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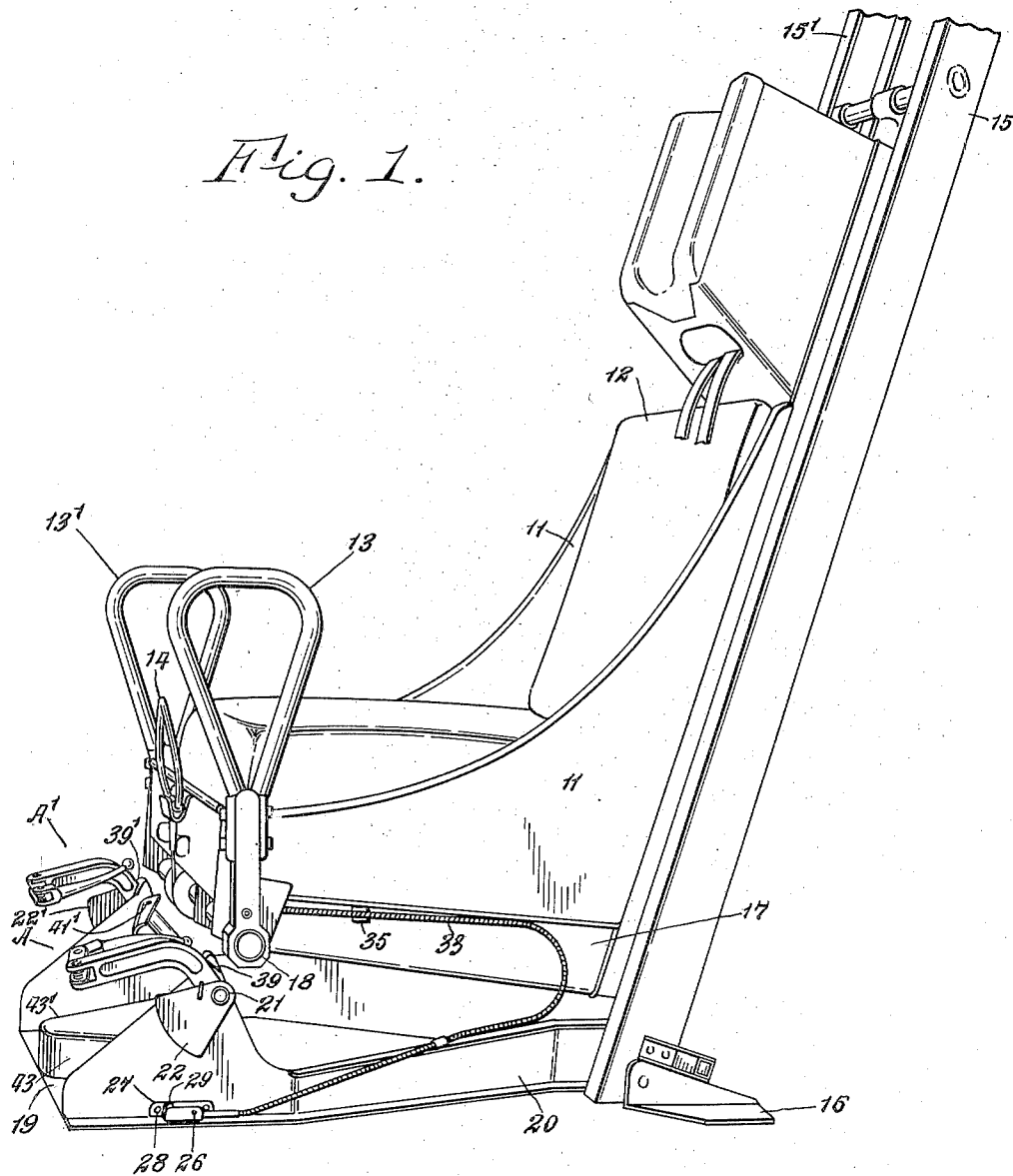
E. H. REPLOGLE ET AL

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EJECTABLE AIRPLANE SEAT HAVING LEG RESTRAINING MEANS

Filed Sept. 8, 1954

4 Sheets-Sheet 1



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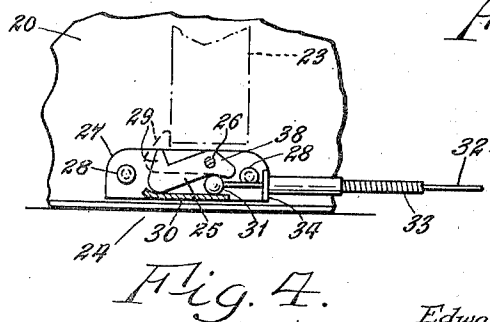
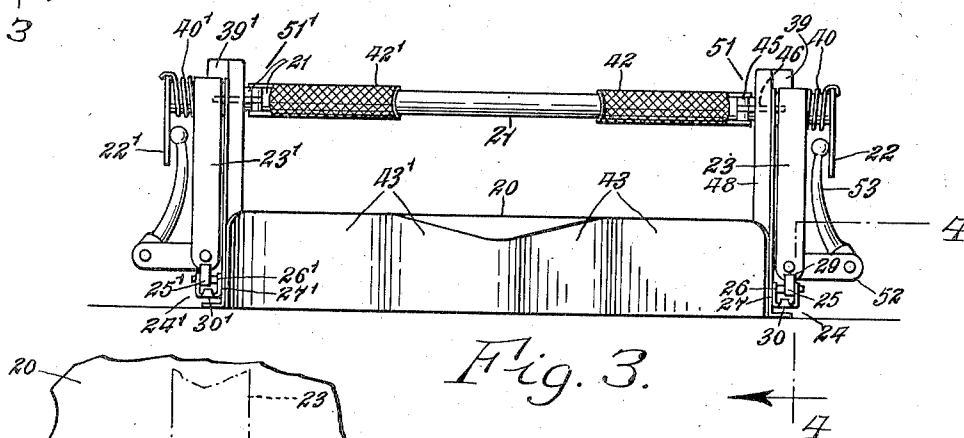
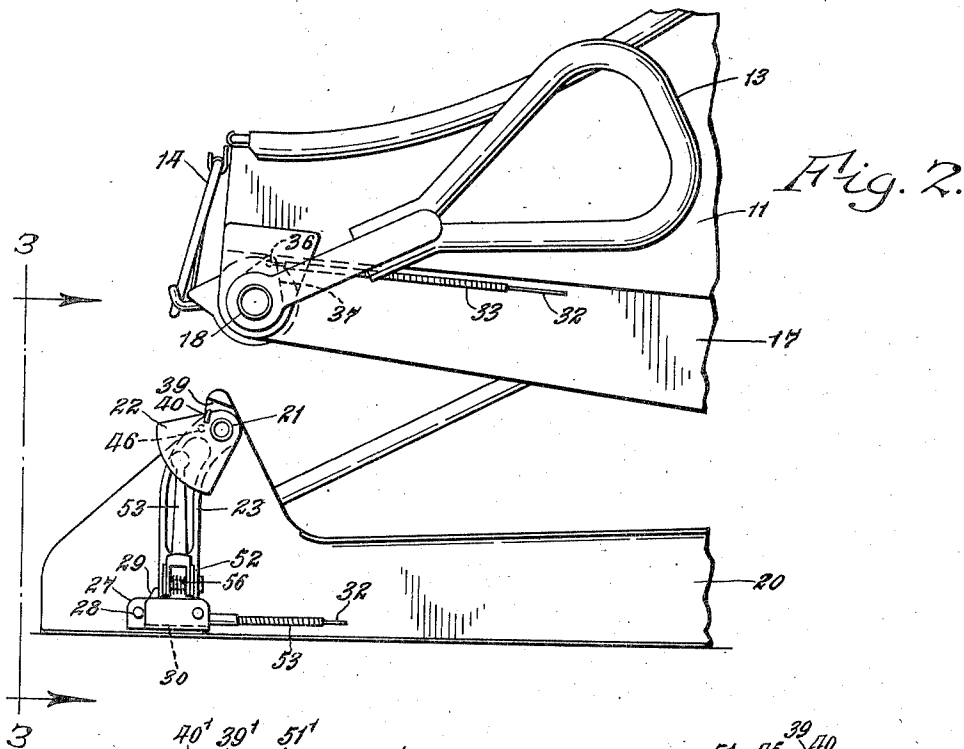
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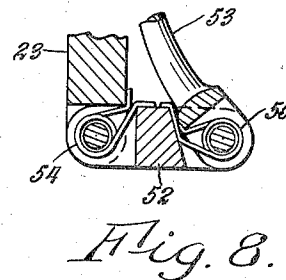
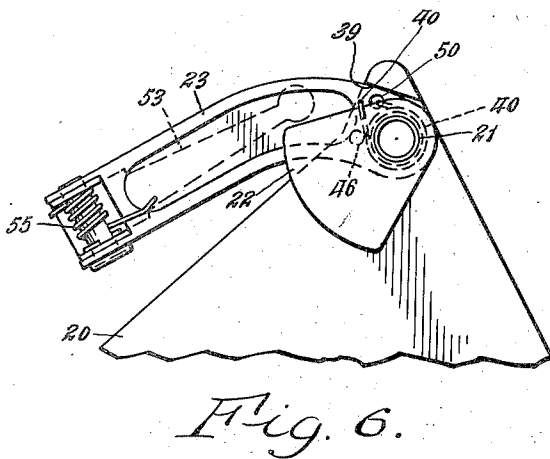
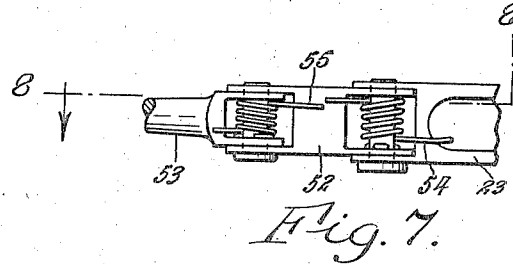
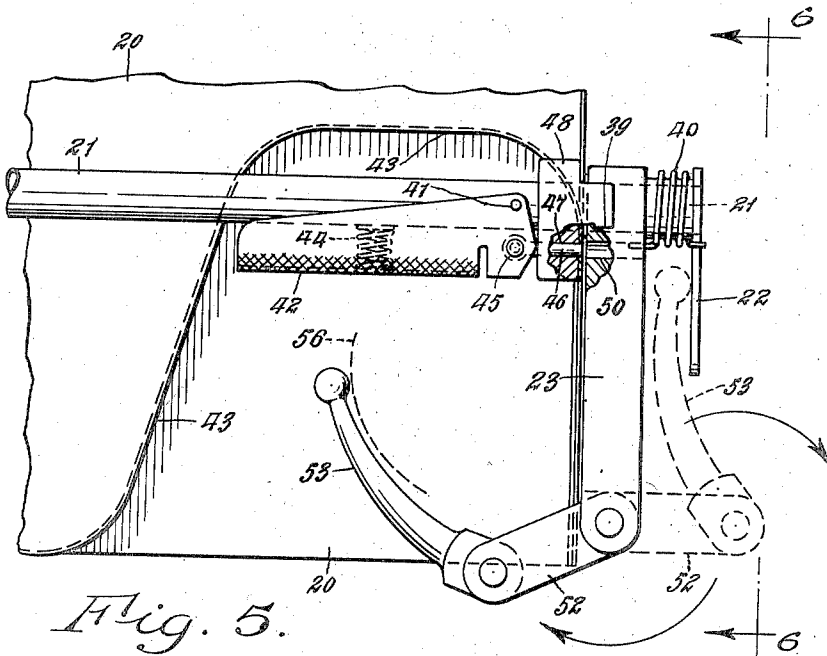
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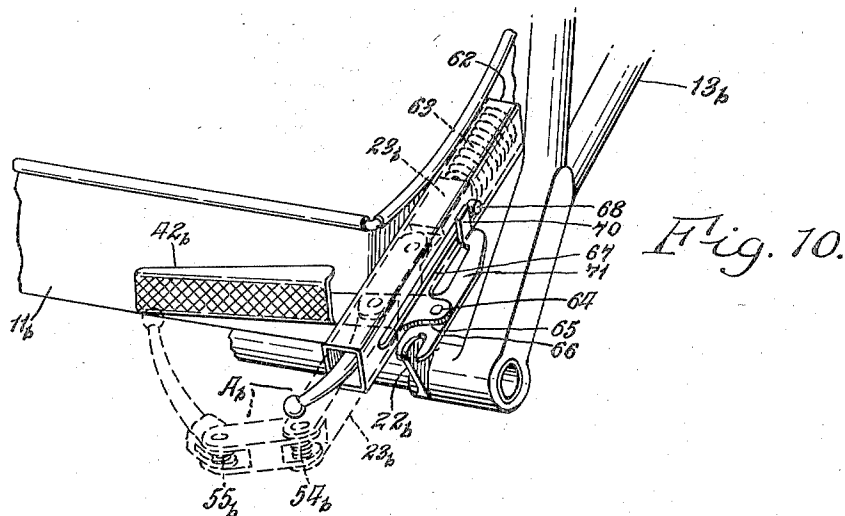
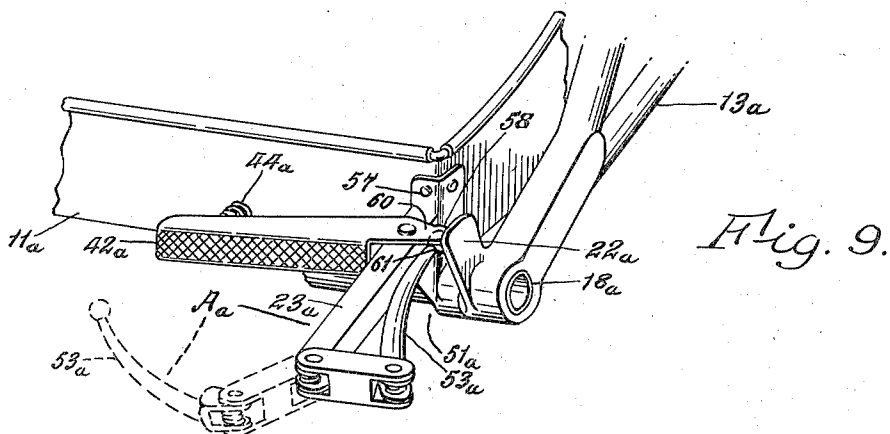
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4 Sheets-Sheet 4



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EJECTABLE AIRPLANE SEAT HAVING LEG RESTRAINING MEANS

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19 Claims. (Cl. 244—122)

This invention relates to a seat in an airplane which is slidably connected with the airplane fuselage and is adapted to be forceably ejected from the airplane, together with its occupant, whenever it becomes desirable for said occupant to "bail out."

The invention relates especially to an aviation seat which is adapted to be forceably ejected in a downward direction, and more particularly to a means associated with said seat for preventing the aviator's legs from flying upwardly, relatively to his seat, when said seat is forceably ejected downwardly.

The objects of the invention are to provide an airplane seat ejector having leg restraining means—

1. Which are normally folded back out of the way in a compact manner when in their normal or inoperative position.

2. Which cannot be actuated until the aviator has first pulled up his lateral leg guards 13, 13', 13a or 13b.

3. Which, even after said leg guards have been pulled up, remains inoperative until the aviator has retracted his legs to their proper ejection position.

4. Which, thereupon, effectively, but not in a completely confining manner, will prevent the aviator's legs from flinging upwardly when his seat is forceably ejected downwardly, and

5. Which will permit the aviator to easily and freely push his legs free of the leg restraining means, or to have them automatically freed, just as soon as the inertia of his body has been overcome and he is travelling downwardly away from the airplane at the same speed as his about-to-be-discarded seat.

Other collateral objects of the invention and practical solutions thereof are disclosed in the following specification and in the appended drawings, wherein:

Fig. 1 is a diminutive perspective view of an ejectable airplane seat provided with our leg restraining means A and A' and showing the latter in their operative positions.

Fig. 2 is a fragmentary, side elevation of the lower front part of the ejectable seat showing the leg restraining means A in its inoperative or normal position.

Fig. 3 is a fragmentary front elevation of the base 20 of the ejectable seat, taken on line 3—3 Fig. 2 and showing the lower leg restraining means A, A' in their inoperative or normal positions.

Fig. 4 is an enlarged, fragmentary, vertical, longitudinal section of the locking mechanism which is located on the base of the seat and is shown in unlocked position; i. e., with the lock of the lower leg restraining means in operative or unlocked position, taken on line 4—4 Fig. 3.

Fig. 5 is an enlarged, fragmentary, top plan of the front left corner of the base 20 of the ejectable seat, showing the lower left leg restraining means A in its operative position and, in dotted lines, in its inoperative or normal position.

Fig. 6 is an enlarged, fragmentary, vertical, longitudinal section of the lower left leg restraining means A,

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taken on line 6—6 Fig. 5 and also showing said lower left leg restraining means in its operative position.

Fig. 7 is an enlarged, fragmentary, front elevation of the three main components of the lower left leg restraining means A, showing the same (for purposes of illustration) turned into a vertical plane and stretched out into a straight line.

Fig. 8 is an enlarged, fragmentary and substantially horizontal section showing the same lower left leg restraining members which are illustrated in Fig. 7 but showing them in their inoperative or normal positions as in Figs. 2 and 3. This section is taken along a line indicated by line 8—8 Fig. 7.

Fig. 9 is a fragmentary, perspective view of the front, left corner of a modified seat construction showing not only the left leg guard 13a mounted directly on the seat 11a, but with also the lower left leg restraining means Aa so mounted.

Fig. 10 is a fragmentary, perspective view of the front left corner of another modified seat construction also showing not only the left leg guard 13b mounted directly on the seat 11b, but with also the lower left leg restraining means Ab so mounted.

The following description is directed specifically to the exact construction of the forms of the invention shown in the accompanying drawings, but it is to be understood that the patent protection embraced by this patent includes any and all constructions which come within the spirit of the invention, and, of course, within the scope of the appended claims.

Figs. 1 to 8 inclusive

It is well known in the art that an aviator cannot bail out of a very fast airplane but must be ejected therefrom. Heretofore, such ejection has usually been effected by ejecting the aviator's seat, together with its occupant, upwardly against the force of gravity. The present invention can be used with such an upwardly ejectable aviator's seat, but it is more particularly advantageously employed in an aviator's seat 11 which is ejectable downwardly and thereby gains an advantage of two G's as compared to an upwardly ejectable aviator's seat.

One of the main problems in downward ejection is to prevent the aviator's legs from suddenly flying upwardly, relatively to his seat, and either fracturing his legs or at least making him very uncomfortable. The present invention avoids this undesirable concomitant of downward ejection by automatically partially wrapping a pair of lower leg restraining means around the front of each of the aviator's legs, just above the feet, after he has pulled back said feet into their proper ejection position. His legs are then definitely and firmly prevented from upward movement relatively to the seat, but the aviator, even when said leg restraining means are in operative position, is at all times able to easily free himself from lower said leg restraining means by merely thrusting his feet forward, though this is usually effected automatically, as will appear hereinafter.

It is to be understood that, prior to the ejection, the aviator has strapped himself to the seat 11 and has harnessed himself to the parachute pack 12, his connection with said seat being effected by the usual shoulder straps, waist straps and crotch strap (not shown). However, the ejection itself cannot occur until he has first swung up the leg guards 13 and 13' into the position of Fig. 1 and has then pulled up the ring trigger 14 that sets off the explosive charge which ejects the seat and its occupant down the inclined channel bars or guide rails 15, 15', the latter being secured to the body of the airplane in any suitable manner, as for instance, by bracket plate 16 and by other suitable securing members. After said seat 11 and its occupant have travelled downwardly for a certain

fixed length of time, another explosive charge automatically releases him from the five straps aforementioned, and the seat 11 is blown by the slip stream of the airplane backwardly, thereby automatically releasing the lower leg restraining means (A, A', A₂ or A₃), and then his parachute is pulled out of the parachute pack 12 and opens up. He then floats more or less gently to earth, suspended from said parachute.

The seat 11 is provided with a subframe 17 in the forward end of which is journaled a horizontal cross shaft 18 to the opposite ends of which are secured the leg guards 13, 13' which latter, as aforementioned, must be pulled up to the position of Fig. 1 before the seat 11 can be ejected. This is to ensure that the aviator's knees will not be dangerously spread apart when the ejection occurs, and operates to cock the firing mechanism of the explosive charge which is adapted to affect the ejection when the ring trigger 14 is pulled upwardly, in the usual and well known manner.

Below the subframe 17 of the seat 11 is arranged a base 20 having a horizontal foot plate 19 which is adapted to support the feet of the aviator. This base 20 is vertically adjustable, relatively to the seat 11 (by means not shown), to enable the height of the seat 11 above the foot plate 19 to be adjusted to the particular leg length of the aviator occupying the seat.

The two front corners of the base 20 extend upwardly and in these upwardly extended portions is secured a horizontal cross tube 21 by means of welding or otherwise. The ends of this cross tube 21 extend out beyond the sides of the base 20 and have secured to their outermost ends, by welding or otherwise, a pair of detaining sector plates 22, 22' which lie in parallel, vertical, longitudinal planes and extend forwardly and downwardly from the opposite ends of said cross tube 21.

Journaled on the opposite ends of said cross tube 21, between the outer faces of the base 20 and the inner faces of the sector plates, 22, 22', is a pair of curvilinear arms, 23, 23'. Each of these arms is normally held in its inoperative position (Figs. 2, 3 and 8) by a companion lock 24, 24', one of which is shown enlarged in Fig. 4. Each lock consists of an S-shaped locking lever 25, 25' which is pivoted at 26, 26' to a U-shaped casing 27, 27', that is secured by rivets 28 to the outer longitudinal vertical faces of the front end of the base 20. The lower, horizontal web 30, 30' of each casing 27, 27' acts as a stop to limit the downward movement of the front end of its companion lever 25, 25' whose upturned ends 29, 29' normally engage the front lower corners of their companion arms 23, 23', as shown by the dotted lines in Fig. 4.

Confining our attention to the one lock 24 shown in Fig. 4, the lever 25 is held up in its locked position by a ball 31 which in this position pushes up the front end of the said lever 25 so that its upturned end 29 engages the lower front face of its companion arm 23. This ball 31 is secured to the lower front end of a flexible push-pull wire 32 which is incased in a flexible, spirally-wound tube 33. The lower front end of this tube is secured to a lip 34 which is bent outwardly at the rear end of the casing 27. From this lip 34 said flexible tube 33 extends longitudinally and horizontally rearwardly and then curves upwardly and is secured at 35 to the subframe 17 of the seat 11. The push-pull wire 32 in said flexible tube 33 is pivotally connected at 36 to a lug 37 which is secured to the cross shaft 18.

When the two leg guards 13, 13' are swung up from their inoperative or normal position of Figs. 2, 3 and 8 to the operative position of Figs. 1, 3, 4, 5, and 6, the ball 31 is pulled back to the position of Fig. 4, striking the rear arm 38 of lever 25 and turning said lever counter-clockwise to the position shown in full lines in Fig. 4. This unlocks the arm 23 and, as far as this lock 24 is concerned, allows the lower end of said arm 23 to swing forwardly and upwardly under the influence of its com-

panion torsion spring 40. Similarly, the lower end of the other arm 23' is independently urged forwardly and upwardly by its companion torsion spring 40'.

However, the unlocking of locks 24 and 24' does not necessarily allow the lower ends of their companion arms 23, 23' to swing forwardly and upwardly from their inoperative or normal positions of Figs. 2, 3, and 8 to their operative positions of Figs. 1, 3, 4, 5, and 6. This will be subsequently explained.

Pivoted vertically at 41 and 41' on cross tube 21 (see particularly Fig. 5) are a pair of trip levers 42, 42' each of which is adapted to be pressed rearwardly by one of the feet of the aviator when his feet are in their proper position for ejection, his feet being laterally guided by the usual stirrups 43, 43'.

Confining our attention for the present to the left trip lever 42, it will be noted that this lever is urged forwardly by a compression spring 44 which is interposed between its rear face and the adjacent front face of the cross tube 21. Pivoted at 45 to said trip lever 42 is a latch pin 46 that is slidably received within a suitable guide hole 47 that is drilled horizontally and laterally thru a vertical buttress block 48 which latter is secured by welding or otherwise to the inner, vertical face of the web of the companion left side member of the base 20.

When the arm 23 is in its downward inoperative position, this latch pin 46 projects into a relatively large hole 50 which is drilled horizontally and transversely (but eccentrically) into its companion arm 23. This prevents said arm 23 from turning up to its operative position under the influence of its torsion spring 40 until the trip lever 42 is tripped, but this turning up of said arm 23 is also prevented by the lock 24 which has priority as far as control is concerned. In other words, as long as the leg guards 13, 13' are in their rearward positions, the locks 24, 24' prevent any freeing of their companion arms 23, 23' irrespective of whether or not the aviator accidentally kicks one or both of the trip levers 42, 42'. However, when he is ready to be ejected and has pulled up the leg guards 13, 13', then, as soon as he has moved his feet backwardly in their stirrups 43, 43', to their proper ejection position, his feet will push the trip levers 42, 42' rearwardly and release their companion arms 23, 23' and allow the latter to swing forwardly and upwardly to their operative positions against stops 39, 39'. It should be noted that each trip lever 42, 42' controls what is in effect its own individual latch 51, 51' so that, if he fails to move one of his feet back to proper position, only the one leg will be broken.

Again confining ourselves to the left side of the ejectable seat, it is to be noted that the distal end of arm 23 is pivoted to a link 52 whose distal end, in turn, is pivoted to the inner end of a curvilinear restraining finger 53. As seen in Fig. 5, the link 52 is resiliently urged in a clockwise direction, relatively to its companion arm 23, by a torsion spring 54, while, similarly, the restraining finger 53 is resiliently urged in a clockwise direction, relatively to its companion link 52, by a torsion spring 55. However, both of these springs, 54, 55 are rendered ineffective so long as the distal end of their companion restraining arm 53 is positioned behind its companion sector 22, and this ineffectiveness continues as long as its companion lock 24 is locked and its latch 51 is latched.

The unlocking of said lock 24 is effected by raising the leg guards 13, 13' while the unlatching of latch 51 is effected by the aviator's pulling his left foot backwardly into proper ejection position, whereupon his heel strikes the trip lever 42. This allows the lower end of the arm 23 to move forwardly and upwardly under the influence of its torsion spring 40, and this frees the distal end of the companion restraining finger 53 from its companion sector 22. This allows the two torsion springs 54, 55 to swing the link 52 and restraining finger 53 from the dotted-line position of Fig. 5 to the full-line position shown. This causes the restraining finger 53 to come

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into contact with the aviator's leg 56, thereby partially wrapping the arm 23, link 52 and restraining finger 53 around said aviator's left leg 56.

It should be noted that the torsion spring 54 is much stiffer than the torsion spring 55. The reason for this is that if the restraining finger 53 should strike an obstruction, the spring 54 will be able to partially wind up the lighter spring 55, and thereby free the restraining finger from said obstruction.

One vital feature of our invention is that the axes of the pivots between the arm 23 and link 52 and between said link and the restraining finger 53 are inclined upwardly and forwardly when they are in operative position. Because of this inclination, the leg restraining means A is prevented from opening up as the aviator's left leg 56 starts to move upwardly relatively to the seat 11 and then, when his foot comes into contact with the lower face of any one of the three components of this leg restraining means A, any further vertically upward movement of his leg is positively prevented. Despite the foregoing, however, he is able to free himself from said leg restraining means A at any time he wishes to do so by merely pushing his foot forward, thereby instantly unwrapping said leg restraining means A from his leg. In actual practice, this unwrapping is effected automatically after the aviator and his seat 11 have been ejected and after there is no longer a force tending to move his legs vertically upward relatively to the seat 11; i. e., when the inertia of his body has been overcome and he is travelling at the same speed as his seat.

Fig. 9

Fig. 9 shows a modified and very simple form of the invention in which the left leg restraining means A_a is mounted directly in the seat 11a instead of on the base as in Figs. 1 to 8 inclusive. In this modification of the invention, the sector plate 22a is secured directly to the left leg guard 13a and the rear end of the arm 23a of the leg restraining means A_a is secured directly, by rivets 57, to the seat 11a. If desired, both the cross shaft 18a and said arm 23a may be connected with said seat 11a in the general manner shown but located at a considerable distance below the seat proper so as to bring the leg restraining means A_a into closer proximity to the upper part of the aviator's foot.

In this construction too, the trip lever 42a is provided with a compression spring 44a but the latching means 51a is much simpler, consisting merely of a longitudinal, semi-cylindrical groove 58 formed on the under face of the arm or extension 60 of the trip lever 42a and adapted to receive the upper part of a ball 61 that is formed at the distal end of the restraining finger 53a. This semi-cylindrical groove 58 is so located that it does not come in physical contact with said ball 61 until the sector plate 22a has been swung forwardly and downwardly to "unlock" the leg restraining means A_a. And at no time does the end of the arm or extension 60 of the trip lever 42a come into contact with the inner vertical face of the sector plate 22a.

Fig. 10

Fig. 10 shows another modified form of the invention in which both the left leg guard 13b and the leg restraining means A_b are secured to the seat 11b. In this construction, the "arm" 23b is of rectangular cross section, and is received within the bore of a rectangular tube 62, the latter being secured by welding or otherwise to the seat 11b. This "arm" 23b is resiliently urged forward by a compression spring 63 which is arranged within the rear end of said rectangular tube 62.

The trip lever 42b is approximately of T-shape and is pivoted at 64 to a lug 65 which extends horizontally outward from the rectangular tube 62. The forward arm 66 of said T-shaped trip lever 42b is longitudinally slotted at its front end to receive a sector plate 22b that is se-

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cured to the hub of the left leg guard 13b. In the normal or inoperative position of the parts shown in Fig. 10, this sector plate restrains the trip lever 42b against any partial rotation about its pivot 64, thereby locking the left leg restraining mechanism A_b.

The rectangular tube 62 is provided on its vertical outer face with a longitudinal slot 67 in which is adapted to slide a pin 68 that projects horizontally outward from the "arm" 23b. Normally, the front face of this pin is in tight engagement with the rear end of an upstanding lip 70 which is formed by bending the rear end of the rear arm 71 vertically upward. When the sector plate 22b has been moved downwardly out of longitudinal slot in the front end of the front arm 66 of trip lever 42b (by raising the leg guard 13b), the lip 70, which has been bearing against pin 68, continues to so bear and to hold the spring 63 in compression and to hold the leg restraining means A_b in its inoperative position as shown in full lines. However, when the aviator pulls back his left foot into proper ejection position, his heel strikes the trip lever 42b and this moves its lip 70 outwardly thereby allowing the compression spring 63 to resiliently push forwardly all three members of the leg restraining means A_b, which, because of the torsion springs 54b, 55b, on their pivots, is caused to move to its operative position shown by the dotted lines. It should be noted that the trip lever 42b does not require a spring to resiliently urge it forwardly as in Figs. 1 to 9 inclusive. Instead, said trip lever is mechanically held in its forward position by the sector plate 22b until the left knee guard 13b is manually moved forwardly into operative position by the aviator.

We claim:

1. An aviator ejector of the character described comprising an ejectable seat; and a restraining finger pivotally connected with said seat on a pivot which is inclined upwardly and forwardly, said restraining finger being arranged to swing against one of the legs of the seated aviator.
2. As in claim 1 with resilient means for swinging said finger against one of the legs of the seated aviator.
3. An aviator ejector of the character described comprising an ejectable seat; a link pivotally connected with said seat on an axis which is inclined upwardly and forwardly, and a restraining finger pivoted to the distal end of said link.
4. As in claim 3 with the pivotal connection between the finger and the link also inclined upwardly and forwardly.
5. As in claim 3 with resilient means interposed between the seat and the link and between the link and the finger, and arranged to resiliently wrap said link and said finger around one of the legs of the seated aviator.
6. As in claim 1 with a stirrup connected with the seat and arranged to guide one of the aviator's feet into proper lateral position for ejection.
7. An aviator ejector of the character described comprising an ejectable seat; an arm connected with said seat; and a restraining finger pivotally connected with the distal end of said arm on an axis which is inclined upwardly and forwardly.
8. As in claim 7 with means for moving the arm relatively to the seat from a folded inoperative to an unfolded, operative position.
9. As in claim 7 with the arm pivotally connected with the seat so that its distal end moves in a vertical plane.
10. As in claim 7 with the arm pivotally connected with the seat so that its distal end is resiliently moved in a vertical plane from a folded, inoperative to an unfolded, operative position.
11. As in claim 1 with resilient means for swinging the finger against one of the legs of the seated aviator and also with releasable means for holding the finger in its folded-up, inoperative position.
12. As in claim 1 with resilient means for swinging the finger into operative position against one of the legs of

the seated aviator and also with a leg guard movably connected with the seat and arranged, when in its inoperative position, to hold said finger in its folded-up, inoperative position.

13. An aviator ejector of the character described comprising an ejectable seat; a heel plate movably connected with said seat; a restraining finger pivotally connected with said seat on an axis which is inclined upwardly and forwardly; and unlatching means interposed between said heel plate and said restraining finger.

14. As in claim 13 with resilient means for urging said heel plate toward its inoperative, latched position.

15. An aviator ejector of the character described comprising an ejectable seat; a leg guard movably connected with said seat; a restraining finger pivotally connected with said seat on an axis which is inclined upwardly and forwardly; and unlocking means interposed between said leg guard and said restraining finger.

16. As in claim 15 with a heel plate movably connected with the seat and also with unlatching means interposed between said heel plate and said finger.

17. An aviator ejector of the character described comprising an ejectable seat; a leg guard movably connected

with said seat and having an inoperative and an operative position; an arm pivotally connected with said seat and having an inoperative and an operative position; means interposed between said arm and said leg guard whereby said arm is held in its inoperative position as long as said leg guard is in its inoperative position; a trip lever; a latch operatively connected with said trip lever and arranged to hold the arm in its inoperative position even when the leg guard has been moved to its operative position; and a restraining finger movably connected with said arm.

18. As in claim 17 with the restraining finger pivotally connected to the arm on an axis which is inclined upwardly and forwardly.

19. As in claim 17 with resilient means urging the arm toward its operative position.

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