Feb. 23, 1937. J. J. SHIVELY 2,071,903

INERTIA OPERATED DEVICE

Filed Dec. 28, 1935 2 Sheets-Sheet 1

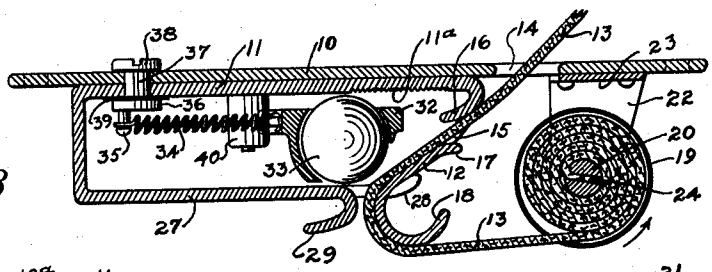

Fig. 3

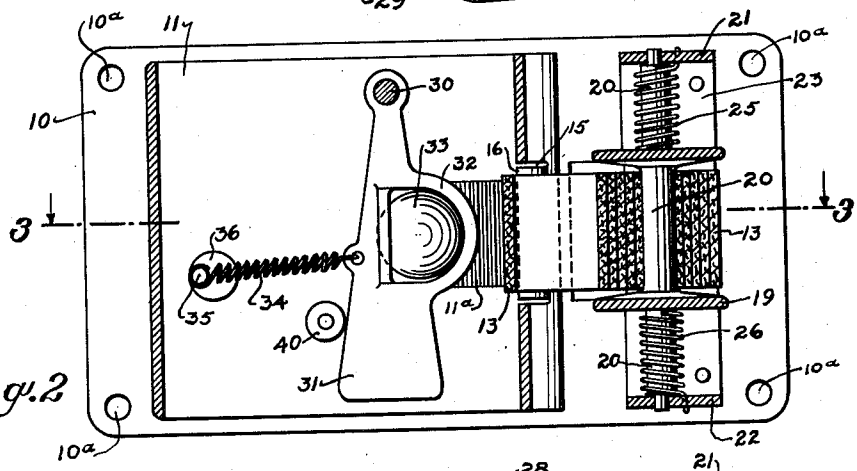

Fig. 2

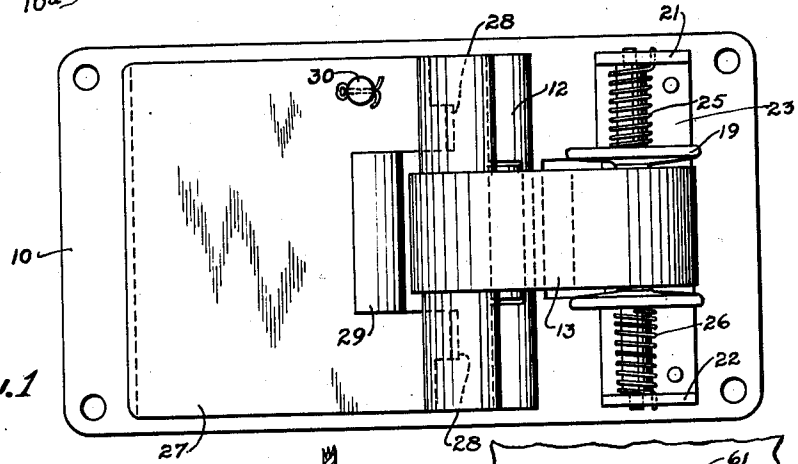

Fig. 1

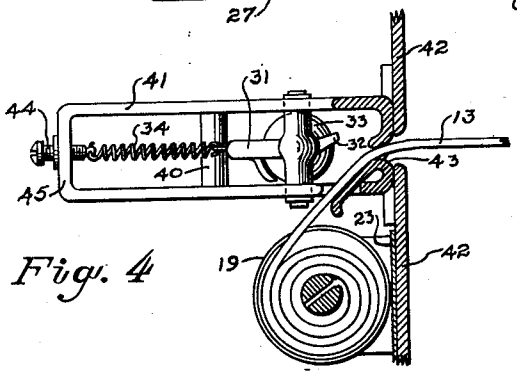

Fig. 4

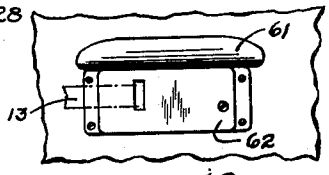

Fig. 10

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INERTIA OPERATED DEVICE

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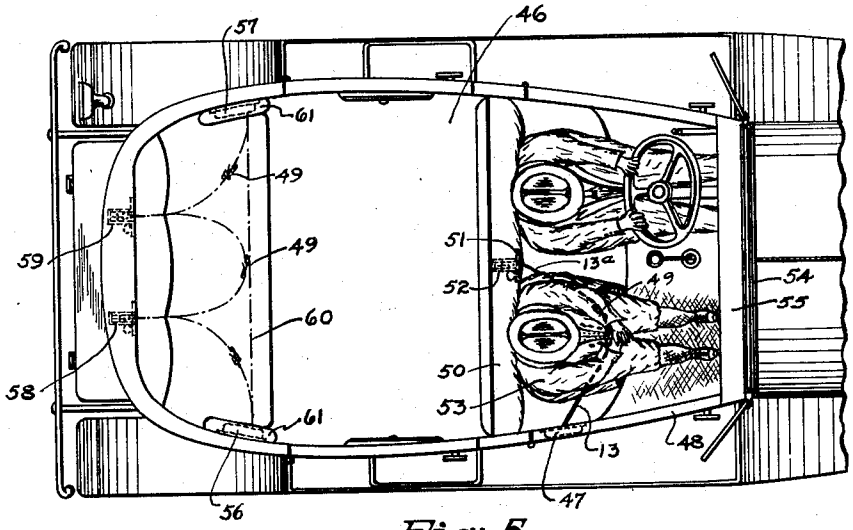

Fig. 5

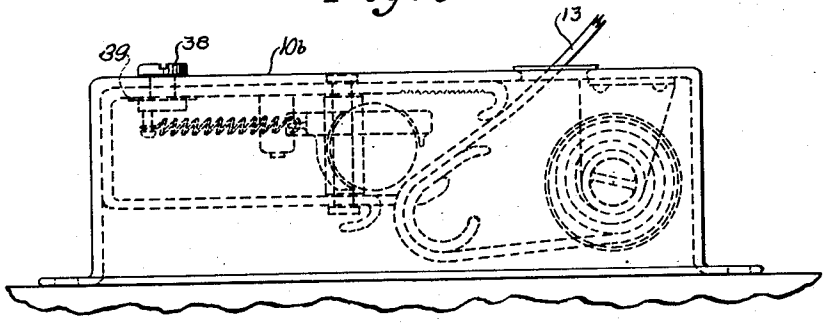

Fig. 9

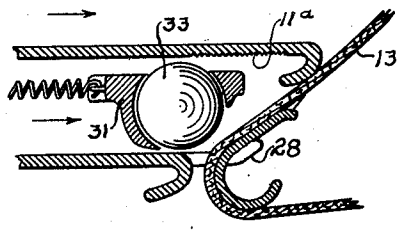

Fig. 7

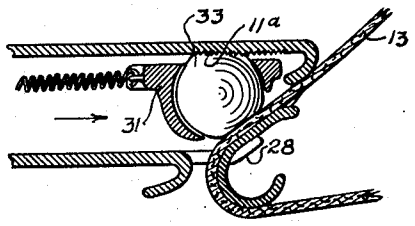

Fig. 8

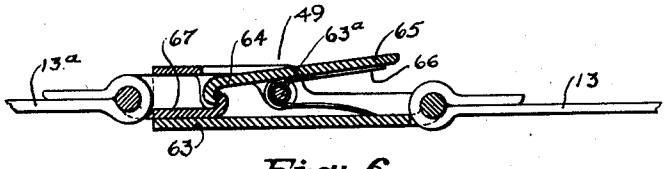

Fig. 6

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UNITED STATES PATENT OFFICE

2,071,903

INERTIA OPERATED DEVICE

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Application December 28, 1935, Serial No. 56,478

9 Claims. (Cl. 280—150)

This invention relates to improvements in inertia operated devices.

An object of the invention is to provide a safety device for use on moving vehicles or aircraft and operable to prevent passengers from being thrown forward during abnormally sudden deceleration of the vehicle.

Another object is to provide a device of the above character which will not restrain or hamper the passenger's movements under normal conditions of travel or deceleration.

A further object is to provide a device of the above character which will automatically release upon cessation of deceleration.

Another object is to provide means by which the device may automatically become operative at lesser degrees of deceleration during down hill travel and at greater degrees of deceleration during up hill travel.

A still further object is to provide a device of the above character which is simply and easily applied.

Other objects and advantages of the invention will appear in the course of the following description in connection with the accompanying drawings, in which

Figure 1 is a rear elevation of a preferred form of the device;

Figure 2 is a vertical sectional view of the same also taken from the rear;

Figure 3 is a horizontal sectional view on the lines 3—3, Figure 2;

Figure 4 is a horizontal sectional view of an alternative form of the device;

Figure 5 is a diagrammatic view illustrating the application of the device to an automobile;

Figure 6 shows a form of fastener for the restraining belt;

Figure 7 is a fragmental section showing the locking means in normal position;

Figure 8 is a similar view showing the locking means in operation;

Figure 9 is a top view of the device contained in a casing suitable for mounting on the surface of a panel, wall or the like; and

Figure 10 illustrates a form of the device having a pad to provide an arm rest.

Referring to Figures 1, 2 and 3, the numeral 10 indicates a mounting plate adapted to be attached to the inside or door of a motor vehicle by any suitable means such as screws through holes 10a. A frame 11 is welded or otherwise attached to the plate 10 and has its right or forward end bent back at a sharp angle to form a guide 12 for a web or belt 13 which extends through a slot 14 in the plate 10. The guide 12 has therein an opening 15 having rearwardly and forwardly turned lips 16 and 17, and terminates at its inner end in a forwardly curved portion 18. The web 13 is threaded through the opening 15, passes around the convex side of portion 18 to a reel 19 having a central shaft 20 journalled in upper and lower angles 21 and 22 formed on a member 23 attached to the plate 10. The shaft 20 may be slotted at 24 to receive the end of web 13 which may be secured therein in any suitable manner such as lap sewing. Light torsion springs 25 and 26 surrounding the shaft 20 engage the reel 19 and angles 21 and 22 so as to urge the reel counter-clockwise in Figure 3. The action of the reel thus tends at all times to retract the web 13 through the slot 14.

The frame 11 has an inner wall 27 extending forward, that is, in the direction of normal travel of the vehicle. The wall 27 may have tabs 28 extending through suitable slots in the guide 12 and secured thereto to brace and strengthen the structure. A central lip 29 is cut out of the wall 27 to provide clearance for the web 13 and may be curved back as shown in Figure 3. In some cases it may be desirable to mount the reel 19 on the back of inner wall 27, in which case the curved lip 29 acts as a guide for the web 13.

A pin 30, secured in the frame 11 and wall 27, supports an inertia member or pendulum 31 disposed between the wall and frame and adapted to swing in the line of the vehicle's motion. The pendulum 31 carries a cage or supporting structure 32 loosely retaining a ball 33, preferably of rubber or other suitable resilient material.

The pendulum 31 is urged backward, that is to the left in Figures 1 and 2, by a tension spring 34 attached to a pin 35 eccentrically located on a disk 36 secured to an adjusting screw 37. The screw 37 is rotatably mounted in the frame 11 and plate 10 and has a slotted head 38 on the front side of plate 10. A spring friction washer 39 may be provided between the disk 36 and the inside of frame 11 to hold the screw in adjustment. The tension of spring 34 normally holds the pendulum 31 back against a suitable stop 40.

In the form of the device shown in Figure 4 the frame 41 is attached at right angles to the plate 42. The reel 19 is mounted at one side of frame 41, and the guide 43, preferably formed by a turned back portion of 41, leads the web 13 to the reel in substantially the manner described in connection with Figures 1, 2 and 3. The spring 34, which normally retracts the pendulum 31, in

this form of the device is attached to an adjusting screw 44 threaded through the rear portion 45 of frame 41. The device may be constructed for attachment to a flat surface, in which case the mounting member 10b forms a casing, as shown in Fig. 9.

Figure 5 illustrates typical applications of the device to a motor car 46. A braking assembly 47, of the type shown in Figures 1, 2 and 3 is mounted in the right hand door 48. The web 13 is adapted to be fastened by suitable means such as the hook fastener 49 illustrated in detail in Figure 6, to a second web 13a extending across the seat 50. The second web 13a may be fastened into the back of the seat 50 at 51, or may lead into a second braking device 52 of the type shown in Figure 4 located at that point.

The operation of the device is as follows:

The ends of webs 13 and 13a are joined as described in front of the passenger 53. During normal operation of the vehicle the pendulum 31 is held against the stop 40 both by its own inertia and the initial tension of the spring 34. The ball 33 is thus held free of the web 13, as shown in Figure 7. The web is thus free to travel in and out through the slot 14 under control of the reel 19. The springs 25 and 26 are light, furnishing only sufficient force to retract the web 13 under normal conditions so that the passenger 53 may move about, lean forward, etc., without being appreciably hampered.

If a sudden deceleration occurs, as in case of collision or sudden application of the vehicle brakes which might ordinarily throw the passenger 53 against the windshield 54 or dashboard 55, the device operates in the following manner:

As the vehicle and consequently the parts supporting the pendulum 31 are suddenly decelerated the pendulum itself, due to its mass and inertia, resists the deceleration and swings forward on the pin 30, overcoming the tension of spring 34. The ball 33 is thereby forced into the V formed by the frame 11 and the web 13 on its guide 12, where it tends to wedge, exerting friction on 13 and also on 11 which preferably roughened at 11a to provide a frictional surface. As the forward force of the passenger's body tends to pull the web farther out through slot 14 the resilient ball 33 is wedged or squeezed more tightly into the V, as shown in Figure 8, thus stopping the web. The passenger's forward motion is thereby restrained, and he is prevented from being thrown.

The ball 33, being resilient, is distorted while wedged. As deceleration ceases, and the tension is removed from the web 13, the force of the spring 34 tending to retract the pendulum 31, the resilience of the ball itself, and the retracting force exerted by the reel 19 all act together to force the ball back out of the V, thereby releasing the braking effect and returning the device to normal condition. The surface of the guide 12 in contact with web 13 is smooth and provides very little friction, so that the web slides readily back over it and allows the ball to release with a rolling motion. Due to this fact, and also to the fact that the high coefficients of friction between the resilient ball and the frame 11 and web 13 allow the angle of the V to be relatively wide, the ball cannot stick and fail to release.

It is evident that the degree of deceleration necessary to lock the device is dependent on the strength of spring 34 and the inertia of the pendulum. For a given pendulum, the spring 34 may be made to allow operation at any pre-determined degree of deceleration on the level, and, if desired, the degree may be varied to suit different conditions by adjusting the spring tension by means of screw 37. It is further evident that while travelling down hill the tendency of the pendulum to swing forward will be augmented by a gravity component varying according to the steepness of the slope, while in up hill travel the tendency to lock will similarly be decreased. In other words, while travelling down hill, when the tendency for passengers to be thrown forward during deceleration is increased the device operates at correspondingly less deceleration, while in up hill travel the reverse is true.

From the foregoing it may be seen that the device acts automatically at all times in accordance with the requirements of safety, exerting restraint only when necessary to prevent possible injury to the passenger.

In the foregoing description the device has been described as operating due to the inertia of the pendulum. By inertia is herein meant the resistance of the mass of the pendulum to a change in velocity. While the actuating force may also be described as supplied by the pendulum's momentum, in case of deceleration during forward movement, the device is also operative in case of sudden rearward acceleration from rest. The word inertia is therefore believed more truly descriptive of the cause of operation than the word momentum, and is accordingly used throughout the specification and claims. In other words, during forward operation the device is actuated by the inertia of the pendulum acting through its momentum acquired due to the forward motion.

The stop 40 may be located so that the pendulum 31 in its normal position is inclined backward, that is, swung to the left, the cage 32 being extended slightly forward on the pendulum to maintain the normal position of the ball 33 with respect to the web 13 the same as shown in Figs. 2 and 3. This arrangement increases the effectiveness of the device in preventing the passenger from being thrown upward as well as forward when bumps are encountered, as the sudden upward motion of the car when striking a bump is resisted by the mass of the pendulum which thus tends to swing downward and forward to vertical position, thereby thrusting the ball 33 into engagement with the web 13 to lock the latter. Since the direction in which the passenger tends to be thrown as a bump is encountered is a combination of an upward and forward movement, the locked web exerts an angularly rearward and downward restraint which tends to hold him to the seat, especially in modern motor cars in which the normal seat position is inclined rearwardly.

While the device has been explained as applied to the front passenger seat of the vehicle in Figure 5, it may also be used in the back seat, either with individual loops of web, shown in dot and dashed lines and leading to locking devices located at points such as 56, 57, 58 and 59, or by a single joined pair of webs 60 spanning the entire seat. The devices indicated at 47, 56 and 57 may advantageously be made in the form shown in Figure 10, in which a pad 61 is provided on the top of the safety device 62 to form a convenient arm rest. A rest of this type aids the passenger in steadying himself during the operation of the device. In a similar manner it is obvious that the device may be applied to the driver's seat.

The form of fastener shown in Figure 6 provides for easy joining and release of the webs 13

and 13a. A female member 63, to which web 13 is attached, has pivoted therein at 63a a flat hook 64 having an outwardly projecting extension 65. A torsion spring 66 on pivot 63a urges the hook 64 counter-clockwise. A male hooked member 67, to which is attached the second web 13a, is adapted to slide in the member 63 to engage the hook 64 as shown. The angle of the hooks is such that they cannot disengage by tension, but disengagement may easily be effected by pressing the extension 65 inward.

The device may be readily applied to motor busses, trucks, railway trains and to aircraft. Its use is not confined to preventing accidents to passengers, as other uses may be in connection with transportation of packages or objects which it is not desired to fasten down rigidly but to restrain from destructive shifting in case of sudden stops.

While the device has been described in preferred form, it is not limited to the precise structures shown, as various changes and modifications may be made without departing from the scope of the appended claims.

What is claimed is:

1. In a device adapted to be used on a moving vehicle, in combination, a support adapted to be secured to said vehicle, a safety element, resilient means operatively connecting said support and said element whereby said element may normally yield with respect to said vehicle, and means associated with said support operable by inertia to restrain said element from yielding when said vehicle is decelerated.

2. In a device adapted to be used on a moving vehicle, in combination, a support attached to said vehicle, a restraining element adapted to engage a passenger in said vehicle, means to lock said element to said support when said vehicle is decelerated, and automatic means to normally disable said locking means.

3. In a device adapted to be used on a moving vehicle, in combination, supporting means attached to said vehicle, a restraining element adapted to engage a passenger in said vehicle, means carried by said supporting means and adapted to lock said element to said supporting means when said vehicle is decelerated at greater than a predetermined rate, and automatic means to disable said locking means when said deceleration is less than said predetermined rate.

4. In a device adapted to be used on a moving vehicle, in combination, supporting means on said vehicle, a restraining element adapted to engage a passenger in said vehicle, means to lock said element to said supporting means when said vehicle is decelerated at greater than a predetermined rate during level travel, and means to disable said locking means when said deceleration is less than said predetermined rate during level travel, said disabling means being operable at a higher rate of deceleration during uphill forward travel and at a lower rate during downhill forward travel.

5. In a safety device adapted to be used on a moving vehicle, in combination, supporting means on said vehicle, a web associated with said supporting means and adapted to engage a passenger in said vehicle, resilient means connected to said web and to said supporting means and adapted to normally maintain a light tension on said web while allowing said web to yield whereby said passenger may be allowed freedom of motion, and means operable by inertia to lock said web to said supporting means during deceleration of said vehicle whereby motion of said passenger with respect to said vehicle may be restrained.

6. In a safety device adapted to be used on a moving vehicle, in combination, a casing secured to said vehicle and having therein an opening, a web slidable through said opening and adapted to engage a passenger in said vehicle, means in said casing to normally maintain a light tension on said web while allowing said web to yield whereby said passenger may be allowed freedom of motion, means in said casing including a pendulum operable by inertia to lock said web during deceleration of said vehicle whereby motion of said passenger with respect to said vehicle may be restrained, and means on said casing to provide an arm rest for said passenger.

7. In a device adapted to be used on a moving vehicle, in combination, a supporting means secured to said vehicle, a safety element, means resiliently connecting said element and said supporting means whereby said element may be normally yieldable with respect to said supporting means and means associated with said supporting means and including a weight operable by inertia to restrain said element from yielding when said vehicle is decelerated during forward travel and when said vehicle is accelerated in reverse direction.

8. A device as claimed in claim 5 including a pad attached to said casing to provide an arm rest for said passenger whereby said passenger may be steadied during the operation of said restaining element.

9. A device as claimed in claim 6 wherein said web normally slides along one inner side of a substantially V-shaped structure in said casing, and wherein said locking means includes a resilient stop member carried by said pendulum and adapted to engage said web in said V-shaped structure.

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Patent No. 2,071,903 Granted February 23, 1937

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The above entitled patent was extended April 24, 1951, under the provisions of the act of June 30, 1950, for 5 years and 38 days from the expiration of the original term thereof.

Commissioner of Patents.