

Aug. 31, 1965

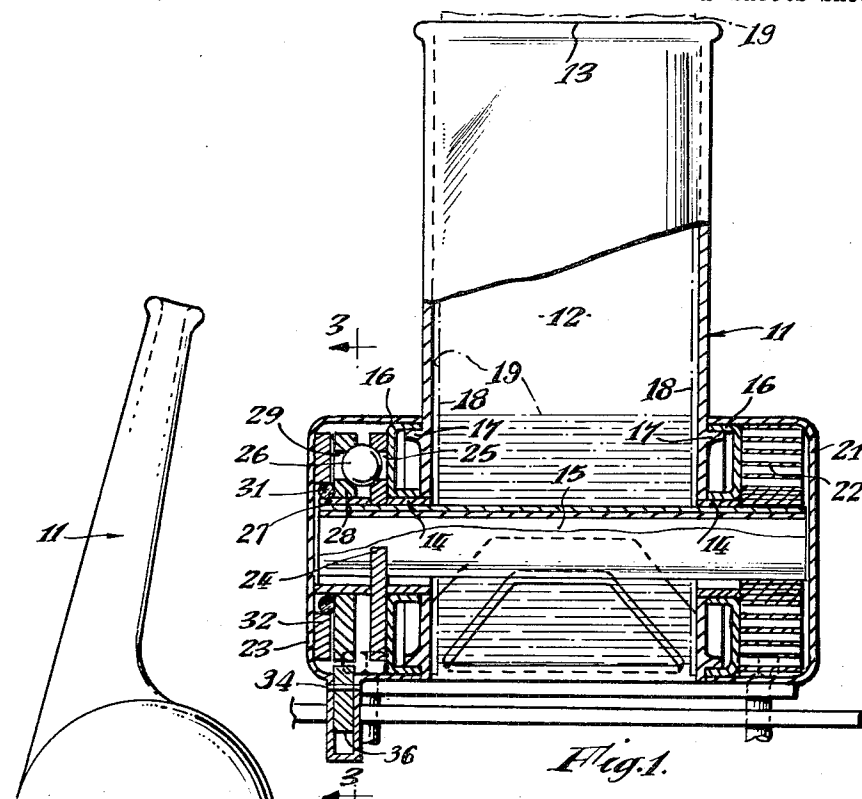
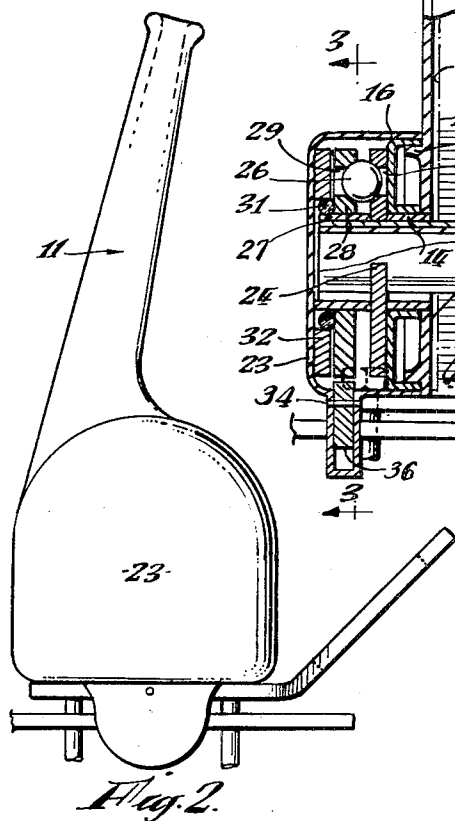
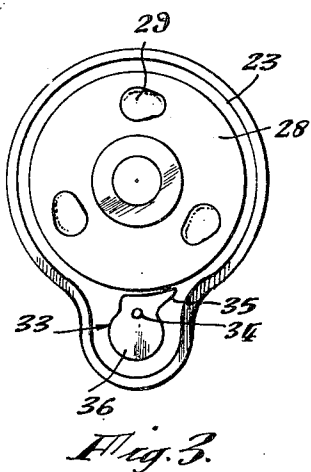
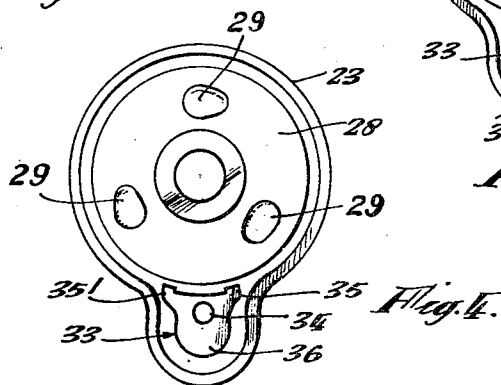
A. H. McFARLANE ETAL

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SAFETY HARNESS

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2 Sheets-Sheet 1



Aug. 31, 1965

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2 Sheets-Sheet 2

Fig. 5.

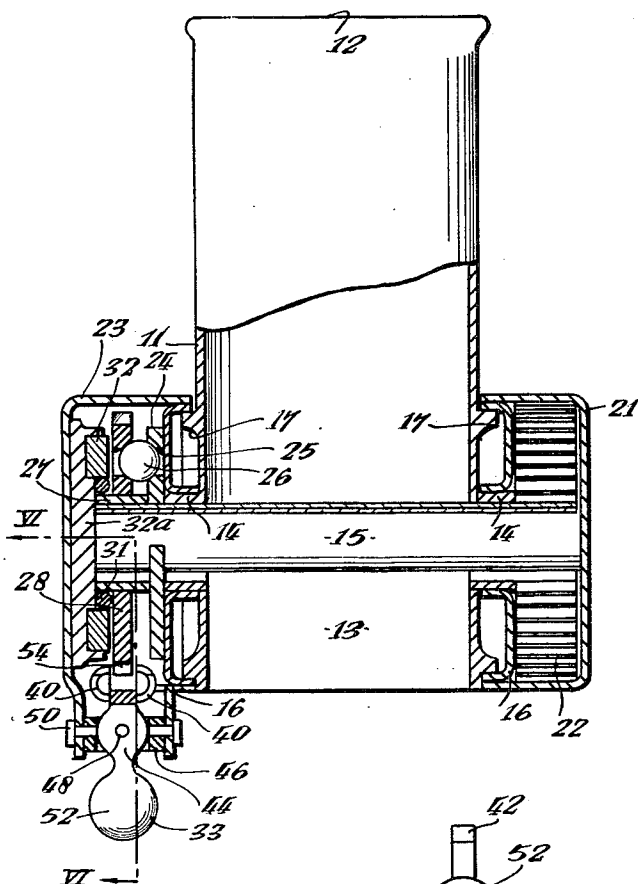
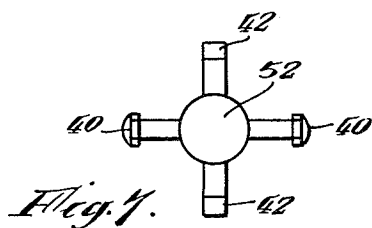
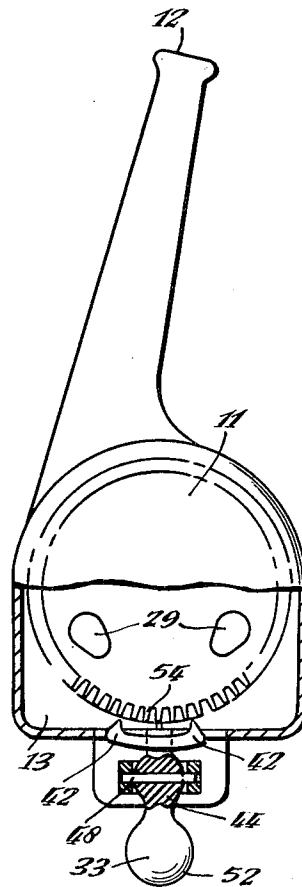


Fig. 6.

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SAFETY HARNESS

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2 Claims. (Cl. 242—107.4)

This invention relates to a safety harness for use by travellers seated or otherwise supported in road and rail vehicles, air and marine craft, and in general to harness reels of the type comprising a casing to be fixed, in a suitable position, to the floor or frame of the vehicle or craft, in which casing a spindle is mounted to turn, to which one end of a strap is fixed, and in which the strap is adapted automatically to be wound into the casing and onto the spindle by a coiled spring of a desired number of turns, one end of which is secured to the spindle and the other to the casing, and unwound from the spindle by pulling on the other end of the strap which passes to the exterior through an opening in the casing, and is detachably or otherwise connected to the harness.

The invention is particularly concerned with harness reels of the above general type and of the further type which includes "inertia" locking means, comprised by an "inertia mass" so mounted in the casing that when the strap is pulled out from the casing relatively slowly (which happens by the normal movements of the traveller) it participates in such slow movement, but which when there is a sudden pull on the strap (by the sudden deceleration of the vehicle which tends relatively to throw the traveller wearing the harness forwards, laterally or otherwise) then the mounting of the "inertia mass" is such that its inertia instantly causes it to lag behind and not to participate in the sudden pull, and by such lagging action to operate associated brake or locking means to hold the strap from further unwinding movement; in the result the harness holds the traveller from being thrown forwards, laterally, or otherwise.

In such a construction it is known to provide at the end of the spindle remote from the coiled spiral spring, a member made integral with the spindle, having a surface of revolution about the axis of the spindle formed with a cam and in which there is provided an inertia mass of general cylindrical form coaxial with and mounted to turn in relation to the spindle, a surface of which is adjacent the cam and shaped to co-operate therewith in the manner of a cam follower spring means of a light nature being provided to hold the inertia mass in contact with the cam with slight force so that said mass is caused to turn with the spindle during the slow movements of the strap, together with locking means carried by the inertia mass adapted to be brought into engagement with co-operating locking means in fixed relation with the casing so that when, by its inertia to sudden movement, the said mass overcomes the slight force of the spring and ceases to turn with the spindle, it relatively moves over the cam, the shape of which then causes the said mass to move axially further away from the member with the cam to cause the locking means of the said mass to engage the fixed locking means of the casing and hold the strap locked in position.

The present invention provides an inertia operated safety harness having a reel, an inertia member adjacent said reel and mounted both for movement therewith and relative movement with respect thereto and means for locking said reel against rotation in the pay-out direction on occurrence of said relative movement wherein

inertia-member-restraining means are provided which are operatively engageable with said inertia member to restrain movement thereof with said reel whereby said reel is immediately locked when moved in the pay-out direction, or its sensitivity varied.

Referring to the drawings filed herewith wherein similar characters of reference are used to designate corresponding parts:

FIG. 1 is a view mainly in section of one form of harness reel made in accordance with the present invention.

FIG. 2 is a view from the left of FIG. 1.

FIG. 3 is a view generally on the line 3—3 of FIG. 1.

FIG. 4 is a view similar to FIG. 3 of a modified gravity sensitive means.

FIG. 5 is a diagrammatic longitudinal section of one form of safety harness made in accordance with the present invention which is adapted to be mounted behind a seat either on the seat frame or on the floor.

FIG. 6 is a view from the right of FIG. 5, the bottom part being cut away to show a section on the line VI—VI of FIG. 5.

FIG. 7 is a detail plan view of the inertia member shown in FIGS. 5 and 6.

In the example shown in FIGS. 1 to 3 the reel comprises central casing 11 providing an entrance tunnel 12 and a reel housing 13. The sides of the reel housing 13 are apertured and bearing sleeves 14 for the reel spindle 15 line the apertures. The bearing sleeves 14 are backed by annular members 16 fitted onto flanges 17 formed integrally with the casing 11. A strap 19 shown in dot-dash lines in the drawings, passes onto the reel housing 13 through the tunnel 12 and is wound onto the spindle 15 constituting the inertia operated safety harness reel. The spindle 15 carries two guide discs 18 positioned on each side of the wound strap to guide the strap as it is wound up. The right hand end, as seen in FIG. 1, of the reel spindle 15 projects into an end housing 21 and is encircled by a helical spring 22. This spring 22 acts between the spindle 15 and the end housing 21 and is preloaded to wind the strap into the reel housing 13.

The other end of the spindle 15 projects into an end housing 23 and carries a thrust plate 24 which is fast with the spindle 15. The thrust plate 24 has three equal spaced recesses 25 in it which provide seats for three ball bearings 26. Beyond the thrust plate 24 the spindle 15 carries a bearing sleeve 27 on which an inertia plate 28 of substantially cylindrical shape is mounted, said plate constituting the inertia member associated with the reel. The plate 28 is free to rotate about the spindle 15. The inertia plate 28 has three equally spaced recesses 29 in it. These recesses 29 have the entrance shape shown in FIG. 3 and together with balls 26 serve as jamming means as will further appear. The inertia plate is urged by a light spring 31 away from a friction pad or locking member 32.

In the use of the reel, when a steady slow pull is exerted on the strap, the inertia plate 28 is carried round with the thrust plate 24. However, on a sudden increase in tension of the strap, the thrust plate 24 accelerates rapidly. This acceleration is not instantly followed by the inertia plate 28 and that plate lags behind the plate 24. Due to the shape of the recesses 29, the ball bearings 26 force or jam the inertia plate 28 axially away from the thrust plate 24 and into contact with the friction pad 32. Rotation of the inertia plate 28 is therefore resisted causing the ball bearing 26 to ride further along the recesses 29. The inertia plate 28 is therefore forced more firmly into contact with the friction pad 32. The reel is therefore locked to the friction pad and winding out of the strap is prevented. Instead of a friction pad

locking means may be provided such as a pawl and ratchet.

In the harness reel modified to embody the present invention, the reel housing 13 is enlarged to accommodate a pawl or sear pivotally mounted on a pintle 34, said pawl or sear 33 constituting the inertia-member-restraining means and is a second inertia member. The pawl 33 has a projecting portion or holding finger 35 shaped to fit against the inertia plate 28. The finger 35 may have a friction surface. The outer end of the pawl 33 is formed as a counterweight 36. The counterweight 36 is arranged to hold the finger 35 away from the inertia plate 28 during steady horizontal movement of the reel.

Consider now that the foregoing inertia reel is fitted in an aircraft. During manoeuvring of the aircraft, circumstances can arise in which the inertia reel does not lock but a person on the seat undergoes forward movement relative to the seat. These circumstances may arise in a dive. During a steady dive or on deceleration, the pawl or sear swings under gravity and contacts the inertia plate 28. The contact may be very light but it is sufficient to cause a lag of the inertia plate 28 relative to the thrust plate 24. The ball bearings 26 therefore ride along the recesses 29 and act to force the inertia plate 28 against the friction pad 32. The movement of the ball bearings 26 along the recesses 29 is progressive and continues until the reel is locked.

In the construction shown in FIG. 4 it will be seen that the pawl 33 is provided with two fingers 35 and 35' respectively. In this arrangement the counter-weight 36 is still arranged to hold the finger 35 and the finger 35' away from the inertia plate 28 during steady horizontal movement of the reel. During a dive or on deceleration the pawl or sear 33 either under the force of gravity or of its inertia during deceleration causes the finger 35 to contact the inertia plate 28. In addition, with the construction shown in FIG. 4 movement of the inertia plate 28 will also be inhibited during a climb or on acceleration and moreover the device would operate if the aircraft were rolled onto its back because in that event the counter-weight 36 would tend to fall either side of the centre line passing through the pintle 34, so that one or other of the fingers 35 or 35' would be caused to engage the inertia plate 28 and inhibit its movement. It will also be appreciated that this arrangement can be used equally well in connection with a backward facing seat as for a forward facing seat, whereas the construction shown in FIG. 3 will only work in one condition.

The provision of a pawl or sear as described above, by engaging and restraining rotation of the inertia member positively ensures locking of the reel during any abnormal condition of an aircraft to which the reel is fitted which affects said second inertia member including forces of gravity.

Turning now to FIGS. 5 to 7 of the drawings which show an inertia operated safety harness reel similar to that shown in FIGS. 1 to 3, the reel housing 13 is enlarged to accommodate a pawl or sear constituting the inertia-member-restraining means.

Instead of this pawl being mounted on a single pintle as described above and arranged to be moved into the restraining position on acceleration or deceleration or when the vehicle is tilted up or down in a forward direction the sear shown is gimbal mounted as hereinafter described and has two pairs of oppositely arranged arms 40 and 42 radiating from a common hub 44. The hub 44 is mounted in a ring 46 on pivot 48 said ring itself being mounted on pintles 50 in the housing 23 so that the pin 48 and pintles 50 constitute a gimbal mounting. Extending downwardly from the hub 44 is a bob weight 52. The inertia member 28 in this arrangement is provided with teeth 54 adapted to be engaged by any one or more of the arms 42 or 44 according to which way the bob weight 52 swings the sear 33. It will be seen that this gimbal arrangement provides a more advantageous arrangement than that

shown above since it is sensitive to forces due to gravity or changes in velocity acting thereon in any direction. In operation when the bob weight 52 is displaced by any such force one or other of the teeth of the arms 40 or 42 will engage the teeth 54 and by restraining the inertia member 28 against rotation will assist the action of the inertia member 28 to cause the reel spindle to be locked.

What we claim and desire to secure by Letters Patent is:

1. An inertia operated safety harness for vehicles including aircraft comprising, a housing, a spindle rotatably carried by said housing, a harness reel fixed on said spindle, a flexible connector adapted to be attached to a seat occupant's harness and extending into said housing for connection to said reel to be wound thereupon, spring means within said housing connected to said spindle for winding the flexible connector onto the said harness reel to apply a slight tension on the flexible connector and on the seat occupant's harness while allowing free normal movements of the occupant in use, a substantially cylindrically surfaced inertia member positioned adjacent said reel and mounted on said spindle both for rotational movement with said reel and relative longitudinal and rotational movement with respect thereto, a locking member fixedly carried by said housing opposite said inertia member, inertia member camming means comprising balls within said housing interposed between said reel and said inertia member for urging said inertia member against said locking member for locking the inertia member and said reel against rotation in the pay-out direction on occurrence of said relative rotational movement due to acceleration movement of said flexible connector exceeding a predetermined value, and a second inertia member comprising a pendulous mass pivoted on said housing and having a projecting portion positioned adjacent said cylindrically surfaced inertia member and responsive to acceleration and deceleration of the vehicle exceeding a predetermined value to cause said projecting portion to grippingly engage the cylindrical surface of said first-named inertia member to thereby operate to restrain rotational movement of said first-named inertia member with respect to said reel, whereby any movement of said reel in the pay-out direction thereafter due to movement of the seat occupant brings the locking means for the first-named inertia member into operation to lock the reel and hold the seat occupant in his seat.

2. An inertia operated safety harness for vehicles including aircraft comprising, a housing, a spindle rotatable within said housing, a harness reel fixed on said spindle to rotate therewith, a flexible connector adapted to be attached to a seat occupant's harness and extending into said housing for connection to said reel to be wound thereupon, spring means within said housing connected to said spindle for winding the flexible connector onto the said harness reel to apply a slight tension on the flexible connector and on the seat occupant's harness while allowing free normal movements of the occupant in use, a thrust plate fixed on said spindle, a substantially cylindrical inertia member having a substantially cylindrical outer surface and turnably mounted on said spindle, jamming means interposed between said thrust plate and said inertia member, a locking member attached to said housing in opposed relation to said inertia member and spring means for normally holding said locking member and said inertia member apart, said inertia member acting upon the movement of said flexible connector outwardly of said housing at an excessive rate of acceleration determined by the mass of said inertia member and the force of said spring means, in cooperation with said jamming means to overcome said spring means and bind said inertia member against said locking member, thereby stopping the outward movement of said flexible connector and retaining the occupant in his seat, and a second inertia member comprising a bob weight suspended from a pivotal support on said casing,

5

said second inertia member having projecting finger means and being movable in response to excessive acceleration and deceleration movements of said vehicle determined by the physical proportions of said bob weight to engage the cylindrical outer surface of said first inertia member to effect the binding of said first inertia member against said locking member upon movement of the seat occupant and said flexible connector to thereby also stop the outward movement of said flexible connector and retaining the occupant in his seat responsive to such excessive vehicle movements.

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