A. BENNETT.

FLYING MACHINE.

APPLICATION FILED JULY 12, 1918.

1,408,496.

Patented Mar. 7, 1922.

3 SHEETS—SHEET 1.

Fig. 1.

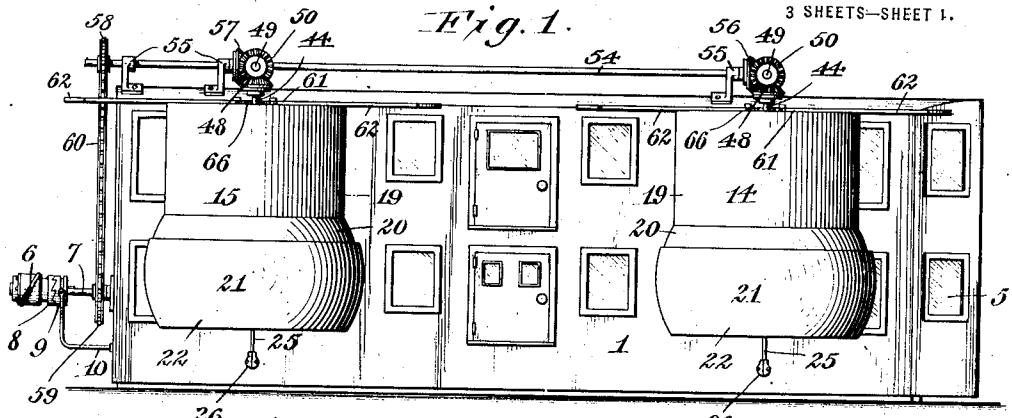


Fig. 2.

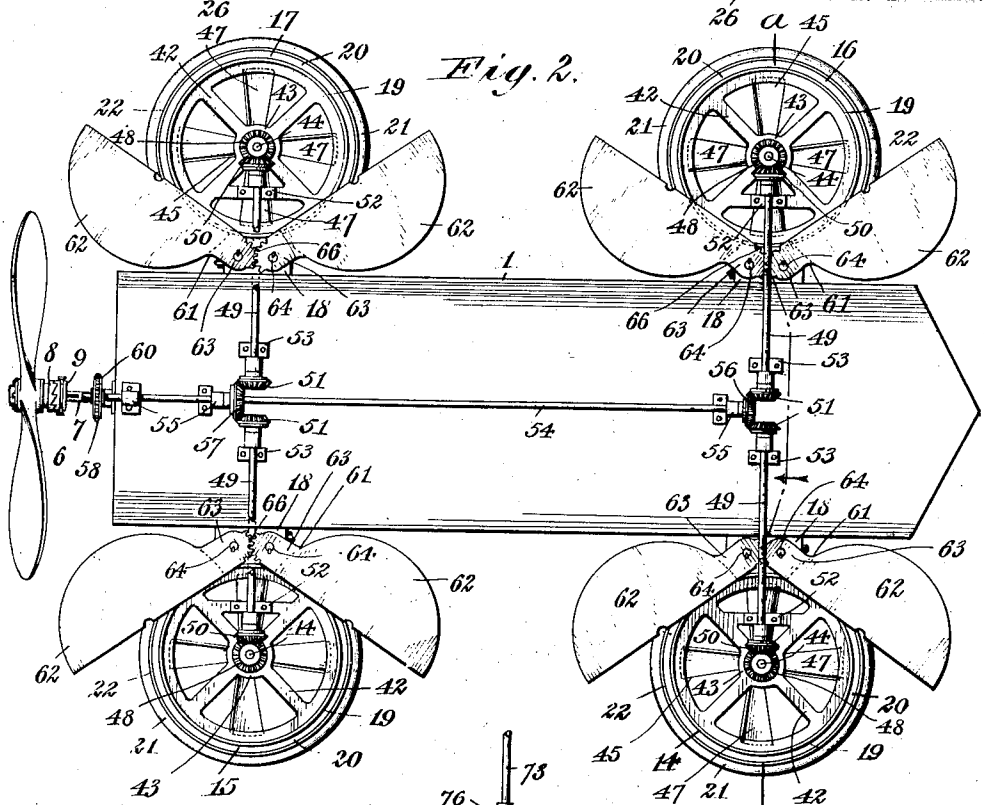
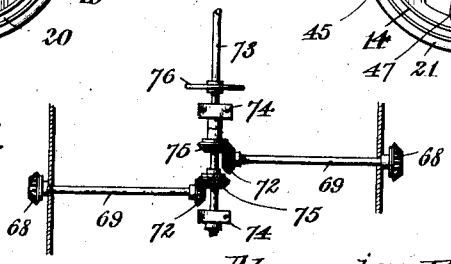


Fig. 3.



Witness:
Jacob Obrst Jr.

Alexander Bennett, Inventor.
By Emil Kuehart
Attorney.

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3 SHEETS—SHEET 2.

Fig. 4.

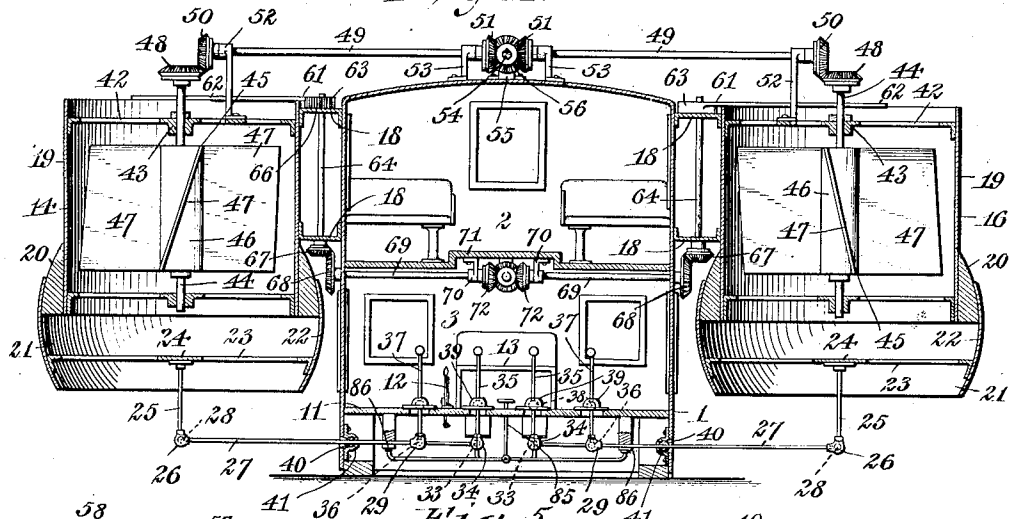


Fig. 5.

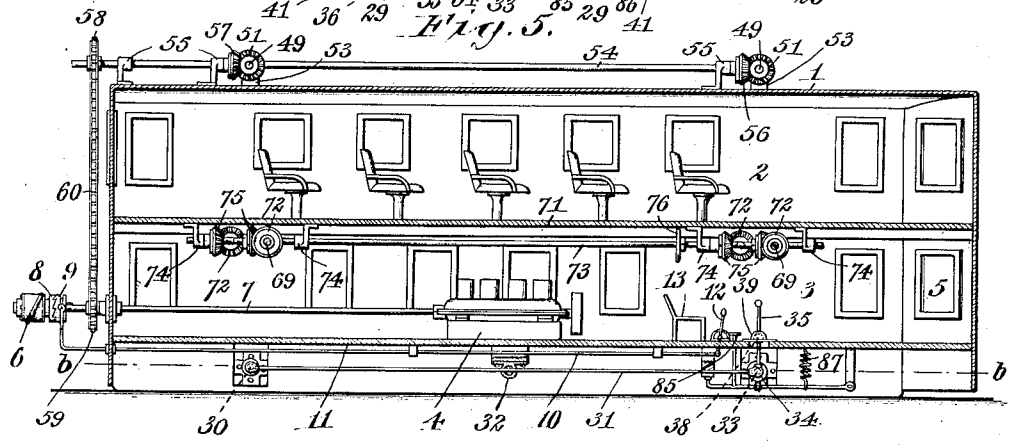
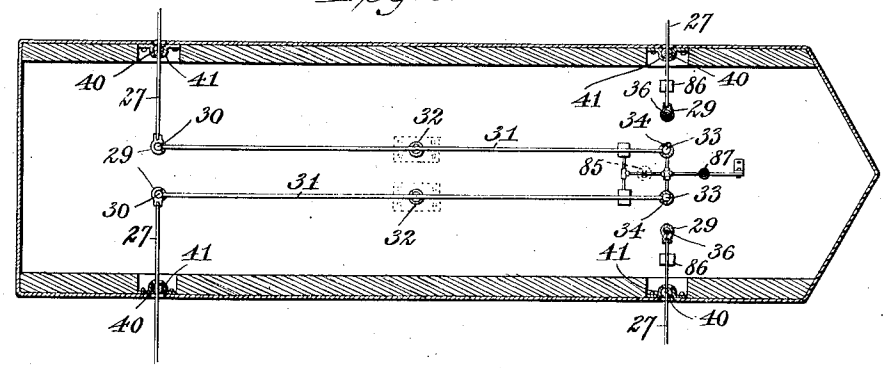


Fig. 6.



Witness:
Jacob Ehrat Jr.

Alexander Bennett, Inventor.
By Emil Neubart
Attorney.

A. BENNETT.

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3 SHEETS—SHEET 3.

Fig. 7.

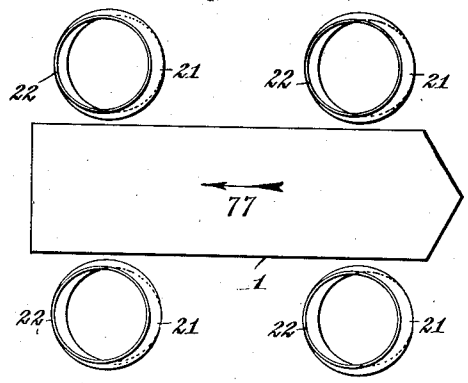


Fig. 8.

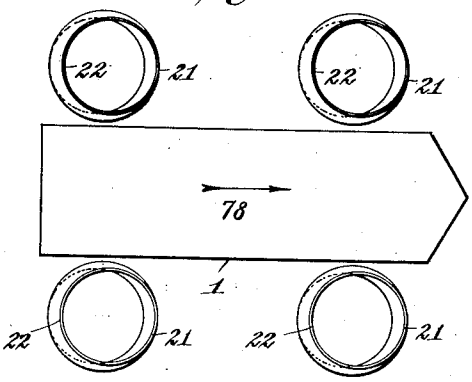


Fig. 9.

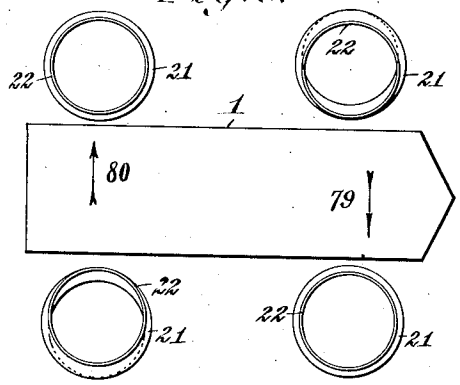


Fig. 10.

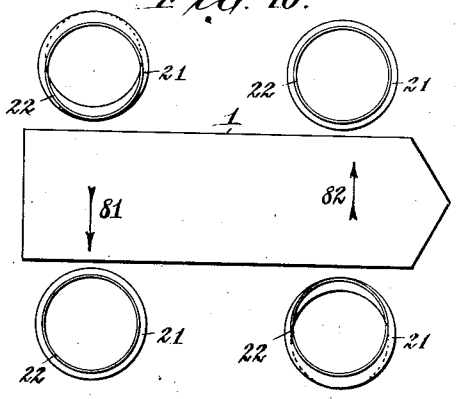


Fig. 11.

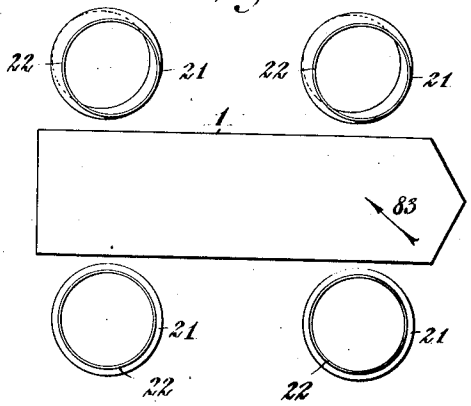
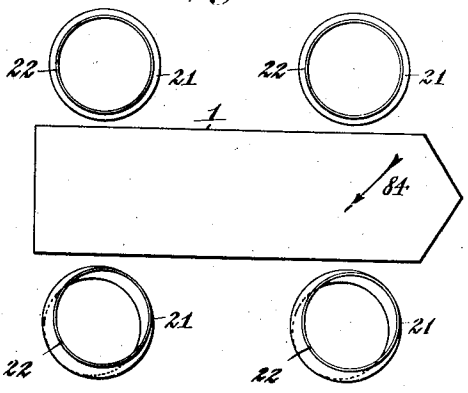


Fig. 12.



Witness:
Jacob Obrst, Jr.

Alexander Bennett, Inventor,
By Emil Kuckuk
Attorney.

UNITED STATES PATENT OFFICE.

ALEXANDER BENNETT, OF BUFFALO, NEW YORK.

FLYING MACHINE.

1,408,496. Specification of Letters Patent. Patented Mar. 7, 1922.

Application filed July 12, 1918. Serial No. 244,558.

To all whom it may concern:

Be it known that I, ALEXANDER BENNETT, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Flying Machines, of which the following is a specification.

This invention relates to airships or flying machines, and more particularly to that type of machine in which the usual lifting and sustaining planes are dispensed with.

The primary object of my invention is the production of an airship or flying machine which is capable of rising directly from the ground in a vertical or substantially vertical direction; which is capable of being sustained in the air in a substantially fixed condition over a fixed position; and which may also be lowered without resorting to the usual gliding or forward lowering movements.

A further object of my invention is the provision of an airship or flying machine having elevating propellers in combination with housings for the same provided with adjustable members capable of being positioned to direct the airship or machine when in flight to the right, to the left, or upwardly or downwardly, as may be desired.

A still further object of my invention is the provision of a machine of this type having a plurality of elevating propellers which are operated in unison and in connection with which means is provided for controlling the amount of air displaced thereby.

With these and other objects in view which will be apparent from the description to follow, my invention consists in the novel features of construction and in the arrangement and combination of parts to be hereinafter described and more particularly pointed out in the subjoined claims.

In the drawings:—

Fig. 1 is a side elevation of an airship or flying machine representatively embodying my invention.

Fig. 2 is a plan view of the same.

Fig. 3 is a detailed view of part of the mechanism for driving the elevating propellers.

Fig. 4 is a transverse section taken on line *a*—*a*, Fig. 2, looking in the direction of the arrow crossing said line.

Fig. 5 is a longitudinal section taken centrally through the machine.

Fig. 6 is a horizontal section taken on line *b*—*b*, Fig. 5.

Figs. 7 to 12 are diagrammatic views showing the adjustable members of the propeller casings in various combinations of positions for changing the direction of the machine, and for equalizing the same.

Reference being now had to the drawings in detail, corresponding numerals refer to corresponding parts in the several figures.

The reference numeral 1 designates the car or body of the machine which will, of course, be constructed of light material and may be of any desired form or outline. It is, however, preferably elongated and comprises an upper compartment 2 and a lower compartment 3, the upper compartment being adapted for passengers while in the lower compartment the engine 4 is located. In said compartment 3, preferably forward of the engine, the operator is to take his place so that he will have a view forward through the lookout windows 5, which may be formed of light transparent material.

At the rear of the car or body is a driving propeller 6 which is loosely mounted on a propeller shaft 7 extending forwardly and being secured to the shaft of the engine 4. On the hub of the propeller, a clutch member 8 is formed. This clutch member is therefore loose on the shaft and rotates with said propeller. A clutch 9 is feathered on said shaft so as to slide lengthwise thereon, and suitable means for moving said clutch member 9 into engagement with or out of engagement from the clutch member 8 is provided, said means comprising a rod 10 extending forwardly underneath the bottom or floor 11 of the car or body and having its rear end bent upwardly and forked to straddle the clutch member 9. At the front end of said rod an operating lever 12 is pivotally connected therewith, said lever being situated in close proximity to the operator's seat 13.

At each side of the car or body 2, propeller housings are located, these housings being designated, respectively, by the numerals 14, 15, 16 and 17, the housings 14 and 15 being at one side of the car or body while the housings 16, 17 are at the other side

thereof. One housing is therefore located at each side near the front end of the car or body and one at each side near the rear end thereof.

These housings are supported from the car or body in any suitable manner, but I have shown brackets 18 secured to the body and extending therefrom and to each pair of brackets one of the housings is secured. Each of these housings comprises a cylindrical propeller-receiving section 19 having the lower end thereof enlarged with the outer surface thereof curved, as at 20, and on the curved enlarged lower end, a combined air deflector and balancing device 21 is placed, each deflector and balancing device being in the form of an annulus 22 having its wall concavo-convex and formed to a circle whose axis is that of the curved enlarged lower end of the cylindrical propeller-receiving section 19. The annuli 22, which may be said to be parti-spherical in form taken in connection with the curved lower ends of the cylindrical section 19 of the propeller housings serve as directional means whereby the machine may be directed in its course through the air, and they also serve as balancing means whereby the equilibrium of the machine may be maintained. Each of the annuli is manually actuated and the means provided for this purpose is constructed and arranged as follows:

A spider 23 is secured in each annulus 22, and depending from the solid center 24 of each spider is a rod 25 having a ball socket 26 at its lower end. A rod 27 extends inwardly from the socketed lower end of each rod 25, and each rod 27 is provided at its outer end with a ball 28 adapted to fit its mating socket 26 and with a ball socket 29 at its inner end. The rods 27 extending inwardly from the two annuli at the rear of the car or body have their socketed inner ends arranged to receive balls 30 formed on the rear end of horizontally disposed rods 31 slidable in suitable ball-socketed guides 32 secured to the floor or bottom of the car or body and provided at their front ends with balls 33 which fit into ball sockets 34 formed on the lower ends of operating levers 35.

The rods 27 secured to the socketed lower ends of the rods 25 depending from the annuli at the front end of the car or body have their socketed inner ends arranged to receive balls 36 formed on the lower ends of operating levers 37. The levers 35 and 37 extend upwardly through the floor or bottom of the car or body and have spherical portions 38 between their ends which fit in sockets 39 secured to the upper side of said floor or bottom. It will be observed therefore that all points of the mechanism for operating the combined directional and balancing means are in the form of ball and socket joints, and with a view to obtaining a freer action of this mechanism each of the rods 27 is guided in a ball 40 fitted within a socket 41 secured to the side wall or frame of the car or body beneath the floor or bottom thereof.

While I have shown an operating lever for operating each deflector or annulus 22, provision may be made for otherwise operating the same.

Near the upper and lower ends of the cylindrical section 19 of each propeller housing, spiders 42 are situated, through the solid central portions 43 of which a propeller shaft 44 is passed, each propeller shaft being arranged axially within its housing and having a propeller 45 secured thereto. Each propeller consists of an elongated hub 46 and wings 47 inclined to the axis of said hub and being co-extensive with said hub. Secured to the upper end of each propeller shaft is a bevel gear 48 adapted to be driven by suitable mechanism operated from the engine. For this purpose four transverse shafts 49 are provided, each having a bevel gear 50 at its outer end in mesh with the bevel gear 48 on one of the propeller shafts, and at the inner end of each shaft 49 a bevel gear 51 is secured. The transverse shafts 49 therefore extend inwardly from the propeller shafts 44. The transverse shafts 49 associated with the front propellers and those associated with the rear propellers have alined axes so that these shafts are paired and the bevel gears 51 at the inner ends thereof are arranged in opposition to each other. Each of the shafts 49 is journaled in bearings 52, 53 secured, respectively, to the spider 42 of the associated propeller housing and to the top of the car or body.

54 designates a shaft arranged lengthwise above the top of the car or body and journaled in bearings 55. Secured to the front end of the shaft 54 is a bevel gear 56 which is in mesh with the opposed bevel gears 51 at the inner ends of the front pair of transverse shafts 49, and a similar bevel gear 57 is secured to said shaft 54 and is in mesh with the bevel gears 51 at the inner ends of the rear pair of transverse shafts 49.

The shaft 54 extends rearwardly beyond the rear end of the car or body, and to the projecting end thereof a sprocket wheel 58 is secured, around which and a sprocket wheel 59 on the propeller shaft 7 a sprocket chain 60 passes. The propellers are therefore rotated from the propeller shaft through means of the driving mechanism, last described. The air displaced downwardly by means of the propellers 45 is of course drawn through the propeller housings from the upper ends thereof. To govern the amount of air displaced I provide regulating means 61, preferably in the form of two semi-circular closure plates 62 having ex-

tensions 63 arranged so that the edges of the extensions of each pair of closure plates co-act. These plates are secured to shafts 64 passing upwardly into or through said extensions 63, and the co-acting edges of said extensions are provided with gear teeth 66. The extensions with the gear teeth thereon serve as gear segments which are integral with the closure plates and are so arranged that when one of the shafts 64 is rotated, the closure plate secured thereto is caused to swing, and by reason of the integral gear segment thereon being in co-action with the gear segment on the other plate, corresponding movement is imparted to said plate.

For the purpose of operating the closure plates, the shaft 64 secured to one of each pair of closure plates is provided with a bevel gear 67 at its lower end, which is in mesh with a bevel gear 68 on a transverse shaft 69 extending into the car or body and being journaled in one of the walls or the frame of the car or body and in a bracket 70 secured to the under side of the floor 71 which separates the upper compartment 2 from the lower compartment 3.

At the inner end of each shaft 69 a bevel gear 72 is secured. 73 designates a longitudinally-disposed shaft journaled in bearings 74 secured to the floor 71, said shaft having bevel gears 75 secured thereto which mesh with the bevel gears 72 at the inner ends of the transverse shafts 69, one bevel gear 75 being provided for each bevel gear 72.

Secured to the longitudinally-disposed shaft 73 is an operating wheel 76 by means of which the shaft may be rotated in either direction, the movement of said shaft being imparted through the shafts 69 and 64 to the closure plates 62 to swing the same outwardly or inwardly for the purpose of regulating the openings in the tops of the respective propeller housings. In this manner the amount of air displaced downwardly by the propellers is regulated according to the ascending or descending movement desired for the machine.

In the diagrammatic views shown in Figs. 7 to 12, the directional means, which the annuli 22 and the mechanism for operating said annuli constitute, is shown in different positions, and it is to be noted that owing to all joints, pivots and guides of this mechanism being of ball and socket construction, each of the depending rods 25, positioned axially with respect to the annulus to which it is secured, may be swung radially in any direction on the center or axis of said annulus, which the extended axis of said rod intersects. Therefore, the annuli may be moved on the lower ends of the cylindrical section of the propeller housings either forwardly, backwardly, laterally in either direction, or they may be inclined obliquely. For example,—in Fig. 7 the annuli are moved forwardly so that the inner surfaces thereof at the rear of the same are exposed to the air being displaced downwardly by the propellers. When therefore the main or driving propeller 6 is inoperative and the elevating or lifting propellers 45 are in motion, the air displaced downwardly by the latter is brought into forcible contact with the rear deflecting portions of the annuli and tend to move the car in a rearward direction, as indicated by the arrow 77 in Fig. 7. When the annuli are thus positioned with the propellers 45 rotating and the driving propeller 6 is reversed to cause rearward movement of the machine, the annuli assist in driving the machine in a rearward direction.

When positioning the annuli as shown in Fig. 8, in which they are adjusted rearwardly to expose the front portions of the inner surfaces thereof to the downwardly displaced air, they tend to drive the machine in a forward direction, as indicated by the arrow 78 in said figure, and when the propellers 45 are operated jointly with the driving propeller 6, these annuli assist in imparting forward movement to the machine. In this position they therefore increase the velocity of the machine although they would naturally tend to lift the machine to a higher altitude.

In Fig. 9 the front annulus at the left of the machine and the rear annulus at the right of the machine are adjusted outwardly, while the remaining annuli are retained in vertical or normal positions. When therefore the driving propeller is operated and the machine is driven in a forward direction, the elevating or side propellers cause the air displaced downwardly by the front propeller at the left of the machine to strike the inner portion of the inner surface of the corresponding annulus while the air displaced downwardly by the rear propeller at the right of the machine acts against the inner portion of the inner surface of the corresponding annulus. The downward displacement of the air in the front annulus at the right of the machine tends to move the front of the machine in the direction indicated by the arrow 79 in said figure, while the air displaced by the propeller in the rear annulus at the right of the machine tends to move the rear of the machine in the direction of the arrow 80 in said figure. It will be observed therefore that a reverse action is caused at the front and rear of the machine which enables the machine to be turned to the right in a very short radius.

In Fig. 10 the front annulus at the right of the machine and the rear annulus at the left of the machine are adjusted laterally with a view of swinging the rear end of the machine in the direction of the arrow 81 in said figure and the front end of the

machine in the direction of the arrow 82 in said figure, thus causing the machine to turn to the left.

The annuli may also be used as balancing means. The positions of the annuli shown in Fig. 7 would tend to overcome the tendency of the machine dipping forwardly, while the positions of the annuli shown in Fig. 8 would overcome the tendency of the machine tilting downwardly and rearwardly. In Figs. 11 and 12 the annuli are shown in positions tending to overcome wind resistance directed in the direction of the arrows 83 and 84, respectively. Any tendency of the machine tipping laterally to the right would be overcome by adjusting the annuli at the left of the machine to the positions in which the front annulus at the left of the machine in Fig. 9 and the rear annulus at the left of the machine in Fig. 10 are shown, while the tendency of the machine tipping to the left would be overcome by tilting the annuli at the right of the machine to the positions in which the front annulus at the right of the machine in Fig. 10 and the rear annulus at the right of the machine in Fig. 9 are shown.

I have therefore provided combined directional and balancing means capable of being used for either purpose or for both purposes at the same time, due to the fact that each annulus is operated independently by a lever, such as 35, which is capable of being swung radially in any direction to swing any of the annuli in the desired direction. The annuli can therefore be adjusted to any desired combination of positions and may be retained in adjusted positions by suitable mechanism, such for example as a pedal 85 extending up through the floor or bottom of the car or body in front of the operator's seat 13, said pedal having operative connection with brake shoes 86 acting against the rods 27 to hold them in any adjusted position, the brake shoes being retained against said rods by means of a spring 87, the action of which is overcome upon depressing the pedal 85.

When starting on a flight, the clutch members of the main propeller 6 are disconnected, and the closure plates 62 operated to fully open the upper ends of the housings of the lifting propellers. Upon rotation of the last-named propellers the machine is caused to ascend in a vertical or substantially vertical plane, and when the desired height has been reached the closure plates 62 may be closed or partially closed, depending on the particular purpose in mind. The main propeller 6 is then brought into action and the machine driven in a forward drection. If the course is to be in a straight line and the altitude maintained, the closure plates are adjusted so that the amount of air displaced downwardly is just sufficient to maintain the plane at the attained elevation. If a slight descension is desired, the plates are closed to reduce the downward displacement of air to the desired degree. If it is desired to travel in a higher altitude, the closure plates are opened to a greater extent, causing increased downward displacement of air in the propeller housings. If the equilibrium of the machine is disturbed the annuli 22 are operated in the necessary directions to produce the combination of adjustments desired and the necessary counteracting effect. If a change in direction is desired the annuli are operated accordingly. When it is desired to maintain the machine in a substantially fixed position and at a desired altitude, the main propeller 6 is disconnected from the engine and the lifting propellers operated with the desired air displacement controlled by the closure plates 62, the amount of air displaced being exactly that required to sustain the machine. The machine is therefore highly desirable for purposes of war, since it would be possible to drop bombs over any desired point, suitable provision of course being made for this purpose, as sufficient space is provided within the car or body of the car for storage purposes.

It is to be understood that the above description and the accompanying drawings are merely illustrations of my invention, and that my invention is capable of being modified in various ways without departing from the spirit thereof or sacrificing any of the advantages of the same.

Having thus described my invention, what I claim is: —

1. In a flying machine, the combination with a car or body, a motor, and a driving propeller operated by said motor, of combined balancing and steering mechanism comprising separate parts having universally adjustable parti-spherical elements and being supported by said car or body at different points thereof, and means for operating each of said parts separately.

2. In a flying machine, the combination with a car or body, a motor, and a driving propeller operated by said motor, of balancing mechanism including separate universally-movable parts of parti-spherical formation arranged at different points of said car or body and through which currents of air are drawn, and means for operating said universally-movable parts.

3. In a flying machine, the combination with an elongated car or body, a motor and a driving propeller operated by said motor, of combined balancing and steering mechanism comprising separate parts arranged in pairs at opposite sides of said car or body, each part comprising a vertical tube having its lower end enlarged and the outer surface

of its enlarged end curved, and a combined air deflector and balancing device having its wall concavo-convex and universally-movable on the enlarged lower end of said housing, each combined air deflector and balancing device being separately operable.

4. The combination with an elongated car or body and a motor operated driving propeller, of directional means comprising a plurality of units arranged at different points of said car or body, each unit comprising a vertically acting propeller, and a shiftable air deflector having a concavo-convex wall.

5. In a flying machine, the combination with a car or body and a motor-operated driving propeller, of directional means comprising a plurality of units, each unit including a vertically-acting propeller and a universally-movable element spaced from said propeller and adapted to present any portion thereof to the air currents created by said propeller, and means for operating each of said universally movable elements separately.

6. In a flying machine, the combination with an elongated car or body and a motor-operated driving propeller, of directional means comprising a plurality of units, each unit including a vertical propeller and a universally adjustable air deflector element, and means for adjusting said elements.

7. In a flying machine, the combination with an elongated car or body and a motor-operated driving propeller, of directional means comprising a plurality of units, each unit including a vertically acting propeller and a universally adjustable element, and means for separately adjusting each element.

8. In a flying machine, the combination of an elongated car or body, a driving propeller, and four lifting propellers, one lifting propeller being adjacent each corner of said car or body, means for driving said driving propeller and said lifting propellers, and air deflector means adapted for co-action with said lifting propellers to direct the machine from a straight course.

9. In a flying machine, the combination with a car or body, of vertically-disposed propeller housings carried by said car or body and having universally adjustable lower ends, lifting propellers within said propeller housings, means for driving said propellers, and means for adjusting said adjustable lower ends.

10. In a flying machine, the combination with an elongated car or body, of a propeller housing near each corner of said car or body having an adjustable lower portion adapted to present a portion of its inner surface to air moving downwardly through said housing, means for adjusting said adjustable lower portions, lifting propellers within each housing above its adjustable portion, and means for operating said lifting propellers.

11. In a flying machine, the combination with a car or body, of a pair of spaced propeller housings at each side of said car or body, each housing comprising a cylindrical upper section provided with an enlarged lower end having a curved exterior surface, and a longitudinally concavo convexed lower section fitting over said curved surface and adjustable thereon to present any portion of the concaved inner surface to air passing downwardly through said housing, means for adjusting said lower section, lifting propellers in said upper section, and means for operating said lifting propellers.

12. In a flying machine, the combination with an elongated car or body, of a pair of vertically-disposed propeller housings at each side of said car or body open at their upper and lower ends, the front and rear housings of the two pairs of housings being oppositely disposed, each housing comprising a cylindrical upper section and a universally-adjustable lower section whereby any portion of the inner surface of the lower section may be presented to air traveling downwardly through said housing, means for separately adjusting each lower section of said housings, lifting propellers in the upper sections of said housings, and means for driving said lifting propellers.

13. In a flying machine, the combination with a car or body, of propeller housings open at their upper and lower ends and arranged at different points of said car or body, each housing having a universally movable lower end adapted to be deflected in any direction or to any angle, means for adjusting said universally movable lower ends in the same or different directions or the lower end of each of said housings only, a lifting propeller in each of said housings, and means for driving said lifting propellers.

14. In a flying machine, the combination with a body, of a plurality of vertically-disposed propeller housings carried by said body and open at their upper and lower ends, propellers within said housings, means for driving said propellers, and semi-circular closure plates for each housing having extensions provided with meshing gear segments, shafts to which said closure plates are secured and which serve as the centers of rotation of said gear segments, and means for rotating one of said shafts to cause operation of said closure plates.

In testimony whereof I affix my signature.

ALEXANDER BENNETT.