

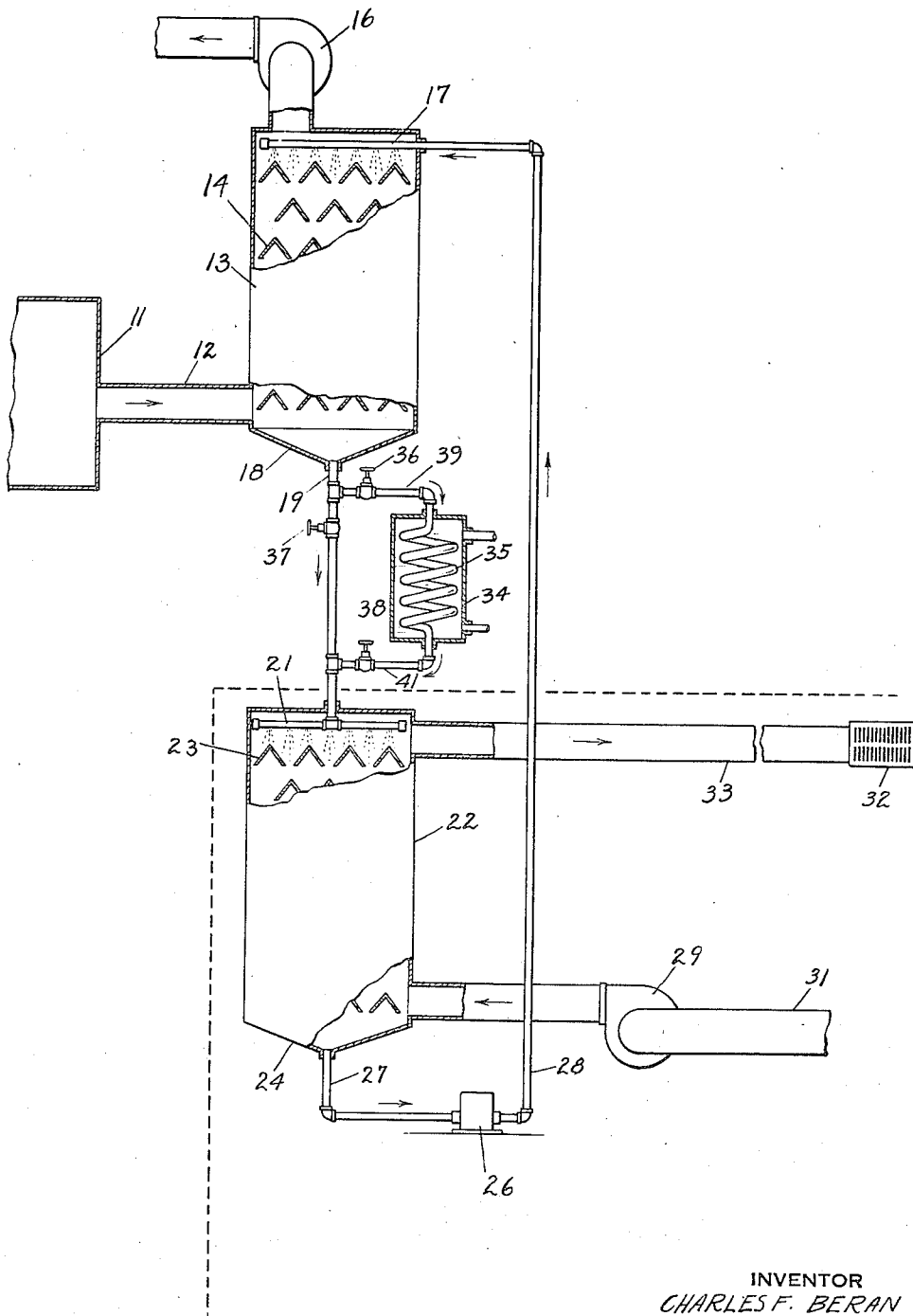
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AIR CONDITIONING

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AIR CONDITIONING

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This invention relates to the air cooling and conditioning of chambers, such as spinning rooms, etc. of an artificial filament manufacturing plant and relates more particularly to the use of the denuded air from which solvents or reagents have been recovered for cooling recirculating water that in turn conditions the air.

5 An object of this invention is to provide an economical liquid cooling plant that utilizes as a cooling medium a gas that normally is released to the atmosphere.

10 Another object of the invention is an economical air conditioning plant which recirculates water as a cooling medium. Other objects of the invention will appear from the following detailed description and drawing.

15 In the drawing there is shown, diagrammatically and partly in section, one mode of a device for carrying out this invention.

20 This invention is described as particularly applicable to air conditioning the spinning chambers of a plant for the manufacture of filaments and yarns of organic derivatives of cellulose. This invention, however, is not limited thereto but may be employed as the means of air conditioning any room or chamber that is within a reasonable distance of a supply of relatively dry air that may or may not contain a small amount of objectionable odoriferous substances.

30 This invention has a great advantage over closed-coil or spraychamber air cooling devices in that it renders possible the conditioning of air by the use of water that is at a higher temperature than normally employed for such purpose. By employing this invention high pressure compressors and expansion chambers are eliminated. There is also utilized a cooling medium, the cooling properties of which are normally wasted.

40 According to this invention a relatively dry current of gas which may be cooled and which may or may not contain small amounts of vapors of organic materials that are not removed by commercial washers, is caused to flow countercurrent to a stream of water or other liquid medium coming from an air conditioning tower. This water or liquid by evaporation gives up part of its heat to the dry gas that may be air and vapors, thus becoming cooled. The water or liquid may be further cooled by the low temperature of the gas if a cool gas is employed. The water or liquid in the cooled state enters a second water tower or air conditioning tower where it flows countercurrent to air drawn from the room to be cooled or from some source of fresh air. This air gives up a part of its contained heat to the water and also becomes practically saturated with water vapor and while in the cooled water-saturated condition it is partly mixed with fresh air when necessary and then distributed to the room to be air conditioned.

In the manufacture of artificial filaments from organic derivatives of cellulose and similarly in the manufacture of other cellulosic products, there are used solvents and the like that are volatile and that become admixed with quantities of air or other gases used as evaporative medium. To recover these solvents or reagents from such liquid or gaseous evaporative media, the mixture of gas or of liquid and vapors are processed in recovery plants. The vapors are separated and/or condensed, collected and purified, and the denuded air or gas exhausted from such recovery plant, and which, although depending on the recovery process in use, in most cases would be cooler and dryer, is released from the plant. Heretofore, this cool and dry air or gas was released to the atmosphere as it contained traces of vapors of the organic solvents, obnoxious at times, that could not be removed in commercial scrubbers, and as the flow, humidity and temperatures would be too uneven for practical air conditioning purposes such as supplying it directly to the chamber to be conditioned.

To illustrate my invention, but without being limited thereto, a detailed description will be given in connection with the dry spinning of a solution of cellulose acetate in acetone where air or other gas is used as an evaporative medium. There the acetone laden air is drawn from the spinning cells to the recovery plant, where it is scrubbed with cold water that absorbs most of the acetone therein. The denuded gas is then passed through a heat exchanger, where it indirectly absorbs some heat from the mixture of air and solvent vapors flowing toward the scrubber.

This air or gas as it leaves the solvent recovery plant which may be at a temperature of about 80° F. and have a relative humidity of 24%, i. e. about 58° F. wet bulb temperature, is conducted into the bottom of a water tower and exhausted from the top. Flowing countercurrent to the gas, from the top of the tower, is a spray of water which may enter this tower at a temperature around 80° F. In passing through the tower the water is minutely mixed with the air or gas to which it gives up some of its contained heat by evaporation of the water due to the dry condition of the air or gas. The tower is made of a height such that the water upon reaching the bottom of the tower may attain a temperature of about 63° F.

The cooled water is conducted from the bottom of the tower by gravity or a pump to a second water tower. Between the two towers there may be interposed an auxiliary cooling means for cooling the water, which cooling means may be a brine tank or other similar means of artificially cooling the water. There may be a by-pass for the water around this auxiliary cooling means

as its use is required only during extremely hot days.

Connected with the bottom of the second tower is a duct which collects the air from the room to be cooled or from any source of fresh air supply. This air is forced up the tower by means of suction or a pump countercurrent to the down-coming spray of water. The air entering this tower may be of a temperature between 85 to 110° F. and have a relative humidity of 50%. Part of the contained heat of the air is given up to the water so that it may leave the tower at about 68° F. and 95% relative humidity. This cooled water-saturated air is then conducted through suitable conduits and distributed in the room or chamber to be cooled and air conditioned. The air passing from the second tower to the room is approximately saturated air and it thereby acts to condition the room both by absorbing of heat from and thereby cooling the air of the room to form a thermal equilibrium and by the water vapor it contains to form a desired humidity equilibrium with the air of the room.

In the drawing there is disclosed a source of air and vapor 11 coming from a solvent recovery plant or other source of cold and/or relatively dry air. The cold and/or dry air which may contain residual amounts of solvent is drawn through a conduit 12 to the bottom of a water tower 13 that contains means 14 such as baffles for causing intimate contact of the air with a downward flowing stream of water or other liquid. The air, after taking up part of the heat from the liquid by cooling and/or evaporation of the liquid, is drawn from the top of the tower 13 by means of a suitable suction pump 16 and is pumped either to the atmosphere or back to the recovery plant to be recirculated therethrough.

The downward flowing liquid in the tower 13 is preferably water; however, other liquids may be used by employing closed coils in the second tower 22, so that there will be no direct contact between the air and the liquid. The water is shown as being admitted to the tower 13 by means of a distributing head 17. This water cooled by direct contact with the air is collected in the bottom 18 of the tower 13 from which it flows, or is pumped by means not shown, through a pipe 19 to a distributing head 21 in a second tower 22, having therein baffles 23 or other means for intimately contacting the water with a current of air blown or pumped up the tower. The water after absorbing heat from the air of the second tower 22 is collected at 24 from which it is pumped by means of a pump 26 through the line 27 and 28 back to the header 17 in the first tower 13.

The air forced through the second tower 22 is drawn from the room or chamber to be conditioned by means of a pump 29 and conduits 31 having openings at suitable points in the room or the air may be drawn from the outside atmosphere. The air after being cooled and saturated with vapor in the second tower 22, is blown into the room or chamber through suitable vents and conduits as indicated on the drawing at 32 and 33.

There may be employed as many vents 32 as desired and these may be distributed through the room in the manner of distributing air from a hot air furnace or like devices. The pumps 16

and 29 may be placed at either end of their respective towers or each tower may be equipped with two pumps.

When the air in the room to be conditioned is warmed by an extraordinary large source of heat, as on an exceptionally hot summer day, the air from the recovery plant may not be sufficient to absorb all the heat from the water as is required to keep the room at a normal temperature. For such emergencies there may be provided a cold brine tank 34 and coil 35 through which the water coming from the first tower may be shunted on its way to the second tower by means of suitable valves 36, 37 and 38 and lines 39 and 41. The brine tank may be cooled by a mechanical or other type of refrigerator not shown.

Other liquids than water may be employed by using the direct contact tower 13 and by substituting for the tower 22 a non-contacting heat exchanger in which the air is caused to pass around pipes containing the liquid. The liquid of the system may be replenished by any suitable means such as introducing it into the line 28 or directly into tower 13.

In place of using the baffle plates 14 for intimately mixing the air and vapor with the liquid there may be used a series of bubble plates customarily employed in absorption towers or fractionating columns. The relative location of one part of the device to the other is not important; thus the tower 22 may be above the tower 13 with the pump 26 inserted in the line 19. The towers 13 and 22 may be on the same level with pumps in both lines 19 and 28.

In place of using a single tower 13 there may be a series of such towers each with an individual supply of cool and/or dry gas through all of which the liquid is adapted to pass giving up a quantity of its heat in each. There may also be a series of towers 13 through which the same cool gas passes absorbing heat from a plurality of streams of liquid, each stream circulating through individual air cooling towers.

Having described my invention, what I desire to secure by Letters Patent is:

1. A process for conditioning the air of textile manufacturing or processing rooms, which comprises passing a gaseous medium, which has been employed to remove solvents by evaporation from extruded products in a dry spinning process and has subsequently been cooled in a solvent recovery plant, whereby it has become dry, in direct contact with a liquid, whereby the gaseous medium absorbs vapors of the liquid and thus causes lowering the temperature thereof, and subsequently passing the said liquid in heat exchange with the air to be conditioned.

2. A process for conditioning the air of textile manufacturing and processing rooms, which comprises passing dry air, which has been employed to remove solvents by evaporation from extruded products in a dry spinning process and has subsequently been cooled in a solvent recovery plant, whereby it has become dry, in direct contact with water, whereby the air absorbs water vapor and thus lowers the temperature of said water, and subsequently passing the said water in direct heat exchange with the air to be conditioned.

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