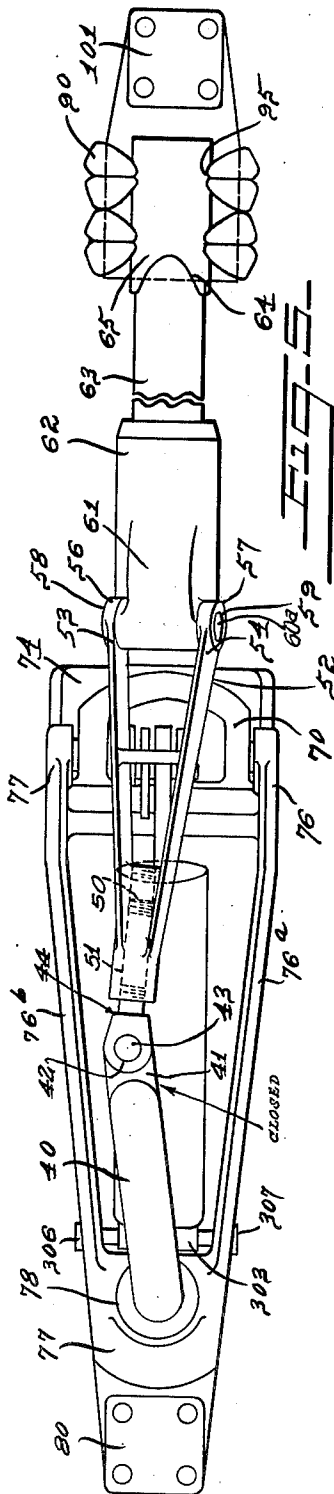


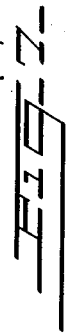
FIG. 4-

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Filed Feb. 21, 1950

DISCONNECT SWITCH

7 Sheets-Sheet 3



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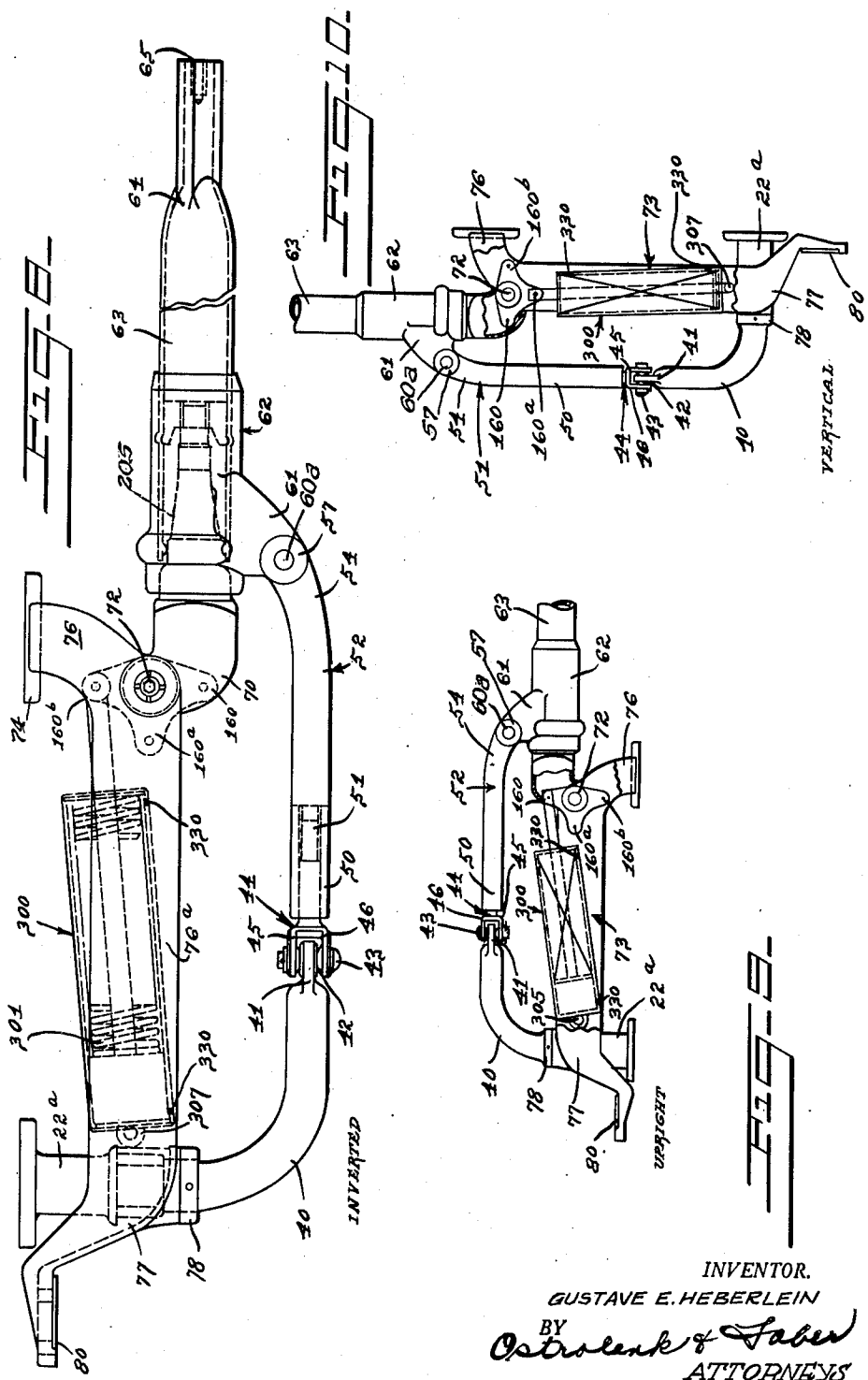
March 30, 1954

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DISCONNECT SWITCH

2,673,902

Filed Feb. 21, 1950

7 Sheets-Sheet 4



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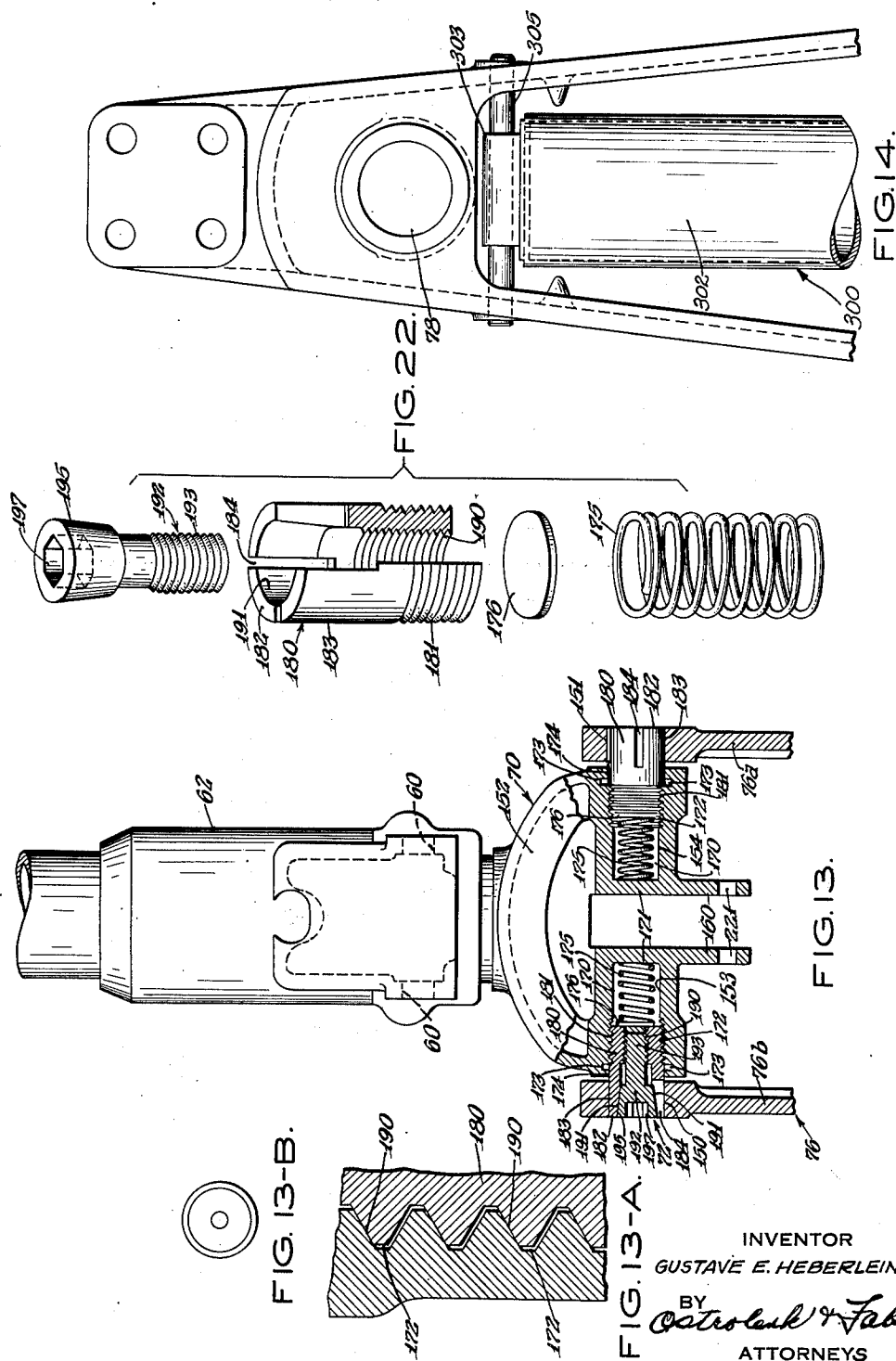
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G. E. HEBERLEIN
DISCONNECT SWITCH

2,673,902

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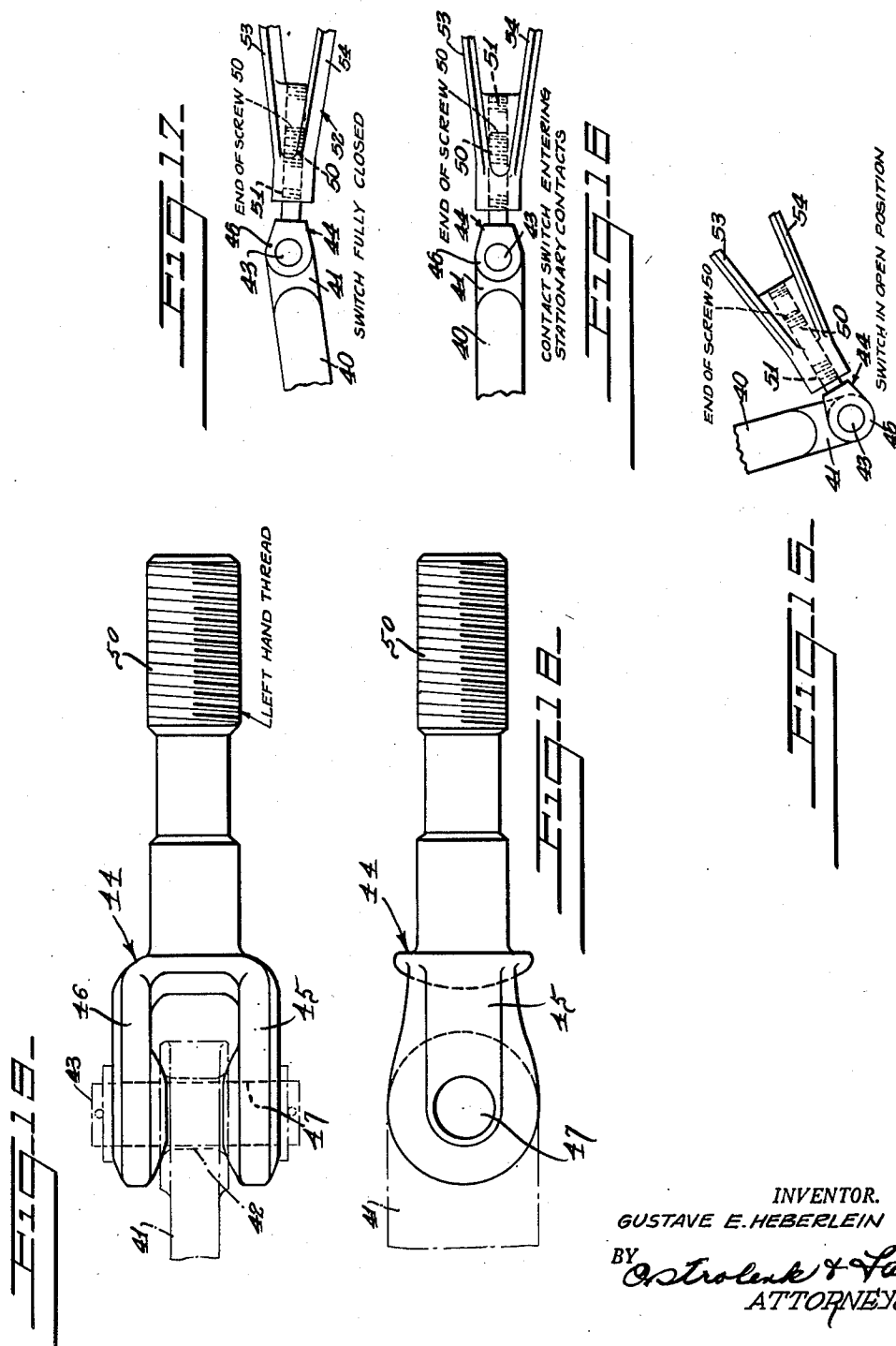
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2,673,902

DISCONNECT SWITCH

Filed Feb. 21, 1950

7 Sheets-Sheet 7



UNITED STATES PATENT OFFICE

2,673,902

DISCONNECT SWITCH

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Application February 21, 1950, Serial No. 145,389

44 Claims. (Cl. 200—48)

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The present invention relates to high pressure contact switches and more particularly to disconnect switches adapted to establish a high pressure contact between a source of electric current and a load and so arranged that all of the circuit connections through the disconnect switch will be through high pressure contact elements which will make it possible to omit all flexible connections such as pigtailed and the like.

High pressure contact disconnect switches of the type shown generally in Patents No. 1,793,177, 2,171,182, 1,949,018, have been mounted primarily on three insulators, one carrying the stationary contact, the second carrying the movable contact arm assembly, and the third carrying the operating crank or assembly for the movable contact arm.

The movable contact arm was arranged so it might rotate angularly from a position substantially 90° or more away from its contacting position to a position where it engages the stationary contact.

The movable contact arm was also arranged so that after its contact carrying end entered the stationary contact the movable contact arm was rotated into high pressure engagement. In most prior constructions, it was thought necessary that a current carrying connection be established from one terminal of the disconnect switch directly to the contact arm; and since at least two separate motions were required to establish contact, it was thought that a flexible connection permitting the rotation of the movable contact in two planes was essential to ensure that a good current carrying connection would at all times be made from the terminal to the movable contact arm.

Where the pigtail or other flexible unit from the terminal to the rotatable contact arm was properly weatherproofed and otherwise protected, these flexible connections have proved highly efficient. Where, however, the weatherproofing was incompletely done or unusual weather or other operating conditions prevailed, it sometimes happened that the flexible connection tended to crystallize and break.

Various attempts have been made to obviate the need for the flexible connection by making some type of direct contact between an element of the terminal and an element of the contact arm. For the most part, such attempts have been substantially limited to constructions wherein the movable contact arm was made as a bridge arm so that the terminal extending to the source of electric current was directly con-

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nected to a stationary contact and the terminal to the load was also directly connected to a stationary contact.

The movable contact arm was then swung in the manner shown in the Koppitz Patent No. 1,793,177 from its open position to a position where it entered into the jaws of both stationary contacts and then also was twisted or rotated to obtain high pressure engagement in the jaws.

While this was a useful type of construction, the two sets of contact jaws created alignment difficulties and doubled the operating effort under normal conditions, as well as under icing or other weather and corrosion conditions.

While appropriate compensation could be made for the increased operating effort under normal conditions, the double number of contact members increased the possibility of failure under emergency or other unusual conditions and also multiplied maintenance requirements.

Various other attempts have been made to provide for sliding contacts in place of flexible connections at the pivot point of the contact arm. In all of these cases, either the sliding contact was exposed to the atmosphere and subjected to weathering or other corroding elements or the angle of movement of the contact element was such that the contact end became cumbersome in use or size, difficult in manufacture, or inefficient in current carrying capacity.

As a matter of fact, in many such cases, it has been found that the current carrying capacity at the contact after a period of use was so low that appreciable current actually passed through hinge connections or crank connections which operated the contact and which were not designed to carry current, resulting in a serious reduction in current carrying capacity and, in some cases, actual destruction of the hinge or crank elements.

The present invention has for its primary object the provision of simplified current carrying elements between a terminal and a moving contact arm of a disconnect switch wherein the need for flexible connecting elements is obviated.

Another object of this invention is the construction of the hinge of a disconnect contact arm in such manner that the hinge becomes an efficient current conducting member.

Another object of this present invention is the provision of spring loaded threaded hinge pins for the disconnect contact arm so arranged that the current may efficiently be carried through the hinge pins to the disconnect contact arm.

Another object of this invention is in a dis-

connect switch having an angularly rotatable contact arm which is also rotatable on its longitudinal axis, the provision of a current carrying contact connection between the contact arm and the support on which it rotates angularly and an additional current carrying contact connection between the portion of the contact arm which rotates on its longitudinal axis and the remainder of the contact arm.

Another object of this present invention is the weatherproofing and protection of the aforesaid current carrying contact connections particularly by mounting them within interior elements of the contact arm.

Another object is the placement of said current carrying connections in a sealed corrosion-proof housing which also contains a corrosion preventing and inhibiting material.

Where the contact arm of a disconnect switch is rotated angularly to enter the stationary contact jaws and then on its longitudinal axis into high pressure engagement with the contact jaws, it becomes important that the maximum force be available for this latter rotation on the longitudinal axis, since that is the portion of the operation of the contact arm wherein current carrying engagement is made.

In such contact arms, there are usually provided a base or principal member which is hinged mounted for angular rotation. The section which is rotatable on its longitudinal axis has often been mounted through an extension of this principal portion. This outside mounting has not only tended to increase the susceptibility of the contact arm to weathering and other corrosive forces which might tend to make it bind or strongly resist rotation about the longitudinal axis, but also this outside mounting of the contact engaging section brings the relatively rotatable parts further out from the axis of rotation.

Thus, the crank arm which rotated the blade portion of the contact arm which in turn rotated on its longitudinal axis was required to overcome the greater leverage of the corrosive forces or ice accumulation which tended to bind the contact arm at a point relatively remote from the axis of rotation.

Another and important object of this invention, therefore, is to mount the blade portion of the contact arm which is rotatable on its longitudinal axis inside an extension of the hinge or angularly rotatable portion of the contact arm, thereby achieving two distinct advantages: (1) the protection and weather-proofing of the current carrying elements or contacts between the blade portion and the hinge member, and (2) bringing the relatively rotatable parts closer to the center of rotation on the longitudinal axis so that whatever weathering or other corrosive forces might tend to bind these elements against rotation would exert their effect at a point closer to the axis of rotation and hence on a shorter lever arm—by this means giving the driving crank arm a more powerful leverage.

In the construction and operation of prior disconnect switches, a single operating crank has been utilized through a link to perform the operations of rotating the contact arm angularly and then rotating a portion thereof about its longitudinal axis after the end of the contact arm has entered between the jaws of the stationary contact. See Patent No. 2,328,283 issued August 31, 1943.

This has made necessary the utilization of some type of cam connection which for the most

part included a pin and slot connection between the main operating crank and the link which was connected to the contact arm. This in turn permitted play in the contact arm and made necessary the utilization of a stop member at the end of the closing movement of the contact arm to ensure that the operating crank could no longer move the arm angularly and must thereafter on continued rotation rotate the contact arm on its longitudinal axis.

This, as above pointed out, was a necessary result of the loose mechanical connection.

Another and important object of the present invention is the provision of a novel connection between the main operating crank and the link connected to the contact arm whereby a rotatable threaded member is made a portion of the connection.

The said threaded member permits relative rotation between the link and the crank. The threaded member has a reverse thread at an appropriate pitch so that the rotation thereof with respect to the link owing to the translatory movement of the crank and the link will result in the threaded member entering or moving out of the element with which it is engaged to a degree necessary to compensate for or achieve the required changes in link length to permit the operation to occur.

In the construction and operation of disconnect switches the contact arm, as above pointed out, consists of two parts: (1) the basic angularly rotatable hinge casting and (2) the blade portion of the contact arm which is mounted for rotation around its longitudinal axis on the hinge casting.

An object of this invention, as above pointed out, is the provision of a novel weather-proof efficient contact connection between the blade portion of the arm and the hinge casting and an efficient weather-proof current carrying connection from the hinge to the terminal.

In addition, it is necessary to lock the blade portion of the contact arm to the hinge.

An object of the present invention is the provision of novel means for securing the blade section of the movable contact arm to the hinge so that it may rotate with respect thereto while having only a predetermined longitudinal movement whatever with respect to the hinge casting.

Another object of my invention is so to arrange the various elements of my structure that manufacturing and assembly operations will be greatly simplified facilitating the full utilization of mass production methods.

A further and corollary object of my invention is the arrangement and combination of parts and elements and the simplification of operation to the end that a minimum number of parts are required to construct my novel switch.

Still another object of my invention is the provision of spring loaded contacts at the hinge of the switch blade and between the switch blade and the hinge structure so arranged that the contacts are always in engagement, thereby simplifying the provision of means for excluding foreign matter from the contacts and thereby preventing corrosion.

A further object of my invention directed also to the simplification of manufacturing procedures is the arrangement of the foregoing contact structures so that they are relatively insensitive to variations in assembly technique while nevertheless they may have at all times and under

all circumstances ample capacity for short time overloads.

Another object of my invention is the placement of the foregoing contacts in a sealed corrosion proof housing adapted to retain a corrosion inhibitor, which housing may nevertheless be readily disassembled for inspection and, if required, replacement of either the contacts or the corrosion inhibitor.

Another object of my invention is the arrangement of the foregoing contacts so that drive pins, bearings and cranks may be isolated from the electrical circuit thereby protecting them from possible burning and damage during fault conditions under which the traversing of shunt paths by heavy overload currents may weld or destroy pins and bearings and interfere with or prevent the operation of the switch.

Another object of the present invention is the provision of novel counterbalancing means for the movable contact arm so arranged that the same counterbalancing element may be used irrespective of the plane of support of the switch. This is made possible by the omission of the pig-tail.

The foregoing and many other objects of the invention will become apparent in the following description and drawings in which:

Figure 1 is a side view of the disconnect switch of the present invention in closed position, the switch being arranged as an upright disconnect switch.

Figure 2 is an end view taken from line 2—2 of Figure 1 showing the stationary contact arrangement of the disconnect switch of Figure 1.

Figure 3 is a view taken from line 3—3 of Figure 1 looking in the direction of the arrows showing the base support and lower operating member for the disconnect switch of Figure 1.

Figure 4 is a cross-sectional view taken from line 4—4 of Figure 1 looking in the direction of the arrows.

Figure 5 is a top view of the disconnect switch of Figure 1 showing the closed position of the contacts.

Figure 6 is a top view of the switch of Figures 1 and 5 showing the open positions of the contacts.

Figure 7 is a top view of the switch of Figures 1, 5 and 6 showing the position of the elements after the movable contact has entered the stationary contact and has just started to rotate into high contact pressure.

Figure 8 is a view corresponding substantially to that of Figure 1 showing, however, the mounting of the disconnect switch in inverted position and illustrating the operation of the counterbalancing mechanism.

Figure 9 corresponds to Figure 1 showing the mounting of the switch in upright position and the arrangement of the counterbalancing mechanism.

Figure 10 corresponds to Figure 1 showing, however, the mounting of the switch as a vertical switch and the corresponding arrangement of the counterbalancing arrangement.

Figure 11 is a view in partly vertical section corresponding substantially to the view of Figure 1 showing the switch in open position illustrating the operation of the counterbalancing mechanism and showing particularly the connection between the portion of the switch arm which is rotatable on its longitudinal axis and the hinge.

Figure 12 is a view corresponding to the upper right hand portion of Figure 11 showing another

view of the connection between the portion of the switch arm which is rotatable on its longitudinal axis and the hinge.

Figure 13 is a cross-sectional view through the hinge taken on line 13—13 of Figure 11 looking in the direction of the arrows and showing the current carrying connection between the hinge casting and the terminal extension.

Figure 13A is a schematic cross-section showing the contact engagement achieved by the threaded hinge of Figure 13.

Figure 13B is a schematic view of an annular contact showing the similarity in principle between the threaded hinge contact of Figure 13 and the annular contact.

Figure 14 is a view taken from line 14—14 of Figure 11 looking in the direction of the arrows and showing a portion of the frame and terminal.

Figure 15 is a fragmentary enlarged top view of the crank and link mechanism for operating the contact arm, the said view corresponding to the elements of Figure 6.

Figure 16 is a top view of the elements of Figure 15 showing the condition after the contact arm has entered the stationary contact jaws but has not been rotated to closed position and corresponds to the elements shown in Figure 7.

Figure 17 is a top view of the elements shown in Figures 15 and 16 with the switch in fully closed condition, the elements corresponding to the position of Figure 5.

Figure 18 is a top view of the threaded adjustable connector between the crank and link of Figures 15 to 17.

Figure 19 is a side view of the threaded adjustable connector of Figure 18.

Figure 20 is a top view of the link of Figures 15 to 17.

Figure 21 is a side view of the link of Figures 15 to 17.

Figure 22 is an expanded view of the hinge pin assembly utilized in connection with the construction of Figure 13.

Referring first to Figure 1, the disconnect switch 10 is mounted on the base 11 which is a suitable longitudinal structural support, in this case shown horizontally arranged for a horizontally or upright mounted disconnect switch.

The base 11 has secured thereto in any suitable manner as by the insulator spacers 12 and 13 the stationary upright supporting posts 14, 15 on the upper portions of which are mounted insulators 16, 17.

Base 11 is also provided with the bearing 20 appropriately secured thereto in any suitable manner as by the bolts 21 and carrying the rotatable vertical shaft 22 to the upper end of which is keyed the insulator 23 for rotation with the vertical shaft or post 22.

Below insulator 23 there is keyed to the shaft 22 the crank 30 secured thereto in any suitable manner as by the bolts 31 connected to the flange or crank plate 32. Bolts 21 which secure the bearing 20 in position also secure the stop plate 34 in position, the stop plate being provided at opposite ends with the adjustable stops 36, 37 which engage at either end with the stop 38 on the operating crank 30.

While stops 36, 37 are herein provided, the construction and operation of my novel switch is such that it may operate properly without the stops at individual poles; in such case, the stops would be provided at the operating means for the entire switch.

Where stops are eliminated at all points, then the switch may be operated by crank 30 to close and then open by a single continuous movement in one direction to establish a contact momentarily and then break it.

Shaft 22a extends above the insulator 23 as effectively a continuation of vertical shaft 22, being, however, spaced therefrom by insulator 23. Crank 40 at the upper end of shaft 22a is preferably integral therewith and, therefore, rotates therewith.

Crank 40 extends horizontally or at least parallel with the base supporting structure 11 and rotates in the horizontal plane. Crank 40 is shown herein as tubular although it may have any desired cross-section consistent with the mechanical loads imposed thereon. The outer end of crank 40 is flattened at 41 and is provided with a circular opening 42 through which pin 43 may pass.

A clevis member 44, see also Figure 9, receives extension 41, the said clevis 44 being provided at its opposite legs 45, 46 with openings 47, 48 hereinafter more specifically described in connection with Figures 15 to 19, the said openings registering with opening 42 in extension 41 of the crank 40 and receiving the pin 43.

Clevis 44 is integral with the threaded extension 50 which enters into the tapped opening 51 in the forked link 52. The threaded extension 50 is so arranged that as the threaded extension 50 rotates with respect to the forked link 52 and its tapped opening 51, it has linear movement with respect thereto.

Forked link 52 as shown in Figures 5, 6, and 7, and especially Figures 20 and 21 has two legs 53, 54 at the end opposite the tapped opening 51, the said legs 53 and 54 terminating in bearings 56, 57 having openings 58, 59 registering with a through opening 60 (see also Figures 12 and 13) in the blade crank 61 which is integral with the rotatable blade support sleeve casting 62.

Pin 60a passes through openings 58, 59, and 60 hinging the forked link 52 to the crank 61. Where desirable insulating bushings 60b (see Figure 4) may serve as bearings and to effectively electrically insulate crank 61 from pin 60a and its forked link 52. The blade support sleeve casting 62 carries the tubular switch blade 63 secured therein and rotatable therewith.

The outer end of the tubular switch blade is flattened at 64 (Figure 1) and is provided with appropriate contacts 65 engageable with the stationary contact jaws 66.

The blade support sleeve casting 62 is mounted for rotation around its longitudinal axis on an extension of the hinge casting 70 in the manner hereinafter described particularly in connection with Figures 12 and 13. The hinge casting 70 is in turn rotatably mounted by the hinge bearings indicated generally at 72 on the forked frame casting 73 in the manner hereinafter more specifically described in connection with Figure 13.

The frame casting 73 has a horizontal section 74 secured in any suitable manner as by the bolts 75 to the top of insulator 16. The sides 76 of the frame provide supports for the hinge bearings 72 forming the members 76a, 76b. Sides 76 extend back to the solid portion 77 which is provided with an opening 78 (Figures 5, 6, 7, 11 and 14) appropriately recessed to form a bearing for crank 40 and its shaft 22a.

The solid portion 77 of the base casting 62 then extends beyond to form the terminal 80 to which appropriate leads may be connected.

The stationary contact 66 comprises the plurality of contact blades 90, 91 on each side biased toward each other by the spring support members 92, 93 and so arranged that when the blade 65 enters at an angle to the horizontal position during the closing operation it will clear the blades 90 on each side.

These contact members are so arranged, however, that when the blade is rotated from the position of Figure 7 to the position of Figures 1, 2, and 5, the blade 65 in turning to the horizontal position will spread the contacts 90 and 91 on each side against the tension of springs 92 and 93 creating the desired contact pressure.

The spring blades 92, 93 are current conducting and are connected in any suitable manner as by the bolts 98 to the base plate 99, which in turn is mounted in any suitable manner as by bolts 100 at the top of insulator 71.

The base 99 of stationary contact structure 66 has an extension 101 which serves as a terminal block or connecting member. Thus, when the disconnect switch is in the closed position of Figures 1 and 5, current enters through terminal 80, passes through the frame casting 73 to the hinge bearings 72, then through the current carrying connection in the hinge bearing 72, hereinafter described in connection with Figure 13, to the hinge casting 70, then through the current carrying connection hereinafter described in connection with Figures 11 and 12, from the hinge casting 70 to the contact blade 63, then through the contact 65 on the contact blade 63 to the stationary contact elements 90, 91, and then through the base 99 to the terminal extension 101.

The present invention is directed to a combination of elements which succeed in providing simplified and improved current carrying connections from frame casting 73 to the blade 63 which improve the mechanical operation and prevent weather or corrosive forces from affecting the successful operation.

Generally, the invention herein may be treated as relating to:

- I. The current carrying connection at the hinge between the frame and the moving blade assembly.
- II. The current carrying connection between the hinge casting (the principal angularly rotatable portion of the blade assembly) and the blade itself to carry current from the hinge casting to the blade while the blade may nevertheless rotate on its longitudinal axis.
- III. The mechanical connection between the hinge casting, the blade support sleeve and the blade itself to permit rotation of the blade on its longitudinal axis.
- IV. The mechanical operating elements including especially the connection between the upper operating crank and the link which turns the blade crank on the contact arm assembly.
- V. The counterbalancing structure.
- VI. The weather-proofing and corrosion resistant protection for the current carrying elements of the hinge and blade assembly.
- VII. The construction and operation of the stationary contact member.

I. The current carrying connection at the hinge between the frame and the moving blade assembly

The current carrying connection between frame 73 and the hinge casting 70 which is the angu-

larly movable portion of the contact arm assembly at the hinge bearings 72 is illustrated specifically in Figures 13 and 22, the hinge casting being also shown in greater detail in Figures 11 and 12. Sides 76 of frame 73 have openings 150, 151 for bearings 72.

The hinge casting 70 (Figure 13) comprises the main reinforced support section 152 provided with openings or wells 153 and 154 on opposite sides registering, respectively, with openings 150 and 151 of the frame casting. Section 152 of casting 70 also has rearwardly directed extensions 160 hereinafter more specifically described in connection with the counterbalancing mechanism of Figures 8, 9, 10, and 11.

Each of the openings 153 and 154 has a smooth bore section 170 with a closed end 171, a tapped section 172, and an annular recess 173 in the smooth bore section 174 extending from the tapped section 172 to the outside.

A compression spring 175 is first dropped into the opening 154 or 153 to come to rest at the bottom 171 thereof. A bearing washer 176 is then placed on the spring and the hollow threaded hinge and contact pin 180 having the external threads 181 is screwed in to be engaged with the threads 172 of the opening.

Preferably, washers 176 are of insulating material to electrically insulate springs 175 from hinge pins 180. They also serve to transmit spring thrust between pins 180 and ends 171 of openings 153, 154 of casting 152.

Before the pin 180 is screwed in, an appropriate gasket or other weather-proofing means is placed in the annular recess 173. Where desired, the annular gasket recess may be in the contact pin 180 at the region at which recess 173 is here shown, thereby obviating the need for a recessing operation. The hinge pin 180 is screwed in on each side until its exterior surface 182 is flush with the side of the base member 73 on each side, thereby compressing the spring 175 so that the threads 181 of the pin 180 are in close current carrying engagement on one side with the threads 172 of opening 153 or 154 as the case may be. See Figure 13A which shows the type of current carrying engagement. As compared with a well-known annular contact (Figure 13B) four times the contact area is available where four threads are in engagement; hence, the screw contact is more efficient.

The interior hollow portion of pin 180 is substantially circular. Therefore, in order to screw in the pin 180 and also to provide for expanding frictional securement means hereinafter described, the outer smooth portion 183 of each pin 180 is provided with a plurality of slots 184. The ends of these slots at surface 182 provide a means by which an appropriate tool may rotate the threaded hinge pins 180 into the flush position shown in Figure 13.

At this time while the threaded hinge pins 180 are in flush position and there is a secure current carrying engagement between the threads 172 and the threads 181, there is yet no secure current carrying connection between the smooth section 183 of the pin 180 and the opening 150 or 151 of the frame member 73.

In order to achieve such a current carrying connection, the interior of each pin 180 is also threaded at 190 and the pin 180 has a smooth conical bore 191 inside the outer section 183.

A screw 192 is provided at each side, the said screw 192 having a threaded section 193 engaging 75

the interior threaded section 190 of the pin 180 and having a conical head 195 adapted to spread the slotted end section 183 of the hinge pin 180.

The head of screw 192 is appropriately shaped, being provided, for instance, with the rectangular or hexagonal recess 197 or other conformation to receive an appropriate tool for rotating the same.

When the screw 192 is rotated into bore 191 of pin 180, the head 195 spreads the smooth portion 183 of the pin 180 into firm frictional engagement with the interior wall of opening 150 or 151 on each side of the base member 73.

Thus, with a pin 180 $\frac{3}{4}$ " in diameter and an opening 150 $\frac{3}{4}$ " in diameter and $\frac{3}{4}$ " in depth, the clamping pressure is such that a 3,500 pound force at the pin was found necessary to move pin 180 out of opening 150 or 151.

By this means, a firm current carrying connection is made between the pin 180 on each side and the frame 73.

The side portions 76, 77 of frame 73 are sufficiently flexible or resilient so that as the contact surfaces at thread 181 of bolt 180 wear, the springs 175 on each side may drive the bolts 180 secured to portions 76, 77 outwardly by the minute amount necessary to maintain contact pressure.

When now the hinge casting 70 rotates from the position of Figures 1 and 5 to the position of Figures 6 and 11 or back again, the threads 172 in opening 153 and the threads 172 in opening 154 move on the threads 181 of the corresponding pin 180.

Since the pitch is relatively low, the quarter turn or approximately 90° rotation of the contact arm results in lateral movement of the hinge casting 70 on the pins 180 on each side by a minute distance equal to one-fourth the distance between adjacent threads of the threaded connection 181 of pin 180.

With the pitch of the threads 181 of pin 180 12 per inch, this total lateral movement of the blade and hinge casting is $\frac{1}{48}$ " between the full open and full closed position of the switch blade.

The heavy springs 175 bearing between the base 171 of each opening 153 and 154 and the ends of the pins 180 drive the threads 172 of openings 153 and 154 into firm engagement with the outer sides of the threads 181 of pin 180 as seen in Figure 13A, thus creating the effect of multiple annular contacts of the type of Figure 13B as previously described.

By this means, therefore, the need for a flexible connection is obviated, while, at the same time, a firm continuously engaged current carrying connection which permits the free rotation of the contact arm assembly between full open and full closed position is provided.

This continuously engaged contact permits the operation of the switch in load break or arcing conditions as the continuously engaged contacts will carry such currents without the need of pig-tails, special intermediate transition contacts or other special by-pass means.

In addition, by the use of appropriate weather-proofing gaskets in the annular recess 173 of openings 153 and 154 on each side, full weather-proofing and corrosion resistant protection is provided for the current carrying elements which comprise the threads 181 of the pins 180 and the threads 172 in openings 153 and 154 of the hinge casting 70.

II. *The current carrying connection between the hinge casting (the principal angularly rotatable portion of the blade assembly) and the blade itself to carry current from the hinge casting to the blade while the blade may nevertheless rotate on its longitudinal axis*

The blade section 63 as seen particularly in Figures 11 and 12 is a tubular metallic member which is extended back inside sleeve 62 which carries the blade crank 61. Sleeve 62 is rotatably mounted on conical extension 205 of the hinge casting 70 by the rotatable interengagement of nut 255 of blade 63 with threaded end 206 of extension 205 of the hinge casting as hereinafter described.

The interior of sleeve 62 is provided with an annular recess 201 at the point of engagement of the sleeve 62 with extension 205 of the hinge casting to receive a weather-proofing gasket.

The primary purpose of the conical extension 205 and its threaded section 207 will be hereinafter described in connection with the securement of the blade 63 within the sleeve 62.

Adjacent the inner end of extension 205 a highly conductive cylindrical contact section 210 is mounted of appropriate contact material and secured to the conical extension.

The section of the tubular blade 63 within the sleeve 62 is split at 212, 212 to form a plurality of contact fingers. The interior of each of the contact fingers 216 is provided with a contact button 213, 213 engaging the contact 210. Where necessary for adequate contact pressure, a garter spring 215 surrounding the contact fingers 216 at the areas thereof having the contact buttons 213 drives the contact buttons 213 into close continuously engaged current carrying engagement with the annular contact ring 210 of the hinge casting 70.

The sleeve 62 is provided with the annular recess 220 seating the garter spring 215 and locating it in position against accidental displacement.

It will thus be seen that the contact blade 63 may readily rotate with respect to casting 70 while, however, an efficient continuously engaged current carrying engagement exists between contact blades 63 and the casting 70.

Thus, the current path from stationary contact 66 to the movable contact 65 and contact blade 63 extends through the contact fingers 216, contact buttons 213, the contact ring 210, to the casting 70 and then through the hinge contacts 72 to the base member 73 to the opposite terminal 80.

The necessity for flexible or exterior connections is obviated. All current carrying connections are completely housed, sealed, and weather-proofed.

The weather-proofing for the hinge contacts has already been described, and the weather-proofing for the current carrying connection between the blade 63 and the hinge casting 70 comprises the solid sleeve 62, the weather-proofing gasket in annular recess 201 and the method of securement of the blade 63 to the sleeve 62 at the opposite end which will hereinafter be described.

It will be obvious that instead of slitting the sleeve the annular contact 210 may be slit and spring biased outwardly against the sleeve or the annular contact 210 may be slit and arranged to surround the tube 63.

Other modifications of the current carrying

connection at this point will also be hereinafter described.

III. *The mechanical connection between the hinge casting, the blade support sleeve and the blade itself to permit rotation of the blade on its longitudinal axis*

It is, of course, essential that the blade 63 be appropriately integrated with the sleeve 62 so that as sleeve 62 is rotated by an appropriate connection hereinafter described to the crank 61, the blade 63 will rotate therewith.

It is also desirable that the method of connection of blade 63 to sleeve 62 form the sleeve 62 into a weather-proof housing or container to avoid the necessity for additional weather-proofing gasketing.

For this purpose, the sleeve 62 is provided with the annular recess 250 adjacent its outer end but inwardly of the turned down threaded extension 206 of the conical extension 205 of the hinge casting 70. See Figures 11 and 12.

After the blade tube 63 is inserted in sleeve 62, the nut 255 is positioned therein with the annular extension 260 of nut 255 aligned with recess 250 in sleeve 62. An appropriate tool then flares out annular extension 260 of nut 255 pressing the material 262 of blade tube 63 into recess 262 thereby integrating the nut 255, the blade tube 63 and the sleeve casting 62. The assembly of sleeve casting 62 and blade tube 63 may then be rotatably mounted on hinge casting 70 by threading nut 255 on threads 207 of end 206 of conical extension 205 of hinge casting 70. The assembly is turned in until contact buttons 213 engage contact ring 210 on hinge casting 70 and is rotated to a position where crank member 61 is in proper alignment for engagement by link 52.

This means of securement provides a ready means of attachment of blade 63 and of removal for replacement or inspection and for examining the contacts and the replacement of the corrosion inhibiting medium.

The engagement of the bead 262 in recess 250 of the sleeve causes a firm weather-proof engagement between the blade 63 and the sleeve 62, locking the blade not only against longitudinal movement but firmly anchoring the blade against both rotating and longitudinal movement with respect to the sleeve 62.

This locking engagement of the blade with the sleeve in addition combines with the gasket in annular recess 201 to form the sealed weather-proof chamber 265 in the interior of the sleeve 62 which is the chamber containing the current carrying connection or contacts, including the buttons 213 and the annular contact 210.

IV. *The mechanical operating elements including especially the connection between the upper operating crank and the link which turns the blade crank on the contact arm assembly*

The mechanical operating elements which operate the contact assembly for annular rotation at the bearings 72 and after the contact element 65 has entered the stationary contact continue on to rotate the blade 63 into appropriate contact pressure are shown in side view in Figure 1, but their operation is illustrated more clearly in Figures 5, 6, and 7 which show, respectively, the full closed position, the full open position, and the partly closed position where the blade has been rotated for entry into the stationary contact without having been rotated on its longitudinal axis to the closed position of Figure 5.

The relationship of the crank to the link at each of the operating positions is also demonstrated in Figures 15, 16, and 17 which show these elements and correspond, respectively, to Figures 6, 7, and 5.

The extensible screw threaded element which permits this operation to occur and which connects the upper operating crank and link is shown in each of the aforesaid figures and is shown specifically in Figures 18 and 19, while the link itself is shown in Figures 20 and 21.

The corresponding operation of the lower operating crank 30 is illustrated schematically in Figure 3.

The basic problem here is to utilize the single operating crank in such manner that by a continuous motion it will first rotate the contact assembly angularly about the bearing 72 and after the end of the blade 63 has registered with the stationary contact jaws 66, it will rotate the blade so that its contact element 65 will be in appropriate high pressure engagement with the stationary contact and will be locked into closed position engagement by the past center crank position so that any magnetic or mechanical or weather forces will tend to drive the parts in the closing or engaging direction. Movement past center provides for possible contact engagement over a substantial arc so that the contacts will engage despite minor misalignments caused by wear or other factors.

The successive steps from the open to the closed position required, therefore, that the crank 40, link 52, and the sleeve crank 61 be connected in such manner that these various operations may occur.

In this full closed position, the sleeve crank 61 extends substantially vertically in the case of an upright mounted switch and, therefore, in a plane which includes the axes of supporting posts 15, 14, and 22, and insulators 16, 17 and 23.

As the crank 40 on post 22 is rotated with the lower operating crank 30 from the position of Figures 5 and 17 toward the position of Figures 7 and 16, the end of link 52 adjacent crank 40 rotates laterally with the crank 40. This results in pulling the sleeve crank 61 laterally or angularly, thereby rotating the sleeve casting 62 around the extension 200. This in turn rotates the blade 63 with the sleeve 62 in order to effect a rotation of contact 65 out of horizontal position and, therefore, out of pressure engagement with the stationary contact jaws 66.

This is the condition which is reached at Figures 7 and 16. Thereafter further rotation of crank 40 from the position of Figures 7 and 16 to the position of Figures 6 and 15 results in drawing the link 52 bodily toward the left with respect to Figures 5, 6, and 7, thereby pulling crank 61 toward the left and lifting the entire contact assembly angularly around the hinge bearings 72 which act as the rotatable bearing therefor.

The connection between link 52 and sleeve crank 61 has already been described. This connection formed by pin 43 through openings 58 and 59 of link 52 and opening 60 of sleeve crank 61 permits rotation of the link 52 with respect to the sleeve crank 61 in that plane only which includes both the axis of the link 52 and the axis of blade 63.

However, the connection between the crank 40 and link 52 must be such as to permit rotation in two planes. In addition, since the link 52 first rotates with sleeve crank 61 and sleeve 62

about the stationary bearing 200 while crank 40 is rotated in a horizontal plane to move the switch to its upright position, there must not only be a connection between the crank 40 and link 52 which permits relative rotation in two planes but also the connection must permit of some adjustment in the length of link 52 in order to compensate for the fact that crank 40 always rotates horizontally about a vertical axis, while the crank 61 to which the other end of link 52 is connected rotates during the initial portion of the closing operation vertically about a horizontal axis and at the end of the closing operation rotates about another horizontal axis normal to its first axis of rotation.

Link 52 must also, therefore, have an automatically adjustable composite motion to maintain appropriate driving connection between crank 40 and crank 61. Preferably, as shown, the adjustment is made by means of left-hand threaded screw 59 at the connection between elements 40 and 52. This cooperates, as herein-after pointed out, with the right-hand thread of nut 255 to have an additive effect to compensate for the necessary differences in link length required as the elements 40 and 52 move from an angular position through a straight line position to an angular position on the other side of the straight line position.

As the crank 40 rotates initially from the closed position of Figure 5 toward the released position of Figure 7, its initial angular movement causes only a relatively very small translatable movement in a longitudinal direction of link 52.

After the crank 40 has reached and even passes the position of Figure 7 on its way to the full open position of Figure 6, the increasing angle which the crank makes with the link produces relatively greater translatable movement of the link 52.

At this time, therefore, the link 52 is drawn rapidly to the left to open the switch rapidly; but at the initial opening movement the translatable motion imparted to the link 52 is relatively very small (the major motion imparted being the rotation about a longitudinal axis of link 52) and the amount of compensation required in the connection between crank 40 and link 52 to permit an effective lengthening of the link 52 is also relatively small.

Previously, this compensation was effected by using a pin and slot connection between the crank and the link. This resulted in turn in the fact that the link as it approached the closed position of the contacts fell free of the pin of the crank and thus tended to close with an undesired hammer blow on a stop on the stationary contact. This also required a definite stop on the stationary contact to ensure that the blade and link would come to rest at a predetermined position.

The present invention provides for a clevis member 44 having the tines 45, 46 in which are placed aligned openings 47, 48. The clevis member 44 fits over extension 41 of the crank 40 with the openings 47 and 48 thereof aligned with the opening 42 in extension 41. An appropriate pin 43 is passed through all of the openings 47, 48, 41 and is locked in position in any suitable manner.

The clevis member 44 now is secured to the crank 40 so that it may rotate in a horizontal plane with respect thereto, while it may have a translatable movement in the horizontal plane. The clevis member 44 is preferably shaped to

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have a rocking motion to prevent binding at the pin 43.

The opposite end of the clevis member constitutes a left-hand thread screw 50 entering into threaded engagement with the similarly threaded tapped opening 51 at the left-hand end of link 52.

The screw threads 51 and 50 are so arranged that when the crank 40 is moved from the position of Figures 5 and 17 to the position of Figures 7 and 16, resulting in rotation around a longitudinal axis of the link 52 and crank 61, the resultant relative rotation between the link 52 and the clevis member 44 will cause a screwing out of the end 50 of the clevis member 44 from the tapped opening 51 of the link. The pitch of the threads 50 and 51 are, therefore, such that this screwing out of member 50 from the tapped opening 51 will substantially equal the amount by which the link 52 must be extended during this rotational operation in order to remain engaged with the crank 61. This operation is achieved by a left-hand thread on screw 50.

The pitch of the thread of screw 50 may be adjusted to provide the equalizing factor above noted. This may, however, require a special non-standard pitch to obtain the in and out camming effect required. The screw 50 is essentially a cam for this purpose. However, the right-hand thread of nut 255 permits the blade assembly to 63-62-61 to move out from casting 70 when screw 50 moves out of opening 51 and vice versa, thereby having an additive effect with screw 50 by moving the pivot 57 of link 52. This additive effect permits the required adjustment to take place without the use of special screw pitches. This is possible especially since the height of contact jaws 66 permits the contact to be made without limitation to an exact area of contact but at various points within the jaw area.

On release of the contact 65 from the stationary contact 66, the clevis member 44 including its threaded end 50 will now pull on the link 52, drawing it to the left and to the open position of Figures 6 and 15.

Similarly, when the contact member is moved from the position of Figure 6 to the position of Figure 7, there will first be a full translating movement, the threaded member permitting such rotation of link 52 with respect to crank 40 to occur as will permit this translating movement to take place.

Thereafter when the crank moves from the position of Figures 7 and 16 to the position of Figures 5 and 17, the threaded member 50 will be screwed into the tapped opening 51 of link 52 as the relative rotation occurs between crank 40 and link 52 to achieve the fully closed position, and this entry of member 50 into opening 51 will, in cooperation with the additive effect of nut 255, be substantially sufficient to compensate for the necessary reduction in link length, and permit the crank to move past center as above described.

V. The counterbalancing structure

In Figure 1, as well as in Figures 8, 9, and 10, there is shown the novel counterbalancing mechanism for supporting the contact arm in the open position.

Referring first to Figures 1, 9, and 11, the counterbalancing mechanism 300 comprises the compression spring 301 in the cylindrical housing 302. The rear end of the cylindrical hous-

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ing 302 is provided with an extension 303 (see also Figures 6 and 14) having an opening 304 receiving the pin 305, which pin is carried in appropriate bearings 306, 307 in the opposite legs 76a and 76b of the base 73.

The front plate 310 of housing 302 is provided with a central opening 311 through which the piston rod 312 passes. Piston rod 312 extends back to the pressure plate 315 to which it is secured. The compression spring 301 is compressed between the pressure plate 315 within the cylinder or housing 302 and the front plate 310 of the housing 302.

The outer end of piston rod 312 is connected by pin 320 to the rearwardly directed extension 160 of the hinge casting 73, the pin 320 passing through the aligned openings 32 in extension 160 which is of clevis formation and being held in place in any appropriate manner as by the cotter pins 323.

The rearwardly directed extension 160 of the casting 73 is preferably a three-pronged extension having the clevis 160, the second clevis 160a and the third clevis 160b. Clevis 160 is substantially vertical and upwardly directed when the switch blade is closed and the switch is in the upright position of Figure 9.

Clevis 160a is substantially horizontal when the switch blade is closed and the switch is in the upright position of Figure 9. Clevis 160b is substantially vertical and downwardly directed when the switch blade is closed and the switch is in the horizontal or upright position of Figure 9.

Clevis 160 is used when the switch is in the upright position of Figures 1, 9, and 11, that is, the piston rod 212 is connected thereto. Clevis 160a is used when the switch is mounted in the vertical position of Figure 10, and clevis 160b is used when the switch is mounted in the inverted position of Figure 8.

In the position of Figure 11, the clockwise moment of blade 63 about hinge 72 is substantially zero; although spring 301 is slightly compressed or pre-stressed, the moment of arm 160 about hinge 72 is also substantially zero. As blade 63 moves clockwise, spring 301 is compressed progressively as the moment of blade 63 increases and also the moment of arm 163 increases progressively.

Thus, the blade is effectively counterbalanced closely in proportion to its own moment through the medium of a changing lever arm and a changing spring compression.

The utilization of three arms or clevises 160, 160a, and 160b permits this type of counterbalance to be achieved irrespective of the type of mounting of the switch.

Where other special mountings at special angles are to be counterbalanced, a clevis or other arm may be provided at an angle where the moment of the clevis arm is substantially zero when the moment of the blade is zero and increases in proportion. Thus, if necessary, for varied mountings a disk clevis with many openings may be used.

By this means, therefore, the single counterbalancing spring 301 may without adjustment be utilized for each of the three positions which the disconnect switch is to occupy.

As seen by a comparison of Figures 11 and 9, when the switch blade 63 is closed spring 301 is compressed. When the switch blade is moved from the position of Figures 1 and 9 to the position of Figure 11, the lifting of the switch blade

is aided by the compression of spring 301 which extends during this opening movement.

The compression spring 301 is preferably arranged so that it substantially counterbalances the weight of the switch blade 63 but does not exert any opening force thereon, the opening force being provided by the operating elements hereinbefore described.

Thus, the mechanical means utilized in opening the switch may be very light but, what is more important, the switch is counterbalanced for substantially its entire weight in the open position and will not accidentally fall into closed position.

Where the switch is to be opened from a horizontal position through an angle less than 90°, then the force of the counterbalancing spring 301 is made sufficient to counterbalance the moment of the switch blade 63 so that it is normally biased in open position and cannot accidentally fall down to closed position.

For a horizontally upright mounted switch, the open condition as seen in Figure 11 places the counterbalancing spring on dead center but moves the switch blade over its center so that its weight retains it in the open position.

By the use of such a counterbalancing spring, therefore, it becomes unnecessary to move the switch blade to or beyond a vertical position to ensure that it will stay open, but the switch blade once having been moved to open position, even though this open position is short of the vertical position, will be held open by the counterbalancing spring.

Where the switch is mounted in the inverted position of Figure 8, the securing of piston rod 312 to the clevis 160b will, as shown in Figure 3, result in compression of spring 301 as the switch blade moves from the horizontal closed position shown downwardly toward an open position.

Thus, the weight of the switch blade 63 will again be counterbalanced, in this case the force of the spring 301 being less than the weight or moment of the blade 63 about its pivot so that the blade will not be driven closed inadvertently by the spring 301.

Where a large blade is used, the counterbalancing spring thus provides a substantial amount of the force needed to close the blade and relatively smaller operating force need be provided.

When the switch is mounted in the vertical position of Figure 10, the piston rod 312 is connected to clevis 160a again in a position so that the spring will be compressed by and, therefore, act as a counterbalance for the blade 63 when it is open.

In each case, the spring 301 acts as a counterbalance reducing the effective force or moment of the blade at the point where this effective force or moment is greatest.

Thus, in the upright position of Figures 1, 9, and 11, the counterbalancing of the blade prevents the closing of the blade with a hammer blow on the stationary contact and assists the movement of the blade from horizontal to vertical.

In the inverted position of Figure 8, the counterbalancing of the blade prevents its falling free and uncontrolled to the open position and assists in moving it to closed position.

In the vertical position of Figure 10, the counterbalancing of the blade also prevents its falling free and uncontrolled to open position during the opening movement.

Thus, by the utilization of the counterbalance

of the present invention, full control of the blade is maintained at all times.

Cylinder 302 may be oil filled, in which case back plate 315 must be appropriately perforated to permit free passage of oil through the cylinder.

Also, where it is oil filled the provision of appropriate sized openings in plate 315 will, where desired, provide a dashpot effect preventing rapid movement of the blade in either direction. In this case, check valves may be provided at the openings to permit a rapid movement in a desired direction.

Preferably, however, cylinder 302 is simply a closed cylinder with no filling of any kind and containing nothing but the compression spring and its associated operating element.

In this case, appropriate drain holes 330, 330 may be provided adjacent the ends of the cylinder to permit any moisture condensed therein to drain off.

VI. The weather-proofing and corrosion resistant protection for the current carrying elements of the hinge and blade assembly

The weather-proofing and corrosion resistant construction of the contact blade current carrying elements has already been described in connection with the description of these specific current carrying elements.

Essentially, there are two contact points or connections which must be weather-proof, that between the base 73 and the hinge casting and that between the blade 63 and the hinge casting 70.

Hinge casting 70 rotates on the hinge bearing 72 and blade 63 rotates within sleeve 62 on an extension of the hinge casting 70.

As seen in Figure 13, the contact at the hinge 72 is between the threads 172 of the opening 170 and the threads 181 of the hinge pin 180.

This contact is thus contained within the cylindrical housing formed by the opening 170. One end of this cylindrical housing is sealed by the integral base 171. The outer end of this cylindrical housing is sealed by the gasket in the annular recess 173 and disc 176, the gasket providing a weather-excluding seal. A corrosion resistant and inhibiting material such as any grease, as for example, silicon grease, may be included in the housing further to protect the contact surfaces; and this material will not, owing to the seal, leak or be contaminated during the life of the seal.

This construction thus provides a contact enclosing cavity containing a relatively large amount of corrosion resistant and inhibiting medium which will serve to keep the contact surfaces from oxidizing or corroding—in other words, electrically clean. The small amount of atmosphere present even with some possible breathing in the seal would have negligible effect on the contact surfaces protected and bathed in the inhibiting medium. The chamber for the contacts provides relatively very small space for the entry of any corroding atmosphere and correspondingly permits a small quantity of inhibitor to fill the space only to protect the contacts.

Since the possible area of entry of corrosion is limited and is remote from the actual contact surfaces, the surface tension of the inhibitor will further prevent corrosion.

Also, since the volume of the free space for possible entry of atmosphere is relatively very small compared to the surface area of the con-

tacts, this by itself will have the effect of inhibiting corrosion and will also permit a relatively very small amount of corrosion inhibitor to protect the contact surfaces fully.

Seal 201 at one end of sleeve 62, and the bead 262 in recess 250 of the sleeve act as weather-excluding seals for the sleeve 62.

Consequently, a corrosion inhibiting film on and adjacent the contact surfaces will not leak out and will not be subject to an undue amount of corroding atmosphere during the life of the switch.

Where desired, appropriate gasket material may also be placed either in the recess 250 or in another annular recess outwardly spaced in sleeve 62 from the recess 250; and may be introduced at the threaded portion 207 to limit communication with the fully closed cavity of blade 63.

By this means, therefore, all of the movable contact elements which act as a substitute for the pigtails of the prior art are completely weather-proofed and sealed.

VII. The construction and operation of the stationary contact member

The stationary contact 66 has already been substantially described in connection with the operation of the blade 63 and its contact 65.

The stationary contact comprises a base 99 which is secured in any suitable manner as by bolts 100 to the top of insulator 71.

The base 99 extends to form the terminal block 101. Spring fingers 92, 93 are secured by bolts 98 to the sides of the base 99. Each of the spring fingers 92, 93 is sufficient in width and cross-section to carry the current efficiently from its associated contact member 90, 91.

Contact members 90, 91 are secured to the upper end of each of the spring fingers 92, 93. The contact faces of the contact members 90 are undercut at 95 to prevent outward movement of the movable contact 65 when it is turned in horizontal position. Each of the contact members 90, 91 is provided with an undercut ledge 450 at its outer side to facilitate the securement of the contact members to the spring fingers 92.

The spring fingers 92 bias the contact members 90 toward each other, the stationary contact elements being, however, adjusted so that they will permit free entry of the movable contact 65 when it is turned at a substantial angle to the horizontal but being so spaced that they will be spread apart by the rotation of the movable contact member 65 to horizontal position, the spring members 92, 93 thereafter forcing contact elements 90, 91 inwardly to exert appropriate contact pressure on the side of the movable contact 65.

The upwardly directed extension 100a under blade 63 serves to provide a support for the blade under an ice load particularly when the blade is subject to a downwardly deflecting force when twisting to open under an ice load. Extension 100a thus serves to prevent deformation of blade 63.

As previously pointed out, the sleeve casting 62 to which the blade 63 is secured rotates on the bearing 200 which is an extension of hinge casting 70.

Heretofore the axially rotatable section of the blade was mounted inside a sleeve of the base or hinge casting. By mounting the casting 62 on the outside of bearing 200, the point of engagement between sleeve 62 and its bearing 200 is

moved inwardly toward the center of rotation while the sleeve crank 61 is relatively further from the center of rotation.

Where the disconnect switch has remained open or closed for a long time, the tendency is for corrosion owing to weathering conditions to effect a binding between the relatively rotatable portions of the switch blade.

This corroded seal must be broken in order to rotate the blade properly. Where the rotatable portion of the blade was mounted inside an extension of the hinge casting, the portion which tended to corrode was thus relatively further from the center and the corroded or bound area had a greater leverage requiring greater force to break it or overcome it.

By mounting the sleeve casting 62 over an extension of the hinge casting 70, this point where a corrosion seal may form is moved inwardly by at least the thickness of the sleeve casting 62, while the end of sleeve crank 61 is thus relatively further from the center of rotation. This increases the relative leverage or gear ratio available for breaking a corrosion crust in rotating the sleeve casting.

By this means, therefore, a novel disconnect switch is provided having sealed weather and corrosion-proof contact elements between the elements of the switch as a substitute for flexible connections, exposed connections or both.

It will be clear that the hinge contact elements at 72 may be utilized in connection with other types of switch members and that the rotatable contact element at 210 may be utilized in connection with other types of switch members. The elements may thus be used independently of each other. The combination creates a weather-proof switch. Each connection is thus suited not only for its mechanical function but also for the electrical load to pass therethrough.

Where desired, also, opposite threads (right and left) may be used at the hinge contact elements 72 to increase pressure at the hinge during closing of the switch.

Since the contact elements at 72 and 210 are continuously in engagement, these contacts or connectors are usable during opening as in arcing.

Since the contact elements at 72 are essentially formed by a surface of revolution (which happens, however, to be helical) they are essentially a multiple set of circular line contacts.

All driving links may be insulated to ensure that the current will follow the predetermined path.

In the foregoing the invention has been described in connection with a preferred illustrative embodiment. Since many variations and modifications thereof should now be obvious to those skilled in the art, it is preferred that the invention be limited not to the specific disclosures herein contained but to the scope of the appended claims.

I claim:

1. In switch gear having a frame and a movable contact arm, said contact arm being angularly movable with respect to said frame; a current carrying connection between said frame and said movable contact arm; said contact arm having angular movement and also having rotative movement about its longitudinal axis; an enclosure for at least a portion of said current carrying connection; said enclosure being secured to said contact arm and being movable in all directions with said contact arms; a member pivotally mounted on said frame; said member

having a threaded portion; said contact arm having a threaded member engageable with said threaded portion for mounting said contact arm on said pivotal member for rotation on its own axis with respect to said pivotal member.

2. In switch gear having a frame and a movable contact arm, said contact arm being angularly movable with respect to said frame; a current carrying connection between said frame and said movable contact arm; said contact arm having angular movement and also having rotative movement about its longitudinal axis; an enclosure for at least a portion of said current carrying connection; said enclosure being secured to said contact arm and being movable in all directions with said contact arm; a member pivotally mounted on said frame; said member having a threaded extension; said contact arm having a threaded member engageable with said threaded extension for mounting said contact arm on said pivotal member for rotation on its own axis with respect to said pivotal member, said threaded member also cooperating in securing said enclosure on said contact arm.

3. In switch gear having a frame and a movable contact arm, said contact arm being angularly movable with respect to said frame; a current carrying connection between said frame and said movable contact arm; said contact arm having angular movement and also having rotative movement about its longitudinal axis; an enclosure for at least a portion of said current carrying connection; said enclosure being secured to said contact arm and being movable in all directions with said contact arm; a member pivotally mounted on said frame; said member having an extension; said contact arm comprising a hollow longitudinal unit, said extension being insertable in one end of said contact arm; an element interiorly of said contact arm rotatably engageable with said extension.

4. In switch gear having a frame and a movable contact arm, said contact arm being angularly movable with respect to said frame; a current carrying connection between said frame and said movable contact arm; said contact arm having angular movement and also having rotative movement about its longitudinal axis; an enclosure for at least a portion of said current carrying connection; said enclosure being secured to said contact arm and being movable in all directions with said contact arm; a member pivotally mounted on said frame; said member having an extension; said contact arm comprising a hollow longitudinal unit, said extension being insertable in one end of said contact arm; an element interiorly of said contact arm rotatably engageable with said extension, said element also cooperating in securing said exterior enclosure on said contact arm.

5. In switch gear having a frame and a movable contact arm, said contact arm being angularly movable with respect to said frame; a current carrying connection between said frame and said movable contact arm; said contact arm having angular movement and also having rotative movement about its longitudinal axis; an enclosure for at least a portion of said current carrying connection; said enclosure being secured to said contact arm and being movable in all directions with said contact arm; a member pivotally mounted on said frame; said member having an extension; said contact arm comprising a hollow longitudinal unit, said extension being insertable in one end of said contact arm;

an element interiorly of said contact arm rotatably engageable with said extension; said current carrying connection including a contact element on said extension and a contact element on said contact arm; said contact elements being biased into engagement, and said enclosure encasing said contact elements.

6. In switch gear having a frame unit and an angularly movable contact arm assembly unit; a rotatable connection between said frame and said contact arm assembly; said rotatable connection including a current carrying contact connection and comprising a threaded extension on one of said units; a recess in the other unit having a threaded surface receiving said threaded extension; the surface to surface engagement of annular portions of said threads forming the said current carrying connection.

7. In switch gear having a frame unit and an angularly movable contact arm assembly unit; a rotatable connection between said frame and said contact arm assembly; said rotatable connection including a current carrying contact connection and comprising a threaded extension on one of said units; a recess in the other unit having a threaded surface receiving said threaded extension; the surface to surface engagement of annular portions of said threads forming the said current carrying connection, and the interengagement of said extension in said recess forming said rotatable connection.

8. In switch gear having a frame unit and an angularly movable contact arm assembly unit; a rotatable connection between said frame and said contact arm assembly; said rotatable connection including a current carrying contact connection and comprising a threaded extension on one of said units; a recess in the other unit having a threaded surface receiving said threaded extension; means biasing said extension in one direction in said recess and effecting a close engagement between the surfaces of said threads on one side of each thread; the surface to surface engagement of annular portions of said threads forming the said current carrying connection.

9. In switch gear having a frame unit and an angularly movable contact arm assembly unit; a rotatable connection between said frame and said contact arm assembly; said rotatable connection including a current carrying contact connection and comprising a threaded extension on one of said units; a recess in the other unit having a threaded surface receiving said threaded extension; means in said recess biasing said extension in one direction in said recess and effecting a close engagement between the surfaces of said threads on one side of each thread; the surface to surface engagement of annular portions of said threads forming the said current carrying connection.

10. In switch gear having a frame unit and an angularly movable contact arm assembly unit; a rotatable connection between said frame and said contact arm assembly; said rotatable connection including a current carrying contact connection and comprising a threaded extension on one of said units; a recess in the other unit having a threaded surface receiving said threaded extension; a compression spring in said recess biasing said extension in one direction in said recess and effecting a close engagement between the surfaces of said threads on one side of each thread; the surface to surface engagement of

annular portions of said threads forming the said current carrying connection.

11. In switch gear having a frame unit and an angularly movable contact arm assembly unit; a rotatable connection between said frame and said contact arm assembly; said rotatable connection including a current carrying contact connection and comprising a threaded extension on one of said units; a recess in the other unit having a threaded surface receiving said threaded extension; the surface to surface engagement of annular portions of said threads forming the said current carrying connection; means sealing said engaged annular surfaces of said threads within said recess.

12. In switch gear having a frame unit and an angularly movable contact arm assembly unit; a rotatable connection between said frame and said contact arm assembly; said rotatable connection including a current carrying contact connection and comprising a threaded extension on one of said units; a recess in the other unit having a threaded surface receiving said threaded extension; the surface to surface engagement of annular portions of said threads forming the said current carrying connection; the end of said recess opposite that which receives the threaded extension being closed; and a sealing member between the other end of the recess and the extension; said current carrying threads being enclosed between said closed end and said sealing member.

13. In switch gear having a frame, a hinge member pivotally mounted at one end on the frame and a switch blade rotatably mounted at the other end of the hinge member for rotation about its own longitudinal connection; an operating crank extending substantially parallel to the frame and rotatable in a plane substantially normal to the plane of pivotal movement of the hinge member; a blade crank connected to the switch blade and rotatable therewith; a link connected between said operating crank and said blade crank; rotation of said operating crank in one direction first moving said blade crank, said hinge member, and said blade angularly about the pivotal mounting of the hinge member and thereafter rotating said blade and blade crank about the longitudinal axis of the switch blade; rotation of said operating crank in the opposite direction first rotating said blade and blade crank about the longitudinal axis of the switch blade and then moving said blade crank, said hinge member and said blade angularly about the pivotal mounting of the hinge member; a swivel connection between said link and said operating crank; said swivel connection including a length compensating member automatically varying the length of the link in accordance with the relative angular position of the operating crank and the link.

14. In switch gear having a frame, a hinge member pivotally mounted at one end of the frame and a switch blade rotatably mounted at the other end of the hinge member for rotation about its own longitudinal connection; an operating crank extending substantially parallel to the frame and rotatable in a plane substantially normal to the plane of pivotal movement of the hinge member; a blade crank connected to the switch blade and rotatable therewith; a link connected between said operating crank and said blade crank; rotation of said operating crank in one direction first moving said blade crank, said hinge member, and said blade angularly about the pivotal mounting of the hinge member and

thereafter rotating said blade and blade crank about the longitudinal axis of the switch blade; rotation of said operating crank in the opposite direction first rotating said blade and blade crank about the longitudinal axis of the switch blade and then moving said blade crank, said hinge member and said blade angularly about the pivotal mounting of the hinge member; a swivel connection between said link and said operating crank; said swivel connection including a screw carried by one of said members longitudinally movable in a threaded opening carried by the other of said members and movable into and out of said threaded opening in accordance with the relative angular position of the operating crank and the link.

15. In switch gear having a frame, a hinge member pivotally mounted at one end on the frame and a switch blade rotatably mounted at the other end of the hinge member for rotation about its own longitudinal connection; an operating crank extending substantially parallel to the frame and rotatable in a plane substantially normal to the plane of pivotal movement of the hinge member; a blade crank connected to the switch blade and rotatable therewith; a link connected between said operating crank and said blade crank; rotation of said operating crank in one direction first moving said blade crank, said hinge member, and said blade angularly about the pivotal mounting of the hinge member and thereafter rotating said blade and blade crank about the longitudinal axis of the switch blade; rotation of said operating crank in the opposite direction first rotating said blade and blade crank about the longitudinal axis of the switch blade and then moving said blade crank, said hinge member and said blade angularly about the pivotal mounting of the hinge member; a swivel connection between said link and said operating crank; said swivel connection including a length compensating member automatically varying the length of the link in accordance with the relative angular position of the operating crank and the link and maintaining a direct continuous connection between said crank and link at all positions thereof, and an additional additive length compensating connection for the opposite end of said link.

16. In switch gear having a frame, a hinge member pivotally mounted at one end on the frame and a switch blade rotatably mounted at the other end of the hinge member for rotation about its own longitudinal connection; an operating crank extending substantially parallel to the frame and rotatable in a plane substantially normal to the plane of pivotal movement of the hinge member; a blade crank connected to the switch blade and rotatable therewith; a link connected between said operating crank and said blade crank; rotation of said operating crank in one direction first moving said blade crank, said hinge member, and said blade angularly about the pivotal mounting of the hinge member and thereafter rotating said blade and blade crank about the longitudinal axis of the switch blade; rotation of said operating crank in the opposite direction first rotating said blade and blade crank about the longitudinal axis of the switch blade and then moving said blade crank, said hinge member and said blade angularly about the pivotal mounting of the hinge member; a swivel connection between said link and said operating crank; said swivel connection including a length compensating member

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automatically varying the length of the link in accordance with the relative angular position of the operating crank and the link and maintaining a direct continuous connection between said crank and link at all positions thereof comprising a threaded connection between said blade and said hinge member.

17. In a switch gear having a frame, a hinge member pivotally mounted at one end of the frame and a switch blade rotatably mounted at the other end of the hinge member for rotation about its own longitudinal connection; an operating crank extending substantially parallel to the frame and rotatable in a plane substantially normal to the plane of pivotal movement of the hinge member; a blade crank connected to the switch blade and rotatable therewith; a link connected between said operating crank and said blade; rotation of said operating crank in one direction first moving said blade crank, said hinge member, and said blade angularly about the pivotal mounting of the hinge member and thereafter rotating said blade and blade crank about the longitudinal axis of the switch blade; rotation of said operating crank in the opposite direction first rotating said blade and blade crank about the longitudinal axis of the switch blade and then moving said blade crank, said hinge member and said blade angularly about the pivotal mounting of the hinge member; a swivel connection between said link and said operating crank; said swivel connection including a screw carried by one of said members longitudinally movable in a threaded opening carried by the other of said members and movable into and out of said threaded opening in accordance with the relative angular position of the operating crank and the link, and an additional additive length compensating connection for the opposite end of said link comprising a threaded connection between said blade and said hinge member.

18. In switch gear having a frame, a hinge member pivotally mounted at one end on the frame and a switch blade rotatably mounted at the other end of the hinge member for rotation about its own longitudinal connection; an operating crank extending substantially parallel to the frame and rotatable in a plane substantially normal to the plane of pivotal movement of the hinge member; a blade crank connected to the switch blade and rotatable therewith; a link connected between said operating crank and said blade crank; rotation of said operating crank in one direction first moving said blade crank, said hinge member, and said blade angularly about the pivotal mounting of the hinge member and thereafter rotating said blade and blade crank about the longitudinal axis of the switch blade; rotation of said operating crank in the opposite direction first rotating said blade and blade crank about the longitudinal axis of the switch blade and then moving said blade crank; said hinge member and said blade angularly about the pivotal mounting of the hinge member; a drive shaft for said operating crank, said shaft extending substantially normal to the crank and frame; said crank comprising a substantially one piece L-shaped member secured to the end of the drive shaft.

19. In switch gear having a frame and a contact arm assembly pivotally mounted thereon; said contact arm assembly comprising a switch blade extending on one side of the pivotal mounting and a connecting arm extending on the opposite side of said pivotal mounting; a counter-

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balancing member connected at one end thereof to the frame and at the opposite end thereof to the connecting arm, and counterbalancing said contact arm assembly for one plane of mounting of said switch gear; an additional connecting arm at an angle to the first connecting arm; said counterbalancing member being connectable selectively to said additional connecting arm for counterbalancing said contact arm assembly for another plane of mounting of said switch gear.

20. In switch gear having a frame and a contact arm assembly pivotally mounted thereon; said contact arm assembly comprising a switch blade extending on one side of the pivotal mounting and a connecting arm extending on the opposite side of said pivotal mounting; a counterbalancing member connected at one end thereof to the frame and at the opposite end thereof to the connecting arm, and counterbalancing said contact arm assembly for one plane of mounting of said switch gear; a pair of additional connecting arms each at 90° to the first connecting arm; said counterbalancing member being connectable selectively to either of said additional arms for counterbalancing said contact arm assembly for other planes of mounting of said switch gear.

21. In switch gear having a line terminal and a movable contact arm, said contact arm being angularly movable with respect to said line terminal; a current carrying connection between said line terminal and said movable contact arm; said contact arm having angular movement and also having rotative movement about its longitudinal axis; an enclosure for at least a portion of said current carrying connection; said enclosure being secured to said contact arm and being movable in all directions with said contact arm; a member pivotally mounted on said line terminal; said member having a threaded portion; said contact member engageable with said threaded portion for mounting said contact arm on said pivotal member for rotation on its own axis with respect to said pivotal member.

22. In switch gear having a line terminal and a movable contact arm, said contact arm being angularly movable with respect to said line terminal; a current carrying connection between said line terminal and said movable contact arm; said contact arm having angular movement and also having rotative movement about its longitudinal axis; an enclosure for at least a portion of said current carrying connection; said enclosure being secured to said contact arm and being movable in all directions with said contact arm; a member pivotally mounted on said line terminal; said member having an extension; said contact arm comprising a hollow longitudinal unit, said extension being insertable in one end of said contact arm; an element interiorly of said contact arm rotatably engageable with said extension; said current carrying connection including a contact element on said extension and a contact element on said contact arm; said contact elements being biased into engagement and said enclosure encasing said contact elements.

23. In switch gear having a line terminal unit and an angularly movable contact arm assembly unit; a rotatable connection between said line terminal and said contact arm assembly; said rotatable connection including a current carrying contact connection and comprising a threaded extension on one of said units; a recess in the other unit having a threaded surface receiving said threaded extension; the surface to surface

engagement of annular portions of said threads forming the said current carrying connection.

24. In switch gear having a line terminal unit and an angularly movable contact arm assembly unit; a rotatable connection between said line terminal and said contact arm assembly; said rotatable connection including a current carrying contact connection and comprising a threaded extension on one of said units; a recess in the other unit having a threaded surface receiving said threaded extension; a compression spring in said recess biasing said extension in one direction in said recess and effecting a close engagement between the surfaces of said threads on one side of each thread; the surface to surface engagement of annular portions of said threads forming the said current carrying connection.

25. In switch gear having a line terminal, a hinge member pivotally mounted at one end on the line terminal and a switch blade rotatably mounted at the other end of the hinge member for rotation about its own longitudinal connection; an operating crank extending substantially parallel to the line terminal and rotatable in a plane substantially normal to the plane of pivotal movement of the hinge member; a blade crank connected to the switch blade and rotatable therewith; a link connected between said operating crank and said blade crank; rotation of said operating crank in one direction first moving said blade crank, said hinge member, and said blade angularly about the pivotal mounting of the hinge member and thereafter rotating said blade and blade crank about the longitudinal axis of the switch blade; rotation of said operating crank in the opposite direction first rotating said blade and blade crank about the longitudinal axis of the switch blade and then moving said blade crank, said hinge member and said blade angularly about the pivotal mounting of the hinge member; a swivel connection between said link and said operating crank; said swivel connection including a length compensating member automatically varying the length of the link in accordance with the relative angular position of the operating crank and the link.

26. In switch gear having a line terminal and a contact arm assembly pivotally mounted thereon; said contact arm assembly comprising a switch blade extending on one side of the pivotal mounting and a connecting arm extending on the opposite side of said pivotal mounting; a counterbalancing member connected at one end thereof to the frame and at the opposite end thereof to the connecting arm, and counterbalancing said contact arm assembly for one plane of mounting of said switch gear; a pair of additional connecting arms each at 90° to the first connecting arm; said counterbalancing member being connectable selectively to either of said additional arms for counterbalancing said contact arm assembly for other planes of mounting of said switch gear.

27. In switch gear having a frame and a movable contact arm, said contact arm being angularly movable with respect to said frame; a current carrying connection between said frame and said movable contact arm; said contact arm having angular movement and also having rotative movement about its longitudinal axis; an enclosure for at least a portion of said current carrying connection; said enclosure being secured to said contact arm and being movable in all directions with said contact arm; a member pivotally mounted on said frame; said member

having an extension; said contact arm comprising a hollow longitudinal unit, said extension being insertable in one end of said contact arm; an element interiorly of said contact arm rotatably engageable with said extension; said current carrying connection including a contact element on said extension and a contact element on said contact arm; said contact elements being biased into engagement, and said enclosure encasing said contact elements; said enclosure being sealed and a corrosion inhibiting medium enclosed therein.

28. In switch gear having a frame unit and an angularly movable contact arm assembly unit; a rotatable connection between said frame and said contact arm assembly; said rotatable connection including a current carrying contact connection and comprising a threaded extension on one of said units; a recess in the other unit having a threaded surface receiving said threaded extension; means biasing said extension in one direction in said recess and effecting a close engagement between the surfaces of said threads on one side of each thread; the surface to surface engagement of annular portions of said threads forming the said current carrying connection; said current carrying connection being contained within said recess.

29. In switch gear having a frame unit and an angularly movable contact arm assembly unit; a rotatable connection between said frame and said contact arm assembly; said rotatable connection including a current carrying contact connection and comprising a threaded extension on one of said units; a recess in the other unit having a threaded surface receiving said threaded extension; means biasing said extension in one direction in said recess and effecting a close engagement between the surfaces of said threads on one side of each thread; the surface to surface engagement of annular portions of said threads forming the said current carrying connection; said current carrying connection being contained within said recess; said recess forming a container for a corrosion inhibiting material.

30. In switch gear having a frame unit and an angularly movable contact arm assembly unit; a rotatable connection between said frame and said contact arm assembly; said rotatable connection including a current carrying contact connection and comprising a threaded extension on one of said units; a recess in the other unit having a threaded surface receiving said threaded extension; means biasing said extension in one direction in said recess and effecting a close engagement between the surfaces of said threads on one side of each thread; the surface to surface engagement of annular portions of said threads forming the said current carrying connection; said current carrying connection being contained within said recess; said recess forming a container for a corrosion inhibiting material and means for sealing said container.

31. In switch gear having a frame unit and an angularly movable contact arm assembly unit; a rotatable connection between said frame and said contact arm assembly; said rotatable connection including a current carrying contact connection and comprising a threaded extension on one of said units; a recess in the other unit having a threaded surface receiving said threaded extension; the surface to surface engagement of annular portions of said threads forming the said current carrying connection; said recess

forming a container for corrosion inhibiting material.

32. In switch gear having a frame unit and an angularly movable contact arm assembly unit; a rotatable connection between said frame and said contact arm assembly; said rotatable connection including a current carrying contact connection and comprising a threaded extension on one of said units; a recess in the other unit having a threaded surface receiving said threaded extension; the surface to surface engagement of annular portions of said threads forming the said current carrying connection; said recess forming a container for corrosion inhibiting material; the gap between said threaded extension and the recess wall having a cross-sectional area restricting the exposed surface of the corrosion inhibiting medium to a relatively small area compared to the volume thereof.

33. In switch gear; a frame member, a hinge member and a switch blade; the hinge member being pivotally mounted at one end on said frame member; the switch blade being mounted for rotatable movement on the other end of the hinge member; a current carrying connection between the frame member and the hinge member at the pivotal mounting, and a current carrying connection between the hinge member and the switch blade at the rotatable mounting and housings individual to each of said current carrying connections; said housings each comprising a container for corrosion inhibiting medium.

34. In switch gear; a frame member, a hinge member and a switch blade; the hinge member being pivotally mounted at one end on said frame member; the switch blade being mounted for rotatable movement on the other end of the hinge member; a current carrying connection between the frame member and the hinge member at the pivotal mounting, and a current carrying connection between the hinge member and the switch blade at the rotatable mounting and housings individual to each of said current carrying connections; said housings each comprising a container for corrosion inhibiting medium, and a corrosion-resistant seal for said housings.

35. In switch gear; a frame member; a hinge member and a switch blade; the hinge member being pivotally mounted at one end of said frame member; the switch blade being mounted for rotatable movement about its longitudinal axis on the other end of the hinge member; a continuously engaged pair of sliding contact current carrying elements between the frame member and the hinge member at the pivotal mounting, and a continuously engaged pair of sliding contact current carrying elements between the hinge member and the switch blade at the rotatable mounting and housings individual to each of said sets of current carrying elements, said housings each comprising sealed containers completely encasing and protecting said current carrying elements, the current interchange surfaces of said contact members being independent of the point of angular movement of the contact arms.

36. In switch gear; a frame member; a hinge member and a switch blade; the hinge member being pivotally mounted at one end of said frame member; the switch blade being mounted for rotatable movement about its longitudinal axis on the other end of the hinge member; a continuously engaged pair of sliding contact current carrying elements between the frame member and the hinge member at the pivotal mounting, and a continuously engaged pair of sliding con-

tact current carrying elements between the hinge member and the switch blade at the rotatable mounting and housings individual to each of said sets of current carrying elements, the current interchange surfaces of said contact members being independent of the point of angular movement of the contact arms.

37. In switch gear having a frame, a hinge member pivotally mounted at one end on the frame and a switch blade rotatably mounted at the other end of the hinge member for rotation about its own longitudinal connection; an operating crank extending substantially parallel to the frame and rotatable in a plane substantially normal to the plane of pivotal movement of the hinge member; a blade crank connected to the switch blade and rotatable therewith; a link connected between said operating crank and said blade crank; rotation of said operating crank in one direction first moving said blade crank, said hinge member, and said blade angularly about the pivotal mounting of the hinge member and thereafter rotating said blade and blade crank about the longitudinal axis of the switch blade; rotation of said operating crank in the opposite direction first rotating said blade and blade crank about the longitudinal axis of the switch blade and then moving said blade crank, said hinge member and said blade angularly about the pivotal mounting of the hinge member; a swivel connection between said link and said operating crank; said swivel connection including a length compensating member automatically varying the length of the link in accordance with the relative angular position of the operating crank and the link, the extension of said operating link and cranks stopping said contact arm at a predetermined angular position thereof.

38. In switch gear having a frame, a hinge member pivotally mounted at one end of the frame and a switch blade rotatably mounted at the other end of the hinge member for rotation about its own longitudinal connection; an operating crank extending substantially parallel to the frame and rotatable in a plane substantially normal to the plane of pivotal movement of the hinge member; a blade crank connected to the switch blade and rotatable therewith; a link connected between said operating crank and said blade crank; rotation of said operating crank in one direction first moving said blade crank, said hinge member, and said blade angularly about the pivotal mounting of the hinge member and thereafter rotating said blade and blade crank about the longitudinal axis of the switch blade; rotation of said operating crank in the opposite direction first rotating said blade and blade crank about the longitudinal axis of the switch blade and then moving said blade crank, said hinge member and said blade angularly about the pivotal mounting of the hinge member; a swivel connection between said link and said operating crank; said swivel connection including a screw carried by one of said members longitudinally movable in a threaded opening carried by the other of said members and movable into and out of said threaded opening in accordance with the relative angular position of the operating crank and the link, and an additional additive length compensating connection for the opposite end of said link comprising a threaded connection between said blade and said hinge member, said last mentioned threaded connection securing the blade to the hinge member.

39. In switch gear having a frame and a contact

arm assembly pivotally mounted thereon; said contact arm assembly comprising a switch blade extending on one side of the pivotal mounting and a connection extending on the opposite side of said pivotal mounting; a counterbalancing member connected at one end thereof to the frame and at the opposite end thereof to the connection, and counterbalancing said contact arm assembly for one plane of mounting of said switch gear; an additional connection at an angle to the first connection; said counterbalancing member being connectable selectively to said additional connection for counterbalancing said contact arm assembly for another plane of mounting of said switch gear.

40. In switch gear having a frame and a contact arm assembly pivotally mounted thereon; said contact arm assembly comprising a switch blade extending on one side of the pivotal mounting and a connection extending on the opposite side of said pivotal mounting; a counterbalancing member connected at one end thereof to the frame and at the opposite end thereof to the connection, and counterbalancing said contact arm assembly for one plane of mounting of said switch gear; a pair of additional connections each at 90° to the first connection; said counterbalancing member being connectable selectively to either of said additional connections for counterbalancing said contact arm assembly for other planes of mounting of said switch gear.

41. A switch having a movable contact arm and a frame; said contact arm comprising an angularly movable hinge member mounted on said frame and a blade member mounted on said hinge member for rotation about its longitudinal axis; a current carrying connection between said blade and said hinge member; said current carrying connection comprising a plurality of contact fingers permanently secured to said blade and extending substantially parallel to the axis thereof; and a contact ring on said hinge member in a plane substantially normal to the axis of the blade; the contact fingers engaging said ring to permit rotational movement of said blade with respect to said hinge while maintaining permanent contact engagement; said contact fingers being of a current carrying resilient material; said blade comprising a rigid tubular member.

42. A switch having a movable contact arm and a frame; said contact arm comprising an angularly movable hinge member mounted on said frame and a blade member mounted on said hinge member for rotation about its longitudinal axis; a current carrying connection between said blade and said hinge member; said current carrying connection comprising a plurality of contact fingers secured to said blade and extending substantially parallel to the axis thereof; and an annular contact ring on said

hinge member in a plane substantially normal to the axis of the blade; the contact fingers engaging said ring; said contact fingers being biased toward said contact ring on said hinge member.

43. In switch gear having a frame unit and an angularly movable contact arm assembly unit; a rotatable connection between said frame and said contact arm assembly; said rotatable connection including a current carrying contact connection and comprising a threaded extension on one of said units; a recess in the other unit having a threaded surface receiving said threaded extension; means biasing said extension in one direction in said recess and effecting a close engagement between the surfaces of said threads on one side of each thread; the surface to surface engagement of annular portions of said threads forming the said current carrying connection; said recess forming a container for corrosion inhibiting material; the gap between said threaded extension and the recess wall having a cross-sectional area restricting the exposed surface of the corrosion inhibiting medium to a relatively small area compared to the volume thereof.

44. In switch gear having a frame unit and an angularly movable contact arm assembly unit, a rotatable connection between said frame and said contact arm assembly, said rotatable connection including a current carrying contact connection comprising a threaded surface on one of said units, a threaded surface for receiving said first mentioned threaded surface, means for applying pressure between the surface to surface engagement of said threaded surfaces, the surface to surface engagement of portions of said threads forming the said current carrying connection.

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