Sept. 23, 1924. 1,509,527

H. F. PARKER

AIRSHIP

Filed June 24, 1921 3 Sheets-Sheet 1

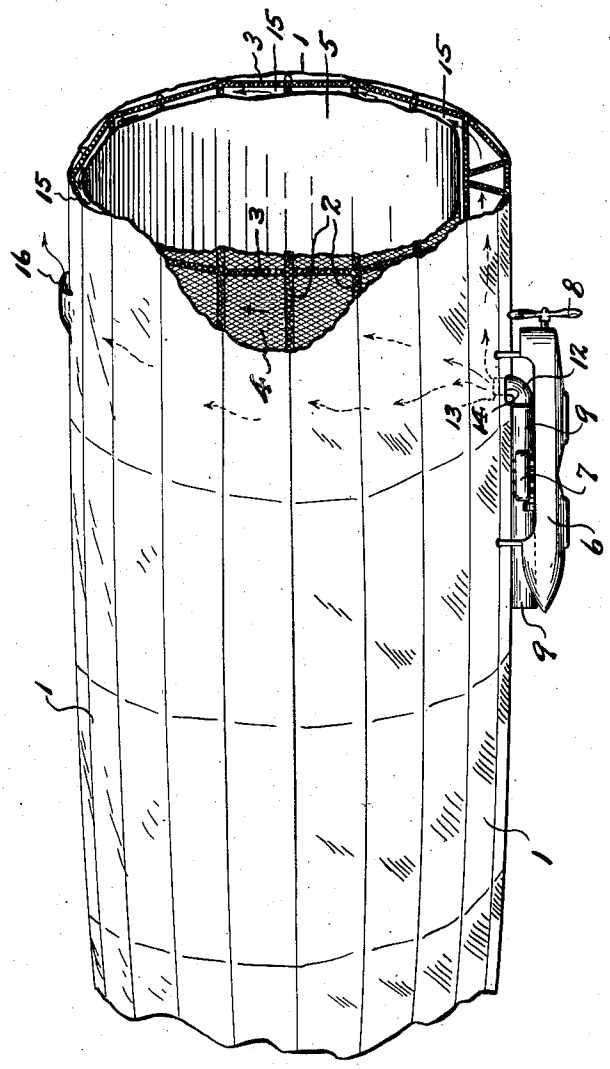


Fig. 1

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Filed June 24. 1921 3 Sheets-Sheet 2

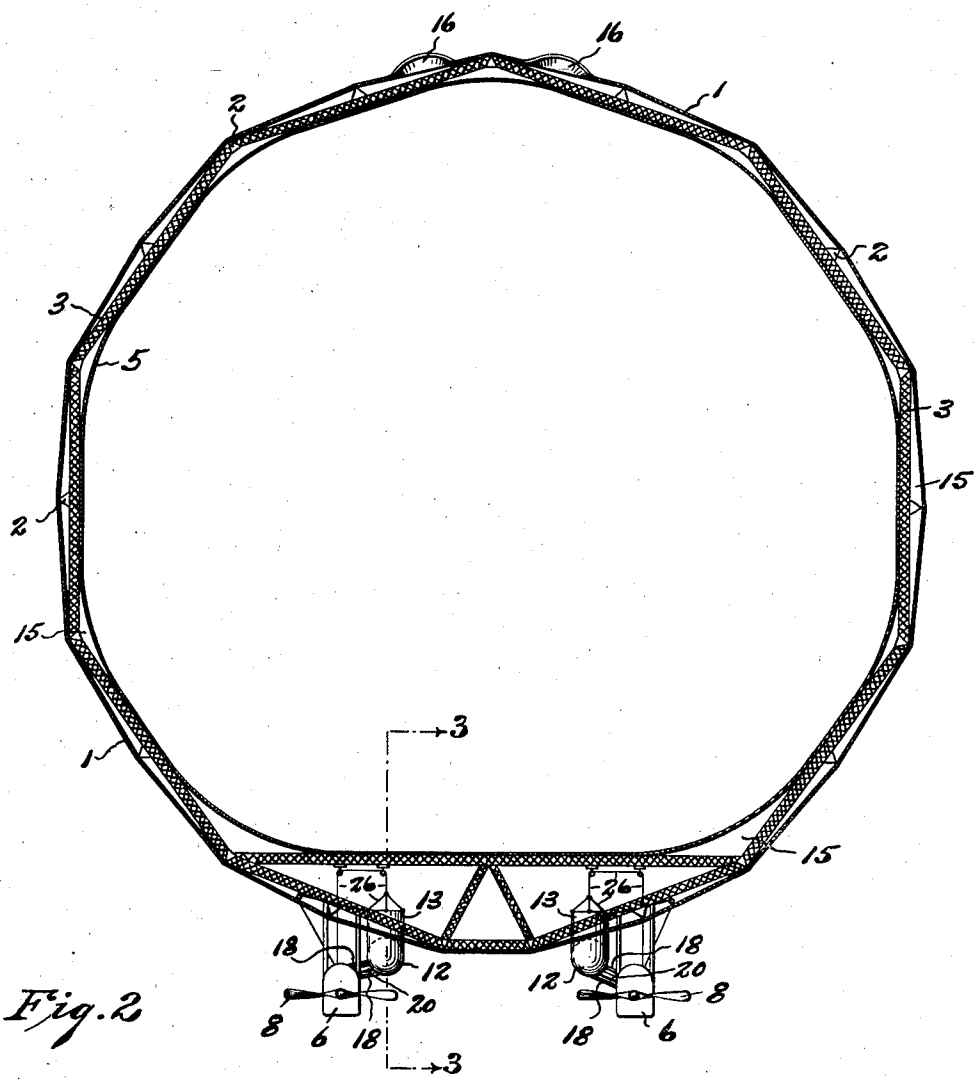


Fig. 2.

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Filed June 24, 1921 3 Sheets-Sheet 3

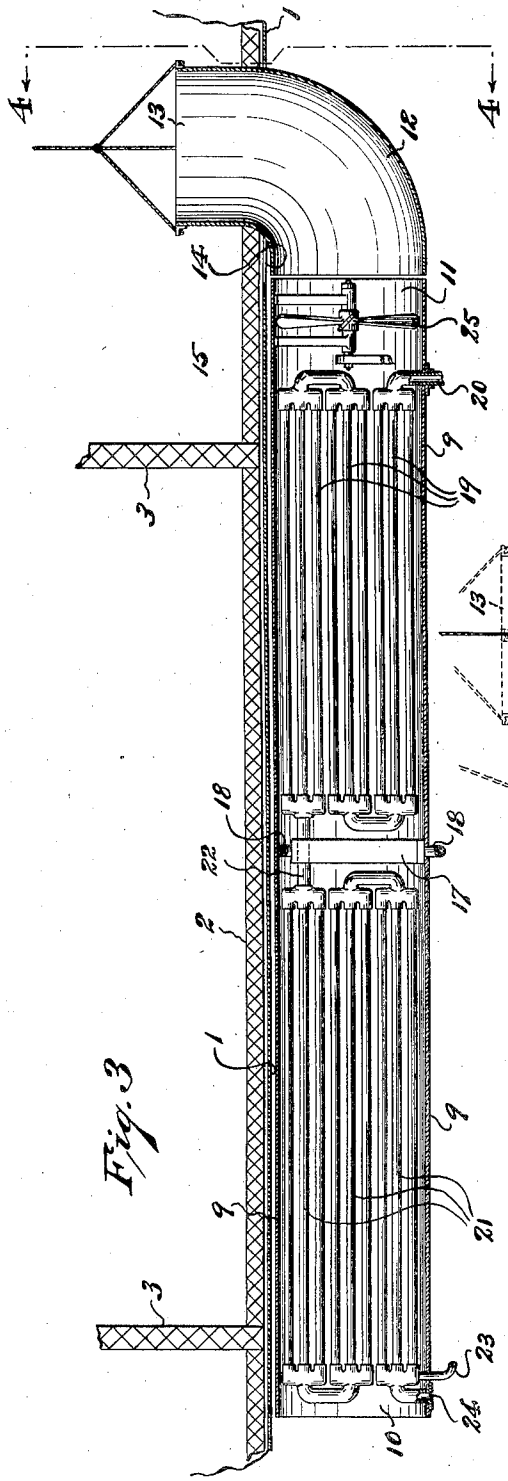


Fig. 3

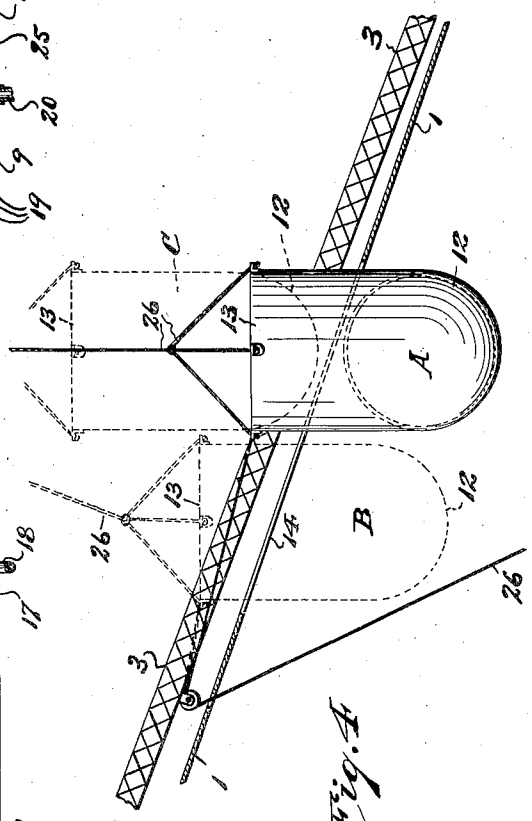


Fig. 4

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Patented Sept. 23, 1924. 1,509,527

UNITED STATES PATENT OFFICE.

HUMPHREY F. PARKER, OF NEW YORK, N. Y.

AIRSHIP.

Application filed June 24, 1921. Serial No. 479,997.

To all whom it may concern:

Be it known that I, HUMPHREY F. PARKER, a citizen of New Zealand, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Airships; and do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to characters of reference marked thereon, which form a part of this specification.

This invention relates, generally, to improved means and method of maintaining the lifting gas in arishipsat substantially atmospheric temperature by circulating air around the gas containers; and the invention relates, more particularly to a novel method and means of maintaining an airship in equilibrium by controlling the temperature of the lifting gas, and in particular, to compensate for temperature changes which at present occur when an airship moves from sun-light into clouds or shadow, or when day changes to night, and vice versa.

The lift of an airship varies as the volume of the gas containers. These containers are not capable of withstanding pressure, so that the pressure of the lifting gas in the containers is practically constant and slightly above atmospheric pressure. This being so, the volume of lifting gas must vary in proportion to the temperature. Consequently a decrease in temperature causes the volume of the lifting gas to decrease, with an accompanying loss of lifting power, so that, if the airship is to remain in equilibrium, its dead weight must be reduced. Under such circumstances, the present practice is to reduce the dead weight of the airship by discharging ballast therefrom. If now the lifting gas becomes heated for any reason, its volume increases and its lifting power becomes greater. Under such conditions, the present method of compensating for the increased lifting power is to voluntarily discharge gas. Obviously this is wasteful and expensive, while the necessity for the carrying of ballast reduces the useful load the airship can transport. Furthermore the discharging of ballast and valving of gas reduces the length of the flight an airship can safely make, for under adverse conditions a point is reached where all available ballast has been discharged and the lift of the remaining gas is only just sufficient to support the weight of the ship itself and necessary loads. A further cooling and contraction of the gas will, under such conditions, be likely to have disastrous results.

The present invention, therefore, has for its principal object to provide a novel method and means for compensating for changes in equilibrium of the airship without necessity for discharging ballast or valving gas, but rather by offsetting changes in the temperature of the lifting gas (which would ordinarily, if permitted, disturb the equilibrium of the airship), thereby so controlling the temperature of the lifting gas that the same is maintained, under varying conditions, stable within desired limits, and consequently the equilibrium of the airship is practically undisturbed.

The novel method and means for maintaining the equilibrium of the airship, which is the subject of this invention, is not limited to the correction of temperature changes only, but may also be made use of to correct for other causes of loss of equilibrium, such as occur when rain or snow falls on the airship envelope; and even to correct, at least partially, for the loss of weight due to the consumption of fuel on a long flight.

This invention provides a means, for the purposes mentioned, which is particularly applicable to rigid airships, and to airships having a double envelope, especially those in which the lifting gas is carried in a number of containers surrounded by an outer covering, and separated therefrom by an annular space. The immediate object of my novel invention is to control the temperature of the air filling the said annular space surrounding the gas container or containers, so that this air in turn will influence the temperature of the gas within said container or containers. This result is accomplished by causing a circulation of air in said annular space, and so controlling or modifying its temperature, that heated air, cold air, or no air at all, may be caused to circulate around the gas container or containers.

Other objects of the invention, not at this time more particularly enumerated, will be clearly understood from the following detailed description of the same.

The invention is clearly illustrated in the accompanying drawings, in which:—

Figure 1 is a fragementary side view and

part cross section of a rigid airship equipped with means embodying the principles of my present invention; Figure 2 is a transverse section of the same, drawn on an enlarged scale; Figure 3 is a longitudinal section through a heating apparatus for supplying heated air for circulation around the gas container, said section being taken on line 3—3 in said Figure 2, and the same being drawn on a still further enlarged scale; and Figure 4 is a detail transverse section, taken on line 4—4 in said Figure 3.

Similar characters of reference are employed in all of the hereinabove described views, to indicate corresponding parts.

Referring now to said drawings, the reference character 1 indicates the outer covering or envelope of the airship, the same being supported by the rigid frame-work consisting of the longitudinal frame members 2 and the transverse or circular frame members 3. Attached to the frame-work, and situated within the same, is a net-work 4 arranged to enclose the gas container 5, and distribute the lift of the same to the frame-work.

The reference character 6 indicates a motor compartment suitably suspended from the frame-work beneath the envelope 1, and within which is carried a power unit in the form of an internal combustion engine or motor 7 adapted to operate the propeller 8.

Longitudinally disposed beneath the envelope 1, and adjacent to a motor compartment 6, is a tubular housing 9, open at its respective forward and rear ends 10 and 11. Associated with the open rear end 11 of said tubular housing 9 is an adjustable duct or conduit 12 having an upturned discharge end 13, which enters through an opening 14 in the outer envelope 1 so as to communicate with an annular space 15 surrounding the gas container 5, and intermediate the same and said outer envelope 1. Said tubular housing 9, particularly when the airship is in motion, receives atmospheric air through its forward end 10, the said air passing through said tubular housing 9, whence it is discharged by said duct or conduit 12 into said annular space 15. Formed in connection with said outer envelope 1, preferably at the upper side thereof, are rearwardly directed outlet ports 16 which communicate with said annular space 15 so as to discharge air therefrom.

Situated within the tubular housing 9 is a radiator 17 of conventional type, the principal function of which is to cool the motor by means of a circulating fluid, such as water. The said radiator is therefore connected with the water jackets surrounding the motor cylinders by circulation pipes 18. Air passing through the core of the radiator removes the heat so as to cool the water for its return to the motor cylinder water jackets, and at the same time the heat thus discharged aids in raising the temperature of the air passing through the tubular housing for discharge into the annular space 15 surrounding the gas container 5.

Situated within the tubular housing 9, and preferably behind the radiator 17, is a heater member, comprising a system of interconnected tubes 19 of small diameter, having at their receiving end an intake pipe 20 adapted to be connected with the exhaust discharging means of the motor 7, whereby the hot exhaust gases are compelled to travel through the tubes 19, so that the heat of said exhaust gases is radiated from said tubes to raise the temperature of the air passing through said tubular housing 9.

If desired, although the same is not absolutely essential, a second series of interconnected tubes 21 is coupled by a pipe or conduit 22 with the discharge end of said first series of tubes 19. Said second series of tubes 21 is preferably located in front of the radiator 17. The exhaust gases from the motor after passing through the tubes 19, pass into and through the tubes 21. The primary purpose of the set of tubes 21 is to further radiate the heat from the exhaust gases so as to cool the same down to a temperature below dew point in order to condense the water which is a product of the combustion that has taken place in the motor cylinders. The water thus reclaimed is discharged from the tubes 21 through a water discharge pipe 23, and may be used as ballast to compensate for the reduction in weight due to the consumption of the motor fuel supply. The residue of the exhaust gases is discharged from the set of tubes 21 through an outlet pipe 24 connected with the discharge end of the same. The above described arrangement of additional tubes 21 adds to the amount of heat available for heating the air for delivery around the gas container to raise the temperature of the lifting gas when desirable so to do, and the same provides a very compact design for the apparatus as a whole.

The forward open end 10 of the housing 9 is exposed to the air, so that when the airship is in motion air will enter therethrough into the housing 9 and will flow past the heater members and thence through the conduit 12 into the annular space 15 surrounding the gas containers. It is desirable that the velocity of the air thus circulated be high, so that a good and rapid circulation through the space 15 is maintained, consequently a fan or impeller 25 may be employed within the housing 9, as shown in Figure 3, to increase the velocity of the air stream, and also for the purpose of producing an air flow or circulation through the housing 9 and space 15 when the airship is not in motion, e. g., as when the airship

is on the ground and it is desirable to superheat the lifting gas preparatory to an ascent.

The conduit 12 is so arranged as to be adjustable or movable to various operative and inoperative positions, and to this end the same may be supported by suitable rigging 26 by which the same may be manipulated. As shown in Figure 4 principally, the said conduit 12 may be arranged to occupy any one of three positions. Normally the said conduit is disposed in alinement with and in communication with the rearward open end 11 of the housing 9, (as indicated by A in said Figure 4) so that the heated air passing from the housing 9 is conducted by said conduit into the annular space 15 to flow around the gas containers of the airship. This is the position of the conduit 12 for flying at night or under conditions when heating of the lifting gas is necessary or desirable. When, however, the airship is flying in a hot sun, superheating of the lifting gas tends to take place, and to prevent this the conduit 12 is moved away from alinement with the rearward end 11 of the housing 9, so that the intake end of the conduit is exposed to the atmosphere to receive cool air and conduct the same to the annular space 15 for circulation therethrough (this position being indicated in dotted lines at B in said Figure 4). Under the conditions presented by the latter positioning of the conduit 12, air at atmospheric temperature will circulate around the gas containers of the airship, and will carry away the heat given by the sun to the outer covering, thus preventing the overheating of the air in the annular space 15, and the transfer of heat therefrom to the gas containers.

When conditions are such that no change of temperature of the lifting gas is desired, the conduit may be hoisted into the interior of the outer envelope 1 (as indicated by dotted lines at *c* in said Figure 4). In this position the conduit is inoperative, and air circulation within the space 15 is substantially stopped, and therefore no artificial means are being used to cause change in the temperature of the lifting gas.

My above described novel means and method for controlling the equilibrium of an airship is effective not only by reason of the changes it brings about in the temperature of the lifting gas, but also because of the change of lift due to the change of temperature produced in the air itself which fills the annular space 15 between the gas containers and the outer envelope 1. When said space 15 is filled with air at atmospheric temperature, the whole lift of the ship is supplied by the lifting gas, but when heated air fills said space 15, said heated air of itself exerts an appreciable lift, and therefore the total lift of the ship is the lift of the lifting gas in the containers plus the temporary lift due to the presence of this heated air. When the heating apparatus is brought into action to supply hot air to the space 15, the first effect is to produce increased lift, and as the heat from said hot air is transferred to the lifting gas in the containers, the latter expands to produce a further increased lifting effect. On the other hand if the annular space 15 is already filled with hot air, and the conduits 12 are moved to position B so as to supply cool air for circulation through said annular space 15, the cool air immediately effects an elimination of lift by the displacement of the hot air, the lift being further reduced as the lifting gas is contracted and cooled by the presence of the cool air.

When equipped with apparatus involving the above described novel method and means for controlling equilibrium, an airship can manoeuvre satisfactorily without the use of ballast, for if an occasion should arise rendering it necessary to reduce the effective weight of the ship, this result can be accomplished by bringing the heating apparatus into operation to supply hot air for lift increasing purposes.

I am aware that changes may be made in the detail construction and arrangement of my apparatus as above described and illustrated in the drawings, without departing from the scope of and while retaining the general principles of this invention. Hence, I do not limit my invention to the exact arrangements and construction of parts, as described in the foregoing specification, nor do I confine myself to the exact details of the construction of the various parts as illustrated in the accompanying drawings.

I claim:—

1. In an airship, an outer envelope, gas containers within said envelope and separated therefrom by an intermediate annular space, an air conveying conduit having a forwardly directed exterior receiving end and an interior discharge end communicating with said annular space, said outer envelope having vent openings for discharging air from said annular space, a longitudinal tubular housing exteriorly disposed relative to said envelope, said housing having open forward and rear ends, the receiving end of said conduit being movable into communication with the rear open end of said housing, and heat interchanging means within said housing for heating air flowing therethrough for discharge by said conduit into said annular space.

2. In an airship, an outer envelope, gas containers within said envelope and separated therefrom by an intermediate annular space, an adjustable air conveying conduit having a forwardly-directed exterior receiving end and an inner discharge end communicating with said annular space at

the under side of said envelope, said outer envelope having vent openings at the upper side of said envelope for discharging air from said annular space, means for heating air for delivery through said conduit, and said conduit being movable to relate the same in communication either directly with the atmosphere or with said air heating means or withdrawn within said envelope to an inoperative position.

3 In an airship, an outer envelope, gas containers within said envelope and separated therefrom by an intermediate annular space, an adjustable air conveying conduit having a forwardly directed exterior receiving end and an inner discharge end communicating with said annular space at the under side of said envelope, said outer envelope having vent openings at the upper side of said envelope for discharging air from said annular space, a longitudinal tubular housing exteriorly disposed beneath said envelope, said housing having open forward and rear ends to permit the flow of air therethrough, an internal combustion motor power plant adjacent to said housing, a heat interchanger within said housing adapted to receive the exhaust from said internal combustion motor power plant, and said adjustable conduit being movable into communication with the rear end of said housing to receive heated air therefrom for delivery into said annular space.

4. In an airship, an outer envelope, gas containers within said envelope and separated therefrom by an intermediate annular space, an adjustable air conveying conduit having a forwardly directed exterior receiving end and an inner discharge end communicating with said annular space at the under side of said envelope, said outer envelope having vent openings at the upper side of said envelope for discharging air from said annular space, a longitudinal tubular housing exteriorly disposed beneath said envelope, said housing having open forward and rear ends to permit the flow of air therethrough, an internal combustion motor power plant adjacent to said housing, a heat interchanger within said housing adapted to receive the exhaust from said internal combustion motor power plant, said adjustable conduit being movable into communication with the rear end of said housing to receive heated air therefrom for delivery into said annular space, and means for collecting water condensed from the exhaust passing through said heat interchanger.

5. In an airship, an outer envelope, gas containers within said envelope and separated therefrom by an intermediate annular space, an adjustable air conveying conduit having a forwardly directed exterior receiving end and an inner discharge end communicating with said annular space at the under side of said envelope, said outer envelope having rearwardly directed vent openings at the upper side of said envelope for discharging air from said annular space, a longitudinal tubular housing exteriorly disposed beneath said envelope, said housing having open forward and rear ends to permit the flow of air therethrough, an internal combustion motor power plant adjacent to said housing, a heat interchanger within said housing adapted to receive the exhaust from said internal combustion motor power plant, and said conduit being movable to relate the same in communication either directly with the atmosphere or with the rear end of said housing or withdrawn within said envelope to an inoperative position.

6. In an airship, an outer envelope, gas containers within and spaced apart from said outer envelope, heat exchanging means for transferring waste heat from the airship motors to a stream of air, and a conduit having an adjustable end adapted to be positioned to receive the heated air from said heat exchange means or cold air from the atmosphere, said conduit having a delivery end communicating with the space intermediate said gas containers and said outer envelope.

7. In an airship, an outer envelope, gas containers within and spaced apart from said outer envelope, heat exchanging means for transferring waste heat from the airship motors to a stream of air, and a conduit having an adjustable end adapted to be positioned to receive the heated air from heat exchange means or cold air from the atmosphere, at a pressure exceeding the pressure in the space within said envelope but not exceeding that of the surrounding air due to the motion of the airship, said conduit having a delivery end communicating with the space intermediate said gas containers and said outer envelope.

8. In an airship, an outer envelope, gas containers within and spaced apart from said outer envelope, heat exchanging means for transferring waste heat from the airship motors to a stream of air, and a conduit having an adjustable end adapted to be selectively positioned at will to receive the heated air, to receive cold air from the atmosphere or to be inoperative to the reception of air, said conduit having a delivery end communicating with the space intermediate said gas containers and said outer envelope.

9. In combination with an airship having an outer envelope surrounding gas containers spaced from said envelope, apparatus for varying the temperature of the air between said envelope and containers, comprising a conduit open at one end and provided at the other end with a selective con-

trol for communication with the space between the envelope and gas containers, heat transfer means in said conduit, and means for directing exhaust gases of the airship engines through said heat transfer means, said selective control being operatable to permit entry of the whole air volume passing through said conduit to said space, to permit only a portion of said volume and a volume of unheated air to enter said space, or to totally cut off said conduit from said space and to direct only cold air from the outer atmosphere thereto.

10. The combination in an airship of means for extracting heat from the exhaust gases of the airship engines and for transmitting the extracted heat to the lifting gas of the ship, means for both cooling the exhaust gases and collecting water obtained by condensation thereof for use as ballast, and means for providing a cooling air stream to extract heat from the lifting gas of the ship whereby complete equilibrium control of the latter can be obtained without waste of either lifting gas or ballast.

11. A method of maintaining equilibrium in an airship wherein the engine exhaust gases are cooled to recover water in compensation for weight losses, heat from said exhaust gases is utilized to raise the temperature of the lifting gas of the ship, and a stream of cold air is utilized to lower the temperature of said lifting gas, all whereby a complete control of lifting conditions is effected.

In testimony, that I claim the invention set forth above I have hereunto set my hand this 22nd day of June, 1921.

HUMPHREY F. PARKER.

Witnesses:
GEORGE D. RICHARDS,
FREDERICK CRYER.