

Aug. 11, 1959

C. J. BARECKI
AUTOMATIC REEL

2,899,146

Filed March 14, 1956

4 Sheets-Sheet 1

Fig. 1

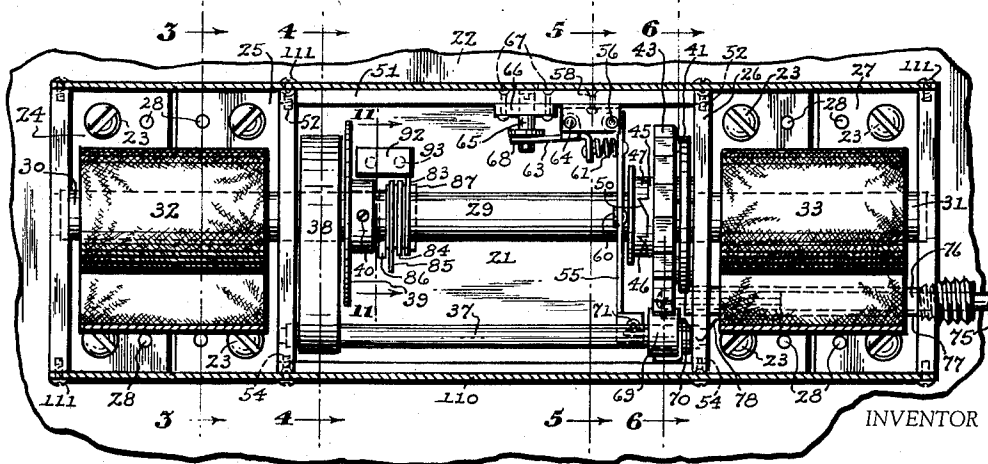
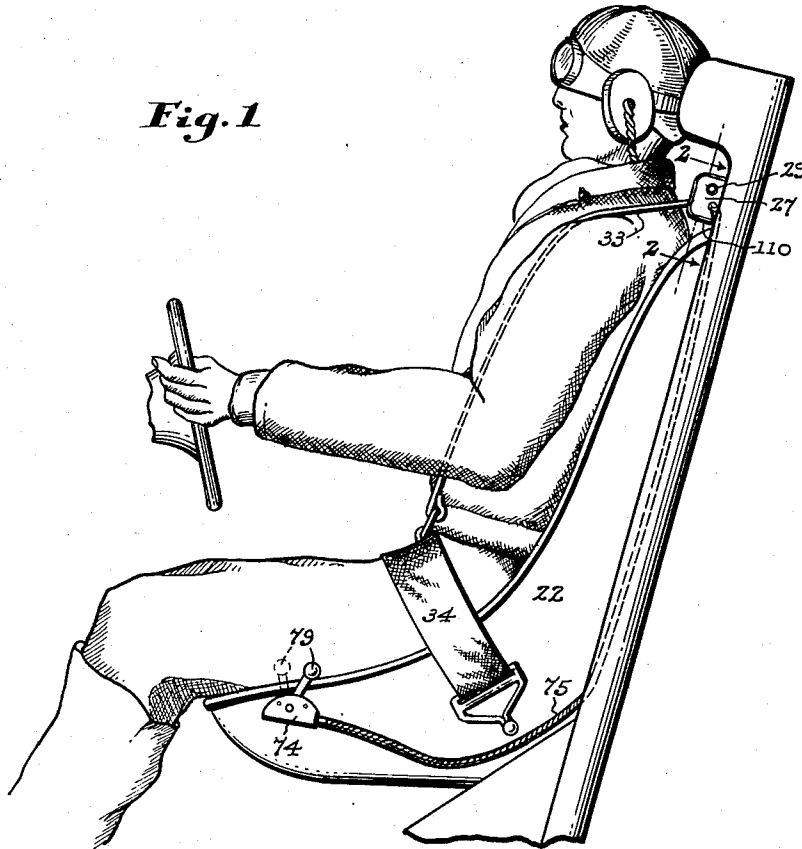


Fig. 2

Chester J. Barecki
BY *John S. Braddock*

ATTORNEY

Aug. 11, 1959

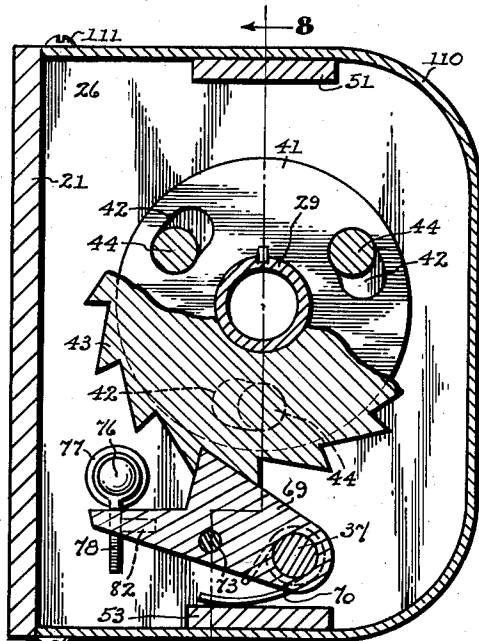
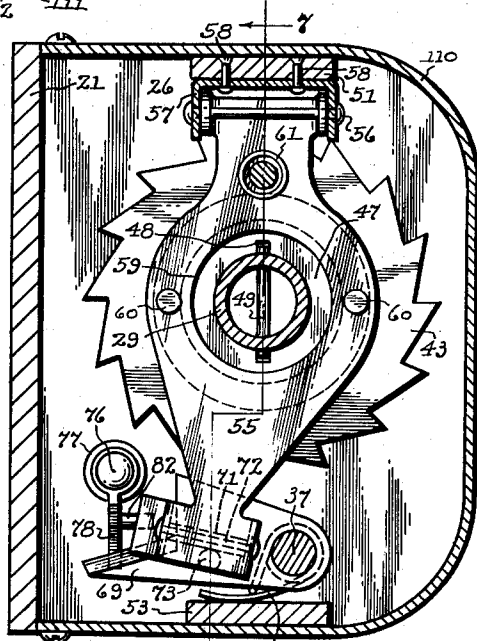
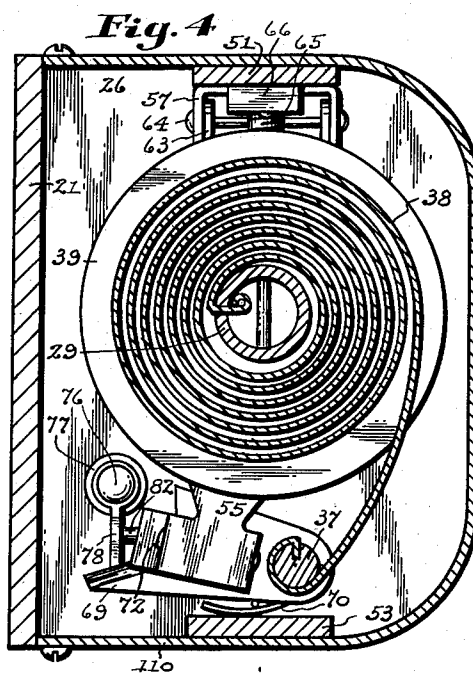
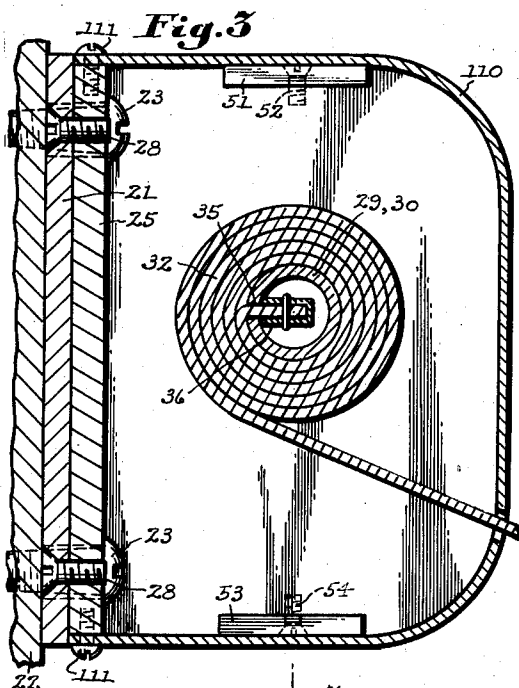
C. J. BARECKI

2,899,146

AUTOMATIC REEL

Filed March 14, 1956

4 Sheets-Sheet 2



INVENTOR

Chester J. Barecki
BY *John S. Braddock*

ATTORNEY

Aug. 11, 1959

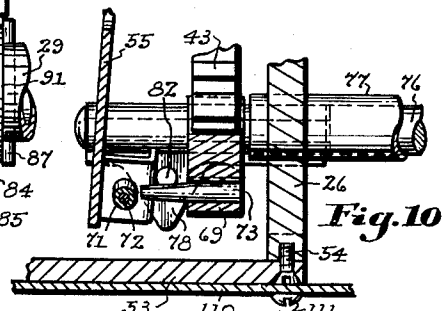
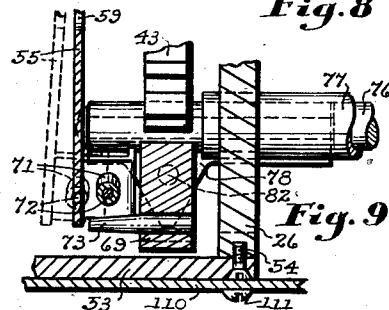
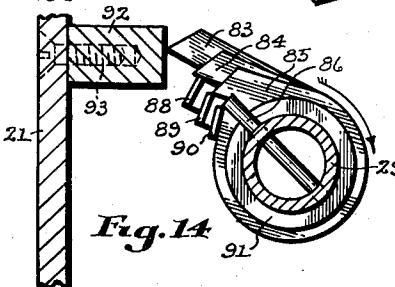
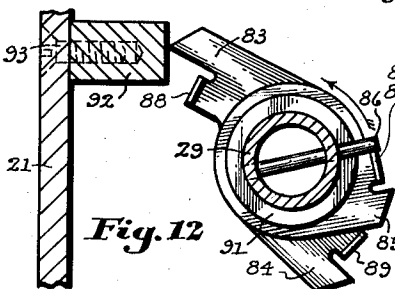
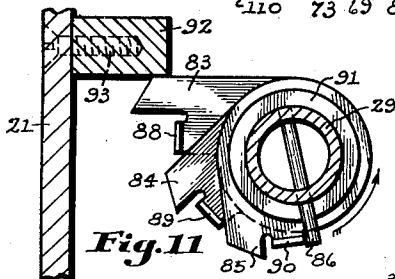
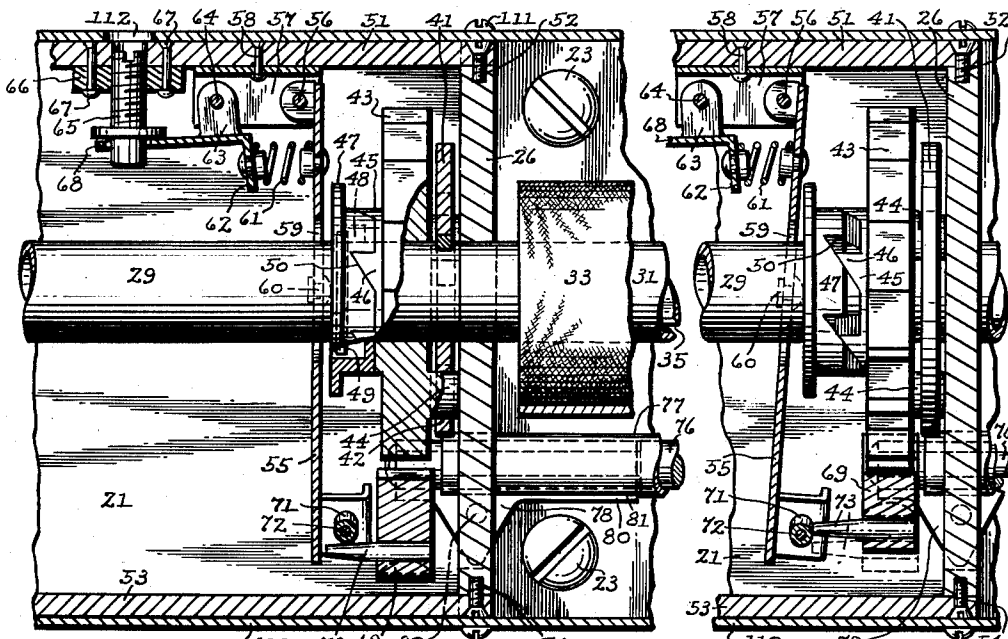
C. J. BARECKI

2,899,146

AUTOMATIC REEL

Filed March 14, 1956

4 Sheets-Sheet 3



INVENTOR

Chester J. Barecki

BY John S. Braddock

ATTORNEY

Aug. 11, 1959

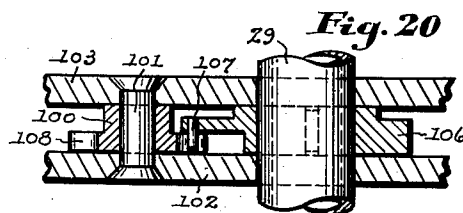
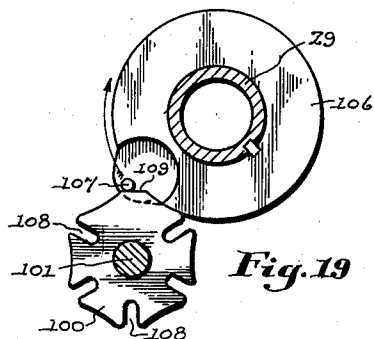
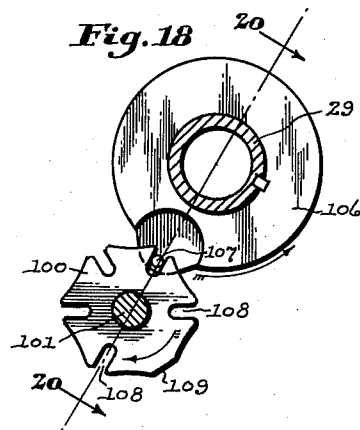
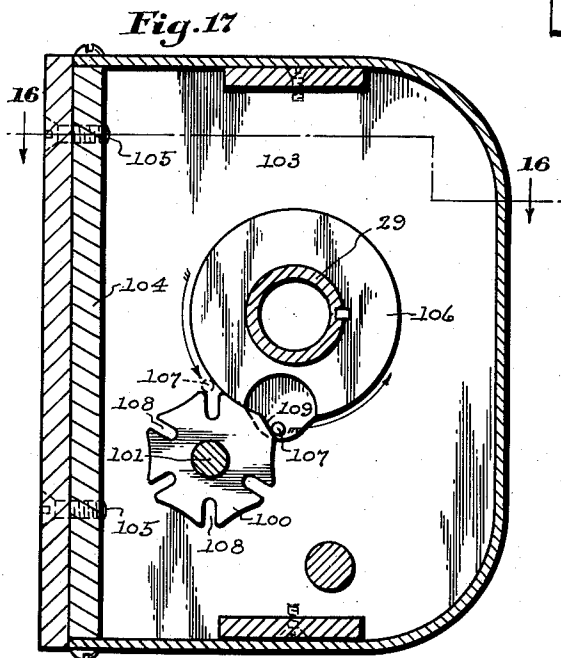
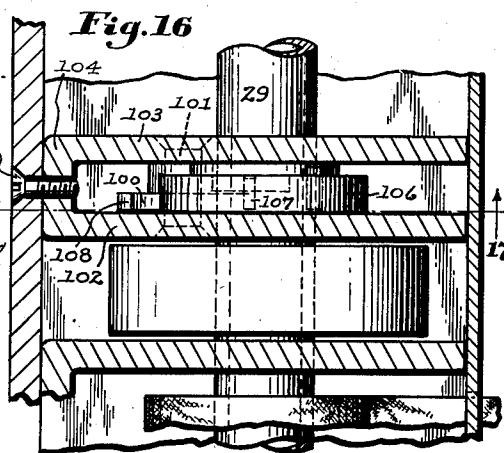
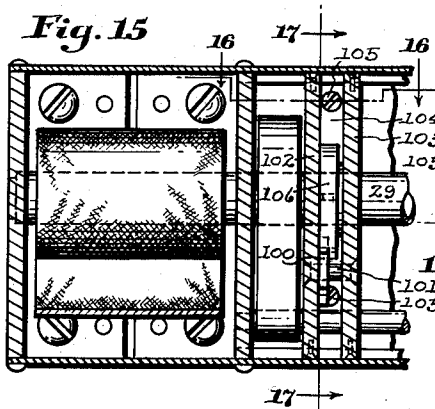
C. J. BARECKI

2,899,146

AUTOMATIC REEL

Filed March 14, 1956

4 Sheets-Sheet 4



INVENTOR

Chester J. Barecki

BY *John P. Braddock*

ATTORNEY

1

2,899,146

AUTOMATIC REEL

Chester J. Barecki, Grand Rapids, Mich., assignor to American Seating Company, Grand Rapids, Mich., a corporation of New Jersey

Application March 14, 1956, Serial No. 571,392

4 Claims. (Cl. 242—107.4)

The present invention relates to automatic reels of the type used to take up slack in safety belts and harnesses for vehicle occupants and adapted to lock so as to restrain the occupant against forward movement in the event of a crash.

The primary objects of the invention are to provide an improved reel of the character indicated which normally winds in any slack in a cable, web or similar elongated flexible element such as might be attached to or be a part of a safety restraining device for a vehicle occupant; to provide such a reel which is readily yielding under normal conditions to permit unwinding of the flexible element, thus affording full freedom of movement to the vehicle occupant; to provide such a reel which when used in conjunction with a safety restraining device for a vehicle occupant will automatically lock whenever the flexible element is suddenly jerked as would occur in the event the vehicle crashed, thus to prevent unwinding of the flexible element so as to restrain the occupant against being thrown forwardly in the vehicle and possibly injured or killed; to provide such a reel having manual control mechanism whereby the occupant of a vehicle seat on which the reel is mounted may lock or unlock the reel at will; to provide novel automatic mechanism for limiting the travel of the reeled flexible element in both the paying-out and taking-up directions; and in general to provide such an automatic reel which is simple in construction, effective in use, and reasonably economical to manufacture.

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

Figure 1 is a side elevational view of an airplane pilot's chair, the occupant shown being provided with a more or less conventional lap belt and shoulder harness, and the shoulder harness being shown connected to the new takeup reel mounted on the chair behind the occupant's shoulders;

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

Figure 3 is a vertical sectional view thereof taken on line 3—3 of Figure 2;

Figure 4 is a vertical sectional view thereof taken on line 4—4 of Figure 2;

Figure 5 is a vertical sectional view thereof taken on line 5—5 of Figure 2;

Figure 6 is a vertical sectional view thereof taken on line 6—6 of Figure 2;

Figure 7 is a fragmentary vertical sectional view of parts of the reel taken on line 7—7 of Figure 5;

Figure 8 is a fragmentary vertical sectional view thereof taken on line 8—8 of Figure 6 and showing certain parts of the reel in different moved positions from their positions shown in Figure 7;

Figure 9 is a fragmentary vertical sectional view of certain parts of the reel in different moved positions from their positions shown in Figures 7 and 8;

Figure 10 is a sectional view similar to Figure 9 and showing the same parts in still other moved positions;

2

Figure 11 is a fragmentary vertical sectional view of parts of the reel taken on lines 11—11 of Figures 2 and 14;

Figure 12 is a fragmentary vertical sectional view similar to Figure 11 and showing certain parts of the mechanism in different positions from their positions shown in Figure 11;

Figure 13 is a fragmentary front elevational view of the parts shown in Figure 12;

Figure 14 is a sectional view similar to Figures 11 and 12 and showing the parts in still other moved positions;

Figure 15 is a fragmentary vertical sectional view of a modified form of the reel, the section being similar to that of the left hand end of the reel shown in Figure 2;

Figure 16 is an enlarged fragmentary horizontal sectional view of parts of the modified form of reel, taken on lines 16—16 of Figures 15 and 17;

Figure 17 is a similarly enlarged vertical sectional view of certain parts of the modified form of reel, taken on lines 17—17 of Figures 15 and 16;

Figure 18 is a vertical sectional view of certain parts shown in Figure 17 in different moved positions;

Figure 19 is a view similar to Figure 18 and showing the same parts in still other moved positions; and

Figure 20 is a fragmentary sectional view of the same parts taken on line 20—20 of Figure 18.

Referring now in detail to these drawings, and referring first particularly to the form of the reel shown in Figures 1 through 14, the device is constructed upon a base 21 which is adapted for mounting on a vehicle seat 22 in the manner shown in Figures 1 and 2 as by means of wood screws 23. Spaced bracket supports 24, 25, 26, and 27 are mounted upon the base 21 as by means of machine screws 28 and are provided with aligned bearings in which a hollow shaft is rotatably mounted or journaled. The opposite end portions of the shaft 29 extend outwardly beyond the inner bracket supports 25, 26 to form spaced apart spools 30, 31 to which are connected elongated flexible, non-stretchable elements or webs 32, 33 which comprise shoulder harness straps passing over the shoulders of the chair occupant and attached at their lower forward ends to a more or less conventional lap belt 34. As seen in Figure 3 the inner end of each web 32 or 33 is passed through a slot 35 in its spool 30 or 31 and is secured therein by means of a clip 36, and the webs are thus connected to the spools and are adapted for winding thereon or unwinding therefrom.

A rod 37 connects the inner bracket supports 25 and 26. A spiral spring 38 is disposed between the support 25 and a circular plate member 39 secured by a set screw 40 on the shaft 29, and this spring 38 has its inner and outer ends connected respectively to the shaft 29 and to the rod 37 as best seen in Figure 4. The spiral spring 38 normally yieldingly urges the shaft 29 in the winding direction, i.e. the direction for winding the webs 32, 33 on the spools 30, 31 thus taking up any slack in the webs but at the same time permitting freedom of movement to the chair occupant.

A disc 41 is keyed to the shaft 29 adjacent the inner face of the bracket support 26 and is provided with arcuate slots 42 arranged coaxially with the shaft 29, as best seen in Figure 6. A ratchet wheel 43 is non-slidably mounted on the shaft 29 adjacent the disc 41 and is provided with studs 44 extending into the disc's arcuate slots 42, and the ratchet wheel 43 is thus permitted limited rotation relative to the disc and to the shaft 29. The ratchet wheel 43 has peripheral ratchet teeth and has also a camming ring 45 extending inwardly therefrom coaxially with shaft 29 and provided with camming teeth 46. A collar 47 is slidably and non-rotatably mounted on the shaft 29 inwardly of the ratchet wheel 43, said collar 47 having a slot 48 into which

extend the ends of a pin 49 which passes through the shaft 29 and which keys the collar to the shaft. The outer end of the collar 47 has a cam ring 50 which is provided with notches and which engages with the camming ring 45 on the ratchet wheel 43.

An upper bar 51 connects the bracket supports 25, 26 spacedly from the shaft 29 and opposite said shaft from the rod 37, said bar 51 being secured to the supports 25, 26 as by means of screws 52. A similar lower bar 53 is secured to the supports 25, 26 as by means of screws 54. A lever 55 is fulcrumed on a pin 56 secured in a bracket 57 mounted on the upper bar 51 by means of rivets 58, as best seen in Figures 5 and 7. The swinging movement of the lever 55 is about an axis normal to the axis of shaft 29, and the lever has a central portion provided with an opening 59 through which said shaft passes freely. At opposite sides of the opening 59 the lever 55 bears against the inner surface of collar 47 and is desirably provided with riveted-in contact elements 60 at these points. The free end of lever 55 extends generally toward the rod 37.

Adjustable spring means are provided for urging the lever 55 against the collar 47. As best seen in Figures 7 and 8 these spring means comprise a helical spring 61 interposed between the lever 55 and an arm 62 of an angle lever 63 fulcrumed on a pin 64 secured in the bracket 57. An adjustment screw 65 is threaded through the upper bar 51 and through a block 66 secured to said bar by means of rivets 67. The lower or inner end of the adjustment screw 65 bears against the other arm 68 of the angle lever 63, and it will readily be seen that by means of the adjustment screw the force exerted by spring 61 on lever 55 can be adjusted. This force maintains collar 47 in camming engagement with the ratchet wheel 43, and the cams are so formed that ratchet wheel 43 is thus biased in the unwinding direction of the reel toward the ratchet wheel's limit of movement relative to shaft 29.

A pawl 69 is mounted on the rod 37 turnably to positions of engagement with or disengagement from the ratchet wheel's periphery. Engagement of this pawl 69 with the ratchet wheel 43 prevents rotation of the ratchet wheel, the disc 41 and shaft 29 in the unwinding direction while permitting rotation of these parts in the winding direction for taking up any slack in the webs. A spring 70 circumscribing rod 37 normally urges pawl 69 toward its position of ratchet-engagement with the ratchet wheel.

Lever 55 has its free end bent into U-shape and a detent 71 is turnably mounted on a pin 72 secured in this free end of the lever. The pawl 69 has an inwardly extending pin 73 which is engageable behind the lever's detent 71 for releasably maintaining the pawl out of engagement with ratchet wheel 43.

A manual control device generally designated 74 is mounted on the side of the vehicle chair within ready access of the chair occupant as seen in Figure 1, and this control device is connected to the reel by means of an encased flexible control cable 75. At the reel end of the control cable it is coupled to a control shaft 76 reciprocally slidably disposed in a tubular bearing 77 mounted on the bracket supports 26 and 27. The inner end of the control shaft 76 is reduced in diameter and has mounted thereon a control key 78 which is reciprocally slidable inwardly and outwardly with the control shaft 76 in response to movements of the manual control device's lever 79 by the chair occupant. The control key 78 is keyed against rotation on the shaft 76 by means of a fin 80 extending into a slot 81 in the tubular bearing 77 (see Figure 7). This control key 78 is so formed as to cam the pawl 69 out of engagement with the ratchet wheel 43 each time it passes over the pawl in either direction, and a pin 82 on the control key 78 is adapted to contact the lever 55 when the key is moved inwardly beyond the pawl, thus to move the lever 55 inwardly.

Operation

In Figures 2, 4, 5 and 7 the parts of the reel are shown set for automatic operation to lock the shoulder harness webs 32 and 33 against payout whenever there is an abrupt jerk on the webs such as would be caused by sudden deceleration of the vehicle as in the event of a crash and consequent sudden acceleration of the chair occupant's body relative to the vehicle. With the parts of the reel so set, pawl 69 is held out of engagement with ratchet wheel 43 by the engagement of the pawl's pin 73 behind detent 71 on lever 55. Shaft 29 is thus free to rotate in either direction to permit paying out or taking up of the harness webs 32, 33 wound on the shaft's end portions or spools 30, 31. The chair occupant is thus permitted full freedom of movement during normal operation of the vehicle, but any slack in the harness webs is taken up by the spiral spring 38 acting on shaft 29.

In the event of a crash of the vehicle resulting in abrupt jerking of the shoulder harness webs 32, 33 and consequent sudden urging of shaft 29 and collar 47 on the shaft in the unwinding direction, ratchet wheel 43 by its own inertia lags behind this sudden movement of the shaft, being permitted to do so to a limited extent by the elongated arcuate slots 42 of disc 41 into which slots extend the ratchet wheel's studs 44. This sudden inertia-effected relative rotation between the ratchet wheel 43 and the shaft 29 causes the toothed camming ring 45 on the ratchet wheel to cam inwardly collar 47 by its notched cam ring 50, as seen in Figure 8. Collar 47 thus urges lever 55 inwardly in a swinging movement about its fulcrum 56, against the biasing influence of spring 61. This inward movement of lever 55 disengages the lever's detent 71 from the pin 73 on pawl 69, thus permitting pawl 69 to be moved by spring 70 into ratchet-engagement with the ratchet wheel 43 (see Figure 6) and thus locking the ratchet wheel and shaft 29 against rotation in an unwinding direction for paying out the webs while permitting rotation of these parts in the opposite or winding direction. The chair occupant is thus prevented from being thrown farther forwardly than he happened to be at the time of the crash, and if he subsequently moves rearwardly any slack in the webs is taken up to further protect the occupant in the event of ensuing or rebounding crashes.

After the reel has become locked as above described, lever 55 remains in its inwardly moved position seen in Figure 8 by reason of the engagement of the lever's detent 71 behind the inner end of the pawl's pin 73, as shown. If it is subsequently desired to reset the reel for automatic operation, this can be accomplished by moving the manual control lever 79 half-way through its limit of travel and then returning it. This first moves the control key 78 from its position seen in Figure 8 to its position seen in Figure 9, thus camming the pawl 69 out of engagement with the ratchet wheel 43 and permitting lever 55 to be moved by spring 61 from its dotted to its solid line position seen in this Figure 9. Return of the control key 78 to its former position releases the pawl 69 so that its pin 73 again engages behind the lever's detent 71, and the reel is thus reset for automatic operation.

In some situations it may be found desirable to manually lock the reel against paying out of the harness webs, and this may be accomplished by the chair occupant by moving the manual control lever 79 as far as it will go, and leaving it there. This moves the control key 78 inwardly to its position seen in Figure 10, and pin 82 contacts lever 55 swinging the lever inwardly and thus permitting pawl 69 to engage the ratchet wheel 43 to lock the reel. Subsequent returning movement of the manual control lever 79 cams the pawl downwardly and permits the several parts to resume their unlocked positions wherein the reel is set for automatic operation.

Means are provided for positively stopping the turning

5

6

movements of shaft 29 in both directions so as to limit the total amount of harness web which can be payed out or taken up by the reel. As shown in Figure 2 and Figures 11 through 14 these means comprise three co-operating counter fingers 83, 84, and 85 secured in position on shaft 29 between pins 86 and 87 passing through the shaft. These counter fingers have stop flanges 88, 89 and 90 respectively, each adapted to engage an adjacent finger or, in the case of counter finger 85, the pin 86, during successive turns of shaft 29. Friction washers 91 are interposed between the counter fingers and between the end fingers and the adjacent pins 86, 87. Shaft 29 is shown in Figure 11 at the limit of its rotation in the winding direction, in which the counter finger 83 engages a block 92 secured to base 21 by screws 93, finger 84 engages flange 88, finger 85 engages flange 89, and pin 86 engages flange 90. The parts are urged into such engagement by the spiral spring 38.

In Figure 12, shaft 29 has been rotated about $1\frac{1}{2}$ turns in the unwinding direction. Counter finger 83 has been stopped against the other side of block 92, while the other counter fingers continue to rotate with the shaft.

In Figure 13, shaft 29 has reached its limit of unwinding rotation. Counter finger 83 engages block 92, finger 84 engages flange 88, finger 85 engages flange 89, and pin 86 engages flange 90. Unwinding movement of shaft 29 is thus stopped after about four revolutions of the shaft.

Figures 15 through 20 illustrate a novel modification of the means for limiting the travel of shaft 29 and as here shown, to about six revolutions. In this modification a notched wheel 100 of Geneva-type is rotatably disposed on a spindle 101 mounted in spaced arms 102 and 103 of a bracket 104 secured to the base by screws 105. A wheel 106 is keyed on the shaft 29 and is provided with a pin 107 adapted to engage in successive notches 108 of the notched wheel 100 to permit continuous rotation of wheel 106 and effect step-by-step rotation of the notched wheel. This movement is similar to that of the usual Geneva-type mechanism, except that in the present device one of the notches has been omitted from the notched wheel and in its place there is an abutment 109 adapted to be contacted by the pin 107 to stop the movement of both wheels, and of shaft 29 after the shaft has completed about six revolutions in either direction. It will be noted that the mechanism provides for approximately one more revolution of the shaft than the number of notches in the Geneva-type wheel, and that the number of revolutions permitted might be varied by varying the number of notches in the notched wheel.

In any form of the invention it is desirable that a cover be provided for the entire mechanism, such a cover being designated 110 in Figures 1 through 10 and being secured to the base 21 as by means of screws 111. It will be seen that the base 21, bracket supports 24, 25, 26 and 27, upper bar 51, lower bar 53 and the cover 110 constitute a rigid housing on which the various parts are mounted and within which they are enclosed. In Figures 15-20, the bracket 104 is also a part of the housing. As seen in Figure 7, the cover is provided with an aperture 112 through which access may be had to the adjustment screw 65 without removing the cover from the base.

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

I claim:

1. In an automatic reel: a housing; a shaft rotatably mounted in the housing and having a spool rotatable

therewith; an elongated flexible, non-stretchable element connected to the spool and adapted to be wound thereon and unwound therefrom; spring means for normally yieldingly urging the shaft in the winding direction; a ratchet wheel non-slidably mounted on the shaft for rotation therewith and for limited rotation relative thereto, said ratchet wheel having peripheral ratchet teeth and having also a camming ring extending therefrom coaxially with the shaft; a collar slidably and non-rotatably mounted on the shaft adjacent the ratchet wheel and having on one side a cam ring in engagement with the camming ring on the ratchet wheel; a lever mounted on the housing for swinging movement about an axis normal to the shaft, said lever bearing against the other side of said collar; spring means urging the lever against the collar to maintain the collar in camming engagement with the ratchet wheel thus biasing said ratchet wheel in the unwinding direction toward its limit of movement relative to the shaft, said limited relative rotation of the ratchet wheel in the opposite direction against the force of the biasing spring means being effected by said wheel's own inertia upon abrupt jerking of the elongated element and consequent sudden urging of the shaft and the collar in the unwinding direction; a pawl mounted in the housing turnably to positions of engagement with or disengagement from the ratchet wheel whereby engagement of the pawl with the ratchet wheel prevents rotation of the ratchet wheel and the shaft in the unwinding direction while permitting rotation of said parts in the winding direction; means normally urging the pawl toward its position of ratchet-engagement with the ratchet wheel; detent means for releasably maintaining the pawl out of engagement with the ratchet wheel; and means responsive to said inertia-effected limited rotation of said ratchet wheel relative to the shaft whereby said detent means is actuated to free the pawl and thus permit engagement of the pawl with said ratchet wheel.

2. In an automatic reel: a base; spaced supports mounted on the base and provided with aligned bearings therein; a shaft journaled in said bearings and having its opposite end portions extending outwardly beyond the supports to form spaced apart spools; elongated flexible, non-stretchable webs connected to the spools and adapted for simultaneous winding thereon or unwinding therefrom; a rod connecting the supports spacedly from the shaft and parallel thereto; a spiral spring disposed between said supports and having its inner and outer ends connected respectively to the shaft and to said rod whereby the shaft is normally yieldingly urged in the winding direction; a disc keyed to the shaft adjacent the inner face of one of said supports and provided with arcuate slots arranged coaxially with the shaft; a ratchet wheel rotatably mounted on the shaft adjacent the disc and provided with studs extending into said disc's arcuate slots whereby the ratchet is permitted limited rotation relative to the disc and the shaft, said ratchet wheel having peripheral ratchet teeth and having also a camming ring extending inwardly therefrom coaxially with the shaft; a collar slidably and non-rotatably mounted on the shaft inwardly of the ratchet wheel and provided with an outwardly extending cam ring in engagement with the inwardly extending camming ring on the ratchet wheel; a bar connecting said supports spacedly from the shaft and opposite the shaft from the rod; a lever fulcrumed at one of its ends on said bar for swinging movement about an axis normal to the shaft, said lever having a central portion provided with an opening through which freely passes the shaft and at opposite sides of which opening the lever bears against the inner surface of said collar, the free end of said lever extending generally toward said rod; spring means urging the lever against the collar to maintain the collar in camming engagement with the ratchet wheel thus biasing said ratchet wheel in the unwinding direction toward its limit of movement relative to the shaft, said limited relative rotation of the ratchet wheel in the opposite direction

against the force of the biasing spring means being effected by said wheel's own inertia upon abrupt jerking of the elongated webs and consequent sudden urging of the shaft and the collar in the unwinding direction; a pawl mounted on the rod turnably to positions of engagement with or disengagement from the ratchet wheel's periphery whereby engagement of the pawl with the ratchet wheel prevents rotation of the ratchet wheel, the disc and the shaft in the unwinding direction while permitting rotation of said parts in the winding direction; spring means normally urging the pawl toward its position of ratchet-engagement with the ratchet wheel; a detent on the free end of said lever; an inwardly extending pin on the pawl engageable behind the lever's detent for releasably maintaining the pawl out of engagement with the ratchet wheel, said inertia-effected limited rotation of the ratchet wheel relative to the shaft resulting in camming of the collar inwardly and consequent swinging of the lever inwardly thus disengaging the lever's detent from the pawl's pin and permitting the pawl to turn into ratchet-engagement with the ratchet wheel.

3. In an automatic reel comprising a housing and a shaft rotatably mounted in the housing for taking up and paying out a reeled element, mechanism for limiting the travel of said reeled element comprising: a notched wheel mounted in the housing for rotation about an axis parallel to that of the shaft, said wheel being of the Geneva-type having equidistantly spaced notches extending completely around its periphery except for an abutment in the place of one notch, and a pin on the shaft adapted to engage in said notches successively with each complete revolution of the shaft thus to rotate the wheel by steps, said pin being adapted to contact said abutment in both directions of rotation of the shaft to stop the movement of the shaft and the wheel and thus limit the

number of revolutions of the shaft to approximately one more than the number of notches in the wheel.

4. A safety device for mounting in a vehicle to restrain the movement of a body within the vehicle when the body is subjected to relatively high acceleration movement relative to the vehicle comprising an elongated flexible element adapted to be coupled to the body, a rotatably mounted reel having said element secured thereon, resilient means coupled to said reel for rotating said reel in a direction to wind said element on said reel, said reel rotating in the opposite direction to unwind said element therefrom due to forces exerted on the element by the body, a rotatably mounted inertia member having camming means thereon, a collar rotatable with the reel and slidable relative thereto, said collar having a cam thereon adjacent said camming means, spring means urging the collar toward the inertia member thus yieldably coupling said inertia member to said reel to thereby cause said member to rotate with said reel during rotation in said unwind direction below a certain acceleration, said camming means operating against said cam to overcome said spring means during rotation at said certain acceleration to cause said reel to rotate relative to said inertia member, and means associated with said collar operated when said reel rotates relative to said inertia member for stopping rotation of the reel in said unwind direction.

References Cited in the file of this patent

UNITED STATES PATENTS

886,387	Mehl	May 5, 1908
2,547,777	Ray	Apr. 3, 1951
2,708,555	Heinemann et al.	May 17, 1955
2,845,234	Cushman et al.	July 29, 1958