Dec. 15, 1942. F. P. DILLON 2,304,781

AUTOMATIC DIVE BOMBER PILOT'S SEAT

Filed April 11, 1941 3 Sheets-Sheet 1

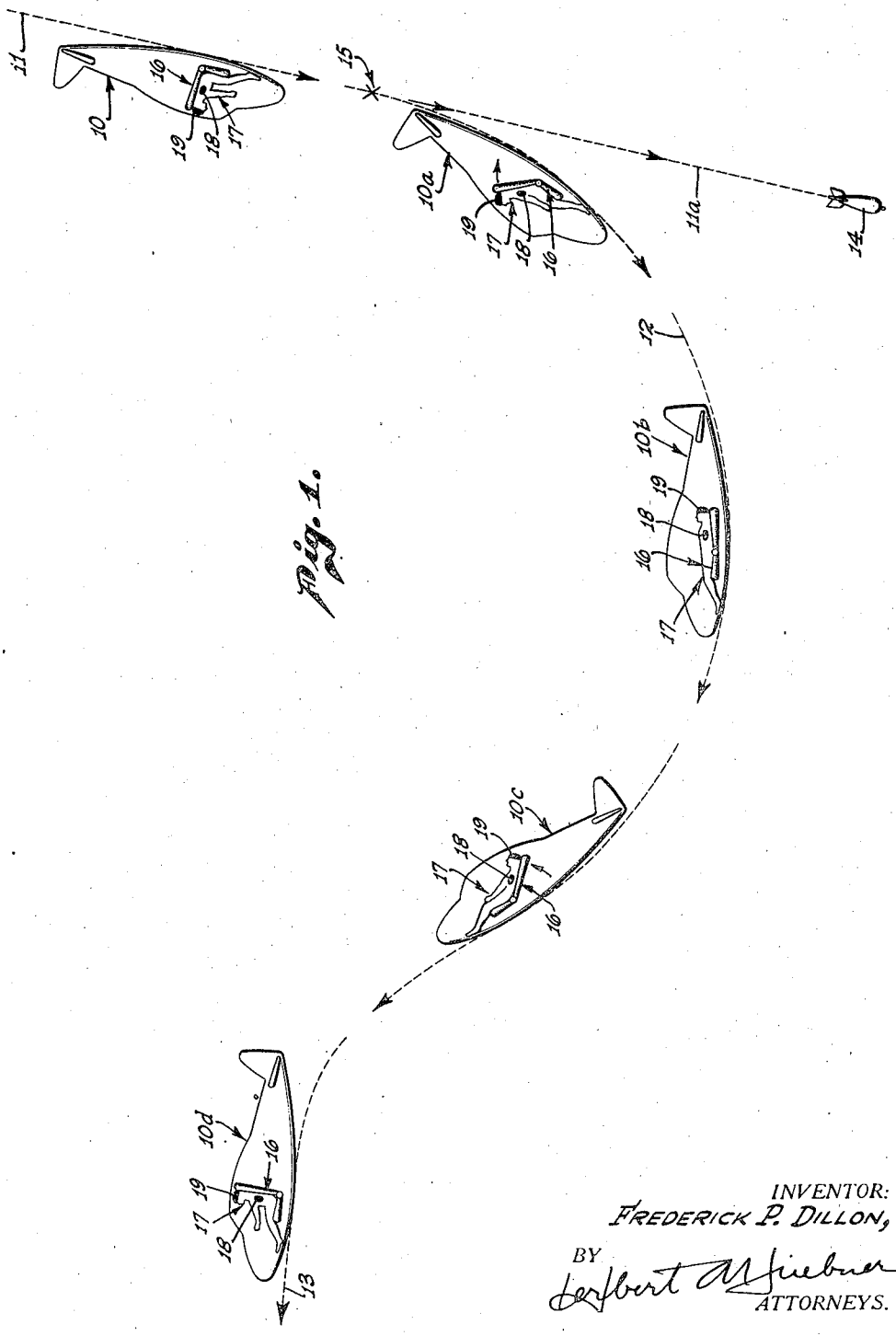

Fig. 1.

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Filed April 11, 1941 3 Sheets-Sheet 2

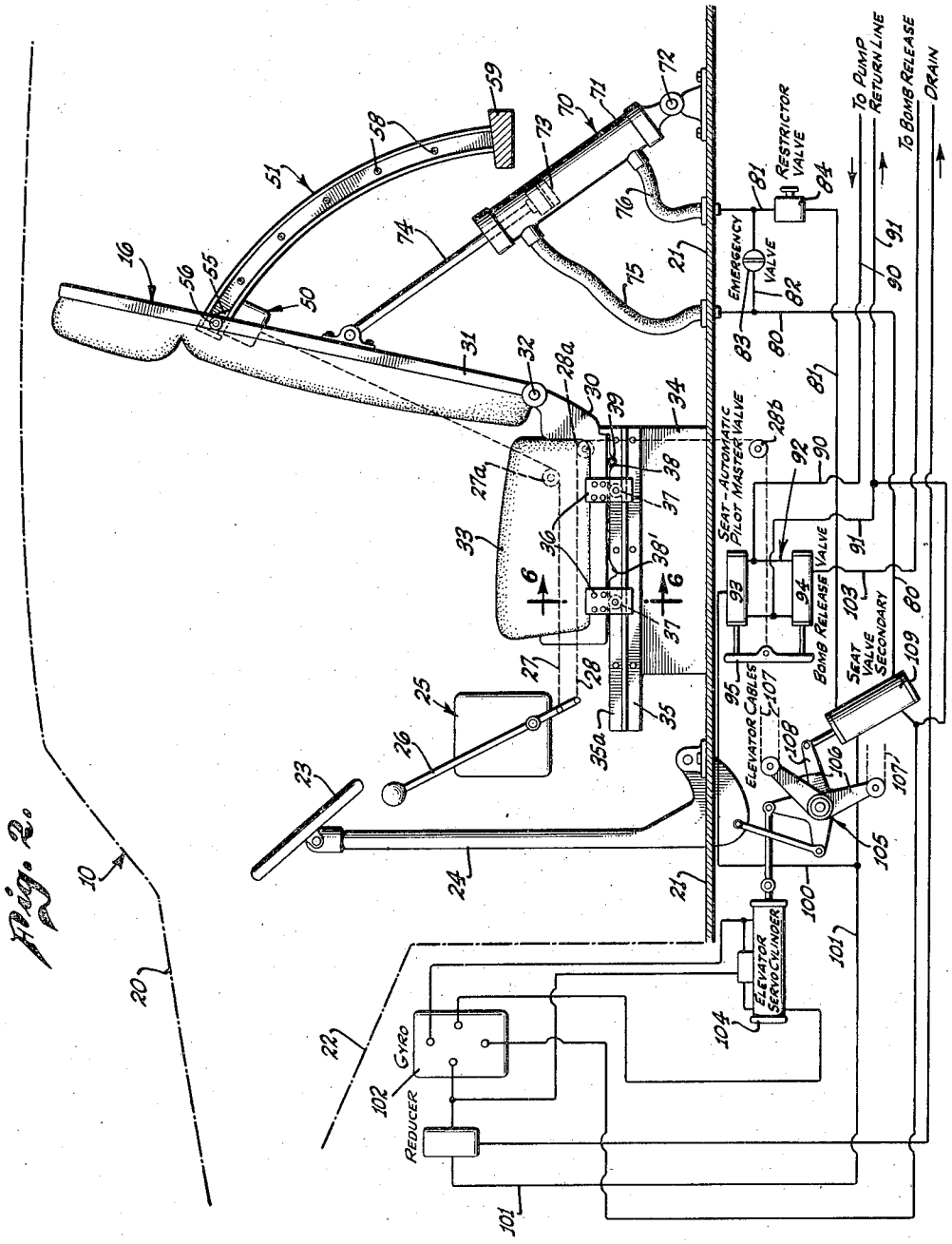

Fig. 2.

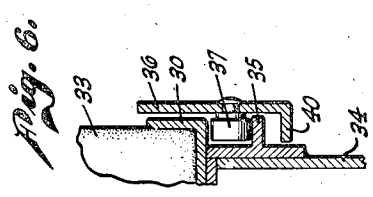

Fig. 6.

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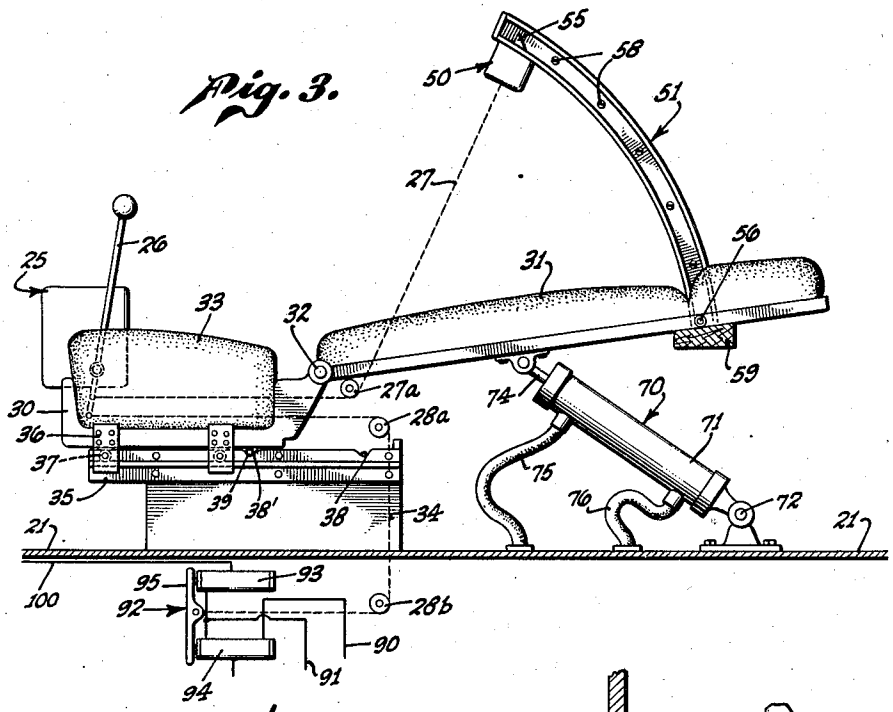
AUTOMATIC DIVE BOMBER PILOT'S SEAT

Filed April 11, 1941 3 Sheets-Sheet 3

Fig. 3.



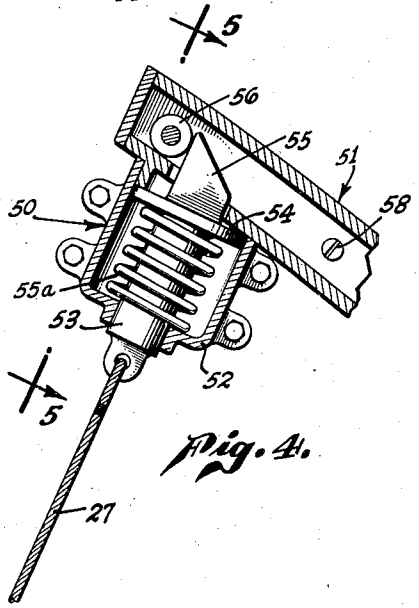


Fig. 4.

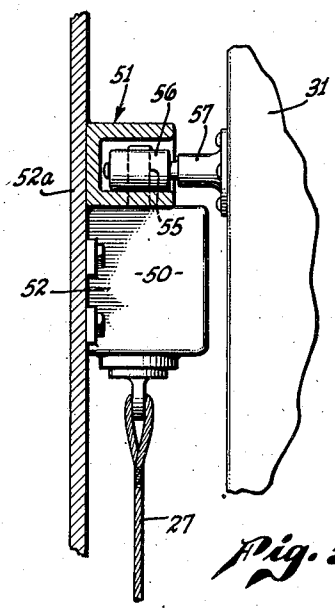


Fig. 5.

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UNITED STATES PATENT OFFICE

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AUTOMATIC DIVE BOMBER PILOT'S SEAT

Frederick P. Dillon, Los Angeles, Calif.

Application April 11, 1941, Serial No. 388,091

6 Claims. (Cl. 244—1)

This invention relates to aircraft and has particular utility in connection with dive bombers. It comprises primarily an automatic dive bomber pilot's seat; and secondarily, a coupling to automatically cut in the gyro (automatic pilot) in connection with the bomb release and operation of the pilot's seat.

In dive bombing tactics the airplane is put into an almost vertical dive which involves speeds of several hundred miles an hour, the bomb is released while in the vertical dive, and the ship is pulled out of the dive in a pullout which normally describes a compound curve at the end of which some of the altitude lost has been regained and the ship leveled off.

A condition known as "black out," in which the pilot frequently loses consciousness, is one of the chief problems encountered in this maneuver. The "black out" is known to be caused by the effect of centrifugal force on the blood stream during the pullout from the dive. In the pullout from the high dive it is known that the centrifugal force often reaches thirteen times gravity (usually expressed as 13G). With possible higher diving speeds this force may be increased still further. The present airplane structures will stand up under forces as high as 15G, but the pilots can endure only about 6G to 8G when in upright position relative to the plane of the earth's surface.

The explanation for the "black out" is that in the present upright position of the pilot the centrifugal force acts substantially parallel to the principal blood vessels, and retards the movement of blood from the heart to the brain. If the pilot is in either a prone or supine position the heart and brain are approximately on the same horizontal plane, and the blood stream continues to flow without material impairment.

Thus, with the pilot sitting in what is normally an upright position with respect to the axis of the airplane he attains a crouching or what amounts to a prone position with his face down during the dive because of the almost vertical direction taken by the airplane In the pullout from the dive, however, the pilot suddenly assumes an upright position with respect to gravity, and although it is sometimes customary for him to turn the control over to a gyro (automatic pilot) after he has released the bomb, the frequently resulting "black out" wherein he becomes dizzy and often completely loses consciousness, is a severe strain on the pilot as well as resulting in subsequent hazards in flight due to the loss of his faculties.

My invention has two principal objects: First, to provide a reclining chair or pilot's seat which is automatically actuated in synchronism with the bomb release mechanism to lower the pilot into a supine position through the pullout from the dive and during the period of greatest centrifugal force, and automatically raise the chair and restore the pilot to his normal upright flying position as the airplane substantially levels off after the pullout, and second, to couple the bomb release mechanism with the automatic pilot control so that synchronously with the release of the bomb or in a properly timed interval thereafter the automatic pilot is brought into use without additional manual effort on the part of the human pilot.

These and other objects of my invention will be made more apparent from a consideration of the entire specification and drawings.

The use of my invention not only spares the pilot from the physical impairment resulting from the effect of a "black out," but removes a psychological hazard in dive bombing by eliminating the mental strain of an anticipated "black out," and consequently improves concentration on the objective.

In the drawings:

Figure 1 is a diagrammatic view illustrating an airplane in flight and the respective positions of the pilot when employing my invention during a dive, the pullout, and the leveling off.

Figure 2 is a vertical elevation partly in section of my invention, illustrating certain conventional elements diagrammatically.

Figure 3 is an elevation showing the pilot's seat with the back dropped.

Figure 4 is an enlarged fragmentary sectional view of a seat lock and release mechanism comprising part of my invention.

Figure 5 is a fragmentary sectional view taken on the line 5—5 of Figure 4.

Figure 6 is a fragmentary sectional view taken on the line 6—6 of Figure 2 illustrating the mounting of the pilot's seat frame.

Referring to Figure 1, an airplane 10 is shown in its various positions relative to the horizon during a dive illustrated by the dotted line 11, the pullout 12, and the leveling off 13. The dotted line 11a represents the path of a bomb 14 which was released at a point designated 15.

The pilot's seat of my invention is illustrated at 16, the human pilot is 17. The relative positions of the heart and brain of the pilot are indicated at 18 and 19 respectively.

With the plane in the position shown for div-

ing, the pilot's seat 16 is in normal position with the pilot sitting upright with respect to the axis of the plane but he is actually in a prone position relative to the plane of the earth's surface. Position 10a of the airplane shows it going into the pullout after releasing the bomb, and the pilot's seat has begun to recline by means of the control mechanism hereinafter described. In position 10b the plane is at the bottom of the curve and the pilot's seat has been completely lowered to place the pilot in a supine position. In position 10c the airplane is climbing, and approaching the leveling off position, and with the resulting decrease in centrifugal force exerted on the pilot the pilot's seat has begun to be elevated. In position 10d the plane is leveling off and the pilot's seat has been returned to normal upright position.

The lowering of the back of the pilot's seat which is shown in progress in position 10a tends to rotate the pilot himself around an axis approximately represented by his pelvis, and in that manner to exert a counter centrifugal force at the beginning of the pullout which to some extent aids the natural pumping action of the heart to send blood into the brain. The elevation of the back of the pilot's seat which is shown in progress at position 10c is preferably so controlled with relation to the flight of the airplane as directed by the automatic pilot that the human pilot in effect remains in a supine position for a substantial part of the climb, giving him ample opportunity to pass through the curve of injurious centrifugal force before being restored to his full upright position which is accomplished substantially, simultaneously with the leveling off of the airplane.

Referring to Figure 2 and subsequent figures, the outline of the upper part of the fuselage of the plane 10 is indicated by the broken lines 20. The floor of the pilot's compartment is shown at 21, and the panel or bulk head at the forward end of the compartment is indicated by the broken lines 22. I show a pilot's wheel 23 on a control stick 24, and a bomb release mechanism 25 including a pivoted lever 26, to the lower end of which are connected cables 27 and 28.

The pilot's chair 16 comprises a seat frame 30 and a back 31 which are hinged together at 32. The back 31 may be upholstered in the conventional manner as illustrated. The seat cushion 33 may be an upholstered cushion but is usually a parachute pack, and is designed to rest in the frame 30. The frame 30 is mounted upon a base 34, the latter being secured to the floor 21. The manner of mounting is as follows: On the base 34 is attached a track 35, this track being in duplicate at opposite sides of the base 34. The frame 30 has attached to its plates 36 upon which are mounted rollers 37 whereby the fore and aft position of the seat frame 30 is made adjustable, the rollers 37 resting upon the tracks 35. Each upper flange 35a of the track 35 is formed with notches 37 and 38, the rear notch 37 preferably having an abrupt drop rearwardly and a more gradual incline forwardly, and the notch 38 having an abrupt drop forwardly and a more inclined wall rearwardly. These notches 37 and 38 are adapted to receive rollers 39 which are mounted on the seat frame 30 whereby the fore or aft position of the seat is yieldably maintained. When the seat slides forwardly from the position shown in Figure 2, the rollers 39 ride up and out of the notches 37, and if the seat is pushed forward far enough the rollers will drop into the notches 38. I may provide an inturned flange 40 along the lower edge of each plate 36, the flange tending to engage with the under side of track 35 and prevent the seat frame from jumping off the track. Any other suitable form of temporary latching arrangement for the fore and aft position of the seat frame may be utilized.

The back 31 of the seat is retained in normal upright position by duplicate latching devices 50 coacting with arcuate tracks 51.

The form of latching device chosen for illustration comprises a housing 52 (see Figures 4 and 5) bolted to any stationary panel or framework 52a mounted within or forming a part of the fuselage of the airplane. Slidably mounted within the housing 52 is a plunger 53 formed with an annular flange 54, and an upwardly projecting latch member 55. A compression spring 55a is disposed in the housing and abuts at one end against the lower end thereof and at its upper end against the flange 54. The latch member 55 is thus normally and yieldably maintained in its upwardly extended position as shown in Figure 4 wherein it engages on its vertical face with a roller or pin 56 secured by means of a bracket 57 to the seat back 31. This roller 56 extends through an opening, as illustrated, into the arcuate track 51, which is preferably U shaped in cross section as shown in Figure 5. It is made in duplicate, each track being mounted on opposite sides of the seat 16, upon the panel or frame 52a by means of screws or bolts 58, and is anchored at its lower end on a cross piece 59 permanently secured in or as a part of the panel or frame 52a. The arcuate tracks 51 act as a support and guide for the seat back 31 when it is raised and lowered.

Assuming the seat back 31 to be in the upright position shown in Figure 2, being retained in that position by the latching devices 50, the seat back may be released for lowering by pulling back on the bomb release lever 26, which pulls cables 27 forwardly, these cables being carried over an idler pulley 27a, and the cables in turn being connected to the plungers 53. Movement of the cables 27 withdraws the latch members 55 against the action of the springs 55a whereby the rollers are freed to roll downwardly in the tracks 51.

The preferred device for lowering and raising the seat back 31 is a hydraulic jack 70, comprising a cylinder 71 swivelly mounted at 72 on the floor 21 and incorporating a piston 73 acting through a connecting rod 74 which is pivotally attached to the seat back 31 to support the seat back in its upright, lower, and intermediate positions. When the seat back is fully lowered as illustrated in Figure 3, it may properly rest upon the cross piece 59.

Flexible hydraulic hose 75 and 76 connect the hydraulic cylinder 71 with the necessary hydraulic lines hereinafter described.

The hydraulic system used for operating the hydraulic jack 70 is illustrated diagrammatically, inasmuch as the conduits, valves, and other parts thereof are of conventional design. The specific details thereof need not be described because modern dive bombers and many other types of airplane utilize various hydraulic controls as standard equipment, and it is only the modifications thereof and the novel combination of certain of the elements which need be described in their relation to the objects to be accomplished by my invention.

A line 80 coupled with the hose 75 supplies pressure for lowering the seat back 31, and a line 81 coupled with the conduit 76 affords pressure for elevating the seat back 31. These two lines are shunted by a line 82 incorporating an emergency valve 83 which should be located within reach of the pilot and is manually operatable to be opened so that the seat back 31 may be raised manually if anything goes wrong with the automatic hydraulic control. In the line 81 I also provide a restrictor valve 84 which is adjustable to control the flow of hydraulic fluid to and from the jack and thus to regulate the speed at which the seat back is raised and lowered.

The primary line from the hydraulic pump (not shown) is designated 90, and the return line 91. These lines connect with a double unit valve 92, one unit 93 of which is the pilot's seat and automatic pilot master valve, and the other of which is the bomb release valve. These valves are simultaneously actuated by a yoke 95 which is shifted by a pull on the cable 28, the latter being attached to the lower end of the bomb release lever 26. The cable 28 is trained over idler pulleys 28*a* and 28*b*. The effect of opening the valve unit 93 is to introduce pressure through lines 100 and 101 to the automatic pilot 102 conventionally referred to as a gyro. At the same instant the valve unit 94 is opened to send pressure through the line 103 to the bomb release mechanism.

The gyro 102 through a conventional elevator "servo" cylinder 104 actuates a bell crank 105, to arms 106 of which elevator cables 107 are attached. The same bell crank through an arm 108 actuates a secondary two-way seat valve 109 to send pressure through the line 80 returning through the line 81 whereby the hydraulic jack 70 operates to lower the seat back 31 into the position shown in Figure 3. The human pilot is thus lowered into supine position where he remains as previously described through the pullout illustrated in Figure 1, until the airplane has passed the lowermost part of the pullout and the force of gravity has begun to lessen on the ascent. As the gyro operates to level off the airplane after the pullout, the secondary seat valve 109 is actuated by the arm 108 of the bell crank 105 to reverse the direction of pressure through the lines 80 and 81 which results in the seat back 31 being elevated into the upright position, at the end of which movement the latch mechanism 50 automatically engages and retains the seat back in its upright position. There is a time lag between the operation of the gyro to lower the elevator for leveling off and the response of the airplane, which results in the back of the pilot's seat beginning to be elevated while the airplane is yet climbing.

It is not necessary that the position of the bomb release lever 26 exert any control over the automatic pilot seat position mechanism after the initial pull-back which throws the yoke 95 of the valve 92. The subsequent control may be entirely automatic, the elevator "servo" cylinder actuating the secondary seat valve 109 to elevate the seat back in response to the action of the gyro in leveling off after the turnout. Or, if desirable, a type of valve may be employed whereby after a time interval allowing for the airplane to pass the point of highest gravity the seat back will be gradually elevated under control of the valve itself until the back has reached its full upright position as the plane levels off into position 10*b*.

Although I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent structures.

While I prefer to mount the bottom frame of the pilot's seat in the manner described, or by equivalent means so that the seat bottom will remain in horizontal position relative to the axis of the fuselage, and I also prefer to provide longitudinal movement of it, this invention is not limited to this detail, nor to any of the other details shown. So far as I am aware, I am the first to conceive and disclose a pilot's seat the back of which can be lowered to place the pilot in a supine position, and means automatically controlling the position of the seat back. This automatic control is not necessarily actuated by the bomb release lever, although in a dive bomber that type of coupling is indicated as preferred. Substantially the same result may be achieved by associating the seat and gyro master valve with any automatic or manual control by which the flight direction is surrendered to the gyro. Moreover, while the hydraulic jack for raising and lowering the seat is the most satisfactory, in my opinion, this function may, within the scope of my invention, be performed by other means, such for example, as an electric motor. Or it may be accomplished by centrifugal force, employing a damping device to prevent the seat from dropping back to quickly. Thus, the seat may be mounted so that upon the latches being released, the thrust of the airplane as its course changes from the dive to the pullout will cause the seat to fall back. I may elevate the seat by a counterbalance on the forward part, or simply by manual means. It may prove feasible to allow the seat to tilt back as a whole, instead of hinging the back and the seat frame. While recognizing these and other possible adaptations of the invention, I have shown and described it in the form I conceive to be most effective, at least in the environment of a dive bomber.

Another important phase of my invention, although not essential, is the setting of the gyro by the action of the bomb release lever. I do not believe that this has ever been proposed before. It enables the pilot to concentrate on the bomb target and to instantly relax upon releasing the bomb.

My invention is obviously not restricted to the particular arrangement of flight controls and bomb release mechanism illustrated. It applies as well to any arrangement of crew accommodations, and by the term pilot's seat I include any seat in the aeroplane, whether occupied by the actual pilot or some other member of the crew. The same automatic controls can be utilized to operate one or any number of seats, and can be as well employed where the flight control and the bomb release mechanism are separately located for use by different members of the crew. In the latter case, the coupling of the seat control and the gyro with the bomb control lever assumes more importance because upon release of the bomb the pullout from the dive should be immediately started, and the pilot's seat lowered. Even without the gyro, some of the advantages of my reclining seat mechanism may be obtained, in that if manual flight control is maintained during the pullout from a dive, the hydraulic jack

may be so adjusted as to lower the seat back to the maximum position at which the pilot can still reach the stick.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a dive bomber, a pilot's seat comprising a back adapted to be positioned in upright or substantially horizontal positions relative to the fuselage, a bomb release mechanism, power means, means operatively connecting said power means to the seat back, and means coupled with the bomb release mechanism controlling the power means to lower the seat back when the bomb release mechanism is operated for discharging the bomb load.

2. In an airplane, a bomb release mechanism, an automatic flight control pilot, and a coupling between the said mechanism and the automatic pilot to actuate the latter upon operation of the said mechanism to discharge the bomb load.

3. In an airplane, a reclinable pilot's seat, a hydraulic jack to raise and lower the seat, manually controlled means to govern the action of the hydraulic jack for lowering the seat, and means actuated by the flight controls of the airplane to govern the action of the hydraulic jack for raising the seat.

4. In an airplane, a reclinable pilot's seat comprising a bottom section mounted in the fuselage for shifting longitudinally thereof and a back hinged to the bottom for swinging up and down, a hydraulic jack to raise and lower the back, the bottom section sliding forward upon the back being lowered and sliding rearwardly upon the back being raised, manually operated means to control the action of the hydraulic jack for lowering the back, and means actuated by the flight controls of the airplane to control the action of the hydraulic jack for raising the seat.

5. In a device of the character described, a reclinable seat, a hydraulic jack to control the position of the seat, an automatic flight control pilot, a manually operated master valve in the line to the hydraulic jack, and a secondary valve in said line operated by the automatic pilot to change the direction of hydraulic pressure in the said jack whereby the seat is raised and lowered.

6. In an airplane, a reclinable seat, means to release the seat so that it can drop back from upright to lowered position when the airplane pulls out from a dive, and means actuated by the elevator controls to raise the seat as the airplane resumes substantially level flight.

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