M. GRUBE.

AIR SHIP.

APPLICATION FILED AUG. 11, 1904.

907,992. Patented Dec. 29, 1908.

3 SHEETS—SHEET 1.

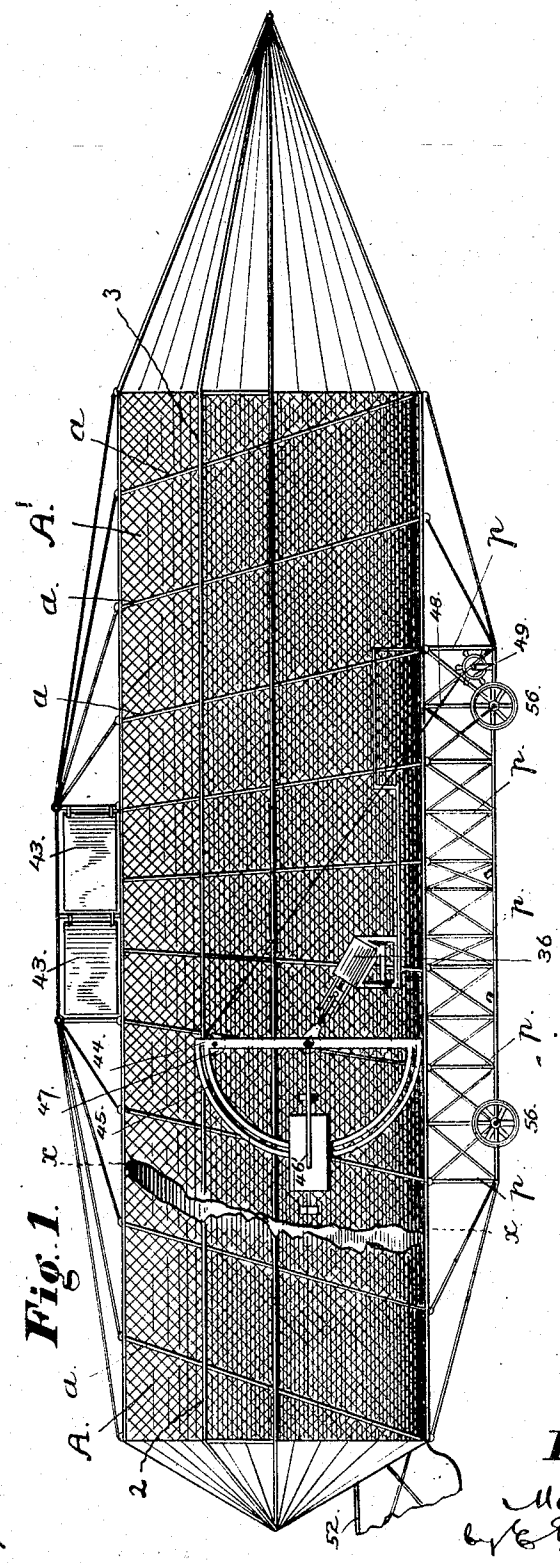


Fig. 1.

Witnesses.
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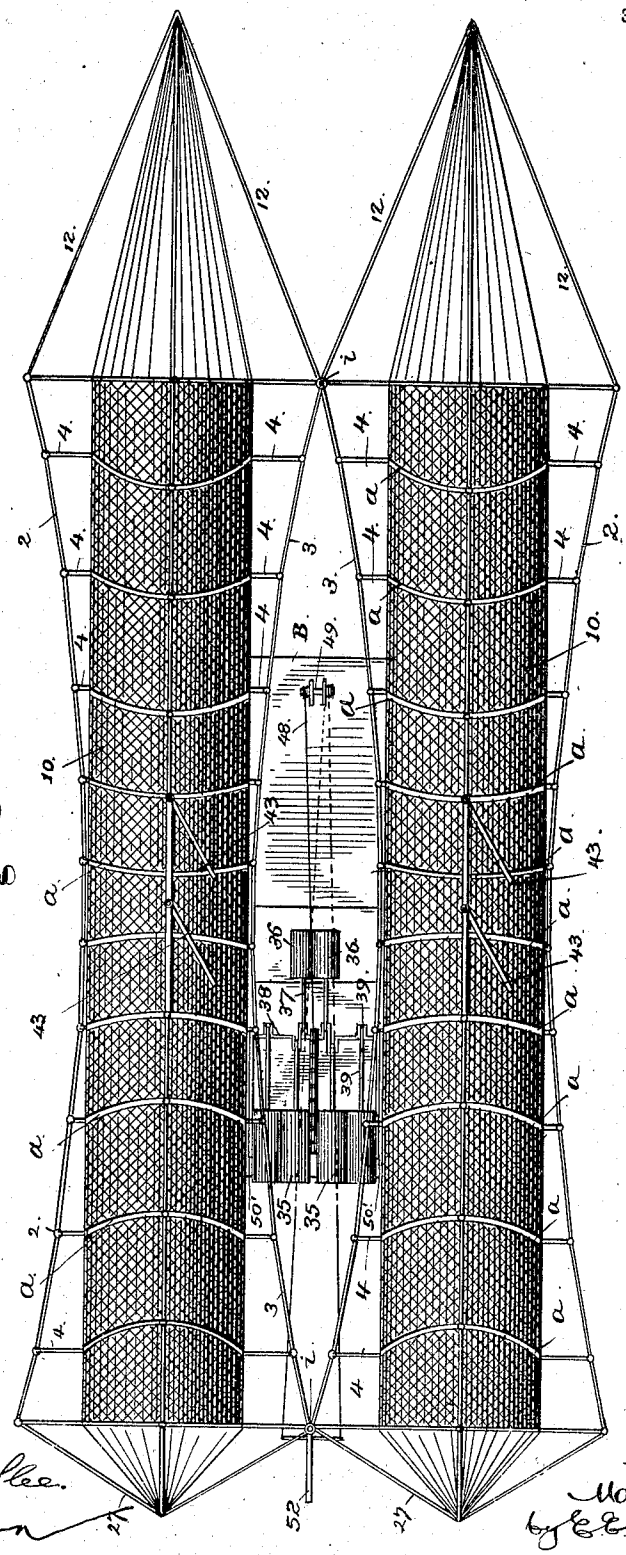
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3 SHEETS—SHEET 2.

Fig. 2



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3 SHEETS—SHEET 3.

Fig. 2.

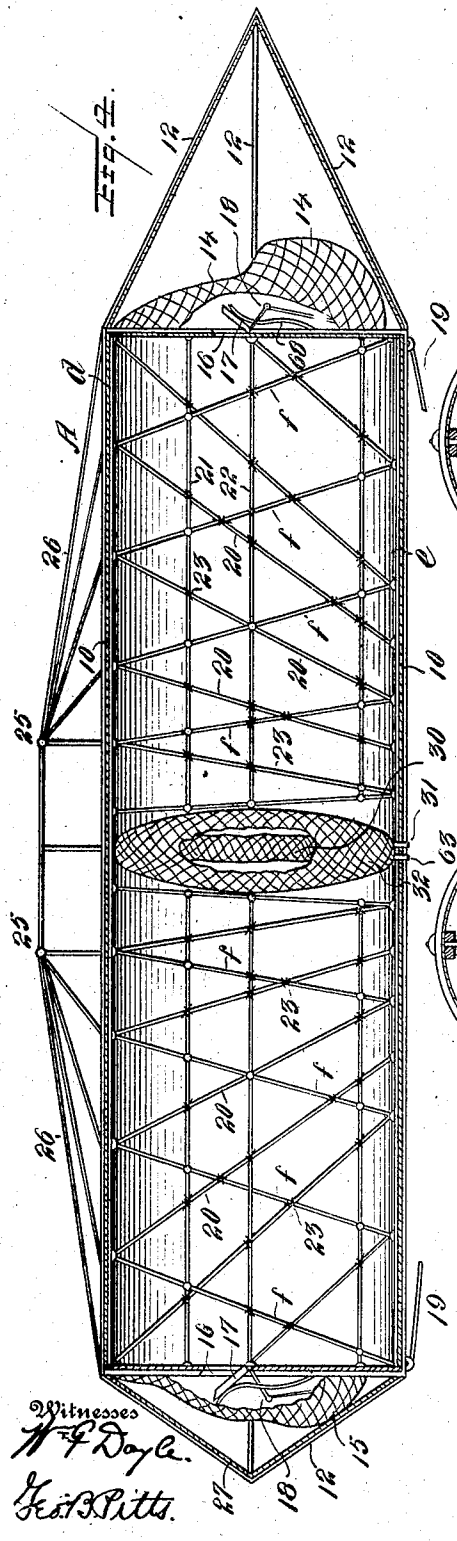
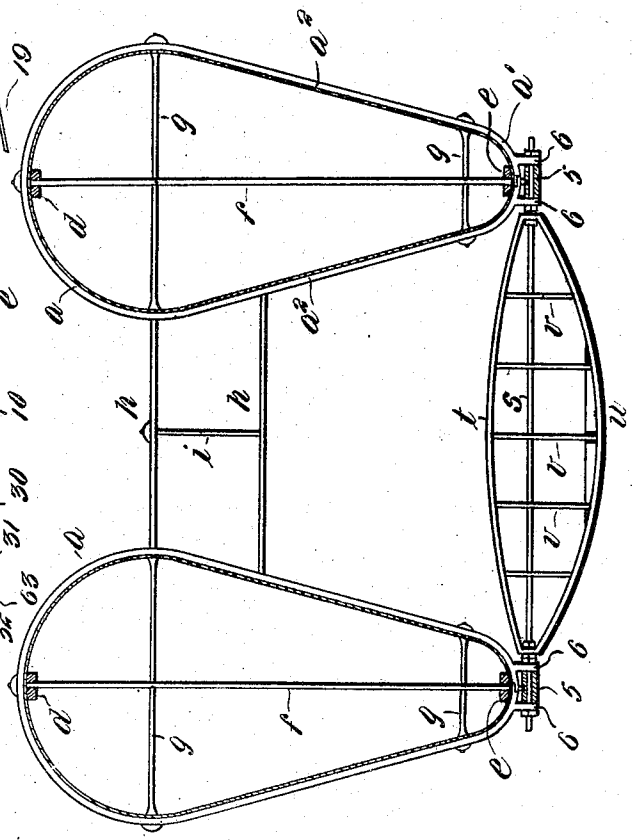


Fig. 1.



Witnesses

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MAX GRUBE, OF OAKLAND, CALIFORNIA.

AIR-SHIP.

No. 907,992. Specification of Letters Patent. Patented Dec. 29, 1908.

Application filed August 11, 1904. Serial No. 220,331.

To all whom it may concern:

Be it known that I, MAX GRUBE, a subject of the Emperor of Germany, residing in Oakland, in the county of Alameda and State of California, have invented new and useful Improvements in Air-Ships, of which the following is a specification.

This invention relates to improvements in air-ships of that class or description having gas containing compartments for buoyancy, and also provided with propelling apparatus and steering devices for controlling the direction of travel.

The improvements embrace a rigid structure consisting of twin hulls or bodies of novel form and construction containing gas holding compartments, and novel means of transferring the charges or bodies of gas from one compartment to another; also, in propelling and steering mechanism of novel construction and operation, and in means for adjusting and controlling the same from the platform.

The nature of these improvements and the manner in which the same are constructed, combined and applied in the production of an improved apparatus for navigating the air, are explained at length in the following description, in which reference is had to the accompanying drawings.

Figure 1 is a side-elevation of the twin hulls or bodies, and the platform between them, the body on the near side being broken away from the point x—x forwards, to show the propelling mechanism in the space between the two bodies. Fig. 2 is a top view of the twin bodies showing the propelling means between them. Fig. 3 is a transverse sectional view of the frame-work of the twin bodies and the platform. Fig. 4 is a longitudinal sectional view of one of the twin bodies showing the inflatable air bag and the end gas-receiving receptacles and the valves therefor.

The two bodies A A^1, which with the platform B form the hull of the ship, consist each of a light skeleton frame-work of transverse, kite-shaped ribs having bow top and bottom ends a—a^1, and straight side-bars a^2. Longitudinal top and bottom rails d—e laid horizontally and parallel unite the kite-shaped ribs and connect them together stiffly at intervals apart lengthwise of the body.

On the inside, cross bars f and 20 and horizontal ones 21 and 22 give strength to the kite-shaped frame. The top and bottom ends of the upright braces are let into the longitudinal rails d—e and fastened by nuts on the ends of the tenons.

The main bars 20 from the middle of the body towards either end are set at varying angles from the vertical, so as to increase in inclination from the middle bars, which are perpendicular, or nearly so, to the longitudinal axis in both directions towards the ends of the body; so that the ribs at the opposite ends of the framework occupy a very much inclined position, with their tops considerably in advance of their bottoms. Curved side-bars 2 extending from end to end and connected to the ribs by short brace-bars 4 form trussed braces along the outer sides of each body, while other curved side-bars 3, with brace-bars 4 on the inner sides, join the two bodies stiffly side by side and hold them firmly together as one structure. These side-braces may be omitted for the purpose of lessening the weight of the structure, as the kite-shaped form given to the ribs contributes to the stiffness of the side-members a^2.

Trussed skeleton braces are placed at intervals apart along part of the bottom of each of the bodies A A^1, and each of these braces gives support to one of a number of tie-rods s with arched top and bottom bars u—t and spaced braces v; which tie-rods form a firm connection between the two bodies.

The tie-rod s are passed through tubular blocks 5 attached to the braces f, and also confined in hangers 6 on the bottom of the kite-shaped frame. The hangers 6 have holes for the rods and the blocks 5 are set between the hangers to form the main support of the platform, the hangers being arranged to serve as supplementary supports in case the other supports get out of order.

The space inside and between the kite-shaped ribs is closed in by a casing 10 of some flexible material such as silk fabric varnished or coated to render it gas-tight, thereby forming the interior space from end to end into a gas-containing compartment. A net-work of cords with relatively fine mesh is stretched over the outside of the fabric to resist the pressure of the gas and strengthen the walls.

In the middle of the gas-holding body composed of the framework and the casing 10, and dividing the space transversely, is fixed an expansible and collapsible air bag 30 provided with an inlet 31 through which air can be forced to expand the bag, and having an

outlet 63 for letting out the air when it is necessary to remove the pressure and allow the bag to collapse. A protecting casing 32 formed of some elastic or flexible fabric surrounded by a net-work of cords inclosing the air-bag 30 allows that bag to expand to its greatest capacity or extent and also prevents it from expanding beyond the limit of safety. In practice the inlet 31 will be connected by means of an air-tight flexible tube with an air-pump of any well-known construction located on the platform before mentioned on which the operator stands, and arranged in position to be conveniently operated by power taken from the motor that drives the propellers. Such a pump can be arranged and connected for operation without special explanation being given in the present description, and the same are therefore omitted from the drawings. In practice also, the outlet 63 for the air is to be provided with a controlling-valve of any suitable construction located within reach of the operator on the platform for closing the outlet to the atmosphere when the air-bag is to be inflated.

The effect of expanding the air-bag 30 and distending its inclosing casing 32 is to force the confined gas in the main gas-bag 10 by displacement into one or the other of two separate gas-holding bags or expansible compartments 14—15 one at each end of the body A, according as one of the other of such compartments is put in communication with the gas-holding space of the body A. Each of these compartments 14—15 communicates with the main compartment through an aperture 16 in the end of the main-casing 10. A valve 17 held normally to a seat on the aperture 16 by a spring 68 shuts off the compartment in the end from the main compartment, and a lever 18 connected to the hinge of the valve and from which a cord is carried down to the platform furnishes a means for opening the valve at the time of inflating the air-bag 30, so as to allow the displaced gas to pass into and inflate the supplementary compartment in the conical end of the body.

At the time of inflating the gas-bag 14 at one end, or the similar bag 15 at the other end, the valve of the bag opposite to the one being inflated is kept closed, so that the gas displaced by the expanding air-bag 30 will be caused to pass through the open valve and inflate that compartment which is beyond it. The object of this operation is to transfer a greater or less portion of the confined body of gas from the main-compartment into one end or the other end and thus increase the buoyancy of the body at that end.

The propelling apparatus comprises a plurality of reciprocating piston-heads inclosed by separate cylindrical casings 35 and connected to a common crank-shaft by rods 39. Each head is composed of a number of flexible flaps which are segments of a circular disk surrounded by a stiff rim of proper diameter to fit closely and slide with a minimum of friction within the surrounding casing 35. These disks, of which the flexible flaps form a part, are firmly clamped and attached to the rim, and thus the flaps will open outwardly by virtue of the pressure of the air against their backs as the head travels in one direction in the casing, and close by the pressure against the opposite sides as the head moves in the other direction. Wire guards extending across the space surrounded by the rim limit the return movement of the flaps, causing them to lie flat against the guard-wires and close the opening, the edges of the flaps fitting together to make a close joint.

The flaps can be made out of any strong, thin and flexible material, and are secured to the circular rim in such manner that they will yield and open outwardly in the back-stroke of the propeller-head, but will close together quickly as the pressure of the air is transferred from the back to the front side by the reverse, or forward, stroke.

The cylindrical casings 35, which are open at both ends, are supported in a stationary frame composed of centrally placed parallel bars 45 of semi-circular shape stiffly joined together. In the present construction the four casings are arranged in pairs on opposite side of the bars 45 and the two pairs of casings are united thereto by a slide-block which is fitted to move easily in the slot between the rails, 45. By this construction the casings may be moved in the frame 45 so that their outer ends may occupy a position parallel with the longitudinal axis of the ship, or any position at a greater or less degree of elevation or depression relative to such axis.

The driving rods 39 of the propeller-heads are connected to a common crank-shaft 38 for which bearings are provided in the stationary-frame, and being placed at the center of the arc in which the swinging-frame is arranged to move, the angular adjustment of the propellers does not affect the connections between the propellers and the crank-shaft. The motor indicated at 36 Fig. 1 may be of any suitable kind or character capable of furnishing the power required to drive the set of propellers. It is placed on the side of the crank-shaft opposite to and a little below the propellers, where connection can conveniently be made with the cranks.

A separate crank is provided for each propeller rod 39, and these as well as the cranks for the connecting rods of the motor are set at different degrees apart around the circle, to avoid conjunction of dead centers.

The casings 35 of the propellers are fastened rigidly together side by side in a row in the movable frame. The propeller casings are raised and lowered in the frame by means

of a cable 48 connected to the frame and carried around a guide sheave down to a windlass 49 on the platform.

The casings can be changed from a position parallel with the longitudinal axis of the ship from time to time so as to have an inclination upward, or be depressed to have a greater or less degree of inclination downward by winding or unwinding the cable. Varying the angle of elevation to a higher one is intended to change the application of the propelling power against the air in such manner as to produce downward movement of the ship, and in like manner changing the position from the horizontal to one or more less inclined downwardly will produce a contrary action of the propellers tending to accelerate the rising movement.

The platform, which supports the propelling means and the persons who control the ship, may be provided with wheels or suitable fenders as may be required in apparatus of this kind. In this position while being free to yield under the weight or impact of the structure as they strike the ground these spring fenders will also act like runners and will slide over the surface without danger of catching in obstructions.

It should be mentioned that the bags or inflatable compartments 14—15 at the ends of the principal gas-holding compartments in the hull, and with which they communicate through the valve-controlled apertures, as before described, are themselves situated in extensions of the body, one at each end, and are formed each of a bag of gas-tight flexible material of the same character as that used for the walls of the principal compartment.

The frame-work of the body and the end extensions as well, therefore, constitute a protective and a supporting structure for the gas-containing receptacles, and while the members are united by rigid joints they can be constructed of light material. This I am enabled to do because of the peculiar shape of the kite-shaped bows or ribs and the manner of bracing them on the inside by the angularly-set braces and of joining them together by the inner bars, which I have termed the back-bone.

A steering-device on the rear end of the hull is provided in the form of a laterally swinging rudder-piece which is both movable on the post from side to side, and is also adapted to be shifted vertically on the post so as to move upward out of the way as it comes in contact with the surface of the ground, but at other times to be set nearer the bottom line of the platform.

Tiller rods and cords connect the rudder with a means for moving and setting it from the platform.

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

1. In an air-ship, a hull comprising twin-hollow bodies kite-shaped in cross-section and each composed of a frame-work formed of longitudinal top bars and bottom bars and transversely set inclined kite-shaped bows varying in inclination one with another from each end towards the middle of the body, a gas-tight casing inclosing the space within the bows and members of the frame-work, a separate gas-containing compartment at each end of the said inclosed space in each body communicating therewith through an aperture, a valve for controlling said aperture, an expansible air-bag within the said inclosed space contained in each body of the hull situated in the middle of said space, and provided with an inlet and an outlet in the bottom.

2. In an air-ship the combination of a hull or body having a principal gas-containing space adapted to float the ship, an inflatable air-bag situated within said space and adapted under its inflation to displace the gas in the said space, an auxiliary expansible gas receiver communicating therewith through a valve-controlled aperture, means for operating said valve, and an air-inlet tube for connecting said air-bag with a source of air under pressure for inflating the air-bag, whereby gas from the gas containing space is forced into the auxiliary gas receiving space and the inclination of the ship is changed and means for escape of the air from the bag to deflate the same.

3. In an air ship, the combination of a framework, a gas containing receptacle surrounding said framework and another frame extending over the gas receptacle, auxiliary gas receiving chambers at the opposite ends of the frames, valves for controlling communication between the gas containing receptacle and the auxiliary gas chambers, and means for forcing gas into said auxiliary gas chambers.

4. In an air ship, the combination of a pair of relatively long bodies, kite-shaped in cross-section and each comprising a framework, a gas containing receptacle inclosing said framework and an additional framework surrounding the gas containing receptacle, an inflatable air bag centrally located within the said receptacle, valves for inflating and deflating the said air bag, an inflatable auxiliary gas bag at each end of each body communicating with the gas containing receptacle through an aperture, and valves for opening and closing the said apertures.

5. In an air-ship, the combination of a principal gas-containing space therein adapted to support the ship, an auxiliary expansible gas holder having communication with the principal gas-containing space through a valve-controlled aperture, of an inflatable air-bag within the said gas-containing space

operating by its inflation to displace a greater or less portion of the body of gas in said space and force the same into the auxiliary compartment in proportion to the degree of inflation of said air-bag whereby the inclination of the ship is changed.

6. In an air ship, a framework kite shaped in cross section, and comprising longitudinal top and bottom bars and transversely arranged kite shaped bows set at varying inclinations relative to each other, those at the center of the frame being nearly vertical those toward the ends inclining more and more relative thereto, and a gas casing carried by the said framework, substantially as set forth.

7. In an air ship, a hull comprising twin frames each kite shaped in cross section arranged longitudinally side by side and connected by rigid braces, each frame comprising longitudinal top and bottom bars and transversely set kite shaped bows, and a gas tight casing carried by each frame, substantially as set forth.

8. In an air ship, a framework kite shaped in cross section and comprising longitudinal top and bottom bars and transversely arranged kite shaped bows set at varying inclinations relative to each other, those at the center of the frame being nearly vertical, and those toward the ends inclining more and more relative thereto, tapering supplemental frames at the ends of the said framework, and expansible gas receivers arranged within the said supplemental frames, substantially as set forth.

In testimony whereof I have hereunto set my name to this specification in the presence of two subscribing witnesses.

MAX GRUBE.

Witnesses:
EDWARD E. OSBORN,
L. OSBORN.