

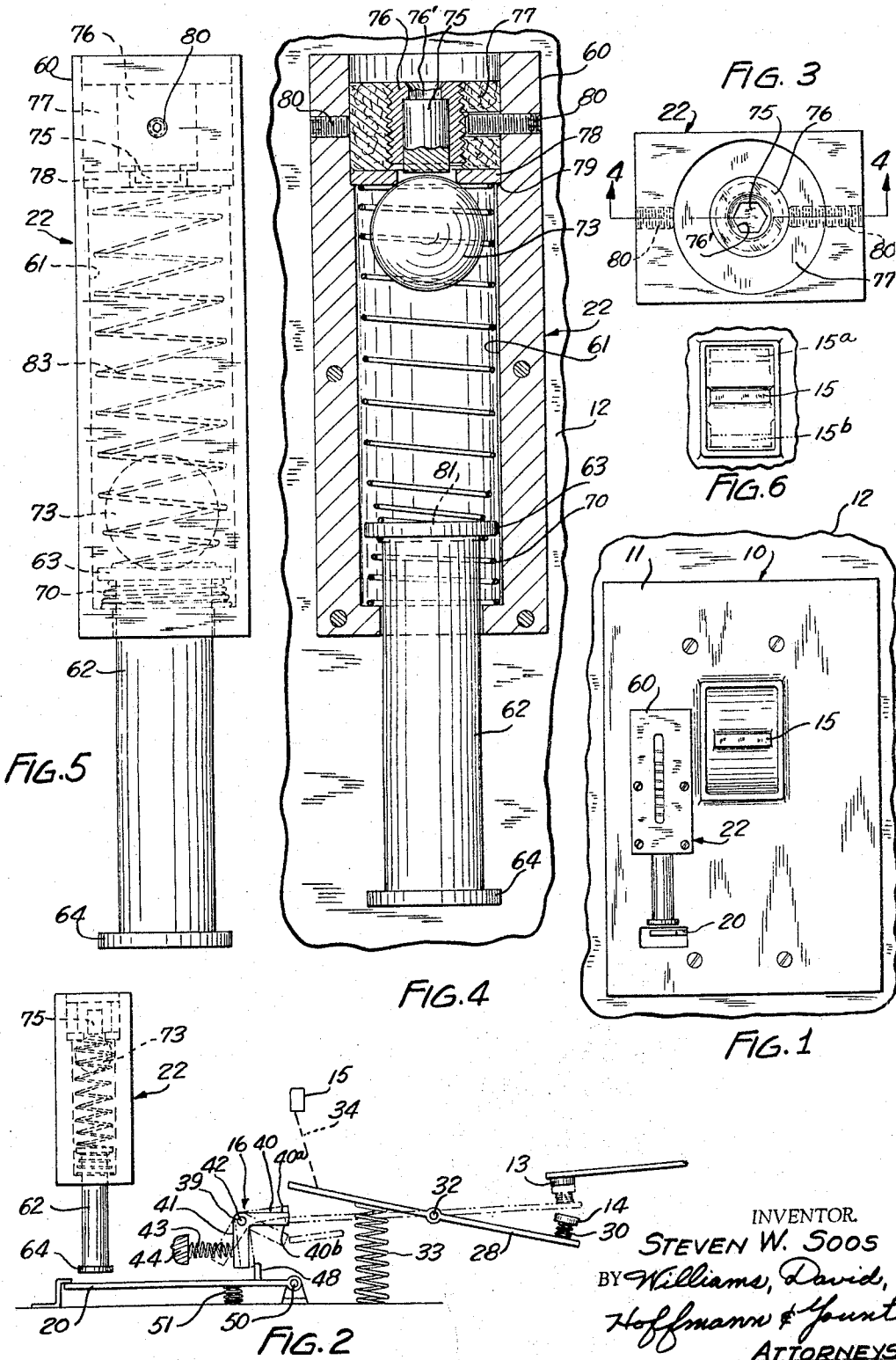
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SHOCK RESPONSIVE CIRCUIT BREAKER

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SHOCK RESPONSIVE CIRCUIT BREAKER

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The present invention relates to a circuit breaker mechanism and particularly to a circuit breaker mechanism which is adapted to be actuated when a shock force is applied thereto.

The circuit breaker mechanism of the present invention is used where it is desired to break a circuit when a shock force is applied to the circuit breaker. By way of example, the circuit breaker mechanism may be secured to a concrete missile launching silo to break a circuit when an atomic blast occurs resulting in shock forces being applied to the silo and circuit breaker. The circuit breaker mechanism also can be secured to buildings and actuated in the event of an earthquake, whereupon the building is shaken and a shock force is applied to the circuit breaker.

An important object of the present invention is the provision of a new and improved circuit breaker mechanism which is mechanically actuated when a shock force is applied thereto and which is simple in construction, durable and extremely reliable in operation.

Another object of the present invention is to provide a new and improved shock responsive circuit breaker mechanism adapted to be tripped to an "off" position in response to shock without requiring the making or breaking of any electric circuits.

A further object of the present invention is the provision of a new and improved circuit breaker mechanism having contacts with open and closed positions and which are latched in closed position, a trip for releasing the latch to open the contacts, and a body held in an elevated position above the trip and released when a shock force is applied thereto to fall through the influence of gravity and actuate the trip.

A further object of the present invention is the provision of a new and improved circuit breaker mechanism of the type described in the next preceding paragraph wherein the body is held above the trip by magnetic means and the body is freed therefrom upon the application of a shock force.

A further object of the present invention is the provision of a new and improved circuit breaker mechanism having operating means for closing contacts therein, latch means for holding the contacts closed, a trip which when actuated releases the latch to permit the contacts to open, and a body held in elevated position above the trip and released when a shock force is applied thereto to fall through the influence of gravity and actuate the trip.

Further objects and advantages of the present invention will be apparent to those skilled in the art to which it relates from the following detailed description of the preferred embodiment thereof made with reference to the following drawings in which:

FIG. 1 is a front elevational view of a circuit breaker mechanism embodying the present invention;

FIG. 2 is a schematic view illustrating the open and closed positions of the contacts of the circuit breaker of FIG. 1 and the latching means for holding the contacts closed;

FIG. 3 is a top plan view of the actuator for the circuit breaker of FIG. 1;

FIG. 4 is a cross-sectional view taken approximately on the line 4—4 of FIG. 3;

FIG. 5 is a view of the mechanism illustrated in FIG.

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4 looking at the mechanism of FIG. 4 from the right; and FIG. 6 is a front elevational view of another circuit breaker mechanism embodying the present invention.

The present invention is preferably embodied in a circuit breaker mechanism 10 illustrated in FIG. 1. The circuit breaker mechanism 10 includes a casing 11 fixedly and solidly secured to a support 12 in any suitable manner. The circuit breaker mechanism 10 may be of various conventional types and for the purposes of illustration a simplified diagrammatic view of one type of mechanism is shown in FIG. 2 and includes contacts 13, 14 having open and closed positions. The contact 13 is fixed while contact 14 is adapted to be moved into engagement with the fixed contact to complete a circuit and moved out of engagement with the fixed contact to break the circuit. The movable contact 14 is moved into engagement with the fixed contact 13 upon manual operation of the circuit breaker handle 15. A latching mechanism 16 is provided to hold the movable contact 14 in engagement with the fixed contact 13 when the movable contact has been moved to complete a circuit there-through. A suitable connection may be provided between the handle 15 and the latching mechanism so that the latching mechanism is releasable by movement of the handle 15 to its "off" position.

The latching mechanism 16 is released to permit the movable contact 14 to move away from the fixed contact 13 upon movement of a trip 20 in a downward direction as viewed in FIG. 1. The trip 20 extends through an opening 21 in the casing 11 and is adapted to be moved downwardly in response to the operation of an actuator 22 which functions when a shock force is applied thereto.

Referring now to FIG. 2 of the drawings, the movable contact 14 is shown preferably mounted on the right end of a pivoted member 28 with a coil spring 30 interposed between the pivoted member 28 and the contact 14, the spring being yieldable to accommodate movement of the pivoted member 28 toward the contact 14 after the contacts 13, 14 engage. The member 28 is pivotally mounted intermediate its ends on a suitable pivot pin 32. The end of the member 28 opposite the end having the contact 14 thereon, that is, the left end of member 28 as viewed in FIG. 2, is biased by means of a relatively strong coil spring 33 in a clockwise direction about pivot pin 32. This biasing force normally maintains the movable contact 14 out of engagement with the fixed contact 13 and in the position shown in full lines in FIG. 2.

The contact 14 is moved into engagement with contact 13 by suitable operating means 34 actuated by manual operation of the handle 15. Movement of the handle 15 toward the left as viewed in FIG. 2 causes the operating means 34, shown diagrammatically in FIG. 2, to move the pivoted member 28 in a counterclockwise direction about pivot pin 32 against the bias of spring 33. This movement of the member 28 causes the contacts 13, 14 to engage and complete a circuit there-through.

The latching mechanism 16 which holds the contacts in closed position preferably includes an L-shaped latch member 39 having a leg portion 40, which extends substantially horizontally, as shown in FIG. 2, and leg portion 41, which extends substantially vertically. The L-shaped member 39 is pivotally mounted on a pivot pin 42 located substantially at the juncture of the legs of the L, and is biased to a normal position, shown in full lines in FIG. 2, by means of a suitable spring 43 interposed between leg 41 and a suitable frame member 44. The leg 40 of the L-shaped member 39 extends horizontally a sufficient distance so that the end thereof is located in the path of pivotal movement of the rod member 28 so that when the member 28 is pivoted against

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the bias of spring 33 the end thereof engages the upper-side 40a of the end of the leg 40.

Continued movement of the member 28 after it has engaged the upperside 40a of leg 40 causes the L-shaped member 39 to be pivoted about the pivot pin 42 in a counterclockwise direction against the bias of spring 43. The member 28 continues to move in a counterclockwise direction about the pivot pin 32 until it passes beyond the L-shaped member 39 to the position shown in dot-dash lines in FIG. 2. When located in this position the contact 14 is in engagement with the contact 13 and the spring 30 is compressed to substantially its full extent. The spring 43, when the member 28 is so positioned, will cause the latch member 39 to return to its normal full-line position, shown in FIG. 2, with the member 28 located below it.

Upon removal of the force overcoming the biasing force of the spring 33 the member 28 will be moved by spring 33 from the dot-dash position shown in FIG. 2, in a clockwise direction about pivot pin 32, and will engage the underside 40b of leg member 40. The spring 33 being stronger than the spring 43 will cause the spring 43 to be extended and will cause the latch member 39 to pivot in a counterclockwise direction about pivot pin 42 into the double dot-dash position illustrated in FIG. 2. When the latch member 39 is so moved the leg 41 thereof engages a stop member 48 which limits the movement of the latch member 39 about the pivot pin 42. The stop member 48 is positioned to limit movement of latch member 39 so that the pivoted member 28 cannot move beyond the leg 40 of the latch member 39 and therefore the latch member holds rod member 28 in latched position illustrated in the double dot-dash lines shown in FIG. 2. The contacts 13, 14 will be in closed position when the member 28 is so latched since spring 30 permits some clockwise movement of the member 28 without disengaging the contacts.

The stop member 48 is supported by and secured to the trip member 20 which is pivotally mounted at one end by pivot pin 50. The trip member 20 is biased by a trip reset spring 51 into a position wherein the stop member 48 is located in the path of movement of the leg 41 of the latch member 39. A suitable stop 52 is positioned above the trip member 20 as shown in FIG. 2 to limit the movement thereof in a clockwise direction about the pivot pin 50. The stop 52 also serves to properly position the stop member 48 relative to leg 41 of the latch member 39, as above described.

It should be apparent that movement of the latch member 20 in a downward direction as viewed in FIG. 2, against the bias of spring 51, will cause the stop member 48 to be moved out of engagement with leg 41 and out of the path of movement of the leg 41 about pivot pin 42. When this occurs the force applied to the pivoted member 28 by the biasing spring 33 is transmitted to the leg 40 of latch member 39 and pivots the latch member 39 in a counterclockwise direction about the pivot pin 42 a sufficient amount to permit the pivoted member 28 to pivot in a clockwise direction about pivot pin 32, thereby moving the contact 14 out of engagement with the contact 13.

The trip member 20 is moved downwardly against the bias of spring 51 by the actuator 22. The actuator 22 is suitably secured to the casing 11 and includes a casing 60 having an axially extending bore 61 therein. A plunger 62 forms a trip actuating means and extends through one end of the casing 60 and is movable axially within the bore 61. A flange member 63 is secured to the end of the plunger 62 located in bore 61 and a flange member 64 is secured to the outer end of the plunger 62. The flange member 64 is adapted to engage the trip member 20, which in turn releases the latch member 39 as above described, when the plunger 62 moves downwardly relative to the casing 60.

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The plunger 62 is normally biased upwardly away from the trip 20 to the position shown in FIG. 4 by a helical spring 70 encircling the plunger 62 and engaging the bottom of the casing 60 and the under side of flange portion 63. The plunger 62 is moved downwardly to engage trip 20 by a downwardly directed force provided by a body 73 which is held in an elevated position above the plunger 62 in the bore 61 and when released drops downwardly in the bore 61 under the influence of gravity to strike the flange 63, and the force of the falling body 73 causes the plunger 62 to move downwardly against the bias of spring 70.

The body 73 comprises a steel ball which is held in the aforementioned elevated position by a magnetic force provided by the permanent magnet 75. The permanent magnet 75 is suitably secured in a threaded nut member 76 which is threaded into a sleeve member 77. The sleeve member 77 is positioned in the bore 61 of the casing 60 and rests in position in the bore 61 on a non-magnetic washer member 78 which in turn engages a ledge 79 within the bore 61. Suitable set screws 80 are provided engaging the sleeve member 77 and the nut member 76 to secure these members in position in the bore 61.

The magnet 75 is normally positioned to extend into the opening in the washer member 78, as shown in FIG. 4, and the magnet holds the ball 73 in engagement with the washer member 78 and is preferably spaced a slight distance from the surface of the ball 73 providing an air gap between the magnet 75 and ball 73 so that the ball will not seat itself. The size of this air gap may vary as long as the force of the magnetic attraction between the ball 73 and magnet 75 is of sufficient strength to hold the ball 73 in an elevated position.

It should be noted that the magnet 75 can be moved relative to the washer member 78 and casing 60 by rotating the nut member 76 relative to the sleeve 77. The nut member 76 is provided with means for moving the magnet 75 relative to the washer member 78 including a wrench connection 76'. By so moving the magnet 75 the force of attraction between the ball 73 and the magnet 75 may be increased or decreased, making the actuator 22 responsive to a greater or lesser shock force. Thus the actuator 22 is adjustable to be responsive to shock forces of varying magnitudes.

When a shock force is applied to the actuator 22 the ball 73 is moved or jarred away from the magnet and falls under the influence of gravity within the bore 61 to engage the flange portion 63 on the end of the plunger. The force of the falling ball compresses the spring 70, as shown in FIG. 5, and moves the plunger 62 downwardly to actuate trip member 20, causing the contacts 13 and 14 to open. The flange portion 63 of the plunger 62 is provided with a concave seat 81 in which the ball rests when it is in engagement with the flange portion 63.

After the ball 73 has dropped, causing the contacts 13 and 14 to separate, the mechanism may be reset and the contacts may again be closed. The mechanism is reset by manually moving the ball 73 upwardly in the bore 61 and into the area where the magnet 75 is operative to attract the ball 73 so that the reset spring 51 will return the trip 20 and the stop member 48 to their normal positions, as shown in FIG. 2. The ball 73 is returned to its elevated position by manual movement of the plunger 62 vertically within the bore 61, which movement causes the ball 73 to be moved sufficiently close to magnet 75 to be magnetically attracted and held in the above described elevated position, and spring 70 to turn to its normal position.

A spring 83 is positioned between the washer member 78 and the flange portion 63 of the plunger and vertical movement of the plunger 62 causes the spring 83 to be compressed. When the force which moves the plunger 62 upwardly within the bore 61 is removed the spring 83 moves the plunger downwardly within the bore 61 and

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the underside of flange member 63 engages spring 70, which is in its normal position. The plunger thereby is returned to its normal position, shown in FIG. 4. The handle 15 may then be moved, causing actuation of operating means 34 to cause the contacts 13 and 14 to be latched in closed position, as above described.

The circuit breaker mechanism illustrated in FIG. 6 is a modified embodiment of the present invention, wherein a different type of operating means and latching mechanism is utilized. This circuit breaker mechanism is of the toggle actuated type wherein the switch handle 15 when moved from a normal position, shown in full lines, to the dot-dash position 15a cocks the latching mechanism and when the handle is moved to the double dot-dash position 15b the contacts therein close. A circuit breaker mechanism of this type is disclosed in Patent No. 2,492,009. Such a mechanism is also manufactured by Westinghouse Corporation and has a catalogue No. MA3800T, style No. 457D452G28 and is shown generally in Westinghouse description bulletin of August 1960, entitled, "AB De-ion Circuit Breakers." This circuit breaker is actuated as described above by an actuator similar to the actuator 22 used to actuate circuit breaker 10.

While the preferred form of the invention has been described in considerable detail, it is to be understood that the invention is not limited to the construction shown nor the uses referred to and it is my intention to cover all adaptations, modifications, and changes which come within the practice of those skilled in the art to which the invention relates and the scope of the appended claims.

Having described my invention, I claim:

1. A circuit breaker mechanism adapted to be actuated when a shock force is applied thereto comprising a pair of electrical contacts biased to an open position, latching means for holding said contacts closed including a trip which when moved in a first direction releases said latching means, and means for moving said trip in said first direction including a body, means for holding said body in an elevated position above said trip and operable to release said body when a shock force of a predetermined magnitude is applied thereto, said body when released falling through the influence of gravity and striking said trip and the force of said falling body moving said trip in said first direction to open said contacts.

2. A circuit breaker mechanism adapted to be actuated when a shock force is applied thereto comprising a pair of electrical contacts biased to an open position, latching means for holding said contacts closed including a trip which when moved in a first direction releases said latching means, means for moving said trip in said first direction including a body, magnetic means providing a magnetic field tending to move said body vertically and for magnetically holding said body in an elevated position above said trip and operable to release said body upon the application of a predetermined shock force thereto, and said body when freed falling through the influence of gravity and striking said trip, the force of said falling body moving said trip in said first direction to open said contacts.

3. A circuit breaker mechanism adapted to be actuated when a shock force is applied thereto comprising a pair of electrical contacts biased to an open position, latching means for holding said contacts closed including a trip which when moved in a first direction releases said latching means, trip actuating means movable from a first position to a second position for moving said trip in said first direction to release said latch means, means biasing said trip actuating means to said first position, means for moving said trip actuating means to said second position including a body means for holding said body in an elevated position above said trip actuating means and operable to release said body when a shock force is applied thereto, means for guiding said body when released from said elevated position through a path of movement into engagement with said trip actuating means, said body when re-

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leased falling through the influence of gravity and striking said trip actuating means and the force of said falling body overcoming the biasing force of said biasing means to move said trip actuating means to said second position.

4. A circuit breaker mechanism comprising a pair of contacts with open and closed positions, latching means for holding said contacts closed, trip means operative to release said latching means, a casing having an axially extending bore, plunger means extending through one end of said casing and movable from a first position to a second position to actuate said trip means, means for yieldably holding said plunger means in its said first position, a washer member positioned on a ledge in said bore adjacent the second end of said casing opposite said first end, an internally threaded sleeve member supported in said bore by said washer member, magnetic means threaded into said sleeve member and positioned in the opening in said washer member, a body held in an elevated position adjacent said second end of said casing by said magnetic means and freed therefrom upon the application of a shock force of a predetermined magnitude thereto and when freed falling through the influence of gravity and striking said plunger means to move said plunger means from its first to its second position to operate said trip means.

5. A circuit breaker mechanism as defined in claim 4 wherein said magnetic means includes means for adjusting the position of said magnet relative to said washer so that said body may be released upon the application of shock forces of varying magnitudes.

6. A circuit breaker mechanism having a pair of contacts with open and closed positions, manually actuated operating means movable to a closed position for closing said contacts, latching means for holding said contacts closed and said operating means in said closed position and effective in response to closing of said contacts by said operating means, trip means operative to release said latching means, a casing having an axially extending bore, plunger means extending through one end of said casing and having one end in said bore and movable therein and a second end above said trip means, said plunger means being movable from a first position to a second position for operating said trip means, means for yieldably holding said plunger means in its first position a body positioned in said bore and movable therein, attaching means for holding said body adjacent the end of said casing opposite the end through which said plunger means extends and operable to release said body upon the application of a shock force of a predetermined magnitude thereto and said body when released falling through the influence of gravity and striking the end of said plunger means in said casing, the force of said falling body moving said plunger means to operate said trip means, the dimension of said body extending parallel to its path of movement when released plus the length of said plunger means being at least equal to the length of said bore so that said body may be raised in said bore by movement of said plunger means so as to be again held in its elevated position by said attaching means.

7. A circuit breaker mechanism having a pair of contacts with open and closed positions, latching means for holding said contacts closed, trip means operative to release said latching means, a casing having an axially extending bore, plunger means extending through one end of said casing and having one end in said bore and movable therein and a second end above said trip means, said plunger means being movable from a first position to a second position for operating said trip means, means for yieldably holding said plunger means in its first position, a body movable in said bore, magnetic means providing a magnetic field tending to move said body vertically and to attract and hold said body adjacent the end of said casing opposite the end through which said plunger means extends and operable to release said body upon the application of a shock force of a predetermined magnitude thereto and said body when released falling through

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the influence of gravity and striking the end of said body moving said plunger means to operate said trip means, the dimension of said body parallel to its path of movement plus the length of said plunger means being at least equal to the length of said bore so that said body may be reset in its elevated position by raising said plunger means and body until said body is attracted by said magnetic means.

8. A circuit breaker mechanism comprising a pair of contacts with open and closed positions, operating means for closing said contacts, a casing supported adjacent to said contacts and having an axially extending bore, plunger means extending through one end of said casing and movable therein from a first to a second position to effect opening of said contacts, means for yieldably holding said plunger means in its first position, a washer member positioned on a ledge in said bore adjacent the second end of said casing opposite said first end, an internally threaded sleeve member supported in said bore by said washer member, magnetic means threaded into said sleeve member and positioned in the opening in said

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washer member, a body held in an elevated position adjacent said second end of said casing by said magnetic means and freed therefrom upon the application of a shock force of a predetermined magnitude thereto and when freed falling through the influence of gravity and striking said plunger means to move said plunger means from its first to its second position.

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