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W. E. NORDMARK ET AL

2,596,427

INERTIA-OPERATED SWITCH

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Fig. 1

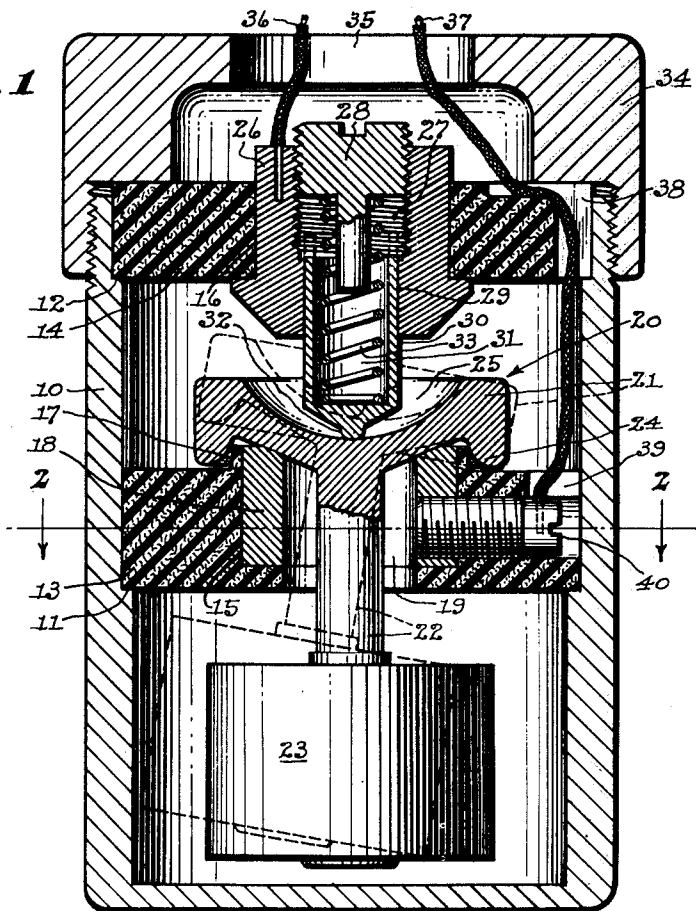


Fig. 2

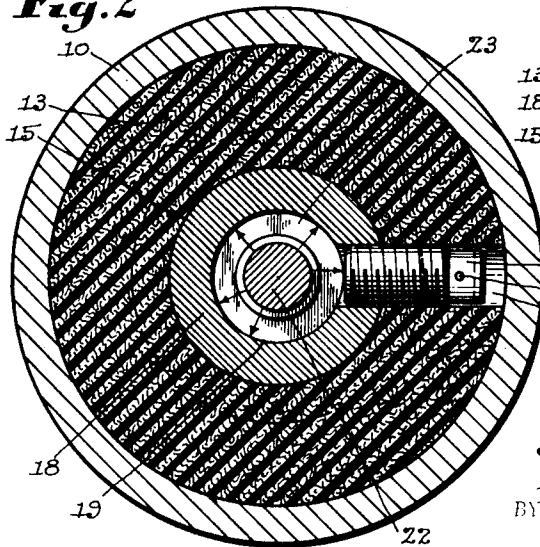
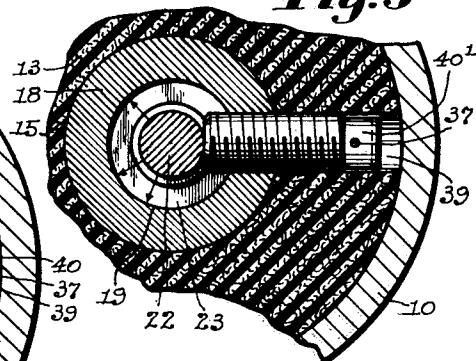


Fig. 3



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INERTIA-OPERATED SWITCH

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16 Claims. (Cl. 200—52)

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The present invention relates to an inertia-operated switch for interrupting an electric circuit.

The primary object of the invention is to provide an inertia-operated switch adapted for installation on a vehicle, whereby upon sudden deceleration of the vehicle an electric circuit is automatically interrupted for effecting any of several results of a precautionary or corrective nature. Such results may include, for example, the desirable interruption of the ignition circuit of a motor vehicle in the event of a crash thus to minimize the hazard of fire, or the activation of certain signal devices, or the operation of certain safety devices such as shoulder harness reels whereby airplane pilots may be secured in their seats and thus prevented from being suddenly thrown forward in the event of a crash or during certain maneuvers, or the detonation of an explosive charge to destroy mechanisms of a secret nature in cases of accidents involving vehicles on which such mechanisms are installed. The foregoing examples are merely illustrative of the uses to which the invention may be put and the invention is applicable in any situation where an inertia-operated switch is desired, the new switch being efficient in operation, multidirectionally operable to the extent desired, sturdy and relatively simple in construction and reasonably economical in manufacture.

Illustrative embodiments of the invention are shown in the accompanying drawing, wherein:

Figure 1 is a central, vertical, longitudinal sectional view through the new switch;

Figure 2 is a horizontal sectional view thereof taken on line 2—2 of Figure 1; and

Figure 3 is a fragmentary sectional view illustrating a slightly modified form of the device.

Referring now in detail to this drawing, the new inertia-operated switch illustrated in Figures 1 and 2, is housed within a generally cylindrical casing 10 which as here shown has a closed bottom and an open, externally threaded top. The internal wall of the casing 10 is stepped so as to form cylindrical sections separated by a lower shoulder 11 and an upper shoulder 12, the lowermost of the three sections thus formed having the smallest diameter and the uppermost section having the greatest diameter of the three. The casing is desirably made of aluminum.

A lower insulation member or ring 13 is supported on the lower shoulder 11 of the casing, and a similar upper insulation member or ring 14 is supported on the upper shoulder 12 of the casing. These horizontally disposed, vertically spaced insulation rings are preferably made of a

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hard fiber, and are provided with vertically aligned, centrally located, circular openings therethrough designated 15 in the lower ring and 16 in the upper ring. The lower ring 13 has an upwardly extending circular rim 17 surrounding the upper end of the central opening through said ring 13.

An annular contact member 18 is mounted in the central opening 15 of the lower insulation ring 13 and is provided with a vertically extending, centrally located, circular opening 19 therethrough. The outer part of the circular upper surface of the contact member 18 is flush with the circular upper surface of the rim 17 on the ring 13, while the inner part of the contact member's upper surface is downwardly convergent.

A contact pendulum generally designated 20 is disposed in the casing and has a circular head 21 supported by the lower insulation ring 13, a stem 22 depending through the central opening 19 in the contact member 18, and an inertia-responsive weight 23 at the lower end of the stem 22, below the ring 13. The lower or under surface of the pendulum head 21 is downwardly convergent in its middle region, and the head is normally seated against the upper surface of the contact member 18. The pendulum's head 21 is also provided with a depending peripheral bead 24 which surrounds the upstanding rim 17 on the ring 13 and restrains the pendulum's head against lateral movement. The upper surface of the pendulum's head 21 is provided with a centrally located concavity 25 therein.

An annular collar 26 is mounted in the central opening 16 in the upper insulation ring 14. The upper portion 27 of the collar 26 is internally screw-threaded to receive an adjustment screw 28, whereas the lower portion of the collar 26 has a centrally located, vertical slide bearing or barrel 29 in which is vertically slidably disposed a plunger 30. This plunger 30 has a well 31 therein opening at the top of the plunger, and the bottom of the plunger is closed and converges downwardly to a rounded tip 32. A helical compression spring 33 is disposed within the well 31 of the plunger, and bears at its upper end against the bottom of the adjustment screw 28 and at its lower end against the closed bottom of the plunger 30. It will be seen that the spring 33 urges the plunger downwardly so that its tip 32 bears against the head 21 of the pendulum 20 in the approximate center of said head's concavity 25, and that the amount of downward pressure thus exerted by the spring may be adjusted by turning the adjustment screw 28.

The casing is provided with a cap 34 threaded on the upper end thereof and provided with a central opening 35 therethrough, through which opening the lead-wires 36, 37 of an electric circuit are introduced into the casing. The lead-wire 36 is connected to the collar 26 in the upper insulation ring 14. The lead-wire 37 extends through a slot 38 in one side of the upper ring 14, thence through a slot 39 in one side of the lower ring 13, and is connected to a lead-screw 40 which is threaded laterally through the ring 13 and into the annular contact member 18. As shown in the modified form of the invention illustrated in Figure 3 the lead-screw 40¹ extends well into the contact member's central opening 19, for a purpose hereinafter described.

Operation

The inertia-operated switch is mounted in a vehicle (or other movable object) in the position illustrated, i. e. with the pendulum 20 depending vertically. The electric circuit to be interrupted by force of inertia, as upon impact of the vehicle with an external object, is normally completed through the lead-wire 36, collar 26, plunger 30, contact pendulum 20, annular contact member 18, lead-screw 40, and lead-wire 37, all of which parts are made of an electrically conductive material such as brass or copper and all of which are insulated from the casing and its cover. The seated contact of the contact pendulum 20 on the annular contact member 18 is normally maintained by the downward pressure of spring 33 on plunger 30.

The pendulum inertia-responsive weight 23 is, as shown in Figures 1 and 2, operable multidirectionally through 360 degrees, that is, it is free to move in any lateral direction as indicated by the small arrows of Figure 2. When so moved, the depending peripheral bead 24 on the pendulum's head 21 engages the upper surface of the insulation ring 13 which serves as a fulcrum about which the pendulum rotates to unseat the pendulum's head 21 from the annular contact member 18 as indicated in dotted lines in Figure 1. The contact between these two members is thus broken and the electric circuit above described is thus interrupted. Such interruption of the circuit may of itself effect the desired result, or it may operate through a relay to effect such result.

In some instances it may be found desirable to prevent the operation of the device in one or more directions of impact and this may be accomplished by limiting the multidirectional movement of the pendulum to less than 360 degrees. In Figure 3 this has been accomplished by simply substituting a longer lead-screw 40¹ for the lead-screw 40, which lead-screw 40¹ would serve to prevent movement of the pendulum to the right as viewed in Figure 3 and thus accomplish the desired end.

It will thus be seen that the invention provides a relatively simple but highly efficient inertia-operable switch, and while but two specific embodiments of the invention have been herein shown and described it will be understood that numerous details may be altered or omitted without departing from the spirit of the invention as the same is defined by the following claims.

We claim:

1. In an inertia-operated switch for interrupting an electric circuit: an insulation member; a contact member mounted in said insulation member and having a vertically extending opening therethrough; a contact pendulum hav-

ing a head normally seated against the upper surface of said contact member and having a stem depending through the opening in said contact member and provided at its lower end with an inertia-responsive weight whereby said contact pendulum is movable so that the peripheral edge of its head bears against the upper surface of said insulation member to serve as a fulcrum about which the pendulum may rotate to unseat the head thereof from the contact member and thus break the contact between the contact pendulum and the contact member to interrupt an electric circuit therethrough.

2. In an inertia-operated switch for interrupting an electric circuit: an insulation member; an annular contact member mounted in said insulation member and having a circular upper surface and a vertically extending opening therethrough; a contact pendulum having a head normally seated against the circular upper surface of said contact member and having a stem depending through the opening in said contact member and provided at its lower end with an inertia-responsive weight whereby said contact pendulum is movable so that the peripheral edge of its head bears against the upper surface of said insulation member to serve as a fulcrum about which the pendulum may rotate to unseat the head thereof from the annular contact member and thus break the contact between the contact pendulum and the contact member to interrupt an electric circuit therethrough.

3. In an inertia-operated switch for interrupting an electric circuit: an insulation member; an annular contact member mounted in said insulation member and having a circular upper surface and a vertically extending opening therethrough; a contact pendulum having a circular head of greater diameter than the annular contact member normally seated against the circular upper surface of said contact member and having a stem depending through the opening in said contact member and provided at its lower end with an inertia-responsive weight whereby said contact pendulum is movable so that the peripheral edge of its head bears against the upper surface of said insulation member to serve as a fulcrum about which the pendulum may rotate to unseat the head thereof from the annular contact member and thus break the contact between the contact pendulum and the contact member to interrupt an electric circuit therethrough.

4. In an inertia-operated switch for interrupting an electric circuit: an insulation member; an annular contact member mounted in said insulation member and having a circular upper surface and a vertically extending opening therethrough; a contact pendulum having a circular head of greater diameter than the annular contact member normally seated against the circular upper surface of said contact member and having a stem depending through the opening in said contact member and provided at its lower end with an inertia-responsive weight whereby said contact pendulum is movable multidirectionally so that the peripheral edge of its head bears against the upper surface of said insulation member to serve as a fulcrum about which the pendulum may rotate to unseat the head thereof from the annular contact member and thus break the contact between the contact pendulum and the contact member to interrupt an electric circuit therethrough.

5. In an inertia-operated switch for interrupt-

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ing an electric circuit: an insulation member; and annular contact member mounted in said insulation member and having a circular upper surface and a vertically extending opening therethrough; a contact pendulum having a circular head of greater diameter than the annular contact member normally seated against the circular upper surface of said contact member and having a stem depending through the opening in said contact member and provided at its lower end with an inertia-responsive weight whereby said contact pendulum is movable through 360 degrees so that the peripheral edge of its head bears against the upper surface of said insulation member to serve as a fulcrum about which the pendulum may rotate to unseat the head thereof from the annular contact member and thus break the contact between the contact pendulum and the contact member to interrupt an electric circuit therethrough.

6. In an inertia-operated switch for interrupting an electric circuit: an insulation member; an annular contact member mounted in said insulation member and having a circular upper surface and a vertically extending opening therethrough; a contact pendulum having a circular head of greater diameter than the annular contact member normally seated against the circular upper surface of said contact member and having a stem depending through the opening in said contact member and provided at its lower end with an inertia-responsive weight whereby said contact pendulum is movable multidirectionally so that the peripheral edge of its head bears against the upper surface of said insulation member to serve as a fulcrum about which the pendulum may rotate to unseat the head thereof from the annular contact member and thus break the contact between the contact pendulum and the contact member to interrupt an electric circuit therethrough; and stop means for preventing movement of the pendulum in one direction for limiting the multidirectional movement thereof to less than 360 degrees.

7. In an inertia-operated switch for interrupting an electric circuit: an insulation member having a vertically extending annular opening therethrough and provided with an upstanding circular rim surrounding the upper end of said opening; an annular contact member mounted in the opening in said insulation member and having a circular upper surface and a vertically extending opening therethrough; a contact pendulum having a circular head of greater diameter than said rim and provided with a depending peripheral bead surrounding said rim, said head being normally seated against the circular upper surface of said contact member and restrained against lateral movement by the engagement of said bead with said rim, the pendulum being also provided with a stem depending from said head through the opening in said contact member and provided at its lower end with an inertia-responsive weight whereby said contact pendulum is movable so that the depending bead on said head bears against the upper surface of said insulation member to serve as a fulcrum about which the pendulum may rotate to unseat the head thereof from the annular contact member and thus break the contact between the contact pendulum and the contact member to interrupt an electric circuit therethrough.

8. In an inertia-operated switch for interrupting an electric circuit: an insulation member having a vertically extending annular open-

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ing therethrough and provided with an upstanding circular rim surrounding the upper end of said opening; an annular contact member mounted in the opening in said insulation member and having a circular downwardly convergent upper surface and a vertically extending opening therethrough; a contact pendulum having a circular head of greater diameter than said rim and provided with a depending peripheral bead surrounding said rim, said head having a downwardly convergent lower surface and being normally seated against the circular upper surface of said contact member and restrained against lateral movement by the engagement of said bead with said rim, the pendulum being also provided with a stem depending from said head through the opening in said contact member and provided at its lower end with an inertia-responsive weight whereby said contact pendulum is movable so that the depending bead on said head bears against the upper surface of said insulation member to serve as a fulcrum about which the pendulum may rotate to unseat the head thereof from the annular contact member and thus break the contact between the contact pendulum and the contact member to interrupt an electric circuit therethrough.

9. In an inertia-operated switch for interrupting an electric circuit: an insulation member; a contact member mounted in said insulation member and having a vertically extending opening therethrough; a contact pendulum having a head seated against the upper surface of said contact member and having a stem depending through the opening in said contact member and provided at its lower end with an inertia-responsive weight whereby said contact pendulum is movable so that the peripheral edge of its head bears against the upper surface of said insulation member to serve as a fulcrum about which the pendulum may rotate to unseat the head thereof from the contact member and thus break the contact between the contact pendulum and the contact member to interrupt an electric circuit therethrough; and spring means bearing against the upper surface of the pendulum's head for normally pressing said head into seated engagement with the upper surface of said contact member.

10. In an inertia-operated switch for interrupting an electric circuit: an insulation member having a vertically extending annular opening therethrough and provided with an upstanding circular rim surrounding the upper end of said opening; an annular contact member mounted in the opening in said insulation member and having a circular downwardly convergent upper surface and a vertically extending opening therethrough; a contact pendulum having a circular head of greater diameter than said rim and provided with a depending peripheral bead surrounding said rim, said head having a downwardly convergent lower surface and being seated against the circular upper surface of said contact member and restrained against lateral movement by the engagement of said bead with said rim, the pendulum being also provided with a stem depending from said head through the opening in said contact member and provided at its lower end with an inertia-responsive weight whereby said contact pendulum is movable so that the depending bead on said head bears against the upper surface of said insulation member to serve as a fulcrum about which the pendulum may rotate to unseat the head thereof from

the annular contact member and thus break the contact between the contact pendulum and the contact member to interrupt an electric circuit therethrough; and spring means bearing against the upper surface of the pendulum's head for normally pressing said head into seated engagement with the upper surface of said contact member.

11. In an inertia-operated switch for interrupting an electric circuit: a casing; a pair of insulation members mounted in the casing in vertically spaced relation, the lower insulation member having a vertically extending opening therethrough; a contact member mounted in the lower insulation member's opening and having a vertically extending opening therethrough; a contact pendulum having a head adapted to seat against the upper surface of said contact member and having a stem depending through the opening in said contact member and provided at its lower end with an inertia-responsive weight whereby said contact pendulum is movable so that the peripheral edge of its head bears against the upper surface of the lower insulation member to serve as a fulcrum about which the pendulum may rotate to unseat the head thereof from the contact member and thus break the contact between the contact pendulum and the contact member to interrupt an electric circuit therethrough; and spring means interposed between the upper insulation member and the upper surface of the pendulum for normally pressing said head into seated engagement with the upper surface of said contact member.

12. In an inertia-operated switch for interrupting an electric circuit: a casing; a pair of insulation members mounted in the casing in vertically spaced relation, the lower insulation member having a vertically extending opening therethrough; a contact member mounted in the lower insulation member's opening and having a vertically extending opening therethrough; a contact pendulum having a head adapted to seat against the upper surface of said contact member and having a stem depending through the opening in said contact member and provided at its lower end with an inertia-responsive weight whereby said contact pendulum is movable so that the peripheral edge of its head bears against the upper surface of the lower insulation member to serve as a fulcrum about which the pendulum may rotate to unseat the head thereof from the contact member and thus break the contact between the contact pendulum and the contact member to interrupt an electric circuit therethrough; a plunger vertically slidably mounted in the upper insulation member and bearing at its lower extremity against the upper surface of said contact pendulum's head; and spring means interposed between the upper insulation member and the plunger for normally urging said plunger downwardly.

13. In an inertia-operated switch for interrupting an electric circuit: a casing; a pair of insulation members mounted in the casing in vertically spaced relation, the lower insulation member having a vertically extending opening therethrough; a contact member mounted in the lower insulation member's opening and having a vertically extending opening therethrough; a contact pendulum having a head adapted to seat against the upper surface of said contact member and having a stem depending through the opening in said contact member and provided at its lower-end with an inertia-responsive weight

whereby said contact pendulum is movable so that the peripheral edge of its head bears against the upper surface of the lower insulation member to serve as a fulcrum about which the pendulum may rotate to unseat the head thereof from the contact member and thus break the contact between the contact pendulum and the contact member to interrupt an electric circuit therethrough; a plunger vertically slidably mounted in the upper insulation member and bearing at its lower extremity against the upper surface of said contact pendulum's head; and spring means interposed between the upper insulation member and the plunger for normally urging said plunger downwardly, the upper surface of said pendulum's head having a concavity therein and the lower extremity of said plunger having a tip bearing in the approximate center of said concavity.

14. In an inertia-operated switch for interrupting an electric circuit: a casing; a pair of insulation members mounted in the casing in vertically spaced relation, said members having vertically aligned openings therethrough; a contact member mounted in the lower insulation member's opening and having a vertically extending opening therethrough; a contact pendulum having a head adapted to seat against the upper surface of said contact member and having a stem depending through the opening in said contact member and provided at its lower end with an inertia-responsive weight whereby said contact pendulum is movable so that the peripheral edge of its head bears against the upper surface of the lower insulation member to serve as a fulcrum about which the pendulum may rotate to unseat the head thereof from the contact member and thus break the contact between the contact pendulum and the contact member to interrupt an electric circuit therethrough; a collar mounted in the opening in the upper insulation member and having an opening therethrough the upper portion of which is internal threaded and the lower portion of which constitutes a vertically extending barrel; a plunger vertically slidably disposed in said barrel and having a well in its upper portion and a closed bottom bearing against the upper surface of said contact pendulum's head; an adjustment screw threaded in the upper threaded portion of said collar's opening; and a spring interposed between said screw and the bottom of the plunger's well for normally urging said plunger downwardly to complete an electric circuit through the collar, the plunger, the pendulum and the contact member.

15. In an inertia-operated switch for interrupting an electric circuit: an insulation member; an annular contact member mounted in said insulation member and having a circular upper surface and a vertically extending opening therethrough; a contact pendulum having a circular head of greater diameter than the annular contact member normally seated against the circular upper surface of said contact member and having a stem depending through the opening in said contact member and provided at its lower end with an inertia-responsive weight whereby said contact pendulum is movable so that the peripheral edge of its head bears against the upper surface of said insulation member to serve as a fulcrum about which the pendulum may rotate to unseat the head thereof from the annular contact member and thus break the contact between the contact pendulum and the contact

member to interrupt an electric circuit there-through; and a lead-screw threaded laterally through the insulation member and into said annular contact member.

16. In an inertia-operated switch for interrupting an electric circuit: an insulation member; an annular contact member mounted in said insulation member and having a circular upper surface and a vertically extending opening there-through; a contact pendulum having a circular head of greater diameter than the annular contact member normally seated against the circular upper surface of said contact member and having a stem depending through the opening in said contact member and provided at its lower end with an inertia-responsive weight whereby said contact pendulum is movable multidirectionally so that the peripheral edge of its head bears against the upper surface of said insulation member to serve as a fulcrum about which the pendulum may rotate to unseat the head thereof from the annular contact member and thus break the contact between the contact pen-

dulum and the contact member to interrupt an electric circuit therethrough; and a lead-screw threaded laterally through the insulation member and through said annular contact member and extending into the vertically extending opening in said contact member, the inner end of said lead-screw serving as a stop against which the pendulum may abut to limit the multidirectional movement of the pendulum to less than 360 degrees.

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