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3,523,340

PUSHBUTTON BUCKLE WITH SLIDE ACTION

Filed April 15, 1968

3 Sheets-Sheet 1

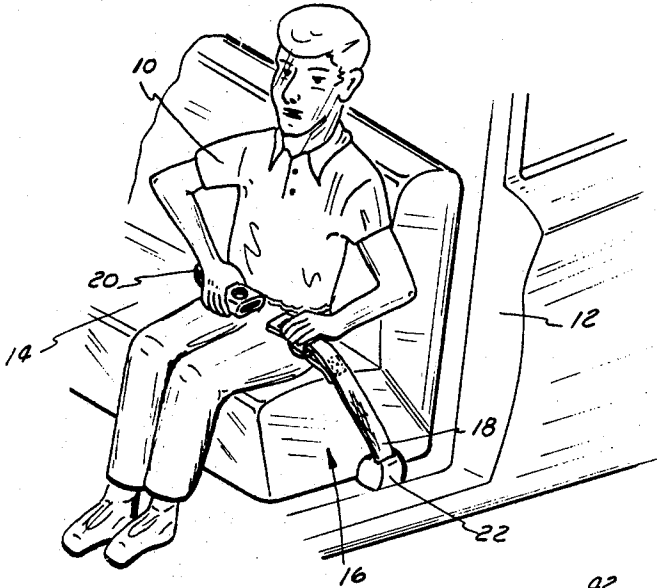


FIG. 1

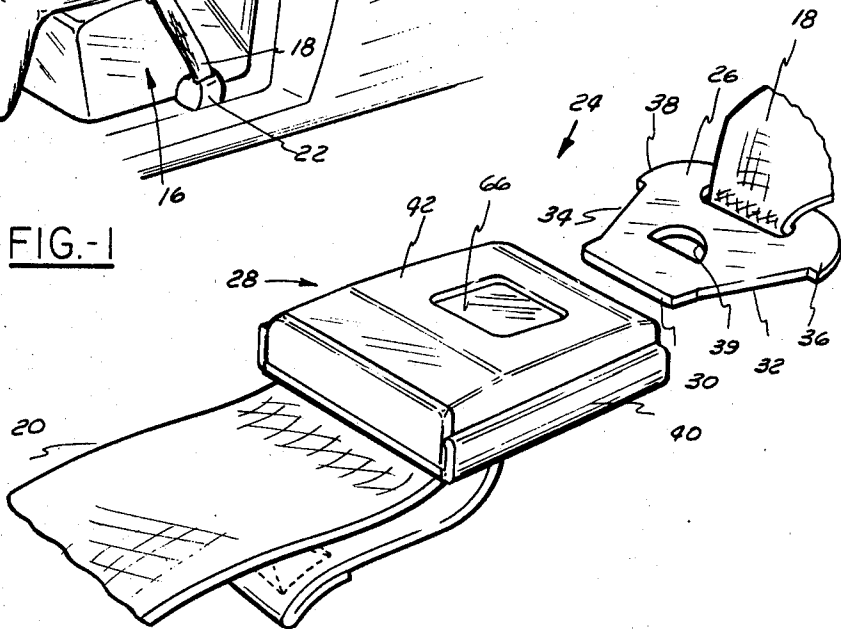


FIG. 2

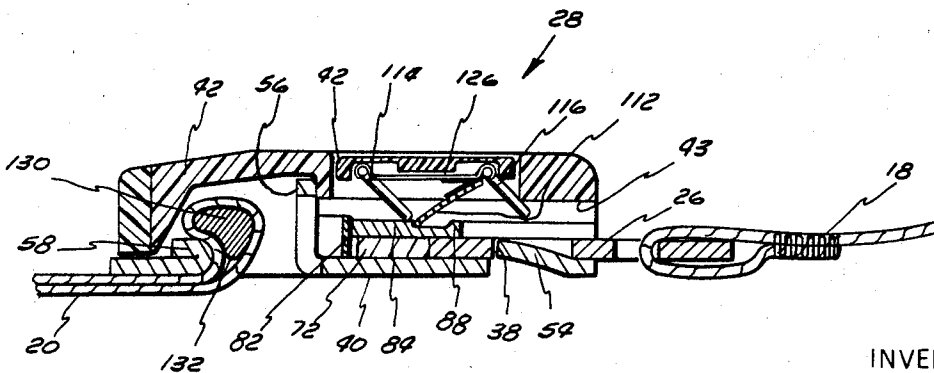


FIG. 3

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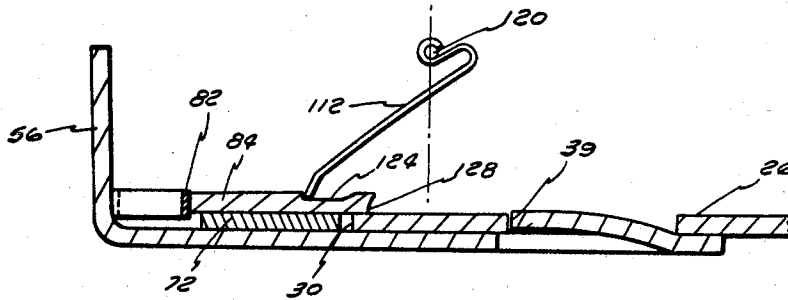


FIG. 6

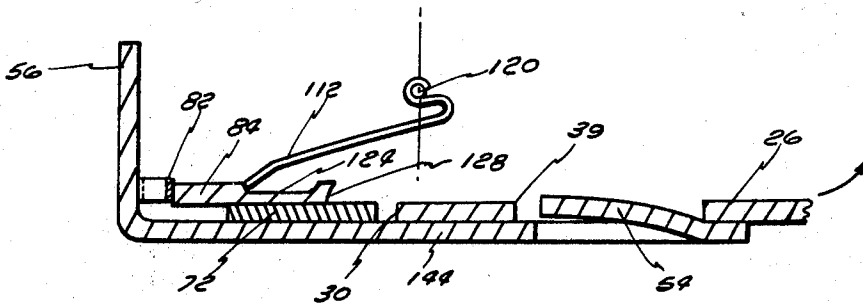


FIG. 7

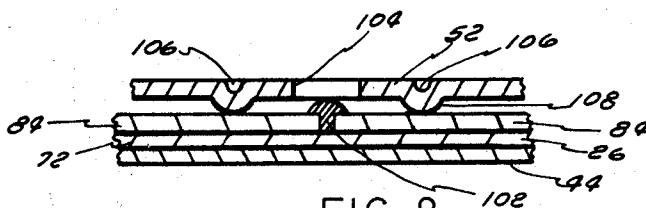


FIG. 8

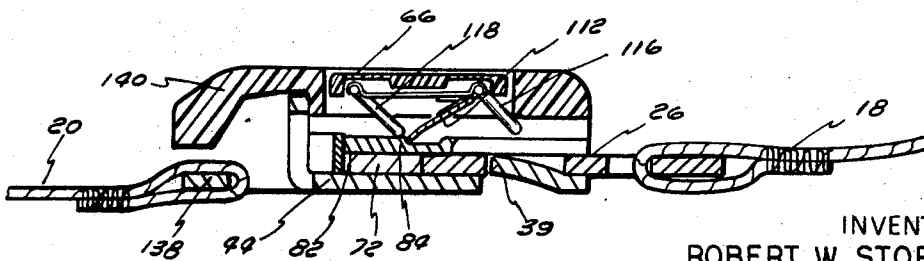


FIG. 9

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U.S. Cl. 24—230

12 Claims

ABSTRACT OF THE DISCLOSURE

A seat belt buckle in which the tongue overlaps the base of the buckle housing in its locking position with locking means on the tongue being engageable with locking means in the base to prevent motion of the tongue parallel to the base. The locking means on the tongue and the base are separable by motion of the tongue perpendicular to the base. A spring-biased hold-down plate in the housing is slidably mounted between a hold-down position where it prevents motion of the tongue perpendicular to the base and a release position where it allows such motion. A pushbutton, supported for motion toward and away from the base is connected by linkage means to the hold-down plate and adapted so that depression of the pushbutton moves the hold-down plate parallel to the base to its release position from its hold-down position.

BACKGROUND OF THE INVENTION

This invention relates to seat belt buckles, and more particularly to a pushbutton buckle and tongue assembly in which the pushbutton is supported for motion perpendicular to the base of the buckle and connected by linkage means to a hold-down plate supported for motion parallel to the base between a first position wherein it prevents separation of the tongue from its locking position adjacent the base of the buckle, and a second position wherein it permits the tongue to be separated from the base by a motion perpendicular to the base.

Pushbutton seat belt buckles have become increasingly popular because the pushbutton is not exposed to accidental forces which might tend to release the buckle locking mechanism. Heretofore pushbutton buckles have generally been employed with a buckle locking mechanism in which a pivotally mounted latch in the buckle housing engages an aperture in the tongue as the tongue is inserted through a suitable opening in the housing. A spring biased lever disposed in the housing provides a motion-transmitting connection between the pushbutton and the latch to enable the user to pivot the latch to a tongue-release position by depressing the pushbutton.

Another type of buckle locking mechanism is shown in the Pat. 3,127,655 issued to A. G. Carter and may be characterized as a slide-action locking mechanism. In this form of mechanism, the tongue upon insertion into the buckle housing engages a fixed abutment in the base which prevents motion of the tongue parallel to the base as opposed to a movable latch member which engages the tongue in conventional buckles. In order to maintain engagement of the tongue with the base of the buckle, a slidably mounted latch or hold-down plate is supported in the buckle for motion parallel to the base between a first position in which it overlaps the locking position of the tongue to prevent separation of the tongue from the base, and a second position in which it allows separation of the tongue from the base. This type of locking mechanism has several advantages in that it provides for a very compact buckle and is very reliable in operation. The prior art, to my knowledge, does not disclose a

seat belt buckle in which a pushbutton release member is incorporated with a slide-action locking mechanism.

SUMMARY

The broad purpose of the present invention is to provide a seat belt buckle assembly having a pushbutton release member coupled with a slide-action locking mechanism to provide a buckle assembly which is more compact than conventional pushbutton buckles and has the reliability and simplicity of a slide-action locking mechanism.

The preferred embodiment of the present invention employs a buckle assembly housing a slide-action locking mechanism in which the hold-down plate is supported for motion in the buckle between its hold-down and its release position in directions parallel to the base. The pushbutton is supported above the hold-down plate for a motion perpendicular to the base and connected to the hold-down plate by the combination of a parallelogram linkage and a pivotally mounted crank member. The parallelogram linkage is mounted on the underside of the pushbutton such that depression of the pushbutton pivots the linkage so that it has components of motion both parallel and perpendicular to the base. The crank member connects the parallelogram linkage to the hold-down plate and is supported so that motion of the linkage toward the base pivots the crank member with respect to the linkage so that it also has a component of motion parallel to the base. Thus the total distance traveled by the hold-down plate in response to depression of the pushbutton is the sum of the components of motion parallel to the base of the parallelogram linkage and the crank member. The combination of the linkage and the crank provides several advantages. The total depression required of the pushbutton in order to release the tongue is reduced so that the overall height of the buckle assembly is extremely thin as compared to conventional pushbutton buckles. Secondly, only a very low release effort need be applied to the pushbutton to permit uncoupling of the tongue from the buckle.

Another feature of the preferred buckle assembly is a novel adjusting pin for connecting the seat belt to the buckle housing. The adjusting pin has a novel shape that allows the user to easily adjust the length of the belt and then provides a non-yielding connection between the buckle housing and the belt. The pin has a longitudinal groove with a concave belt-clamping surface that cooperates with a convex belt-clamping surface on the buckle to firmly connect the belt to the buckle, but which easily separates from the belt to permit adjustment.

Another feature of the present invention lies in the construction of the hold-down plate and the buckle housing. The housing is preferably formed of a steel plate having a flat base and a pair of up-turned sides which terminate in a pair of inwardly bent flanges to form a channel-like section for receiving the tongue as well as for mounting the hold-down plate. The hold-down plate is mounted adjacent and below the flanges and has a pair of round-headed rivets facing the lower surface of the flanges. The flanges are dimpled in such a manner that they form a pair of bulges facing the hold-down plate. As the hold-down plate moves toward its hold-down position the rivets on the hold-down plate engage the bulges on the flanges so that the hold-down plate is cammed toward the base of the buckle in such a manner that the hold-down plate and the locking tongue are wedged between the base and the flanges. In addition to providing a better connection between the tongue and the buckle, the bulges on the flanges accommodate greater manufacturing tolerances and reduce the sliding friction of the hold-down plate.

Still other advantages of the present invention will readily occur to those skilled in the art to which the invention pertains upon reference to the following detailed description.

DESCRIPTION OF THE DRAWINGS

The description refers to the accompanying drawings in which like reference characters refer to like parts throughout the several views in which:

FIG. 1 is a perspective view of the interior of a passenger compartment of a motor vehicle showing an occupant of the vehicle coupling himself to a seat belt restraining system by a buckle assembly illustrating the preferred embodiment of the invention;

FIG. 2 is an enlarged perspective view of the buckle assembly of FIG. 1;

FIG. 3 is a sectional view of the preferred buckle assembly showing the tongue disposed in its locking position in the buckle housing;

FIG. 4 is an exploded view of the preferred buckle assembly;

FIG. 5 is an enlarged view showing the motion of parallelogram linkage on the underside of the pushbutton;

FIG. 6 is an enlarged schematic view showing the crank member engaged with the hold-down member with the pushbutton in its raised position;

FIG. 7 is a view similar to FIG. 6, but showing the pushbutton depressed and the hold member in its release position;

FIG. 8 is an enlarged view showing the bulge on the underside of the flange of the buckle base and its relationship to the rivet head on the hold-down plate; and

FIG. 9 is a sectional view through a modified form of the buckle assembly without the retaining pin arrangement.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Now referring to the drawings, FIG. 1 shows an occupant 10 of a vehicle 12 on a seat assembly 14 in the passenger compartment of the vehicle with a seat belt restraining system 16. The restraining system 16 comprises a pair of belt sections 18 and 20. The lower end of the belt section 18 is connected to the floor of the vehicle 12 by suitable means such as retractor 22, and the lower end of the belt section 20 is anchored to the floor by means (not shown).

The preferred buckle assembly 24 comprises a tongue member 26 carried on the free end of the belt section 18 and a buckle means, generally indicated at 28, carried on the free end of the belt section 20. The occupant 10 encloses himself in the restraining system 16 by joining the tongue 26 with the buckle means 28 which has an internally mounted locking mechanism.

The tongue 26 is preferably formed of a plate-like section of metal with a leading edge 30 and a pair of tapered side edges 32 and 34 terminating rearwardly in a pair of lateral shoulders 36 and 38. The tongue 26 has a semi-circular locking aperture 39 which is centrally located rearwardly of the leading edge 30.

The buckle means 28 comprises a metal base member 40 and a plastic cover member 42 mounted on the base member 40 to form a buckle-receiving opening 43. The base member 40 is formed of a plate-like section of steel into a flat base section 44 and a pair of upturned sides 46 and 48 terminating at their upper edges in a pair of inwardly bent flanges 50 and 52. Flanges 50 and 52 are spaced above and parallel to the base section 44. The base section 44 has a pushed up abutment 54 which is engageable with the aperture 39 when the tongue 26 is disposed in its locking position in face-to-face relationship with the base section 44. Thus it can be seen that the aperture 39 in the tongue and the abutment 54 of the base member form cooperating locking means which, when engaged, prevent the tongue 26 from being removed from the base member 40 in a direction parallel

to the base section 44. The aperture 39 and the abutment 54 are engageable and separable by motion of the tongue 26 in directions perpendicular to the base.

The base member 40 also has an upturned section 56 which forms a crush bar and extends above the flanges 50 and 52. The base member 40 also has a reverse bent stiffener portion 58 which with the turned-up portion 56 defines a transverse edge of an opening in the base 44 for receiving the seat belt section 20.

The cover member 42 is mounted on the base member 40 by suitable means such as lugs 60 and 62 which snap under the flanges of the base member. The cover 42 also has an opening 64 in which is slidably disposed a pushbutton 66. The pushbutton has a pair of lugs 68 (only one of which is shown) which are disposed in a pair of sockets 70 in the cover member which guide the pushbutton for motion in directions perpendicular to the base section 44.

A guide plate 72 is mounted on the base section 44 of the base member and has a contour 74 complementary to the profile of the contour of the tongue 26 so that it positions the tongue 26 in its locking position. The guide plate has substantially the same thickness as the tongue 26 and is formed with a pair of downwardly depending lugs 76 which seat in suitable openings formed in the base 44 on opposite sides of the up-turned section 56 and a pair of shoulders 78 which are in abutment with the up-turned section 56. The mid-section 80 of the guide plate is spaced from the up-turned section 56 to provide a seat for a leaf spring 82 which has its ends in abutment with the turned-up section 56 and a bowed mid-section extending toward the mid-section 80 of the guide plate.

A hold-down plate 84 is slidably mounted on the guide plate 72 for motion parallel to the base 44 with its rear edge 86 in abutment with the spring 82. The spring 82 biases the hold-down plate 84 toward the opening 43 so that it is normally disposed in a hold-down position where-in the mid-section 88 of its forward edge overlaps the leading edge 30 of the tongue when the tongue is in its locking position. The forward edge of the hold-down plate also has a pair of tapered side edges 90 and 92 which do not overlap the tongue 26, and a pair of end edges 94 and 96 which extend beyond the forward edge of the guide plate 72 and overlap the shoulders 36 and 38 of the tongue.

Thus when the hold-down plate is in its hold-down position, it overlaps the leading edge of the tongue and also a pair of points on the side edges of the tongue which are separated by non-overlapped portions of the tongue. The tongue is engaged by the hold-down plate, at positions both forwardly and rearwardly of the engagement of the aperture 38 of the tongue with the abutment 54 of the base. This three point engagement is achieved by moving the hold-down plate in a very short stroke of about $\frac{1}{8}$ inch from its hold-down position to its release position.

The hold-down plate 84 also has a pair of apertures 98 adjacent its rear edge which receive downwardly depending legs of a staple 100 which engage the rear edge of the guide plate 72 to limit the travel of the hold-down plate toward the opening 43. A pair of rivets 102 are mounted adjacent the side edges of the hold-down plate 84 beneath the flanges 50 and 52 of the base member. When the buckle mechanism is being assembled, the hold-down plate is inserted within the base member and then the rivets are inserted through a pair of openings 104 in the flanges and threadably mounted in place between a pair of dimpled sections 106 in the flanges.

Referring to FIG. 8, the hold-down plate 84 is shown in its release position. As the hold-down plate moves toward its hold-down position it approaches a bulge 108 formed on the lower side of the flange 52 by the dimpled section 106. As the rivet 102 engages the bulge 108, the hold-down plate 84 is cammed toward the base section 44 so that it and the tongue 26 are firmly held in posi-

tion between the flange 52 and the base section 44. It is to be understood of course that a similar bulge 108 is formed below each of the dimpled sections 106. The curvilinear structure provided by the head of the rivet 102 could be formed by other methods. This structure allows greater manufacturing tolerances and easier assembly as well as eliminating the sliding friction that exists in conventional structure between the hold-down plate 84 and the flanges of the base member 40.

The downward motion of the pushbutton 42 is transmitted to the hold-down member 84 by a parallelogram linkage generally indicated at 110 and a crank member 112. The linkage 110 comprises a pair of similarly-shaped links 114 and 116 each having their ends pivotally mounted on the cover 42 for rotation about an axis parallel to the base 44. The two links 114 and 116 have eccentric portions 118 and 120 respectively connected by a plate-like connecting link 122 which is slidably engaged with the lower surface of the pushbutton as can best be seen in FIG. 3.

As best seen in FIG. 5, depression of the pushbutton 66 toward the base causes the eccentric portions 118 and 120 of the links to pivot about their ends so that they have a first component of motion perpendicular to the base and a second component of motion parallel to the base in a direction away from the opening 43. The crank member 122 has its upper end connected to the eccentric portion 120 of the link 116 and its lower end engaged in a recess 124 of the hold-down plate. Thus it can be seen that the upper end of the crank 112 moves with the eccentric portion 120 of the link.

As can best be seen in FIGS. 6 and 7, the downward motion of the eccentric portion 120 of the link 116 toward the base causes the crank 112 to pivot in such a manner that its lower end has a component of motion parallel to the base 44. Thus it can be seen that the displacement of the hold-down plate from its hold-down position, illustrated in FIG. 6 wherein it overlaps the tongue 26, to its release position is the sum of the component of motion of the eccentric 120 parallel to the base with respect to the pushbutton 66, and the component of motion of the lower end of the crank 112 parallel to the base with respect to the eccentric 120. When the depressive force on the pushbutton is released, the spring 82 biases the hold-down plate 84 forwardly toward its normal hold-down position illustrated in FIG. 6. As best seen in FIG. 3, a spring 126 mounted on eccentric 120 acts between the connecting link 122 to bias the crank 112 away from the connecting link to maintain its seated position in the recess 124 in the hold-down plate.

It is to be noted that the forward edge of the hold-down plate has a cammed portion 128 which engages the leading edge 30 of the tongue when the tongue is inserted in the buckle housing and cams the tongue downwardly until such time as the locking aperture 39 in the tongue engages the abutment 54 so that the tongue snaps into its locking position in face-to-face relationship with the base 44.

Now referring to FIG. 3, the belt 20 is preferably looped around a retaining pin 130 which is disposed behind the up-turned section 56 and has a generally tear drop cross-section with a concave belt-clamping groove 132. The concave groove 132 extends the full length of the mid-section of the pin 130 and faces the reversely bent transverse edge 58 which presents a convex belt-clamping surface to the pin. By applying a force on the belt 20 which moves the pin 130 toward the transverse edge 58, the belt becomes clamped between the convex portion formed by the reversely bent section 58 and the concave section 132. Changing the direction of the force on the belt to move the pin 130 away from the edge 58 releases the belt for adjustment. A pair of lateral ear portions 134 formed on the ends of the pin 130 are disposed between the flanges 50 and 52 and base

44 of the base member. A staple 136 which is inserted through the rear end of the base member has a pair of elongated legs 138 and 140 on which the ears 134 of the retaining pin ride. Thus the pin is movable toward and away from the reversely bent portion 58 parallel to the base and retained against rotation about its longitudinal axis. The tips of the legs 138 and 140 have cutout portions 142 which engage the rear edge of the guide plate adjacent the feet 76.

FIG. 9 shows a modified form of a buckle which has the same internal locking mechanism as the preferred embodiment but with a shortened base member 44 and an aperture 138 through which the belt 20 is looped without a retaining pin. This modified form of the invention shows how the buckle mechanism can be further reduced in size as compared to conventional buckle mechanisms with the seat belt adjustment being accomplished by means removed from the buckle mechanism. The embodiment of FIG. 9 also has a shortened cover member 140 to accommodate the modified base member.

Thus it is to be understood that I have described in detail an improved seat belt buckle assembly which incorporates the advantages of both the pushbutton release means as well as the slide action locking mechanism. This is possible by employing a novel form of linkage means which connect the pushbutton 66 with the hold-down plate 84 in such a manner that depression of the pushbutton toward the base moves the hold-down plate parallel to the base.

Although I have described but two embodiments of my invention, it is to be understood that various changes and revisions can be made therein without departing from the spirit of the invention.

What is claimed is:

1. A pushbutton seat belt buckle assembly, comprising:
 - (a) a tongue having a first locking section;
 - (b) buckle housing means having an opening for receiving said tongue in a locking position and a planar base with a second locking section, the locking section on the tongue being engageable with the locking section on the base to lock the tongue against motion in a direction parallel to the base, and being separable from the locking section on the base by motion in a directional normal to the base;
 - (c) a hold-down member disposed in the buckle housing means for motion in directions parallel to the base between a hold-down position and a release position, said hold-down member having a portion which is operative when the hold-down member is in its hold-down position to maintain engagement of said first and second locking sections, said portion being inoperative to prevent separation of said first and second locking sections when the hold-down member is in its release position;
 - (d) bias means urging the hold-down member toward its hold-down position;
 - (e) a pushbutton mounted on said buckle housing means for motion toward and away from the base; and
 - (f) means connecting said pushbutton with said hold-down member so that motion of the pushbutton toward the base moves the hold-down member parallel to the base from its hold-down position to its release position.
2. A seat belt buckle assembly as defined in claim 1, wherein said tongue is formed with a socket, and the base has an abutment engageable with the socket extending normal to the surface of the base.
3. A seat belt buckle assembly as defined in claim 1, wherein said means connecting said pushbutton with said hold-down member comprises a lever pivotally supported on said housing means for motion about an axis parallel to the base, said lever having an eccentric portion spaced from said axis and engageable with the pushbutton in such a manner that motion of the pushbutton toward the base

pivots the lever so that the eccentric portion has a component of motion parallel to the base, and means connecting the eccentric portion to the hold-down member to transmit the parallel component of motion to the hold-down member.

4. A seat belt buckle assembly as defined in claim 1, wherein said means connecting said pushbutton with said hold-down member comprises a crank member supported between the pushbutton and the hold-down member and having one end connected to the pushbutton and its other end connected with the hold-down member in such a manner as to move the hold-down member parallel to the base as the pushbutton is depressed toward the base.

5. A seat belt buckle assembly as defined in claim 1, wherein said means connecting said pushbutton with said hold-down member comprise a lever pivotally supported on said housing means for motion about an axis parallel to the base, said lever having an eccentric portion separated from said axis and connected with the pushbutton in such a manner that motion of the pushbutton toward the base pivots the lever so that the eccentric portion has components of motion parallel to and normal to the base, and a crank member having a first end connected to the eccentric portion of the lever and its second opposite end connected with the hold-down member so that motion of the eccentric portion toward the base moves the second end of the crank in a direction parallel to the base with respect to its first end whereby the distance the hold-down member moves parallel to the base as the pushbutton is depressed toward the base is the sum of the parallel components of movement of the eccentric portion with respect to the pushbutton, and the second end of the crank with respect to the eccentric portion.

6. A seat belt buckle assembly as defined in claim 1, wherein said means connecting said pushbutton with said hold-down member comprises a pair of similarly formed levers pivotally supported on said housing means for motion about a pair of individual spaced axes, each of said axes being disposed parallel to the base and to one another, each of said levers having an eccentric portion separated from its axis of motion; a connecting link connecting the eccentric portions of said levers to form a parallelogram linkage, said connecting link being engageable with said pushbutton as the pushbutton is depressed toward the base in such a manner as to have a component of motion parallel to the base; and a crank member having a first end movable with said connecting link and its second, opposite end in abutment with the hold-down member so that motion of the connecting link toward the base moves the second end of the crank member parallel to the base, with respect to its first end whereby the distance the hold-down member moves parallel to the base as the pushbutton is depressed toward the base is the sum of the components of movement parallel to the base of the connecting link with respect to the pushbutton, and the second end of the crank with respect to the connecting link.

7. A seat belt buckle assembly as defined in claim 1, wherein the tongue is formed of a plate-like section with a portion of its perimeter formed with a predetermined contour, and including a guide plate in said housing means having a contour complementary with respect to the perimeter of the tongue engageable with the tongue to position the tongue in its locking position.

8. A seat belt buckle assembly as defined in claim 1, wherein said base has a locking abutment; said tongue is formed of a plate-like section having a locking aperture engageable with the butment in the base, said hold-down member has first edge portions for overlapping the leading edge of the tongue in its locking position and other

edge portions for overlapping the side edges of the tongue at points between the engagement of said locking aperture with said abutment and the trailing edge of said tongue, said first edge portions and said other edge portions of the hold-down member being separated by edge portions that do not overlap said tongue.

9. A seat belt buckle assembly as defined in claim 1, wherein said housing means includes a housing having a flange fixed with respect to the base and spaced therefrom with a curvilinear structure facing said base, and said hold-down member and said tongue are formed of a pair of plate-like sections movable between said base and said flange, said hold-down member having a second curvilinear structure engageable with the curvilinear structure on the flange as the hold-down member approaches its hold-down position to wedge the hold-down member and the tongue between the flange and the base.

10. A seat buckle assembly as defined in claim 8, wherein at least one of said curvilinear structures is a bulge.

11. A seat belt buckle assembly as defined in claim 1, wherein said tongue engages the hold-down member as it is inserted into the housing to move the hold-down member toward its release position.

12. A pushbutton seat belt buckle assembly, comprising:

- (a) a plate-like tongue having first locking means;
- (b) a buckle housing having a planar base fixed structure overlapping the base, and an opening for receiving the tongue to a locking position in face-to-face relationship with the base, said base having second locking means engageable with the locking means in the tongue to prevent motion of the tongue parallel to the base from its locking position, the locking means on the tongue being separable from the locking means on the base by motion of the tongue perpendicular to the base;
- (c) a hold-down plate disposed in said housing between said fixed structure and the base, said hold-down plate being movable in directions parallel to the base toward and away from a hold-down position and having portions overlapping the locking position of said tongue in its hold-down position to maintain engagement of the locking means in the tongue and the base;
- (d) means biasing the hold-down plate toward its hold-down position;
- (e) first curvilinear structure on the fixed structure of said housing facing said base;
- (f) second curvilinear structure on the hold-down plate engageable with the first curvilinear as the hold-down plate approaches its hold-down position so as to wedge the hold-down plate and the tongue between the base and the fixed structure of the housing; and
- (g) release means for moving the hold-down plate away from its hold-down position to permit separation of the tongue from the base.

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