Oct. 12, 1948. P. J. REIFSCHNEIDER 2,451,239

SHOCKPROOF ELECTROMAGNET WITH ARMATURE

Filed Jan. 26, 1948

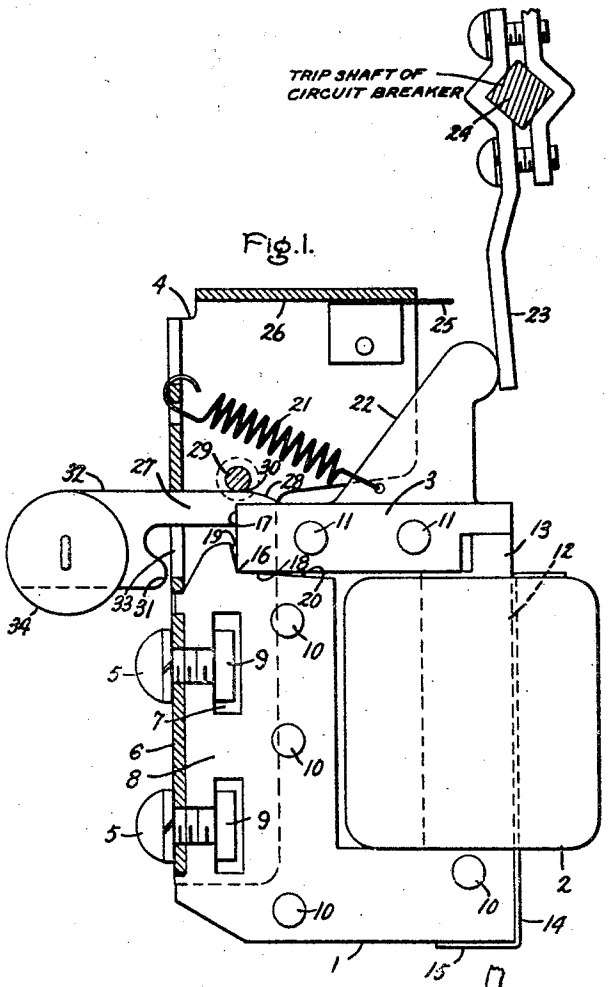

Fig. 1.

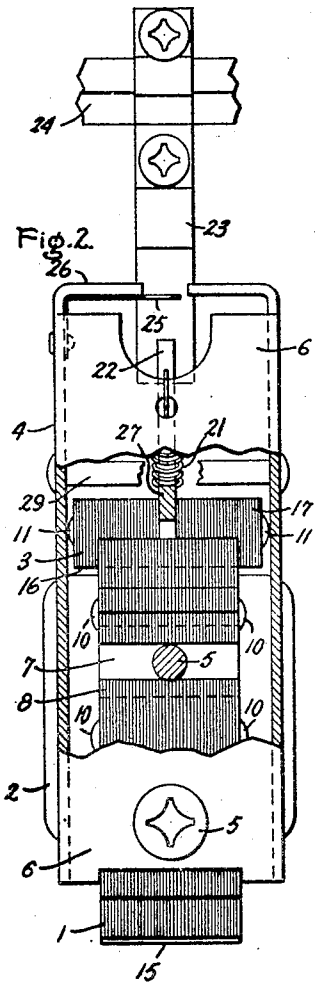

Fig. 2.

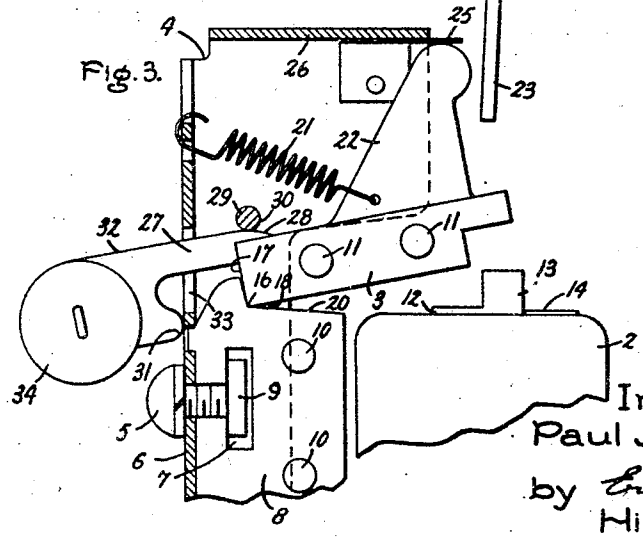

Fig. 3.

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Patented Oct. 12, 1948

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UNITED STATES PATENT OFFICE

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SHOCKPROOF ELECTROMAGNET WITH ARMATURE

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Application January 26, 1948, Serial No. 4,403

4 Claims. (Cl. 175—336)

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My invention relates to improvements in electromagnetic devices and more particularly to improvements in electromagnetic devices for directly tripping circuit breakers.

An object of my invention is to provide a compact, simple and economical electromagnetic device. Another object of my invention is to provide for circuit breakers an improved direct trip electromagnetic device which is so effectively shockproof as to avoid false tripping actions in cases of shock and the like. These and other objects of my invention will appear in more detail hereinafter.

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

In the accompanying sheet of drawings, Fig. 1 is a side elevation, partly in section, of a direct trip electromagnetic device embodying my invention with the tripping armature shown in the attracted or tripping position; Fig 2 is a rear elevation, with a part of the mounting frame and a part associated with the armature broken away, of the embodiment of my invention shown in Fig. 1; and Fig. 3 is a partial view similar to Fig. 1 showing the armature in the fully retracted position.

In the illustrated embodiment of my invention, I have shown an electromagnetic tripping device comprising a generally U-shaped core 1 of suitable magnetic material. The core is provided with an energizing winding 2 and a cooperating armature 3. As shown, the core 1 is mounted on a channel-shaped supporting frame 4 by suitable fastening means such as bolts 5. These pass through the web 6 of the frame 4 into T-shaped slots 7 in the leg 8 of the core 1 and engage nuts 9. The core 1 and the armature 3 are shown laminated since such a structure is desirable for use with either alternating or direct current, the laminations being held together by suitable means such as rivets 10 and 11 in the core and armature respectively. Also, the end of the leg 12 of the core 1 and the end of armature 1 are shown with stepped pole faces so that a short circuiting or shading winding, not shown, may be conveniently placed about the higher or projecting portion 13 of the core to reduce chatter as is well-known to the art. Alternatively, a steel ring may be placed about the portion 13 to reduce the air gap between the vertical faces of the poles thereby increasing the magnetic force at the open air-gap position of the armature, as is well-known to the art. An anchoring strip 14 is used to hold the coil 2 in place on the core leg 12, the lower flange 15 being bent over after assembly.

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In accordance with my invention, the armature 3 has a pivotal edge 16 which, in the illustrated embodiment of my invention, is formed by the intersection of the substantially plane end and side surfaces 17 and 18 respectively of the armature. Also in accordance with my invention, I provide means mounting the pivotal edge 16 of the armature 3 adjacent one end of the core 1 for angular movement of the armature toward and away from the other end of the core. As shown, this means comprises, at the free end of the core leg 8, two intersecting substantially plane surfaces 19 and 20 forming a notch within which the pivotal edge 16 of the armature 3 is seated substantially coincidently with the line of intersection of the plane surfaces 19 and 20 of the notch. As shown, the angle between the end and side surfaces 17 and 18 of the armature is substantially 90°, whereas the angle between the plane surfaces 19 and 20 forming the notch is greater than 90° by a predetermined amount sufficient to permit the desired angular movement of the armature 3 to and from the attracted position shown in Fig. 1.

For moving the armature 3 away from the attracted position which, in the illustrated embodiment of my invention, happens to be at the end of the tripping movement, I provide suitable preferably resilient energy storing means such as a spring 21 which is suitably connected between the web 6 of the frame 4 and a tripping arm or projection 22 mounted on the armature. As shown, the tripping arm 22 is so arranged relatively to the trip lever 23 on the trip shaft 24 of a circuit breaker that, upon movement of the armature to the attracted position, the trip lever is turned counterclockwise to effect a similar movement of the trip shaft whereby to release the tripping mechanism, not shown, of the circuit breaker. For easing the end of the counterclockwise movement of the armature 3 away from the attracted position, I provide a resilient stop such as a leaf spring element 25 which, as shown, is mounted on the inside of the frame 4 near the top thereof and on an inturned flange 26. In the unattracted position of the armature, this spring element also prevents bouncing of the armature on the occurrence of shocks.

It will be apparent that the spring 21 has a vertical or upward component of force which tends to lift the armature 3 bodily out of its pivotal

support by moving the pivotally supported edge 16 upwardly along the notch face 19. Such movement cannot, of course, be tolerated lest tripping arm 22 not strike trip lever 23. In accordance with my invention, I provide means for preventing this movement whether due to the spring 21 or to shocks and the like. As shown, this means includes on the armature 3 an arm 27 which can be an extension of arm 22 and which has a portion 28 of substantially circular configuration with its center of curvature in the pivotal edge 16 of the armature and of an angular extent at least equal to the desired angular movement of the armature. The upward motion preventing means further includes a blocking member such as a transverse rod 29 positioned adjacent the notch intersection substantially directly above the intersection of surfaces 19 and 20 and, as shown, extending transversely of the frame 4 between the sides thereof. Also, the rod 29 has on its lower side a confining surface 30 in engagement with the circular configuration 28 of the arm 27 whereby to prevent upward movement of the pivoted end thereof under the vertical component of force of the spring 21.

Further in accordance with my invention, I provide means for preventing movement of the armature 3 along the face 20 of the notch in consequence of shocks and the like. As shown, this means comprises a stop element such as the web 6 of the frame 4 and a cooperating projection 31 on an extension 32 of the arm 27 projecting through an opening 33 in the web. This projection is engageable with the rear face of the web 6 in case of a shock having a force component from right to left as viewed in Figs. 1 and 2 tending to move the armature 3 to the right. The projection 31 is suitably shaped or rounded to permit the desired angular movement of the armature 3.

If desired, one or more weights 34 may be mounted on the extension 32 of the arm 27 to balance the armature 3 about the pivotal edge 16.

Assuming the parts positioned as shown in Fig. 2 with the armature 3 away from the attracted position against its cushioned stop 25 where it is held by the spring 21, then, if the winding 2 is energized by current sufficient to attract the armature, clockwise movement thereof to the attracted position actuates the trip lever 23 in a counter-clockwise direction to release the circuit breaker tripping mechanism, not shown. During the movement of the armature 3 in the clockwise direction as well as in the reverse direction, the curved surface 28 on the arm 27 rides along the bottom 30 of the stop 29 whereby to maintain the pivotal edge 16 of the armature 3 coincident with the intersection of the notch faces 18 and 19. Also, any shock having a downwardly directed force component tending to lift the pivotal edge of the armature 3 out of the notch will be ineffective to do so because of the stop 29. The armature 3, however, will always be free to move about its pivotal edge 16.

In case of shocks or the like having a force component from the left, the armature will tend to remain more firmly seated in its pivotal notch. Shocks with a force component from the right will be ineffective to displace the pivotal end of the armature to the right by virtue of the projection 31 on the arm 27 engaging the web 6 of the frame 4.

In short, I have provided a sturdy, simple, inexpensive and shockproof pivotal mounting for the armature of an electromagnetic device which is particularly adapted for tripping circuit breakers on war craft and the like where all apparatus on board may be subjected to violent shock conditions.

While I have shown and described my invention in considerable detail, I do not desire to be limited to the exact arrangements 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. In an electromagnetic device comprising a generally U-shaped core, an energizing winding, and an armature having a pivotal edge at one end, means mounting the pivotal edge of the armature adjacent one end of the core for angular movement of the armature toward and away from the other end of the core comprising two intersecting plane surfaces on the one end of the core forming a notch within which the pivotal edge of the armature is seated substantially coincidently with the line of intersection of the plane surfaces of the notch, resilient means tending to turn the armature away from the other end of the core and having a force component tending to move the pivotally supported edge of the armature out of said notch, and means for preventing such movement of the armature including an arm on the armature having a portion of circular configuration with its center in the pivotal edge of the arm and of an angular extent at least equal to the angular movement of the armature, and a blocking member positioned adjacent the notch intersection and having a confining surface in engagement with the circular configuration of said arm during the angular movement of the armature.

2. In an electromagnetic device comprising a generally U-shaped core, an energizing winding, and an armature having a plane end surface and a plane side surface intersecting at an angle of substantially 90 degrees to form a pivotal edge at one end, means mounting the pivotal edge of the armature adjacent one end of the core for limited angular movement of the armature toward and away from the other end of the core comprising two plane surfaces on the one end of the core interesecting at an angle greater than 90 degrees by a predetermined amount to form a notch within which the pivotal edge of the armature is seated substantially coincidently with the line of intersection of the plane surfaces of the core, a spring tending to turn the armature away from the other end of the core and having a force component tending to move the pivotally supported edge of the armature out of said notch, and means for preventing such movement of the armature including an arm on the armature having a portion of circular configuration with its center in the pivotal edge of the armature and of an angular extent at least equal to the angular movement of the armature, and a blocking member positioned adjacent the notch intersection and having a confining surface in engagement with the circular configuration of said arm during the angular movement of the armature.

3. In an electromagnetic device comprising a generally U-shaped core, an energizing winding, and an armature having a plane end surface and a plane side surface intersecting at an angle of substantially 90 degrees to form a pivotal edge at one end, means mounting the pivotal edge of

the armature adjacent one end of the core for limited angular movement of the armature toward and away from the other end of the core comprising two plane sufaces on the one end of the core interesecting at an angle greater than 90 degrees by a predetermined amount to form a notch within which the pivotal edge of the armature is seated substantially coincidently with the line of intersection of the plane surfaces of the notch, a spring tending to turn the armature away from the other end of the core and having a force component tending to move the pivotally supported edge of the armature along one of the faces of said notch, means for preventing such movement of the armature including an arm on the armature having a portion of circular configuration with its center in the pivotal edge of the armature and of an angular extent at least equal to the angular movement of the armature, and a blocking member positioned adjacent the notch intersection and having a confining surface in engagement with the circular configuration of said arm during the angular movement of the armature, and means for preventing movement of the armature along the other face of said notch in consequence of shocks and the like comprising a stop element and a projection on said arm engageable with said stop element.

4. In an electromagnetic device comprising a generally U-shaped core, an energizing winding, and an armature having a pivotal edge at one

end, means mounting the pivotal edge of the armature adjacent one end of the core for angular movement of the armature toward and away from the other end of the core comprising two intersecting plane surfaces on the one end of the core forming a notch within which the pivotal edge of the armature is seated substantially coincidently with the line of intersection of the plane surfaces of the notch, resilient means tending to turn the armature away from the other end of the core and having a force component tending to move the pivotally supported edge of the armature along one of the faces of said notch, means for preventing such movement of the armature including an arm on the armature having a portion of circular configuration with its center in the pivotal edge of the armature and of an angular extent at least equal to the angular movement of the armature, and a blocking member positioned adjacent the notch intersection and having a confining surface in engagement with the circular configuration of said arm during the angular movement of the armature, and means for preventing movement of the armature along the other face of said notch in consequence of shocks and the like comprising a stop element and a projection on said arm engageable with said stop element.

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No references cited.