Nov. 14, 1933. W. A. ATWOOD 1,935,428

ELECTRIC SWITCH

Filed Nov. 4, 1931

Fig. 1.

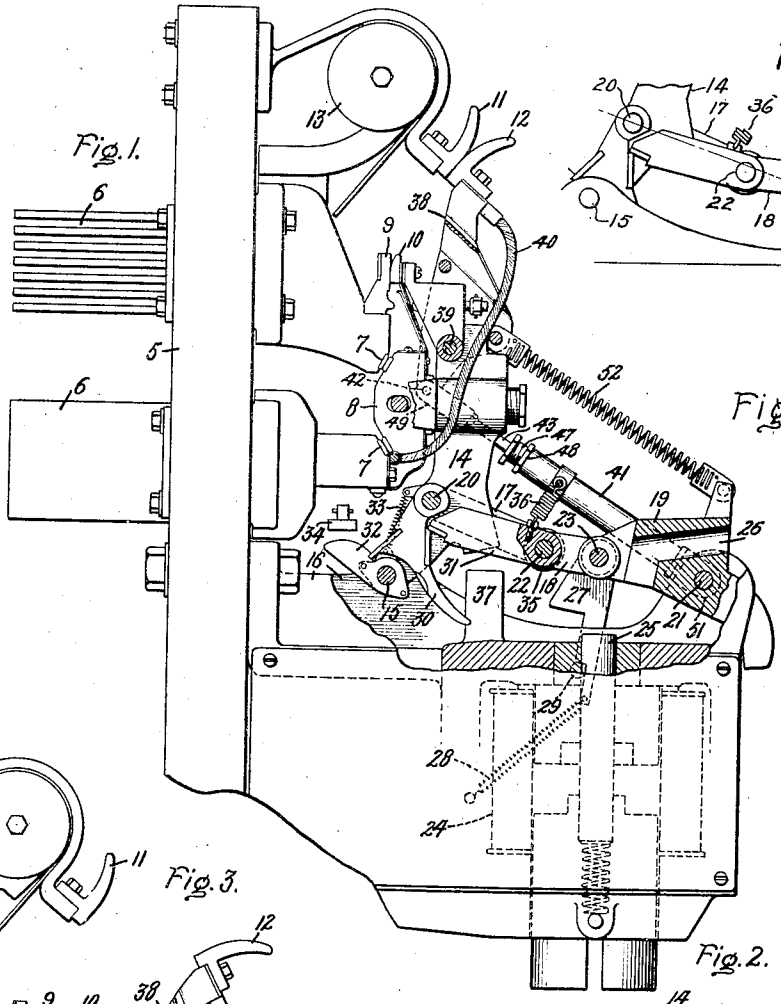


Fig. 5.

Fig. 4.

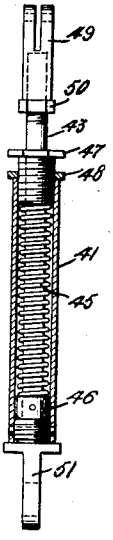
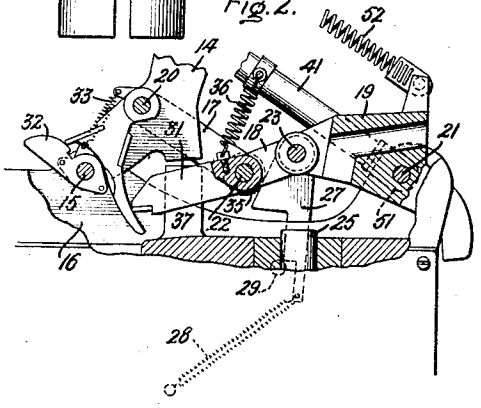
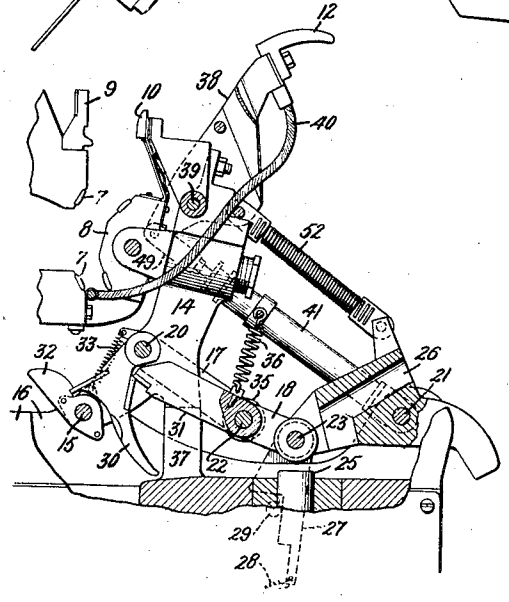


Fig. 3.

Fig. 2.





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ELECTRIC SWITCH

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6 Claims. (Cl. 200—146)

My invention relates to electric switches and more particularly to automatic trip-free circuit breakers which are provided with arc dissipating means including relatively movable cooperating arcing contacts and which are intended to be closed usually by other than manual operation. One object of my invention is to provide an improved circuit breaker construction whereby quickly to separate the arcing contacts a distance which is disproportionately greater than the movement of the movable main contact or circuit controlling member without additional space requirements or undue complications. Another object of my invention is to provide an improved trip-free circuit breaker mechanism which does not require a special resetting operation before the circuit breaker can be reclosed after the tripping thereof.

In circuit breaker operation it is usual to provide arcing contacts which may be used either with or without a blowout coil and which take the burden of final circuit interruption so as to save the main contacts. In air circuit breakers the longer the arc is the greater its resistance and the more readily it can be extinguished particularly if a blowout coil is employed. A quick and wide separation of the arcing contacts is, therefore, desirable but this must not be accomplished at the expense of increased space requirements and a multiplicity of added complications. In accordance with my invention I obtain a separation of the arcing contacts which is disproportionately greater than the movement of the movable main contact by an arrangement which positively maintains the arcing contacts in engagement until the main contacts are definitely separated the necessary amount and then actuates one of the arcing contacts relatively to the movable main contact so as to insure a large movement of the movable arcing contact.

Before trip-free circuit breakers, with which I am familiar, can be reclosed after tripping, a special resetting operation must be performed after the completion of a circuit breaker opening movement. Obviously, the extra operation is disadvantageous, particularly so where a solenoid, motor, pneumatic, or other form of operating mechanism is employed because it necessitates additional complications. In accordance with my invention, I eliminate this extra operation by an improved trip-free mechanism which is automatically reset during a part of the circuit breaker opening movement.

My invention will be better understood from the following description when considered in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

In the accompanying drawing, Fig. 1 is a side elevation of an air circuit breaker embodying my invention, the circuit breaker being shown in the closed position with certain parts, not pertinent to my invention, omitted for clearness; Fig. 2 is a side elevation of a part of the circuit breaker mechanism with the circuit breaker nearly in the full open position; Fig. 3 is a side elevation with the circuit breaker in the full open position; Fig. 4 is a partly sectional detail of a link mechanism for obtaining a separation of the arcing contacts disproportionate to the movement of the movable main contact; and Fig. 5 illustrates a modification of my invention.

For the purpose of illustrating my invention, I have shown in Fig. 1 a solenoid operated air circuit breaker mounted on a switchboard or panel 5 and provided with studs or terminals 6, stationary main contacts 7, connected to the studs, a movable main contact 8 of the bridging type, relatively movable cooperating burning tips or contacts 9 and 10, relatively movable cooperating final arcing contacts 11 and 12, respectively, stationary and movable, as shown, and a blowout coil 13 whose arc chute is omitted for the sake of clarity in the illustration.

For actuating the movable contacts 8, 10 and 12 to and from circuit closing position, they may be mounted on a movable contact carrying member 14 which, as shown, is rotatably mounted on a stationary pivot 15 in the circuit breaker frame 16. In order to actuate the member 14 to circuit closing position, I provide an improved trip-free toggle mechanism having at least three links 17, 18 and 19. The link 17 is rotatably mounted on a pivot 20 carried by the member 14. The link 19 is rotatably mounted on a stationary pivot 21 in the frame 16. The link 18 joins the links 17 and 19 at pivots 22 and 23, respectively.

The links 17 and 18 form a tripping toggle which, when rigid, forms with the third link 19 a closing toggle. The closing toggle may be operated to close the circuit breaker by a solenoid mechanism which includes a coil 24 mounted in the frame 16 and a movable rod or plunger 25 which, during the circuit closing operation, abuts a roller carried by the pivot 23. The closing operation may also be performed manually by inserting a suitable bar in the socket 26 of the link 19 and then turning this link clockwise about its pivot 21. In order to maintain the closing toggle in the closed position of the switch, as long as the tripping toggle is rigid, I provide a holding

means, such as a catch 27, mounted on the pivot 23 and suitably biased as by a spring 28 to engage a stop or projection 29 on the frame 16.

For maintaining the tripping toggle 17—18 rigid there may be provided, as shown, a latching mechanism of the shock-proof type disclosed in U. S. Letters Patent 1,589,924. As shown, this mechanism includes a catch 30 mounted on the pivot 20 and arranged to engage an arm 31 on the link 18, a catch 32 mounted on the pivot 15 and arranged to engage the catch 30, and a spring 33 for biasing the catches 30 and 32 to the latching or toggle restraining position. The tripping toggle 17—18 may be collapsed to effect the opening of the circuit breaker by a number of tripping members or a single tripping member, such as an arm 34 downwardly movable, as shown, to engage and release the catch 32 and thereby effect the release of the catch 30 from the link 18. The tripping member 34 may be manually actuated or operated in response to abnormal circuit conditions, or otherwise, by any suitable means, examples of which are well known to the art.

In accordance with my invention, I release the closing toggle holding catch 27 and reset the tripping toggle 17—18 so as to be ready for a reclosing operation immediately after the circuit breaker is tripped and the circuit opening operation is completed. For releasing the catch 27, I provide suitable means, such as a roller 35, which is mounted on the pivot 22 and which at a predetermined point in the circuit opening operation abuts the catch 27 and disengages it against the bias of the spring 28 from its stop 29. For resetting the tripping toggle during the circuit opening operation, I provide energy storing means, such as a spring 36, so mounted that during the first part of the circuit opening operation energy is stored therein, as shown in Fig. 2, and is subsequently released after the release of the catch 27 and during the remainder of the circuit opening operation to reset the tripping toggle 17—18, as shown in Fig. 3, where the opening movement of the circuit controlling member 14 is arrested by suitable buffer means, such as a stop 37.

Instead of using the catch 27 to maintain the holding toggle closed, I may so arrange the parts that this toggle is overset in the closed position of the circuit breaker, as shown in Fig. 5. In this case, the movement of the toggle to the overset position with the center of the pivot 23 above the line adjoining the centers of the pivots 20 and 21 may be limited in any suitable manner as by having the arm 53 of the link 19 abut the side of the frame 16, as shown.

For the purpose of effecting a movement of the movable arcing contact 12 disproportionately greater than the movement of the main movable contact 8, I so mount the arcing contact 12 that it is movable relatively to the main contact 8 and provide means for effecting this relative movement during the circuit breaker operation. Thus, as shown, the arcing contact 12 is mounted on a contact carrying arm 38 which is rotatably mounted on a pivot 39 carried by the circuit controlling member 14. A flexible lead 40 connects the contact 12 with the lower stationary main contact 7. In order to insure the desired relative motion between the contacts 8 and 12 in the correct sequence, I provide suitable means which, as shown, includes a resiliently controlled variable length link 41 in which energy is stored during the closing operation of the circuit breaker. As shown, this link extends between the pivot 21 and a pivot 42 on the arm 38 located intermediate the pivots 15 and 39. The structure of the link 41 is such that during a part of the circuit opening operation the link gives up its stored energy to assist in opening the circuit breaker and maintaining the arcing contacts 11 and 12 engaged. During the process of giving up its energy the link acts as a tension member, its length being decreased until after the main contacts are open the required amount when its length becomes fixed and it acts as a compression member to turn the arm 38 relatively to the member 14. In this way there is secured an amplified opening movement dependent on the movement of the member 14 and the movement of the arm 38 relatively thereto.

The construction of the link will be clear from Fig. 4 which shows it as including a cell or cylinder 41 within which a rod 43 is movable against the bias of a spring 45 included between a guide and retaining plunger 46 on the end of the rod within the cylinder and a bushing 47 adjustably positioned in the cylinder so that the spring compression can be varied. A lock nut 48 serves to hold the bushing 47 in any fixed position desired. The rod 43 carries at its other end an adjustably positioned yoke 49 whereby it is possible to adjust the over-all length of the link so as to insure that the arcing contacts engage each other in relation to the position of the main contact 8 when and as desired. The lock nut 50 may be used to insure that the yoke 49 remains in any position to which it is adjusted. For effecting the circuit opening movement of the member 14 and the movement of the arm 38 relatively thereto, suitable biasing means such as a spring 52 connected to the link 19 and to the arm 38 on the side of the pivot 39 opposite the pivot 42 may be used, the spring 52 being tensioned when the circuit breaker is closed, as shown in Fig. 1.

With the parts in the circuit closed position, shown in Fig. 1, the rod 43 is retracted from the cylinder 41 its maximum amount for any given adjustment, thus putting the spring 45 in compression so as to hold the arcing contacts 11 and 12 closed against the tension of the spring 52. If now the tripping arm 34 is actuated to engage the catch 32 whereby to release the catch 30, the tripping toggle 17—18 is collapsed to cause the opening of the circuit breaker. As the circuit controlling member 14 is turned clockwise about its pivot 15 under the bias due to the weight of the parts and to the springs 45 and 52, the arcing contact 12 will be maintained against the contact 11 until the desired opening is effected between the main contacts 7 and 8. During this time in which the spring 45 is giving up its energy, relative movement between the member 14 and the arm 38 occurs, member 14 turning clockwise relatively to arm 38. When the link 41 assumes its fixed length as shown in Fig. 4, that is after the rod 43 has reached the bottom of the cylinder 41, further movement of the member 14 causes the arm 38 to turn clockwise relatively thereto since the pivot 42 is then in effect a stationary pivot. Consequently, the angular opening movement of the contact 12 is greater than the angular opening movement of the contact 8, as is clearly shown in Fig. 3.

During the opening movement the toggle reset spring 36 is stretched, as shown in Fig. 2, until the roller 35 on the pivot 22 engages and releases the catch 27 from its stop 29, as shown in Fig. 2. On further opening movement the tripping toggle 17—18 is reset by the spring 36, as shown in

Fig. 3. With the toggle reset the circuit breaker can be reclosed by energizing the solenoid 24 whose plunger 25 pushes against the roller on pivot 23 until the closing toggle assumes the position shown in Fig. 1, where it is held by the catch 27 as it is biased into engagement with its stop 29.

During the closing movement the arm 38 is moved counter-clockwise relatively to member 14, the initial stress of spring 45 predominating over the stress being acquired by spring 52 until the arcing contact 12 engages contact 11, whereupon the member 14 is moved counter-clockwise relatively to the arm 38, thus storing energy in the spring 45 and lengthening the link 41 until the circuit breaker is in the fully closed position, shown in Fig. 1.

While I have shown and described my invention in considerable detail, I do not desire to be limited to the exact arrangement shown but seek to cover in the appended claims all those modifications that fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. An electric switch having a movable member, a contact mounted on said member for movement relatively thereto, a stationary element and means for effecting a movement of said contact disproportionately greater than the movement of said member including a variable length link interconnecting said contact and said stationary element operative during a part of the circuit opening operation of the switch to maintain said contact in a given position and during the remainder of the circuit opening operation to effect movement of said contact relatively to said member.

2. An electric switch having a rotatably mounted member, a contact pivotally mounted on said member for movement relatively thereto, a stationary element and means for effecting a rotary movement of said contact greater than the rotary movement of said member including a resiliently controlled variable length link interconnecting said contact and said stationary element operative during a part of the circuit opening operation of the switch to maintain said contact in a given position and during the remainder of the circuit opening operation to effect rotary movement of said contact relatively to said member.

3. An electric switch having a movable member, a contact mounted on said member for movement relatively thereto, a stationary element and means for effecting a movement of said contact greater than the movement of said member including a variable length link interconnecting said contact and said stationary element and having means in which energy is stored during the circuit closing operation of the switch, said energy storing means acting during a part of the circuit opening operation of the switch to release energy for changing the length of said link whereby to maintain said contact in a given position and for the remainder of the circuit opening operation to keep the length of said link substantially constant whereby to effect rotary movement of said contact relatively to said member.

4. An electric switch having a rotatably mounted circuit controlling member, relatively movable cooperating arcing contacts one of which is mounted on said member for movement relatively thereto, a stationary element and means in which energy is stored during the circuit closing operation of the switch for effecting a rapid separation of said contacts and an angular movement of said one contact greater than the angular movement of said member including a resiliently controlled variable length link interconnecting said one contact and said stationary element operative during a part of the circuit opening operation of the switch to maintain said contacts in engagement and then to effect angular movement of said one contact relatively to said member.

5. A circuit breaker having a pivoted circuit controlling member, a contact pivotally mounted on said member, the contacting portion of said contact and the pivot of said member being on opposite sides of the pivot of said contact and means for effecting a rapid angular movement of said contact greater than the angular movement of said member including a resiliently controlled variable length link in which energy is stored during the circuit closing operation of the circuit breaker connected to said contact at a point intermediate the pivots of said contact and said member, said link acting during a part of the circuit opening movement of the circuit breaker to give up its stored energy and change its length whereby to maintain said contact in a predetermined position and during the remainder of the circuit opening movement to maintain its length substantially constant whereby to turn said contact relatively to said member.

6. A circuit breaker having a pivotally mounted circuit controlling member, a stationary arcing contact, a cooperating arcing contact pivotally mounted on and movable relatively to said member, the contacting portion of said cooperating contact and the pivot of said member being on opposite sides of the pivot of said cooperating contact and means for effecting a rapid angular movement of said cooperating contact greater than the angular movement of said member including a resiliently controlled variable length link in which energy is stored during the circuit closing operation of the circuit breaker connected to said cooperating contact at a point intermediate the pivots of the contact and said member, said link acting during a part of the circuit opening movement of said member to give up its stored energy and change its length whereby to maintain the arcing contacts in engagement and during the remainder of the circuit opening movement of said member to maintain its length substantially constant whereby to turn said cooperating contact relatively to said member.

WINFIELD A. ATWOOD.