

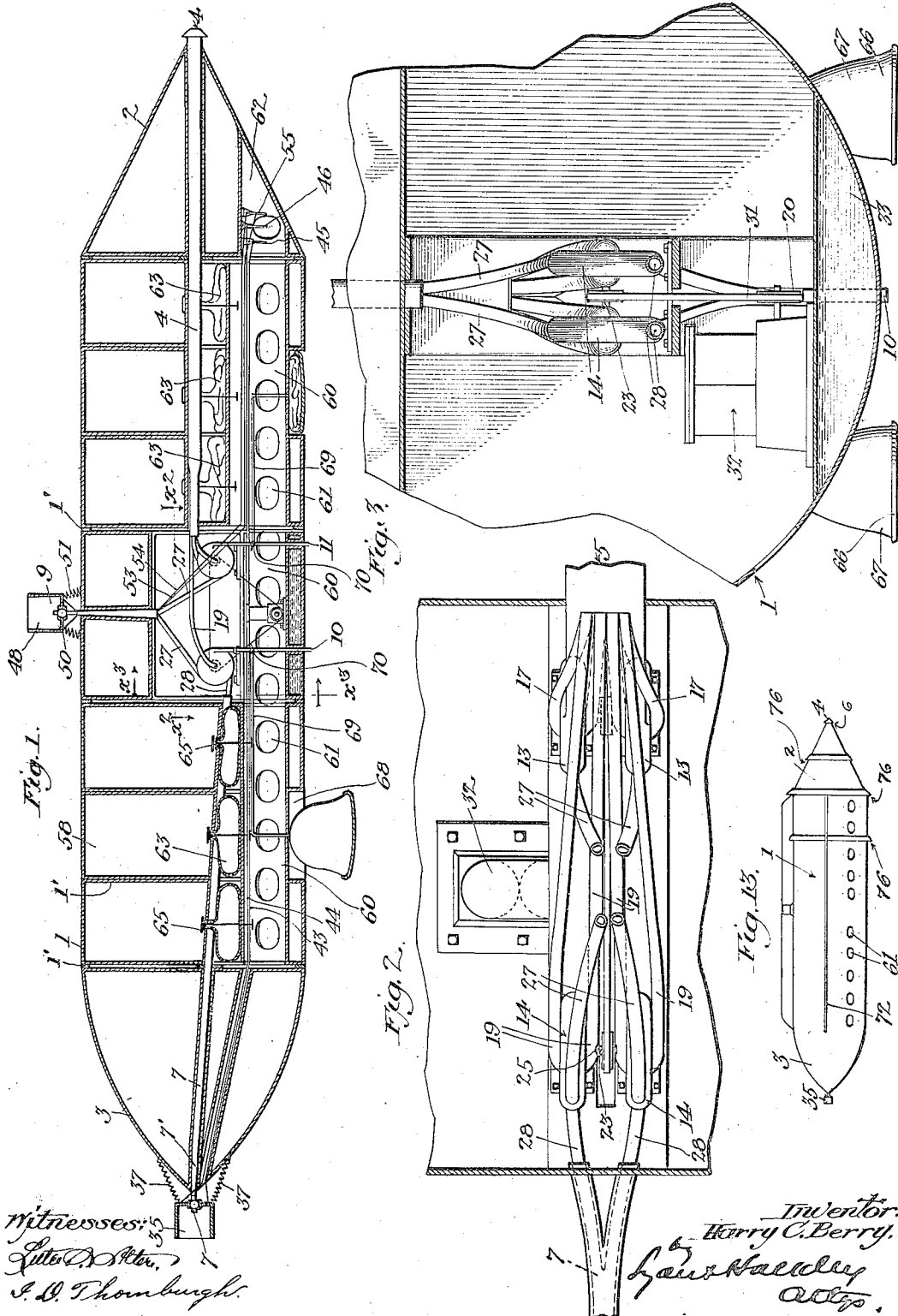
H. C. BERRY.
AERIAL NAVIGATION MACHINE.

APPLICATION FILED MAY 6, 1911. RENEWED AUG. 22, 1914.

1,133,609.

Patented Mar. 30, 1915.

2 SHEETS—SHEET 1.



Witnesses:
J. D. Thomburgh.

Inventor:
Harry C. Berry.
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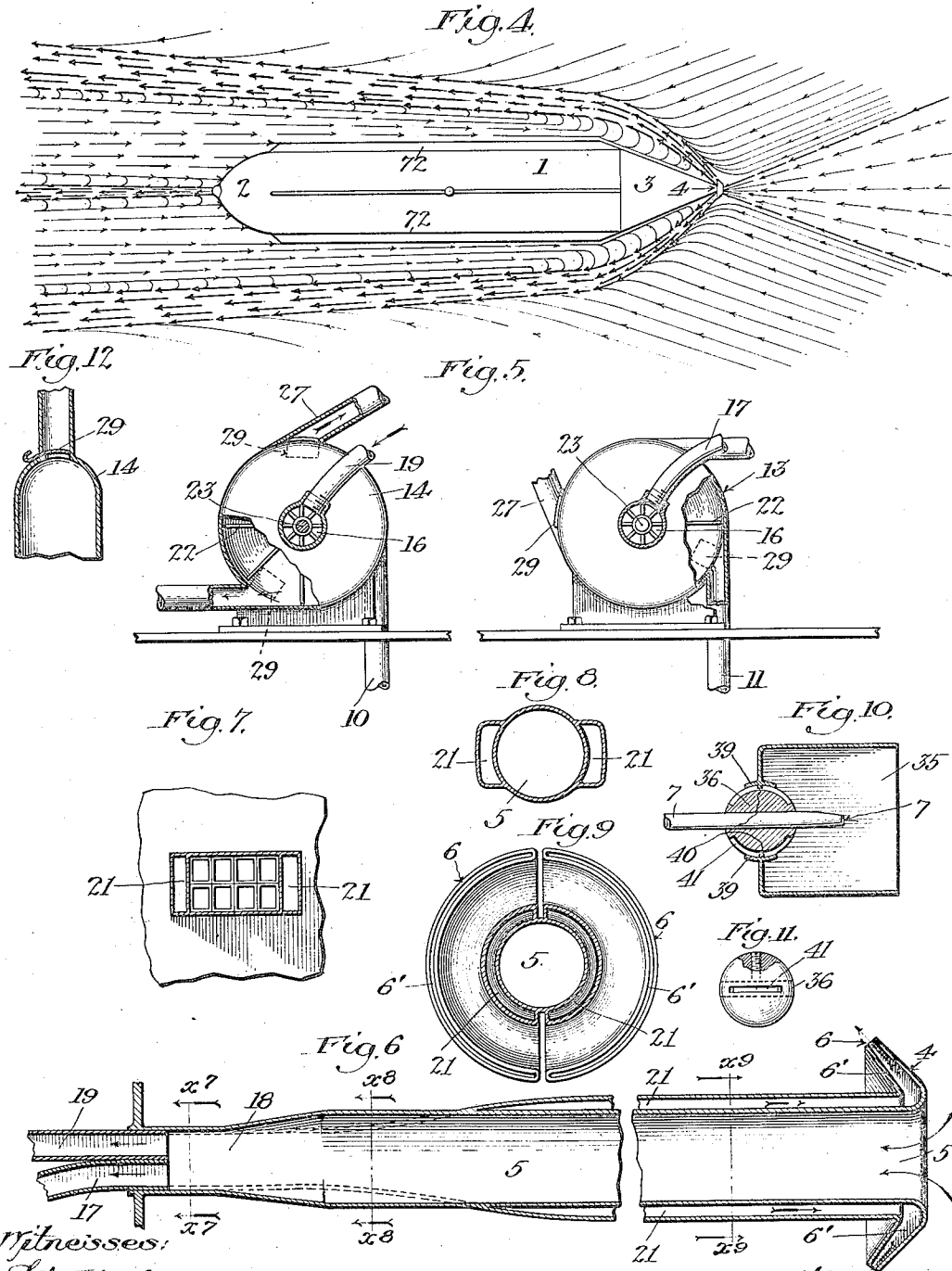
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Witnesses:
Lute D. Alter,
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Inventor:
Harry C. Berry
by *James H. [illegible]*

UNITED STATES PATENT OFFICE.

HARRY C. BERRY, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO RAPID TRANSIT AIR NAVIGATION COMPANY, OF LOS ANGELES, CALIFORNIA, A CORPORATION OF CALIFORNIA.

AERIAL-NAVIGATION MACHINE.

1,133,609.

Specification of Letters Patent.

Patented Mar. 30, 1915.

Application filed May 6, 1911, Serial No. 625,594. Renewed August 22, 1914. Serial No. 858,128.

To all whom it may concern:

Be it known that I, HARRY C. BERRY, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Aerial-Navigation Machine, of which the following is a specification.

This invention relates to aerial navigation machines and the main object of the invention is to provide for reducing or eliminating the head on resistance at the front of the machine.

The invention is particularly applicable in connection with machines of the dirigible balloon type, and in such connection it provides for producing an outward and rearwardly moving conical current of the air in front of the balloon, the outward movement of this air continually removing air from the path of the balloon, so as to reduce the obstruction to forward movement.

Another object of the invention is to provide simple and effective means for guiding the machine in vertical and horizontal planes.

A further object of the invention is to provide means for facilitating the ascent and descent of the machine.

Other objects of the invention will appear from the following specification.

The accompanying drawings illustrate the invention, and referring thereto:

Figure 1 is a longitudinal section of the machine. Fig. 2 is a horizontal section on line x^2-x^2 in Fig. 1, showing the blowers. Fig. 3 is a transverse section on line x^3-x^3 in Fig. 1. Fig. 4 is a plan of the machine, showing diagrammatically the course of the air currents produced by the blowers. Fig. 5 is a side elevation of the blowers with parts broken away. Fig. 6 is a vertical section of the combined inlet and outlet nozzle at the forward end of the machine. Fig. 7 is a vertical section on line x^7-x^7 in Fig. 6. Fig. 8 is a vertical section on line x^8-x^8 in Fig. 6, showing the construction of the air connections from the blowers to the said nozzle. Fig. 9 is a similar section taken on line x^9-x^9 Fig. 6, showing the connections at a point forward of the junction of the connecting tubes. Fig. 10 is a vertical section of the box rudder at the rear end of the machine. Fig. 11 is an end view of the ball for the joint of the box rudder. Fig. 12 is a section

through one of the blower casings showing the controller valve for the outlet of the blower. Fig. 13 is a side elevation of a form of the invention in which a plurality of nozzle devices are provided for producing a series of sheets of air passing rearwardly around the machine at different points along its length to insure free movement of the machine.

1 designates the body of the dirigible balloon, which body may be cylindrical in shape and provided with conical front and rear portions 2 and 3. Within the body 1 are provided the blowing devices connected to inlet and outlet means for affecting the propulsion and guiding of the vehicle by reaction of air currents produced by the blower.

An inlet and outlet nozzle 4 is provided at the front or forward end of the machine, said nozzle having a central inlet opening or passage 5 opening directly at the front of the machine and said nozzle being provided with a rearwardly directed discharge or outlet means 6 surrounding said inlet or suction opening 5. Said nozzle is conical and surrounds the forward, conical end of the body 1, at the apex thereof, so as to discharge a conical sheet of air, rearwardly and outwardly around the conical front end of the body 1, thereby tending to remove the air from the path of the body of the machine and to reduce the head on resistance.

Another outlet or discharge means 7 is provided at the rear end of the machine and there may also be provided a discharge pipe or outlet means 9 at the top of the machine and one or more discharge pipes or outlet means 10, 11 at the bottom of the machine, these pipes 9, 10 and 11 serving to control the vertical movement, as hereinafter set forth.

The aforesaid blowers are preferably of the centrifugal compressor type, each blower comprising a casing having a central inlet at each side and a plurality of peripheral outlets connected to the pipes leading to the points of discharge. I prefer to arrange the blowers in pairs, there being a forward pair of blowers indicated at 13 and a rear pair of blowers indicated at 14. The casing of each of the forward pair of blowers has its central inlets 16 at the respective sides connected respectively by pipes 17 to a main suction pipe 18 leading forwardly to the inlet 5 at

the forward end of the machine. The casing of each of the rear blowers has its central inlets 16 connected by pipes 19 to the main suction pipe 18, all of these subsidiary suction pipes 17 and 19 being preferably connected to the main suction pipe 18 at a common point, as indicated in Figs. 2 and 6. The combined force of all of the blowers is thereby exerted in drawing in air through the inlet 5, producing a partial vacuum in front of the machine and tending to draw the machine forward through the air. In addition to this suction effect there is a positive driving effect due to the currents of air passing from the rearwardly discharging outlet means 6, said outlet means being preferably formed with an approximately annular outlet consisting, for example, of two goose-neck members 6 having their discharge portions extended circumferentially to form approximately semicircular outlet portions 6' at their rear ends, the other ends of said goose-neck members being connected to pipes 21 leading to the pressure side of the blowers. These rearwardly directed outlet means 6 extending through approximately a complete circle producing a cone-shaped sheet or current of air which surrounds or envelops the body of the machine and not only drives the same forward by positive reaction on the air but eliminates the resistance due to surface friction in passage of the machine through the air, as hereinafter explained. In order to compensate for the circumferential expansion of these nozzle members, the same are preferably made tapering in a radial direction so as to maintain a constant area or even a slight contraction of the area rearward so as to accelerate the discharge. The pressure pipes 21 leading to the respective nozzle members 6 are connected to the casings of the respective forward blowers 13 at the peripheral portions of said casings.

A fan or runner 22 is supported by a shaft 23 in each of the blowers, said shaft being, for example, mounted on a central bearing 25 between the blowers of each pair.

Means are provided for rotating the shaft, so as to cause the runner to rotate forwardly and drive the air by centrifugal action from the central inlets to the peripheral outlets, the air passing in at the inlet at each side of the casing and the currents of air so passing meeting one another and passing out together through the outlet, so that the full suction and compressing effects are secured. The downwardly extending discharge pipe 11 may also be connected to the casing of one or both of the forward blowers and the other downward discharge pipe 10 being connected similarly to the casing of one or both of the rear blowers. Other pipes, indicated at 27, may lead to the casings of the forward and rear blowers upwardly to the

upward discharge pipe 9. The main outlet connection of the rear pair of blowers is through pipes 28 extending from the peripheral portion of the casing thereof to the rearward discharge pipe 7. Each of the outlet pipes from the casings of the respective blowers extends tangentially from the casing in the direction of rotation of the runner within the casing, so that the air moving at high velocity within the casing under the action of the runner passes out through the discharge pipe by reason of its own velocity as well as by reason of the centrifugal action of the runner. A valve 29 may be provided at the outlet from the blower casing to each of these discharge pipes.

Shafts 23 carrying the runners 22 may be operated by pulley and belt connections 30 and 31 from an engine or motor 32.

33 indicates a fuel tank for supplying the engine.

A box rudder 35 is mounted on a ball and socket joint 36 at the rear end of the machine, said ball and socket joint surrounding the rear discharge pipe 7 and said box rudder being formed as, for example, a rectangular box open at its rear end and surrounding the discharge outlet of said pipe 7. Springs 37 tend to hold this box rudder in normal position, facing directly rearward. The said ball and socket joint may consist of a ball-shaped member surrounding said pipe 7 and working within a spherical bearing 39 in the box rudder, said bearings being formed with inwardly extending projections 40 engaging in circumferential grooves 41 in said ball, as shown in Figs. 10 and 11. Said box rudder may be operated by wires or flexible connections 43 and 44 extending forwardly within the body 1 and connected to operating levers 45 and 46. A box rudder 48 may be similarly mounted on the upwardly discharging pipe 9, by ball and socket joint 50, springs 51 being provided tending to hold said top box rudder in position in which it faces directly upward, and controlling means consisting of wires 53 and 54 being connected to said box rudder and to controlling lever 55 to turn the said box rudder forwardly or rearwardly. Any one or more of the discharge pipes may be provided with a rearwardly tapering outlet or nozzle portion, as indicated at 7' for the rearward discharge pipe 7, so as to accelerate the outwardly flowing current of air and increase the reaction on the air.

The body 1 of the balloon is preferably nearly cylindrical with a slight rearward taper, and with conical front and rear ends. Said body is provided with a frame 1' formed with a series of compartments or gas bags 58 arranged end to end, and the conical forward and aft portions 2 and 3 of said body may also serve as gas bags.

The body 1 may be cylindrical in shape and the lower portion of the body may be occupied by a cabin 60 having port holes or windows 61 which may also serve as doors for entrance into the cabin and a pilot or operator's room 62 may be provided in the forward chamber or portion of the machine, the gas bags aforesaid extending over the cabin and pilot chamber.

Between the cabin and the gas bags 58, spaces may be provided occupied by supplementary gas bags 63 connected to the respective gas bags by valves 65, said gas bags 63 being collapsed under normal condition and being adapted to receive gas from the respective bags 58 when the pressure in the gas bags 58 becomes excessive by reason of heat of the sun's rays, for example, thus relieving the pressure on the main gas bags 58.

For use in alighting, pontoon devices or extensible skids may be provided consisting of shoes or members 66 for engaging the surface on which the machine alights, said shoes being preferably convex and bags or collapsible receivers 67 formed of flexible material and seated within pockets or chambers 68 on the bottom of the body 1, said shoes serving as doors or closures for said chambers when the bags 67 are collapsed.

Pipe connections 69 controlled by valves 70 are provided from the blowing devices above described to the respective bags 67, so that on opening said valves compressed air may be admitted to said bags to distend the same and force the shoes 66 downwardly below the bottom of the body 1.

The body 1 may be provided with longitudinal fins 72 on the periphery thereof to prevent rolling side motion and to assist in raising and sustaining the machine.

The operation of the invention as applied to a dirigible balloon or aerial navigation machine is as follows: The engine 32 being set in operation, the runners 22 of the blowers 13 and 14 are rotated, causing air to be drawn in through the central inlets of said blowers and to be discharged at high velocity through the peripheral elements thereof, the inlets of all of the blowers being connected to the central inlet 5 at the forward end of the machine, air is drawn in through said inlet continually removing the air from in front of the machine and diminishing the resistance to the forward movement and drawing the machine forward by reason of the deficiency of pressure at the forward end as compared with that at the rear end. The air drawn into the blowers in this manner is discharged in part through the forwardly extending pipes 21 to the respective nozzle members 6 and is turned backward at the forward end of said pipes by said nozzle members and discharged rearwardly

through the approximately annular outlets formed by the outlet portions 6', the air being discharged from said outlet in a substantially continuous conical sheet or current around the front end of the body, throwing off all head-on resistance by diverting all of the air not drawn in by the suction. It will be understood that it is not necessary that the nozzle members 6 should quite meet to effect this operation as the spreading of said nozzle members in a circumferential direction produces a corresponding spread in the jets issuing therefrom, so that they will meet at a greater or less distance rearward of the nozzle to form a complete conical current or sheet of moving air. If in any case the operation of a single nozzle of this character is not sufficient to divert the air from in front of and away from the body of the machine sufficiently to eliminate the head-on and frictional resistance, additional outlet means may be provided as indicated at 76 in Fig. 13, said outlet means being formed as annular outlets extending around the body of the machine at various points along the length thereof to produce a conical outflowing sheet of air at each of these points, these annular outlet devices being connected to the outlets or compressor sides of the blowing devices above described. The rearwardly flowing conical sheets of air are not in direct contact with the body of the machine, but are separated somewhat therefrom, as shown in Fig. 4, so that space is left for eddy or return currents which tend to pass forwardly in contact with the body and further remove the frictional resistance to forward movements. The discharge from the rear blowers 14, or most of such discharge, passes rearwardly through the pipes 7, being discharged at the rear end of the machine and giving a direct forward action, this rearward current also being utilized in steering by the aid of the box rudder 35, said box rudder being turned upward or downward or to one side or the other in such manner that the said current impinges on one or more walls of the said rudder producing a reaction tending to change the direction of movement of the machine. The top box rudder 48 may also be used for controlling the direction, being turned forward or rearward so that the discharge from the upwardly extending pipe 9 impinges on the rear or forward wall thereof. The discharge through this top pipe 9 is regulated by opening or closing valves 29 for the corresponding outlets of the blowers, such valves being opened when it is desired to use the said top pipe either for effecting the operation of the box rudder 48 or for direct depression of the machine by reaction on the air due to the ascending current from said pipe 9. The downwardly extending

pipes 10 and 11 are brought into action by opening the corresponding valves 29 when it is desired to produce a direct upward action on the machine, the currents of air passing from said pipes serving by reaction on the surrounding air or surfaces to give a lifting effect on the machine.

In filling the main gas bags 58, with gas, valves 65 may be temporarily closed, said valves being thereafter opened to allow the gas to pass to the supplementary bags 63 in case of expansion by heat or to flow back to the main bag in case of contraction by cold, said supplementary bags being sufficiently elastic to receive and expel gas.

What I claim is:

1. In an aerial navigation machine, the combination of a cylindrical machine body having a conical forward end, blowing means within said body, an inlet pipe for said blowing means, said inlet pipe having an inlet opening at the apex of the forward end of the body, and a conical nozzle, surrounding said inlet pipe and surrounding the conical forward end of the body, and nozzle being connected to the outlet of said blowing means to discharge a conical current of air around said forward end of the body.

2. In an aerial navigation machine, the combination with the body of the machine, blowing means mounted thereon, an inlet means for said blowing means, an outlet means for said blowing means extending to the rear of the machine and having a rearwardly opening outlet, a box rudder surrounding said outlet, said box rudder being mounted to swing in vertical and horizontal planes, and means for controlling the angular position of said box rudder.

3. In an aerial navigation machine, the combination with the body of the machine,

blowing means mounted thereon, an inlet means for said blowing means, an outlet means for said blowing means extending to the rear of the machine and having a rearwardly opening outlet, a box rudder surrounding said outlet, said box rudder being mounted to swing in vertical and horizontal planes, means for controlling the angular position of said rudder, and springs connected to said box rudder tending to retain the same in normal position.

4. In an aerial navigation machine, the combination with the body of the machine, blowing means mounted thereon, an inlet means for said blowing means, an outlet means for said blowing means extending to the top of the machine and having an upwardly opening outlet, a box rudder surrounding said outlet, said box rudder being mounted to swing in vertical and horizontal planes, and means for controlling the angular position of said box rudder.

5. In an aerial navigation machine, the combination with the body of the machine, blowing means mounted thereon, an inlet means for said blowing means, an outlet means for said blowing means extending to the top of the machine and having an upwardly opening outlet, a box rudder surrounding said outlet, said box rudder being mounted to swing in vertical and horizontal planes, means for controlling the angular position of said box rudder, and springs connected to said box rudder tending to retain the same in normal position.

In testimony whereof, I have hereunto set my hand at Los Angeles, California this 29th day of April, 1911.

HARRY C. BERRY.

In presence of—

ARTHUR P. KNIGHT,
GLADYS RUSSELL.