

F. F. FOOTE.
AEROPLANE.
APPLICATION FILED DEC. 22, 1913.

1,123,720.

Patented Jan. 5, 1915.

4 SHEETS—SHEET 1.

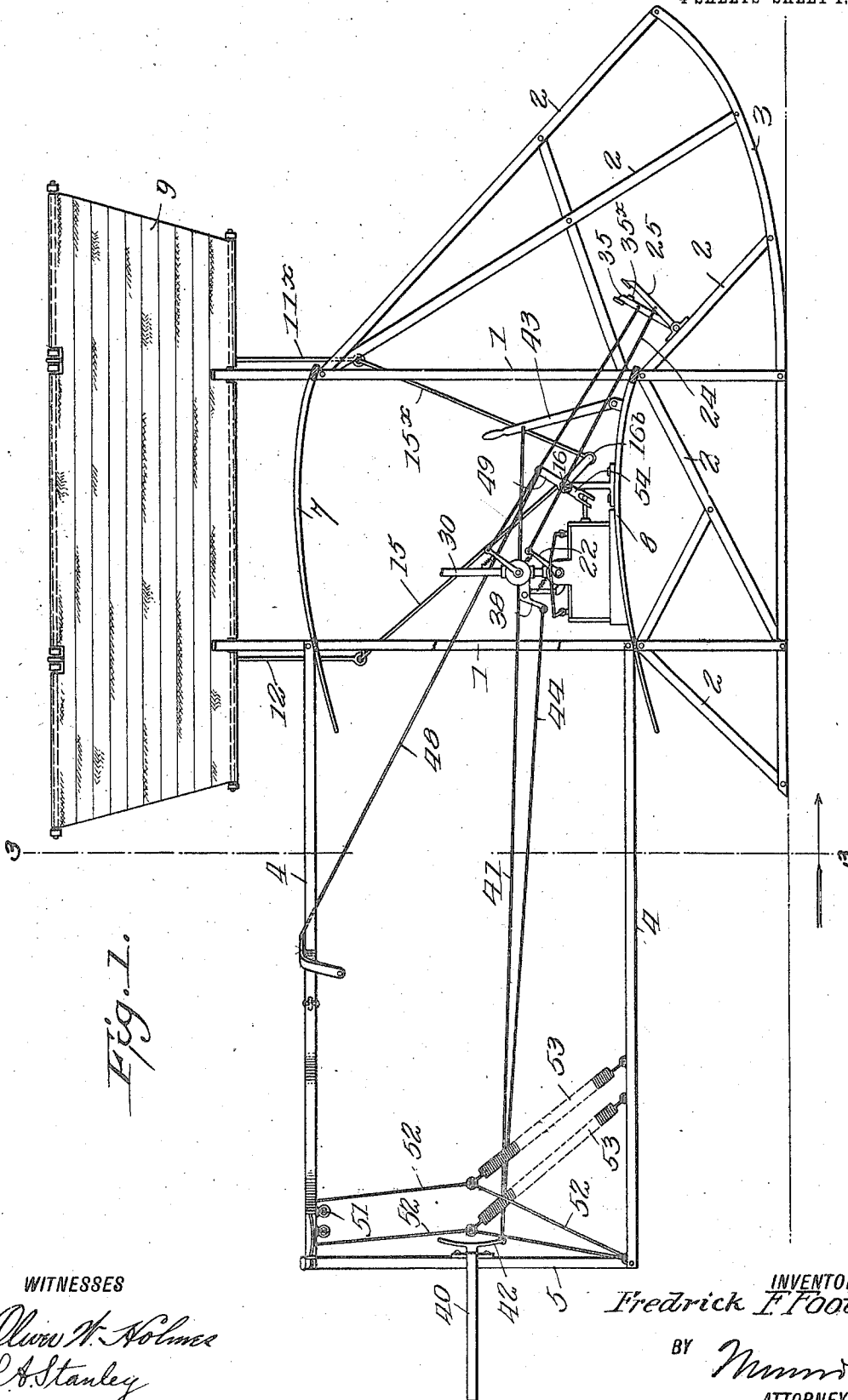


Fig. 1.

WITNESSES

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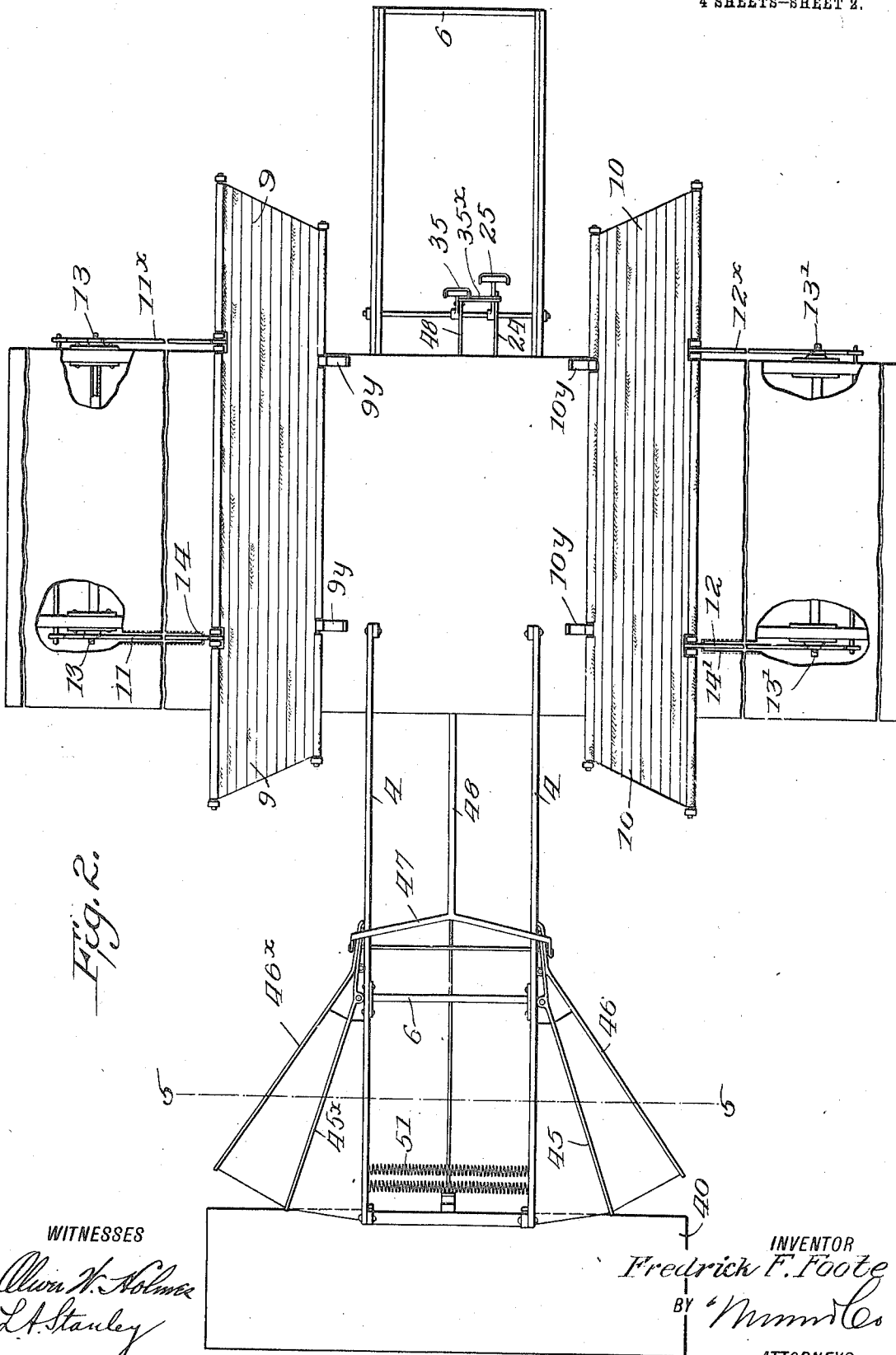
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4 SHEETS—SHEET 2.



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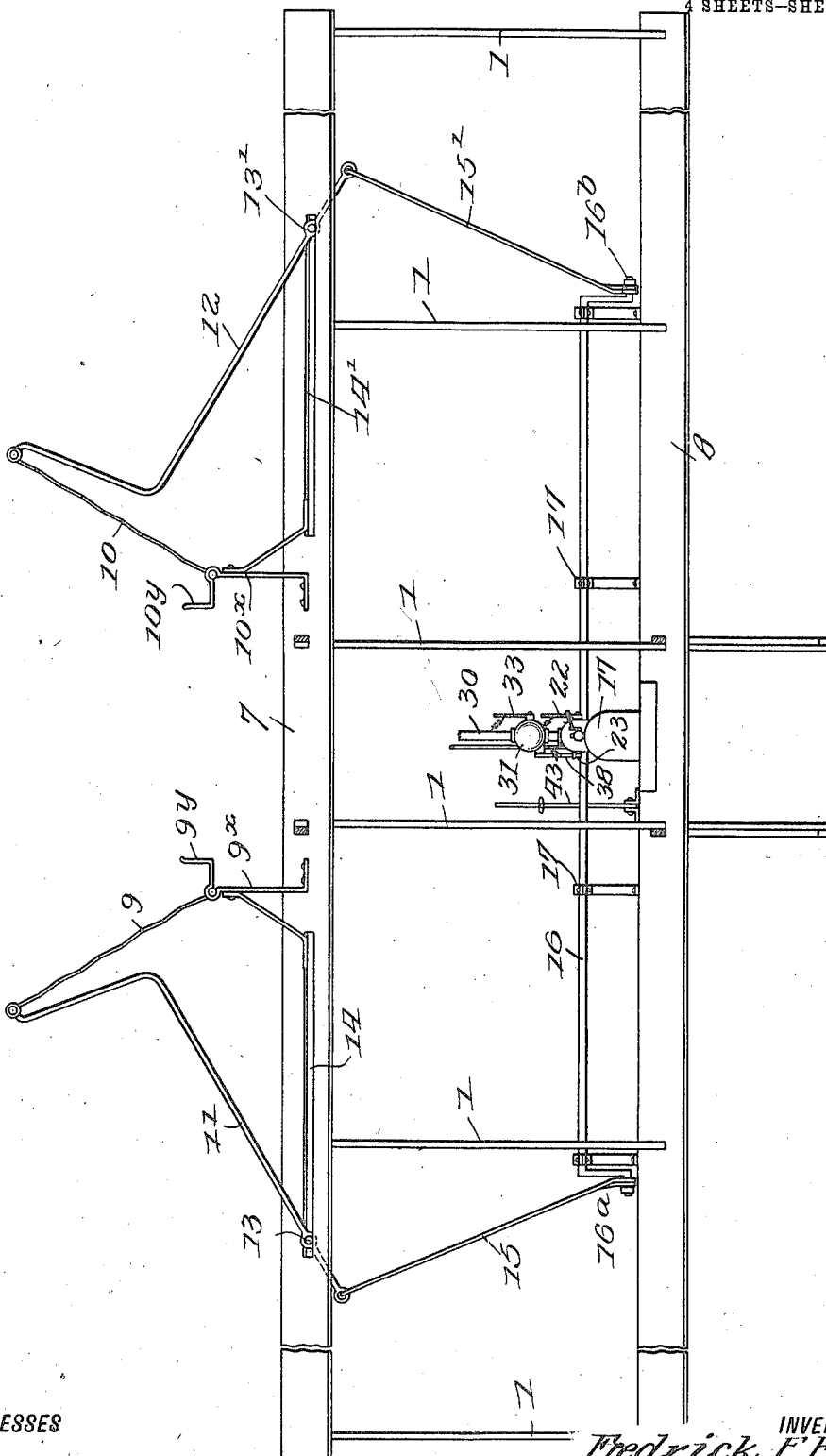
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4 SHEETS-SHEET 3.

Fig. 3.



WITNESSES

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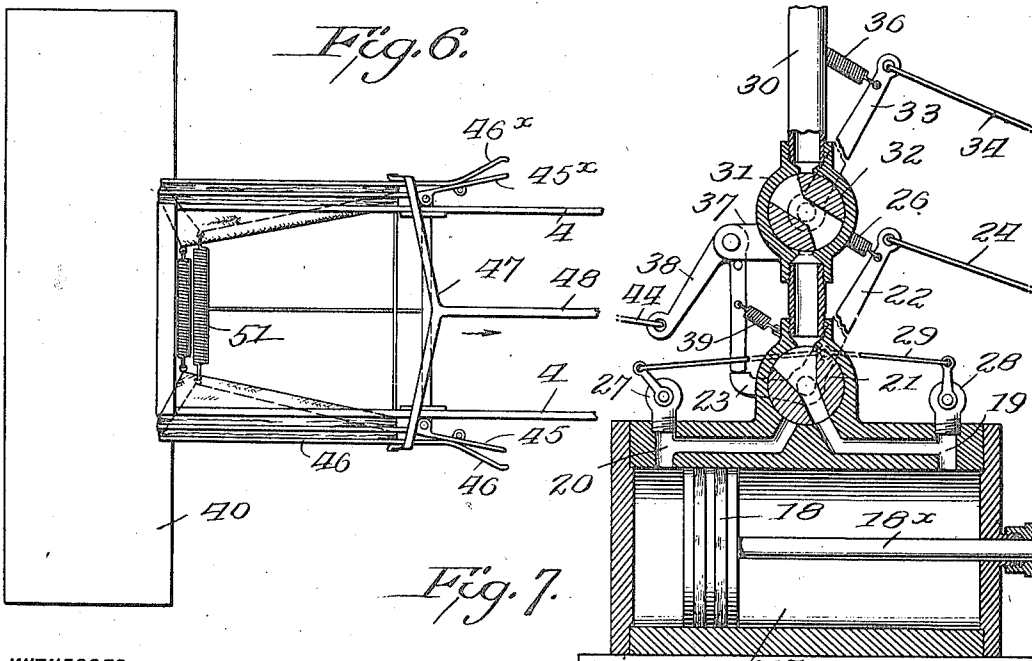
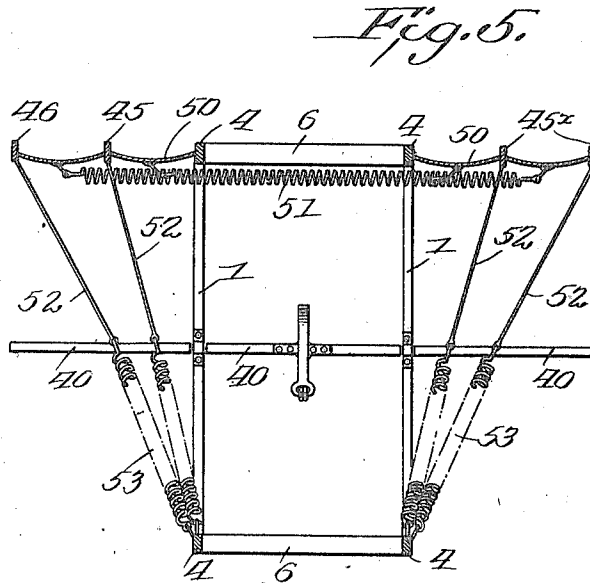
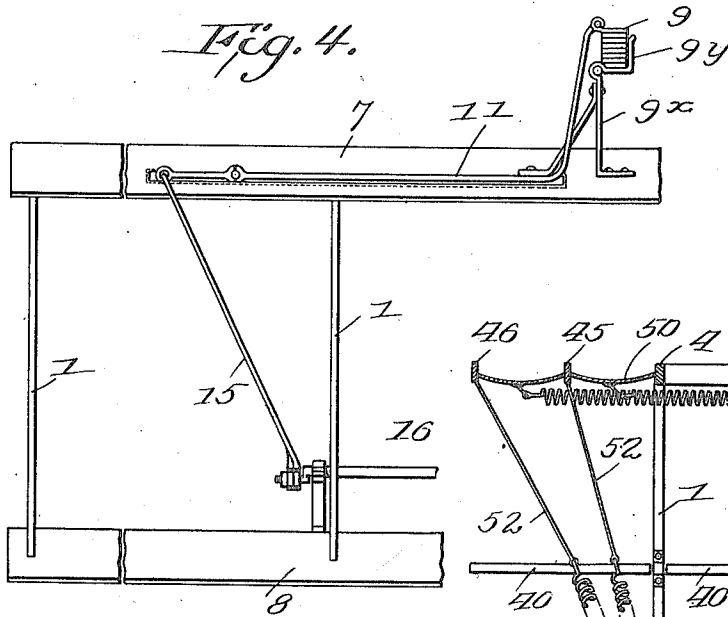
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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

FREDRICK F. FOOTE, OF FALLS CHURCH, VIRGINIA.

AEROPLANE.

1,123,720.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, FREDRICK F. FOOTE, a citizen of the United States, and a resident of Falls Church, in the county of Fairfax and State of Virginia, have made certain new and useful Improvements in Aeroplanes, of which the following is a specification.

My invention relates to improvements in aeroplanes, and it consists in the combinations, constructions, and arrangements hereinafter described and claimed.

An object of my invention is to provide a device having stabilizing means which will prevent the machine from plunging headlong, and by means of which it may be brought to earth on an even balance fore and aft and laterally.

A further object of my invention is to provide a novel form of extensible and collapsible stabilizing planes, and means for manipulating them simultaneously.

A further object of my invention is to provide auxiliary stabilizing planes at the rear of the device which may be extended in a horizontal direction to co-act with the first mentioned stabilizing planes, and the main sustaining plane so as to bring the device to earth by gravity on an even balance.

A further object of my invention is to provide pneumatic means for operating both sets of stabilizing planes with a special device for necessitating the raising of the rear elevating plane before the forward stabilizing planes can be collapsed, thereby preventing any danger of a headlong dive due to the sudden decrease of resistance at the forward end of the machine.

Other objects and advantages will appear in the following specification, and the novel features of the device will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawings forming part of this application, in which similar reference characters indicate like parts in the several views and in which—

Figure 1 is a section through the device with the forward stabilizing planes extended, Fig. 2 is a plan view of the device showing both sets of the stabilizing planes extended, Fig. 3 is a front view, Fig. 4 is a detailed view showing the means for extending and collapsing the forward stabiliz-

ing planes, Fig. 5 is a section along the line 5-5 of Fig. 2, Fig. 6 is a detailed plan view of the rear portion of the machine showing the auxiliary stabilizing planes collapsed, and Fig. 7 is a section through the air cylinder and the valves controlling the cylinder.

In carrying out my invention I may make use of an aeroplane of either the monoplane type or the biplane type. In the drawings I have shown a biplane. This comprises the uprights 1, braces 2, skids or runners 3, rearwardly extending longitudinal members 4, vertically extending rear members 5, and cross members, such as that shown at 6. Carried by the frame is the upper sustaining plane 7 and the lower plane 8. These planes may be made of any suitable material and may be braced in any suitable manner.

Above the upper plane 7 are a pair of extensible and collapsible stabilizing planes 9 and 10 respectively. These stabilizing planes are made of strips of wood covered with flexible material so that they will fold in the manner of a folding fan. The lower edge of each of these stabilizing planes is secured to a bracket such as those shown at 9^a and 10^a in Fig. 3. These brackets have L-shaped extensions 9^b and 10^b respectively, which serve as holding means for the planes when in their collapsed condition, as shown in Fig. 4.

Secured to the upper ends of the stabilizing planes 9 and 10 are levers 11 and 12 respectively. The lever 11 is pivoted at 13 and extends through a slot 14 in the upper sustaining plane 7. One end of the lever 11 is pivotally secured by means of the link 15 to the end 16^a of a crank shaft 16 which is mounted in bearings 17 and which extends transversely of the machine above the lower sustaining plane 8. The lever 12 extends through a slot 14' in the sustaining plane 7 being pivoted at 13' and being provided with a link 15' which is connected to the end 16^b of the crank shaft. As will be seen from Fig. 1, there is a lever 11^a connected with the plane 9 which is similar to the lever 11 but which passes in front of the forward edge of the upper sustaining plane 7, and is connected by means of a link 15^a to the end 16^a of the crank shaft 16. A similar lever 12^a is connected to the forward

portion of the stabilizing plane 10 (see Fig. 2) and has connection with the end 16^b of the crank shaft 16 in a similar manner that the lever 11^{*} is connected with the end 16^a of the crank shaft 16. It will thus be seen that each end of the crank shaft 15 is connected by two levers which operate upon one of the stabilizing planes.

The means for operating the crank shaft is best shown in Fig. 7. It consists of an air cylinder 17 which is provided with a piston 18 and having ports 19 and 20 controlled by a rotary valve 21. The latter has a valve handle or arm 22 having an extension 23. The upper end of this arm is connected by means of a rod or other suitable connection 24 with the foot lever 25. The arm 22 is normally held back by a spring 26 so as to leave the valve 21 in position to communicate with the port 19. At 27 and 28 are outlet valves which are operated by means of a rod 29 secured to the arm 22.

A pipe 30 leads from any suitable source of compressed air carried by the aeroplane (not shown). This pipe communicates with the valve casing 31 having a valve 32 controlled by an arm 33 which is connected by a rod or other suitable connection 34 with a foot lever 35. A spring 36 tends to hold the valve 32 in a normally closed position. A bracket 37 on the valve casing 31 supports a bell crank lever 38, one arm of which is normally held by a spring 39 in the path of the projection 23 on the lever 22.

At the rear end of the aeroplane is an elevating plane 40 which may be manipulated in any suitable manner as by means of a rod 41 attached to a projecting arm 42 at one end, and to a lever 43 at the other end. The arm 42 is connected by means of a rod 44 with the bell crank lever 38 (see Figs. 1 and 7).

Pivotally secured to the rearwardly extending upper horizontal members 4 are the ribs 45 and 45^{*}. The rib 46 is pivotally secured to the rib 45 while the rib 46^{*} is pivotally secured to the rib 45^{*}. The forward ends of the ribs 46 and 46^{*} are curved to provide cam surfaces, and the forward ends of the ribs 45 and 45^{*} are bent outwardly as shown in Fig. 6. A yoke 47 is provided which straddles the two sets of ribs 45-46 and 45^{*}-46^{*}. This yoke is connected by means of a downwardly and forwardly extending rod 48 to an arm 49 which is carried by the crank shaft 16.

The ribs 45 and 46 are connected by fabric 50 so as to form an extensible plane, while a similar fabric 50 connects the ribs 45^{*} and 46^{*}. The planes formed by the extensible fabric members on opposite sides of the center of the machine are connected together by tension members such as the spring 51 so as to hold them normally closed. The ribs are also connected by brace wires

52 with the frame members 4, the springs 53 also being provided for taking up any slack.

From the foregoing description of the various parts of the device the operation thereof may be readily understood.

As stated before, the device is primarily designed for use as an emergency device for enabling the aviator to descend safely to the ground. Normally the front stabilizing planes are collapsed, as shown in Fig. 4, and the rear stabilizing planes are collapsed as shown in Fig. 6. If, however, the aviator should lose control of the machine, and it should tend to plunge downwardly, he presses forwardly on the foot lever 35. Air is admitted through the pipe 30, valve 32, and valve 21, into the port 19, forcing the piston 18 to the rear. The piston rod 18^{*} connects with a rock arm 54 which is secured to the shaft 16. The shaft 16 is therefore rotated from the position shown in Fig. 4 to that shown in Fig. 3. The levers 11 and 12, and their companion levers 11^{*} and 12^{*} are swung on their pivots 13 and 13^{*} thereby extending the stabilizing planes in the manner shown in Fig. 3. It will be seen that these planes are inclined slightly from the vertical. The turning of the crank shaft 16 will cause the rotation of the arm 49 which will cause the yoke 47 to slide along the frame members 4 in the direction shown by the arrow (see Fig. 6). When the ends of the yoke have passed the pivotal connections of the inner ribs 45 and 45^{*} with the frame members 4, the ribs will be swung outwardly from the frame members, and when on further movement the ends of the yoke engage the cam surfaces or bent ends of the ribs 46 and 46^{*}, these ribs will be swung outwardly from their companion ribs 45 and 45^{*}. The result is to suddenly extend the rear auxiliary stabilizing planes in a horizontal direction. With both the front and rear stabilizing planes extended the machine will be kept from plunging, but will descend to the ground on an even keel fore and aft, and if the motor is running, will at the same time move forwardly. With the stabilizing planes extended there is also no possibility of the machine diving laterally, since when the machine tips to one side it will, of course, bring the stabilizing plane on that side with its full surface presented to the resisting air, while the stabilizing plane on the opposite side will, of course, be brought into a more nearly vertical position. This will quickly right the machine so that the machine will come down on an even keel laterally as well as fore and aft, being balanced by gravity.

The stabilizing planes may be "reefed" or collapsed while the machine is in the air. It is dangerous to do this, however, unless the elevating plane is first raised, as for ascent, since if the forward stabiliz-

ing planes should be suddenly collapsed, the withdrawal of the air-resisting surfaces might cause the machine to dive forwardly. In order to prevent an accident of this kind I provide the bell crank lever 38 which, as stated above, is in the path of the projection 23 of the lever 22 and which prevents the movement of the lever. When the lever 43 is manipulated to raise the elevating plane 40, as for ascending, the movement of the latter will cause the rod 44 to shift the bell crank lever 38 so as to permit the movement of the lever 22. The shifting of the lever 22 is accomplished either by a continued movement of the foot lever 35, in which case a projection 35* on the lever 35 comes into contact with the lever 25, or by direct pressure on the foot lever 25. This will reverse the direction of flow of the air which will now enter through the port 20 and thus force the piston 18 in the opposite direction, the valve 28 being open to permit the exit of air on one side of the piston, and the valve 27 being closed by the member 29. The reverse movement of the piston rod 18* will again bring the crank shaft into the positions shown in Fig. 4, and will thus collapse the front stabilizing planes. At the same time the rearward movement of the rod 48 is occasioned by the swinging of the arm 49 and the yoke 47 will resume its original position (shown in Fig. 6) thereby closing the rear auxiliary stabilizing planes, this action also being aided by means of the tension members 51.

I desire to call particular attention to the fact that the stabilizing of the machine so as to bring it to earth on an even keel fore and aft and laterally is effected solely by gravity in conjunction with the main sustaining planes which coacts with both the front and rear stabilizing planes.

In considering the ways in which a machine might fall, it may be stated that certain machines such as the Farman machine have a slightly lifting rear surface, and it depends on speed to balance it fore and aft. If the collapsible rear auxiliary stabilizing plane is put on such a machine this lifting effect would have to be increased a little bit to give more lift when the stabilizing plane is reefed. If a machine should start to fall backward the rear surface would be expanded offering more resistance to the air when the machine falls backwardly than when it is proceeding in a forward direction. This together with the main planes and the backward stabilizing planes restores the balance by the action of gravity fore and aft and laterally. Furthermore the head resistance of the forward stabilizing planes overcomes the small lift of the rear plane on a machine such as the Farman machine, in a dive, so that a ma-

chine of this type equipped with my flexible rear stabilizing planes would not offer excessive hindrance or resistance to the head resistance of the forward stabilizers which will bring the machine down on an even balance. Thus, it will be seen that no matter whether the machine is diving forward or backward, a device equipped with stabilizing planes such as herein described will be brought to earth by gravity on an even keel fore and aft and laterally. I am aware that other forms of the device based upon the same general idea might be made, but I consider as my own all such modifications as fairly fall within the spirit and the scope of the invention.

I claim:

1. The combination with an aeroplane having a main supporting plane, of a pair of collapsible stabilizing planes disposed above said main sustaining plane and each comprising members, adapted to fold one upon the other, supports to which the lower members are secured, and means connected with the upper members for extending said stabilizing planes simultaneously.

2. The combination with an aeroplane having a main supporting plane, of a pair of collapsible stabilizing planes disposed above said main sustaining plane, and each comprising a plurality of members flexibly connected together and adapted to fold one upon the other, supporting means carried by the main supporting plane to which the lower members of the stabilizing planes are secured, and means connected with the upper members of the stabilizing planes for extending said stabilizing planes simultaneously and maintaining them in a position inclined at an angle toward the perpendicular.

3. The combination with an aeroplane having a main supporting plane, of a pair of collapsible stabilizing planes disposed above said main sustaining plane and each comprising a plurality of longitudinal members, flexibly connected together and adapted to fold one upon the other, and means for extending said stabilizing planes simultaneously and maintaining them in a position inclined at an angle toward the perpendicular, the said stabilizing planes inclining downwardly and inwardly toward each other.

4. The combination with an aeroplane having a frame, and a main sustaining plane extending transversely of said frame, of a pair of collapsible stabilizing planes disposed above said main sustaining plane and longitudinally of said frame, the said stabilizing planes each comprising members adapted to fold one upon the other, supports to which the lower members of said stabilizing planes are secured, a crank shaft, means for turning said crank shaft, and

connections between the said crank shaft and the upper members of said stabilizing planes for extending said planes simultaneously, and for collapsing them simultaneously.

5. The combination with an aeroplane having a main supporting plane, of a pair of collapsible stabilizing planes disposed above said supporting plane and secured at their lower edges, levers connected with the upper edges of said stabilizing planes, a crank shaft, links connecting said levers with said crank shaft, and pneumatic means for rotating said shaft to extend said stabilizing planes simultaneously and to collapse them simultaneously.

6. The combination with an aeroplane having a frame and a main supporting plane carried thereby, of a shaft disposed beneath said main supporting plane, pneumatic means for rotating said shaft, a pair of stabilizing planes carried by said frame above said main sustaining frame, levers pivotally connected to said frame, said levers being connected to said stabilizing planes, and means connected with said shaft for operating said levers to extend or collapse said stabilizing planes.

7. The combination with an aeroplane having a main supporting plane, of a pair of collapsible stabilizing planes disposed above said main sustaining plane, means for extending said stabilizing planes and for maintaining the latter at an angle to the vertical, collapsible auxiliary stabilizing planes disposed in the rear of said main supporting plane, and means for simultaneously extending said auxiliary collapsible stabilizing planes in a horizontal direction, and for maintaining them in their extended position.

8. In an aeroplane, a pair of frame members, a rib pivoted to each of said frame members and having an extension, a second rib pivoted to the extension of the first named rib, and a yoke arranged to straddle both frame members and to engage the second named ribs.

9. In an aeroplane, a pair of frame members, a rib pivoted to each of said frame members and having an extension, a second rib pivoted to the extension of the first named rib and having a cam surface, a slidable yoke arranged to straddle both frame members and to engage the second named ribs, and means for moving said yoke to

engage said cam surfaces thereby causing the spreading of the ribs.

10. The combination with an aeroplane having a main frame and a main supporting plane, of collapsible stabilizing planes disposed above said main supporting plane, means for simultaneously collapsing the stabilizing planes, a rear elevating plane, means for raising the said elevating plane, and means for preventing the collapsing of the stabilizing planes until the elevating plane has been raised.

11. The combination with an aeroplane having a main frame and a main supporting plane, of a pair of collapsible stabilizing planes disposed above said main sustaining plane, a pair of collapsible auxiliary stabilizing planes disposed in the rear of said main supporting plane, means for simultaneously collapsing both sets of said collapsible stabilizing planes, a rear elevating plane, and means for preventing the collapsing of the stabilizing planes until the elevating plane has been lifted as for ascent.

12. The combination with an aeroplane having a main supporting plane, of a pair of collapsible stabilizing planes disposed above said main supporting plane, the said planes being secured at their lower edges and means connected with the upper edges of the said planes for extending said planes simultaneously.

13. The combination with an aeroplane having a main supporting plane, of a pair of collapsible stabilizing planes disposed above said main supporting plane, brackets carried by the main supporting plane and adapted to hold the said stabilizing planes when collapsed, the lower edges of said stabilizing planes being secured to said brackets, levers connected with the stabilizing planes, and means for operating said levers to extend or collapse said planes.

14. The combination with an aeroplane having a main supporting plane, of collapsible stabilizing planes, pneumatic means for extending said stabilizing planes simultaneously and for collapsing them simultaneously, a reversing lever for said pneumatic means, an elevating plane, and a stop for said reversing lever controlled by the movement of the elevating plane.

FREDRICK F. FOOTE.

Witnesses:

H. E. BROWN,
J. G. ADAMS.