

DESCRIPTION

VEHICULAR FUEL SUPPLY APPARATUS

TECHNICAL FIELD

This invention relates to a circuit breaker and, more particularly, to a circuit breaker having a function of restricting the handle position to a predetermined position between a closed position and an open position when the contacts are welded together in the closed position (hereinafter referred to as the isolation function).

BACKGROUND ART

Fig. 8 is sectional view of the main portion of an opening and closing mechanism unit showing a conventional circuit breaker disclosed in Japanese Patent Laid-Open No. 4-229920, for example. In the figure, 1 is stationary contact member mounted to a housing or a base (not shown) and has a stationary contact 2. 3 is a movable contact member including a movable contact 4 capable of contacting and separating the stationary contact 2 and is pivotally supported by a pivot pin 5. 6 is a cross bar made of an insulating material and connecting one end of each of the movable contact members for the respective pole units. 7 is an arc extinguisher for extinguishing an electric arc generated between the separated contacts 2 and 4.

8 is a movable contact member side link (hereinafter referred to as a lower link) having one end pivotally supported on the movable contact member 3 by a shaft 9, 10 is a handle side link (hereinafter referred to as an upper link) pivotally supported at one end on the other end of the lower link 8 and at the other end on a cradle 11. 14 is a toggle link mechanism composed of the lower link 8, the upper link 10, the shaft 12, the toggle spring (not shown) and the like, the shaft 12 serving as knee joint. 15 is a handle arm having one end (not shown) pivotally supported in a predetermined positional relationship with respect to the toggle link mechanism 14. 16a is a handle knob formed of a

synthetic resin, which can be operated from outside of a housing or a cover (not shown) and which is mechanically connected to the handle arm 15 for moving together. The handle arm 15 and the handle knob 16a together constitute a handle 16 of the circuit breaker.

500 is a projection portion formed on the lower link 8 and 501 is a projection portion formed on the upper link 10, 502 is a pin disposed on the handle arm 15, which is a member for holding the mechanism portion to restrict the handle 16 to a predetermined position when the handle knob 16a is being driven from its closed position to the open position when the movable contact 2 and the stationary contact 4 are welded together.

In such the conventional circuit breaker, when the handle 16 is tried to be moved from the closed position toward the open position when the stationary contact 2 and the movable contact 4 are welded together, the pin 502 disposed on the handle arm 15 engages with the projection portion 501 formed on the upper link 10 and the projection portion 500 formed on the lower link 8 engages the cross bar 6, whereby the mechanism portion is restricted, so that the handle 16 cannot be pivoted to the open position, whereby it is possible to restrict the handle position to a predetermined position different from the open position.

In the conventional circuit breaker as above described, the pin 502 formed on the handle arm 15 out of the members that restrict the mechanism portion passes through a position very close to the projection 501 on the upper link 10 upon the opening or closing operation or the tripping motion. Therefore, when the distance between the pin 502 and the projection portion 501 is made large so that they do not interfere with each other during the usual opening and closing operation, it is not possible to ensure a sufficient engagement between the member, and when the above distance is made small to ensure the operation, precise dimensional tolerance of the members is required.

Further, since the pin 502 on the handle arm 15 and the projection portion 501 on the upper link 10 are positioned close to and directly faced with the arc extinguisher chamber unit 7, the molten debris and the like generated by the arc during the current interrupting operation deposit on the projection portion 501 and the pin 502. When such the deposition of the molten debris occurs, since the distance between the members are made small to provide the isolation function, the clearance between the members becomes small or even zero,

resulting in a problem that the circuit breaker may become inoperable during the opening or closing operation or upon the trip operation.

This invention has been made to solve the above-discussed problems and has as its object the provision of a circuit breaker in which, a stable opening and closing operation can be achieved during the ordinary opening and closing operation or the tipping operation, the isolation function can be ensured upon the contact welding, and the deposition of molten debris to the mechanism unit can be minimized during the current interrupting operation to provide a smooth isolation function.

DISCLOSURE OF INVENTION

A circuit breaker according to the present invention comprises a stationary contact member, a movable contact member opposing to and capable of separating from and contacting with the stationary contact member, a cross bar rotatably supporting the movable contact member, a toggle link mechanism for driving the movable contact member, and a handle pivotally supported with respect to the toggle link mechanism to predetermined relative positions of a frame, the circuit breaker further comprising a restriction member rotatably supported at one end from the frame and engaging with the handle and the cross bar when the handle is being moved into an open position in the state where a stationary contact of the stationary contact member and a movable contact of the movable contact member are welded, thereby to preventing the handle from moving into the open position.

Also, a restriction point between the restriction member and the handle is preferably positioned closer to a center of rotation of the holding member within a range at which the restriction point can be provided on the handle.

Also, a restriction point between the restriction member and the cross bar is preferably positioned outside of the frame.

Also, the restriction point between the restriction member and the handle may be positioned further from the pivot point of the handle than the restriction point between the restriction member and the cross bar, and the restriction member may have an opening portion formed on the side opposite to the restriction point between the restriction member and the cross bar.

Further, the circuit breaker of the present invention may comprise a

stationary contact member, a movable contact member opposing to and capable of separating from and contacting with the stationary contact member, a cross bar rotatably supporting the movable contact member, a toggle link mechanism for driving the movable to predetermined relative positions; and a restriction member rotatably supported at one end from the frame and engaging with the handle and a movable contact member side link of the toggle link mechanism when the handle is being moved into an open position in the state where a stationary contact of the stationary contact member and a movable contact of the movable contact member are welded, thereby to preventing the handle from moving into the open position.

Also, the movable contact member side link may be provided with a restriction pin for engaging with the restriction member.

Also, the restriction point between the restriction member and the handle may be positioned further from the pivot point of the handle than the restriction point between the restriction member and the movable contact member side link and the restriction member has an opening portion formed on the side opposite to the restriction point between the restriction member and the toggle link mechanism.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a partially removed perspective view showing the inside of the circuit breaker of the first embodiment of the present invention.

Fig. 2 is an enlarged side view of the main portion of the opening and closing mechanism when the circuit breaker shown in Fig. 1 is in its closed position.

Fig. 3 is an enlarged side view of the main portion of the opening and closing mechanism when the circuit breaker shown in Fig. 1 is in its open position.

Fig. 4 is an enlarged side view of the main portion in which the handle is moved toward the open position and its movement is restricted when the contacts of the circuit breaker shown in Fig. 1 are in the welded position.

Fig. 5 is an enlarged side view of the main portion of the opening and closing mechanism when the circuit breaker of the second embodiment of this invention is in its closed position.

Fig. 6 is an enlarged side view of the main portion of the opening and closing mechanism when the circuit breaker shown in Fig. 5 is in its opened position.

Fig. 7 is an enlarged side view of the main portion in which the handle is moved toward the open position and its movement is restricted when the contacts of the circuit breaker shown in Fig. 5 are in the welded position.

Fig. 8 is a sectional view of the main portion showing the opening and closing mechanism of the conventional circuit breaker.

BEST MODES FOR CARRYING OUT THE INVENTION

Embodiment 1

Fig. 1 is a partially removed perspective view showing the inside of the circuit breaker of the first embodiment of the present invention. Fig. 2 is an enlarged side view of the main portion of the opening and closing mechanism when the circuit breaker shown in Fig. 1 is in its closed position. Fig. 3 is an enlarged side view of the main portion of the opening and closing mechanism when the circuit breaker shown in Fig. 1 is in its open position.

In these figures, 20 is an insulating housing composed of a base 20a and a cover 20b, both being made of a synthetic resin. 21 is a stationary contact member mounted within the insulating housing 20 and has a stationary contact 22. 23 is a movable contact member including a movable contact 24 capable of contacting and separating the stationary contact 22 and is pivotally supported by a pivot pin 25. 26 is a cross bar made of an insulating material and connecting one end of each of the movable contact members 24 for the respective pole units. 27 is an arc extinguisher for extinguishing an electric arc generated between the separated contacts 22 and 24.

28 shown in Fig. 2 is a movable contact member side link (hereinafter referred to as a lower link) having one end pivotally supported on the cross bar 26 by a shaft 29, 30 is a handle side link (hereinafter referred to as an upper link) pivotally supported at one end on the other end of the lower link 28 and at the other end on a cradle 31 by shafts 32 and 33, respectively. 34 is a toggle link mechanism composed of the lower link 28, the upper link 30, the toggle spring (not shown) and the like, a shaft 32 serving as knee joint. 35 is a handle arm

having one end (not shown) pivotally supported in a predetermined positional relationship with respect to the toggle link mechanism 34. 35a is a handle knob formed of a synthetic resin, which can be operated from outside of a cover 20b of a housing 20 and which is mechanically connected to the handle arm 35 for moving together. Thus, the handle arm 35 and the handle knob 35a together constitute a handle 36 that is pivotally supported in a predetermined positional relationship with respect to the toggle link mechanism 34.

40 is a frame mounted to the bottom portion of the base 20a of the housing 20 and has a support 40a for pivotally supporting the handle arm 35. 41 is a restriction member or a stopper including a first engaging portion 41a for engaging the cross bar 26 and a second engaging portion 41b for engaging a first restriction pin 43 disposed on the handle arm 35 and will be described later, the stopper being pivotally supported on the frame 40 by a shaft 42. The first restriction pin 43 may be integrally formed in the handle arm 35 by embossing press or the like so that it projects toward the viewer from the plane of Fig. 2.

The operation will now be described. In Fig. 3 in which the contacts are in the open state, when the handle 36 is moved to the closed position (tilted to the left), the toggle mechanism 34 is elongated and the movable contact 24 is brought into contact with the stationary contact 22 to become into the state shown in Fig. 2. Then, when the handle 36 is moved to the open position (tilted to the right), the toggle mechanism 34 is collapsed to lift the lower link 28 and the movable contact 24 is separated from the stationary contact 22 to become into the state shown in Fig. 3.

Fig. 4 illustrates a state in which the stationary contact 22 and the movable contact 24 are welded together due to a massive pulse current in a position in which the engagement between the cradle and the latch of the unillustrated opening and closing mechanism are not released. In this state, the toggle mechanism 34 is held at the same position as that of the closed position and, when the handle 36 is moved clockwise toward the open position as shown in Fig. 4 in order to put it in the open position for the maintenance and inspection purpose, then the toggle spring (not shown) expands to rotate the handle arm 35 clockwise toward the open position.

However, during the movement of the handle 36 in the clockwise direction or in the direction of the arrow A, the first restriction pin 43 disposed on

the handle arm 35 engages the second restriction portion 41b of the stopper 41 at the restriction point 55, causing the stopper 41 to rotate in the direction of the arrow B about the shaft 42 of the stopper 41, whereby the first restriction portion 41a of the stopper 41 abuts against the stop 26a of the cross bar 26 at the restriction point 50 to prevent the handle 36 from further moving toward the open position.

Thus, in the circuit breaker of the present invention as above described, there is no crossing movements of the components in the vicinity of the position other than the position at which the opening and closing mechanism portion is restricted upon normal switching operation or the tripping operation. Also, as best shown in Fig. 1, since the restriction portion is located at a position far from the molten debris generating portion such as the arc extinguisher 27 and since there are various mechanism components and partitions intervening between the arc extinguisher 27 and the restriction portion, the molten debris generated and scattered upon the current interruption do not deposit on the restriction portion, realizing a stable opening and closing operation.

When the restriction point 50 (shown in Fig. 4) between the stopper 41 and the cross bar 26 is located on the outside of the frame 40 as viewed (arrow C) from the arc extinguisher 27 which is the molten debris generating portion or the opposite side of the opposing surface of the frame 40 facing to the toggle link mechanism 34 shown in Fig. 1, then the frame 40 can be said to intervene between the molten debris generating portion of the arc extinguisher 27 and the restriction point 50, further increasing the above advantageous results.

Also, when the cross bar 26 is moved from the contact closed position shown in Fig. 2 to the contact welded position shown in Fig. 4, the stopper 41 is rotated counterclockwise about the shaft 42 by a distance corresponding to the gap G (see Fig. 2) defined between the cross bar 26 and the movable contact member 23 and the handle arm 35 is moved to the open position. When the restriction point 55 between the handle arm 35 and the stopper 41 is positioned further than the shaft 42 which is the center of rotation of the stopper 41, the amount of movement of the stopper 41 is increased to allow the handle arm 35 to move further toward the open position, decreasing the room for ensuring the isolatin function. Therefore, the restriction point 55 between the handle arm 35 and the stopper 41 should preferably be as close as possible to the shaft 42 or

the rotational center of the stopper 41 within a realistic range.

Also, if it is assumed that the external force applied to the handle arm 35 is constant, the moment due to that external force is decreased when the restriction point 55 between the handle arm 35 and the stopper 41 is located above the restriction point at the opening and closing mechanism portion, which is the restriction point 50 between the stopper 41 and the cross bar 26 or on the side of the handle 36, as viewed in Fig. 4. Therefore, the load applied to the restriction point 50 (shown in Fig. 4) between the stopper 41 and the cross bar 26 is decreased, thus improving the mechanical strength requirements to the cross bar 26 and the stopper 41. The restriction point 55 between the handle arm 35 and the stopper 41 can be located higher or closer to the handle 36 by providing an opening portion P in the stopper 41 at the opposite side to the restriction point 50 between the stopper 41 and the cross bar 26, permitting to further decrease the load applied to the restriction point 50.

Embodiment 2

Figs. 5 to 7 are enlarged side views of the main portion of the opening and closing mechanism of the circuit breaker of the second embodiment of the present invention, in which Fig. 5 shows the circuit breaker in its closed position, Fig. 6 shows the circuit breaker in its opened position, and Fig. 7 shows a position in which the handle is moved toward the open position when the engagement between the cradle and the latch of the opening and closing mechanism is not released and when the welding phenomenon occurs between the stationary contact 22 and the movable contact 24 and the movable contact 24 cannot be separated. In these figures, the components 21 to 43 are similar to those in the previously described first embodiment, so that their explanations will be omitted. 57 is a restriction pin secured to the lower link 28 and is projected toward the viewer in Fig. 5.

The operation of the circuit breaker of the structure as above described is similar to that of the circuit breaker of the first embodiment and its explanation will be omitted. When the handle 36 is moved clockwise toward the open position in the state in which a massive pulse current flows through the circuit breaker in the closed contact position and the welding phenomenon occurs between the stationary contact 22 and the movable contact 24 in the state in

which the engagement between the cradle and the latch of the unillustrated opening and closing mechanism is not released, then the toggle spring (not shown) is expanded to permit the handle arm 35 to be also moved clockwise toward the open position.

However, as shown in Fig. 7, during the clockwise movement or the movement in the direction of the arrow A of the handle 36, the first restriction pin 43 on the handle arm 35 engages the second restriction portion 41b of the stopper 41 at the restriction point 55, thereby rotating the stopper 41 about the shaft 42 in the direction of the arrow B. Then, the first restriction portion 41a of the stopper 41 abuts and engages with the second restriction pin 57 secured to the lower link 28 to prevent the handle 36 from further moving toward the open position. 60 is a restriction point between the lower link 28 and the stopper 41.

According to the second embodiment of this invention, since the first restriction portion 41a of the stopper 41 engages at the restriction point 60 with the second restriction pin 57 secured to the lower link 28, the handle 36 can be prevented from moving into the open position and, since the first restriction portion 41a engages the second restriction pin 57 and the lower link 28 is subjected to a large force pulling it upward in Fig. 7, the operational force on the handle 36 can be used in breaking the weld between the contacts 22 and 24 when the weld is weak.

The present invention, having the above described structure, has the advantageous results as discussed below.

By providing a restriction member and arrange it such that the restriction member engages the handle arm and the cross bar upon the contact welding, the handle can be prevented from moving into the open position, and since there is no crossing movements of the components in the vicinity of the position other than the position at which the opening and closing mechanism portion is restricted upon normal switching operation or the tripping operation, making the high dimensional precision not required.

Also, since the restriction portion is located at a position far from the molten debris generating portion such as the arc extinguisher and since there are various mechanism components and partitions intervening between the molten debris generating portion (the arc extinguisher) and the restriction portion, the molten debris generated and scattered upon the current interruption deposits

at lesser amount on the restriction portion, realizing a stable opening and closing operation.

Also, by providing a restriction member that engages the handle arm and the movable contact side link of the toggle mechanism and that prevent the handle from moving into the open position, the handle can be prevented from moving into the open position, and the operational force on the handle 36 can be used in lifting the lower link and the breaking the weld between the contacts 22 and 24 when the weld is weak.

INDUSTRIAL APPLICABILITY

As has been described, the circuit breaker of the present invention is useful as the circuit breaker for protecting various electric devices used in the power distribution system.

CLAIMS



1. A circuit breaker comprising:
 - a stationary contact member;
 - a movable contact member opposing to and capable of separating from and contacting with said stationary contact member;
 - a cross bar rotatably supporting said movable contact member;
 - a toggle link mechanism for driving said movable contact member;
 - a handle pivotally supported with respect to said toggle link mechanism to predetermined relative positions of a frame; and
 - a restriction member rotatably supported at one end from said frame and engaging with said handle and said cross bar when said handle is being moved into an open position in the state where a stationary contact of said stationary contact member and a movable contact of said movable contact member are welded, thereby to preventing said handle from moving into the open position.
2. A circuit breaker as claimed in claim 1, wherein a restriction point between said restriction member and said handle is positioned closer to a center of rotation of said holding member within a range at which said restriction point can be provided on said handle.
3. A circuit breaker as claimed in claim 1 or 2, wherein a restriction point between said restriction member and said cross bar is positioned outside of said frame.
4. A circuit breaker as claimed in any one of claims 1 to 3, wherein said restriction point between said restriction member and said handle is positioned further from said pivot point of said handle than said restriction point between said restriction member and said cross bar, and said restriction member has an opening portion formed on the side opposite to said restriction point between said restriction member and said cross bar.
5. A circuit breaker comprising:
 - a stationary contact member;



a movable contact member opposing to and capable of separating from and contacting with said stationary contact member;

a cross bar rotatably supporting said movable contact member;

a toggle link mechanism for driving said movable contact member;

a handle pivotally supported with respect to said toggle link mechanism to predetermined relative positions; and

a restriction member rotatably supported at one end from said frame and engaging with said handle and a movable contact member side link of said toggle link mechanism when said handle is being moved into an open position in the state where a stationary contact of said stationary contact member and a movable contact of said movable contact member are welded, thereby to preventing said handle from moving into the open position.

6. A circuit breaker as claimed in claim 5, wherein said movable contact member side link is provided with a restriction pin for engaging with said restriction member.

7. A circuit breaker as claimed in claim 5 or 6, wherein said restriction point between said restriction member and said handle is positioned further from said pivot point of said handle than said restriction point between said restriction member and said movable contact member side link, and said restriction member has an opening portion formed on the side opposite to said restriction point between said restriction member and said toggle link mechanism.