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METHOD OF AND APPARATUS FOR LIFTING FOGS.

APPLICATION FILED APR. 22, 1908.

990,121. Patented Apr. 18, 1911.

2 SHEETS—SHEET 1.

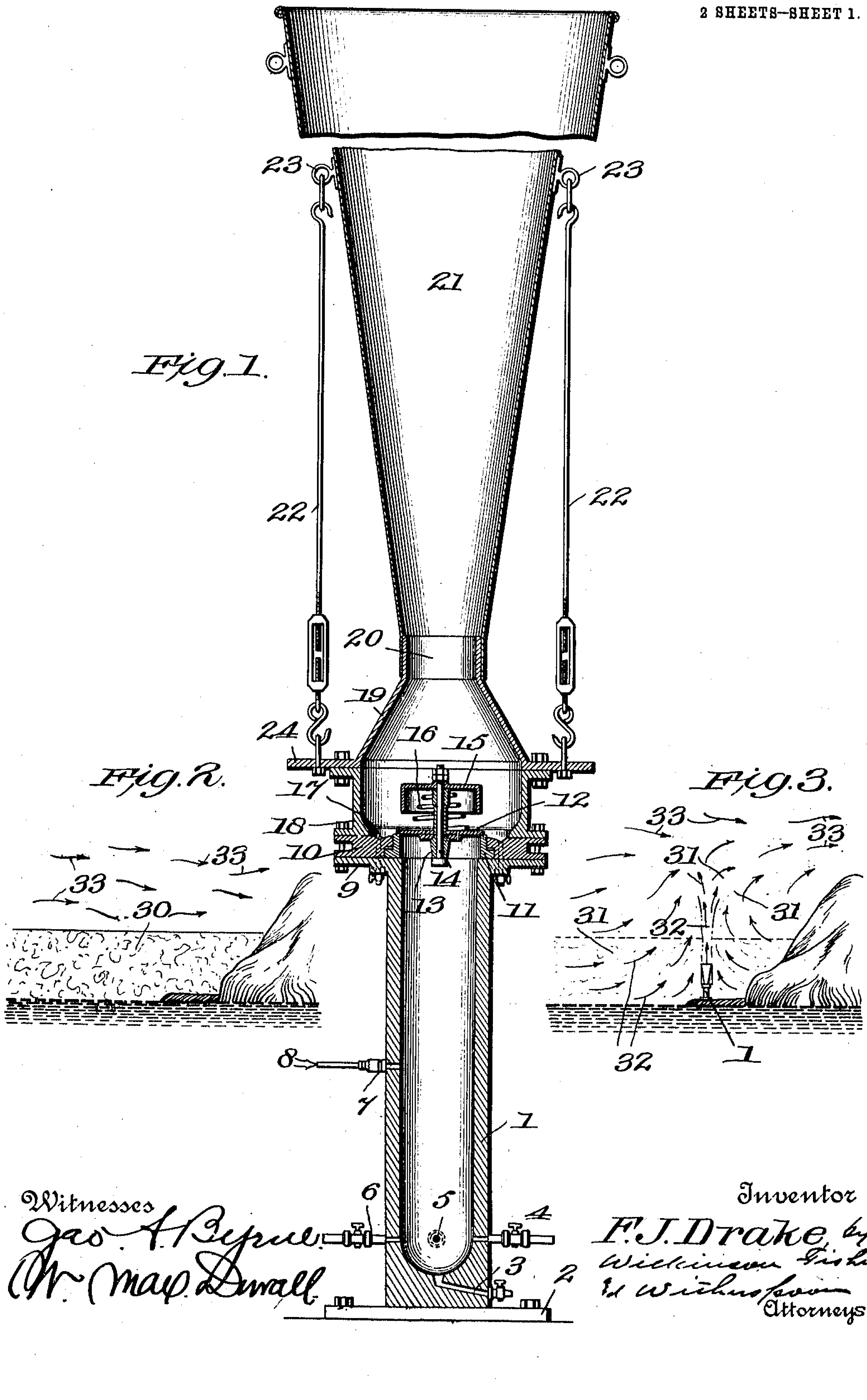

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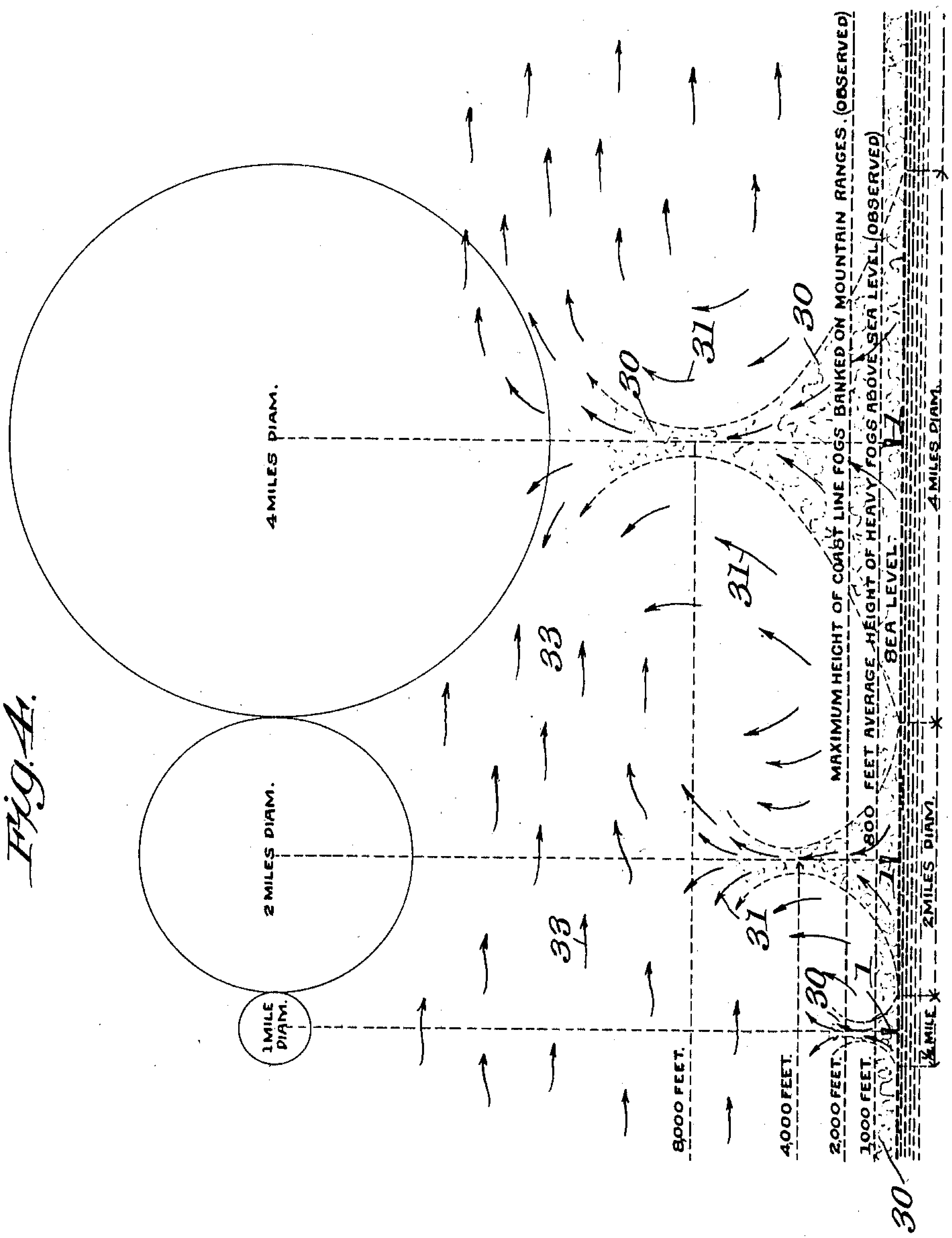
Fig. 4.



Witnesses

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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR LIFTING FOGS.

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To all whom it may concern:

Be it known that I, Franklin J. Drake, rear admiral, United States Navy, retired, at present residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Methods of and Apparatus for Lifting Fogs; and I 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.

My invention relates to a method of and apparatus for lifting fogs and the primary object of my invention is to secure greater safety to navigation upon the high seas, approaches to shore lines and harbors, and upon all inland waters, as will appear more fully hereinafter.

Having made a careful study of fogs and the physical laws governing the same with a view to discovering some means by which the conditions of the atmosphere that produce or generate fogs could be themselves utilized or artificially assisted to disperse them, I have been impressed with the facts that fogs generally if not always consist of relatively thin and quiescent blankets only a few hundred feet thick, or less, which cut off or absorb the heat radiated from the earth, and in a large measure prevent the natural, upward circulation due to rising convection currents of warmer air, which would if once established lift or dissipate the ordinary fog. Above these quiescent blankets of fog, the colder air is in constant circulation and it becomes evident that if said blankets could be brought under the influence of these upper currents, they would soon lift or disappear.

While in command of the U. S. S. *Albatross*, and engaged in making deep sea explorations, I observed that in the great fog generating belt of the Behring Sea, in the Japan and Gulf streams, as well as in the polar currents, the fog is suspended in barely perceptible air currents near the surface of the water, and does not reach to the higher altitudes at all. These conditions were also found to be the same whether the fog was heavy or light. As a rule, however, in observing fogs in all parts of the world, I have found that the ordinary fog blankets which make navigation difficult and dangerous, exist generally without air currents, and are approximately not over two hundred feet in height above the sea level. In fact while approaching from the sea in the presence of wind the high land of coast ranges or channels, the fog may be observed to bank, and rise with a velocity depending upon the force of the wind and friction of the slope of the range. Upon reaching the summit it then pours down the other side having the appearance of a huge water fall.

Since the line of least resistance of all hot air currents is upward it is clear that any pneumatic force which induces or increases the velocity of these ascending currents will tend to cause portions of the fog to be brought into the path of the overlying colder currents and thereby cause the same to be carried away. Not only would this be the case, but the greater the lifting effect produced on the fog, the greater will be the tendency of the natural convection currents of the warmer air next the earth to rise and assist the lifting, since they will not be so completely checked or blocked off by the fog blanket.

From actual experiments extending over a long period, I have practically demonstrated that if a column of air of a higher temperature than the surrounding medium, and having a certain weight is projected toward the zenith with a given velocity that it not only will have a rotary movement in its ascent, but through the action of suction and vibration from the discharge, it will set up additional rising air currents, which will rarefy and lift the fog to the higher moving air currents, cause the same to be carried away and will leave a clear sky and horizon. In fact with a comparatively small apparatus, I found no difficulty in clearing a space of a quarter of a mile in this manner.

Since the density of a cubic foot of air at atmospheric pressure decreases with an increase of temperature, and since the volume varies inversely as the pressure, the rarefaction caused by the explosion and the heat liberated from the ascending projected column become important factors in producing induced ascending convection currents, which when once established have a tendency to automatically continue.

Further objects of my invention are to lift or dissipate fogs at any points or places desired, and to the above ends my invention consists broadly in dissipating or lifting fogs by the agency of a projected column or columns of air and thereby bringing portions of such fog under the influence of the overlying strata of air and at the same time inducing upwardly ascending air currents and creating a tendency for the lifting action to become automatic.

My invention further consists broadly in a suitable mechanism for carrying out the above method.

Referring to the accompanying drawings forming a part of this specification in which like numerals refer to like parts in all the views, Figure 1 represents a sectional view of my fog lifting machine; Fig. 2, a view of a quiescent fog blanket; Fig. 3, a view of the fog blanket shown in Fig. 2, after my machine has projected a column of heated air upwardly through the same, and Fig. 4, a view illustrating the zones of action of my fog lifting machine when of different orders.

1, represents any suitable combustion chamber, preferably a cylinder, supported on a base, 2, and provided with a drain, 3, for cleaning purposes. This chamber is preferably provided with a stop valve connection, 4, for admitting acetylene gas, and with a similar connection, 6, for admitting chemically equivalent proportions of air to said chamber; while 5, represents a connection by which all air and other gases may be exhausted from the chamber before the acetylene gas is admitted thereto.

7 represents any suitable igniter for exploding the mixture of acetylene gas and air in the chamber, and 8 represents the electric conductors for the same.

The upper end of the chamber, 1, is preferably provided with a flange 9, to which is fitted the ring 10, in which further fits the ring 11 forming a valve seat for the valve 12, as shown. The ring 11 is provided with a web, 13, through which passes the rod, 14, which supports the inverted cup-shaped guard, 15, and around which is the spring, 16, normally holding the valve, 12, to its seat.

17 represents drains in the ring 10, for cleaning purposes. Mounted upon the ring, 10, is the cylindrical section 18, and upon said section 18, is mounted the conical section 19, provided with a contracted neck or outlet portion 20, as shown. Fitted over this neck 20, is an upwardly expanding conical section 21, firmly braced by the stay rods 22, secured to suitable fastenings 23 near the upper end of said section, and to flanges 24 on the section 19, as illustrated.

The parts 19 and 21 serve to hold a column of air which is projected upwardly by the gases of explosion in the combustion chamber for a purpose to be presently described.

In operation the combustion chamber is charged with one part of acetylene (C_2H_2) gas, and about eight parts of air, when the circuit through the wires 8 is closed, and the mixture exploded. The explosion lifts the valve 12 which is held down by the spring 16, with a force of about six pounds and until it strikes the guard 15. As the valve lifts the gases of explosion which are at a temperature of about 2400 degrees F. and at a pressure of about 82 pounds to the square inch, escape around its edges and pass into the conical chamber formed by the sections 18 and 19 of the machine. The hot gases are preferably so proportioned to the column of air in the sections 19 and 21 that as they pass up through the contracted neck, 20, they will heat up said column to a temperature of about 900 F., which of course compresses the said column, and gives it a rotary motion at the same time. The parts are so designed that the velocity imparted to said column is about 450 feet per second. As soon as the pressure in the combustion chamber is sufficiently lowered, the valve 12 closes, and the air pump connected to the pipe 5, clears the chamber of substantially all remaining gases, when the acetylene and air is again admitted and then ignited, when the foregoing cycle is repeated.

In a machine which I term of the first order, the parts are so proportioned that the air column contains about 780 cubic feet, and has a velocity of about 450 feet per second, as it leaves the machine. This upwardly projected rotating column of hot air causes a disturbance to a height of about 12,000 feet, and has an effective radius of about 3 miles. That is to say its influence extends over a circular area of about six miles in diameter.

A machine which I term of the second order is so designed as to project a column of air containing about 541 cubic feet, at a velocity of 450 feet per second, and reaches a height of about 8,000 feet. A third order of machine lifts 303 cubic feet of air at the same velocity and disturbs a height of 4,000 feet, and has an effective radius of action of one mile: while a machine of the fourth order, suitable for carrying aboard ships, lifts a column containing 65 cubic feet at 450 feet per second, and disturbs a height of 1,000 feet, with an effective radius of one half a mile.

By actual trial under natural conditions with a comparatively small apparatus, I have repeatedly demonstrated that if at first successive explosions are had at say five minute intervals, the quiescent layers of air 30, Fig. 2, holding in suspension the condensed vapor particles constituting the fog are soon set into motion, as diagrammatically shown at 31, Fig. 3, and that very soon convection, or other ascending currents, 32, are induced, which in a short time become self-acting or automatic; and therefore tend to keep up this motion of the previously quiescent air, 30. By then upwardly projecting columns of air at longer intervals these currents, 32, grow stronger and reach to higher altitudes; so that it is really only a question of comparatively a short time before the fog finds itself slowly carried by these ascending currents into the upper moving air strata, 33, and is then, by them lifted or dissipated. As above stated, I found no difficulty in lifting or dissipating a fog in this manner over a space of one-quarter mile radius, leaving a clear sky overhead, and a clear horizon.

Of course different places produce fogs of different thicknesses, and the overlying moving air strata are generally found at different heights. It is to be able to reach under all conditions, suitably moving strata and to bring the fog banks under their influence, that I employ machines of different orders, and the power of any particular machine therefore, of course, is determined by the local conditions existing at the place in question. In Fig. 4, I have shown diagrammatically the relative spheres of influence exerted by machines of various orders, and it will be seen at once that when small machines are used, they must be placed closer together than when larger machines are employed, in order that there may be no portion of the bank left undisturbed.

My method and apparatus should be carefully distinguished from the methods and apparatus pertaining to the so called rain making machines, which employ explosive charges of powder and which project upwardly particles of matter heavier than the air. These smoke like particles after losing their velocity begin to descend; and thereby they create a tendency of the fog to settle with them, which of course is just the opposite effect desired to lift a fog. And again the use of these machines at intervals suitable to start natural convection currents has not heretofore been proposed.

Of course, I do not wish to be understood as limiting myself to any particular theory of operation. For although I believe the theory above outlined to be the only correct explanation of the remarkable results which I have obtained in practice, yet, at the same time, I am well aware that later scientific research may throw additional light on the same. Nor do I wish to be understood as limiting myself to any particular mechanism, or machine for carrying out my method; for although Fig. 1, was made from actual working drawings of an actual full size machine, and which were only decided upon after the instruction obtained by numberless experiments, yet, I am well aware that other machines widely differing from the one here disclosed could be devised by those skilled in the art without departing from the spirit of my invention.

What I claim is:—

1. The method of lifting or dissipating fogs underlying moving air strata, and in a measure absorbing the heat radiated from the earth and thereby preventing natural convection currents, which consists in projecting upwardly through said fog at suitable intervals suitable columns of gases under pressure to a distance sufficient to penetrate said strata, and thereby permitting said natural convection currents to be brought into action and together with said strata to lift or dissipate said fog, substantially as described.

2. The method of lifting or dissipating fogs underlying moving colder air strata, and in a measure absorbing the heat radiated from the earth and thereby preventing natural convention currents, which consists in projecting upwardly through said fog at suitable intervals suitable heated rotating columns of gases under pressure to a distance sufficient to penetrate said strata and thereby permitting said natural convection currents to be brought into action and together with said strata to lift or dissipate said fog, substantially as described.

3. In a fog lifting machine the combination of a chamber, pressure controlled means for closing the same, and means extending beyond and communicating with said chamber for holding a column of air, substantially as described.

4. In a fog lifting machine the combination of a combustion chamber adapted to hold gases; means connected therewith for igniting said gases, pressure controlled means for closing said chamber and an extension communicating with said chamber for holding a column of air until said gases are ignited, substantially as described.

5. In a fog lifting machine the combination of a combustion chamber, suitable gas inlets for said chamber, a pressure controlled means for normally closing said chamber, an igniting means for the gases contained in said chamber, and a cone shaped extension adapted to hold a column of air adapted to communicate with said chamber when said pressure controlled means is lifted, substantially as described.

In testimony whereof, I affix my signature, in presence of two witnesses.

FRANKLIN J. DRAKE.

Witnesses:

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T. A. Witherspoon.