

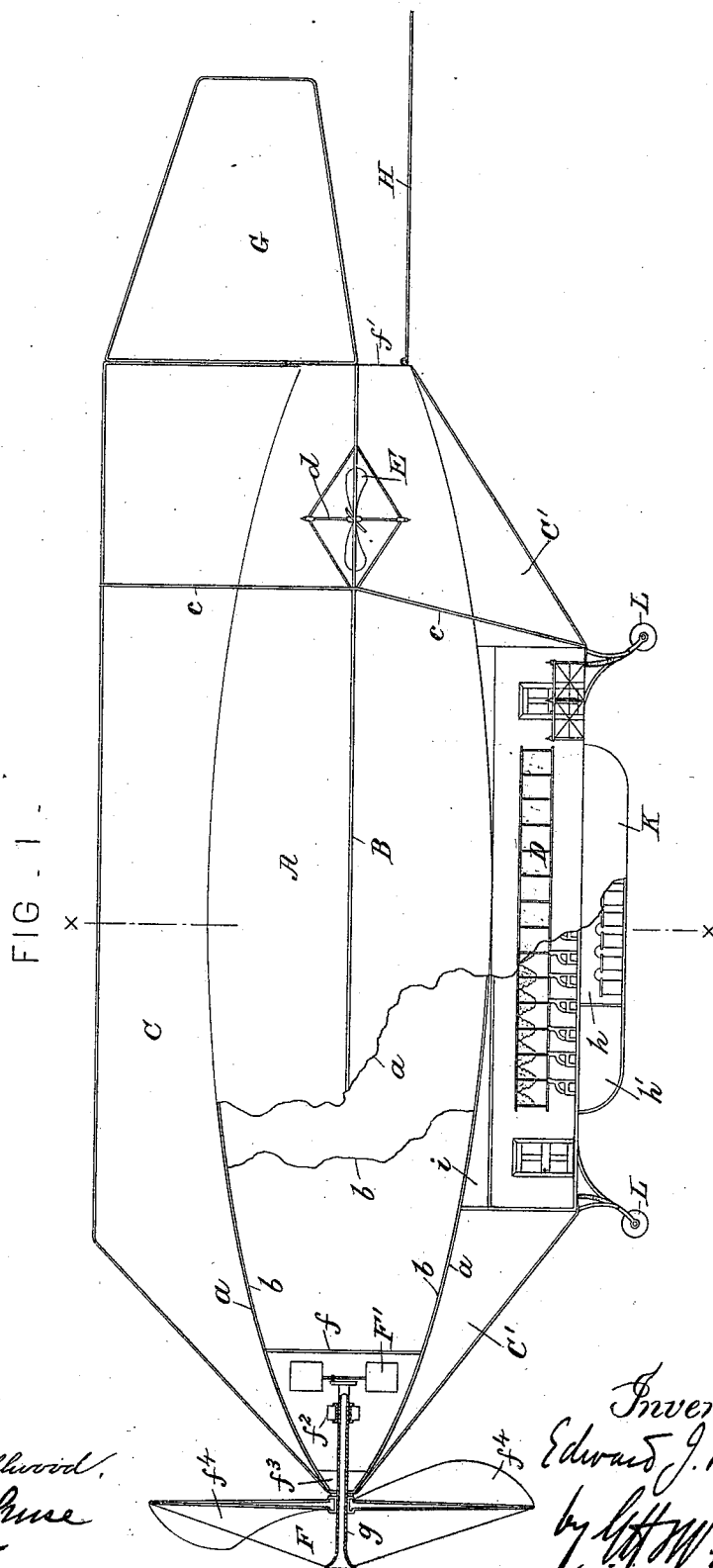
(No Model.)

3 Sheets—Sheet 1.

E. J. PENNINGTON.
AERIAL NAVIGATION.

No. 552,443.

Patented Dec. 31, 1895.



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Inventor:
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(No Model.)

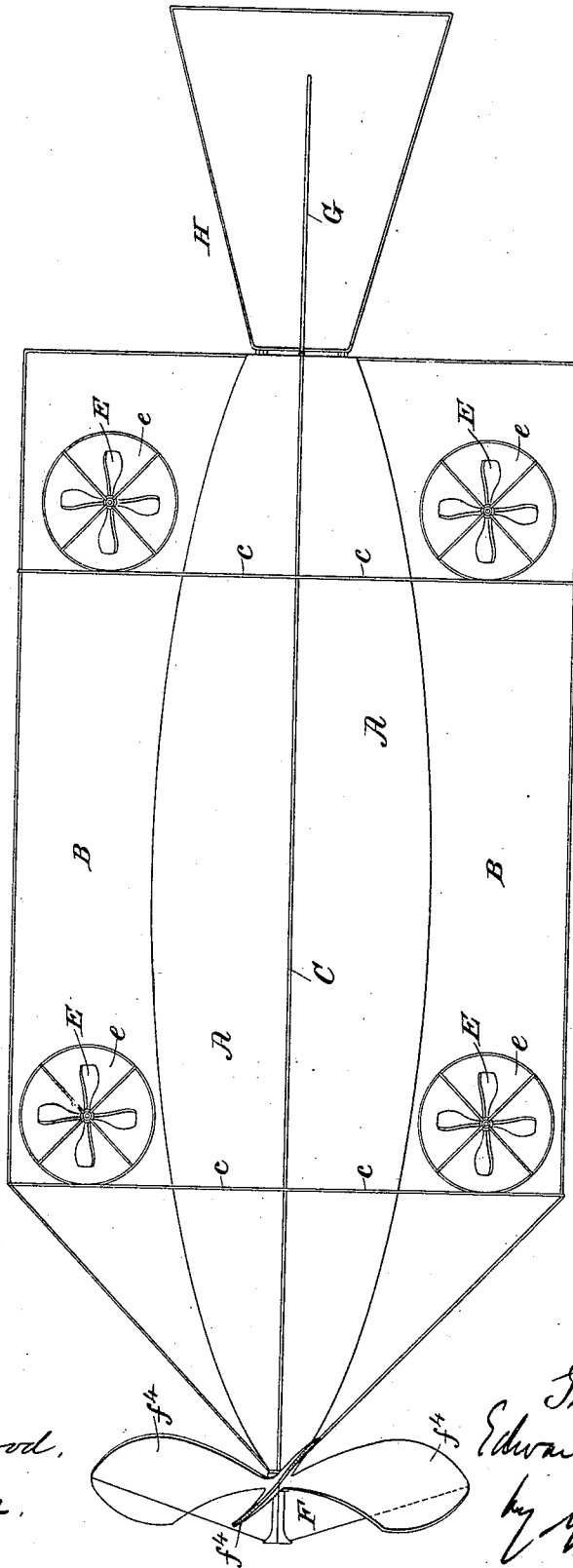
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FIG 2



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FIG. 3.

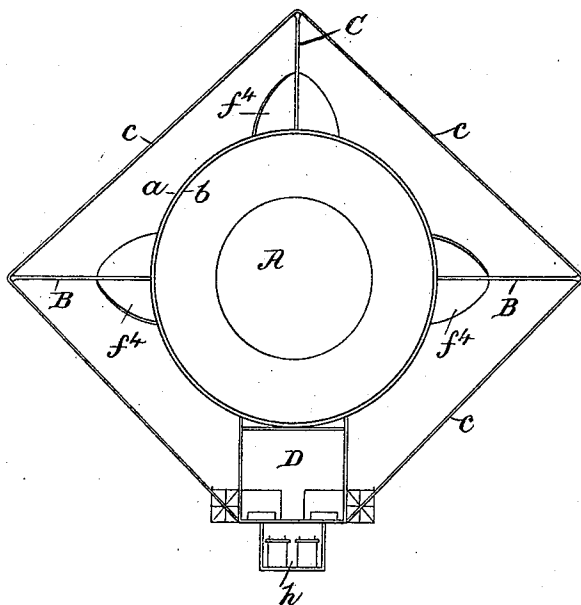


FIG. 4.

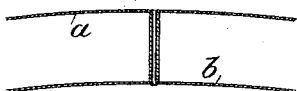
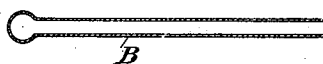


FIG. 5.



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UNITED STATES PATENT OFFICE.

EDWARD J. PENNINGTON, OF MOUNT CARMEL, ILLINOIS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO WILLIAM B. KEEP, OF CHICAGO, ILLINOIS, AND JOEL C. PENNINGTON, OF MOORE'S HILL, INDIANA.

AERIAL NAVIGATION.

SPECIFICATION forming part of Letters Patent No. 552,443, dated December 31, 1895.

Application filed April 5, 1892. Renewed December 11, 1895. Serial No. 571,737. (No model.)

To all whom it may concern:

Be it known that I, EDWARD J. PENNINGTON, of Mount Carmel, in the county of Wabash and State of Illinois, have invented certain new and useful Improvements in Vessels for Aerial Navigation, of which the following is a specification, reference being had to the accompanying drawings and to the letters of reference marked thereon.

My invention relates to the construction of navigable aerial vessels designed to be impelled, maneuvered and steered by machinery arranged within the vessel itself, the latter having the necessary capacity for the carrying of passengers and freight and for making long voyages, the whole structure being compact, strong, and adapted to overcome the chief obstacles heretofore encountered in aerial navigation—viz., head-winds and adverse currents and ordinary atmospheric resistance.

In the accompanying drawings, Figure 1 is a view, mainly in longitudinal section, of my improved aerial vessel. Fig. 2 is a plan. Fig. 3 is a transverse section on the line *xx* of Fig. 1. Figs. 4 and 5 are enlarged details.

Similar letters of reference indicate similar parts in the respective figures.

The hull or buoyancy-chamber A of the vessel, which generally is of cigar shape, is constructed with the view to lessening the resistance of the atmosphere. The shell of the buoyancy-chamber is made double, the inner and outer skins being represented by *a* and *b*, which are held apart, so that a space of uniform width is made between them, by means of bolts and thimbles, or other well-known devices for the purpose, as shown on enlarged scale in Fig. 4.

In my present application I show the buoyancy-chamber A as undivided by partitions, or without sectional construction; but in other applications—viz., Serial Nos. 427,952, 427,953, and 431,430—the interior construction of the buoyancy-chamber is shown, as also are the means of partitioning it or dividing it into sections, the methods of bracing, and other details. It is only necessary here to say that the construction of the buoyancy-chamber is such as to give it the greatest

possible resistance against the exterior pressure of air, or against collapse, by reason of the presence within it of a fluid lighter than the atmosphere, and such as to permit the building of the buoyancy-chamber in sections for the purpose of convenience, ease of transportation and repair, and, if necessary, the substitution of new sections in the event that any first entering into the structure shall have become damaged or inoperative.

The buoyancy-chamber A and most of its adjuncts or inferior parts are constructed of such material or metal as aluminum, which possesses the necessary strength, lightness, toughness and ductility for the purpose required, although I do not limit myself to its use, as other suitable metal or substance may be employed. The spaces between the two skins of the buoyancy-chamber are gas-tight, and by preference filled with hydrogen gas.

Throughout the entire construction of my aerial vessel, wherever practicable, hollow bodies are charged with a fluid lighter than atmospheric air, whereby increased strength is obtained with the least possible weight, so that all parts of the vessel, including its buoyancy-chamber, aeroplanes, car, fins, rudders, partitions, bracing, &c., and, so far as possible, its machinery, furniture and appurtenances (as in my application, Serial No. 427,957) are all made hollow and filled with a fluid lighter than atmospheric air, preferably hydrogen gas, the buoyant qualities of the whole structure and outfit being as far as practicable preserved. I also prefer to bead or render tubular the edges of the aeroplanes, fins, rudders, and the like to give increased strength. This construction is shown on enlarged scale in Fig. 5 hereof.

BB represent what I term the "aeroplanes," consisting of planes extending from the two outer sides of the buoyancy-chamber, preferably at or near its axial line, although its position thereto is unessential.

C represents a vertical fin running longitudinally of the upper part of the buoyancy-chamber in the axial line thereof. The fin C is connected by hollow braces *c* to the aeroplanes at the respective sides of the buoyancy-chamber. An under fin C is similarly ar-

ranged at the under side of the buoyancy-chamber, but divided into two longitudinal sections by the car D. The car D occupies a length equal to about half that of the buoyancy-chamber A, and is suitably secured and braced thereto and also to the aeroplanes; to the latter by means of the braces *c c*. The construction is such that the aeroplanes, upper and lower fins and the car are rigidly united and the aeroplanes and fins maintained in their respective horizontal and vertical planes.

At each corner of each of the aeroplanes B is mounted upon a vertical shaft *d* a side propeller E, driven by any suitable machinery. (Not herein shown.) In order to provide for the reception of the propellers E the aeroplanes B are provided with circular openings *e*, each concentric with the shaft of the propeller adapted to revolve therein and in the plane of the aeroplane. The shaft of each of the side propellers E is provided with a bearing above and one below the aeroplanes B, which bearings are suitably braced to the latter. The objects of the side propellers D are to raise and lower the vessel, as may be desired, in ascending and landing, and to assist, if necessary, the altitude-rudder in regulating the elevation when in flight. The said propellers may be capable of either conjoint or independent action.

Each end of the buoyancy-chamber A is closed by means of a bulkhead, that at the forward end being indicated by *f* and that at the aft end by *f'*. Forward of the bulkhead *f* is a bearing *f²*, which, in connection with the bearing *f³* at the prow of the buoyancy-chamber, supports the main propeller-shaft *g*, which is preferably hollow. Upon the shaft *g* is placed the main propeller F, the inner end of the shaft *g* being connected to a gas-engine or other motor, (herein shown generally by F'.)

The propeller and shaft are claimed in my application Serial No. 427,956.

The aft end of the hull or buoyancy-chamber is provided with a rudder G, standing in a vertical plane and hinged at its inner end to the buoyancy-chamber and the vertical fin C, the purpose of the rudder G being that of the ordinary rudder used in steering sea-vessels.

It is what I term the "altitude-rudder," which normally rests in a horizontal plane, being hinged to the aft end of the buoyancy-chamber, as shown. In my present application I do not show means for vibrating either the rudder G (which I term the "right" or "left" rudder) or the altitude-rudder H; but the construction of and means for operating the rudders are claimed in my applications Serial Nos. 431,431, 429,666, and 429,667.

The main propeller F, the general construction of which is specially set forth and claimed in application Serial No. 427,956, is placed at the prow of the vessel and so constructed with respect to its blades *f⁴* as to be capable, when in revolution, of producing a partial vacuum or of rarefying the atmosphere ahead

of the vessel, so that propulsion is not effected, as is common in navigation by sea-vessels, by a thrust against the fluid upon which the propeller acts, but by the excess of pressure in the rear of the vessel due to the production of a partial vacuum or the rarefying of the air ahead. The blades of the propeller F are given a peculiar character or construction, adapting them to disturb or displace the atmosphere as it is encountered by the prow of the buoyancy-chamber and to discharge it over the said chamber or hull, as more fully set forth in my application for Letters Patent, Serial No. 427,955.

Below and rigidly secured to the car D is a chamber K, divided longitudinally by preference into a central room *h* for storage-batteries to furnish electricity for any purpose and two lockers *h'* for packages. The space *i* above the car D, between it and the buoyancy-chamber A, is employed as a reservoir for gas used for driving the gas-engine or principal motor, as set forth more especially in my application Serial No. 440,770. This may be a naphtha, ammonia, vapor, aqua-ammonia, ether, chloride of calcium, or other engine. I do not here describe any motor or any means of using bisulphide of carbon or other medium as a motive-power fluid; but a motor adapted to the purpose in view is described in my application Serial No. 440,771, and means for supplying it with a motive fluid are set forth in application Serial No. 440,770.

Trucks L are provided below and rigidly secured to the car D for landing.

Having described my invention, I claim—

1. In an aerial vessel, a buoyancy chamber combined with a longitudinal fin projecting vertically from its back or upper portion; and aeroplanes projecting in a horizontal plane from the sides of said chamber, substantially as described.

2. In an aerial vessel, a buoyancy chamber, practically of cigar-shape, combined with a longitudinal fin projecting vertically from its back or upper portion, and aeroplanes projecting in a horizontal plane from the sides of said chamber, substantially as described.

3. In an aerial vessel, a buoyancy chamber combined with a longitudinal fin projecting vertically from its back or outer portion, aeroplanes projecting in a horizontal plane from the sides of said chamber, a car rigidly secured to the under side of the said buoyancy chamber, and fins extending longitudinally of the under side of the buoyancy chamber and uniting with the car, substantially as described.

4. In an aerial vessel, a buoyancy chamber having a longitudinal fin projecting vertically from its back or upper portion, aeroplanes projecting in a horizontal plane from the sides of said chamber, a car rigidly secured at the under side of the buoyancy chamber, a fin projecting vertically from the under side of said buoyancy chamber and connecting with the

car, a propeller at the forward end or prow of the buoyancy chamber, a rudder hinged in a vertical plane at the aft end of the buoyancy chamber, a rudder hinged in a horizontal plane

5 also at said aft end of the buoyancy chamber, side propellers adapted to revolve in the plane of the aeroplanes, and suitable machinery for revolving the main propeller and the side propellers, and for steering, substantially as described.

10 5. In an aerial vessel, a buoyancy chamber practically of cigar-shape, combined with aeroplanes projecting in a horizontal plane from the sides thereof, propellers adapted to revolve in the plane of said aeroplanes and
15 suitable machinery for driving said side propellers, substantially as described.

20 6. In an aerial vessel, a buoyancy chamber having an upper and a lower vertical fin, and aeroplanes, combined with a shaft placed at

the forward end of said buoyancy chamber axially thereof, a motor for driving said shaft, and a propeller mounted on said shaft, substantially as set forth.

7. In an aerial vessel, a buoyancy chamber 25 having an upper and a lower vertical fin, and aeroplanes, combined with a shaft placed at the forward end of said buoyancy chamber axially thereof, a motor for driving said shaft, and a propeller mounted on said shaft, and 30 having a diameter equal to, or exceeding that of, the greatest diameter of the buoyancy chamber, substantially as set forth.

In testimony whereof I hereunto set my hand and seal.

EDWARD J. PENNINGTON. [L. S.]

Witnesses:

R. H. BUTLER,
W. G. ALLISON.