J. R. FROBERG.

AIRSHIP.

APPLICATION FILED OCT. 4, 1909.

998,844.

Patented July 25, 1911.

7 SHEETS—SHEET 1.

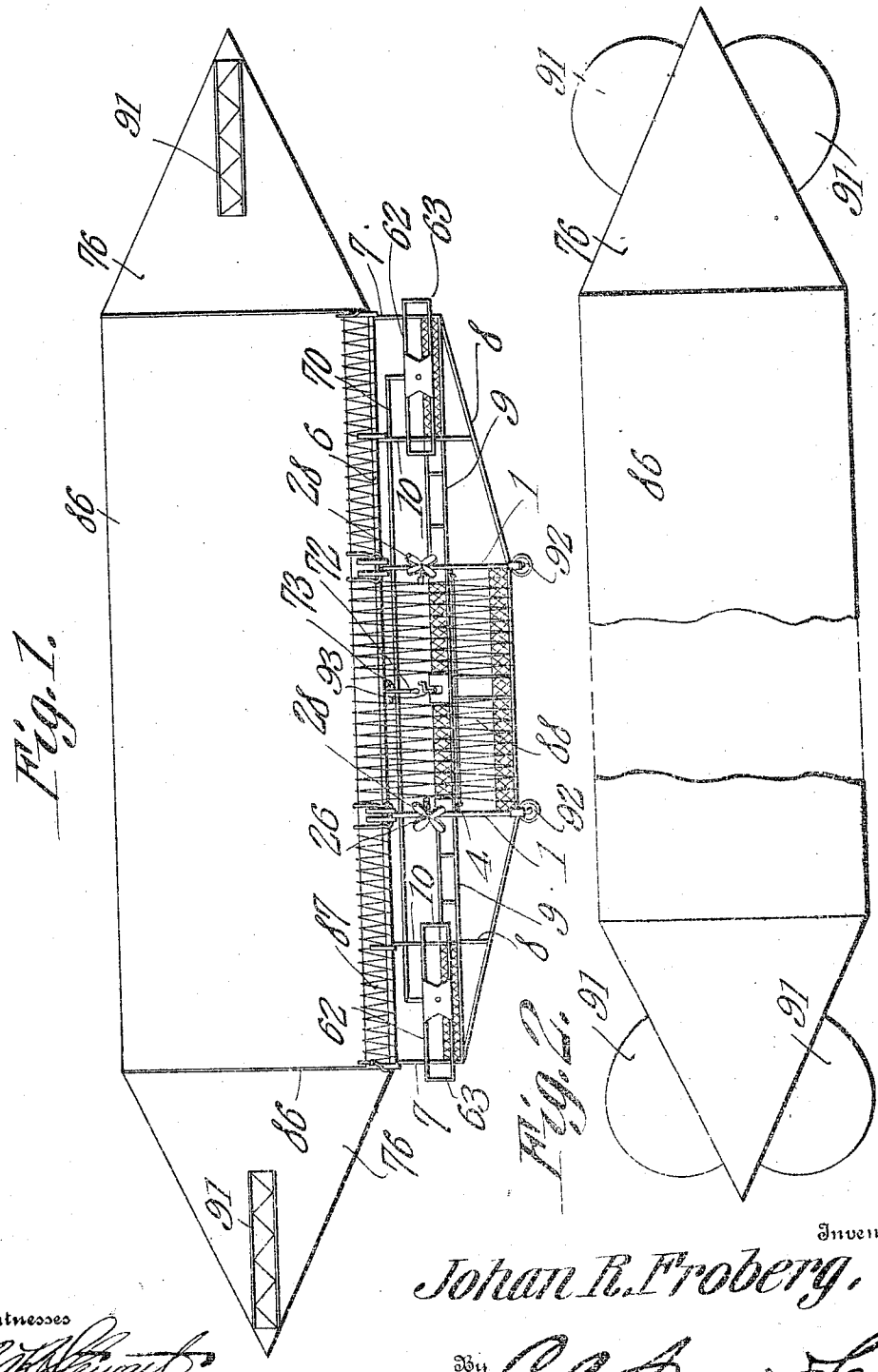

Fig. 1.

Fig. 2.

Witnesses

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7 SHEETS—SHEET 2.

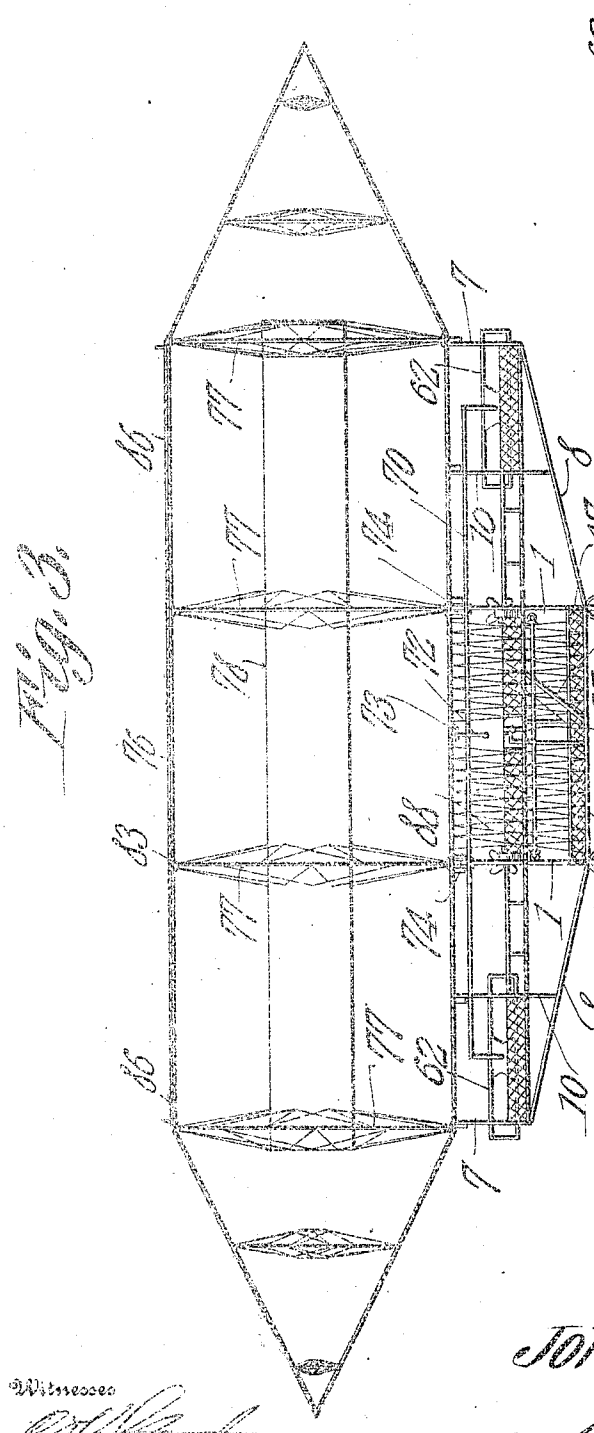

Fig. 11.

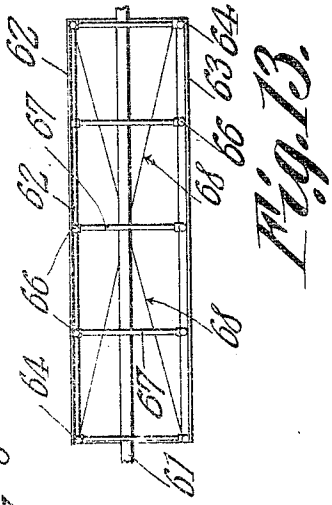

Fig. 13.

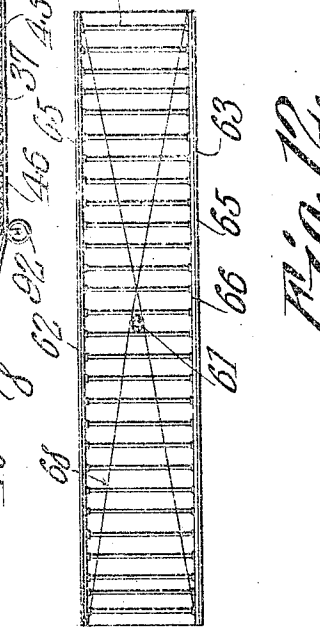

Fig. 12.

Witnesses

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7 SHEETS—SHEET 3.

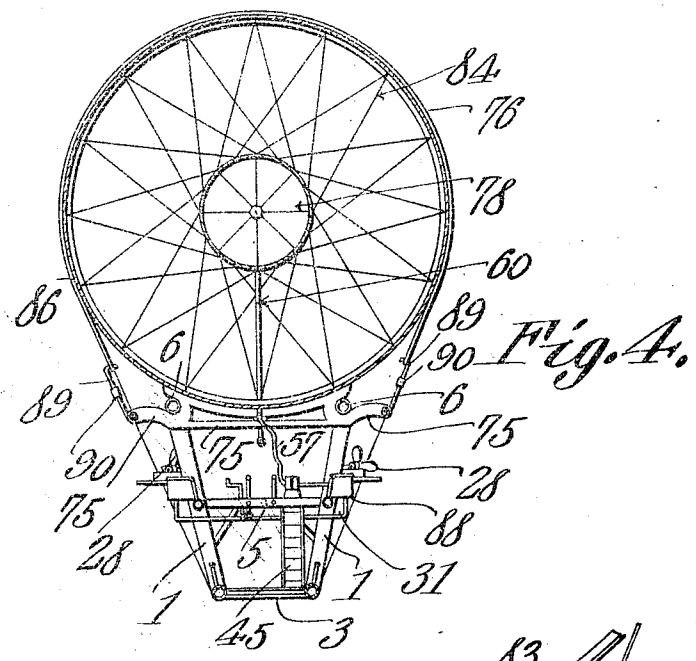

Fig. 4.

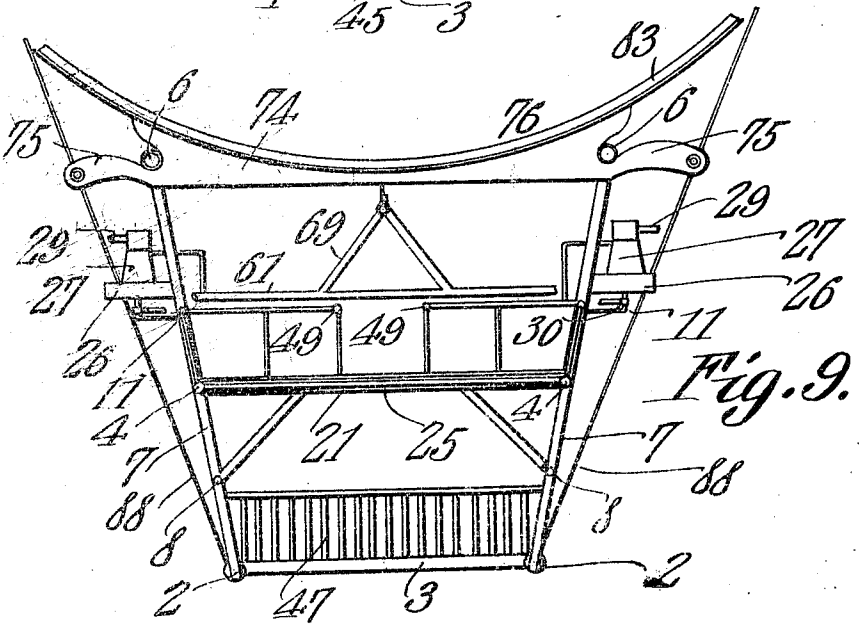

Fig. 9.

Witnesses

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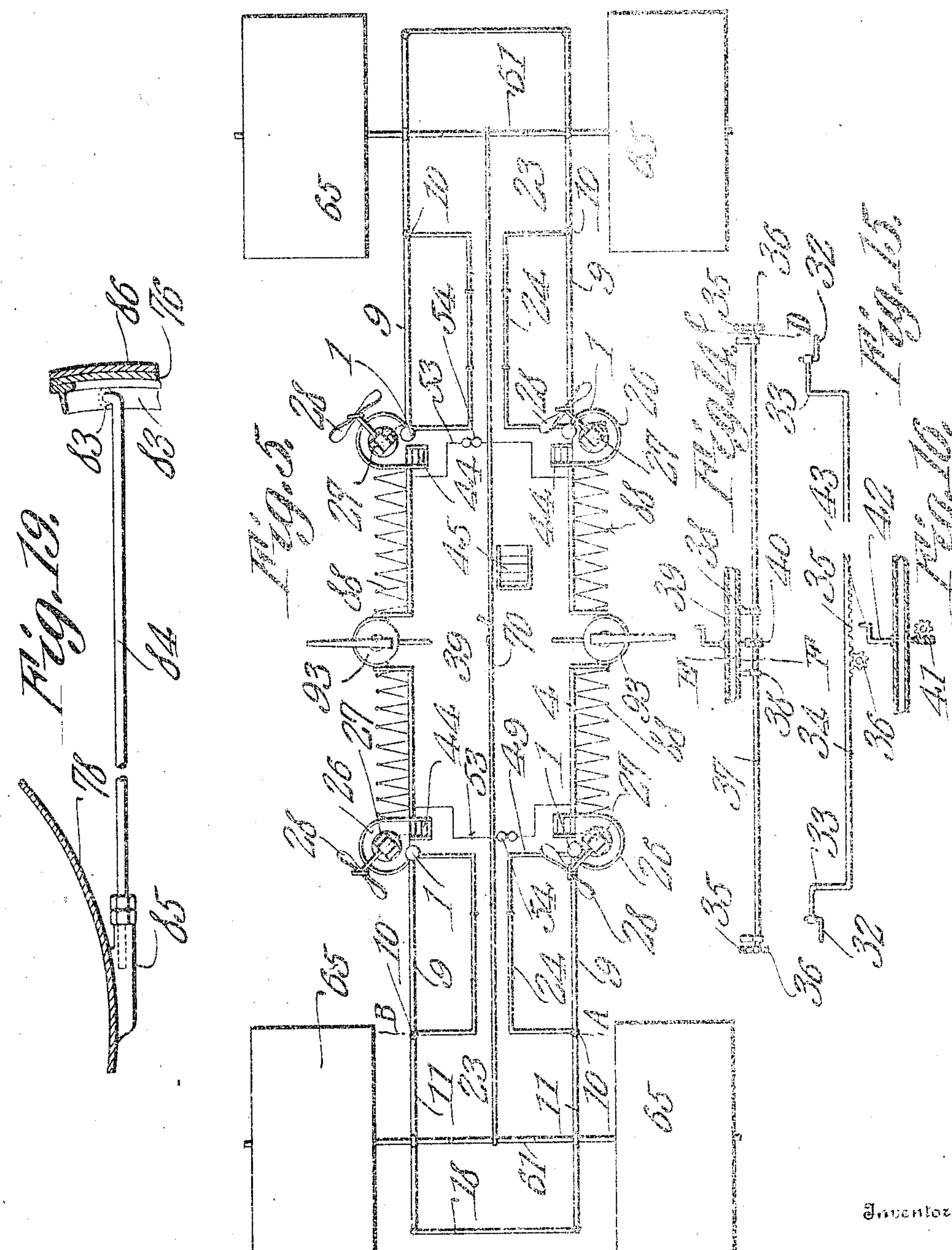
7 SHEETS—SHEET 4.



Witnesses

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7 SHEETS—SHEET 5.

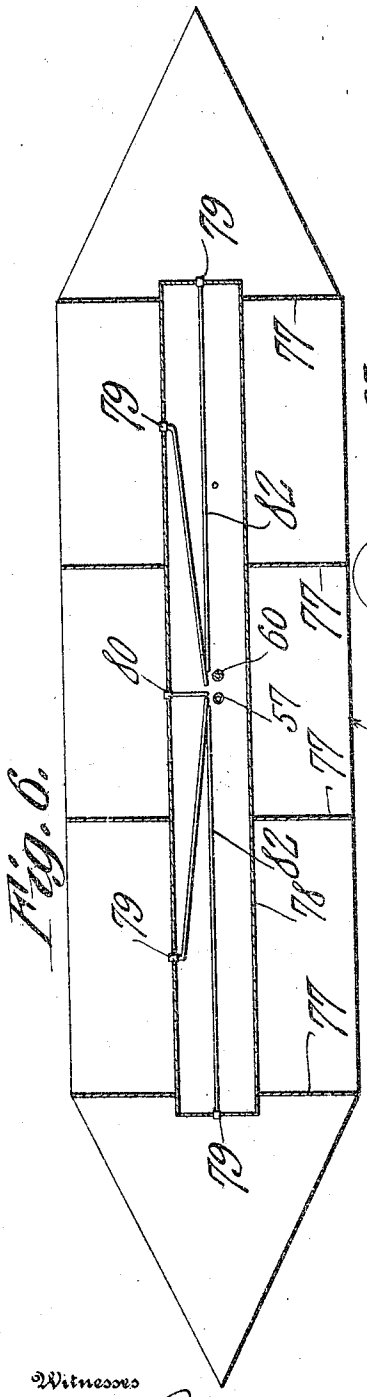

Fig. 6.

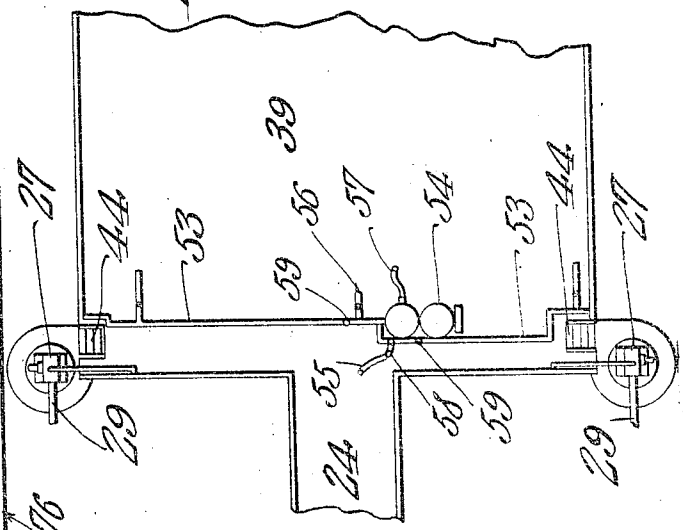

Fig. 8.

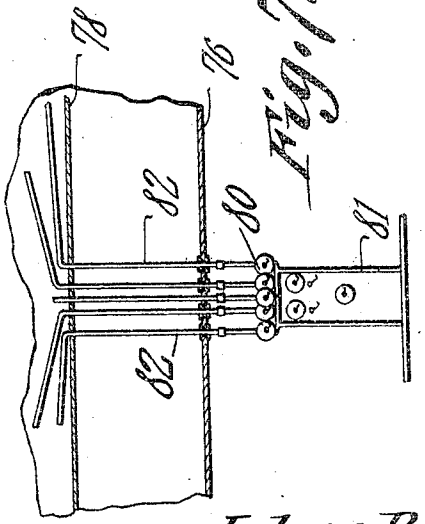

Fig. 7.

Witnesses

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APPLICATION FILED OCT. 4, 1909.

998,844. Patented July 25, 1911.

7 SHEETS—SHEET 6.

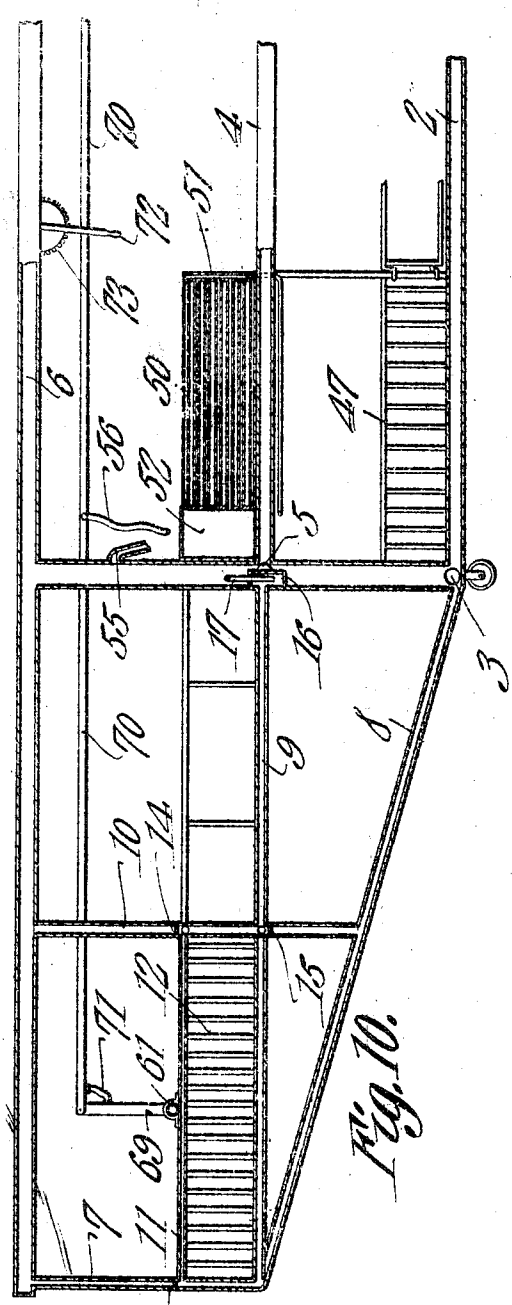

Fig. 10.

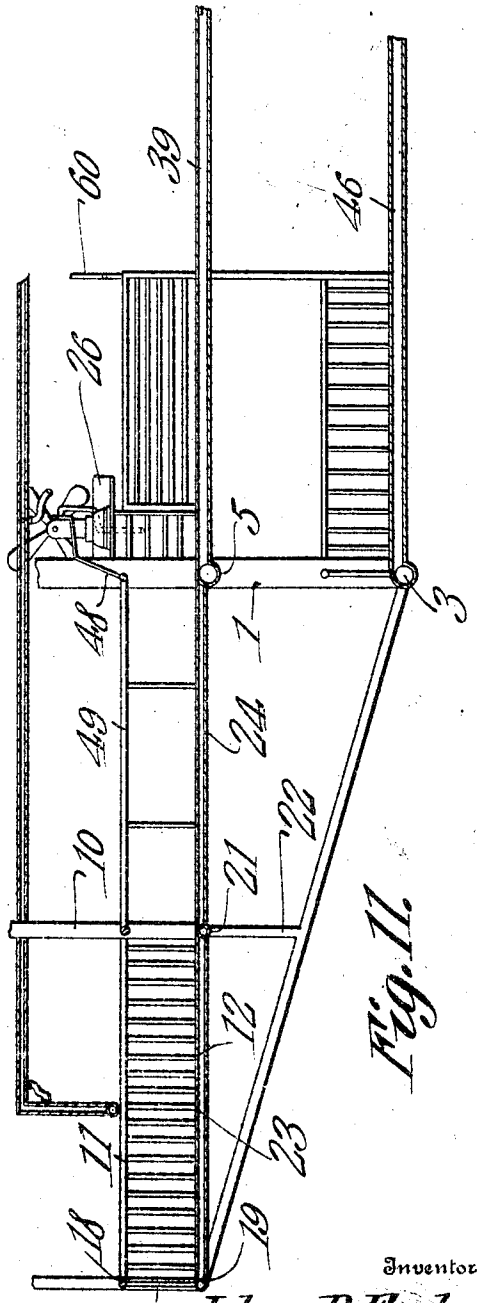

Fig. 11.

Witnesses

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7 SHEETS—SHEET 7.

Fig. 17.

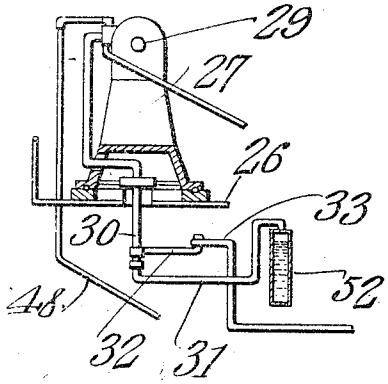


Fig. 18.

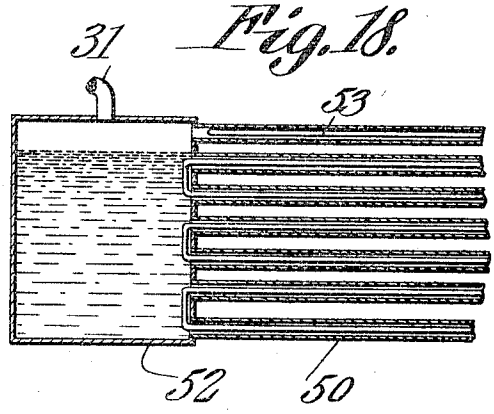
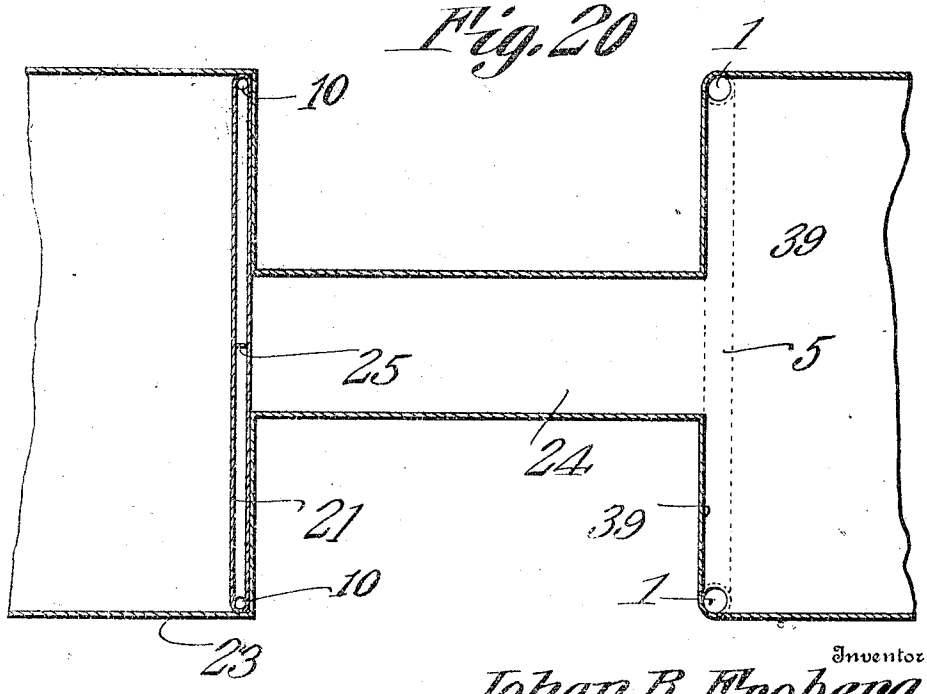


Fig. 20



Witnesses

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UNITED STATES PATENT OFFICE.

JOHAN RICHARD FROBERG, OF GOLDFIELD, NEVADA.

AIRSHIP.

998,844. Specification of Letters Patent. Patented July 25, 1911.

Application filed October 4, 1909. Serial No. 520,803.

To all whom it may concern:

Be it known that I, JOHAN R. FROBERG, a citizen of the United States, residing at Goldfield, in the county of Esmeralda and State of Nevada, have invented a new and useful Airship, of which the following is a specification.

This invention relates to air ships of the dirigible lighter-than-air type and one of its objects is to provide a machine of this character carrying a fixed quantity of gas under all conditions, means being utilized whereby any proportion of the gas can be stored under pressure outside of the main gas container, and whereby the gas can be readily withdrawn from or directed into the main container either for the purpose of elevating or lowering the machine or for maintaining a uniform altitude under changeable climatic conditions.

Another object is to provide an air-ship having the main gas container subdivided into compartments provided with valved means for establishing communication therebetween and whereby different quantities of gas may be held within the various compartments so as to support the deck thereof in a substantially horizontal position irrespective of the location of the center of gravity thereof.

Another object is to utilize the frame and floors of the car for the purpose of storing gas under pressure, certain portions of the frame being also used for the storage of motive fluid.

A still further object is to utilize pivotally supported motors each of which is designed to drive a propeller, means being provided whereby all of the motors can be simultaneously shifted to change the direction of the axes of the propellers with relation to the longitudinal center of the machine, this shifting of the propellers being sufficient to change the direction of movement of the machine. It thus becomes necessary to utilize rudders for steering purposes.

Another object is to provide cooling means whereby surplus fuel discharged from the motors in a heated condition can be quickly and thoroughly cooled and subsequently directed into the fuel storage tank.

Another object is to provide means whereby the exhaust gases from the engines can be utilized for the purpose of heating the gas within the main container, means being employed for establishing a circulation of this gas around and past the tubes carrying the hot exhausted gases.

Another object of the invention is to provide adjustable controlling planes whereby the movement of the machine in an upward or downward direction can be controlled, these planes being provided with means whereby the gas stored within the main container can be cooled.

A still further object is to provide improved means for connecting the main container to the car, this means including an envelop designed to extend over said container and which can be adjusted to receive containers of different proportions, according to the load to be sustained.

With these and other objects in view the invention consists of certain novel details of construction and combination of parts hereinafter more fully described and pointed out in the claims.

In the accompanying drawings the preferred form of the invention has been shown.

In said drawings, Figure 1 is a side elevation of an air ship embodying the present improvements. Fig. 2 is a top plan view thereof, a portion of the main container and the parts thereunder being broken away. Fig. 3 is a vertical longitudinal section through the machine. Fig. 4 is a transverse section through the central portion thereof. Fig. 5 is a plan view of the car and of the parts connected thereto, the gas container and its cradle and envelop being removed. Fig. 6 is a longitudinal section through the main gas container showing the valve controlling tubes of the equalizing mechanism. Fig. 7 is an elevation of said equalizing mechanism and of the tubes extending therefrom and a portion of the main container shown in section. Fig. 8 is a plan view of a portion of the deck of the car and showing the condenser and certain of its connections and two of the engines. Fig. 9 is an enlarged transverse section through the car at the inner end of one of the end decks and on the line A—B of Fig. 5. Fig. 10 is a vertical longitudinal section through the end portion of one side of the car and showing the fuel cooler and the gas heater in section.

Fig. 11 is a central vertical longitudinal section through said end portion of the car. Fig. 12 is a side elevation of one of the controlling planes. Fig. 13 is a front elevation thereof. Fig. 14 is a side elevation of the longitudinal shaft of the motor shifting mechanism and of the parts connected thereto. Fig. 15 is a section on line C—D of Fig. 14, and showing the slidable motor actuating bar complete. Fig. 16 is a section on line E—F of Fig. 14. Fig. 17 is an elevation of one of the engines and of its connections with the gas heater. Fig. 18 is a vertical longitudinal section through one end portion of said heater. Fig. 19 is a detail view of one of the connections between the inner tube and the outer tube of the main gas container. Fig. 20 is a longitudinal section through a portion of the car and including part of the upper deck and one of the bridges.

It is to be understood that all of that part of the machine located below the gas-container constitutes the car of the air ship, and this car has intermediate tubular standards 1 connected at their lower ends by lower side tubes 2 and by lower transversely extending tubes 3. Said standards 1 are also connected by intermediate side tubes 4 and intermediate transverse tubes 5. Longitudinally extending top tubes 6 are secured upon the upper ends of the standards 1 and extend desired distances beyond these standards, the outer ends of these top tubes having vertical end tubes 7 extending downward therefrom to the forward ends of bottom inclined tubes 8 extending from the ends of the tubes 2. Intermediate side tubes 9 extend from the upper ends of the tubes 8 to the standards 1, the said tubes 9 being in alinement with the intermediate side tubes 4. An intermediate vertical tube 10 connects each inclined tube 8 with the top tube 6 thereabove and is also connected to a tube 9. A manifold tube 11 connects the upright tubes 7 and 10 at points above the tube 9, the same constituting a railing and being connected with the tube 9 therebelow by means of a series of short upright tubes 12.

By referring to Fig. 10 it will be seen that a partition 13 is located within each tube 7 directly above the manifold tube 11 and another partition 14 is located within the tube 10 above said manifold 11. Moreover a partition 15 is arranged within tube 10 at a point below the tube 9 and that end of said tube 9 opening into the standard 1, is surrounded by a receptacle 16 which is located within said standard 1 and has a suction pipe 17 extending therefrom for the purpose hereinafter set forth. The end tubes 7 are connected by transversely extending upper and lower tubes 18 and 19 which constitute the top and bottom members of a railing, the said members being connected by uprights 20 which can if desired be hollow and open into the tubes 18 and 19 for the purpose hereinafter set forth.

A cross tube 21 connects the intermediate vertical tubes 10 and is disposed in the same plane with the tubes 9, this tube 21 being braced by and connected to inclined truss tubes 22 which are secured to and open into the bottom inclined tubes 8. A hollow floor or platform 23 is secured to and supported by the tubes 9, 19 and 21 and a hollow bridge 24 extends from this floor 23 along the longitudinal center of the machine to the tube 5 which serves to support one end thereof. The hollow bridge 24 opens into the tube 5 and it will be apparent therefore that communication is thus established between the said tube 5 and the hollow bridge or deck 23, bridge 24 and standards 1, as well as the other tubes 2, 4, 6 and 8 opening into the standards 1. The tube 21, while extending continuously from one tube 10 to the other at opposite sides of the car, has a central partition 25 (see Fig. 20) and it will be seen therefore that the interior of one half of the tube 21, of the tube 11, the tube 9 and those portions of the tubes 7 and 10 between the partitions constitute a combined fuel storage tank and cooler as will be hereinafter particularly pointed out.

A substantially semi-circular support 26 is mounted on and extended laterally from each of the intermediate standards 1 of the car and a hydro-carbon engine 27 is mounted thereon to move about a vertical axis, each of these engines having a propeller 28 connected to the main shaft 29 thereof. As shown particularly in Fig. 17 the pivot 30 about which the engine moves, can be in the form of an exhaust pipe extending from the engine and opening into a fixed tube 31. An arm 32 is secured to and extends radially from the revoluble exhaust pipe 30 and constitutes a crank on which is pivotally mounted the angular end 33 of a cross bar 34. A rack 35 is arranged along the center portion of the cross bar and meshes with a gear 36. One of these gears is secured to each end of a longitudinally extending shaft 37 and said shaft is journaled in bearings 38 extending downward from the upper deck 39 of the middle portion of the car, this upper deck being hollow and supported by the tubes 4 and 5. Moreover said hollow deck opens into the tubes 4 and 5 at desired points so that the contents thereof can readily flow into the tubes. A worm gear 40 is secured to the longitudinal shaft 37 at any suitable point thereon and is actuated by a worm 41 mounted on a vertical shaft 42 which extends through the deck 39 and has a crank or other suitable actuating device 43 secured to the upper end thereof. The parts are so arranged and proportioned that, by rotating the worm 41, the shaft 37 can be rotated and

the bars 34 shifted longitudinally so as to simultaneously shift the engines about their vertical axes. In this connection attention is directed to Fig. 5 of the drawing, wherein it will be seen that the engines at each side of the car are oppositely disposed, the propellers at one end of the machine serving to draw the same forward while those at the other end thereof exert a pushing action. By simultaneously shifting the bars 34 the said propellers can all be swung toward one side of the machine in order to exert a pulling and pushing action along intersecting lines, this obviously resulting in turning the entire machine, the radius of the curve described by said machine being dependent upon the angles of the shafts 29 to the longitudinal axis of the machine.

Each of the extensions or supports 26 constitutes a platform which can be reached from the upper deck 39 by steps 44 and steps 45 also lead from the upper deck down to the lower deck 46 which is mounted on and secured to the tubes 2 and 3. This lower deck is hollow and therefore constitutes a gas container, the same opening into the tubes which support it. Hollow railings 47 are mounted along the sides of the lower deck and open thereinto and these railings also constitute gas containers.

Each of the engines 27 is of the usual type having a supplemental reservoir thereon into which the liquid fuel is directed from the supply tank and a pipe 28 conducts the surplus or overflow motive fluid from this reservoir to a hollow railing 49 located along one side of the bridge 24 adjoining the engine, this railing opening into that portion of the adjoining vertical tube 10 disposed between the partitions 14 and 15. In this connection see Figs. 10 and 11 of the drawings.

The railings of the upper deck 39 are formed of horizontally extending water tubes 50 each series of tubes opening at one end into a manifold tube 51 and at its other end into a water tank 52 into which the exhaust gases from the adjoining engine are discharged through the pipe 31 heretofore referred to. See Fig. 17. A gas conducting pipe 53 extends continuously through the tubes 50 and one end thereof is connected to the gas-pump 54 which is located upon one of the decks of the car. A pipe 55 also extends from the pipe 53 to one of the standards 1 and a pipe 56 extends from pipe 53 to cooling apparatus which will be hereinafter described. It is of course to be understood that the condenser is in communication with the main gas container through a pipe 57. One heater such as herein described is provided for each engine and all of said heaters coöperate to form the side railings of the upper deck. The gas-pump communicates with all of these heaters so that gas can be forced into them simultaneously. A suitable arrangement of valves is provided whereby the gas is prevented from going into the pipes 55 and 56 while the gas-pump is in use for the purpose of forcing the gas into the heaters. These valves have been indicated at 58 in Fig. 8. Additional valves 59 are utilized for cutting off the heaters from the gas-pumps. As heretofore stated each tube or pipe 53 is connected at one end to a gas-pump. The other end of each tube may be attached to the main gas container in any preferred manner as by means of a tube 60.

A hollow rock shaft 61 is mounted upon the tubes 11 at each end of the car and each rock shaft projects beyond the sides of the car and supports the controlling planes of the machine. These planes are arranged in pairs, there being an upper plane 62 and a lower plane 63, the said planes each consisting of a rectangular frame 64 formed of tubing and having a covering 65 of fabric or other suitable material secured thereon. The front and rear ends of each frame are connected by longitudinally extending intermediate tubes 66 and all of these intermediate tubes as well as the side tubes are connected by a series of vertically extending pipes 67 forming radiators, those of the pipe 67 arranged along the transverse center of the planes being in communication with the hollow rock shaft 61. Brace wires 68 may be arranged diametrically between the upper and lower planes so as to prevent the same from being distorted or changing their relation to each other. Upwardly converging hollow arms 69 are secured upon each rock shaft 61 and a longitudinally extending hollow actuating tube or rod 70 is pivotally connected to the upper ends of these arms of both shafts, there being a flexible tubular connection between the end portions of the arms and the rods as indicated at 71, this connection serving as a means for directing gas from the tube 70 to the arms 69. The tube or rod 70 is connected to the gas-pump by means of the pipe 56 heretofore referred to, this pipe being preferably flexible so as to permit the necessary longitudinal movement of the tube or rod 70. A lever 72 is supported in the upper portion of the car and is pivotally connected to the tube or rod 70 there being a toothed segment 73 or other suitable means for locking the lever in any position to which it may be adjusted. By shifting this lever the two rock shafts 61 can be simultaneously swung upon their pivots and all of the planes thus shifted at the same time and in the same direction.

A series of longitudinally bowed cross beams 74 is supported on the top tubes 6 of the car, each of these beams being provided at each end with an outwardly

curved arm 75 extending under the adjoining tube 6. The said beams 74 form a cradle to support the main gas container 76 of the machine. This container is preferably in the form of an elongated metallic cylinder having conical ends, the interior of the cylinder being subdivided by partitions 77 into separate compartments as shown particularly in Fig. 3. A centrally disposed inner tube 78 extends through all of the partitions and is attached at its ends to the end partitions 77, there being valved openings 79 within the inner tube and through which communication is established between said inner tube and the respective compartments within the main gas container. The valves 80 utilized for closing these openings can be controlled electrically, pneumatically, or in any other preferred manner from a controller 81 located upon one of the decks of the car, this mechanism being of any well known type such as is supplied for opening valves located at a distance. In the present instance the means for effecting this actuation pneumatically have been indicated in Figs. 6 and 7, the tubes 82 for directing air under pressure to open the valves, being shown extending from the controlling mechanism 81. By means of this mechanism it is designed to place any one of the compartments in communication with the inner tube and that permits a portion of the gas contained in one compartment to flow therefrom and into the inner tube and thence to one or more of the other compartments. The pipe 57 which serves to supply to the condenser from the main gas container, opens into the inner tube as indicated at 57 and the return pipe 60 from the gas heater also opens into this inner tube as shown in Fig. 6.

Each partition 77 is preferably riveted or otherwise secured to an annular T-iron 83 secured to the inner surface of the main container 76 and having apertures in which are secured the ends of spokes 84. These spokes extend into lugs 85 outstanding from the inner tube 78 and constitute efficient means for not only holding the inner tube in proper relation to the partitions and outer tube but also bracing the entire gas containing body so as to prevent it from buckling or otherwise becoming injured from any cause.

The means employed for securing the main gas container upon the cradle consists of an envelop 86 the longitudinal edges of which are disposed close to the top tubes 6 and are fastened thereto by shrouds 87 which are laced through the edge portions of the envelop and are wrapped around the said tubes 6. That portion of the envelop above the middle decks of the car is connected by shrouds 88 with the lower tubes 3. Moreover the said envelop is preferably connected to the arms 75 of the cross beams 74, by means of threaded rods 89 connected by turn buckles 90. By tightening these buckles, the envelop can be drawn tightly around the gas container and said container held firmly upon its cradle. Moreover this envelop can also be additionally held by the shrouds 87 and 88.

Each of the engines 27 is provided with a pump attachment whereby fuel contained within the receptacle 16 can be elevated through the suction pipe 17 to the engine.

As heretofore stated, and as shown in the drawings, there is one engine located adjacent each of the standards 1 and each of the engines has grouped with it a gas heater, such as has been heretofore described and in which exhausted gas is utilized as a heating medium; a surplus fuel cooler constituting a side railing of one of the end decks, and a fuel tank formed by certain of the tubes of the frame adjacent the fuel cooler and which tank supplies a receptacle from which a suction pipe extends to the exhaust. It is also to be understood that the various arrangements of tubes heretofore set forth are duplicated at the two ends of the car there being a bridge extending from each end of the middle upper deck to the respective end decks or platforms.

All of the tubes of the car, with the exception of those constituting the gas heater, the fuel cooler, and the fuel tank, are in communication with each other and with the hollow decks, these tubes and decks thus constituting a vast storage tank in which gas may be held under pressure for an emergency.

It is to be understood that before making an ascent all of the gas storage tubes and platforms as well as the gas container 76 are charged with gas after which a sufficient quantity of the gas contained within the container 76 can be withdrawn therefrom and condensed within the containing tubes constituting the framework so as to prevent the machine from making an ascent. This withdrawal of the gas from the container 76 and its compression within the tubes and platforms of the car, is effected by the gas-pump 54. When it is desired to make an ascent a predetermined quantity of the compressed gas is permitted to flow through the gas-pump to the container 76 until the same is rendered capable of elevating the entire machine. When the engines are set in motion the propellers 28 are simultaneously rotated so as to propel the machine in a desired direction, it being possible to steer the machine by shifting the engines about vertical axes in the manner hereinbefore described. Such shifting will result in the propeller swinging laterally so as to bring the longitudinal axes of their shafts at desired angles to the longitudinal center of the car. In Fig. 5 the relative positions of the propellers, while the

machine is turning, have been shown but it is to be understood that when the machine is traveling in a straight course the shafts of the propellers at each side of the car are disposed in alinement. By shifting the lever 72 the upper and lower planes 62, 63 can be moved to any desired inclination relative to the horizontal and can thus be utilized for the purpose of directing the car upwardly or downwardly without changing the quantity of gas contained within the container 76.

As has heretofore been pointed out the spent gases discharged from the engines are directed into water contained within the compartment 52 and quickly raise the temperature thereof, and inasmuch as the pipes 53 containing gas used for elevating purposes, pass through the water tubes 52, it will be apparent that whenever a circulation of gas is set up through the tubes 53, said gas can be readily heated. This is especially desirable under certain climatic conditions, while under other conditions it is desirable to cool gas contained within the main container 76. To effect this result the gas is withdrawn from the container 76 and directed by the gas-pump through the tubes 56 to the rod 70 and thence by way of the flexible tubes 71 to the arm 69 and rock shaft 61 from which the gas is distributed into the tubes constituting the framework of the controlling planes. The air passing between and around the various tubes of the planes will quickly cool the warm gas contained within the tubes and the gas-pump can then be utilized for returning this gas to the container 76 after which another quantity can be removed therefrom and the foregoing operation repeated, it being obvious that the temperature of the gas within the container 76 will be materially reduced each time a portion of it has been directed into and returned from the coolers in the manner described.

As has been heretofore pointed out there is more or less excess motive fluid discharged from the engines and this fluid is directed through the pipes 48 to the railing tubes 49 and thence to the tubes 11 from which the fluid flows downward through the tubes 12 to the tubes 9. During this operation the said tubes are cooled by the atmosphere surrounding them and the said fuel is therefore reduced in temperature and returned to the tank which is formed of tubes 9.

When it is desired to descend it is not necessary to allow a portion of the gas to escape from the container 76 as heretofore. Instead the gas pump is set in motion so as to remove a desired quantity of gas from the container and compress it within the storage tubes constituting the car frame. The gas thus stored can be used at a future time for producing ascent, merely by returning it to the container 76.

If desired, and as shown especially in Figs. 1 and 2, steadying wings or planes 91 may be extended laterally from the conical terminals of the container 76. Also, if desired, supporting wheels 92 may be arranged below the front and rear portions of the lower deck 46 to facilitate the movement of the machine along the ground.

By loosening the shrouds 87 and 88 and the turn buckles, the envelope 86 can be loosened from the container 76 and another container of a greater or less capacity can be placed within the envelop and held by tightening the shrouds and the turn buckles.

All parts of the container, envelop and car, are preferably formed of light sheet metal.

It is designed, for the purposes of warfare, to arrange turrets 93 at the sides of one or more of the decks.

It is to be understood of course that various changes may be made in the construction and arrangement of the parts of the machine without departing from the spirit or sacrificing any of the advantages of the invention.

What is claimed is:

1. An air ship including a gas container, a car supported thereby, an engine upon the car, water tubes upon said car and constituting a railing, a tank opening into said tubes, means for directing exhausted gases from the engine and into the tank to heat the water, and a gas conducting tube extending from the container and through the water tubes.

2. In an air ship, the combination with a gas container, and a car supported thereby, of controlling planes movably connected to the car, tubular connections between the planes, said connections communicating and constituting coolers, means for directing gas from the container to the coolers, and means for shifting the planes.

3. In an air ship, a car including standards and side members connected to the tops of the standards, cross beams having forked ends straddling said members and supported thereby, each beam having terminal arms, the upper faces of the beams being concaved longitudinally to constitute a cradle, a non-flexible gas container bearing upon the concaved faces of the beams, said beams being arranged at intervals throughout the length of the container, and a flexible envelop extending over and bearing upon the container, and adjustable connections between said envelop and the arms.

4. An air ship including a gas container, a car, water tubes, an engine, means for utilizing exhaust gases from the engine to heat the water, and a gas conducting tube extending from the container and through the water tubes.

5. In an airship, the combination with a

gas container, of spaced planes, tubular connections between the planes, said connections communicating and constituting coolers, and means for directing gas from the container to the coolers.

6. In an airship, a car including side members, cross beams having forked ends straddling said members, each beam having terminal arms, a non-flexible gas container bearing on the beams, said beams being arranged at intervals throughout the length of the container, and adjustable connections between the container and the arms.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

JOHAN RICHARD FROBERG.

Witnesses:
C. E. DOYLE,
C. E. PREINKERT.