

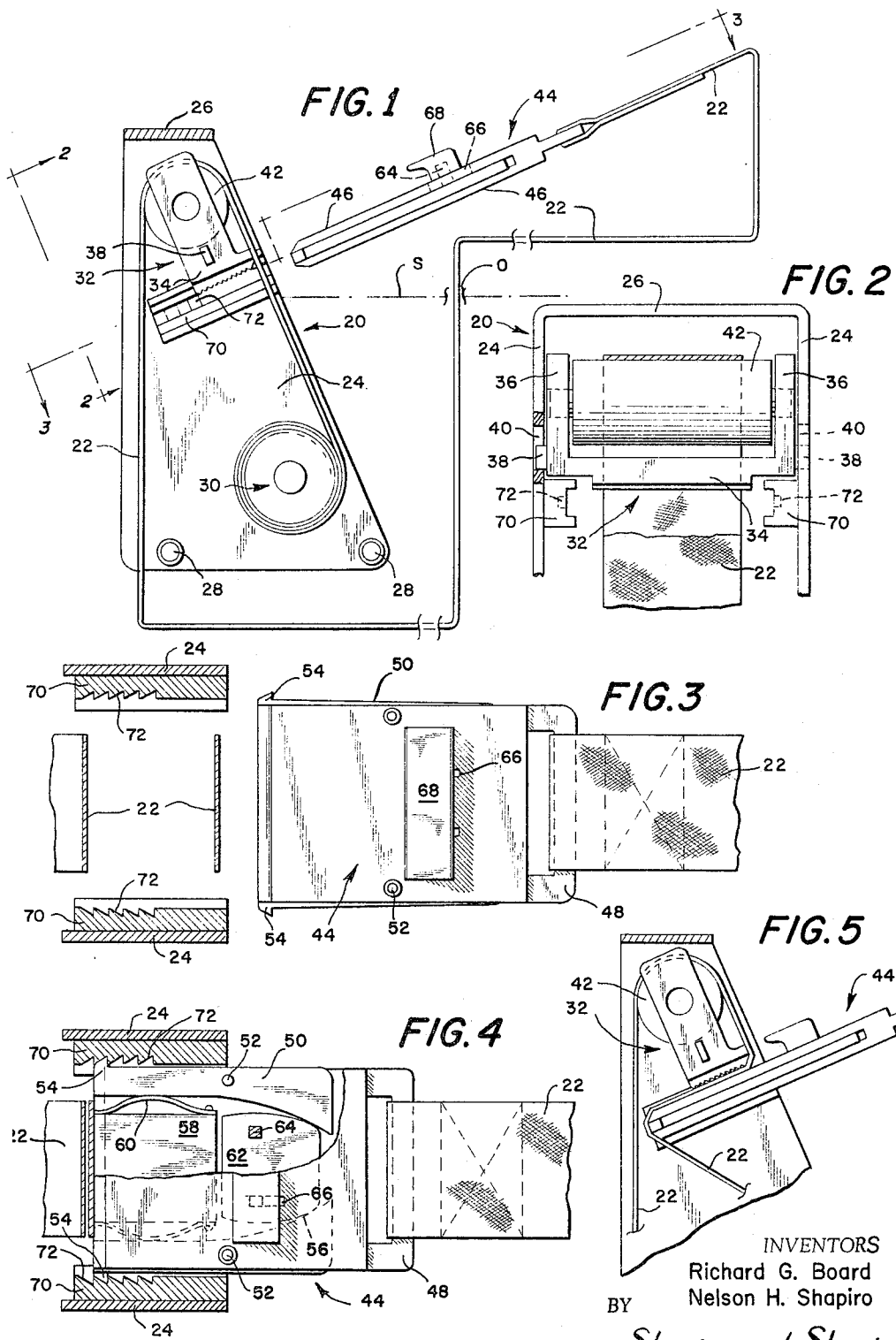
Nov. 29, 1966

R. G. BOARD ETAL
RETRACTABLE SAFETY BELTS

3,288,528

Filed Feb. 12, 1964

3 Sheets-Sheet 1



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FIG. 6

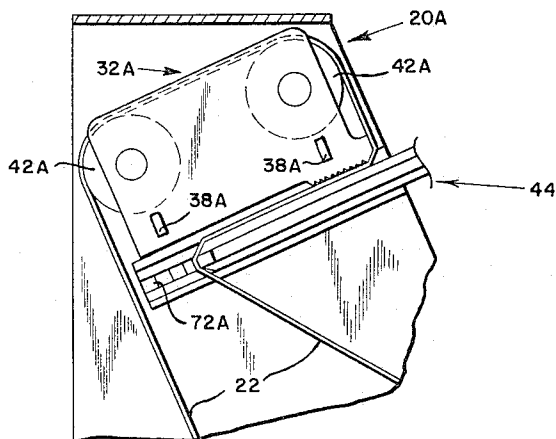


FIG. 7

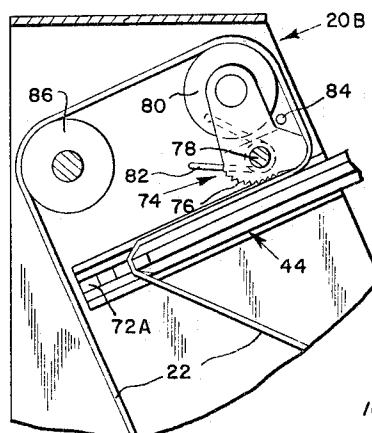


FIG. 8

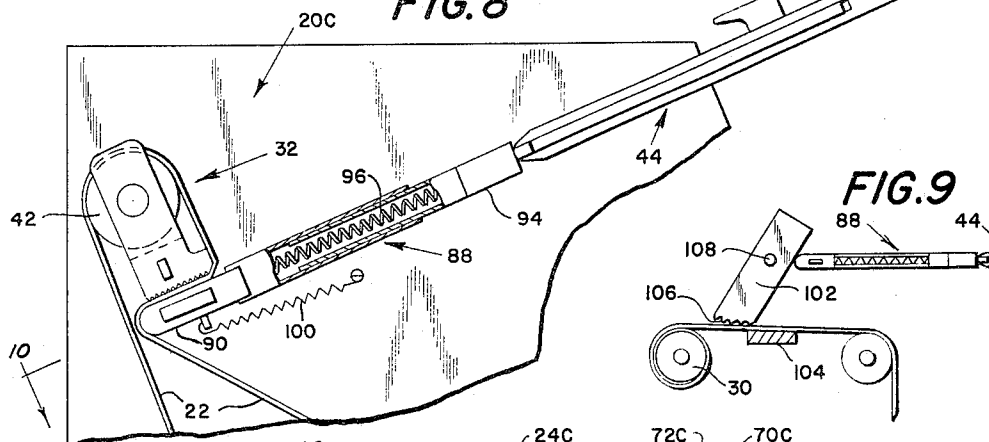


FIG. 9

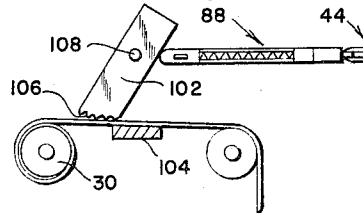
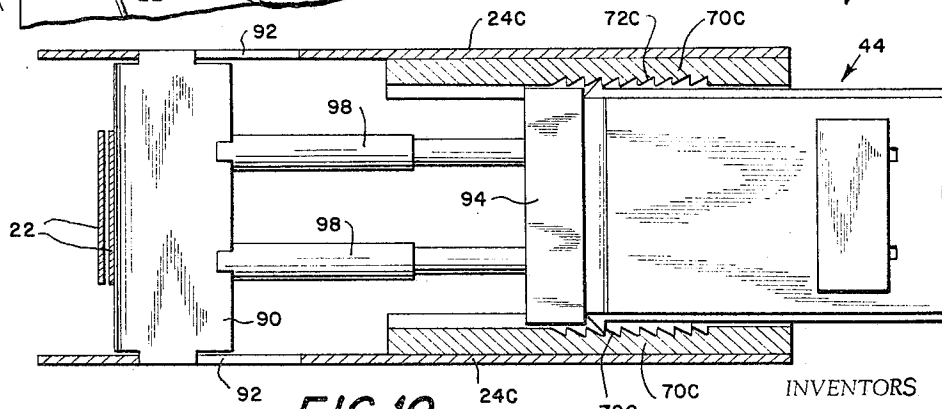


FIG. 10



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FIG. 11

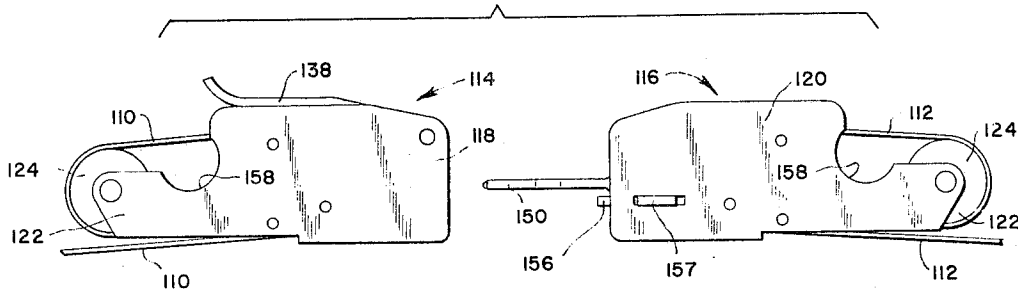


FIG. 12

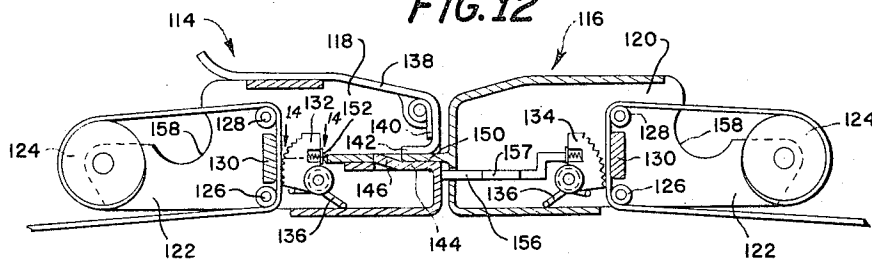


FIG. 13

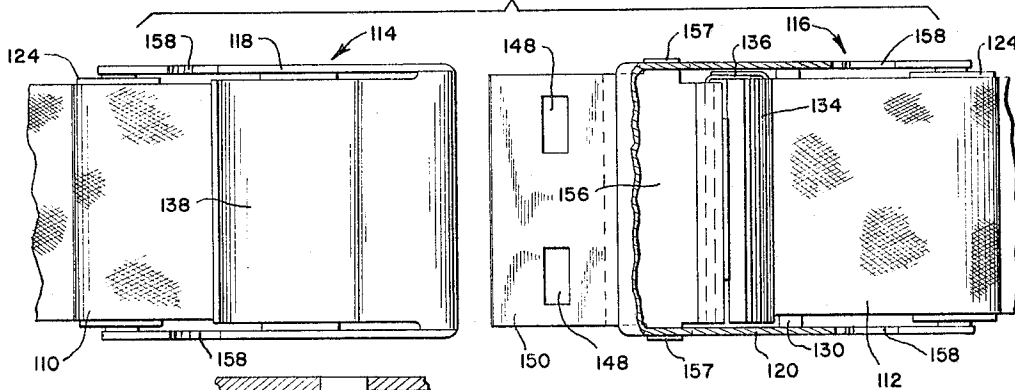
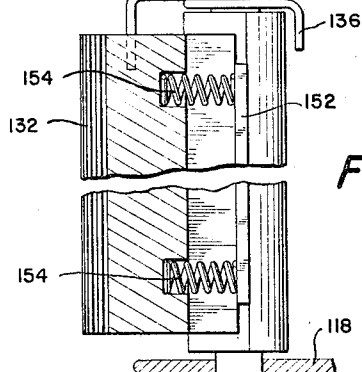


FIG. 14

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RETRACTABLE SAFETY BELTS

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2 Claims. (Cl. 297—388)

This invention relates to retractable safety belts, and more particularly to so-called "seat belts" for use in automotive vehicles.

This application discloses and claims modifications of the inventions disclosed and claimed in the applicants' copending applications, Serial No. 273,696, filed April 17, 1963, Serial No. 298,914, filed July 31, 1963, Serial No. 313,948, filed October 4, 1963, and Serial No. 319,847, filed October 29, 1963.

Broadly speaking, the copending applications are concerned with apparatus which permits the extension of a seat belt by the user, automatic retraction when the belt is released, and automatic setting of the effective belt length when the belt is placed in its operative position. The present invention is concerned with improvements in such apparatus, specifically with respect to the adjustment of belt tension, the simplification and esthetic enhancement of the belt fastening mechanism (particularly for a custom or built-in installation such as the single loop installations disclosed in certain of the copending applications), and in the provision of a double, push-actuated belt clamping arrangement (particularly for use in two-strap versions in which the buckle or fastener assemblies may carry retracting reels).

It is accordingly a principal object of the invention to provide improved apparatus of the foregoing type.

A further object of the invention is to provide improved retractable seat belt apparatus in which extensible movement of the belt is prevented upon engagement of a fastener couple and in which belt tension may be adjusted by adjusting the position of one of the elements of the fastener couple.

More specifically, it is an object of the present invention to provide an increase in belt tension in a single-strap continuous loop seat belt installation by permitting additional insertion of a fastener member into a cooperating receptacle after initial insertion has served to prevent extensible movement of the belt.

An additional object of the invention is to provide an improved fastener couple for a retractable seat belt or the like in which unfastening is accomplished by a simple manual movement in the direction of retraction.

Still another object of the invention is to provide improved apparatus for clamping a retractable seat belt or the like to prevent extension of the belt.

Yet another object of the invention is to provide an improved two-strap retractable seat belt in which extensible movement is prevented upon engagement of a fastener couple and in which belt tension may be increased by manipulation of a belt portion extending to a retraction reel mounted rearwardly of the fastener couple.

The foregoing and other objects, advantages, and features of the invention and the manner in which the same are accomplished will become more readily apparent upon consideration of the following detailed description of the invention in conjunction with the accompanying drawings, which illustrate preferred and exemplary embodiments, and wherein:

FIGURE 1 is a partly sectional elevation view illustrating one embodiment of the invention;

FIGURE 2 is a sectional view taken along line 2—2 of FIGURE 1;

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FIGURE 3 is a sectional view taken along line 3—3 of FIGURE 1;

FIGURE 4 is a view similar to FIGURE 3, but illustrating a different condition of a fastener couple;

FIGURE 5 is a fragmentary view similar to FIGURE 1, but illustrating the fastener couple condition of FIGURE 4;

FIGURE 6 is a fragmentary view similar to FIGURE 5, but illustrating a modification of the invention;

FIGURE 7 is a similar fragmentary view illustrating still another modification;

FIGURE 8 is a similar view illustrating a different embodiment;

FIGURE 9 is a similar view illustrating still another embodiment;

FIGURE 10 is a sectional view taken along line 10—10 of FIGURE 8;

FIGURE 11 is an elevation view illustrating a different embodiment of the invention;

FIGURE 12 is a partly sectional elevation view illustrating a different condition of the embodiment of FIGURE 11;

FIGURE 13 is a plan view of the embodiment of FIGURE 11; and

FIGURE 14 is an enlarged sectional view taken along line 14—14 of FIGURE 12.

Referring to the drawings, and initially to FIGURE 1 thereof, reference numeral 20 designates generally a casing through which a belt 22 is trained for extensible and retractile movement. The term "casing" as employed herein is not intended to be restricted to an enclosure, but also describes a frame which may be at least partially open in its construction. In the form shown the casing has side walls 24 and an end wall 26, the side walls being joined near the bottom of the casing by cross members 28. Belt 22 may be conventional in construction and may be formed on the usual nylon webbing, for example. One end of the belt is attached to a retraction device 30, which may be a conventional spring-wound reel as disclosed in the aforementioned copending applications. The reel is rotatably supported upon the side walls 24 of the casing and serves to retract the belt automatically, yet to permit extensible movement of the belt against the spring bias of the reel.

The casing also contains a slider 32, which as shown in FIGURE 2, may comprise a U-shaped yoke, the right portion of which may have a serrated or roughened lower surface. The legs 36 of the slider have protuberances 38 which reciprocate in slots 40 in the side walls 24 of the casing. The legs of the slider also support a roller 42 about which the belt is trained. The belt extends from the reel 30 over the roller 42 and then downwardly as shown in FIGURE 1.

The free or exposed end of the belt is provided with a fastener 44, which in the retracted position of the belt may be located at one side of the seat S adjacent the user, while the casing 20 is located at the opposite side of the seat adjacent the user. Such a continuous loop retractable seat belt installation has been described in the copending applications Serial No. 298,914 and Serial No. 313,948. As indicated diagrammatically in FIGURE 1 the belt extends under the seat surface from one side to the other. In a custom or built-in installation the casing 20 will be built into the seat or at the side of the seat, and in the retracted condition of the belt the fastener 44 will be located above a belt outlet O, which may be a slot in the seat small enough to prevent entrance of the fastener. As disclosed in the said applications, suitable guide means, such as rollers or guide tubes, may be provided for training the belt under the surface of the seat. In this connection it should be noted that the orientation of the

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casing 20 as shown in FIGURE 1 is not intended to represent the necessary orientation after installation, wherein the orientation of the casing will be selected in accordance with the convenience of receiving the fastener 44 and esthetic considerations.

Fastener 44 is shown more clearly in FIGURES 3 and 4. It is essentially a tongue and may comprise outer plates 46 of generally rectangular configuration joined at the rear end to the belt 22, which may pass through a loop 48 and be stitched to itself. (The attachment of the so-called "end" of the belt to the fastener may be adjustable if desired.) Between the plates 46 are a pair of laterally movable arms 50, which turn about pivots 52 with respect to the plates 46. The forward end of each arm 50 is provided with a tooth or detent 54, which may have a tapered lateral surface followed by an abutment surface in the manner of a sawtooth. Additional such teeth may also be provided between the teeth 54 and the pivots 52 if desired, and the shape and size of the teeth may be varied in accordance with requirements of strength and ease of operation to be described. The rear portions of arms 50 have inwardly curved or tapered surfaces 56. A filler plate 58 fixed to plates 46 may be located between the arms 50 and provided with leaf springs 60 which urge arms 50 away from the filler plate.

Behind plate 58 is a slider 62 having convex or tapered lateral surfaces adapted to engage surfaces 56 and turn arms 50 when the slider is moved rearwardly. The slider may have a pair of upwardly extending pins 64 which pass through longitudinal slots 66 in the upper plate 46 to guide and accommodate the reciprocating motion of the slider. A concavely contoured finger grip 68 may be fixed to the pins above the upper plate 46 to produce rearward movement of the slider 62, forward movement of the slider being produced by the action of springs 60 and by an additional return spring if desired.

Casing 20 is arranged to form a receptacle for the fastener 44. In the form shown in FIGURE 1 the entire front of the casing is open to receive the fastener, but in actual practice it is preferred that the casing be positioned and constructed so that only a suitably dimensioned slot is visible for reception of the fastener. The length of the slot is defined by the distance between a pair of guide members 70, which are fixed to the sides 24 of the casing preferably perpendicular to the direction of movement of the slider 32. As shown in FIGURE 2, the inner surfaces of the guide members 70 may be channel-shaped so as to receive and guide the side portions of the fastener 44. The entrance to the guide members may be tapered somewhat to facilitate initial insertion of the fastener. Each guide member is formed with a row of teeth 72 which are shaped to complement the shape of the teeth 54 of the fastener. The distance between teeth 54 is normally sufficient so that the arms 50 of the fastener must be moved inwardly at their forward end to permit insertion of the fastener. This is facilitated by the complementary sloping surfaces of the teeth 54 and the teeth 72. Teeth 54 snap into the recesses between teeth 72 under the action of springs 60. Thus, when the fastener is inserted into the casing, the teeth of the fastener are locked behind teeth of the casing to prevent withdrawal of the fastener unless the finger grip 68 is pulled so as to disengage the teeth. The direction in which the finger grip is pulled is the same direction as the movement of the fastener 44 in retraction of the belt, so that a simple unidirectional finger movement is sufficient to disengage the teeth, to withdraw the fastener from the casing, and to start the fastener on its way toward its retracted position. Only one hand is required for this action.

When the fastener is first inserted into the casing, it immediately engages the flight of the belt between the reel 30 and the roller 42. Further insertion causes the flight of belt to be deflected under the bight 34 of the slider as shown in FIGURE 5, the slider being normally positioned so that insertion of the fastener imparts an up-

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ward movement to the slider. Once the fastener has been inserted under the slider, further extensile movement of the belt is prevented, because any extensile force applied to the belt jams the belt between the slider 32 and the fastener, assuming of course that the belt is trained over the roller 42 at such an angle that there is a substantial component of force in the direction of the slider movement.

In accordance with the present invention the tension in the belt may be increased by continued insertion of the fastener after extensile belt movement has been prevented. Thus, as shown in FIGURE 5, the fastener may be moved past the position required for clamping the belt, and because extensile movement of the belt is prevented, the further insertion of the fastener can only increase the tension in the belt. Because the reel 30 is free to turn, the additional deflection of the belt caused by further insertion of the fastener is accommodated by some withdrawal of belt from the reel, although initially, before tension has built up in the belt, some of the belt is pulled back around the roller 42.

If the insertion of fastener 44 is permitted to proceed until the fastener starts to deflect the flight of the belt extending from the roller 42 toward the bottom of the casing, the belt tension will increase even more. However, such deflection cannot be permitted substantially to change the angle of this flight of belt with respect to the direction of the slider movement, because this would decrease the slider pressure.

FIGURE 6 illustrates a modification which provides greater insertion of the fastener without engaging the flight of belt which extends downwardly from the slider. In this instance the casing 20A is provided with longer rows of teeth 72A, and the slider 32A is wider and is provided with a pair of rollers 42A and a pair of sliding protuberances 38A at each side plate of the casing. The operation will be apparent from the description of the foregoing embodiment.

FIGURE 7 illustrates a slightly different embodiment in which the casing 20B again has long rows of teeth 72A, but instead of a reciprocating slider, a pivoting clamp 74 is utilized. This clamp may comprise a roughened or serrated cam surface 76 at one side of a pivot 78 supported on the side plates of the casing and a guide roller 80 at the other side of the pivot, a torsion spring 82 being utilized to bias the clamp toward the stop pin 84, so that the clamp is open in its normal position. The belt extends from the retraction reel, which may be located as in FIGURE 1, then over roller 80 and another roller 86 rotatably supported on the side plates of the casing, and then downwardly and under the surface of the seat as before. The portion of the belt between rollers 80 and 86 is substantially orthogonal to the lever arm between the pivot 78 and the axis of roller 80, which facilitates turning of the cam 76.

When the fastener 44 is inserted into the casing 20B, the belt is deflected under the cam as shown in FIGURE 7. Further insertion tends to increase the tension of the belt, and the initial friction between the belt and the cam is sufficient to impede the extensile movement of the belt and to cause the cam to turn under the extensile force which is applied to roller 80. The cam 76 may be involutely or otherwise shaped as to increase the clamping pressure applied to the belt between the cam and the fastener 44 as the cam is turned counterclockwise in FIGURE 7.

FIGURE 8 illustrates another embodiment, in which slack may be taken up by means of a resiliently biased lost-motion coupling. In this instance the casing 20C has a slider 32 as in FIGURE 1, but a collapsible member 88 is interposed between the slider and the fastener 44. As shown in FIGURE 10, the side walls 24C of the casing may support guides 70C with teeth 72C as previously described. The collapsible member 88 has

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a bar 90 guided for reciprocating movement in slots 92 on the casing side walls. Bar 90 is adapted to enter beneath the slider 32 as shown in FIGURE 8 and to serve the function of the fastener 44 in the previously described embodiments as to the clamping of the strap. Another bar 94 of the collapsible member is spaced from bar 90 and is adapted to be moved upon insertion of the fastener 44. Bar 94 may be guided by the same guide members 70C which guide the fastener. Bars 90 and 94 are resiliently biased apart by a pair of springs 96 which may be housed within telescoping tubes 98, the end portions of which are fixed to bars 90 and 94, respectively. Springs 96 are rather stiff, so that upon initial insertion of the fastener 44 the springs act as solid members and transmit the inserting force to bar 90 of the lost-motion coupling, ensuring that bar 90 is inserted under the slider 32 and that the belt is clamped. Continued insertion of the fastener causes coupling 88 to collapse against the force of springs 96. The continued insertion movement of the fastener is effective to increase the tension in the belt as previously described. When the fastener is withdrawn from the casing 20C, coupling 88 extends itself, bar 90 being ultimately moved from under the slider 32, as by a return spring 100, the spring force of which is relatively small compared to the force of springs 96. Spring 100 could of course be attached to bar 94 of the collapsible coupling.

FIGURE 9 illustrates an embodiment in which the lost-motion coupling 88 is employed in conjunction with a push-actuated clamp member 102, the belt passing from the reel 30 and then between a fixed abutment 104 and a cam surface 106 of the clamp, which may be similar to the cam surface 76 previously described. When clamp member 102 is turned about its pivot 108 so as to clamp the belt, further extensile movement is prevented. The clamp member 102 is pushed by lost-motion coupling 88 upon initial insertion of the fastener 44 in the casing (not shown), and after the belt is clamped, further insertion of the fastener is accommodated by collapse of coupling 88, so that the fastener 44 may be adjustably inserted and retained, as previously described, to increase the tension in the belt. Upon withdrawal of the fastener, clamp member 102 may turn to release the belt under the bias of a return spring (not shown).

FIGURES 11 through 14 illustrate another embodiment of the invention. In the form shown this embodiment utilizes a pair of straps 110 and 112, which may be fixed at their distal end (not shown) to the floor of a vehicle in the manner of two-strap seat belts now in vogue. The straps pass from the floor around the seat, or through an opening at the crotch of the seat, to a pair of fastener members 114 and 116. Each fastener member may comprise a housing 118 or 120, and each housing may have a pair of rearwardly extending outrigger side arms 122 between which a self-winding retraction reel 124 is mounted. One end of each belt 110 or 112 is fixed to the associated retraction reel.

The rear portion of each casing 118 or 120 is preferably open so as to expose the reels and the adjacent portions of the straps. Each strap passes through the bottom of the casing and then upwardly by and around a pair of rollers 126 and 128 and onto the reel 124. Between the rollers, which may be rotatably supported upon the side walls of the casing, is a fixed abutment 130, which also may be supported upon the side walls of the casing. Normally the strap passes by this abutment without quite touching the abutment.

Each casing also encloses a clamp cam 132 or 134, which may be pivotally supported on the side walls of the casing and normally biased away from the abutment 130 by means of a spring 136. The cam is preferably roughened and shaped, as previously described, so that once the cam is engaged with the strap it draws itself in,

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and the more the cam is turned toward the abutment 130 the greater is the clamping pressure.

Casing 118 may be provided with a conventional latch release lever 138 pivotally supported on the side walls of the casing and normally urged by a return spring 140 to the position in FIGURE 12. The lower end of lever 138 is turned inwardly at 142 and is spaced from a cross member 144 to provide an access opening at the front of the casing in a well known manner. Cross member 144 has a pair of upwardly extending abutments 146 for insertion in openings 148 of a tongue 150 associated with casing 120, as will be described hereinafter. As is well known in the art, the tongue 150 may be inserted within the casing 118 and held therein by the abutments 146 until the release lever 138 is turned to permit withdrawal of the tongue by increasing the size of the access opening to casing 118.

As shown in FIGURE 12, tongue 150 is utilized to push cam 132 into strap-clamping position. For a purpose to be described hereinafter, a resiliently biased push member 152 (FIGURE 14) may be interposed between the tongue and the cam, the member being supported upon cam 132 by relatively stiff compression springs 154.

Tongue 150 is fixed to the front of casing 120. A shorter tongue or slider 156 extends through a slot in the front wall of the casing 120 beneath tongue 150 and is arranged to reciprocate with respect to its casing. For this purpose a pair of lateral ears 157 may slide in slots in the side walls of the casing. The inner end of tongue 156 pushes upon cam 134 in the same manner that tongue 150 pushes upon cam 132. Here again a resiliently supported pusher member may be utilized.

When the fastener members 114 and 116 are brought together and latched, cams 132 and 134 are turned sufficiently to engage the straps 110 and 112, so that any further tendency toward extensile movement of the straps will only increase the pressure of the now self-energizing cams and will prevent such movement. Each strap may thus be pulled out to the desired length and then effectively fixed in length when the fastener members are engaged.

Occasionally after the fastener members are engaged it is desired to increase the tension in the belt, that is, to take up slack. For this purpose one or both of the fastener members is provided with the resiliently mounted pusher bar 152, so that the cams 132 and 134 may be turned away from the abutments 130 to permit retractile movement of the straps even after the fastener members are engaged. Such retractile movement may be accomplished by manually grasping the exposed portion of the straps which extends between rollers 128 and reels 124 and pulling the strap in the retracting direction. This will release the cams 132 and 134 sufficiently to permit the straps to slip by the cams and to permit the slack to be wound upon the reels 124. However, as soon as the straps are released, the friction between the straps and the cams will cause the cams to clamp the straps again. To facilitate pulling the straps, the side members 122 may be cut back or notched as indicated at 158. If the slack take-up feature is not desired, the spring-mounted pusher members 152 and the notches 158 may be omitted.

When the latch release lever 138 is moved so as to permit the tongue 150 to be withdrawn, the fasteners may be disengaged. The cams 132 and 134 will move away from the abutments 130 to permit the straps to be retracted upon the reels 124. In the retraction of the straps the fastener members 114 and 116 will be drawn to their retracted positions at the sides of or at the crotch of the seat. In the retracted condition of the straps the reels 124 will carry the most strap, while in the extended condition the reels will carry the minimum amount of strap. Hence, the effective size of the reels will be relatively small when the fastener members are engaged upon the body of the user.

While preferred embodiments of the invention have been shown and described, it will be apparent to those skilled in the art that changes can be made without departing from the principles and spirit of the invention, the scope of which is defined in the appended claims. For example, adjustable insertion of a fastener tongue or the like can be provided by other means, such as by the provision of multiple holes in the tongue 150 of FIGURE 13, or by the provision of multiple abutments such as the abutments 146 of FIGURE 12. The feature of adjustable insertion of the fastener may be utilized with other belt-clamping or extension-preventing apparatus, such as the pivoting lever type shown in FIGURES 15 and 16 of the copending Serial No. 313,948. Such a lever could be used in conjunction with the sliders of FIGURES 1 and 6 of the present application, for example, or with the pivoting cam of FIGURE 7. The slack take-up feature and exposed reel feature of FIGURE 11 of the present application may also be used in a pull-actuated belt clamp unit, as shown in FIGURE 7 of Serial No. 313,948 for example, there being no need for the lost-motion coupling in such a unit. In a continuous loop embodiment the flight of strap extending beneath the seat may be lifted off the floor, while maintaining floor-mounted guides, by passing the strap over additional guides suspended beneath the seat. Moreover, the strap may pass from the casing at one side of the seat, over the seat, and reversely about a guide, and then back across the seat to the casing. While this would provide a double flight above the seat, the user would have to thread the strap through the guide to use the belt. Accordingly, the foregoing embodiments are to be considered illustrative, rather than restrictive of the invention, and those modifications which come within the meaning and range of equivalency of the claims are to be included therein.

The invention claimed is:

1. In a retractable seat belt or the like, a casing, a strap arranged for extensile and retractile movement with respect to said casing, a strap fastener, said casing having means for receiving and releasably retaining said fastener, and means responsive to initial insertion of said fastener in said casing for preventing extensile movement of said

strap, said receiving and retaining means comprising means permitting further insertion of said fastener to increase strap tension and for retaining said fastener after said further insertion, said extensile movement preventing means comprising a lost-motion coupling engaged by said fastener.

2. In a retractable seat belt or the like, a casing, a slider supported for movement in said casing and having a strap guide at one end and an abutment at the other end, a strap trained about said guide and oriented to urge said slider in a first direction, a latch member supported upon said casing adjacent a flight of said strap, a fastener tongue, and means for guiding said tongue into said casing for retention by said latch member and for deflecting said flight beneath said abutment in response to insertion of said tongue in said casing, said guide means being positioned to permit said slider to move in a direction opposite to said first direction upon insertion of said tongue, said latch member comprising means for retaining said tongue with different amounts of insertion of said tongue in said casing, whereby the tension in said strap may be adjusted, said casing having a collapsible member for deflecting said flight upon initial insertion of said fastener tongue in said casing, and for collapsing upon further insertion of said tongue.

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