A. E. LYCAN.

AEROPLANE.

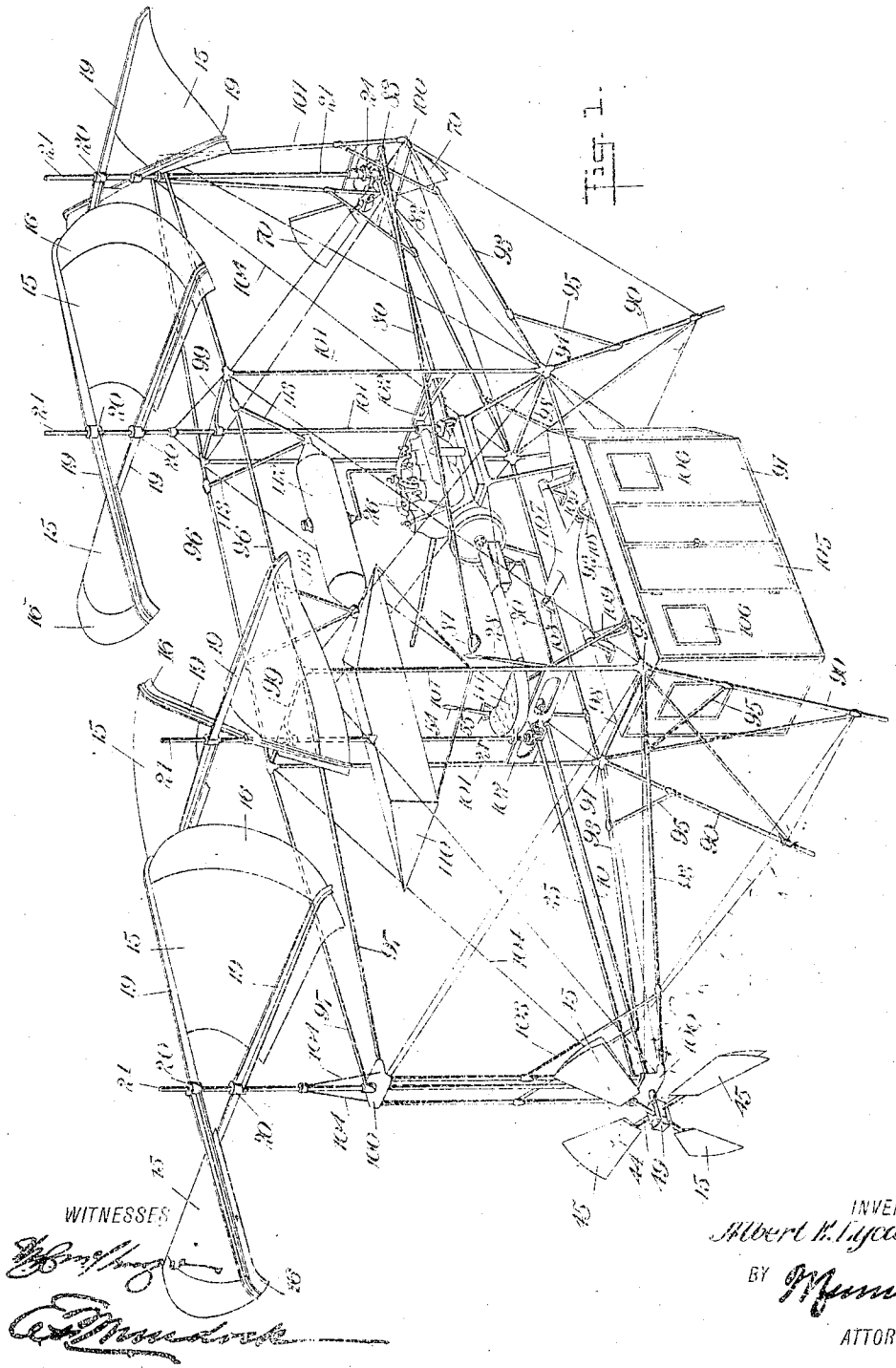
APPLICATION FILED APR. 20, 1911.

1,015,200.

Patented Jan. 16, 1912.

4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

INVENTOR

Albert E. Lycan

BY Munn & Co

ATTORNEYS

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4 SHEETS—SHEET 2.

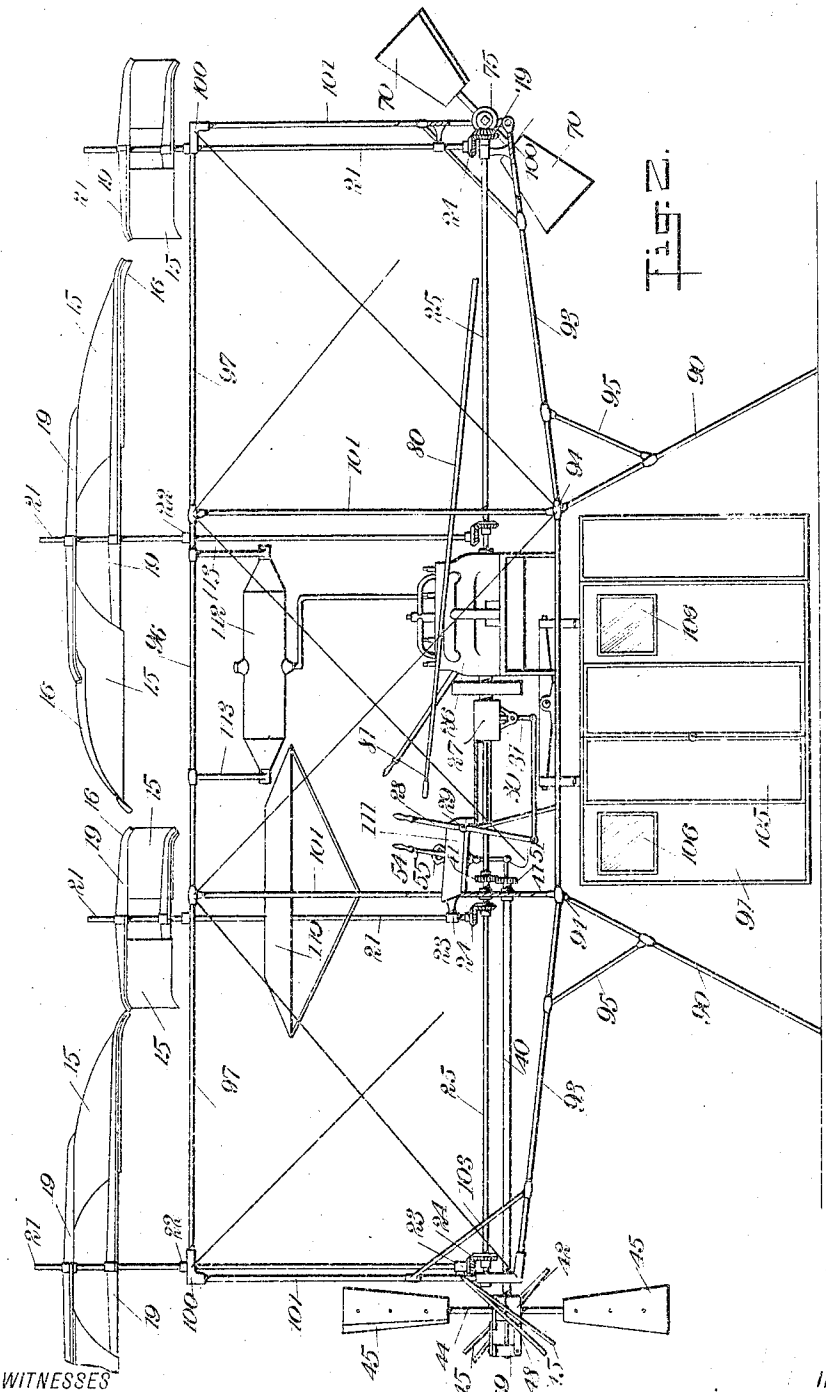

Fig. 2.

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4 SHEETS—SHEET 3.

Fig. 6.

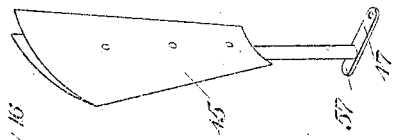


Fig. 8.

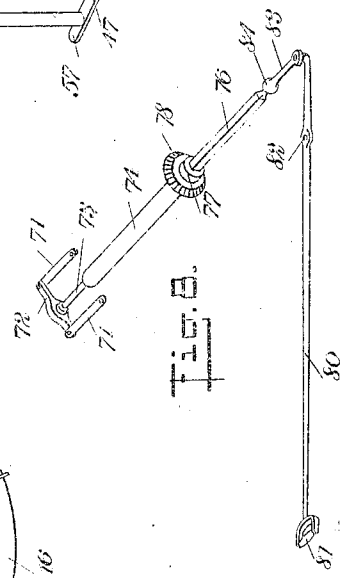


Fig. 4.

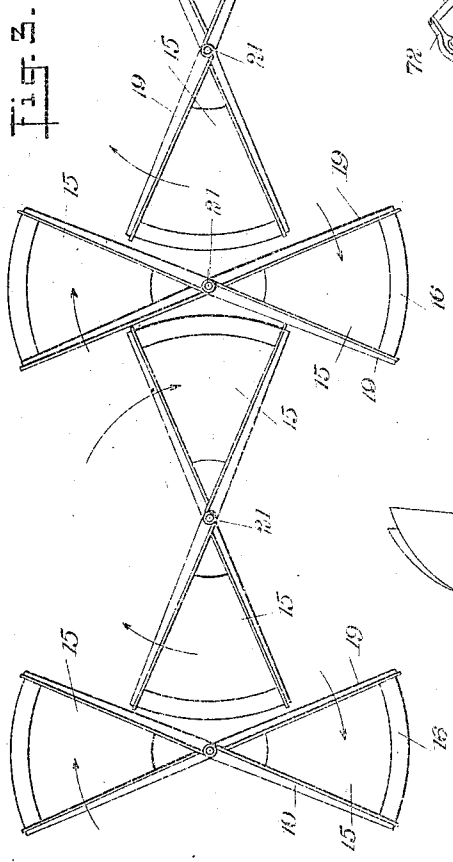


Fig. 5.

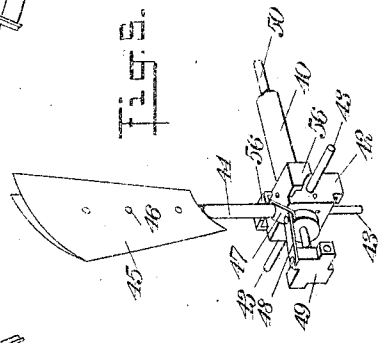
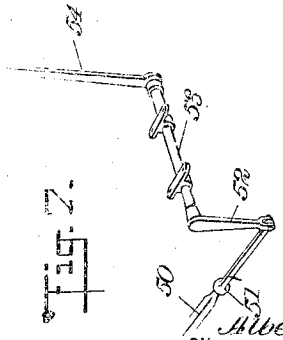


Fig. 7.



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4 SHEETS—SHEET 4.

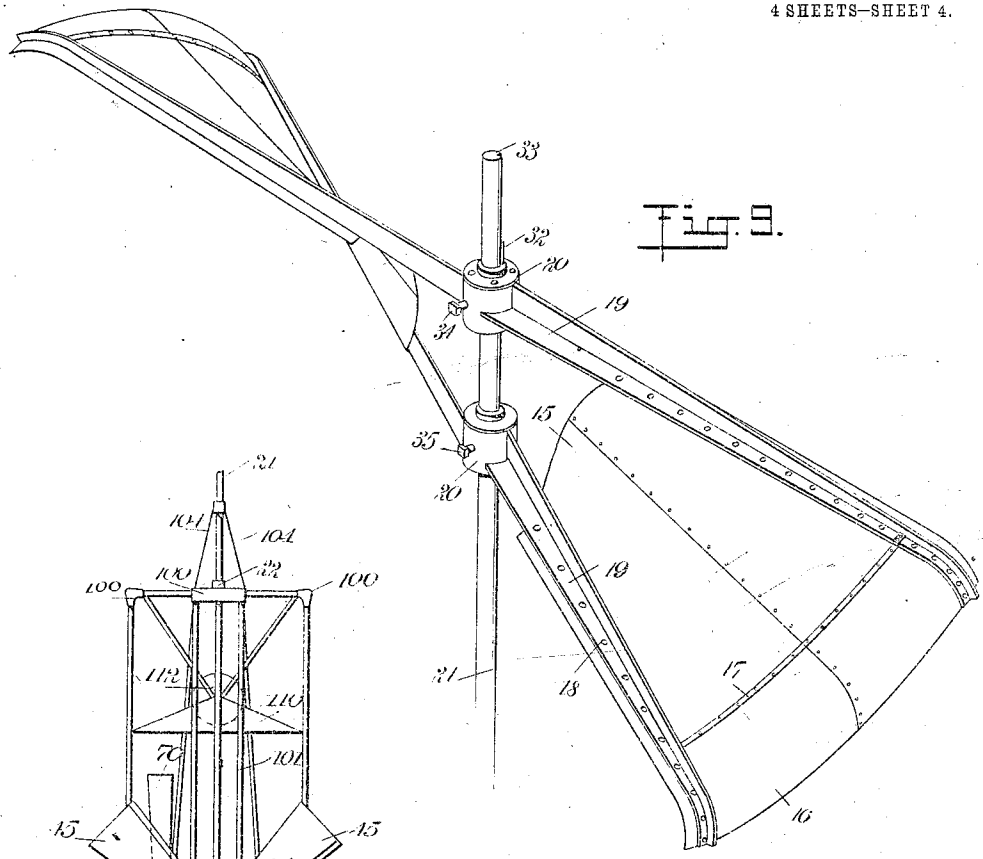


Fig. 9.

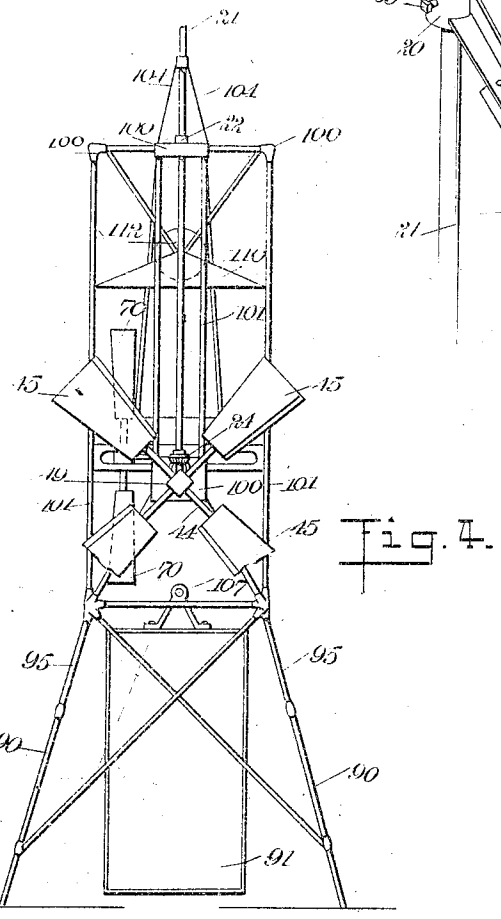
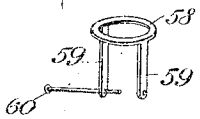


Fig. 4.

Fig. 10.



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INVENTOR

Albert E. Lycan

BY Munn & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

ALBERT E. LYCAN, OF TAHOE, IDAHO.

AEROPLANE.

1,015,200. Specification of Letters Patent. Patented Jan. 16, 1912.

Application filed April 29, 1911. Serial No. 624,002.

To all whom it may concern:

Be it known that I, ALBERT E. LYCAN, a citizen of the United States, and a resident of Tahoe, in the county and State of Idaho, have invented a new and Improved Aeroplane, of which the following is a full, clear, and exact description.

Among the principal objects which the present invention has in view are: to provide an aeroplane in which the planes are rotated in a manner similar to vertical lifting propellers whereby the machine may be lifted from the ground without a preliminary run thereon; to provide a propelling mechanism constructed and arranged to produce a reversing action on the machine without reversing the driving shaft; to provide a steering mechanism embodying a propeller and rotary mechanism therefor adapted to move the head of the machine transversely to the line of flight; to provide a ballasting device adapted to permit a flexibility in the frame and driving mechanism of the machine and to right the same after any variation from the vertical disposition thereof; to provide levitating devices and a driving mechanism therefor adapted for control by varying the effective speed thereof; and to generally provide a carrying frame constructed and arranged to secure lightness, strength and durability.

One embodiment of the present invention is disclosed in the structure illustrated in the accompanying drawings, in which like characters of reference denote corresponding parts in all the views, and in which—

Figure 1 is a perspective view of an aeroplane constructed and arranged in accordance with the present invention; Fig. 2 is a side elevation of the same; Fig. 3 is a disconnected view in plan showing the construction and arrangement of the levitating planes; Fig. 4 is a rear elevation of an aeroplane constructed and arranged in accordance with the present invention, a portion of certain of the propeller blades being cut away to show the construction of the frame in this position; Fig. 5 is a detail view, on an enlarged scale, of the rear end of the propeller shaft and one of the propeller blades shown in conjunction therewith, the remaining propeller blades being removed; Fig. 6 is a detail view, on an enlarged scale and in perspective, of a propeller blade; Fig. 7 is a detail view in perspective of the lever for controlling the driving propeller; Fig. 8 is a detail view in perspective of the controlling mechanism for the steering propeller; Fig. 9 is a detail view in perspective of two of the rotary planes employed in a construction embodying the present invention; and Fig. 10 is a detail view of a safety ring for the propeller blades.

To facilitate the description of the invention the instrumentalities have been grouped and will be so described. The first group consists of the instrumentalities forming the rotary levitating planes and the driving mechanism therefor; the second group consists of the driving propeller and controlling mechanism therefor; the third group consists of the steering propeller and operating mechanism therefor; and the fourth group consist of the carrying frame and ballast supported thereon.

The levitating planes.—As shown in the accompanying drawings there is employed in the construction embodying the present invention, in lieu of the inclined planes usually employed in machines of this character, a series of rotary planes, the angle of incidence whereof may be varied and the rate of speed whereof controls the levitating power produced by the said planes. The planes 15 are preferably shaped as best seen in Fig. 9 of the drawings, and are constructed from any suitable material, such as aluminum. The sheets comprising the planes 15 are molded to form a dip portion 16 at the outer edge. At suitable location lengthwise of the planes are mounted reinforcing strips 17. When using metal for forming the planes 15 the said planes are secured by means of rivets 18 to the spoke arms 19. The arms 19 are radiated from hubs 20. It will be understood that as the hubs 20 are moved to and from each other the angle of incidence of the planes 15 is varied to a less or greater degree. The hubs 20 are pierced to pass one of the shafts 21. In the construction of the machine shown in the accompanying drawings there are four shafts 21. It will be understood that the number of shafts employed may be augmented or decreased to suit the design and purpose of the constructor. Each of the shafts 21 is suitably mounted in bearings 22 fixedly mounted in the carrying frame and disposed lengthwise of the machine on the longitudinal median line thereof. The lower end of the shafts is properly stepped in the

bracket bearings 23, and each shaft is provided below the said bearing with a bevel gear wheel 24. The gear wheels 24 are properly mated with gear wheels on the driving shaft 25. The shaft 25 is suitably connected with a motor 26 and gear casing 27, a variable speed gear therefor being interposed between the crank shaft of the said motor and the shaft 25, as best seen in Fig. 2 of the drawings.

Disposed in suitable adjacency to the aviator's chair is a hand lever 28. The lever 28 is pivoted at 29 and connected at the lower end thereof by means of a connecting rod 30 with the lever 31 for shifting the speed gears connecting the crank shaft of the motor 26 and the driving shaft 25. It will be understood that in the operation of the present machine the levitation of the planes 15 is dependent on the speed at which they are gyrated. The speed of the shaft 25, and incidentally the speed of the shafts 21 connected therewith and the planes 15, is controlled, at will, by the aviator moving the lever 28, much in the manner as now employed in changing the speed gears of an automobile. Thus, when in the operation of the machine, when the same has been levitated to the proper height, the aviator, by moving the lever 28 may slow the speed of the shafts 21 until the planes 15 maintain at a fixed height the elevation of the machine.

As shown best in Fig. 9 of the drawings, the uppermost of the hubs 20 is secured to the shafts 21 by a feather or spline 32, which spline slides in a groove 33 formed in the shaft 21. It is preferred to set the hub 20 rigidly in position on the shaft 21 when the proper adjustment has been secured, using for that purpose a set screw 34. Any suitable method for securing in fixed position the hub 20 may be employed. As shown in the drawings the hub is held by a set screw 35. It will be understood that the adjustment of the arms 19 and hubs 20 on the shafts 21 is preliminary to the operation of the shafts for flight. It will be understood that after the flight has commenced the variation in the force of the operation of the planes 15 is solely dependent on the rate of speed imparted thereto by the shafts 21 and 25.

The adjustment of the planes 15 whereby the angle of incidence is varied is advantageous in that weather conditions which are at times prohibitive to flight, may in this manner be accommodated. As for instance, if intending to fly, any storm or gust within the angle of incidence imparted to the planes 15 can be reduced to minimize the dangerous conditions; while on the other hand, should the weather be such as to require that the gripping of the planes be at the maximum, the angle of incidence of the said planes may be so adjusted as to accommodate this condition.

If cloth or similar material is employed instead of metal sheets, as shown in Fig. 9 of the drawings, it will be understood that the planes will not be molded, as shown in the drawings. The molding of the planes is considered as a decided advantage, the grip of the air being materially increased thereby. In all forms of material, however, it is desired that the planes shall be arranged to produce the downwardly dip portion 16. The air when moved by planes of the character described is moved radially from approximately the center of gyration and is delivered from the planes 15 outward therefrom. In passing from the said planes over the dip portion 16 a slight upward impulse is imparted to the planes.

The driving propeller.—Having above described the method of lifting the machine from the ground, I will now proceed to describe the method of propelling the same in the line of flight. For this purpose, primarily, there is provided the driving propeller, which is preferably mounted at the stern end of the machine upon the driving shaft 40. The shaft 40 is tubular in form, and is connected with the shaft 25 through the transmission gear wheels 41. At the outer end the shaft 40 is provided with a head block 42, as best seen in Fig. 6 of the drawings. The head block 42 is preferably rectangular in form, and is provided with pintles 43 extended radially therefrom. The pintles 43 are designed to extend within and form a bearing for the hollow tubular shafts 44, upon which are mounted the propeller blades 45. The blades 45 are constructed as best seen in Figs. 5 and 6 from two sheets of suitable metal converged at the forward edge and flared to the rear to form a wedge-shape in cross section. The purpose in the construction is to avoid suction at the back of the propellers to a large degree, and to provide a construction where the grip of the propeller on the air will be more quickly felt when turned from the neutral position in either direction. The blades thus constructed are secured by means of rivets 46 to the shafts 44.

The construction employing the tubular shafts 44 and the pintles 43 provides for rotating the shaft 44 and the blade 45 connected therewith. For this purpose the shaft 44 is provided with a crank arm 47 fixedly mounted upon the said shaft 44 and extended therefrom. The arm 47 is connected by means of the link 48 with the head 49. The head 49 is fixedly mounted on the end of a rod 50. The rod 50 is extended through the tubular shaft 40, and is connected by means of a ball and socket joint 51 to the lever arm 52 rigidly extended from the pivot shaft 53. The pivot shaft 53

is rigidly connected with the lever 54. The lever 54 is conveniently located adjacent the aviator's chair, and preferably on the opposite side thereof to that where is mounted the lever 28. It will be seen that as the lever 54 is moved back and forth the rod 50 is moved within the shaft 40, and the head 49 is caused to separate from or approach the block 42, rocking the shafts 44 to and from the neutral position thereof. When the blades 45 are properly adjusted the same are locked in position by any suitable form of detent mounted on the levers 54, locking upon the quadrant 55.

It is to prevent the centrifugal disadjustment of the shafts 44 and blades 45 that there are provided the overhanging frames 56, under which the ends 57 of the arms 47 at all times extend. The frames 56 aid in supporting by forming a foot for the shafts 44 to resist the strain on the blades 45.

It is to provide against the accident of the blades 45 flying from off the pintles 43 that I have provided the safety rings 58. The rings 58 are connected with the arms 59, the lower ends whereof are pierced to receive pins 60 which are driven through perforations properly provided in the block 42 to lock the rings 58 and arms 59 connected therewith in position in the said blocks.

It will be understood that within the scope of the operation of the blades 45 the lever 54 may be moved to rock the shaft 44 to present either side of the blade 45 as the operating side of the propeller, thus reversing the action of the propeller of the machine. Thus it is within the capacity of the present machine to govern the speed of propulsion thereof; to arrest the machine in its horizontal flight; or to reverse the horizontal flight; and this without disturbing the operation of the planes 15 to maintain the levitated position of the machine.

The steering mechanism.—In the present machine the usual rudder for varying the horizontal line of travel, or the inclined line of travel, is dispensed with, and instead thereof is provided a propeller disposed at the forward end of the machine, mounted to operate in a line perpendicular to the longitudinal center of the machine. The propeller utilized as a steering device is preferably provided with two blades 70. It will be understood that if more blades are desired they may be employed without altering the scope or purpose of the present invention. The blades 70 are to all intents and purposes identical in construction to the blades 45. The links 48 are in this construction substituted by the links 71, as seen in Fig. 8 of the drawings, and the head 49 is substituted by the cross head 72, which is rigidly mounted on the end of the rod 73. The rod 73 is, in this construction, extended through a short tubular shaft 74, which shaft is mounted in suitable bearings 75 provided in the frame of the machine. The rod 73 is provided with a squared extension 76. A cap 77 is provided on the shaft 74 to guide the said squared extension 76 and to mount the bevel gear wheel 78. The gear wheel 78 is meshed with a double faced bevel gear wheel 79, which is fixedly mounted on the forward end of the shaft 25, and with the back face whereof the bevel gear wheel 24 of the forward shaft 21 is meshed.

To control the disposition of the blades 70 there is provided a steering lever 80, the handle 81 whereof is disposed adjacent the aviator's chair. The lever 80 is pivoted at 82 upon the frame of the machine, and the short arm of the said lever is pivotally connected with the link 83. At the end of the link 83 removed from the short arm of the lever 80 it is provided with a socket 84 to holdingly receive a pawl formed on the end of the extension 76. This construction forms a resilient connection between the lever 80 and the rotary shaft 74. It will be understood that when the aviator moves the lever 80 to the right or left the blades 70 are rotated about from the center to present the one or other face thereof to the air through which they are passing, or, in other words, to propel to the right or left of the longitudinal center of the machine. This action on the part of the propeller blade 70 draws forward the end of the machine or pushes out to the right in answer to the movement of the lever 80.

The frame.—The frame on which the motor, aviator's chair and shafts above described are mounted is provided preliminarily with the struts 90. The struts 90 are sufficiently long to form supports, which, when resting on the ground, lift the cab 91 above the ground. The struts 90 are connected with the horizontal bars 92 and the framing bars 93 by means of the socket plates 94. The frame is reinforced by corner braces 95. Upon the horizontal bars 92 and the framing bars 93 is supported a superstructure arranged in the same shape as the bars 92 and 93, and consisting of the parallel bars 96 and the framing bars 97. The bars 92 are maintained in their separated relation by braces 98, and the bars 96 are maintained in separated relation by braces 99. The bars 93 and 97 are converged at the ends of the machine, and are mounted rigidly in the socket plates 100 there provided. To support the shaft 25 and to render the frame more rigid, the stanchions 101 are reinforced by cross braces 102. When the frame thus constructed is reinforced by the corner braces 103, and tied by means of the guy wires 104, it will be found to be flexible and sufficiently rigid to support the driven members as above described.

Suspended from the bars 92 is the cab 91.

The cab 91 is provided to receive, as desired, passengers or freight. For this purpose the doors 105 and windows 106 are formed in the said cab. The cab is employed in the machine as a ballast therefor. With this purpose in view it is desired that the connection between the cab 91 and the frame of the machine shall be flexible, to insure which the gimbal spider 107 is formed. The spider 107 is provided with bearings formed in the plates 108 which are fixedly mounted upon the bars 92. This arrangement of the bearings insures the ride of the cab in a horizontal position independent of the disposition of the body of the machine. To likewise balance the cab transversely on the fore and aft extensions of the spider 107 are provided bearings for brackets 109 secured to the roof of the cab 91 and upon which the said cab is primarily swung. It will be seen that by reason of this hanging of the cab the same will be permitted any suitable movement about the center of the spider 107, hanging plumb thereunder.

The frame herein described supports the shield roof 110 which is disposed above the aviator's chair 111, to shield the aviator from the down draft of air induced by the planes 15. It will be understood that while I prefer to use the shield 110 the same is not indispensable to the proper operation of the machine. The frame also furnished a convenient support for the gasolene tank 112 to supply the motor 26. As seen in Fig. 1 of the drawings the tank 112 is suspended in bearings formed at the converged ends of the bracket arms 113. The bracket arms 113 are depended from the bars 96.

The operation.—The operation of a machine constructed and arranged as described and as shown in the accompanying drawings is as follows:—The motor 26 having been started, the aviator having climbed to the chair, and the passengers or freight being seated or deposited in the cab, the lever 28 is operated to slowly throw in the speed gears connecting the crank shaft of the motor with the driving shaft 25. As the connection is established the shafts 21 and 40 are rotated. By moving the lever 28 the speed is gradually increased until the rotation of the shafts 21 is sufficient to lift the frame, mechanism and passengers carried thereon from the ground. If it is desired to make a vertical ascent the lever 54 is moved to dispose the blades 45 of the driving propeller in neutral position wherein they offer no resistance to the surrounding air but cut cleanly therethrough. The steering lever 80 is also moved to dispose the blades 70 of the steering propeller in the same position, that is, in a neutral position. The machine being thus disposed to avoid horizontal travel the planes 15 lift the same vertically above the position in which the machine has rested. When the machine has been lifted to the elevation desired, the aviator, by manipulating the lever 28 slows the shafts 21 and the planes 15 until the lifting effect of the planes 15 compensate for the weight carried thereby, when the elevation of the machine will cease. The lever 54 is now shifted to rotate the blades 45 of the propelling shaft, when the machine will be propelled in a forward direction, gradually gathering headway as the blades 45 are adjusted to a more acute or positive angle. The machine will now progress in a horizontal plane. If it be desired to change the line of flight horizontally the aviator moves the lever 80 to right or left, as the case may be, to change the angle of incidence of the blades 70 of the steering propeller, this operating to move the machine to right or left in answer to the pull or push of the said propeller. If in the course of the horizontal flight it be desired to increase or diminish the elevation of the machine, the lever 28 is manipulated to vary the speed of the shafts 21 and incidentally the shaft 40, when the planes 15 will lift the machine to yet greater height, and if desired the blades 45 will drive the same at an increased horizontal speed. If, however, it be desired to maintain the rate of speed formerly attained, this may be accomplished by manipulating the lever 54 to change the angle of incidence to accommodate the increased speed of the shaft 40. Should it be desired to lower the elevation of the machine, or to bring the same to the ground, this is accomplished by slowing the speed of the shafts 21 until the lift of the planes 15 is insufficient to support the weight of the machine, when the same will settle gradually through the air. It will be understood that by manipulating the lever 28 the machine may be brought to a rest upon the ground without shock. If during the operation of the machine it be desired to arrest the same in its horizontal flight, this may be accomplished by manipulating the lever 54 to rotate the blades 45 to their neutral position, or by further rotation to change the angle of incidence of the said blades to pull against the shaft 40 and the machine connected therewith in opposition to the former propulsion imparted thereto.

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

1. An aeroplane, comprising a horizontally disposed driving shaft; a plurality of vertically disposed rotary shafts operatively connected with said driving shaft; a plurality of arms fixedly connected with said rotary shafts; a plurality of inclined planes connecting said arms to form levitating planes when said shafts are rotated; a propeller operatively connected with said driving shaft; a prime mover for said

driving shaft; means for varying the effective speed of said driving shaft; and means for varying the angle of incidence of the blades of said propeller to compensate for the variation in speed of said driving shaft.

2. An aeroplane, having a driving shaft disposed longitudinally in said aeroplane; rotary levitating means arranged to operate vertically and perpendicularly to said driving shaft, said levitating means being operatively connected with said driving shaft; a driving propeller operatively connected with said driving shaft and disposed to operate in line therewith; a steering propeller operatively connected with said driving shaft and at the end opposite that at which the said driving propeller is connected, said steering propeller being disposed to operate horizontally and perpendicular to the said shaft; means for varying the rotary speed of said driving shaft; and manually operated means for independently varying the operative angle of the blades of said propellers.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ALBERT E. LYCAN.

Witnesses:

WESLEY PACKER,

PHIL. HARTMAN.