

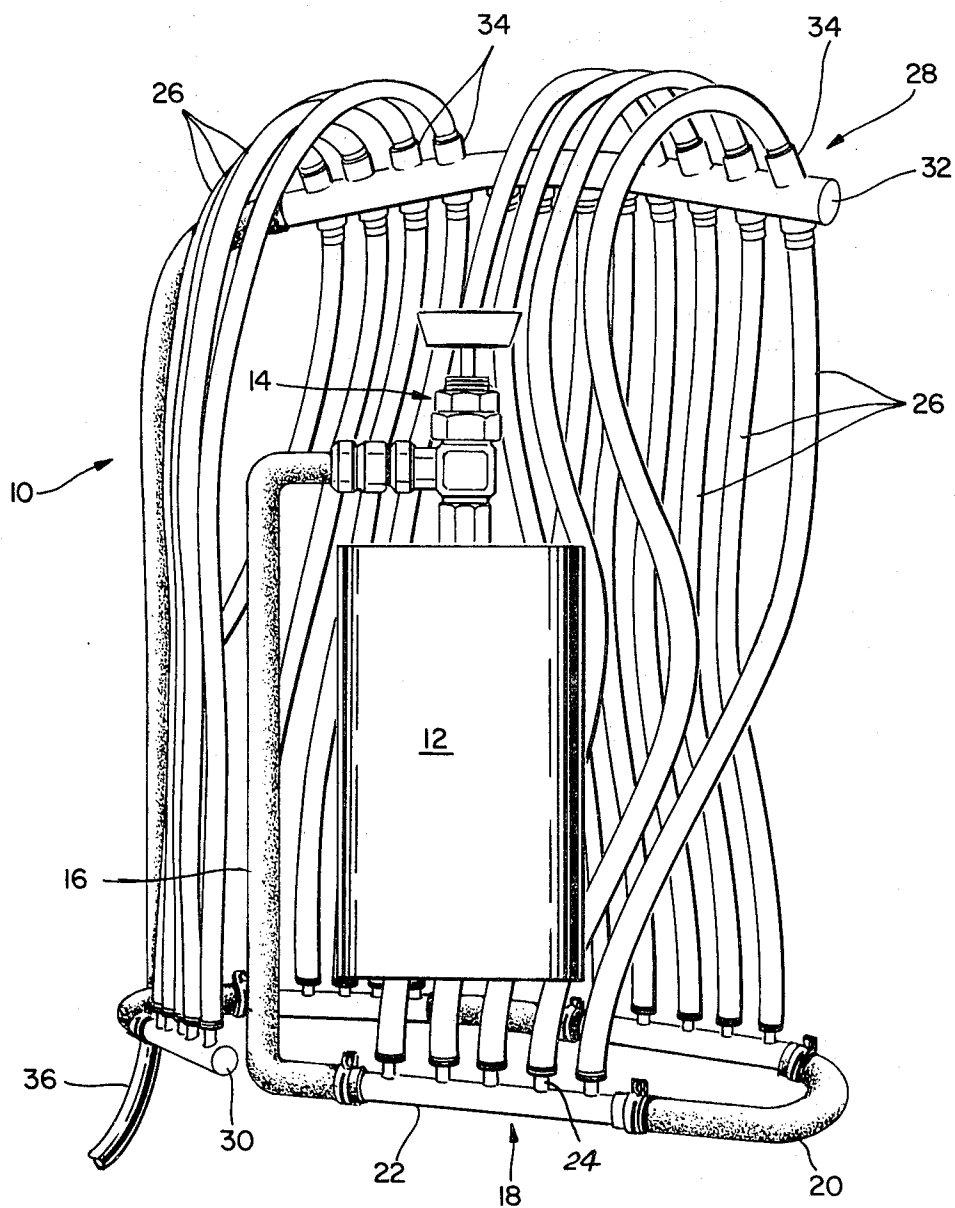
March 16, 1971

D. L. CURTIS

3,570,264

EVAPORANT COOLING SYSTEM

Filed March 13, 1969



INVENTOR.
DANIEL L. CURTIS

1

3,570,264

EVAPORANT COOLING SYSTEM

Daniel L. Curtis, Manhattan Beach, Calif., assignor to
Litton Systems, Inc., Beverly Hills, Calif.

Filed Mar. 13, 1969, Ser. No. 806,970

Int. Cl. F25d 23/12

U.S. Cl. 62—259

3 Claims

ABSTRACT OF THE DISCLOSURE

An evaporant cooling system for a light weight garment having a plurality of tubes connected in parallel between an inlet manifold and an exhaust manifold, the tubes being selectively positioned on the body of the wearer, the inlet manifold being near a low point of the wearer for being supplied with a liquid ammonia-water evaporant, and the exhaust manifold being near a high point of the wearer and being provided with an exhaust tube for discharging the expended evaporant.

BACKGROUND OF THE INVENTION

The effectiveness and safety of fire fighters, heavy equipment operators, or industrial workers in gas tight clothing necessitates that some form of cooling the wearers of such clothing be provided. Enclosing the subject in such protective garments precludes normal ventilation and radiation cooling. The wearers effectiveness is therefore reduced by the accumulation of his own body heat in addition to heat inputs from the external environment. A fire fighter, for example, even with protective clothing can exist for only a few minutes in a fire without some form of external cooling.

Some prior art devices have utilized a replaceable Dry Ice charge carried in a special container while other prior art systems have employed a supply of liquid oxygen or liquid air as part of the system. The former approach adds excess bulk and weight and is limited in its utility while the latter approach would be feasible as both a cooling and breathing gas supply system but is not practical for a general purpose solution to the problem as the requirement for long term liquid air storage would greatly limit its effectiveness.

Accordingly, it is an object of this invention to provide a new and improved evaporant cooling system.

It is another object of this invention to provide a new and improved evaporant cooling system for utilization in a light weight cooling garment.

It is a further object of this invention to provide a new and improved evaporant cooling system which utilizes an expendable evaporant.

It is still another object of this invention to provide a new and improved evaporant cooling system which utilizes an evaporant which can exist in a liquid state at room temperature for convenient storage.

It is still a further object of this invention to provide a new and improved evaporant cooling system which is efficient in its use, simple in its operation, and adds very little additional bulk or weight.

SUMMARY OF THE INVENTION

The foregoing and other objects of the invention are accomplished by providing a liquid ammonia-water evaporant from an inlet manifold to a plurality of cooling tubes encircling the desired part of the body of the wearer which tubes are connected in parallel between the inlet manifold and an exhaust manifold which has an exhaust tube connected thereto for discharging the expended evaporant.

2

DESCRIPTION OF THE DRAWINGS

Other objects, features, and advantages of the invention will become apparent from the following description when taken in conjunction with the accompanying drawings in which the sole figure shows the evaporant cooling system according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing there is shown an evaporant cooling system generally designated 10, which includes a coolant canister 12 having a valve 14 for controlling the flow of pressurized liquid ammonia-water evaporant contained therein.

The evaporant is released through the valve 14 through a tube 16 to an inlet manifold 18. The inlet manifold 18 includes serially connected flexible tubing 20 and rigid tubing 22, the rigid tubing 22 being provided with a plurality of nipples 24 to which are affixed a plurality of flexible cooling tubes 26 which extend upwardly to an exhaust manifold 28. The free end 30 of inlet manifold 18 is capped as is one end 32 of exhaust manifold 28.

The exhaust manifold 28 is provided with a plurality of nipples 34 to which the other ends of cooling tubes 26 are connected. The other end of the exhaust manifold 28 is provided with an exhaust tube 36 for discharging the expended evaporant to the atmosphere.

Structurally the cooling system 10 is configured for placing about the upper part of torso of a wearer, and for convenient usage may be interwoven with or enclosed by fabric in the form of a vest or coat with the canister 12 adjacent the front of the wearer for convenient control. The inlet manifold 18 is positioned at a low point of the system, for example, adjacent the waist of the wearer. The cooling tubes 26 are selectively positioned on the body of the wearer. Tubes 26 are connected in parallel relationship and extend upwardly to the exhaust manifold 28 positioned adjacent a high point of the system, adjacent the shoulders of the wearer on his back. The exhaust manifold 28 may be rigid, semi-rigid or flexible.

Operationally in one embodiment the inlet manifold 18 permanently contains a small amount of water at a low point in the system. The canister 12 contains pressurized liquid ammonia which, when discharged by actuation of valve 14 partially vaporizes and is initially partially absorbed by the water in the system. The water then acts as a transport mechanism allowing subsequent evaporation and thus cooling to occur throughout the system. The ammonia interacts with the water causing the water to be in a constant state of agitation providing cooling throughout the system 10 without loss of water through the exhaust manifold 28 at the high point of the system.

The water serves the essential role of distributing the cooling through the cooling system 10. The system will not work without the water as the ammonia will completely vaporize at the control valve 14 with essentially all the cooling taking place at this point. The cold gas passing through the remainder of the system 10 will produce only minimal cooling.

In a second embodiment the canister 12 contains a liquid ammonia-water mixture under pressure. Although in this embodiment the filled storage weight of the evaporant is slightly heavier by the added weight of the water. This embodiment ensures that a small amount of water is always contained in the remainder of the system 10. With the ammonia-water mixture the amount of water required in canister 12 would be about 5% by weight to the stored ammonia. The exhaust ammonia vapor is discharged in either embodiment through a flexible exhaust tube 36 which is disposed on the back

3

side of the wearer and is directed downwardly and away from the wearer to be discharged into the atmosphere.

While these have been shown and described preferred embodiments, it is to be understood that various other adaptations and modifications may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. A system for cooling a human body comprising:

(a) an inlet manifold located along a lower portion of the body at a low point in the system;

(b) an outlet manifold located along an upper portion of the body at a high point in the system;

(c) a plurality of cooling tubes connected in parallel between said input and output manifolds, said cooling tubes being disposed throughout a garment to be worn by a wearer and capable of selective positioning about a portion of the body of the wearer;

(d) controllable means for providing an equal concentration of a liquid ammonia and water mixture in said inlet manifold whereby said ammonia vaporizes uniformly throughout said input manifold thereby providing uniform cooling in each of said plurality of tubes; and

(e) an exhaust tube connected to said exhaust manifold and adapted to discharge the ammonia vapor to ambient in a direction downwardly and rearwardly of the human body.

2. The system of claim 1 wherein said controllable means includes a canister containing pressurized liquid ammonia and having a valve connected to the output of

4

said canister for controlling the flow of ammonia therefrom, the output of said canister being connected to said inlet manifold and said inlet manifold containing a small amount of water, said ammonia being partially vaporized and partially absorbed by said water to produce uniform cooling in each of said plurality of tubes.

3. The system of claim 1 wherein said controllable means includes a canister containing a mixture of liquid ammonia and water under pressure and having a valve connected to said canister for controlling the flow of mixture therefrom, said canister being connected to said inlet manifold and said ammonia being partially vaporized and partially absorbed by said water to produce uniform cooling in each of said plurality of tubes.

References Cited

UNITED STATES PATENTS

1,684,083	9/1928	Bloom	165—175
2,129,987	9/1938	Berkson	62—514
2,612,760	10/1952	Baggette	62—514
3,001,374	9/1961	Hutton	62—514
3,234,755	2/1966	Richelli	165—175
3,242,979	3/1966	Shlosinger	165—46
3,425,487	2/1969	Tucker	165—46

WILLIAM J. WYE, Primary Examiner

U.S. Cl. X.R.

62—514; 165—46, 132; 128—379, 362