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(54) **SYSTEM FOR VAPORIZATION OF LIQUIDS**

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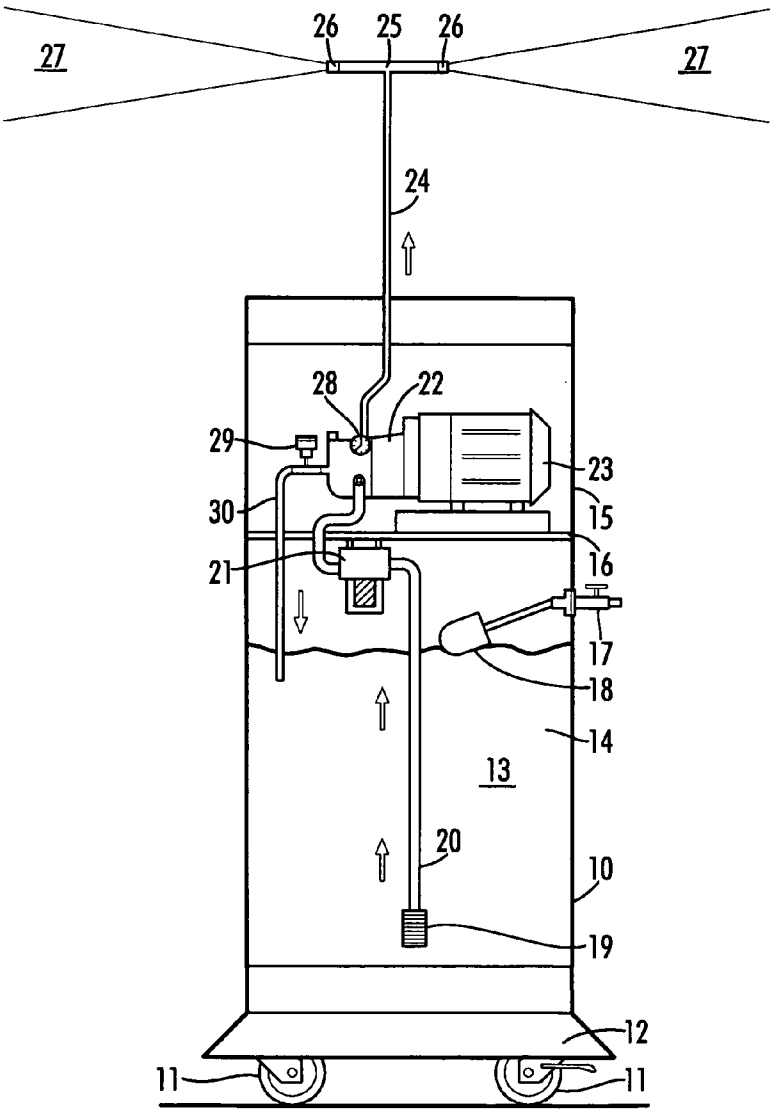
(57) **ABSTRACT**

A system for vaporizing a liquid. The system has a container for the liquid. A nozzle is provided for vaporizing the liquid and discharging the liquid into an environment. A pump transfers the liquid from the container to the nozzle and the container contains a sufficient quantity of liquid to allow operation for a predetermined amount of time without replenishing the liquid in the container.



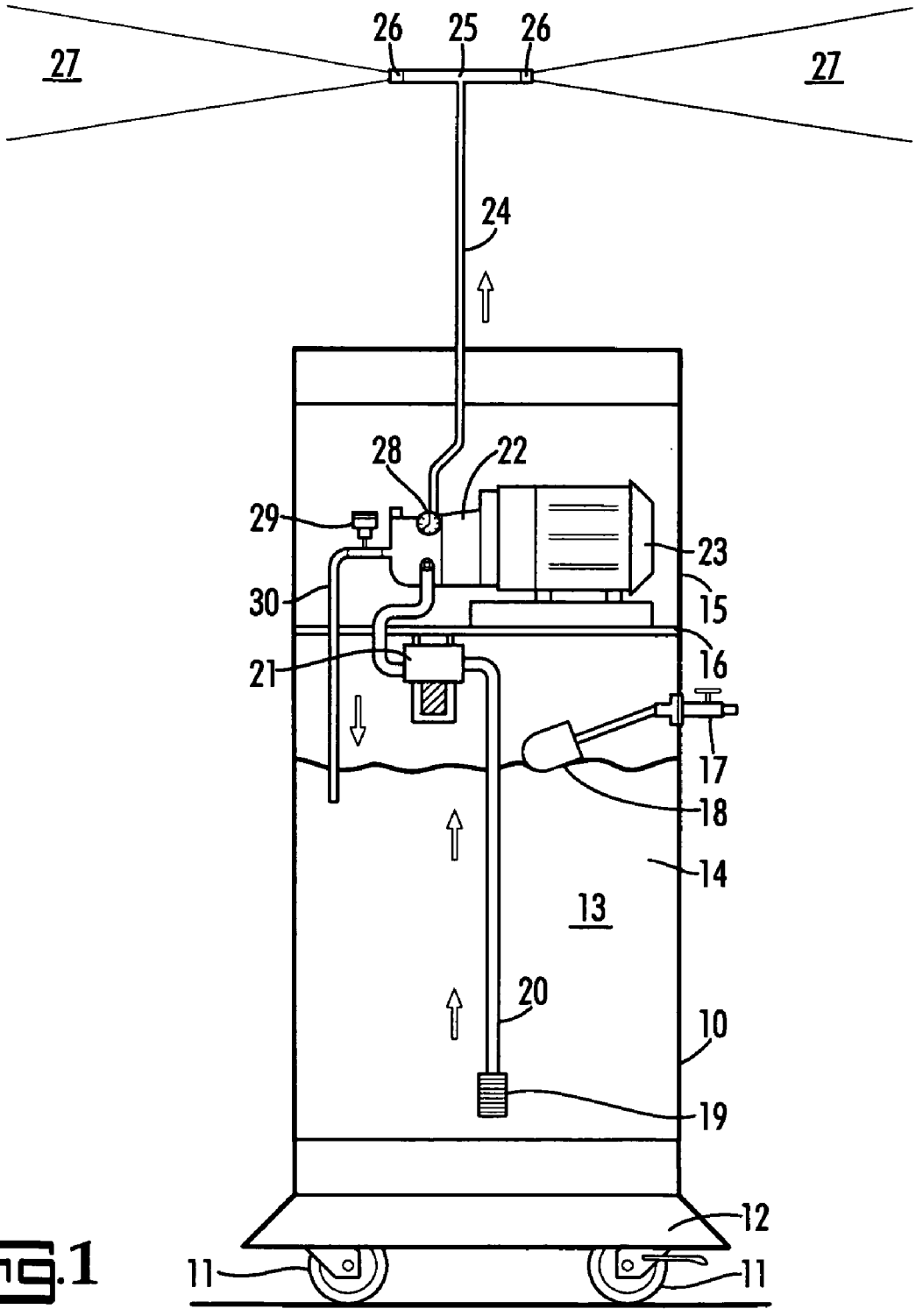


FIG. 1

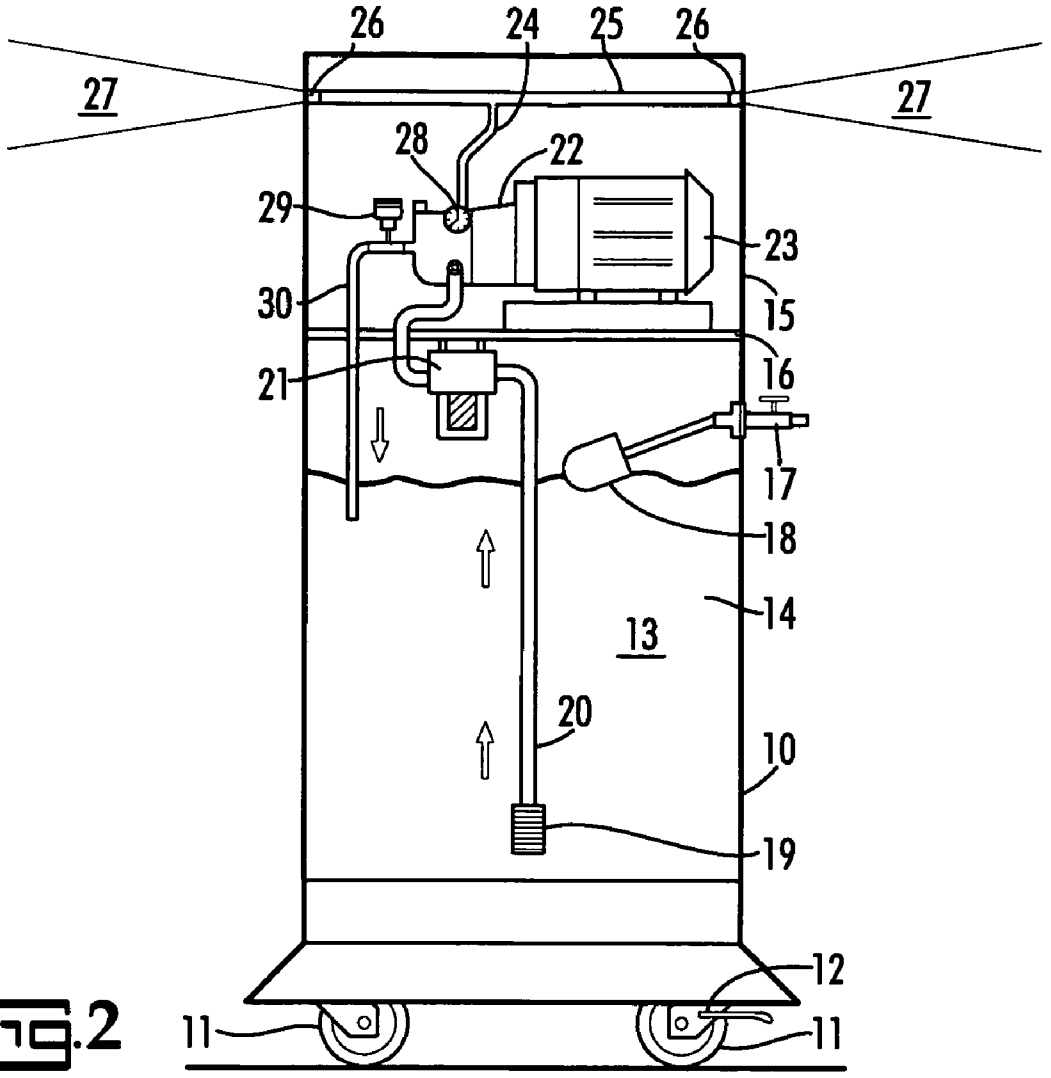


FIG.2

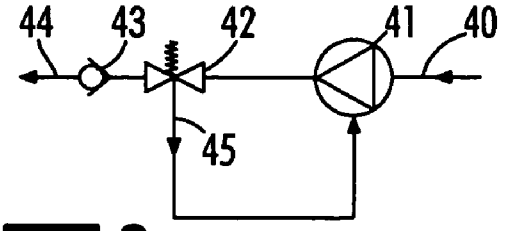


FIG.3

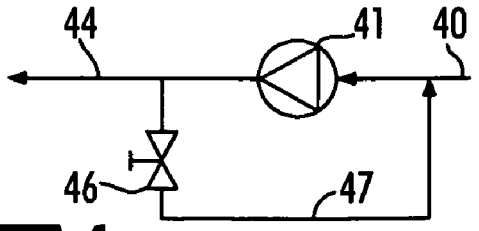


FIG.4

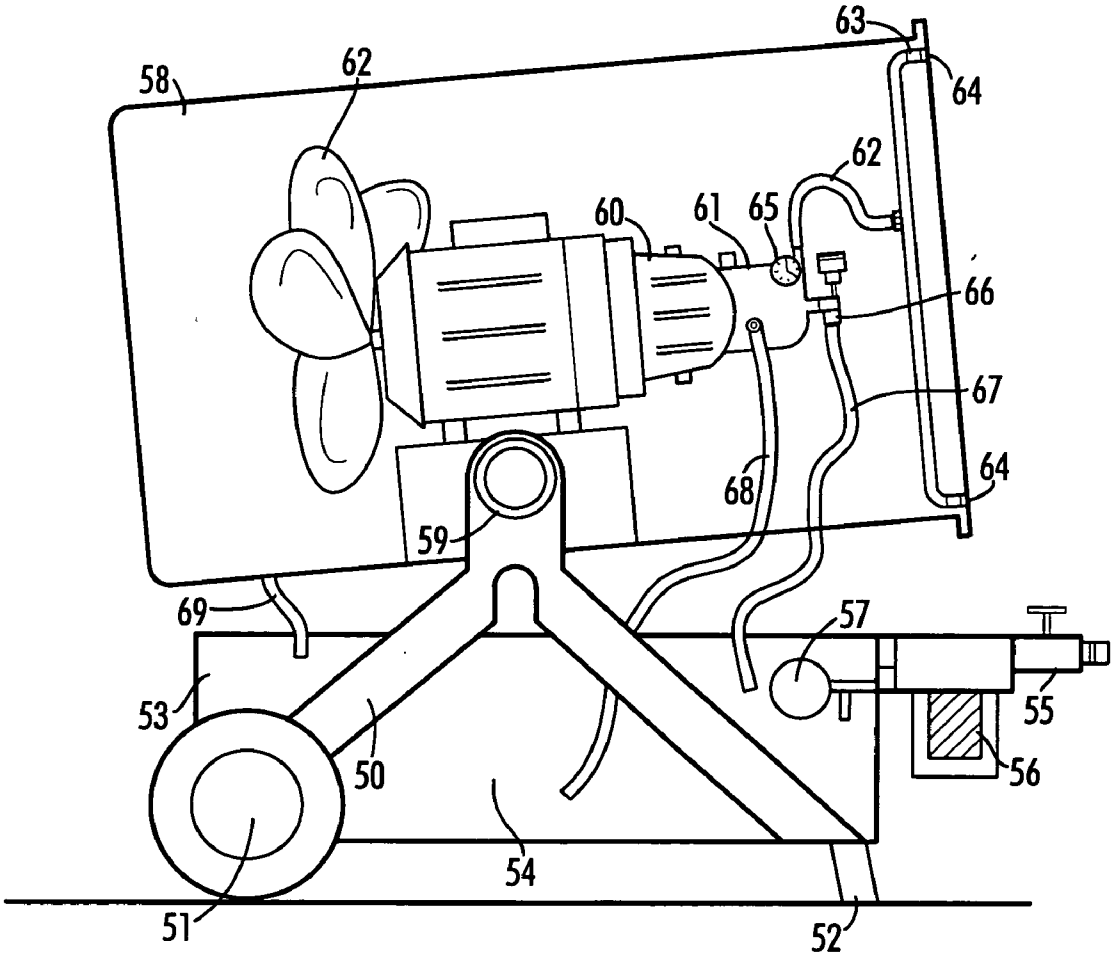


FIG.5

SYSTEM FOR VAPORIZATION OF LIQUIDS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present invention claims priority to pending U.S. Provisional Appl. No. 60/670,766 filed Apr. 13, 2005 which is incorporated herein by reference thereto.

BACKGROUND OF THE INVENTION

[0002] The present invention is related to a system for vaporization of liquids and is particularly suited for cooling and/or humidification of an environment.

[0003] There are a myriad of devices for providing mist. One category of misters utilizes pressurized air either from a pressurized air bottle or by a compressor which pressurizes the container. A pressurized air supply limits the length of time the device can be used and the cost of replenishing an air bottle is prohibitive. An air compressor is typically noisy and the pressure in the tank must greatly exceed the pressure at the nozzle due to pressure drop within the transfer tubes. Examples of such devices utilizing pressurized air are described in U.S. Pat. Nos. 5,979,793; 6,158,669; 6,219,961; 6,371,388 and 6,481,642. Devices utilizing an air compressor are described in U.S. Pat. No. 6,189,805.

[0004] Hand held misters have been described however they are typically only for personal use and are of minimal value in an environment. The mist is typically localized to about the size of a persons face. Examples of such devices are described in U.S. Pat. Nos. 5,667,732 and 6,471,194.

[0005] Other devices are known in the art, however, each has specific limitations. A chemical based system is described in U.S. Pat. No. 6,241,164.

[0006] Misters combined with fans, purifiers, and the like are known to be advantageous. These typically require attachment to a liquid supply during use which limits the locations within which they can be employed. Such devices are described in U.S. Pat. Nos. 6,257,501; 6,454,190; 6,581,855 and 6,796,136.

[0007] Misters including a condenser, or refrigeration unit, are described in the art. These devices are expensive due to the refrigeration unit and typically not readily portable. Such devices are described in U.S. Pat. Nos. 6,293,121 and 7,021,070.

[0008] There has been a long standing desire for a system for humidifying and cooling an environment which is simple, inexpensive, portable and which does not require extensive infrastructure for installation and use.

SUMMARY OF THE INVENTION

[0009] It is an object of the present invention to provide an apparatus, and system, for cooling and humidifying an environment.

[0010] It is another object of the present invention to provide an apparatus, and system, for cooling and humidifying an environment which is simple in design.

[0011] It is another object of the present invention to provide an apparatus, and system, for cooling and humidifying an environment which is portable.

[0012] It is another object of the present invention to provide an apparatus, and system, for cooling and humidifying an environment which does not require special connectivity to a liquid or power supply.

[0013] A particular feature of the present invention is the ability to cool and humidify an environment for extended periods of time without attention.

[0014] These and other advantages, as will be realized, are provided in a system for vaporization of liquids including a chamber for accumulating liquid wherein the chamber contains a sufficient amount of liquid to allow unattended operation over an extended period of time, at least one nozzle for vaporization of the liquid, a pump to transfer the liquid from the chamber to the nozzle and a valve mechanism which allows the chamber to be reversibly attached to a liquid supply, such as a water system, wherein the chamber can be replenished as it is depleted.

[0015] Yet another advantage is provided in a system for vaporizing a liquid. The system has a container for the liquid. A nozzle is provided for vaporizing the liquid and discharging the liquid into an environment. A pump transfers the liquid from the container to the nozzle and the container contains a sufficient quantity of liquid to allow operation for a predetermined amount of time without replenishing the liquid in the container.

[0016] Yet another embodiment is provided in a system for vaporizing a liquid. The system has a container for the liquid and a nozzle for vaporizing the liquid and discharging the liquid into an environment. A pump is provided for transferring the liquid from the container to the nozzle. An inlet tube supplies liquid from the container to the pump and a delivery tube receives pressurized liquid from the pump. A bypass valve is positioned to pass liquid from the delivery tube to the inlet tube if a pressure in the delivery tube exceeds a predetermined value. The container contains a sufficient quantity of liquid to allow operation for a predetermined amount of time without replenishing the liquid in the container. A fan provides an air flow for contacting the vapor for increasing a velocity of the vapor after discharge from the nozzle.

[0017] A particularly preferred embodiment is provided in a system for vaporizing a liquid. The system has a container for the liquid and a nozzle for vaporizing the liquid and discharging the liquid into an environment. A motor cabinet is provided containing an engine and a pump for transferring the liquid from the container to the nozzle. An inlet tube supplies liquid from the container to the pump and a delivery tube receives pressurized liquid from the pump. A bypass valve is positioned to pass liquid from the delivery tube to the inlet tube if a pressure in the delivery tube exceeds a predetermined value. The container contains a sufficient quantity of liquid to allow operation for at least 4 hours without replenishing the liquid in the container. A fan provides an air flow for contacting the vapor and increasing a velocity of the vapor after discharge from the nozzle.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] **FIG. 1** is a schematic representation of an embodiment of the system for vaporization of liquids of the invention.

[0019] **FIG. 2** is a schematic representation of another embodiment of a system for vaporization of liquids of the invention.

[0020] **FIG. 3** is a schematic representation of an embodiment of a pump system of the present invention.

[0021] **FIG. 4** is a schematic representation of another embodiment of a pump system of the present invention.

[0022] **FIG. 5** is a schematic representation of another embodiment of the system for vaporization of liquids of the invention.

DESCRIPTION OF THE INVENTION

[0023] The instant invention is directed to a portable system for vaporizing liquid, preferably water, to cool and/or humidify an environment. The system is economical to operate, simple in design and can operate unattended for extended periods of time.

[0024] The invention will be described with reference to the figures which form an integral part of the instant application. In the various figures similar elements are numbered accordingly.

[0025] An embodiment of the present invention is illustrated in **FIG. 1**. In **FIG. 1**, a container, generally shown at **10**, forms a reservoir within which the liquid is contained. The container is preferably cylindrical, however, other shapes such as a parallelepiped are within the scope of the instant invention. Attached to the lower part of the container are wheels, **11**, preferably with movement restraints, **12**, such as a wheel lock mechanism. The container contains an inferior, or inner, area, **13**, within which the liquid, **14**, is contained. A superior area, or motor cabinet, **15**, is mounted above the container with a gap, **16**, there between. The gap may be a physical separation or it may contain a gasket or similar material. The gap insures that moisture from the container does not enter the motor cabinet since this would limit the motors available for use due to the potential for explosion.

[0026] An entrance valve, **17**, for introduction of the liquid, **14**, passes through the container, **10**. In a particularly preferred embodiment the valve, **17**, comprises an exterior cutoff, such as is common with a spigot, and an interior float valve, **18**. In operation the entrance valve can be opened from the outside, connected to a liquid supply such as a municipal water system, and liquid can be input into the container. As the liquid height rises the float valve, **18**, becomes engaged and begins to lift in concert with the liquid level. When the float valve reaches a predetermined height the entrance valve, **17**, is mechanically closed thereby precluding the entrance of additional liquid.

[0027] A pick up valve, **19**, is positioned in the lower end of the container and connected to a tube, **20**, which is in turn connected to a filter element, **21**. The pick up valve, tube and filter element are the exit means for the liquid within the container.

[0028] Located within the motor cabinet, **15**, is a pump, **22**, and associated engine **23**. The engine can utilize electricity or combustion with an electrical motor operating on alternating current being most preferred due to the simplicity in operation and low cost relative to a combustion engine. The engine, **23**, turns the pump which draws liquid from the container through the filter, tube and pick up valve.

[0029] Pressurized liquid is forced through a delivery tube, **24**, to a distributor, **25**, and ultimately is dispensed through at least one nozzle, **26** as a vapor, **27**, or water droplets into the environment. The vapor then humidifies and cools the environment as would be readily understood without further elaboration.

[0030] A gauge, **28**, monitors the pressure exiting the pump and a pressure regulator, **29**, protects the distribution and nozzles from excessive pressure by passing high pressure liquid back to the container through a return tube, **30**. The pressure regulator is typically set to a pressure of about 70 bar, however, it would be understood that the pressure would be determined for each application and is dependent on the nozzle type, number of nozzles, and the size of the exit orifice for the nozzles.

[0031] The size of the container is based on the use and duration of use without refilling. For example, if four nozzles are employed with a flow of 1.5 L/h and it is desirable for the system to be used for 8 consecutive hours the amount of water in the container capable of passing through the pick up valve must be at least 48 L. It is preferred that the container have a volume of liquid sufficient to endure at least 4 hours of continuous use without replenishment. More preferably it is preferred that the container have a volume of liquid sufficient to endure at least 8 hours of continuous use without replenishment.

[0032] It is preferred that a multiplicity of nozzles be used and that they be in a spaced distribution symmetrically around the distributor, **25**. This arrangement provides improved spreading of the liquid within the environment.

[0033] The liquid is preferably water with other liquids being suitable for use. The liquid may be neat or it may contain additives such as perfumes, disinfectants, ultraviolet protectors and the like.

[0034] In a particularly preferred use the system can be attached to a municipal water supply at the valve, **17**, and used with a constant replenishment since the float valve will prohibit overfilling or under replenishment assuming the water supply has sufficient volume to add at least as much water as the water vaporized. Alternatively, the container can be filled up to capacity, or to a level desired, disconnected from the water supply and transported on the wheels to a location of use. The only limit to the location is a means for energizing the engine and this may be overcome with the use of batteries, preferably rechargeable batteries.

[0035] An alternate embodiment is illustrated in **FIG. 2**. In **FIG. 2**, the individual elements are as described with reference to **FIG. 1**. In this embodiment the distributor, **25**, and nozzles, **26**, are mounted inside the motor cabinet, **15**. This embodiment provides advantages in aesthetics and avoids having a pipe, distributor and nozzles protruding beyond the boundaries of the system where they are susceptible to tamper, collision and potential damage. It is particularly preferred that the nozzles be directed to multiple sides of the system.

[0036] In another preferred embodiment the motor cabinet is smaller than the container.

[0037] The pump is preferably a high pressure pump preferably comprising pistons as commonly employed with high pressure pumps.

[0038] An embodiment of the pumping mechanism is illustrated in **FIG. 3**. In **FIG. 3** the liquid is drawn to the

pump, **41**, through an inlet tube, **40**. A bypass valve, **42**, allows a portion of the liquid to pass through to the distributor (not shown) through tube, **44**. The pressure passing through tube **44** is monitored by a gauge, **43**. Excess liquid returns to the pump through a return tube **45**. The embodiment of **FIG. 3** requires a greater effort on the pump, the liquid temperature increases and the energy consumption is higher.

[**0039**] A preferred embodiment is illustrated in **FIG. 4**. In **FIG. 4**, the inlet tube, **40**, supplies liquid to the pump, **41**, for passage to the tube, **44**. A bypass valve, **46**, prohibits the pressure in the tube, **44**, from exceeding a predetermined level and, if the predetermined pressure is reached, the excess pressure is released by returning a portion of the liquid back to the inlet tube, **40**, through return tube **47**. A pressure gauge is not typically required in this embodiment though one could be employed if desired. The pressure can be very accurately regulated by bypass valve **46** and avoiding the recirculation of the liquid back to the pump avoids the drawback of traditional pumps. Furthermore, this eliminates the need for more expensive recirculating pumps.

[**0040**] The shape of the container is preferably cylindrical with the height being greater than the diameter. Other shapes such as parallelepiped with the base length larger than the height are also within the scope of the invention and in same cases preferred since the motor cabinet can be placed beside the container instead of having to be above the container with parallelepiped containers.

[**0041**] In another embodiment an air source is provided wherein vapor is entered into a flowing stream of air as it exits the nozzle. The flowing air increases the velocity of the vapor thereby increasing the efficiency of cooling. The tube supplying the nozzle is preferably about 0.5 cm, however, the inside diameter is preferably at least as large as the orifice of the nozzle. The air pressure is preferably supplied by a fan with a velocity that is preferably between about 2 and 5 times the velocity of the exiting vapor.

[**0042**] A particularly preferred embodiment is illustrated in **FIG. 5**. The system of **FIG. 5**, comprises a transportation truck, **50**, with wheels, **51**, and legs, **52**. The container, **53**, with liquid, **54**, is supported by the transportation truck preferably in a fixed relationship relative to the transportation truck. An inlet valve, **55**, with associated filter, **56**, and float valve, **57**, allows liquid to be introduced into the container. The motor cabinet, **58**, is attached to the truck by pivots, **59**, and suspended above the container, **53**. The pivots allow the motor cabinet to rotate upward and downward about the pivot such that the direction of the vapor can be altered. The motor cabinet contains a motor, **60**, adapted to rotate a pump, **61**. Opposite the pump, and integral to the motor, is a fan, **62**, for providing air flow to improve the distribution of the vapor and to cool the motor. In a particularly preferred embodiment the fan and pump are rotated by engagement with the shaft of the motor. Even more preferably both the pump and fan are mounted on the motor shaft. In this preferred embodiment the fan rotation is initiated in concert with the initiation of the pumping. This embodiment improves the overall energy efficiency and eliminates the requirement of a second motor for the fan. The pump passes pressurized liquid through a tube, **62**, to a distributor, **63**, and ultimately through nozzles, **64**. A bypass valve, **66**, controls the pressure and passes excess liquid to the container via tube **67**. A gauge, **65**, monitors the pressure. The liquid is drawn from the container by an aspiration tube, **68**, and any condensation which accumulates in the motor cabinet is deposited in the container through tube **69**. The fan, **62**, is selected to supply a flow of air in the direction of the nozzle discharge and the motor cabinet has an open zone through which the air flow passes.

[**0043**] The device of the present invention is particularly advantageous over the art due to the ability to provide a cooling and humidification unit without a refrigeration unit. The absence of a refrigeration unit greatly increases the energy efficiency, lowers the cost of manufacturing, decreases the weight of the unit and minimizes maintenance requirements.

[**0044**] The device of the present invention also avoids the difficulties associated with pressurization either from a pressurized bottle or due to reliance of a compressor to increase the head pressure inside the container. The ability to provide a mist without air pressure assist greatly increases the usefulness of the device.

[**0045**] The invention has been described with reference to the preferred embodiments without limit thereto. One of skill in the art would realize additional embodiment and improvements based on the teachings herein. Additional embodiments and improvements are within the metes and bounds of the invention which is more specifically set forth in the claims appended hereto.

Claimed is:

1. A system for vaporizing a liquid comprising:

a container for said liquid;

a nozzle for vaporizing said liquid and discharging said liquid into an environment;

a pump for transferring said liquid from said container to said nozzle;

wherein said container contains a sufficient quantity of liquid to allow operation for a predetermined amount of time without replenishing said liquid in said container.

2. The system of claim 1 wherein said predetermined amount of time is at least 4 hours.

3. The system of claim 2 wherein said predetermined amount of time is at least 8 hours.

4. The system of claim 1 further comprising a motor cabinet containing an engine and said pump.

5. The system of claim 4 wherein said motor cabinet further comprises a fan.

6. The system of claim 1 wherein said system comprises an inlet tube supplying liquid from said container to said pump and a delivery tube receiving pressurized liquid from said pump and a bypass valve positioned to pass liquid from said delivery tube to said inlet tube if a pressure in said delivery tube exceeds a predetermined value.

7. The system of claim 6 wherein said delivery tube does not have a gauge.

8. The system of claim 1 system comprises an inlet tube supplying liquid to said pump and a delivery tube receiving pressurized liquid from said pump and a bypass valve positioned to pass liquid from said delivery tube to said container if a pressure in said delivery tube exceeds a predetermined value.

9. The system of claim 1 further comprising wheels.

10. The system of claim 1 wherein said liquid is water.

11. The system of claim 1 wherein said liquid further comprises a UV protector.

12. The system of claim 1 further comprising an air flow contacting said vapor and increasing a velocity of said vapor after discharge from said nozzle.

13. The system of claim 12 wherein said air flow is provided by a fan.

14. The system of claim 13 wherein said fan is integral to said motor.

15. The system of claim 13 wherein said fan and said pump are on a common shaft.

16. A system for vaporizing a liquid comprising:

a container for said liquid;

a nozzle for vaporizing said liquid and discharging said liquid into an environment;

a pump for transferring said liquid from said container to said nozzle;

an inlet tube supplying liquid from said container to said pump and a delivery tube receiving pressurized liquid from said pump and a bypass valve positioned to pass liquid from said delivery tube to said inlet tube if a pressure in said delivery tube exceeds a predetermined value;

wherein said container contains a sufficient quantity of liquid to allow operation for a predetermined amount of time without replenishing said liquid in said container; and

a fan providing an air flow for contacting said vapor and increasing a velocity of said vapor after discharge from said nozzle.

17. The system of claim 16 wherein said fan is integral to said motor.

18. The system of claim 16 wherein said fan and said pump are on a common shaft.

19. The system of claim 16 further comprising an entrance valve associated with said container wherein said entrance valve comprises a float valve.

20. The system of claim 16 wherein said predetermined amount of time is at least 4 hours.

21. The system of claim 20 wherein said predetermined amount of time is at least 8 hours.

22. The system of claim 16 further comprising a motor cabinet containing an engine and said pump.

23. The system of claim 22 further comprising a transportation truck wherein said motor cabinet and said container are mounted to said transportation truck.

24. The system of claim 23 wherein said motor cabinet further comprises a fan.

25. The system of claim 24 wherein said motor cabinet is pivotally mounted to said transportation truck.

26. The system of claim 16 wherein said liquid is water.

27. A system for vaporizing a liquid comprising:

a container for said liquid;

a nozzle for vaporizing said liquid and discharging said liquid into an environment;

a motor cabinet containing an engine and a pump for transferring said liquid from said container to said nozzle;

an inlet tube supplying liquid from said container to said pump and a delivery tube receiving pressurized liquid from said pump with a bypass valve positioned to pass liquid from said delivery tube to said inlet tube if a pressure in said delivery tube exceeds a predetermined value;

wherein said container contains a sufficient quantity of liquid to allow operation for at least 4 hours without replenishing said liquid in said container; and

a fan providing an air flow for contacting said vapor and increasing a velocity of said vapor after discharge from said nozzle and wherein said fan is integral to said motor.

28. The system of claim 27 wherein said motor comprises a shaft and both of said fan and said pump are rotated by engagement with said shaft.

29. The system of claim 28 wherein said fan and said pump are mounted on said shaft.

30. The system of claim 27 wherein said liquid further comprises a UV protector.

31. The system of claim 27 wherein said delivery tube does not have a gauge.

32. The system of claim 27 further comprising an entrance valve associated with said container wherein said entrance valve comprises a float valve.

33. The system of claim 27 further comprising a motor cabinet containing an engine and said pump.

34. The system of claim 33 further comprising a transportation truck wherein said motor cabinet and said container are mounted to said transportation truck.

35. The system of claim 34 wherein said motor cabinet further comprises a fan.

36. The system of claim 35 wherein said motor cabinet is pivotally mounted to said transportation truck.

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