March 10, 1942. R. T. COE 2,275,890

CIRCUIT BREAKER

Filed April 18, 1940

Fig. 1.

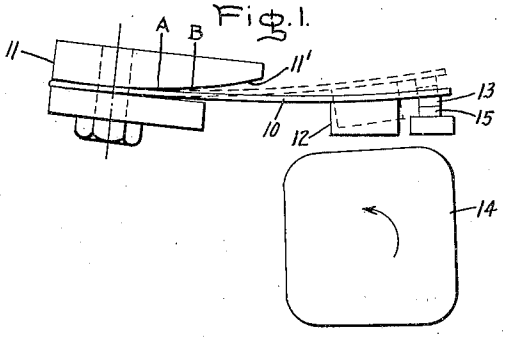


Fig. 2.

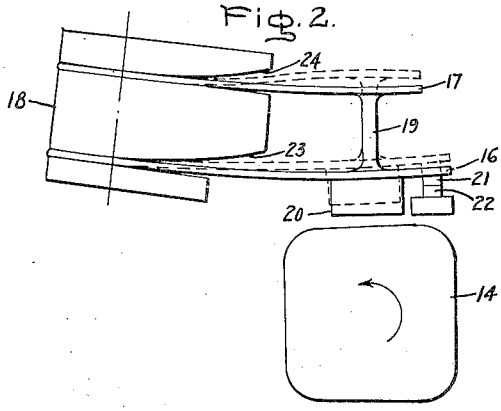
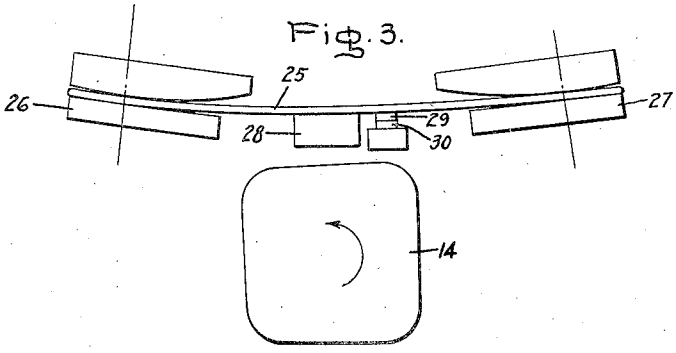


Fig. 3.



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CIRCUIT BREAKER

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Application April 18, 1940, Serial No. 330,333
In Great Britain July 17, 1939

3 Claims. (Cl. 200—153)

My invention relates to circuit breakers and more particularly to circuit breakers of the pivotless type.

An object of my invention is to provide a circuit breaker with improved mechanical and electrical characteristics.

Another object of my invention is to so construct a circuit breaker that the movable contact arm will have a non-linear force-deflection characteristic.

I accomplish these and other objects by providing a curved support on which the movable contact arm is progressively forced thereby progressively decreasing the unsupported length thereof and consequently increasing its deflection characteristic.

My invention will be more fully set forth in the following description referring to the accompanying drawing, and the features of novelty which characterize my invention will be pointed out in the claims annexed to and forming a part of this specification.

In the drawing Fig. 1 diagrammatically illustrates a circuit breaker provided with an embodiment of my inventtion; Fig. 2 diagrammatically illustrates a circuit breaker provided with a modification of my invention; Fig. 3 illustrates a circuit breaker provided with a further modification of my invention.

Referring to the drawing, in Fig. 1 I have illustrated a circuit breaker having a resilient member 10 fixed at one end to a support 11 and an engaging heel 12 and a contact 13 at the other end. The engaging heel 12 is shown between the contact 13 and the support. However, it is to be understood that the relative positions of the engaging heel 12 and the contact 13 may be reversed. The resilient member 10 may be actuated in any suitable manner, and in the illustrated embodiment of my invention this member is actuated by a rotating cam 14, the lobes of which push against the engaging heel 12 as the cam is rotated. Adapted to co-operate with the movable contact 13 I provide a stationary contact 15. It may be seen therefore, that with the contacts biased in their closed position, due to the normal resiliency of the spring member 10 and to the fact that the support 11 is tipped slightly from the vertical, the contacts may be made to open each time one of the lobes of the cam member pushes against the engaging heel 12, the contacts, of course, reclosing as that lobe slides away from the engaging heel.

In circuit breakers which have particular application in electric ignition systems, it is important to prevent bouncing of the movable contact on the stationary contact, since such a phenomenon results in resonant oscillations being built up. In order to prevent this and other difficulties, I so construct the circuit breaker that the movable contact arm thereof has a non-linear force-deflection characteristic. With such a system the natural frequency changes continuously as the contact moves, with the attending result that the contacts may be kept constantly closed during any certain desired period and constantly open during another desired period. I accomplish this by providing a curved surface 11' on the support 11 on which the spring member is progressively forced as one of the lobes of the cam member 14 pushes against the engaging heel 12. From an inspection of Fig. 1 it will be seen therefore that when the heel 12 is between adjacent lobes of the cam member that the contacts 13 and 14 are closed and the spring member 10 will lie along the surface of the curved support to some point A. However, as the heel is moved by a cam lobe and the gap between the contact increases, the spring 10 will wrap around the support curve to such a point as B, at which point the contacts will be fully opened. This open position of the spring member 10 is shown by dotted lines in Fig. 1. The above described movement has the effect of progressively decreasing the unsupported length of the resilient member 10 and thereby increasing its deflection characteristic, or stiffness. Therefore, it will be seen that the movable contact arm 10 is given the required non-linear force-deflection characteristic.

In order to produce the desired non-linear characteristic the support curve illustrated is of circular or arcuate shape, but it is, of course, to be understood that any other support curve may be employed which allows the unsupported length of the spring member to be progressively changed as the gap between the movable and stationary contact varies.

In Fig. 2 the resilient member takes the form of two spring members 16 and 17, each of which are supported at one of their ends by a support 18. Near the free ends of the resilient members 16 and 17, I provide a connecting member 19 for rigidly connecting together the free ends thereof. As shown in Fig. 1, one of the resilient members, such as 16, carries an engaging heel 20 and a contact 21. I also provide a stationary contact 22 which is adapted to co-operate with the movable contact 21. As in Fig. 1 also, the cam member 14 upon rotation pushes against the engaging heel

20 to open the contacts. Each of the fixed ends of the spring members 16 and 17 cooperate respectively with curved portions 23 and 24 of the support member 18. These curved supports are of the same type as the curved support 11, which has already been described. It will be seen, therefore, that as one of the lobes of the cam member pushes against the engaging heel that each of the spring members 16 and 17 wrap around their respective support curves so that the unsupported length of each spring is progressively decreased. Furthermore, since the two free ends of the spring members are rigidly joined together, the heel and contact end of the spring member 16 moves substantially parallel to its original undeflected position, its final position with the contacts open being shown by dotted lines on the drawing. It may be seen therefore, that both the ends which are held by the support member 18 cooperate with the curved portions. However, the required non-linear spring characteristic could be obtained, if desired, to a somewhat reduced extent, by fitting only one of the spring members with a curved support, the other spring member therefore having a fixed length during its movement. Also, in the construction shown in Fig. 2 the contact is shown attached to the lower spring near the heel, but it is, of course, to be understood that the contact could equally well be attached to the top spring if desired.

Fig. 3 illustrates a circuit breaker with a further modification of my invention which has a spring member 25, both ends of which being supported by supports 26 and 27 which are similar in construction to the support 11 shown in Fig. 1. Between the two supported ends I provide the resilient member 25 with an engaging heel 28 and a contact 29. A stationary contact 30 is provided to cooperate with the contact 29. As in Figs. 1 and 2 a cam member 14 is provided to push against the engaging heel 28 to actuate the spring member 10. It will be seen, therefore, that as one of the lobes pushes against the heel 28 that the unsupported length of the spring will be progressively decreased as was true with the spring members illustrated in Figs. 1 and 2. It will also be seen that the heel and contact move substantially parallel to their original undeflected position.

In view of the foregoing it will be seen that I have provided a circuit breaker with a movable spring member which has a non-linear force-deflection characteristic, with the attending result that the natural frequency of the system changes continuously as the gap between the contacts changes. When such an improved circuit breaker construction is used with an electric ignition system, bouncing of the contact is reduced thereby leading to an improved wave front and a more desired operating characteristic of the ignition system.

Modification of the particular arrangements which I have disclosed embodying my invention will occur to those skilled in the art, so that I do not desire my invention to be limited to the particular arrangements set forth and I intend in the appended claims to cover all modifications which do not depart from the spirit and scope of my invention.

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

1. A circuit breaker including a support, a plurality of resilient members having fixed ends held by said support, connecting means for rigidly connecting together the relatively free ends of said members, a contact carried by one of said members, a stationary contact adapted to cooperate with said first mentioned contact, means for actuating said members, and means including said support for varying the deflection characteristic of said members as said members are moved by said actuating means.

2. A circuit breaker including a support, a plurality of resilient members having fixed ends held by said support, connecting means for rigidly connecting together the relatively free ends of said members, a contact carried by one of said members, a stationary contact adapted to cooperate with said first mentioned contact, and means for actuating said members, said support having a plurality of curved portions on which said members are respectively progressively forced by said actuating means so that the deflection characteristics of said members will vary as they are forced on their respective curved portions of said support.

3. A circuit breaker including a support, a plurality of resilient members having fixed ends held by said support, connecting means for rigidly connecting together the relatively free ends of said members, a contact carried by one of said members, a stationary contact adapted to cooperate with said first mentioned contact, and means for actuating said members, said support having a curved portion on which one of said members is progressively forced by said actuating means so that the deflection characteristics of said members will vary as said one member is forced on said curved portion of said support.

REGINALD T. COE.