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C. D. LAKE ET AL

2,255,012

CIRCUIT BREAKER

Filed Sept. 13, 1940

FIG. 1.

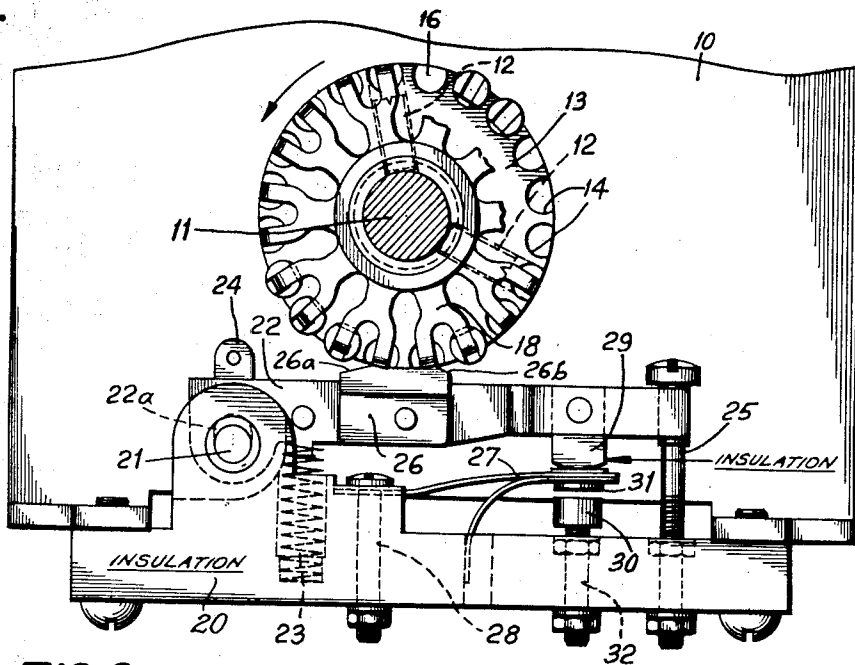


FIG. 2.

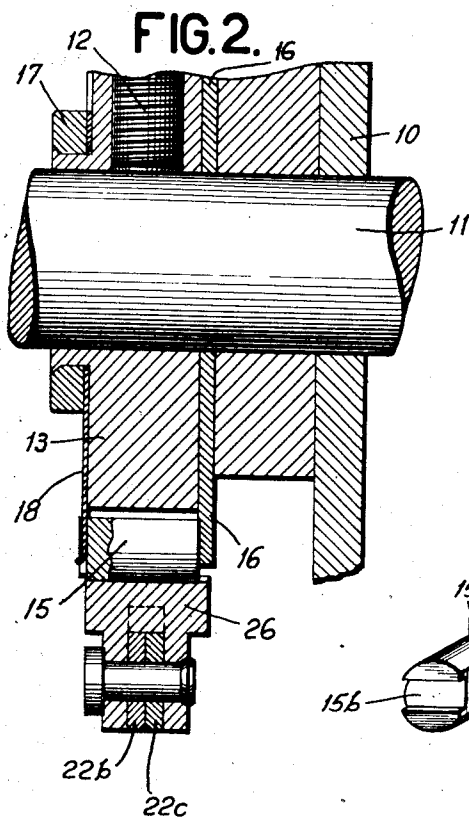


FIG. 3.

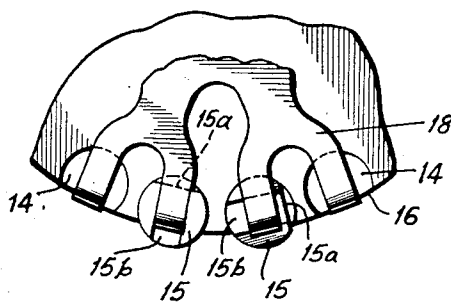
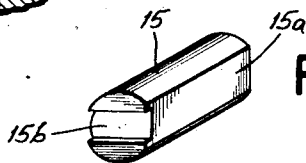


FIG. 4.



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CIRCUIT BREAKER

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6 Claims. (Cl. 200—30)

This invention relates to circuit breakers and, more particularly, to cam operated contacts for making and breaking an electrical circuit.

The general object of the instant invention resides in the provision of improved cam means for operating electrical contacts according to predetermined timing requirements.

More specifically, an object is to provide a rotatable member with novel cam elements differentially disposed about the periphery of the member for operating electrical contacts at predetermined times according to the disposition of the cam elements.

Another object is the provision whereby the location of the cam elements on the rotatable member may be readily changed by a simple manipulation to meet certain predetermined changes in timing requirements without necessitating a shift in the rotatable member. Only where other changes in timing are to be made and close timing is required, must the member itself be shifted.

Still another object is to provide an improved contact operating arm controlled by the cam elements and having a resilient pivot so as to be capable of both rotary and translatory movement to effect a positive control over the opening and closing of the contacts and thereby to minimize arcing conditions.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawing, which discloses, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawing:

Fig. 1 shows the circuit breaker in front elevation.

Fig. 2 is a sectional view taken through the rotatable member.

Fig. 3 is a detail view of the holding means for the cam elements.

Fig. 4 is a detail view of one of the cam elements itself.

Referring now to the drawing, 10 represents a supporting plate in which is journaled a shaft 11. The shaft is arranged to be driven in a counter-clockwise direction, as viewed in Fig. 1, by any suitable power means (not shown). Fastened to the shaft in a predetermined relationship by means of set screws 12, is a circular disk 13 having curved recesses 14 adapted to receive insertible cam elements 15. Mounted on the disk 13 is a backing plate 16 which serves to close one end of the recesses 14. In front of disk 13

and held under tension against the face of the disk by a collar 17 is a multiple arm retaining spring 18 which serves to prevent the inserted cam elements from coming out the front end of the recesses 14 under normal operating conditions. The disk 13, plate 16, collar 17 and retaining spring 18 form a compact assembly which is conveniently secured to shaft 11 by screws 12 as indicated above.

Cam element 15 is provided with a flat side 15a and an end slot 15b. The side 15a is aligned with an edge of one of the recesses 14 when the cam element is being inserted or removed. The position which the cam element must assume for insertion or removal is illustrated by the right hand element in Fig. 3. In this position the sides of the element will clear the edges of the recess. However, if the cam element 15 is rotated to a position illustrated by the element at the left in Fig. 3, then the curved contour of the cam element engages with the outer edges of the recess so as to prevent withdrawal of the element. The flat surface 15a is aligned with the bottom of the recess at this time and the slot 15b receives an arm of the retaining spring 18 to maintain this relationship of cam element and disk during normal operating conditions. The removal of an element 15 is effected by merely prying the spring arm 18 out of slot 15b and rotating the element until its flat side 15a comes adjacent one of the edges of recess 14.

An insulated support 20 is secured to the plate 10, and pivoted to the support at 21 is an arm 22. The pivoted connection is a loose one by virtue of an elongated hole 22a in arm 22 surrounding the pivot 21. Arm 22 is biased upward at its pivot by a spring 23 causing pivot 21 normally to be maintained flush with the lower edge of hole 22a. The arm is actually formed from two strips 22b, 22c (Fig. 2) riveted together and spaced apart at each end so as to straddle guide members 24 and 25. A cam engaging member 26 is riveted to the arm 22 and its upper surface is provided with beveled front and rear edges 26a and 26b, respectively, which cooperate with cam elements 15 on the disk 13 as will be explained hereinafter. The remainder of the upper surface of member 26 is curved to provide a slight clearance between the member and the disk under normal conditions.

The insulated support 20 also carries a spring contact 27 fastened to the support by a small bolt 28 which extends down beneath the support to provide an electrical terminal. The spring con-

tact is tensioned upwardly against an insulated piece 29 on arm 22 so as to maintain the right end of the arm normally against the top of guide 25. A stationary contact 30 is mounted directly beneath a contact 31 carried by the spring 27, the contact 30 being secured to the support 20 by a bolt 32 which extends down beneath the support to serve as a second electrical terminal. Contacts 30, 31 are normally spaced apart as shown in Fig. 1.

In the operation of the device, as the disk 13 rotates to bring a cam element 15 into engagement with the beveled edge 26a of member 26, arm 22 is cammed downwardly about its pivot 21 so as to close contacts 30, 31 and thus bring the slight rotation of the arm 22 to an end. Cam element 15 applies further pressure on the beveled edge 26a to cause arm 22 to collapse at its pivot point by overcoming the bias of spring 23. The effect of this is to insure full and positive closure of contacts 30, 31 and to prevent the contact 31 from bouncing off contact 30, thereby minimizing arcing condition. As the cam element 15 rides on the curved upper surface of member 26, the arm 22 is held depressed and the contacts 30, 31 are held closed. Then as cam element 15 encounters the beveled edge 26b of member 26, spring 23 forces the left end of arm 22 up to its normal position, and contact spring 27 moves the right end of the arm up against the top of guide 25. The beveled edge 26b is made steeper than the edge 26a so as to provide for a quick breaking of contacts.

It will be noted that the disk 13 is provided with a considerable number of the recesses 14. These recesses are located close enough together so that with cam elements 15 placed in adjacent recesses, contacts 30, 31 are not permitted to open between the engagement of successive cam elements with the member 26. Thus, if it is assumed that shaft 11 is connected to the power means of a machine having a definite operating cycle, the contacts 30, 31 may be maintained closed for a predetermined portion of that cycle by inserting cam elements 15 in the required number of successive recesses 14. In other instances where it is desirable to have the contacts open and close more than once during the cycle, this can be accomplished by merely spacing the cam elements around the disk properly as illustrated in Fig. 1. However, for proper operation with cam elements 15 placed in adjacent recesses 14, the cam engaging member 26 is provided with a different contour comprising a shorter operating surface than that shown to permit contacts 30 and 31 to open between the engagement of successive cam elements by member 26. Whenever the timing of the contacts is desired to be altered, this may be readily accomplished by removal or addition of certain of the cam elements in the manner previously described herein. It may be also necessary to loosen screws 12 and to move disk 13 rotatably on shaft 11 to obtain close timing.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. Electrical circuit controlling apparatus comprising a support, an arm loosely pivoted to the support so as to be capable of both oscillatory and translatory movement with respect to said support, a movable contact and a stationary contact each carried by the support and engageable one with the other for completing an electrical circuit, spring means for biasing the movable contact normally against the arm and away from the stationary contact, a second spring means for biasing the arm to a normal position at its pivot, a plurality of cam elements, and a rotatable disk having recesses therein to receive the cam elements in a predetermined relationship for engagement with the arm during rotation of the disk, said arm, upon being engaged by a cam element, first being rotated to force the movable contact into engagement with the stationary contact against the bias of the first mentioned spring means and then being displaced from the normal position at its pivot point against the bias of the second spring means to insure positive closure of the contacts.

2. An electrical circuit controller comprising a support, an arm loosely pivoted to the support so as to be capable of both oscillatory and translatory movement with respect to said support, a stationary contact mounted on the support, a movable spring member on said support having a contact engageable with the stationary contact to make an electrical circuit, said spring normally biasing its contact away from the stationary contact and also biasing the free end of the arm to a normal position, a second spring carried by the support for biasing the pivoted end of the arm to a normal position, a plurality of cam elements, and a rotatable disk having recesses therein to hold the cam elements fitted therein for sequential engagement with the arm during rotation of the disk, said arm, upon being engaged by a cam element, first being rotated to force the movable contact into engagement with the stationary contact against the bias of the spring member and then being displaced from the normal position at its pivot against the bias of the second spring to insure positive closure of the contacts.

3. An electrical circuit controller comprising a pair of contacts normally biased to the open position, a rotatable actuator provided with a plurality of notches therein, a contact operating arm, and cam elements insertible in said notches for engaging said arm during the rotation of the actuator to close the contacts at predetermined times and for predetermined periods, each cam element being shaped to conform generally with the shape of the notches but having a controlling surface which must be aligned in a predetermined manner with a notch upon insertion, after which the element is rotated within the notch to destroy said alignment to cause the inserted element to be held within the notch.

4. An electrical circuit controller comprising a pair of contacts normally biased to the open position, a rotatable actuator provided with a plurality of curved notches spaced around the periphery thereof, the distance between the outer edges of said notches being less than the interior diameter thereof, and curved cam elements each provided with a flat surface which must be aligned with an edge of one of said notches for insertion into or removal from the actuator and which is rotated out of alignment with the edge of said notch after insertion to cause the cam element to be held within the notch, said cam

elements effecting closure of the contacts at predetermined times and for predetermined periods during the rotation of the actuator.

5. An electrical circuit controlling device comprising a support, a pair of contacts carried by the support and normally biased to the open position, a rotatable actuator having spaced notches therein, a plurality of cam elements insertible in said notches, an operating arm pivoted loosely to said support and arranged to be engaged by the cam elements at predetermined times during rotation of the actuator for effecting closure of the contacts, and resilient means supporting the operating arm both at the pivot and at the free end for providing a cushioning effect to prevent rebound of the contacts at the time of closure.

6. An electrical circuit controller comprising

a support, a pair of contacts carried by the support and normally biased to the open position, an operating arm pivoted to said support for closing said contacts upon rotation of said arm, yieldable means supporting the arm at its pivot point, a power actuator, cam elements differentially disposed on said actuator for causing rotation of said arm at predetermined times during the operation of said actuator to close the contacts, the operating arm, after being rotated by a cam element to close the contacts, being collapsed at its pivot by the continued pressure of said cam element so as to absorb the shock produced at the time of closure of the contacts.

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