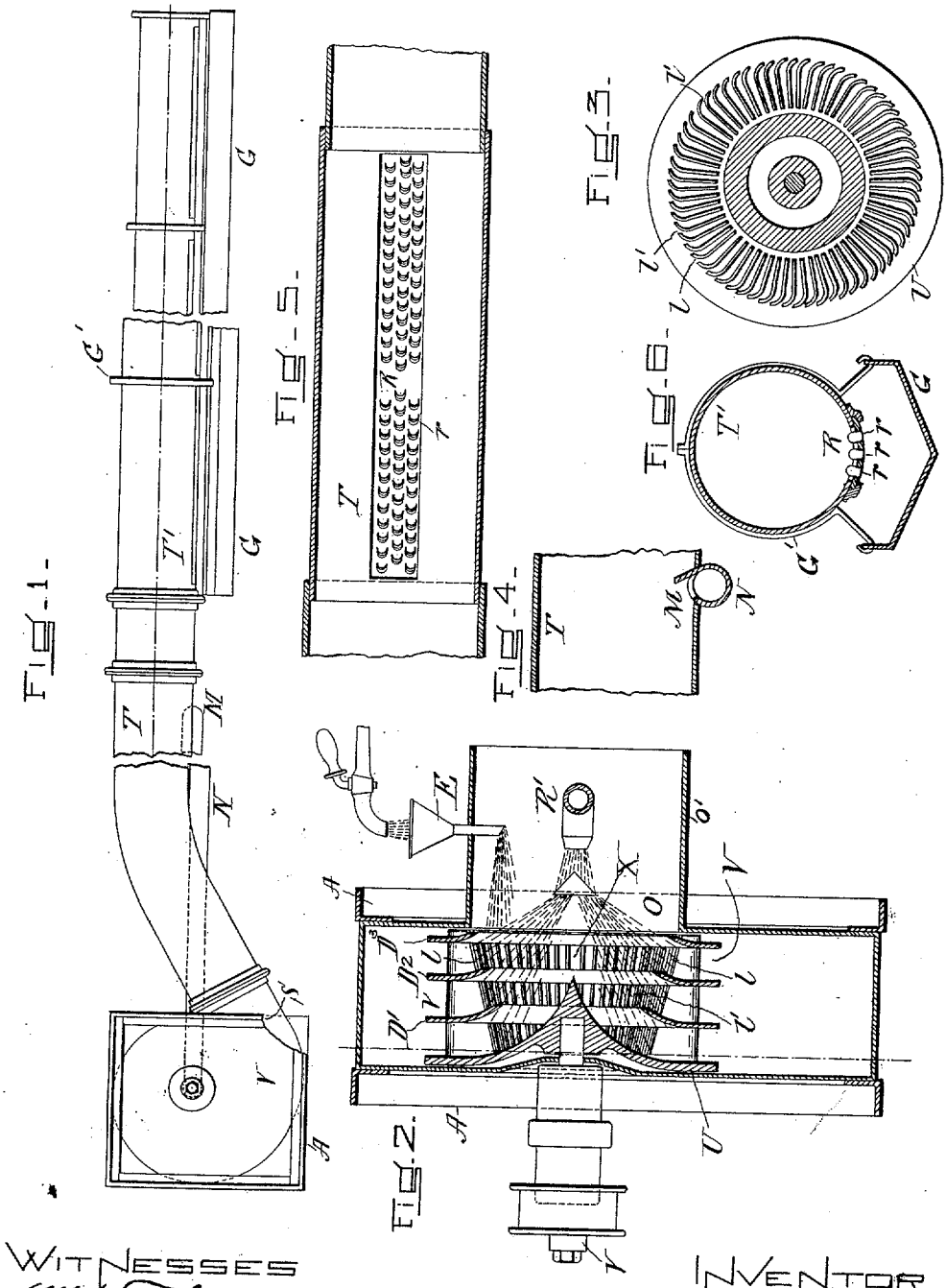
No. 888,444. PATENTED MAY 19, 1908.

P. KESTNER.

APPARATUS FOR INTIMATELY MIXING LIQUID AND GASEOUS FLUIDS.

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APPARATUS FOR INTIMATELY MIXING LIQUID AND GASEOUS FLUIDS.

No. 888,444. Specification of Letters Patent. Patented May 19, 1908.

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To all whom it may concern:

Be it known that I, PAUL KESTNER, of Lille, France, a citizen of the Republic of France, have invented a new and useful Improvement in Apparatus for Intimately Mixing Liquid and Gaseous Fluids, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in explaining its nature.

In a copending application for Letters Patent of the United States, Serial No. 218,701, filed July 29, 1904, of which this case is a divisional application, I have described an invention relating to processes for intimately mixing liquid and gaseous fluids, the essential object of which invention as referred to in said application being to so supersaturate air with water by a mechanical mixture as to produce a vapor of such permanent character that it may be distributed through pipes; or for the purpose of purifying the liquid fluid or washing the gas. In such application the invention was claimed in the light of the process for accomplishing the object above referred to. In the present application I desire to describe and claim the invention in the light of the means or instrumentality employed for accomplishing the object of my invention and which means comprises not only the means by which the mechanical admixture between the air and water may be obtained but also the means by which the vapor produced by such mechanical mixture may be properly distributed.

The apparatus can best be seen and understood by reference to the drawings in which—

Figure 1 shows a diagrammatic view of the apparatus including the delivery or distributing pipe. Fig. 2 shows in vertical section the atomizer or fan which comprises the essential feature of the apparatus. Fig. 3 is a cross section of said atomizer or fan. Fig. 4 shows in detail a section of the delivery pipe to which special reference will hereinafter be made. Fig. 5 shows in plan a portion of said delivery pipe. Fig. 6 is a cross section of the extension to the delivery pipe.

Referring to the drawings:—A represents a casing preferably rectangular in shape so that it may conveniently be fixed either to the ceiling or wall of the room in which the apparatus is set up. Inside this casing is the atomizer V. This comprises a rotary fan consisting of a disk U from which there project outwardly, in a direction substantially parallel with the axis of the fan, a large number of blades *l*, set relatively near together in order to form narrow passages *l'* between them. These passages open outwardly from an interior water and air intake or receiving chamber X and may be arranged at the point of the exit by curving the outer edges of the blades. It is also to be noted that the fan blades are made preferably tapering, being wider at the point of their juncture with the disk and tapering towards their outer extremities, this tapering being, however, along the inside edge of the fan blade, the outer edge of each fan blade being preferably in a line parallel with the axis of the fan. The fan blades also are shown crossed by a series of disks D^1, D^2, D^3. The fan is rotated by means of the pulley-driven shaft V^1 extending through the casing and connecting with the disk U.

O is an opening in the casing forming the inlet to the chamber X of the fan. The casing at this point connects with the outside of the room by a pipe O^1 forming the entrance passage into the chamber X of the fan for the admittance of air and water, water being admitted into the passage through any suitable conduit of discharge E. At the point S at right angles to the axis of the fan is another opening in the casing connecting with the interior chamber thereof outside the fan blades and forming the outlet thereto. Connecting with the casing at this point is a discharge pipe T extending out into the room into which the vapor or humidified air is to be delivered. This pipe turns upwardly and at the bottom thereof at the point M is provided with a guard for directing surplus water into a drainage pipe N extending back and entering the inlet passage O^1 where this pipe is provided with a nozzle R^1 pointed in the direction of the inlet to the chamber of the fan.

Attached to and extending from the delivery pipe T is an extension thereof or duct T^1. This latter is provided along the bottom with a slide R contained in guideways located on the bottom of the pipe T^1 and which slide has a considerable number of perforations *r* providing an exit from the pipe T downward into a gutter G. This gutter is supported by hangers G^1 which are arranged upon and depend from the duct T^1, the ar-

rangement of the gutter being such that the gutter will be opened laterally along the sides above the bottom thereof.

The operation of the means above described is as follows:—When the fan V is very rapidly rotated the blades of the fan will carry around with them the air contained in the passages between said blades and will centrifugally expel the air from said passages. This action may be increased by slightly contracting the exits from the passages done by curving the outer edges of the blades. The effect of such centrifugal expulsion is that very rapidly moving currents of air are made to pass through the passages between the blades of the fan and become centrifugally expelled therefrom. Such development of air currents and the centrifugal expulsion thereof necessarily implies a rapid flow of air into the inlet chamber of the fan from the inlet passage, air necessarily rapidly flowing into this chamber to take the place of that expelled. Now when water is admitted into the inlet passage the effect is that it is pulled or drawn along into the intake chamber of the fan and propelled in the direction of the fan blades. By reason of their exceedingly rapid rotation when the water reaches these blades it is broken up into fine particles and by centrifugal expulsion made to flow over the surfaces of the blades towards the outer edges thereof. At the same time, also, the currents of air rapidly flowing through the passages between the blades, assist in the distribution of the water over the surfaces of the blades; in other words, the force of the air currents assists in spreading the water over the surfaces of the blades of the fan in thin films. In their passage over these films of water, by reason of the force of their propulsion and by reason also of the narrow passages between the fan blades by which the currents of air are brought into immediate contact with the water, said currents act to take up or absorb a portion of the water before its centrifugal discharge from the fan. The air currents also assist in the centrifugal expulsion of the water from the outer edges of the blades of the fan for the reason that the air itself is impelled to move by the centrifugal expulsion in the same direction as the water which is thrown off from the edges of the fan blades. The result is that the water is discharged from the edges of the fan blades with an unimpeded velocity, the water, as said before, having been reduced by the currents of air into exceedingly fine films which discharge at the same time with, and into the currents of air moving in the same direction. The effect is that a very rapid and exceedingly fine atomization of the water is produced. In point of fact the air and water become so intimately mixed that the air becomes humidified to a point of oversaturation, producing, in other words, a vapor of such permanent character that it may be conveyed through pipes. In this connection it is to be observed that the fan not only acts as a means for obtaining a mechanical admixture between the air and water, but it also acts at the same time to propel the humidified air through the delivery pipes or ducts.

Reference has already been made to the fact that the passages between the blades should be narrow as distinguished from wide passages. The reason for this is that if these passages are too wide then drops or particles of water not sufficiently broken up might be carried by the currents of air through the passages between the blades without coming in contact with the surfaces of the blades. The effect would be that these heavier drops or particles of water coming in contact with the more finely pulverized water beyond the edges of the blades would act to take up or absorb the same, in other words, to extract it from the air in which it would otherwise remain and be expelled through the delivery pipe. The reason also for providing narrow passages between the blades is to obtain more effective centrifugal expulsion of air and so an increase of pressure in the air currents. In other words, the air should be carried around in the fan, being centrifugally expelled therefrom as distinguished from that type of fan which practically only beats the air. It is therefore an essential point, in order to satisfactorily practice the process, that the passages between the blades of the fan be reduced to a relatively small width, the narrowness of the passages being such, however, as not to interfere with the air-propelling feature of the fan, that is, so as not to prevent that proper development of the currents of air above referred to.

Reference has already been made to the fact that the fan blades are preferably tapered, being wider at the point of their juncture with the disk supporting the same at the back of the inlet chamber of the fan. The reason for this is that when the water is drawn into the intake chamber it has a tendency to be sucked into the back of the fan and flood the back parts of the blades or that portion of the blades nearest the disk supporting the same. It is essential, of course, in order to procure a proper centrifugal pulverization of the water that it should be very finely and evenly distributed over the surfaces of the blades. As before explained, this distribution is materially assisted by the currents of air passing over these surfaces. The equal distribution of water over the blades is primarily obtained, however, by making the portions of the blades receiving more water wider than those portions receiving a lesser amount of water; in other words, the rear portions of the blades which receive

more water are wider than the forward portions thereof in order that the water may have a larger surface to flow over. By providing a tapering blade, therefore, a more equal distribution of water is obtained over the entire blade.

The disks which were before described as attached to the blades, assist to a certain degree in stopping the water and distributing it at intermediate points along the blades of the fan. In other words, the disks impede the water in its passage towards the further end of the intake chamber.

During its passage through the fan practically all the water introduced is taken up. A certain amount, however, is pulverized less finely and falls very rapidly to the bottom of the tube T. This water is stopped by the guard placed close to the bottom of the tube at the point M as before explained, by which it is returned into the passage connecting with the intake chamber of the fan into which it discharges through the nozzle on the end of the pipe. A certain quantity of air returns at the same time by this pipe and disperses the water, this air being in fact under pressure. A return of the surplus water is better obtained by reason of the fact that the delivery pipe of the fan rises obliquely to such height that the bottom part thereof at the point M is in line with the fan inlet. This is not necessary, however, as the water will return by the pressure even if the point M is lower than the fan inlet. Owing to the speed of discharge from the fan up through the delivery pipe no water remains in the same, any water which might collect on its walls being made to climb along the inclined plane and made to enter the drainage tube above explained. Accordingly a certain amount of water circulates in a continuous manner in a cycle and produces a complete humecting of the fan even if the amount of water supplied be very small.

After the humidified air has entered the pipe T^1 it discharges therefrom perpendicularly through the perforations in the bottom of said pipe into the gutter below against which it strikes, freeing itself from any excess of water and then discharging laterally from the pipe or duct T^1 into the room.

Having thus fully described my invention, I claim and desire to secure by Letters Patent of the United States:—

1. An apparatus of the character specified having an atomizing fan comprising a rotatable disk and a series of tapering blades carried by it which blades project in the direction of the axis of said fan and form narrow passages between them.

2. An apparatus of the character specified having an atomizing fan comprising a rotatable disk, a series of blades carried by said disk and projecting in the direction of the axis of said fan and forming narrow passages between them, means for delivering air and water to the interior chamber of said fan to be acted upon by said blades, and means for directing the water so introduced evenly over the surfaces of said blades.

3. An apparatus of the character specified having an atomizing fan, a series of blades extending in the direction of the axis of said fan, means for supporting said blades, and one or more disks crossing said blades.

4. An apparatus of the character specified having an atomizing fan, a series of blades extending in the direction of the axis of said fan, and one or more disks crossing said blades and extending inwardly beyond the internal edges of said blades.

5. An apparatus of the character specified having in combination an atomizer, a moist air duct leading therefrom and a drain pipe leading from a point in the moist air duct back to the atomizer, whereby water accumulating in said duct may be delivered back to the atomizer.

6. In an apparatus of the character specified having in combination a humidifier, a moist air duct leading therefrom, openings in the bottom of said duct, and an open gutter arranged beneath the same.

7. An apparatus of the character specified having in combination a casing, an atomizing fan arranged within said casing, means for admitting air and water to said fan, a pipe leading from said casing and furnishing a delivery duct for said fan, means for returning water accumulating in said duct back to the fan, said pipe or duct having openings in the bottom thereof, and a gutter arranged beneath said openings.

PAUL KESTNER.

In the presence of—
HENRI CHARRIER,
LÉON PECKEL.