

W. REIFERSCHIED.

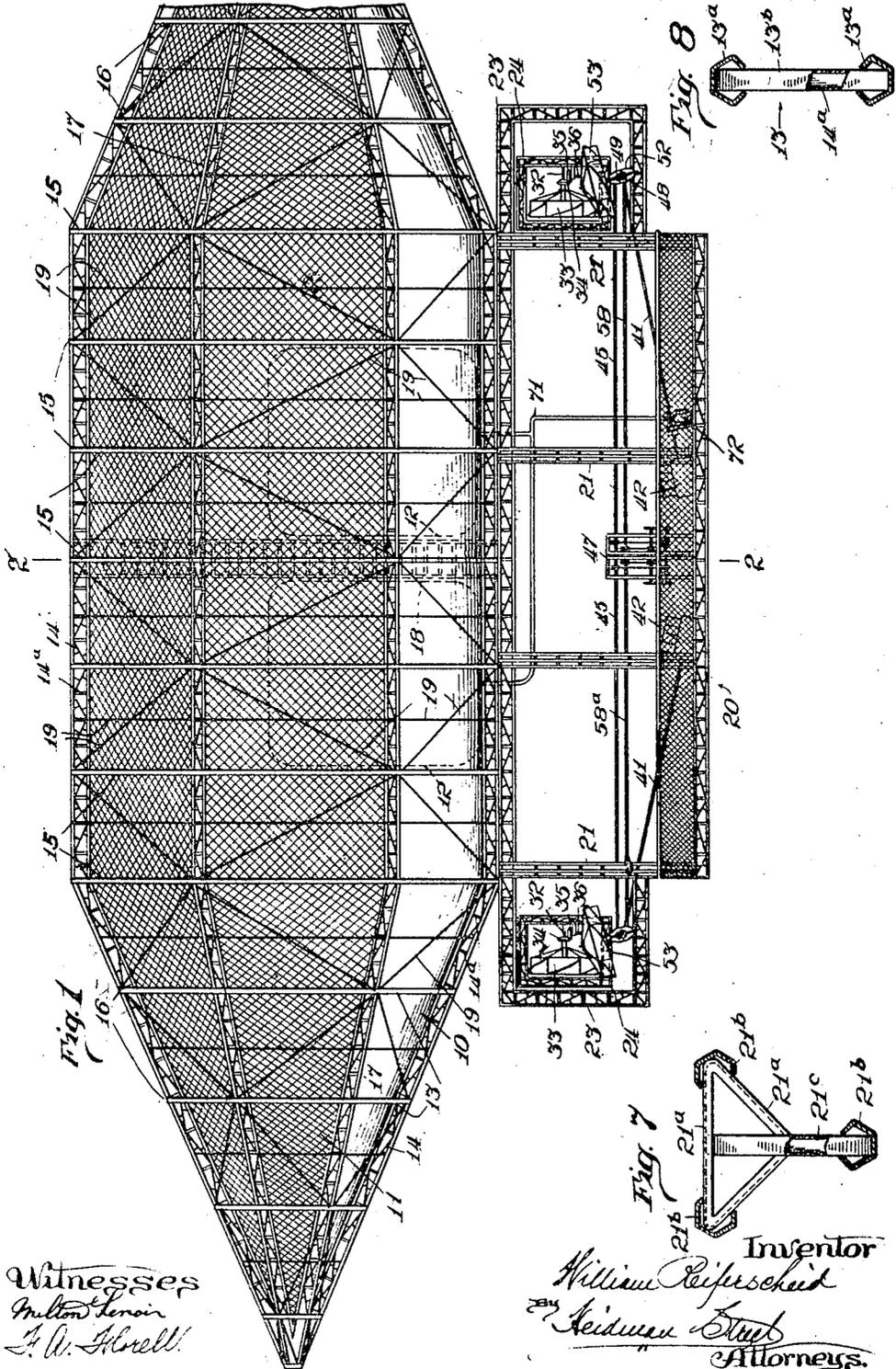
AIRSHIP.

APPLICATION FILED MAR. 8, 1917.

1,291,686.

Patented Jan. 14, 1919.

4 SHEETS—SHEET 1.



Witnesses
 Milton Senoir
 J. W. Howell

Inventor
 William Reiferschied
 by Aidman E. Stueb
 Attorneys.

W. REIFERSCHIED.

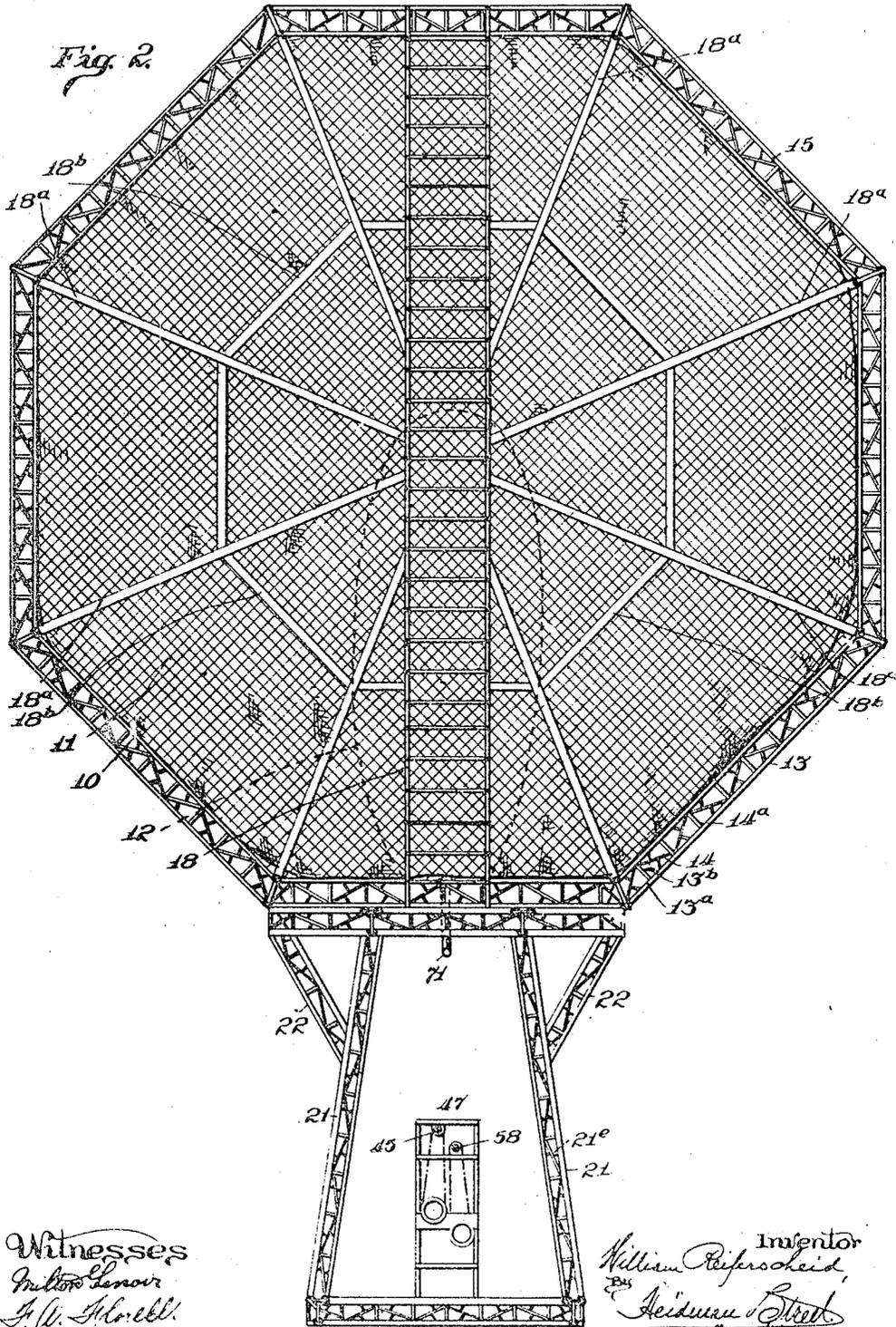
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4 SHEETS—SHEET 2.



Witnesses
Miller Lenoir
J. W. Howell.

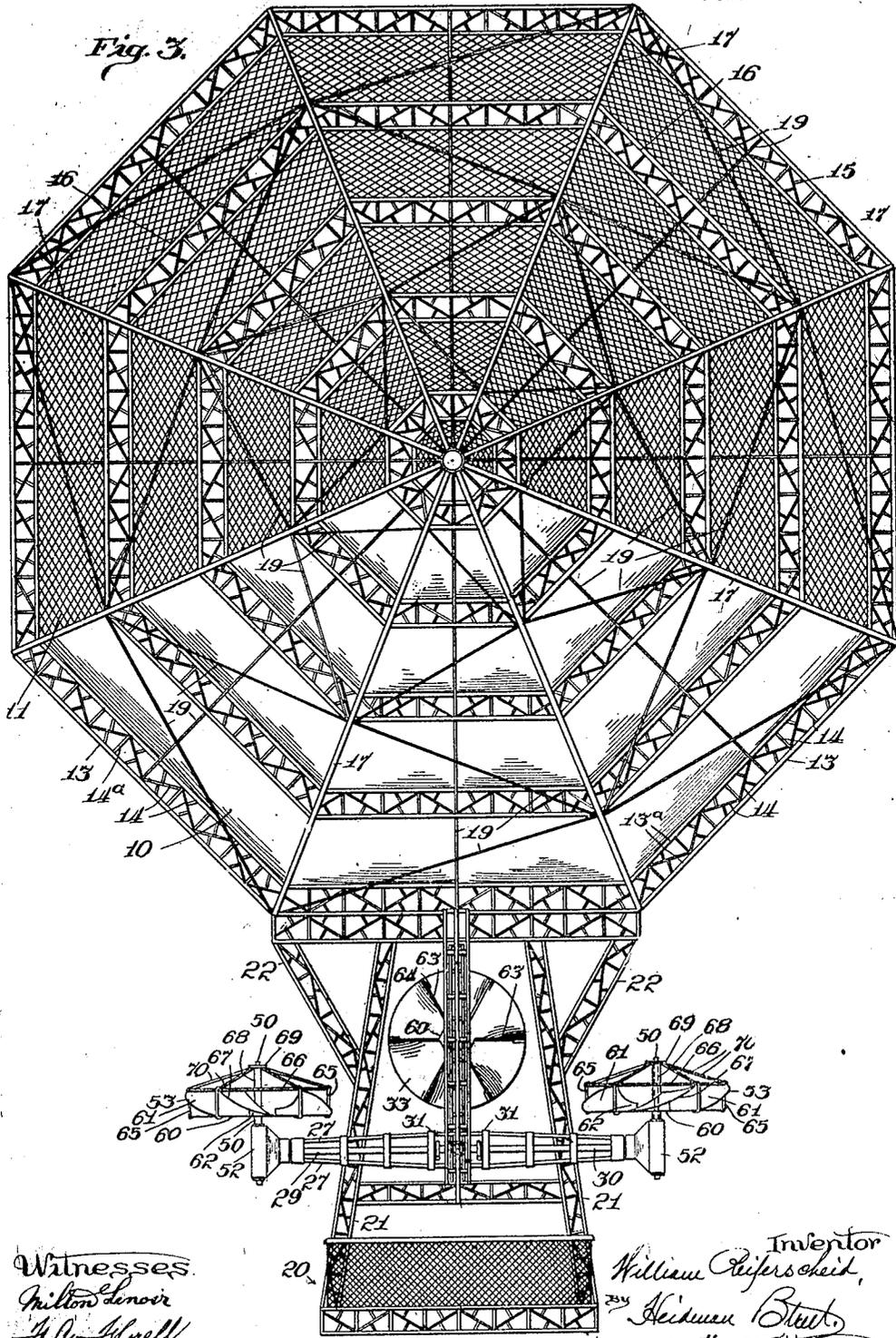
Inventor
William Reiferschied,
By
Heidman & Strick
Attorneys.

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Milton Lenoir
J. W. Howell

Inventor
William Reiferschied,
Attorneys

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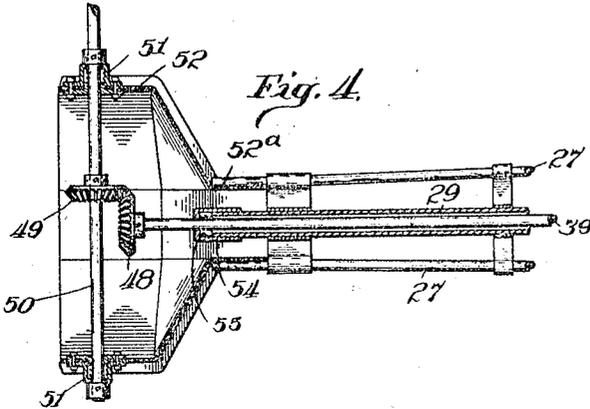


Fig. 4.

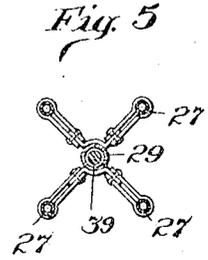


Fig. 5.

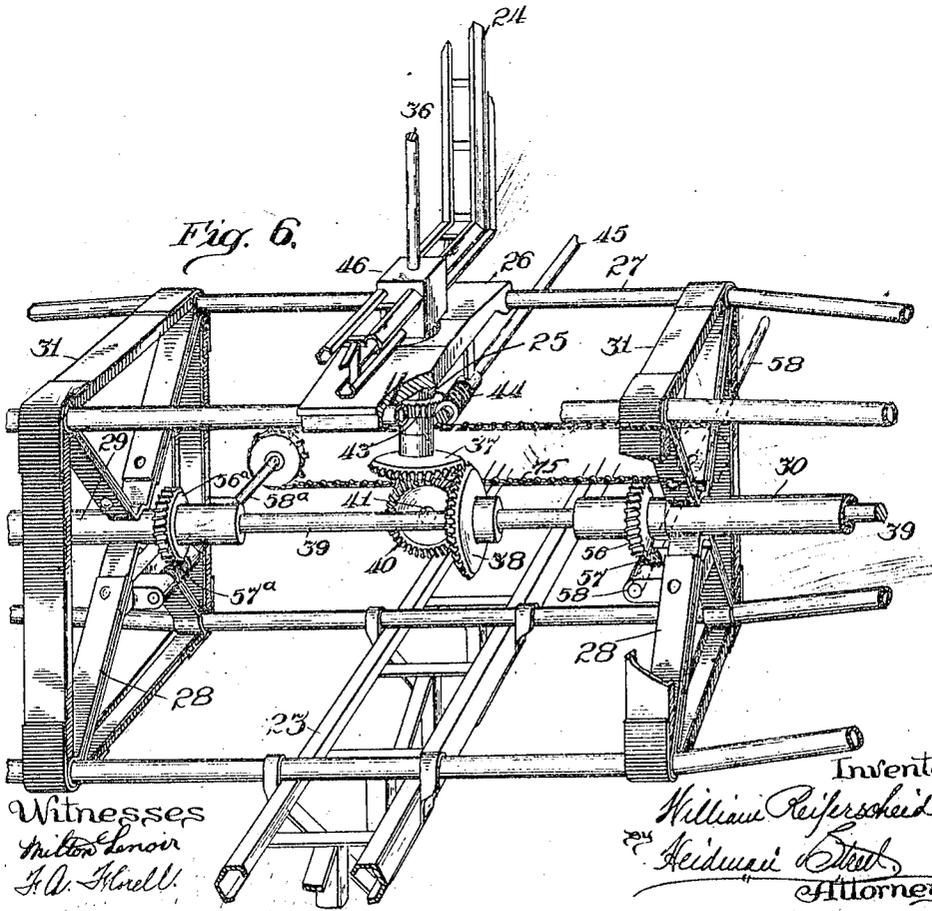


Fig. 6.

Witnesses
 Milton Lenoir
 J. A. Skell.

Inventor
 William Reiferschied,
 Heidmann & Steub
 Attorneys.

UNITED STATES PATENT OFFICE.

WILLIAM REIFERSCHIED, OF CHICAGO, ILLINOIS.

AIRSHIP.

1,291,686.

Specification of Letters Patent.

Patented Jan. 14, 1919.

Application filed March 8, 1917. Serial No. 153,465.

To all whom it may concern:

Be it known that I, WILLIAM REIFERSCHIED, a citizen of the United States, and resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Airships, of which the following is a description, reference being had to the accompanying drawings, which form a part of my specification.

My invention relates to improvements in air ships of the dirigible type, and has for its object the provision of a suitable frame adapted to encircle or surround the gas-holding means or bag and provide a suitable support for a cab or car, as well as for the power generating and imparting means; the frame being provided with a suitable net to maintain or hold the gas-bag or gas-holding means in proper condition within the metallic frame, but out of immediate contact therewith and prevent any possible injury to the gas-bag or bags due to improper contact with the frame.

One object of my invention is to provide a suitable metallic frame of comparatively light metal so formed and secured together as to provide a construction possessing sufficient strength and rigidity not only as an inclosure for the gas-bag but also permit of a suitable car or platform to be suspended therefrom; the latter being also constructed of similar material.

Another object of the invention is to provide a construction wherein several gas-bags are employed and arranged independent of each other; the frame being so arranged as to provide a vertical passageway through the gas-bag holding portion of the frame from the lower or car-side to the top of the air-ship at a point intermediate of the ends of the air-ship.

Another object of the invention is to provide an air-ship provided with a plurality of steering propellers mounted in adjustable carriers or frames at opposite ends of the ship which enable the steering propellers to be moved through arcs of horizontally disposed circles whereby the ship may be steered in the desired direction of travel in the same horizontal plane, or be caused to turn bodily on an imaginary axis through the arc of a circle if desired; or the propellers at opposite ends made to pull against

each other and the ship thus substantially held against horizontal movement; these steering propellers being adjustable so as to constantly pull in the direction of travel except under the condition last mentioned and when it is desired to ascend or descend.

A further object of the invention is to provide a plurality of what may be termed power propellers mounted on adjustable shafts at opposite ends of the air-ship and preferably on opposite sides of the steering propellers; the shaft of each of said power propellers being controlled by suitable means whereby the shafts or axes of said propellers may be moved through arcs of vertically disposed circles, or in other words vertically adjustable. With these power propellers, the altitude of the air-ship may be controlled and the latter be made to travel either up or down or at an inclination. The last mentioned propellers are also adapted to assist the buoyancy of the gas-bags in the event of their lifting power having become impaired or affected; these propellers enabling the pilot or operator to maintain the air-ship in the desired air current found most favorable or conducive to rapid travel in the desired direction. The last mentioned set of propellers are also designed to enable the pilot or operator to prevent the air-ship rising beyond the altitude desired when the load or ballast of the air-ship has been changed or affected; these propellers being so adjustable as to permit them to exert a pulling force against the rising tendency of the gas-bags.

The steering propellers and power propellers are arranged at both ends of the air-ship, the propellers at opposite ends of the ship being independently controllable and adjustable; the steering propellers at opposite ends of the air-ship permitting such adjustment that the one will counteract the other and thus result in the air-ship being held substantially stationary at any desired point and place in the air; while the power propellers at both ends of the air-ship may at such time be adjusted so as to hold the air-ship against upward movement or vice versa; or induce the air-ship to descend in a substantially perpendicular direction.

A further object of the invention is to provide means, under the control of the op-

erator or pilot, for maintaining the gas-bags in proper expanded condition regardless of whether the gas expands or contracts through the action of varying atmospheric conditions or temperatures.

The foregoing enumerated objects and advantages obtained thereby, as well as other advantages inherent in the construction, will be more fully comprehended from the following detailed description of the construction illustrated in the accompanying drawings, wherein:—

Figure 1 is a side elevation of my improved air-ship with a portion at the right-hand end broken away.

Fig. 2 is a vertical central sectional view, taken on the line 2—2 of Fig. 1.

Fig. 3 is an end view of my improved air-ship.

Fig. 4 is a detail longitudinal sectional view of a portion of one end of the housings or frame for the power propellers.

Fig. 5 is an end view of the detail illustrated in Fig. 4.

Fig. 6 is a detail perspective view of a portion of the power-transmitting shafts and frame or support therefor; the frame illustrating the intermediate portion of the power-propeller carrying frame and a portion of the steering propeller frame.

Fig. 7 is a detail view, partially in section, illustrating the preferred formation of the metallic elements or truss members employed for the lower or cab-portion of the frame.

Fig. 8 is a detail view of another portion of frame illustrating the formation of the metallic members preferably employed for the upper or gas-bag containing portion of the frame.

In the particular exemplification of the invention as illustrated in the drawings, the gas-bag containing portion of the frame of the air-ship is shown as preferably octagonal in cross section; the gas-bags and the inclosing frame therefor being preferably made elongated, as disclosed in Fig. 1. The gas-bags are cylindrical and provided with conical ends to conform with the inner circumference of the gas-bag holding frame.

In the preferred embodiment of my invention, I employ a plurality of gas-bags; the construction illustrated contemplating two gas-bags arranged end for end on opposite sides of the vertical center of the frame, as more clearly shown in Fig. 2, where the end of one gas-bag 10 is shown arranged on the opposite side of the central vertical passage with which the gas-bag holding frame of the ship is provided, as will hereinafter be described.

I prefer that the gas-bags be kept out of direct contact with the frame of the air-ship, and for that reason have shown the

gas-bag holding frame provided with a suitable net 11 inclosing the upper portion of the compartment or space within the frame; the netting being suitably secured to the frame and adapted to entirely incase the upper or major part of the gas-bags, as very clearly shown in Figs. 1 and 3. In view of the rising tendency of the bag, toward the upper part of the frame, the lower portion of the frame is not shown provided with netting.

Each gas-bag is preferably provided with an inflatable member or balloon shown in dotted lines at 12 in Figs. 1 and 2; the balloon in Fig. 2 being shown in collapsed or non-inflated condition. The inflatable members or balloons 12 are provided for the purpose of compensating for the expansion and contraction of the gas within the bags through the action of atmospheric conditions; the object of the inflatable members or balloons being to maintain the gas-bags in expanded or inflated condition when the gas within the bags contracts; the inflatable members or balloons, however, having no communication with the interior of the gas-bags, as will be hereinafter described.

One object of my invention, as illustrated in the drawings, is to provide a frame composed of thin sheet metal, such as tin and the like; the respective elements or members of the frame and the general construction thereof being such that a very light air-ship may be obtained; with the frame, however, possessing the requisite strength necessary to support the suspended car or platform for the operators, passengers and motors for operating and controlling the propellers. The frame, therefore, consists of truss members arranged so as to transmit pressure endwise; the various truss members having their top and bottom chords and braces individually composed of thin sheet metal. The chords of the truss members 13 employed in the gas-bag holding frame are preferably constructed as shown in the detail view, Fig. 8, namely sheet metal bent longitudinally so as to present the pentagonal shape in cross-section as shown at 13^a, 13^a in Fig. 8; while the intermediate or brace portions 13^b are composed of sheet metal tubing, rectangular in cross-section as shown in section in Fig. 8 at 14^a. These respective portions are suitably secured together. The diagonal braces 14 of the truss members extend diagonally from one chord 13^a to the other chord 13^a of a truss intermediate of adjacent brace portions 13^b, (see Fig. 3), and are preferably composed of thin sheet metal having the longitudinal edges bent at right angles so as to provide braces of channel form; the edges of the channel sides or legs being preferably bent back upon themselves or beaded. The respective chords and braces

of the truss-members are, of course, secured together at their abutting points in any suitable manner, as by welding or soldering. By bending and forming the respective portions of the truss-members, as described, they provide sufficient strength and rigidity; the bent edges reinforcing the elements against lateral or transverse bending. The gas-bag containing frame portion consists of a series of transversely arranged encircling members, preferably octagonal, as clearly shown in Fig. 3; the members at the ends of the gas-bag holding frame being of gradually decreasing diameter so as to provide tapering ends to the ship; the encircling frame members 15, which constitute the main or intermediate portion of the ship, are preferably all of the same size or diameter, as shown in Fig. 1, while each succeeding transversely disposed frame member 16, at both ends of the ship, is of gradually decreasing diameter or size, as shown in Figs. 1 and 3. The various angles or corners of the octagonal frame members are all united to the longitudinally disposed frame members 17, which are also preferably formed in the nature of truss members, as more clearly shown in Fig. 1; the respective portions of these truss members being preferably composed like the truss members constituting the sides of the octagonal frames as previously described; the chord portion whereof is illustrated in Fig. 8.

The gas-bag containing portion of the frame is shown provided at a point intermediate of the ends, to wit, preferably at a central point in proximity to the longitudinal center line thereof, with a vertically disposed shaft or open space arranged intermediate of the two gas-bags. The walls of this shaft or passageway are formed by the vertically disposed ladders, shown at 18 in Fig. 2, for the purpose of enabling the operator to go to the top of the air-ship.

The longitudinal members of the ladders 18 may be composed of thin sheet metal bent or formed like the intermediate portions or braces 13^b of the truss-members heretofore described.

The ladder formation of frame for the passageway may also provide means for further anchoring the respective sides or angles of the intermediate encircling frame-member 15, as illustrated in Fig. 2, where the tie-wires 18^a are secured to the ladder in the radial manner; the tie-wires being preferably secured together by means of the circumferentially disposed tie-wires 18^b, thus providing the spider-web formation shown in Fig. 2, whereby a rigid and strong construction is obtained without sacrificing the desideratum, to wit lightness.

In addition to the longitudinally disposed members 17 of the frame, the gas-bag containing frame is also preferably provided

with suitable tie-rods or wires 19 disposed in the diagonal manner, shown in Fig. 1; any suitable number of tie-wires or rods 19 being employed to assist in maintaining the frame rigid.

The underside of the gas-bag containing frame is provided with a suitable car or cab 20 disposed lengthwise of the air-ship, as shown in Fig. 1; this car or cab being also preferably constructed of thin sheet metal. The frame of the car or cab of the air-ship is composed of truss members 21, the cross-sectional configuration whereof is somewhat in the nature of a Y, as clearly shown in Fig. 7, wherein the top chord is shown comprising the triangular transversely disposed portion 21^a preferably composed of a sheet metal channel, with the edges of the legs or sides of the channel bent inward upon themselves, as indicated in dotted lines, with the corners of the triangular portion 21^a provided with the longitudinal members 21^b, 21^b composed of sheet metal bent longitudinally into the pentagonal configuration in cross-section. The perpendicular portion or brace 21^c of the truss-member is composed of the sheet metal tubing preferably rectangular in cross-section.

The lower chord or longitudinal portion 21^a is preferably bent longitudinally, like the portions 21^b, at the corners of the triangular portion 21^a, into the pentagonal configuration in cross-section, as clearly shown in Fig. 7. The respective portions or parts of the truss-members are suitably secured together, and with the diagonal braces 21^c, which may be similar in construction with the braces 14, provide a very firm and rigid construction. The car or cab 20 is shown composed of a series of upwardly converging truss frame members 21; the upper ends whereof are properly secured to the under side of the gas-bag frame; and the car or cab braced against lateral movement by means of the bracing members or struts 22 secured to the upright members 21 at a distance somewhat removed from the upper ends and to the opposite sides of the lower surface of the balloon frame. The respective elements of the struts 22 are preferably formed like the truss-members of the car frame just described.

The ends of the cab or car are provided with extensions or longitudinally disposed frames 23, at each end of the cab or car; the extensions being also preferably composed of sheet metal formed in a manner similar to that of the car-frame, as heretofore described.

Mounted in each frame or extension 23 is a vertically disposed propeller carrying frame 24 (which may be constructed like the other portion of the car-frame) pivotally secured at its top in the frame 23 and on its bottom on a vertically disposed sleeve 25, see

Fig. 6; the sleeve having bearing in the cross-member or block 26 mounted on the tubing 27 of the transversely disposed propeller frame; the tubing being maintained in parallel and spaced relation by means of the double angle braces 28, so as to provide the rectangular or square formation in cross-section, as shown in Figs. 5 and 6; the inner ends of the angle braces or frames 28 being adapted to provide bearing for the sleeves 29 and 30, as shown in Fig. 6. The upper and lower portions of this frame are maintained in proper relation by means of a suitable encircling band or member 31, see Fig. 6, which may consist of channeled strips of sheet metal secured together at the rod engaging ends by means of flat strips, welded or otherwise secured to adjacent portions of the frame-members and passing across the tubing 27 of the frame.

Each vertically arranged frame 24 is provided with a horizontally disposed shaft 32 on which is mounted a vertically disposed steering propeller 33; namely one propeller at each end of the car, as shown in Fig. 1. The sleeve or extended hub-portion of the propeller is provided with a suitable beveled gear 34 which meshes with bevel gear 35 secured to the upper end of the vertically disposed shaft 36 which extends through the sleeve 25 and into the frame 24, as shown in Figs. 1 and 6. The lower outer end of each shaft 36 is provided with a suitable bevel gear 37, see Fig. 6, arranged in mesh with bevel gear 38 keyed on the transversely disposed line shaft 39. The gear 38 also has meshing with it bevel gear 40 secured to the power-shaft 41 driven by a suitable motor 42. In the particular exemplification of the invention, the air-ship is shown provided with two motors; each motor driving a power-shaft 41 leading toward opposite ends of the car or cab so as to impart power to the propellers at opposite ends of the air-ship.

The sleeve 25, of the steering propeller carrier frame 24, at its outer end, is provided with a worm-gear 43 arranged in mesh with the worm 44 on the end of the operating rod or shaft 45; it being understood that the operating rod or shaft, as well as all propeller operating mechanism, is similar in construction at both ends of the air-ship, so that a description of one member or element at one end of the air-ship will suffice.

The sleeve 25 affords suitable bearing for shaft 36 and is properly secured in the block 46 of the frame 24 so that rotation of the sleeve 25, through operation of rod 45, and worm 44 meshing with worm-gear 43, will cause the frame 24 to be swung through a horizontally disposed circle or any desired arc or degree of a circle. The rod 45 extends to the pilot stand 47, being mounted in suitable bearings; the pilot stand being pro-

vided with suitable mechanism whereby the pilot is enabled to rotate or control the rods 45,—extending toward opposite sides of the air-ship,—thereby inducing the steering propellers 33 to move laterally in the desired direction.

The transversely disposed power shaft 39 is provided at each end with a bevel gear 48, see Fig. 4, where merely one end of the shaft is shown. The gear 48 meshes with a bevel gear 49 keyed to the perpendicular shaft 50 which has suitable antifriction bearing, as at 51, in the gear housing 52. As will be seen in Fig. 3, the framework composed of the rods 27 is disposed transversely of the ends of the car or cab of the ship, with the ends of this framework terminating in the housings 52, as clearly shown in Fig. 3.

The outer end of each shaft 50 is provided with a suitable propeller 53; these propellers, of which there are preferably two at each end of the car, constitute the power propellers; the propellers 53 being located preferably beyond the sides of the car-frame, as shown in Fig. 3. The housings 52 have their inner or closed sides tapered toward the center, terminating in the hub portion to which the sleeves 29 and 30, respectively, are secured at the end by means of similar members, as shown at 54 in Fig. 4 which may be secured to the housing by radial spokes or bands; the member 54 being also formed to provide a cup or race-way for the antifriction bearings 55 for the shaft 39 within the sleeve. The members 54 are so secured to sleeves 29 and 30, respectively, that rotation of the latter will impart similar movement to the housings 52 at the outer ends of sleeves 29 and 30, respectively; the rotation of sleeve 29 being induced by means of the worm gear 56^a which meshes with the worm 57^a on the end of the shaft 58^a which leads to the pilot stand 47, while sleeve 30 is rotated by means of worm gear 56 meshing with worm 57 on the end of rod or shaft 58. The rods 58 and 58^a are both adapted to be controlled by the pilot through the medium of suitable mechanism which will enable the pilot to either simultaneously or independently manipulate the different power propellers at the same and also at opposite ends of the car, so that they may be moved through the same arcs or degrees of a circle either in unison or independently. Where it is desired to control the two propellers 53 at the same end of the ship, the two worm-shafts leading to the same end of the ship may be operatively connected by sprockets and chain as for example shown in Fig. 6 by chain 75 and sprocket 76 shown in dotted lines on shaft 58 and sprocket 77 on shaft 58^a.

The propellers 53, as is apparent from the construction shown, are intended to swing through vertically disposed circles and are

adapted to either assist in maintaining the altitude of the ship, or the equilibrium thereof, or to change the altitude by inducing the ship to travel in a substantially perpendicular manner or at an inclination.

Should it be desired to have the air-ship rise in a perpendicular manner, the four power propellers 53 are positioned so as to be below the carrying frame, thereby presenting the cutting side of the propeller upward; whereas if it is desired to descend in a perpendicular manner, the four power propellers 53 are reversed, as illustrated in Fig. 3, the propellers set in motion by means of the motor or motors. When the propellers are swung below the transverse frame and the housings 52, the propellers will assist the gas-bags in lifting the air-ship and induce it to ascend in a substantially perpendicular manner, at which time the steering propellers 33 need not be put in motion. If it is desired to have the air-ship make a landing, the propellers 53 are then swung through the arc of a vertically disposed circle so as to be above the carrier-frame or the housings 52; this being accomplished by proper operation of the controlling rods or shafts 58 and 58^a. Should it be desired to descend in a gradually declining manner, then the propellers 53 are disposed slightly at an angle to the perpendicular and in a plane above the housings 52 or transverse carrier-frame. Where the desired altitude of the air-ship is obtained through the buoyancy of the gas-bags, the power-propellers 53 will be kept idle and merely steering propellers 33 employed for steering the ship in the desired horizontal direction. For example with the propeller-carrying frames 24 swung into the position indicated in Fig. 1, the steering propellers 33 will tend to guide the air-ship horizontally toward the left in said figure. Should it be desired to reverse the direction, then the carrier-frames 24 are swung about on their pivotal points by means of shafts 45, 45 worms 44, 44 and worm-gears 43, 43, mounted on sleeves 25, 25 secured to the lower part of each vertically disposed carrier-frame so that the propellers 33 will present their cutting faces in the opposite direction, thus completely reversing the direction of travel of the air-ship. It will be understood, of course, that movement of the carrier-frames 24, 24, through ninety, or a lesser number of degrees of a circle, will induce the steering propellers 33, 33 to direct the air-ship so as to cause it to swing horizontally.

The propellers 33 and 53 are all similar in construction and formation, so that the general description of a single propeller will suffice as a description of all the propellers. The propellers comprise a central portion or shaft-receiving disk 60 which is formed

to receive the shaft, see Fig. 3, preferably composed of thin sheet metal and from which the propeller blades 61 radiate; the propeller blades also being preferably composed of thin sheet metal and at the base portion being bent substantially at right angles to the main portion of the blade, as indicated at 62, which also forms a means for securing the blades 61 to the center or shaft-receiving plate 60. The angular portion or flange 62 corresponds with the amount of slope or pitch given the blades at their inner ends. The blades extend outward from the shaft substantially at right angles with the cutting edges 63 (see steering propeller 33 in Fig. 3) all disposed in the same plane; that is, the cutting edges 63 are all flush with the face of the plate 60, see propellers 53 in Fig. 3.

The outer ends of the cutting edges 63 are shown provided with small sleeves or sockets 64 which receive the bent ends of brace rods 65, the other ends of the rods 65 terminating at the lower outer end of the rear edge of the preceding blade, where the rods are secured to the circumferential brace or ring 66 to which the lower ends of the blades are secured by means of a sleeve formation, which sleeve formation may be produced by an integral extension of the rear outer ends of the propellers and bent about the circumferential brace 66 and soldered or otherwise secured thereto. The blades are curved downwardly toward their rear edges, as shown at 67, so as to offer the greatest resistance to the air, and thus enable a pulling power to be obtained when the propellers are revolved in proper direction so as to present their straight cutting edges in the direction of rotation. The center plate 60 is shown provided with a shaft-receiving sleeve 68 which extends slightly beyond the front side of the propeller and forms a bearing against the frame 52, as shown to the under side of the propellers 53, as illustrated in Fig. 3, while the sleeve extends a considerable distance toward the rear of the propeller and has its rear end provided with a flange or small disk 69 to which the brace rods or tie wires 70 are secured; the other ends of the brace rods or tie wires 70 being secured to the circumferential brace 66. The construction shown and described provides a very rigid propeller; enabling the propeller to be made of thin sheet metal having the outer ends at both forward and rear edges of the blades securely braced. The propellers are, of course, maintained on their respective shafts by suitable nuts and washers.

With my improved construction, should it be desired to maintain the air-ship above a given point, in other words to hold it substantially stationary against the action of

the air currents, then the propellers at one end of the air-ship may be moved so as to counteract the action of the propellers at the opposite end, in other words so that the propellers at both ends are bodily swung through arcs of circles so as to present the cutting sides of the propellers at one end toward the cutting sides or faces of the propellers at the other end, and thus cause them to pull against each other. This will cause the air-ship to remain substantially stationary.

The gas-bags 10 are shown provided with the small inflatable members or balloons, indicated in dotted lines at 12 in Figs. 1 and 2; the balloons 12 being intended to be inflated with air when the gas in the gas-bags contracts, so that the gas-bags may be maintained in their inflated or distended condition. The balloons 12 are mounted within the respective gas-bags 10, preferably at the inner ends, as shown in Fig. 1, and are secured to the ends of the ramified tube or piping 71 which communicates with a suitable air compressor or air-forcing element, shown at 72 in Fig. 1, whereby air will be forced through the tube or piping 71 and into the balloons. As soon as conditions are such that the air balloons need no longer be inflated, the air will be allowed to freely escape through the piping 71, at which time the air-forcing element 72 will, of course, be shut off or put out of operation. It will be readily understood that the air-forcing element 72 may be driven by connecting the same in any suitable manner to one of the motors 42.

The pilot stand 47, it will be understood, may be provided with crank shafts or any other suitable mechanism for operating the various controlling shafts whereby the positions of the propellers, relative to their power-transmitting shafts, may be determined. In practice, the framework and load of the air-ship may overbalance, to a more or less extent, the buoyancy of the gas-bags, so that the elevation of the air-ship may be controlled by the power propellers 53. It is readily apparent that with the respective propellers in rotation, the positioning of the different propellers may be readily accomplished without the exertion of any great power, due to the gyroscopic action, so that the pilot can readily swing or move the propellers into any desired position whereby the effect desired or direction of travel will be obtained; the steering propellers being so positioned and rotating so as to always exert a pull in the direction of travel, except when ascending and descending.

I have shown and described what I believe to be the best and simplest form of my invention, whereby the desired lightness will be had and at the same time the necessary

rigidity obtained; it is apparent, however, that the construction may be varied in certain details without, however, departing from the spirit of my invention.

What I claim as my invention is—

1. An air-ship, comprising gas-holding means, a car supported by said means and provided with power-generating apparatus, the opposite ends of said car being provided with vertically disposed pivoted frames adapted to have movement in a horizontal circular manner, a propeller mounted on a fixed horizontal axis in each of said frames, means for separately imparting movement to said frames and to the propellers, frames disposed transversely to the longitudinal axis of the ship and at opposite ends thereof, both ends of each of said last mentioned frames being provided with propeller-carrying housings, a propeller revolvably mounted on each housing, the housings and said propellers being adapted to bodily move through vertically disposed circles, and means disposed lengthwise of said transverse frames for separately imparting movement to said housings and to said last mentioned propellers.

2. An air-ship provided with a gas-bag containing frame having a vertical passage-way or shaft leading from top to bottom, said frame consisting of series of transversely disposed and longitudinally disposed truss-members, netting within said frame arranged so as to maintain the gas-bag out of contact with the frame, and a frame suspended beneath the gas-bag containing frame, the upright portions of said suspended frame converging toward the upper ends, and side braces or struts adjacent the upper ends of the suspended frame for maintaining the latter against sidewise movement.

3. An air-ship provided with a gas-bag containing frame and a suspended car, said frame and car being composed of truss-members composed of thin sheet metal, the braces of the respective truss-members being composed of tubing rectangular in cross-section, while the chords are composed of channels pentagonal shape in cross-section, with the open sides of the channels receiving the ends of said braces.

4. An air-ship, the frame whereof is composed of a series of truss-members, the various elements of the truss-members being composed of thin sheet metal having the longitudinal edges thereof bent so as to reinforce said elements transversely, the opposite ends of the air-ship being provided with transversely disposed frames, power shafts and sleeve shafts mounted in said frames, each of said frames being provided with a plurality of propellers, a portion whereof are adapted to be bodily moved through horizontally disposed circles while the other

portion are adapted to be bodily moved through vertically disposed circles, said power shafts being in operative engagement with the axes of the different propellers so as to rotate the same, while the sleeve shafts are in operative relation with the propeller axes-bearings and adapted to move the same through arcs of circles, and means, controllable from a common point, whereby the sleeve shafts may be actuated.

5. An air-ship provided with a gas-bag holding frame and a car suspended therefrom, means mounted within the gas-bag holding frame for maintaining the gas-bag out of frictional contact with the frame, inflatable means located within the gas-bag for maintaining the inflated condition of the latter, a plurality of propellers mounted at each end of the car, a portion of said propellers being disposed vertically and adapted to bodily move through horizontally disposed circles to act as steering propellers, while the other portion of said propellers are adapted to be moved bodily through vertically disposed circles and act as power

propellers, and means for controlling the positions of the respective propellers.

6. An air-ship provided with a gas-bag holding frame composed of truss-members of thin sheet metal, a car suspended from said frame, the car-frame being composed of thin sheet metal truss-members, a transversely disposed frame at each end of the car, said frames being provided with a plurality of propeller-carrying housings rotatably mounted at the ends of the frames and at an intermediate point, propellers, the axes whereof are mounted in said housings, the said housings intermediate of the ends of the frames being adapted to swing through horizontally disposed circles, while the housings at the ends of the frames are adapted to swing through vertically disposed circles, and means for separately controlling the propellers and said housings.

WILLIAM REIFERSCHIED.

Witnesses:

GEORGE HEIDMAN,
F. A. FLORELL.