

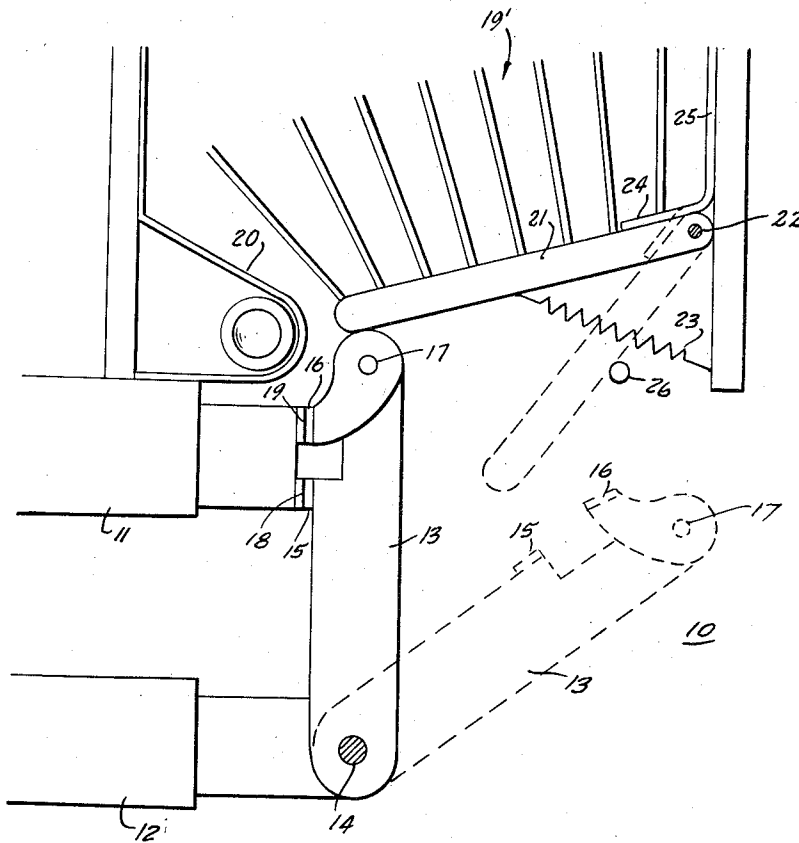
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PIVOTALLY MOUNTED RETURN CONNECTION

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PIVOTALLY MOUNTED RETURN CONNECTION

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My invention relates to circuit breakers and is more particularly directed to a pivotally mounted return connection which is in electrical engagement with a movable contact arm only during the initial opening movement thereof.

In the prior art arrangements, circuit breakers have been designed with both a stationary front arcing horn and a permanent flexible lead connection from the front of the arc chute to the movable contact. Thus, during the opening operation of the circuit breaker, the above configuration formed by the front and back arc horn provide a venturi effect for the arc to thereby force it into the arc chute. This venturi effect, due to the position of the arc horns, exists only during the initial opening movement of the movable contact. Thus, after the arc is forced into the arc extinguishing means and the movable contact arm has moved to its completely open position, it is necessary to provide the above mentioned return path from the front end of the arc horn to the movable contact arm. This arrangement was necessary in order to avoid the highly undesirable striking of an arc between the front end of the arc chute and the movable contact arm to thereby ionize the gases in this region. Thus, it was necessary to provide a permanent flexible connection from the front end of the arc chute to the movable contact arm in order to eliminate restriking and ionization of the gases in the region surrounding the movable contacts.

Although the permanent return connection from the arc chute to the movable contact arm has the advantage of eliminating the above mentioned undesirable effect, it has an inherent disadvantage when the circuit breaker is in the completely open static condition.

Even though the arc plates of the arc chute are made of an insulating material, a moist atmosphere may result in a conducting path from the stationary contact through the arc plates of the arc chute down through the flexible return lead to the movable contact arm. That is, even though the circuit breaker is in the fully open position, the source potential applied across the disengaged cooperating contacts may find an electrical path through the arc chute thereby resulting in current flow even though the circuit breaker is in the fully open position.

Although the magnitude of the current flowing through the arc chute when the circuit breaker is in the static open position may only be of the magnitude of a few milli amperes, it may be sufficient to create a dangerous condition. This is especially true if the load being protected by the circuit breaker is a motor or other type of rotating equipment.

My instant invention is directed to a novel construction whereby the flow of leakage current through the arc chute when the circuit breaker is in the open position is completely eliminated. I achieve this desirable result by providing a pivotally mounted front arc horn which will be engaged by the movable contact arm when this latter unit is in the engaged or closed position.

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The movable front arc horn is biased toward the front of the arc chute but movement thereof is prevented by the movable contact arm when the circuit breaker is closed. During the initial opening operation of the circuit breaker, the movable arc horn of my invention is in V-relationship with the stationary arc horn associated with the stationary contact member so that a desirable venturi effect upon the arc will exist during the initial opening operation. During the continued opening movement of the movable contact arm, the movable front arc horn associated therewith will follow the movable contact due to the biasing force exerted on the horn. Thus, even though the arc has been moved up into the arc extinguishing means, the continued electrical engagement between the front arc horn and the movable contact arm will provide a return path for the current prior to the complete extinction of the arc. Thus, after the arc has been lifted or forced into the arc chute, the arc will be confined thereto and there will be no arcing to reionize the gases within the area occupied by the cooperating contacts. That is, since there is a continuous conducting path from the movable front arc horn to the movable contact arm, there will be no arc in this area and hence, no undesirable reionization of the air in this area will result.

In the prior art arrangement, above described, a permanent return path was provided from the arc chute to the movable arc horn so that a return path might be provided during the period of time following the movement of the movable contact arm past the front arc horn till the time the movable arc horn reaches a point prior to its open position. However, after the movable contact arm has reached a point in the opening stroke where the arc has been completely extinguished, the return through the movable contact arm is not required.

My novel apparatus is so constructed that after the movable contact arm has reached a predetermined position during which period of time the arc should be extinguished, the return path through the movable arcing horn is automatically interrupted. That is, at a time within the opening stroke after the arc has been extinguished, the electrical connection between the movable front arcing horn and the movable contact arm is automatically interrupted thereby removing the return path which is no longer needed. Thus when the movable contact arm has reached its full open position, i. e., in the static open position, no return path will exist from the arc chute through the movable contact arm. Hence, the disadvantages above noted with regard to the prior art arrangement is eliminated. That is, even though a moist atmosphere or other similar condition may exist to render the arc plates of the arc chute partially conductive, no return path will exist from the arc horn to the movable contact arm due to the automatic separation of the movable contact arm from the movable front arc horn.

It will be noted that it is necessary for automatic interrupting equipment to withstand an impulse test whereby a predetermined voltage can be applied across the open or disengaged cooperating contacts without having breakdown therebetween and also the circuit breaker must withstand this impulse test without having leakage current between its cooperating contacts. That is, the circuit breaker must be able to withstand a predetermined magnitude of voltage across its opened contacts without striking an arc therebetween and without having leakage current flowing therebetween. However, in the event a moist atmosphere exists, it is possible that the circuit breaker will not withstand the impulse test since the magnitude of voltage may be sufficient to cause a current flow from the movable contact arm to the arc chute through the permanent return lead to the front of the arc chute which is provided in the prior art arrangements.

With the pivotally mounted movable front arc horn of my invention, the return path from the movable contact arm to the arc chute through the return lead is eliminated. Hence, the circuit breaker will be able to withstand the impulse test without having leakage current flow between the cooperating contacts since a large arc gap will not only exist between the cooperating contacts but also between the movable contact arm and the arc chute or movable front arc horn.

Accordingly, with my novel apparatus, the problems and disadvantages of the prior art circuit breakers having a flexible permanent return path and movable contact arm are completely eliminated.

The novel operating mechanism of my invention not only overcomes all of the disadvantages and problems of the prior art arrangements but also maintains all of the desirable features thereof. Thus, the operating mechanism can be either manually or automatically closed and is provided with trip free operation.

Accordingly, a primary object of my invention is to provide a circuit breaker construction in which continuous contact engagement is maintained between the movable contact arm and a movable front arc horn during the initial part of the opening motion to thereby render it unnecessary to provide a return lead from the arc chute to the movable contact arm in the final open position.

Another object of my invention is to provide a pivotally mounted movable contact arc horn for a circuit breaker which moves with the movable contact arm and maintains electrical contact therewith during the initial opening operation and thereafter permits the movable contact arm to separate therefrom.

Another object of my invention is to provide an interrupting device which eliminates the necessity for a permanent return lead from the arc chute to the movable contact arm.

A still further object of my invention is to provide an arcing horn and movable contact arm combination which serves as a return connection to the lower lead and the circuit breaker during the initial portion of the opening operation and also provides an air gap therebetween when the circuit breaker is in the final open position.

Still another object of my invention is to provide a circuit breaker arrangement in which a V-relationship exists between the arcing horns in which one of the arcing horns serves as a return lead to the movable contact arm.

A still further object of my invention is to provide a spring biased member which serves as an arcing horn and a return lead during the initial opening operation.

Another object of my invention is to provide an arcing horn-return lead for a circuit breaker which is in electrical contact with the movable contact arm during the initial opening operation thereof with means to cause separation therebetween when the circuit breaker is in a final open position.

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

The figure is a side schematic view of one pole of a multi-pole circuit breaker illustrating the position of the components when the circuit breaker is in the closed position. The circuit breaker 10 is provided with an upper line terminal 11 and a lower line terminal 12 which is bridged by the movable contact arm 13. Movable contact arm 13 is pivotally mounted on one end of the line terminal 12 at point 14, and at the other end contains the movable main contact 15 and the movable arcing contact 16.

The movable arcing contact 16 may be pivotally mounted on the movable contact arm 13 at point 17. The upper line terminal or side 11 is provided with a stationary main contact 18 and a stationary arcing contact 19 which respectively cooperate with the movable main contact 15 and the arcing contact 16. Arc chute 19 having a plurality of spaced parallel plates perpendicular to the arc

formed between the cooperating contacts 15—18 and 16—19 is positioned above the cooperating contact structure. The arc chute has a stationary back arc horn 20 which is electrically connected to the upper line terminal 11.

The movable front arcing horn 21 which forms the basis of my invention is pivotally mounted at point 22 and is biased in a clockwise direction by means of the spring 23 which is secured at one end to the arc horn 21 and at its opposite end to some stationary point within the breaker. The movable front arcing horn 21 is in continuous electrical contact with the flexible metallic member 24 which is a continuation of a metal side wall 25 of the arc chute 19. A stop pin 26 is permanently mounted within the breaker to limit the counterclockwise rotation of the movable front arcing horn 21, as will hereinafter be more fully described.

When the circuit breaker is in the closed position as indicated by the solid lines of the figure, a complete current path will be provided from the lower terminal 12 through the pivot point 14 to the movable contact arm 13, main movable contact 15 to the main stationary contact 18 to the upper line terminal or stud 11. When the circuit breaker is in this closed position, the movable front arcing horn 21 is in electrical engagement with the movable contact arm 13 as illustrated.

When the circuit breaker starts to open, the main current path will transfer from the main contacts 15—18 to the arcing contact 16—19. It will be noted that during this period of time, the movable front arc horn 21 will be in continuous electrical engagement with the movable contact arm 13. Following the separation of the cooperating arcing contact 16—19, the arc will be transferred from the arcing contact 16—19 to the stationary back arcing horn 20 and the movable front arcing horn 21.

Since the movable front arcing horn 21 is biased in a counterclockwise direction by means of the spring 23, it will be continuously urged into electrical engagement with the movable contact arm 13 during this initial opening operation. Thus, it will be noted that the V-relationship between the stationary back arcing horn 20 and the movable front arcing horn 21 will be maintained and thus, the arc extinguished therebetween will be under the influence of a venturi effect.

As the arc is moved up into the arc chute either by a blow out coil or the above mentioned venturi effect and prior to the final open position of the breaker, the movable front arcing horn 21 will continue to remain in electrical engagement with the movable contact arm 13 to thereby provide a return lead to the lower terminal or stud 12. That is, as the movable contact arm 13 is continuously rotated in the clockwise direction, the biasing spring 21 will continuously rotate the movable contact arm 21 in a counterclockwise direction thereby maintaining an electrical return path as long as the arc exists.

When the movable contact arm 13 reaches a point intermediate the completely closed position indicated by the solid lines and the fully open position indicated by the dotted lines, the movable arcing horn 21 will be moved against its stop pin 26 to thereby limit its counterclockwise rotation. Thus, following this initial movement of the movable contact arm, and after the arc has been extinguished in the arc chute 19, the movable contact arm 13 will continue to move to its fully open position and will no longer be in electrical engagement with the movable front arcing horn 21. That is, since electrical contact is maintained between the arc horn 21 and the movable contact arm 13 during the initial movement of the arm 13 due to the biasing spring 23, there will be automatic separation between these two members when the arc horn 21 engages stop pin 26 and the movable contact arm 13 continues to move to its fully open position. Thus, at the period of time after the arc has been extinguished and there is no longer a necessity for a return line to the lower terminal 12, there will be an automatic

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separation between the arc horn 21 and the movable contact arm 13.

Thus, I have provided a novel arrangement wherein the member 21 serves as an arcing horn immediately following (second position) the separation of the cooperating contacts and thereafter serves as a return lead to the lower line terminal 12 when the movable contact arm 13 is in intermediate opening position.

With the circuit breaker of my invention, the necessity of a separate independent return lead to the lower line terminal 12 is completely eliminated by providing a novel movable front arcing horn.

Since an air gap exists between the movable front arcing horn and the movable contact arm 13 when the circuit breaker 10 is in the fully open position, there will be no danger of leakage current flowing through the arc chute when the circuit breaker 10 is either on an energized line or subjected to an impulse test.

It will be noted that during the closing operation of the circuit breaker, the reverse sequence of events will take place. That is, the movement of the movable contact arm from its fourth or fully open position to a third intermediate position will bring the free end of the contact arm 13 into engagement with the movable front arcing horn 21. Thereafter, as the movable contact arm 13 is moved from this third intermediate position toward its first or fully closed position, indicated by the solid lines in the drawing, it will push the movable front arcing horn 21 in a clockwise direction about its pivot 22 against the bias of the spring 23. Thus, if the circuit breaker is in the fully closed position, the components will assume the position indicated by the solid lines of the figure.

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. In a circuit breaker having a stationary contact and a movable contact; said stationary contact being electrically connected to one line terminal of said circuit breaker and said movable contact being electrically connected to a second line terminal of said circuit breaker; said movable contact having a closed and open position with respect to said stationary contact; a stationary arcing horn and a movable arcing horn; said stationary arcing horn electrically associated with said stationary contact; said movable arcing horn electrically associated with said movable contact when said movable contact is in said closed position; a first means to maintain said movable arcing horn in electrical contact with said movable contact during a portion of its travel from said closed position to said open position; a second means to prevent electrical engagement between said movable arcing horn and said movable contact when said movable contact is in said open position.

2. In a circuit breaker having a movable and stationary contact; said movable contact having an engaged and disengaged position with respect to said stationary contact; a stationary back arcing horn; said stationary arcing horn permanently connected to said stationary contact; a movable arcing horn selectively connected to said movable contact; a first means to maintain said movable arcing horn in electrical contact with said movable contact during a portion of its travel from said engaged position to said disengaged position; a second means to prevent electrical engagement between said movable arcing horn and said movable contact when said movable contact is in said disengaged position.

3. In a circuit breaker having a movable and stationary contact; said movable contact having an engaged and disengaged position with respect to said stationary contact; a stationary back arcing horn; said stationary arcing horn

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permanently connected to said stationary contact; a movable arcing horn in electrical connection with said movable contact when said movable contact is in said engaged position; a first means to maintain said movable arcing horn in electrical contact with said movable contact during a portion of its travel from said engaged position to said disengaged position, said movable arcing horn spaced from said movable contact when said movable contact is in said disengaged position.

4. In a circuit breaker having a movable and stationary contact; said movable contact having an engaged and disengaged position with respect to said stationary contact; a stationary back arcing horn; a movable front arcing horn pivotally mounted on said circuit breaker and biased toward said movable contact; said stationary arcing horn permanently connected to said stationary contact; said movable arcing horn selectively connected to said movable contact; a first means to maintain said movable arcing horn in electrical contact with said movable contact during a portion of its travel from said engaged position to said disengaged position; a second means to prevent electrical engagement between said movable arcing horn and said movable contact when said movable contact is in said disengaged position.

5. In a circuit breaker having a stationary contact, a pivotally mounted movable contact, a stationary arcing horn, and a movable arcing horn; said movable arcing horn pivotally mounted on said circuit breaker and biased toward said movable contact; said movable contact having a closed and open position with respect to said stationary contact; a biasing means maintaining electrical engagement between said movable arcing horn and said movable contact when said movable contact is in said closed position and as said contact moves toward said open position; means to interrupt the electrical connection between said movable arcing horn and said movable contact when said movable contact is in said open position.

6. In a circuit breaker with a movable contact arm having a first and second position; a pivotally mounted spring biased member mounted on said circuit breaker for electrical engagement with said movable contact arm when said contact arm is in said first position; said pivotally mounted spring biased member serving as an arcing horn when said movable contact arm is moved from said first position toward said second position; means to disconnect said pivotally mounted biased member from said movable contact when said movable contact is in said second position said pivotally mounted biased member serving as a return lead prior to said disconnection by said means, said means ineffective to prevent electrical contact between said pivotally mounted arcing horn and said movable contact arm during a portion of the movement from said first to said second position.

7. In a circuit breaker having an upper and lower line terminal; stationary contacts electrically connected to said upper line terminal; a movable contact arm pivotally mounted on and electrically connected to said lower line terminal; movable contacts mounted on the free end of said movable contact arm; a stationary arcing horn and a movable arcing horn; said stationary arcing horn electrically connected to said upper line terminal; said movable arcing horn pivotally mounted on said circuit breaker and biased toward said movable contact; said movable arcing horn biased into electrical engagement with said movable contact arm when said movable contacts of said movable contact arm are in engagement with said stationary contacts; said movable arcing horn remaining in electrical engagement with said movable contact arm when said movable contacts initially separate from said stationary contacts; said movable arcing horn in electrical engagement with said movable contact arm to serve as a return connection when said movable contact arm is in a position between said initially separated position and fully opened position; means to prevent the electrical engagement between said movable arcing horn and said

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movable contact arm when said movable contact arm is in said fully opened position.

8. In a circuit breaker having a movable contact, a stationary contact and an arc chute; said arc chute positioned above said movable and stationary contact and having a stationary back arcing horn and a movable front arcing horn pivotally mounted thereon; said stationary back arcing horn electrically connected to said stationary contacts; said movable contacts being in electrical engagement with said pivotally mounted movable first arcing horn when said movable contacts are in engagement with said stationary contacts and also when said contacts are initially separated; biasing means to maintain said movable front arcing horn in electrical engagement with said movable

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contacts when said movable contacts are in a position preceding the fully open position; means to render said biasing means ineffective to maintain electrical contact between said movable front arcing horn and said movable contact when said movable contact is in said fully open position.

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