

[54] INSTANTANEOUS TRIP MEANS

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[58] **Field of Search**..... 335/176, 42

[56] **References Cited**

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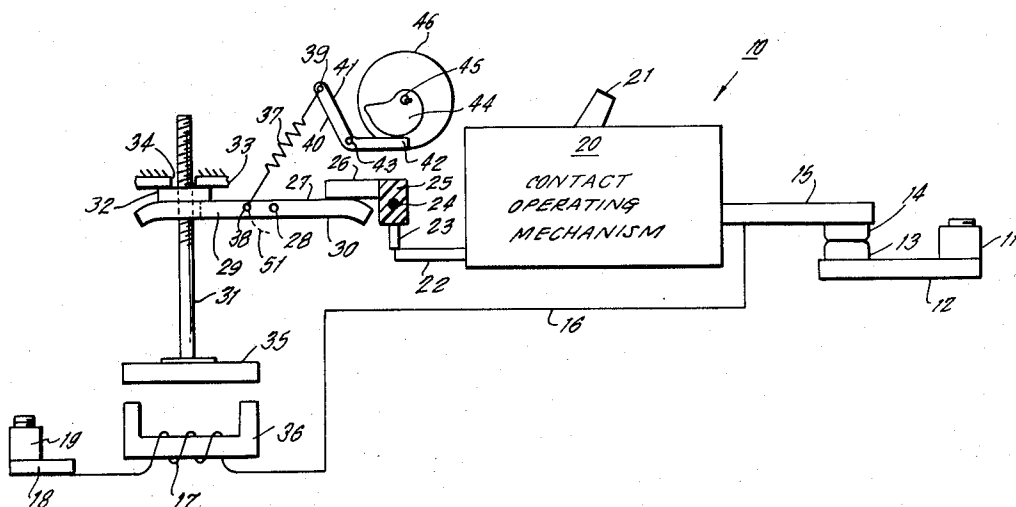
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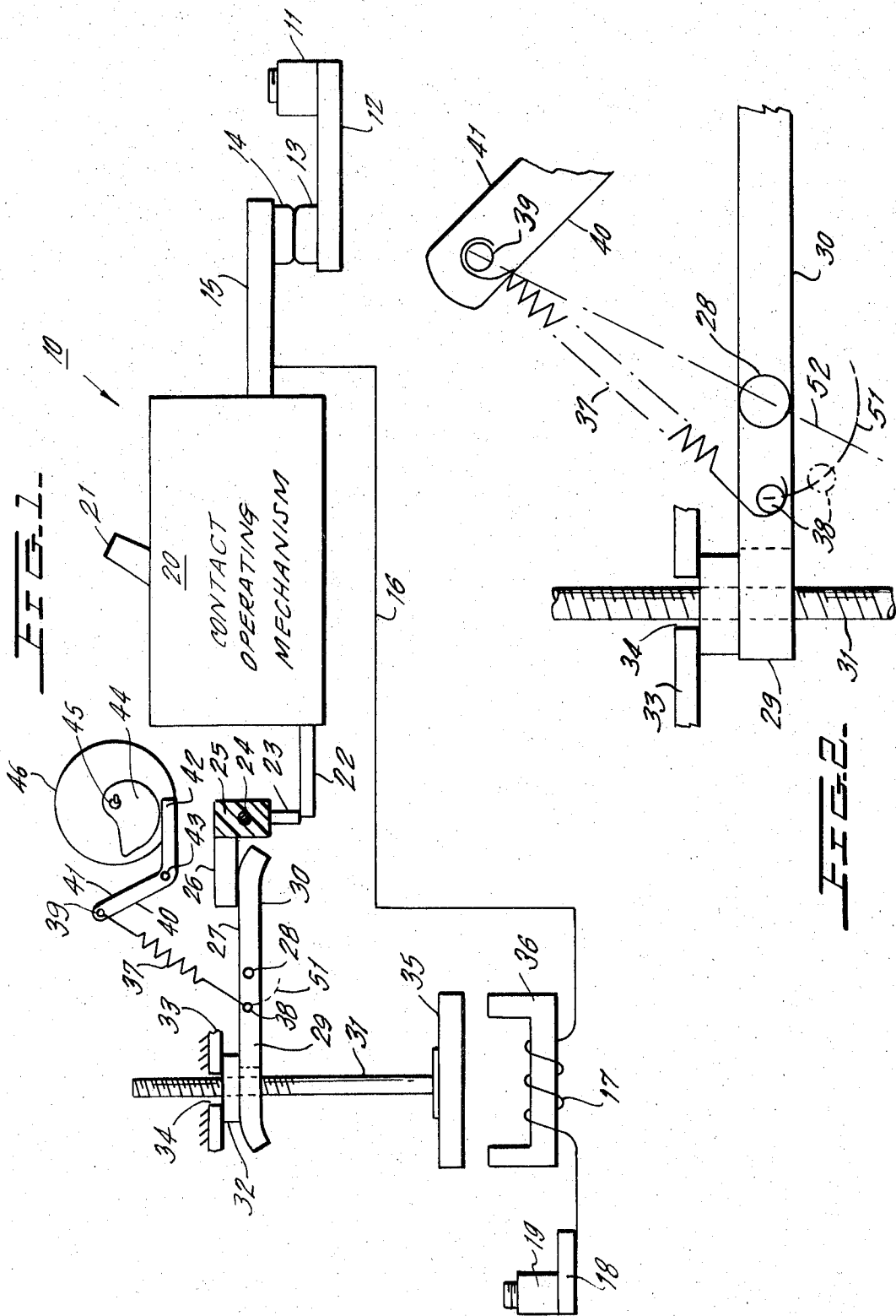
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[57] ABSTRACT

The instantaneous trip means for a circuit breaker is constructed with an electromagnet having a movable armature biased away from a stationary yoke. A biasing spring for the armature acts on the armature through a pivoted trip lever. One end of the biasing spring is connected to the trip lever at a point very close to the pivot for the trip lever, and the line of action for the spring is so positioned that as the armature moves toward tripping position increased loading of the biasing spring is negligible thereby permitting extremely rapid movement of the armature to its tripping position.

2 Claims, 2 Drawing Figures





INSTANTANEOUS TRIP MEANS

This invention relates to circuit breakers in general and more particularly relates to magnetic trip means therefor.

Most relatively high current molded case circuit breakers are provided with a so-called instantaneous trip means that automatically causes opening of the circuit breaker upon the occurrence of predetermined fault current conditions. The instantaneous trip means usually consists of an electromagnet having an armature that is normally restrained from moving by a biasing spring. When the fault currents exceed a predetermined level, magnetic flux generated in the electromagnet structure creates forces which overcome the armature biasing force and move the armature to a tripping position.

However, even upon the occurrence of extremely high fault current conditions, such as a phase-to-phase short in a circuit capable of delivering extremely high currents, opening of the circuit breaker is not really instantaneous. One of the reasons for delay in operation of the instantaneous trip means is the fact that as the armature moves toward tripping position there is a significant increase in loading of the armature biasing spring, with this increased loading serving to retard armature movement toward the tripping position.

In order to overcome this deficiency of the prior art, the instant invention provides a mounting for the armature biasing spring, so constructed that as the armature moves from its normal position to its tripping position, increased loading of the armature biasing spring is minimized. This is accomplished by applying biasing forces to the armature through a pivoted trip lever and by appropriately positioning the line of action for the biasing spring. These biasing forces are provided by a coiled tension spring, one end of which is secured to an adjustably positionable relatively fixed anchor, and the other end of which is secured to the trip lever at a location very close to the pivot for the trip lever. Positioning of the biasing spring is such that as the armature moves from its normal to its tripping position, the increase in length of the spring is negligible, so that there is no significant increase in loading on the armature as it moves toward tripping position. Thus, this armature movement is very rapid.

Accordingly, a primary object of the instant invention is to provide a novel construction for the instantaneous trip means of a circuit breaker.

Another object is to provide a magnetic trip means in which biasing forces acting on the magnetic armature are not increased substantially as the armature moves toward tripping position.

Still another object is to provide a magnetic trip means of this type in which the magnetic air gap remains fixed during adjustment of armature biasing forces.

A further object is to provide automatic trip means of this type which is suitable for simultaneous multipole adjustments.

These objects as well as other objects of this invention will become readily apparent after reading the following description of the accompanying drawings in which:

FIG. 1 is a schematic of a circuit breaker including magnetic instantaneous trip means constructed in accordance with teachings of the instant invention.

FIG. 2 is an enlarged fragmentary portion of FIG. 1 showing a selected portion of the instantaneous trip means.

Now referring to the Figures. Circuit breaker 10, shown schematically in FIG. 1, is preferably of the molded case type and is a multipole unit only one pole of which is illustrated. The current path through each pole of circuit breaker 10 between wire grips 11 and 19 extends through line terminal strap 12, stationary contact 13, movable contact 14, movable contact arm 15, flexible conductor 16, multiturn coil 17 and load terminal strap 18. Contact 14 is operable into and out of engagement with contact 13 by contact operating mechanism 20 which is connected to movable contact arm 15 and is provided with manual operating handle 21. Contact operating mechanism 20 is typically constructed with a trip-free spring-powered overcenter toggle and includes releasable latch means (not shown). Extension 22 of the releasable latch means for mechanism 20 is normally restrained by transverse projection 23 of common tripper bar 25 that extends between all poles of circuit breaker 10 and is mounted on longitudinally extending pivot 24.

Another radial projection 26 of tripper bar 25 is positioned for engagement by leg 27 of trip lever 30 which is mounted at its mid-region on pivot 28. The other leg 29 of trip lever 30 is bifurcated at its free end so as to provide a passage for threaded rod 31. Calibrating nut 32 is threadably mounted to rod 31 above lever section 29 and below stationary abutment 35 having guide opening 34 through which the upper end of rod 31 extends. Magnetic armature 35 is fixedly secured to the lower end of rod 31 so as to be movable toward and away from generally U-shaped magnetic yoke 36 having coil 17 wound about its web portion.

Coiled tension spring 37 biases armature 35 upward toward its normal position shown in FIG. 1. One end of spring 37 is connected to movable anchor 38 on lever 29 and the other end of spring 37 is connected to crank 40 at relatively stationary anchor 39 located near the free end of crank arm 41. Crank 40 is mounted to stationary pivot 43 and is provided with follower arm 42 that is biased into engagement with cam 44. The latter is keyed to shaft 45 having manually operable adjusting wheel 46 keyed thereto. Shaft 45 extends through all poles of circuit breaker 10 and mounts cams corresponding to cam 44 of the other poles, so that as wheel 46 is pivoted there is simultaneous movement of the cams 44 in all poles to simultaneously change the positions of their respective cranks 40. It should now be apparent to those skilled in the art that a peripheral portion of wheel 46 is accessible for manual operation from a position outside of the molded housing for circuit breaker 10.

Upon the occurrence of fault current conditions exceeding a predetermined level, magnetic flux generated in magnetic frame 35, 36 by current flowing through coil 17 generates forces sufficient to overcome the biasing forces exerted by spring 37 and move armature 35 downward toward yoke 36. During this downward movement of armature 35 calibrating nut 32 on rod 31 also moves downward thereby engaging lever arm 29 to pivot lever 30 in a counterclockwise direction. This causes lever arm 27 acting through tripper bar projection 26 to pivot tripper bar 25 in a clockwise direction, moving latching projection 23 to the left clear of latch means extension 22. This releases the latch of contact

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operating mechanism 20 so that the latter separates movable contact 14 from stationary contact 13.

Because movable spring anchor 38 is located so close to trip lever pivot 28 and because of the location of relatively stationary anchor 39 with respect to pivot 28, as armature 35 moves from its normal position to its tripping position, spring 37 increases very little in length so that the additional loading thereof is negligible. That is, during the downward stroke of armature 35 movable anchor 38 moves along an arcuate path 51 (FIG. 2) about pivot 28 as a center toward the extension 52 of a straight line drawn between anchor 39 and pivot 28, until at the tripping position of armature 35 anchor 38 is at the phantom position shown in FIG. 2. It is noted that the total movement for anchor 38 is substantially less than 90° and the distance between extension 52 and anchor 38 in the normal position of armature 35 is also substantially less than 90°.

Although there have been described preferred embodiments of this novel invention, many variations and modifications will now become apparent to those skilled in the art. Therefore, this invention is to be limited not by the specific disclosure herein but only by the appending claims.

The embodiments of the invention in which an exclusive privilege or property is claimed are defined as follows:

1. A circuit breaker including cooperating contact means, an operating mechanism for opening and closing said contact means, trip means including an electromagnet comprising a relatively stationary section and

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an armature mounted for movement toward said relatively stationary section to a trip position from a normal position remote from said stationary section, said armature moving to said trip position upon the occurrence of fault current above a predetermined level, thereby automatically actuating said operating mechanism to open said contact means, a trip member interposed between said armature and said operating mechanism, a spring means acting through said trip member to bias said armature toward said normal position, a pivot about which said trip member pivots as said armature moves from the normal position to the trip position, a relatively fixed anchor for one end of said spring means and another anchor connecting the other end of the spring means to the trip member at a point very close to said pivot to minimize increased loading of said spring as the armature moves toward the trip position; adjustable means to adjust biasing forces exerted by said spring means on said armature by repositioning the relatively fixed anchor without altering the normal position of the armature; said adjustable means including a cam means selectively operable to reposition the relative fixed anchor; a pivotally mounted element which carries the relatively fixed anchor, said spring means biasing a follower portion of said element into operative engagement with said cam means.

2. A circuit breaker as set forth in claim 1 also including calibrating means to establish the normal position of the armature without altering the biasing forces acting on the armature.

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