No. 853,542. PATENTED MAY 14, 1907.

H. FAEHRMANN.

AIR SHIP.

APPLICATION FILED APR. 2, 1903.

4 SHEETS—SHEET 1.

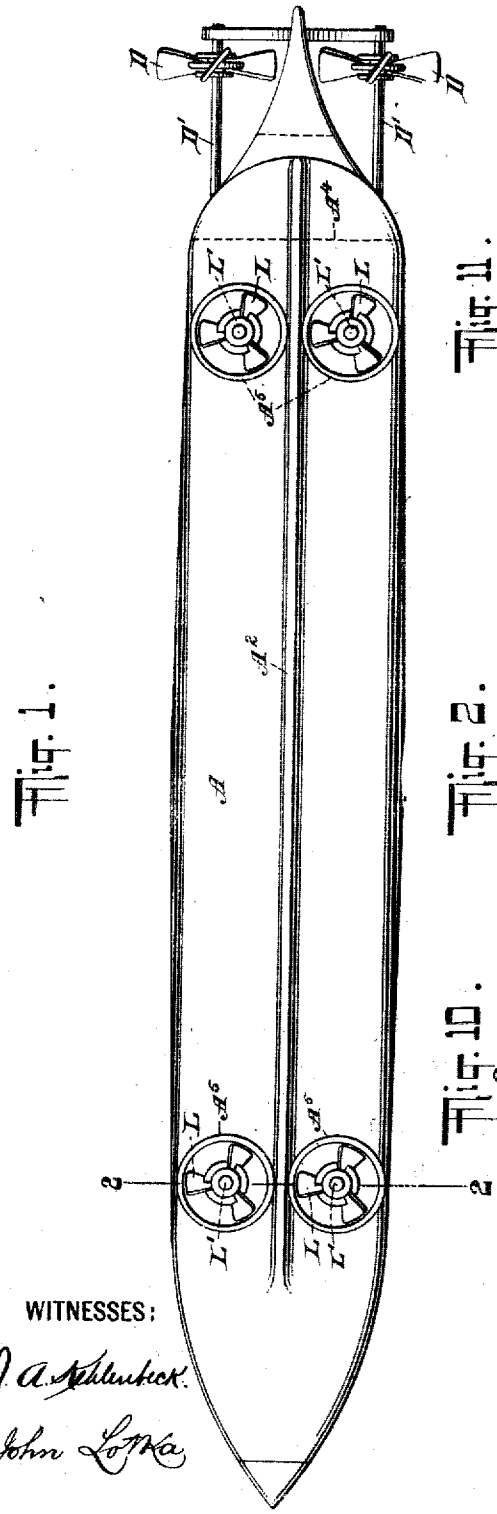


Fig. 1.

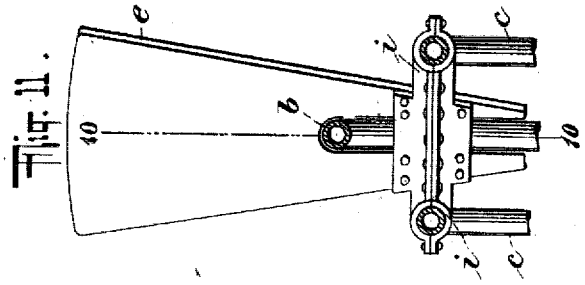


Fig. 11.

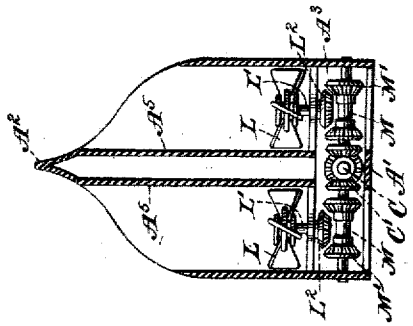


Fig. 2.

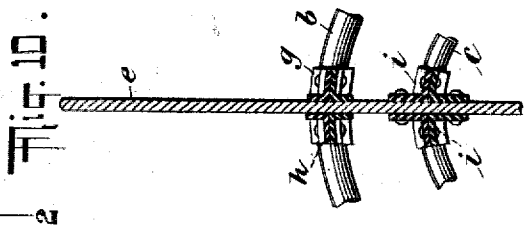


Fig. 19.

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4 SHEETS—SHEET 2.

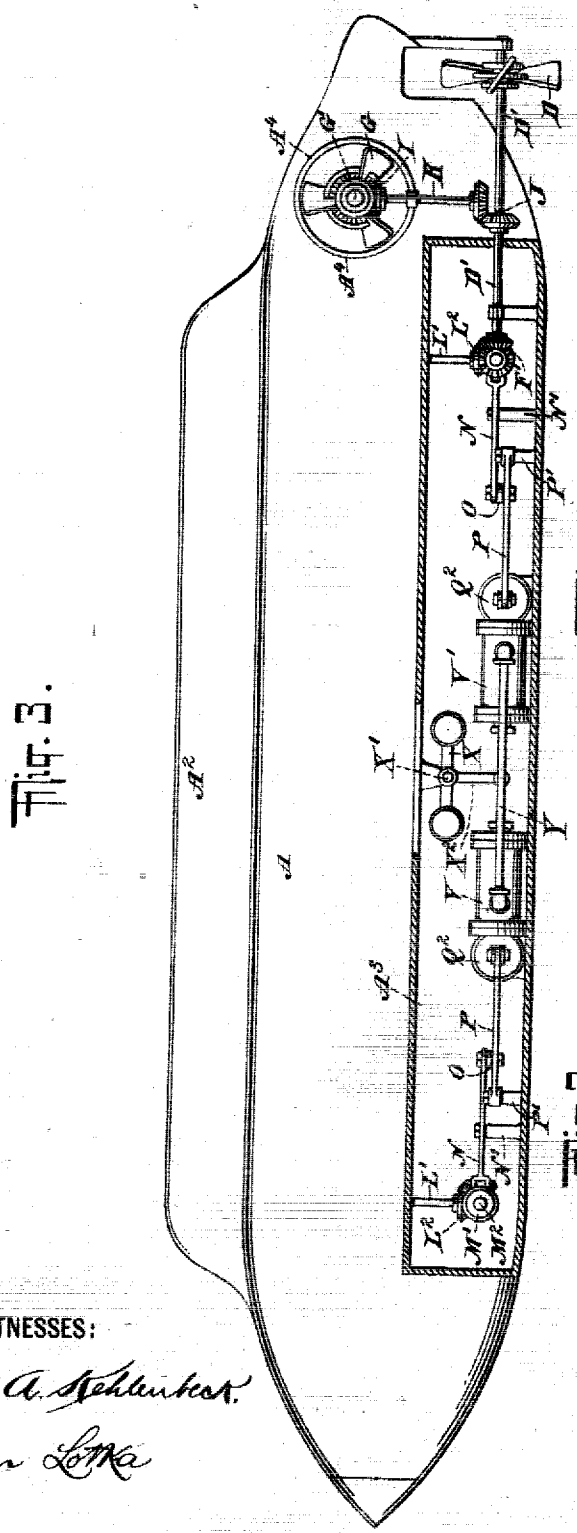


Fig. 3.

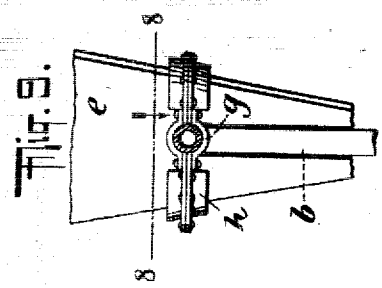


Fig. 5.

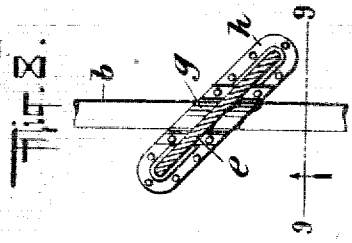


Fig. 6.

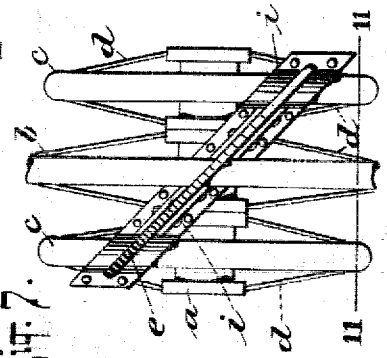


Fig. 7.

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4 SHEETS—SHEET 3.

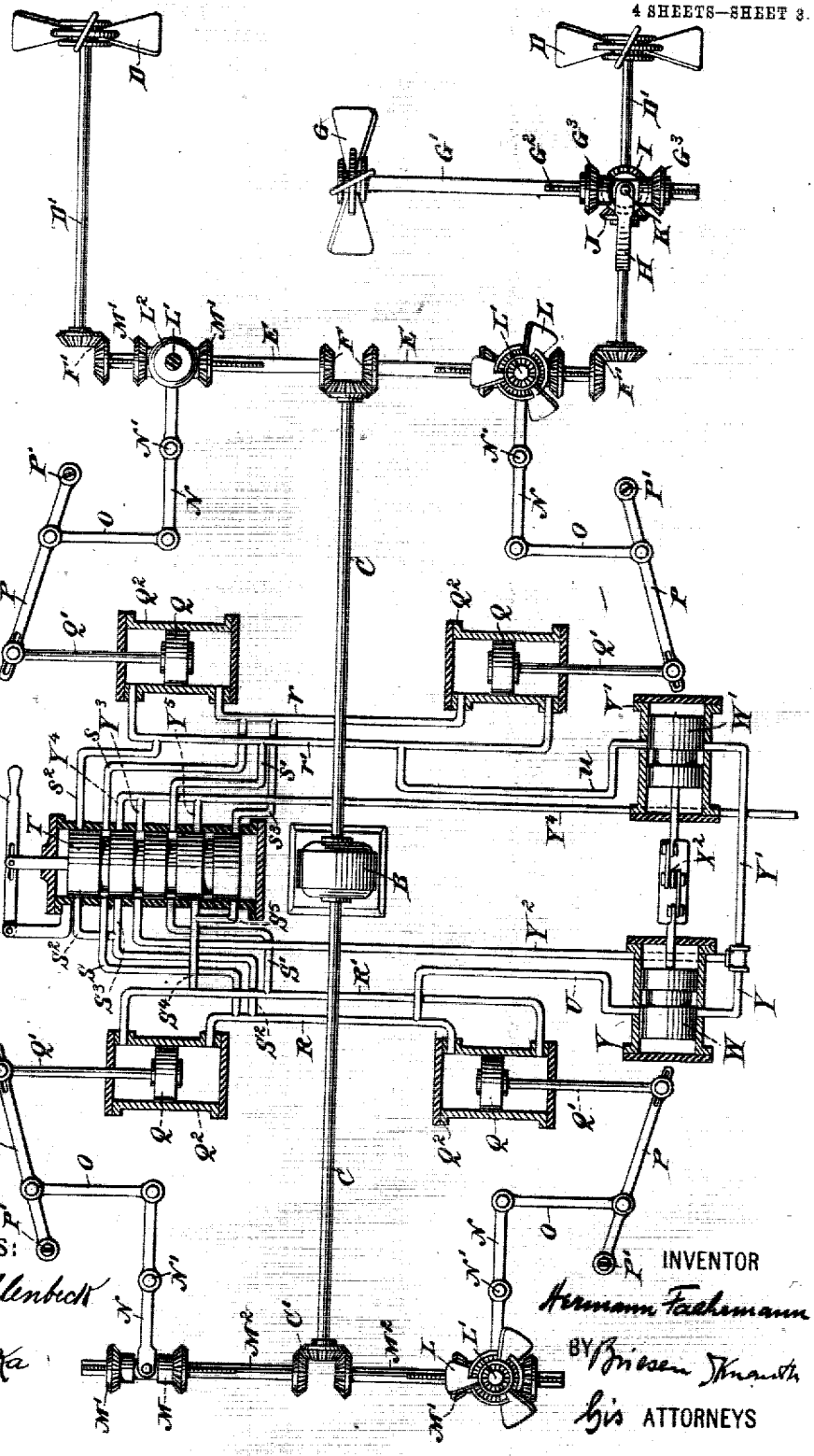


Fig. 4.

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4 SHEETS—SHEET 4.

Fig. 6.

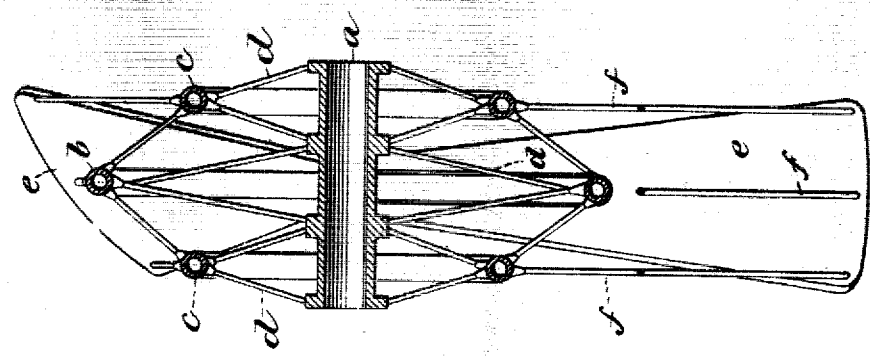
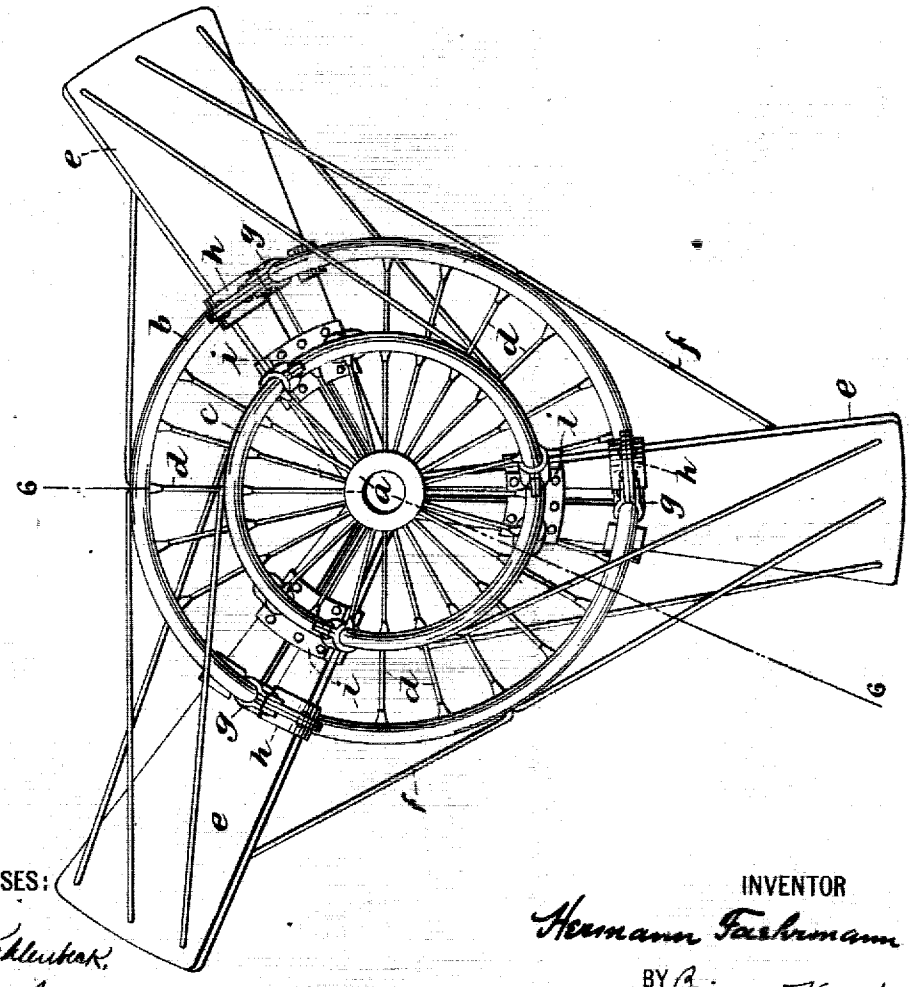


Fig. 5.



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HERMANN FAEHRMANN, OF NEW YORK, N. Y.

AIR-SHIP.

No. 853,542. Specification of Letters Patent. Patented May 14, 1907.

Application filed April 2, 1903. Serial No. 150,741.

To all whom it may concern:

Be it known that I, HERMANN FAEHRMANN, a subject of the Emperor of Germany, and a resident of the borough of Brooklyn, county of Kings, city and State of New York, have invented certain new and useful Improvements in Air-Ships, of which the following is a specification.

My invention relates to air ships, and has for its object to provide a strong, readily dirigible construction capable of being used for high speed propulsion, and in which the danger of capsizing is avoided by a device automatically keeping the ship horizontal or "on an even keel." I also provide mechanism by which the ship may be raised and lowered at will, without the use of ballast.

In constructing my air ship, I give its body substantially the shape of the inverted hull of a yacht or like craft, so that the body has a flat bottom virtually forming an aeroplane and a central upper rib or fin, which construction enables the ship to readily glide on the air and to follow a true course. Fore and aft, I arrange horizontal screws or propellers, and by properly rotating them, the entire ship may be caused to rise or fall without the use of ballast. An automatic device normally controls the forward and rearward horizontal propellers in such a manner that the two sets of propellers will exert opposite influences if the ship should lose its horizontal position; that is, the forward propellers will then have a tendency to lift the bow, and the rearward propellers a tendency to lower the stern, or vice-versa, thereby quickly restoring the ship to a horizontal position. A propeller rotating about a horizontal axis disposed transversely of the ship is employed for steering the air ship. The driving propellers rotate about axes extending lengthwise of the ship. These propellers are of a novel construction, combining lightness, strength and efficiency.

A typical form of my invention will now be described with reference to the accompanying drawings, and the features of novelty will then be pointed out in the appended claims. I may here remark that for the sake of clearness, I have exaggerated the relative sizes of various parts, and the drawings therefore are not to be considered correct in the matter of proportions.

Figure 1 is a plan of my improved air ship; Fig. 2 is a sectional elevation on line 2—2 of Fig. 1; Fig. 3 is a side elevation with parts in section; Fig. 4 is a diagrammatic plan of the mechanism; Fig. 5 is a face view of the propeller; Fig. 6 is a broken sectional elevation thereof, substantially on line 6—6 of Fig. 5; Fig. 7 is a detail showing the manner of securing the blade to the framework of the propeller; Fig. 8 is a sectional detail of the propeller on line 8—8 of Fig. 9; Fig. 9 is a cross section on line 9—9 of Fig. 8; Fig. 10 is a sectional elevation substantially on line 10—10 of Fig. 11; and Fig. 11 is a cross section on line 11—11 of Fig. 7.

The buoyant hull or body A of the air ship is of elongated form, pointed at both ends and provided with a flat bottom A′ adapted to form an aeroplane, and with a longitudinal central rib or fin A^2 at the top. The sides of the body converge toward the free edge of the rib or fin A^2. The shape of the hull is therefore somewhat like that of a yacht in an inverted position. The distribution of weight is, of course, entirely different, so that the airship will float with the flat surface at the bottom, and will have no tendency to turn turtle.

At the lower part of the body is a compartment A^3, preferably open, the relative height of which has been greatly exaggerated in Fig. 3, and which is adapted to serve as a platform or bridge for the operator and passengers, and also for the reception of the engine and the greater part of the machinery. The engine (indicated at B in Fig. 4) is preferably located at the center, and actuates a main shaft C from which power is transmitted to the driving propellers D, mounted on longitudinal horizontal shafts D′, by means of cross shafts E and bevel gearing F, F′.

A steering propeller G is provided, preferably at the stern and at a higher level than the driving propeller shafts D′, said steering propeller being mounted on a transverse horizontal shaft G′ which is located in a channel A^4 extending through the body A from side to side. This shaft is provided with a key or spline G^2, upon which is adapted to slide a sleeve carrying two opposing bevel wheels G^3. A shifting lever H, under the control of the operator, permits of bringing either of the wheels G^3 into engagement with a bevel wheel I, located between them, and permanently rotated from one of the driving propeller shafts D′ by means of bevel gearing J and a vertical shaft K. A spring or other means is provided for normally holding the wheels G^3 out of engagement with the wheel

1, so that the steering propeller will normally be idle. By swinging the lever H one way or the other, the ship may be efficiently steered, without the assistance of a rudder, although a suitable rudder may be added at the bow or stern, if desired. It will be observed that when the steering propeller is operated, an additional load is thrown on the shaft of the driving propeller, and the speed of the latter is thus reduced, which facilitates the evolutions of the airship.

One of the difficulties encountered in the operation of airships having an elongated body is their tendency to "dive," and various correctives have been employed, which, however, are slow in action and difficult to handle, besides being very liable to get out of order. The mechanism which I will now describe automatically keeps the ship level, is very sensitive, producing a corrective action immediately upon the ship's dipping at either end, and is little liable to get out of order. These results are due chiefly to the use of compressed air or a similar medium as a means for transmitting energy to the switch mechanism which I employ. Near the bow and stern, and preferably at opposite sides of the rib or fin A^2, I provide propellers L mounted on shafts L′ to rotate about vertical geometrical axes, so that said propellers may exert a lifting or lowering action on the ship. These propellers I prefer to arrange in upright channels or chambers A^5 extending through the body A and open to the atmosphere at the top and at the bottom. At the lower end of each of the shafts L′ a bevel wheel L^2 is provided, adapted to mesh with either one of two opposing bevel wheels M′ carried by a sleeve M which is capable of sliding on a shaft M^2 or E, but held to turn therewith. The shafts M^2, E are driven from the main shaft C by bevel gearing C′, F. The position of each sleeve M is controlled by a shifting lever N fulcrumed at N′ and connected by a link O with a lever P fulcrumed at P′. Each lever P is also connected with a rod Q′ extending from a piston Q working in a cylinder Q^2. Similar chambers of the two cylinders at the same end of the airship are connected by pipes R, R′, *r*, *r*′, respectively. By "similar" chambers, I mean chambers which are similar in function, so that the admission of air into them will cause both pistons to be shifted in such a manner as to cause the corresponding propellers to rotate with a like effect, that is, either a lifting effect or a lowering effect. Admission of air into the pipes R and *r*′ produces a like effect, that is, for instance, a lifting effect of all the propellers L, and similarly all the propellers will produce say a lowering effect if air is admitted into the pipes R′ and *r*. Normally, the wheels M′ are kept out of engagement with the wheels L^2 by springs, or in any other suitable manner.

The pipes R *r* are connected by pipes S *s* and in the particular instance shown the connection is controlled by a governing device or governing valve T, which also controls the connection S′ *s*′ leading from the pipe R′ to the pipe *r*′. Furthermore, from the pipes R *r*′ connections are made by pipes U *u* to the automatic controller consisting for instance of cylinders V V′ containing connected piston valves W W′. These pistons are adapted to be moved by a balance device consisting as shown of a weighted beam X pivoted at X′ about a horizontal axis extending transversely of the airship, and provided with an operating arm X^2 connected with said piston valves W W′. Opposite the cylinder ports which communicate with the pipes U *u*, I arrange inlet ports communicating with pipes Y Y′, from which a pipe Y^2 Y^3 Y^4 leads to source of compressed air, for instance receptacles in which compressed air is stored. The governing valve T also controls the connection between the pipe portions Y^2, Y^3.

Normally, that is, when the airship is in a horizontal position, the valves W W′ are in the position shown, so that no compressed air is admitted to the pipes U, *u*, and the propellers L are consequently idle. Should the ship for any reason deviate from a horizontal position, the valves W W′ will shift so as to admit compressed air to one of the pipes U, *u*, while keeping the other inactive. If, for instance, air passes into the pipe U, it will reach the bow cylinders Q^2 through the pipe R, and the stern cylinders Q^2 through the pipes R, S, *s*, and *r*. All the propellers L will now be rotated, but those at the bow with a different effect from those at the stern, raising the one while lowering the other, and thus quickly restoring the ship to a horizontal position. As soon as this result is obtained, the valves W W′ will close automatically. Should the deviation of the ship be in the opposite direction, air will pass into the pipes *u*, *r*′, *s*′, S′ and R′, and thus again cause the bow propellers and stern propellers L to correct the deviation and bring the ship back to a horizontal position.

In some cases it may be desirable to produce the same effect with all propellers L, that is, either a lifting or a lowering effect, so as to cause the ship to rise bodily without the use of ballast, or to descend. For this purpose I provide suitable mechanism for admitting air simultaneously to the pipes R and *r*′, or R′ and *r*. In the particular construction shown, this is accomplished by the governing valve T, which is under the control of the operator, for instance by means of a lever Z, capable of three positions, one (as shown) for the automatic action described above, another for a bodily upward movement of the ship, and the third for the bodily downward movement of the ship. Suitable mechanism will be provided for locking the lever Z and

the valve T in any one of the three positions. The valve T has a series of piston portions separated by grooves three of which are operative in the position shown to connect pipe S with s, Y^2 with Y^3, and S' with s', as above described. The portions of full diameter are adapted to close the ports of all the said six pipes when the valve T is moved either into the "up" or into the "down" position. The following additional pipe connections are controlled by the governing valve T: from a pipe S^2, which connects with the pipe R, to a pipe s^2, which connects with the pipe r'; from a pipe S^3, which is a branch of pipe S^2, to the pipe Y^4; from a pipe S^4, which connects with the pipe R', to a branch Y^5 of the pipe Y^4; and from a pipe S^5, which is a branch of pipe S^4, to a pipe s^3 which communicates with pipe r. Now if the valve T is shifted to the "up" position all the passages are closed except those that make the following connections: S^4 with Y^5, and S^5 with s^3. Compressed air will therefore flow from the pipe Y^4 Y^5 to the bow cylinders Q^2 through the pipes S^4 R', and to the stern cylinders through the pipes S^4 S^5 s^2 r, producing the desired operation of the propellers L. If the valve T is shifted to the "down" position, all the passages are closed except those that make the following connections: S^3 with s^2, and S^5 with Y^4. Thus compressed air will be admitted from the pipe Y^4 to the bow cylinders Q^2 through the pipes S^3 S^2 R, and to the stern cylinders through the pipes S^3 S^2 s^2 r', thus again producing the desired operation of the propellers L.

By the mechanism above described, I am enabled to use the same propellers L either for raising or lowering the air ship bodily, or for automatically preserving the horizontal position of the ship.

I have through experience acquired the conviction that success in aerial navigation will depend largely on the use of propellers rotating at a high rate of speed. In order to be able to employ high velocities, I have devised a propeller which will be very light yet very strong and rigid. Figs. 5 to 11 represent my improved propeller. It comprises a hub a and three (or more) rims c b c surrounding the same, the central rim b being of greater diameter than the others, c. Each of the rims is connected with the hub a by wire stays or braces d, which converge toward the respective rims. To the framework thus formed I secure the vanes or blades e, made of thin metal, or of frames covered with silk or other resistant material. Each blade fits between the outer rims c, and over the central rim b, being slotted for this purpose for a distance from its inner end. To hold the blades steady, wire braces f extend from them to the three rims. Furthermore, the central rim b is embraced by two half-sockets g (see Figs. 8 and 9) which also clasp between them the ends of four angle irons h, the abutting flanges of which are bolted or riveted together, while the other flanges lie against the vane and are secured thereto. These angle irons are bent around the edges of the vanes.

As shown best in Figs 7, 10 and 11, the outer or lateral rims c are connected by braces i formed with socket portions at the ends to embrace the said rims, and with angular central portions the abutting flanges of which are riveted together while the other flanges lie against the blades e at opposite sides and are secured thereto. The great strength of this propeller enables it to be operated at a high rate of speed.

Various modifications may be made without departing from the nature of my invention as set forth in the appended claims.

What I claim as my invention and desire to secure by Letters Patent is—

1. In an air-ship, a body provided near the bow and stern respectively with normally stationary propellers mounted to turn about vertical axes, means controlled by a deviation of the ship from a horizontal position, for simultaneously rotating said propellers to produce opposite effects at the bow and stern to restore the ship to a horizontal position, and a governing device, under the control of the operator, for causing all of said propellers to rotate with similar effects to bodily raise or lower the ship.

2. In an air-ship, a body provided near the bow and stern with propellers mounted to turn about vertical axes, a reversing mechanism for the bow propeller, another reversing mechanism for the stern propeller, each reversing mechanism comprising a piston and means operated by the movement thereof to cause the respective propeller to rotate in one direction or the other, according to the position of said piston, and a cylinder containing said piston and divided thereby into two chambers, means for connecting similar chambers of the cylinders of the bow and stern propellers with a source of compressed fluid to cause all the propellers to rotate with the same effect, and means for connecting unlike chambers of the cylinders of the bow and stern propellers with a source of compressed fluid, to produce opposite effects at the bow and stern.

3. In an airship, a body provided near the bow and stern with propellers mounted to turn about permanently vertical axes, means for operating the said propellers so that they will produce similar effects to raise or lower the ship bodily, and means controlled by a deviation of the ship from a horizontal position, for simultaneously turning the said propellers to produce opposite effects at the bow and stern.

4. In an airship, a body provided near the bow and stern with propellers mounted to

turn about vertical axes, mechanism controlling the motion and the direction of rotation of the said propellers, compressed air pipes leading to said mechanism, a controller governing the admission of compressed air to said pipes, and a balance device arranged to actuate said controller.

5. In an airship, a body provided near the bow and stern with propellers mounted to turn about vertical axes, mechanism for controlling the motion and direction of rotation of said propellers, compressed air pipes leading to said mechanism, a controller operated by a deviation of the ship from a horizontal position, for admitting air to said pipes in such a manner as to cause the propellers to produce opposite effects at the bow and stern, and another device under the control of the operator for rendering the said first named controller inactive and so admitting compressed air to the said mechanism that the propellers will produce like effects at the bow and stern.

6. In an airship, a body provided with bow and stern propellers mounted to turn about vertical axes, mechanism operated automatically upon a deviation of the ship from a horizontal position, for causing the said propellers to rotate with opposite effects at the bow and stern, and a governing device under the control of the operator, which in one position allows the said mechanism to act, and in other positions renders the said mechanism inactive and causes the propellers to rotate with like effect at the bow and stern.

7. In an airship, a propeller comprising a framework having a central hub, a central rim and two lateral rims of smaller diameter than said central rim connected with said hub, and vanes or blades connected with said framework.

8. In an airship, a propeller comprising a central hub, rims surrounding said hub, braces or stays connecting the hub with the rims and converging some toward one rim, and some toward another, and vanes or blades carried by said rims.

9. In an airship, a propeller comprising a framework having connected rims, one of said rims being of larger diameter than the adjacent ones, and blades fitted over said large rim and between the smaller rims.

10. In an airship, a propeller comprising a framework having connected rims, one of said rims being of larger diameter than the adjacent ones, blades fitted over said large rim and between the smaller rims, and connections extending from one small rim to the other and secured to the said blades.

11. In an airship, a propeller comprising a framework having connected rims, one of said rims being of larger diameter than the adjacent ones, blades fitted over said large rim and between the smaller rims, and braces extending in opposite directions from the large rim and secured to the said blades.

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