Oct. 16, 1962 J. S. BENTLEY 3,058,687

SAFETY HARNESS

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Fig. 1

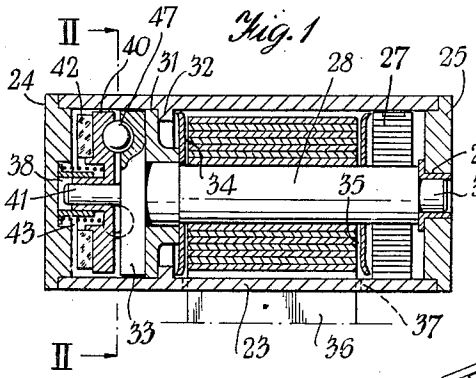


Fig. 2

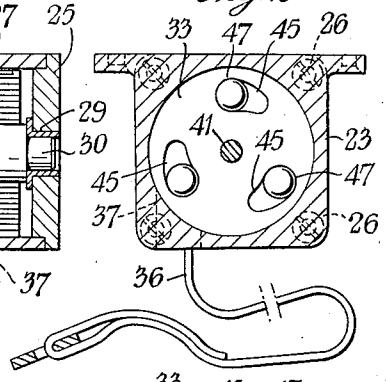


Fig. 3

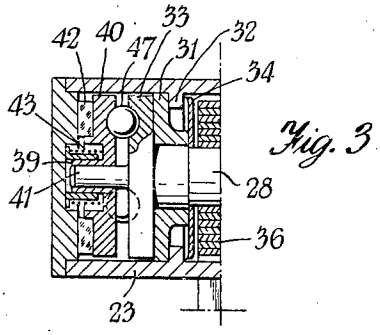


Fig. 4

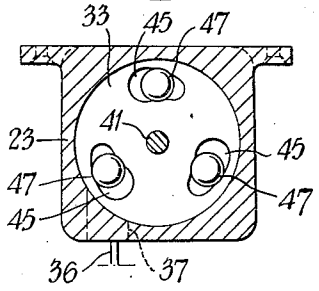


Fig. 5

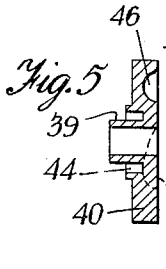
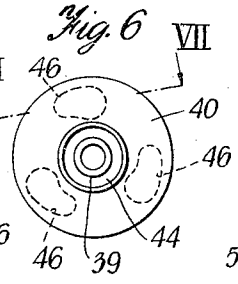


Fig. 6



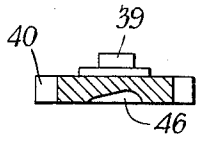


Fig. 7

Fig. 8

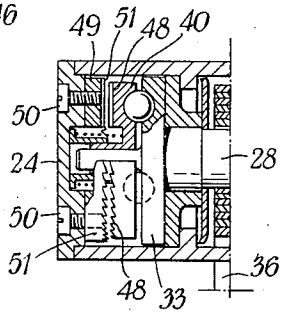


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Fig. 9

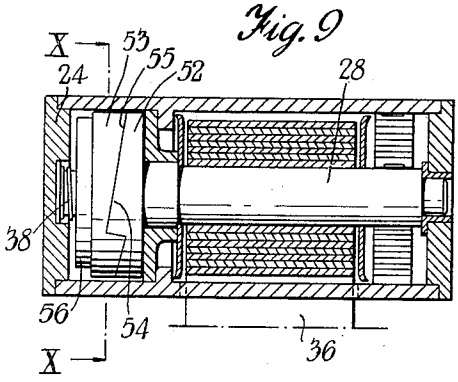
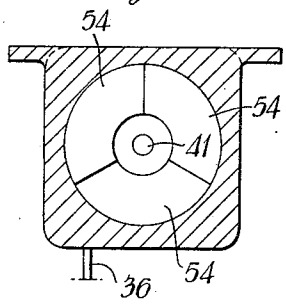


Fig. 10



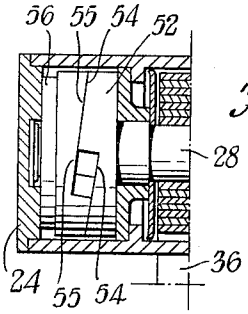


Fig. 11

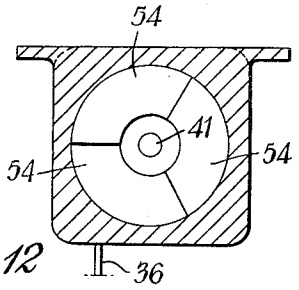


Fig. 12

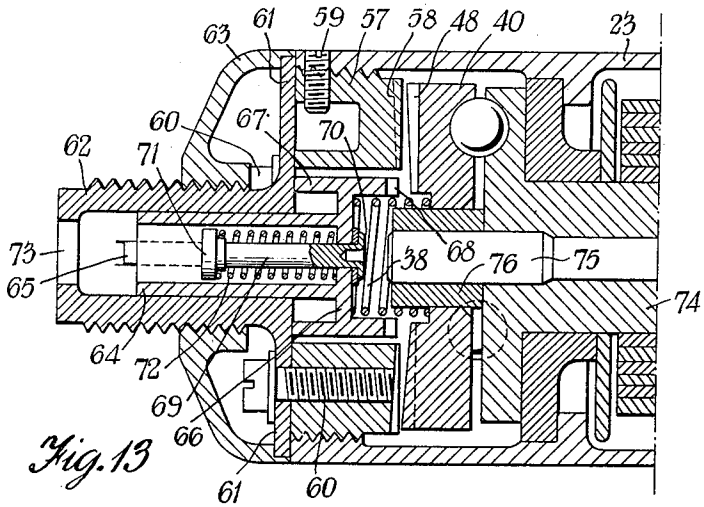


Fig. 13

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Fig. 14

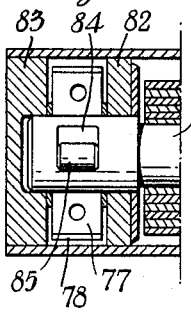


Fig. 15

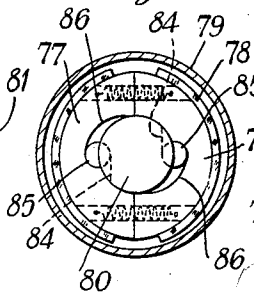
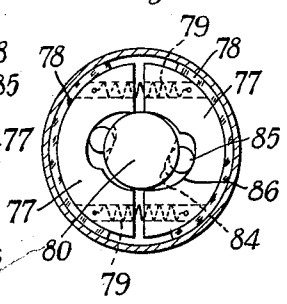


Fig. 16



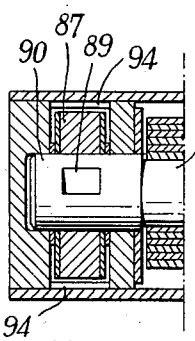


Fig. 17

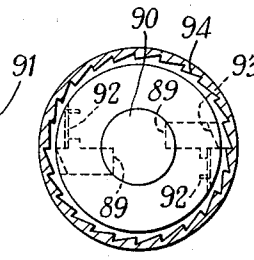


Fig. 18

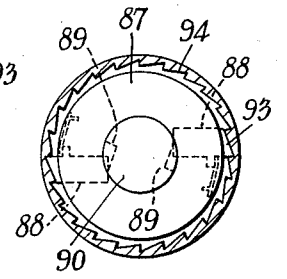


Fig. 19

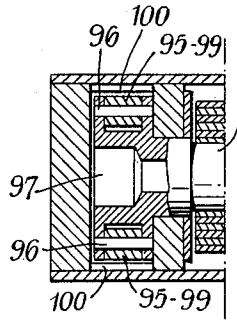


Fig. 20

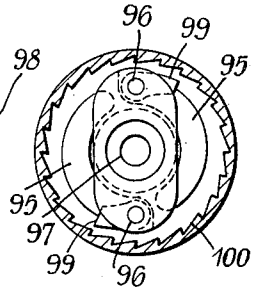


Fig. 21

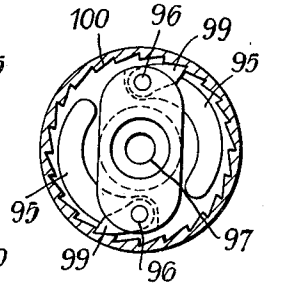


Fig. 22

United States Patent Office 3,058,687 Patented Oct. 16, 1962

3,058,687

SAFETY HARNESS

James Sydney Bentley, London, England, assignor to Teleflex Products Limited, London, England, a company of Great Britain

Filed Feb. 12, 1960, Ser. No. 8,427
Claims priority, application Great Britain Feb. 18, 1959
6 Claims. (Cl. 242—107.4)

This invention relates to 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 spiral 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.

In particular, the present invention is concerned with harness reels of the above general type and of the further type which include "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.

According to the present invention, safety harness reels of the above combined general and particular types have, 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 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 gives the said mass a movement in another direction, which may be axially or radially of the spindle, 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.

According to one form, the member made integral with the spindle is a cylindrical cam plate, and this co-operates with a cylindrical plate forming the inertia mass and brake plate, which is a loose running fit on the spindle.

The facing surfaces of the cam and brake plates are formed in three equiangular positions with engaging inclines or wedge surfaces (each of which is curved to a

portion of a circumference) of such nature that if the brake plate is held from rotation and the shaft and cam plate turned by the pulling out of the strap, then the brake plate is forced axially away from the cam plate. This is due to the fact that each wedge surface of a pair of contacting wedge surfaces rides up the other wedge surface of the pair.

In place of the wedge surfaces, however, contacting between themselves, it is preferred to recess the facing surfaces of the cam and brake plates in the three angular positions, for an angle extending over a desired degree, for example 30°, and to locate between each co-operating pair of recessed inclined surfaces, a bearing ball of desired diameter.

By this arrangement, when the plates are closest together and almost touching, a ball penetrates to a maximum extent, slightly less than a hemisphere, into each co-operating inclined recess of a pair. When the plates are forced apart by the balls, each ball rolls up a circumferentially curved inclined path, which gradually becomes shallower and of less width, in each plate.

In another form, radially arranged detent members or sears carried by the cylindrical inertia mass which is mounted to turn on the spindle which preferably is of enlarged diameter in this position, co-operate by their inner ends with cams on the curved surface of the spindle normally being pressed thereto by light spring stress.

Upon a sudden pull on the strap, however, the lagging inertia mass holds the detents from rotation and the cams force the detents radially outwards against the action of their springs, so that shaped outer ends of the detents engage ratchet teeth in the interior of the casing to lock the spindle, and consequently the strap, from movement.

With a somewhat similar arrangement, the cylindrical inertia mass is made in two halves divided by a diametric plane, kept lightly held together by tension springs of slight stress passing between the halves, the curved outer surfaces of which are faced with braking material to co-operate with the interior surface of the casing, and the cams on the curved surface of the cylindrical member of the spindle operate through anti-friction rollers on shaped interior surfaces of the halves of the inertia mass.

In order that the invention may be better understood, it will now be described with reference to the accompanying somewhat diagrammatic drawings, which are given by way of example only and in which:

FIG. 1 is a sectional elevation of one embodiment of an inertia reel constructed according to the invention, with the parts in the unlocked position.

FIG. 2 is a sectional end elevation on the line II—II, FIG. 1.

FIG. 3 is a portion of a sectional elevation similar to FIG. 1, but with the parts in the locked position.

FIG. 4 is a view similar to FIG. 2, but showing the parts in the locking position.

FIG. 5 is a sectional elevation, FIG. 6 an end view, and FIG. 7 a sectional plan on the line VII—VII, FIG. 6, of a constructional member shown in FIGS. 1 and 2 and constituting the inertia mass.

FIG. 8 shows a fragmentary sectional side elevation of another method of carrying the invention into effect similar to that shown in FIGS. 1 to 7 but having another form of locking mechanism and with the parts in the unlocked position.

FIGS. 9, 10, 11 and 12 show similar views to FIGS. 1 to 4, but of another embodiment of the invention.

FIG. 13 shows to a larger scale a sectional elevation of one end of a harness reel according to another method of carrying the invention into effect, somewhat similar to that shown in FIG. 8, and also having means for manually locking the strap from being pulled out.

FIG. 14 shows a fragmentary sectional elevation, FIG. 15 a sectional end view showing the parts in the unlocked position, and FIG. 16 a sectional end view showing the parts in the locked position, of another method of carrying the invention into effect.

FIGS. 17, 18 and 19 show similar views to FIGS. 14, 15 and 16, of another embodiment of the invention, and FIGS. 20, 21 and 22 show similar views of a still further embodiment.

In the particular method of carrying the invention into effect shown in FIGS. 1 to 4, **23** is the casing of somewhat square section on the exterior, having end plates **24** and **25** spigoted thereto and held by thrust-taking screws **26**. The end plate **25** adjacent the spiral spring **27**, one end of which is fixed to the spindle **28** and the other end to the interior of the casing **23**, is bushed at **29** to form a bearing for one stepped end **30** of the spindle **28**.

This spindle is mounted to turn freely in a thrust plate **31** the peripheral portion of the rear surface of which bears against an inwardly projecting flange **32** integral with the casing. The front surface of the thrust plate **31** contacts the rear surface of the cam plate **33** formed integral with the spindle **28**.

Additionally, the spindle **28** has mounted thereon two guide discs **34** and **35** to come on each side of the strap **36** the inner end of which is attached to the spindle **28** so that upon rotation due to the spiral spring **27**, the strap is wound on the said spindle. After the strap is fully wound, there still remains sufficient stress in the spring **27** to hold the strap wound up, so that when the strap is pulled outwardly through the opening **37**, this pull is against the spring stress. The other end plate **24** is recessed on the interior to locate a flanged bush **38** for a loosely fitting bored boss **39**. This, as will be appreciated from FIGS. 5, 6 and 7, is an integral part of the cylindrical inertia mass **40** which is mounted coaxial with the spindle **28** on a small-diameter peg-like extension **41** thereof which passes through the bored boss **39**.

The front surface of the inertia mass **40** carries a brake pad **42** formed of a suitable friction or braking material, the outer surface of which, in the unlocked position of the parts shown in FIG. 1, comes closely adjacent but out of contact with the inner surface of the end plate **24**.

43 is a compression spring located around the bush **38** and at one end abutting the flange thereof. The other end enters an annular recess **44** in the inertia mass and abuts against the end of such recess. When mounted in position, in the unlocked position of the parts, this spring **43** presses with only a slight force on the inertia mass **40**.

The facing surfaces of the plate **33** and inertia mass **40** are recessed in three angular positions for an angle extending over substantially 30°. The recesses have the shapes shown in FIGS. 2, 4 and 6, and as will be seen from FIG. 7 these recesses incline upwardly to the outer surface of the respective plates from their larger end to the smaller end. The arrangement of the recesses in the plate **33** in relation to those of the plate **40** is such that when viewed from the left-hand side of FIG. 1 the recesses of the plate **33** are as shown in FIG. 2, and those of the plate **40** as shown in FIG. 6.

Further, the arrangement is such that in the unlocked position of the parts, the deep ends of the recesses of both plates are in angularly coincident positions, and when the plates move relatively angularly towards the locking position the shallow ends of the recesses are moving towards angularly concident positions, although the locking position is attained before these are reached.

45 are the recesses in the plate **33**, **46** those in the plate **40**, and **47** are bearing balls between each opposed pair of recesses **45** and **46**, to transmit the axial thrusts between the plates **33** and **40**.

The bearing surfaces of the recesses **45** and **46** are made to the curvature of the balls **47** and as a consequence when the plates **33** and **40** are closest together and almost touching, as shown in FIG. 1, the ball **47** penetrates to a maximum extent, slightly less than a hemisphere, into each co-operating inclined recess of a pair. When the plates **33** and **40** are forced apart by the balls, each ball **47** rolls up a circumferentially curved inclined path, which gradually becomes shallower aand of less width in each plate, to come into the locking position as shown in FIG. 3. FIG. 4 shows how, in the locking position, each ball is in an intermediate position of its associated recesses.

The operation is as follows:

When the strap **36** is pulled out relatively slowly, which happens by the normal movements of the traveller, the light pressure of the spring **43** causes the brake plate **40** to travel round with the cam plate **33**.

When there is a sudden pull on the strap **36**, for example by the initial movement relatively to throw the traveller wearing the harness forwards, laterally, or otherwise, then the "inertia" of the brake plate **40** causes it instantly to lag behind the cam plate **33** and to overcome the slight axial pressure of the spring **42** so that the balls **47** ride up the inclines of the pairs of recesses **45** and **46**, to effect the axial displacement of the brake plate **40**, to apply the brake **42** against the interior face of the end plate **24**, hold the balls **47** gripped between the two plates **33** and **40** in the mid positions of the recesses **45** and **46**, and thus prevent any further movement of the strap **46** beyond the slight initial movement. In the result, the harness holds the traveller from being thrown forwards, laterally, or otherwise.

The arrangement shown in FIG. 8 is the same as that shown in FIGS. 1 to 7, except that the braking material **42** is not used.

In place of this, the front face of the inertia or braking plate **40** has ratchet-like radial teeth **48** of fine pitch. The end plate **24** has attached thereto, on the interior, a ring member **49** of suitable metal, held in position by screws **50**. The exterior face of the ring member has radial rigid teeth **51** for cooperation with those **48** of the braking plate **40**.

The arrangement is such that upon a sudden pull on the strap **36**, the brake plate **40** is axially moved in the manner before set forth, but in this case to cause the teeth **48** to engage the teeth **51** and lock the strap **36** from further movement.

The embodiment shown in FIGS. 9 to 12 again is similar to that shown in FIGS. 1 to 7, except that the recesses **45** and **46**, and the bearing balls **47**, are dispensed with.

In this case there is a cam plate **52** integral with the spindle **28** and a brake plate **53** mounted as in the previously described constructions, but the facing surfaces of the cam and brake plates are formed in three equiangular positions with engaging inclines or wedge surfaces. **54** are the inclined surfaces on the cam plate, and **55** corresponding co-operating inclined surfaces on the brake plate. These are shaped as shown in FIG. 9 so that in the unlocked position of the parts they nest together. It will be realised that the inertia brake plate **52** is mounted to rotate on a peg-like member such as **41** hereinbefore referred to, and also carries an annular brake pad **56** to cooperate with the inner surface of the end plate **24**.

When the parts are in the unlocked position as shown in FIGS. 9 and 10, by a normal slow pull on the strap **36** it will be realised that the cam plate **52** carries round with it the brake plate **53** by the slight pressure of the spring **38**. When, however, there is a sudden pull on the strap **36**, the inertia of the brake plate **53** takes charge and this causes its inclined surfaces **55** relatively to ride over the inclined surfaces **54** of the cam plate, in turn to cause the brake plate **53** to move axially against the slight compression of the spring **43**. This applies the annular braking member **56** to the inner surface of the end plate **24** to lock the brake plate **53** in position, and this by its inclined surfaces **55** thrusting against the inclined surfaces **54** of the cam plate, holds this latter from movement, preventing any further pulling out of the straps **36**, beyond the slight

initial amount. The locked position of the parts is shown in FIG. 11 and from this figure the relative positions which the cam and brake plates assume can be seen.

It should be appreciated that FIGS. 10 and 12 only show on the interior of the casing the inclined surface portion of the brake plate which, as will be appreciated from FIG. 12, has moved through a slight angle to effect the axial movement of the brake plate.

Although in most cases it would not be necessary, particularly for travellers in road or rail vehicles or in marine craft, yet in some cases, and more particularly for aircraft, means may be provided whereby the inertia reel may be manually locked to prevent the strap from being pulled out. Such a construction is shown in the enlarged fragmentary view FIG. 13. In so far as the primary construction is concerned, this is substantially similar to the method of carrying the invention into effect shown in FIG. 8, except that the annular member **57** having ratchet teeth **58** for co-operation with the ratchet teeth **48** of the braking member **40**, is screwed into the end of the casing **23** and is retained in a defined position by a grub screw **59**.

To this annular member **57** is secured, by means of screws **60**, an end plate **61** having a long axially extending hollow boss **62** screw-threaded on the exterior to receive a sealing cap **63** to cover-in the heads of the screws **60**.

In the interior of the boss **62** there is mounted to slide a sleeve **64** which is held from rotation by a key **65** secured in the boss **62** and engaging a keyway of the sleeve **64**. The inner end of the sleeve **64** has an integral end plate **66**, flanged portions of which extend beyond the sleeve **64** and carry an integral exterior hollow cylindrical portion **67**. One end of this normally, as shown in FIG. 13, abuts the inner surface of the end plate **61**, and the other end has a crown **68** of ratchet teeth of the same pitch and corresponding to the teeth **48** of the brake plate **40**. Further, in the normal position of the parts, as shown in FIG. 13, these teeth are slightly spaced from the teeth **48** even when these latter are in the locking position, that is to say, engaging the teeth **58**.

In this case the light compression spring **38**, one end of which abuts the brake plate **40**, has its other end abutting the end plate **66** of the sleeve **64**, and in the normal position of the parts the compression spring **38** then holds the sleeve **34** in such position that the end of the cylinder **60** is pressed with a slight pressure against the inner surface of the end plate **61**.

The plate **66** has a central bore in which a rod **69** of small diameter is adapted to slide. The inner end of this rod is swaged over at **70** on to a retaining washer so that this rod, once having been inserted through the bore of the plate **66**, cannot be removed. The other end of the rod **69** has a head **71** which comes within the bore of the sleeve **64**, and between this head **71** and the plate **66** there is disposed a compression spring **72** having a greater compression force than that of the spring **38**.

The sleeve **62** has an open end **73** and into this is adapted to be fitted and retained in any suitable manner a reciprocating plunger in connection with a Bowden or other similar control. The end of this plunger bears upon the head **71** in the normal rest position of the parts. Should it be required at any time to prevent the strap from being pulled out from the inertia reel, it is simply necessary to operate the Bowden control so that the plunger presses the head **71** inwardly against the action of its compression spring **72**.

As this compression spring is of greater strength than the compression spring **43**, in the result the rod **69** does not move in relation to the sleeve **64** but through the compression spring **72** the sleeve **64** is caused to move by its keyway on the key **64** and carry with it (to the right in FIG. 13) the integral cylinder **67**, compressing the spring **38** and bringing the teeth **68** into locking engagement with the teeth **48**. In this position, as the cylinder **67** cannot rotate, due to the key **65**, it will be understood that the brake plate **40** is held from rotation and consequently the cam plate and reel cannot be rotated by the strap.

As will be seen, in the construction shown in FIG. 13 the spindle **74** is formed with a bore into which is driven a spigot **75** so that this latter turns with the spindle, and this spigot has mounted to turn thereon a bush **76** around which is disposed the inner turns of the spring **38** and upon which the brake plate **40** is mounted to turn.

In the method of carrying the invention into effect somewhat diagrammatically illustrated in the fragmentary views FIGS. 14, 15 and 16, the cylindrical inertia mass is made in two halves **77** divided by a diametric plane and having attached to their curved surfaces somewhat semi-cylindrical brake shoes **78**. The two halves are kept pulled together by light tension springs **79**. This combined cylindrical mass, which is a true cylinder except for the slight amounts removed at the diametric plane, is mounted, as shown in FIG. 15, to turn on an enlarged end **80** of the spindle **81** on which the strap is wound, and is axially confined between a partition **82** in the casing and an end plate **83** in which the outer end of the enlargement **80**, which is an extension of the spindle **81**, has its bearing.

The curved surface of the enlargement **80** has cams **84** in diametrically opposite positions, and these cams co-operate through rollers **85** with shaped surfaces **86** on the hollow interior of the halves **77** of the inertia mass.

When, upon a sudden pull of the strap, the inertia of the mass takes charge, the enlargement **80** continues its rotation with the spindle **81** and its cams **84** ride over the surface of the rollers **85**, forcing them slightly radially outwards against the light tension of the springs **79**, to apply the brake bands **78** against the interior surface of the casing to lock the parts, in which position, as shown in FIG. 16, the rollers **85** are gripped between the surfaces **86** of the halves of the inertia mass and of the cams **84** which consequently prevent the spindle from rotating and the strap being pulled out.

The construction shown in FIGS. 17, 18 and 19 is similar to that shown in FIGS. 14, 15 and 16, with the exception that the brake plate or inertia mass **87** has symmetrically arranged guideways for substantially radially disposed detents or sears **88**, the inner ends of which co-act with diametrically arranged cams **89** in an enlargement **90** of the spindle **91**. The detents are normally held pressed inwardly by light strip springs **92**, and the outer ends of the detents have engaging shaped noses **93** for co-operation with ratchet teeth **94** of fine pitch cut in the inner surface of the casing.

In normal operation, the parts remain unlocked as shown in FIG. 18 but when there is a sudden pull on the strap, the inertia mass lags behind as previously and the cams radially project the detents for these latter, by their shaped ends **93**, to engage the ratchet teeth and hold the intertia mass from rotation, whilst the inner ends of the detents, by the cams engaging them, prevent any further movement of the spindle and consequently of the strap.

In the form shown in FIGS. 20, 21 and 22, the inertia mass is divided into two similar portions **95** shaped as shown in FIGS. 21 and 22 and each pivoted at one end to an eccentrically mounted pin **96** between two lugs arranged in diametric positions in an extension **97** of the spindle **98**. Between the lugs in each case the inertia masses are formed with shaped detents **99** adapted to co-operate with ratchet teeth **100** cut in the interior surface of the casing. Light springs (not visible in the drawings) are provided around the eccentric pins **96** normally to keep the masses in the unlocked position shown in FIG. 21 in which the detents **99** are clear of the teeth **100**.

When, however, there is a sudden pull on the strap, then although the pins **96** continue to partake of the rotation, the inertia masses lag behind and as a consequence they turn outwardly upon the pins **96** to the position shown in FIG. 22 in which they have caused the detents **99** to engage the ratchet teeth **100** of the casing and hold

the extension 97 of the spindle, and consequently the strap, from rotation.

The invention is not limited to the precise forms or details of construction herein described, as these may be varied to suit particular reqirements.

What I claim is:

1. A safety harness reel for a traveller in a vehicle, comprising a casing, means for fixing the casing to the vehicle, a spindle mounted to turn in the casing, an opening in the casing, a strap connected at one end to the spindle and passing through the opening in the casing so that its other end is on the exterior of the casing and having a length for a plurality of turns to be wound on the spindle, a coiled spiral spring in the casing connected at the inner end to the spindle and at the outer end to the casing and tending always automatically to wind the strap on to the spindle, a member made integral with the spindle, said member having a surface of revolution about the axis of the spindle, an inclined cam on said surface of revolution, a separate inertia mass of cylindrical form coaxial with and mounted to turn in relation to the spinlle and moved to and away from said surface of revolution and having a shaped surface to come adjacent said cam, bearing balls interposed between the cam and the shaped surface of the inertia mass, light spring means for applying the shaped surface of the inertia mass with slight pressure against said bearing balls to said cam, so that the inertia mass is held pressed towards the cam and caused to turn with the cam and spindle during slow pulling-out movements of the strap, locking means carried by and moving with the inertia mass, and cooperating locking means in fixed relation with the casing and normally spaced from the locking means of the inertia mass, the inertia of the inertia mass being such that it overcomes the slight pressure of the light spring, upon sudden pulling-out movements of the strap, to cause the shaped surface of the inertia mass to move circumferentially in relation to the incline of the cam and thus cause the inertia mass through the intermediary of said bearing balls to move away from the surface of revolution, to move the locking means of the inertia mass through the space separating the locking means of said mass and the locking means of the casing, to engage said two locking means and lock the strap from further movement.

2. A safety harness reel for a traveller in a vehicle, as claimed in claim 1, including means manually operable from the exterior of the casing, which are held from rotation and mounted to move in relation to the casing, to engage the inertia mass to hold said mass in its unlocked position from rotation, in order to hold the strap fixed from movement.

3. A safety harness reel for a traveller in a vehicle, as claimed in claim 1, including a thrust plate mounted non-rotatably in the casing and having a bearing therein for the spindle, an inwardly projecting flanged abutment on the interior and integral with the casing, a bearing surface on the rear face of the member made integral with the spindle and having the cam means, the said thrust plate being mounted so that one face thereof bears on the flanged abutment of the casing and the other face forms a thrust bearing surface for the said bearing surface on the rear face of the member integral with the spindle.

4. A safety harness reel as claimed in claim 1, in which the member made integral with the spindle has a surface of revolution about the axis of the spindle, which is at right angles to said axis so that the cam on said surface of revolution is adapted to impart travel in the direction of the axis of the spindle in such a manner that when the inertia of the inertia mass is overcome upon the exertion of sudden force on the strap the shaped surface of the inertia mass will be caused to move in a direction axially away from the inertia mass, to move the inertia mass and cause its locking means to engage the locking means of the casing.

5. A safety harness reel as set forth in claim 1 in which the member made integral with the spindle has a surface of revolution about the axis of the spindle which is at right angles to said axis, while the separate inertia mass is of cylindrical form coaxial with and mounted to turn on the spindle and to move axially to and away from said surface of revolution and having an end surface at right angles to the axis, parallel to, adjacent and facing said surface of revolution, the facing surfaces each being formed in three equiangularly spaced positions with shaped recesses extending over a desired angle and having bases inclined to said surfaces, those in the surface of revolution consisting of cams and those in the inertia mass forming cooperating surfaces for the cams, the bearing balls being located between each cooperating pair of recessed inclined surfaces, the light spring means applying the shaped recessed surfaces of the inertia mass, through the bearing balls, with slight pressure in an axial direction against the recessed cam surfaces in such a manner that the bearing balls are held in contact with the lowest points of the inclines of the pairs of shaped recesses during slow pulling out movement of the strap, and so that when the inertia of the inertia mass overcomes the slight pressure of the light spring the inertia mass causes the bearing balls to move up the inclines of the cams and thus cause the inertia mass to move axially away from the surface of revolution to effect the engagement of the locking means of the inertia mass with that of the casing.

6. A safety harness reel as set forth in claim 1, in which the member integral with the spindle is a cylindrical disc-shaped member having a radial face extending at right angles to the axis thereof, a second disc-shaped member forming an inertia mass and arranged coaxial with and to turn on the spindle and to move to and away from the first mentioned disc, the radial wall of the second mentioned disc being at right angles to the axis and parallel to and facing the radial surface of the first mentioned disc-shaped member, the facing surfaces of each being formed with three equiangularly spaced shaped recesses extending over a predetermined angular distance and having bases inclined to the radial walls of said members, the recesses in the first mentioned disc-shaped member constituting cams and those in the second mentioned disc-shaped member being adapted to form cooperating surfaces for the cams, the bearing balls being located between each pair of cooperating inclined recessed surfaces and the cross-section of the recesses being curved to conform to the curvature of the balls, the light spring means being adapted to apply pressure to the second mentioned disc-shaped member forming the inertia mass, and to exert slight pressure thereon in an axial direction so that the bearing balls will be retained in the deepest part of their recesses and in contact with the lowest points of the inclined cam surfaces whereby said walls will rotate with the cams and spindle during slow outward movement of the strap and so that when the inertia of the inertia mass overcomes the slight pressure of said spring the inertia mass will cause the balls to move up the inclined portions of the cams to the mid positions thereof and thus move the inertia mass axially away from the first mentioned disc-like member to effect the engagement of the locking means of the inertia mass with that of the casing.

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