No. 607,240. Patented July 12, 1898.

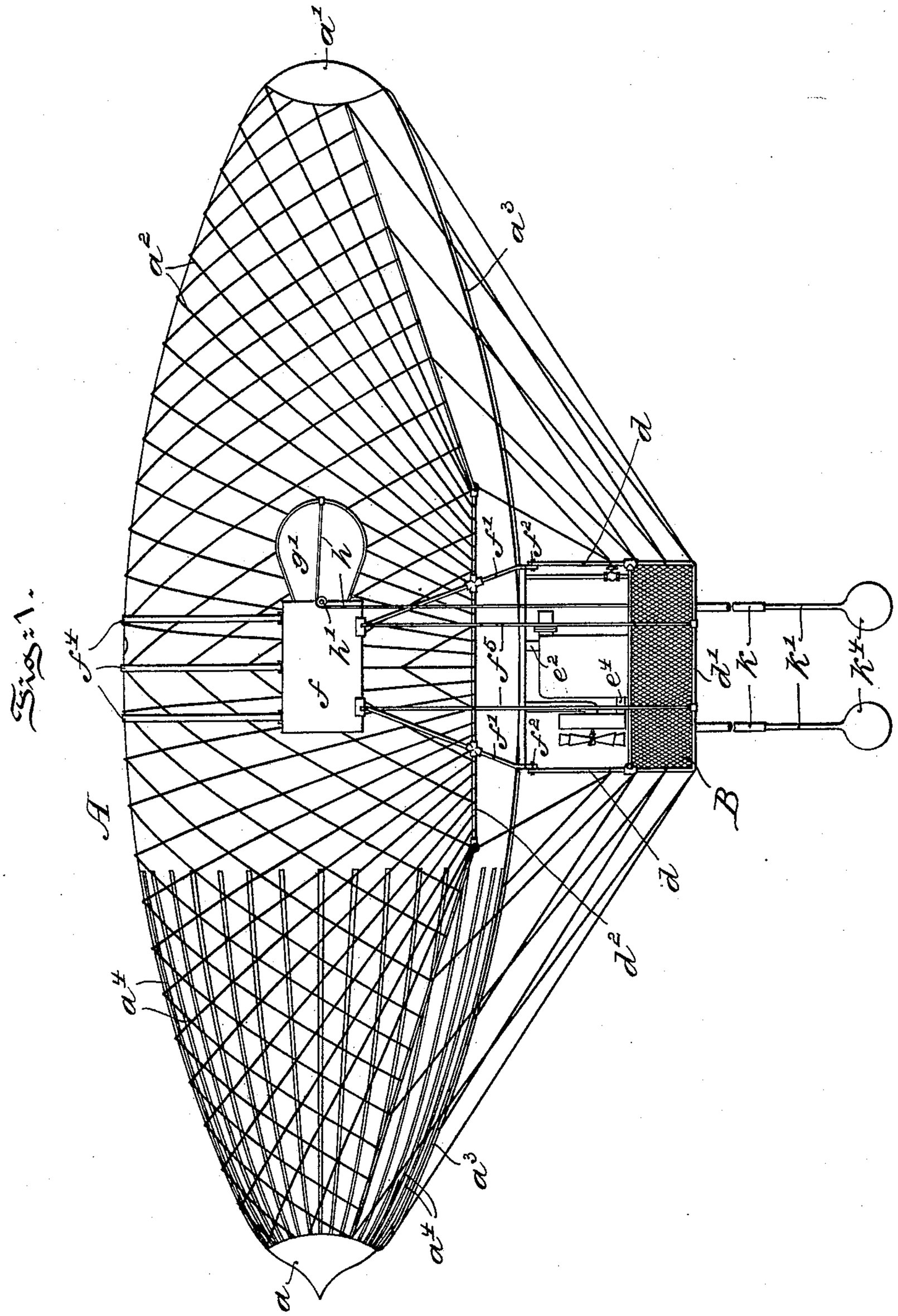
C. E. HITE.

AIR SHIP.

(Application filed Sept. 23, 1897.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



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4 Sheets—Sheet 2.

Fig: 2.

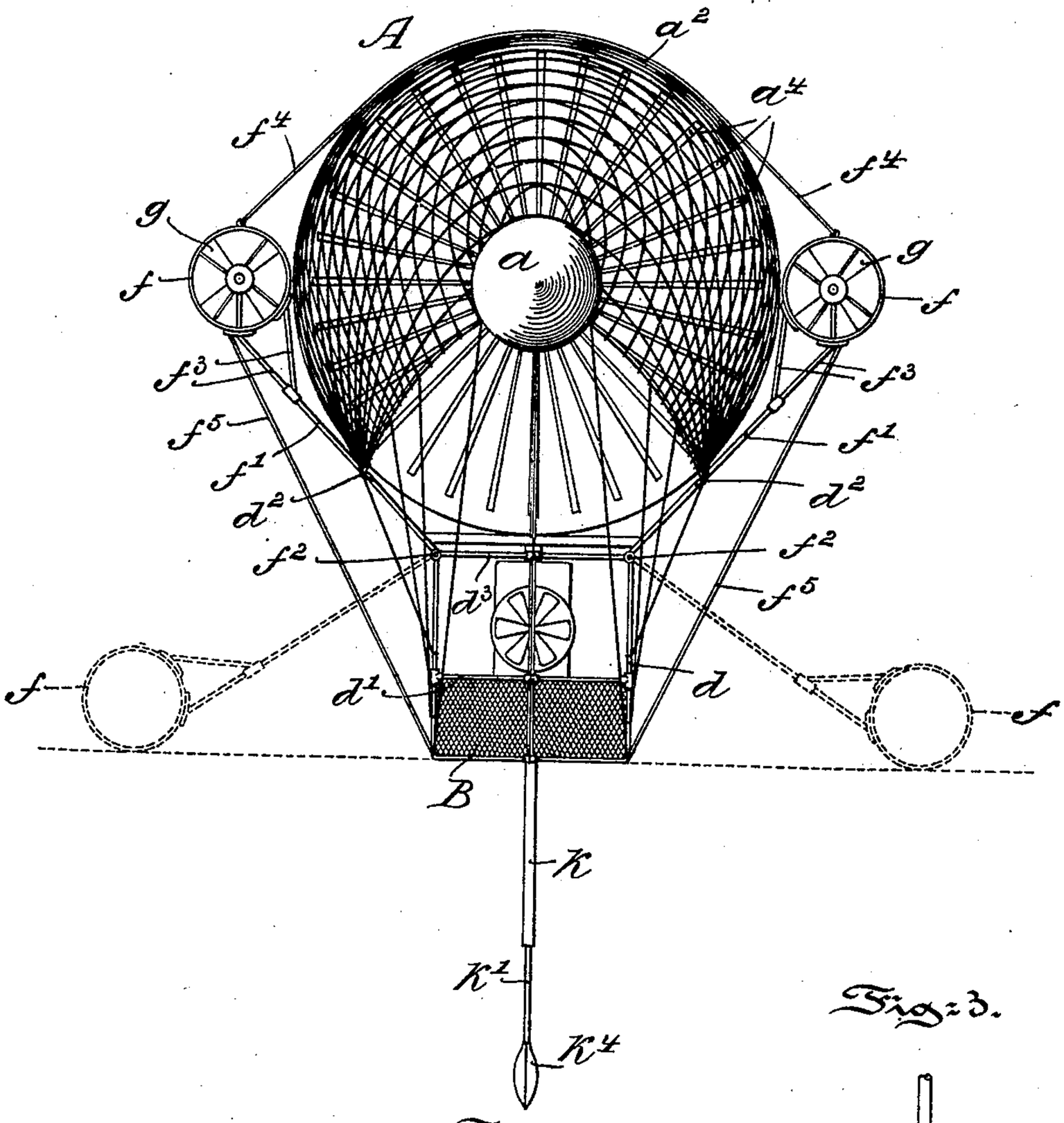


Fig: 3.

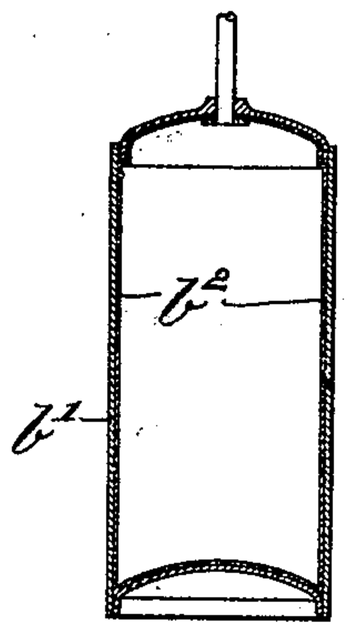


Fig: 4.

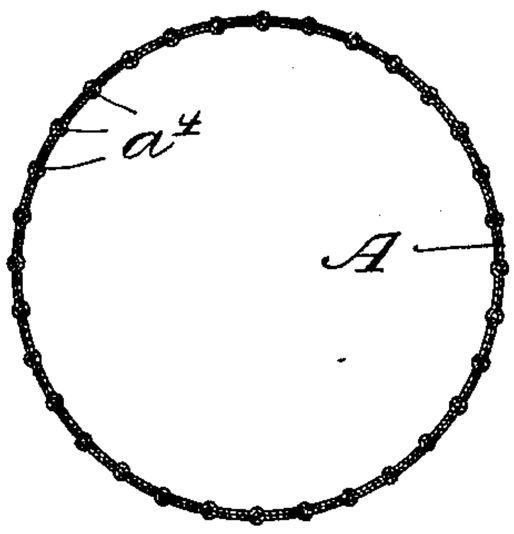
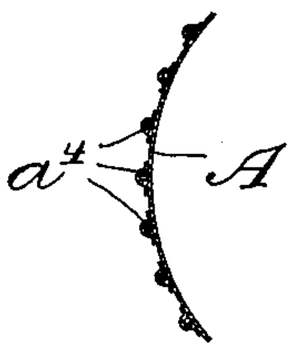


Fig: 5.



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(No Model.) 4 Sheets—Sheet 3.

Fig. 6.

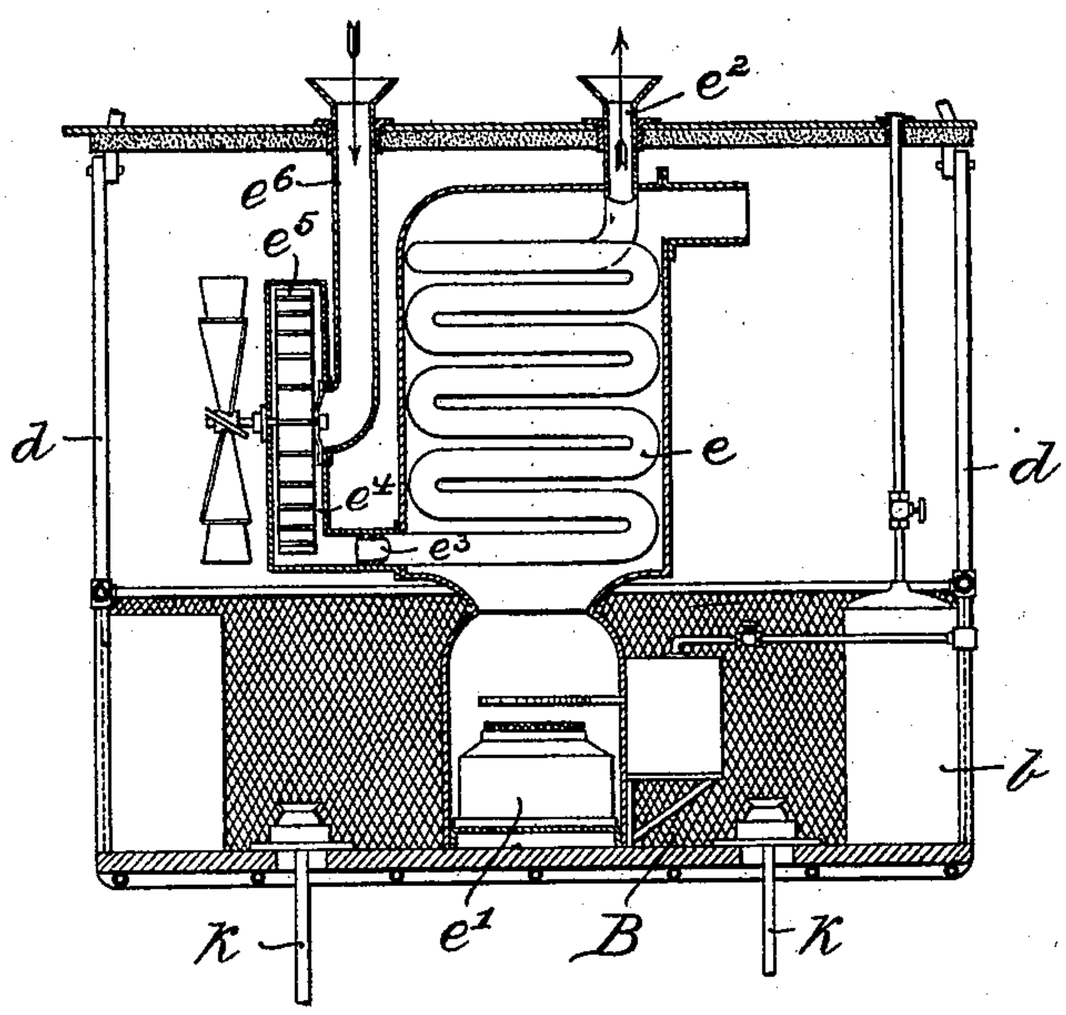


Fig. 8.

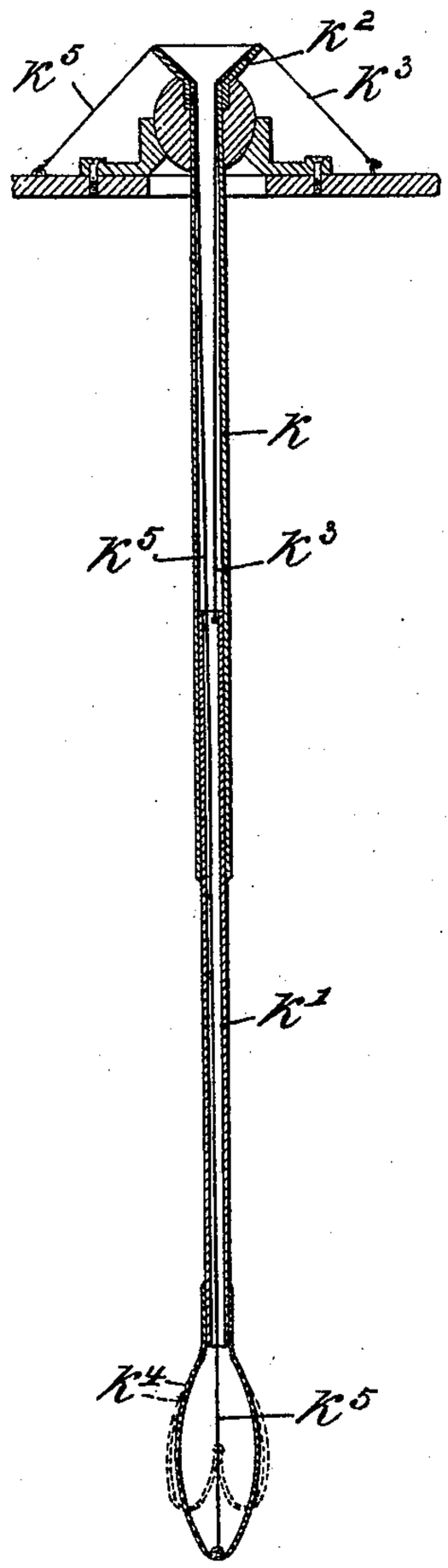
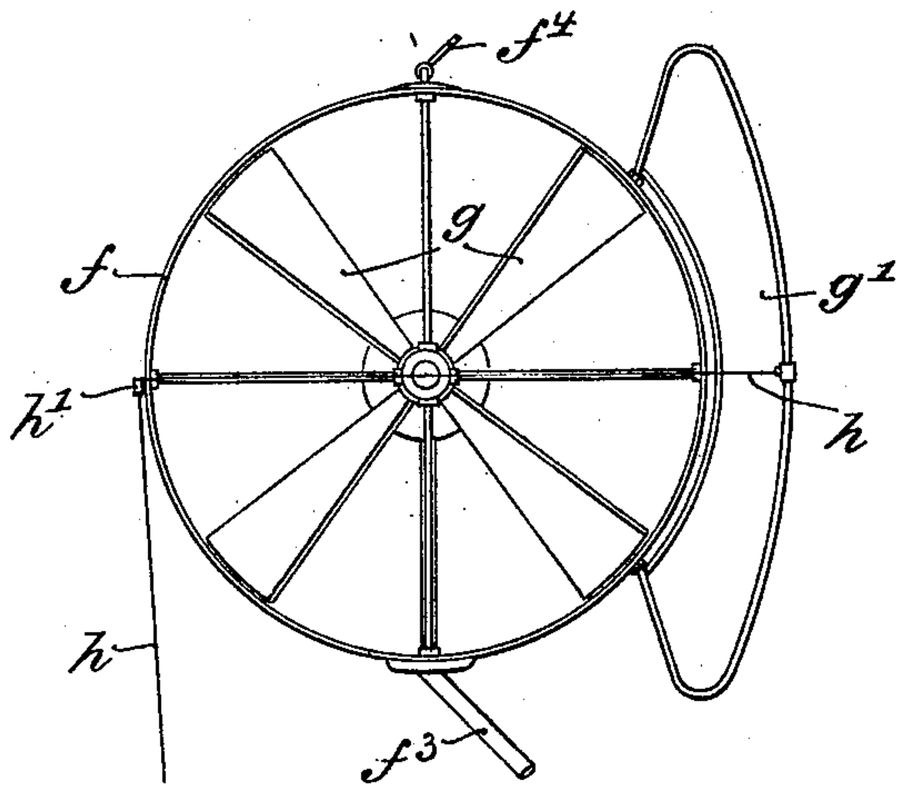


Fig. 7.



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(No Model.) 4 Sheets—Sheet 4.

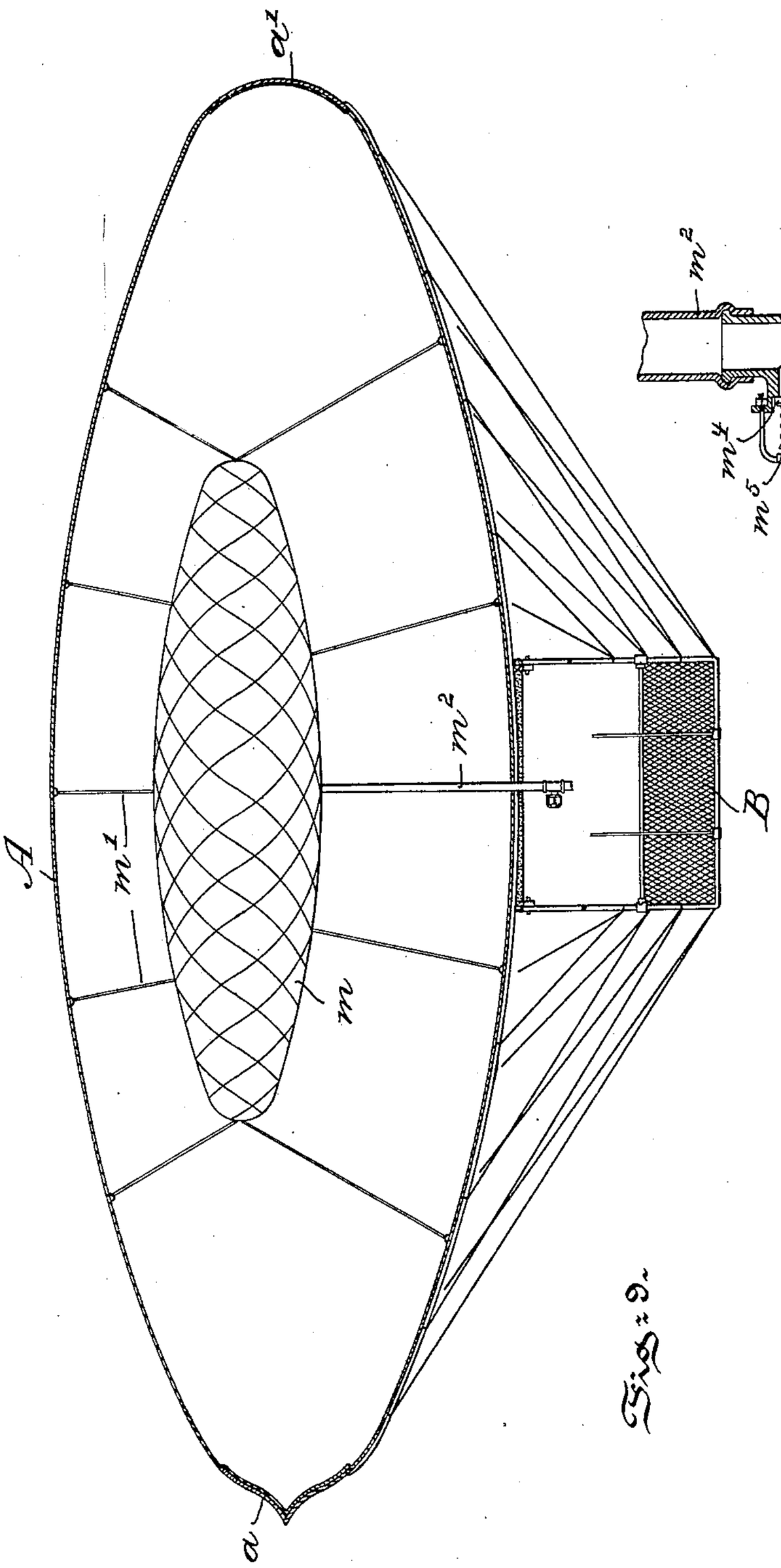

Fig. 9.

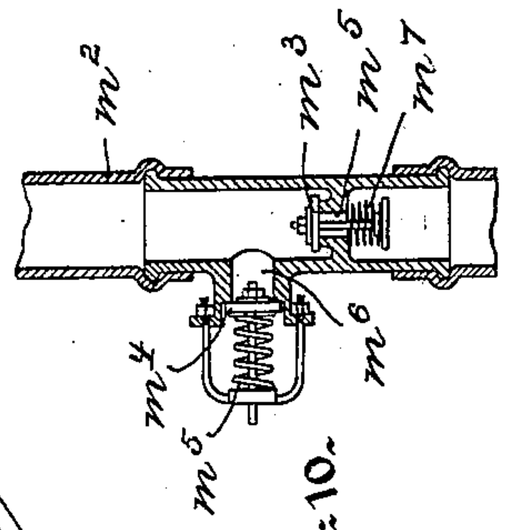

Fig. 10.

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UNITED STATES PATENT OFFICE.

CHARLES E. HITE, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE HITE MANUFACTURING AND NAVIGATION COMPANY, OF SAME PLACE.

AIR-SHIP.

SPECIFICATION forming part of Letters Patent No. 607,240, dated July 12, 1898.

Application filed September 23, 1897. Serial No. 652,677. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. HITE, a citizen of the United States, residing at the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Air-Ships, of which the following is a specification.

My invention has relation to an air-ship of the type or character wherein the car is supported or elevated by a balloon or gas-receptacle, and in such connection it relates particularly to the construction and arrangement of such an air-ship.

My invention consists, first, in providing in an air-ship a balloon or flexible gas-receptacle adapted to be inflated by hydrogen or other gases, in combination with two pipes leading from and to the balloon, a fan or other suction apparatus connected to one of said pipes and adapted to suck gas from the balloon therethrough, a heating-coil or similar apparatus into which the gas so sucked is adapted to be discharged, said coil being connected with another pipe, whereby, when required, a constant circulation and heating of the gas in the balloon may be accomplished; second, in providing in an air-ship, in connection with the balloon and on either side parallel with the medial line of the balloon, a tube or cylinder, the forward end of which is closed by a propeller or fan and having at its rear end a rudder for steering, said rudder being curved to correspond with the periphery of the tube, to which it is pivotally connected, and, third, in providing in an air-ship a movable or adjustable ballast consisting of a telescoping tube, at the lower end of which is secured a flexible sack or bag, the tube adapted to be collapsed or extended and serving, with the bag, to form a receptacle for water, heavy oil, or similar liquid ballast, the bag being adapted to be collapsed independently of the tubes.

My invention further consists of an air-ship constructed and arranged in substantially the manner hereinafter described and claimed.

The nature and scope of my invention will be more fully understood from the following description, taken in connection with the accompanying drawings, forming part hereof, in which—

Figure 1 is a side elevational view of an air-ship embodying main features of my invention. Fig. 2 is an elevational view of the forward end of the air-ship. Fig. 3 is a vertical sectional view, enlarged, of the gas-reservoir. Fig. 4 is a cross-sectional view of the reinforced forward end of the balloon. Fig. 5 is a similar view illustrating a modification of the reinforced end illustrated in Fig. 4. Fig. 6 is a side elevational view, enlarged, of the means for heating and circulating the gas in the balloon. Fig. 7 is a rear elevational view, enlarged, of one of the side tubes, the propeller, and the rudder. Fig. 8 is a vertical sectional view, enlarged, of the adjustable ballasting tube and bag. Fig. 9 is a longitudinal sectional view of the balloon, showing the internal bag or sack; and Fig. 10 is an enlarged sectional view of the tube and valves leading to the internal bag or sack.

Referring to the drawings, A represents the balloon, which may by preference be prolately spheroidal in shape or cylindriform with conical ends. The forward end of the balloon is protected by a pointed cap a and the rear end by a spherical cap a', the two caps being held to position by the harness a^2 and a lower rope a^3, as clearly illustrated in Fig. 1. The outer shell of the balloon consists of one or more thicknesses of fabric of suitable character and of such size and capacity as to lift a given weight. The forward end of the balloon is reinforced by a series of strengthening-ribs a^4, of bamboo or other suitable material, which may either be secured between the thicknesses of the covering, as illustrated in Fig. 4, or secured to the outside of the covering, as illustrated in Fig. 5. These ribs a^4 serve to keep the forward end of the balloon distended against the pressure of the air when the air-ship is traveling through the atmosphere, and hence help to preserve the equilibrium of the balloon.

The balloon A may be supplied with gas from a tank or reservoir b, carried in the car B of the air-ship, and this tank or reservoir, as illustrated in Fig. 3, is of the following preferred construction: It consists of an outer shell or cylinder b', of light metal, such as aluminium alloy, sufficiently strong to with-

stand the pressure under which the gas is to be held in the tank or reservoir, and snugly fitting within the cylinder b' is located a bag b^2, of gold-beaters' skin or other similar impervious material, into which the gas is forced. A tank of such construction will be found to be exceedingly light in weight and yet practically gas-tight.

The car B is suspended below the balloon A, and it consists of a series of upright piping d, properly braced by the cross-tubes d', which piping depends from a frame consisting of the longitudinal tubes d^2, suspended from the bottom of the harness a^2, as illustrated in Figs. 1 and 3. Within the car is located the apparatus for heating and circulating gas within the balloon A. As illustrated in Fig. 6, this apparatus consists of a coil e, heated by a lamp or other suitable means e'. One end e^2 of the coil is connected directly with the interior of the balloon, while the other end e^3 is connected with the outlet from a chamber e^4, in which rotates a fan or suction-blower e^5, the inlet to the chamber communicating with the balloon A by a pipe e^6. When the fan e^5 is in operation, gas is sucked through the pipe e^6 from the balloon A, passed through the coil e, and discharged by the pipe e^2 into the balloon, thereby creating within the same a circulation of gas and forming a means of constantly heating the gas in the balloon.

Along the sides of the balloon and in the medial line thereof are arranged the tubes f, which are supported above the car B by the levers f', pivoted at one end, as at f^2, in the cross-bars d^3 of the frame, carried by the harness a^2. The other end of said levers f' is forked, as at f^3, to form a support for the tube f. The tubes are connected to the top of the harness a^2 by bands or straps f^4, and are also connected to the base of the car B by tie-ropes f^5.

From the foregoing description it will be obvious that the tubes f are maintained in their proper position when the balloon is inflated and will sink to a position substantially parallel with the base of the car, as indicated in dotted lines in Fig. 2, when the balloon is deflated, the supporting-levers f' turning upon their pivotal connection f^2 to permit of the change in position of the tubes f. At the forward end of each tube is located a fan or suction-wheel g, adapted when rotating to suck air into the tube f and to discharge it from the rear end, the impact of the discharged air against the circumambient atmosphere forming a means of propulsion for the airship. To the periphery of the rear end of each tube f is hinged a rudder g', the shape of which in cross-section corresponds with that of the tube and is pivoted on that side of the tube which is adjacent to the balloon. To the free end of the rudder g' is secured a rope or chain h, passing over a pulley h', secured to the side of the tube f and extending to the car B, as illustrated in Fig. 1. By pulling on this rope or chain h the rudder g' may be moved to close more or less of the rear aperture of the tube f, the force of the wind passing through the tube serving to throw the rudder normally away from the aperture and toward the side of the balloon. From the bottom of the car extends the ballasting device, which, as illustrated in Fig. 8, consists, preferably, of the telescoping tubes k and k', the upper end or mouth of the external tube k being funnel-shaped, as at k^2. The tube k', sliding within the tube k, may be raised or lowered by a cord or chain k^3, and its lower end is closed by a bag or sack k^4. This bag or sack k^4 may be partially or completely collapsed and drawn upward within the tube k' by means of the cord or chain k^5, passing through both tubes k and k', a partial collapse of the bag being indicated by the dotted lines in Fig. 8. The tubes k and k' and bag k^4 may be partially or completely filled with water, heavy oil, or other liquid ballast poured into the funnel k^2, and when the bag k^4 is drawn upward and collapsed this liquid ballast will rise in the tubes k and k', and if sufficient ballast be used to completely fill the tubes and bag the collapse of the bag or raising of the pipe k' will cause the ballast to overflow from the funnel k^2.

In Figs. 9 and 10 there is illustrated a means whereby the shell of the balloon may be kept taut when the pressure of gas within the balloon varies by reason of heating or cooling of the gas or any expansion or contraction of the gas due to varying climatic or atmospheric changes. Within the shell of the balloon A is suspended, preferably above the central line thereof, a sack or bag m, which is secured by ropes or cords m' to the top and bottom of the interior of the shell of the balloon. Leading from the sack or bag m to the car B is a pipe m^2, having at its lower end two valves m^3 and m^4, normally closing the inlet m^5 and outlet m^6 of the tube m^2 by means of suitable springs. The springs m^7 of the valve m^3 seats the valve downward, and inrushing air lifts the valve off its seat against the pressure of the spring before the air can enter the tube m^2. The spring m^5 of the valve m^4 presses the valve m^4 against its seat with a force sufficient to overcome a certain predetermined pressure within the tube m^2. When now the cover or shell of the balloon becomes loose by reason of a less pressure of gas within the balloon, the bag or sack m is inflated by forcing air under pressure through the tube m^2 until the pressure thus exerted internally upon the gas is sufficient to stretch the shell of the balloon taut. When the pressure of gas within the balloon becomes greater, it will so compress the bag or sack m that the air in the sack will be forced out through the tube m^2 and the valve m^4, and the collapse of the sack m will relieve the internal pressure of the gas upon the shell or cover of the balloon.

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

1. In an air-ship, a balloon or flexible gas-receptacle, in combination with an inlet and outlet pipe for gas, a fan or similar suction apparatus connected with one of said pipes, and a heating-coil connected with the suction apparatus and with the other pipe, all arranged so that a constant circulation and heating of the gas in the balloon may be maintained, substantially as and for the purposes described.

2. In an air-ship, in combination with a balloon or flexible gas-receptacle, two tubes or hollow cylinders, each arranged on either side of the balloon and in the medial line thereof, a suction-fan located in the forward end of said tube and a rudder pivotally connected to the periphery of the tube at the rear end thereof, said rudder being curved in cross-section to correspond to the shape of that part of the periphery of the tube to which it is pivoted, substantially as and for the purposes described.

3. In an air-ship, in combination with a balloon or flexible gas-receptacle, two tubes or hollow cylinders each arranged on either side of the balloon and in the medial line thereof, a suction-fan located in the forward end of said tube, a rudder pivotally connected to the periphery of the tube adjacent to the balloon, a frame supported below the balloon, a lever pivoted at one end to said frame and adapted to support the tube in operative position and to permit of its dropping below the balloon when deflated, substantially as and for the purposes described.

4. In an air-ship, a ballasting device, comprising two telescoping tubes, a bag or sack closing the end of one of said tubes, means for collapsing said bag, and means for telescoping said tubes, substantially as and for the purposes described.

In testimony whereof I have hereunto set my signature in the presence of two subscribing witnesses.

CHARLES E. HITE.

Witnesses:
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THOMAS M. SMITH.