June 21, 1966 A. G. CARTER 3,257,147

DEVICE FOR REMOVING SLACK FROM A SAFETY BELT

Filed Jan. 13, 1964 3 Sheets-Sheet 1

FIG. 1

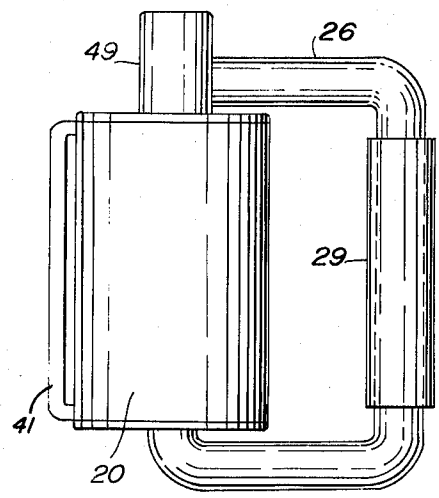


FIG. 2

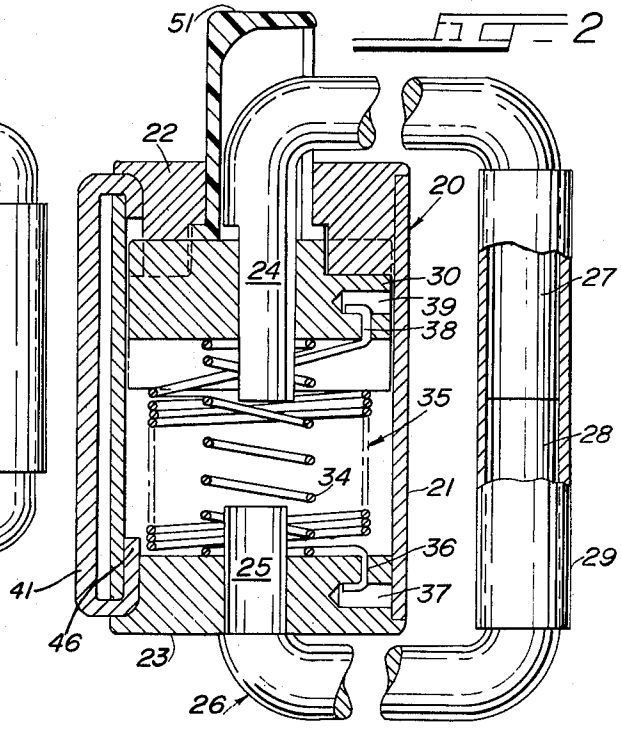


FIG. 3

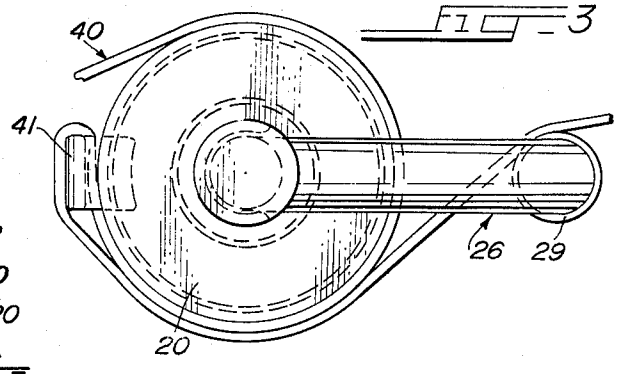
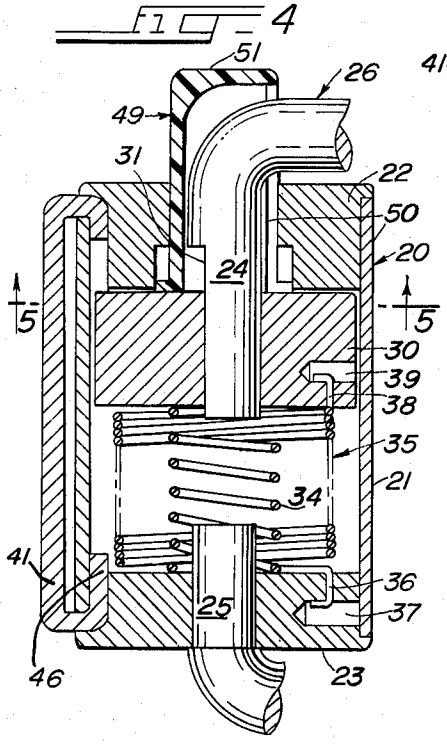


FIG. 4



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June 21, 1966 A. G. CARTER 3,257,147

DEVICE FOR REMOVING SLACK FROM A SAFETY BELT

Filed Jan. 13, 1964 3 Sheets-Sheet 2

FIG. 5

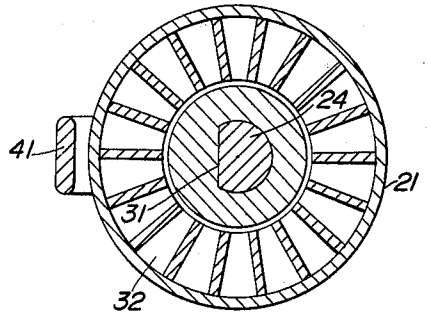


FIG. 6

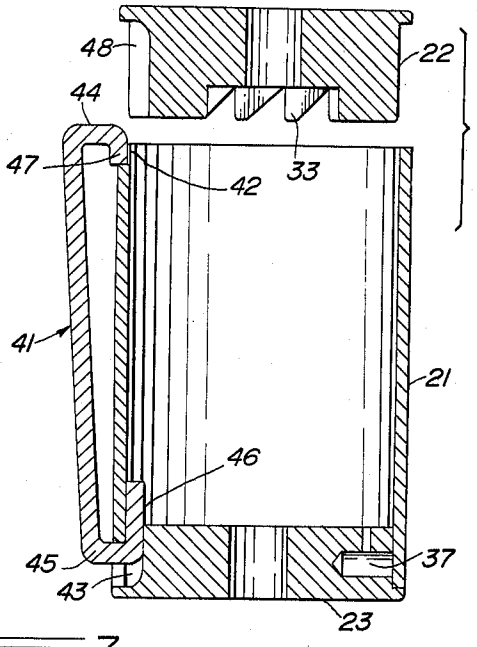
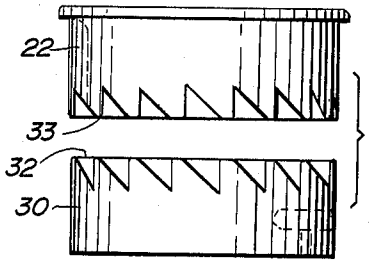


FIG. 7



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June 21, 1966 A. G. CARTER 3,257,147

DEVICE FOR REMOVING SLACK FROM A SAFETY BELT

Filed Jan. 13, 1964 3 Sheets-Sheet 3

FIG. 8

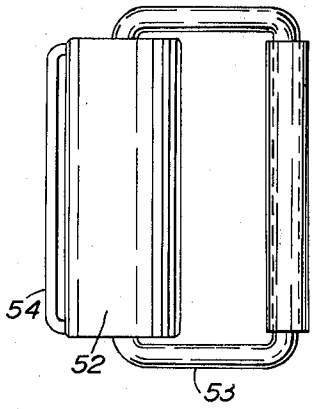


FIG. 9

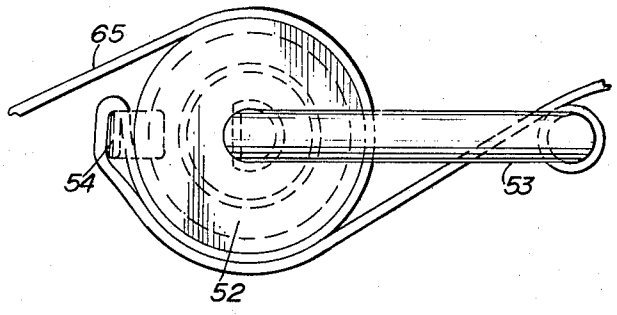
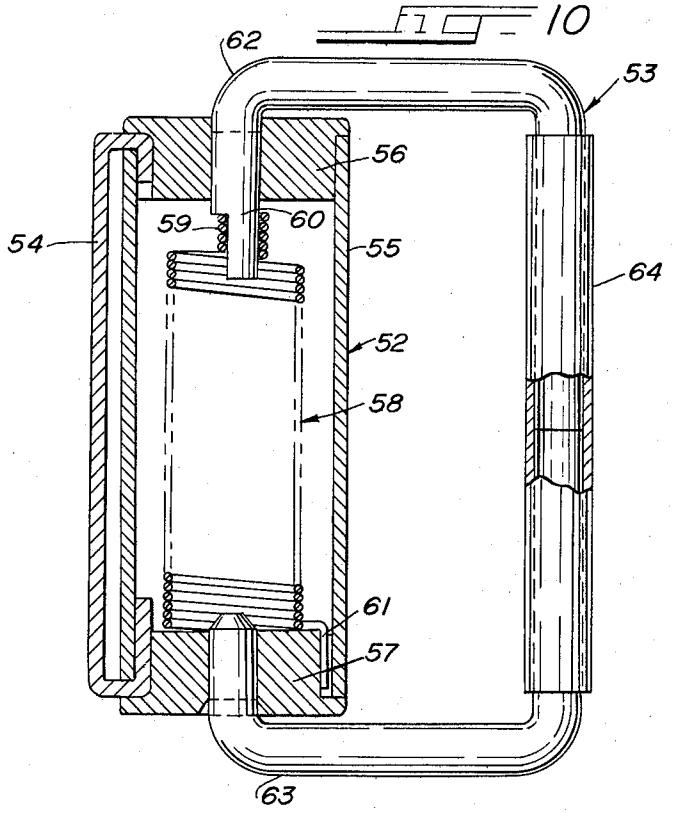


FIG. 10



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3,257,147

DEVICE FOR REMOVING SLACK FROM A SAFETY BELT

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Filed Jan. 13, 1964, Ser. No. 337,209
4 Claims. (Cl. 297—388)

This invention relates to safety belts. A frequent objection to the use of these belts centers in the tendency of the disconnected sections of the belt to fall to the floor of the vehicle and become soiled. The next use of the belt obviously applies the accumulation of soil to the clothing of the user of the belt. Even if the belt sections do not fall completely to the floor, they tend to assume random positions on the seat when not in use. The next occupant finds himself sitting on the buckle section, or otherwise interfering with the belt because portions of it are underneath him.

Another problem that has faced the manufacturers of safety belt equipment is the provision of a length adjustment which is easy enough to operate that the user will eliminate unnecessary slack. Obviously, any slack in the belt will decrease the retention of the occupant in an accident. The average user, however, apparently cannot be expected to take the time and care to make the length adjustment associated with the girths of different occupants, or different seat positions.

This invention provides a biased system for reeling in the slack of a safety belt, and then locks the belt against extension until released. The coupling of the buckle sections is also made easier by the large amount of slack that immediately becomes available on the release of the locking action. The buckle sections can be brought together in full view of the user without interference from clothing. When properly engaged, the occupant can simply drop the buckle into his lap. The take-up device will then automatically draw the belt into the required degree of tension, and lock it in that condition with sufficient security to withstand the forces involved in a crash. On disengagement of the buckle sections, the belt is simply reeled in to a pre-determined position at the side of the user, and the unit will always be ready for his grasp at the same place.

In the preferred form of the invention, a take-up device is provided in conjunction with both of the belt sections. If desired, both of these could be lockable, but a more economical arrangement follows from the use of a mere biasing device of one buckle section, with a lockable feature incorporated in the opposite buckle section. If this arrangement is used, the take-up biasing of the lockable device should be strong enough to overcome the biasing effect on the opposite belt section. If this is not arranged in this manner, it becomes necessary for the occupant to manually pull the belt in the direction of the lockable device to completely remove the belt accumulation on the non-lockable unit.

In summary, the lockable take-up device provided by the preferred form of the invention includes a spool with a peripheral anchor for engaging a loop of belt. Both of the resulting portions of the belt (the opposite sides of the loop) are together wrapped around the spool. A bail is arranged to bear on the belt on one side of the spool, and a rotative biasing action between the bail and spool will cause the belt to be wound upon the spool. The take-up device is then suspended at an intermediate position between the oppositely-extending sections forming the loop. The locking action which prevents extension until a release is actuated merely blocks the relative rotation between the bail and the spool. Tension between the opposite belt ends will therefore produce a more and more violent

tendency for the bail to engage the belt, but it is entirely practical and feasible to construct a device along this principle which will have the capability of withstanding the stresses resulting from several thousand pounds of belt tension.

The several features of the invention will be analyzed in further detail through a discussion of the particular embodiments illustrated in the accompanying drawings. In the drawings:

FIGURE 1 is a plan view of a lockable take-up device constructed according to the present invention.

FIGURE 2 is an axial section of the device shown in FIGURE 1, on an enlarged scale, in the locked condition.

FIGURE 3 is an end view of the device shown in FIGURE 2.

FIGURE 4 is a sectional view of the device shown in FIGURE 1, in the release position.

FIGURE 5 is a section taken on the plane 5—5 of FIGURE 4.

FIGURE 6 is an exploded view showing the manner of assembling the sleeve, the end plugs, and the retainer bar of the prefererd form of the invention.

FIGURE 7 shows the preferred pattern of tooth formation of the end plug and the clutch member to provide a ratchet action.

FIGURE 8 is a plan view of a non-locking take-up device.

FIGURE 9 is an end view of the unit shown in FIGURE 8, on an enlarged scale.

FIGURE 10 is an axial section showing the construction of the device illustrated in FIGURES 8 and 9.

Referring to FIGURES 1 through 7, inclusive, the illustrated lockable take-up device includes a spool generally indicated at **20** formed by the hollow sleeve **21** and the end-plugs **22** and **23**. Both of these end-plugs have central openings traversed by the opposite axial portions **24** and **25** of the bail **26**. This bail is preferably constructed as shown from opposite U sections, with one leg of each forming the portions **24** and **25**, respectively. The opposite legs **27** and **28** are axially aligned, and are joined by the tube **29** in a press fit, or otherwise rigidly secured.

The spool **20** is rotatably mounted with respect to the bail **26**, but such relative rotation can be prevented by the action of the clutch member **30**. The portion **24** of the bail **26** is provided with a flat shown at **31**, and the clutch member **30** has a central opening conforming to the cross-section of the portion **24** at this point. The clutch member **30** is therefore slidable along the portion **24**, but non-rotatable with respect thereto. The clutch member **30** and the end plug **22** have interengagable teeth as shown at **32** and **33** in FIGURE 7. A spring **34** urges the clutch member **30** axially along the portion **24** of the bail to a position in which the teeth **32** and **33** are interengaged, thus locking the spool against relative rotation with respect to the bail in the direction against which the teeth are inclined. A torsion spring **35** applies a torsional biasing action in an opposite direction which will tend to rotate the spool in the direction permitted by the slant of the teeth **33** and **32**, accompanied by reciprocating axial movement of the clutch member **30**. The relative strength of the springs **34** and **35** should be selected to permit this function to take place. It should be noted that the functions of the springs **34** and **35** can easily be provided in a single spring by proper design. Since the functions themselves are separate, however, they are treated herein as the action of two different springs. The spring **35** is fixed with respect to the end plug **23** by inserting the spring end **36** through a suitable axial hole, and then applying a tool in the radial hole **37**, which will clinch the spring end in position. The same arrangement

is provided at the opposite end of the spring **35**, where the end **38** engages an axial hole in the clutch member **30**, and the end is clinched through access provided by the hole **39**.

The belt **40** is retained in engagement with the device by the action of the bar **41**, which extends along adjacent periphery of the spool **20**. The interengagement of the bar **41** with the spool components is best shown in FIGURE 6. The sleeve **21** has axially-aligned slots **42** and **43**, which are engaged by the ends **44** and **45** of the bar **41**. The slot **43** is of substantial length, and the return-bent portion **46** of the bar **41** is adapted to maintain retention with the sleeve **21** under all conditions in which the opposite and shorter return bent portion **47** is in its assembled position. The bar **41** may therefore be slid upwardly, as shown in FIGURE 6, to permit the engagement of the portion **47** with the sleeve **21**. The bar is then moved axially so that the outer extremity of the portion **44** is in approximate alignment with the upper end of the cylinder **21**, at which time the end plug **22** is inserted with the keyway **48** engaging the portion **47** of the bar. The resulting assembly not only secures the bar **41** in position but rotatively interlocks the sleeve and the end plug **22**. Since the relative rotation of the entire spool assembly is locked by the action of the teeth **33**, it is important that such a positive interengagement be maintained. The final insertion of the end plug **22**, of course, is not made until the interior components of the device shown in FIGURES 2 and 4 are installed.

The disengagement of the teeth **32** and **33** is accomplished by the manipulation of the actuator **49**. This essentially is a cylindrical button with an elongated opening shown at **50** in the side wall for receiving the bail **26**. Actuation of the button **49** by pressure on the end surface **51** will communicate this pressure to the clutch member **30** and axially displace it against the action of the spring **34** to disengage the teeth **32** from the teeth **33**. Under these conditions, the spool is free to rotate with respect to the bail, except for the action of the spring **35**.

Referring to FIGURES 8, 9, and 10, the non-lockable take-up device includes a spool **52**, a bail **53**, and a retaining bar **54**. These components are essentially similar to the corresponding components of the lockable device shown in FIGURES 1 through 7. The assembly of the bar **54** to the spool involves an essentially similar interrelationship between the sleeve **55**, the end plugs **56** and **57**, and the ends of the bar **54**. A torsion spring **58** has a series of coils of reduced diameter shown at **59**, and these are formed to closely register with the D-shaped cross section of the axial portion **60** of the bail **53**. This fixes the rotation of that portion of the spring with respect to the bail, and the opposite spring end **61** is formed parallel to the axis of the device, and is received within a suitable groove in the periphery of the end plug **57**. The bail **53** is also preferably formed in the same manner as the bail **26**, and includes the opposite U-shaped portions **62** and **63** interconnected by the tubular member **64**.

The functioning of the device shown in FIGURES 8, 9, and 10 is merely to apply a continuous biasing action tending to wind up slack in the belt section with which the device is associated. It is preferable that the degree of biasing action provided by the spring **58** be sufficiently less than that of the spring **35** of the unit shown in FIGURES 1 through 7 that the latter unit will cause the unwinding of all of the belt **65** from the device shown in FIGURES 8, 9, and 10, so that all of the belt slack is accumulated in the lockable device of FIGURES 1 through 7. Under these conditions, a subsequent crash would find the belt in locked condition. The sole function of the non-lockable device would be to reel in the belt after the buckle sections had been uncoupled, so that the associated portion of the belt would be withdrawn to a predetermined position on the seat, and prevented from falling to the floor.

The bail-type take-up devices described herein are considered to be the simplest and preferred form of this invention, but the overall performance characteristics can also be provided by other devices suspended by the belt sections. A reel can be interposed in a belt section, rather than engaging a loop. Such an arrangement requires severing the belt section, or manufacturing it with the take-up device installed. The device is inserted at the point where the belt section is severed, and one of the severed ends is secured to the bail of the device—usually by a sewn loop.

The particular embodiments of the present invention which have been illustrated and discussed herein are for illustrative purposes only and are not to be considered as a limitation upon the scope of the appended claims. In these claims, it is my intent to claim the entire invention disclosed herein, except as I am limited by the prior art.

I claim:

1. In combination with a safety belt assembly including first and second belt sections having interengageable buckle portions, respectively, a device for taking in slack from one of said belt sections comprising:

a hollow spool,

said spool including a sleeve and also including end-plugs providing coaxial openings, respectively;

loop-retaining means extending axially adjacent the periphery of said sleeve;

a bail having axial portions traversing said end-plug openings, respectively, said bail also having a portion parallel with the axis of said spool and spaced outward from the periphery thereof, said spool being rotatable with respect to said bail,

said bail including opposite U-shaped members disposed with one leg of each forming said axial portions, and the opposite legs of each in axial alignment, and also including a tubular member interconnecting said latter axially-aligned legs;

a clutch member slidably and non-rotatably engaging one of said bail axial portions within said spool, said clutch member and the end plug adjacent thereto having interengageable teeth for locking said spool rotatively with respect to said bail in one direction of rotation;

first biasing means, said first biasing means tending to rotate said spool with respect to said bail in the opposite direction of rotation from the direction of locking previously specified;

an exteriorly accessible actuator traversing said adjacent end-plug opening and extending to said clutch member, and operable to displace said clutch member axially to disengage the teeth thereof from said adjacent end-plug teeth; and

second biasing means, said second biasing means urging said clutch member axially into engagement with said adjacent end-plug.

2. In combination with a safety belt assembly including first and second belt sections having interengageable buckle portions, respectively, a device for taking in slack from one of said belt sections comprising:

a hollow spool,

said spool including a sleeve having axially-opposite notches, and also including end-plugs providing coaxial openings, respectively;

a loop-retaining bar engageable with said notches and said end-plugs and extending axially adjacent the periphery of said sleeve;

a bail having axial portions traversing said end-plug openings, respectively, said bail also having a portion parallel with the axis of said spool and spaced outward from the periphery thereof, said spool being rotatable with respect to said bail;

a clutch member slidably and non-rotatably engaging one of said bail axial portions within said spool, said clutch member and the end plug adjacent thereto having interengageable teeth for locking said spool

rotatively with respect to said bail in one direction of rotation;

first biasing means, said first biasing means tending to rotate said spool with respect to said bail in the opposite direction of rotation from the direction of locking previously specified;

an exteriorly accessible actuator traversing said adjacent end-plug opening and extending to said clutch member, and operable to displace said clutch member axially to disengage the teeth thereof from said adjacent end-plug teeth,

said actuator having a cylindrical wall provided with an elongated opening receiving a portion of said bail; and

second biasing means, said second biasing means urging said clutch member axially into engagement with said adjacent end-plug.

3. In combination with a safety belt assembly including first and second belt sections having interengageable buckle portions, respectively, a system for taking in slack from said assembly comprising:

a spool receiving one of said belt sections;

loop-retaining means extending axially adjacent the periphery of said spool;

a bail having axial portions engaging said spool, respectively, said bail also having a portion parallel with the axis of said spool and spaced outward from the periphery thereof, said spool being rotatable with respect to said bail;

a clutch member slidably and non-rotatably engaging one of said bail axial portions, said clutch member and said spool having interengageable teeth for locking said spool rotatively with respect to said bail in one direction of rotation;

first biasing means, said first biasing means tending to rotate said spool with respect to said bail in the opposite direction of rotation from the direction of locking previously specified;

an exteriorly accessible actuator operable to separate said clutch member and spool axially to disengage the teeth thereof;

second biasing means, said second biasing means urging said clutch member axially into engagement with said spool; and

a biased take-up device engaging the other of said belt sections, said device having substantially less biasing action than that of said first biasing means.

4. In combination with a safety belt assembly having first and second belt sections normally interconnected by a buckle device, a system for removing slack from said assembly comprising:

a first take-up device, said first take-up device including a spool receiving one of said belt sections, and also including a member engaging said belt section, said first take-up device having a biasing means tending to rotate said spool with respect to said member and releaseable locking means operable to prevent rotation of said spool with respect to said member; and

a second take-up device, said second take-up device including a spool receiving said other belt section, and a member engaging said other belt section, and also including biasing means tending to rotate the said spool and member of said second take-up device with respect to each other,

the biasing means of said first take-up device being substantially stronger than the biasing means of said second take-up device.

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