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COMBINED DUAL MOTION DISCONNECT SWITCH AND INTERRUPTER ATTACHMENT

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FIG. 1.

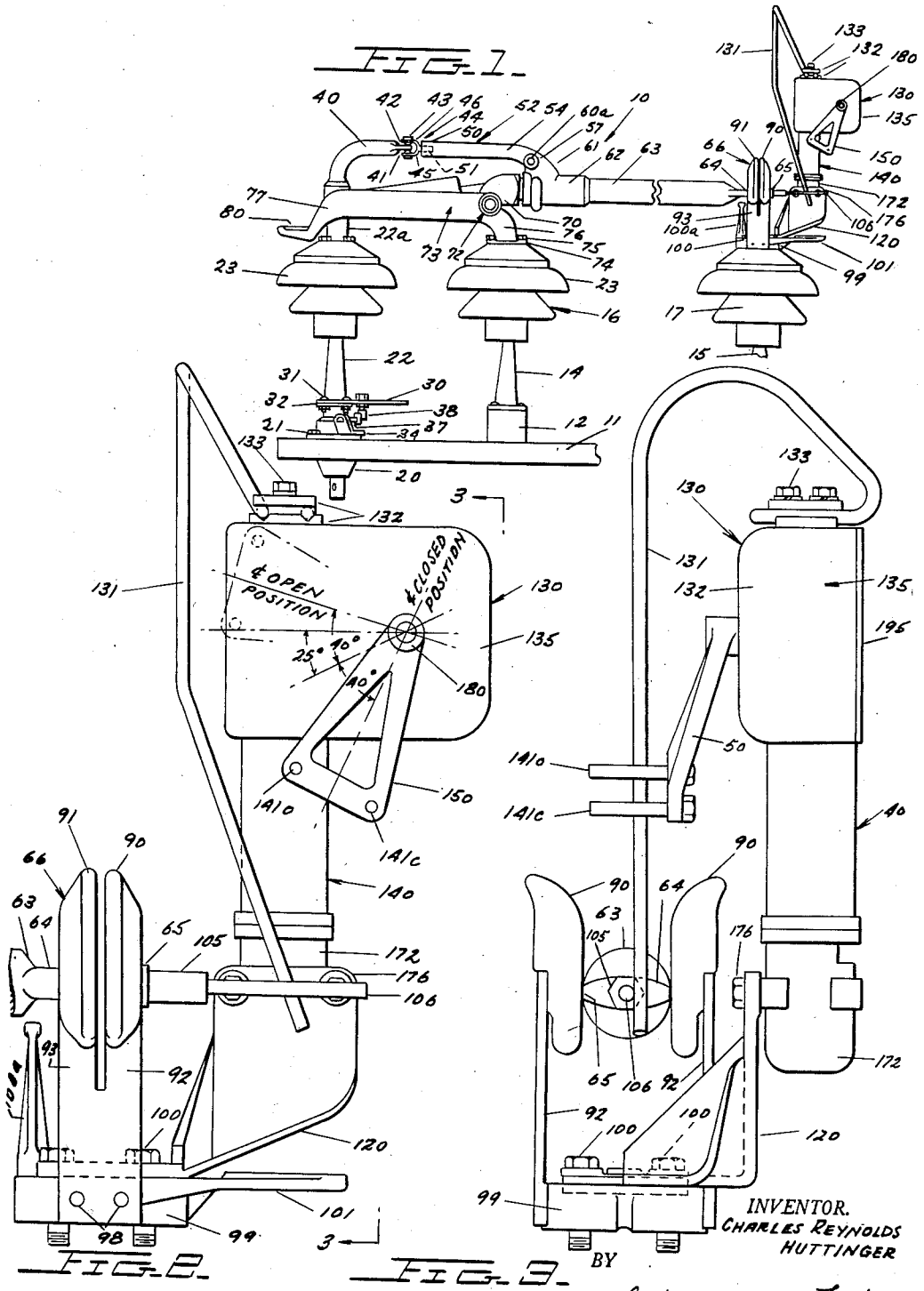


FIG. 2.

FIG. 3.

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COMBINED DUAL MOTION DISCONNECT SWITCH AND INTERRUPTER ATTACHMENT

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5 Claims. (Cl. 200—146)

My invention relates to the combination of an interrupter attachment and a disconnect switch wherein the blade of the disconnect switch revolves about its own axis and subsequently rotates about its hinge during the opening operation.

Disconnect switches are used in high voltage lines where it is desirable to isolate the load to enable the workman to inspect or repair the line.

The primary function of the disconnect switch is to provide a sufficient airgap so that the load will be completely isolated isolated from the source. However, this type of switch is usually designed to be opened or closed on a circuit which is not carrying load circuit. In the event an attempt is made to open a disconnect switch on a circuit which is carrying load current, severe damage may be done to either the switch or the circuitry.

In order to modify the disconnect switch so that it can be opened on circuits carrying load current, these switches have been adapted with interrupter attachments. The interrupter attachment has a pair of cooperating contacts which are placed in electrical parallel with the cooperating contacts of the disconnect switch.

During the opening operation of the disconnect switch, electrical engagement between the blades of the switch and the interrupter attachment must be either made or maintained so that the interrupter attachment contacts are in parallel with the disconnect switch contacts when these contacts are opened. Thereafter, the continued opening movement of the disconnect switch blade makes mechanical engagement with the operating lever of the interrupter attachment to thereby drive the cooperating contacts of the interrupter attachment open. Thus, all the interrupting duty is placed on the cooperating contacts of the interrupter attachment and thereby relieves the main contacts of the disconnect switch from this duty. Upon continued opening movement of the disconnect switch blade, it is necessary that the blade break electrical contact with the interrupter attachment so that a sufficient space exists between the moving blade and its stationary jaw to provide the necessary isolation of the load.

During the closing operation of the blade of the disconnect switch, it is necessary to remake electrical engagement between the blade of the disconnect switch and the interrupter attachment. Thereafter, a mechanical connection is made between the blade and a disconnect switch to thereby drive the cooperating contacts of the interrupter attachment closed prior to the time that the contacts of the disconnect switch are closed. Thus, any arcing which may exist if the unit is closed on a hot line will exist across the cooperating contacts of the interrupter attachment rather than the disconnect switch contacts. Thereafter, the cooperating contacts of the disconnect switch are closed and as soon as the contacts of the interrupter attachment are parallel therewith, no arcing will occur across these contacts.

The above described combination of an interrupter attachment and a disconnect switch plus the general sequence outlined have been used in the prior art. However, in the prior art, the interrupter attachment has been successfully adapted to only two types of switch, namely, the single throw disconnect switch in which the blade has rotation only about its hinge and does not rotate about its own axis. This type of disconnect switch is illustrated in Patent 2,738,402, Patent 2,789,189, Patent 2,787,690, and copending application (E–49) Serial No. 483,737, filed January 24, 1955, all of which are assigned to the assignee of the instant application.

In addition to this type of switch, the interrupter attachment has also been applied to side opening disconnect switches of the type shown in Patent 2,688,667 and Patent 2,702,323, both of which are assigned to the assignee of the instant application.

However, in recent years, with the increase in the magnitude of load currents and available short-circuit currents, the dual motion type switch has been extensively used in high voltage circuits. This type of switch has a blade which, during the closing operation, initially rotates about its hinge and thereafter makes high contact pressure engagement with the stationary jaw by revolving about its own axis. This type of switch is shown and described in Patents 2,658,964, 2,673,902, 2,673,903, 2,673,904 and 2,673,913, all of which are assigned to the assignee of the instant application.

Since, as above noted, the blade of the disconnect switch must both make electrical and mechanical connection with the interrupter attachment, prior attempts to adapt this type of switch with an interrupter attachment have not been successful. That is, since the blade revolves about its own axis, it also rotates about its pivotal hinge during both the opening and closing operation. Prior attempts have been unsuccessful to enable this dual motion blade to mechanically and electrically engage an interrupter attachment during the opening and closing operation.

My invention is directed to a novel combination of an interrupter attachment to a dual motion disconnect switch wherein the desired and required sequence of operation between these two components is achieved in spite of the dual motion of the blade.

Accordingly, a primary object of my invention is to provide an interrupter attachment for a high pressure contact disconnect switch having a blade with dual motion.

Another object of my invention is to provide a combination of a disconnect switch and an interrupter attachment wherein a standard type dual motion blade disconnect switch can be adapted with an interrupter attachment without substantial alteration to the disconnect switch.

These and other objects of my invention will be apparent from the following description when taken in connection with the drawings in which:

Figure 1 is a side view of a dual motion disconnect switch in the closed position. This figure also illustrates the interrupter attachment adapted to the jaw end of the switch.

Figure 2 is an enlarged side view of the jaw end of the combined disconnect switch and interrupter attachment of Figure 1.

Figure 3 is an enlarged end view of the disconnect switch and interrupter attachment of Figure 1 and is taken in the direction of the arrows 3—3 of Figure 2.

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 up-

right 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 22*a* 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 22*a* 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 receives the extension 41 and is secured thereto by 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.

Link 52 has two legs 54 at the opposite end of the tapped opening 51 terminating in the bearings 57.

The blade support sleeve casting 62 carries a tubular switch blade 63 secured therein and rotatable therewith. The blade crank 61, which is an extension of the sleeve casting 62, has openings which register with the openings in the legs 54 so that a pin 60*a* passes therethrough. The outer end of the tubular switch blade is flattened at 64 and is provided with appropriate contacts 65 engageable with the stationary contact jaw 66. The blade sleeve casting 62 is mounted for rotation about its longitudinal axis on an extension of the hinge casting 70. The hinge casting 70 is in turn rotatably mounted on the hinge bearing indicated generally at 72 on the forked frame casting 73.

The frame casting 72 has a horizontal section 74 secured in any suitable manner as by bolts 75 to the top of the insulator 16. The sides 76 of the frame casting 73 provide supports for the hinge bearing 72. The frame casting 73 also extends toward the end 77 and is provided with an opening properly recessed to form a bearing for the crank 40 and its shaft 22*a*. The solid portion 77 of the base casting 73 then extends beyond to form a terminal 80 to which appropriate leads may be connected.

The stationary contact 66 comprised of the plurality of contact blades 90—91 has each side biased toward each other by a spring support member 92 and 93. The blade beaver-tail 64 enters at an angle to the horizontal during the closing operation, and will clear the stationary contacts 90—91 on each side. These contacts are so arranged, however, that when the blade 63 is thereafter rotated about its own axis, the beaver tail portion 64 in turn will rotate to its horizontal position and will spread the stationary contacts 90—91 on each side against the tension of the springs 92—93 thereby creating the desired contact pressure. The spring blades 92—93 are current conducting and are connected in any suitable manner to the base plate 99 as for example by bolts 98.

The base plate 99 is secured to the insulator 17 in any suitable manner as for example by means of the bolts 100 which also serve to secure the interrupter attachment maintaining bracket 120 thereto.

The base 99 of the stationary contact structure has an extension 101 which serves as a terminal block or connecting member. Thus, when the disconnect switch 10 is in the closed position of Figure 1, current enters through the terminal 80, passes through frame casting 73 to the hinge bearing 72, then through the current carrying connection in the hinge bearing 72, the hinge casting 70, then through current carrying connection of the contact blade to the switch blade 63, then through the beaver tail 64 to the stationary contacts 90 and 91, then through the base 99 to the terminal extension 101.

When the switch 10 is in the fully closed position illustrated in Figure 1, then initial rotation of the operating crank 30 will be transmitted through the crank 40 to the link 52 and will result in initial rotation of the blade 63 about its own axis. This initial rotation of the blade 63 about its own axis will relieve the high pressure engagement between its beaver tail 64 and its stationary contacts 90—91.

Continued rotation of the operating crank 30 will thereby be transmitted through the members 40—52 to thereby move the blade 63 about its hinge support 72. In like manner, the closing operation is achieved by this dual rotation.

Opposite rotation of the operating crank 30 will then be transmitted again through the members 40—52 so that the blade 63 will be initially rotated about its pivot 72. As it enters the jaw formed by the stationary contacts 90—91, it will be rotated about its own axis to thereby make high pressure contact engagement with the stationary contacts.

A detailed description of the switch and its operation is contained in Patent 2,673,902.

In Figures 2 and 3, I have shown an enlarged view of the manner in which the interrupter attachment is placed on the disconnect switch 10 so that the desired mechanical and electrical sequence of operation can be obtained even though the blade 63 has dual motion.

The interrupter attachment 130 is of the type and operates as shown and described in copending application Serial No. 483,737, filed January 24, 1955, which is assigned to the assignee of the instant invention. The interrupter attachment 130 is provided with a housing 135 which has an operating shaft 180 extending through one side thereof. The operating lever 150 is rigidly secured to the operating shaft 180.

The interrupter attachment also has an interrupting chamber 140 with a mounting base muffler 172 at the bottom thereof. The base 172 is provided with mounting lugs 176 so that the interrupter attachment 130 can be mechanically and electrically secured to the mounting bracket support 120. The other end of the mounting bracket support 120 is mechanically and electrically secured to the base 99 of the switch 10 by means of the bolts 100.

The stationary contact contained within the interrupting chamber 140 is permanently and electrically connected to the base 172 in a manner fully described in the above mentioned application, Thus, the stationary contact of the interrrupter attachment is permanently and electrically connected to the jaw end of the disconnect switch 10 through the base 172, supporting base 120 to the base plate 99.

The movable contact of the interrupter attachment 130 is permanently electrically connected to the conductive housing 135. A stationary shunt horn 131 is rigid-

ly mechanically and electrically secured to the housing **135** by means of the horn clamp **132** and the bolts **133**.

As heretofore noted, the blade **63** has a beaver tail portion **64** by which it makes high pressure contact engagement with the jaw end **90—91** of the disconnect switch. In order to adapt the disconnect switch to the proper mechanical and electrical sequence of operation with the interrupter attachment, an extension is provided on the blade **63—64**. The extension is comprised of a lock nut **105** which is secured to the beaver tail **64** in any desirable manner. A cylindrical conductive section **106**, which may be threadably engaged with the lock nut **105**, is provided as an extension for the blade **63—64** and hence, is at the same potential as the blade **63**.

The resilient stationary shunt horn **131** is properly positioned so that it is biased toward and into electrical engagement with the extension **106** of the blade **63**. Thus, as clearly seen in Figures 2 and 3, the interrupter attachment **130** is electrically connected in parallel with the jaw and blade of the disconnect switch **10**.

By providing a cylindrical extension **106** for the blade **103**, the relative position of this unit with respect to the stationary arcing horn **131** remains the same when the blade **63** is initially rotated about its own axis. That is, since the stationary arcing horn **131** is biased into electrical engagement with the extension **106**, the rotation of the member **106** about its own axis will not disengage or change the relative position of this member in a horizontal plane with respect to the horn **131**.

Thus, during the initial opening operation of the disconnect switch **10**, electrical engagement can either be made or maintained with the interrupter attachment **130**. Following the rotation of the blade **63** about its own axis to thereby disengage the beaver tail **64** from the cooperating jaws **90—91**, the blade is rotated about its hinge **72**. Thus, the extension **106** will move in an arcuate path upwardly and will retain its electrical engagement with the stationary shunt horn **131**.

As seen in the figures, the pin **141***o* is positioned within the arcuate path of the extension **106** of the blade **63**. Hence, during the opening operation, the extension **106** will engage the pin **141***o* thereby rocking the operating lever **150** in a clockwise direction about its axis **180**. After a predetermined rotation of the operating lever **150**, the cooperating contacts within the interrupting chamber will be opened with snap action as fully described in the above noted copending application. Thereafter, the blade **63** will continue to rotate upwardly and its extension **106** will both disengage the pin **141***o*, which will have rotated out of the path of movement of the extension **106**, and also eventually disengage the stationary shunt horn **131** when the blade **63** is rotated to a position which is approximately 30° to 40° to its fully closed position illustrated in Figure 1. At this time, the operating lever will assume the dotted position illustrated in Figure 2.

Thus, it will be noted that during the opening operation, both electrical and mechanical engagement between the blade **63** and the interrupter attachment **130** can be maintained even though the blade **63** has dual motion, namely, about its own axis and about its hinge. Furthermore, a proper sequence of operation is still obtained in spite of the dual motion of the blade, namely, the electrical engagement with the interrupter attachment prior to the disengagement of the main contacts of the disconnect switch, the mechanical engagement with the interrupter and also the mechanical and electrical disengagement between the disconnect switch and the interrupter after the disconnect switch contacts have opened and the interrupter attachment contacts have opened in that order.

The reverse of the above noted sequence also occurs during the closing operation in spite of the dual motion operation of the blade **63**. That is, during the closing operation, the extension **106** of the blade **63** initially makes contact with the stationary shunt horn **131**. Thereafter, it engages the pin **141***c* of the operating lever **150** (which is in the dotted position of Figure 2) and rotates this member in a counterclockwise direction so that the cooperating contacts of the interrupter attachment are now closed with snap action before the main contacts of the disconnect switch are closed. Thereafter, the main contacts of the disconnect switch are closed and since the contacts of the interrupter attachment, which are connected in parallel therewith, have already closed, there will be no arcing or damage to the contacts of the disconnect switch.

Thus, I have provided a novel arrangement wherein an interrupter attachment having a single operating lever for both opening and closing the cooperating contacts is mounted on a disconnect switch having a blade with dual motion and in which the desired and required sequence of mechanical and electrical operation is obtained in spite of the dual motion of the blade.

In the foregoing, I have described my invention only in connection with preferred embodiments thereof. Many variations and modifications of the principles of my invention within the scope of the description herein are obvious. Accordingly, I prefer to be bound not by the specific disclosure herein but only by the appending claims.

I claim:

1. A disconnect switch having a hinge end and a jaw end; a blade pivotally supported at said hinge end; means to rotate said blade about said hinge end and about its own axis into high pressure contact engagement with said jaw end; an interrupter attachment being comprised of a housing section and an interrupter section; an operating lever extending from one side of said housing section for controlling the opening and closing of cooperating contacts within said interrupter section; a conducting bus on said interrupter section mounted at the jaw end of said disconnect switch; a stationary shunt horn mounted on the housing of said interrupter attachment; said blade of said disconnect switch having an extension made of conducting material; said stationary shunt horn operatively positioned in electrical engagement with said extension of said blade; said extension engaging said operating lever during the opening operation of said disconnect switch while maintaining electrical engagement with said stationary shunt horn; said extension operative to rotate said operative lever to effect contact disengagement within said arc chamber while maintaining electrical engagement with said stationary shunt horn; said extension disengaging said stationary shunt horn when said blade of said disconnect switch is moved to a fully open position.

2. A disconnect switch having a hinge end and a jaw end; a blade pivotally supported at said hinge end; means to rotate said blade about said hinge end and about its own axis into high pressure contact engagement with said jaw end; an interrupter attachment being comprised of a housing section and an interrupter section; an operating lever extending from one side of said housing section for controlling the opening and closing of cooperating contacts within said interrupter section; a conducting bus on said interrupter section mounted at the jaw end of said disconnect switch; a stationary shunt horn mounted on the housing of said interrupter attachment; said blade of said disconnect switch having an extension made of conducting material; said stationary shunt horn operatively positioned in electrical engagement with said extension of said blade; said extension engaging said operating lever during the opening operation of said disconnect switch while maintaining electrical engagement with said stationary shunt horn; said extension operative to rotate said operative lever to effect contact disengagement within said arc chamber while maintaining electrical engagement with said stationary shunt horn; said extension disengaging said sta-

tionary shunt horn when said blade of said disconnect switch is moved to a fully open position; said shunt horn and said operating lever positioned in the path of movement of said extension when said blade of said disconnect switch is moved from the fully open position to the fully closed position.

3. A disconnect switch having a hinge end and a jaw end; a blade pivotally supported at said hinge end; means to rotate said blade about said hinge end and about its own axis into high pressure contact engagement with said jaw end; an interrupter attachment being comprised of a housing section and an interrupter section; an operating lever extending from one side of said housing section for controlling the opening and closing of cooperating contacts within said interrupter section; a conducting bus on said interrupter section mounted at the jaw end of said disconnect switch; a stationary shunt horn mounted on the housing of said interrupter attachment; said blade of said disconnect switch having an extension made of conducting material; said stationary shunt horn operatively positioned in electrical engagement with said extension of said blade; said extension engaging said operating lever during the opening operation of said disconnect switch while maintaining electrical engagement with said stationary shunt horn; said extension operative to rotate said operative lever to effect contact disengagement within said arc chamber while maintaining electrical engagement with said stationary shunt horn; said extension disengaging said stationary shunt horn when said blade of said disconnect switch is moved to a fully open position; said extension engaging said stationary shunt horn and said operating lever when said blade of said disconnect switch is moved from the fully open position to the fully closed position; said extension maintaining electrical engagement with said stationary shunt horn when said extension mechanically moves said operating lever from open to closed position during the closing operation of said disconnect switch.

4. A disconnect switch having a hinge and jaw end; a blade pivotally mounted on said hinge end; means to rotate said blade about said hinge end and also to rotate said blade about its own axis in high pressure engagement with said jaw end; an interrupter attachment secured to the jaw end of said disconnect switch; said interrupter attachment having an operating lever with a first and second position; said operating lever operatively connected to disengage cooperating contacts of said interrupter attachment when moved from said first position to said second position; said operating lever operative to effect engagement of cooperating contacts of said interrupter attachment when said operating lever is moved from said second position to said first position; said blade of said disconnect switch sequentially making electrical and mechanical engagement with said interrupter attachment during the opening and closing operation of said disconnect switch; said blade operative to move said operating lever from said first position to said second position while maintaining electrical engagement with said interrupting attachment during the opening operation of said disconnect switch; said blade operative to move said operating lever from said second position to said first position while maintaining electrical engagement with said interrupting attachment during the closing operation of said disconnect switch.

5. A disconnect switch having a hinge end and a jaw end; a blade pivotally supported at said hinge end; means to rotate said blade about said hinge end and about its own axis into high pressure contact engagement with said jaw end; an interrupter attachment being comprised of a housing section and an interrupter section; an operating lever extending from one side of said housing section for controlling the opening and closing of cooperating contacts within said interrupter section; a conducting bus on said interrupter section mounted at the jaw end of said disconnect switch; a stationary shunt horn mounted on the housing of said interrupter attachment; said blade of said disconnect switch having an extension made of conducting material; said stationary shunt horn operatively positioned in electrical engagement with said extension of said blade; said extension engaging said operating lever during the opening operation of said disconnect switch while maintaining electrical engagement with said stationary shunt horn; said extension operative to rotate said operative lever to effect contact disengagement within said arc chamber while maintaining electrical engagement with said stationary shunt horn; said extension disengaging said stationary shunt horn when said blade of said disconnect switch is moved more than 40° toward open position.

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