

Aug. 27, 1946.

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2,406,427

INERTIA SAFETY SWITCH

Filed June 18, 1943

Fig. 1.

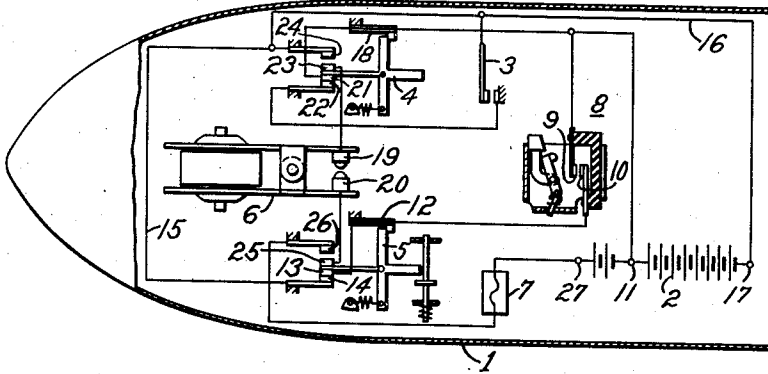


Fig. 2.

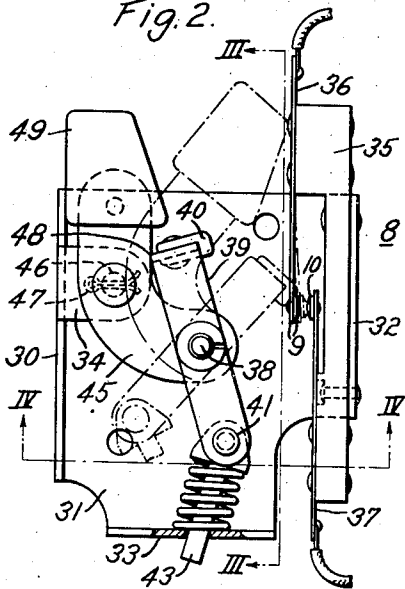


Fig. 3.

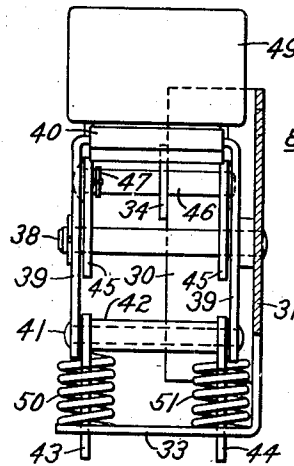
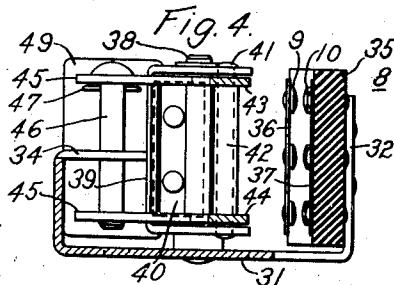


Fig. 4.



WITNESS

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2,406,427

INERTIA SAFETY SWITCH

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Application June 18, 1943, Serial No. 491,321

6 Claims. (Cl. 200—52)

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My invention relates to electric switches and, more particularly, to inertia responsive switches for closing a circuit in a torpedo when the torpedo, and thus the switch, is subjected to a mechanical impulse.

The Government of the United States has been granted a certain royalty-free license for governmental purposes with respect to the invention herein described.

Inertia responsive switches as such are well known in the art, but usually such switches are complicated, expensive, and not particularly reliable.

In torpedoes it is extremely important that the charge be not detonated prematurely. A number of safety devices and switches are thus essential.

One object of my invention is the provision of an inertia responsive safety switch that is reliable, simple, and inexpensive.

Another object of my invention is the provision of a switch that is responsive to one mechanical shock and is thereafter no longer inertia responsive, but for successive operation has to be manually reset.

Another object of my invention is the provision of an inertia trip safety switch for an electric torpedo.

The objects hereinbefore expressed are merely illustrative. Other objects and advantages will become more apparent from a study of the following specification and the accompanying drawing, in which:

Figure 1 is a schematic showing of the war head of a torpedo provided with my invention;

Fig. 2 is a side view of my invention with some parts broken away for purposes of clarity of the showing;

Fig. 3 is a vertical sectional view on the plane indicated by section line III—III in Fig. 2; and

Fig. 4 is a horizontal sectional view on the plane indicated by section line IV—IV in Fig. 2.

In Figure 1, the torpedo is indicated by 1. The torpedo, with many other devices, includes a battery 2, a long-time time-limit switch 3, a thermostatic time-limit switch 4, a second thermostatic time-limit switch 5, an inertia responsive switch 6, a detonator 7, and the inertia responsive safety switch 8 constituting the subject matter of the invention disclosed herein.

During firing of the torpedo, it is subjected to considerable acceleration. I take advantage of this acceleration to operate my safety switch to close the contact members 9 and 10. When contact members 9 and 10 are closed, an ener-

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gizing circuit is established for the thermostatic switch 5. This circuit may be traced from junction 11 of the battery through contact members 9 and 10, the bimetal 12, contact members 13 and 14 and conductors 15 and 16, to the junction 17 of the battery.

In due time after, the firing of the torpedo switch 3 is closed. A circuit is thus established from junction 11, through bimetal 18, contact members 21 and 22, switch 3, to junction 17. After the desired time intervals selected for the operation of time-limit relays 4 and 5 have expired, these relays operate to close contact members 23 and 24, and 25 and 26, respectively.

Since the detonator circuit, which circuit may be traced from junction 27, through the detonator 7, contact members 25 and 26, 20 and 19, 23 and 24, and conductor 16, to junction 17, can not be closed unless contact members 25 and 26 are closed; and since the closure of these contact members depends on my safety switch 8, it is apparent that no premature detonation of the torpedo is possible, even though contact members 19 and 20 of the inertia responsive relay 25 6 may close during firing.

To fully understand my invention, reference should be had to the showings in Figs. 2, 3 and 4. I construct the base of my switch of a single piece of metal having the front vertical wall 30, the side wall 31, the back wall 32, and the bottom 33. The front wall 30 is provided with the ear 34, the utility of which will become apparent as the disclosure proceeds. On the back wall 32, and on the insulating block 35, I mount the spring conductor strips 36 and 37, carrying the contact members 9 and 10 normally in spaced relation.

On the farther side wall 31, I rigidly position the main pivot pin 38. On this pin 38, I pivot the U-shaped member 39 at substantially the mid-portion of the legs of the U. The member 39 is balanced about pivot pin 38, that is, the pivot includes the center of gravity. Member 39 is thus not affected in position by any acceleration of pivot 38. At the bight of the U, I fix a contact member actuating pad 40 and, at the ends of the legs of the U, I fix the pin 41 carrying the spacing sleeve 42 and carrying the generally T-shaped guide stems 43 and 44. Positioned on these stems, as shown, are a pair of compression springs 50 and 51. These springs normally hold the parts in the position shown in full line in Fig. 2.

I also pivot the ends of the arms of the crooked U-shaped member 45 on pivot pin 38. At the elbow regions of the crooked arms of this U-shaped

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member, I provide suitable apertures that register with an aperture in the ear, or tab 34. When the torpedo is stored, a pin 46 held in position by cotter key 47, holds the member 45 in the position shown in full line in Fig. 2. When the torpedo is ready to be fired, the cotter key 47 and pin 46 are removed. The position of member 45 is, however, not altered in the least by the removal of pin 46, since the springs 50 and 51 acting on U-shaped member 39 forces the back of the bight at 48 against the member 45.

The upper end, or bight, of member 45 is provided with lead weight 49. My device is positioned in the torpedo, as shown in Fig. 1. When the torpedo is fired, the lead weight 49, by reason of its inertia, causes both members 39 and 45 to rotate clockwise, as seen in Fig. 2. Member 39 is thus carried to the position shown in dotted line in Fig. 2.

Since the compression force of springs 50 and 51 is thus caused to pass to the left of pivot pin 38, balanced member 39 is firmly held in the position to close contact members 9 and 10. Any subsequent mechanical shocks on the torpedo, since member 39 is balanced about pivot 38, as when it hits the water from deck tubes, or for any other reason, can not affect the position of contact members 9 and 10. Weight 49 may bob back and forth ever so much, but will have no further effect on the completed operation of member 39.

The foregoing disclosure is merely illustrative of my invention. I am, therefore, not to be limited to the particular showing made, but wish to be limited only by the scope of the claims hereto appended.

I claim as my invention:

1. In an inertia responsive safety switch, in combination, a frame structure disposed on a device subject to rapid acceleration, a pair of normally spaced contact members mounted on the frame, an elongated member, a pivot center, said elongated member being pivoted intermediate its ends on the pivot center, over-center spring means bolting said member in either of two angular positions, depending on the position to which the member has been actuated, said elongated member being operable in one position to close said contact members, and an inertia member pivoted on the pivot center and operable when the frame is subject to acceleration a single time and in one direction only to actuate said elongated member to cause closing of said contact members, said inertia member being arranged so as to rest against said frame structure and forming a stop for said elongated member so that said spring means cause said elongated member to bias said inertia member against said structure when said elongated member is in position not closing said contact members.

2. In an inertia responsive safety switch for establishing a portion of an electric circuit in a torpedo when the torpedo is fired from its tube, in combination, a frame structure rigidly mounted in a torpedo, a pair of normally spaced contact members, a bearing stud disposed transverse of the torpedo axis, inertia responsive means movable backward when the torpedo is fired, a member pivoted intermediate its ends on the bearing stud, over-center spring means acting on the pivoted member to hold it either in one position against the inertia responsive means or firmly against the contact members to hold them closed, said inertia responsive means being arranged to operate on the pivoted member to move it to the

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position to close said contact members when the torpedo is fired and being disposed to rest against said structure under biasing force effected by said spring means through said pivoted member before the torpedo is fired.

3. In an inertia trip safety switch for establishing a portion of an electric circuit in a torpedo, in combination, a frame structure so positioned in a torpedo when in the tube to be fired to have vertical front and back walls and at least one vertical side wall, a horizontally disposed bearing stud fixed in the vertical side wall, a somewhat resilient contact member fixed to the back wall, a second somewhat resilient contact member disposed on the back wall in spaced relation to the first contact member, said contact members being electrically insulated from each other and from the back wall, a U-shaped member having the bight thereof provided with a contact engaging pad and having its legs intermediate their ends pivoted on the bearing stud, a pair of compression springs acting on the ends of the legs of the U-shaped member in a direction to tend to rotate the member counterclockwise, whereby the said pad is held out of contact of the contact members, a second generally U-shaped member having a weight disposed on the bight of the U, said second U-shaped member having the ends of its leg pivoted on said stud and being so positioned that the back, generally the midportion of the legs, engage the front portion of the bight of the first U-shaped member while said weight rests against said frame structure under biasing force exerted by said springs on said weight through said first U-shaped member, whereby the inertia of said weight, upon rapid movement of the frame structure in a forward direction, causes both U-shaped members to rotate clockwise whereupon the force of the compression springs is moved over-center with reference to the bearing stud and the pad causes the closing of the contact members.

4. In an inertia responsive safety switch for closing contact members, in combination, a frame structure disposed on a device subject to rapid changes in speed, a pair of resilient spaced contact members mounted on the frame structure, an inertia member pivoted on the frame so as to normally rest against said frame while being movable away from its position of rest when said frame structure is accelerated in a given direction, an elongated member also pivoted, intermediate its ends, on the frame, over-center spring means acting on one end of the elongated member to hold said elongated member in one position, said elongated member being arranged to abut against said inertia member to hold it in position of rest against said frame under force of said spring means, said inertia member when the frame structure is accelerated once in a given direction operating the elongated member to close said contact members.

5. In an inertia responsive safety switch for closing contact members, in combination, a frame structure disposed on a device subject to rapid changes in speed, a pair of resilient contacts mounted in spaced relation to each other on the frame structure, an elongated member pivoted intermediate its ends on the frame, an over-center spring acting on one end of said elongated member to bolt the said member to either one of two positions, an inertia member pivoted on a common pivot with said elongated member and designed to have only contact engagement with one side of the other end of the elongated

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member, said inertia member being arranged to normally rest against said frame structure under biasing force exerted on said spring through said elongated member when said elongated member is in contact engagement with said inertia member, whereby pivotal movement of the inertia member in one direction only actuates said elongated member from a first position to a second position, said contacts being disposed to be actuated to closed position upon actuation of said elongated member by said inertia member.

6. In inertia actuated safety switching means for a torpedo, in combination, a frame having side walls and front and back walls, switching means in the frame, pivot means disposed transverse of said frame in said side walls, an inertia member pivoted on the pivot means having freedom of angular movement between the front wall

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and the rear wall, an elongated member, also pivoted on the pivot means, having an upper end in one position engaging the inertia member above the pivot means and in another position engaging said switching means to alter the circuit connection of said switching means, over-center spring means acting on the lower end of said elongated member to hold said elongated member either in such a position that the upper end is in contact with said inertia member so as to bias said inertia member against said front wall or in such a position that the upper end actuates the switching means, whereby forward acceleration of said frame may actuate said elongated member only once to thus actuate said switching means.

MERRILL G. LEONARD.