

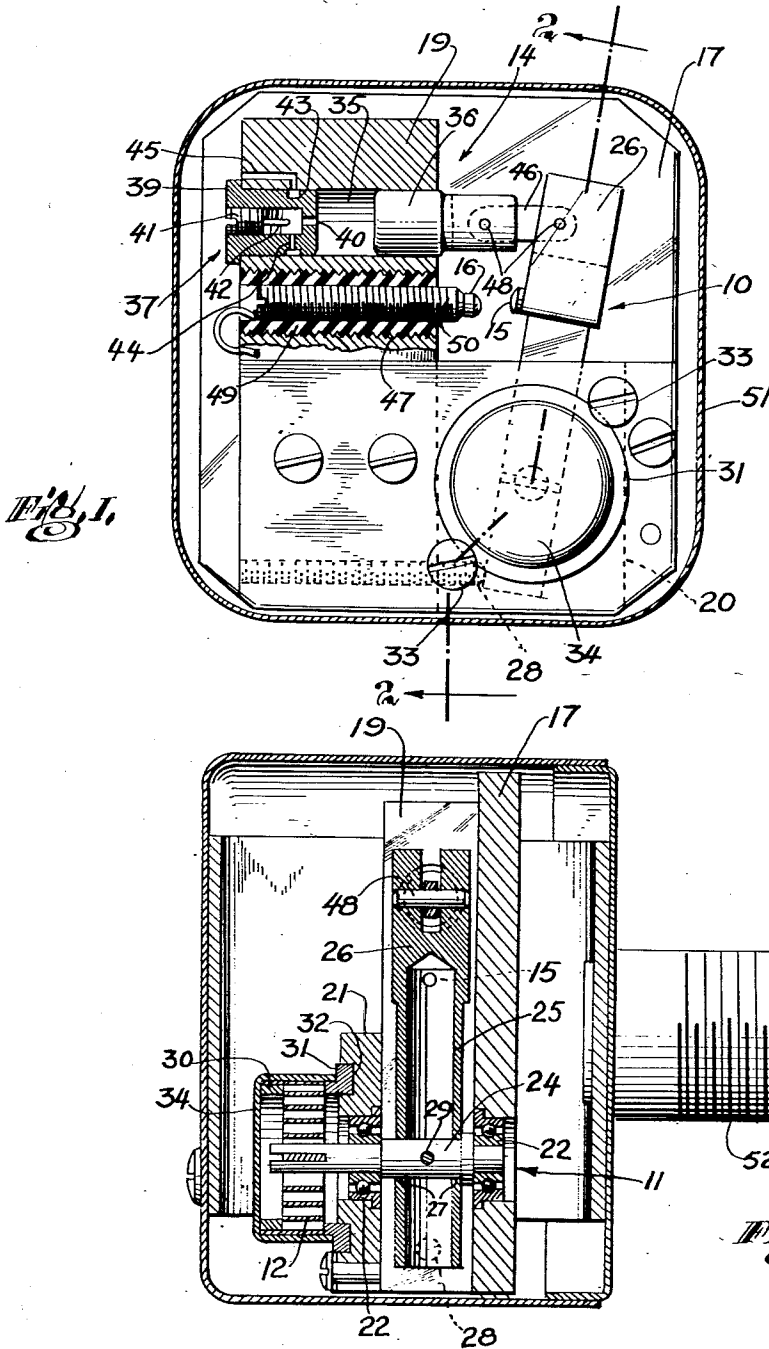
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R. G. TOWLE ET AL

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INERTIA SWITCH

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INVENTOR
Robert G. Towle
Roger B. Jones
BY Robert J. Gantner
J. William Carson
ATTORNEY

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INERTIA SWITCH

Robert G. Towle, New City, N. Y., and Roger B. Jones, Colonia, and Robert J. Ganther, Smoke Rise, N. J., assignors to Specialties Development Corporation, Belleville, N. J., a corporation of New Jersey

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This invention relates to circuit makers, and, more particularly, to switches or control mechanisms which are inertia actuated.

An object of the present invention is to provide an inertia actuated switch is actuatable by a deceleration of a predetermined magnitude upon being effective for a predetermined duration of time.

Another object is to provide such a switch wherein the magnitude of deceleration required for actuation may be varied.

Another object is to provide such a switch wherein the duration of deceleration required for actuation may be varied.

A further object is to provide such a switch which is self-resetting.

A still further object is to provide such a switch which is simple and economical in construction and is accurate and reliable in operation.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description, and is shown in the accompanying drawing, forming a part of the specification, wherein:

Fig. 1 is an elevational view, partly in section, illustrating a switch in accordance with the invention, and

Fig. 2 is a sectional view taken substantially along the line 2—2 on Fig. 1.

Referring to the drawing herein, there is shown an inertia switch comprising a pendulum 10, supporting means 11 for pivotally mounting the pendulum, a spring 12 adapted to resist pivotal movement of the pendulum, dashpot means 14 linked to the pendulum, an electrical contact 15 on the pendulum, and a second electrical contact 16 positioned to be engaged by the first contact upon movement of the pendulum in its direction.

The foregoing elements are supported on a frame including a base plate 17 formed with an elongate upstanding boss or projection 19 adjacent one side thereof, a boss or projection 20, and a bearing plate 21 extending across the projections 19 and 20 and secured thereto.

Conventional ball bearings 22 are mounted in opposed apertures in the base plate 17 and the bearing plate 21, and serve as journals for pivotally mounting a shaft 24 having one end extending beyond the bearing plate 21 and being longitudinally slotted for the purpose to be described.

The pendulum 10 comprises a tubular shank 25 and an enlarged portion 26 at one end thereof. The shank is formed with a pair of apertures 27 adjacent its end opposite the enlarged portion through which the shaft 24 extends, and a pin 29 secures the pendulum to the shaft for pivotal movement therewith. A rod 28 is adjustably

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screw threaded into a suitable bore in the projection 19 so that its end protrudes therefrom and engages the end of the pendulum adjacent the shaft 24 to serve as a stop to limit the excursion of the pendulum.

The spring 12 is of the spiral torsion type having its inner end secured to the slotted end of the shaft 24 and having its outer end secured to a cylindrical casing or retainer 30 surrounding the spring which is formed with an annular flange 31 at one end thereof adapted to fit into an annular groove 32 provided for such purpose in the surface of the plate 21. A pair of screws 33 are threaded into suitable bores in the plate 21 so that the heads thereof overlap the flange 31 to maintain the desired tension on the spring 12. A cover 34 is provided to prevent the spring ends from sliding out of their respective slots.

The dashpot means 14 consists of a cylinder 35 bored in the projection 19 adjacent the enlarged portion of the pendulum, a plunger 36 slideably disposed in the cylinder, and valve means 37 in one end of the cylinder. The valve means 37 comprise an interiorly screw threaded cup-shaped member 39 formed with a central aperture 40 in its closed end, and a needle valve member 41 adjustably threaded into the member 39 having a centrally disposed conical finger 42 for controlling the area of the aperture 40. The member 39 further has an external annular groove 43 adjacent its closed end formed with an aperture 44 for establishing communication between the groove 43 and the interior of the member 39 and a passageway 45 in the projection 19 provides for communication between the groove 43 and the ambient atmosphere.

The exposed end of the plunger 36 and the enlarged end portion 26 of the pendulum are provided with clevis joint means including a link 46 and pins 48.

The projection 19 further is formed with a bore 47 extending therethrough which is adjacent and parallel to the cylinder 35 and a tubular insulating member 49 is mounted therein. A rod 50 is secured within the member 49 and projects therefrom in a direction towards the pendulum so that its exposed end serves as the electrical contact 16. The contact 15 is located on the pendulum so as to engage the contact 16 when the pendulum is actuated.

The apparatus may be protected from dust and moisture by mounting the same in a hermetically sealed can 51 provided with a conventional electrical connector 52 to which a conductor extending from the contact 16 may be secured in the usual manner. The contact 15 may be grounded to the can.

The apparatus, when installed, is mounted in a vehicle or craft, such as an airplane, in a manner whereby the direction of the pendulum excursion is the same as the direction in which the airplane was moving prior to deceleration thereof.

In operation, in the event of such a deceleration, the pendulum contact 15 is caused to engage the contact 16 in opposition to the spring load provided by the spring 12. Such movement of the pendulum is retarded by the plunger 36 which then moves in the cylinder 35 in a direction towards the valve means 37 as air in the cylinder 35 escapes to the ambient atmosphere through the valve means 37 by way of the apertures 40 and 44 and the groove 43 in the cup-shaped member 39 and the passageway 45.

The magnitude of deceleration required to actuate the switch may be varied by loosening the screws 33 and rotating the spring retainer 30 and cover 34 clockwise or counterclockwise, as viewed in Fig. 1, to increase or decrease, respectively, the spring tension urging the pendulum in a direction to maintain the contacts 15 and 16 apart. The duration of time during which the decelera-

tion of a predetermined magnitude must be sustained in order to effect engagement of the contacts may be varied by altering the rate of flow of air permitted to escape from the cylinder 35 when the pendulum moves in its direction. This is accomplished by locating the conical finger 45 in the desired position with respect to the aperture 40.

Since the deceleration, to be effective, must be sustained for a predetermined period of time, it will be understood that the switch is insensitive to deceleration of considerably greater magnitudes if the time duration thereof is less than the pre-set duration. However, because the time duration of deceleration required for actuation is inversely proportional to the required magnitude of deceleration, the switch will be actuated by high shock, characterized by high deceleration, for a short duration of time and by a smaller shock, characterized by a lesser deceleration, for a greater duration of time.

Since the apparatus of the present invention consists primarily of a pendulum restrained by a spring force, it is self-resetting, and will return to its normal position whenever a deceleration is of insufficient magnitude or a duration of time is too small to cause engagement of the contacts 15 and 16.

From the foregoing description, it will be seen that the present invention provides an accurate and reliable self-resetting inertia switch which is actuable by a deceleration of a predetermined value applied for a predetermined duration of time wherein the magnitude of deceleration and the duration of time required for actuation may be varied.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense.

We claim:

1. An inertia switch comprising a pendulum, means including a bearing and a shaft journaled in said bearing for pivotally mounting said pendulum adjacent one end thereof, a spring constructed and arranged to resist a given force tending to effect pivotal movement of said pendulum, and to normally urge the same into an inactive position dashpot means including a plunger linked to said pendulum adjacent its other end, an electrical contact on said pendulum, and a second electrical contact adjacent said first contact and positioned to be engaged thereby upon movement of said pendulum in its direction, said dashpot means having a vent dimensioned to determine the time required for a force sensed by said spring in excess of the given force and sufficient to overcome said spring to cause said contacts to engage.

2. An inertia switch comprising a pendulum, means including bearings and a shaft journaled in said bearings for pivotally mounting said pendulum adjacent one end thereof, a torsion spring connected to said shaft and adapted to resist pivotal movement of said pendulum and to normally urge the same into an inactive position, dashpot means including a plunger linked to said pendulum adjacent its other end, an electrical contact on said pendulum, a second electrical contact adjacent said first contact and positioned to be engaged thereby upon movement of said pendulum in its direction, and stop means associated with said pendulum to limit the excursion of said pendulum under the influence of said spring.

3. A control mechanism of the class described comprising a frame including a pair of bearing plates, a shaft rotatably journaled in said plates, a pendulum mounted

adjacent one end thereof on said shaft for rotation therewith, dashpot means including a cylinder provided with a vent, a piston slideably supported in said cylinder and linked to said pendulum adjacent the other end thereof to oppose oscillation of said pendulum and rotation of said shaft, adjustable valve means for regulating the rate of flow of air through said vent, a torsion spring having one end secured to said frame and having its other end secured to said shaft and acting with said dashpot means to oppose rotation of said shaft, an electrical contact on said frame, and an electrical contact on said pendulum adapted to engage said first mentioned contact upon movement of said pendulum through a predetermined arc, and stop means adjustably mounted on said frame adjacent said pendulum to limit the excursion thereof.

4. A control mechanism of the class described comprising a frame including a pair of bearing plates, a shaft rotatably journaled in said plates, a pendulum mounted adjacent one end thereof on said shaft for rotation therewith, dashpot means including a cylinder provided with a vent, a piston slideably supported in said cylinder and linked to said pendulum adjacent the other end thereof, adjustable valve means for regulating the rate of flow of air through said vent, a torsion spring having one end secured to said shaft to oppose rotation thereof, a housing for said spring adjustably secured to said frame and having the other end of said spring secured thereto, an electrical contact on said frame, an electrical contact on said pendulum adapted to engage said first mentioned contact upon movement of said pendulum through a predetermined arc, and stop means adjustably mounted on said frame adjacent said pendulum to limit the excursion thereof.

5. A control mechanism of the class described comprising a frame, a shaft rotatably journaled in said frame, a pendulum having one end mounted on said shaft for rotation therewith, cylinder means provided with an air vent, piston means slideably supported in said cylinder means, one of said means being supported on said frame and the other of said means being pivotally linked to said pendulum at its other end, a spring constructed and arranged to normally oppose oscillation of said pendulum in the direction causing said piston means to effect compression of air in said cylinder means and to normally urge said pendulum into an inactive position, an electrical contact on said frame adjacent said cylinder and piston means, an electrical contact on said pendulum normally out of contact with said first mentioned contact and adapted to engage said first mentioned contact upon oscillation of said pendulum through a predetermined arc in the direction movement is opposed by said spring, and stop means on said frame engaged by said pendulum to determine the inactive position thereof.

6. Mechanism according to claim 5, wherein one of said contacts is adjustably mounted to determine the distance between said contacts when said pendulum is in its inactive position.

7. Mechanism according to claim 5, wherein said stop means is adjustably mounted to vary the inactive position of said pendulum.

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