(No Model.) 2 Sheets—Sheet 1.

D. HURLBUT.

AIR SHIP.

No. 526,394. Patented Sept. 25, 1894.

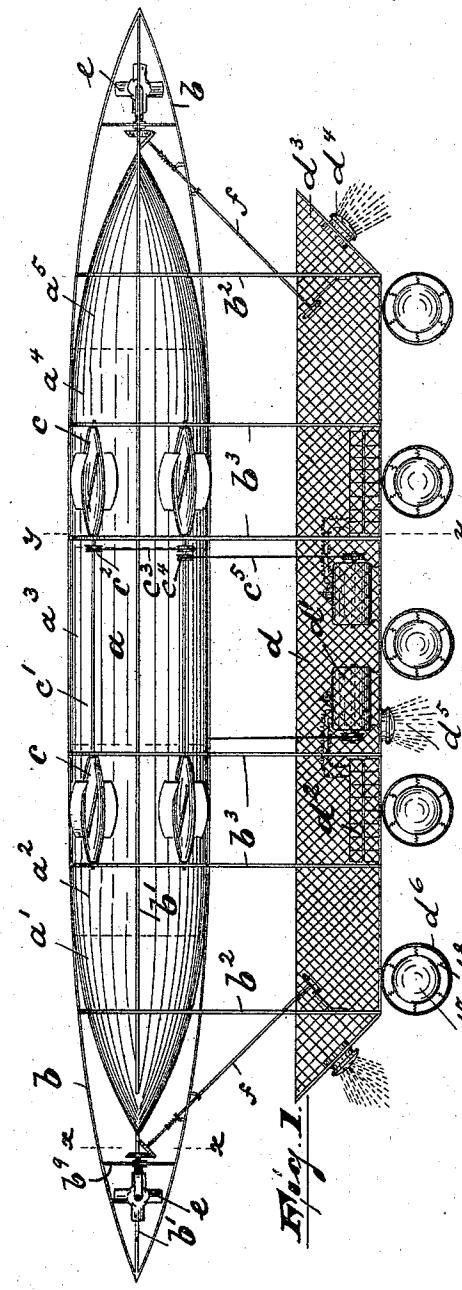

Fig. 1.

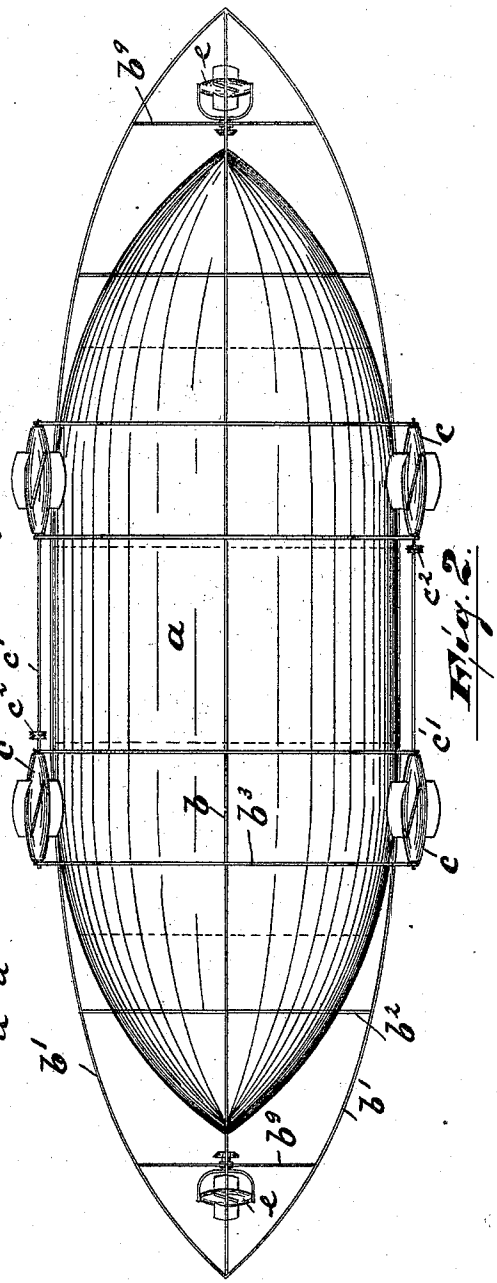

Fig. 2.

WITNESSES:
Henry E. Erwding.
Wm. D. Bell.

INVENTOR:
Duane Hurlbut
BY
Gartner & Co
ATTORNEYS.

(No Model.) 2 Sheets—Sheet 2.

D. HURLBUT.

AIR SHIP.

No. 526,394. Patented Sept. 25, 1894.

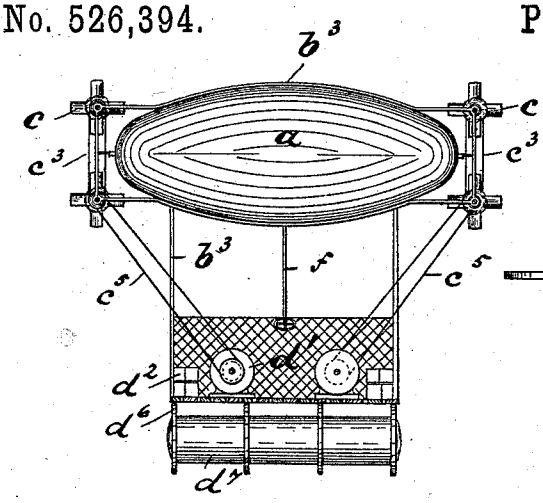

Fig. 3.

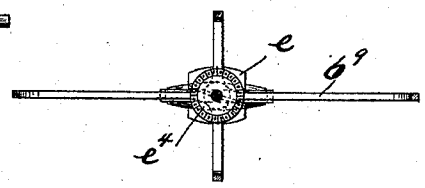

Fig. 5.

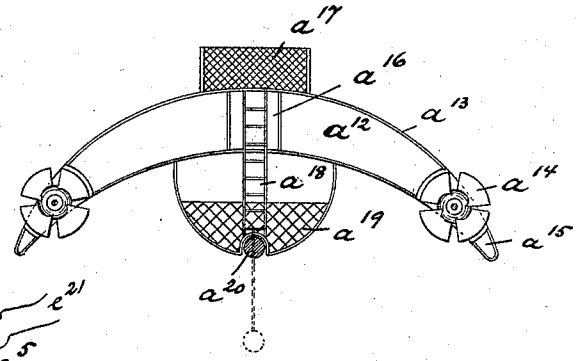

Fig. 6.

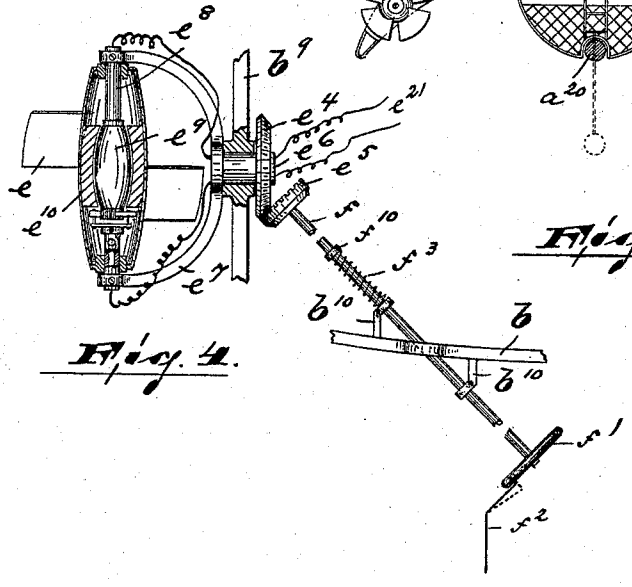

Fig. 4.

WITNESSES:

Henry C. Ewing.

Wm. D. Bell.

INVENTOR:

Duane Hurlbut

BY Dartner & Co

ATTORNEYS.

UNITED STATES PATENT OFFICE.

DUANE HURLBUT, OF PATERSON, NEW JERSEY.

AIR-SHIP.

SPECIFICATION forming part of Letters Patent No. 526,394, dated September 25, 1894.

Application filed October 24, 1893. Serial No. 489,014. (No model.)

To all whom it may concern:

Be it known that I, DUANE HURLBUT, a citizen of the United States, residing in Paterson, county of Passaic, and State of New Jersey, have invented certain new and useful Improvements in Air-Ships; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

This invention relates to a new and useful improvement in air ships and it consists in the novel construction, arrangement and combination of parts hereinafter described and claimed.

This invention is illustrated by the accompanying drawings, wherein—

Figure 1 is a side elevation of the air ship; Fig. 2, a top plan view thereof. Fig. 3 is a cross section on the line *y—y*, Fig. 1. Fig. 4 is an enlarged detail view partly sectioned of the steering apparatus placed at either end of the balloon. Fig. 5 is a cross section taken on the line *x—x*, Fig. 1, and Fig. 6 is a cross section showing the invention especially adapted to be used both as an air and marine ship.

In said drawings *a* represents the balloon or gas chamber which is substantially cigar shaped and elliptical in cross section. The balloon proper is composed of one or more sections a', a^2, a^3, a^4, and a^5 of oiled silk, aluminum or similar light but durable material. These sections are united together in any suitable manner to form either one large gas chamber or a balloon composed of two or more separate gas compartments. The balloon *a* is inclosed in a frame work consisting of the longitudinal rods *b* and *b'* and the connecting braces b^2, arranged vertically at either end and adapted to support the car *d*, and of the intermediate vertical braces b^3, which are adapted also to support said car as well as to serve another purpose hereinafter set forth. Along both sides of the chamber *a* are arranged the propellers *c* the shafts *c'* of which have suitable bearings in the frame work surrounding the balloon *a*. It has been deemed preferable to arrange these propellers in sets of four, one set on either side of the balloon, two of each set being arranged forward and two to the rear of the center line of the balloon, although such an arrangement may be varied should occasion require. The shafts *c'* by preference have their bearings in the vertical braces b^3 and are each provided with a pulley c^2, these pulleys being connected by a belt c^3. The lowermost of the shafts *c'* also carries a pulley c^4 and is connected by belt c^5, passing over said pulley c^4, with the power pulley of an electric or other motor d' placed in the car *d* of the balloon *a*. The arrangement of these propellers *c*, the method of connecting their shafts *c'* together and with the motor d', is clearly indicated in Fig. 3. The motor d' is by preference an electric motor and operated by storage batteries d^2, which are charged prior to the ascension of the ship.

The car *d* is provided with wedge shaped ends d^3, so that it will offer less resistance to the air when the ship is moving, and each end is provided with adjustable search lights d^4. On the bottom of the car are placed other search lights d^5. These lights d^4 d^5 may be fed by the storage batteries d^2. Depending from the bottom of the car *d* is a series of rings d^6, within which are held by suitable springs d^8, the cylindrical cushions d^7 containing air, or gas, (see Fig. 3,) and which assists in elevating the car.

At either end of the balloon *a* and having a pivotal bearing in the cross bar b^9 of the frame work, is a propeller *e* or steering wheel. This propeller *e* is supported in a forked bracket e^7, the shaft e^6 of which is pivoted in the bar b^9 and is provided with a miter wheel e^4. The shaft e^8 of the propeller *e* is hollow and is fixed in said bracket e^7, and secured to said shaft e^8 is an armature e^9 actuated by electricity from wires e^{21}, passing through the shaft e^8 and leading from the same to the storage batteries d^2 through the bracket e^7 and its shaft e^6. The body of the propeller carries the fields e^{10} for said armature, which fields rotate with the propeller. The bracket e^7 and its shaft e^6 may be turned in the cross bar b^9 substantially as shown in Fig. 4, wherein the toothed surfaces of the miter wheel e^4 on said shaft e^6 may be engaged by the teeth of a second miter gear e^5 carried on the end of the shaft *f*, which is supported in suitable

brackets b^{10}, secured to one of the braces b. This shaft f extends within the car d and is provided with a hand wheel f'. The shaft f is pressed upward and the miter wheels e^4 and e^5 held in engagement by the spiral spring f^3 surrounding the shaft f. One end of this spring f^3 bears against a fixed collar f^{10} on the shaft f, while the other bears by preference against one bearing of the supporting bracket b^{10}. A spring clip f^2 rests upon the periphery of the hand wheel f', which may be notched to receive said clip. By means of this clip f^2 the hand wheel and shaft are prevented from rotating.

In Fig. 6 I have illustrated an air ship, which may in case of accident be used as a marine ship. In this figure the separate gas chambers a^{12} are crescent shaped in cross-section and are united together and then held or supported in a correspondingly shaped frame a^{13}. Near the ends of the crescent that is to say along the edges or sides of the balloon chambers a^{12}, the propellers a^{14} are placed and they are operated from the car a^{19} in a manner similar to that heretofore described. At the extreme points of the crescent are placed the air chambers a^{15}. The car a^{19} is provided with a weight or ballast a^{20}, which may be raised or lowered in the manner of a center board.

At the center of the balloon and leading from the car is a man hole a^{16} and on the upper frame work is placed the platform a^{17} reached from the car by means of the stairway or ladder a^{18}. Should this form of my invention by reason of accident, be precipitated into a body of water the balloon a^{12} will float and the propellers a^{14} will be sufficiently submerged to propel the ship through the water. In this case the motor and batteries are placed in watertight compartments in the car a^{19} and are controlled from the platform a^{17}.

The operation is as follows: The balloon a contains sufficient gas to sustain and raise the weight of the entire machine. When the air ship has ascended a sufficient height the direction to be taken is regulated by one or the other of the steering propellers e, and the ship is propelled in that direction by the side propellers c attached to the frame work surrounding the gas chamber. By turning one or both of the propellers e in the bearings b^9 direction may be given to the ship, up—down or any line desired. To turn the ship both propellers e are rotated.

As the balloon a is by preference composed of separate gas chambers or compartments a', a^2, &c., an injury to one or less than all of the same will not result in the total collapse of the balloon, and hence in case of such injury the ship will descend gradually. The arrangement of the gas cushions d^7 beneath the car serve not only to assist in the support of the car but also to break the shock or contact with the earth when the ship descends. The direction to the balloon is as heretofore explained given by the end propellers e and the proper position of these propellers is easily obtained by turning the hand wheel f' and the shaft f.

It is of course manifest that the exact shape of the balloon may be varied. In Fig. 6 I have illustrated but one variation from the usual double conical and elliptical shape. It is also obvious that various means of operating the side and end propellers may be used without departing from the spirit of my invention.

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

In an air ship, the combination with the balloon and the frame work surrounding the same, of a car suspended from said balloon, a series of flexible rings placed at the bottom of the car and spring controlled air or gas cushions supported in and by said flexible rings, substantially as and for the purposes described.

In testimony that I claim the foregoing I have hereunto set my hand this 18th day of October, 1893.

DUANE HURLBUT.

Witnesses:
HENRY E. EVERDING,
ALFRED GARTNER.