April 19, 1955 J. A. MILLER 2,706,603

SAFETY REEL AND SPRING ASSEMBLY THEREFOR

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Fig. 1

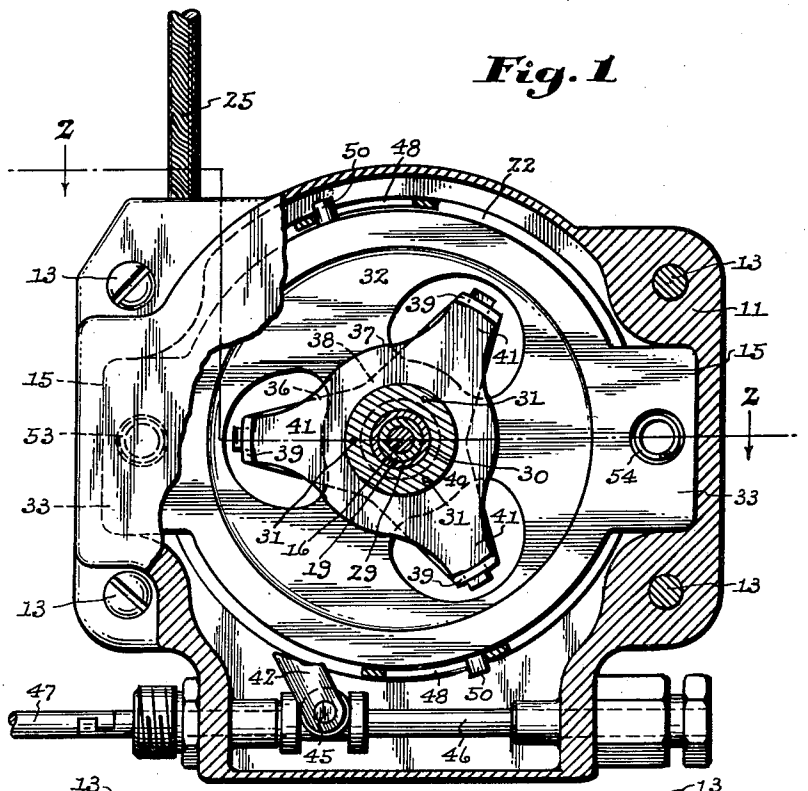


Fig. 2

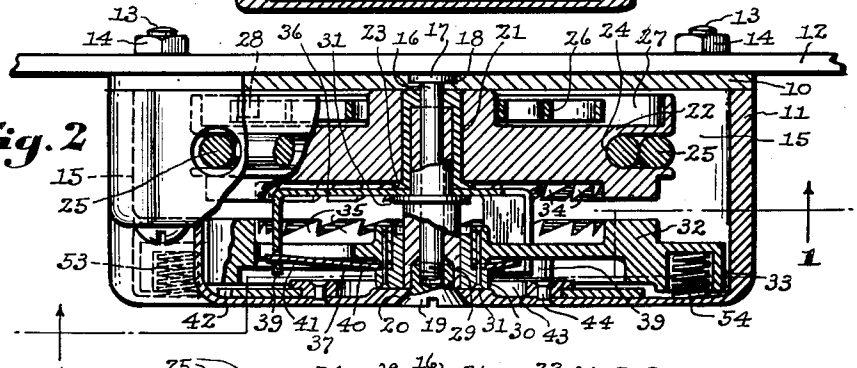
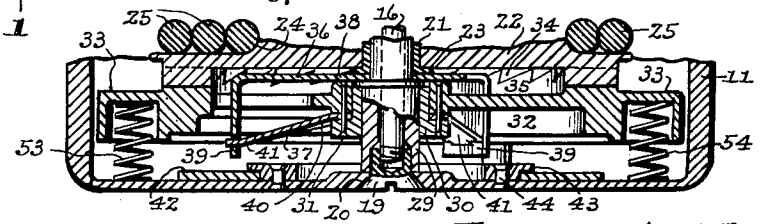


Fig. 3



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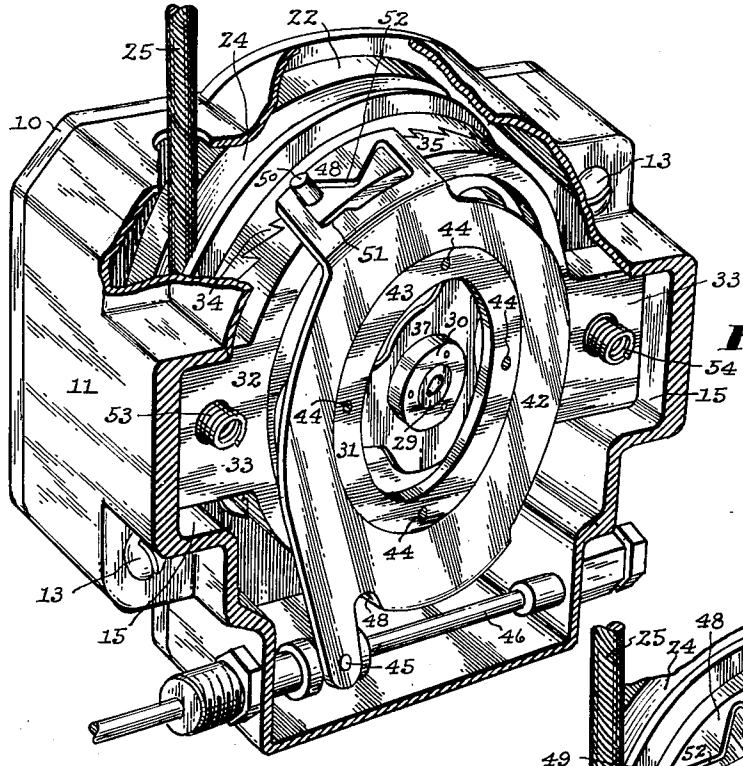


Fig. 5

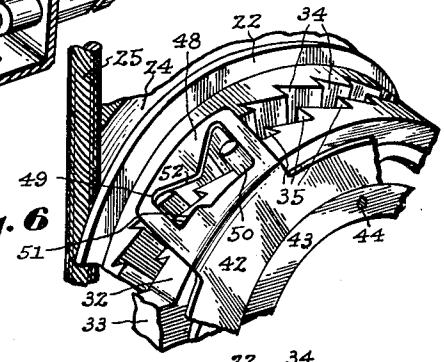


Fig. 6

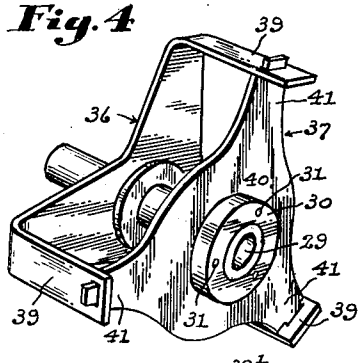


Fig. 4

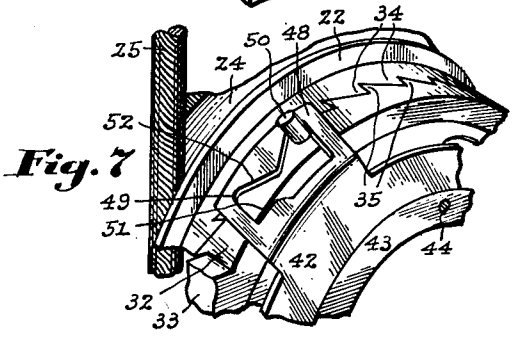


Fig. 7

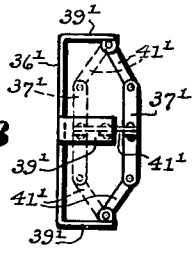


Fig. 8

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2,706,603

SAFETY REEL AND SPRING ASSEMBLY THEREFOR

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Application December 3, 1952, Serial No. 323,903

2 Claims. (Cl. 242—107)

The present invention relates to safety reels and more particularly to an automatic inertia-operated reel for taking up the cable on a shoulder harness by means of which an occupant of an airplane or other vehicle is secured in his chair in the event of a crash.

The primary objects of the invention are to provide an improved inertia-actuated safety reel of the same general type as those disclosed in Nordmark Patents No. 2,434,119 issued January 6, 1948 and No. 2,480,335 issued August 30, 1949; and to provide an improved spring assembly adaptable for use in such a reel whereby the limits within which the reel will become inertia-locked may be more accurately controlled and whereby a "stay-locked" feature is incorporated in the spring assembly of the reel rather than being an independent mechanism as disclosed in Patent No. 2,434,119. Certain general characteristics of the safety reel herein disclosed are also disclosed and claimed in a co-pending application Serial No. 211,076 filed February 15, 1951 (now Patent No. 2,701,693 issued February 8, 1955) by Nordmark et al. and by them assigned to my assignee.

Illustrative embodiments of the invention are shown in the accompanying drawings, wherein:

Figure 1 is a view partly in rear elevation and partly in vertical section taken on line 1—1 of Figure 2, of an inertia-operated shoulder-harness takeup reel embodying the invention;

Figure 2 is a horizontal sectional view of the same taken on line 2—2 of Figure 1;

Figure 3 is a fragmentary horizontal sectional view similar to Figure 2 but showing certain parts of the reel in different moved positions;

Figure 4 is a perspective view of a new spring assembly for the reel;

Figure 5 is a perspective view of the reel with portions of the housing cover broken away to reveal parts on the interior of the reel;

Figure 6 is a fragmentary perspective view of parts inside the reel, certain of said parts being here shown in different positions from their positions illustrated in Figure 5;

Figure 7 is a similar fragmentary perspective view showing certain parts in still other moved positions; and

Figure 8 is a side elevational view of a modified form of spring assembly for the reel.

Referring now in detail to these drawings, the reel there illustrated is adapted for securing to the back panel of a vehicle seat such as the pilot's seat in an airplane, for automatically taking up a cable which is attached to a shoulder-harness for the pilot. The reel is so constructed that the pilot, by means of a cable control, may manually set it so that the reel is locked against paying out the cable, or so that the reel automatically takes up the harness cable but will yield to permit freedom of movement for the pilot. in which latter setting the reel is also set to automatically lock by inertia in the event of a crash so that the pilot is held in a more safe rearwardly position in his chair.

The reel is mounted in a housing made in two parts—a base **10** and a cover **11** adapted for securing to the back panel **12** of the pilot's chair by means of screws **13** passing through aligned apertures in the cover, the base and the chair back, and provided with nuts **14**.

The housing being mounted in upright position as shown, for which position the reel is designed, the interior opposite sides of the housing cover **11** are provided with rearwardly extending guides **15** the purpose of which will hereinafter be fully described. A center pin or

spindle **16** extends rearwardly from the center of the base **10** intermediate the guides **15**, said spindle **16** having a head **17** seated within a recess **18** in the front surface of the base **10** and having its rearward end threaded into a stop nut **19** seated in a counterbore **20** in the rearward surface of the housing cover **11**. By this means the entire reel is secured in assembly prior to its installation on the pilot chair.

A bushing **21** is mounted on the forward or head end of the spindle **16**, and a drum **22** is rotatably mounted on this bushing **21**, the hub of the drum being confined between the base **10** and a flange **23** on the bushing **21** so that the drum is non-slidable longitudinally. The drum **22** has a peripheral groove **24** therein for the accommodation of several turns of the harness-cable **25**, the inner end of the cable being secured to the drum by any suitable means (not shown).

Means are provided for normally urging the drum **22** in a direction for winding the cable **25** thereon, so that slack in the cable is taken up at all times. These means comprise a spiral spring **26** disposed in an annular cavity **27** in the forward end of the drum, the inner end of the spiral spring being secured to the hub of the drum and the outer end of the spring being hooked over a pin **28** on the base.

A sleeve member **29**, which forms part of a spring assembly which is described in detail hereinafter, is mounted on the center pin or spindle **16**. This sleeve member **29** comprises a middle flange portion, a forward sleeve portion extending into the bushing **21**, and a rearward sleeve portion extending from the flange portion to the housing cover **20**. The sleeve member **29** is non-rotatable and non-slidable on the spindle **16**. A collar **30** is slidably disposed on the rearward sleeve portion of the sleeve member **29**, and to this collar is secured, as by means of rivets **31**, the hub of a locking member **32** which is slidable forwardly-rearwardly in the housing and which has key means **33** at opposite sides thereof which are movable in the housing guides **15**. The locking member **32** is thus keyed to the housing and is non-rotatable on the sleeve member **29**.

Cooperative locking means here shown in the form of ratchets **34** and **35** are provided on the rearward part of the drum **22** and on the forward part of the locking member **32**, respectively. It will be seen that when the locking member is slid forwardly into engagement with the drum, these ratchet teeth **34** and **35** interlock to prevent rotation of the drum in a direction for unwinding the cable while permitting rotation of the drum in the opposite direction for winding the cable thereon. Thus when these parts are in engagement the cable cannot pay out to permit farther forward movement of the chair occupant, but should the occupant move farther rearwardly the cable will be taken up.

The spring assembly, which per se and in combination with the other elements of the inertia reel constitutes the essence of the invention, comprises an actuating spider element **36** and a flexible plate element **37**. The actuating spider element **36** has a flat middle body **38** fixedly mounted on the spindle **16** between the flange **23** on bushing **21** and the middle flange portion of the sleeve member **29**, and is provided with radially spaced rearwardly extending laterally springable legs **39** having slots in their rearward ends. The flexible plate element **37** has a flat middle body **40** connected to the locking member **32** and to the collar **30** by the rivets **31** which pass through all three of these members, and is provided with radially spaced laterally extending forwardly-rearwardly flexible arms **41** the outer ends of which are fitted into the slots in the rear ends of the spider element's legs **39**. It will be seen that the legs **39** of the actuating spider element **36** are sprung outwardly when the flexible plate element **37** is in a substantially plane center position with its arms **41** at right angles to said legs **39**, and that the body of the plate element **37** and also the locking member **32** are together urged forwardly or rearwardly on the spindle **16** by the inwardly contracting forces of the spider's springable legs **39** acting on the plate's flexible arms **41** whenever the body of the plate is moved forwardly or rearwardly respectively of said center position. The legs **39** of the spider element ex-

end rearwardly through voids provided in the locking nember **32**.

Means are provided whereby the chair occupant may nanually control the setting of the locking member **32**. Fhese means comprise a control lever **42** turnably nounted on a guide ring **43** secured by rivets **44** to the rear wall of the housing cover **11**, said control lever being operably connected at **45** to a control rod **46** connected to one end of a cable **47** exteriorly of the housing. The other end of the cable **47** connects with a manually operable switch or lever (not shown) accessible to the chair occupant. The control lever **42** has a pair of diametrically opposite, forwardly extending cam arms **48** having cam slots **49** therethrough into which extend pins **50** on the outer periphery of the locking member **32**.

Operation

When the chair occupant desires to manually lock the reel so that the cable **25** will positively not pay out, the control lever **42** is turned clockwise from either of its positions shown in Figures 6 and 7 to its position shown in Figure 5, during which movement the cam shoulders **51** insure that the locking member **32** will move forwardly past center so that the spring assembly **36, 37** will snap the locking member into ratchet engagement with the drum **22**. It is frequently desirable that an airplane pilot be thus locked rearwardly in his seat under conditions of take-off or landing. In normal flight, however, it is more desirable that the pilot have complete freedom of movement and yet be protected in the event of a crash. The reel is set to accomplish these objectives by moving the control lever counterclockwise from its position shown in Figure 5 to its position shown in Figure 6. During this movement the cam surfaces **52** move the locking member **32** rearwardly past center and the spring assembly **36, 37** snaps the locking member to its rearward position of disengagement from the drum **22**. The cable **25** will then pay out freely, but any slack therein will be taken up by the turning of the drum effected by spring **26**. However, in the event of a crash the locking member will move by a force of inertia, if it be great enough to overcome the force of the spring assembly **36, 37**, to the position of locked engagement with the drum **22** as shown in Figure 7. The spring assembly **36, 37** will thereafter maintain the reel in this locked condition until it is again manually unlocked.

Springs **53** and **54** interposed between the locking member **32** and the housing's cover **11** serve merely to equalize the movement of the locking member at its opposite sides.

The modified form of spring assembly illustrated in Figure 8 may if desired be substituted for that shown in Figure 4. In Figure 8 the actuating spider element **36¹** is substantially like the element **36** in Figure 4, but the body of the flexible element **37¹** is flexibly connected to the springable legs **39¹** of the actuating element by means of links **41¹** pivotally connected to said flexible element's body and to the actuating element's legs **39¹**. This modified spring assembly functions in the same manner as that previously described.

It will thus be seen that the invention provides an efficient inertia-operable shoulder harness takeup reel and spring assembly therefor, and while but two specific embodiments thereof have been herein shown and described, it will be understood that numerous details may be altered or omitted without departing from the spirit of the invention as defined by the following claims.

I claim:

1. In a reel device of the class described: a housing adapted for mounting in an upright position on a suitable supporting structure, said housing having rearwardly extending guides at the opposite interior sides thereof; a spindle mounted in the housing and projecting rearwardly therein between said guides; a drum rotatably and non-slidably mounted on the spindle and adapted to receive a cable wound thereon; a locking member slidably mounted on the spindle rearwardly of the drum and having key means at opposite sides thereof forwardly-rearwardly movable on the housing's guides whereby the locking member is keyed against rotation; cooperative locking means on the rearward part of the drum and on the forward part of the locking member adapted to engage when the locking member is slid forwardly into engagement with the drum; an actuating spider element having a body fixedly mounted on the spindle adjacent the drum and radially spaced rearwardly extending laterally springable legs; a flexible plate element having a body connected to the locking member movably therewith and laterally extending forwardly-rearwardly flexible arms connected at their outer ends to the rearward ends of said spider element's laterally springable legs, whereby the legs of the spider element are sprung outwardly when the plate element is in a substantially plane center position and whereby the locking member is urged forwardly or rearwardly on the spindle by the inwardly contracting forces of the spider element's legs acting on the plate element's flexible arms whenever the body of the plate element is moved forwardly or rearwardly respectively of said center position.

2. In a reel device of the class described: a housing adapted for mounting in an upright position on a suitable supporting structure, said housing having rearwardly extending guides at the opposite interior sides thereof; a spindle mounted in the housing and projecting rearwardly therein between said guides; a drum rotatably and non-slidably mounted on the spindle and adapted to receive a cable wound thereon; spring means normally urging the drum in a direction for winding the cable thereon; a locking member slidably mounted on the spindle rearwardly of the drum and having key means at opposite sides thereof forwardly-rearwardly movable on the housing's guides whereby the locking member is keyed against rotation; cooperative ratchet means on the rearward part of the drum and on the forward part of the locking member adapted to engage when the locking member is slid forwardly into engagement with the drum thus to prevent rotation of the drum in a direction for unwinding the cable while permitting rotation of the drum in a direction for winding the cable thereon; an actuating spider element having a body fixedly mounted on the spindle adjacent the drum and radially spaced rearwardly extending laterally springable legs; a flexible plate element having a body connected to the locking member movably therewith and laterally extending forwardly-rearwardly flexible arms connected at their outer ends to the rearward ends of said spider's laterally springable legs, whereby the legs of the spider element are sprung outwardly when the plate element is in a substantially plane center position and whereby the locking member is urged forwardly or rearwardly on the spindle by the inwardly contracting forces of the spider element's legs acting on the plate's flexible arms whenever the body of the plate element is moved forwardly or rearwardly respectively of said center position.

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