C. A. LONG.

AIRSHIP.

APPLICATION FILED DEC 2 , 1910.

Patented Jan. 16, 1912.

1,014,763.

4 SHEETS—SHEET 1.

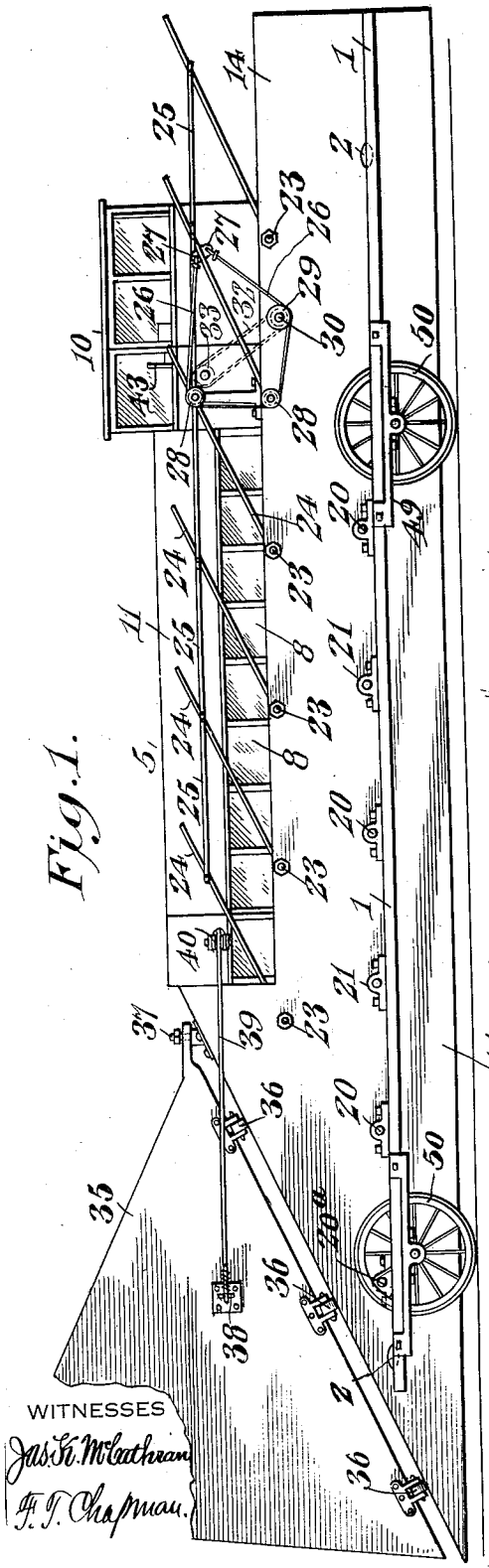

Fig. 1.

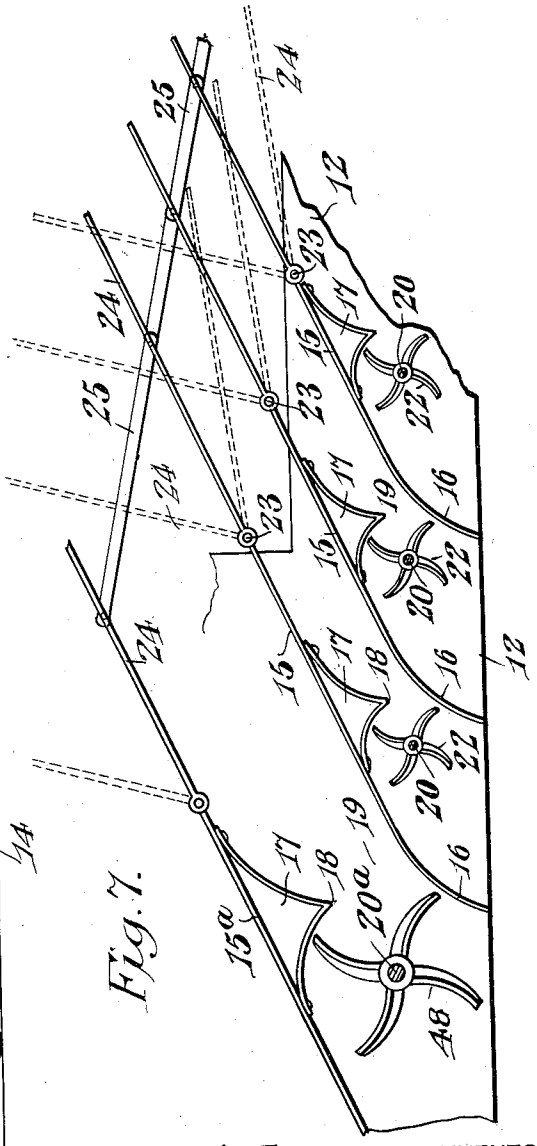

Fig. 7.

WITNESSES

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4 SHEETS—SHEET 2.

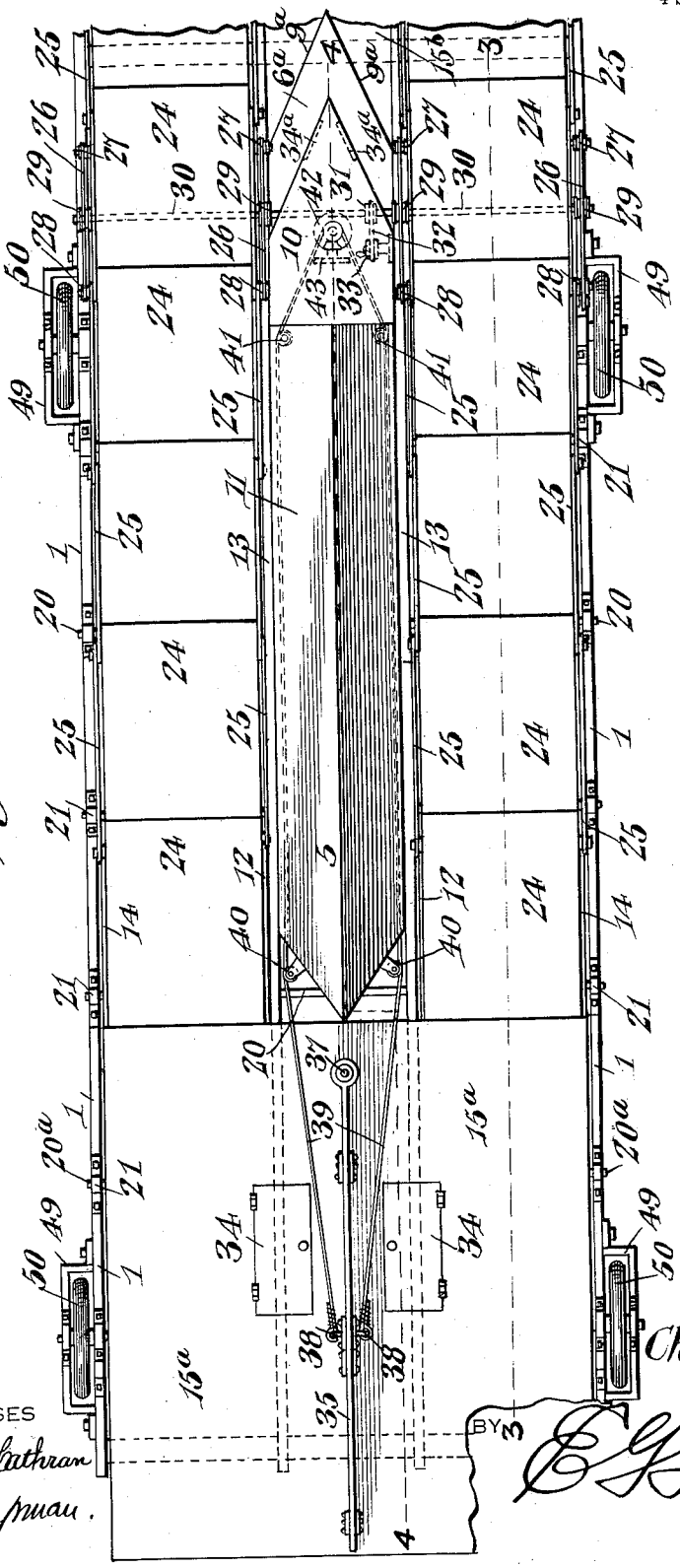

Fig. 2.

WITNESSES

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4 SHEETS—SHEET 3.

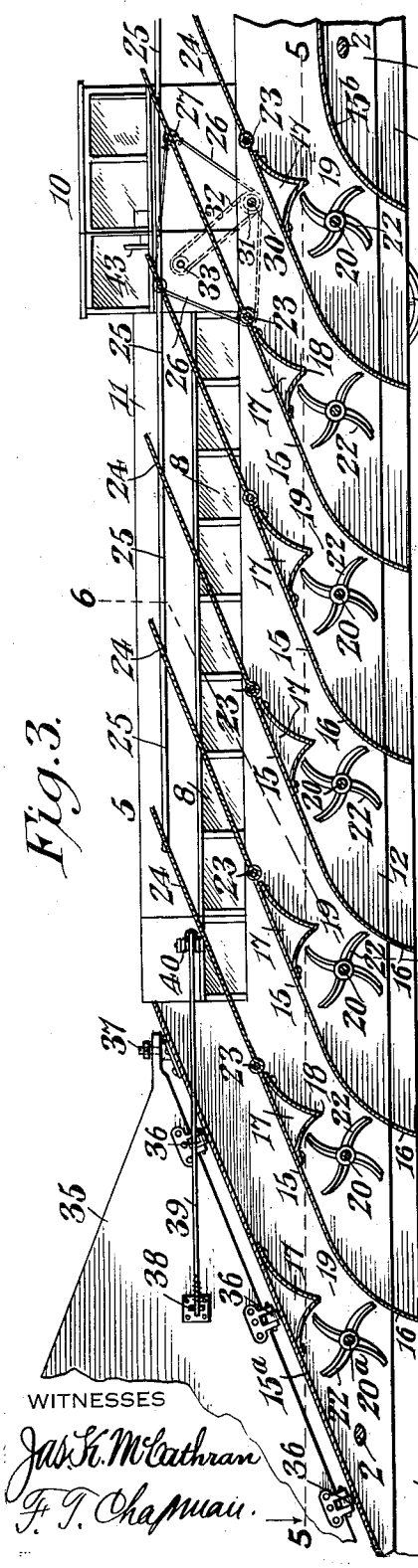

Fig. 3.

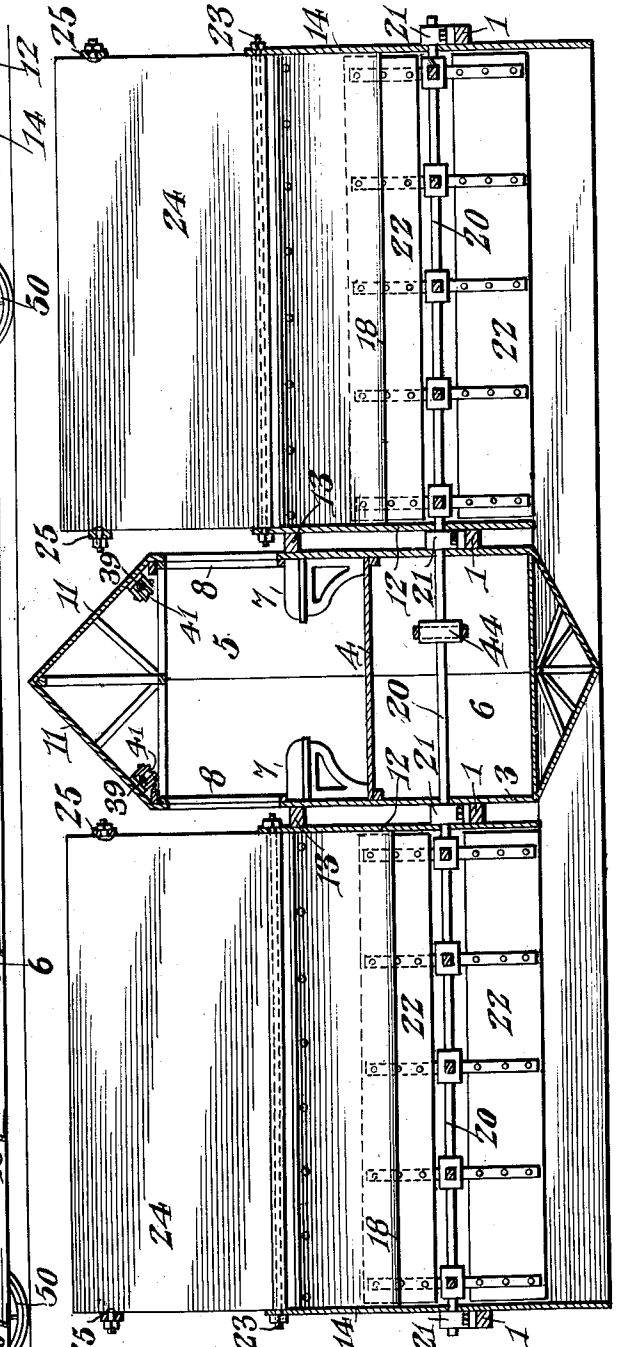

Fig. 6.

WITNESSES

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APPLICATION FILED DEC. 21, 1910.

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Patented Jan. 16, 1912.

4 SHEETS—SHEET 4.

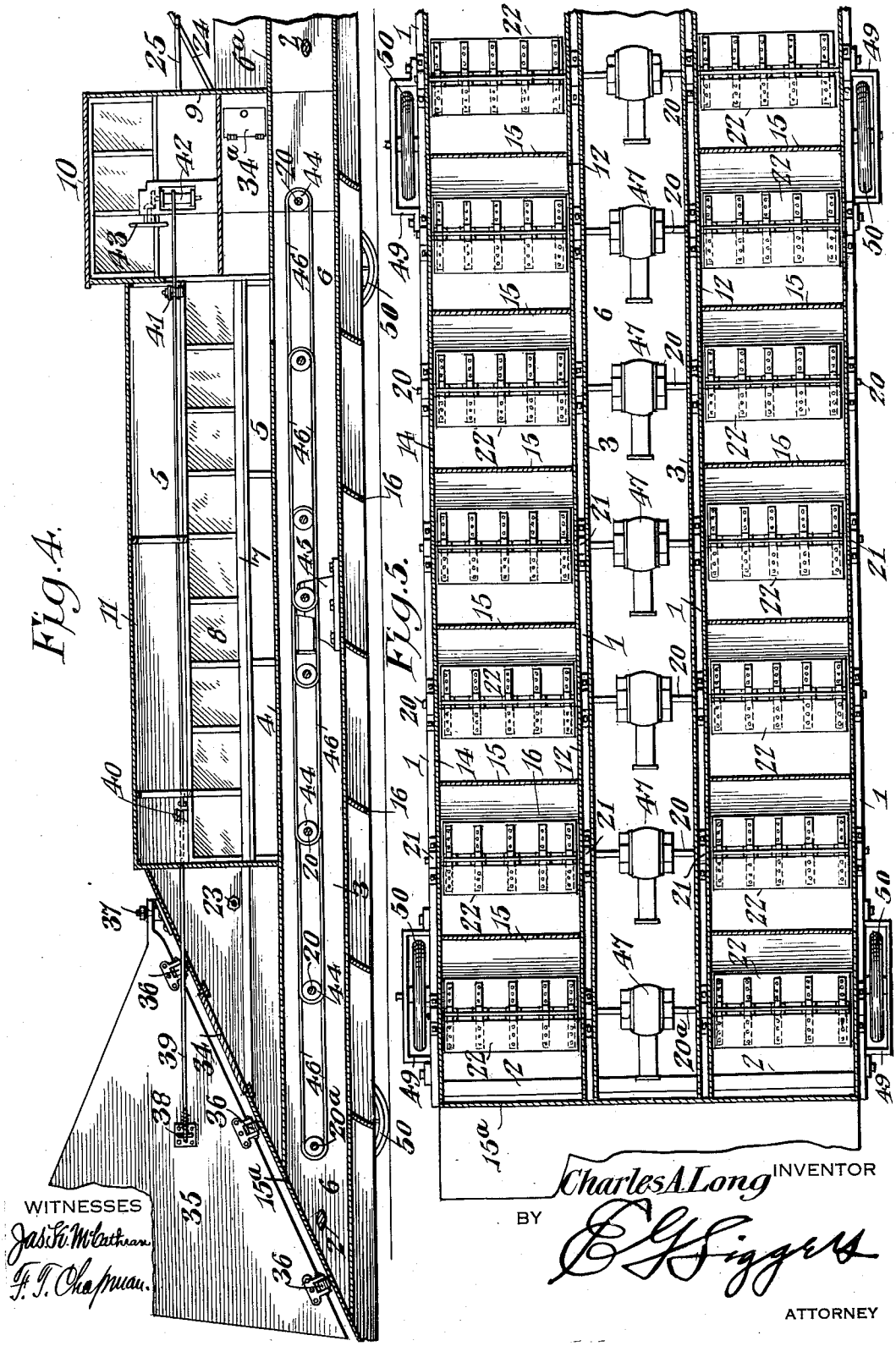

Fig. 4.

Fig. 5.

WITNESSES

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UNITED STATES PATENT OFFICE.

CHARLES ALBERT LONG, OF SPOKANE, WASHINGTON.

AIRSHIP.

1,014,763. Specification of Letters Patent. Patented Jan. 16, 1912.

Application filed December 21, 1910. Serial No. 598,646.

To all whom it may concern:

Be it known that I, CHARLES A. LONG, a citizen of the United States, residing at Spokane, in the county of Spokane and State of Washington, have invented a new and useful Airship, of which the following is a specification.

This invention has reference to improvements in air-ships, and its object is to provide means whereby a heavier-than-air type of airship may be made to move in a substantially vertical direction to any desired height and to remain there poised as long as the operator may desire, while progressive movement may be imparted to the vessel when such progressive movement is desirable. Furthermore, the device is capable of sufficient sustaining powers to permit the carrying of numerous passengers or an equivalent weight in freight or other material.

In accordance with the present invention a compression of the air is produced by suitable fans, which latter may be taken as generally typical of any means for compressing the air, and the air compressed by these fans is so directed that the reaction or natural expansion of the air so compressed will overcome the weight of the vessel and cause it to rise in the air and by a proper adjustment of the speed of the fans dependent upon their capacity and motive power the ship may be caused to remain poised in the air.

By the employment of planes, which in part are adjusted to different angles each about a substantially horizontal axis, considering the vessel as poised on even keel in the air, and by the employment of a propelling fan or fans, progressive movement may be imparted to the vessel up to any speed within the capacity of the power plant of the vessel.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings forming a part of this specification, with the understanding, however, that the showing of the drawings is largely illustrative without attempt to show exact proportions, and, therefore, the invention is not confined to the particular form and arrangement of parts illustrated, but may be embodied in other forms than shown.

In the drawings:—Figure 1 is a side elevation of an air-ship constructed in accordance with the present invention. Fig. 2 is a plan view, some parts being broken away. Fig. 3 is a section on the line 3—3 of Fig. 2. Fig. 4 is a section on the line 4—4 of Fig. 2. Fig. 5 is a section on the line 5—5 of Fig. 3, with some parts omitted, and showing a different arrangement of driving devices than in Fig. 4. Fig. 6 is a section on the line 6—6 of Fig. 3, with some parts omitted. Fig. 7 is a partly schematic view illustrating a slightly modified construction of the planes and their relation to the elevating or compressing fans, and, also, showing the propelling fan or fans.

Referring to the drawings, there is shown a frame comprising longitudinally disposed members 1 and cross members 2, and while in the drawing but two cross members are shown, it will be understood that as many such members are employed in the full size structure as may be necessary, the framework being modified in accordance with the size of the structure, and consequently can be typified only in the drawings.

The longitudinal bars 1 as shown in the drawings are so located that two of these bars are adjacent the body of the vessel and all are exterior thereto, and are in substantially the same plane, the inner bars being spaced one from the other and from the outer bars, and preferably more distant from the outer bars than from each other. The inner bars 1 carry a rectangular body 3 divided by a flooring 4 into an upper chamber 5 and a lower chamber 6, and above the flooring there may be provided seats 7 for passengers, and adjacent these seats windows 8 for light and ventilation. The chamber 5 is provided with front walls 9 which approach toward the front to form an air cleavage member for a purpose which will hereinafter appear, and adjacent the front end, which in the drawings is the end toward the right in Figs. 1, 2, 3, 4 and 5, there is provided a cab 10, and, moreover, the chamber 5 has roof or cover members 11 rising and approaching toward the central longitudinal vertical plane of the body 3 and

meeting at a central ridge. The chamber 6 is extended forwardly beyond the cab as indicated at 6ª and has approaching front walls 9ª.

Fast to the longitudinal members 1 on each side of the body 3 are longitudinal partitions 12 extending above the level of the floor 4 so that, as shown, the side walls of the body 3 to the height of the partitions 12 are double, though, of course, this particular construction is not mandatory. The partitions 12 are joined to other longitudinal members or beams 13 above the longitudinal members 1 on each side of the body 3, the members 13 serving to stiffen and strengthen the structure. The partitions 12 extend to about the bottom of the main portion of the body member 3. Secured to the outer longitudinal members 1 are walls 14 similar to the partitions 12, being of approximately the same height but extending to a greater distance downward, the expression of direction being with relation to the vessel either as resting on ground level or as poised on an even keel in the air.

The partitions 12 and walls 14 on each side of the central body 3 are joined at intervals by other partitions 15 each constituting a plane at an angle to both the horizontal and vertical, the angle in the particular showing of the drawings being somewhat less than forty-five degrees with relation to the horizontal. Each partition 15 terminates at its lower end in a curved portion 16 to which reference will hereinafter be made. The arrangement of the partitions 15 is such that there are provided between them inclined channels open at about the top of the partitions 12 and walls 14 and expanding toward the lower end because of the curved walls or partitions 16.

The rearmost partition or plane, indicated at 15ª, may be straight throughout its length instead of terminating in a curved portion 16, and this partition 15ª extends above the line of the partitions 12 and walls 14 to a height nearly that of the roof 11 of the chamber 5 in the particular structure shown in the drawings. There is a front partition or plane 15ᵇ which may be nearer horizontal than the partitions 15. The intermediate partitions 15, as well as the rear partition 15ª, have secured to the under wall and extending between the partitions 12 and walls 14 a curved throat member 17 of approximately triangular cross section, but with its walls curved where approaching a free edge 18 directed toward the wall in front of it. The purpose of the throat member is to form a contracted throat or passage 19 between adjoining partitions or planes 15 and between the rearmost partition or plane 15ª and the partition or plane 15 immediately in front of it so as to permit the fans to take advantage of a compressed body of air. Extending through the partitions 12 and walls 14 and through the chamber 6 is a series of shafts 20, one for each space between the partitions 12, while a similar shaft 20ª extends through the like members in the space defined by the rearmost partition 15 and the curved portion 16 immediately in front of it. The shafts 20 are each provided with journal bearings 21 on the several longitudinal beams or members 1 in substantially concentric relation to the lower curved face of the respective throat members 17, and in the spaces between the partitions 12 and walls 14 each shaft carries a fan 22 having its blades suitably shaped to coact with the throat member 17, so that on rotating the fans the air is strongly drawn into the upper ends of the spaces between the slanting planes and these air currents are then strongly compressed and discharged through the openings between the lower ends of the partition 16, the direction of discharge being downward and rearward.

Fast at the ends of the partitions 12 and walls 14 adjacent the upper ends of the partitions 15 are pivot rods 23, to each of which is pivotally attached the corresponding end of a movable plane 24, the other end of which when the plane 24 is in line with the partition 15 being in substantially the same plane as the upper end of the rear partition or plane 15ª, the planes 24 forming continuations of the partitions or planes 15. In the operation of the vessel, it is desirable that the planes 24 should be simultaneously adjustable about their pivot rods 23 and for this purpose all the movable planes 24 on the same side of the machine are connected together at the opposite edges by links 25. For the adjustment of the planes 24 there is provided at each edge of the front plane of each series a strand 26 connected at the ends to eyes 27 on the respective plane and carried around direction-changing pulleys 28, and, also, about a driving drum 29 on a shaft 30 carried into and through the cab where it is provided with another drum 31 connected by a strand 32 to a manipulating member 33 within ready reach of the operator, so that the several planes 24 may be moved simultaneously to the desired position.

In Fig. 7 the pivot rods 23 are shown as progressively higher toward the rear of the machine and the planes 24 are progressively longer toward the rear of the machine, so that their free or upper edges are progressively more elevated. In dotted lines in this figure are shown two positions of the planes, one approaching the horizontal and the other the vertical. The purposes of these positions will appear hereinafter.

The rear partition or plane 15ª extends substantially across the machine from one wall 14 to the other and forms the rear wall

of the compartment 6. This partition in line with the compartment 5 is provided with doors 34, whereby access to the compartments 5 and 6 may be had, and other doors 34ª in the walls 9 also give access to the compartments. Mounted on the rear partition 15ª is a rudder 35 for directing the ship, and supported upon rollers 36 riding on the rear partition 15ª. The rudder tapers toward the front end where it is mounted upon a pivot pin or stud 37, so that the rudder may be swung from one side to the other, the median position of the rudder being in the central longitudinal vertical plane of the vessel. In order that the rudder may be manipulated from the cab 10 it has fast to it on opposite faces eyes 38 to which are attached the corresponding ends of strands 39 passing over direction-diverting rollers 40 and 41 on and in the body 3 and ultimately entering the cab 10, where these strands may pass around a drum 42 under the control of a manipulating member 43 controllable by the operator. Each shaft 20 may carry one or more pulleys 44 within the compartment 6 and one of the shafts may be driven by a motor 45 indicatively shown in Fig. 4. The pulleys 44 of the several shafts 20 may be connected by belts 46, so that these shafts may all be rotated in the same direction at the same time by power furnished by the motor 45, which latter may be an explosion or any other suitable engine of appropriate power. Instead of driving all the shafts simultaneously with a single engine, each shaft may be provided with a motor 47 individual thereto as indicated in Fig. 5. Of course, more than one motor may be used for each shaft where needed.

The rear shaft 20ª is designed to carry a propeller 48 which may be of larger size than the fans or propellers 22 and shaped to take hold of the air in a manner to drive the vessel forwardly while the other fans or propellers 22 are acting to lift the vessel with or without any tendency to drive the vessel forwardly.

The action of the propeller 48 in giving to the vessel a forward impulse and the action of the fans or propellers 22 to cause a lifting of the vessel is due not only to the shape of the fans or propellers, but to the channels in which they are located. Those channels in which the fans or propellers 22 are located have their lower ends directed more nearly downward than the main bodies of the channels, while the channel in which the propeller 48 is lodged is not provided with a downwardly curved portion, but as before stated, may be straight throughout its length.

It is customary to mount air-ships upon wheels for supporting the air-ship while on the ground and for this purpose the outer beams 1 have yokes 49 attached thereto and between these yokes and the beams 1 there are mounted wheels 50, these wheels being disposed at opposite sides of the front and rear of the framework, so as to sustain the vessel above the ground when the wheels are resting on the ground, and, also, permitting movement of the vessel along the ground.

The chamber 5 is designed primarily for the accommodation of passengers, but is not necessarily limited to such use, while the chamber 6 is designed for the accommodation of freight and the driving machinery and such supplies as may be necessary. The compartment 6 may be of the air-tight chamber type, so as to uphold the vessel on water and the freight, driving machinery and supplies bring the center of gravity of the vessel low, thus facilitating the balancing of the vessel when poised or traveling in the air or upon water.

Let it be assumed that it is desirable to operate the machine, then the operator sets the motor or motors in motion, thus imparting to the fans 22 a speed sufficient for the purpose and the planes 24 have been adjusted to the desired angle, then air streams are drawn through the spaces between the planes 24 and their corresponding partitions 15 and striking the curved extensions 16 of the partitions 15 these air streams are directed downwardly near the perpendicular to a horizontal plane or to the ground, and the reaction of these streams of compressed air is sufficient to lift the vessel and force it upwardly into the air, the fans being such as to cause the displacement and compression of large volumes of air which may be brought about by imparting to the fans high speed with great power, the fans having comparatively great lateral extent. The incoming air streams are diverted by the slanting roof members 11 of the chamber 5 toward the planes on opposite sides thereof, and these air streams pass into the space between the planes and are finally caught by the fans, greatly compressed and powerfully ejected through the spaces between the curved partitions 16. The rarefication of the air at the upper ends of the passages defined by the planes 24 and the natural expansion from powerful condensation of the air below the vessel contribute to overcome the weight of the vessel and cause its rise into the air. Whether the rise of the vessel shall be practically vertical, or whether it shall also move progressively will depend upon the inclination of the planes 24 which may be moved to an approximately vertical position, or may be moved to or below a horizontal position.

If it be assumed that it be desirable to impart to the vessel a progressive movement, then the fan or propeller 48 is set into mo-

tion and the reaction of this fan being more nearly horizontal will cause a forward movement of the vessel, and then the reaction of the air streams against the under faces of the planes 24 will cause the sustaining of the vessel during its forward movement in addition to the lifting effect of the vanes 22. As the vessel progresses the front walls of the body 3 cause the air to move toward the front plane 15, and this plane also contributes toward sustaining the vessel in the air while moving forward by compressing (to the extent of its perpendicular depth) the air passing under it. The rear plane or planes 15^a and the front planes 15^b likewise contribute to the sustaining of the vessel when moving forward.

When it is desired that the vessel move forward with speed, then the free ends of the planes 24 are dropped to the requisite extent, but when it is desirable that the vessel remain substantially poised in the air the planes 24 may be raised toward the vertical position, so that the sustaining action of the fans 22 is utilized and the vessel will then have no progressive movement due to the action of the fans or propellers. If it be desirable to maintain the vessel poised in the air in moving air currents then the planes 24 and the rudder are properly adjusted and the fan 28 is caused to rotate at a suitable speed to overcome the drifting effect of the air currents, so that the vessel may remain poised over some fixed spot. The air-ship may, therefore, be caused to rise in a substantially vertical line, or may so rise and then be moved forwardly in a substantially horizontal line, or any resultant of these two movements may be brought about by a suitable adjustment of the rudder and the plans 24 and a suitable adjustment of the speed of the fans or propellers.

While the propelling fan is shown as mounted on a shaft transverse to the length of the vessel and at the rear thereof, it will be understood that the propelling fan may follow the prevailing practice as to location, structure and axis of rotation with relation to the vessel, and, furthermore, that the use of a single fan or propeller is not mandatory since in large vessels as many propellers are used as may be necessary for causing the vessel to move with the desired speed. Furthermore, the number and size as well as the shape and speed of the lifting fans cannot be definitely given, since these details vary with vessels of different sizes, but in order that the lifting fans shall act upon the air to compress and discharge it effectively the blades must be properly curved in the direction of rotation.

What I claim is:—

1. An air ship having a body member with longitudinal series of planes on opposite sides thereof defining like series of air channels, said air channels having intake openings adjacent the top of the ship and above all obstructions to the flow of air into them and having their discharge openings adjacent the bottom of the ship, each air channel having an air propelling and compressing means therein.

2. An air ship having air directing forwardly inclined planes defining channels each provided with means individual thereto for indrawing the air at the upper end of the channel and forcibly expelling it at the lower end of said channel, each channel having a forward inclination with the upper end open and a lower end or extension expanded in the direction of the length of the vessel and directed downwardly substantially perpendicular to a transverse longitudinal plane of the vessel.

3. An air-ship having inclined air directing channels intaking at the upper ends and each with means for the forcible production of an air current therethrough, each channel being provided with a wall having a plane constituting a continuation thereof at the upper end, said plane being adjustable about an axis transverse to the length of the channel.

4. In an air ship, a longitudinal series of planes defining air channels between them, each channel being provided with means individual thereto for the forceful production of a current of air therethrough and having means at the intake end for determining the relation of said end to the remainder of the channel.

5. In an air-ship, air directing channels each having a forward inclination with the intake at the upper end, means within each channel for the forcible drawing of a current of air therethrough, and an adjustable plane at the intake end of each channel for determining the inclination of the intake end with relation to the remainder of the channel.

6. In an air-ship, a series of air directing channels inclined forwardly, each channel having a wall carrying a fixed throat member, an air impelling means in each channel adjacent the throat member, and an adjustable member forming a continuation of the channel at the intake end, said adjustable member being in the form of a plane adjustable about an axis transverse to the length of the channel.

7. In an air ship, a series of air channels arranged one back of the other in the direction of the length of the ship and each provided with means for the forcible production of a current of air therethrough, said channels being inclined forwardly with reference to the length of the ship, and an adjustable plane for each channel at the intake end thereof and constituting a continuation of one wall of the channel, said plane being

adjustable on an axis transverse to the length of the channel.

8. In an air-ship, a series of air channels each provided with means for the forcible production of a current of air therethrough, said channels being inclined forwardly with reference to the length of the ship, and an adjustable plane for each channel at the intake end thereof, said plane being adjustable on an axis transverse to the length of the channel, and means for the simultaneous adjustment of all the planes of the series.

9. An air ship having a centrally located body member and flanking series of planes on opposite sides of the body member, each plane of each series being inclined with reference to the length of the body member and provided with means for the forcible production of a current of air under said plane from the forward end toward the rear end thereof, the said planes when acted on by the air currents constituting the sole sustaining means for the air ship.

10. An air ship comprising a central body member, flanking series of air channels inclined with reference to the length of the body member and having their discharge ends below the body member and in fixed relation to and substantially perpendicular to a longitudinal plane transverse to the body member, and means in each air channel for the forcible production of a current of air therethrough.

11. An air ship provided with a centralized body member, a series of planes on each side of said body member inclined in the direction of the length of the ship, and an air impelling fan in operative relation to and under and individual to each plane, the said planes when acted on by the air currents constituting the sole sustaining means for the air ship.

12. An air ship provided with a centralized body member, a series of inclined air channels on each side thereof, said channels being defined by spaced, inclined transverse planes and spaced vertical partitions, an air impelling fan in each channel, and adjustable planes forming continuations of the transverse planes at the intake ends of the channels.

13. An air ship provided with a centralized body member, a series of inclined air channels on each side thereof, said channels being defined by spaced inclined transverse planes and spaced vertical partitions, an air impelling fan in each channel, and adjustable planes forming continuations of the transverse planes at the intake ends of the channels, said adjustable planes on both sides of the central body being connected for simultaneous movement.

14. An air-ship comprising a central body, longitudinal outer walls in spaced relation to the sides of the central body, transverse partitions or planes each set at an inclination to the length of the body and extending from the body to the respective longitudinal outer walls, each transverse partition or plane being inclined forwardly and a downwardly directed curved continuation at the lower end, the several walls and planes coacting to form inclined air channels, a fan for each air channel, a throat member in each air channel coacting with the fan, and driving means for the fans located in the central body.

15. An air-ship comprising a central body, longitudinal outer walls in spaced relation to the sides of the central body, transverse partitions or planes each set at an inclination to the length of the body and extending from the body to the respective longitudinal outer walls, each transverse partition or plane being inclined forwardly beyond the upper end and curved downwardly at the lower end, the several walls coacting to form inclined air channels, a fan for each air channel, a throat member in each air channel coacting with the fan, planes for the intermediate transverse walls connected to the upper ends thereof and adjustable with relation to the transverse walls each on an axis transverse to the length of the vessel, and driving means for the fans located in the central body.

16. In an air-ship, a series of inclined air channels each provided with means for forcibly impelling the air through the respective air channel, the air channels progressively increasing in length toward the rear end of the vessel.

17. In an air ship, a series of inclined air channels of progressively increasing length toward the rear of the vessel, air impelling means in each channel, and an adjustable plane forming a continuation of each channel, the series of planes terminating at progressively higher points toward the rear of the vessel.

18. An air ship provided with a plurality of forwardly inclined air directing channels, an air impelling means in each channel, and an inclined channel located at the rear of the first named channels and provided with a propelling fan for imparting progressive movement to the vessel.

19. In an air-ship, a central body having the end walls projecting to a centralized point of intersection coincident with the central vertical longitudinal plane of the body, a series of forwardly inclined air channels on each side of the central body, and air impelling means individual to each channel.

20. An air-ship having a central carrying body provided with approaching end walls meeting in the central longitudinal plane of the body, a series of forwardly inclined air channels on each side of the body, fans in each channel for the forcible creation of air

currents through the channels, each channel having the discharge end directed downwardly, driving means for the fans located in the central body, and planes constituting continuations of the air channels at the intake ends thereof, said planes being adjustable on axes transverse to the length of the vessel.

21. An air-ship having a central body with superposed compartments, motive means located in the lower compartment, inclined planes defining air channels between them and located on opposite sides of the body member, and air impelling means in the air channels receiving motion from the motive means in the lower compartment.

22. An air-ship comprising a centrally located elongated body member with upper and lower chambers, the front end of the body member having the walls approaching to a central vertical edge and the top approaching to a central ridge, motive means in the lower chamber of the body member, longitudinal side walls in spaced relation to the sides of the body member, inclined partitions between the sides of the body member and the side walls spaced therefrom, said partitions terminating at the lower ends in downwardly directed curved portions, fans in the spaces between the transverse partitions and connected for actuation with the motive means in the lower chamber of the body member, and inclined planes on each side of the body member extending above the side walls spaced from the body member and constituting continuations of the partitions connecting such side walls with the body member.

23. An air-ship comprising a centrally located elongated body member with upper and lower chambers, the front end of the body member having the walls approaching to a central vertical edge and the top approaching to a central ridge, motive means in the lower chamber of the body member, longitudinal outer side walls in spaced relation to the sides of the body member, inclined partitions between the sides of the body member and the side walls spaced therefrom, said partitions terminating at the lower ends in downwardly directed curved portions, fans in the spaces between the transverse partitions and connected for actuation with the motive means in the lower chamber of the body member, and inclined planes on each side of the body member extending above the side walls spaced from the body member and constituting continuations of the partitions connecting such side walls with the body member, said planes being connected to the partitions by joints about which the planes are adjustable, the several planes being connected for simultaneous movement.

24. An air-ship comprising a centrally located elongated body member with upper and lower chambers, the front end of the body member having the walls approaching to a central vertical edge and the top approaching to a central ridge, motive means in the lower chamber of the body member, longitudinal outer side walls in spaced relation to the sides of the body member, inclined partitions between the sides of the body member and the side walls spaced therefrom, said partitions terminating at the lower ends in downwardly directed curved portions, fans in the spaces between the transverse partitions and connected for actuation with the motive means in the lower chamber of the body member, and inclined planes on each side of the body member extending above the side walls spaced from the body member and constituting continuations of the partitions connecting such side walls with the body member, said planes being connected to the partitions by joints about which the planes are adjustable, the several planes being connected for simultaneous movement, and a rudder carried by the body member.

25. An air-ship comprising a centrally located elongated body member with an upper and lower chamber, the front end of the body member having the walls approaching to a central vertical edge and the top approaching to a central ridge, motive means in the lower chamber of the body member, longitudinal outer side walls in spaced relation to the sides of the body member, inclined partitions between the sides of the body member and the side walls spaced therefrom, said partitions terminating at the lower ends in downwardly directed curved portions, fans in the spaces between the transverse partitions and connected for actuation with the motive means in the lower chamber of the body member, and inclined planes on each side of the body member extending above the side walls spaced from the body member and constituting continuations of the partitions connecting such side walls with the body member, said planes being connected to the partitions by joints about which the planes are adjustable, the several planes being connected for simultaneous movement, and a rudder carried by the body member, said body member being provided with a cab for an operator and with connections from the planes and from the rudder to said cab for control by the operator.

26. An air ship provided with a central body having a top inclining toward each side, and a series of inclined air channels on each side of and exterior to the central body, each series being disposed fore-and-aft with relation to the body of the ship and all the

channels and the declining portions of the top of the central body contributing to relieve the top of the ship from downwardly directed air pressure, said channels having air propelling and compressing means therein to establish air currents through the channels from the top downwardly.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

CHARLES ALBERT LONG.

Witnesses:

JOHN H. SIGGERS,

EDITH L. BROWN.