

United States Patent

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[54] **CANOPY BUCKLE**
18 Claims, 12 Drawing Figs.

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[51] Int. Cl. A44b 11/25

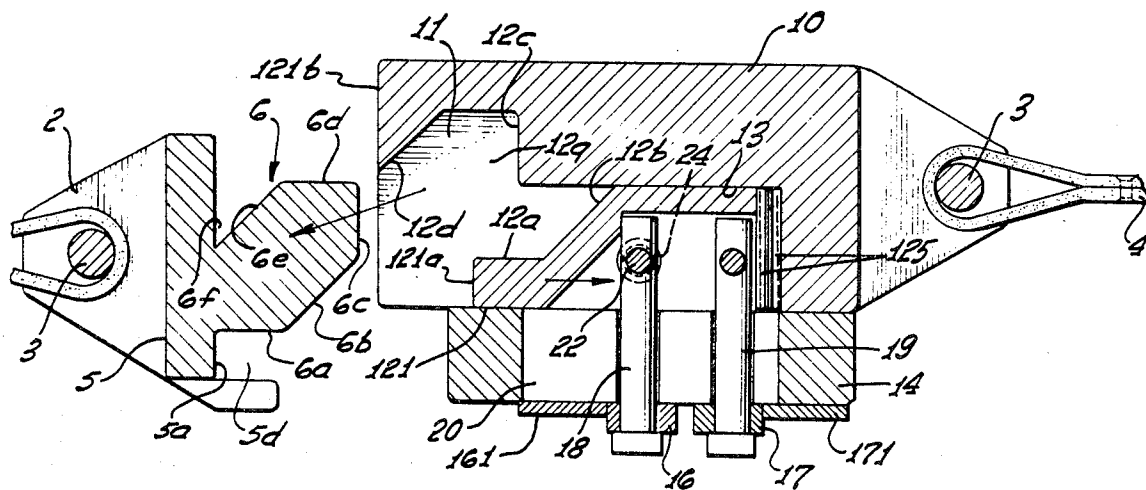
[50] Field of Search 24/230.1,
 230, 201.6, 201

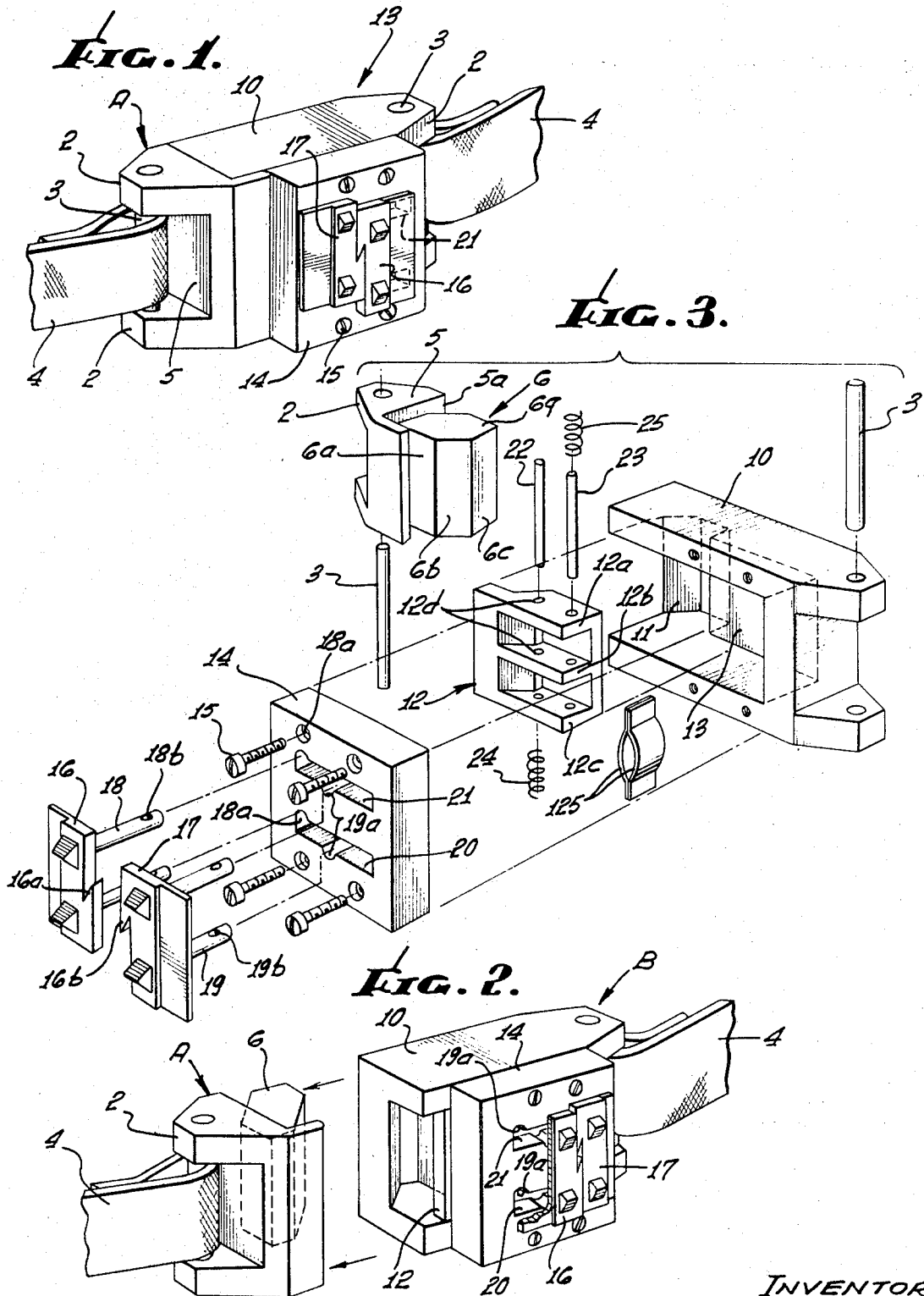
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ABSTRACT: A failure safe buckle in which a lug of a male buckle part is captured in a recess of a female buckle part by a latch slide, the latch slide being releasably locked in a position overlying the recess and engaged with the lug. Such a buckle in which the lock mechanism includes relatively movable parts biased to locking positions to lock the latch slide against movement, the relatively movable parts requiring simultaneous opposite movement to permit shifting of the latch slide to a position releasing the lug.





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FIG. 4.

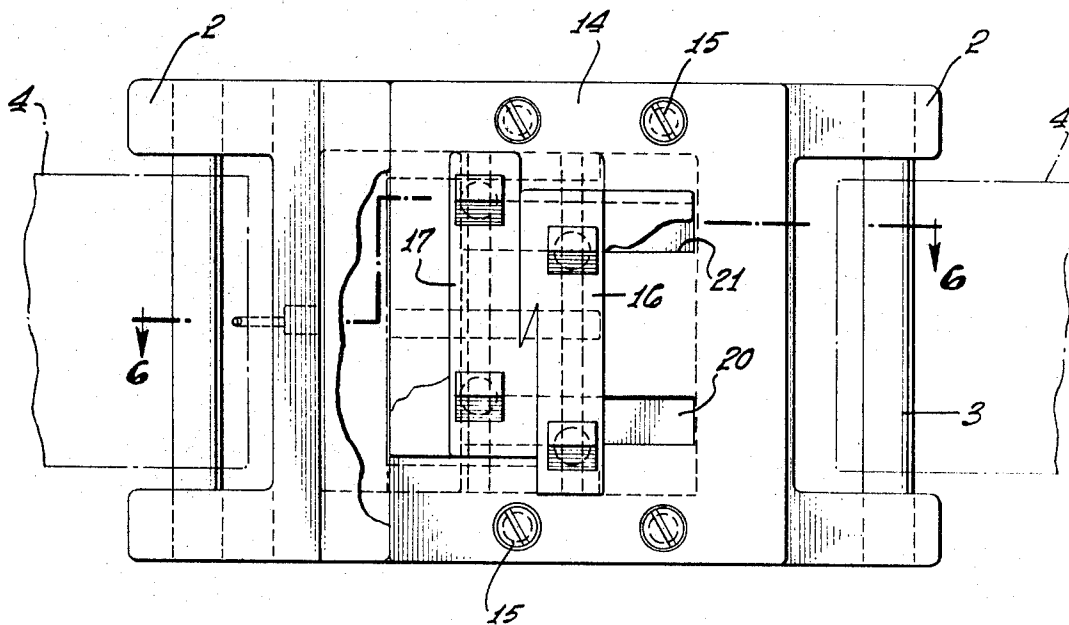
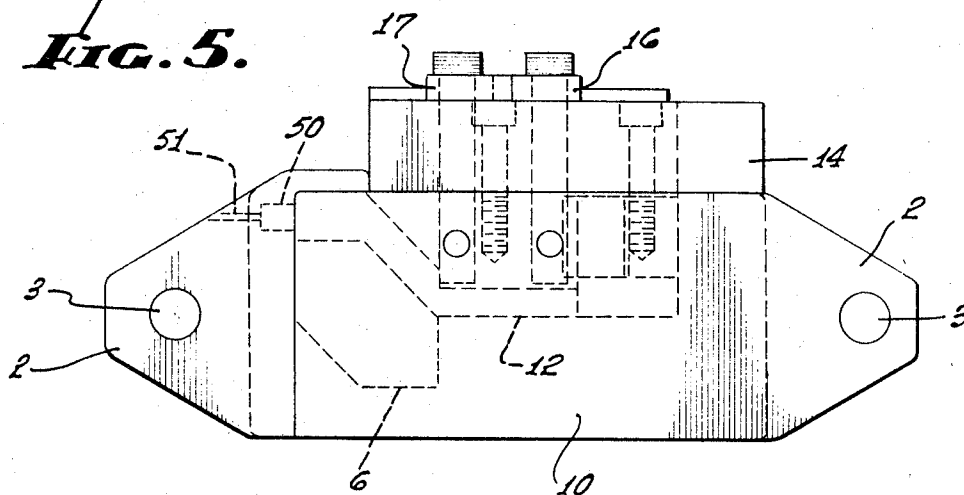
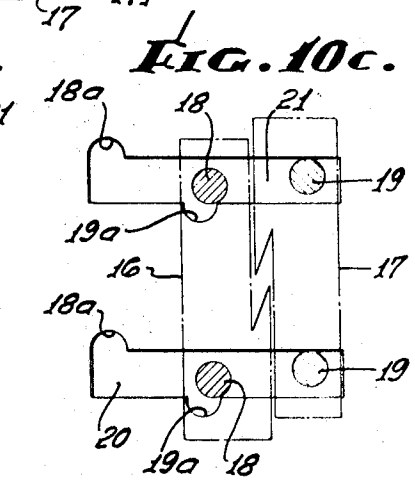
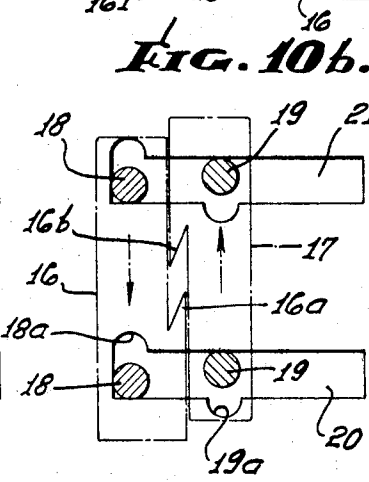
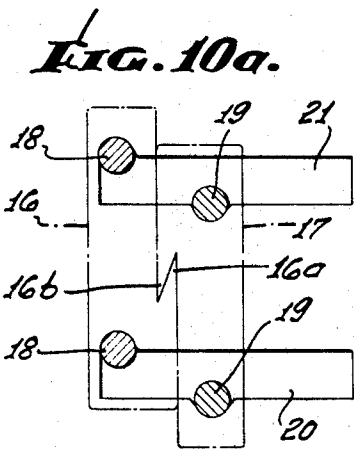
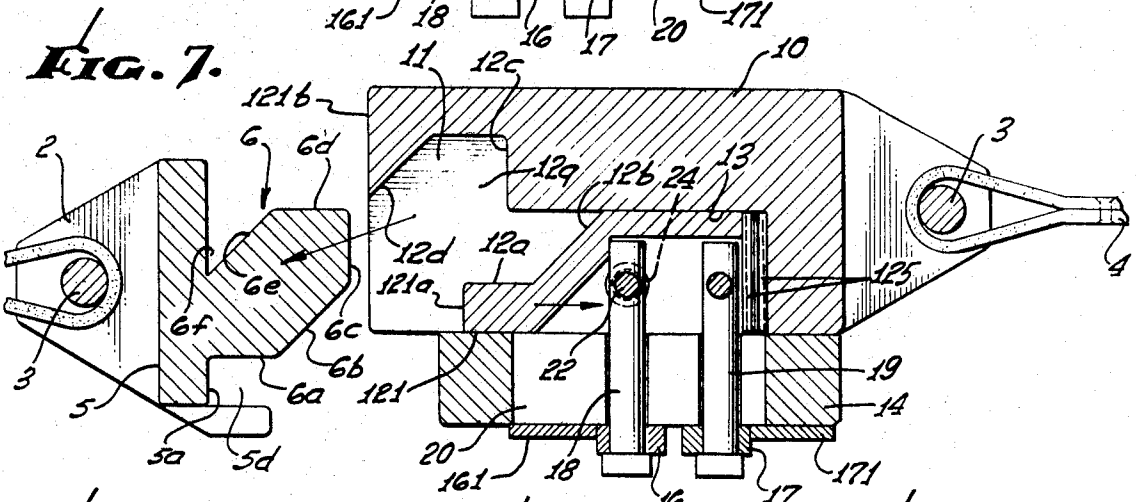
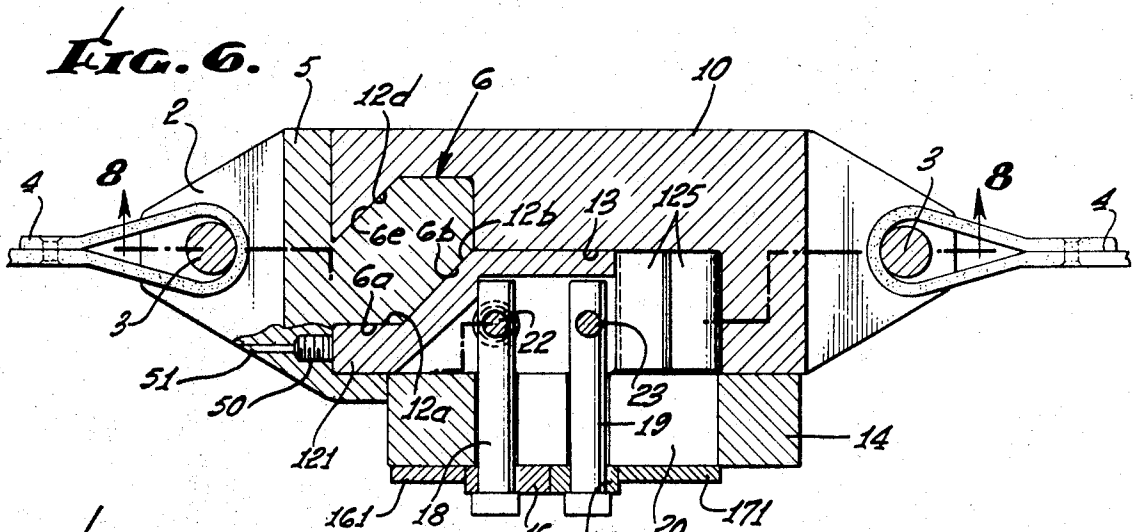


FIG. 5.



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FIG. 8.

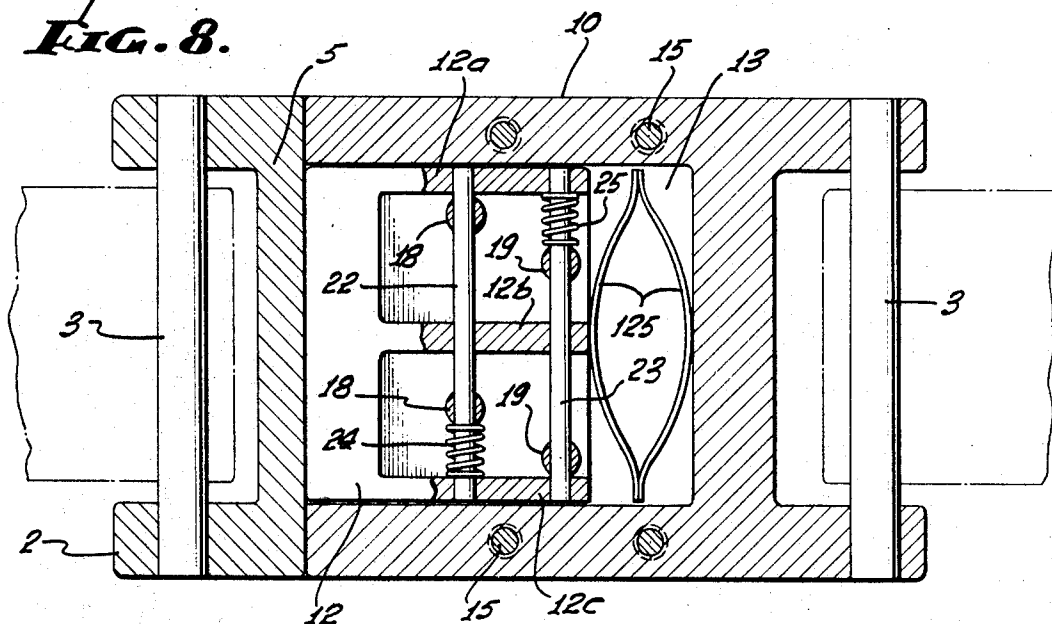
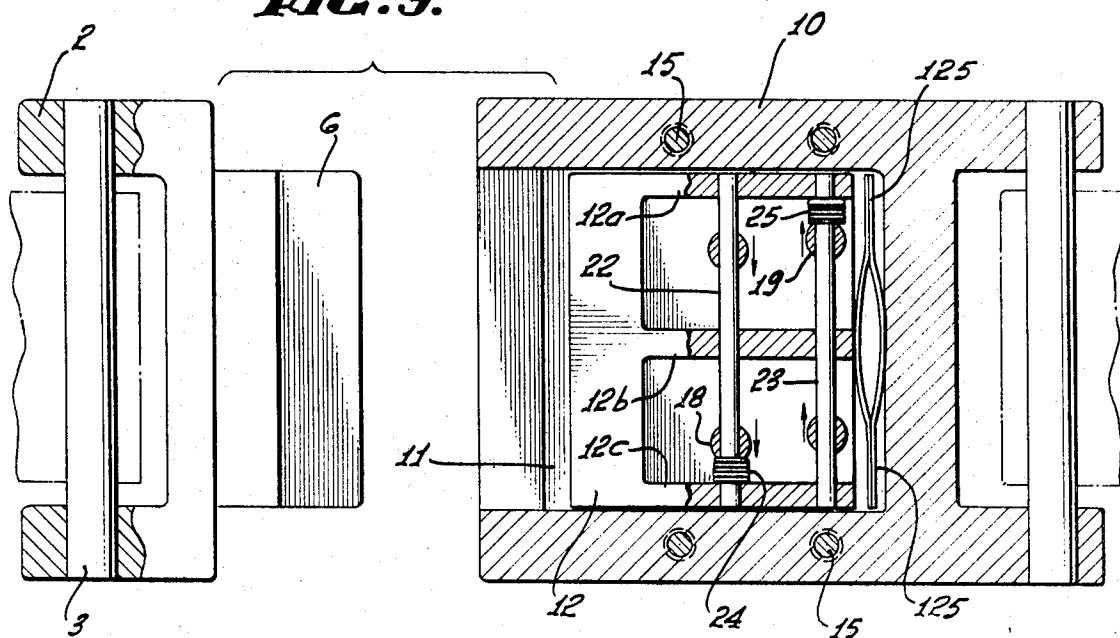


FIG. 9.



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CANOPY BUCKLE

BACKGROUND OF THE INVENTION

It is the practice to provide harness equipment for use in securing cargo in various airplanes, helicopters and other craft and to provide harness equipment for aircraft pilots and crew, the harness equipment including buckles which are subjected to severe forces during flight, as well as sonic vibrations, which forces and vibrations sometimes cause failure or inadvertent opening of a buckle. On the other hand, such buckles when included in the harness for the pilot or crew must be openable with ease and dispatch in emergency situations, but should not be subject to inadvertent opening in the event of accidental contact with the release mechanism.

In addition, a buckle for use in the above-mentioned environment should be capable of being opened by an explosive or pressure charge if the pilot or crewman is injured and incapable of manipulating the release mechanism. Another advantage of a buckle adapted for release by an explosive or gas charge would be the ability to release materials from a parachute at a given or selected elevation by triggering the separation of the buckle when the parachute reaches the selected elevation.

The above considerations are not satisfied by the buckles available prior to the present invention.

SUMMARY

The present invention, therefore, provides a canopy buckle which is of strong, rugged construction, and which is easily released in response to manipulation of a release mechanism in a manner which cannot be caused by forces or vibrations imposed on the buckle during use. In accomplishing this, the buckle is constructed so as to remain locked until releasable locking means are specifically manually operated in a sequence of steps which cannot be effected by forces applied to the locking means by accident or mistake, or as a result of such catastrophe as an aerial collision.

More specifically, the invention provides a buckle comprising complementary male and female buckle parts, the male part being receivable in a recess in the female part and being latched in place, the latch means being locked against displacement from a latching position, except following specific and intentional operation of the locking means, but upon release of the latch means, the male part being completely free of any restraint from separation from the female part. In this construction, the buckle latch means are independent of the locking means, and the arrangement of parts is such that destruction of the locking means or the male buckle component cannot result from loads on the buckle.

Moreover, the latch and locking means for the latch are so constructed that an explosive charge or gas charge may be employed, in extreme emergency or in the response to a condition such as altitude, to effect release of the locking means by the application of the explosive force or gas pressure to the latch.

In addition to the foregoing, the buckle is so constructed as to be tightly connected, thereby avoiding annoying rattle, without need for the use of cushioning members between relatively movable, loosely fitting parts.

Among the objects of the invention is the provision of a rugged and durable buckle construction which satisfies the above requirements but which has few parts, thereby reducing the possibility of mechanical difficulties in operation of the latch, as well as enabling comparatively less costly manufacture of the components and ease of assembly of the components.

Another object of the invention is to provide a buckle assembly having a male part having a lug adapted to be received in a complementary recess of a female buckle part, wherein a latch slide is adapted to engage the lug to hold the lug in the recess, and locking means being provided for holding the latch in a latching position, the locking means including first and

second members normally biased to a locking position and requiring opposite movement of both members to release the locking means, so that inadvertent movement of one of the locking members alone cannot suffice to release the latch for movement to a position at which the lug is free to move out of the recess, whereby neither accidental movement of one of the lock members, nor the application of inertia forces to the lock members in any direction can cause opening of the buckle.

Yet another object is to provide a buckle assembly that includes a lug on one buckle part adapted to be received in a complementary recess of the other buckle part and retained therein by a retractable slide which is locked in place, wherein the assembly can be explosively separated or separated by a gas charge in an emergency.

In order to prevent the entry of foreign matter into the buckle which might otherwise tend to interfere with operation of the buckle, a further object of the invention is to provide a sealed assembly, all of the moving parts of which are substantially encased.

Other objects and advantages of the invention will be hereinafter described or will become apparent to those skilled in the art, and the novel features of the invention will be defined in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in perspective illustrating a buckle assembly exemplifying the invention;

FIG. 2 is a view corresponding to FIG. 1, but showing the buckle parts disconnected;

FIG. 3 is an exploded detail view in perspective showing the components of the assembly;

FIG. 4 is a top plan view, showing the buckle assembly latched and locked;

FIG. 5 is a side elevation of the buckle assembly;

FIG. 6 is a longitudinal sectional view through the assembly, showing the buckle latched, as taken on the line 6-6 of FIG. 5;

FIG. 7 is a view corresponding to FIG. 6, but showing the buckle released;

FIG. 8 is a longitudinal sectional view, as taken on the line 8-8 of FIG. 6, showing the buckle latched;

FIG. 9 is a view corresponding to FIG. 8, but showing the buckle released;

FIG. 10a is a view diagrammatically showing the lock means locked;

FIG. 10b is a view diagrammatically showing the lock means released; and

FIG. 10c is a view diagrammatically showing the lock means shifted to the latch releasing position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, the buckle assembly of the invention will be seen to comprise a male buckle part A and a female buckle part B, each of which has ears 2 adapted to support a pin 3 for attachment of suitable webbing 4. In practice, for example, the male part A may be attached to webbing of a parachute for a pilot or crewman of an aircraft, and the female part B may be attached to webbing secured to the uniform of the pilot or crewman, so that upon entering the aircraft the pilot or crewman need only effect assembly of the buckle parts with one another, as will be hereinafter described. On the other hand, one of the buckle parts may be connected to anchor webbing for cargo, and the other buckle part secured to webbing to snub the cargo tightly in place.

Generally speaking, the male buckle part A includes a body 5 having the ears 2 integral therewith, and projecting from the body 5 is an elongated rib or lug 6 adapted to be engaged in the female buckle part B. The female buckle part B generally comprises a body 10 having the ears 2 integral therewith, the body having a recess 11 at the opposite end thereof from the ears 2 for reception of the lug 6. Slidably supported by the body 10 is a latch or slide 12 which is reciprocable in a chan-

nel 13 within the body 10 between lug-latching and lug-releasing positions relative to the lug 6 when the lug is in the recess 11. The latch or slide 12 is confined in the channel 13 by a top plate 14 secured to the body 10 by suitable fasteners 15.

Lock means are provided for holding the latch or slide 12 in the position for holding the lug 6 in the recess 11, such lock means including a pair of operating members 16 and 17 having lockpins 18 and 19 thereon, respectively, adapted for locking and unlocking engagement in slot means 20 and 21 in the plate 14. These lockpins 18 and 19 extend through the slots 20 and 21 and are shiftably connected to the latch or slide 12 by pins 22 and 23, a spring 24 serving to bias the lock members 18 towards a locking position and a spring 25 serving to bias the lock members 19 in the opposite direction towards a locking position. The plate 14 provides notches 18a along one side of the slots 20 and 21 and notches 19a along the opposite side of the slots 20 and 21 from the notches 18a, the lock members 18 and 19 being locked when engaged in the respective notches 18a and 19a.

In order to assemble the female buckle part B, the lock members 18 and 19 are inserted through the slots 20 and 21 and into spaces defined between webs 12a, 12b and 12c provided in the latch or slide 12. The pins 22 and 23 are then inserted through aligned apertures 12d in the webs 12a, 12b and 12c, and through apertures 18b and 19b in the lock members 18 and 19, respectively, the spring 24 being interposed between the web 12c and the adjacent lock member 18, and the spring 25 being interposed between the web 12a and the adjacent lock member 19, whereby to provide normal biasing of the lock members 18 and 19 oppositely and towards the notches 18a and 19a respectively.

This sub assembly, comprising the plate 14 and the latch or slide 12, with the lock members 18 and 19 connected thereto is then placed in the channel 13 of the body 10, and the plate 14 is secured to the body by the fasteners 15. In the illustrative embodiment, spring means in the form of opposing leaf springs 25, may be provided to bias the latch or slide 12 to a latching position, such spring means being installed in the channel 13 prior to the slide 12.

The assembly as thus far described is a simple one in consideration of the buckle-latching and latch-locking functions performed thereby, and in consideration of the safety and reliability factors provided for, all as will be hereinafter more fully described.

More specifically, the male lug 6 projects outwardly at an angle from the body 5 and has a face 6a extending normal to the end face 5a of the body 5. The face 6a merges with an angular face 6b which leads to an outer face 6c which is generally parallel to the end face 5a. Another face 6d leads from the outer face 6c to an angular face 6e forming a recess 6f with the end face 5a of the body 5. At its lateral ends, the lug 6 has parallel end faces 6g.

The recess 11 in the female buckle body 10 and the slide or latch 12 are provided with faces or walls which are adapted to conform in size and shape with the faces or walls of the lug 6, so as to prevent relative twist of the assembled buckle parts in any direction.

Thus, the slide 12, as best seen in FIGS. 6 and 7, has an end flange 121 providing an end face 121a adapted to oppose the end face 5a of the male body 5. This flange 121 also provides a face 12a normal to the end face 121a adapted to oppose the lug face 6a, and an angular face 12b adapted to oppose the angular face 6b of the lug 6. Within the recess 11, the body 10 is provided with an inner face 12c adapted to oppose the outer face 6c of the lug, and an angular face 12d defines the outer wall of the recess 11 and is adapted to oppose the angular wall 6e of the lug 6. At the end of the body 10 is a face 121b forming with the face 12d a lip 12f complementary to the recess 6f of the male buckle part. Laterally, the recess is bounded by inner sidewalls 12g which define the width of the recess and oppose the end faces 6g of the lug 6.

It will now be understood that when the lug 6 is disposed in the recess 11 and the latch or slide 12 is in the position of FIG.

6, at which the lug is held in the recess, the lug 6 is opposed at all locations by complementary faces of the female latch part so that the lug cannot twist in any direction. In order to reinforce the slide 12 against upward movement to allow escape of the lug, the male body 5 has a flange 5c projecting therefrom to define a groove 5d with the lug 6 into which groove the flange 121 on the slide 12 extends when the latch is closed on the lug.

With such a construction, all tendency of the components to bend is resisted by other components, and the ability of the latched buckle to withstand twist is substantially enhanced. Moreover, the coengaged surfaces are essentially "stripproof" in the sense that there are no prongs or other elements subjected to load which are permitted to move into holding engagement with other elements during reversals of force applied to the buckle. It is also significant to note that the lug and latch means cooperate to hold the buckle together without reliance upon engagement of the male part by means which lock the buckle together, as will now be described.

As will be understood from the general description of the locking means set forth above, the latch or slide 12 is adapted to be held in its closed position by engagement of the locking members 18 and 19 in the notches 18a and 19a in the slots 20 and 21 of the top plate 14, the locking members 18 and 19 being biased laterally in locking directions by the springs 24 and 25 (see FIG. 8). The locking members 18 and 19 may be released from the notches 18a and 19a in response to relative lateral movement of the locking members by the movement of operator members 16 and 17 both in opposite directions, but one of the pairs of locking members 18 or 19 will remain in engagement with the respective notches 18a or 19a if only one of the operating members 16 or 17 is moved.

In this connection, it is notable that the operating members 16 and 17 are free to move laterally of the buckle part B, only to the extent of the distance required to move the lock members 18 and 19 into abutting engagement with the wall of slots 20 and 21 opposing the notches 18a and 19a. Interfitting parts 16a and 16b are formed on the contiguous sides of the operating members 16 having a component formed as an inclined surface extending in the direction of travel of the members 16 and 17 a distance greater than the possible travel of only one of the members 16 and 17 but less than the extent of cumulative travel of these members when they are both moved to the extreme. The inclined surface of the parts 16a and 17a, when the members 16 and 17 are in their locking positions in the slots 20 and 21 assures proper spacing of the lock members 18 and 19 along the slots 20 and 21, so that the members 18 and 19 will inherently be positioned relative to one another for coengagement in the notches 18a and 19a. A further advantage of this interfitting structure resides in the fact that even if one of the springs 24 or 25 should be incapable of holding its lock members in the notches 18a or 19a, as the case may be, inadvertent movement of the other lock members in an unlocking direction will cause engagement of the parts 16a and 17a, resulting in movement of the other lock members 18 or 19 back into the notches 18a or 19a. In other words, it is absolutely necessary that the lock members 18 and 19 be purposefully moved from the notches 18a and 19a in order to unlock the latch or slide 12. Accordingly, inertia or "G" forces cannot effect release of the lock means, nor can sonic vibrations or instantaneous reversals of forces. Indeed the lock means must be manually released, or, in an emergency, opened by applying an opening force between the latch or slide 12 and the male part 5, as will be hereinafter described.

In order to seal the female buckle part against entry of such foreign matter as might interfere with its operation, the operating members are preferably provided with barrier means overlying the slots 20 and 21. Thus, the respective operating members 16 and 17 in the illustrative embodiment have extensions 161 and 171 adapted to slide on the outer surface of the plate 14 to cover the slots 20 and 21 upon movement of the slide 12 to its locked and open positions.

It sometimes occurs that an emergency arises in which a pilot or crewman is seriously injured and incapable of manipu-

lating the operating means 16 and 17 to release the lock for the buckle latch 12. Under such circumstances, the pilot or crewman may be lost due to his inability to free himself from the aircraft. Accordingly, the invention provides a structure which not only has the previously described advantages, but which also lends itself to pressure separation. Such pressure separation may also be condition responsive, say in the event that it is desired that a buckle be released at a given altitude to drop cargo or supplies.

As seen in FIGS. 4, 5 and 6, the assembly includes a bore 50 having a passage 51 leading thereto, this bore being adapted to contain an explosive capable of generating pressure between the body 5 of the male buckle part and the end face 121a of the slide or latch 12. The passage 51 may contain a detonator connected to a suitable trigger mechanism (not shown). Upon firing of the charge in the bore 50, a force will be applied directly to the slide 12 tending to kick the same open, but such force should be calculated in excess of the normal inertia forces which are incapable of opening the lock means for the latch.

From the foregoing, it will now be apparent that the invention provides a failureproof buckle which is ideally suited for use in aircraft where certainty of operation and strength are critical considerations.

While the specific details of an illustrative embodiment of the invention have been herein shown and described, changes and alterations may be made without departing from the spirit of the invention as defined in the following claims.

I claim:

1. A canopy buckle assembly comprising: a male buckle part having a lug, a female buckle part having a recess for receiving said lug, latch means for releasably holding said lug in said recess, and lock means for releasably holding said latch means in a position latching said lug in said recess, said latch means including a slide, means slidably supporting said slide on said female buckle part for movement from said position holding said lug in said recess to a second position for releasing said lug from said recess, said lock means including operating means for releasing said lock means, said female buckle part having a flat end face and an inwardly inclined surface leading from said end face and merging with a transverse surface normal to said end face and an inner surface parallel to said end face to form said recess, said slide having a surface parallel to said transverse surface and merging with an inclined surface parallel to said first-mentioned inclined surface, and said male body part, having a flat end face engageable with the end face of said female buckle part, said lug having parallel inclined surfaces merging with parallel surfaces normal to said end face of said male buckle part, one of said latter parallel surfaces extending between a front face of said lug parallel to said end face of said male buckle part and one of the inclined surfaces of said lug, the other of said latter parallel surfaces extending between said end face of said male buckle part and the other of the inclined surfaces of said lug, whereby said lug is complementary to said recess and said slide and all of said surfaces are in mutually contacting relation when said lug is held in said recess by said slide.

2. A canopy buckle as defined in claim 1, wherein said male buckle part has a flange projecting therefrom and defining with said other of said latter parallel surfaces a transversely extended groove, and said slide having a flange engageable in said groove when said lug is held in said recess by said slide.

3. A canopy buckle assembly comprising: a male buckle part having a lug, a female buckle part having a recess for receiving said lug, latch means for releasably holding said lug in said recess, and lock means for releasably holding said latch means in a position latching said lug in said recess, said male buckle part comprising a body having said lug thereon and a shoulder adjacent said lug, said latch means including a slide slidably carried by said female part and having an end face engageable with said shoulder when said slide is in said first position, and means for applying a force between said shoulder and said face for forcing the same apart to overcome said lock

means and move said slide to a second position for releasing said lug from said recess.

4. A canopy buckle as defined in claim 3, wherein said means for applying a force between said shoulder and said face comprises means for releasing gas under pressure.

5. A canopy buckle assembly comprising: a male buckle part having a lug, a female buckle part having a recess for receiving said lug, latch means for releasably holding said lug in said recess, and lock means for releasably holding said latch means in a position latching said lug in said recess, said male buckle part comprising a body having said lug projecting therefrom, said body having a flange spaced from said lug so that opposed walls of said lug and said flange form a groove, and said latch means includes a slide slidably carried by said female part, said slide having an end flange engageable in said groove when said slide is in said position holding said lug in said recess and movable from said groove upon movement of said slide to a second position releasing said lug from said recess.

6. A canopy buckle assembly comprising: a male buckle part having a lug, a female buckle part having a recess for receiving said lug, latch means for releasably holding said lug in said recess, and lock means for releasably holding said latch means in a position latching said lug in said recess, said female buckle part comprising a body having said recess therein, a channel in said body, said latch means comprising a slide slidably disposed in said channel for movement therein from said position for holding said lug in said recess to a second position releasing said lug from said recess, a plate attached to said body and overlying said channel and said slide to retain said slide in said channel, said lock means including lock members shiftably carried by said slide and cooperative lock elements on said plate releasably engageable by said lock members, said plate having means cooperative with said lock members for allowing movement of said lock members with said slide upon release of said lock members from said lock elements, and actuator means for shifting said lock members to release the latter from said lock elements and move said slide.

7. A canopy buckle assembly comprising: a male buckle part having a lug, a female buckle part having a recess for receiving said lug, latch means for releasably holding said lug in said recess, and lock means for releasably holding said latch means in a position latching said lug in said recess, said female buckle part comprising a body having said recess therein, said body having a channel, said latch means including a slide slidably disposed in said channel for movement from said position holding said lug in said recess to a second position releasing said lug from said recess, said lock means including a plate overlying said channel, said plate having elongated slots extending along said channel, lock members extending into said channel through said slots, means connecting said lock members to said slide for movement of said lock members laterally of said slots, said plate having oppositely facing notches opening into said slots in spaced relation therealong, means for biasing certain of said lock members laterally in one direction for engagement in said notches, and operating means for moving said lock members oppositely out of said notches to allow movement of said lock members longitudinally of said slots to move said slide to the position for releasing said lug from said recess.

8. A canopy buckle as defined in claim 7, wherein said means connecting said lock members to said slide comprises laterally spaced webs on said slide, pins extending laterally through said webs, said lock members being slidably supported on said pins.

9. A canopy buckle as defined in claim 7, wherein said means connecting said lock members to said slide comprises laterally spaced webs on said slide, pins extending laterally through said webs, said lock members being slidably supported on said pins, and said means for biasing said lock members comprises oppositely acting coiled springs on said pins and engaged with said certain and said other lock members.

10. A canopy buckle as defined in claim 7, wherein barrier means are provided on said operating means for closing said slots.

11. A canopy buckle as defined in claim 7, wherein said operating means includes a pair of members slidably disposed on said plate, said certain lock elements being connected to one of said pair of members and said other of said lock elements being connected to the other of said pair of members, and said members having means coengageable to position said lock elements relative to one another for engagement in said notches.

12. A canopy buckle as defined in claim 7, wherein said operating means includes a pair of members slidably disposed on said plate, said certain lock elements being connected to one of said pair of members and said other of said lock elements being connected to the other of said pair of members, and said members having cooperative portions having opposing interfitting walls for positioning said lock elements relative to one another for engagement in said notches when one of said pair of members is moved relative to the other of said pair of members to move its lock elements out of its notches.

13. A canopy buckle as defined in claim 7, wherein said lug is a bar extending outwardly at an angle from said male buckle part, and said female buckle part has walls defining said recess engageable with all surfaces of said bar.

14. A canopy buckle assembly comprising: a male buckle part having a lug, a female buckle part having a recess for receiving said lug, latch means for releasably holding said lug in said recess, and lock means for releasably holding said latch means in a position latching said lug in said recess, said female buckle part comprising a body having said recess therein, said body having a channel, said latch means including a slide slidably disposed in said channel for movement from said position holding said lug in said recess to a second position releasing said lug from said recess, said lock means including a plate overlying said channel, said plate having an elongated slot extending along said channel, lock members slidable in said slot, means connecting said lock members to said slide for movement of said lock members laterally of said slot, said plate having oppositely facing notches opening into said slot in spaced relation therealong, means for biasing certain of said lock members laterally in one direction and other of said lock members laterally in the other direction for engagement in said notches, and operating means for moving said lock mem-

bers oppositely out of said notches to allow movement of said lock members longitudinally of said slot to move said slide to the position for releasing said lug from said recess.

15. A canopy buckle as defined in claim 14, wherein said means connecting said lock members to said slide comprises laterally spaced portions of said slide receiving said lock members therebetween, and pins extending between said laterally spaced portions, said lock members being slidably supported on said pins.

16. A canopy buckle as defined in claim 14, wherein said means connecting said lock members to said slide comprises laterally spaced portions of said slide receiving said lock members therebetween, pins extending between said laterally spaced portions, said lock members being slidably supported on said pins, and said means for biasing said lock members comprises oppositely acting coiled springs on said pins between said laterally spaced portions and said lock members.

17. A canopy buckle assembly comprising: a male buckle part having a lug, a female buckle part having a recess for receiving said lug, latch means for releasably holding said lug in said recess, and lock means for releasably holding said latch means in a position latching said lug in said recess, said female buckle part comprising a body having said recess therein, said body having opposed sidewalls and top and bottom walls defining a channel, said latch means including a slide slidably disposed in said channel for movement from said position holding said lug in said recess to a second position releasing said lug from said recess, longitudinally extended slot means in one of said top and bottom walls and opening into said channel, lock members slidably engaged in said slot means, means connecting said lock members to said slide for lateral movement, laterally extended opposed notch means in longitudinally spaced relation with respect to said slot, means for biasing certain of said lock members laterally in one direction and other of said lock members laterally in the other direction for engagement in said opposed notch means, and operating means for moving said lock members oppositely out of said notch means to allow movement of said lock members longitudinally of said slot means to move said slide to the position for releasing said lug from said recess.

18. A canopy buckle as defined in claim 17, including explosive means for moving said slide to said second position for releasing said lug from said recess.

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